Exploiting RS/6000 SP Security:

Keeping It Safe

Learn PSSP 3.2 security features step by step

Discover time-saving troubleshooting tips

Explore additional security tools

Abbas Farazdel
Chris DeRobertis
Marc Genty
Maarten Kreuger
Michael Wilkop

Redbooks

ibm.com/redbooks

SG24-5521-00

International Technical Support Organization

Exploiting RS/6000 SP Security: Keeping It Safe

September 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix D, “Special notices” on page 501.

First Edition (September 2000)

This edition applies to IBM Parallel System Support Programs for AIX (PSSP) Version 3, Release 2 for use with AIX 4.3.3.

Comments may be addressed to:
IBM Corporation, International Technical Support Organization
Dept. JN9B Building 003 Internal Zip 2834
11400 Burnet Road
Austin, Texas 78758-3493

When you send information to IBM, you grant IBM a non-exclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

Contents

Preface

This IBM Redbook explains how to exploit the enhanced security features of PSSP 3.2. It walks you through the process of moving from where you are today to making full use of the new security features. Similarly, if you are already in a trusted environment, it shows you how to turn off many of the security features you may not need.

Much of this redbook is written in a cookbook style. It is primarily aimed at Information Technology (IT) professionals responsible for managing and securing SP systems. The focus is on installing, configuring, administering, and troubleshooting security technologies ranging from standard AIX to Kerberos 4, DCE, Restricted Root Access, and beyond. The reader should be familiar with both AIX and PSSP in an SP environment before reading this redbook.

The subjects discussed in this redbook include:

- Planning for SP security
- Implementing SP security states
- Moving from one security state to another
- Planning for and implementing Restricted Root Access (RRA)
- Packet filtering by IPsec
- NIS and NFS security risks
- Intrusion Detection tools: TCB, Tripwire, and The Deception Toolkit
- Additional security tools: TCP Wrappers, Postfix, COPS, SATAN, and Tiger
- DCE user management in an SP environment
- Configuring DCE clients

Creating DCE Security and CDS Master and Replica servers

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization, Poughkeepsie Center.

Abbas Farazdel is an SP System Strategist, Technical Consultant, and Senior Project Manager at the International Technical Support Organization, Poughkeepsie Center. Before joining the ITSO in 1998, Dr. Farazdel worked in the Global Business Intelligence Solutions (GBIS) group at IBM Dallas as an Implementation Manager for Data Warehousing and Data Mining Solutions and in the Scientific and Technical Systems and Solutions (STSS) group at the IBM Thomas J. Watson Research Center as a High Performance Computing Specialist. Dr. Farazdel holds a Ph.D. in Computational Quantum Chemistry and an M.Sc. in Computational Physics from the University of Massachusetts.

Chris DeRobertis has been the IBM RS/6000 SP, PSSP Functional Verification Test (FVT), Security Team Lead since 1997. His responsibilities include developing the overall FVT security test strategy, testing specific PSSP components and their interoperability with IBM AIX DCE, and working closely with the PSSP software security developers on the architecture, implementation, and delivery of PSSP security services. Chris' duties also include working with other PSSP test and development areas to develop security test strategies, debugging and corrective action analysis, and interdepartmental security test projects. In addition, Chris works closely with IBM AIX and DCE security teams on solutions that span PSSP, AIX, and DCE. Prior to his FVT position, Chris was a co-team lead for an IBM Global Services Web solutions and services department where he worked on projects for large-scale e-commerce accounts and several large IBM U.S. intranet accounts.

Marc Genty is a Systems Management Integration Professional working for IBM Global Services at the Western Geoplex Service Delivery Center in Boulder, Colorado. He has worked on UNIX environments for 10 years and is an RS/6000 Certified Advanced Technical Expert (CATE). He holds a BS degree in Manufacturing from Colorado State University. His areas of expertise include UNIX, AIX, RS/6000 SP, HACMP, and DCE/DFS. He is currently the SP complex lead for the Global Web Architecture (GWA) Internet complex in Boulder.

Maarten Kreuger is an IT specialist in the AIX software services department of IBM Global Services in The Netherlands. He joined IBM after studying electrical engineering at the Hogeschool in Alkmaar. His areas of expertise include SP systems, performance tuning, and HACMP.

Michael Wilkop is a IT specialist in the Systems Management and Networking Services division of IBM Global Services, Germany. Since joining IBM in 1996, he has provided support for AIX and RS/6000 SP. He holds a degree in electrical engineering from the University of Bochum. His areas of expertise include UNIX, AIX, RS/6000 SP, HACMP, and ADSM.

Thanks to the following people for their invaluable contributions to this project:

Larry Parker, Pat Meehan, Linda Mellor, Mary Nisley, Brian Croswell
IBM Poughkeepsie

John Juenemann, Cary Aipperspach, Robert Kirby, Cory Hartel
IBM Boulder

Comments welcome

Your comments are important to us!

We want our Redbooks to be as helpful as possible. Please send us your comments about this or other Redbooks in one of the following ways:

- Fax the evaluation form found in "IBM Redbooks review" on page 541 to the fax number shown on the form.
- Use the online evaluation form found at **ibm.com**/redbooks
- Send your comments in an Internet note to redbook@us.ibm.com

Part 1. Basic security concepts and the SP

Chapter 1. Introduction

The subject of computer and network security is huge, and many volumes have been written about it. It is not our intention to teach you the fundamentals of security here. We have provided references to several fine books on the subject at the end of this redbook. Instead, the goal of this book is to offer practical information on how you can implement security on an SP system. In addition to covering the built-in security features of the SP, we show you some other tools that you can use to enhance and augment your SP security environment. This redbook in no way claims to be the final word on SP security. Rather, it should be viewed as a starting point for developing and implementing your overall SP security policies and environment.

1.1 General security considerations

With respect to security, an SP system can, for all practical purposes, be viewed as a cluster of RS/6000 workstations connected to one or more LANs, with the control workstation (CWS) serving as the central point of control for the entire system. The SP system is exposed to the same security threats as any other networked cluster of workstations.

At the simplest level, computer and network security come down to a trade-off between trust and money:

- Trust

  There is no such thing as absolute security, as much as we, system administrators, would like to believe otherwise. At some point, you have to have a certain level of trust in the environment in which your system operates. It is really a question of acceptable risk.

- Money

  In general, the more trust you want, the more money you have to spend to get it. That may be money spent implementing security of your SP system, or it may be money spent on other security measures, such as firewalls and physical security measures.

  Deciding how much money to spend and where to spend it is a business decision that needs to be made in the context of your overall security environment. You have to look at the environment as a whole and develop your security strategy at that level.

Like many other business trade-offs, this one follows the 80/20 rule. In the spectrum from no security to fortress-like security, an 80 percent level of trust can be achieved with 20 percent of the funds. Your business environment and your overall security strategy will determine where and how you fortify your system.

An SP system can be situated anywhere from an isolated network to a network directly connected to the Internet. In addition, the SP system may or may not be an integral part of the overall security strategy. Different environments and different strategies call for different security levels on the SP system. This redbook shows you how to tailor the security state of the SP system to meet these diverse needs.

1.2 SP security design

As we already mentioned, for all practical purposes, an SP system can be viewed as a cluster of RS/6000 workstations connected to one or more LANs, with the CWS serving as the central point of control for the entire system. It is a distributed system that follows the client/server model.

In an SP system, the Parallel System Support Program (PSSP) software provides the centralized command and control functions. It runs on all machines in an SP system and enables the CWS to act as the management console for all SP system activities. PSSP is implemented as a cooperating set of client and server (daemon) programs, which are collectively known as the SP Trusted Services.

1.2.1 The SP Trusted Services

Table 1 contains a partial listing of the SP Trusted Services.

Table 1. SP Trusted Services

SP Trusted Service	Description
System Data Repository (sdrd)	The central repository of SP-specific configuration information.
Hardware Monitor (hardmon)	The subsystem that monitors and manages the state of the frames, nodes, and switches in an SP system.
Secure System Command Execution Tool (sysctl)	An authenticated client/server system for running commands remotely and in parallel.
Topology Services (hats)	The subsystem that provides information about the state of the nodes and network adapters to other PSSP subsystems.

SP Trusted Service	Description
Group Services (hags)	The subsystem that provides facilities for coordinating and monitoring changes to the state of a client program running on a set of nodes.
Event Management (haem)	The subsystem that generates events based on the state of system resources and resource monitor requests.
Problem Management (pmand)	The subsystem that provides the ability to execute actions based on the occurrence of specific events.
LoadLeveler	A workload management facility for interactive and batch processing.
General Parallel File System	A distributed filesystem that provides concurrent, shared access to files spanning multiple disk drives located on multiple nodes.
Parallel Environment	A facility for developing and executing parallel, message-passing applications.

The SP Trusted Services comprise a set of distributed applications. As with all distributed applications, security is an issue. The clients and servers should have some way of verifying one another's identity. They should also have some way of controlling who has access to what for the resources they manage. In an SP system, these security mechanisms are provided by some combination of one or more of the following technologies: AIX, Kerberos V4, and DCE, which includes Kerberos V5.

1.2.2 The SP central point of management

The CWS provides the single point of control for monitoring and managing an SP system. The SP Trusted Services provide the foundation for this centralized control, but there are additional tasks that must be performed by the system administrator (*root*) in the normal day-to-day operation of an SP system. It is the remote command facility that provides the economy of scale to these tasks. A single command executed by the system administrator on the CWS can simultaneously perform tasks on any number of nodes in the SP system concurrently. This is a tremendously powerful facility, but it is also one that requires the same type of security mechanisms as the SP Trusted Services.

This redbook describes the security mechanisms for the SP Trusted Services and remote command execution in detail. It gives you information on how to make good decisions about which security mechanism(s) to use, and it shows you ways in which to implement those choices on your SP system.

1.3 How to use this book

This redbook is primarily a cookbook on how to implement various types of security on your SP system. You should have some knowledge of and experience with AIX and PSSP before reading this book. If you plan to take advantage of the PSSP integration with DCE, you should be familiar with DCE. We have provided a number of references to introductory redbooks on the SP and DCE in the bibliography at the end of this redbook.

Before you implement a specific security technology, such as Restricted Root Access, you first need to decide how much security you need and can afford. That decision will guide you in choosing the right security technology for your environment.

1.3.1 How much security do you need?

Depending on the kind of business you are in and the environment in which your system operates, you will have to decide on the level of security you are going to implement. As described earlier, it mostly depends on the amount of trust you have in your environment and the amount of money you can spend to enhance your security to reach that target level of trust.

Suppose your system is connected to your intranet, and you do not trust that network. You will have to shield your system from that network using firewalls or a comparable technology. This will raise the level of trust you have in the data transfer over that network. It does, however, mean that you will have to pay for a firewall and its maintenance.

Before adding any kind of security feature to your system, you should first plan for the amount of time it takes to implement and maintain it. Maintaining a high-security environment will require a large investment in time.

1.3.2 Choosing the right security technology for your environment

Communication between systems is always risky. You will be sending information through a network that you can, probably, never trust completely. Since most of the SP management is done through the network, your system is vulnerable to two common types of network fraud:

- Sniffing
- Spoofing

Sniffing means that somebody on the network has a network device that will read all packets on the network, regardless of whether they were meant for them. You can try to prevent this by designing your physical network using switches, bridges, and subnets so that it will be harder to gain access to your stream of packets. You can also encrypt all sensitive data on your network using software or hardware methods.

Spoofing means assuming the identity of another system on the network. To achieve this, the original system should be disabled. This can be done with a *denial of service* attack (for instance, flooding the system with packets). The false system can now profit from any trust you placed in the real system. You can prevent this by using an authentication scheme. This will guarantee that the system in which you are placing trust is really that system and not a deceiver.

Both sniffing and spoofing are also used for bona fide purposes. Sniffing is used to determine network problems, and spoofing is used in Network Address Translation (NAT).

In an SP environment, it is important to have the system and network security at the level consistent with the amount of trust that is placed in the environment. To achieve this, PSSP supports three security mechanisms:

- Standard AIX
- Kerberos V4
- DCE (using Kerberos V5)

Standard AIX uses the normal UNIX facilities. When a host sends you a request across the network, AIX only checks the originating IP address. Spoofing is possible by using the same IP address as the original system. Sniffing can, for example, be used to catch a password that was typed in during a telnet session.

Kerberos V4 uses a secret key mechanism based on system IDs to identify all systems within its realm. The whole authentication process is encrypted, making it a secure way to prove the identity of your systems. An explanation of how it works is included in Appendix A, “How Kerberos works” on page 485.

DCE is the most advanced method because it uses Kerberos V5. Kerberos V5 improvements over Kerberos V4 include:

- Use of an improved level of encryption
- More secure ticketing system (less vulnerable to sniffing)

- Use of the Generic Security Services API (GSSAPI), an industry-standard application programming interface (API)

Of course, DCE provides much more than just Kerberos V5. It also has a directory service, a time service, user management, and, through the separate DFS LPP, a distributed file service.

Because DCE is more like a framework, of which Kerberos V5 is an integral part, it is much more complex than a Kerberos V4 implementation. We do not recommend using DCE by PSSP unless you also wish to use additional features of DCE, such as user management or DFS.

We will have more to say about DCE in this redbook. More information on Kerberos V5 can be found at the MIT Web site:
`http://web.mit.edu/kerberos/www/index.html`

1.3.3 Proceeding from here

So, having analyzed your environment and determined your security needs, where do you go from here? The remainder of the redbook is organized as follows:

- Read Chapter 2, “SP security concepts and terminology” on page 11. It contains concepts and terminology used throughout the remainder of the redbook and is essential to your understanding of the remaining chapters.
- If you are thinking about using DCE, read Chapter 3, “What you need to know if you plan to use DCE” on page 23. It highlights the areas of DCE with which you must be familiar when implementing it in an SP environment.
- If you are installing a new SP system, read Chapter 4, “Implementing a specific security state” on page 57. It gives you step-by-step instructions on how to implement your chosen security state.
- If you wish to change the security mechanism used on your SP, read Chapter 5, “Changing from one security state to another” on page 131. It gives you step-by-step instructions on how to change security states. You might also read this chapter as a follow-up to Chapter 4, “Implementing a specific security state” on page 57. For example, suppose you just installed your SP system with minimal security to shorten your installation time. Now that your system is up and running, you want to implement stronger security prior to connecting it to an external network. This chapter shows you how to do that.
- If you want to restrict root access on your SP nodes, read Chapter 6, “Restricted Root Access (RRA)” on page 183. It explains the ramifications

of restricting root access and shows you how to enable this feature of PSSP 3.2.

- Now that your SP system is at a specific security state, what else can you do to fine tune your security environment? Read Chapter 7, “Example security scenarios” on page 199. It will help you further analyze your environment and show you additional tools and techniques you can use to enhance your existing SP security state.
- Implementing security is not a simple task. If something goes wrong along the way, Chapter 8, “Problem isolation and resolution” on page 237, gives you step-by-step problem determination and troubleshooting procedures for the most common situations.
- If you want to know the internal workings of Kerberos, turn to Appendix A, “How Kerberos works” on page 485. It contains a great description of Kerberos from the redbook *The RS/6000 SP Inside Out*, SG24-5374.
- An overview of most of the commands and tools used throughout this redbook can be found in Appendix B, “Security command and tool reference” on page 493.

Chapter 2. SP security concepts and terminology

To understand the rest of the redbook, you must become familiar with the SP security concepts and terms defined in this chapter.

The RS/6000 SP is an enormously flexible and versatile computing platform. SPs are used in many environments for many different purposes, from playing chess, to modeling weather phenomena, to housing corporate databases, to hosting Web sites - just to name a few. This, coupled with other considerations, such as company policy, business needs, cost and effort versus risk, and so on, define unique security requirements, ranging from as little as possible to fortress-like and everything in between. To accommodate these varied security requirements, IBM has provided the capability that enables you to tailor the security configuration of your SP system to your specific needs. In this redbook, the term *security state* is used to describe the configuration of your SP with respect to security.

The purpose of the present chapter is to give you conceptual information about the various SP security attributes and explain how they can be combined into a specific SP security state. We begin by covering some general SP and security concepts that are prerequisite to the discussion of the security attributes. We next move into a discussion about the SP security attributes and show you how they can be combined into specific well-defined security states. The following chapters contain step-by-step instructions for installing and configuring your SP system to a specific security state and migrating from one security state to another.

2.1 Authentication and authorization

Before going any further, we need to discuss the terms *authentication* and *authorization*. Most computer security mechanisms are based on a two-step process. The first stage is authentication, which ensures that a user is who he or she claims to be. The second stage is authorization, which allows the user access to various resources based on the user's identity.

In other words, authentication is the process of validating the identity of an entity (usually based on a user name and password), but says nothing about the access rights of the entity. Authorization is the process of granting or denying individuals access to system objects based on their identity.

Think of it this way, if I call you up on the telephone, I first need to identify myself to you in such a way that you are sure I am who I claim to be (authentication); then, depending on my relationship to you, you decide whether or not to give me the information for which I am asking (authorization). If I happen to be a member of your immediate family, I will probably have higher authorization than a casual acquaintance for family-related matters.

You need to consider both authentication and authorization in the security planning of your SP system. When talking about authentication within an SP environment, there are two distinctions to be made:

- Authentication used by AIX remote commands (`telnet`, `rsh`, `ftp`, and so on)
- Authentication used by SP Trusted Services (`hardmon`, `sysctl`, `sdr`, and so on)

The security settings may differ for these two groups. They are managed by setting attributes in the SDR, and should only be changed by running the appropriate PSSP commands. Authorization only applies to AIX remote commands.

The following security mechanisms are supported by PSSP:

- **Standard AIX** - The login authentication method is done through the DES-encrypted password stored in the /etc/security/passwd file and the UNIX login program. Remote command authentication is done by reading the IP address and user ID in the network request packet from the originating host.

  The authorization method is implemented through the normal UNIX base file permissions and ownership, through the AIX extended permissions, and, optionally, through mechanisms, such as .rhosts or hosts.equiv files.

  Additional security features and tools for AIX are covered in detail in Chapter 7, “Example security scenarios” on page 199.

- **Kerberos V4** - The authentication method is implemented through the kerberos daemon on the master security server (typically, the control workstation (CWS)), and the kinit program on the client machines, which include the nodes and the CWS.

  The authorization method is implemented through the kerberos daemon and mechanisms, such as the .klogin and /etc/krb-srvtab files.

  For a detailed description of how Kerberos works, see Appendix A, “How Kerberos works” on page 485.

- **DCE (Kerberos V5)** - This represents the authentication and authorization services provided by DCE or, more specifically, Kerberos V5. The authentication method is implemented by the secd daemon on the DCE Security server(s) and the dced daemon on the DCE clients.

The authorization method is implemented through DCE Access Control Lists (ACLs) and mechanisms, such as the .k5login file and DCE keytab files in the /spdata/sys1/keyfiles/ssp/<hostname>/ directory.

Chapter 3, “What you need to know if you plan to use DCE” on page 23, contains additional information about implementing DCE for security in an SP system. Section 3.12, “Suggested reading for DCE” on page 52, gives you pointers to additional sources of information about DCE.

As you can see, there are three different security mechanisms available for use, each having its own authentication and authorization methods. To simplify the process of categorizing and specifying the different combinations of each, PSSP has defined these authentication and authorization settings in a finite set of security attributes. It is these security attributes taken together that define the security state of your SP system.

2.2 Restricted Root Access (RRA)

One of the key aspects of SP system management is keeping the effort to manage large numbers of nodes low. To achieve this, Kerberos was implemented and, because of the strong authentication it provided, it was possible to securely authorize root to perform actions on all nodes from any node. This simplifies SP management enormously since remote command and copy instructions can be run to any node, and scripts that can access anything anywhere within the SP can be written. This makes the SP function more like a single system.

From a security standpoint, this means that once root access on a single node has been compromised, the entire SP is compromised. It is also not possible to grant root access to an application manager on a single node because he or she will immediately have access to the entire SP. This is desirable within a scientific/technical environment where the SP functions as a parallel system because all nodes are running the same application anyway. Most commercial sites will not have a problem with this because all nodes are typically managed by the same people.

However, there are sites that will have a problem with automatic root access:

- High security commercial, mostly financial environments
- Internet sites that need to contain security breaches
- Commercial sites that have different customers within their SP
- Server consolidation sites that need to be able to, temporarily, give root access to non-administrators on specific nodes

To prevent this automatic root access, it would suffice to remove all entries in the appropriate authorization file (/.rhosts, /.klogin, or /.k5login), but this would also disable a lot of PSSP functionality. The Restricted Root Access feature, which is available as of PSSP 3.2, will set up the SP system so only the CWS has remote access to the nodes, and the nodes do not have root access to each other. This means that each node has its own root user, which has no authority over other nodes.

The Restricted Root Access feature is turned off by default and can be turned on using SMIT, SP TaskGuides, or the command line. If activated, it will change all authorization files within the SP, and configure sysctl so that it can be used to take over the tasks that normally required rsh or rcp access.

There are some considerations to keep in mind when using the SP in Restricted Root Access mode:

- Since nodes do not have remote command ability on other nodes, boot/install servers other than the CWS are not supported.
- Since the Restricted Root Access feature required changes to PSSP, all nodes within the SP need to be at least at PSSP 3.2.
- Manual action is required to update Kerberos on the CWS when HACMP/ES is used in high security mode.
- GPFS and VSD are not supported in Restricted Root Access mode.

Restricted Root Access is a new feature with PSSP 3.2 and is described in Chapter 6, “Restricted Root Access (RRA)” on page 183. This chapter describes the Restricted Root Access feature, how it works, restrictions imposed on the SP when using it, and how to activate this new feature.

2.3 SP security attributes

To completely and unambiguously describe the authentication and authorization settings of an SP system, PSSP has added the following four security attributes to the Syspar class in the SP System Data Repository (SDR):

- auth_install
- auth_root_rcmd
- ts_auth_methods
- auth_methods

Each attribute can be set to one or more of the authentication/authorization methods available for it. Each method is called a *base security option*, and when more than one method is used, we call it a *combination security option*. When used in combination, each method has a *failover* behavior. The method listed first is tried first; if it fails, the method listed second is tried second, and so on.

The **auth_install** attribute defines which authentication capabilities to install and/or configure on the nodes. This attribute only takes effect when the nodes are installed or customized. Since the Kerberos V4 and AIX filesets are installed by default on the nodes, this attribute only controls whether or not they get configured.

The **auth_methods** attribute defines which authentication methods will be used for AIX remote commands, such as `telnet`, `ftp`, `rlogin`, `rcp`, `rsh`, etc. At boot time, the /etc/rc.sp script, which is launched from the inittab, sets the authentication methods using the AIX `chauthent` command.

The **auth_root_rcmd** attribute defines which authorization methods are used for root access to the AIX remote commands. At boot time, the /etc/rc.sp script, which is launched from the inittab, runs the PSSP `updauthfiles` command to create or update the appropriate authorization file(s).

The **ts_auth_methods** attribute defines which authentication methods will be used for the SP Trusted Services, such as hardmon, sysctl, sdr, etc. The setting takes effect immediately.

Table 2 lists the four security attributes and their respective base security options. It explains the purpose of each attribute and the effect of setting each base security option on it.

Table 2. Descriptions of SP security attributes and their settings

Attribute	Description	
auth_install	Defines which authentication capabilites to install and/or configure on the nodes.	
Base options:	`dce`	Install and configure DCE client filesets on the nodes.
	`k4`	Configure Kerberos V4 on the nodes. The filesets are installed by default.
	`std`	No installation or configuration is required for `std`.
auth_root_rcmd	Defines which authorization methods are used for root access to the AIX remote commands.	

Attribute	Description	
Base options:	`dce`	Create .k5login file for root on the nodes and CWS.
	`k4`	Create .klogin file for root on the nodes and CWS.
	`std`	Create .rhosts file for root on the nodes and CWS.
ts_auth_methods	Defines which authentication methods are used for the SP Trusted Services, such as hardmon, sysctl, sdr, topology services.	
Base options:	`dce`	SP Trusted Services use DCE.
	`compat`	SP Trusted Services use the same methods as they did in earlier releases of PSSP.
	`""`	SP Trusted Services use AIX only.
auth_methods[1]	Defines which authentication methods are used for AIX remote commands, such as `telnet`, `ftp`, `rlogin`, `rcp`, `rsh`.	
Base options:	`k5`	The commands require valid Kerberos V5 (DCE) credentials.
	`k4`	The commands require valid Kerberos V4 credentials.
	`std`	The commands require valid AIX credentials.
[1] These are AIX operating system settings controlled by PSSP.		

In some cases, the settings of one security attribute limit the valid settings of another security attribute. Care should be taken not to use conflicting settings. For instance, if the auth_methods attribute is set to k5 and the auth_root_rcmd attribute is set to std, the AIX authentication method performs only Kerberos V5 authentication. The .rhosts authorization file is created but never used because the standard AIX authentication method is not enabled. Even worse, the .k5login file that it requires is never created.

2.4 SP security states

The SP security state is defined by the settings of the four security attributes. Many combinations of security attribute settings are possible, only a small number of which result in valid security states. In this redbook, we cover scenarios dealing with three security states: *Minimal*, *Compatibility*, and *DCE*.

The Minimal security state is the easiest possible security implementation to manage. It is also the least secure. The AIX remote commands and the SP Trusted Services use only standard AIX authentication and authorization.

The **Compatibility** security state is equivalent to how PSSP operates in versions prior to PSSP 3.2. The authentication mechanism is Kerberos V4 combined with AIX. Authorization is done through Kerberos V4 only. The SP Trusted Services use the compat option, which means that some services use AIX authentication and others use Kerberos V4 authentication.

The **DCE** security state is the most secure and the most complex to manage. The authentication mechanism is Kerberos V5 combined with AIX. Authorization is done through Kerberos V5 only. The SP Trusted Services use the dce option, which means that all services use DCE (Kerberos V5) authentication.

Table 3 displays the attribute settings for each of these three security states.

Table 3. SP security states covered in this redbook

Security Attribute	**Security State**		
	Minimal	Compatibility	DCE
auth_install	`std`	`k4`	`dce`
auth_root_rcmd	`std`	`k4`	`dce`
ts_auth_methods	`""` (none)	`compat`	`dce`
auth_methods	`std`	`k4:std`	`k5:std`

Notice that some of the security attributes are set to base security options, while others are set to combination security options. It is also important to know that, when adding additional security options, you must work from the top down, that is, from auth_install to auth_methods. When removing security options, you must work from the bottom up, that is, from auth_methods to auth_install. This is covered in detail in Chapter 5, “Changing from one security state to another” on page 131.

2.5 Each SP partition has its own security state

An RS/6000 SP system is comprised of a CWS, processor nodes, frames, and, optionally, switches. By default, all nodes in an SP system are included in a single system partition, but you can change this. Partitioning enables you to divide an SP system into separate logical SPs. For example, you may want to have one partition for production, another for test, and a third for development.

With partitioning, the nodes in one partition are no longer able to communicate across the switch to nodes in other partitions. In other words, partitioning an SP system partitions the switch. However, the CWS remains a member of all partitions.

One of the benefits of partitioning is that you can set different policies in each partition. This now includes security states. For example, you could set the production partition to DCE, the test partition to Compatibility, and the development partition to Minimal. This is shown in Figure 1.

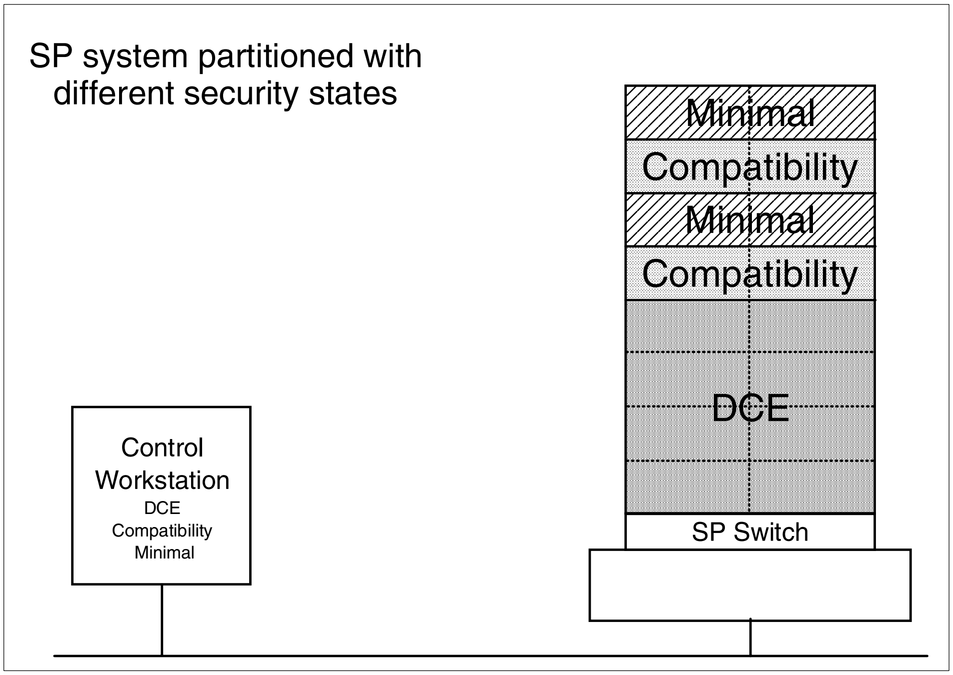


Figure 1. SP system partitioned with different security states

By definition, the CWS is a member of each and every partition on your SP system. Therefore, the CWS must be configured with each and every security state used. For Figure 1, that means that the CWS would be configured with the combination of the DCE, Compatibility, and Minimal security states.

Important

Because the CWS is a member of all partitions, the entire SP system is only as secure as the least secure partition in it.

For this redbook, we assume an SP system configured as a single system partition. However, when we give an example of a command that takes a partition name as an option, we use the default partition name (spcws, for our SP system) for the option in the example.

Part 2. Planning for DCE

Chapter 3. What you need to know if you plan to use DCE

Important

The use of DCE in the SP environment is optional. If you do not plan to implement DCE as a security state on your SP system, skip this chapter.

In the previous chapter, you were introduced to the concept of SP security states. The primary focus of this chapter is to provide you with information on the way in which DCE is implemented as a security state within the SP. The information presented here builds the foundation for what follows in subsequent chapters.

DCE, the Distributed Computing Environment from the Open Software Foundation (OSF), is comprised of a set of integrated services designed to support distributed applications, such as PSSP. You can think of DCE as *middleware* or *enabling technology* because it is not intended to exist alone, but rather to provide a platform on which to run distributed applications.

Note

The purpose of this chapter is not to teach you DCE. There are already many fine books whose purpose is to do just that, and we have listed some of them for you in Section 3.12, “Suggested reading for DCE” on page 52.

3.1 The DCE Secure Core

The primary components of DCE are:

- DCE Threads
- Remote Procedure Call (RPC)
- Distributed Time Service (DTS)
- Cell Directory Service (CDS)
- Security Service (Security)
- Global Directory Service (GDS)
- Distributed Management Environment

Although often described as a DCE primary component, the Distributed File System (DFS) is really a DCE application. It is the most widely-used DCE application and, for that reason, is, generally, grouped with the list of DCE primary components. These components are illustrated in Figure 2.

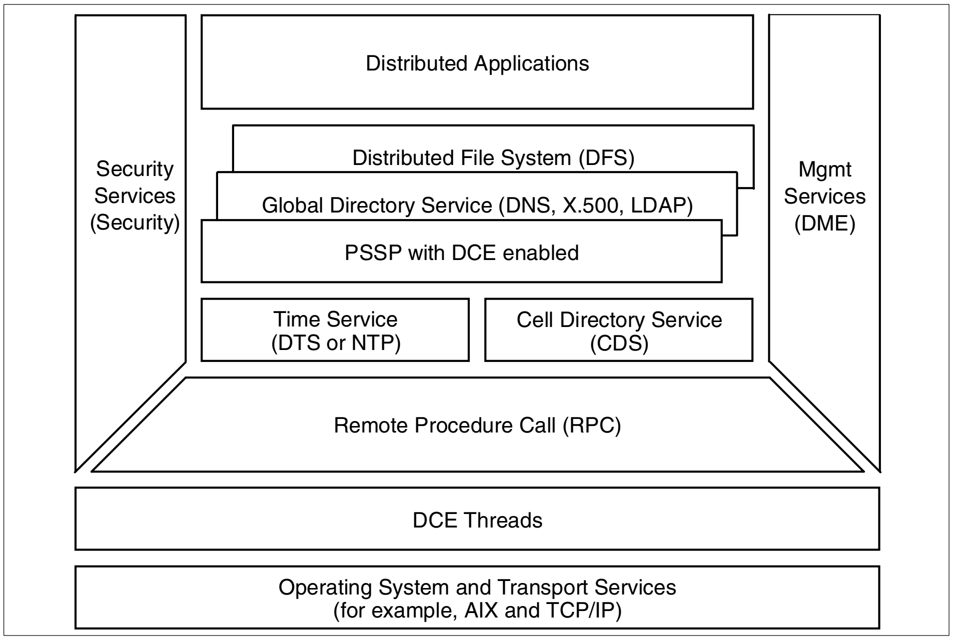

Distributed Applications
Security Services (Security)
Distributed File System (DFS)
Global Directory Service (DNS, X.500, LDAP)
PSSP with DCE enabled
Mgmt Services (DME)
Time Service (DTS or NTP)
Cell Directory Service (CDS)
Remote Procedure Call (RPC)
DCE Threads
Operating System and Transport Services (for example, AIX and TCP/IP)

Figure 2. DCE architecture

The Threads, RPC, CDS, Security, and DTS components are commonly referred to as the *Secure Core*. Of these, CDS and Security are the components that you will work with in configuring DCE security on the SP.

3.2 Synchronized time

All DCE components rely on highly-synchronized time. In particular, Kerberos is extremely time-sensitive. Therefore, it is critical to have the clocks on all DCE machines synchronized.

DTS is the time synchronization facility provided with DCE, but its use is not mandatory. All that matters is that time is synchronized. The time synchronization facility provided with the SP is the Network Time Protocol (NTP). It provides much the same service as DTS.

When using NTP with DCE, it is always a good idea to check a machine’s notion of time before starting DCE. For example, when the motherboard is replaced in a machine, it is not uncommon for that machine to boot up with a notion of time that is very far back in the past. This will cause problems if you attempt to start DCE before adjusting the clock to the current time. A simple check is to run `date` on the local machine and compare it with the output of a `setclock` from a normal user login against your time master. For example, if `jueneman` is your normal user login and the control workstation (CWS), `spcws`, is your time master:

```
spn01/ # date ; su - jueneman -c setclock spcws

Fri Oct 15 07:27:57 MDT 1999
Fri Oct 15 07:27:57 1999

spn01/ #
```

If the two values do not match, set the clock on the local machine to match the time master before starting DCE. Internally, DCE uses Universal Coordinated Time (UTC), and it is the UTC time that must match between clients and servers. This becomes important if your cell is spread across multiple timezones.

3.3 The concept of a DCE cell

Another key concept in DCE is that of the *cell*. A cell is a collection of machines that are managed together as a DCE unit. The cell is the administrative domain for DCE. DCE cells can be comprised of anywhere from one to many hundreds of machines, but an SP system can only be part of one cell. At a minimum, a cell must contain a DCE Security Master server, a Primary CDS server, and a Time server (DTS, NTP, or some other). These servers can all run on a single machine, or they can be distributed across multiple machines in the cell.

In addition, you can create additional DCE *Security Replica* servers and *Secondary CDS* servers in the cell. They can be used to provide the cell with higher availability and enhanced performance.

The Security and CDS components of DCE store information in their own databases. The Security database is known as the *registry*, and the CDS database is known as a *clearinghouse*. DCE Security Master servers and Primary CDS servers hold the read-write copies of the databases, while DCE Security Replica servers and Secondary CDS servers hold read-only copies. In a typical DCE cell with replication, the DCE Security Master server and the Primary CDS server are on one machine, with two additional machines each holding a DCE Security Replica server and Secondary CDS server pair.

Important

All DCE servers, especially Security servers, should be configured to not allow end-user access, and they should be secured with stringent physical access controls. If the security registry is compromised, your entire DCE cell is compromised.

3.4 DCE administrative principals

There are three DCE principals that you need to be familiar with:

- The cell-administrator principal
- The self-host principal
- The optional SP-administrator principal(s)

The DCE cell-administrator principal is the principal used to do the initial cell configuration. In a rough sense, the cell-administrator principal is to DCE what root is to AIX. The typical name for the cell-administrator principal is cell_admin, but you are free to use another name. If you plan to use DCE with PSSP, you will need to have valid DCE cell-administrator credentials to perform some of the routine tasks associated with installing an SP system and/or customizing SP nodes.

The next DCE principal that you need to be familiar with is the self-host principal. Each machine in a DCE cell has an associated self-host principal (/.:/hosts/<hostname>/self). The self-host, or machine, principal is the principal that is used by the DCE client daemons to authenticate to DCE. The self-host principal is also the principal that a root user, who is unauthenticated to DCE, inherits by default. If you plan to use DCE with PSSP, you will need to know which tasks require self-host credentials and which tasks require cell-administrator credentials.

In a DCE-only configuration, many of the routine installation, configuration, and monitoring tasks associated with managing an SP system require valid DCE credentials. You have a lot of flexibility here. You have control over which DCE principals have access to the different components of the SP system, such as writing to the SDR or controlling hardmon. For example, you could create several new SP administrator principals and assign different rights to each, or you could assign all rights to either the cell-administrator principal or the self-host principal for the CWS. Which principals to create and what access rights to give to each really depends on your specific environment. Here are some questions to consider:

- Do you have the need to divide up the SP administrative tasks?
- Do you own the DCE cell-administrator principal, or is that controlled by another group?
- Do you want to use DCE with PSSP but allow the root user to perform the administrative tasks without having to explicitly authenticate to DCE?

In this redbook, we show examples with all three types of administrative principals. Giving all access rights to either the cell-administrator principal or the self-host principal on the CWS simplifies the installation and initial configuration of your SP system. Then, once your SP system is set up with your chosen security state, you can create the SP administrator principal(s) with the appropriate access rights.

You can use the `klist` command to figure out who you are at any given time as shown in the following screen.

```
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login: root
root's Password:
...
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin
sp3en0/ # kdestroy ; exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
```

3.5 DCE groups for PSSP

The PSSP software creates a number of groups in DCE. These groups are used by the SP Trusted Services to grant privileges. Determining which principals to make members of the PSSP DCE groups all depends on how you wish to manage your SP system.

During installation and configuration of PSSP, you have a choice of using the following principals when configuring PSSP components:

- The cell_admin principal
- The self-host principal
- Some other principal that you have already created, such as sp_admin

The DCE administrative principal (cell_admin) has administrative privileges for the entire DCE cell. The cell_admin principal is a very powerful principal. The cell_admin principal controls membership to all DCE groups, and, if DCE user management is implemented, the rights of the cell_admin principal extend into the AIX domain as well. The cell_admin principal is to DCE what the root user is to UNIX. When the DCE cell extends beyond the SP system, it is not advisable to use the cell_admin principal for SP tasks.

There is a unique self-host principal (/.:/hosts/hostname/self) for each machine in a DCE cell. The root user automatically inherits self-host principal credentials on the CWS and the nodes when the SP system is configured in a DCE cell. Adding the self-host principal to the SP groups is very convenient for the root user because a separate DCE login is not required for doing SP tasks. However, it does circumvent an added layer of security.

Creating a new principal for SP management tasks is, probably, the most secure option. It splits the responsibilities into clearly-defined areas. It is also the most complex solution. To use this option, you will need a thorough understanding of DCE and the way it is used by the PSSP software.

By adding a principal to one of the groups listed in Table 4, you authorize that principal to do certain tasks and use certain commands.

Table 4. DCE groups created by PSSP

User access group	Authorizes a member to do this
haem-users	Authorizes use of Event Management.
hm-admin	Authorizes administrative tasks used to manage the SP Hardware Monitor.
hm-control	Authorizes all SP Hardware Monitor tasks except administration.
hm-monitor	Authorizes monitoring of SP hardware. This is read-only access to the SP Hardware Monitor.
sdr-admin	Authorizes SDR tasks on partitioned classes.
sdr-write	Authorizes SDR updates to existing partitioned classes, but not the addition or deletion of classes or other administrative tasks.
sdr-system-class-admin	Authorizes any SDR tasks on global system classes.
sdr-system-class-write	Authorizes SDR updates to existing system classes, but not the addition or deletion of system classes or other administrative tasks.

User access group	Authorizes a member to do this
spsec-admin	Authorizes DCE ACL control authority for PSSP object ACL management tasks.
switchtbld-clean	Authorizes cleanup (the unloading) of switch tables.
switchtbld-load	Authorizes loading of switch tables.
switchtbld-status	Authorizes querying the status of loaded switch tables.
sysctl-cwsroot	Authorizes use of certain switch management commands by non-root users of SP Perspectives. Sysctl creates a group entry for it in the /etc/sysctl.rootcmds.acl DCE ACL file.
sysctl-default	Sysctl creates a group entry for it in any ACL added by customization (not supported by IBM).
sysctl-logmgt	Authorizes use of log management commands by non-root users. Sysctl creates a group entry for it in the `/etc/logmgt.acl` DCE ACL file.
sysctl-master	Authorizes full access to all Sysctl facilities including Sysctl administration. Sysctl creates a group entry for it in the `/etc/sysctl.acl` DCE ACL file.
sysctl-mmcmd	Authorizes access to GPFS commands. Sysctl creates a group entry for it in the `/etc/sysctl.mmcmd.acl` DCE ACL file.
sysctl-pman	Authorizes access to Problem Management commands. Sysctl creates a group entry for it in the `/etc/sysctl.pman.acl` DCE ACL file.
sysctl-vsd	Authorizes access to Problem Management commands. Sysctl creates a group entry for it in the `/etc/sysctl.vsd.acl` DCE ACL file.
PSSP also creates a number of *service access* groups. These are used by service principals, such as hardmon. The names of these groups end in *-services*.	

For more information about the DCE groups created for PSSP, see the *PSSP Administration Guide*, SA22-7348.

3.6 DCE keyfiles for PSSP

Servers, which can also be called applications or services, that engage in communications across the network can run under their own network identity or the network identity of the principal who started them. To run under their own identity, servers must be programmed to perform a login and authenticate that identity.

During login, all principals (human, server, and machine) must pass their password to the DCE Authentication Service, which uses these passwords to generate authentication keys. The most common method for human users is to simply enter their password. A different method must be provided for server principals. This is accomplished through the use of a keyfile.

A keyfile contains principal keys, which are the basis of DCE security, and encrypted password data. A keyfile exists as an encrypted file in the AIX file system and contains principal names, types, versions, and values. Specific DCE commands and APIs are used to read from and write to a keyfile. During login, a server can access a keyfile to obtain its key (password), pass its key to the authentication service, log in, and be authenticated.

Part of a DCE client's local configuration is the creation of a DCE keytab object for the DCE self-host, or machine, principal and an associated keyfile for the self-host principal. As part of PSSP's configuration for DCE security, keytab objects and associated keyfiles are created for the set of PSSP services that comprise its Trusted Services, such as Sysctl, Hardmon, and SDR.

A list of all keytab objects for a particular host can be displayed by issuing the command, shown in the following screen, as the root user:

Control workstation example:

```
sp3en0/ # dcecp -c keytab cat
/.../sp_cell/hosts/sp3en0/config/keytab/self
/.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
/.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/Kbdd
...
/.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/switchtbld
/.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
```

Node example:

```
sp3n05/ # dcecp -c keytab cat
/.../sp_cell/hosts/sp3n05/config/keytab/self
/.../sp_cell/hosts/sp3n05/config/keytab/LoadL/sp3n05/GSmonitor
...
/.../sp_cell/hosts/sp3n05/config/keytab/ssp/sp3n05/switchtbld
/.../sp_cell/hosts/sp3n05/config/keytab/ssp/sp3n05/sysctl
```

The output shown includes PSSP keytab objects in addition to the self-host principal's keytab object.

The location of the physical keyfile associated with a keytab object can be determined by showing the contents of the keyfile. This does not actually display the encrypted password data of a keyfile. The physical location of a keyfile is defined to DCE for read and update purposes. The location is stored in the keyfile and is part of the storage field when the contents of a keyfile are displayed.

As shown in the next screen, the physical location of the self-host principal's keyfile is `/krb5/v5srvtab`, while that of the PSSP principal sysctl is `/spdata/sys1/keyfiles/ssp/sp3en0/sysctl`.

```
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/self
{uuid 00096565-4301-1d77-9108-0000c09ce054}
{annotation {Host Principal Keytab}}
{storage /krb5/v5srvtab}
{/.../sp_cell/hosts/sp3en0/self des 1}
{/.../sp_cell/host/sp3en0 des 1}
{/.../sp_cell/host/sp3en0 des 2}
{/.../sp_cell/ftp/sp3en0 des 1}
{/.../sp_cell/ftp/sp3en0 des 2}
{/.../sp_cell/hosts/sp3en0/self des 2}
{/.../sp_cell/hosts/sp3en0/cds-server des 1}
{/.../sp_cell/hosts/sp3en0/cds-server des 2}
...
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
{uuid 580d4810-984d-11d3-b5d8-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/ssp/sp3en0/sysctl}
{/.../sp_cell/ssp/sp3en0/sysctl des 1}
{/.../sp_cell/ssp/sp3en0/sysctl des 2}
```

While the above use of `keytab show` is an excellent general way to determine the physical locations of keyfiles, the following shows the default locations of DCE self-host principal and PSSP DCE principal keyfiles.

`dced` (the self-host principal) keyfile is `/krb5/`

Under normal conditions, this directory will exist and will contain the following keyfile:

```
sp3en0/ # ls -l /krb5
total 16
-rw-r--r--   1 root     system        23 Nov 11 09:14 krb.conf
-rw-------   1 root     system       436 Nov 11 09:18 v5srvtab
```

PSSP Trusted Services keyfiles are under `/spdata/sys1/keyfiles/` (main path)

Under normal conditions, this directory will exist and will contain the following directories:

```
sp3en0/spdata/sys1/keyfiles/ # ls -l
total 40
drwxr-xr-x   3 root     system       512 Oct 26 13:04 LoadL/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 mmfs/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 ppe/
drwxr-xr-x   4 root     system       512 Oct 26 13:06 rsct/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 ssp/
```

There will be another directory under each of these directories. The name of this directory is the DCE hostname of the control workstation or nodes:

```
sp3en0/spdata/sys1/keyfiles/ssp/ # ls -l
total 32
drwxr-xr-x   2 root     system       512 Nov 17 12:29 sp3en0
```

The DCE keyfile(s) for a given service or services will be under the DCE hostname directory:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # ls -l
total 64
-rw-------   1 root     system       298 Oct 27 23:43 css
-rw-------   1 root     system       382 Oct 27 23:43 pmand
-rw-------   1 root     system       407 Oct 27 23:44 sp_configd
-rw-------   1 root     system       397 Oct 27 23:44 spbgroot
-rw-------   1 root     system       382 Oct 27 23:43 spmgr
-rw-------   1 root     system       407 Oct 27 23:43 switchtbld
-rw-------   1 root     system       152 Oct 26 12:22 sysctl
```

The keyfiles on the control workstation and on the nodes differ in two ways:

1. On the control workstation, the ssp/ directory will contain at least two subdirectories. In addition to the DCE hostname directory, a second directory will appear, and it will be named after the default partition of the system. If more than two subdirectories exist, their names will correspond to the names of the remaining PSSP partitions in the system. The ssp/{partition name} subdirectories contain a DCE keyfile for each sdrd. The following example relates to a system running with three partitions, named secsys1, secsys2, and secsys3:

```
sp3en0/spdata/sys1/keyfiles/ssp/ # ls -l
total 32
drwxr-xr-x   2 root     system       512 Nov 17 12:29 sp3en0/
drwxr-xr-x   2 root     system       512 Oct 26 12:21 secsys1/
drwxr-xr-x   2 root     system       512 Oct 26 12:22 secsys2/
drwxr-xr-x   2 root     system       512 Oct 26 12:22 secsys3/
sp3en0/spdata/sys1/keyfiles/ssp/ # cd secsys1
sp3en0/spdata/sys1/keyfiles/ssp/secsys1/ # ls -l
total 8
-rw-------   1 root     system       112 Oct 26 12:22 sdr
```

2. There are keyfiles that will only appear on the control workstation. These keyfiles are for sdr, hardmon, and SNMP Manager as shown in the following screen:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # ls -l
total 64
-rw-------   1 root     system       298 Oct 27 23:43 css
-rw-------   1 root     system       154 Oct 26 12:21 hardmon
-rw-------   1 root     system       382 Oct 27 23:43 pmand
-rw-------   1 root     system       407 Oct 27 23:44 sp_configd
-rw-------   1 root     system       397 Oct 27 23:44 spbgroot
-rw-------   1 root     system       382 Oct 27 23:43 spmgr
-rw-------   1 root     system       407 Oct 27 23:43 switchtbld
-rw-------   1 root     system       152 Oct 26 12:22 sysctl
```

Note

Even if the SP system is not configured for LoadLeveler, POE, GPFS, or an SP switch, PSSP DCE keyfiles are created for these services, including a css keyfile for use with PSSP switch services/commands.

This does not pose or create a security exposure, as the keyfiles can only be read and used by a root id.

It is important to note that keyfiles are stored on the same machine as the services whose keys they contain; so, if these keys are compromised, security can also be compromised. Therefore, it is critical to maintain the security of both the keytab objects (with DCE ACLs) and the keyfiles themselves (with AIX file permissions).

Creating separate individual keyfiles for each service principal that runs on a local node prevents services from accessing each other’s keys and, thus, impersonating each other. Furthermore, keyfiles should exist such that they are readable only by root. If you do this, the servers must be started by root in order to read their keytab files and obtain their key during login. During login, the service can access this file to obtain its key, pass its key to the authentication service, log in, and be authenticated.

In an SP system configured for DCE security, the control workstation and each node have their own set of PSSP DCE keyfiles for the Trusted Services on that host. Each PSSP DCE keyfile contains data unique to the service on a given host; so, it is not possible to use PSSP DCE keyfiles that are copied from one host to another, except in the case of RSCT services. (RSCT services use a DCE keyfile to encrypt/decrypt messages, not for login purposes.)

Note

Hardmon's keyfile exists only on the control workstation, since this is the only host within an SP where Hardmon runs. Likewise, the SNMP Manager keyfile exists only on the control workstation.

Access to DCE keytab objects is maintained through the local dced daemon, which protects all keytab objects on the host via ACLs. By default, only the self-host principals have read and write access to the keytab objects, and only a well-defined set of administrative DCE principals have read access to the objects. It is recommended that the default values be used in production environments.

To view the ACL permissions for keytab objects on a host, use the DCE `acl show` command as root in conjunction with a keytab object:

```
sp3en0/ # dcecp -c keytab cat | grep self
/.../sp_cell/hosts/sp3en0/config/keytab/self
sp3en0/ # dcecp -c acl show /.../sp_cell/hosts/sp3en0/config/keytab/self
{unauthenticated ------}
{user hosts/sp3en0/self acdepr}
{group subsys/dce/dced-admin a-depr}
{any_other ------}
...
sp3en0/ # dcecp -c keytab cat | grep sysctl
/.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
sp3en0/ # dcecp -c acl show /.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
{unauthenticated ------}
{user hosts/sp3en0/self acdepr}
{group subsys/dce/dced-admin a-depr}
{any_other ------}
```

Given that keyfiles contain password data, there must be a way to manage the contents of a keyfile. Specifically, there must be a way to change a password in a DCE keyfile.

In actuality, DCE does not provide a way to change a password stored in a keyfile. Passwords or, as DCE refers to them, keys, can only be added to or deleted from a keyfile. This is how a keyfile can contain multiple keys (passwords). Each key within a keyfile contains an associated principal name, type, version, and value. In doing so, a single keyfile can contain various keys with various principal names, which a server or service may use during a login. Typically, a keyfile contains only the principal name for the server for which it was created. However, there may be many key versions for that one principal name.

This is an important concept to note because, while a keyfile can contain many keys, the DCE Registry for a principal's account stores only one key. This means that when a server uses its keyfile to log in, there must exist, in its keyfile, a key version that matches the key stored in its Registry account. If not, the server cannot log in. This is no different than a human typing an incorrect password at login. However, unlike a human that can correct a typo, the server can only use the keys that are stored in its keyfile. This makes managing a keyfile critical to the normal operation of servers.

Depending on how the server or service application is written, managing a DCE keyfile is either done by the server or a key management service or manually maintained.

For example, the DCE self-host principal's keyfile is managed by the local dced (daemon). The dced spawns a thread and manages its own keyfile based on default DCE values that cannot be changed.

On the other hand, PSSP DCE keyfiles are managed in one of two ways, depending on the PSSP service for the keyfile:

Manual update of the keyfile and then the keyfile is pushed out the needed hosts.

This is true only for HATS (RSCT) services that use DCE keyfiles for message encryption purposes.

To add a new key version to the HATS keyfile and then distribute the keyfile to all nodes in the partition, perform the following steps:

1. Add a new key version to the HATS keyfile as the DCE self-host principal (as root) on the control workstation.

   The new key version is determined by taking the highest key version number in the current HATS keyfile and adding 1 to it.

```
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/rsct/sp3en0/hats
{uuid 4d92b078-984d-11d3-9cca-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/rsct/sp3en0/hats}
{/.../sp_cell/rsct/sp3en0/hats des 1}
{/.../sp_cell/rsct/sp3en0/hats des 2}
...
sp3en0/ # dcecp -c keytab add /.:/hosts/sp3en0/config/keytab/rsct/sp3en0/hats -member
/.../sp_cell/rsct/sp3en0/hats -key i45-Xbv04 -version 3
...
sp3en0/#dcecp-ckeytabshow/.../sp_cell/hosts/sp3en0/config/keytab/rsct/sp3en0/hats
{uuid 4d92b078-984d-11d3-9cca-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/rsct/sp3en0/hats}
{/.../sp_cell/rsct/sp3en0/hats des 1}
{/.../sp_cell/rsct/sp3en0/hats des 2}
{/.../sp_cell/rsct/sp3en0/hats des 3}
```

Keep in mind that, in the keytab show example, the `sp3en0` in the `/.../sp_cell/hosts/sp3en0/config/keytab/rsct/sp3en0/hats` string represents the partition name.

2. Copy the updated keyfile to all nodes in the partition from the control workstation as shown in the following screen:

```
sp3en0/ # dsh -av "ls -l /spdata/sys1/keyfiles/rsct"
sp3n05: total 16
sp3n05: drwxr-xr-x   2 root     system       512 Nov 11 18:08 sp3n05
sp3n06: total 16
sp3n06: drwxr-xr-x   2 root     system       512 Nov 11 18:13 sp3n06
sp3en0/ # rcp -p /spdata/sys1/keyfiles/rsct/sp3en0/hats
sp3n05:/spdata/sys1/keyfiles/rsct/sp3n05/hats
sp3en0/ # rcp -p /spdata/sys1/keyfiles/rsct/sp3en0/hats
sp3n06:/spdata/sys1/keyfiles/rsct/sp3n06/hats
```

Keep in mind that, in each of the rcp examples, the `sp3en0` in the `/spdata/sys1/keyfiles/rsct/sp3en0/hats` strings represents the partition name, while the `sp3n05` and `sp3n06` in the `/spdata/sys1/keyfiles/rsct/{sp3n0*}/hats` represent the DCE hostname on the target.

3. Refresh the RSCT subsystems from the control workstation as root:

```
sp3en0/ # syspar_ctrl -r
0513-095 The request for subsystem refresh was completed successfully.
0513-095 The request for subsystem refresh was completed successfully.
0513-095 The request for subsystem refresh was completed successfully.
```

This will refresh HATS, HAGS, and HAEM.

A PSSP Per Node Key Management daemon that runs on each host and manages all other PSSP DCE keyfiles that are not HATS (RSCT)-related.

To see the list of keyfiles managed by Per Node Key Management on the current host, issue the following from the command line as root: `spnkeymand -l`.

> **Note**
>
> An expiration value equal to 0 (zero) indicates that keys do not need to be updated. A value other than 0, represented in ISO time stamp format, indicates the expiration value returned by a query to the `spsec-services` organizational attributes.

Control workstation example:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
service=LoadL/Schedd expiration=0
service=LoadL/Startd expiration=0
service=LoadL/Starter expiration=0
service=LoadL/Negotiator expiration=0
service=LoadL/Master expiration=0
service=LoadL/Kbdd expiration=0
service=LoadL/GSmonitor expiration=0
service=mmfs/mmfsd expiration=0
service=rsct/rsct expiration=0
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/spmgr expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

To see the list of keyfiles managed by Per Node Key Management on a remote host, issue an rsh to the host as root.

Node example:

```
sp3en0/ # rsh sp3n05 "/usr/lpp/ssp/bin/spnkeymand -l"
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
service=LoadL/Schedd expiration=0
service=LoadL/Startd expiration=0
service=LoadL/Starter expiration=0
service=LoadL/Negotiator expiration=0
service=LoadL/Master expiration=0
service=LoadL/Kbdd expiration=0
service=LoadL/GSmonitor expiration=0
service=mmfs/mmfsd expiration=0
service=rsct/rsct expiration=0
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

The Per Node Key Management daemon runs on the control workstation and each node in the SP. Once every 24 hours, the daemon wakes up and checks to see if the keyfiles that it manages need to be updated. The 24-hour period is a fixed value and cannot be changed. The check is done by having the Per Node Key Management daemon log in to DCE using a service's keyfile and then perform the actual check.

If, based on the results of the spsec-services organizational query, the key in the Registry account is slated to expire within the next 24 hours, Per Node Key Management updates the account first and the keyfile second with a new key version. This process ensures that the account password and the keyfile password are not out of sync with each other. (Given that the account can store only one password, or key, at a time, and given that a keyfile can contain many keys, if the account password gets updated with a new value but not the keyfile, the PSSP service cannot log in to DCE.) The key is a randomized value that is automatically generated by Per Node Key Management.

If the key is not ready to expire, no updates are performed, and Per Node Key Management goes back to sleep.

The 24-hour cycle begins at the time the daemon is initialized. For example, if the daemon is started at 4:05 p.m., it performs its keyfile checks, returns to sleep, and, then, 24 hours from the start time, the daemon will wake up and perform its check.

Per Node Key Management does not have its own log. Instead, it writes any errors detected during processing to the AIX error log. The AIX `errpt` command should be used to review the contents of the error log. (The `errpt -N spnkeyman` command is useful for quickly identifying just those entries that pertain to Per Node Key Management.) Normal processing (must update or no need to update) messages are not currently written to any log. This means that, to determine if a keyfile has been updated, the date/time stamp of a keyfile must be inspected, and the contents of the keyfile must be examined via a DCE keytab show command. (If the keyfile is being updated, there will be multiple key version numbers listed in the keyfile. Provided that an administrator is not pruning, or deleting, older key versions in a keyfile.)

The Per Node Key Management daemon is automatically started on the nodes during PSSP installation and configuration. It is manually started on the control workstation as part of the PSSP control workstation installation and configuration procedure.

To see whether or not Per Node Key Management is active on a host, issue the following `lssrc -s spnkeyman` command.

```
sp3en0/ # lssrc -s spnkeyman
Subsystem         Group            PID     Status
 spnkeyman                         14044   active
```

To see the state of Per Node Key Management on all hosts in the system, issue the following command: `dsh -avG "lssrc -s spnkeyman" | dshbak`.

```
sp3en0/ # dsh -avG "lssrc -s spnkeyman" | dshbak
HOST: sp3n05
-------------
Subsystem         Group            PID     Status
 spnkeyman                         11108   active

HOST: sp3n06
-------------
Subsystem         Group            PID     Status
 spnkeyman                         12142   active
```

If Per Node Key Management is not running on a host (the `lssrc` returns inoperative), the daemon can be started by issuing the following command as root: `startsrc -s spnkeyman`. (Per Node Key Management does not take any arguments or flags at startup.)

```
sp3en0/ # lssrc -s spnkeyman
Subsystem         Group            PID     Status
 spnkeyman                                 inoperative
sp3en0/ # startsrc -s spnkeyman
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 14058.
sp3en0/ # lssrc -s spnkeyman
Subsystem         Group            PID     Status
 spnkeyman                         14058   active
```

The remainder of this section shows an example of the DCE Registry (account) and keyfile changes when Per Node Key Management updates a keyfile, as well as an example of when Per Node Key Management determines there are no updates to make. For both examples, the results of an `errpt` query for `spnkeyman` reveal no matches since there were no errors detected during processing.

Note

Given that Per Node Key Management manages over fifteen keyfiles, the examples focus on two services, css and GSmonitor, to make the examples readable and easy to follow. Any of the queries done against the two services in the examples can be performed against any of the services managed by Per Node Key Management.

Example when key data does not need to be updated.

Establish the current date and time. This will be useful for translating the ISO date stamp in the examples.

```
sp3en0/ # date
Sun Dec 19 09:31:15 EST 1999
```

The spsec-services organization does not contain an explicit pwdexpdate value. This means that, for all accounts in the `spsec-services` organization, their password expiration is equivalent to *none*, that is, they do not have an expiration date.

```
sp3en0/ # dcecp -c org show spsec-services -all
{fullname {}}
{orgid 100}
{uuid 00000064-9844-21d3-9202-02608c2d4a7f}
nopolicy
```

A query of the expiration data reveals 0, indicating that the keys are not ready to expire.

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
service=LoadL/Schedd expiration=0
service=LoadL/Startd expiration=0
service=LoadL/Starter expiration=0
service=LoadL/Negotiator expiration=0
service=LoadL/Master expiration=0
service=LoadL/Kbdd expiration=0
service=LoadL/GSmonitor expiration=0
service=mmfs/mmfsd expiration=0
service=rsct/rsct expiration=0
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/spmgr expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

Examine the AIX date/time stamps of some of the keyfiles managed by Per Node Key Management. This provides a "before" view of the keyfiles' file system attributes. Should Per Node Key Management update the keyfiles' key versions, the date/time stamps and the file size will change along with the list of key versions stored within the file.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/ssp/sp3en0/
total 72
-rw-------   1 root     system       106 Nov 11 10:33 css
-rw-------   1 root     system       114 Nov 11 10:33 hardmon
-rw-------   1 root     system       110 Nov 11 10:33 pmand
-rw-------   1 root     system       106 Nov 11 10:33 sdr
-rw-------   1 root     system       120 Nov 11 10:33 sp_configd
-rw-------   1 root     system       116 Nov 11 10:33 spbgroot
-rw-------   1 root     system       110 Nov 11 10:33 spmgr
-rw-------   1 root     system       120 Nov 11 10:33 switchtbld
-rw-------   1 root     system       112 Nov 11 10:33 sysctl
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/css
{uuid 4ff2053a-984d-11d3-93df-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/ssp/sp3en0/css}
{/.../sp_cell/ssp/sp3en0/css des 1}
{/.../sp_cell/ssp/sp3en0/css des 2}
```

Examine the DCE account attributes that relate to one of the keyfiles that Per Node Key Management will manage, and search for the “lastchange” attribute. This provides a "before" view of when account data was last changed. When Per Node Key Management (or any other authorized principal) updates the account's key (password), the lastchange value is updated to show when the change was made and what principal made the change.

```
sp3en0/ # dcecp -c account show ssp/sp3en0/css | grep last
{lastchange /.../sp_cell/ssp/sp3en0/css 1999-11-11-10:33:15.000-05:00I-----}
```

Repeat the AIX file attributes and DCE account attribute "before" checks for the second service in the example, GSmonitor:

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/LoadL/sp3en0/
total 56
-rw-------   1 root     system       122 Nov 11 10:32 GSmonitor
-rw-------   1 root     system       112 Nov 11 10:32 Kbdd
-rw-------   1 root     system       116 Nov 11 10:32 Master
-rw-------   1 root     system       124 Nov 11 10:32 Negotiator
-rw-------   1 root     system       116 Nov 11 10:33 Schedd
-rw-------   1 root     system       116 Nov 11 10:33 Startd
-rw-------   1 root     system       118 Nov 11 10:33 Starter
sp3en0/ # dcecp -c keytab cat | grep GSmonitor
/.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
{uuid 435b5182-984d-11d3-b8ea-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/LoadL/sp3en0/GSmonitor}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 1}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 2}
sp3en0/ # dcecp -c account show LoadL/sp3en0/GSmonitor | grep last
{lastchange /.../sp_cell/LoadL/sp3en0/GSmonitor 1999-11-11-10:32:54.000-05:00I-----}
```

Stop Per Node Key Management and then start it to trigger the check:

```
sp3en0/ # stopsrc -s spnkeyman
0513-044 The spnkeyman Subsystem was requested to stop.
sp3en0/ # lssrc -s spnkeyman
Subsystem         Group            PID     Status
 spnkeyman                                 inoperative
sp3en0/ # startsrc -s spnkeyman
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 14068.
```

`errpt` shows no error conditions for Per Node Key Management processing.

```
sp3en0/ # errpt -s 1219000199 -N spnkeyman
sp3en0/ #
```

Reexamining the AIX file attributes reveals no changes to the files as the result of Per Node Key Management processing. Likewise, no changes are made to the DCE account attributes.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/ssp/sp3en0/
total 72
-rw-------   1 root     system       106 Nov 11 10:33 css
-rw-------   1 root     system       114 Nov 11 10:33 hardmon
-rw-------   1 root     system       110 Nov 11 10:33 pmand
-rw-------   1 root     system       106 Nov 11 10:33 sdr
-rw-------   1 root     system       120 Nov 11 10:33 sp_configd
-rw-------   1 root     system       116 Nov 11 10:33 spbgroot
-rw-------   1 root     system       110 Nov 11 10:33 spmgr
-rw-------   1 root     system       120 Nov 11 10:33 switchtbld
-rw-------   1 root     system       112 Nov 11 10:33 sysctl
sp3en0/ # dcecp -c account show ssp/sp3en0/css | grep last
{lastchange /.../sp_cell/ssp/sp3en0/css 1999-11-11-10:33:15.000-05:00I-----}
sp3en0/ # ls -l /spdata/sys1/keyfiles/LoadL/sp3en0/
total 56
-rw-------   1 root     system       122 Nov 11 10:32 GSmonitor
-rw-------   1 root     system       112 Nov 11 10:32 Kbdd
-rw-------   1 root     system       116 Nov 11 10:32 Master
-rw-------   1 root     system       124 Nov 11 10:32 Negotiator
-rw-------   1 root     system       116 Nov 11 10:33 Schedd
-rw-------   1 root     system       116 Nov 11 10:33 Startd
-rw-------   1 root     system       118 Nov 11 10:33 Starter
sp3en0/ # dcecp -c account show LoadL/sp3en0/GSmonitor | grep last
{lastchange /.../sp_cell/LoadL/sp3en0/GSmonitor 1999-11-11-10:32:54.000-05:00I-----}
```

Example when key data does need to be updated

Establish the current date and time. This will be needed when comparing the ISO date stamp value in the examples.

```
sp3en0/ # date
Sun Dec 19 11:03:15 EST 1999
```

The `spsec-services` organization `pwdexpdate` value reveals that passwords for accounts in the `spsec-services` organization will expire on 1999-12-20 at 07:59:00, less than twenty-four hours from the current time.

```
sp3en0/ # dcecp -c org show spsec-services -all
{fullname {}}
{orgid 100}
{uuid 00000064-9844-21d3-9202-02608c2d4a7f}
{acctlife unlimited}
{pwdalpha yes}
{pwdexpdate 1999-12-20-07:59:00.000-05:00I-----}
{pwdlife unlimited}
{pwdminlen 0}
{pwdspaces yes}
```

A query via the spnkeymand command reveals an expiration value of 945694740:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=945694740
service=ppe/dpcl expiration=945694740
service=LoadL/Schedd expiration=945694740
service=LoadL/Startd expiration=945694740
service=LoadL/Starter expiration=945694740
service=LoadL/Negotiator expiration=945694740
service=LoadL/Master expiration=945694740
service=LoadL/Kbdd expiration=945694740
service=LoadL/GSmonitor expiration=945694740
service=mmfs/mmfsd expiration=945694740
service=rsct/rsct expiration=945694740
service=ssp/switchtbld expiration=945694740
service=ssp/css expiration=945694740
service=ssp/pmand expiration=945694740
service=ssp/spmgr expiration=945694740
service=ssp/sp_configd expiration=945694740
service=ssp/spbgroot expiration=945694740
```

Examine the AIX date/time stamps of some of the keyfiles managed by Per Node Key Management. This provides a "before" view of the keyfiles' file system attributes. Should Per Node Key Management update the keyfiles' key versions, the date/time stamps and the file size will change along with the list of key versions stored within the file.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/ssp/sp3en0/
total 72
-rw-------   1 root     system       106 Nov 11 10:33 css
-rw-------   1 root     system       114 Nov 11 10:33 hardmon
-rw-------   1 root     system       110 Nov 11 10:33 pmand
-rw-------   1 root     system       106 Nov 11 10:33 sdr
-rw-------   1 root     system       120 Nov 11 10:33 sp_configd
-rw-------   1 root     system       116 Nov 11 10:33 spbgroot
-rw-------   1 root     system       110 Nov 11 10:33 spmgr
-rw-------   1 root     system       120 Nov 11 10:33 switchtbld
-rw-------   1 root     system       112 Nov 11 10:33 sysctl
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/css
{uuid 4ff2053a-984d-11d3-93df-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/ssp/sp3en0/css}
{/.../sp_cell/ssp/sp3en0/css des 1}
{/.../sp_cell/ssp/sp3en0/css des 2}
```

Examine the DCE account attributes that relate to one of the keyfiles Per Node Key Management will manage, and search for the *lastchange* attribute. This provides a "before" view of when account data was last changed. When Per Node Key Management (or any other authorized principal) updates the account's key (password), the lastchange value is updated to show when the change was made and what principal made the change.

```
sp3en0/ # dcecp -c account show ssp/sp3en0/css | grep last
{lastchange /.../sp_cell/ssp/sp3en0/css 1999-11-11-10:33:15.000-05:00I-----}
```

Repeat the AIX file attributes and DCE account attribute "before" checks for the second service in the example, GSmonitor.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/LoadL/sp3en0/
total 56
-rw-------   1 root     system       122 Nov 11 10:32 GSmonitor
-rw-------   1 root     system       112 Nov 11 10:32 Kbdd
-rw-------   1 root     system       116 Nov 11 10:32 Master
-rw-------   1 root     system       124 Nov 11 10:32 Negotiator
-rw-------   1 root     system       116 Nov 11 10:33 Schedd
-rw-------   1 root     system       116 Nov 11 10:33 Startd
-rw-------   1 root     system       118 Nov 11 10:33 Starter
sp3en0/ # dcecp -c keytab cat | grep GSmonitor
/.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
{uuid 435b5182-984d-11d3-b8ea-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/LoadL/sp3en0/GSmonitor}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 1}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 2}
sp3en0/ # dcecp -c account show LoadL/sp3en0/GSmonitor | grep last
{lastchange /.../sp_cell/LoadL/sp3en0/GSmonitor 1999-11-11-10:32:54.000-05:00I-----}
```

Stop Per Node Key Management, and then start it to trigger the check:

```
sp3en0/ # stopsrc -s spnkeyman
0513-044 The spnkeyman Subsystem was requested to stop.
sp3en0/ # lssrc -s spnkeyman
Subsystem         Group            PID     Status
 spnkeyman                                 inoperative
sp3en0/ # startsrc -s spnkeyman
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 30164.
```

Get the current date/time to compare it against date/time stamps of attributes to check. Any changes made by Per Node Key Management will be relative to this data.

```
sp3en0/ # date
Sun Dec 19 11:07:03 EST 1999
```

`errpt` shows no error conditions for Per Node Key Management processing.

```
sp3en0/ # errpt -s 1219000199 -N spnkeyman
sp3en0/ #
```

Reexamining the AIX file attributes reveals changes to the files managed by Per Node Key Management as a result of its processing. Likewise, changes are made to the DCE account attributes. Notice that, in this example, there are three unchanged files: hardmon, sdr, and sysctl. Each of these keyfiles is managed by the server that owns them, not by Per Node Key Management.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/ssp/sp3en0/
total 72
-rw-------   1 root     system       160 Dec 19 11:07 css
-rw-------   1 root     system       114 Nov 11 10:33 hardmon
-rw-------   1 root     system       166 Dec 19 11:07 pmand
-rw-------   1 root     system       106 Nov 11 10:33 sdr
-rw-------   1 root     system       181 Dec 19 11:08 sp_configd
-rw-------   1 root     system       175 Dec 19 11:08 spbgroot
-rw-------   1 root     system       166 Dec 19 11:08 spmgr
-rw-------   1 root     system       181 Dec 19 11:07 switchtbld
-rw-------   1 root     system       112 Nov 11 10:33 sysctl
```

A new key version appears in the keyfiles that were updated:

```
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/css
{uuid 4ff2053a-984d-11d3-93df-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/ssp/sp3en0/css}
{/.../sp_cell/ssp/sp3en0/css des 1}
{/.../sp_cell/ssp/sp3en0/css des 2}
{/.../sp_cell/ssp/sp3en0/css des 3}
```

The lastchange data has also been updated to reflect modifications to the account.

```
sp3en0/ # dcecp -c account show ssp/sp3en0/css | grep last
{lastchange /.../sp_cell/ssp/sp3en0/css 1999-12-19-11:07:58.000-05:00I-----}
```

The same type of checks are performed for the other service in the example, GSmonitor.

```
sp3en0/ # ls -l /spdata/sys1/keyfiles/LoadL/sp3en0/
total 56
-rw-------   1 root     system       184 Dec 19 11:07 GSmonitor
-rw-------   1 root     system       169 Dec 19 11:07 Kbdd
-rw-------   1 root     system       175 Dec 19 11:07 Master
-rw-------   1 root     system       187 Dec 19 11:07 Negotiator
-rw-------   1 root     system       175 Dec 19 11:07 Schedd
-rw-------   1 root     system       175 Dec 19 11:07 Startd
-rw-------   1 root     system       178 Dec 19 11:07 Starter
sp3en0/ # dcecp -c account show LoadL/sp3en0/GSmonitor | grep last
{lastchange /.../sp_cell/LoadL/sp3en0/GSmonitor 1999-12-19-11:07:55.000-05:00I-----}
sp3en0/ # dcecp -c keytab show /.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
{uuid 435b5182-984d-11d3-b8ea-02608c2d4a7f}
{annotation {}}
{storage /spdata/sys1/keyfiles/LoadL/sp3en0/GSmonitor}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 1}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 2}
{/.../sp_cell/LoadL/sp3en0/GSmonitor des 3}
```

3.7 Split configuration for DCE clients

When configuring machines as DCE clients, you can split the configuration steps into two parts: An admin-only part, and a local-only part. The admin-only part is done by someone with DCE cell administrator credentials and can be done from any machine that is already a member of the DCE cell. This step preconfigures the client machine into the DCE cell. The local-only part is then done by the local system administrator of the client machine and only requires root-level authority on that machine.

The DCE split configuration mechanism maps quite nicely to the way in which nodes are normally installed in an SP system. In the standard node install process, information is first entered into the SP System Data Repository (SDR), and then the nodes are installed. If PSSP is enabled for DCE, in addition to the data being entered into the SDR, the admin-only portion of the DCE node configuration is done first. During node install, the local-only portion is performed on the nodes by the /usr/lpp/ssp/bin/spauthconfig script, which is called as part of the normal node customization process.

If you plan to use DCE with PSSP, you will need to keep in mind this two-step process for DCE node configuration. Note that, if you are already a DCE cell administrator, this may represent a significant change from the way you normally configure and unconfigure DCE clients.

3.8 The DCE security server bootstrap file

When a DCE client needs to communicate with a DCE Security server, it typically does so by first looking up the server name in the CDS namespace. If these CDS lookups are frequent, the impact on performance can be significant.

The DCE Security server bootstrap file, /opt/dcelocal/etc/security/pe_site, is available on all DCE clients and servers in the cell. It contains the names and locations of the cell's DCE Security server(s). When the TRY_PE_SITE environment variable is set to 1, the DCE client first attempts to locate a DCE Security server using the information in the pe_site file, thus, bypassing the CDS lookup. If that fails, the DCE client will then try to find the DCE Security server with a normal CDS namespace lookup. In general, locating a DCE Security server using the `pe_site` file is faster than a CDS namespace lookup.

The `TRY_PE_SITE` variable is, typically, set in the `/etc/environment` file:

```
sp3en0/ # cat /etc/environment
...

ODMDIR=/etc/objrepos
DOCUMENT_SERVER_MACHINE_NAME=localhost
DOCUMENT_SERVER_PORT=49213
CGI_DIRECTORY=/var/docsearch/cgi-bin
DOCUMENT_DIRECTORY=/usr/docsearch/html
# IMNSearch DBCS environment variables
IMQCONFIGSRV=/etc/IMNSearch
IMQCONFIGCL=/etc/IMNSearch/dbcshelp
RPC_UNSUPPORTED_NETIFS=css0
DCE_USE_WCHAR_NAMES=1
TRY_PE_SITE=1
```

When you configure your SP system for DCE security, this entry is added to the `/etc/environment` file for you.

Important

Changes to your DCE cell are not automatically reflected in the /opt/dcelocal/etc/security/pe_site file. For example, if you configure your cell for high-availability by adding additional DCE Security Replica servers and Secondary CDS servers, you need to run /usr/bin/chpesite on all DCE clients to add the entries for the additional DCE Security replica server(s) into the pe_site file.

3.9 Network interface routing considerations

By default, DCE servers use and advertise all available network interfaces. This process is referred to as *binding*. For performance reasons, it may be desirable to exclude some interfaces from binding if there are clients that do not have a route to those interfaces. This implies that you have a good understanding of your network topology. Care must be taken not to inadvertently disable an interface through which a DCE client is solely dependent on reaching a DCE server.

DCE provides the following environment variables to exclude specific interfaces:

- RPC_UNSUPPORTED_NETIFS
- RPC_UNSUPPORTED_NETADDRS

The first environment variable allows you to exclude the interfaces by interface name, and the second allows you to exclude the interfaces by IP address. For example:

- To exclude the en1 and tr1 interfaces:

  ```
  export RPC_UNSUPPORTED_NETIFS=en1:tr1
  ```

- To exclude the interface corresponding to IP address 123.45.67.89:

  ```
  export RPC_UNSUPPORTED_NETADDR=123.45.67.89
  ```

It is best to pick one form of environment variable and use it consistently throughout your cell. RPC_UNSUPPORTED_NETIFS is the most common one in use. The recommended way to set it is by editing the /etc/environment file so that all processes in the system inherit this value by default.

If your SP system is contained in the DCE cell and you are using *file collections*, you can add /etc/environment to the *user.admin* collection and have supper propagate it to all of your nodes.

3.10 Options for setting up DCE

You now have a number of choices when it comes to using DCE on your SP system. They are:

- Do not use it at all.
- Create a new self-contained cell within the SP system.
- Integrate the SP system into an existing cell.

Before choosing one of these options, you need to consider your current environment as well as your future growth plans. Time spent in up-front planning of a DCE cell will more than pay for itself when the time comes to implement and support the cell. The following options provide a starting point for your planning activity:

Do not use it at all

DCE adds complexity and an extra layer of administration to your SP system. If you have no need for the added security that DCE provides, you can choose not to install or enable it. Besides DCE, there are two other security options available to you:

- Kerberos Version 4

  This is the standard option for earlier releases of PSSP. It is also known as *compatibility mode* because it provides the migration entry point for systems migrating from earlier releases of PSSP, such as PSSP 3.1. This option is a good second choice if you are not ready to take on the additional tasks involved with deploying DCE.

- Standard AIX

  This option is best suited for a self-contained SP system that is completely isolated from external networks and has adequate physical access controls. It is the simplest option to install and administer. It also provides a good starting point for the initial installation of an SP system, provided the above-mentioned controls are in place. Once the installation is complete, you can migrate the SP system to a higher level of security and then connect it to external networks.

Create a new, self-contained cell within the SP system

You can think of this option as entry-level DCE. It is a good way to get some exposure to DCE without having to deal with the complexities of managing a large-scale DCE cell.

With this option, you configure the CWS as the DCE Security Master server and the Primary CDS server, and your nodes become DCE clients. You will need to set up the master servers on the CWS prior to choosing this as a security option, but PSSP will handle making the nodes DCE clients.

Once your cell is in production, you may also want to configure DCE Security Replica servers and Secondary CDS servers for higher availability or enhanced performance. For example, you could configure the first node on each ethernet segment as a DCE Security Replica and Secondary CDS server.

Integrate the SP system into an existing cell

This option assumes that you already have an existing DCE cell and that you want to integrate your SP system into it. How you enable this option depends on how your existing cell is configured:

- All DCE servers are located on machines external to the SP system.

  This is the simplest configuration to work with. There are four main steps:

  a. If necessary, upgrade the cell to the same level of DCE required by PSSP.

  b. Verify that the CWS and all DCE-enabled nodes have network routes to the servers in your cell.

  c. Configure your CWS as either a DCE client only or as a DCE Security Replica server and/or a Secondary CDS server.

  d. Implement the DCE security state.

- All DCE servers are located on machines (nodes) internal to the SP system.

  This option is a bit more challenging. There are five main steps:

  a. Relocate the DCE Security Master server and the Primary CDS server to a machine or machines external to the SP system. This is required to prevent a circular dependency between the CWS and the DCE server node. For example, if both are down, the CWS may hang waiting for the DCE server node to come up, but the DCE server node cannot be powered on using PSSP if the CWS is down.

  b. If necessary, upgrade the cell to the same level of DCE required by PSSP.

  c. Verify that the CWS and all DCE-enabled nodes have network routes to the servers in your cell.

  d. Configure your CWS as either a DCE client only or as a Security Replica server and/or a Secondary CDS server.

  e. Implement the DCE security state.

- Some DCE servers are on external machines; others are on internal ones.

  This is a combination of the other two configurations. The key consideration is where the DCE Security Master server and the Primary CDS server are located:

  - If the these servers are on a machine external to the SP system, proceed as though all DCE servers are machines external to the SP system.

- If the these servers are on a node in the SP system, proceed as though all DCE servers are on machines (nodes) internal to the SP system.

In Chapter 4, “Implementing a specific security state” on page 57, we show you how to install your SP system to your chosen security state. After that, in Chapter 5, “Changing from one security state to another” on page 131, we show you how to change from one security state to another.

3.11 An important note about partitioning

The SP security options can be enabled on a partition-by-partition basis. In other words, you can have DCE enabled in one partition, Kerberos 4 in a second, and Standard AIX in a third. The CWS must be configured with all security options used within the partitions of the SP system. Since the CWS is contained within all partitions and effectively connects all partitions together, the entire SP system is no more secure than its least secure partition.

3.12 Suggested reading for DCE

Redbooks:

- *DCE Cell Design Considerations*, SG24-4746
- *Administering IBM DCE and DFS Version 2.1 for AIX and OS/2 Clients*, SG24-4714
- *DCE and DFS Performance Tuning and Problem Determination on AIX and OS/2 Warp*, SG24-4949

Other publications:

Note

The DCE documentation is shipped as softcopy on the DCE product media.

- *Distributed Computing Environment for AIX: Quick Beginnings*
- *IBM Distributed Computing Environment for AIX: Introduction to DCE*
- *IBM Distributed Computing Environment for AIX: Administration Guide -- Introduction*
- *IBM Distributed Computing Environment for AIX: Administration Guide -- Core Components*

- *RS/6000 SP Planning Volume 2, Control Workstation and Software Environment*, GA22-7281
- *Parallel System Support Programs for AIX Administration Guide Version 3 Release 2*, SA22-7348

External publications:

- *Understanding DCE*, Ward Rosenberry, David Kenney, Gerry Fisher, published 1992 by O'Reilly & Associates, ISBN 1565920059

Part 3. SP security

Chapter 4. Implementing a specific security state

Now that you know about the different security states, the question of how you can implement a specific security state on your SP system remains. This chapter provides you with step-by-step procedures for setting up your SP system to use any desired security state. Note that, when you decide on a particular security state, you are not locked into it. Chapter 5, “Changing from one security state to another” on page 131, will give you directions on how to go from one security state to another.

4.1 Overview of the examples

In the following paragraphs, we discuss the security-related installation steps of five examples. There, we give you a detailed view into the configuration of SP security that should help you make the right choices in the numerous security options offered by PSSP 3.2. The described installation steps cover the setup of the three common security states, *Minimal*, *Compatibility*, and *DCE*, as defined in Section 2.4, “SP security states” on page 16. For the DCE security state, we go more into detail. We explain how you can configure and install a DCE cell on your SP system in the last three examples.

- **Example 1: Minimal Security** covers the simplest security state you can configure on your SP system.
- **Example 2: Compatibility Security** covers the security state that was used by default in PSSP 3.1 and earlier versions.
- **Example 3: Simple DCE cell** shows you how to implement the DCE security state and how to configure a DCE cell in the simplest setup you can use with PSSP 3.2.
- **Example 4: Advanced DCE cell** expands the configuration of Example 3 to use a DCE Security Replica Server, a Secondary CDS Server, and an SP administrative principal in your system.
- **Example 5: Existing DCE cell** shows you how to integrate your SP system in an already working DCE cell.

You can see a comparison of all five examples and their security states in Table 5.

Table 5. The security state of the examples

Example	Security state
Example 1: Minimal Security	Minimal

Example	Security state
Example 2: Compatibility Security	Compatibility
Example 3: Simple DCE cell	DCE
Example 4: Advanced DCE cell	DCE
Example 5: Existing DCE cell	DCE

4.2 Our lab environment

Before we go into the implementation processes of the different examples, you might want to know more about the hardware and network environment we used in this project. The SP system, shown in Figure 3 on page 59, consists of one frame with twelve nodes: One high node, ten thin nodes, and one wide node. The networks used by the nodes are the switch network and the SP administrative ethernet with the control workstation (CWS) connected to it. The CWS also has a token ring interface that connects to two external systems that are used as DCE security server and DCE client for the SP external DCE cell in Section 4.8, “Example 5: Existing DCE cell” on page 112.

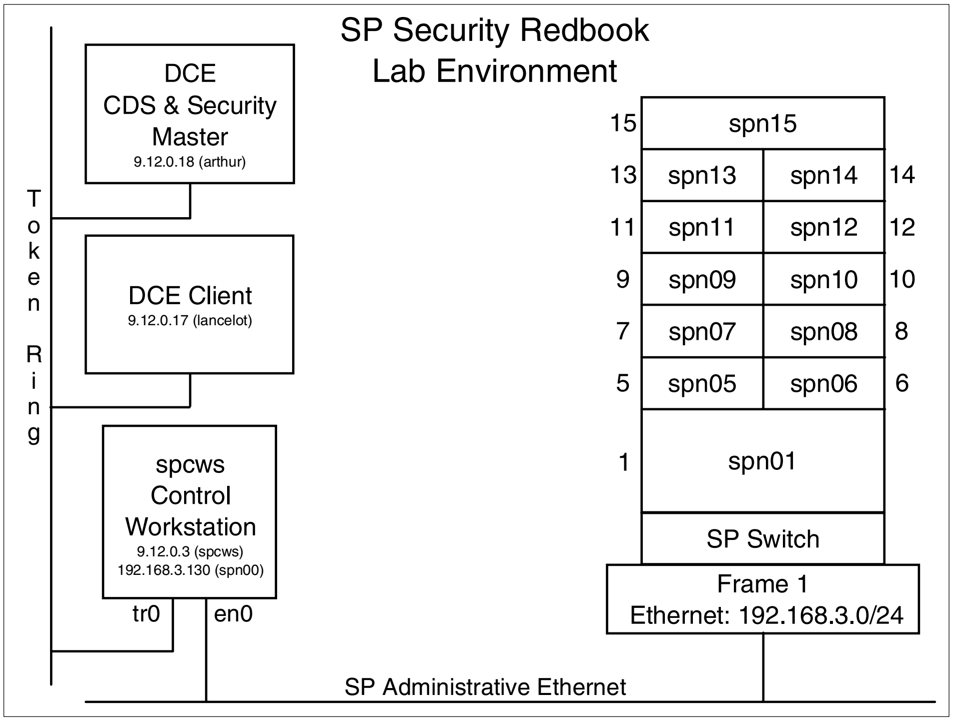


Figure 3. Our lab environment

The CWS and the external nodes are installed with AIX 4.3.3 and the latest available PTF sets. The lppsource (directory name: aix433) also has this AIX level.

Note

There must not be any DCE filesets older than release 3.1 contained in the lppsource.

To keep it simple, we have not configured PSSP user management, supper, or automounter. Additional PSSP features, such as GPFS or LoadLeveler, are also not included in our installation.

4.3 A template for the security installation process

Before we continue with a detailed step-by-step description of the security-related installation steps in the specific examples, it can be very useful to get an overview of the main procedures of this process. All examples go through the following seven steps, and you can use this list as a template to implement any security state on your system:

1. Install the authentication method server(s) on the CWS, SP nodes, and/or systems external to the SP, for instance, your DCE servers.
2. Configure the CWS as a client for the authentication method.
3. Set the authentication method to be automatically installed/configured on the nodes within the desired partition.
4. Set the authentication methods to be used for AIX remote command authorization for the root user.
5. Ensure that the authentication configuration is updated on the nodes within the partition (either by rebooting the nodes and letting the `pssp_script` command do the job for you or by using the `dsh` command to change the security authentication on each node in the partition).
6. Enable the authentication method for use within the AIX remote commands in the partition.
7. Enable the authentication method for use within SP Trusted Services in the partition.

4.4 Example 1: Minimal security

In this example, we go through the security-related installation steps of the *PSSP Installation and Migration Guide*, GA22-7347, for a new installation. We install the SP system with the simplest security state offered by PSSP 3.2, that is, the *Minimal security* state defined in Chapter 2, “SP security concepts and terminology” on page 11. Recall, from Table 2 on page 15, that this configures only AIX standard methods for authentication as well as authorization for remote commands and no authentication method for SP Trusted Services. Enabling no authentication method, SP Trusted Services, which are critical for installation, administration, and operation of the SP system, still function correctly using methods, such as “client must be root “ or “client must be authorized by an ACL”. In this scenario, you do not have to deal with Kerberos V4 or DCE; so, this setup can be a good starting point for a fast SP installation. On the other hand, implementing this security state requires.rhosts files to grant root access through remote commands. It is, therefore, not a recommended configuration for an untrusted environment. The security state for this scenario is shown in Table 6.

Table 6. SP security state of Example 1 (Minimal Security)

Scenario	**Security State: Minimal**			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
Minimal Security	`std`	`std`	`""` (none)	`std`

High-level outline for example 1

1. Planning considerations
2. Installation steps

4.4.1 Example 1: Planning considerations

There are no special planning considerations for this security state compared to a normal RS/6000 environment. Authentication is based on IP address or a user ID and password. Access is granted based on the .rhosts file in the user's home directory, which contains the list of authorized hosts and user names.

4.4.2 Example 1: Installation steps

Go through the installation steps provided in Chapter 2, "Installing and Configuring a New RS/6000 SP System" of the *PSSP Installation and Migration Guide*, GA22-7347.

1. In "**Step 14:** Copy the AIX LPP Images and Other Required AIX LPPs and PTFs", you do not need the dce.* filesets. Continue with the normal installation steps.
2. In "**Step 18:** Set Authentication Methods for AIX Remote Commands on the Control Workstation" select **std** as the authentication method for remote commands.

   Issue the `chauthent` command, and confirm the setting with the `lsauthent` command:

```
sp3en0 # chauthent -std
sp3en0 # lsauthent
Standard Aix
```

> **Important**
>
> Issuing the `chauthent` command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

3. Skip “**Step 19:** Set Authentication Methods for AIX Remote Commands on the Control Workstation” and “**Step 20: I**nitialize RS/6000 SP Kerberos V4” and go on to “**Step 21:** Configure DCE for the Control Workstation (Required for DCE)” and select ““ (none) as the authentication method for SP Trusted Services.

   Issue the `chauthts` command without any parameters:

   ```
   sp3en0 # chauthts
   sp3en0 #
   ```

4. Skip “**Step 22:** Set the Authentication Method for SP Trusted Services on the Control Workstation” and go on with your installation proceeding with the following steps as described in the *PSSP Installation and Migration Guide*, GA22-7347, to “**Step 39:** Select Security Capabilities Required on Nodes”.

   To check your current security settings, you can issue the `splstdata -p` command:

   ```
   sp3en0/ # splstdata -p
   List System Partition Information

   System Partitions:
   ------------------
   sp3en0

   Syspar: sp3en0
   -----------------------------------------------------------------------------
   syspar_name     sp3en0
   ip_address      192.168.3.130
   install_image   default
   syspar_dir      ""
   code_version    PSSP-3.2
   haem_cdb_version ""
   auth_install    ""
   auth_root_rcmd  std
   ts_auth_methods ""
   auth_methods    std
   ```

   Figure 4. Viewing initial SDR settings

In this step, we set the auth_install attribute in the SDR. As described in Section 2.3, “SP security attributes” on page 14, this attribute defines the set of authentication capabilities for the node that PSSP uses to determine if it needs to install and/or configure authentication mechanisms on the nodes. Since all standard AIX authentication methods come with a minimal AIX installation by default, setting this attribute to `std` does not have any effect on the nodes. Nevertheless, setting this attribute to `std` can help with problem determination or problem source identification.

Issue the `smitty spauth_config` command to get to the SMIT panel, RS/6000 SP Security; select **Select Security Capabilities Required on Nodes**, insert your system partition name, and enter **`std`** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Select Security Capabilities Required on Nodes

           Select Security Capabilities Required on Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
* System Partition name                            sp3en0              +
* Authentication  Methods                          std                 +
```

You can also use the following command:

```
spsetauth -i -p <syspar> std
```

After this, you can verify the change of your security settings with the `splstdata -p` command. The settings should now look like the following:

```
sp3en0/ # splstdata -p
List System Partition Information

System Partitions:
------------------
sp3en0

Syspar: sp3en0
-------------------------------------------------------------------------------
syspar_name     sp3en0
ip_address      192.168.3.130
install_image   default
syspar_dir      ""
code_version    PSSP-3.2
haem_cdb_version ""
auth_install    std
auth_root_rcmd  std
ts_auth_methods ""
auth_methods    std
```

5. Skip **Step 40:** Create DCE Hostnames (Required for DCE) to **Step 42:** Configure Admin Portion of DCE Clients, and proceed with "**Step 43:** Select Authorization Methods for AIX Remote Commands".

   Issue the `smitty spauth_config` command and select **Select Authorization Methods for AIX Remote Commands** from the "RS/6000 SP Security" SMIT panel; then, insert your system partition name and specify **std** as the authorization method.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

              Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* System Partition name                             sp3en0               +
* Authorization Methods                             std                  +
```

   Or use the following command:

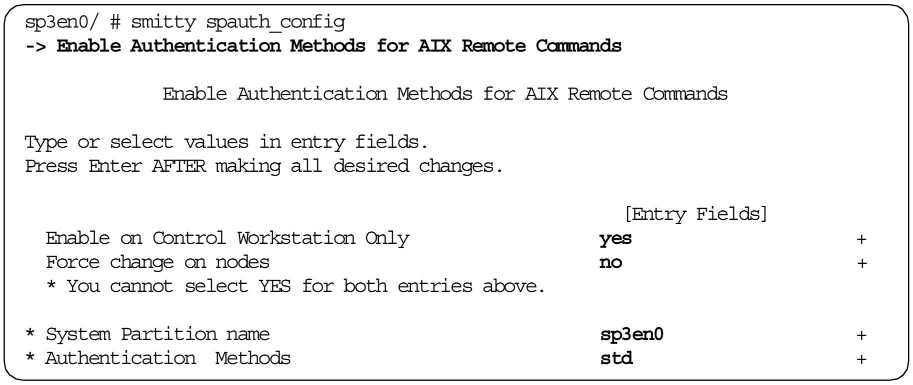
   `spsetauth -d -p <syspar> std`

   Since we did not configure any DCE hostnames in the SDR, this results in the following output:

```
updauthfiles: Attention! DCE hostname information obtained from SDR for
the CWS is not valid. It will be ignored for the .k5login entry.
```

6. Skip ”**Step 44:** Configure SP Trusted Services to Use DCE Authentication (Required for DCE)” and “**Step 45:** Create SP Services DCE Keyfiles (Required for DCE)” and proceed to “**Step 46:** Enable Authentication Methods for AIX Remote Commands”.

   Select **Enable Authentication Methods for AIX Remote Commands** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes**, and set the “Force change on nodes” flag to **no**. Select your system partition and **std** as authentication methods:

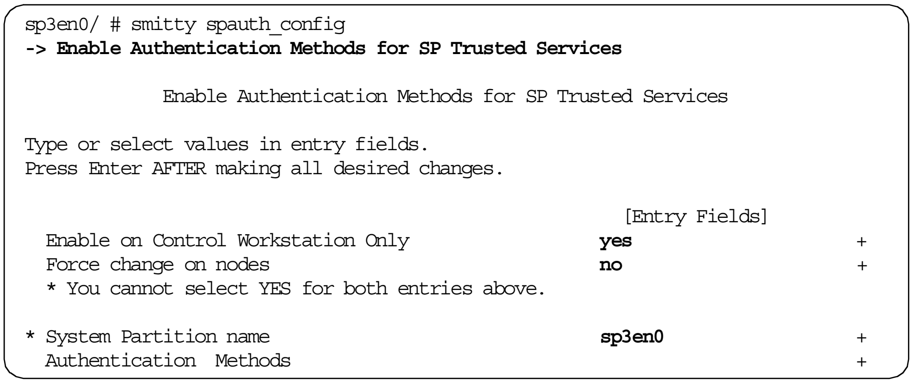


```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for AIX Remote Commands

             Enable Authentication Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
  Enable on Control Workstation Only                  yes                  +
  Force change on nodes                               no                   +
  * You cannot select YES for both entries above.

* System Partition name                               sp3en0               +
* Authentication  Methods                             std                  +
```

   or use the following command:

   `chauthpar -p <syspar> std`

7. In “**Step 47:** Enable Authentication Methods for SP Trusted Services”, select **Enable Authentication Methods for SP Trusted Services** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes**, and set the “Force change on nodes” flag to **no**. Select your system partition and ““ (none) as authentication methods.



```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for SP Trusted Services

             Enable Authentication Methods for SP Trusted Services

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
  Enable on Control Workstation Only                  yes                  +
  Force change on nodes                               no                   +
  * You cannot select YES for both entries above.

* System Partition name                               sp3en0               +
  Authentication  Methods                                                  +
```

Note

Do not select anything in the "Authentication Methods" field.

You can also use the following command:

```
chauthpts -p <syspar> -v std
```

to enable the authentication methods for SP Trusted Services.

8. Skip "**Step 48:** Start the Key Management Daemon", and finish the normal installation process as described in the *PSSP Installation and Migration Guide*, GA22-7347.

4.5 Example 2: Compatibility security

In this example, we go through the security-related installation steps of the *PSSP Installation and Migration Guide*, GA22-7347, for a new installation. We install the SP system with the security state that was used by default setting for PSSP 3.1 and earlier versions as described in Section 2.4, "SP security states" on page 16. We call this the *Compatibility security* state. This configures Kerberos V4 for authentication and authorization for remote commands and SP Trusted Services. Recall, from Chapter 2, "SP security concepts and terminology" on page 11, that this sets the security-related SDR attributes as shown in Table 7.

Table 7. SP security state of Example 2 (Compatibility Security)

Scenario	**Security State: Compatibility**			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
Compatibility Security	k4	k4	compat	k4:std

High-level outline for example 2

1. Planning considerations
2. Installation steps

4.5.1 Example 2: Planning considerations

To set up the compatibility security state, you can have four different configurations of the Kerberos V4 environment:

- CWS as the primary authentication server with Kerberos database

- CWS as a secondary authentication server with Kerberos database (a primary server must be initialized prior to this)
- CWS as a AFS authentication server (and AFS Client)
- CWS as an authenticated client (at least a Kerberos V4 primary server must be initialized prior to this)

We decided for this example to configure the CWS as a primary Kerberos V4 server, which is the most common configuration. Refer to the *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281, for more information. It is necessary to have the whole SP system, including the CWS, in a single Kerberos realm. The authentication servers can be on any workstation in this realm, but not on your SP nodes.

To use Kerberos V4 for SP security, you must, at least, define one user principal as a system administrator, which can have any name with the instance, admin. We recommend to use the user principal, root.admin, by the root user on the CWS for installation and administration tasks of the SP system.

4.5.2 Example 2: Installation steps

Go through the installation steps provided in Chapter 2, “Installing and Configuring a New RS/6000 SP System”, of the *PSSP Installation and Migration Guide*, GA22-7347.

1. In “**Step 14:** Copy the AIX LPP Images and Other Required AIX LPPs and PTFs”, you do not need the `dce.*` filesets. Continue with the normal installation steps.
2. In “**Step 18:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”, select **k4** and **std** as the authentication methods for remote commands. Issue the `chauthent` command, and use the `lsauthent` command to verify the correct settings.

```
sp3en0 # chauthent -k4 -std
sp3en0 # lsauthent
Kerberos 4
Standard Aix
```

Important

Issuing the `chauthent` command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

3. Go through “**Step 19:** Set Authentication Methods for AIX Remote Commands on the Control Workstation” as described in the *PSSP Installation and Migration Guide*, GA22-7347.

```
sp3en0 # setup_authent
...
```

4. Skip “**Step 20:** Initialize RS/6000 SP Kerberos V4” and go on to “**Step 21:** Configure DCE for the Control Workstation (Required for DCE)”. Select **Compatibility** as the authentication method for SP Trusted Services. Issue the `chauthts` command, and verify the settings with the `lsauthts` command:

```
sp3en0 # chauthts compat
sp3en0 # lsauthts
Compatibility
```

5. Skip “**Step 22:** Set the Authentication Method for SP Trusted Services on the Control Workstation”, and proceed with the normal installation steps, described in the *PSSP 3.2: Installation and Migration Guide*, GA22-7347, to “**Step 39:** Select Security Capabilities Required on Nodes”.

   Issue the `smitty spauth_config` command to get to the “RS/6000 SP Security” SMIT panel; select **Select Security Capabilities Required on Nodes**; insert your system partition name, and specify **k4** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Select Security Capabilities Required on Nodes

            Select Security Capabilities Required on Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* System Partition name                             sp3en0              +
* Authentication  Methods                           k4                  +
```

   Instead of using SMIT, you can use the following command:

   `spsetauth -i -p <syspar> k4`

6. Go on with the installation process described in the *PSSP 3.2: Installation and Migration Guide*, GA22-7347, and skip “**Step 40:** Create DCE Hostnames (Required for DCE)” ,“**Step 41:** Update the SDR with DCE Master Security and CDS Server Hostnames (Required for DCE)”, and

“**Step 42:** Configure Admin Portion of DCE Clients”. Continue with “**Step 43:** Select Authorization Methods for AIX Remote Commands”.

Select **Select Authorization Methods for AIX Remote Commands** from the “RS/6000 SP Security” SMIT panel; insert your system partition name, and specify **k4** as the authorization method:

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

         Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                  [Entry Fields]
* System Partition name                          sp3en0              +
* Authorization Methods                          k4                  +
```

You can also use the following command:

`spsetauth -p <syspar> -d k4`

Do not worry if you get the following output:

```
updauthfiles: Attention! DCE hostname information obtained from SDR for
the CWS is not valid. It will be ignored for the .k5login entry.
```

7. Skip “**Step 44:** Configure SP Trusted Services to Use DCE Authentication (Required for DCE)” and “**Step 45:** Create SP Services DCE Keyfiles (Required for DCE)”, and go on to “**Step 46:** Enable Authentication Methods for AIX Remote Commands”.

   Select **Enable Authentication Methods for AIX Remote Commands** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **no** and the “Force change on nodes” flag to **no**. Select your system partition and specify **k4** and **std** as the authentication methods.

```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for AIX Remote Commands

       Enable Authentication Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                       [Entry Fields]
  Enable on Control Workstation Only                 no                     +
  Force change on nodes                              no                     +
  * You cannot select YES for both entries above.

* System Partition name                              sp3en0                 +
* Authentication  Methods                            k4 std                 +
```

Or use the following command:

```
chauthpar -p <syspar> k4 std
```

8. "**Step 47:** Enable Authentication Methods for SP Trusted Services".

   Select **Enable Authentication Methods for SP Trusted Services** from the "RS/6000 SP Security" SMIT panel. Set the "Enable on Control Workstation Only" flag to **no** and the "Force change on nodes" flag to **no**. Select your system partition, and specify **compat** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for SP Trusted Services

        Enable Authentication Methods for SP Trusted Services

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                       [Entry Fields]
  Enable on Control Workstation Only                 no                     +
  Force change on nodes                              no                     +
  * You cannot select YES for both entries above.

* System Partition name                              sp3en0                 +
  Authentication  Methods                            compat                 +
```

   You can also use the following command:

```
chauthpts -p <syspar> -v compat
```

   Verify the settings of the security state with the `splstdata -p` command. This should result in output similar to that shown in the following screen:

```
sp3en0/ # splstdata -p
List System Partition Information

System Partitions:
------------------
sp3en0

Syspar: sp3en0
-------------------------------------------------------------------------------
syspar_name     sp3en0
ip_address      192.168.3.130
install_image   default
syspar_dir      ""
code_version    PSSP-3.2
haem_cdb_version 20111964,28101999,0
auth_install    k4
auth_root_rcmd  k4
ts_auth_methods compat
auth_methods    k4:std
```

9. Skip “**Step 48:** Start the Key Management Daemon”, and finish the normal installation process as described in the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

4.6 Example 3: Simple DCE cell

In this scenario, we go through the security-related installation steps of the *PSSP Installation and Migration Guide*, GA22-7347, to install the SP system with the DCE security state. As described in Chapter 2, “SP security concepts and terminology” on page 11, this configures Kerberos V5 as the method for authentication as well as authorization for remote commands and SP Trusted Services. The security state for this scenario is shown in Table 8.

Table 8. SP security state of Example 3 (DCE Security; PSSP only)

Scenario	**Security State: DCE**			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
simple DCE cell	dce	dce	dce	k5:std

We configure the DCE Security server and CDS server on the CWS for PSSP authentication only and do not use any other features, such as user management or DFS. This simple DCE cell only contains the SP system with the CWS used as DCE Security Server and CDS Primary Server and all nodes configured as DCE clients. No DCE Security Replica Server or Secondary CDS Server is configured in the cell.

Note

This is a limited DCE environment. Going this route may limit you if you want to expand your cell at a later date. Refer to the *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281, and the other DCE examples for more complex DCE configurations. This DCE configuration is also not recommended if you need a highly-available environment because the CWS is a single point of failure as long as no DCE Security Replica Servers are configured in the DCE cell (see Example 4 and Example 5).

High-level outline for example 3

1. Planning considerations
2. Dealing with mksysb images in a DCE environment
3. Setting up the CWS as DCE server
4. Installation steps

4.6.1 Example 3: Planning considerations

Like most distributed systems, DCE is highly-dependent on the integrity of the underlying network. Before configuring any DCE component, verify that the following are properly configured and functioning correctly:

- Host name settings (hostname)
- Forward and reverse name resolution (nslookup, host, /etc/resolv.conf, /etc/netsvc.conf, and /etc/hosts)
- Network routings (netstat -rn, ping, and traceroute)

Also, verify that your date, time, and timezone settings are correct. DCE is extremely sensitive to time discrepancies.

DCE processes write their data (including core files) into /var/dce. These core files can be quite large. For this reason, we recommend creating a /var/dce filesystem at least 200 MB in size, especially on machines that are DCE servers. However, if you do not have the disk space or are not concerned about preserving DCE core files, you can go with the recommended minimum size of 32 MB.

During the node installation process, PSSP installs and configures a DCE client on each node. Unfortunately, this process does not contain the creation of a separate `/var/dce` filesystem on the nodes. To prevent the use of the root filesystem by the DCE client, you can add the following line to your `script.cust` file:

```
crfs -v jfs -g'rootvg'  -a size='64000' -m /var/dce -A'yes' -p'rw' -t'no'
```

In the following step-by-step-procedure, you will be asked to supply the following:

- A name for your DCE cell
- A name for your DCE cell administrator (typically cell_admin)

For this first scenario, we assume that the SP administrator with root authority will also be the DCE cell administrator. This seems like a fair assumption since the DCE cell exits only within the SP system. In the section following this example, we discuss other scenarios where this assumption may not be true. As explained in the *PSSP Administration Guide*, SA22-7348, you can decide to use other DCE principals that do not need root authorization for SP configuration and monitoring tasks if you want to establish a higher granularity of object protection on your SP system.

4.6.2 Dealing with mksysb images in a DCE environment

You will not be able to use your mksysb images of your nodes to clone new nodes in your system when a DCE client is configured on the node without a few reconfiguration steps in the cloning process because PSSP will not reconfigure the DCE hostname of the new node during installation. For this reason, you must deinstall the DCE client before booting the new node for the first time. You can automate these configurations in the script.cust file as shown in the following screen. This will deinstall the DCE client filesets after the image installation on the new node but before it boots for the first time. This way, the `psspfb_script` will be able to install and configure DCE properly.

```
#
# DCE mksysb image cloning cleanup procedure
#
/usr/lpp/ssp/install/bin/node_number | read NN || NN=-1

case $NN in
9999)   rm -rf /var/dce
        rm -rf /etc/dce
        rm -f /etc/krb5.conf
        rm -rf /var/sysctl
        rm -rf /spdata/sys1/keyfiles
        rm -rf /krb5
        # the rm commands are needed to trick DCE in thinking
        # it is not configured. It will then un-install.
        installp -u dce\* ;;
esac
```

Figure 5. Node cloning procedure entries in script.cust

To install a new node with a mksysb image containing a configured DCE client you must replace the number 9999 in the `case` statement with the new node's node number before you reboot the node for installation. Do not forget to change the number back again after the installation has succeeded. This procedure is not suitable for disaster recovery of the same node or for cloning to an existing node, that was configured in your DCE cell before, because the procedure does not remove the admin part of the DCE client configuration on the DCE server.

To restore a system image of the same node where it was created for disaster recovery reasons do not use this procedure. In this case you can run into problems with DCE when the keyfiles in the mksysb image are out of date. You can restore the keyfiles from your ADSM server to complete your disaster recovery.

To restore a system image on a node that was configured in your DCE cell before this process, you will also have to remove the admin part of the DCE client configuration. Refer to Section 8.12.2, "Unconfigure the node (admin-only)" on page 479, and Section 8.12.3, "Reconfigure the node (admin only)" on page 480, for a step-by-step procedure for the additional actions you must perform.

4.6.3 Setting up the CWS as DCE server

Perform the following steps to set up the CWS as a DCE server:

1. Set the `RPC_UNSUPPORTED_NETIFS` variable to exclude network interfaces that should not be used for DCE traffic by either the control workstation or the

nodes (for example, interfaces on the nodes to which the control workstation has no route):

```
sp3en0/ # export RPC_UNSUPPORTED_NETIFS=tr1:en1:css0
sp3en0/ #
```

Note

DCE does not check for the existence of these network interfaces. Therefore, you can use a common setting for the control workstation and all nodes in your SP system.

2. You may also want to add the `RPC_UNSUPPORTED_NETIFS=tr1:en1:css0` line to the `/etc/environment` file on the control workstation and the nodes:
3. Before installing the DCE filesets, create the DCE related directories, filesystems, and mount points. We recommend that you use separate file systems for the DCE configuration files. A good starting point for the server installation on the CWS can be using the following parameters:
   a. Create filesystem: crfs -v jfs -g'rootvg' -a size='400000' -m /var/dce -A'yes' -p'rw' -t'no'
   b. Mount filesystem: mount -v'jfs' /var/dce
4. Remove any DCE version 2.x filesets from the lppsource directory:

```
sp3en0/ # rm -i /spdata/sys1/install/aix433/lppsource/dce*
...
```

Note

Some DCE Version 2.x filesets are included on the AIX 4.3.3 media. If you copied the entire AIX 4.3.3 distribution into your lppsource directory, you will need to remove the DCE Version 2.x filesets.

5. Copy the DCE version 3.1 filesets into the lppsource directory:

```
sp3en0/ # ls /spdata/sys1/install/aix433/lppsource | grep dce
dce.bundles.3.1.0.0.I
dce.cds.3.1.0.0.I
dce.client.3.1.0.0.I
dce.compat.3.1.0.0.I
dce.doc.en_US.3.1.0.0.I
dce.doc.rte.3.1.0.0.I
dce.msg.Es_ES.3.1.0.0.I
dce.msg.Ja_JP.3.1.0.0.I
dce.msg.Zh_TW.3.1.0.0.I
dce.msg.en_US.3.1.0.0.I
dce.msg.es_ES.3.1.0.0.I
dce.msg.ja_JP.3.1.0.0.I
dce.msg.ko_KR.3.1.0.0.I
dce.msg.zh_TW.3.1.0.0.I
dce.priv.3.1.0.0.I
dce.security.3.1.0.0.I
dce.sysmgmt.3.1.0.0.I
dce.tools.3.1.0.0.I
dce.web.3.1.0.0.I
dce.xdsxom.3.1.0.0.I
```

These filesets are not part of the AIX 4.3.3 distribution. Instead, they can be found on the DCE Version 3.1 distribution media, which is a separately-purchasable product from IBM. If you did not use `bffcreate` or SMIT to copy the files to the lppsource, do not forget to rebuild the `.toc` file in the lppsource directory using the `inutoc` command.

6. Install the DCE filesets on the CWS using the `installp` command or SMIT. Follow normal software installation steps to install the DCE filesets. Table 9 contains the filesets that need to be installed.

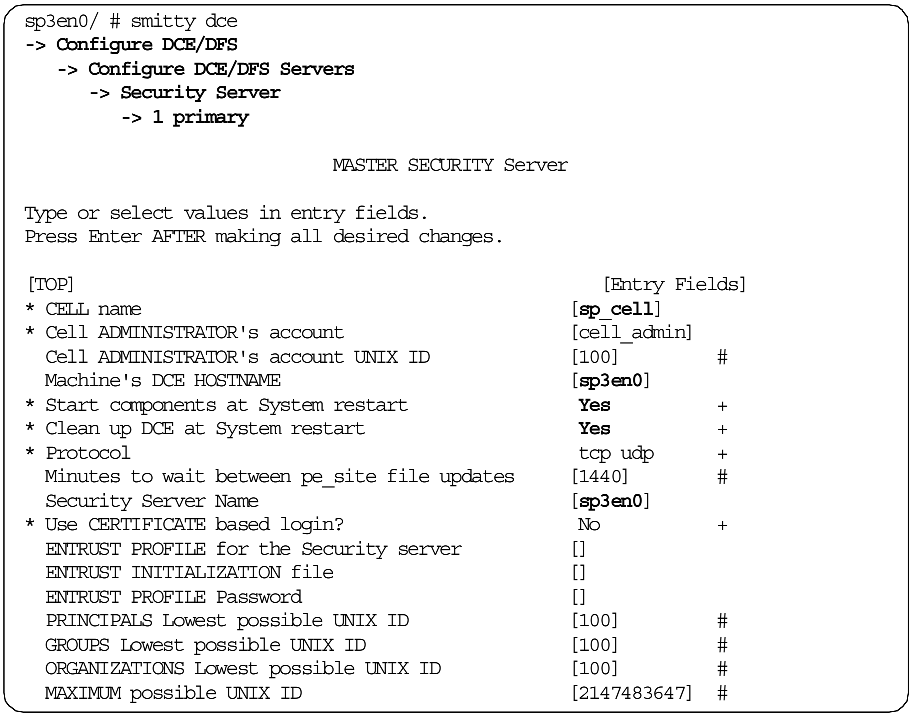
Table 9. DCE filesets to be installed on the CWS (DCE Client and Server)

Fileset	Description
dce.cds	
dce.cds.rte	DCE Cell Directory Services
dce.cds.smit	DCE SMIT Cell Directory Services
dce.client	
dce.client.rte.admin	DCE Client Administrative Tools
dce.client.rte.cds	DCE Client CDS Tools
dce.client.rte.config	DCE Client Configuration Tools
dce.client.rte.rpc	DCE Client RPC Tools
dce.client.rte.security	DCE Client Security Tools

Fileset	Description
dce.client.rte	DCE Client Services
dce.client.core.rte	DCE Client Services - FOR UPGRADES
dce.client.rte.time	DCE Client Time Tools
dce.client.rte.zones	DCE Client Time Zones
dce.client.smit	DCE SMIT Client Tools
dce.client.rte.pthreads	DCE Threads Compatibility Library
dce.client.rte.web	DCE Web Secure
dce.security	
dce.security.smit	DCE SMIT Security Services
dce.security.rte	DCE Security Services
dce.xdsxom	
dce.xdsxom.rte	X.500 API Library

Configure DCE Security and CDS servers after the DCE filesets have been installed. Note that this automatically configures a DCE client.

7. To configure the DCE Security Server, issue, as root, the `smitty dce` command to get to the DCE main SMIT panel, and perform the following sequence of SMIT menu options:



```
sp3en0/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> Security Server
         -> 1 primary

                              MASTER SECURITY Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                  [Entry Fields]
* CELL name                                         [sp_cell]
* Cell ADMINISTRATOR's account                      [cell_admin]
  Cell ADMINISTRATOR's account UNIX ID              [100]        #
  Machine's DCE HOSTNAME                            [sp3en0]
* Start components at System restart                 Yes         +
* Clean up DCE at System restart                     Yes         +
* Protocol                                           tcp udp     +
  Minutes to wait between pe_site file updates      [1440]       #
  Security Server Name                              [sp3en0]
* Use CERTIFICATE based login?                       No          +
  ENTRUST PROFILE for the Security server           []
  ENTRUST INITIALIZATION file                       []
  ENTRUST PROFILE Password                          []
  PRINCIPALS Lowest possible UNIX ID                [100]        #
  GROUPS Lowest possible UNIX ID                    [100]        #
  ORGANIZATIONS Lowest possible UNIX ID             [100]        #
  MAXIMUM possible UNIX ID                          [2147483647] #
```

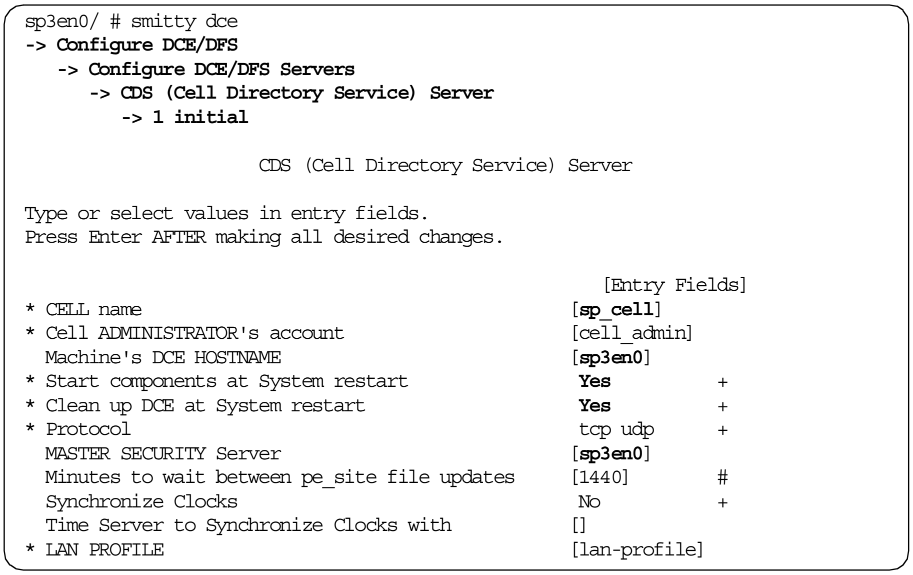
Figure 6. DCE Security Server configuration for example 3

At the "MASTER SECURITY Server" screen, fill in the fields as appropriate. Some conventions are:

- Choose a name for your dce cell in the “CELL name” entry field.
- Do not change the "Cell ADMINISTRATOR's account" data
- Insert the symbolic TCP/IP hostname of the first TCP/IP address that appears after the loopback address when a netstat -i is issued, which, in most cases, should be an en* address, in the “Machine's DCE HOSTNAME” entry field.
- Select **Yes** to “Start components at System restart”
- Select **Yes** to “Clean up DCE at System restart”
- Do not change the "protocol" field
- Use the value specified in the "Machine's DCE HOSTNAME" field as “Security Server Name”. Note the value used, as it will be required during the CDS server configuration process.
- Ignore the remaining fields

Choose a password for the principal `cell_admin`, and enter it when prompted. It will take several minutes to configure.

8. After the Security Server is configured, you have to configure the CDS Server. Issue, as root, the `smitty dce` command to get to the DCE main SMIT panel, and perform the following sequence of SMIT menu options:



```
sp3en0/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> CDS (Cell Directory Service) Server
         -> 1 initial

                      CDS (Cell Directory Service) Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* CELL name                                        [sp_cell]
* Cell ADMINISTRATOR's account                     [cell_admin]
  Machine's DCE HOSTNAME                           [sp3en0]
* Start components at System restart                Yes         +
* Clean up DCE at System restart                    Yes         +
* Protocol                                          tcp udp     +
  MASTER SECURITY Server                           [sp3en0]
  Minutes to wait between pe_site file updates     [1440]       #
  Synchronize Clocks                                No          +
  Time Server to Synchronize Clocks with           []
* LAN PROFILE                                      [lan-profile]
```

Figure 7. CDS Server configuration for example 3

All the fields should be filled in automatically. However, verify that the "MASTER Security Server" field contains the same address that was used in the "Security Server Name" field during the Security Server configuration steps. You will be prompted for your `cell_admin` password again to start the configuration. This will take several minutes to configure.

9. DCE Security and CDS servers should now be configured and running. You can verify this with a few simple commands:

   - Issuing `ps -ef | grep dce` should show at least five daemons:

     - `dced` - The security service client daemon
     - `cdsadv` - CDS part of the client, one per machine
     - `cdsclerk` - Used by `cdsadv`, one or more per machine
     - `cdsd` - The cds process manages the clearinghouse on the CDS server.
     - `secd` - The security server daemon.

```
sp3en0/ # ps -ef | grep dce | grep -v grep
root  9084     1   0 10:15:19      -  0:00 /opt/dcelocal/bin/cdsadv
root 12538  9084   0 10:15:23      -  0:10 /opt/dcelocal/bin/cdsclerk\
-w FATAL:STDOUT:-;FILE:/opt/dcelocal/var/svc/fatal.log -w ERROR:STDOUT:\
-;FILE:/opt/dcelocal/var/svc/error.log -w WARNING:STDOUT:-;FILE:/opt/dcelocal\
/var/svc/warning.log -w NOTICE:DISCARD: -w NOTICE_VERBOSE:DISCARD:
root 12678     1   0 10:15:26      -  0:10 /opt/dcelocal/bin/cdsd -a
root 13876     1   0 10:12:50      -  0:06 /opt/dcelocal/bin/secd -boot\
strap
root 15406     1   0 10:12:40      -  0:03 /opt/dcelocal/bin/dced -b -t 1440
```

- Issuing `klist` prints out all information concerning your DCE identity. Especially the second line (Global Principal:) of the output shows your current global DCE principal.

```
sp3en0/ # klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3en0/self
        Cell:      c2c9bc24-888a-11d3-8bce-02608c2d4a7f /.../sp_cell
        Principal: 00000066-888a-21d3-8b00-02608c2d4a7f hosts/sp3en0/self
        Group:     0000000c-888a-21d3-8b01-02608c2d4a7f none
        Local Groups:
                0000000c-888a-21d3-8b01-02608c2d4a7f none
                0000006b-888a-21d3-b501-02608c2d4a7f subsys/dce/sec-servers
                0000006d-888a-21d3-b501-02608c2d4a7f subsys/dce/dts-servers
...
```

- Issuing the command `cdsli -cworld` prints out the whole CDS namespace of the cell. This information is gathered from the `cdsd` process.

```
sp3en0/ # cdsli -cworld
o p     /.:/cell-profile
o       /.:/fs
o       /.:/lan-profile
o g     /.:/sec
o g     /.:/sec-v1
c       /.:/sp3en0_ch
d       /.:/hosts
d       /.:/hosts/sp3en0
o b     /.:/hosts/sp3en0/cds-clerk
o b     /.:/hosts/sp3en0/cds-server
o b     /.:/hosts/sp3en0/config
o p     /.:/hosts/sp3en0/profile
o b     /.:/hosts/sp3en0/self
...
o b     /.:/subsys/dce/sec/sp3en0
d       /.:/users
```

4.6.4 Example 3: Installation steps

Go through the installation steps provided in Chapter 2, “Installing and Configuring a New RS/6000 SP System”, of the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

1. Proceed with the installation steps as described in the *PSSP Installation and Migration Guide*, GA22-7347, to “**Step 18:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”. Make sure that you have set up your DCE server as described in Section 4.6.3, “Setting up the CWS as DCE server” on page 74.

   Select **k5** and **std** as the authentication methods for remote commands, and use the `chauthent` command. You can verify your settings with the `lsauthent` command.

   ```
   sp3en0/ # chauthent -k5 -std
   sp3en0/ # lsauthent
   Kerberos 5
   Standard Aix
   ```

   Caution

   Issuing the command `chauthent` without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

2. Skip “**Step 19:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”. To continue with “**Step 20:** Initialize RS/6000 SP Kerberos V4”, you must first have a DCE server installed and configured on your system. Refer to the verification section, Section 4.6.3, “Setting up the CWS as DCE server” on page 74, if you are not sure about this.

   Important

   The following installation steps require DCE cell administrator credentials.

   If the DCE server is up and running, log in as the `cell_admin` principal. It is normal to be prompted to change your password the first time you do this. You can reenter the initial password you have chosen when you set up the server.

```
sp3en0/ # dce_login cell_admin
Enter Password:
Password must be changed!
DCE LOGIN SUCCESSFUL
Warning: This account has been marked by an administrator, recommending that the
 password be changed.
Do you wish to change now [y/n]? (y)
Enter New Password:
Re-enter New Password:
PASSWORD SUCCESSFULLY CHANGED
```

Going through “**Step 20.2:** Create DCE Groups, Organizations, Principals and Accounts”, you have to use the `config_spsec` command and enter `cell_admin` for the cell administrator ID . When prompted, enter your password. This must be done using the `cell_admin` principal.

```
sp3en0/ # config_spsec -c -v

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: \
cell_admin
...
```

3. In “**Step 20.3:** Create SP Administrative Principals”, you must add an administrative principal to several DCE access groups. We recommend that you use the `cell_admin` principal as the administrative principal for the rest of the installation in this example. Make sure you are still logged in as `cell_admin`.

```
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin
sp3en0/ # dcecp -c group add sdr-admin -member cell_admin

sp3en0/ # dcecp -c group add hm-admin -member cell_admin

sp3en0/ # dcecp -c group add sdr-system-class-admin -member cell_admin

sp3en0/ # dcecp -c group add spsec-admin -member cell_admin

sp3en0/ # dcecp -c group add hm-control -member cell_admin
```

Later in the installation process, it can be necessary to add additional membership to more access groups, for example, to be authorized to issue switch commands.

> **Important**
>
> The following installation steps require **DCE self-host** credentials.

4. Because the `create_keyfiles` command must be run with the self-host principal in “**Step 20.4:** Create Control Workstation Specific Keyfiles”, log out of your `cell_admin` principal, and issue the `create_keyfiles` command. You can verify your current DCE identity using the `klist` command.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # create_keyfiles -c -v
...
```

5. Go on to “**Step 21:** Configure DCE for the Control Workstation (Required for DCE)”, and select **Kerberos Version 4** as the authentication method for SP Trusted Services. Use the `chauthts` command, and verify the settings with the `lsauthts` command.

```
sp3en0/ # chauthts dce
sp3en0/ # lsauthts
DCE
```

> **Important**
>
> The following installation steps require **SP administrator** (cell_admin) credentials.

6. Because you have changed the DCE credentials of the SP administrative principal `cell_admin` prior to “**Step 22:** Set the Authentication Method for SP Trusted Services on the Control Workstation” you must log in as `cell_admin` again to get the new credentials. You can verify that all access groups are added to your principal with the `klist` command.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep -p Groups
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/cell_admin
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 00000064-9842-21d3-a500-02608c2d4a7f cell_admin
        Group:     0000000c-9842-21d3-a501-02608c2d4a7f none
        Local Groups:
                0000000c-92c2-21d3-a501-0004ac5e69d6 none
                0000006d-92c2-21d3-9d01-0004ac5e69d6 subsys/dce/dts-servers
                00000086-9397-21d3-9d01-0004ac5e69d6 sdr-admin
                00000080-9397-21d3-9d01-0004ac5e69d6 hm-admin
                0000007c-9397-21d3-9d01-0004ac5e69d6 spsec-admin
                00000088-9397-21d3-9d01-0004ac5e69d6 sdr-system-class-admin
                00000081-9397-21d3-9d01-0004ac5e69d6 hm-control
```

7. Continue with the normal installation steps to “**Step 39:** Select Security Capabilities Required on Nodes”.

   Issue the `smitty spauth_config` command to get to the “RS/6000 SP Security” SMIT panel, and select **Select Security Capabilities Required on Nodes**. Insert your system partition name and specify **dce** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Select Security Capabilities Required on Nodes

           Select Security Capabilities Required on Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     [Entry Fields]
* System Partition name                             sp3en0                +
* Authentication  Methods                           dce
```

   You can also use the following command:

   `spsetauth -i -p <syspar> dce`

8. In “**Step 40:** Create DCE Hostnames (Required for DCE)”, the reliable hostname of the nodes are entered as DCE hostname in the SDR. Select **Create DCE hostnames** from the “RS/6000 SP Security” SMIT panel, or use the `create_dcehostname` command.

```
sp3en0/ # smitty spauth_config
-> Create DCE hostnames

create_dcehostname: Checking state of dce ...
create_dcehostname: Reading SDR data...

Obtaining DCE host entries...

Setting DCE hostnames in the SDR...
```

You can verify the creation of the DCE hostnames in the SDR by issuing the `splstdata -n` command.

```
sp3en0/ # splstdata -n
                  List Node Configuration Information

node# frame# slot# slots initial_hostname  reliable_hostname dce_hostname\
default_route   processor_type processors_installed \
description
----- ------ ----- ----- ----------------- ----------------- \
----------------- --------------- -------------- -------------------- \
---------------
    1      1     1     4 sp3n01            sp3n01            sp3n01 \
           192.168.3.130   MP                                1 \
""
    5      1     5     1 sp3n05            sp3n05            sp3n05 \
           192.168.3.130   UP                                1 \
""
...
```

9. To insert the DCE and CDS server hostnames in the SDR, go to “**Step 41:** Update the SDR with DCE Master Security and CDS Server Hostnames (Required for DCE)”, and select **Update SDR with DCE Master Security and CDS Server Hostnames** from the “RS/6000 SP Security” SMIT panel. Insert the hostname of the DCE Master Security server and the Primary CDS server in the appropriate entry fields.

```
sp3en0/ # smitty spauth_config
-> Update SDR with DCE Master Security and CDS Server Hostnames

          Update SDR with DCE Master Security and CDS Server Hostnames

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
  Master Security Server hostname                  [sp3en0]
  CDS Server hostname                              [sp3en0]
```

Or use the following command:

```
setupdce -v -u -s <master_security_server> -d <initial_cds_server>
```

You can verify the settings in the SDR with the `splstdata -e` command.

```
sp3en0/ # splstdata -e
...
sec_master               sp3en0
cds_server               sp3en0
cell_name                /.../sp_cell
...
```

10. In “**Step 42:** Configure Admin Portion of DCE Clients”, you create the needed DCE security and CDS entries for the SP nodes. Select **Configure DCE Clients (Admin portion)** from the “RS/6000 SP Security” SMIT panel, and enter `cell_admin` as the administrator ID and “`/.:/lan-profile`” as the profile ID.

```
sp3en0/ # smitty spauth_config
-> Configure DCE Clients (Admin portion)

                 Configure DCE Clients (Admin portion)

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     [Entry Fields]
  Cell Administrator id                              [cell_admin]
  Lan Profile id                                     [/.:/lan-profile]
```

Instead of using SMIT, you can use the following command:

```
setupdce -c cell_admin -l /.:/lan-profile
```

Important

The next installation step requires the DCE cell administrator password.

When you are prompted, enter the password for the cell_admin principal. After the configuration of all your DCE hosts has ended successfully, you can verify the creation of the entries with the `dcecp -c cell show` command.

```
sp3en0/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/sp3en0}
{cdsservers
 /.../sp_cell/hosts/sp3en0}
{dtsservers}
{hosts
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n01
...
/.../sp_cell/hosts/sp3n15}
```

This commands provides a view of all defined hosts in a DCE cell. You should now see all your SP nodes including the CWS in the output.

11. Go on with “**Step 43:** Select Authorization Methods for AIX Remote Commands”, and issue the `smitty spauth_config` command to get to the SMIT security menu. Select **Select Authorization Methods for AIX Remote Commands**. In the next panel, insert your system partition name, and specify **dce** and **std** as the authorization methods.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

         Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                          [Entry Fields]
* System Partition name                                 sp3en0              +
* Authorization Methods                                 dce std                +
```

Or use the following command:

```
spsetauth -d -p <syspar> dce std
```

Note

You need to use the two methods, `dce` and `std`, at this point because you must have at least one common method defined for the system partition and the remote commands. Since we have not yet changed the authentication method for the partition, it is still set to `std`. At a later time, we will change these methods to only use `dce`.

12. In “**Step 44:** Configure SP Trusted Services to Use DCE Authentication (Required for DCE)”, select **Configure SP Trusted Services to use DCE Authentication** from the “RS/6000 SP Security” SMIT panel, and enter `y`

when prompted. Then, enter `cell_admin` as the administrator ID and the password when required.

```
sp3en0/ # smitty spauth_config
-> Configure SP Trusted Services to use DCE Authentication

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: cell_admin

Adding cell administrator id to group spsec-admin ...
Creating org - spsec-services ...
Creating group - spsec-services ...
Running "create_accts_on_cws" subroutine ...

Your cell administrator password is required to create accounts.
Please enter your cell administrator password:
...
```

Instead of using SMIT, you can use the following command:

```
config_spsec -v
```

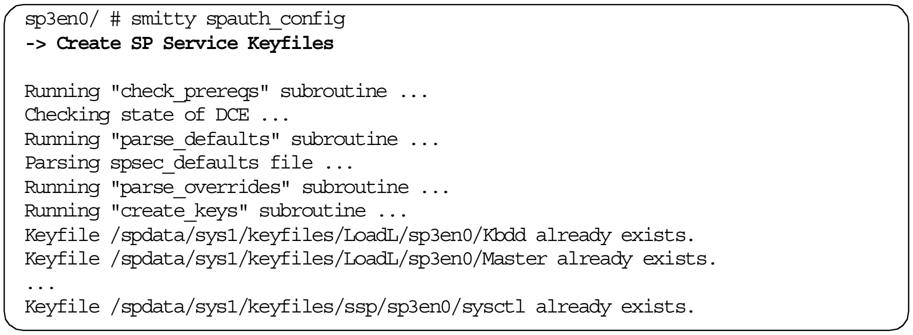
Important

The following installation step requires DCE self-host credentials.

13. To continue with “**Step 45:** Create SP Services DCE Keyfiles (Required for DCE)”, you must exit your `cell_admin` principal. This step has to be done with the self-host principal.

```
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
```

When you run “Create SP Services Keyfiles” from the “RS/6000 SP Security” SMIT panel, you should get an output, such as the one shown in the next screen:



```
sp3en0/ # smitty spauth_config
-> Create SP Service Keyfiles

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_keys" subroutine ...
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Kbdd already exists.
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Master already exists.
...
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/sysctl already exists.
```

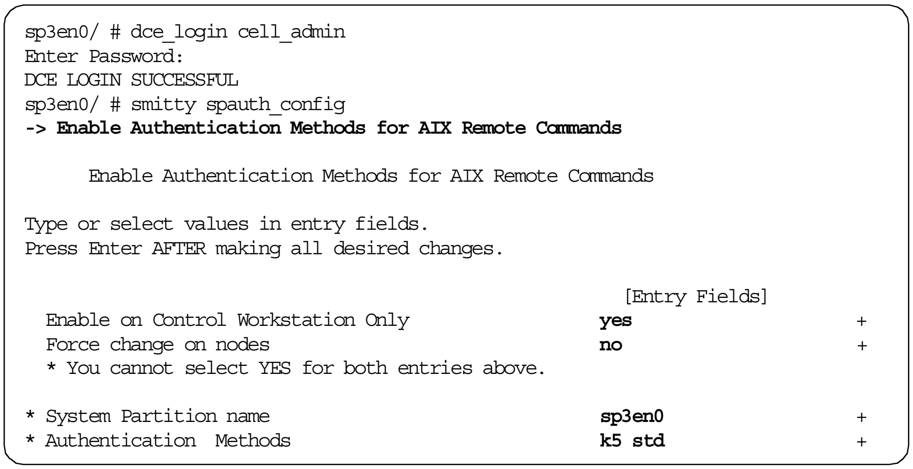
You can also use the following command:

```
create_keyfiles -v
```

Important

The remaining installation steps require SP administrator (cell_admin) credentials.

14. In "**Step 46:** Enable Authentication Methods for AIX Remote Commands", log in as `cell_admin` again to have the right credentials to change attributes of the SDR. Then, issue the `smitty spauth_config` command, and select **Enable Authentication Methods for AIX Remote Commands** from the "RS/6000 SP Security" SMIT panel. Set the "Enable on Control Workstation Only" flag to **yes** and the "Force change on nodes" flag to **no**. Select your system partition, and set **k5** and **std** as the authentication methods.

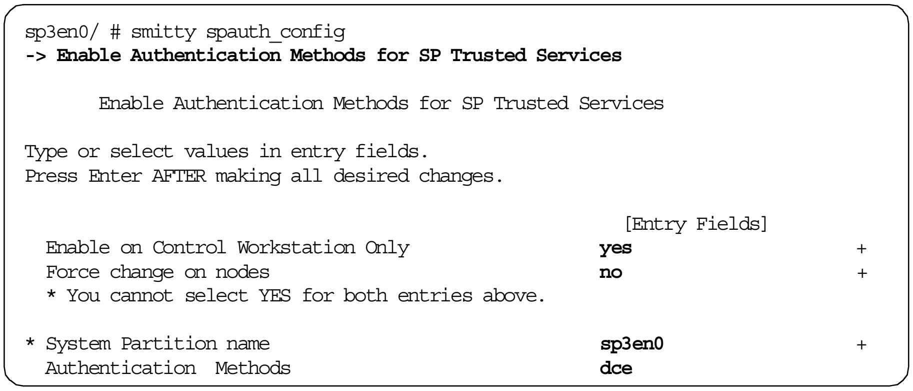


```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for AIX Remote Commands

      Enable Authentication Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  Enable on Control Workstation Only               yes               +
  Force change on nodes                            no                +
  * You cannot select YES for both entries above.

* System Partition name                            sp3en0            +
* Authentication  Methods                          k5 std            +
```

Instead of using SMIT, you can use the following command:

```
chauthpar -c -p <syspar> k5 std
```

15. In “**Step 47:** Enable Authentication Methods for SP Trusted Services”, you do this by selecting **Enable Authentication Methods for SP Trusted Services** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes** and the “Force change on nodes” flag to **no**. Select your system partition and **dce** as the authentication methods.



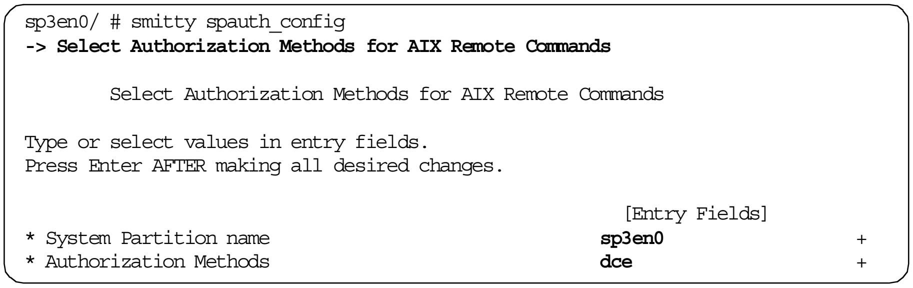
```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for SP Trusted Services

       Enable Authentication Methods for SP Trusted Services

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
  Enable on Control Workstation Only                  yes                   +
  Force change on nodes                               no                    +
  * You cannot select YES for both entries above.

* System Partition name                               sp3en0                +
  Authentication  Methods                             dce
```

You can also use the following command:

```
chauthpts -c -p <syspar> dce
```

This can take several minutes.

16. You can now change the authorization methods for the AIX remote commands to only use dce (remember Step 11 of this procedure). Issue the `smitty spauth_config` command to get to the SMIT security menu, and select **Select Authorization Methods for AIX Remote Commands**. In the next panel, insert your system partition name, and specify **dce** as the authorization method.



```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

        Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
* System Partition name                               sp3en0                +
* Authorization Methods                               dce                   +
```

You can also use the following command:

```
spsetauth -d -p <syspar> dce
```

Verify your SRD settings with the `splstdata -p` command.

```
sp3en0/ # splstdata -p
List System Partition Information

System Partitions:
------------------
sp3en0

Syspar: sp3en0
-------------------------------------------------------------------------------
syspar_name     sp3en0
ip_address      192.168.3.130
install_image   default
syspar_dir      ""
code_version    PSSP-3.2
haem_cdb_version 20111964,28101999,0
auth_install    dce
auth_root_rcmd  dce
ts_auth_methods dce
auth_methods    k5:std
```

17. In “**Step 48:** Start the Key Management Daemon”, use the `spnkeyman_start` command to start the key management daemon on the CWS. You can verify that the daemon is running with the `lssrc` or `ps` command.

```
sp3en0/ # spnkeyman_start
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 2068.
sp3en0/ # lssrc -a | grep key
 spnkeyman                         2068    active
sp3en0/ # ps -ef | grep key | grep -v grep
    root  2068  4170   0 14:30:29      -  0:02 /usr/lpp/ssp/bin/\
spnkeymand
sp3en0/ #
```

18. Finish the configuration of the CWS and the installation of the nodes following the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

    After the successful NIM installation of the nodes, the `psspfb_script` runs the `spauthconfig` command on each node. This script installs and configures all needed DCE filesets automatically. Then, you can see the LED u95 during installation on the 3-digit display.

4.7 Example 4: Advanced DCE cell

In this scenario, we go through the security-related installation steps of the *PSSP Installation and Migration Guide*, GA22-7347, for a new installation. We install the SP system with the DCE security state. For more information on this security state, see Chapter 2, “SP security concepts and terminology” on page 11. As described there, this security state uses Kerberos V5 as the method for authentication and authorization for remote commands and SP Trusted Services. The security state for this scenario is shown in Table 10.

Table 10. SP security state of Example 4 (DCE Security - full DCE cell)

Scenario	**Security State: DCE**			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
advanced DCE cell	`dce`	`dce`	`dce`	`k5:std`

We will configure the CWS as DCE Security Master Server and Primary CDS Server. To improve high availability, we will add a DCE Security Replica Server and a Secondary CDS Server on an SP node. For installation and configuration tasks, we will add an SP administrator principal to the DCE cell.

High-level outline for example 4

1. Planning considerations
2. Adding the SP administrator DCE principal to the DCE cell
3. Installation steps
4. Setting up a Secondary CDS server on a node
5. Setting up a DCE Security Replica server an a node

4.7.1 Example 4: Planning considerations

Refer to “Example 3: Planning considerations” on page 72 for the basic planning issues that need to be considered when installing an SP system to use the DCE security state.

In this example, we add a special SP administrator DCE principal, called sp_admin, to the DCE cell for installation and administration tasks on the SP system.

Recall from Section 3.3, “The concept of a DCE cell” on page 25, that DCE servers, especially Security servers, should be configured to not allow end-user access, and they should be secured with stringent physical access controls. If the security registry is compromised, your entire DCE cell is compromised. For this reason, it is not recommended to install any DCE server on a node or the CWS. Refer to Section 4.8, “Example 5: Existing DCE cell” on page 112, for an appropriate configuration.

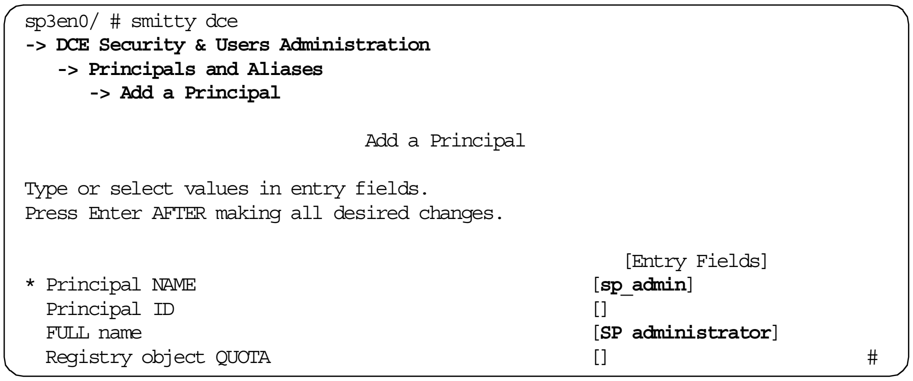
Nevertheless, we will install a DCE Security Replica server and a Secondary CDS server on an SP node for high availability and performance reasons. You are free to choose a system for the DCE Security Master server and the Primary CDS server. If you decide to use the CWS, go to Section 4.6.3, “Setting up the CWS as DCE server” on page 74, for information about how to set up the CWS as a DCE server. If you like to use a system that is external to the SP, see Section 4.8.2, “Setting up a DCE client on the CWS” on page 114.

Also see Section 4.6.2, “Dealing with mksysb images in a DCE environment” on page 73, to learn how to work with the mksysb images of your SP nodes.

4.7.2 Adding the SP administrator DCE principal to the DCE cell

The following installation steps require *DCE cell administrator* credentials.

1. As cell administrator on any DCE client node, issue `smitty dce` to get to the DCE main SMIT panel, and perform the sequence of SMIT menu options shown in Figure 8 on page 93.



```
sp3en0/ # smitty dce
-> DCE Security & Users Administration
   -> Principals and Aliases
      -> Add a Principal

                                Add a Principal

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                   [Entry Fields]
* Principal NAME                                [sp_admin]
  Principal ID                                  []
  FULL name                                     [SP administrator]
  Registry object QUOTA                         []                  #
```

Figure 8. SP administrator principal configuration for example 4

On the “Local DCE/DFS Client Configuration” SMIT panel, use the following conventions:

   a. Insert `sp_admin` as “Principal Name”.

   b. Insert a description for this principal in the “FULL name” entry field, for example, **SP administrator**.

2. To add an account to this principal, issue `smitty dce` to get to the DCE main SMIT panel, and perform the sequence of SMIT menu options shown in Figure 9 on page 94.

```
sp3en0/ # smitty dce
-> DCE Security & Users Administration
   -> Accounts
      -> Add an Account
         -> 1 user

                                 Add an Account

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* PRINCIPAL to create account for                   [sp_admin]           +
* LOGIN user?                                        Yes                 +
* GROUP to associate with this account              [none]               +
* ORGANIZATION to associate with this account       [none]               +
  HOME directory                                    [/]
  Initial PROGRAM                                   []
  ACCOUNT information                               []
* Require user to CHANGE PASSWORD on first login?    Yes                 +
  Allow account to be a SERVER principal?            Yes                 +
  Allow account to be a CLIENT principal?            Yes                 +
  Maximum ticket LIFETIME (+dd-hh:mm:ss)            [+1-00:00:00]
  Maximum ticket RENEWABLE lifetime (+dd-hh:mm:ss)  [+28-00:00:00]
  EXPIRATION date (YYYY-MM-DD-hh:mm:ss)             [none]
  GOOD SINCE date (YYYY-MM-DD-hh:mm:ss)             []

Enter Account Password:
Again:
Enter Your Password:
```

Figure 9. SP administrator account configuration for example 4

On the “Add an Account” SMIT panel, use the following conventions:

- Insert `sp_admin` as the “Principal Name”.
- Select **Yes** in the “LOGIN user?” entry field.
- Select **none** in the “GROUP to associate with this account “ entry field.
- Select **none** in the “ORGANIZATION to associate with this account “ entry field.

3. You can verify the process using the `dce_login` and `klist` commands:

```
sp3en0/ # exit
sp3en0/ # dce_login sp_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/sp_admin
```

Note

In our configuration, you cannot run any remote commands with the SP administrator principal. You need the self-host principal for these tasks (for example to run setup_server).

4.7.3 Example 4: Installation steps

Go through the installation steps provided in Chapter 2, “Installing and Configuring a New RS/6000 SP System”, of the *PSSP Installation and Migration Guide*, GA22-7347.

1. Proceed with the installation steps as described in the *PSSP Installation and Migration Guide*, GA22-7347, up to “**Step 18:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”. Make sure that you have set up your DCE server as described in Section 4.6.3, “Setting up the CWS as DCE server” on page 74.

   Select **k5** and **std** as the authentication methods for remote commands, and use the `chauthent` command. You can verify your settings with the `lsauthent` command:

   ```
   sp3en0/ # chauthent -k5 -std
   sp3en0/ # lsauthent
   Kerberos 5
   Standard Aix
   ```

   Important

   Issuing the `chauthent` command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

2. Skip “**Step 19:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”, and go to “**Step 20:** Initialize RS/6000 SP Kerberos V4”. You need to have a DCE server installed and configured on your system before you can go on. If you are not sure about this, refer to the verification section, Section 4.6.3, “Setting up the CWS as DCE server” on page 74.

   Important

   The following installation steps require DCE cell administrator credentials.

If the DCE server is up and running, log in as the `cell_admin` principal. Since it is normally the first time you do this, you are prompted to change your password. You can reenter the initial password you have chosen when you set up the server.

```
sp3en0/ # dce_login cell_admin
Enter Password:
Password must be changed!
DCE LOGIN SUCCESSFUL
Warning: This account has been marked by an administrator, recommending that the
 password be changed.
Do you wish to change now [y/n]? (y)
Enter New Password:
Re-enter New Password:
PASSWORD SUCCESSFULLY CHANGED
```

Going through "**Step 20.2:** Create DCE Groups, Organizations, Principals and Accounts", you have to use the `config_spsec` command and enter `cell_admin` as the cell administrator ID. When prompted, enter your password. This must be done using the `cell_admin` principal.

```
sp3en0/ # config_spsec -c -v

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: \
cell_admin
...
```

3. In "**Step 20.3:** Create SP Administrative Principals", you must add an administrative principal to several DCE access groups. We recommend that you use the sp_admin principal, which you added in Section 4.7.2, "Adding the SP administrator DCE principal to the DCE cell" on page 93, on the CWS as the administrative principal for the rest of the installation.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # dcecp -c group add sdr-admin -member sp_admin

sp3en0/ # dcecp -c group add hm-admin -member sp_admin

sp3en0/ # dcecp -c group add sdr-system-class-admin -member sp_admin

sp3en0/ # dcecp -c group add spsec-admin -member sp_admin

sp3en0/ # dcecp -c group add hm-control -member sp_admin
```

Later, in the installation process and for administrative tasks, it might be necessary to add membership to more access groups, for example, to be authorized to issue switch commands.

Important

The following installation steps require DCE self-host credentials.

4. Because the `create_keyfiles` command must be run with the self-host principal in “**Step 20.4:** Create Control Workstation Specific Keyfiles”, log out of your cell_admin principal, and issue the `create_keyfiles` command. You can verify your current DCE identity using the `klist` command.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # create_keyfiles -c -v
...
```

5. Go on to “**Step 21:** Configure DCE for the Control Workstation (Required for DCE)”, and select **Kerberos Version 4** as the authentication method for SP Trusted Services. Use the `chauthts` command, and verify the settings with the `lsauthts` command.

```
sp3en0/ # chauthts dce
sp3en0/ # lsauthts
DCE
```

Important

The following installation steps require SP administrator (sp_admin) credentials.

6. Because you have changed the DCE credentials of the SP administrative principal, sp_admin, prior to “**Step 22:** Set the Authentication Method for SP Trusted Services on the Control Workstation”, you must log in as `sp_admin` to get the new credentials. You can verify that all access groups are added to your principal with the `klist` command.

```
sp3en0/ # dce_login sp_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep -p Groups
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/sp_admin
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 0000007f-984e-21d3-9200-02608c2d4a7f sp_admin
        Group:     0000000c-9842-21d3-a501-02608c2d4a7f none
        Local Groups:
                0000000c-9842-21d3-a501-02608c2d4a7f none
                00000086-9844-21d3-9201-02608c2d4a7f sdr-admin
                00000080-9844-21d3-9201-02608c2d4a7f hm-admin
                00000088-9844-21d3-9201-02608c2d4a7f sdr-system-class-admin
                0000007c-9844-21d3-9201-02608c2d4a7f spsec-admin
                00000081-9844-21d3-9201-02608c2d4a7f hm-control
```

7. Continue with the normal installation steps to “**Step 39:** Select Security Capabilities Required on Nodes”.

   Issue the `smitty spauth_config` command to get to the “RS/6000 SP Security” SMIT panel, and select **Select Security Capabilities Required on Nodes**. Insert your system partition name, and specify **dce** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Select Security Capabilities Required on Nodes

           Select Security Capabilities Required on Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     [Entry Fields]
* System Partition name                             sp3en0             +
* Authentication  Methods                           dce
```

   You can also use the following command:

```
spsetauth -i -p <syspar> dce
```

8. In “**Step 40:** Create DCE Hostnames (Required for DCE)”, the reliable hostname of the nodes are entered as DCE hostname in the SDR. Select **Create DCE hostnames** from the “RS/6000 SP Security” SMIT panel, or use the `create_dcehostname` command:

```
sp3en0/ # smitty spauth_config
-> Create DCE hostnames

create_dcehostname: Checking state of dce ...
create_dcehostname: Reading SDR data...

Obtaining DCE host entries...

Setting DCE hostnames in the SDR...
```

You can verify the creation of the DCE hostnames in the SDR by issuing the `splstdata -n` command.

```
sp3en0/ # splstdata -n
                  List Node Configuration Information

node# frame# slot# slots initial_hostname  reliable_hostname dce_hostname\
default_route   processor_type processors_installed \
description
----- ------ ----- ----- ----------------- ----------------- \
----------------- --------------- -------------- -------------------- \
---------------
    1      1     1     4 sp3n01            sp3n01            sp3n01 \
       192.168.3.130   MP                                    1 \
""
    5      1     5     1 sp3n05            sp3n05            sp3n05 \
       192.168.3.130   UP                                    1 \
""
...
```

9. To insert the DCE and CDS server hostnames in the SDR, go to “**Step 41:** Update the SDR with DCE Master Security and CDS Server Hostnames (Required for DCE)”, and select **Update SDR with DCE Master Security and CDS Server Hostnames** from the “RS/6000 SP Security” SMIT panel. Insert the hostname of the DCE Master Security server and the Primary CDS server in the appropriate entry fields.

```
sp3en0/ # smitty spauth_config
-> Update SDR with DCE Master Security and CDS Server Hostnames

          Update SDR with DCE Master Security and CDS Server Hostnames

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
  Master Security Server hostname                    [sp3en0]
  CDS Server hostname                                [sp3en0]
```

Or use the following command:

```
setupdce -v -u -s <master_security_server> -d <initial_cds_server>
```

You can verify the settings in the SDR with the `splstdata -e` command:

```
sp3en0/ # splstdata -e
...
sec_master              sp3en0
cds_server              sp3en0
cell_name               /.../sp_cell
...
```

10.In “**Step 42:** Configure Admin Portion of DCE Clients”, you create the necessary DCE security and CDS entries for the SP nodes. Select **Configure DCE Clients (Admin portion)** from the “RS/6000 SP Security” SMIT panel, and enter `cell_admin` as the cell administrator ID and `/.:/lan-profile` as the profile ID.

```
sp3en0/ # smitty spauth_config
-> Configure DCE Clients (Admin portion)

                 Configure DCE Clients (Admin portion)

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     [Entry Fields]
  Cell Administrator id                              [cell_admin]
  Lan Profile id                                     [/.:/lan-profile]
```

Instead of using SMIT, you can use the following command:

```
setupdce -c cell_admin -l /.:/lan-profile
```

Important

The next installation step requires the DCE cell administrator password.

When you are prompted, enter the password for the `cell_admin` principal. After the configuration of all your DCE hosts has ended successfully, you can verify the creation of the entries with the `dcecp -c cell show` command:

```
sp3en0/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/sp3en0}
{cdsservers
 /.../sp_cell/hosts/sp3en0}
{dtsservers}
{hosts
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n01
...
/.../sp_cell/hosts/sp3n15}
```

This command provides a view of all defined hosts in a DCE cell. You should now see all your SP nodes including the CWS in the output.

11.Go to “**Step 43:** Select Authorization Methods for AIX Remote Commands”, and issue the `smitty spauth_config` command to get to the SMIT security menu. Select **Select Authorization Methods for AIX Remote Commands**. In the next panel, insert your system partition name and specify **dce** and **std** as the authorization methods.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

         Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
* System Partition name                           sp3en0              +
* Authorization Methods                           dce std                +
```

Or use the following command:

```
spsetauth -d -p <syspar> dce std
```

Note

You need to use the two methods, `dce` and `std`, at this point because you must have at least one common method defined for the system partition and the remote commands. Since we have not yet changed the authentication method for the partition, it is still set to `std`. Later, we will change these methods to only use `dce`.

Important

The following installation step requires DCE cell administrator credentials.

12. In “**Step 44:** Configure SP Trusted Services to Use DCE Authentication (Required for DCE)”, select **Configure SP Trusted Services to use DCE Authentication** from the “RS/6000 SP Security” SMIT panel and enter `y` when prompted. Then, type in your administrator ID and the password when required.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # smitty spauth_config
-> Configure SP Trusted Services to use DCE Authentication

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: \
cell_admin

Adding cell administrator id to group spsec-admin ...
Creating org - spsec-services ...
Creating group - spsec-services ...
Running "create_accts_on_cws" subroutine ...

Your cell administrator password is required to create accounts.
Please enter your cell administrator password:
...
```

Instead of using SMIT, you can use the following command:

`config_spsec -v`

Important

The following installation step requires DCE self-host credentials.

13. To continue with “**Step 45:** Create SP Services DCE Keyfiles (Required for DCE)”, you must exit your cell administrator principal. This step has to be done as the self-host principal.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
```

When you run “Create SP Services Keyfiles” from the “RS/6000 SP Security” SMIT panel, you should get an output, such as the one shown in the next screen:

```
sp3en0/ # smitty spauth_config
-> Create SP Services Keyfiles

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_keys" subroutine ...
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Kbdd already exists.
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Master already exists.
...
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/sysctl already exists.
```

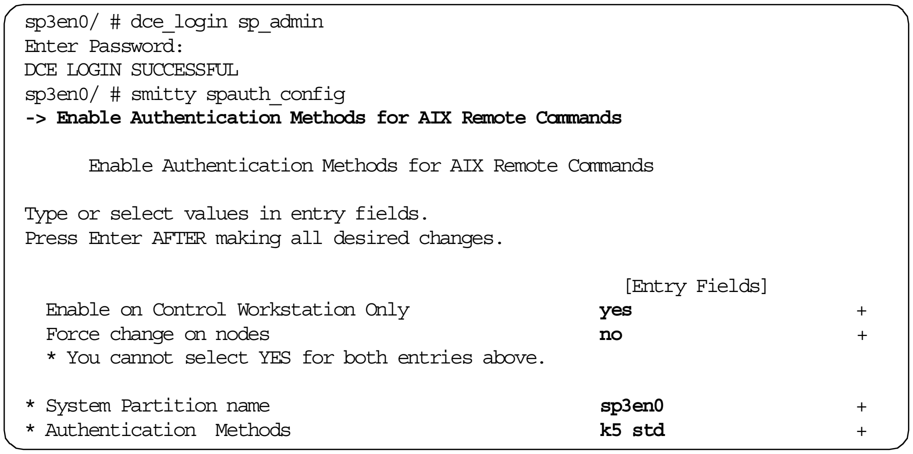
You can also use the following command:

```
create_keyfiles -v
```

Important

The remaining installation steps require SP administrator (sp_admin) credentials.

14. In “**Step 46:** Enable Authentication Methods for AIX Remote Commands”, log in as `sp_admin` again to have the right credentials to change attributes of the SDR. Then, issue `smitty spauth_config`, and select **Enable Authentication Methods for AIX Remote Commands** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes** and the “Force change on nodes” flag to **no**. Select your system partition, and specify **k5** and **std** as the authentication methods.

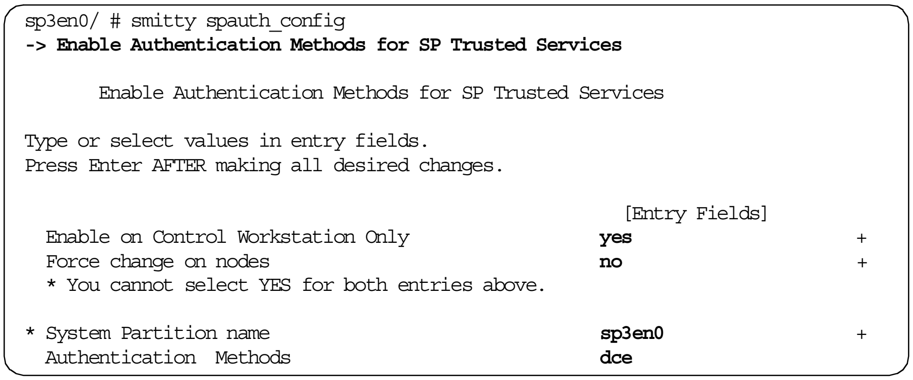


```
sp3en0/ # dce_login sp_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for AIX Remote Commands

      Enable Authentication Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  Enable on Control Workstation Only              yes               +
  Force change on nodes                           no                +
  * You cannot select YES for both entries above.

* System Partition name                           sp3en0            +
* Authentication  Methods                         k5 std            +
```

Instead of using SMIT, you can use the following command:

```
chauthpar -c -p <syspar> k5 std
```

15. In “**Step 47:** Enable Authentication Methods for SP Trusted Services”, you do this by selecting **Enable Authentication Methods for SP Trusted Services** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes** and the “Force change on nodes” flag to **no**. Select your system partition and specify **dce** as the authentication method.



```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for SP Trusted Services

       Enable Authentication Methods for SP Trusted Services

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  Enable on Control Workstation Only              yes               +
  Force change on nodes                           no                +
  * You cannot select YES for both entries above.

* System Partition name                           sp3en0            +
  Authentication  Methods                         dce
```

You can also use the following command:

```
chauthpts -c -p <syspar> dce
```

This can take several minutes.

16. You can now change the authorization methods for the AIX remote commands to only use `dce` (remember step 11 of this procedure). Issue

the smitty spauth_config command to get to the SMIT security menu, and select **Select Authorization Methods for AIX Remote Commands**. In the next panel, insert your system partition name, and specify **dce** as the authorization method.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

        Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                       [Entry Fields]
* System Partition name                               sp3en0              +
* Authorization Methods                               dce                 +
```

You can also use the following command:

```
spsetauth -d -p <syspar> dce
```

Verify your SDR settings with the splstdata -p command.

```
sp3en0/ # splstdata -p
List System Partition Information

System Partitions:
------------------
sp3en0

Syspar: sp3en0
-------------------------------------------------------------------------------
syspar_name     sp3en0
ip_address      192.168.3.130
install_image   default
syspar_dir      ""
code_version    PSSP-3.2
haem_cdb_version 940617228,332373504,0
auth_install    dce
auth_root_rcmd  dce
ts_auth_methods dce
auth_methods    k5:std
```

17. In “**Step 48:** Start the Key Management Daemon”, use the spnkeyman_start command to start the key management daemon on the CWS. You can verify that the daemon is running with the lssrc or ps command.

```
sp3en0/ # spnkeyman_start
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 2068.
sp3en0/ # lssrc -a | grep key
 spnkeyman                        2068    active
sp3en0/ # ps -ef | grep key | grep -v grep
    root  2068  4170   0 14:30:29      -  0:02 /usr/lpp/ssp/bin/\
spnkeymand
sp3en0/ #
```

18. Finish the configuration of the CWS and the installation of the nodes following the *PSSP Installation and Migration Guide*, GA22-7347.

    After the successful NIM installation of the nodes, the `psspfb_script` runs the `spauthconfig` command on each node. This script installs and configures all needed DCE filesets automatically. Then, you can see the LED u95 during installation on the 3-digit display.

4.7.4 Setting up a secondary CDS server on a node

Perform the following steps to set up a secondary CDS server on a node:

1. As root, on the Secondary CDS Server node, issue `smitty dce` to get to the DCE main SMIT panel, and perform the following sequence of SMIT menu options:

```
sp3en0/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> CDS (Cell Directory Service) Server
         -> 2 additional

CDS (Cell Directory Service) Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                   [Entry Fields]
* CELL name                                     [sp_cell]
* Cell ADMINISTRATOR's account                  [cell_admin]
  Machine's DCE HOSTNAME                        [sp3n05]
* Start components at System restart             Yes                +
* Clean up DCE at System restart                 Yes                +
* Protocol                                       tcp udp            +
  MASTER SECURITY Server                        [sp3en0]
  Minutes to wait between pe_site file updates. [1440]               #
  Other CDS Server (If in a separate network)   [sp3en0]
  List of additional CDS Servers                []
  Synchronize Clocks                             No                 +
  Time Server to Synchronize Clocks with        []
* LAN PROFILE                                   [lan-profile]
```

Figure 10. Secondary CDS Server configuration for example 4

Make sure that all entry fields match your configuration (especially the “Machine’s DCE HOSTNAME” and the “MASTER SECURITY Server” fields) before you start the configuration.

When prompted, enter the password for your cell administrator, cell_admin. You should get the following output:

```
...
Component Summary for Host: sp3n05
           Component                  Configuration State   Running State
Security client                           Configured           Running
RPC                                       Configured           Running
Directory client                          Configured           Running
Additional Directory server               Configured           Running

The component summary is complete.
Configuration of DCE Host, sp3n05, was successful.

Configuration completed successfully.
```

2. Verify the configuration with the `dcecp -c cell show` command:

```
sp3n05/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/sp3en0}
{cdsservers
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n05}
{dtsservers}
{hosts
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n01
 /.../sp_cell/hosts/sp3n05
...
```

To make sure that all necessary daemons are running, you can use the `ps` command. Here, you should see the `cdsd` daemon running on the node:

```
sp3n05/ # ps -ef | grep dce | grep -v grep
    root  4914     1   0   Oct 29      -  1:09 /opt/dcelocal/bin/dced -b \
-t 1440
    root 19196 21152   0 14:02:55      -  0:08 /opt/dcelocal/bin/cdsclerk \
-w FATAL:STDOUT:-;FILE:/opt/dcelocal/var/svc/fatal.log -w ERROR:STDOUT\
:-;FILE:/opt/dcelocal/var/svc/error.log -w WARNING:STDOUT:-;FILE:\
/opt/dcelocal/var/svc/warning.log -w NOTICE:DISCARD: -w NOTICE_VERBOSE:\
DISCARD:
    root 20544     1   0 14:31:16      -  0:01 /opt/dcelocal/bin/cdsd
    root 21152     1   0   Oct 29      -  0:03 /opt/dcelocal/bin/cdsadv
```

3. Unfortunately, this process only replicates the /.:/subsys/dce/sec directory of the DCE namespace and not the whole namespace into the new Secondary CDS Server. Nevertheless, since this directory contains the

binding information to locate the master security server, this replication increases accessibility to the security server even when the initial CDS Server is unavailable.

To replicate the whole DCE namespace into the Secondary CDS Server you can use the following script:

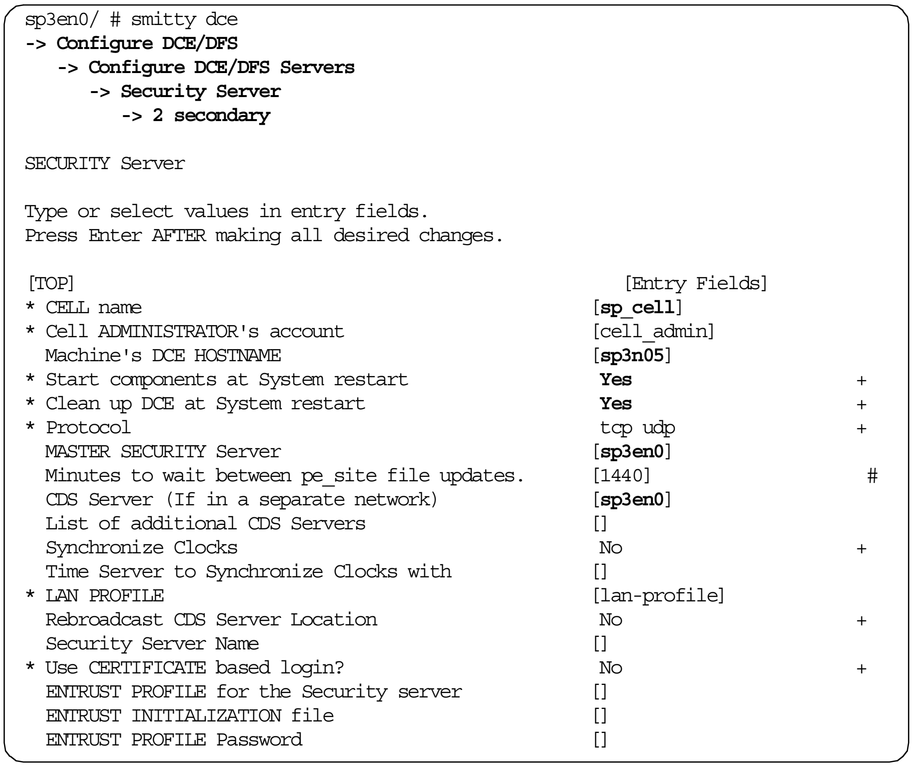
```
#!/bin/ksh
# /usr/local/bin/cds-replicate.ksh
# Replicate all cds directories in master cds
# to all cds clearinghouse replicas configured
# in the cell.

function list_chouses
{
 cdscp show cell | awk 'BEGIN { ch_name_found=nil; i = 0}
  /Clearinghouse Name/ { ch_name[i]=$4; ch_name_found=t }
  /Replica Type/       { ch_type[i]=$4; ch_name_found=nil; i++ }
  END { for (j=0; j<i; j++) {
        printf ("%s %s\n", ch_name[j], ch_type[j])
      } }'
}

function list_dirs
{
 # root directory
 print "/.:"
 # all other directories
 cdsli -r
}

function replicate_dir
{
 typeset dir=$1 chouse=$2 output
 output=$(dcecp -c dir create $dir -replica -clearinghouse $chouse)
 if [[ $? != 0 ]]
 then
  print $output | grep -y already >/dev/null
  if [[ $? = 0 ]]
  then
   print "Replica of $dir already exists in $chouse."
  else
   print "Failed to create $dir in clearinghouse $chouse:"
   print $output
   exit 1
  fi
 else
  print "New replica of $dir created in chouse $clearinghouse."
 fi
 dcecp -c directory synchronize $dir
}

# main()
typeset chouse dirs dir
dirs=$(list_dirs)
for chouse in $(list_chouses | awk '/Readonly/ {print $1}')
do
 for dir in $dirs
 do
  replicate_dir $dir $chouse
 done
done
```

Figure 11. Script to replicate the CDS namespace (cds-replicate.ksh)

4.7.5 Setting up a DCE Security Replica Server on a node

Perform the following steps to set up a DCE Security Replica Server on a node:

1. As root, on the DCE Security Replica Server node, issue `smitty dce` to get to the DCE main SMIT panel, and perform the sequence of SMIT menu options shown in the following screen:



```
sp3en0/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> Security Server
         -> 2 secondary

SECURITY Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                   [Entry Fields]
* CELL name                                           [sp_cell]
* Cell ADMINISTRATOR's account                        [cell_admin]
  Machine's DCE HOSTNAME                              [sp3n05]
* Start components at System restart                   Yes              +
* Clean up DCE at System restart                       Yes              +
* Protocol                                             tcp udp          +
  MASTER SECURITY Server                              [sp3en0]
  Minutes to wait between pe_site file updates.       [1440]             #
  CDS Server (If in a separate network)               [sp3en0]
  List of additional CDS Servers                      []
  Synchronize Clocks                                   No               +
  Time Server to Synchronize Clocks with              []
* LAN PROFILE                                         [lan-profile]
  Rebroadcast CDS Server Location                      No               +
  Security Server Name                                []
* Use CERTIFICATE based login?                         No               +
  ENTRUST PROFILE for the Security server             []
  ENTRUST INITIALIZATION file                         []
  ENTRUST PROFILE Password                            []
```

Figure 12. Secondary DCE Security Server configuration for example 4

Make sure that all entry fields match your configuration, especially the “Machine’s DCE HOSTNAME” and the “MASTER SECURITY Server” fields before you start the configuration.

When prompted, enter the password for your cell administrator, cell_admin. You should get the output shown in the following screen:

```
...
Component Summary for Host: sp3n05
           Component                 Configuration State   Running State
Security client                          Configured           Running
RPC                                      Configured           Running
Directory client                         Configured           Running
Security Replica server                  Configured           Running
Additional Directory server              Configured           Running

The component summary is complete.
Configuration of DCE Host, sp3n05, was successful.

Configuration completed successfully.
```

2. Verify the configuration with the `dcecp -c cell show` command:

```
sp3n05/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/sp3en0
 /.../sp_cell/subsys/dce/sec/sp3n05}
{cdsservers
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n05}
{dtsservers}
{hosts
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n01
 /.../sp_cell/hosts/sp3n05
...
```

To make sure that all necessary daemons are running, you can use the `ps` command. Here, you should see the `secd` daemon running on the node.

```
sp3n05/ # ps -ef | grep dce | grep -v grep
    root  4914     1   0   Oct 29      -  1:09 /opt/dcelocal/bin/dced -b -t 1440
    root 19196 21152   0 14:02:55      -  0:08 /opt/dcelocal/bin/cdsclerk \
-w FATAL:STDOUT:-;FILE:/opt/dcelocal/var/svc/fatal.log -w ERROR:STDOUT:\
-;FILE:/opt/dcelocal/var/svc/error.log -w WARNING:STDOUT:-;FILE:\
/opt/dcelocal/var/svc/warning.log -w NOTICE:DISCARD: -w NOTICE_VERBOSE:\
DISCARD:
    root 20544     1   0 14:31:16      -  0:01 /opt/dcelocal/bin/cdsd
    root 21152     1   0   Oct 29      -  0:03 /opt/dcelocal/bin/cdsadv
    root 21788     1   0 14:45:58      -  0:02 /opt/dcelocal/bin/secd
```

3. To populate the information about the new DCE Security Replica Server to your nodes, you can use the `chpesite` command. This command must run on all DCE clients in your cell to manipulate the /opt/dcelocal/etc/security/pe_site file. Do not forget to also run this command on the CWS.

```
sp3en0/ # /usr/bin/chpesite
sp3en0/ # dsh -av /usr/bin/chpesite
...
```

4. To verify the population process, you should see an entry for your new DCE Security Replica Server in each `/opt/dcelocal/etc/security/pe_site` file.

```
sp3en0/ # dsh -av cat /opt/dcelocal/etc/security/pe_site | dshbak -c
HOSTS -------------------------------------------------------------------------
sp3n05            sp3n06            sp3n07            sp3n08
sp3n09            sp3n10            sp3n12            sp3n13
sp3n14
-------------------------------------------------------------------------------
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncadg_ip_udp:9.12.0.3[]
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncacn_ip_tcp:9.12.0.3[]
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncadg_ip_udp:192.168.3.130[]
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncacn_ip_tcp:192.168.3.130[]
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncadg_ip_udp:192.168.3.5[]
/.../sp_cell 60389198-8c9a-11d3-99de-02608c2d4a7f@ncacn_ip_tcp:192.168.3.5[]
```

The `pe_site` file is parsed from top to bottom; so, you may want to rearrange the order of the entries in the file for performance or load balancing reasons.

4.8 Example 5: Existing DCE cell

In this scenario, we go through the security-related installation steps of the *PSSP Installation and Migration Guide*, GA22-7347, to install the SP system with the DCE security state. This security state uses Kerberos V5 as the method for authentication and authorization for remote commands and SP Trusted Services. The security state for this scenario is shown in Table 11.

Table 11. SP security state of Example 5 (DCE Security- existing DCE cell)

Scenario	**Security State: DCE**			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
existing DCE cell	`dce`	`dce`	`dce`	`k5:std`

We will use the DCE Security Server and CDS Server of a node external to the SP. The DCE Security Master server and the Primary CDS server for this cell, called `itso_cell`, are located on a system with the hostname, `arthur`. The CWS and all SP nodes will be added as DCE clients to this existing DCE cell.

In our lab environment, we need to configure the CWS as gateway because the nodes do not have a direct connection to the external network.

High-level outline for example 5

1. Planning considerations
2. Setting up a DCE Client on the CWS
3. Installation steps

4.8.1 Example 5: Planning considerations

Like most distributed systems, DCE is highly-dependent on the integrity of the underlying network. Before configuring any DCE component, verify that the following are properly configured and functioning correctly:

- Host name settings (hostname)
- Forward and reverse name resolution (nslookup, host, /etc/resolv.conf, /etc/netsvc.conf, and /etc/hosts)
- Network routings (netstat -rn, ping, and traceroute)

Also, verify that your date, time, and timezone settings are correct. DCE is extremely sensitive to time discrepancies.

DCE processes write their data (including core files) into /var/dce. These core files can be quite large. For this reason, we recommend creating a /var/dce filesystem at least 200 MB in size, especially on machines that are DCE servers. However, if you do not have the disk space or are not concerned about preserving DCE core files, you can go with the recommended minimum size of 32 MB.

During the node installation process, PSSP installs and configures a DCE client on each node. Unfortunately, this process does not contain the creation of a separate /var/dce filesystem on the nodes. To prevent the use of the root filesystem by the DCE client, you can add the following line in your script.cust file:

```
crfs -v jfs -g'rootvg'  -a size='64000' -m /var/dce -A'yes' -p'rw' -t'no'
```

In the following step-by-step-procedure, you will be asked to supply the following:

- The IP address and hostname of your DCE and CDS server
- The name of your DCE cell administrator (typically, `cell_admin`)

For this example, we assume that the SP administrator with root authority will not be the DCE cell administrator. You will need to have somebody with cell administrator authority available at several steps during the install process.

We will use the self-host principal as an SP administrator with authorization for SP Trusted Services and access to the SDR for ease-of-use. As explained in the *PSSP Administration Guide*, SA22-7348, you can decide to use other DCE principals that do not need root authorization for SP configuration or monitoring tasks if you want to establish a higher granularity of object protection on your SP system. Refer to Section 4.7.2, “Adding the SP administrator DCE principal to the DCE cell” on page 93, and the *PSSP Administration Guide*, SA22-7348, for information about how to set up the authorizations.

For performance reasons, it can be very useful to install a DCE Security Replica Server and a Secondary CDS Server on one of the SP nodes. Refer to Section 4.7.4, “Setting up a secondary CDS server on a node” on page 106, and Section 4.7.5, “Setting up a DCE Security Replica Server on a node” on page 110, for a detailed step-by-step-procedure for this. On the other hand, all DCE servers, especially DCE Security servers, should be configured to not allow end-user access, and they should be secured with stringent physical access controls. If the security registry is compromised, your entire DCE cell is compromised. For this reason, it is not recommended that you install any DCE server on a node or the CWS.

See also Section 4.6.2, “Dealing with mksysb images in a DCE environment” on page 73, for information about how to work with the mksysb images of your SP nodes.

4.8.2 Setting up a DCE client on the CWS

As described in Section 3.7, “Split configuration for DCE clients” on page 47, you can split a DCE client configuration into two parts: The admin-only part, which is done by the DCE cell administrator on the DCE Security Server, and the local-only part, which must be done by `root` on the client node. In the following paragraphs, we will give you a step-by-step procedure for both parts. Nevertheless, it is easier to do a full client configuration on the CWS if you have root access to the CWS and cell administrator access in the DCE cell.

Preparing the CWS for DCE client configuration

1. Before installing the DCE filesets, create the DCE-related directories, filesystems, and mount points. We recommend that you use separate file

systems for the DCE configuration files. A good starting point for the server installation on the CWS can be using the following parameters:

c. Create filesystem: crfs -v jfs -g'rootvg' -a size='64000' -m /var/dce -A'yes' -p'rw' -t'no'
d. Mount filesystem: mount -v'jfs' /var/dce

2. Install the DCE filesets on the CWS using the `installp` command or SMIT. Follow normal software installation steps to install DCE filesets. Refer to Table 12 for more information about which filesets must be installed.

Table 12. DCE filesets to be installed on the CWS (DCE client)

Fileset	Description
dce.client	
dce.client.rte.admin	DCE Client Administrative Tools
dce.client.rte.cds	DCE Client CDS Tools
dce.client.rte.config	DCE Client Configuration Tools
dce.client.rte.rpc	DCE Client RPC Tools
dce.client.rte.security	DCE Client Security Tools
dce.client.rte	DCE Client Services
dce.client.core.rte	DCE Client Services - FOR UPGRADES
dce.client.rte.time	DCE Client Time Tools
dce.client.rte.zones	DCE Client Time Zones
dce.client.smit	DCE SMIT Client Tools
dce.client.rte.pthreads	DCE Threads Compatibility Library
dce.client.rte.web	DCE Web Secure
dce.xdsxom	
dce.xdsxom.rte	X.500 API Library

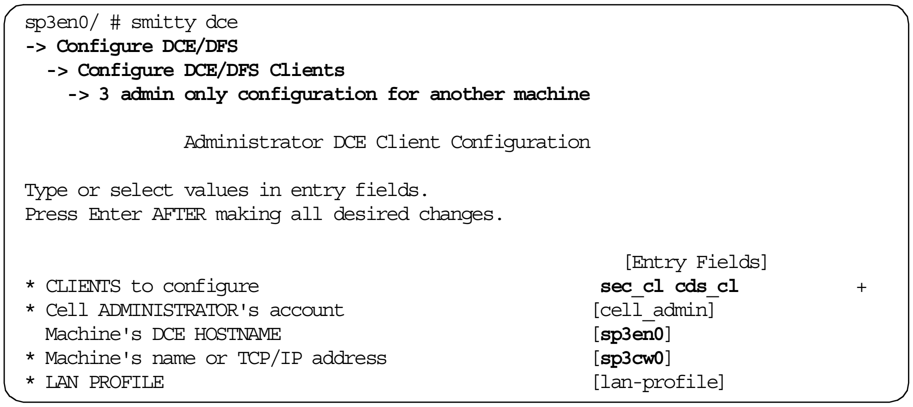
3. Before you begin with the client configuration, make sure that your name resolution and routing information is set up correctly on the client and server (see Section 4.8.1, “Example 5: Planning considerations” on page 113).

Configuring the admin-only part of the DCE client

Important

The admin-only part of the DCE client configuration requires DCE cell administrator credentials.

1. On your DCE Security Server, log in as cell administrator and issue `smitty dce` to get to the DCE main SMIT panel. Perform the following sequence of SMIT menu options:



```
sp3en0/ # smitty dce
-> Configure DCE/DFS
  -> Configure DCE/DFS Clients
    -> 3 admin only configuration for another machine

               Administrator DCE Client Configuration

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* CLIENTS to configure                                 sec_cl cds_cl          +
* Cell ADMINISTRATOR's account                        [cell_admin]
  Machine's DCE HOSTNAME                              [sp3en0]
* Machine's name or TCP/IP address                    [sp3cw0]
* LAN PROFILE                                         [lan-profile]
```

Figure 13. DCE client configuration (admin only) for example 5

   Perform the following steps from the “Administrator DCE Client Configuration” SMIT panel:

   a. Select `sec_cl` and `cds_cl` as from the list of DCE clients in the entry field for “CLIENTS to configure”

   b. If you do not use the default `cell_admin` as cell administrator insert the name of your cell administrator’s account.

   c. Enter the DCE hostname of the CWS. This should normally be the name of the en0 IP-label or the hostname of the CWS.

   d. Enter the hostname or the equivalent IP-address of the CWS.

   e. If you have use an other lan profile than the default `lan-profile` for the clients in your cell, enter the profile the CWS should use in the appropriate entry field.

   This will update the namespace entries and security registry database of the DCE cell.

2. You can verify the settings with the `dcecp` and `cdsli` commands.

```
[arthur:/]# dcecp -c cell show
{secservers
 /.../itso_cell/subsys/dce/sec/arthur}
{cdsservers
 /.../itso_cell/hosts/arthur}
{dtsservers}
{hosts
 /.../itso_cell/hosts/arthur
 /.../itso_cell/hosts/sp3en0}

[arthur:/]# cdsli -cworld
...
d       /.:/hosts/sp3en0
o b     /.:/hosts/sp3en0/cds-clerk
o p     /.:/hosts/sp3en0/profile
o b     /.:/hosts/sp3en0/self
...
```

Configuring the local-only part of the DCE client

1. As root, on the client node (CWS), issue `smitty dce` to get to the DCE main SMIT panel, and perform the following sequence of SMIT menu options:

```
sp3en0/ # smitty dce
-> Configure DCE/DFS
  -> Configure DCE/DFS Clients
    -> 2 local only configuration for this machine

               Local DCE/DFS Client Configuration

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
* CLIENTS to configure                          rpc sec_cl cds_cl       +
* CELL name                                     [itso_cell.itso.ibm.com]
  Machine's DCE HOSTNAME                        [sp3en0]
* Start components at System restart            Yes                     +
* Clean up DCE at System restart                Yes                     +
* Protocol                                      tcp udp                 +
  MASTER SECURITY Server                        [arthur]
  Minutes to wait between pe_site file updates  [1440]                   #
  CDS Server (If in a separate network)         [arthur]
  List of additional CDS Servers                []
  Synchronize Clocks                            No                      +
  Time Server to Synchronize Clocks with        []
  Rebroadcast CDS Server Location               No                      +
```

Figure 14. DCE client configuration (local only) for example 5

Perform the following steps in the “Local DCE/DFS Client Configuration” SMIT panel:

a. Select rpc, sec_cl and cds_cl as from the list of DCE clients in the entry field for “CLIENTS to configure”

b. Insert the (fully-qualified) cell name of your DCE cell.

c. Insert the DCE hostname of the CWS that was chosen in the admin-only part of the DCE client configuration.

d. Select **yes** for “Start components at System restart”.

e. Select **yes** for “Clean up DCE at System restart”.

f. Insert the hostname of the Master Security Server and the hostname of the CDS Server.

2. To verify if your configuration succeeded, you can use the klist command.

```
sp3en0/ # klist | grep Global
        Global Principal: /.../itso_cell.itso.ibm.com/hosts/sp3en0/self
```

4.8.3 Example 5: Installation steps

Go through the installation steps provided in Chapter 2, “Installing and Configuring a New RS/6000 SP System”, of the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

1. Proceed with the installation steps as described in the Installation and Migration Guide to “**Step 18:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”. Make sure that you have setup your DCE client as described in the previous section “Setting up a DCE client on the CWS” on page 114.

   Select k5 and std as authentication method for remote commands and use the chauthent command. You can verify your settings with the lsauthent command:

```
sp3en0/ # chauthent -k5 -std
sp3en0/ # lsauthent
Kerberos 5
Standard Aix
```

Important

Issuing the chauthent command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

2. Skip “**Step 19:** Set Authentication Methods for AIX Remote Commands on the Control Workstation”. To go on with “**Step 20: I**nitialize RS/6000 SP Kerberos V4”, you need to have a DCE client installed and configured on the CWS before you can go on. Refer to the verification section, Section 4.8.2, “Setting up a DCE client on the CWS” on page 114.

Important

The following installation step requires **DCE cell administrator** credentials.

Going through “**Step 20.2:** Create DCE Groups, Organizations, Principals and Accounts”, you have to use the `config_spsec` command and enter `cell_admin` as the cell administrator ID. When prompted, enter your password. This must be done using the `cell_admin` principal.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # config_spsec -c -v

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: \
cell_admin
...
```

3. In “**Step 20.3:** Create SP Administrative Principals”, you must add an administrative principal to several DCE access groups. We recommend that you use the self-host principal as the administrative principal for the rest of the installation in this example.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # dcecp -c group add sdr-admin -member /.:/hosts/sp3en0/self

sp3en0/ # dcecp -c group add hm-admin -member /.:/hosts/sp3en0/self

sp3en0/ # dcecp -c group add spsec-admin -member /.:/hosts/sp3en0/self

sp3en0/ # dcecp -c group add sdr-system-class-admin -member /.:/hosts/\
sp3en0/self

sp3en0/ # dcecp -c group add hm-control -member /.:/hosts/sp3en0/self
```

Later in the installation process, it can be necessary to add additional membership to more access groups, for example, to be authorized to issue switch commands.

Important

The following installation step requires **DCE self-host** credentials.

4. In "**Step 20.4:** Create Control Workstation Specific Keyfiles", you must run the command with the self-host principal. Log out of your `cell_admin` principal, and issue the `create_keyfiles -c -v` command. You can verify your current DCE identity using the `klist` command.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # create_keyfiles -c -v
...
```

5. Go on to "**Step 21:** Configure DCE for the Control Workstation (Required for DCE)", and select **Kerberos Version 4** as the authentication method for SP Trusted Services. Use the `chauthts` command, and verify the settings with the `lsauthts` command.

```
sp3en0/ # chauthts dce
sp3en0/ # lsauthts
DCE
```

Important

The following installation steps require SP administrator (self-host) credentials.

6. Because you have changed the DCE credentials of the SP administrative principal self-host prior to “**Step 22:** Set the Authentication Method for SP Trusted Services on the Control Workstation”, you have to stop your DCE client and start it again to get the new credentials. You can verify that all access groups are added to your principal with the `klist` command.

```
sp3en0/ # exit
sp3en0/ # stop.dce
sp3en0/ # start.dce
sp3en0/ # klist | grep -p Groups
DCE Identity Information:
        Global Principal: /.../itso_cell.itso.ibm.com/hosts/sp3en0/self
        Cell:      6855621a-92c2-11d3-a5fb-0004ac5e69d6 /.../itso_cell.itso.ibm.com
        Principal: 0000007f-9396-21d3-9d00-0004ac5e69d6 hosts/sp3en0/self
        Group:     0000000c-92c2-21d3-a501-0004ac5e69d6 none
        Local Groups:
                0000000c-92c2-21d3-a501-0004ac5e69d6 none
                0000006d-92c2-21d3-9d01-0004ac5e69d6 subsys/dce/dts-servers
                00000086-9397-21d3-9d01-0004ac5e69d6 sdr-admin
                00000080-9397-21d3-9d01-0004ac5e69d6 hm-admin
                0000007c-9397-21d3-9d01-0004ac5e69d6 spsec-admin
                00000088-9397-21d3-9d01-0004ac5e69d6 sdr-system-class-admin
                00000081-9397-21d3-9d01-0004ac5e69d6 hm-control
```

7. Continue with the normal installation steps to “**Step 39:** Select Security Capabilities Required on Nodes”.

   Issue the `smitty spauth_config` command to get to the “RS/6000 SP Security” SMIT panel, and select **Select Security Capabilities Required on Nodes**. Insert your system partition name, and specify **dce** as the authentication method.

```
sp3en0/ # smitty spauth_config
-> Select Security Capabilities Required on Nodes

           Select Security Capabilities Required on Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
* System Partition name                            sp3en0              +
* Authentication  Methods                          dce
```

   You can also use the following command:

   `spsetauth -i -p <syspar> dce`

8. In “**Step 40:** Create DCE Hostnames (Required for DCE)”, the reliable hostname of the nodes are entered as DCE hostname in the SDR. Select

Create DCE hostnames from the “RS/6000 SP Security” SMIT panel, or use the `create_dcehostname` command.

```
sp3en0/ # smitty spauth_config
-> Create DCE hostnames

create_dcehostname: Checking state of dce ...
create_dcehostname: Reading SDR data...

Obtaining DCE host entries...

Setting DCE hostnames in the SDR...
```

You can verify the creation of the DCE hostnames in the SDR by issuing the `splstdata -n` command.

```
sp3en0/ # splstdata -n
                  List Node Configuration Information

node# frame# slot# slots initial_hostname  reliable_hostname dce_hostname\
default_route   processor_type processors_installed \
description
----- ------ ----- ----- ----------------- ----------------- \
----------------- --------------- -------------- -------------------- \
---------------
    1      1     1     4 sp3n01            sp3n01            sp3n01 \
       192.168.3.130   MP                                    1 \
""
    5      1     5     1 sp3n05            sp3n05            sp3n05 \
       192.168.3.130   UP                                    1 \
""
...
```

9. To insert the DCE and CDS server hostnames in the SDR, continue with “**Step 41:** Update the SDR with DCE Master Security and CDS Server Hostnames (Required for DCE)”, and select **Update SDR with DCE Master Security and CDS Server Hostnames** from the “RS/6000 SP Security” SMIT panel. Insert the hostname of the DCE Master Security server and the Primary CDS server in the appropriate entry fields.

```
sp3en0/ # smitty spauth_config
-> Update SDR with DCE Master Security and CDS Server Hostnames

      Update SDR with DCE Master Security and CDS Server Hostnames

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
  Master Security Server hostname                  [arthur]
  CDS Server hostname                              [arthur]
```

Or use the following command:

```
setupdce -v -u -s <master_security_server> -d <initial_cds_server>
```

You can verify the settings in the SDR with the `splstdata -e` command.

```
sp3en0/ # splstdata -e
...
sec_master              arthur
cds_server              arthur
cell_name               /.../itso_cell.itso.ibm.com
...
```

10. In “**Step 42:** Configure Admin Portion of DCE Clients”, you create the necessary DCE security and CDS entries for the SP nodes. Select **Configure DCE Clients (Admin portion)** from the “RS/6000 SP Security” SMIT panel, and enter `cell_admin` as the cell administrator ID and “`/.:/lan-profile`” as the profile ID.

```
sp3en0/ # smitty spauth_config
-> Configure DCE Clients (Admin portion)

                 Configure DCE Clients (Admin portion)

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                  [Entry Fields]
  Cell Administrator id                           [cell_admin]
  Lan Profile id                                  [/.:/lan-profile]
```

Instead of using SMIT, you can use the following command:

```
setupdce -c cell_admin -l /.:/lan/profile
```

Important

The next installation step requires the **DCE cell administrator** password.

When you are prompted, enter the password for the `cell_admin` principal. After the configuration of all your DCE hosts has ended successfully, you can verify the creation of the entries with the `dcecp -c cell show` command:

```
sp3en0/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/sp3en0}
{cdsservers
 /.../sp_cell/hosts/sp3en0}
{dtsservers}
{hosts
 /.../sp_cell/hosts/sp3en0
 /.../sp_cell/hosts/sp3n01
...
/.../sp_cell/hosts/sp3n15}
```

This commands provides a view of all defined hosts in a DCE cell. You should now see all your SP nodes, including the CWS, in the output.

11. Go on to “**Step 43:** Select Authorization Methods for AIX Remote Commands”, and issue the `smitty spauth_config` command to get to the SMIT security menu. Select **Select Authorization Methods for AIX Remote Commands**. In the next panel, insert your system partition name and specify **dce** and **std** as authorization methods.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

         Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                     [Entry Fields]
* System Partition name                             sp3en0              +
* Authorization Methods                             dce std             +
```

Or use the following command:

```
spsetauth -d -p <syspar> dce std
```

Note

You need to use the two methods, `dce` and `std`, at this point because you must have at least one common method defined for the system partition and the remote commands. Since we have not yet changed the authentication method for the partition, it is still set to `std`. Later, we will change these methods to only use `dce`.

Important

The following installation step requires **DCE cell administrator** credentials.

12. In “**Step 44:** Configure SP Trusted Services to Use DCE Authentication (Required for DCE)”, select **Configure SP Trusted Services to use DCE Authentication** from the “RS/6000 SP Security” SMIT panel, and enter `y` when prompted. Then, type in your administrator ID and the password when required.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # smitty spauth_config
-> Configure SP Trusted Services to use DCE Authentication

This command requires cell administrator authority. Continue? (y/n) y

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "open_io" subroutine ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_default" subroutine ...


Please enter cell administrator id to be added to ACL admin group: \
cell_admin

Adding cell administrator id to group spsec-admin ...
Creating org - spsec-services ...
Creating group - spsec-services ...
Running "create_accts_on_cws" subroutine ...

Your cell administrator password is required to create accounts.
Please enter your cell administrator password:
...
```

Instead of using SMIT, you can use the following command:

```
config_spsec -v
```

Important

The following installation step requires DCE self-host credentials.

13. To continue with “**Step 45:** Create SP Services DCE Keyfiles (Required for DCE)”, you must exit your cell administrator principal. This step has to be done as the self-host principal.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
```

When you run “Create SP Services Keyfiles” from the “RS/6000 SP Security” SMIT panel, you should get an output, such as the one shown in the next screen:

```
sp3en0/ # smitty spauth_config
-> Create SP Services Keyfiles

Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_keys" subroutine ...
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Kbdd already exists.
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Master already exists.
...
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/sysctl already exists.
```

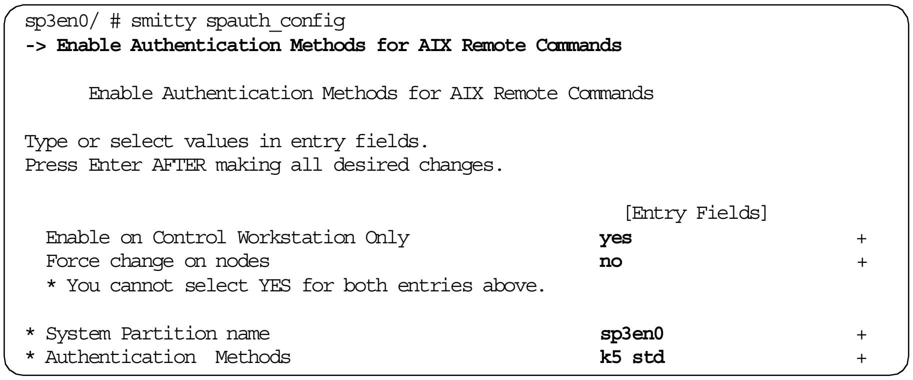
You can also use the following command:

```
create_keyfiles -v
```

Important

The remaining installation steps require SP administrator (self-host) credentials.

14.In “**Step 46:** Enable Authentication Methods for AIX Remote Commands”, issue `smitty spauth_config`, and select **Enable Authentication Methods for AIX Remote Commands** from the “RS/6000 SP Security” SMIT panel. Set the “Enable on Control Workstation Only” flag to **yes** and the “Force change on nodes” flag to **no**. Select your system partition, and specify **k5** and **std** as the authentication methods.

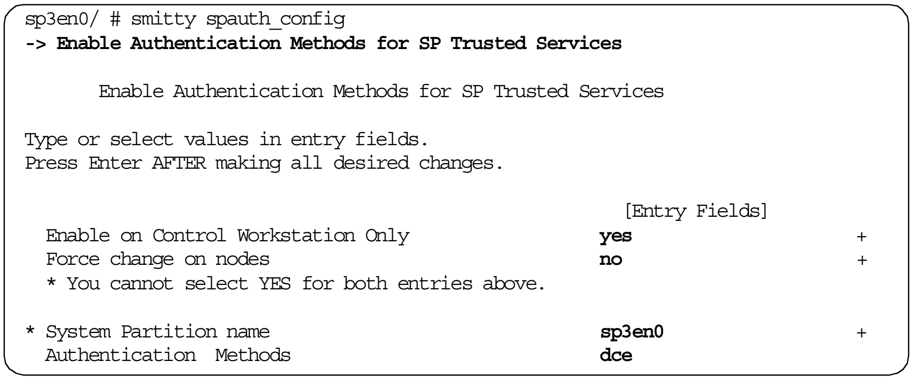


```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for AIX Remote Commands

      Enable Authentication Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  Enable on Control Workstation Only              yes                    +
  Force change on nodes                           no                     +
  * You cannot select YES for both entries above.

* System Partition name                           sp3en0                 +
* Authentication  Methods                         k5 std                 +
```

Instead of using SMIT, you can use the following command:

```
chauthpar -c -p <syspar> k5 std
```

15. In "**Step 47:** Enable Authentication Methods for SP Trusted Services", you do this by selecting **Enable Authentication Methods for SP Trusted Services** from the "RS/6000 SP Security" SMIT panel. Set the "Enable on Control Workstation Only" flag to **yes** and the "Force change on nodes" flag to **no**. Select your system partition, and specify **dce** as the authentication method.



```
sp3en0/ # smitty spauth_config
-> Enable Authentication Methods for SP Trusted Services

       Enable Authentication Methods for SP Trusted Services

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                    [Entry Fields]
  Enable on Control Workstation Only              yes                    +
  Force change on nodes                           no                     +
  * You cannot select YES for both entries above.

* System Partition name                           sp3en0                 +
  Authentication  Methods                         dce
```

You can also use the following command:

```
chauthpts -c -p <syspar> dce
```

This can take several minutes.

16. You can now change the authorization methods for the AIX remote commands to only use `dce` (remember step 11 of this procedure). Issue the `smitty spauth_config` command to get to the SMIT security menu, and select **Select Authorization Methods for AIX Remote Commands**. In

the next panel, insert your system partition name, and specify **dce** as the authorization method.

```
sp3en0/ # smitty spauth_config
-> Select Authorization Methods for AIX Remote Commands

        Select Authorization Methods for AIX Remote Commands

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
* System Partition name                                sp3en0              +
* Authorization Methods                                dce                 +
```

You can also use the following command:

`spsetauth -d -p <syspar> dce`

Verify your SRD settings with the `splstdata -p` command.

```
sp3en0/ # splstdata -p
List System Partition Information

System Partitions:
------------------
sp3en0

Syspar: sp3en0
-------------------------------------------------------------------------------
syspar_name      sp3en0
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940617228,332373504,0
auth_install     dce
auth_root_rcmd   dce
ts_auth_methods  dce
auth_methods     k5:std
```

17. In “**Step 48:** Start the Key Management Daemon”, use the `spnkeyman_start` command to start the key management daemon on the CWS. You can verify that the daemon is running with the `lssrc` or the `ps` command.

```
sp3en0/ # spnkeyman_start
0513-059 The spnkeyman Subsystem has been started. Subsystem PID is 2068.
sp3en0/ # lssrc -a | grep key
 spnkeyman                           2068    active
sp3en0/ # ps -ef | grep key | grep -v grep
    root  2068  4170   0 14:30:29      -  0:02 /usr/lpp/ssp/bin/\
spnkeymand
sp3en0/ #
```

18. Finish the configuration of the CWS and the installation of the nodes following the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

    After the NIM installation of the nodes has succeeded, the `psspfb_script` runs the `spauthconfig` command on each node. This script installs and configures all needed DCE filesets automatically. Then, you can see the LED u95 during installation on the 3-digit display.

Chapter 5. Changing from one security state to another

In the previous chapter, we showed you how to install and configure your SP system with a specific security state. This chapter shows you how to migrate from one security state to another. Not all migration scenarios are covered here. Instead, we have picked the three most typical ones to illustrate the step-by-step procedures and to give you a feel for the kinds of things you need to consider when changing security states. The scenarios are based on a single-partition SP system with all nodes at PSSP 3.2 or higher.

5.1 Security state transitions

Our first two scenarios begin with the SP system in the Compatibility security state. This is the typical state for an SP system that has been migrated from a release of PSSP prior to version 3.2. The first scenario moves the SP system from Compatibility up to DCE. The second one moves it from Compatibility down to Minimal. The third scenario moves the SP system from Minimal back up to Compatibility. This last scenario might be used on a newly-installed, SP system that was initially configured with the Minimal security state prior to connecting it to outside networks and allowing normal user access.

Each of the scenarios takes you from the initial security state to a transitional security state in which both the old and the new states are active, and then to the final security state. The transitional state is the point at which you can verify that the new state is functioning as expected while still having access to the old state in case of problems. The transitional state also enables you to do the migration with the least amount of disruption to the production applications running on the SP system. The migration scenarios are summarized in Table 13.

Table 13. Security state transitions

Initial state	Transitional state	Final state
Compatibility	Compatibility:DCE	DCE
Compatibility	Compatibility:Minimal	Minimal
Minimal	Minimal:Compatibility	Compatibility

The procedures in the following sections all follow the same general outline:

- Scenario introduction
- Planning considerations
- Procedure overview

- Assumptions
- Procedure step-by-step
- Optionally, additional considerations or variations

5.2 Our lab environment

Note

For your convenience, we repeat this section here. You will also find it in Chapter 4, “Implementing a specific security state” on page 57.

Our lab environment for the following scenarios was comprised of a single-frame SP system with a switch and twelve nodes: One high node, ten thin nodes, and one wide node, and, of course, the control workstation (CWS). The nodes and CWS were connected by the SP administrative Ethernet, and the nodes all shared the SP switch network. The CWS had a token ring interface connecting it to an outside network on which were two additional standalone machines configured as an external DCE cell. One of the standalones was configured as the DCE Security Master and Primary CDS server, and the other was configured as a DCE client. The system diagram is shown in Figure 15 on page 133.

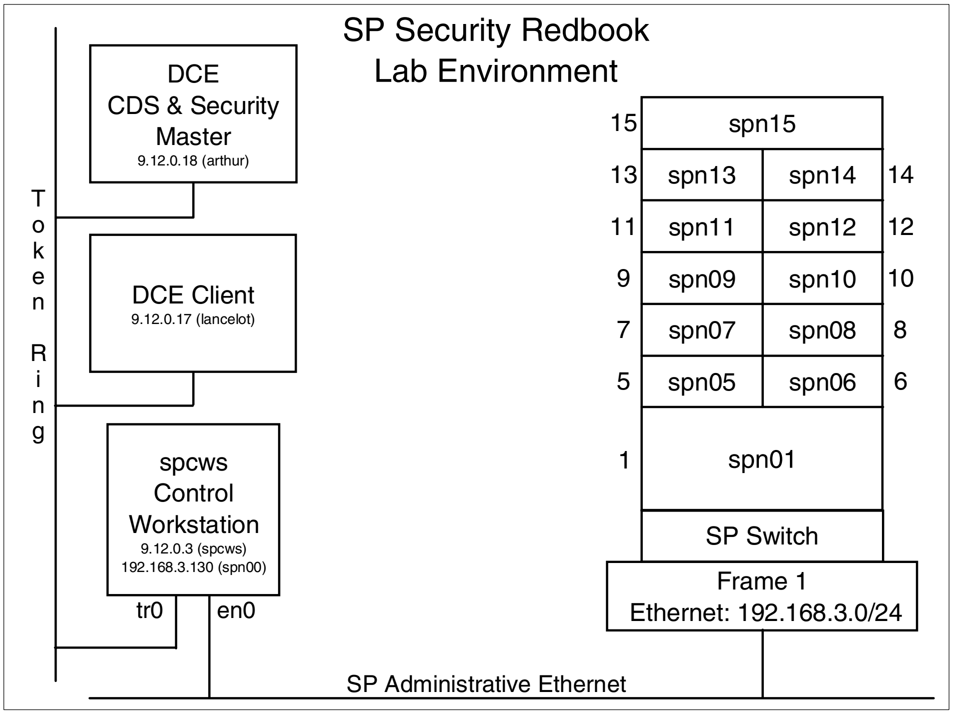


Figure 15. SP security redbook lab environment

Note

The external DCE cell does not exist for the initial DCE scenario. In that scenario we create a self-contained DCE cell in the SP system. The CWS serves as the DCE Security Master and Primary CDS server, and the nodes are DCE clients.

5.3 Moving from Compatibility to DCE

If your SP system existed prior to the release of PSSP 3.2, you will have to begin with it in the Compatibility state. Once you have migrated your SP system (or at least one partition in it) to PSSP 3.2, it will, by definition, have a security state of Compatibility. This procedure shows you how to change the security state from Compatibility to DCE. If you have not already done so, read Chapter 3, “What you need to know if you plan to use DCE” on page 23.

In this procedure, we will be configuring a self-contained, DCE cell on the SP system. The only purpose of the DCE cell is to support configuration of the

SP system at the DCE security state. To that end, we will be configuring the CWS as the DCE Security Master and Primary CDS server. Our DCE cell name is sp_cell, and DCE administrative principal is cell_admin. Following this procedure, we describe other possible DCE scenarios and configuration variations.

5.3.1 From Compatibility to DCE: Planning considerations

Before you begin this procedure, read through it, and make sure you understand its general flow. Again, if you have not already done so, read Chapter 3, “What you need to know if you plan to use DCE” on page 23. As with any change to your SP system, be sure that you have a current set of verified system backups. If possible, you should perform this procedure during a normal maintenance window for your SP system.

Like most distributed systems, DCE is highly-dependent on the integrity of the underlying network. Before configuring any DCE component, verify that the following are properly configured and are functioning correctly:

- Host name settings (hostname)
- Forward and reverse name resolution (nslookup, host, /etc/resolv.conf, /etc/netsvc.conf, and /etc/hosts)
- Network routings (netstat -rn, ping, and traceroute)
- Packet forwarding settings (ipforwarding)

Also, verify that your date, time, and timezone settings are correct. DCE is extremely sensitive to time discrepancies.

In this procedure, you will be asked to supply the following:

- A name for your DCE cell
- A name for your DCE cell administrator (typically, `cell_admin`)

For this first scenario, we assume that the SP administrator with root authority will also be the DCE cell administrator. This seems like a fair assumption since the DCE cell exits only within the SP system. In the section following the procedure, we discuss other scenarios where this assumption may not be true.

5.3.2 From Compatibility to DCE: High-level outline

The step-by-step procedure to move from Compatibility to DCE can be broken down into these main sections:

1. Create the DCE cell

2. Initial verification
3. Move from Compatibility to Compatibility:DCE
4. Midpoint review
5. Move from Compatibility:DCE to DCE
6. Final verification

After creating a DCE cell, you will get a snapshot of your current environment. Transition to a point where you have both the old and new security states enabled and verified; transition to just the new security state, and finish with a final snapshot of the environment.

Important

Do not try to go directly from the old security state to the new one, bypassing the transitional state in which both old and new are active. The purpose of the transitional state is to ensure that your system remains operative while you enable the new state. Shutting off the old state too early in the process will result in communication disruptions between the CWS and the nodes.

5.3.3 From Compatibility to DCE: Step-by-step procedure

This procedure is based on the following assumptions:

- The SP system is configured with a single system partition.
- All nodes are at PSSP 3.2 or higher.
- The CWS and nodes are not configured with Kerberos V5 as an AIX authentication method.
- The CWS and nodes are not already members of a DCE cell.

To move from Compatibility to DCE, do the following:

Create the DCE cell

1. From the command line and, optionally, in the /etc/environment file, set the RPC_UNSUPPORTED_NETIFS variable to exclude network interfaces that should not be used for DCE traffic by either the CWS or the nodes (for example, interfaces on the nodes to which the CWS has no route):

```
spcws/ # export RPC_UNSUPPORTED_NETIFS=tr1:en1:css0

spcws/ # cat /etc/environment
...
RPC_UNSUPPORTED_NETIFS=tr1:en1:css0
...
```

Note

DCE does not check for the existence of these network interfaces. Therefore, you can use a common setting for the CWS and all nodes in your SP system.

2. Create `/var/dce` as a separate filesystem on the CWS:

```
spcws/ # crfs -v jfs -g rootvg -a size=400000 -m /var/dce \
 -A yes -p rw -t no

Based on the parameters chosen, the new /var/dce JFS file system
is limited to a maximum size of 134217728 (512 byte blocks)
New File System size is 401408

spcws/ # mount /var/dce

spcws/ # df -k /var/dce

Filesystem    1024-blocks      Free %Used    Iused %Iused Mounted on
/dev/lv00          200704    192676    4%       17     1% /var/dce
```

Note

DCE processes write their core files into `/var/dce`. These core files can be quite large. For this reason, we recommend creating a `/var/dce` filesystem at least 200 MB in size, especially on machines that are DCE servers. However, if you do not have the disk space or are not concerned about preserving DCE core files, you can go with the recommended minimum size of 32 MB.

3. Remove any DCE filesets earlier than Version 3.1 from the lppsource directory:

```
spcws/ # rm -i /spdata/sys1/install/aix433/lppsource/dce*
...
```

Note

Some DCE version 2.x filesets are included on the AIX 4.3.3 media. If you copied the entire AIX 4.3.3 distribution into your lppsource directory, you will need to remove the DCE Version 2.x filesets.

4. Copy the DCE Version 3.1 filesets into the lppsource directory and rebuild the `.toc` file:

```
spcws/ # ls /spdata/sys1/install/aix433/lppsource | grep dce
dce.cds.3.1.0.0.I
dce.client.3.1.0.0.I
dce.compat.3.1.0.0.I
dce.doc.en_US.3.1.0.0.I
dce.doc.rte.3.1.0.0.I
dce.msg.Es_ES.3.1.0.0.I
dce.msg.Ja_JP.3.1.0.0.I
dce.msg.Zh_TW.3.1.0.0.I
dce.msg.en_US.3.1.0.0.I
dce.msg.es_ES.3.1.0.0.I
dce.msg.ja_JP.3.1.0.0.I
dce.msg.ko_KR.3.1.0.0.I
dce.msg.zh_TW.3.1.0.0.I
dce.priv.3.1.0.0.I
dce.security.3.1.0.0.I
dce.sysmgmt.3.1.0.0.I
dce.tools.3.1.0.0.I
dce.web.3.1.0.0.I
dce.xdsxom.3.1.0.0.I

spcws/ # cd /spdata/sys1/install/aix433/lppsource
spcws/spdata/sys1/install/aix433/lppsource # inutoc .
```

These filesets are not part of the AIX 4.3.3 distribution. Instead, they can be found on the DCE Version 3.1 distribution media, which is a separately purchasable product from IBM.

5. Using the information in Table 14, install the DCE filesets on the CWS using the `installp` command or the smitty install_latest fastpath:

Table 14. DCE Security, CDS, and client filesets

Fileset	Description
dce.security	
dce.security.smit	DCE SMIT Security Services
dce.security.rte	DCE Security Services
dce.cds	
dce.cds.rte	DCE Cell Directory Services

Fileset	Description
dce.cds.smit	DCE SMIT Cell Directory Services
dce.client	
dce.client.rte.admin	DCE Client Administrative Tools
dce.client.rte.cds	DCE Client CDS Tools
dce.client.rte.config	DCE Client Configuration Tools
dce.client.rte.rpc	DCE Client RPC Tools
dce.client.rte.security	DCE Client Security Tools
dce.client.rte	DCE Client Services
dce.client.core.rte	DCE Client Services - FOR UPGRADES
dce.client.rte.time	DCE Client Time Tools
dce.client.rte.zones	DCE Client Time Zones
dce.client.smit	DCE SMIT Client Tools
dce.client.rte.pthreads	DCE Threads Compatibility Library
dce.client.rte.web	DCE Web Secure
dce.xdsxom	
dce.xdsxom.rte	X.500 API Library

6. Use SMIT to configure the CWS as the DCE Security Master server for the new sp_cell DCE cell:

```
spcws/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> Security Server
         -> 1 primary

                             MASTER SECURITY Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                  [Entry Fields]
* CELL name                                         [sp_cell]
* Cell ADMINISTRATOR's account                      [cell_admin]
  Cell ADMINISTRATOR's account UNIX ID              [100]        #
  Machine's DCE HOSTNAME                            [spcws]
* Start components at System restart                 Yes         +
* Clean up DCE at System restart                     Yes         +
* Protocol                                           tcp udp     +
  Minutes to wait between pe_site file updates      [1440]       #
  Security Server Name                              [spcws]
* Use CERTIFICATE based login?                       No          +
  ENTRUST PROFILE for the Security server           []
  ENTRUST INITIALIZATION file                       []
  ENTRUST PROFILE Password                          []
  PRINCIPALS Lowest possible UNIX ID                [100]        #
  GROUPS Lowest possible UNIX ID                    [100]        #
  ORGANIZATIONS Lowest possible UNIX ID             [100]        #
  MAXIMUM possible UNIX ID                          [2147483647] #
```

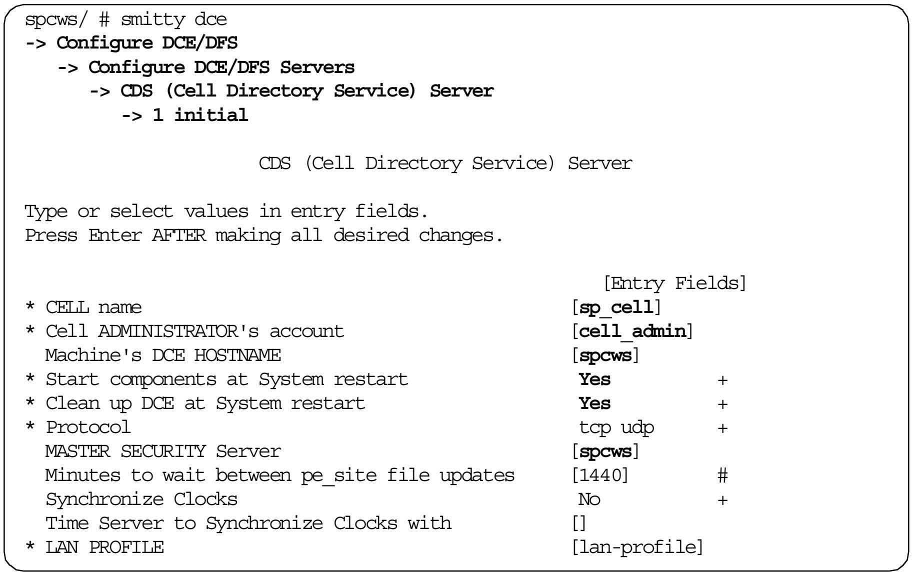
You will need to enter information for your DCE cell as follows:

- For **Cell name**, enter the name of your DCE cell, such as `sp_cell`.
- For **Cell ADMINISTRATOR's account**, if you are not using cell_admin as the name of the administrative principal for your DCE cell, enter your chosen name instead.
- For **Machine's DCE HOSTNAME**, enter a symbolic TCP/IP hostname for the CWS, such as `spcws`. The name you pick should be the first name that appears after the `loopback` address in a `netstat -i` listing. In most cases, this will be an `en*` address.
- For **Start components at System restart**, select **Yes** to have an entry added to the `/etc/inittab` file.
- For **Clean up DCE at System restart**, select **Yes** if you also selected Yes for **Start components at System restart**.
- For **Security Server Name**, enter the same name you entered for **Machine's DCE HOSTNAME**, for example, `spcws`. (You will also use this same name for the Initial CDS Server in the next step.)
- For all other fields, take the defaults.

Note

It normally takes SMIT several minutes to configure the DCE Security Master server.

7. Use SMIT to configure the CWS as the Primary CDS server for the new sp_cell DCE cell:



```
spcws/ # smitty dce
-> Configure DCE/DFS
   -> Configure DCE/DFS Servers
      -> CDS (Cell Directory Service) Server
         -> 1 initial

                      CDS (Cell Directory Service) Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
* CELL name                                          [sp_cell]
* Cell ADMINISTRATOR's account                       [cell_admin]
  Machine's DCE HOSTNAME                             [spcws]
* Start components at System restart                  Yes          +
* Clean up DCE at System restart                      Yes          +
* Protocol                                            tcp udp      +
  MASTER SECURITY Server                             [spcws]
  Minutes to wait between pe_site file updates       [1440]        #
  Synchronize Clocks                                  No           +
  Time Server to Synchronize Clocks with             []
* LAN PROFILE                                        [lan-profile]
```

Note

SMIT sets up the screen with the values you used to configure the DCE Security Master server. You should not have to change anything here. As was the case with the DCE Security Master server configuration, it normally takes SMIT several minutes to configure the Primary CDS server.

8. Verify that the DCE Security and CDS servers have been created on the CWS:

```
spcws/ # show.cfg
Gathering component state information...

                 Component Summary for Host: spcws
           Component              Configuration State   Running State
Security Master server                Configured           Running
Security client                       Configured           Running
RPC                                   Configured           Running
Initial Directory server              Configured           Running
Directory client                      Configured           Running
```

9. Verify that the sp_cell DCE cell has been created:

```
spcws/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/spcws}
{cdsservers
 /.../sp_cell/hosts/spcws}
{dtsservers}
{hosts
 /.../sp_cell/hosts/spcws}
```

Initial verification

10.Get a baseline listing of the current security state:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

Move from Compatibility to Compatibility:DCE

11.Archive the SDR:

```
spcws/ # SDRArchive Compatibility.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99303.1202.Compatibility.19991030
```

12.Login as the DCE administrative principal, and reset the password:

```
spcws/ # dce_login cell_admin
Enter Password:
Password must be changed!
DCE LOGIN SUCCESSFUL
Warning: This account has been marked by an administrator,
 recommending that the password be changed.
Do you wish to change now [y/n]? (y) y
Enter New Password:
Re-enter New Password:
PASSWORD SUCCESSFULLY CHANGED

spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin
```

13.Create the DCE groups, organizations, principals, and accounts for PSSP, and verify that they were created:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # config_spsec -v -c
This command requires cell administrator authority. Continue? (y/n) y
...

spcws/ # dcecp -c group cat | pg
...
spcws/ # dcecp -c organization cat
...
spcws/ # dcecp -c principal cat | pg
...
spcws/ # dcecp -c account cat | pg
...
```

14.Create the DCE keyfiles for PSSP, and verify that they were created:

```
spcws/ # exit
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self
spcws/ # create_keyfiles -c -v
...

spcws/ # dcecp -c keytab cat | pg
...
spcws/ # ls -l /spdata/sys1/keyfiles/ssp/spcws
total 72
-rw-------   1 root     system       102 Oct 27 15:31 css
-rw-------   1 root     system       110 Oct 27 15:31 hardmon
-rw-------   1 root     system       106 Oct 27 15:31 pmand
-rw-------   1 root     system       102 Oct 27 15:31 sdr
-rw-------   1 root     system       116 Oct 27 15:31 sp_configd
-rw-------   1 root     system       112 Oct 27 15:31 spbgroot
-rw-------   1 root     system       106 Oct 27 15:31 spmgr
-rw-------   1 root     system       116 Oct 27 15:31 switchtbld
-rw-------   1 root     system       108 Oct 27 15:31 sysctl
```

15. Set the authentication method for SP Trusted Services on the CWS to both `DCE` and `Compatibility`, and verify the settings:

```
spcws/ # chauthts dce compat

spcws/ # lsauthts
DCE
Compatibility
```

Important

This next step makes `cell_admin` the DCE SP administrative principal. You might want to use the self-host principal or a special principal that you have already created for this purpose instead.

16. Add the DCE administrative principal to the SP Trusted Services administrative and control groups, and obtain fresh DCE credentials to verify:

```
spcws/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # dcecp -c group add sdr-admin -member cell_admin

spcws/ # dcecp -c group add hm-admin -member cell_admin

spcws/ # dcecp -c group add spsec-admin -member cell_admin

spcws/ # dcecp -c group add sdr-system-class-admin -member cell_admin

spcws/ # dcecp -c group add hm-control -member cell_admin

spcws/ # exit
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self
spcws/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
spcws/ # klist | grep -p Groups
DCE Identity Information:
    Warning: Identity information is not certified
    Global Principal: /.../sp_cell/cell_admin
    Cell:      602218d2-8c9a-11d3-99de-02608c2d4a7f /.../sp_cell
    Principal: 00000064-8c9a-21d3-9900-02608c2d4a7f cell_admin
    Group:     0000000c-8c9a-21d3-9901-02608c2d4a7f none
    Local Groups:
          0000000c-8c9a-21d3-9901-02608c2d4a7f none
          00000064-8c9a-21d3-8201-02608c2d4a7f acct-admin
          00000065-8c9a-21d3-8201-02608c2d4a7f subsys/dce/sec-admin
          00000066-8c9a-21d3-8201-02608c2d4a7f subsys/dce/cds-admin
          00000068-8c9a-21d3-8201-02608c2d4a7f subsys/dce/dts-admin
          00000069-8c9a-21d3-8201-02608c2d4a7f subsys/dce/audit-admin
          0000006a-8c9a-21d3-8201-02608c2d4a7f subsys/dce/dced-admin
          00000067-8c9a-21d3-8201-02608c2d4a7f subsys/dce/dfs-admin
          0000007c-8ca4-21d3-8201-02608c2d4a7f spsec-admin
          00000086-8ca4-21d3-8201-02608c2d4a7f sdr-admin
          00000080-8ca4-21d3-8201-02608c2d4a7f hm-admin
          00000088-8ca4-21d3-8201-02608c2d4a7f sdr-system-class-admin
          00000081-8ca4-21d3-8201-02608c2d4a7f hm-control
```

Note

Obtaining fresh DCE credentials is required so that you pick up the changes made to the SP Trusted Services administrative and control groups.

17.Complete system support installation on the CWS:

```
spcws/ # install_cw
...
install_cw: If you want to bring up the Perspectives Launch Pad
 to help you complete your installation, enter "perspectives &" now.
```

Note

This step sets the security attributes for the default system partition.

18. Add `dce` as one of the security capabilities required on nodes, and verify that the `auth_install` attribute is set to `dce:k4`:

```
spcws/ # spsetauth -i -p spcws dce k4
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

19. Create DCE hostnames for the nodes, and verify that they were created:

```
spcws/ # create_dcehostname
spcws/ #

spcws/ # splstdata -n | pg
List Node Configuration Information

node# frame# slot# slots initial_hostname  reliable_hostname         \
dce_hostname default_route   processor_type processors_installed     \
description
----- ------ ----- ----- ----------------- -----------------         \
----------------- --------------- -------------- --------------------\
---------------
    1      1     1     4 spn01             spn01                     \
spn01        192.168.3.130   MP             1                        \
""
    5      1     5     1 spn05             spn05                     \
spn05        192.168.3.130   UP             1                        \
""
...
```

20. Update the SDR with the DCE Security Master and Primary CDS server hostnames, and verify that it was updated:

```
spcws/ # setupdce -v -u -s spcws -d spcws
setupdce: Checking state of dce ...
setupdce: Updated cell_name information into SDR
setupdce: Updated DCE security master information into SDR.
setupdce: Updated DCE CDS server information into SDR.

spcws/ # splstdata -e | pg
             List Site Environment Database Information

attribute               value
----------------------- ------------------------------------------------
control_workstation     spcws
...
sec_master              spcws
cds_server              spcws
cell_name               /.../sp_cell
...
```

21. Configure the nodes as DCE clients (admin-only portion):

```
spcws/ # setupdce -v -c cell_admin -l /.:/lan-profile
...
Configuration of DCE Host, spn01, will now begin.
Configuring the Security client...
Security client configuration is complete.
Configuring the Directory client...
Directory client configuration is complete.
Configuration of DCE Host, spn01, was successful.
...
Configuration completed successfully.
```

Note

In the sp_cell DCE cell, we used `cell_admin` for our DCE administrative principal and `/.:/lan-profile` for our DCE lan profile. These are the default names. If you used different names in your DCE cell, be sure to substitute the correct values in the `setupdce` command.

22. Verify that the nodes have been added to the DCE cell:

```
spcws/ # dcecp -c cell show
{secservers
 /.../sp_cell/subsys/dce/sec/spcws}
{cdsservers
 /.../sp_cell/hosts/spcws}
{dtsservers}
{hosts
 /.../sp_cell/hosts/spcws
 /.../sp_cell/hosts/spn01
 /.../sp_cell/hosts/spn05
 /.../sp_cell/hosts/spn06
...
 /.../sp_cell/hosts/spn15}
```

23. Add `dce` as one of the authorization methods for AIX remote commands, and verify that the `auth_root_rcmd` attribute is set to `dce:k4`:

```
spcws/ # spsetauth -d -p spcws dce k4
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name       spcws
ip_address        192.168.3.130
install_image     default
syspar_dir        ""
code_version      PSSP-3.2
haem_cdb_version  941039977,692774656,0
auth_install      dce:k4
auth_root_rcmd    dce:k4
ts_auth_methods   compat
auth_methods      k4:std
```

24. Configure SP Trusted Services to use DCE authentication:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # config_spsec -v
...
```

25. Create and/or update the SP Trusted Services keyfiles:

```
spcws/ # exit
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self
spcws/ # create_keyfiles -v
```

26. Update the `.k5login` and `.klogin` files on the CWS:

```
spcws/ # updauthfiles
spcws/ #
```

Note

It is not uncommon for `updauthfiles` to take several minutes to complete.

27. Enable `dce` one of the authentication methods for SP Trusted Services, and verify that the `ts_auth_methods` attribute is set to `dce:compat`:

```
spcws/ # chauthpts -c -p spcws -v dce compat
0513-095 The request for subsystem refresh was completed successfully.
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   dce:k4
ts_auth_methods  dce:compat
auth_methods     k4:std
```

Note

The `-c` flag on the `chauthpts` command sets `ts_auth_methods` on the CWS only. The change will be propagated to the nodes in a later step.

28. Add `k5` as one of the authentication methods for AIX remote commands, and verify that the `auth_methods` attribute is set to `k5:k4:std`:

```
spcws/ # chauthpar -c -p spcws -v k5 k4 std
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name       spcws
ip_address        192.168.3.130
install_image     default
syspar_dir        ""
code_version      PSSP-3.2
haem_cdb_version  941039977,692774656,0
auth_install      dce:k4
auth_root_rcmd    dce:k4
ts_auth_methods   dce:compat
auth_methods      k5:k4:std
```

Note

The -c flag on the `chautpar` command sets `auth_methods` on the CWS only. The change will be propagated to the nodes in a later step.

29.Start the key management daemon on the CWS:

```
spcws/ # spnkeyman_start
0513-071 The spnkeyman Subsystem has been added.
0513-059 The spnkeyman Subsystem has been started. \
 Subsystem PID is 20260.
spcws/ #
```

30.Create `/var/dce` as a separate file system on the nodes (you could also do this with the `script.cust` script):

```
spcws/ # dsh -av 'crfs -v jfs -g rootvg -a size=400000 -m /var/dce \
 -A yes -p rw -t no'
...
spcws/ # dsh -av 'mount /var/dce'

spcws/ # dsh -av 'df -k /var/dce'
...
```

Note

DCE processes write their `core` files into `/var/dce`. These `core` files can be quite large. For this reason, we recommend creating a `/var/dce` filesystem at least 200 MB in size, especially on machines that are DCE servers. However, if you do not have the disk space or are not concerned about preserving DCE core files, you can go with the recommended minimum size of 32 MB.

31.Configure the nodes as DCE clients (local-only portion):

```
spcws/ # dsh -av ‘/usr/lpp/ssp/bin/spauthconfig’
...
```

Note

You can monitor the progress of `spauthconfig` by doing a `tail -f /var/adm/SPlogs/auth_install/log` on the nodes.

32.Verify that the nodes are configured correctly:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'lsauthts;lsauthent;wc -c /.k5login' | dshbak -c
HOSTS -------------------------------------------------------------------
spn01              spn05              spn06              spn07
spn08              spn09              spn10              spn11
spn12              spn13              spn14              spn15
-------------------------------------------------------------------------
DCE
Compatibility
Kerberos 5
Kerberos 4
Standard Aix
     650 /.k5login

spcws/ # dsh -av 'show.cfg' | pg
spn01: Gathering component state information...
spn01:
spn01:             Component Summary for Host: spn01
spn01: Component                 Configuration State   Running State
spn01: Security client             Configured            Running
spn01: RPC                         Configured            Running
spn01: Directory client            Configured            Running
spn01:
spn01: The component summary is complete.
...
```

Midpoint review

33.At this point, your `splstdata -p` listing should look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
---------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   dce:k4
ts_auth_methods  dce:compat
auth_methods     k5:k4:std
```

Figure 16. SDR settings for the Compatibility:DCE transitional security state

- You are at the transitional state of Compatibility:DCE.
- You have verified that DCE is configured correctly.
- You are now ready to turn off Compatibility.

Move from Compatibility:DCE to DCE

34.Archive the SDR:

```
spcws/ # SDRArchive Compatibility-DCE.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99304.1625.Compatibility-DCE.19991031
```

35.Remove `k4` as one of the authentication methods for AIX remote commands, and verify that the `auth_methods` attribute is set to `k5:std`:

```
spcws/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # chauthpar -p spcws -v k5 std
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   dce:k4
ts_auth_methods  dce:compat
auth_methods     k5:std
```

36. Remove `compat` as one of the authentication methods for SP Trusted Services, and verify that the `ts_auth_methods` attribute is set to `dce`:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # chauthpts -p spcws -v dce
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   dce:k4
ts_auth_methods  dce
auth_methods     k5:std
```

37. Remove `k4` as one of the authorization methods for AIX remote commands, and verify that the `auth_root_rcmd` attribute is set to `dce`:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # spsetauth -d -p spcws dce
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce:k4
auth_root_rcmd   dce
ts_auth_methods  dce
auth_methods     k5:std
```

38. Remove `k4` as one of the security capabilities required on nodes, and verify that the `auth_install` attribute is set to `dce`:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/cell_admin

spcws/ # spsetauth -i -p spcws dce
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name       spcws
ip_address        192.168.3.130
install_image     default
syspar_dir        ""
code_version      PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install      dce
auth_root_rcmd    dce
ts_auth_methods   dce
auth_methods      k5:std
```

39. Verify that `Kerberos 5` and `Standard AIX` are now set as the authentication methods for AIX remote commands on the nodes:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'lsauthent | dshbak -c
HOSTS -------------------------------------------------------------
spn01              spn05              spn06              spn07
spn08              spn09              spn10              spn11
spn12              spn13              spn14              spn15
-------------------------------------------------------------------
Kerberos 5
Standard Aix
```

40. Verify that `DCE` is now set as the authentication method for SP Trusted Services on the nodes:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'lsauthts' | dshbak -c
HOSTS ---------------------------------------------------------------
spn01              spn05              spn06              spn07
spn08              spn09              spn10              spn11
spn12              spn13              spn14              spn15
---------------------------------------------------------------------
DCE
```

41. Verify that the `.k5login` file exists on the nodes and is not zero-length:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'wc -c /.k5login' | dshbak -c
HOSTS ---------------------------------------------------------------
spn01              spn05              spn06              spn07
spn08              spn09              spn10              spn11
spn12              spn13              spn14              spn15
---------------------------------------------------------------------
650 /.k5login
```

42. Verify that DCE is configured and running on the nodes:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'show.cfg' | pg
spn01: Gathering component state information...
spn01:
spn01:             Component Summary for Host: spn01
spn01: Component                 Configuration State   Running State
spn01: Security client             Configured            Running
spn01: RPC                         Configured            Running
spn01: Directory client            Configured            Running
spn01:
spn01: The component summary is complete.
...
```

43. Verify that the DCE keyfiles for PSSP exist on the nodes and are not zero-length:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'ls -l /spdata/sys1/keyfiles/ssp/$(hostname)/' | pg
spn01: total 48
spn01: -rw-------   1 root  system       102 Oct 29 16:13 css
spn01: -rw-------   1 root  system       106 Oct 29 16:13 pmand
spn01: -rw-------   1 root  system       116 Oct 29 16:13 sp_configd
spn01: -rw-------   1 root  system       112 Oct 29 16:13 spbgroot
spn01: -rw-------   1 root  system       116 Oct 29 16:13 switchtbld
spn01: -rw-------   1 root  system       108 Oct 29 16:13 sysctl
...
```

44. Verify that the SP Per Node Key Management is functioning properly on the nodes:

```
spcws/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/spcws/self

spcws/ # dsh -av 'spnkeymand -l' | dshbak -c
HOSTS -------------------------------------------------------------------
spn01              spn05              spn06              spn07
spn08              spn09              spn10              spn11
spn12              spn13              spn14              spn15
-------------------------------------------------------------------------
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
service=LoadL/Schedd expiration=0
service=LoadL/Startd expiration=0
service=LoadL/Starter expiration=0
service=LoadL/Negotiator expiration=0
service=LoadL/Master expiration=0
service=LoadL/Kbdd expiration=0
service=LoadL/GSmonitor expiration=0
service=mmfs/mmfsd expiration=0
service=rsct/rsct expiration=0
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

45. Remove `k4` as one of the authentication methods for AIX remote commands on the CWS, and verify that `Kerberos 5` and `Standard AIX` are still enabled:

```
spcws/ # chauthent -k5 -std

spcws/ # lsauthent
Kerberos 5
Standard Aix
```

Important

Issuing the `chauthent` command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

46. Update the boot logical volume on the CWS with the authentication method change:

```
spcws/ # /usr/sbin/savebase
spcws/ #
```

47. Stop the kerberos daemons on the CWS:

```
spcws/ # stopsrc -s kerberos
0513-044 The kerberos Subsystem was requested to stop.
spcws/ # stopsrc -s kadmind
0513-044 The kadmind Subsystem was requested to stop.
```

48. Comment out the `kerberos` and `kadmind` entries in the `/etc/inittab` file on the CWS:

```
spcws/ # cat /etc/inittab
...
:kerb:2:once:/usr/bin/startsrc -s kerberos
:kadm:2:once:/usr/bin/startsrc -s kadmind
...
```

49. Remove old Kerberos V4 ticket cache files on the CWS and the nodes:

```
spcws/ # /usr/bin/k4destroy
...
spcws/ # dsh -av ‘/usr/bin/k4destroy’
...
```

50. You may also want to clean up other miscellaneous remnants from Kerberos V4, such as:

    - The `/etc/krb.conf`, `/etc/krb.realms`, and `/etc/krb-srvtab` files
    - The `/.klogin` files
    - The `/.k` file on the CWS
    - The Kerberos V4 database in the `/var/kerberos/database` directory

- The Kerberos V4 entries in the `/etc/services` file

Final verification

51. Your `splstdata -p` listing should now look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 941039977,692774656,0
auth_install     dce
auth_root_rcmd   dce
ts_auth_methods  dce
auth_methods     k5:std
```

Figure 17. SDR settings for the DCE security state

52. Archive the SDR:

```
spcws/ # SDRArchive DCE.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99304.1654.DCE.19991031
```

53. (Optional) At this point, you can configure some of your nodes as DCE Security Replica and Secondary CDS servers for the cell. For example, to increase cell performance and availability, you might choose to configure the first node on each ethernet segment as a DCE Security Replica and Secondary CDS server. The process to configure these servers is virtually the same one you used to configure the DCE Security Master and Primary CDS servers. For the DCE Security Replica server, select **secondary** instead of primary. For the Secondary CDS server, select **additional** instead of initial. For more details on how to set up these additional servers, see Section 4.6.3, “Setting up the CWS as DCE server” on page 74, and Section 4.7.5, “Setting up a DCE Security Replica Server on a node” on page 110.

5.3.4 From Compatibility to DCE: Further considerations

If your SP system is already part of or will be joining an existing DCE cell, there are further considerations that you need to be aware of prior to migrating your SP system to the DCE security state:

- You will need to coordinate the migration with your DCE cell administrator. Certain steps in the procedure require cell_admin credentials.
- The DCE cell will need to be upgraded to DCE 3.1 or higher if it is not already there. DCE 3.1 is the minimum version of DCE supported by PSSP 3.2.
- If the DCE Security Master server and/or Primary CDS server is on a node, it will need to be moved to either the CWS or, preferably, a machine outside of the SP system. This is required to avoid a circular dependency that can occur between the node and the CWS. From the DCE standpoint, the CWS (as DCE client or DCE Security Replica and Secondary CDS server) cannot come up unless the node (as DCE Security Master and Primary CDS server) is up. On the other hand, the node cannot be powered up using PSSP if the CWS is down. The result is a deadlock between the two.
- You will need to configure the CWS as either a DCE client only or a DCE Security Replica and Secondary CDS server, rather than a DCE Security Master and Primary CDS server.
- You will need to verify that all machines in your SP system have network routes to the other machines in the DCE cell. Name resolution must also be thoroughly validated throughout the cell.
- Joining an existing DCE cell creates a software dependency between your SP system and the DCE cell. Software fixes and upgrades to the DCE cell will also need to be applied to the machines in your SP system.

If there is even a remote possibility that you will be joining an existing DCE cell, do not configure your SP system as a self-contained DCE cell. Reconfiguring your SP system to be part of the existing cell at a later date will be painful at best. You are much better off taking the time now to architect the correct solution. DCE is not trivial, merging two cells is even less so.

5.4 Moving from Compatibility to Minimal

If your SP system existed prior to the release of PSSP 3.2, you will have to begin with it in Compatibility state. Once you have migrated your SP system (or at least one partition in it) to PSSP 3.2, it will, by definition, have a security state of Compatibility. This procedure shows you how to change the security state from Compatibility to Minimal. If you are interested in removing Kerberos V4, this is the procedure for you.

5.4.1 From Compatibility to Minimal: Planning considerations

Before you begin this procedure, read through it, and make sure you understand its general flow. As with any change to your SP system, be sure that you have a current set of verified system backups. If possible, you should perform this procedure during a normal maintenance window for your SP system.

Important

This procedure shows you how to reduce the security state of your SP system. We do not recommend using this procedure if your SP system is connected to external networks, and under no circumstance should you use it if your SP system is connected to the Internet.

5.4.2 From Compatibility to Minimal: High-level outline

The step-by-step procedure to move from Compatibility to Minimal can be broken down into these main sections:

1. Initial verification
2. Move from Compatibility to Compatibility:Minimal
3. Midpoint review
4. Move from Compatibility:Minimal to Minimal
5. Final verification

You will get a snapshot of your current environment. Transition to a point where you have both the old and new security states enabled and verified; transition to just the new security state, and finish with a final snapshot of the environment.

Important

Do not try to go directly from the old security state to the new one, bypassing the transitional state in which both old and new are active. The purpose of the transitional state is to ensure that your system remains operative while you enable the new state. Shutting off the old state too early in the process will result in communications disruptions between the control workstation and the nodes.

5.4.3 From Compatibility to Minimal: Step-by-step procedure

This procedure is based on the following assumptions:

- The SP system is configured as a single-partition system.
- All nodes are at PSSP 3.2 or higher.
- The nodes and CWS are not configured with Kerberos V5 as an AIX authentication method.

To move from Compatibility to Minimal, do the following:

Initial verification

1. Get a baseline listing of the current security state:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

Move from Compatibility to Compatibility:Minimal

2. Archive the SDR:

```
spcws/ # SDRArchive Compatibility.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99303.1058.Compatibility.19991030
```

3. Add `std` as one of the security capabilities required on nodes, and verify that the `auth_install` attribute is set to `k4:std`:

```
spcws/ # spsetauth -i -p spcws k4 std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

4. Add `std` as one of the authorization methods for AIX remote commands, and verify that the `auth_root_rcmd` attribute is set to `k4:std`:

```
spcws/ # spsetauth -d -p spcws k4 std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  compat
auth_methods     k4:std
```

5. Distribute or update the `.rhosts` and `.klogin` files on the nodes with the entries in the corresponding files on the CWS:

```
spcws/ # dsh -av '/usr/lpp/ssp/bin/updauthfiles'
...
```

Note

It is not uncommon for `updauthfiles` to take several minutes to complete.

6. Verify that the `.rhosts` files exist on the nodes, that they are not zero-length, and that there is at least one entry for the CWS in them:

```
spcws/ # dsh 'ls -l /.rhosts'
spn01: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn05: -rw------- 1 root system 218 Oct 19 18:17 /.rhosts
spn06: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn07: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn08: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn09: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn10: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn11: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn12: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn13: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn14: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts
spn15: -rw------- 1 root system 218 Oct 19 18:16 /.rhosts

spcws/ # dsh -av 'grep spcws /.rhosts'
spn01: spcws
spn01: spcws
spn05: spcws
spn05: spcws
spn06: spcws
spn06: spcws
...
```

Midpoint review

7. At this point, your `splstdata -p` listing should look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
-------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  compat
auth_methods     k4:std
```

Figure 18. SDR settings for the Compatibility: Minimal transitional security state

- You are at the transitional state of Compatibility: Minimal.
- You have verified that Minimal is configured correctly.
- You are now ready to turn off Compatibility.

Move from Compatibility:Minimal to Minimal

8. Archive the SDR:

```
spcws/ # SDRArchive Compatibility-Minimal.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/ \
backup.99303.1101.Compatibility-Minimal.19991030
```

9. Remove `k4` as one of the authentication methods for AIX remote commands, and verify that the `auth_methods` attribute is set to `std`:

```
spcws/ # chauthpar -p spcws -v std
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  compat
auth_methods     std
```

10. Remove `compat` as one of the authentication methods for SP Trusted Services, and verify that the `ts_auth_methods` attribute is set to `""` `(`none`)`:

```
spcws/ # chauthpts -p spcws -v
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  ""
auth_methods     std
```

11. Remove `k4` as one of the authorization methods for AIX remote commands, and verify that the `auth_root_rcmd` attribute is set to `std`:

```
spcws/ # spsetauth -d -p spcws std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   std
ts_auth_methods  ""
auth_methods     std
```

12. Remove `k4` as one of the security capabilities required on nodes, and verify that the `auth_install` attribute is set to `std`:

```
spcws/ # spsetauth -i -p spcws std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     std
auth_root_rcmd   std
ts_auth_methods  ""
auth_methods     std
```

13. Remove `k4` as one of the authentication methods for AIX remote commands on the CWS, and verify that `Standard Aix` is still enabled:

```
spcws/ # chauthent -std

spcws/ # lsauthent
Standard Aix
```

Important

Issuing the command `chauthent` without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

14. Update the boot logical volume on the CWS with the authentication method change:

```
spcws/ # /usr/sbin/savebase
spcws/ #
```

15. Stop the kerberos daemons on the CWS:

```
spcws/ # stopsrc -s kerberos
0513-044 The kerberos Subsystem was requested to stop.
spcws/ # stopsrc -s kadmind
0513-044 The kadmind Subsystem was requested to stop.
```

16. Comment out the `kerberos` and `kadmind` entries in the `/etc/inittab` file on the CWS:

```
spcws/ # cat /etc/inittab
...
:kerb:2:once:/usr/bin/startsrc -s kerberos
:kadm:2:once:/usr/bin/startsrc -s kadmind
...
```

17. Remove old Kerberos V4 ticket cache files on the CWS and the nodes:

```
spcws/ # /usr/bin/k4destroy
...
spcws/ # dsh -av '/usr/bin/k4destroy'
...
```

18. You may also want to clean up other miscellaneous remnants from Kerberos V4, such as:

    - The `/etc/krb.conf`, `/etc/krb.realms`, `/etc/krb-srvtab` files

- The `/.klogin` files
- The `/.k` file on the CWS
- The Kerberos V4 database in the `/var/kerberos/database` directory
- The Kerberos V4 entries in the `/etc/services` file

Final verification

19.Your `splstdata -p` listing should now look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name       spcws
ip_address        192.168.3.130
install_image     default
syspar_dir        ""
code_version      PSSP-3.2
haem_cdb_version  940342361,764607232,0
auth_install      std
auth_root_rcmd    std
ts_auth_methods   ""
auth_methods      std
```

Figure 19. SDR settings for the Minimal security state

20.Archive the SDR:

```
spcws/ # SDRArchive Minimal.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99303.1105.Minimal.19991030
```

5.5 Moving from Minimal to Compatibility

This procedure will typically be used by someone who has just finished installing a new SP system with PSSP 3.2 configured to the Minimal security state. The SP system should not be connected to an external network until this procedure has been successfully completed and the new security state fully tested.

5.5.1 From Minimal to Compatibility: Planning considerations

Before you begin this procedure, read through it, and make sure you understand its general flow. You should also read through the steps for setting up Kerberos V4 in the *PSSP 3.2: Installation and Migration Guide*, GA22-7347. As with any change to your SP system, be sure that you have a current set of verified system backups. If possible, you should perform this procedure during a normal maintenance window for your SP system.

This procedure assumes that you will be configuring your CWS as the Kerberos V4 master. When configuring Kerberos V4, you will be asked to supply the following:

- The master password for the Kerberos V4 database.
- The Kerberos V4 administrative principal and instance name (typically `root.admin`)

Moreover, if you do not want to use the default Kerberos V4 realm name, which is your DNS domain name in uppercase, you will need to create an `/etc/krb.conf` file before running `setup_authent`. Details can be found in the *PSSP Installation and Migration Guide*, GA22-7347.

5.5.2 From Minimal to Compatibility: High-level outline

The step-by-step procedure to move from Minimal to Compatibility can be broken down into these main sections:

1. Initial verification
2. Move from Minimal to Minimal:Compatibility
3. Midpoint review
4. Move from Minimal:Compatibility to Minimal
5. Final verification

You will get a snapshot of your current environment. Transition to a point where you have both the old and new security states enabled and verified; transition to just the new security state, and finish with a final snapshot of the environment.

> **Important**
>
> Do not try to go directly from the old security state to the new one, bypassing the transitional state in which both old and new are active. The purpose of the transitional state is to ensure that your system remains operative while you enable the new state. Shutting off the old state too early in the process will result in communications disruptions between the CWS and the nodes.

5.5.3 From Minimal to Compatibility: Step-by-step procedure

This procedure is based on the following assumptions:

- The SP system is configured with a single system partition.
- All nodes are at PSSP 3.2 or higher.
- The nodes and CWS are not configured with Kerberos V5 like an AIX authentication method.
- The CWS will house the master copy of the Kerberos V4 database.

To move from Minimal to Compatibility, do the following:

Initial verification

1. Get a baseline listing of the current security state:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     std
auth_root_rcmd   std
ts_auth_methods  ""
auth_methods     std
```

Move from Minimal to Minimal:Compatibility

2. Archive the SDR:

```
spcws/ # SDRArchive Minimal.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99303.1145.Minimal.19991030
```

3. Update root’s PATH with /usr/lpp/ssp/kerberos/bin

```
spcws/ # echo $PATH
/usr/bin:/etc:/usr/sbin:/usr/ucb:/usr/bin/X11:/sbin:/usr/local/bin:/usr/lpp/ssp/
bin:/usr/lib/instl:/usr/lpp/ssp/kerberos/bin
```

4. Add `k4` as one of the authentication methods for AIX remote commands on the CWS, and verify that `Kerberos 4` and `Standard AIX` are enabled:

```
spcws/ # chauthent -k4 -std

spcws/ # lsauthent
Kerberos 4
Standard Aix
```

Important

Issuing the `chauthent` command without any parameters turns off all authentication methods for this machine, effectively disabling remote logins for everyone.

5. Initialize RS/6000 SP authentication services:

```
spcws/ # setup_authent
...
```

6. Verify that you now have Kerberos V4 set up on the CWS:

```
spcws/ # ps -ef | grep kerb | grep -v grep
root 14326 4170 0 15:57:45 -  0:00 /usr/lpp/ssp/kerberos/etc/kerberos
root 23972 4170 0 15:57:48 -  0:00 /usr/lpp/ssp/kerberos/etc/kadmind -n

spcws/ # grep kerb /etc/inittab
kerb:2:once:/usr/bin/startsrc -s kerberos
spcws/ # grep kadm /etc/inittab
kadm:2:once:/usr/bin/startsrc -s kadmind

spcws/ # klist
Ticket file:    /tmp/tkt0
Principal:      root.admin@SPCWS

  Issued          Expires         Principal
Oct 19 15:58:19  Nov 18 14:58:19  krbtgt.SPCWS@SPCWS
```

7. Set `compat` as the authentication method for SP Trusted Services on the CWS, and verify the setting:

```
spcws/ # chauthts compat

spcws/ # lsauthts
Compatibility
```

8. Complete system support installation on the CWS:

```
spcws/ # install_cw
...
```

9. Add `k4` as one of the security capabilities required on nodes, and verify that the `auth_install` attribute is set to `k4:std`:

```
spcws/ # spsetauth -i -p spcws k4 std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   std
ts_auth_methods  ""
auth_methods     std
```

10. Add `k4` as one of the authorization methods for AIX remote commands, and verify that the `auth_root_rcmd` attribute is set to `k4:std`:

```
spcws/ # spsetauth -d -p spcws k4 std
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  ""
auth_methods     std
```

11. Enable `compat` as the authentication method for SP Trusted Services, and verify that the `ts_auth_methods` attribute is set to `compat`:

```
spcws/ # chauthpts -c -p spcws -v compat
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name       spcws
ip_address        192.168.3.130
install_image     default
syspar_dir        ""
code_version      PSSP-3.2
haem_cdb_version  940342361,764607232,0
auth_install      k4:std
auth_root_rcmd    k4:std
ts_auth_methods   compat
auth_methods      std
```

Note

The -c flag on the `chauthpts` command sets `ts_auth_methods` on the CWS only. The change will be propagated to the nodes in a later step.

12. Add `k4` as one of the authentication methods for AIX remote commands, and verify that the `auth_methods` attribute is set to `k4:std`:

```
spcws/ # chauthpar -c -p spcws -v k4 std
...

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  compat
auth_methods     k4:std
```

Note

The -c flag on the `chauthpar` command sets `auth_methods` on the CWS only. The change will be propagated to the nodes in a later step.

13. Run `setup_server` on the CWS to populate the Kerberos V4 database with rcmd principals for the nodes, and verify that the rcmd principals were added:

```
spcws/ # setup_server
...
setup_server: Processing complete (rc= 0).

spcws/ # /usr/lpp/ssp/kerberos/etc/kdb_util dump /tmp/kerberos.out
spcws/ # pg /tmp/kerberos.out
...
rcmd spn01 255 1 1 0 ...
rcmd spn05 255 1 1 0 ...
rcmd spn06 255 1 1 0 ...
...
spcws/ # rm /tmp/kerberos.out
```

Note

Be sure to remove the `/tmp/kerberos.out` file as soon as you are finished with it.

14. Enable `k4` as one of the authentication methods for AIX remote commands on the nodes:

```
spcws/ # chauthpar -p spcws -v k4 std
...
```

15. Set the nodes to `customize`, run `setup_server`, and verify the settings:

```
spcws/ # spbootins -r customize -l 1,5,6,7,8,9,10,11,12,13,14,15 \
> 2>&1 | tee /tmp/setup_server.out
spcws/ #

spcws/ # splstdata -b
...
```

16. Customize the nodes:

```
spcws/ # dsh -av ‘/etc/rc.sp’
...
```

17. Verify that `Kerberos 4` and `Standard Aix` are now set as the authentication methods for AIX remote commands on the nodes:

```
spcws/ # dsh -av ‘lsauthent’ | dshbak -c
HOSTS ----------------------------------------------------------------
spn01           spn05           spn06           spn07
spn08           spn09           spn10           spn11
spn12           spn13           spn14           spn15
----------------------------------------------------------------------
Kerberos 4
Standard Aix
```

18. Verify that `Compatibility` is now set as the authentication method for SP Trusted Services on the nodes:

```
spcws/ # dsh -av ‘lsauthts’ | dshbak -c
HOSTS ----------------------------------------------------------------
spn01           spn05           spn06           spn07
spn08           spn09           spn10           spn11
spn12           spn13           spn14           spn15
----------------------------------------------------------------------
Compatibility
```

19. Verify that there are rcmd service tickets for each of the nodes:

```
spcws/ # klist
Ticket file:    /tmp/tkt0
Principal:      root.admin@SPCWS

  Issued          Expires         Principal
Oct 19 15:58:19  Nov 18 14:58:19  krbtgt.SPCWS@SPCWS
Oct 19 16:08:40  Nov 18 15:08:40  hardmon.spcws@SPCWS
Oct 19 17:04:32  Nov 18 16:04:32  rcmd.spn01@SPCWS
Oct 19 17:02:49  Nov 18 16:02:49  rcmd.spn05@SPCWS
Oct 19 17:04:26  Nov 18 16:04:26  rcmd.spn06@SPCWS
Oct 19 17:04:30  Nov 18 16:04:30  rcmd.spn07@SPCWS
Oct 19 17:04:28  Nov 18 16:04:28  rcmd.spn08@SPCWS
Oct 19 17:04:22  Nov 18 16:04:22  rcmd.spn09@SPCWS
Oct 19 17:04:42  Nov 18 16:04:42  rcmd.spn10@SPCWS
Oct 19 17:04:27  Nov 18 16:04:27  rcmd.spn11@SPCWS
Oct 19 17:04:38  Nov 18 16:04:38  rcmd.spn12@SPCWS
Oct 19 17:04:52  Nov 18 16:04:52  rcmd.spn13@SPCWS
Oct 19 17:04:23  Nov 18 16:04:23  rcmd.spn14@SPCWS
Oct 19 17:04:54  Nov 18 16:04:54  rcmd.spn15@SPCWS
```

Midpoint review

20.At this point, your `splstdata -p` listing should look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4:std
ts_auth_methods  compat
auth_methods     k4:std
```

Figure 20. SDR settings for the Minimal:Compatibility transitional security state

- You are at the transitional state of Minimal:Compatibility.
- You have verified that Compatibility is configured correctly.
- You are now ready to turn off Minimal.

Move from Minimal:Compatibility to Compatibility

Since the auth_methods and ts_auth_methods attributes are already set to the correct values for the Compatibility security state, we only need to change the auth_root_rcmd and auth_install attributes.

21. Archive the SDR:

```
spcws/ # SDRArchive Minimal-Compatibility.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/ \
backup.99303.1148.Minimal-Compatibility.19991030
```

22. Remove std as one of the authorization methods for AIX remote commands, and verify that the auth_root_rcmd attribute is set to k4:

```
spcws/ # spsetauth -d -p spcws k4
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4:std
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

23. Remove std as one of the security capabilities required on nodes, and verify that the auth_install attribute is set to k4:

```
spcws/ # spsetauth -i -p spcws k4
spcws/ #

spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

24.Set the nodes to `customize`, run `setup_server`, and verify the settings:

```
spcws/ # spbootins -r customize -l 1,5,6,7,8,9,10,11,12,13,14,15 \
> 2>&1 | tee /tmp/setup_server.out
spcws/ #

spcws/ # splstdata -b
...
```

25.Customize the nodes:

```
spcws/ # dsh -av '/etc/rc.sp'
...
```

Note

This step removes the PSSP entries from the `.rhosts` files on the nodes. If those entries were the only ones in the file, it also removes the file.

26.Verify the status of the `.rhosts` files on the nodes:

```
spcws/ # dsh 'ls -l /.rhosts'
spn01: ls: 0653-341 The file /.rhosts does not exist.
spn05: ls: 0653-341 The file /.rhosts does not exist.
spn06: ls: 0653-341 The file /.rhosts does not exist.
spn07: ls: 0653-341 The file /.rhosts does not exist.
spn08: ls: 0653-341 The file /.rhosts does not exist.
spn09: ls: 0653-341 The file /.rhosts does not exist.
spn10: ls: 0653-341 The file /.rhosts does not exist.
spn11: ls: 0653-341 The file /.rhosts does not exist.
spn12: ls: 0653-341 The file /.rhosts does not exist.
spn13: ls: 0653-341 The file /.rhosts does not exist.
spn14: ls: 0653-341 The file /.rhosts does not exist.
spn15: ls: 0653-341 The file /.rhosts does not exist.
```

Note

This listing is for an SP system where the system-generated `/.rhosts` files have not been modified.

Final verification

27.Your `splstdata -p` listing should now look like the following:

```
spcws/ # splstdata -p 2>&1 | tee /tmp/splstdata.$(date +%Y%m%d)
List System Partition Information

System Partitions:
------------------
spcws

Syspar: spcws
----------------------------------------------------------------------
syspar_name      spcws
ip_address       192.168.3.130
install_image    default
syspar_dir       ""
code_version     PSSP-3.2
haem_cdb_version 940342361,764607232,0
auth_install     k4
auth_root_rcmd   k4
ts_auth_methods  compat
auth_methods     k4:std
```

Figure 21. SDR settings for the Compatibility security state

28.Archive the SDR:

```
spcws/ # SDRArchive Compatibility.$(date +%Y%m%d)
0025-322  SDRArchive: SDR archive file name is
/spdata/sys1/sdr/archives/backup.99303.1149.Compatibility.19991030
```

Chapter 6. Restricted Root Access (RRA)

Several SP system components use `rsh` to remotely issue commands on the CWS (from a node) or on various nodes (from the CWS). Likewise, several components use `rcp` to copy files between the CWS and SP nodes (and vice versa). In order to provide this capability, PSSP has effectively defined one root user across the entire SP system. As such, gaining access as root on any node in the SP system implies that the user can gain access as root on the CWS and all other nodes in the SP.

When, for instance, the SP is used as a server consolidation system, this single root user may not be desirable. As of PSSP 3.2, a feature called Restricted Root Access (RRA) is included to limit the uses of `rsh` and `rcp` within PSSP software. When RRA is enabled, it restricts root `rsh` and `rcp` authorizations from the nodes to the CWS, but permits CWS-to-node `rsh` and `rcp` access. When RRA is activated, it will reconfigure the SP and the root owned remote command authorizations such that:

- When run as a root process on the CWS, SP software can continue to issue `rsh` and `rcp` commands to any node within the SP system. Authorization file entries will be created by PSSP on the nodes for which a root process on the CWS can obtain the necessary credentials to issue these commands.
- SP software run as a root process on a node no longer requires the capability to issue `rsh` and `rcp` commands to the CWS or to any other node within the SP system. PSSP will no longer create authorization file entries on the CWS or nodes that grant a root process on a node remote command access.

Furthermore, when PSSP software on the nodes needs to copy or access files or execute commands on other nodes or the CWS, `sysctl` is used to perform the task from the CWS. The restrictions imposed by using RRA have implications for the functionality of some PSSP and non-PSSP components as well as system management.

RRA can be activated under all supported security configurations in PSSP 3.2. However, RRA is of most interest in PSSP `dce`, `dce:compat`, and `compat` security modes. RRA use under PSSP’s Minimal security state (none/std) is of little value. RRA within all four major security configurations is described later in this chapter.

For the remainder of the RRA sections, all references to access control lists (ACLs) apply to root owned `sysctl` and AIX remote command ACLs because they apply to the different PSSP security configurations.

6.1 How does it work?

RRA can be turned on by changing an indicator in the SDR. Because the SDR (in non-DCE environments) can be changed by root automatically, it was necessary to create a new SDR class that can only be changed by root on the CWS. This class is the `SP_Restricted` class, which contains the `restrict_root_rcmd` attribute. The default value is `false`.

The indicator can be changed by using the “Site environment” SMIT panel or by using the `spsitenv` command. If changed, the authorization files on the CWS and the nodes are immediately updated.

All commands that require `rsh/rcp` access check the indicator each time access is required. They will automaticaly use the sysctl method if RRA is enabled.

6.1.1 AIX and PSSP remote commands

AIX remote command authorization files for root on the nodes and the CWS are generated and updated by the `updauthfiles` script. This script is run at various times including when the RRA state is changed, when the security settings on the system are modified, and when a node is installed or booted.

When RRA is enabled, `updauthfiles` removes all known SP-generated entries in the remote command authorization files and adds the following entries, which are dependent on the authentication method set for `auth_root_rcmd`:

Standard AIX: `/.rhosts` is modified to contain only:

- <cwsname>
- <additional cws interface names>

Kerberos V4: `/.klogin` is modified to contain only:

- rcmd.<cwsname>@<realm>

Kerberos V5: `/.k5login` is modified to contain only:

- ssp/<cwsname>/spbgroot@<realm>
- hosts/<cwsname>/self@<realm>

Any manual changes previously made to these files are *not* removed automatically. Also, prior to PSSP 3.2, the /.klogin entries generated by the SP were not saved in a separate file. If you have migrated your system from a previous release of PSSP, there may be SP-generated entries in your /.klogin file that are no longer recognized. It is, therefore, a good idea to check the content of all root remote command authorization files after activating RRA.

6.1.2 The sysctl facility

The sysctl facility is an authenticated client/server system for running commands and TCL scripts remotely and in parallel. The sysctl server daemon, sysctld, processes all sysctl client requests for the node on which it runs. There is a sysctld daemon running on each node of the SP system as well as on the control workstation.

By default, the /etc/sysctl.conf configuration file is read and interpreted each time the sysctl server is started or restarted. This file contains the definitions of the commands that can be executed by sysctl. Additional sysctl commands are supplied with PSSP 3.2 to enable RRA. Since the contents of the /etc/sysctl.conf file on the CWS are different from the one on the nodes, the CWS version should not be included in any file distribution scheme.

Access to the new sysctl commands is provided through a set of sysctl access control list (ACL) files shipped with PSSP. For Compat mode, these ACLs are installed in the /etc directory and contain a Kerberos V4 entry for the global SP principal root.SPbgAdm. For DCE mode, the sysctl daemon initializes new DCE ACL objects (relating to the new sysctl commands) with entries for the PSSP DCE principal, ssp/.../spbgroot, which allow the principal to access the new sysctl commands. (For Minimal mode, none/std, with RRA enabled, sysctl's ACL entries must be manually updated to allow the new sysctl commands to be executed. However, this is not a recommended security configuration under which to enable RRA. This is discussed further in Section 6.3.4, "Security state Minimal" on page 194.

For sysctl to function correctly in an RRA-enabled environment, it is important that the sysctl daemon use the same default TCP/IP port number on all nodes and the CWS.

Overall, sysctl becomes a critical part of the SP environment when operating in an RRA-enabled mode.

Sysctl usage, ACLs, and other considerations are covered extensively in Chapter 7, “Example security scenarios” on page 199. The reader is encouraged to review this chapter for additional information about `sysctl`.

6.2 Limitations

RRA is a feature that creates new functionality within PSSP and fundamentally changes authorization methods. Obviously, this has consequences for some PSSP components and some AIX software products that are used in an SP environment.

6.2.1 Coexistence

Because of the new functionality, when RRA is enabled, it can only be used in an SP in which all nodes are, at least, at PSSP 3.2. At activation time, the `spsitenv` command will check whether all nodes are at a correct level. If there are nodes at a lower PSSP level, RRA cannot be activated.

6.2.2 VSD/GPFS

During configuration and runtime, VSD and GPFS rely on existing combinations of `rsh` and `sysctl` commands and nested `sysctl` calls to access information on the CWS as well as other nodes (node-to-node). The existing architecture relies on the existence of a common PSSP root identity that can be authorized successfully under `rsh` and `sysctl` ACLs. As such, when RRA is enabled, the common PSSP root access required by VSD and GPFS is disabled. When attempting to activate RRA, if VSD adapters are defined or if GPFS is installed on the control workstation, the activation will fail.

6.2.3 HACMP

HACMP/ES 4.3.0 or HACMP 4.3.1 can use Kerberos V4 as an authentication and authorization method that requires additional principals and interfaces defined in the Kerberos V4 database.

When RRA is not enabled, adding additional principals to the Kerberos V4 database can be done manually or by running the `cl_setup_kerberos` script. This script is run from an HACMP node and does the following:

- It reads the HACMP topology.
- It uses `rsh` and `rcp` to update the Kerberos database on the CWS.
- It creates new client keys for the HACMP nodes.
- It copies the keys from the CWS to the HACMP nodes.

When RRA is enabled, the actions performed by `cl_setup_kerberos` are no longer possible due to the HACMP `rsh` and `rcp` requirements from a node to the CWS. Also, the HACMP nodes can no longer use `rsh` and `rcp` to synchronize the HACMP ODM, given that the remote command authorization files on the CWS (and other nodes) will no longer have common root authorization from node-to-node or node-to-CWS. These authorizations will have to be added manually to the appropriate root-level remote command authorization file(s).

The synchronization capability can be restored by editing the `/.klogin` files on the HACMP nodes, for a `compat/k4` enabled security mode, explicitly allowing both systems to have root access to each other. The RRA function will not interfere with custom settings.

Updating the Kerberos V4 database using the `cl_setup_kerberos` script requires root access to the CWS, which is exactly what RRA was designed to eliminate. Manual updating of the Kerberos V4 database is the most secure way to ensure that the database is updated, but this is a complex and error-prone method. A workaround is to temporarily add the HACMP nodes to the `/.klogin` file on the CWS, for a `compat/k4` enabled security mode, run the `cl_setup_kerberos` script, and then remove the authorizations immediately afterwards.

Refer to the official HACMP documentation for details on running with HACMP under various PSSP security configurations.

6.2.4 HACWS

When using a Highly Available Control Workstation (HACWS), there are no problems in the authentication of both systems on the nodes. It is, however, a manual action to copy the authorization files, `/.rhosts` or `/.klogin`, to the backup CWS. It is also important that the activation of RRA be done from the (active) primary CWS, since this is also the Kerberos V4 Master.

There are several restrictions and limitations for HACWS when running under a DCE-enabled security mode and in other situations that apply when running under an RRA-enabled mode as well. Refer to the “Limitations and Restrictions” section in Chapter 4 of the book, *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281, for complete details.

6.2.5 Boot/install servers

Currently, only one Boot/Install Server (the CWS) is supported when RRA is activated. Since Boot/Install Servers are NIM Masters, they need to have remote command access to the CWS when changing SP nodes. Boot/Install Servers also need `rsh` capability on their client nodes during installation time. At runtime, remote command authorization on the client nodes is only needed when a software (or patch) update is required.

Refer to Section 6.3.5, “Multiple Boot/install Servers in RRA” on page 195, for details on using multiple Boot/Install Servers in an RRA-enabled environment.

6.2.6 Ecommands

When RRA is activated, the following switch management commands can only be run from the control workstation:

- `CSS_test`
- `Eclock`
- `Efence`
- `Eprimary`
- `Equiesce`
- `Estart`
- `Eunfence`
- `Eunpartition`
- `mult_senders_test`
- `switch_stress`
- `wrap_test`

6.2.7 System management commands

When RRA is activated, the following list of system management commands should only be run from the control workstation. If run from a node, authorization failures may prevent successful completion.

- `dsh`
- `lppdiff`
- `pcat`
- `pcp`
- `pexec`
- `pexescr`
- `pfind`

- pkill
- pls
- pmv
- ppred
- pps
- prm
- ptest
- setup_authent
- spacctnd
- spgetdesc
- splstdata (-d, -h, -i options only)
- spmkuser

6.2.8 Additional security implications

Using RRA will not, in itself, make your SP system more secure. The fact that PSSP does not automatically authorize root to rsh and rcp from a node and gain default access on other nodes within the SP does not prevent root from logging in to another node using telnet. Even if you disable the ability for root to remotely log in to nodes and the CWS, root can still su to any user and then exploit that user's rsh or other AIX and PSSP remote command capability to access other nodes or the CWS.

You will have to adapt your user management for root to fit into the new access policy. You might want to implement the policy described in Section 7.2.4, "Restricting user access" on page 205.

6.3 RRA enablement - General steps

In order to enable (activate) RRA, all nodes within the SP system require a minimum level of PSSP 3.2. If there are any nodes that are below this level of PSSP, RRA cannot be enabled. Also, if any VSD adapters are defined, or if GPFS is installed, attempts to enable RRA will fail.

For new PSSP installs:

1. Complete all steps in Chapter 2, Task C (including CWS installation and security install/configuration steps) of the *PSSP Installation and Migration Guide*, GA22-7347.

2. Enable RRA via `spsitenv` or SMIT
3. Complete the steps for customizing the nodes in Chapter 2, Task D, of the *PSSP 3.2: Installation and Migration Guide*, GA22-7347; if performing Step 56, follow the additional instructions outlined in Section 6.3.6, “Node install customization” on page 196 of this book.
4. Complete the steps for powering on and installing the nodes in Chapter 2, Task E of the *PSSP 3.2: Installation and Migration Guide*, GA22-7347.

For migrations to PSSP 3.2:

- Complete all tasks for migrating the CWS to PSSP 3.2 in Chapter 4 of the *PSSP Installation and Migration Guide*, GA22-7347*.*
- Complete all tasks for migrating nodes to PSSP 3.2 in Chapter 4 of the *PSSP Installation and Migration Guide*, GA22-7347*.*
- Enable RRA via `spsitenv` or SMIT.
- If multiple Boot/Install Server nodes exist, follow the instructions outlined in Section 6.3.5, “Multiple Boot/install Servers in RRA” on page 195.
- For future installations of new nodes that require customization, follow the instructions in Section 6.3.6, “Node install customization” on page 196.

6.3.1 Spsitenv and RRA

You can set the `restrict_root_rcmd` attribute using the SMIT menu that configures the “Site environment Information”:

smit site_env_dialog

-> Change the “Root remote command access restricted” field

or by using `spsitenv`:

```
spsitenv restrict_root_rcmd=true
```

or by using the “Set Site Environment Information” TaskGuide.

You can see the current setting by using the following command:

```
splstdata -e
```

and scanning for the line containing `restrict_root_rcmd`, or by simply issuing the following command:

```
splstdata -e | grep restrict_root_rcmd
```

A value of `false` means that RRA is not enabled, and `true` means that it is enabled.

When the state of RRA is changed to true, action is taken immediately to update all authorization files within the SP. All PSSP commands that required rsh/rcp access will switch to using sysctl procedures.

All old entries in the root remote command authorization files will be preserved. The SP-generated entries are identified by looking at the files. All entries that are present in those files will be removed from the authorization files when RRA is activated, leaving only entries that allow the CWS to access the host, as well as any previously existing custom entries.

Issuing spsitenv will generate a failure message and not enable RRA if any of the following conditions are satisfied:

- VSDs exist
- GPFS exists
- A node at a level of PSSP below 3.2
- In dce mode, when the DCE identity (principal) under which the spsitenv command is being issued is not a member of the PSSP DCE group, sdr-restricted.

6.3.2 Security state DCE

To change the RRA indicator in the SDR via spsitenv, the DCE identity (principal) under which the command is being issued must be a member of the PSSP DCE group, sdr-restricted. Once RRA is enabled, root's /.k5login file on the nodes will be updated to contain only one PSSP DCE principal, the CWS's spbgroot principal, and an entry for the CWS's DCE self-host principal. All customer entries are not touched by RRA enablement.

If you were using the DCE self-host principal as the principal under which you work normally, nothing will change when operating from the CWS in an enabled RRA mode. From other nodes, however, the automatic authorization of root-level self-host principals on those nodes will no longer be allowed. This is exactly what is intended.

If you use a different DCE principal to work under, and that principal was added to /.k5login prior to enabling RRA, this entry is preserved by PSSP as noted earlier.

However, it must be noted that, if SP administrators create DCE credentials on nodes under the same DCE principal that appears in the CWS's /.k5login file, unless the credentials are destroyed on the nodes, another root user can use these credentials to gain entry to the CWS via rsh, rlogin, and telnet. It is strongly recommended that administrators not issue dce_login commands on nodes under principals whose identities appear in the CWS /.k5login file or in the /.k5login files on other nodes. Doing so introduces the risk of a security compromise that RRA seeks to help reduce.

Root-owned DCE credentials that do not belong to PSSP services or the DCE self-host principal should be destroyed on the nodes as appropriate. Refer to the IBM DCE for AIX guides for commands on destroying DCE credentials and other recommendations for cleaning up DCE credentials.

6.3.3 Security state Compatibility

Before you activate RRA, first, destroy all Kerberos V4 root administrator (root.admin) tickets on the nodes: dsh -av k4destroy. This prevents root users on the nodes from gaining access on the CWS. Note, however, that the k4destroy command remotely executed on all the nodes (via dsh) will only destroy the Kerberos V4 credentials stored in root's default Kerberos V4 ticket cache location, /tmp/tkt0. All other root-owned credential files stored under /tmp or other directories must be removed manually.

As an overview, when RRA is enabled, root's /.klogin files are changed automatically, and the PSSP software will start to use sysctl commands in place of rsh and rcp commands. The appropriate PSSP Kerberos V4 principal entries are already present in the needed sysctl ACL files.

From a more detailed point of view, when RRA is activated, the /.klogin files on the nodes are changed to contain only the PSSP Kerberos V4 rcmd.* principal for the CWS. (Non-PSSP Kerberos V4 principals are not removed.)

However, on the CWS, the root administrator entry is preserved. This means that you cannot use the root administrator principal to gain access via remote commands to the nodes, but you can use it on the nodes to the CWS. This may seem contradictory, but the idea is that the root administrator principal is no longer used for remote commands, especially not on the nodes. If a ticket file (/tmp/tkt0) is left behind on a node, the root user could get to the CWS automatically.

There are three scenarios that you could follow to do remote commands when RRA is enabled:

1. Standard: Use the root.admin principal only for administrative purposes, such as adding nodes to the SP or adding Kerberos V4 principals. Use the /usr/lpp/ssp/rcmd/bin/rcmdtgt command to get a ticket automatically for the rcmd.<CWS> principal to use for remote commands.

    - You will need to use the root administrator principal for access to hardmon; so, you will need to switch to this principal when using the spmon command.
    - The rcmd principal has a never-ending ticket. This forms a security risk.
    - You could add the rcmd principal to the hmacl file (see scenario #3), but that would increase the security risk.

2. Simple: Keep using the root administrator principal for remote commands. You will need to add an entry for the root administrator to the /.klogin files on the nodes.
    - Using the root administrator principal actively may expose the CWS and all nodes any time a ticket file for this principal exists on a node.

3. Secure: Create a new Kerberos principal for daily use. All the necessary actions are explained in the following:
    - Activities that involve changing the Kerberos database still require the root administrator principal, but all other activities can be performed using a new root principal that does not have administrative access to the Kerberos database.
    - This is the most secure method because it separates Kerberos administration privileges from remote commands privileges.
    - The following steps need to be taken on the CWS to configure the new principal:

```
sp3en0/ # kadmin
Welcome to the Kerberos V4 Administration Program, version 2
Type “help” if you need it.
admin: ank Usage: add_new_key <user_name>
admin: ank sp_admin
Admin password:
Password for sp_admin:
Verifying, please re-enter Password for sp_admin:
sp_admin added to database.
admin: quit
Cleaning up and exiting.
sp3en0/ # echo “1 sp_admin vsm” >> /spdata/sys1/spmon/hmacls
sp3en0/ # cat /spdata/sys1/spmon/hmacls
sp3en0 root.admin a
1 root.admin vsm
1 root.SPbgAdm vsm
1 hardmon.sp3en0 vsm
1 sp_admin vsm
sp3en0/ # stopsrc -s hardmon
sp3en0/ # startsrc -s hardmon
```

Now, change the /.klogin file on the nodes to contain sp_admin@<REALM>, and authenticate yourself as sp_admin on the CWS. You can now issue rsh and rcp commands to the nodes and use spmon on the CWS.

6.3.4 Security state Minimal

Enabling RRA when running the SP with the authentication method for Trusted Services set to "" (none) does make each node more independent than in other PSSP security configurations. However, there is no additional security to be gained by running with RRA enabled in a none/std mode (where std is the AIX authentication method).

In none/std, PSSP services either perform authentication and authorization based on the user's apparent uid and gid, or, in the case of sysctl, based on the apparent uid@hostname entries in its compat ACL files. (Of course, in none/std, the sysctl daemon can only authenticate the user based on the apparent uid of the user's request.)

There are three instances when sysctl access on the CWS is required:

1. During node installation: /etc/sysctl.install.acl
2. When using switch commands: /etc/sysctl.rootcmds.acl
3. When using event management: /etc/sysctl.haem.acl

When RRA is enabled in a none/std environment, the sysctl ACLs on the CWS, as noted above, are *not* automatically updated with root@node_host_name entries. Without these entries, the sysctl commands will fail. Such sysctl ACL entries must be manually entered into the needed ACL files.

However, granting the nodes such authority on the CWS will partly undo the result the RRA-enabled mode attempts to curtail, thus, the need to manually update the ACLs. But, caution must be exercised when updating the ACLs with such data. Once sysctl ACLs are updated with root@node_host_name for each node in the SP, any user on a node that appears to be root@node_host_name can now run sysctl commands protected by the ACLs.

Furthermore, as nodes are added or deleted from the system, while under a none/std mode, the CWS's sysctl ACL entries must be updated accordingly.

You can run the SP in a Minimal security state with RRA enabled, but you will encounter problems when using Switch or Event Management and when installing nodes. To avoid these problems, you could add the _other_unauth entry in various sysctl ACL files, but this would open up the CWS. In fact, the use of _other_unauth should be avoided at all costs because this grants authorization to any user, regardless of their uid or hostname.

Important

In short, running with RRA enabled in a none/std security environment is not recommended.

6.3.5 Multiple Boot/install Servers in RRA

Using multiple Boot/Install Servers in RRA is not recommended and is not automatically supported by PSSP. However, depending on the size of your system and network loads, it may not be possible to install your system with a single Boot/Install Server.

Boot/Install Servers are NIM Masters and, therefore, require rsh and rcp access to both the CWS and to the nodes they serve. PSSP will not automatically create the correct entries in the authorization files to allow these commands to work.

To use additional Boot/Install Servers, follow this procedure to manually establish the correct authorizations on your system:

On the CWS, the authorization files must have the following changes, depending on the setting of auth_root_rcmd:

- standard: An entry for the Boot/Install Server node host name in /.rhosts
- k4: An entry for the Boot/Install Server node rcmd principal in /.klogin
- dce: An entry for the self-host and the spbgroot principal for the Boot/Install Server node

On the Boot/Install Server node, you need to edit /etc/sysctl.conf to include the following entries:

- Include /usr/lpp/ssp/sysctl/bin/install.cmds
- Include /usr/lpp/ssp/sysctl/bin/switch.cmds
- Include /usr/lpp/ssp/samples/sysctl/firstboot.cmds, if initiating a node install customization

You need to recycle sysctld (stopsrc -s sysctld; startsrc -s sysctld) on the CWS (and all Boot/Install Servers) to pick up the sysctl changes.

Because multiple Boot/Install Server nodes require additional manual configuration, warning messages to this effect will be generated by the following commands:

- spsitenv
- SDR_config
- spmkvgobj
- spchgvgobj

Additional considerations for node install customization are addressed in the following section.

6.3.6 Node install customization

In order to do install customization using the firstboot-cust procedure when RRA is enabled, you need to do the following:

- Add the sysctl call for copy_env_files to firstboot.cust on the CWS (and all Boot/Install Servers).
- Edit the copy_env_file TCL procedure in the /usr/lpp/ssp/samples/sysctl/firstboot.cmds file on the CWS (and all Boot/Install Servers) to include the rsh and rcp commands required for your customization.

Once the node is installed, or as part of firstboot.cust, the remote command authorization files on the node serviced by the non-CWS Boot/Install Server need to be updated with the following changes:

- standard - An entry for the Boot/Install Server node host name in /.rhosts
- k4 - An entry for the Boot/Install Server node rcmd principal in /.klogin
- dce - An entry for the self-host and the spbgroot principal for the Boot/Install Server node

6.4 Troubleshooting tips

If you experience unexpected remote command authorization failures, the following should be checked:

- The SDR Site Environment settings. Run splstdata -e on the CWS to make sure the RRA setting is correct. If not, run spsitenv for the restrict_root_rcmd attribute.

- The remote command authorization files on the CWS. If they are not correct, run `spsitenv` for the `restrict_root_rcmd` attribute to force all authorization files to be regenerated.
- The remote command authorization files on the nodes. If they are not correct, run `spsitenv` for the `restrict_root_rcmd` attribute to force all authorization files to be regenerated.

Chapter 7. Example security scenarios

The security features that PSSP software provides were explained in the previous chapters, and scenarios described how to achieve a desired security state. There were three security states defined in Section Chapter 2., “SP security concepts and terminology” on page 11: Minimal, Compatibility, and DCE. This chapter outlines four common site environments that use these security states and recommends additional security measures for them. After the scenarios, a few considerations for high security environments are discussed, followed by intrusion detection techniques.

For each site environment, a set of security measures are discussed. The aim is not to provide a detailed theoretical explanation of the subject but to provide enough information to get you started. When appropriate, an example is given. You need to consult the system manuals or the documentation provided with the tool for more detailed information.

For more information on general security and network security, you could read the O’Reilly book, *Practical Unix and Internet Security*, ISBN 1565921488, by Simson Garfinkel and Gene Spafford.

Detailed information on basic AIX security is available in the redbook, *Elements of security: AIX 4.1*, GG24-4433. It provides you with descriptions of many standard AIX security features.

The following section discusses four typical scenarios, ranging from low security to high security. You may pick one of these scenarios or simply select features from them at will. Of course, the security measures discussed in lower security scenarios also apply to the higher security ones. Keep in mind that your overall security is just as strong as its weakest part.

Scenarios discussed:

1. Open environment
    - Low security, the environment is highly-trusted
    - Uses the Minimal security state
2. Standard commercial systems
    - Used internally within a company
    - Use common sense security measures
    - Gain security with a minimum of money and effort
    - Use the Compatibility security state

3. Mission-critical commercial systems
   - High value internal systems, downtime is not acceptable
   - Cannot trust the intranet
   - Needs extra effort to prevent disruption of service
   - Uses the Compatibility security state
4. Internet connected systems
   - Potential threat is high
   - Cannot trust networks
   - Requires strong authentication and encryption
   - Requires intrusion detection
   - Uses the DCE security state

After the scenarios, some considerations for high security environments are discussed. Concluding this chapter is a section on intrusion detection. Tools to help you discover whether your system has been compromised are described in Section 7.6, “Intrusion detection and monitoring” on page 226.

7.1 Open environment

Having hardly any security at all is something that will appeal especially to technical and scientific users. This scenario should not be considered for commercial systems or systems that have confidential data stored on them.

An open environment does not imply that there is no authorization or authentication mechanism at all. Normal UNIX methods, such as password and host authentication still apply, and these give the system a certain base level of protection. The environment in which the SP operates has to be trusted to use this security level. If the network or the other systems connected through it are not trusted, better ways of authentication are required.

With PSSP 3.2, the possibility exists to refrain from using security enhancements, such as Kerberos, and rely on the basic AIX authentication and authorization schemes. This means that all authorizations required for the PSSP daemons and remote commands should be done through `.rhosts` files in the root user’s home directory. The authentication is only performed by checking the IP address referred to in the incoming packet and doing a reverse name lookup, which is then automatically accepted when listed.

This setup will reduce the complexity of installation and maintenance of PSSP significantly, but, because the network is highly-trusted, the system is very vulnerable to attack there. This should be taken into account.

SP security state: Minimal

The authentication methods to be installed (`auth_install`) are set to `std`, which means that no extra software needs to be installed. The authentication setting for the SP Trusted Services (`ts_auth_methods`) is set to `""` (none); so, they only use standard AIX authentication and verification methods. The authentication methods (`auth_methods`) used by AIX are set to `std`; so, normal AIX authentication is used. The authorization for remote commands (`auth_root_rcmd`) is set to `std`, which means `.rhosts` files for root.

Table 15. SP security state advised for an open environment

Security State	Security Attribute Setting			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
Minimal	`std`	`std`	`""` (none)	`std`

7.2 Standard commercial systems

Most commercial systems are not connected to the Internet but operate on an internal network. These networks tend to be trusted more than the Internet making the demands on security less drastic. The security measures discussed in this setup mostly apply to system internal security and avoiding network services that are not secure.

If you enhance security, it will require more time and effort. The 80/20 rule states that 80 percent of the result is reached with 20 percent of the effort. This scenario is probably closest to this rule. Once you are required to enhance security beyond this, be prepared to invest more time and money in doing so.

Security standards should be raised by using AIX and PSSP features or by disabling some of them. Standard system security measures should be taken, such as password rules, ftp restrictions, and so on.

You need to define a security policy. To help you, there are several security-related books available. For example, Chapter 2 of the O'reilly book, *Practical Unix and Internet Security*, ISBN 1565921488, by Simson Garfinkel and Gene Spafford, explains the relevant issues when defining a policy. When defining a policy for an SP system, the choices are sometimes different than for a standalone system. For example, the SP switch is a private network, which can be trusted more than a normal network.

To help you understand the consequences of standard AIX security measures, we discuss these topics in the following sections:

- NIS and NFS risks
- NIS+ and Secure NFS
- Disable services that are not needed
- Restrict user access
- Disable automatic authorization using the `.rhosts` or `hosts.equiv` file
- Do not use X11, or secure the connection
- Take backup tapes offline to prevent tampering

SP security state

PSSP is set to the Compatibility security state. This state is the same as the standard on PSSP 3.1 and earlier. It provides proper authentication for all `rsh` and `rcp` commands needed for managing the system. Authorization will be automatic for kerberized commands, and password entry is required for any other command.

The authentication methods to be installed (`auth_install`) are set to `k4`, which means the ssp.clients fileset will be installed. The authentication setting for the trusted services (`ts_auth_methods`) is set to `compat`, which will cause most of the PSSP Trusted Services to do a simple (non-K4) authentication check. The authentication methods (`auth_methods`) used by AIX are set to `k4` and `std`, which will cause AIX to try to get Kerberos V4 authentication first, and, if that fails, it will try the standard AIX method. The authorization for remote commands (`auth_root_rcmd`) is done by using the Kerberos V4 method, which means a `.klogin` file is generated for root when customizing or installing a node. Table 16 shows the SP security state advised for commercial systems.

Table 16. SP security state advised for commercial systems

Security State	Security Attribute Setting			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
Compatibility	`k4`	`k4`	`compat`	`k4:std`

7.2.1 NIS and NFS risks

NIS and NFS both use Sun's Remote Procedure Call (RPC) protocol to access data on remote systems. The RPC protocol can use several authentication methods; the one used by NIS and NFS is called AUTH_UNIX or, sometimes, AUTH_SYS.

With AUTH_UNIX, the client will include the user and group ID of the user in the call. The server assumes that the client provides the correct information, and, based on its access control lists (for NFS, the /etc/exports file), it will either grant or deny permission.

In an SP environment, the use of NIS for providing password data should be avoided since there are other, more secure ways available. These include supper, DCE user management, and NIS+. Using NIS to access non-sensitive data is, of course, not a security risk.

NFS is required in an SP because PSSP uses it to install nodes, customize nodes, and boot nodes in maintenance mode. You cannot disable NFS on the CWS, but you should always use NFS on the internal SP networks (ethernet, switch) only.

This example shows how you can unintentionally expose your system:

> You export the mksysb images filesystem on the CWS with root-access for the external interface of a node. On the external network, another system uses the same IP address as your node(spoofing) and mounts the NFS file system. Because it has root access, it can read the backup image and extract the `/etc/security/passwd` file. It could even alter the image.

To make NFS a bit more secure, you should always specify which hosts have access to the exported filesystems and the filesystems should be exported read-only if possible. You should also add the following line to /etc/rc.net:

```
no -o ipignoreredirects=1
```

This will prevent AIX from accepting redirect messages for IP addresses, thus, preventing a system on another network from succeeding in impersonating a node on the internal SP ethernet.

7.2.2 NIS+ and Secure NFS

NIS+ and Secure NFS use Sun's RPC protocol, just as NIS and NFS do, but they differ in the authentication protocol used. Standard NIS and NFS use the AUTH_UNIX method, while the more secure variants use AUTH_DES to authenticate all calls.

The AUTH_DES protocol is used by *Secure RPC*. This protocol uses DES-based encryption employing a public and private key system. This ensures proper authentication of all requests and, thus, provides a secure way of sharing data through Secure NFS and user management.

In order to use Secure RPC, you will need to set up the public and private keys and create principals for all users. The easiest way to do this is to set up NIS+, which is still no trivial matter.

NIS+ is included in AIX version 4.3.3. More information on setting up and adminstering NIS+ can be found in the system manual, *Network Information Services (NIS and NIS+) Guide*, SC23-4310.

7.2.3 Disabling services

Not giving the opportunity to exploit weaknesses in AIX is a good idea. By disabling services that you are not using anyway, you can tighten security without much effort. Whether or not you require these services depends on the use of your system. You should use caution when disabling services.

The following services are candidates for disabling:

- Run by `/etc/inetd.conf`:
  - `rexec`, this requires `.netrc` files, which should never be allowed.
  - `ntalk`, responds to the `talk` command
  - `rwalld`, responds to the `rwall` command
  - `rstatd`, gives performance information about the system
  - `rusersd`, responds to the `rusers` command
  - `sprayd`, responds to packets sent by the `spray` command
  - `pcnfsd`, used for NFS exports to PCs
  - `echo`, returns data packets to a host
  - `discard`, discards incoming data packets
  - `chargen`, discards incoming packets, and sends random packets back
  - `daytime`, returns the date and time in user readable form
  - `time`, returns the date and time in machine readable form
  - `cmsd`, used for the Common Desktop Environment
  - `dtspcd`, used for the Common Desktop Environment
- Run from the `/etc/inittab`:
  - `rc.dt`, starts up the common desktop daemons
  - `rc.nfs`, starts NFS server daemons, not needed for client access.
  - `httpdlite`, used for man page lookups
  - `infod`, only AIX 4.2 and earlier, used by the Info Explorer.
  - `pdnsd`, used by xlC++ for documentation services

- Run from /etc/rc.tcpip:
  - `sendmail`, if mail is not actively used, it is a security risk
  - `snmpd`, if the PSSP level is less then 3.1, and not used
  - `dpid2`, legacy snmp thing, no longer used

7.2.4 Restricting user access

Since the network in which the system operates is more or less trusted, the main threat will be users logging in to systems where they should have no rights to log in. The PSSP software provides the `spacs_cntrl` tool for controlling interactive user access to nodes. It can be used to allow or deny access on a node for a specific user.

The `spacs_cntrl` tool will change the following attributes for a denied user:

In the `/etc/security/user` file:

```
ttys = ALL,!RSH,!REXEC
login = false
rlogin = false
```

You can deny access to each user separately for each node in the system, or you can deny access to the system by default and only allow certain users to log in. If you want to deny all, you will have to set this manually:

```
chsec -f /etc/security/user -s root -a tty="ALL"
chsec -f /etc/security/user -s default -a rlogin=false
chsec -f /etc/security/user -s default -a tty="ALL,!RSH,!REXEC"
spacs_cntrl allow user1
```

Root access should be restricted to certain key administrators, but, in practice, the root password tends to go around among more people than was intended. One way of restricting access to root is to disable remote login possibilities for root.

Of course, this means that users will now have to use the `su` command to become root. This can be restricted to just a few people by creating a *suroot* group. Only members of this group can then `su` to root. This is how it is done:

```
mkgroup -a id=300 suroot
chgroup users=root,admin1,admin2 suroot
chuser sugroups=suroot rlogin=false root
```

Now, only the admin1 and admin2 user can su to root. For safety reasons, you should always leave the login attribute as true on all systems.The only way to get to the console of a node is by using the s1term program on the CWS, which requires root authority there.

7.2.5 Do not allow automatic login authorization

The standard UNIX remote authentication mechanism is not very sophisticated. It will believe whatever the client tells it; so, if an IP address has been spoofed, the incoming rlogin session will be granted access because the name belonging to that address is listed in the .rhosts file of that user.

We advise that you not have any automatic login authorization enabled within the SP. The /etc/hosts.equiv file and the /.rhosts file should not contain any entries. Also, .netrc files should not be created. Within AIX, it is not possible to prevent users from creating such files, but, if stated in the security policy, it could be enforced by regularly scanning the home directories of all users.

7.2.6 Securing X11 connections

This section has been taken from the redbook, *The RS/6000 SP Inside Out*, SG24-5374.

If configured improperly, the X Windows system can be a major security hole. It is used to connect X servers (machines with a graphical display like the SP administrator's workstation) with X clients (machines that want to display graphical output on an X server, like the SP control workstation). If the X server is not secured, everybody can monitor or, even, control the X server's resources. This includes the keyboard and screen; so, everything that is typed or displayed on an unprotected X server can be monitored.

There are two access control commands to restrict X connections to an X server: xhost, which controls access based on IP names/addresses of the clients, and xauth, which provides more fine-grained access control through the use of *cookies*. Both are contained in the X11.apps.config fileset.

The xhost command is the simplest way to restrict access; it has to be invoked on the X server (the machine whose display/keyboard is to be secured). Entering the command without parameters lists the current setup; xhost + or xhost - globally enables or disables access to the X server, and individual client hosts can be added or removed by specifying the host's name after the plus or minus parameter. The following sequence of commands illustrates this. At the end of the sequence, only X clients running on the control workstation, sp5cw0, can access the local X server.

```
sp3en0/ # which xhost
xhost is a tracked alias for /usr/bin/X11/xhost

sp3en0/ # xhost +
access control disabled, clients can connect from any host

sp3en0/ # xhost -
access control enabled, only authorized clients can connect

sp3en0/ # xhost -
access control enabled, only authorized clients can connect
sp3en0/ # xhost + sp5cw0
sp5cw0 being added to access control list
sp3en0/ # xhost
access control enabled, only authorized clients can connect
sp5cw0.itso.ibm.com
```

Figure 22. Granting access to X11 remote displays

However, this is insecure if the client machine is a multi-user machine. Anybody who has a login on sp5cw0 is allowed to connect to the local machine's X server and can, for example, record passwords typed in at this workstation.

To limit access to specific users, such as the root user on sp5cw0, the Xauthority mechanism is used. When the X server starts up, it generates a secret key called a cookie (normally in a format called MIT-MAGIC-COOKIE-1, although other formats exist) and stores this key in the $HOME/.Xauthority file in the home directory of the user who started the X server. If an X client wants to access the X server, it needs to know this key and has to present it to the X server.

The local user who started the X server immediately has access to it, but all other users on the X server machine and all users on other X client machines first need to get this key. Of course, this transfer has to be secured. Securely transferring the key can be challenging. Using an NFS-mounted file system, for example, cannot be considered secure since it is relatively easy to bypass file access permissions of NFS-exported file systems. If the shared file system is in AFS or DFS, this is much more secure. If there is no shared file system, an actual copy has to be performed, which might also expose the key.

The `xauth` command can be used on the client machine to add the cookie to the .Xauthority file of the user whose processes want to access the X server as shown in the following example:

```
sp3en0/ # which xauth
xauth is a tracked alias for /usr/bin/X11/xauth

sp3en0/ # xauth info
Authority file:       /home/joe/.Xauthority
File new:             No
File locked:          Yes
Number of entries:    2
Changes honored:      Yes
Changes made:         No
Current input:        (argv):1

sp3en0/ # xauth list
desktop/unix:0  MIT-MAGIC-COOKIE-1 1234567890abcdef084a48716447704c
desktop.itso.ibm.com:0  MIT-MAGIC-COOKIE-1 1234567890abcdef084a48716447704c

sp3en0/ # xauth add risc123:0 MIT-MAGIC-COOKIE-1 234567890abcdef084a48716447704c
sp3en0/ # xauth remove risc123:0
```

Figure 23. Using xauth to authenticate access to X11 resources

The `xauth list` command displays the contents of the .Xauthority file, showing one line per <hostname>:<display> pair. The cookies are displayed as a string of 32 hex digits. Individual keys for a <hostname>:<display> pair can be added and removed by the `add` and `remove` options, using the same format as the `list` output. Each time the X server starts, it creates a new cookie that has to be transferred to its clients.

The secure shell, described in Section 7.3.2, “Using encrypted login sessions” on page 213, transparently encrypts all X traffic in a separate channel. On the remote node, a new .Xauthority file is created, and the cookie is used to secure the communication between the sshd daemon and the X client. On the local node, the cookie is necessary to set up a secure connection between the X server and the ssh client. This is very convenient because both the text-based login and any X Windows traffic are automatically protected.

7.2.7 Securing your backups

Many sites use a centralized backup system with a large tape library for backups. Because of the large number of tapes in the library, it is no longer necessary to load tapes for each backup. The main reason to export tapes from the library is when they need to be transported elsewhere for disaster recovery services.

Imagine this: Hackers have gained access to your system. They start using your system for their own purposes. When they no longer need your system, they have two options: Simply leave or erase their tracks. To erase all signs of their presence they gain access to your backup server and delete all the backups that are in the library. They then delete all files in your system. No one will now be able to find out their identity.

You could classify a successful attack on your system as a disaster and, accordingly, have a disaster recovery plan ready. This will require offline storage of a complete set of backup tapes; so, you can rebuild your system from scratch.

7.3 Mission-critical commercial systems

These systems have to be protected from misuse because their value is such that corruption could threaten the existence of the company. Since they are not connected to the Internet, the main threat is an attack from the inside. It should, therefore, not trust the intranet.

Since it is not connected to the Internet, many of the standard UNIX services are not needed outside of the SP. We can, therefore, block them more easily. The threat with internal systems is probably not from professional hackers but from your own employees. Since these employees are operating in a more controlled environment, they cannot use the same tactics as Internet-based hackers because they can be identified more easily.

To ensure that the system is well-shielded from internal attacks, It should use authentication for root commands. It can also use the packet filtering option that is built into AIX to block services that are not required on the intranet.

Encrypted login sessions protect against password sniffers. Grabbing a password simply by installing a program on a PC that listens in on all passing traffic is a way of gaining illegal access that is too simple to ignore.

We recommend the following additional security measures:

- Restrict access to the system by setting up IP security and blocking all ports lower than 1024 on the external network interface.
- Allow only encrypted logins over insecure networks via SSH.
- Optionally set `umask` on nodes and CWS for root to `027`.

SP security state

The SP security state is the same as on a standard commercial system, Compatibility. The authentication for remote commands is done through Kerberos V4. The authorization is Kerberos V4 for `rcp` and `rsh`, and a password is required for all other access. When SSH is used instead of standard telnet, this prevents sending passwords unencrypted over the network, thus, increasing security. Table 17 lists the SP security state advised for mission-critical commercial systems.

Table 17. SP security state advised for mission-critical commercial systems

Security State	Security Attribute Setting			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
Compatibility	`k4`	`k4`	`compat`	`k4:std`

7.3.1 Restrict access to the system by setting up IP Security

IP Security (IPSec) is a separately-installable fileset provided with AIX 4.3. The software is actually derived from the IBM Secure Network Gateway (SNG) product and provides AIX with the ability to support IP tunnels and filters.

IP tunnels are a standard way of encapsulating data transferred over IP in a secure manner. To achieve this, the tunnel is authenticated, and all data passing through it is encrypted. Tunnels are, by nature, point-to-point connections and, therefore, not of much use inside an SP. They can be very useful, however, to provide secure access to a remote system, even if the connection is made over the Internet. This could very well apply to remote system management.

IP filtering is a basic function in which incoming and outgoing packets can be accepted or denied based on a variety of characteristics. This allows a system administrator to configure the host to control the traffic between this host and other hosts. Filtering is done on a variety of packet properties, such as source and destination addresses, IP Version (4 or 6), subnet masks, protocol, port, routing characteristics, fragmentation, interface, and tunnel definition. This filtering is done only at the IP layer; nothing is changed at the application layer; so, no changes to the applications are required.

IP filtering can be set up on a per-tunnel basis. If no tunnels are defined, the filtering settings apply to regular network traffic. Filter definitions are known as *rules*. The rules are processed from lower to higher numbers. If a rule is found that applies to the packet, it will be used, and all remaining rules will be disregarded. There are two basic ways of setting up filtering. One way is to start out by denying all traffic on a given interface (or all interfaces) and then permitting certain ports to have inbound, outbound, or both-way traffic. The other way is to permit all traffic on an interface and then deny access to certain ports.

For a mission-critical system, it is most likely that the application (which is really the critical part) will want to use IP ports located in the higher range (larger than 1023). The ports ranging from 1-1023 are also known as *trusted ports*. These ports can only be listened to by a program running with root authority. The services these ports provide are well-defined; so, the results of blocking them are known. The application's port should not be restricted, but the trusted ports are not needed on the external network of an SP and can, therefore, be blocked. If a specific service is needed, a special rule can be added to exclude that port from the blockade.

If you are not sure which ports are used exactly, you can look it up in the `netstat -a` output, or (and this is much nicer) by using the `lsof` (list open files) program, a public domain tool that can tell you what files (and this includes sockets) a program has open. The `lsof` tool can be downloaded in installp format from: `http://www.bull.com`.

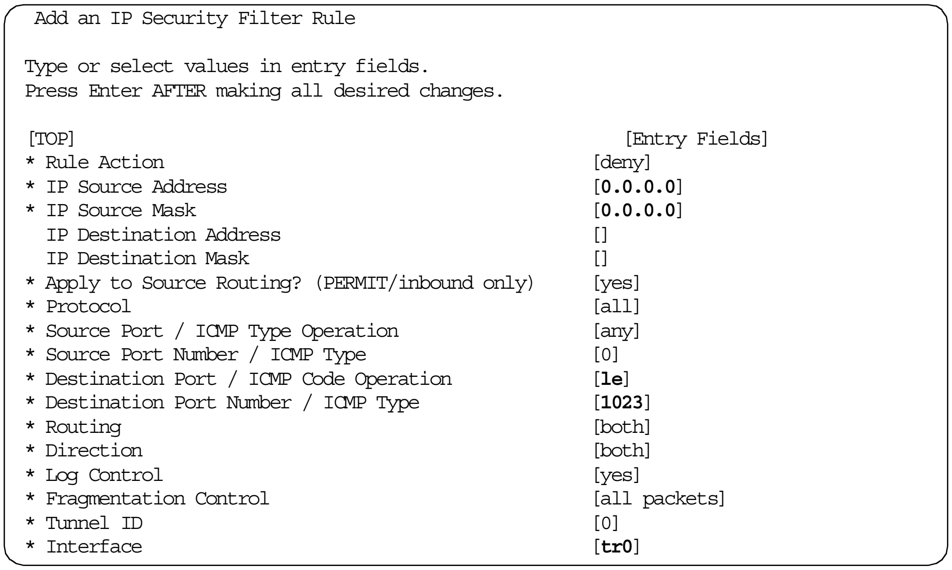
The following steps show how to set up the filter rules and activate the filter mechanism. For more information, see the IP Security configuration section of the system manual, *AIX Version 4.3 System Management Guide: Communications and Networks*, SC23-4127.

The IP Security software can be found in the `bos.net.ipsec.rte` fileset. Before filtering can be activated, rules must be set up properly. This can be done using the following fastpath:

#smitty ips4_conf_filter

```
 Configure IP Security Filter Rules

Move cursor to desired item and press Enter.

  List IP Security Filter Rules
  Add an IP Security Filter Rule
  Change IP Security Filter Rules
  Move IP Security Filter Rules
  Export IP Security Filter Rules
  Import IP Security Filter Rules
  Delete IP Security Filter Rules
```

Choose **Add an IP Security Filter Rule**, and add a standard rule to prevent access to any of the trusted ports (port 1-1023) on the `tr0` interface.



```
 Add an IP Security Filter Rule

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                [Entry Fields]
* Rule Action                                       [deny]
* IP Source Address                                 [0.0.0.0]
* IP Source Mask                                    [0.0.0.0]
  IP Destination Address                            []
  IP Destination Mask                               []
* Apply to Source Routing? (PERMIT/inbound only)    [yes]
* Protocol                                          [all]
* Source Port / ICMP Type Operation                 [any]
* Source Port Number / ICMP Type                    [0]
* Destination Port / ICMP Code Operation            [le]
* Destination Port Number / ICMP Type               [1023]
* Routing                                           [both]
* Direction                                         [both]
* Log Control                                       [yes]
* Fragmentation Control                             [all packets]
* Tunnel ID                                         [0]
* Interface                                         [tr0]
```

Figure 24. Adding a rule to IP Security filtering

If you want to be able to log in to the server, you might want to grant access on the telnet port to a certain subset of systems. Just make a rule that permits that. Once you have made the rule, you want to be sure the rules are in the correct order so that, when a telnet packet is evaluated, it is allowed through.

NFS services can be disabled by blocking port 2049. Only do this for the external interface, you should not disable NFS on the internal SP ethernet.

You will need to disable the SP Trusted Services on the external interface to prevent their outside use. The ports are different on each installation and can be found in the `/etc/services` file and by running the following command:

```
SDRGetObjects SP_ports
```

Choose **Move IP Security Filter Rules** from the Configure IP security Filter Rules SMIT menu. The filter rules are always parsed form the top down. The first rule that applies to the packet is used, and the remaining rules are not evaluated. You may need to move several entries around to fit your design.

Once you are satisfied with the filtering settings, you can start the IPSec device and then start the filtering.

```
1. mkdev -l ipsec -t 4
2. mkfilt -v 4 -u
```

To check your work:

```
sp3n15/ # lsdev -Cc ipsec
ipsec_v4 Available  IP Version 4 Security Extension
sp3n15/ # lsfilt
Beginning of IPv4 filter rules.
Rule 1:
Rule action         : permit
Source Address      : 0.0.0.0
Source Mask         : 0.0.0.0
Destination Address : 0.0.0.0
Destination Mask    : 0.0.0.0
Source Routing      : no
Protocol            : udp
Source Port         : eq  4001
Destination Port    : eq  4001
...
```

When you are satisfied with the settings, you can use the `expfilt` command to export your filter definitions. You can then distribute them to other nodes and use the `impfilt` command to import them there.

7.3.2 Using encrypted login sessions

You may have very strict password rules and require your users to regularly refresh their passwords, but, if the network over which those passwords are transmitted is not secure, anybody with access to it may listen in. This is also known as *sniffing*, and, with the right equipment, it is not difficult to do.

To prevent password sniffing, you need to secure the communication between the client and the server system. You could do this by using hardware methods, such as building a separate ethernet segment that is connected to a few administrators workstations and the server, or by using a hardware encryption card in your system. You could also use a software mechanism that encrypts the traffic between two hosts. Of course, using encryption will have a performance impact if a large amount of data is sent. You will need to take this into account before implementing an encryption system.

When Kerberos V4 or DCE is used as an authentication method in PSSP, the kerberized versions of `rsh` and `rcp` only authenticate the connection. They do not encrypt the data. This means that, although the remote system is guaranteed to be the right one, passwords that are entered in a kerberized `rsh` are still sent in clear text over the network.

If you want to have encrypted sessions, you can use one of the following options:

- IP tunnels provided by IPSec

- Secure Shell (SSH)

IPSec provides an encrypted, authenticated *tunnel* between two hosts on an IP level. This guarantees that all communication between those hosts is encrypted. This also means that, for each server that needs to be communicated with, a tunnel should already have been created.

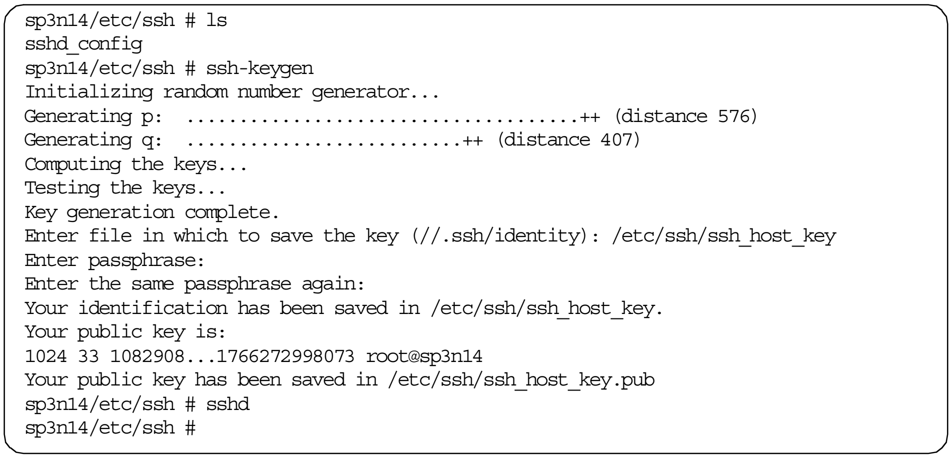
SSH is a commercial product by Data Fellows Inc. but is freely-available for some non-commercial use. See their Web-site for more details:

`http://www.ssh.org`

Setting up SSH is not a difficult task. In fact, one of the design criteria was to make it as easy as possible. SSH uses a private/public key scheme, whereby the server process (`sshd`) and the client process (`ssh`, `scp`) each have their own set of keys. Users need their own set of client keys, and must make sure the public key is available on the remote system.

Each system that is an SSH server needs its own set of private and public keys. The server must keep the private key secret, but it will give its public key to any `ssh` process that makes a connection to it.

After installing SSH, create the `/etc/ssh` directory, and copy the config file into it. Now, you can call the `ssh-keygen` program that will generate a pair of private and public keys:



```
sp3n14/etc/ssh # ls
sshd_config
sp3n14/etc/ssh # ssh-keygen
Initializing random number generator...
Generating p:  ...................................++ (distance 576)
Generating q:  .........................++ (distance 407)
Computing the keys...
Testing the keys...
Key generation complete.
Enter file in which to save the key (//.ssh/identity): /etc/ssh/ssh_host_key
Enter passphrase:
Enter the same passphrase again:
Your identification has been saved in /etc/ssh/ssh_host_key.
Your public key is:
1024 33 1082908...1766272998073 root@sp3n14
Your public key has been saved in /etc/ssh/ssh_host_key.pub
sp3n14/etc/ssh # sshd
sp3n14/etc/ssh #
```

Figure 25. Generating keys for an SSH server

Now that you have your server set up, you can set up your user account. You can use the same `ssh-keygen` program to generate your keys. If you just press

Enter at the `Enter passphrase` line, you will not be asked for a password when using SSH. We recommend that you do use a password.

```
sp3n14/home/joe # ssh-keygen
Initializing random number generator...
Generating p:  ............................++ (distance 402)
Generating q:  ......++ (distance 66)
Computing the keys...
Testing the keys...
Key generation complete.
Enter file in which to save the key (/home/joe/.ssh/identity):
Enter passphrase:
Enter the same passphrase again:
Your identification has been saved in /home/joe/.ssh/identity.
Your public key is:
1024 37 115969...9479637 joe@sp3n14
Your public key has been saved in /home/joe/.ssh/identity.pub
```

Figure 26. Generating keys for an SSH user

The `identity.pub` file contains your public key. Each user needs to have their own set of keys. The public key has to be copied to the remote site and renamed to a file, called `.ssh/authorized_keys`. You can copy the `authorized_keys` file to all nodes on which you want to use SSH.

When using DFS or automounter for home directories, there is no need to remote copy files. Just change the name of the `identity.pub` file to `authorized_keys`, and your public key is known everywhere.

More information can be found at the following Web site:

`http://www.ssh.org`

7.3.3 Umask settings for root

The default `umask` setting for root on the CWS or the nodes is `022`. This is often not acceptable since many companies have standard rules for setting the `umask` to 027 or even 077. You can set the `umask` to these values on an SP, but you should be aware that the PSSP software expects a `umask` of `022`. We, therefore, do not recommend changing the `umask` for root on an SP system.

If you decide to change the `umask` anyway, you should set the `umask` back to `022` before performing any of the following tasks (this is probably not a complete list):

- `setup_server`
- `syspar_ctrl`
- `services_config`

- On the node, before customizing it
- On the node, before migrating it

The files in the following directories should have read permission set for the world:

- /spdata/sys1/install/pssp
- /spdata/sys1/install/<lppsource name>/lppsource
- /spdata/sys1/install/pssplpp/PSSP-X.Y/
- /tftpboot (except *-srvtab files)

When restoring a system, the backup will have the umask set too restrictive. To change that, you will need to change the umask before it becomes active. You can do this by adding this line to the script.cust file:

```
chsec -f /etc/security/user -s root -a umask=022
```

You can change it back after the migration completes.

7.4 Internet connected systems

In the default PSSP configuration, by exposing one node in an SP system to the Internet, the whole SP system automatically becomes exposed. This is because, by default, each node has root access to all other nodes and the CWS and is connected through an Ethernet with each other node and the CWS. You can implement the Restricted Root Access feature, or you can divide the SP in partitions to separate it into multiple root-domains, but the CWS still has access to all of them. In order to protect the whole SP, each node needs to be made secure individually, but all should have the same security level.

As standard, all communication should be authenticated, and, if sensitive data, such as passwords, is transmitted, it should be encrypted. Furthermore, all services that are vulnerable to attacks should be disabled. Monitoring, integrity checking, and security tests should be performed regularly.

New security holes are being found and exploited. You will need to keep your system up-to-date with the latest patches. Information and warnings can be found at:

http://www.cert.org
http://www.ers.ibm.com

You need to know what is out there. Hackers are not the only threat, but they are the most technically advanced one. You can find out more about them at the following Web sites:

```
http://www.ccc.de (partly german)
http://packetstorm.securify.com (Large download area)
http://www.attrition.org/ (Not a "Hacker site" of course)
http://www.cyberarmy.com/t-50/index.shtml (Top 50 "security" sites)
```

Downloading anything from the above sites is of course risky; be very careful when unpacking and compiling any software you have found there.

We will now discuss a number of tools for protecting the whole SP complex (not all of them in this section - some are discussed in Section 7.6, “Intrusion detection and monitoring” on page 226).

Reducing threats from the Internet:

- Use IPSec’s packet filtering ability to shield the SP system from unwanted outside access.
- Set up DCE so that the SP Trusted Services are properly authenticated

Encrypting important data:

- The `supper` tool should not be used for distributing password files because it does not encrypt the data. User management should be made secure by:
  - Having no user access to the systems
  - NIS+, although the encryption is not very strong
  - Using DCE user management

Intrusion detection:

- Use TCB or Tripwire
- Check log files

Disabling or restricting unsecure services:

- The `sendmail` daemon should be disabled, unless it is tcp-wrapped or absolutely required.
- NFS should only be used over a trusted network.
- Use TCP Wrappers to restrict access to services provided by `inetd`.

SP security state

The potential threat caused by connecting a system to the Internet requires the highest possible security setting in PSSP. The DCE security state provides better authentication schemes than the Compatibility security state and a framework that can be exploited to increase user and system security.

The authentication methods to be installed (`auth_install`) are set to `dce`, which means that the DCE client software will be installed. The authentication setting for the SP Trusted Services (`ts_auth_methods`) is also set to `dce`, which causes them to authenticate themselves as DCE principals. The authentication methods (`auth_methods`) used by AIX are set to `dce` and `std`, which will cause AIX to try to get Kerberos V5 authentication first, and, if that fails, it will try the standard AIX method. The authorization for remote commands (`auth_root_rcmd`) is done by using the Kerberos V5 method, which means a `.k5login` file is generated for root when customizing or installing a node.

Table 18. SP security state settings advised for Internet connected systems

Security State	Security Attribute Setting			
	auth_install	auth_root_rcmd	ts_auth_methods	auth_methods
DCE	dce	dce	dce	dce:std

7.4.1 Set up DCE to properly authenticate PSSP daemons

When the `ts_auth_methods` security attribute is set to `compat`, the SP Trusted Services use a locally-based authentication scheme. Some daemons, such as `sysctld`, also use Kerberos V4. Most of the SP Trusted Services daemons will accept a request if it comes from a node inside the SP and is issued by root. This authentication method is not very strong and, certainly, is not adequate for an Internet-connected system.

As of PSSP 3.2, when DCE is set as the authentication method, Kerberos V5 is used as authentication for all of the SP Trusted Services daemons. This will prevent unauthenticated programs to disrupt or abuse PSSP services.

7.4.2 Enhance filtering by IPsec

The procedure described in Section 7.3.1, “Restrict access to the system by setting up IP Security” on page 210, illustrates how to set up IP security to block traffic on ports lower than 1024. This was done to simplify the administration, since most commercial applications are not clear about which ports they use, although they do use port numbers higher than 1023.

When operating in an Internet-exposed environment, the security should be cranked up to the highest possible level. The packet filtering done by IP

Security can be enhanced by starting out denying all ports on the external interface and only opening up specific ports. Since the way the applications running in this environment operate should be better documented, the consequences of blocking all ports and allowing only specific ports to pass traffic can be predicted better.

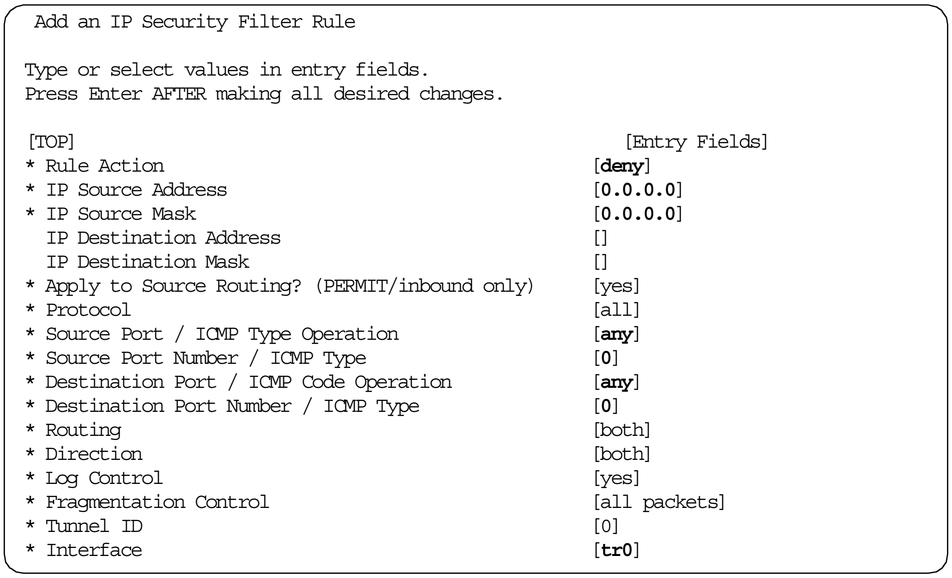
The filter rule that is evaluated last can be set with the `-z` option of the `mkfilt` command. When `-z D` is specified, all packets will be denied by default. `-z P` permits all packets to pass by default. This option can only be used for all interfaces at the same time. We do not recommend denying all packets on all interfaces because this also blocks the SP Ethernet.

Instead, you can deny all access to a certain adapter by filling out the following SMIT screen:

```
# smitty ips4_conf_filter
```

Choose **Add an IP Security Filter Rule**.

Now, you can add a rule that prevents any packet to pass on the tr0 interface:



```
 Add an IP Security Filter Rule

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                [Entry Fields]
* Rule Action                                     [deny]
* IP Source Address                               [0.0.0.0]
* IP Source Mask                                  [0.0.0.0]
  IP Destination Address                          []
  IP Destination Mask                             []
* Apply to Source Routing? (PERMIT/inbound only)  [yes]
* Protocol                                        [all]
* Source Port / ICMP Type Operation               [any]
* Source Port Number / ICMP Type                  [0]
* Destination Port / ICMP Code Operation          [any]
* Destination Port Number / ICMP Type             [0]
* Routing                                         [both]
* Direction                                       [both]
* Log Control                                     [yes]
* Fragmentation Control                           [all packets]
* Tunnel ID                                       [0]
* Interface                                       [tr0]
```

Figure 27. Adding a filter rule to IP Security to deny all access to a specific interface

You will now have to make rules for all services you want to allow to pass the filtering system. You can limit access to those ports even more by allowing traffic to go in only one direction, inbound or outbound.

You might need to sort the rules you entered because they are evaluated from top to bottom. You need to make sure the *deny all traffic on the adapter* rule is evaluated last.

7.4.3 Using TCP Wrappers to restrict access to services

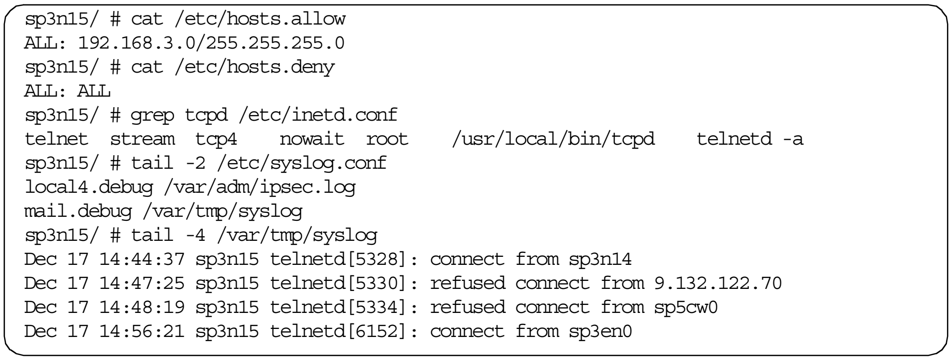
Building you own local packet filtering using IPSec can be very complex. If your setup requires you to allow connections on certain ports, you might want to use an external program instead of having a very long and complex set of filtering rules. Filter rules are examined for each packet until a match has been found; so, a long, very specific list will most likely cost you performance.

The TCP Wrapper tool, written by Wietse Venema, allows for a high degree of control over incoming TCP connections. The program uses access control lists to determine if a connection is allowed or not. All TCP services supported by `inetd` can be wrapped by editing the `/etc/inetd.conf` file and inserting the wrapper program before a daemon.

Access can be granted or denied by creating the `/etc/hosts.allow` and `/etc/hosts.deny` files. The TCP Wrapper installp package (`http://www.bull.com`) has not been compiled to support language extensions. If you want to use those functions, you will need to compile the TCP Wrapper yourself. An explanation on the format of the permission files can be seen using:

```
man 5 hosts_access                    # you may need to set MANPATH
```

We next list a simple setup that will allow systems on the internal Ethernet to connect to node 15 using `telnet`, but connections coming from any other network will be rejected.



```
sp3n15/ # cat /etc/hosts.allow
ALL: 192.168.3.0/255.255.255.0
sp3n15/ # cat /etc/hosts.deny
ALL: ALL
sp3n15/ # grep tcpd /etc/inetd.conf
telnet  stream  tcp4    nowait  root    /usr/local/bin/tcpd    telnetd -a
sp3n15/ # tail -2 /etc/syslog.conf
local4.debug /var/adm/ipsec.log
mail.debug /var/tmp/syslog
sp3n15/ # tail -4 /var/tmp/syslog
Dec 17 14:44:37 sp3n15 telnetd[5328]: connect from sp3n14
Dec 17 14:47:25 sp3n15 telnetd[5330]: refused connect from 9.132.122.70
Dec 17 14:48:19 sp3n15 telnetd[5334]: refused connect from sp5cw0
Dec 17 14:56:21 sp3n15 telnetd[6152]: connect from sp3en0
```

Figure 28. How to use TCP wrappers

7.4.4 Sendmail

The sendmail program is very complex and has a long history of security-related problems. Caution should be used when activating sendmail. If possible, do not use sendmail at all.

If you need to use sendmail, the following setups might help reduce the risk to your SP system:

1. Use IPSec to deny inbound mail.
2. Use TCP Wrappers to start sendmail (if required) and shield inbound traffic from untrusted networks.
3. Use TCP Wrappers to deny access to sendmail from the outside network, and set up a mail relay system outside the SP. This system will forward all mail to the external network.
4. Use postfix as a replacement for sendmail.

Option one is the simplest one to achieve. You will need to add a rule that denies all inbound traffic to port 25 from the external interface.

Option two requires setting up TCP Wrappers. You can wrap any TCP-based service as long as it exits after each connection. If you tell inetd to watch for port 25, and then start the tcpd program, you can filter requests. You only need to have sendmail running when you receive mail. When you send it yourself, the mail command will start sendmail for you.

This is how it is done:

- Comment out sendmail in /etc/rc.tcpip, and stop the daemon:

  ```
  -stopsrc -s sendmail
  ```

- Enter the following line in /etc/hosts.allow to permit incoming mail only from the internal SP Ethernet:

  ```
  -smtp: 192.168.129.0/255.255.255.0
  ```

- Enter the following line in /etc/inetd.conf, and activate it:

  ```
  -smtp stream tcp nowait root /usr/local/bin/tcpd sendmail -bs
  -refresh -s inetd
  ```

Option three applies when not all your systems have an external network interface, but you still want to be able to send mail through that network. It also ensures that there is only one copy of sendmail running, and it does not run on an SP node.

You can set up the external system as a relay host for the other systems, which, then, need to be set up as clients. You will need to modify the sendmail configuration files on all systems. Do not use the CWS as a relay host.

External system: (`sendmail` relay host)

- Edit the `/etc/sendmail.cf` file. Change the following line to contain all interface names of the system, in short *and* long notation:

```
Cw localhost $w $?m$w.$m$. internal-host internal-host.itso.ibm.com. \
external-mailhost external-mailhost.itso.ibm.com.
```

On all other systems, make `sendmail` use the relay host:

- Edit the `/etc/sendmail.cf` file and fill in the `Ds` field:

```
DSinternal-host
```

Option four is to replace the `sendmail` daemon with a more secure variant. Wietse Venema wrote a more secure solution for using the SMTP protocol on UNIX systems while on working at the IBM Watson Research Center. It is available under two names: IBM Secure Mailer and postfix.

Postfix is designed to be sendmail-compatible to make migration easy. Postfix supports `/var/spool/mail`, `/etc/aliases`, NIS, and `.forward` files. However, Postfix also attempts to be easy to administer, and, therefore, it does not use `sendmail.cf`.

Postfix uses multiple layers of defense to protect the local system against intruders. Almost every Postfix daemon can run in a `chroot` jail with fixed low privileges. There is no direct path from the network to the security-sensitive local delivery programs; an intruder has to break through several other programs first. Postfix does not even trust the contents of its own queue files, or the contents of its own IPC messages. Postfix filters sender-provided information before exporting it through environment variables. Last but not least, no Postfix program is set-uid.

More information on Postfix can be found at: `http://www.postfix.org`

It can be downloaded in `installp` format at: `http://www.bull.com`

7.4.5 DCE user management on an SP

The SP environment is different from the one for which DCE was originally designed in that it is not a distributed system but, rather, a centrally-managed system. In a DCE cell, all systems share security data and have a common clock source but are managed locally. The local system administrator can add users, create backups, and so on. On an SP system, the CWS is responsible for a lot of tasks that would normally be done locally. This can also be true for user management. The root user on the CWS has root access to all nodes within the SP. In a DCE environment, this is not always the case.

Using DCE user management instead of `supper` has many advantages. The central database containing all information eases the administration effort. Passwords can be changed on any DCE client in the cell, users are instantly available when created and password data does not need to be transmitted over the network.

How to set up user management in DCE is documented in chapters 7, 30, and 31 of the DCE manual, *Administrative Core Services*, SC23-2730. After creating a DCE user, you will need to add DCE as an authentication method for logins, activate the method for all users (except root), and then make sure the `dceunixd` daemon starts after a reboot:

```
chsec -f /etc/security/login.cfg -s DCE \
      -a "program=/usr/lib/security/DCE"
chsec -f /etc/security/user -s root -a "SYSTEM=files"
chsec -f /etc/security/user -s default -a "SYSTEM=DCE OR COMPAT"
mkitab "dceun:2:respawn:/usr/bin/dceunixd >/dev/console 2>&1"
telinit q
```

Instead of using `SYSTEM=DCE OR COMPAT`, you could also opt for `SYSTEM=DCE OR DCE[UNAVAIL] AND COMPAT`. The first method will allow normal AIX users to log in if their DCE login failed. The second method will only allow AIX logins if DCE is not available.

At this point, any DCE user in the cell can log in to the node. This is probably not intended. The SP access control system(`spacs_cntrl`) does not work for DCE users because they have no corresponding AIX user IDs. You can, however, circumvent this by adding those stanzas yourself. You can set the *rlogin attribute* to be `false` by default, and then grant access for specific users by adding a stanza for that user containing the *rlogin attribute* set to `true`.

To disable remote access to the node by default (excluding root `rsh` commands):

```
chsec -f /etc/security/user -s root -a rlogin=false
chsec -f /etc/security/user -s default-a rlogin=false
chsec -f /etc/security/user -s root -a tty="ALL,!RSH,!REXEC"
chsec -f /etc/security/user -s root -a tty="ALL"
```

You could keep an access program list for user access to all SP nodes central on the CWS and run it on all nodes. It might look like the following example:

```
#!/bin/ksh
# User access control program. Users can be allowed on a per node basis
function allow_user {
   for user in $*; do
      chsec -f /etc/security/user -s $user -a rlogin=true
      chsec -f /etc/security/user -s $user -a ttys="ALL"
   done
}

/usr/lpp/ssp/install/bin/node_number | read NN || NN=-1
case $NN in
1|5|9|11|13) allow_user user01 user02 user03 ;;
*)           allow_user user04 user05 ;;
esac
```

Figure 29. Example script to manage remote login permissions (con_user.ksh)

DCE does not provide a central mechanism that limits access to a node for specific users. It does provide a local mechanism, the `/opt/dcelocal/etc/passwd_overwrite` file, which can be used to alter user attributes locally. By providing an illegal length password, it will prevent access to the system for the user with that password.

7.5 Special considerations for high-security environments

The SP system was originally not designed to be used in a high-security environment but, rather, in a low-security technical environment. Because of its distributed setup, with a central point of management, it is vulnerable because of its prolific use of network-based services.

Most of the vulnerabilities can be solved by using secure authentication methods, such as Kerberos, and by encrypting sensitive data. However, there are still a number of vulnerabilities left if the environment in which the SP operates cannot be trusted. Sometimes, the SP design requires the use of tools and services that cannot be made totally secure.

If the internal SP Ethernet cannot be trusted, there are some major problems concerning the installation of new nodes and the restoration of `mksysb` images.

Of course, users must not be allowed to log in without proper authentication and encryption, but, in a high-security environment, this option should not even be possible.

7.5.1 Using DCE as the only authentication method

As discussed in Section 7.4.5, “DCE user management on an SP” on page 223, you can use DCE user management in addition to regular AIX user management. If you do not include standard AIX authentication as a method, there are some caveats with which you should be concerned.

The authentication method set by `chauthent` only applies to remote commands, such as `rsh`, `rlogin`, `telnet`, and so on. The `SYSTEM` attribute in the `/etc/security/user` file determines the authentication methods used when logging into a node. This also applies to logging in to the console.

If you want to restrict remote access to your system to only DCE-authenticated users, you will have to set the AIX authentication method to DCE:

```
chauthpar -v k5
```

You can only change the authentication methods for the whole partition. If you do it manually on the node, the `rc.sp` script that is run from the `inittab` will change the value back to the partition default.

The authentication for logging into the node should also be set to DCE, except for root, who is only allowed console access:

```
chsh -f /etc/security/user -s root -a "SYSTEM=files"
chsh -f /etc/security/user -s default -a "SYSTEM=DCE"
```

If no DCE Security servers are available, all access to the system is denied, and password lookups for DCE users will fail. DCE users that are already logged on will not experience problems because file access is done by UID and GID instead of names.

When there are such problems, the root user can use the `s1term` program and access the node through the serial cable from the CWS.

7.5.2 Installing or restoring a node in a safe way

When a node is being installed, there are a number of security weaknesses:

- It will broadcast for a `bootp` server accepting the first response.
- It will create a temporary `.rhosts` file for use during installation.

- NFS is used during the installation.

Most of the vulnerabilities can be solved by disconnecting the node for any external network during installation and only connecting it when the installation has completed.

If the SP Ethernet is not trusted, the following procedure may be a solution:

1. Create a separate Ethernet
   - When using bnc cabling, create an Ethernet containing only the node and a unused Ethernet card in the CWS.
   - When using utp cabling, attach the node to an unused hub, and connect an unused Ethernet card in the CWS.
2. Set up the SDR to use a new subnet for this node
3. Install and configure the node
4. Move the IP address from the extra adapter in the CWS to the SP Ethernet adapter as an IP alias.
5. Join the node into the normal SP Ethernet

This approach will mean that any communication between this node and the other nodes over the internal Ethernet will go through the control workstation. The CWS will then need to have `ipforwarding` turned on.

A node is as vulnerable to attack during restoration as it is during installation. You will need to use the same procedure as for installing a new node, but you will need to change the IP address of the en0 adapter so that it is in a different subnet. This also means that you will need to reconfigure DCE to reflect this change.

7.6 Intrusion detection and monitoring

Even if you are up-to-date with all the latest security fixes and have implemented a very strict security policy, a hacker might still be able to break through your defenses. New exploits are continuously created by hackers, and software fixes are generated to stop them. Since there is no such thing as bug-free software, there is no such thing as an absolutely secure system.

Therefore, if a break-in has occurred, it is vital to know this as soon as possible so that countermeasures can be taken to avoid further damage. But, how can you tell if your system has been compromised? Hackers will do their utmost to avoid detection by exchanging system commands for their own, by editing log files, and by making it seem as if they are not present.

You will need to be vigilant if you want to keep your defences up and observant to detect if they have been breached. Vigilance can be exercised by testing the defences of your SP using tools, such as SATAN, SAINT, COPS, or Tiger. Observing the system can be done by checking its integrity with tools, such as TCB or Tripwire, and by monitoring your log files.

7.6.1 Trusted Computing Base (TCB)

The Trusted Computing Base (TCB) is a part of AIX that is designed to make sure the operating system can be trusted and to provide a means to ensure it remains that way. This is done by regular checks with the `tcbck` tool, and the use of the trusted shell. A detailed description can be found in the book, *AIX Version 4.3 System Management Guide: Operating System and Devices*, SC23-4126.

The TCB needs to be enabled at install time so it is assured that the binaries on the system can be trusted. It will then create a database with the attributes of a list of files. These files are then *trusted*, which can be seen by using the `-e` flag on the `ls` command.

In an SP environment, the minimal image provided by IBM to install the nodes does not have TCB enabled. You will, therefore, need to create an image from a system with TCB enabled from outside the SP, and use that as a minimal image. When setting up an SP, the CWS could be used for such a purpose.

The TCB database is located in the `/etc/security/sysck.cfg` file and contains stanzas, such as the following:

```
/usr/bin/lssrc:
          owner = root
          group = system
          mode = TCB,SGID,555
          type = FILE
          class = apply,inventory,bos.rte.SRC
          size = 3994
          checksum = "59775     4 "
```

File authenticity is defined by the size and checksum. Since there are programs available that can create new files with identical size and checksum as the original one, we do not recommend using the Trusted Computing Base for file integrity checking. We suggest using `tripwire` for that purpose.

7.6.2 Tripwire

Tripwire is a public domain tool that can perform about the same function as the tcbck tool from the TCB. It generates a database containing information about each file listed in its configuration file and can then compare the current situation against a known (non-compromised) one.

The main purpose of this procedure is to spot whether a system has been compromised. If a hacker has gained root access to the system, he will try to hide his presence from the system administrator by altering commands, such as netstat, who, ls, and so on. If the system administrator wants to spot these changes, he or she will need a reference to which to compare the current files. Tripwire will generate such a reference consisting of file size, date, permissions, and two types of checksum. The double checksum and size data makes it virtually impossible to create a replacement file with the same characteristics.

The tripwire database needs to be stored in a safe location, or a hacker might change it to reflect the alterations he or she has made. This safe location is preferably a removable read-only device, such as a floppy drive. Since most SP nodes do not have floppy drives, a secure location elsewhere in the network should be used. The CWS would apply because it has the highest security requirements. Also, the tripwire database of the CWS can be written to a floppy drive.

Once you have installed the tripwire fileset, you have two important files:

- The program file: /usr/security/bin/tripwire
- The configuration file: /usr/adm/tcheck/tw.config

You may need to adapt the configuration file to suit your installation. It is prepared for AIX 4.1, but you will have to add the SP binaries to it yourself. When you are ready, initialize the database:

```
/usr/security/bin/tripwire -initialize
```

This will create a database in the /usr/adm/tcheck/databases directory called tw.db_<hostname>. This file may be several megabytes in size. You will need to secure this database. The problem with securing the tripwire database binary and config file is that you need a location that is secure but can be reached easily from the node. The node should not, normally, have access to this location because, if it was compromised, a hacker could alter the tripwire files. Since all nodes have root access to the CWS, it is not a safe place to store the tripwire files. You will need an external system if you want the tripwire files to be secure.

To access the trusted versions of the tripwire files, you need to access them in a secure manner. This could be done through DFS or by using an authenticated remote copy. NFS cannot be used because it is not secure. The checking should be initiated from the external system, which would need remote command authority on all nodes and the CWS. The checking of a node could be done using the following script that uses `rcp` and `rsh` (when DFS is used, you could simplify the script):

```
#!/bin/ksh
# Tripwire control program, options are a list of nodes.
OUT=/home/root/tripwire.out.‘date +%y%m%d‘
TR=/tripwire

for node in $* ; do
   /bin/echo "Starting tripwire on $node at ‘/bin/date‘"
   /bin/rcp $TR/tw.db_$node $node:/usr/adm/tcheck/databases/tw_db_$node ||\
            /bin/echo "copy of database failed on $node"
   /bin/rcp $TR/tw.config $node:/usr/adm/tcheck/tw.config ||\
            /bin/echo "copy of config file failed on $node"
   /bin/rcp $TR/tripwire $node:/tmp/tripwire.$$ ||\
            /bin/echo "copy of tripwire binary failed on $node"
   /bin/rsh $node /tmp/tripwire.$$ -q
   /bin/rsh $node /bin/rm /tmp/tripwire.$$ -q
   /bin/rsh $node /bin/rm /usr/adm/tcheck/tw.config
   /bin/rsh $node /bin/rm /usr/adm/tcheck/databases/tw.db_$node
done 2>&1 >> $OUT
```

Figure 30. Example script to use with tripwire (`runtrip.ksh`*)*

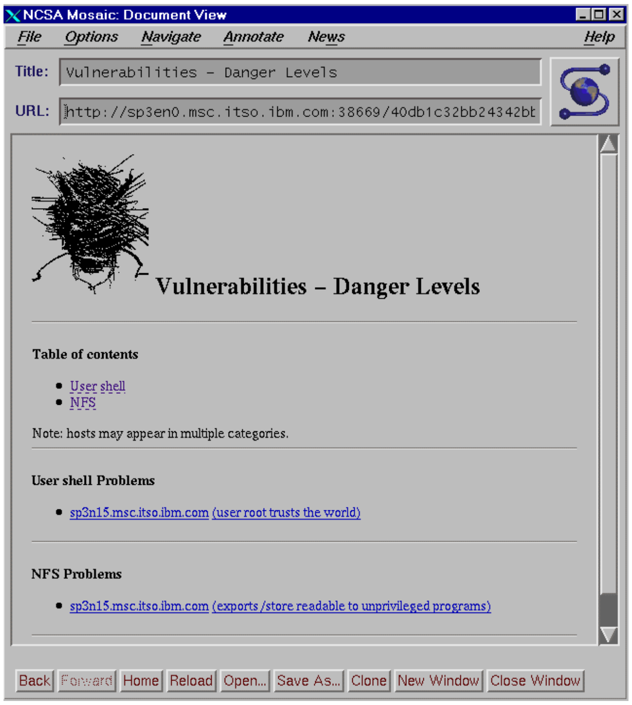
The script copies the tripwire files to the nodes and then executes the program. This is just a simple example. For instance, you could copy the files back to the server and compare them to see if they have been altered. It is always good to be a little paranoid when it comes to integrity checking.

7.6.3 SATAN

SATAN, by Dan Farmer and Wietse Venema, is the Security Administrator Tool for Analyzing Network. This tool can help you find security weaknesses in the network configuration of your system. It probes the system from the outside and tries to find weaknesses.

A complete description of all of SATAN's features can be found here:
`http://www.cerias.purdue.edu/coast/satan.html`

A packaged version of SATAN can be found at `http://www.bull.com`. This version requires `mosaic` and `fping` as prerequisites. You can delete the PERL package from the .toc file because an SP node already has `perl` installed by default.



Title: Vulnerabilities - Danger Levels

URL: http://sp3en0.msc.itso.ibm.com:38669/40db1c32bb24342bt

Vulnerabilities – Danger Levels

Table of contents

- User shell
- NFS

Note: hosts may appear in multiple categories.

User shell Problems

- sp3n15.msc.itso.ibm.com (user root trusts the world)

NFS Problems

- sp3n15.msc.itso.ibm.com (exports /store readable to unprivileged programs)

Figure 31. Example SATAN screen

SATAN can be very useful to find out about weaknesses in your network security. If used regularly, new weaknesses can be spotted early on.

7.6.4 The Deception Toolkit (DTK)

The Deception Toolkit (DTK), written by Fred Cohen, is a novel approach to intrusion detection. By faking programs on certain ports and logging any connects to them, intruders are detected early and, quite possibly, confused about the responses they are getting.

You can turn all entries in the `/etc/inetd.conf` file that are deactivated into deceptive ports, and ports that are active can be guided through the TCP Wrappers tool into a deception program while approved source addresses are handled normally.

You can download the toolkit and find more information about it on:
`http://all.net`

After installing The Deception Toolkit, you can activate entries in the `inetd` configuration file to use a deception directly, or go through TCP Wrappers first to use it selectively.

```
# cat /etc/inetd.conf
finger  stream  tcp     nowait  nobody  /usr/local/dtk/coredump
pop3    stream  tcp     nowait  root    /usr/local/bin/tcpd pop3d
# cat /etc/hosts.allow
pop3d:      all:    twist /usr/local/dtk/Generic.pl %a 110 %u %d unknow
# refresh -s inetd
# finger root@sp3n15
[sp3n15]
 core dumped
# telnet sp3n15 110
Trying...
Connected to sp3n15.
Escape character is '^]'.
+OK fake.ibm.com POP3 Server (Version 1.004) ready.
USER root
+OK please send PASS command
PASS root
+OK root has 1 message(s) (1385 octets).
list
-ERR Invalid command; valid commands:  RETR,  QUIT
QUIT
+OK fake.ibm.com POP3 Server (Version 1.004) shutdown.
Connection closed.
# cat /usr/local/dtk/log
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:12 13994 13994:1 Generic.pl S0 R-0
unknown pop3d unknown
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:17 13994 13994:1 Generic.pl S0 R1-1
 USER root
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:20 13994 13994:1 Generic.pl S1 RTry
- PASS root
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:22 13994 13994:1 Generic.pl S2 R6-4
 list
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:24 13994 13994:1 Generic.pl S2 R6-4
 QUIT
192.168.3.15 -1 0.0.0.0 110 1999/12/04 17:53:24 13994 13994:1 Generic.pl S2 R6-4
 WeClose
```

Figure 32. Example how to use the Deception Toolkit

7.6.5 COPS

COPS, an acronym for Computer Oracle and Password System, is a tool that you can run to check the settings on your system. It consists of a collection of scripts that each check a part of system security, such as file permissions, users, passwords, and so on. It only reports problems; it does not fix them.

Using COPS on AIX tends to be somewhat of a challenge. It was written in 1989, and the last version, 1.04, was released in AIX 3.1 in 1991. It will run on the latest AIX release, but will need some work.

When installing the COPS distribution available from http://www.bull.com you will need to delete the following lines from the .toc file:

```
>0 {
*prereq freeware.gnu.perl.rte 5.3.0.0
*prereq freeware.perl.rte 5.4.0.0
```

Since perl is already installed, these prerequisites are no longer required. You will need to add a link in /usr/local/bin to point to perl in /usr/bin:

```
ln -s /usr/bin/perl /usr/local/bin/perl
```

The perl-version of COPS can now be run by typing pcops on the command line. You can find the output in the /usr/local/lib/p-cops/<hostname> directory.

7.6.6 TAMU's Tiger

Tiger is a set of scripts that scan a UNIX system looking for security problems, in the same fashion as Dan Farmer's COPS. Tiger was originally developed to provide a check of UNIX systems on the Texas A&M University after a major security breach.

Tiger was written in 1993 by Doug Schales, and last updated in 1994. It supports AIX 3.x but can be used with AIX 4.x when default scripts are used. Not all scripts will function when doing this, and some should be disabled. Some tests require compiled C code; so, a compiler should be available for those.

Tiger can be downloaded from:
http://wuarchive.wustl.edu/packages/security/TAMU/

The following steps should get you going:

1. Unpack the archive
2. Change to the Tiger directory and enter the following:

   ```
   make install
   ```

3. Edit the /usr/local/tiger/tigerrc file, and change following:

   ```
    -Tiger_Check_RHOSTS=N
    -Tiger_Check_PERMS=N
    -Tiger_Check_SIGNATURES=N
    -Tiger_Check_FILESYSTEM=N
    -Tiger_Check_PATH=N
    -Tiger_Check_EMBEDDED=N
   ```

4. Create the necessary subdirectories:

```
-mkdir -p /usr/spool/tiger/logs
-mkdir -p /usr/spool/tiger/work
-mkdir -p /usr/spool/tiger/bin
```

5. Run Tiger by typing: `/usr/local/tiger/tiger`

The output file will contain messages such as these:

```
...
# Performing NFS exports check...
--FAIL-- [nfs006f] Directory /store exported R/W to everyone.
--WARN-- [nfs011w] Unprotected directory /store is exported with root \
access to host(s) sp3en0.
...
```

You can check what each message means by calling the `tigexp` command with the message ID:

```
# /usr/local/tiger/tigexp nfs011w

Exporting a file-system R/W to everyone means that anyone can modify
the data on your system, possibly making changes that allow them to
login to the system and access or destroy other files.

See `nfs013i'
```

If you want to check for weak passwords, you will need to install the `crack` program. Tiger does check for some useful security vulnerabilities, but it also reports settings that are normal on AIX but non-standard on other versions of UNIX. We recommend running this program weekly, or, at least, monthly.

7.6.7 Log files you should check

The following logs should be checked on a daily basis:

/var/adm/sulog

This file contains all uses of the `su` command in the system.

For example, to see today’s switch user commands:

```
# grep "`date +%m/%d`" /var/adm/sulog
```

/etc/security/failedlogin

This file contains a list of all failed login attempts in the `utmp` format.

For example, to get today’s failed login attempts:

```
# who /etc/security/failedlogin | grep "‘date +%b’ ’$d‘"
```

syslog daemon log files

The system log daemon (`syslogd`) can be configured to record messages at different levels. The messages can also be forwarded to another system. For analyzing attempts at compromising a system or analyzing a compromise, it can give invaluable information. When setting up this daemon, care should be taken that there is enough free space in the filesystem, and the log files should, preferably, be written into their own filesystem.-

On the nodes, the configuration file `/etc/syslog.conf` forwards the messages. In this example, we forward them to a system called `sec-host`:

```
# tail -3 /etc/syslog.conf
daemon.notice          /var/adm/SPlogs/SPdaemon.log
*.crit @sec-host
*.debug;mail.none; @sec-host
```

One system `sec-host` the incoming messages are redirected to a log file:

```
# tail -2 /etc/syslog.conf
*.crit /var/syslog/syslog.crit
*.debug;mail.none; /var/syslog/syslog.debug
```

The `/var/syslog/syslog.debug` file on `sec-host` will probably grow quite fast. You will need to prune that file regularly.

Part 4. Troubleshooting

Chapter 8. Problem isolation and resolution

The security services of PSSP have been designed and implemented to minimize the complexities that are often associated with security features, especially during their installation and configuration phases.

However, due to the nature of security - both its pervasiveness and global scope - conditions may arise that may, at first, appear to be "security" problems but are, in many cases, actually, problems with environmental conditions that affect security services or problems with the interactions of software components and their related or dependent security services.

This chapter provides examples of some common problems and their corrective actions, as well some general troubleshooting tips and problem determination techniques as they relate to PSSP security services, especially in conjunction with DCE.

While the majority of the items in this chapter focus on PSSP and DCE, several of the techniques can be generalized and applied to PSSP's compatibility mode, PSSP Kerberos Version 4, and other security software that may be part of your SP system.

Note, however, that this chapter is not intended to be an exhaustive examination of root cause analysis and corrective actions relating to general security problems or customized security considerations. The wealth of existing information technology literature is abundant with white papers, articles, and texts covering this type of material. Plus, there is a growing number of Web sites dedicated to the broad spectrum of computer security. Also, this chapter is not meant to replace the problem determination procedures established at a site or to circumvent its established problem reporting process(es).

The reader is encouraged to use the aforementioned items, along with product-specific problem determination guides, such as DCE's Problem Determination Guide, software diagnostic guides, and other problem determination and isolation techniques/materials when analyzing a problem event.

Note

In the sections that follow, a reference to the DCE admin log refers to /opt/dcelocal/etc/cfgdce.log, while a reference to DCE run-time logs refers to logs under /var/dce/svc/.

Likewise, a reference to the PSSP security installation and configuration log refers to /var/adm/SPlogs/auth_install/log, while a reference to PSSP logs refers to those logs generated by PSSP services, such as those under /var/adm/SPlogs/.

A blanket reference to PSSP and DCE logs refers to all of the above, as they apply to a given situation.

There are several possible periods during which problems/issues might arise for PSSP security services:

- **During installation and configuration of security services**

  Due to the dependencies between various installation and configuration steps (and their processes) and any requirements for additional software installation and configuration, such as those associated with DCE, problems/issues are often due to a lack of planning for the security services required, bypassed steps during installation and configuration, and/or run time process failure.

  The PSSP Planning Guide covers considerations and requirements needed prior to installing and configuring PSSP security services, while the Migration and Installation Guide provides a step-by-step approach to establishing the planned security settings.

  Installation and configuration of security services is the most likely place for problems/issues, if there are any, to arise.

  Section 8.1, “PSSP security installation and configuration” on page 240, provides a list of problem determination and isolation items for PSSP security installation and configuration procedures.

- **Events that may occur during normal run time, that is, steady-state events after security services installation and configuration**

  Once PSSP is running with a security configuration, the problems/issues that may occur will, most likely, be due to DCE servers (client or master) not being available, file systems that are full, a daemon that hangs, or a user that does not have the proper authentication and/or authorization to access a requested resource.

These things may occur as out-of-the-ordinary anomalous events, or as the result of a process failure.

DCE and PSSP diagnostic guides, administrative guides, and command references should be consulted under these scenarios.

Several of these problems are examined in expanded detail in Section 8.2, “Steady-state run time” on page 244, and from Section 8.5 to the end of the chapter.

- **A system is repartitioned, a node is reinstalled, and a node is added or deleted from an existing system**

  Partitioning, re-installing a node, or adding/deleting a node from an existing system requires several additional steps that take into account the security services of PSSP.

  These are scenarios that take place on an irregular basis, and problems/issues are often the result of a process failure, misconfiguration, or lack of planning for changes in the security environment.

  DCE and PSSP diagnostic guides, administrative guides, and command references should be consulted under these scenarios.

  The items presented in Section 8.1, “PSSP security installation and configuration” on page 240, apply to these scenarios.

- **The DCE cell is reconfigured**

  If the DCE cell into which PSSP services is reconfigured (for whatever reasons), then the following will be required:

  - Disabling and/or enabling PSSP and AIX authentication methods
  - Cleaning up existing DCE-related files used by PSSP (and originally created by PSSP installation and configuration)
  - Rerunning PSSP installation and configuration scripts relating to DCE security services

  This is the least likely scenario. Reconfiguring a DCE cell would not only impact PSSP security services, but any other software component dependent upon DCE.

  Section 8.3, “DCE cell reconfiguration impacts” on page 353, provides a procedure to recover PSSP DCE security services when a DCE cell is reconfigured.

- **DCE Security and CDS servers cannot be reached or contacted (includes master and replica servers)**

  When PSSP security services is running in a dce/k5 only mode and all DCE Security and CDS servers, including replica servers, cannot be reached or contacted, PSSP will hang and/or generate authentication and authorization failures. In this type of environment, PSSP processing effectively comes to a halt because the security services protecting PSSP resources cannot be satisfied.

DCE network connectivity must be restored. If DCE network connectivity cannot be restored, or the problem turns out to be a catastrophic failure with all hosts running DCE servers, it must be determined if the site should run its SP system without dce/k5 PSSP security.

When PSSP security services is running in a dce:compat/k5:k4:std mode, or in a compat/k5:k4:std mode, and all DCE Security and CDS servers, including replica servers, cannot be reached or contacted, PSSP will hang and/or generate authentication and authorization failures for the dce mode and then fail-over to compat and k4:std processing. In this type of environment, PSSP performance is impacted because dce-related security calls will time-out due to DCE server unavailability. However, PSSP processing will continue under compat mode (once the dce calls time-out).

DCE network connectivity must be restored. If DCE network connectivity cannot be restored, or the problem turns out to be a catastrophic failure with all hosts running DCE servers, it must be determined if the site should run its SP system with only compat/k4:std security.

These are the least likely scenarios. The unavailability of DCE servers would not only impact PSSP security services, but any other software component dependent upon DCE.

Section 8.4, “Temporarily disabling dce/k5 when DCE is not available” on page 363, provides a general procedure to disable the dce and/or k5 methods from PSSP use when DCE Security and CDS servers cannot be reached.

8.1 PSSP security installation and configuration

It is imperative that the *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281, be used prior to any installation of PSSP Version 3.2 (this includes both migration and new installs) to determine which security configuration is right for a site and identify any prerequisites required by the selected security configuration.

Given that there are several possible PSSP security configurations available in an SP environment, and that, within a security configuration, there are PSSP and AIX security settings, choosing the appropriate combinations of security values for a configuration, having the selected security mechanisms installed and configured, populating the SDR and, possibly, DCE with needed values, and then enabling the SP system to use the security settings presents new considerations and requirements for PSSP administrators.

Strict adherence to the PSSP Installation and Migration Guide for security installation and configuration will take PSSP administrators through the necessary steps to ensure that needed security settings and scripts are executed in the required order.

The list to follow represents common problem areas related to installation and configuration.

8.1.1 Scripts setupdce or config_spsec did not run successfully

Probable cause(s) for the setupdce or config_spsec scripts not running successfully include the following:

- DCE daemons are not running on the control workstation. Use the DCE command, `show.cfg`, to display the status of DCE.
- DCE is configured on the control workstation but is not at the level required for PSSP DCE security services. Use the following AIX command to see information for all the installed DCE filesets on the host:
  `lslpp -l "*dce*"`
- The DCE master servers (Security and CDS) are not running or are not reachable. There are several DCE and AIX commands that can be used to determine the state of DCE services and network connectivity. DCE commands, such as `show.cfg`, `dcecp -c cell ping`, `dcecp -c cdsli -c -C high`, and `dce_login`, are useful for determining DCE server status. AIX commands, such as `netstat -rn`, `ping` (with `-R`), `traceroute`, and `no -a | grep ipf` (check for ipforwarding), are useful for determining network connectivity between points. Run the AIX command, `ps -ef | more`, and look for the existence of DCE daemons.
- The Security and/or CDS server data specified on the PSSP script command lines contained a typo.
- The DCE cell administrator password is not valid.
- The SDR does not contain hostnames for the nodes.
- Write operations to the SDR fail.
- The filesystems where the DCE Security and CDS databases are stored are full.
- The DCE Security servers are in read-only mode and cannot be updated.

The following is/are the corrective action(s):

> **Note**
>
> Once corrective actions are complete, the scripts that failed must be rerun.

1. Start the DCE daemons on the control workstation.
2. Upgrade DCE to the required level for PSSP DCE security services.

   > **Note**
   >
   > Before upgrading DCE to a new level, refer to DCE's documentation on recommended upgrade procedures. This will ensure that existing DCE services not required by PSSP services, such as DFS and/or DTS, are properly upgraded.

3. Start the DCE master servers and/or restore network connectivity between the control workstation and the hosts running the DCE master servers.
4. Obtain the correct names of the DCE servers, and enter this information via PSSP scripts, where appropriate.
5. Specify the correct DCE cell administrator password.
6. Rerun PSSP installation procedures that populate the SDR with hostnames for the nodes.
7. Root authority on the control workstation is required to write to the SDR.
8. On the host(s) running the DCE Security and CDS servers, alleviate the file system full state so that the DCE databases can be updated.
9. On a host already configured for DCE and logged in as a DCE cell administrator, enable the Security server for write operations. The following example represents a DCE cell where only one Security server is running. In cells with more than one Security server, the server must be explicitly named on the DCE registry `enable` command.

```
sp3en0/ # dcecp -c registry catalog
/.../sp_cell/subsys/dce/sec/sp3en0
sp3en0/ # dcecp -c registry dump | grep status
{status disabled}
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # dcecp -c registry enable

sp3en0/ # dcecp -c registry dump | grep status
{status enabled}
sp3en0/ # kdestroy
sp3en0/ # exit
```

8.1.2 Authentication methods cannot be enabled on a node

If the PSSP trusted services authentication method or AIX authentication methods cannot be enabled on a node, the probable cause(s) are:

- The SDR security attributes are not correct.
- Required PSSP and/or DCE filesets are not installed.
- Kerberos Version 4 and/or DCE is not configured properly.
- PSSP DCE keyfiles were not created on a host.

The following is/are the corrective action(s):

Note

Once corrective actions are complete, the scripts that failed must be rerun.

1. Verify that SDR security attributes for the partition in which the node resides contain the correct values. If not, use the PSSP `chauthpts` and `chauthpar` commands, with their -c flags, to alter the SDR values. Likewise, use spsetauth to set other security values in the SDR.
2. If DCE was selected to be installed, configured, and started on a node, but was not successfully installed, configured, and started on a node, verify that the control workstation's /spdata/sys1/install/{default}/lppsource directory contains the correct level of IBM AIX DCE filesets.

Note

{default} is replaced with a value chosen by the customer at installation and configuration time. Refer to the *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281, and *PSSP: Installation and Migration Guide*, GA22-7347 for DCE level requirements.

3. Examine PSSP and DCE logs on the node for additional information. For PSSP errors, refer to the *PSSP Diagnosis Guide*, GA22-7350, for corrective measures. For DCE errors, refer to the *DCE Problem Determination Guide*.

4. Ensure that DCE is configured and running, and then rerun node customization, or, manually, run `spauthconfig` on the node.

   The DCE installp process might generate a failed return code due to a pre-req failure or a back-leveled DCE fileset existing in the same directory as up-to-date DCE filesets, but the DCE client itself may still install and configure successfully. (A failure in the installp process does not necessarily mean that the DCE client configuration process will not complete.) However, since the installp generated a failed return code, this will be captured by PSSP installation and configuration scripts, and PSSP security configuration will exit before PSSP DCE keyfiles are created and before the dce trusted service method is enabled on the node. Provided that the DCE client configured successfully and that DCE is running on the node, simply rerunning spauthconfig on the node (as root) will complete the security configuration process for the node.

The following is/are the additional corrective action(s):

1. Ensure that setupdce and config_spsec ran successfully on the control workstation. If these scripts did not run successfully, a node set to run with dce as a PSSP trusted service authentication method cannot be configured properly.

2. Ensure that there is enough filespace in the system for DCE to be installed and configured.

3. Ensure that the SDR is reachable and can be read from the node. PSSP security installation and configuration scripts attempt to set values on the node based on values read from the SDR.

4. Ensure that the node has network connectivity to the host or hosts running the DCE Security and CDS servers. DCE client configuration on a node must update entries in these servers.

8.2 Steady-state run time

The examples in this section are not meant to be exhaustive. Rather, they provide specific PSSP and AIX examples of security concepts that can be applied to various areas within an SP environment. They are, for all intents and purposes, representative samples.

Problems during steady state operation normally fall into three general areas; the first two are the most likely impact points:

- Disjoint security settings (authentication methods) between nodes or between the control workstation and nodes
- User (SP administrator and non-administrator) identities and access controls
- "Other" events, which include anomalous events, such as a hung daemon, all services appear to be hung, low paging space, a file system that reaches its storage capacity, or a severe time skew between hosts

8.2.1 Disjoint security settings (authentication methods)

This section covers disjoint security settings (authentication methods) between nodes, or between the control workstation and nodes.

Beginning with PSSP V3.2, security controls need to be viewed in two flavors:

- AIX Authentication Methods (for Remote Commands)
  - AIX level (operating system)
  - Methods: k5 (Kerberos 5), k4 (Kerberos 4), std (Standard AIX)

    An SP can be configured and enabled for one or more combinations of AIX authentication methods, but at least one AIX authentication method must be enabled in the SP (including the control workstation)
  - Used directly by AIX remote commands (`rsh`, `rcp`, `telnet`, `ftp`, `rlogin`) for client/server authentication and authorization.
  - AIX methods are known only to AIX remote command services
  - AIX methods are used indirectly by PSSP remote parallel commands (`dsh`, `pcp`, `pexec`, `pexscr`, and others). PSSP remote commands invoke rsh and/or rcp
  - The AIX commands, `chauthent` and `lsauthent`, are used to manage the methods on a per-host basis. `chauthent` requires root authority. `lsauthent` is available to all users.
  - The PSSP commands, `chauthpar` and `lsauthpar`, are used to manage the methods on a per-partition boundary. `chauthpar` requires root authority and authorization to write to the SDR. `lsauthpar` is available to all users.
- PSSP Authentication Methods (for Trusted Services)
  - PSSP level (PSSP is an LPP on AIX).
  - PSSP Authentication Methods: dce, compat.

An SP can be configured and enabled for one, both, or none of the methods.

- Used directly by PSSP Trusted Services (SDR, Hardmon, Sysctl, and others) for client/server authentication and authorization.
- PSSP methods are known only to PSSP Trusted Services.
- The PSSP commands, `chauthts` and `lsauthts`, are used to manage the methods on a per-host basis. `chauthts` requires root authority. `lsauthts` is available to all users.
- The PSSP commands, `chauthpts` and `lsauthpts`, are used to manage the methods on a per-partition boundary. `chauthpts` requires root authority and authorization to write to the SDR. `lsauthpts` is available to all users.

The AIX and PSSP authentication method sets exist and are managed independently. Likewise, the way in which they influence the behavior of their respective client/server applications is independent of one another. The only "relationship" between the two is established by the overall PSSP security design, as follows:

When a PSSP authentication method is enabled for use by Trusted Services, the corresponding authentication method must also be enabled for the AIX remote commands.

Examples:

If the PSSP authentication methods include dce, the AIX authentication methods must include at least k5. (A situation where PSSP's dce method is enabled, but AIX's k5 method is not enabled, is precluded.)

If the PSSP authentication methods include compat, the AIX authentication methods must include at least k4. (A situation where PSSP's compat method is enabled, but AIX's k4 method is not enabled, is precluded.)

If the PSSP authentication methods include dce and compat, the AIX authentication methods must include at least k5 and k4. The following variations would be valid: dce:compat/k5:k4 and dce:compat/k5:k4:std. The following variations would not be valid: dce:compat/k5, dce:compat/k4, dce:compat/k5:std, and dce:compat/k4:std.

8.2.1.1 PSSP authentication methods

Used by the PSSP code only. These methods are not used, or known, to the operating system. PSSP authentication methods are not used for remote command processing of any kind.

Partition level settings

1. methods = dce, compat, "none" (where "none" means that no PSSP authentication method is set).
2. SDR attribute value = ts_auth_methods.
3. SDR class value = Syspar.
4. To query the PSSP authentication methods stored in the SDR, for all partitions in the system, issue: `splstdata -p`.

Local host settings

1. methods = dce, compat, "none," dce:compat (where "none" means that no PSSP authentication method is set).
2. Methods are stored in a file on the local host in /spdata/sys1/spsec/auth_methods.

Failover flow

The precedence ordering of the PSSP authentication methods is dce:compat, or {} in the case of no PSSP authentication methods. When dce processing fails and the compat method is enabled, compat processing is tried. When compat fails, a PSSP service will not process requests.

In the case of a single authentication method, such as dce, when dce processing fails, the service will reject the request due to authentication failure. There is no fail-over.

Querying the PSSP methods

- Partition Level - `lsauthpts` (PSSP command)
- Local Host - `lsauthts` (PSSP command)

About the PSSP methods

The dce method uses DCE authentication and authorization, implemented through the PSSP library, libspsec.a.

compat method means that a service is to use, or behave, as it did in releases prior to PSSP v3.2, with respect to security processing.

The following are service examples of security processing policies for dce and compat:

- SDR

  dce - DCE credentials and DCE group membership(s)

  compat - requires the user to be root
- Sysctl

dce - DCE credentials and DCE ACLs

compat - Kerberos V4 credentials and Kerberos V4 ACLs

- Hardmon

  dce - DCE credentials, DCE ACLs, and DCE group membership(s)

  compat - Kerberos V4 credentials and Kerberos V4 ACLs

8.2.1.2 AIX authentication methods

Used directly by AIX remote commands, such as `rcp`, `rsh`, and so on, and indirectly by PSSP remote parallel commands that exploit AIX remote commands, such as dsh and pcp, to achieve their functionality.

Partition level settings

1. methods = k5, k4, std, "none" (where "none" means that no authentication method is set; note that the SP requires and enforces that at least one AIX authentication method be enabled)
2. SDR attribute value = auth_methods
3. SDR class value = Syspar
4. To query the AIX authentication methods stored in the SDR, for all partitions in the system, issue: `splstdata -p`

Local host settings

1. methods = k5, k4, std, "none" (where "none" means that no authentication method is set; note that the SP forces at least one AIX authentication method to be set).
2. Methods are stored on the local host in the ODM, in the file CuAt, under /etc/objrepos. (CuAt is also the name of the object class.)

Failover flow

The precedence ordering of the AIX authentication methods is the SP enforced order of k5:k4:std. When k5 processing fails, k4 processing is attempted. When k4 fails, std processing is attempted. When std fails, no further attempts are made at completing the remote command request.

In the case where two authentication methods are set, such as k5:k4, when k5 fails, k4 is attempted. When k4 fails, no further attempts are made to complete the remote command request.

The same holds true for the case where a single authentication method is set, such as k4. When k4 fails, no further attempts are made at completing the remote command request.

Querying the AIX methods

- Partition Level - `lsauthpar` (PSSP command)
- Local Host - `lsauthent` (AIX command)

About the AIX methods

The k5 method uses the Kerberos Version 5 protocol, implemented through Kerberos Version 5 libraries supplied by DCE and AIX, and DCE credentials, which are upgraded to Kerberos Version 5 format for use with remote commands.

The $HOME/.k5login file is used for authorization when k5 is enabled.

The k4 method uses the Kerberos V4 protocol, implemented through a Kerberos V4 compatibility library (supplied by and shipped only with PSSP), and Kerberos V4 credentials. The Kerberos V4 compatibility library is /usr/lib/libspk4rcmd.a.

The $HOME/.klogin file is used for authorization when k4 is enabled.

> **Note**
>
> Only the AIX remote commands, `rsh` and `rcp`, use Kerberos V4 processing. All other AIX remote commands DO NOT use the k4 method. (They simply ignore it.) PSSP remote commands, such as `dsh` and `pcp`, use the k4 method when enabled because these commands exploit `rsh` and `rcp`.

std method uses IP-based "authentication," implemented through the operating system. There are no credentials or tickets, such as those used with k5 and k4.

The $HOME/.rhosts file is used for authorization when std is enabled.

"none" means that all AIX remote commands are disabled and cannot be used. This, in turn, means that those PSSP remote commands that implement their functionality through the exploitation of AIX remote commands are, effectively, "disabled."

AIX and PSSP remote commands

- AIX remote commands:
  - rsh
  - rcp
  - telnet

  - ftp
  - rlogin
- PSSP remote commands:

  Items in parentheses denote other command dependencies.
  - dsh (rsh)
  - pcp (dsh; rsh; rcp)
  - pexec (dsh; rsh)
  - pexscr (dsh; rsh)
  - p-cat (dsh; rsh)
  - pfind (dsh; rsh)
  - pls (dsh;rsh)
  - pmv (dsh; rsh)
  - ppred (dsh; rsh)
  - pps (dsh; rsh)
  - prm (dsh; rsh)

8.2.1.3 Disjoint PSSP authentication methods

PSSP Trusted Service client requests will fail when the client and the server do not share at least one PSSP authentication method in common. For example, if the client is running in a dce only mode, then the server must be running in a mode that includes dce, as in dce (only) or dce:compat. An example of a disjoint set of authentication methods between a client and a server is when the client is running in a compat only mode and the server is running in a dce only mode.

A disjoint set of PSSP authentication methods occurs under the following conditions:

1. In a multi-partition environment, where each partition is running a different security mode
2. In a multi- or single partition environment where the PSSP authentication methods on a host (node or the control workstation) are changed to something other than the partition or system-wide security settings

There are two ways to query the authentication methods in the partition to determine if methods are disjoint.

The first way is to use the `lsauthpts -v` command to compare the current partition's SDR values against each of the nodes in the partition. (In a one partition system, this is equivalent to testing the entire system.) lsauthpts automatically reads, from the SDR, the authentication methods for the partition and compares a node's values to the SDR values. (When the partition name is not specified by the issuer, the current partition is assumed.) For each host with a disjoint set of methods, a "discrepancy" message is displayed.

```
sp3en0/ # lsauthpts -v
Trusted services authentication methods for the partition: dce:compat
No discrepancies were found.

sp3en0/ # lsauthpts -v
Trusted services authentication methods for the partition: dce:compat
lsauthpts: 0016-313 On sp3n06 the trusted services authentication methods are
incorrectly set to "dce".
```

The second way is to use the `dsh -a` command to query the local authentication methods on each host in the current partition and pipe the results to dshbak -c. (dsh -avG will work over all nodes in the system, regardless of their partition association.) The dshbak program collapses identical output from more than one host so that identical results are displayed only once. Unlike the `lsauthpts -v` command, the administrator must know what the authentication methods are for the current partition and visually compare the node results to this value.

Further, if environmental variables that control the set of nodes over which dsh will operate (WCOLL, SP_NAME) include nodes that span partitions, the results will indicate a discrepancy where one does not actually exist. Conversely, if the environment variables include a subset of nodes within a partition, the results will not indicate a true view of the entire partition.

The following example uses dsh to display the authentication methods on a set of nodes. However, the dsh WCOLL variable points to a file containing only a subset of nodes within the system. In contrast, the `splstnodes` command reveals all the node names in the system.

```
sp3en0/ # env WCOLL
/3-node-group
sp3en0/ # cat /3-node-group
sp3n01
sp3n06
sp3n09
sp3en0/ # dsh -a "lsauthts" | dshbak -c
HOSTS --------------------------------------------------------------------------
sp3n06
-------------------------------------------------------------------------------
DCE

HOSTS --------------------------------------------------------------------------
sp3n01  sp3n09
-------------------------------------------------------------------------------
DCE
Compatibility
sp3en0/ # splstnodes -s reliable_hostname reliable_hostname
reliable_hostname
sp3n01
sp3n05
...
sp3n14
sp3n15
```

Knowing exactly which nodes within the system (or within a partition) are disjoint (if any) with respect to PSSP authentication methods is critical for normal security operations. Using the `lsauthpts -v` command is the easiest and most reliable way of gathering that information. Corrective actions can then be taken depending on the type of disjoint environment.

1) Multi-partition environment, each running a different security mode

There is no corrective action for this case, in the sense of correcting a problem, since it's a PSSP requirement that, for two of its Trusted Services to communicate, they must share at least one PSSP authentication method in common. (This is equivalent to humans speaking a common language in order to communicate verbally.) However, multiple partitions don't have to be enabled for the same set of authentication methods, if that is what is desired in the system.

The example set for a multi-partition environment assumes three partitions, sp3en0, sp3sp1, and sp3sp2, where each partition is enabled for a different set of PSSP authentication methods.

In the first example, the commands are issued from the control workstation out to the nodes, and all attempts are successful. The control workstation contains the union of all the PSSP authentication methods in the SP, given that the control workstation must be able to communicate with each node in the system.

In the second set of examples, the commands are issued from a node in one partition to nodes in other partitions. Some of the requests are successful because a common PSSP authentication method is shared, while other requests are not successful because a method is not shared.

For the scope of these examples, the following partition security methods (including PSSP authentication methods), along with a node name in each partition, were in place. The data was extracted from the `splstdata -p` command.

```
    Syspar: sp3en0
    -------------------------
    ts_auth_methods dce:compat
    auth_methods    k5:k4:std
    node            sp3n01

    Syspar: sp3sp1
    -------------------------
    ts_auth_methods compat
    auth_methods    k4:std
    node            sp3n04

    Syspar: sp3sp2
    -------------------------
    ts_auth_methods dce
    auth_methods    k5:std
    node            sp3n03
```

Control workstation to nodes example. dce:compat to compat, dce:compat, and dce nodes.

The Sysctl client request from the dce:compat control workstation to nodes at various authentication method settings is successful because the client shares at least one method in common with each host.

Security configuration and user's credential identities.

```
sp3en0/ # lsauthts ; klist | grep lob ; k4list | grep pal:
DCE
Compatibility
        Global Principal: /.../sp_cell/hosts/sp3en0/self
Principal:      root.admin@ITSO.IBM.COM
```

Client request to multiple nodes.

```
sp3en0/ # sysctl -h sp3n01 -h sp3n04 -h sp3n03 whoami -v
>> sp3n04
DCE:
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
>> sp3n01
DCE: /.../sp_cell/hosts/sp3en0/self
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
>> sp3n03
DCE: /.../sp_cell/hosts/sp3en0/self
K4:
AIX: root
<<
```

Node to node example #1. compat to dce node and compat node

The Sysctl client request from a compat node to a compat node is successful, while the compat to dce node request is denied.

```
sp3n04/ # lsauthts
Compatibility
sp3n04/ # k4list | grep pal:
Principal:      root.admin@ITSO.IBM.COM
sp3n04/ # sysctl -h sp3n01 -h sp3n03 whoami -v
>> sp3n03
sysctl:  2501-122 svcconnect: Insufficient Authorization.
<<
>> sp3n01
DCE:
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
```

Node to node example #2. dce to dce node and compat node

The Sysctl client request from a dce node to a dce node is successful, while the dce node to compat node request is denied.

```
sp3n03/ # lsauthts ; klist | grep lob ; k4list | grep pal:
DCE
        Global Principal: /.../sp_cell/hosts/sp3n03/self
sp3n03/ # sysctl -h sp3n04 -h sp3n01 whoami -v
>> sp3n01
DCE: /.../sp_cell/hosts/sp3n03/self
K4:
AIX: root
<<
>> sp3n04
sysctl:  2501-122 svcconnect: Insufficient Authorization.
<<
```

To establish communication between the client and server, the security settings of one (or both) partitions must be changed to include a common method. This is accomplished through PSSP administrative commands that either enable or disable PSSP authentication methods.

Remove an authentication method from a partition. (The change is reflected in the SDR and on the nodes.)

```
sp3en0/ # lsauthpts -p sp3en0
DCE
Compatibility
sp3en0/ # chauthpts -p sp3en0 dce
0513-095 The request for subsystem refresh was completed successfully.
sp3en0/ # lsauthpts -p sp3en0
DCE
```

Add an authentication method to a partition. (The change is reflected in the SDR and on the nodes.)

```
sp3en0/ # lsauthpts -p sp3sp1
Compatibility
sp3en0/ # chauthpts -p sp3sp1 dce compat
0513-095 The request for subsystem refresh was completed successfully.
sp3en0/ # lsauthpts -p sp3sp1
DCE
Compatibility
```

Attempt to add an authentication method to a partition, but the required software to support the method is not installed.

```
sp3en0/ # lsauthpts -p sp3sp2
DCE
sp3en0/ # chauthpts -p sp3sp2 dce compat
chauthpts: 0016-349 You cannot enable compat, because the partition has not
been configured for Kerberos V4 use.
sp3en0/ # lsauthpts -p sp3sp2
DCE
```

The example that enables authentication methods assumes that the required security software is already installed in the needed partition. Note, however, that there are no restrictions when disabling already set authentication methods. In an environment where the software is not already installed for the partition, the attempt to set PSSP authentication methods for the partition will fail, as shown. In the event of such a failure, refer to the PSSP Administration guide for the steps needed to install the required security code on the nodes, then re-run the command. Also note that chauthpts automatically refreshes certain PSSP subsystems as part of the PSSP authentication methods enablement.

Likewise, in a coexistence environment where SP nodes include Version 3.2 and pre-3.2 PSSP levels, attempting to disable a PSSP authentication method that is required to be compatible with previous levels of PSSP is not permitted, as shown here:

```
sp3en0/ # chauthpar -p sp3coexist dce
chauthpar: 2545-047 The set "dce" is not valid; compat must be included since
there is at least one node in the partition running a
PSSP code level prior to 3.2.0.0.
```

2. Methods do not match system or partition level values

In the case of disjoint PSSP authentication methods being on one host only, the corrective action is for the SP administrator to bring that host's PSSP authentication methods in line with the partition settings. This is accomplished through PSSP administrative commands in one of three ways:

1. Issue chauthpts -f {methods list} from the control workstation:

```
sp3en0/ # lsauthpts
DCE
Compatibility
sp3en0/ # rsh sp3n05 lsauthts
compat
sp3en0/ # chauthpts -f dce compat
0513-095 The request for subsystem refresh was completed successfully.
sp3en0/ # rsh sp3n05 lsauthts
DCE
Compatibility
```

2. `rsh` the command `chauthts` {methods list} to the host:

```
sp3en0/ # lsauthpts
DCE
sp3en0/ # rsh sp3n05 lsauthts
compat
sp3en0/ # rsh sp3n05 "chauthts dce"
sp3en0/ # rsh sp3n05 lsauthts
DCE
```

3. Log in to the node and issue the `chauthts` {methods list} locally

   Except for logging in to the node, the PSSP commands needed to set the PSSP authentication methods locally is shown in the rsh portion of the previous example.

The first approach is the preferred synchronization method, as it automatically refreshes certain PSSP subsystems as part of the PSSP authentication methods enablement. The other approaches do not provide this automation and should be used only under conditions where chauthpts fails.

However, should the chauthpts fail, the chances that the rsh approach will work are low, given that chauthpts exploits the PSSP dsh command, which, in turn, exploits rsh. If chauthpts fails due to an rsh failure, then the rsh alone will most likely fail. (Issuing an indvidual rsh command to each host that chauthtpts will operate over is an excellent way to help identify any problems with the state of AIX authentication method settings within the system.) chauthpts failing because it cannot write/contact an SDR is due to a stopped SDR daemon, hung SDR daemon, invalid partition name on the `chauthpts` command, or an invalid SDR hostname in the PSSP environment variable SP_NAME. These errors are clearly identified by chauthpts.

SDR daemon is not running.

```
sp3en0/ # chauthpts dce
/usr/lpp/ssp/bin/SDRGetObjects: 0025-080 The SDR routine could not connect to
server.
chauthpts: 0016-224: SDR problem. rc=80.
sp3en0/ # lsauthpts
/usr/lpp/ssp/bin/SDRGetObjects: 0025-080 The SDR routine could not connect to
server.
lsauthpts: 0016-224: SDR problem. rc=80.
sp3en0/ # ps -ef | grep sdr
    root 12356 13910   1 09:03:42  pts/2  0:00 grep sdr
sp3en0/ # lssrc -a | grep sdr
 sdr.sp3en0       sdr             11170   inoperative
```

Attempt to enable authentication methods for a non-existent partition.

```
sp3en0/ # chauthpts -p sp3en dce
host: 0827-801 Host name sp3en does not exist.
chauthpts: 0016-344 System partition sp3en does not exist.
sp3en0/ # SP_NAME=sp3sp1 chauthpts dce
host: 0827-801 Host name sp3sp1 does not exist.
chauthpts: 0016-344 System partition sp3sp1 does not exist.
```

When neither chauthpts nor rsh/chauthts is successful, logging in to the node and changing the methods locally is the only course of synchronization action, short of rebooting the node, and is less disruptive than rebooting a node. (Node log in may take the form of telnet, rlogin, s1term (in write mode), ssh, or other processes that open a terminal session to a node.)

Given that chauthpts ultimately issues a chauthts on hosts for which the underlying rsh was successful, chauthpts and chauthts will experience a failure (will not set methods as requested) under the following conditions:

- /sptdata is full (the file /spdata/sys1/spsec/auth_methods cannot be updated).
- The required software for a method is not installed on the host.

```
sp3n10/ # chauthts dce compat
chauthts: 2502-641 dce is not valid, because required software is not installed
and configured on this host.
```

- The order of the methods is incorrect, or the methods are invalid.

```
sp3en0/ # chauthts compat dce
chauthts: 2502-634 You specified the authentication methods in an incorrect order.
Usage: chauthts {-h|[dce][compat]}

sp3en0/ # chauthts dec compat
chauthts: 2502-638 dec is not a valid trusted services authentication method.
Usage: chauthts {-h|[dce][compat]}
```

8.2.1.4 Disjoint AIX authentication methods

Like the PSSP authentication methods, the AIX authentication methods for remote commands (both AIX and PSSP remote commands) must also share at least one method in common if the client and server are to communicate. In fact, the PSSP authentication model, as well as its authentication management commands, were modeled after the AIX authentication methods and management commands.

Remote command client requests will fail when the client and the server do not share at least one AIX authentication method in common. For example, if the client is running in a k5 only mode, the server must be running in a mode that includes k5, as in k5 (only), k5:k4, or k5:k4:std. An example of a disjoint set of authentication methods between a client and a server is when the client is running in a k4 only mode and the server is running in a k5 only mode.

A disjoint set of AIX authentication methods occurs under the following conditions:

1. In a multi-partition environment, where each partition is running a different security mode
2. In a single partition environment, where the AIX authentication methods on a host (node or the control workstation) are changed to something other than the system-wide security settings

There are two ways to query the authentication methods in the partition to determine if methods are disjoint.

The first is to use the `lsauthpar -v` command to compare the current partition's SDR values against each of the nodes in the partition. (In a one partition system, this is equivalent to testing the entire system.) `lsauthpar` automatically reads from the SDR the authentication methods for the partition and compares a node's values to the SDR values. (When the partition name is not specified by the issuer, the current partition is assumed.) For each host with a disjoint set of methods, a "discrepancy" message is displayed.

```
sp3en0/ # lsauthpar -v
Remote command authentication methods for the partition: k4:std
No discrepancies were found.

sp3en0/ # lsauthpar -v
Remote command authentication methods for the partition: k5:k4:std
krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
lsauthpar: 0016-314 On sp3n15 the remote command authentication methods are
incorrectly set to "k4:std".
```

The second way is to use the `dsh -a` command to query the local authentication methods on each host in the current partition and pipe the results to dshbak -c. (dsh -avG will work over all nodes in the system, regardless of their partition association.) The dshbak program collapses identical output from more than one host so that identical results are displayed only once. Unlike the `lsauthpar -v` command, the administrator must know what the authentication methods are for the current partition and visually compare the node results to this value. Furthermore, if environmental variables that control the set of nodes over which dsh will operate (WCOLL, SP_NAME) include nodes that span partitions, the results will indicate a discrepancy where one does not actually exist. Conversely, if the environment variables include a subset of nodes within a partition, the results will not indicate a true view of the entire partition.

Using dsh to display the authentication methods on a set of node. The dsh WCOLL variable is set and points to a file containing only a subset of nodes within the system. splstnodes reveals all the node names in the system.

```
sp3en0/ # env WCOLL
/3-node-group
sp3en0/ # cat /3-node-group
sp3n01
sp3n06
sp3n09
sp3en0/ # dsh -a "lsauthent" | dshbak -c
HOSTS -------------------------------------------------------------------------
sp3n06
-------------------------------------------------------------------------------
Kerberos 5
Standard Aix

HOSTS -------------------------------------------------------------------------
sp3n01  sp3n09
-------------------------------------------------------------------------------
Kerberos 5
Kerberos 4
Standard Aix
sp3en0/ # splstnodes -s reliable_hostname reliable_hostname
reliable_hostname
sp3n01
sp3n05
sp3n06
...
sp3n11
sp3n12
sp3n13
...
```

Knowing exactly which nodes within the system, or within a partition, are disjoint (if any) with respect to AIX authentication methods is critical for normal security operations. Using the `lsauthpar -v` command is the easiest and most reliable way of gathering that information. Corrective actions can then be taken depending on the type of disjoint environment:

1. Multi-partition environment, each running a different security mode

There is no corrective action for this case, in the sense of correcting a problem, since it's an AIX requirement that, for its client/server processes to communicate, they must share at least one AIX authentication method in common. (This is equivalent to humans speaking a common language in order to communicate verbally.) However, multiple partitions don't have to be enabled for the same set of authentication methods, if that is what is desired in the system.

The example set for a multi-partition environment assumes three partitions, sp3en0, sp3sp1, and sp3sp2, where each partition is enabled for a different set of AIX authentication methods.

In the first example, the commands are issued from the control workstation out to the nodes, and all attempts are successful. The control workstation contains the union of all the AIX authentication methods in the SP, given that the control workstation must be able to communicate with each node in the system. Note that the control workstation can contain more AIX authentication methods beyond the union of the AIX authentication methods of the SP. For example, if the union of all AIX authentication methods in the SP is k5:k4, the control workstation can have k5:k4:std, with k5:k4 being the minimum set of methods. This allows the SP administrator to tailor which remote command requests are satisfied by the control workstation by host requests external-to-the-SP, in environments where such remote access to the control workstation is required.

In the second set of examples, the commands are issued from a node in one partition to nodes in other partitions. Some of the requests are successful because a common AIX authentication method is shared while other requests are not successful because a method is not shared.

For the scope of these examples, the following partition security methods (including AIX authentication methods), along with a node name in each partition, were in place. The data was extracted from the `splstdata -p` command.

```
Syspar: sp3en0
-------------------------
ts_auth_methods dce:compat
auth_methods    k5:k4
node            sp3n01

Syspar: sp3sp1
-------------------------
ts_auth_methods compat
auth_methods    k4
node            sp3n04

Syspar: sp3sp2
-------------------------
ts_auth_methods dce
auth_methods    k5
node            sp3n03
```

Control workstation to nodes example. k5:k4 to k4, k5:k4, and k5 nodes

The rsh client request from the k5:k4 control workstation to nodes at various authentication method settings is successful because the client shares at least one method in common with each host. Error messages returned by the remote daemon are for failed remote command protocol attempts and are not failures of the commands actually issued on the remote hosts.

Security configuration and user's credential identities.

```
sp3en0/ # lsauthent ; klist | grep lob ; k4list | grep pal:
Kerberos 5
Kerberos 4
        Global Principal: /.../sp_cell/hosts/sp3en0/self
Principal:      root.admin@ITSO.IBM.COM
```

rsh to a k5:k4 enabled node.

```
sp3en0/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
```

rsh to a k4 enabled node.

```
sp3en0/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to
support Kerberos 5.
sp3n04
Kerberos 4
```

rsh to a k5 enabled node.

```
sp3en0/ # rsh sp3n03 "hostname -s ; lsauthent"
sp3n03
Kerberos 5
```

The protocol error message going from k5:k4 to k4 is expected, given that the client tried to communicate with the remote server via k5 first. Once that attempt failed, the client and server communicated via k4.

Node to node example #1. k5:k4 to k5 node and k4 node

The rsh client request from a k5:k4 node to a k4 node is successful, as is the k5:k4 to k5 node request. Error messages returned by the remote daemon are for failed remote command protocol attempts only. The commands to be run on the remote host were ultimately executed because a common authentication method between client and server was found.

```
sp3n01/ # lsauthent ; klist | grep lob ; k4list | grep pal:
Kerberos 5
Kerberos 4
        Global Principal: /.../sp_cell/hosts/sp3n01/self
Principal:      root.admin@ITSO.IBM.COM
sp3n01/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to
support Kerberos 5.
sp3n04
Kerberos 4
sp3n01/ # rsh sp3n03 "hostname -s ; lsauthent"
sp3n03
Kerberos 5
```

The protocol error message going from k5:k4 to k4 is expected since the client tried to communicate with the remote server via k5 first. Once the k5 attempt failed, the client and server communicated via k4.

Node-to-node example #2. k4 to k5 node and k5:k4 node

The rsh client request from a k4 node to a k4 node is successful, while the k4 to k5 node request is denied. For failed rsh attempts, error messages returned by the remote daemon are for failed remote command protocol attempts. The commands to be run on the remote host were never executed, due to the disjoint authentication methods between client and server.

```
sp3n04/ # lsauthent ; k4list | grep pal:
Kerberos 4
Principal:      root.admin@ITSO.IBM.COM
sp3n04/ # rsh sp3n03 "hostname -s ; lsauthent"
krshd: Kerberos Authentication Failed.
spk4rsh: 0041-004 Kerberos rcmd failed: rcmd protocol failure.
sp3n04/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
```

The protocol error message going from k4 to k5 is expected since the client and server do not share a common method. The commands to be run on the remote host, `hostname -s` and `lsauthent`, are not attempted.

The protocol error message going from k4 to k5:k4 is expected since the client only tried to communicate with the remote server via k4.

Node to node example #3. k5 to k5:k4 node and k4 node.

The rsh client request from a k5 node to a k5:k4 node is successful, while the k5 to k4 node request is denied. For failed rsh attempts, error messages returned by the remote daemon are for failed remote command protocol attempts. The commands to be run on the remote host were never executed due to the disjoint authentication methods between client and server.

```
sp3n03/ # lsauthent ; klist | grep lob
Kerberos 5
        Global Principal: /.../sp_cell/hosts/sp3n01/self
sp3n03/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
sp3n03/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to
support Kerberos 5.
```

The protocol error message going from k5 to k4 is expected since the client and server do not share a common method. The commands to be run on the remote host, `hostname -s` and `lsauthent`, are not attempted.

To establish communication between the client and server, the security settings of one (or both) partitions must be changed to include a common method. This is accomplished through PSSP administrative commands that either enable or disable AIX authentication methods.

Removing an authentication method from a partition (The change is reflected in the SDR and on the nodes.):

```
sp3en0/ # lsauthpar -p sp3en0
Kerberos 5
Kerberos 4
sp3en0/ # chauthpar -p sp3en0 k5
sp3en0/ # lsauthpar -p sp3en0
Kerberos 5
```

Adding an authentication method to a partition. (The change is reflected in the SDR and on the nodes.):

```
sp3en0/ # lsauthpar -p sp3sp1
Kerberos 4
sp3en0/ # chauthpar -p sp3sp1 k5 k4
sp3n04: krshd: Kerberos 5 Authentication Failed: This server is not configured
to support Kerberos 5.
sp3n06: krshd: Kerberos 5 Authentication Failed: This server is not configured
to support Kerberos 5.
sp3en0/ # lsauthpar -p sp3sp1
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n04 "hostname ; lsauthent"
sp3n04
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n06 "hostname ; lsauthent"
sp3n06
Kerberos 5
Kerberos 4
```

Attempt is made to add an authentication method to a partition, but the required software to support the method is not installed:

```
sp3en0/ # lsauthpar -p sp3sp2
Kerberos 5
sp3en0/ # chauthpar -p sp3sp2 k5 k4
chauthpts: 0016-349 You cannot enable k4, because the partition has not been
configured for Kerberos V4 use.
sp3en0/ # lsauthpar -p sp3sp2
Kerberos 5
```

The example that enables authentication methods assumes that the required security software is already installed in the needed partition. Note, however, that there are no restrictions when disabling already-set authentication methods. In an environment where the software is not already installed for the partition, the attempt to set PSSP authentication methods for the partition will fail, as shown. In the event of such a failure, refer to the *PSSP Administration Guide*, SA22-7348, for the steps needed to install the required security code on the nodes, and then rerun the command.

Likewise, in a coexistence environment where SP nodes include Version 3.2 and pre-3.2 PSSP levels, attempting to disable an AIX authentication method that is required to be compatible with previous levels of PSSP is not permitted, as shown in the following screen:

```
sp3en0/ # chauthpar -p sp3coexist k5 std
chauthpar: 2545-047 The set "k5:std" is not valid; k4 must be included since
there is at
least one node in the partition running a
PSSP code level prior to 3.2.0.0.
```

2. Methods do not match system or partition level values

In the case of disjoint AIX authentication methods on one host only, the corrective action is for the SP administrator to bring that host's AIX authentication methods in line with the partition settings. This is accomplished through PSSP or AIX administrative commands in one of three ways:

1. Issue `chauthpar -f` {methods list} from the control workstation:

```
sp3en0/ # lsauthpar
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 4
sp3en0/ # chauthpar -f k5 k4
sp3n05: krshd: Kerberos 5 Authentication Failed: This server is not configured
to support Kerberos 5.
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
Kerberos 4
```

2. rsh the command, `chauthent` {methods list}, to the host:

```
sp3en0/ # lsauthpar
Kerberos 5
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n05 "chauthent -k5"
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
```

3. Log in to the node and issue the chauthent {methods list} locally

Except for logging in to the node, the PSSP commands needed to set AIX authentication methods locally is shown in the rsh portion of the previous example.

The first approach is the PSSP preferred synchronization method. The other approaches should be used under conditions where chauthpar fails.

However, should the chauthpar fail, the chances that the rsh approach will work are low, given that chauthpar exploits the PSSP dsh command, which, in turn, exploits rsh. If chauthpar fails due to an rsh failure, the rsh alone will, most likely, fail. (Issuing an indvidual `rsh` command to each host over which chauthpar will operate is an excellent way to help identify any problems with the state of AIX authentication method settings within the system.)

Given that chauthpar ultimately issues a chauthent on hosts for which the underlying rsh was successful, chauthpar and chauthent will experience a failure (will not set methods as requested) under the following conditions:

- /tmp is full (chauthent comments/uncomments rshd and rlogind entires in /etc/inetd.conf, based on the inclusion or absence of -std in chauthent, and uses /tmp to hold a copy of the file it has modified). The error message received is:

```
sp3en0/ # chauthent -k4 -std
chsubserver: error in updating /etc/inetd.conf
chsubserver: error in updating /etc/inetd.conf
```

- The required software for a method is not installed on the host:

```
sp3n09/ # chauthent -k5 -k4 -std
Kerberos 4 permitted on SP node only.
Kerberos 5 requires DCE version 2.2 or greater.
```

- The order of the methods is incorrect, or the methods are invalid:

```
sp3en0/ # chauthent -std -k5 -k4
Invalid authentication method or ordering of methods
```

When neither chauthpar nor rsh/chauthent is successful, logging in to the node and changing the methods locally is the only course of synchronization action, short of rebooting the node, and is less disruptive than rebooting a node. (Node login may take the form of telnet, rlogin, s1term (in write mode), ssh, or other processes that open a terminal session to a node.)

8.2.2 User identities and access controls

This section covers user (SP administrator and non-administrator) identities and access controls.

This area covers items that a user needs to do, or things that a user needs to be a member of, before access is granted by PSSP services. These are areas that the user can directly manipulate or that an SP administrator must manipulate or enable.

The user's identity, the state of his/her credentials, and the access controls that grant/deny a user access to resources are the key impact items during normal state operation and administration.

Many problems a user may face can be quickly isolated and solved by asking the following questions:

- What is my identity?
- How do I establish an identity that I need?
- Am I authorized to do what I have requested? (Am I allowed to access the resource I am trying to use?)

8.2.2.1 What is your identity?

This applies to AIX (user/group identity), DCE (principal identity), and Kerberos V4 (principal identity).

An SP user can determine what his/her identities are on any SP node, plus the control workstation, with the following commands:

```
AIX:  whoami
DCE:  klist  (requires DCE installed)
KV4:  k4list (requires Kerberos V4 installed)
```

Depending on the PSSP security configuration of the system (or partition), one or more of these identities may need to be established to use or administer PSSP resources. PSSP services grant access to resources based on the authenticated identities of a user and the access controls (specific authorizations) associated with the identities.

8.2.2.2 How do you establish an identity that you need?

An identity is "who you say you are." An identity is established by authenticating to some service and that service providing you with a way to prove who you say you are to other services or applications. (This would be akin to obtaining a driver's license and presenting it to someone to prove your identity.)

It's possible that a single SP user can have up to three identities at any given time: AIX, DCE, and Kerberos V4. (This is true for both SP administrators and non-administrators.)

In the case of AIX, this is the AIX user ID/group ID pair assigned at the creation of the ID and established with each AIX login. When a user successfully logs in to a system with a valid user ID and password, the AIX user ID/group ID pair is established for the user by AIX. Once logged in to AIX, a user can change to another AIX identity by issuing the AIX `su` command and supplying the appropriate password.

AIX user IDs are managed across an SP system through PSSP-supplied software or through customer-supplied controls.

A DCE identity is the unique DCE principal name within a specific DCE cell. A DCE identity is established after an AIX user successfully issues a dce_login. (For AIX/DCE integrated login environments, a separate dce_login is not required to establish an initial DCE principal identity. A DCE identity is established as part of the AIX login.) A DCE cell administrator creates DCE user principals and accounts based on the site's user policies. Once logged in as a DCE principal, a user can change to another DCE identity by issuing a dce_login for another principal name and supplying the appropriate password.

PSSP installation and configuration provides scripts that will create PSSP-specific DCE principals/accounts, groups, and organizations for use by PSSP Trusted Services when the services run under a dce security configuration (dce or dce:compat).

All DCE principals and accounts are managed by the DCE cell administrator. PSSP does not supply management routines for DCE principals, accounts, groups, or organizations. Management of these DCE items is covered extensively by DCE administrative facilities.

As with DCE, to establish a Kerberos V4 principal identity, an AIX user must issue a successful `k4init` command. (Refer to the "Integrating Login For Kerberos V4 with AIX" subsection of Chapter 3, “Managing and Using SP Security Services”, of the *PSSP Administration Guide*, SA22-7348, for details on how to set-up the AIX/PSSP Kerberos V4 integrated login.) PSSP installation and configuration scripts create specific Kerberos V4 principals used by PSSP services in a compat security configuration (compat or dce:compat). An SP administrator creates additional Kerberos V4 principals based on the site's user policies and requirements. Once logged in as a Kerberos V4 principal, a user can change to another Kerberos V4 principal by issuing a k4init for another principal name and supplying the appropriate password.

All Kerberos V4 principals are managed by the SP administrator. PSSP provides a Kerberos V4 administrative facility to manage its database of principals.

In the case of DCE and Kerberos V4 credentials, the state of the held credentials at the time of command execution will impact whether or not PSSP services, or AIX secure remote command services, will respond to the request. (Examples of DCE and Kerberos Version 4 credential states are covered elsewhere in this chapter.)

8.2.2.3 Are you authorized?

You may ask yourself: Am I authorized to do what I have requested? (Am I allowed to access the resource I'm trying to use?)

Simply because a user has an AIX identity, a DCE identity, a Kerberos Version 4 identity, or some combination thereof, does not automatically grant the user access to a particular resource. The ability to selectively grant/deny access to a resource is made possible through access controls, commonly referred to as access control lists (ACLs).

Note, however, that an ACL can take the form of text files, AIX user/group memberships, DCE objects, or other formats recognized by a given server or program. Also, an ACL need not be a simple "list." It may be a complex series of cascading controls that join multiple data elements to determine grant/deny access. The actual implementation of an ACL is up to the security mechanisms associated with a server or resource.

For example, the AIX command shutdown requires the following for the command to be executed by the operating system:

- If the user is root, run the command.
- If the user is not root, but the user is in the AIX group shutdown, then setuid to 0 (zero), and run the command.

Therefore, to use the `shutdown` command, the issuer must either be root or a member of the AIX shutdown group. Access is controlled by the AIX user ID of 0 (zero), or membership in the AIX group shutdown. The AIX operating system controls access to the `shutdown` command through programs that determine the AIX identity and the AIX group membership of the user issuing `shutdown`.

In this case, the ACL comes in two forms: The first is a comparison of the issuer's user ID to that of an internal list, where the list contains one element, 0 (zero). If that check fails, the issuer's user identity is compared to those in the AIX shutdown group. If the issuer's user identity appears as a member of the shutdown group, the command is issued; otherwise, the command attempt is rejected.

As would be expected, the ability to query, or display, elements of an ACL are dependent on the security mechanisms that support a particular ACL type. For instance, DCE has commands that show the contents of a DCE ACL object and to manipulate the elements within an ACL object.

In the case of the `shutdown` command, the AIX command, `lsgroup`, displays users that are a member of a particular group, while the AIX command lsuser displays group and user ID information about a particular user.

In the samples shown below, the AIX users, `sp_admin` and `dero`, are both members of the shutdown group, although, they are not root IDs. These IDs can issue the `shutdown` command. The user, maarten, is not a member of the shutdown group, is not a root ID, and, therefore, cannot issue the `shutdown` command.

```
sp3en0/ # lsgroup shutdown
shutdown id=21 admin=true users=sp_admin,dero dce_export=false
sp3en0/ # lsuser -a id groups dero
dero id=202 groups=staff,security,shutdown
sp3en0/ # lsuser -a id groups sp_admin
sp_admin id=300 groups=system,shutdown
sp3en0/ # lsuser -a id groups maarten
maarten id=201 groups=staff
sp3en0/ # whoami
maarten
sp3en0/ # shutdown -Fr
ksh: shutdown: 0403-006 Execute permission denied.
...
sp3en0/ # whoami
dero
sp3en0/ # lsuser -a id groups dero
dero id=201 groups=staff,security,shutdown
sp3en0/ # shutdown -Fr
SHUTDOWN PROGRAM
Wed Dec 29 09:38:34 EST 1999

Wait for 'Rebooting...' before stopping.
```

In terms of PSSP services, access control is maintained through Kerberos V4 ACLs, DCE ACLs, DCE group memberships, and AIX user/group identity. Additionally, the AIX secure remote commands, such as rsh and rcp, have their own set of ACLs for each AIX user. The AIX secure remote command ACLs come in the form of authorization files that exist in the user's home directory. (Examples of AIX remote command authentication and authorization messages are covered in a separate section of this chapter.)

8.2.2.4 *PSSP examples*

The remainder of this subsection contains examples of PSSP Trusted Services under various user identities and ACL states. The examples focus on three areas of PSSP: SDR, Sysctl, and Hardmon.

SDR

The SDR protects its resources (the SDR databases and files) through DCE group membership (in a dce only mode), or when the user is root on the control workstation (in dce:compat or compat security modes). There are eight SDR DCE groups configured by PSSP services that an SDR daemon uses to grant/deny access under a dce only security mode. (The groups can be displayed by issuing `dcecp -c group cat | grep sdr`.)

SDR read operations are permitted by any AIX user, under any security mode, and do not require any specific DCE or AIX group memberships or DCE credentials.

In the first sequence, a root user running in a dce only security mode attempts to write to existing entries in the SDR but is denied due to lack of DCE group membership in a required PSSP DCE group, sdr-write.

After the cell administrator adds the DCE principal to the needed group, the user must destroy and create new DCE credentials in order to reflect the new membership. In the case of a root user holding the DCE self-host principal credentials, that is, the DCE machine principal context/identity, DCE (or just its security client, sec_cl) must be stopped and then started on the host (node or control workstation) in order for the self-host principal's credentials to reflect the new group membership. (User membership in DCE groups is reflected through the user's DCE credentials and is considered part of the user's ticket privilege attributes. The credentials, also called tickets, can only reflect group memberships that were in place at the time the user's credentials were created. Any group associations established after user credentials were generated will not be reflected until new credentials are created. For more information about DCE credentials (tickets) and their privilege attributes, refer to the "Displaying Privilege Attributes and Tickets" subsection of Chapter 31, "Creating and Maintaining Accounts", of the book, *IBM DCE Version 3.1 for AIX and Solaris: Administration Guide -- Core Components*.)

Once this takes place, the user can update existing items in the SDR:

```
sp3en0/ # whoami ; klist | grep lob
root
       Global Principal: /.../sp_cell/dero2
sp3en0/ # SDRChangeAttrValues Syspar auth_methods=k5:std
SDRChangeAttrValues: 0025-001 A read-only SDR session was obtained.  Operations
that create or change data are not allowed.
sp3en0/ # dcecp -c prin show dero2 | grep groups
{groups none}
```

As a cell administrator, add the DCE principal, dero2, to the sdr-write class:

```
sp3en0/ # dcecp -c group add sdr-write -member dero2

sp3en0/ # dcecp -c group list sdr-write
/.../sp_cell/cell_admin
/.../sp_cell/dero2
```

Note that even as the DCE principal dero2, which is now a member of the sdr-write group, the command still fails. The user must destroy the current credentials and create new ones:

```
sp3en0/ # SDRChangeAttrValues Syspar auth_methods=k5:std
SDRChangeAttrValues: 0025-001 A read-only SDR session was obtained.  Operations
that create or change data are not allowed.
sp3en0/ # SDRGetObjects -x -q Syspar auth_methods
k5
sp3en0/ # kdestroy ; exit
sp3en0/ # dce_login dero2
...
DCE LOGIN SUCCESSFUL
...
sp3en0/ # SDRChangeAttrValues Syspar auth_methods=k5:std
sp3en0/ # SDRGetObjects -x -q Syspar auth_methods
k5:std
```

The reason why the user had to destroy and then create new credentials after the cell administrator added the principal to the needed group is due to the way in which DCE credentials are created.

At the time dero2 logged into DCE, dero2 was not a member of the sdr-write group; so, the DCE credentials obtained did not reflect such an association. When the cell administrator added dero2 to the sdr-write group, the dero2 credentials still reflected the memberships at the time the credentials were originally created by the user. For dero2's credentials to reflect the sdr-write membership, the current credentials must be destroyed and the security context re-created by way of a kdestroy/dce_login sequence. Note that simply issuing kinit will not create credentials that reflect the new group association.

This is what the dero2 credentials looked like before and after the kdestroy/dce_login. Notice that the new credentials reveal membership in the sdr-write group.

Before:

```
sp3en0/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero2
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 0000019e-be0f-21d3-9a00-02608c2d4a7f dero2
        Group:     0000000c-9842-21d3-a501-02608c2d4a7f none
        Local Groups:
                0000000c-9842-21d3-a501-02608c2d4a7f none
...
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_1cb46000
Default principal: dero2@sp_cell
...
```

kdestroy and dce_login take place.

After:

```
sp3en0/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero2
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 0000019e-be0f-21d3-9a00-02608c2d4a7f dero2
        Group:     0000000c-9842-21d3-a501-02608c2d4a7f none
        Local Groups:
                0000000c-9842-21d3-a501-02608c2d4a7f none
...
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_40146600
Default principal: dero2@sp_cell
...
```

In this next sequence, a root user is running in dce:compat, and then just compat. The user then attempts to create items in the SDR and is successful even though the user's DCE identity is not a member of the sdr-write group. The create operation is permitted since the user is root and is running the command from the control workstation, which is node number 0 (zero) in SP terms.

Sequence 3’s security configuration information, SP node number, user credential identities, and DCE group membership:

```
sp3en0/ # /usr/lpp/ssp/install/bin/node_number
0
sp3en0/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/dero2
sp3en0/ # lsauthts
DCE
Compatibility
sp3en0/ # dcecp -c group list sdr-write
/.../sp_cell/atest
/.../sp_cell/sp_admin
```

Update values in the SDR:

```
sp3en0/ # SDRGetObjects -x -q Syspar auth_methods
k5
sp3en0/ # SDRChangeAttrValues Syspar auth_methods=k5:std
sp3en0/ # SDRGetObjects -x -q Syspar auth_methods
k5:std
```

In the third sequence, a non-root user running in a dce only security mode attempts to create items in the SDR, but is denied due to lack of DCE group membership in the PSSP DCE group, sdr-admin. After the cell administrator adds the DCE principal to the needed group, the user must destroy and create new DCE credentials in order to reflect the new membership. Once this takes place, the user can create items in the SDR:

```
sp3en0/ # whoami ; klist | grep lob
dero
        Global Principal: /.../sp_cell/dero
sp3en0/ # SDRCreateClass testclass attr=string
SDRCreateClass: 0025-001 A read-only SDR session was obtained.  Operations
that create or change data are not allowed.
sp3en0/ # dcecp -c prin show dero | grep groups
{groups spsec-admin hm-control}
```

As a cell administrator, add the DCE principal dero to the sdr-admin class:

```
sp3en0/ # dcecp -c group add sdr-admin -member dero

sp3en0/ # dcecp -c group list sdr-admin
/.../sp_cell/sp_admin
/.../sp_cell/dero
```

As the DCE principal, dero, the `SDRCreateClass` command still fails, even though dero was added to the sdr-admin group. The user must destroy the current credentials and create new ones:

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/dero
sp3en0/ # SDRCreateClass testclass attr=string
SDRCreateClass: 0025-001 A read-only SDR session was obtained.  Operations
that create or change data are not allowed.
sp3en0/ # ls -l /spdata/sys1/sdr/defs/testclass
ls: 0653-341 The file /spdata/sys1/sdr/defs/testclass does not exist.
sp3en0/ # kdestroy ; exit
sp3en0/ # dce_login dero
...
DCE LOGIN SUCCESSFUL
...
sp3en0/ # SDRCreateClass testclass attr=string
sp3en0/ # ls -l /spdata/sys1/sdr/defs/testclass
-rw-------   1 root     system        10 Dec 28 14:08 /spdata/sys1/sdr/defs/
testclass
sp3en0/ # cat /spdata/sys1/sdr/defs/testclass
pS1=attr
```

The reason why the user had to destroy and then create new credentials after the cell administrator added the principal to the needed group is due to the way in which DCE credentials are created.

At the time dero logged into DCE, dero was not a member of the sdr-admin group; so, the DCE credentials obtained did not reflect such an association. When the cell administrator added dero to the sdr-admin group, the dero credentials still reflected the user’s memberships at the time the credentials were created. For dero's credentials to reflect an sdr-admin membership, the current credentials must be destroyed and the security context re-created through a kdestroy/dce_login sequence. Note that simply issuing kinit will not create credentials that reflect the new group association.

This is what the dero credentials looked like before and after the kdestroy/dce_login. Notice that the new credentials reveal membership in the sdr-admin group.

Before:

```
sp3en0/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 0000019d-b654-21d3-9300-02608c2d4a7f dero
        Group:     0000007c-9844-21d3-9201-02608c2d4a7f spsec-admin
        Local Groups:
                0000007c-9844-21d3-9201-02608c2d4a7f spsec-admin
                00000081-9844-21d3-9201-02608c2d4a7f hm-control
...
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_4ac41b00
Default principal: dero@sp_cell
...
```

kdestroy and dce_login take place.

After:

```
sp3en0/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 0000019d-b654-21d3-9300-02608c2d4a7f dero
        Group:     0000007c-9844-21d3-9201-02608c2d4a7f spsec-admin
        Local Groups:
                0000007c-9844-21d3-9201-02608c2d4a7f spsec-admin
                00000081-9844-21d3-9201-02608c2d4a7f hm-control
                00000086-9844-21d3-9201-02608c2d4a7f sdr-admin
...
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_4ad4e200
Default principal: dero@sp_cell
...
```

In the fourth sequence, a root user running in dce:compat and compat security modes attempts to create items in the SDR and is successful even though the user's DCE identity is not a member of the sdr-admin group. The create operation is permitted since the user is root and is running the command from the control workstation, which is node number 0 (zero) in SP terms.

Sequence four’s security configuration information, SP node number, user credential identities, and DCE group membership follow:

```
sp3en0/ # /usr/lpp/ssp/install/bin/node_number
0
sp3en0/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/dero1
sp3en0/ # lsauthts
DCE
Compatibility
sp3en0/ # dcecp -c group list sdr-admin
/.../sp_cell/sp_admin
/.../sp_cell/cell_admin
```

Create an SDR class:

```
sp3en0/ # SDRCreateClass testclass3 attr=string
sp3en0/ # ls -l /spdata/sys1/sdr/defs/testclass3
-rw-------   1 root     system        10 Dec 29 11:04 /spdata/sys1/sdr/defs/
testclass3
```

Sysctl

Sysctl is a powerful PSSP client/server package. In addition to the default PSSP Sysctl Systems Management procedures and wealth of built-in commands and scripts, Sysctl can be customized and extended through the use of customer-supplied Tool Control Language (TCL) programs. Plus, Sysctl commands can be defined so that sets of users--or just one user--can execute Sysctl commands. Further, non-root users can be granted access to root level commands by wrapping the root level commands in Sysctl procedures, which, in turn, become the actual “commands” issued by users.

Since a Sysctl server runs as root and all Sysctl client command requests are actually executed by the server, it is possible for a non-root user to run a command, a program, or a script that requires root authority. Since a non-root user can be granted authority to specific sets of Sysctl commands, the user can have access to various root functions without actually having any true root authority. It is an excellent way to define AIX and PSSP administrative responsibilities to an administrative team without granting them total root access. (An excellent use would be to allow certain users the ability to issue startsrc commands for a well-defined set of servers, such as Web servers, in the event that a server is down.) The same approach can be applied to non-root users requiring access to specific sets of root commands, ranging from technical computing, to data processing, to custom applications, without actually granting them complete root authority.

Obviously, the need for Sysctl to securely and reliably grant/deny access to the resources it protects is critical. This is accomplished through a two-tier process.

First, when a Sysctl client connects to a Sysctl server (daemon), the Sysctl svcconnect built-in procedure is evaluated before evaluating any commands sent by the user (or before entering an interactive Sysctl session). The results of the svcconnect procedure determines whether the server will allow client requests to be processed. In short, if the client can be authenticated, Sysctl command processing will begin; otherwise, the client's request is denied due to an authentication failure.

Sysctl servers are shipped with a default svcconnect of “AUTH”, meaning the client must be authenticated by the server before allowing the client's command requests to be processed. This setting can be changed by adding an svcconnect statement to the server's configuration file, /etc/sysctl.conf, and then restarting the server. For example, to allow any client to connect to a Sysctl server on a given node without any authentication requirements, add the line “rename svcconnect {}” to the configuration file (less the quotes). Note, however, that this is not a recommended way to run a Sysctl server because it takes away the first tier of Sysctl protection. (For complete details on Sysctl configuration and the `svcconnect` command, refer to the PSSP Administration guide and Sysctl on-line help.)

The second tier comes into play once the client is authenticated by the server. After the server authenticates the client, it determines whether or not the client is authorized to execute the requested Sysctl command. The server determines the authorization level associated with the command, and, if the authorization criteria for a command are satisfied, the server will run the command for the client; otherwise, the request is denied due to an authorization failure. (A Sysctl command has one of four possible authorizations associated with it: NONE - any user can run the command; AUTH - any authenticated user can run the command; ACL - only principals that appear in the command's ACL can run the command; SYSTEM - only the server can run the command. Clients are not permitted to run the command.)

By and large, once a client is authenticated and connected to a server, the most common Sysctl problems are those related to command authorization failures. Most authorization failures are due to a lack of membership in one or more Sysctl ACLs. Unlike the earlier SDR examples, where DCE group membership or AIX user ID are the deciding grant/deny factors, or the forthcoming Hardmon examples, where DCE group membership and/or ACLs (DCE or Kerberos V4) are the deciding grant/deny factors, Sysctl bases final grant/deny access on its ACLs.

Sysctl ACLs come in two formats: Kerberos V4 ACLs, used in a compat mode, and DCE ACL objects, used in a dce mode. When a Sysctl server runs under a combined dce:compat mode, both ACL types may be checked depending on the authenticated identities of the client). Under conditions where both ACL types are checked, the Sysctl server checks DCE ACLs first, then Kerberos V4 ACLs.

Note

When a Sysctl server under a dce:compat mode determines that the client is authroized by way of a DCE ACL, it does not check Kerberos V4 ACLs.

The Sysctl examples to follow cover authentication failures, authorization failures, various Sysctl ACL query commands, failures when the Sysctl client is running in one PSSP security mode and the remote Sysctl server is running in a different PSSP security mode, and suggestions on managing Sysctl ACLs.

The “Controlling Remote Execution by using Sysctl” chapter of the *PSSP Administration Guide*, SA22-7348, contains additional information that will prove useful to the SP administrator.

Authentication Failure Examples

The Sysctl requests fail because the client could not be authenticated to the server. To correct the situation, the client must obtain valid credentials.

Expired DCE and Kerberos V4 credentials:

```
sp3en0/ # sysctl whoami -v
2502-605 Your DCE credentials have expired.
Authentication ticket expired
2502-605 Your Kerberos V4 credentials have expired.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

DCE credentials do not exist and Kerberos V4 credentials have expired:

```
sp3en0/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-605 Your Kerberos V4 credentials have expired.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

Neither DCE nor Kerberos V4 credentials exist:

```
sp3en0/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-603 You do not have Kerberos V4 credentials.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

DCE and Kerberos V4 credentials are corrupt.

```
sp3en0/ # sysctl whoami -v
2502-607 GSSAPI error in gss_init_sec_context: The routine failed.
Unsupported credentials cache format version number
2502-608 Kerberos error in krb_mk_req: 2504-079 Bad Kerberos ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

A non-root user attempts to "steal" root's DCE and Kerberos V4 credentials:

```
sp3en0/ # whoami
dero
sp3en0/ # ls -l /opt/dcelocal/var/security/creds/dcecred_ffffffff
-rw-------   1 root     system      4465 Jan 06 22:19
/opt/dcelocal/var/security/creds/dcecred_ffffffff
sp3en0/ # ls -l /tmp/tkt0
-rw-------   1 root     system      3065 Jan 04 15:03 /tmp/tkt0
sp3en0/ # export KRB5CCNAME=FILE:/opt/dcelocal/var/security/creds/
dcecred_ffffffff
sp3en0/ # export KRBTKFILE=/tmp/tkt0
sp3en0/ # klist
No DCE identity available: No currently established network identity for this
context exists
(dce / sec)
Kerberos Ticket Information:
klist: Credentials cache file permissions incorrect (dce / krb) while setting
cache flags
(ticket cache /opt/dcelocal/var/security/creds/dcecred_ffffffff)
sp3en0/ # k4list
Ticket file:    /tmp/tkt0
k4list: 2504-077 Can't access Kerberos ticket file
sp3en0/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos error in krb_mk_req: 2504-077 Can't access Kerberos ticket file
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The preceding example is particularly interesting because it shows how klist (a DCE program), k4list (a Kerberos V4 program), and Sysctl (a PSSP program) react to a user that attempts to use DCE and Kerberos V4 credentials created and owned by another user - access is denied. In this example, the non-root user, dero, set his KRB5CCNAME and KRBTKFILE credential cache environment variables to point to credential cache files owned by root:system.

The programs that generate (create) DCE and Kerberos V4 credential files ensure that only the AIX users for whom the credentials are created have read/write permissions to these files. (Of course, root can read any file.) The files created are set to the user's AIX user and group names, and the permission bits are set to 600 (-rw-------). Users should *not* alter the file permissions or user/group ownership of their credential files. Doing so may allow another user to read, use, and, possibly, modify the credentials.

In the following examples, the Sysctl client and server are in a dce:compat environment. The client requests are successful because the client can be authenticated to the server, even when the client only has valid credentials for one of the security methods. Also, note that there are no authentication errors returned when the client only has one type of valid credentials (either DCE or Kerberos V4). When a Sysctl server can authenticate a client under at least one of the enabled PSSP security methods, it does not return error messages for failures in authenticating the client against the other method. This is shown by the results of the Sysctl command, `whoami -v`. (`whoami` is not ACL protected and can be issued by any authenticated request.)

User's DCE credentials have been destroyed (via kdestroy), but the Kerberos V4 credentials are valid.

```
sp3en0/ # lsauthts
DCE
Compatibility
sp3en0/ # klist
No DCE identity available: No currently established network identity for this
context exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_bd587100)
sp3en0/ # k4list | grep pal:
Principal:      root.admin@ITSO.IBM.COM
sp3en0/ # sysctl whoami -v
DCE:
K4:  root.admin@ITSO.IBM.COM
AIX: root
```

User's DCE credentials are valid, but the Kerberos V4 credentials are destroyed (via k4destroy).

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/dero4
sp3en0/ # k4list
Ticket file:    /tmp/dero-cache
k4list: 2504-076 Kerberos ticket file was not found
sp3en0/ # sysctl whoami -v
DCE: /.../sp_cell/dero4
K4:
AIX: root
```

Sysctl client requests will fail when the client and the server do not share at least one PSSP authentication method in common. (For example, if the client is running in a dce only mode, the server must be running in a mode that includes dce, as in dce (only) or dce:compat.)

In a multi-partition environment, where each partition is running a different security mode, it is expected that the client and server will not communicate unless they share a PSSP authentication method in common. (This is equivalent to humans speaking a common language in order to communicate verbally.)

In a single partition environment, where all hosts should be running the same security mode, should the PSSP authentication methods between a client and server (nodes or the control workstation) become disjoint such that they do not share a method in common, communication will not be successful.

In the next example, the control workstation is at dce:compat, while the nodes on which the Sysctl client request is to run are at compat, dce:compat, and dce. As such, the Sysctl client request from the dce:compat control workstation to the nodes is successful in all cases because the client shares at least one method in common with each node.

```
sp3en0/ # lsauthts ; klist | grep lob ; k4list | grep pal:
DCE
Compatibility
        Global Principal: /.../sp_cell/hosts/sp3en0/self
Principal:      root.admin@ITSO.IBM.COM
sp3en0/ # sysctl -h sp3n01 -h sp3n04 -h sp3n03 whoami -v
>> sp3n04
DCE:
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
>> sp3n01
DCE: /.../sp_cell/hosts/sp3en0/self
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
>> sp3n03
DCE: /.../sp_cell/hosts/sp3en0/self
K4:
AIX: root
<<
```

In this next example, a compat node sends a Sysctl request to a node in dce and a node in compat. As such, the Sysctl client request from a compat node to a compat node is successful, while the request from a compat to a dce node is denied.

```
sp3n04/ # lsauthts ; k4list | grep pal:
Compatibility
Principal:      root.admin@ITSO.IBM.COM
sp3n04/ # sysctl -h sp3n01 -h sp3n03 whoami -v
>> sp3n03
sysctl:  2501-122 svcconnect: Insufficient Authorization.
<<
>> sp3n01
DCE:
K4:  root.admin@ITSO.IBM.COM
AIX: root
<<
```

In the third example, a dce node sends a sysctl request to a node in dce and a node in compat. As such, the Sysctl client request from the dce node to a dce node is successful, while the request from the dce node to the compat node is denied.

```
sp3n03/ # lsauthts ; klist | grep lob
DCE
       Global Principal: /.../sp_cell/hosts/sp3n03/self
sp3n03/ # sysctl -h sp3n04 -h sp3n01 whoami -v
>> sp3n01
DCE: /.../sp_cell/hosts/sp3n03/self
K4:
AIX: root
<<
>> sp3n04
sysctl:  2501-122 svcconnect: Insufficient Authorization.
<<
```

Authorization failure examples

In all authorization examples, the user has been authenticated by the server; otherwise, the authorization process would not have taken place, and all Sysctl command examples imply that the command is ACL protected, that is, it has a callback of ACL.

When Sysctl requests fail due to authorization, the user's DCE principal or Kerberos V4 principal does not appear in a required ACL. The first step in Sysctl authorization failure problem determination is to determine whether or not the user has access to a Sysctl object, where a Sysctl object is a Sysctl command, variable, or class.

There are two Sysctl commands that are important to SP administrators and other users:

1. `checkauth` - This command executes the authorization callback of an object and determines whether or not a user is authorized to access or run a Sysctl command, variable, or class.
2. `getauth` - This command displays the authorization callback of an object, that is, what type of authorization is required to access a Sysctl command, variable, or class.

When `checkauth` is issued against a Sysctl object that is ACL protected, the user's authorization is checked against both DCE and Kerberos V4 ACLs, provided that both the dce and compat methods are enabled; otherwise, only DCE or Kerberos V4 ACLs are checked.

If the user is authorized by way of, at least, one of the enabled ACL types, an *Authorization OK* message is returned; otherwise, an *Authorization denied* message is returned. In the event that an ACL object exists in one mode but not in the other, in a dce:compat environment, the results of `checkauth` are based on the ACL object that was found.

Checking access requirements to the Sysctl command, pdf. Authorization granted:

```
sp3en0/ #
getauth -cmd pdf
Object Name: pdf
Object Type: command
Object Callback = {AUTH}
sp3en0/ # sysctl pdf | head -n 3
Filesystem          Size-KB    Used-KB    Free-KB %Free   iUsed    iFree  %iFree
--------------------------------------------------------------------------------
/                    32768       8604      24164   74%     1263    15121    93%
```

Checking access requirements to the Sysctl environment variable, SCDEPRIN. Authorization granted:

```
sp3en0/ # sysctl checkauth -var SCDCEPRIN
SCDCEPRIN: Authorization OK.
sp3en0/ # sysctl getauth -var SCDCEPRIN
Object Name: SCDCEPRIN
Object Type: variable
Object Callback = {NONE}
sp3en0/ # sysctl echo '$SCDCEPRIN'
/.../sp_cell/hosts/sp3en0/self
```

Checking access requirements for the Sysctl command, whoami. Authorization granted:

```
sp3en0/ # sysctl checkauth -cmd whoami
whoami: Authorization OK.
sp3en0/ # sysctl getauth -cmd whoami
Object Name: whoami
Object Type: command
Object Callback = {NONE}
sp3en0/ # sysctl whoami
/.../sp_cell/hosts/sp3en0/self
```

Checking access requirements for the Sysctl command include (used in Sysctl server configurations). Authorization denied:

```
sp3en0/ # sysctl checkauth -cmd include
sysctl:  2501-131 checkauth: Authorization denied for object include.
sp3en0/ # sysctl getauth -cmd include
Object Name: include
Object Type: command
Object Callback = {SYSTEM}
sp3en0/ # sysctl include /tmp/dero/testprog.cmd
sysctl:  2501-122 include: Insufficient Authorization.
```

Even the checkauth and getauth commands can be checked using themselves because every Sysctl resource has an associated authorization callback.

```
sp3en0/ # sysctl getauth -cmd getauth
Object Name: getauth
Object Type: command
Object Callback = {NONE}
sp3en0/ # sysctl checkauth -cmd getauth
getauth: Authorization OK.
```

```
sp3en0/ # sysctl getauth -cmd checkauth
Object Name: checkauth
Object Type: command
Object Callback = {NONE}
sp3en0/ # sysctl checkauth -cmd checkauth
checkauth: Authorization OK.
```

A benefit of using the `getauth` command is that, when an object's callback is ACL, the name of the ACL is also returned. For getauth results containing only the string "{ACL}," the default Sysctl ACL, /etc/sysctl.acl, is the name of the ACL object associated with the Sysctl function.

Checking access requirements for the TCL commands puts and exec. Authorization denied.

```
sp3en0/ # sysctl checkauth -cmd exec
sysctl:  2501-131 checkauth: Authorization denied for object exec.
sp3en0/ # sysctl getauth -cmd exec
Object Name: exec
Object Type: command
Object Callback = {ACL}
sp3en0/ # sysctl getauth -cmd puts
Object Name: puts
Object Type: command
Object Callback = {ACL}
sp3en0/ # sysctl puts [exec env] | grep cell
sysctl:  2501-122 exec: Insufficient Authorization.
```

Checking access requirements for puts and exec after the administrator added the user's DCE principal to the needed ACL. Authorization granted.

```
sp3en0/ # sysctl puts [exec env] | grep cell
SCDCEPRIN=/.../sp_cell/sp_admin
SCCELL=/.../sp_cell
SCLCELL=/.../sp_cell
SCLDCEPRIN=/.../sp_cell/ssp/sp3en0/sysctl
```

Checking access requirements for the PSSP Problem Management command pmanSDRadd. It doesn't matter that the command is used incorrectly because authorization to the command itself is denied.

```
sp3en0/ # sysctl checkauth -cmd pmanSDRadd
sysctl:  2501-131 checkauth: Authorization denied for object pmanSDRadd.
sp3en0/ # sysctl getauth -cmd pmanSDRadd
Object Name: pmanSDRadd
Object Type: command
Object Callback = {ACL /etc/sysctl.pman.acl}
sp3en0/ # sysctl pmanSDRadd junk
sysctl:  2501-122 pmanSDRadd: Insufficient Authorization.
```

Checking access requirements for the custom Sysctl procedure test-proc1:

```
sp3en0/ # sysctl checkauth -cmd test-proc1
sysctl:  2501-131 checkauth: Authorization denied for object test-proc1.
sp3en0/ # sysctl getauth -cmd test-proc1
Object Name: test-proc1
Object Type: command
Object Callback = {ACL /test-proc1.acl}
sp3en0/ # sysctl test-proc1 logmsg
sysctl:  2501-122 test-proc1: Insufficient Authorization.
```

Checking access requirements for svclog. Authorization denied.

```
sp3en0/ # sysctl checkauth -cmd svclog
sysctl:  2501-131 checkauth: Authorization denied for object svclog.
sp3en0/ # sysctl getauth -cmd svclog
Object Name: svclog
Object Type: command
Object Callback = {ACL}
sp3en0/ # sysctl svclog {This is a test.}
sysctl:  2501-122 test-proc1: Insufficient Authorization.
```

Checking access requirements for svclog after the administrator added the user's DCE principal to the needed ACL. Authorization granted.

```
sp3en0/ # sysctl svclog {This is a test.}
sp3en0/ # tail -n 2 /var/adm/SPlogs/sysctl/sysctld.log
Jan  7 19:15:39  root [/.../sp_cell/dero2] [] on sp3en0
Jan  7 19:15:39  This is a test.
```

For a single Sysctl client request directed to Sysctl servers on different hosts, Sysctl command authorization is controlled by the ACLs associated with the command on each host. Thus, the ACLs for Sysctl commands can vary from host to host, depending on the requirements of the site.

In this simple example, a Sysctl `whoami` command is directed to two hosts, where the authorization callback of `whoami` on the first host is NONE and ACL on the second host. (The command's authorization callback was changed by the SP administrator.) The client's principal identity is not in the whoami ACL on the second host.

```
sp3en0/ # sysctl -h sp3n05 -h sp3n06 whoami -v
>> sp3n06
DCE: /.../sp_cell/hosts/sp3en0/self
K4:
AIX: root
<<
>> sp3n05
sysctl:  2501-122 whoami: Insufficient Authorization.
<<
```

Taking this idea one step further, in a dce:compat mode, where the user’s DCE identity is not authorized by a Sysctl DCE ACL, but the user’s Kerberos V4 identity is authorized by the associated Kerberos V4 version ACL, the Sysctl command runs without a DCE authorization failure. Like its authentication process, Sysctl’s authorization process will not report an authorization failure if the client can be successfully authorized by at least one of the enabled security methods.

In the next example, the user has DCE and Kerberos V4 identities but is only permitted to execute the `svclog` command according to the Kerberos V4 ACL. When the Kerberos V4 ACL is updated and no longer includes the user's Kerberos V4 identity, the user is no longer authorized to run the `svclog` command.

```
sp3en0/ # sysctl whoami -v
DCE: /.../sp_cell/sp_admin
K4:  dero@ITSO.IBM.COM
AIX: root
sp3en0/ # sysctl getauth -cmd svclog
...
Object Callback = {ACL}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{user sp_admin --t}
...
sp3en0/ # sysctl acllist -f /etc/sysctl.acl
_principal root.admin@ITSO.IBM.COM
_principal dero@ITSO.IBM.COM
sp3en0/ # sysctl svclog {...MESSAGE LOGGED...}
sp3en0/ # tail -n 1 /var/adm/SPlogs/sysctl/sysctld.log
Jan 16 11:58:18  ...MESSAGE LOGGED...
```

dero@ITSO.IBM.COM is removed from /etc/sysctl.acl:

```
sp3en0/ # sysctl svclog {...NEXT MESSAGE LOGGED...}
sysctl:  2501-122 svclog: Insufficient Authorization.
sp3en0/ # sysctl checkauth -cmd svclog
sysctl:  2501-131 checkauth: Authorization denied for object svclog.
```

Querying and managing Sysctl ACLs

Determining which users require access to Sysctl ACL protected resources is critical to ensuring the security and integrity of the SP nodes and the control workstation. A well-defined policy that outlines which Sysctl resources are available to the user population is the first level of control. The second is a documented procedure that users follow to request access to Sysctl resources. Once it is determined that a user's DCE and/or Kerberos V4 principal will be added to, removed from, or changed within a Sysctl ACL, an SP administrator must then take the necessary steps to manage Kerberos V4 and/or DCE ACLs. Managing Sysctl ACLs is achieved through the use of PSSP, DCE, and basic UNIX commands.

Sysctl Kerberos V4 ACL

The names of the PSSP shipped (default) Kerberos V4 ACLs are:

- /etc/sysctl.acl
- /etc/sysctl.mmcmd.acl
- /etc/sysctl.vsd.acl
- /etc/logmgt.acl
- /etc/sysctl.rootcmds.acl
- /etc/sysctl.pman.acl
- /etc/sysctl.haem.acl
- /etc/sysctl.install.acl

Note

The last two ACLs will only appear when the Restricted Root Access (RRA) function of PSSP is enabled.

Refer to the RRA section of this book for information on enabling and using the RRA function.

There are six Sysctl commands to manage its Kerberos V4 ACLs, one Sysctl command to check a user's authorization based on entries in a Kerberos V4 ACL (denoted with "*"), and one Sysctl command to display the names of all ACLs used by the server (denoted with "**").

- acladd - Inserts news entries into an existing ACL file
- *aclcheck - Determines whether a user is authorized by the entries in an ACL
- aclcreate - Creates a new ACL file and, optionally, allows principals to be added to it
- acldelete - Removes entries from an ACL file. It does not delete the ACL file iteself
- acldestroy - Deletes an ACL file from the local host
- acllist - Verifies that the ACL file exists and, if so, displays all its entries
- aclrecreate - Deletes an ACL file from the local host, then re-creates it, and optionally allows principals to be added to it
- **whatacls - Displays the names of all ACLs used by a Sysctl server on a host. It does not display the entries in the ACLs

The `aclcheck` and `whatacls` commands are the only ones in the list that work with both Kerberos V4 and DCE ACLs. All of the other commands are only valid for use with Kerberos V4 ACLs. The `aclcheck`, `acllist`, and `whatacls` commands are the only ones in the list that have an authorization callback of NONE. All other commands have an authorization callback of ACL and require a principal entry in /etc/sysctl.acl to be executed by a user.

The documentation for these commands exists in softcopy only. To access command syntax and associated examples, use the Sysctl `help` command. Example: # sysctl help acladd. The results of the command can be piped to "more" or redirected to a file.

Except for acllist, caution and care must be exercised when using the acl* commands. The acl* commands will work over a specific ACL file when they are invoked with -f {filename}. In the absence of an explicit -f file name, /etc/sysctl.acl is assumed as the default. /etc/sysctl.acl is the ACL used for all Sysctl commands where no explicit ACL file name has been specified. This includes the commands, `svcrestart`, `svclog`, `exec`, and `system`. It also gives users the authority to delete or modify ACLs and ACL entries for any other Kerberos V4 ACL. Only those users that require this level of authority should be placed in /etc/sysctl.acl. (Chapter 2 of the *PSSP: Command and Technical Reference*, SA22-7351, contains a section, called sysctl.acl, which identifies the required file format and valid entry types for all Sysctl Kerberos V4 ACLs.)

Since Kerberos V4 ACL files are stored in plain text (ASCII) format, the files can also be edited using a text editor, such as vi. However, managing the entries using a text editor requires root authority because the files are owned by root:system and have permissions of 644 (-rw-r--r--), except for etc/sysctl.pman.acl, which has permissions of 600 (-rw-------). Users other than root should not have AIX write authority to these files. Whether or not general users should have read authority to these files should be evaluated carefully for security reasons.

From one perspective, general read access to the ACL files does not compromise system integrity. They do not contain password data, user profile information, or access protocols. From another perspective, the files do contain "sensitive" data in that they list the exact principals that do/do not have authorization to Sysctl resources. A hacker can use this information to scan for credential files that match specific principals, steal those credentials, and then continue other attacks through Sysctl (depending on the stolen principal's membership in the ACLs).

While this might sound like an unrealistic scenario, keep in mind that some security compromises are clandestine stealth attacks. “Closing” otherwise "open" data, such as the Kerberos V4 ACL information, only helps to reduce risk points within the system. This is not unlike the reason for displaying the message, *You entered an invalid login name or password*, at an AIX login when an incorrect password has been entered. If the message stated that the password was incorrect, it implies that the user ID is correct. This is valuable information! Now, a hacker has only to find the right password to go with the account in order to access the system. (And there are plenty of password generating/dictionary attack programs available on the Internet to do just that.) The bottom line is this: If there is no legitimate reason to make data read accessible by general users, restrict it. In the end, any data that can be gathered about a system can, eventually, be used to build attack profiles, for social engineering, and to map out possible weaknesses.

A list of Kerberos V4 ACLs known to a Sysctl daemon can be displayed with the `whatacls` command. The list displayed is built when Sysctl's configuration files are processed during server initialization. However, the server does not actually scan the file system at start time to determine if the files actually exist. The only time the server attempts to access an ACL file is when a command with an authorization callback of ACL is processed. If the ACL file does not exist, authorization is denied; otherwise, authorization is granted/denied based on the client's identity in the ACL file.

The ACL file /etc/no-acl-file.acl doesn't exist in the file system, but whatacls lists it as a known ACL. The client's request to the no-acl-file command is denied because the authorization file doesn't exist:

```
sp3en0/ # tail -n 3 /etc/sysctl.conf
create proc no-acl-file {} {ACL /etc/no-acl-file.acl} {
puts "This message is only displayed when the file /etc/no-acl-file.acl exists
and a valid principal is in it."
}
sp3en0/ # ls -l /etc/no-acl-file.acl
ls: 0653-341 The file /etc/no-acl-file.acl does not exist.
sp3en0/ # sysctl whatacls
etc/sysctl.acl
etc/no-acl-file.acl
...
etc/sysctl.pman.acl
sp3en0/ # sysctl checkauth -cmd no-acl-file
sysctl:  2501-131 checkauth: Authorization denied for object no-acl-file.
sp3en0/ #  sysctl no-acl-file
sysctl:  2501-122 no-acl-file: Insufficient Authorization.
```

The /etc/no-acl-file.acl was created, and the client's Kerberos V4 principal was added to it. The Sysctl server did not need to be restarted in order to “know” about the ACL since it already had a reference to the ACL file.

```
sp3en0/ # ls -l /etc/no-acl-file.acl
-rw-r--r--   1 root     system       205 Jan 11 19:09 /etc/no-acl-file.acl
sp3en0/ # k4list | grep pal:
Principal:      root.admin@ITSO.IBM.COM
sp3en0/ # sysctl checkauth -cmd no-acl-file
no-acl-file: Authorization OK.
sp3en0/ # sysctl no-acl-file
This message is only displayed when the file /etc/no-acl-file.acl exists and a
valid principal is in it.
```

As far as synchronizing, or managing, the contents of Kerberos V4 ACL files is concerned, if the contents of the various ACL files are identical throughout the system or identical with respect to some collection(s) of nodes, the PSSP remote parallel copy command, `pcp`, can be used to move the files from a source host to the target hosts. The `pcp` command can copy on partition, node group, and system-wide boundaries. It also has the flexibility to copy an entire directory in one invocation. (`pcp` could even be automated through a shell script launched by cron.)

A similar approach to pushing the ACL files from a source location to various destinations is to use PSSP's File Collections facility. The Kerberos V4 ACLs can be pushed from the control workstation to nodes in different collections at specific intervals. In essence, a "master set" of Kerberos V4 ACLs are used to periodically refresh the files on the nodes.

Still another approach is for the SP administrator to issue Sysctl Kerberos V4 ACL management commands to multiple hosts. (You cannot connect to multiple servers in Sysctl's interactive mode.) Note, however, that, except for the `aclcheck` and `acllist` commands, `acl*` commands that add, delete, or modify ACLs require that the SP administrator have authority to run the commands on the remote hosts. The administrator's Kerberos V4 principal identity must appear in /etc/sysctl.acl on the remote hosts; otherwise, the server will deny the request.

In the following example, the /etc/sysctl.acl file is checked on two hosts for a principal entry of dero. A 0 (zero) return code means that no match was found.

```
sp3en0/ # sysctl -h sp3n04 -h sp3n05 aclcheck -f /etc/sysctl.test.acl dero
>> sp3n04
0
<<
>> sp3n05
0
<<
```

The SP administrator adds the principal dero to the two ACL files:

```
sp3en0/ # sysctl -h sp3n04 -h sp3n05 acladd -f /etc/sysctl.test.acl -p dero
>> sp3n04
_principal dero@ITSO.IBM.COM
<<
>> sp3n05
_principal dero@ITSO.IBM.COM
```

Then, the SP administrator checks the ACLs again for the principal entry, dero, and receives a return code of 1, which means a principal match was found:

```
sp3en0/ # sysctl -h sp3n04 -h sp3n05 aclcheck -f /etc/sysctl.test.acl dero
>> sp3n04
1
<<
>> sp3n05
1
```

The SP administrator pushes the control workstation's /etc/sysctl.custom-cmds.acl file to all the nodes in the system via pcp. The date/time stamp of the file is preserved in the copy.

```
sp3en0/ # pcp "-avG" -p /etc/sysctl.custom-cmds.acl /etc/sysctl.custom-cmds.acl
```

Sysctl DCE ACLs

The names of the PSSP shipped (default) DCE ACLs are:

- etc/sysctl.acl
- etc/sysctl.mmcmd.acl
- etc/sysctl.vsd.acl
- etc/logmgt.acl
- etc/sysctl.rootcmds.acl
- etc/sysctl.pman.acl
- etc/sysctl.haem.acl
- etc/sysctl.install.acl

Note

The last two ACLs will only appear when the Restricted Root Access (RRA) function of PSSP is enabled.

Refer to the RRA section of this book for information on enabling and using the RRA function.

There are two commands to manage Sysctl DCE ACLs (PSSP supplied and DCE supplied), one Sysctl command to check a user's authorization, based on entries in a DCE ACL (denoted with "*"), and one Sysctl command to display the names of all ACLs used by the server (denoted with "**").

- `spacl` (SP ACL Management) - This is the PSSP command to display and alter PSSP DCE ACL object entries (for Hardmon and Sysctl) by authorized users. The command only works with PSSP DCE ACLs and does not create/delete ACL objects.
- `acl` - This is the DCE `dcecp` command that, in conjunction with its qualifiers (check, show, modify, and others), allows authorized DCE principals to display and alter Sysctl ACL object entries.
- `* aclcheck` - This is the Sysctl command that determines whether a user is authorized by the entries in an ACL.
- `** whatacls` - This command displays the names of all ACLs used by a Sysctl server on a host. It does not list the entries within the ACLs.

Sysctl DCE ACLs are not stored in individual files, such as the Sysctl Kerberos V4 ACL files. The DCE ACL objects are part of a DCE ACL database that the Sysctl server manages. The database exists on a per-host basis and is actually made up of three files, db_acl, db_name, and db_object, and stored under /var/sysctl/. (These files are stored in a binary format and cannot be edited directly.) All Sysctl and dcecp client requests that view or modify the contents of an ACL object are actually performed through a Sysctl daemon's DCE ACL manager. The Sysctl daemon's DCE ACL manager is transparent to all client requests, including `dcecp acl` commands, but is ultimately responsible for reading/writing the Sysctl DCE database files.

Unlike Kerberos V4 ACL files, which can be copied from host-to-host for synchronization reasons, copying the DCE database files from one host to another will cause a Sysctl server to hang (on the host to which the database files were copied). This, in turn, will hang Sysctl client requests that connect to the hung server. Data that is specific to an instance of the Sysctl daemon running on a node (or control workstation) is stored in the db_* files.

Moreover, unlike Kerberos V4 ACL files, the SP administrator does not directly create a Sysctl DCE ACL object. Instead, at initialization time, the Sysctl daemon creates DCE ACL objects in its database files, based on the Sysctl include and proc statements found in its configuration file, /etc/sysctl.conf. Of the procedures detected by the Sysctl daemon at initialization, those that have ACL authorization callbacks will have corresponding DCE ACL objects created in its local DCE ACL database. To define a new ACL object for a custom procedure, the SP administrator need only ensure that a unique ACL name appears in the proc definition of a custom procedure. To associate a new command with an existing ACL object, the administrator need only include the name of an existing ACL object in the command's proc definition.

For example, when the following proc definition is placed in the /etc/sysctl.conf file and the daemon is restarted, a new Sysctl command, `TclTime`, and a new DCE ACL object, tcltime.acl, will exist.

```
create proc TclTime {} {ACL /tcltime.acl} {
puts [fmtclock [getclock] %X]
}
```

Issuing the Sysctl whatacls commands reveals the new DCE ACL object:

```
sp3en0/ # sysctl whatacls
etc/sysctl.acl
tcltime.acl
etc/sysctl.mmcmd.acl
etc/sysctl.vsd.acl
etc/logmgt.acl
etc/sysctl.rootcmds.acl
etc/sysctl.pman.acl
```

When the following proc definition is placed in the /etc/sysctl.conf file and the daemon is restarted, a new Sysctl command, syscd-DCE-identity, would exist, and its ACL would be associated with default ACL, etc/sysctl.acl. (This small procedure actually lists the DCE credentials of the Sysctl server at the time the command is executed. Such a command might prove to be useful when debugging custom Sysctl procedures, or debugging Sysctl DCE problems in general.)

```
create proc syscd-DCE-identity {} ACL {
global SCLDCEPRIN
global SCLCELL
global SCLHOST

puts "Sysctld DCE Identity Information for host \[$SCLHOST\]: Executed on [exec date]"
puts "Principal identity  = \[$SCLDCEPRIN\]"
puts "Cell identity       = \[$SCLCELL\]"
puts "Credentials data    ="
puts [exec /bin/klist]
}
```

Up to this point, Sysctl DCE ACL objects have been referenced in an ambiguous way, as just some "objects" that live in a special DCE database that is owned and accessed by a Sysctl daemon. In order to effectively use either the PSSP `spacl` command or the DCE `dcecp acl` command, some explanation of what a Sysctl DCE ACL object “looks like” is in order.

Whether `spacl` or `dcecp` commands are used to access Sysctl DCE ACL objects, the objects are, ultimately, referenced as fully-qualified DCE Cell Directory Service (CDS) names consisting of the cell name (or the string /.: to denote the local cell), the CDS directory path for the DCE RPC entry for the Sysctl server, and the object name itself. For Sysctl, the CDS path to the Sysctl server on a DCE host, named DCEhostname, is “/.:/subsys/ssp/DCEhostname/sysctl”.

The object name, appended to the CDS path, is taken from the ACL name found in a command’s proc definition statement. A good way to find the object name is to use the Sysctl `getauth` command because it returns, as part of its output, the ACL name associated with a command (when the command is ACL protected). The Sysctl `whatacls` command displays only the object names of all Sysctl DCE objects known to the local daemon.

For example, a fully-qualified CDS name for the default Sysctl ACL object might be: “/.:/subsys/ssp/DCEhostname/sysctl/etc/sysctl.acl”.

The default Sysctl DCE object names, listed earlier, are associated with Sysctl procedures and commands as part of the daemon's initialization process. In a previous example, a new ACL object, tcltime.acl, was created at the time the daemon initialized and appeared in the ACL name in TclTime's proc definition.

Consider, for a moment, what is required and how to use the `dcecp acl` and `spacl` commands. The common mistake, when managing Sysctl ACLs through dcecp, is to use only the DCE object name instead of the fully-qualified CDS name; use etc/sysctl.acl instead of /.:/subsys/ssp/DCEhostname/sysctl/etc/sysctl.acl. When managing Sysctl DCE ACLs via dcecp, using anything other than a fully-qualified name will result in an error.

Actually, this is only "mostly" true. A user with DCE cell administrator authority can actually manipulate the ACL of /.:/subsys/ssp/DCEhostname/sysctl through the `dcecp acl` command, provided the modifier, `-entry`, is specified. (`spacl` does not permit this type of access, however.) A Sysctl server stores its network location information in a server entry in the CDS. (Network location information is also referred to as RPC end-points in DCE terms.) The server entry in the CDS has the same name as the server itself and an associated CDS ACL. The `acl` command's `-entry` option is used to operate on the server entry ACL in the CDS, rather than the Sysctl server's ACL objects. In general, the SP administrator should never need to manipulate Sysctl's ACL entry in the CDS.

To be able to manage each of the Sysctl DCE ACL objects, the administrator's DCE principal must be a member of the PSSP DCE group, spsec-admin. To facilitate this effort, it is recommended that a unique DCE principal be created for PSSP DCE administrative purposes. Make this principal a member of the spsec-admin group. This group is created by the PSSP DCE security installation and configuration routines, and spsec-admin is automatically added as a member to the default Sysctl DCE ACLs.

The Sysctl DCE ACL manipulation examples in this section were done by a DCE principal, sp_admin. sp_admin, which was added to the spsec-admin group.

The sp_admin attempts to display DCE ACL entries using dcecp before the principal is a member of the spsec-admin group.

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/sp_admin
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
Error: msgID=0x17122025  permission not valid for this acl
sp3en0/ # dcecp -c account show sp_admin | grep groups
{group none}
```

The sp_admin attempts to display DCE ACL entries using spacl before the principal is a member of the spsec-admin group. (-n instructs spacl to work over the local instance of the specified ACL object. In this case, it's for the control workstation.)

```
sp3en0/ # spacl -a show -s ssp/sysctl -o etc/sysctl.acl -n
spacl:  No show action was performed on any instance.
```

As the DCE cell administrator, add the DCE principal to the spsec-admin group.

```
sp3en0/ # dcecp -c group add spsec-admin -member sp_admin

sp3en0/ # dcecp -c group list spsec-admin | grep sp_admin
/.../sp_cell/sp_admin

sp3en0/ # dcecp -c account show sp_admin | grep groups
{group none spsec-admin}
```

After sp_admin issues a new dce_login to reflect membership in the spsec_admin group, access to Sysctl DCE ACLs is authorized.

```
sp3en0/ # kdestroy
sp3en0/ # exit
sp3en0/ # dce_login sp_admin
...
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{group spsec-admin -c-}
{group sysctl-master a-t}
...
sp3en0/ # spacl -a show -s ssp/sysctl -o etc/sysctl.acl -n
sp3en0
{group spsec-admin -c-}
{group sysctl-master a-t}
```

sp_admin, along with any other DCE principal, has authorization to view Sysctl's CDS ACL entry but does not have authority to alter the ACL. (If this type of authority is required by the SP administrator, the DCE cell administrator needs to add the appropriate entry in the CDS ACL.)

```
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl -entry
{unauthenticated r--t-}
{user cell_admin rwdtc}
{user ssp/sp3en0/sysctl rwdtc}
{group subsys/dce/cds-admin rwdtc}
{group subsys/dce/cds-server rwdtc}
{any_other r--t-}

sp3en0/ # dcecp -c acl modify -entry /.:/subsys/ssp/sp3en0/sysctl -add {user dero rt}
Error: msgID=0x17122033  operation on acl not authorized
```

One way to manage the entries of Sysctl DCE ACL objects throughout an entire system is through the use of the `spacl` command. (As noted previously, to use `spacl`, the issuer must have valid DCE credentials and a DCE principal that is authorized to access Sysctl DCE ACLs.)

Displaying the entries of etc/sysctl.acl on all nodes in the system where PSSP services are configured for DCE security, including the control workstation.

```
sp3en0/ # spacl -a show -s ssp/sysctl -o etc/sysctl.acl -G
sp3n02
{user hosts/sp3en0/self act}
{user hosts/sp3n05/self act}
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n05
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n06
{group spsec-admin -c-}
{group sysctl-master a-t}
{group spsec-admin -c-}
sp3n09
{group sysctl-master a-t}
sp3en0
{group spsec-admin -c-}
{group sysctl-master a-t}=
```

Adding the DCE principal to all etc/sysctl.acl objects in the system, with "at" permissions:

```
sp3en0/ # spacl -a add -s ssp/sysctl -o etc/sysctl.acl -e user:dero -p at -G
sp3en0/ # spacl -a show -s ssp/sysctl -o etc/sysctl.acl -G
sp3n02
{user dero a-t}
{user hosts/sp3en0/self act}
{user hosts/sp3n05/self act}
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n05
{user dero a-t}
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n06
{user dero a-t}
{group spsec-admin -c-}
{group sysctl-master a-t}
{group spsec-admin -c-}
sp3n09
{user dero a-t}
{group sysctl-master a-t}
sp3en0
{user dero a-t}
{group spsec-admin -c-}
{group sysctl-master a-t}
```

Attempting to add a non-existent principal to an ACL. Unless spacl is issued with its -v (verbose mode) flag, the dcecp version of the command provides more information on the nature of the failure. (Note that -v does increase the number of messages received for each host over which spacl operates. This is in contrast to the single message response of dcecp.)

```
sp3en0/ # dcecp -c prin show derp
Error: msgID=0x1712207A  Registry object not found
sp3en0/ # spacl -a add -s ssp/sysctl -o etc/sysctl.acl -e user:derp -p at -n
spacl:  No add action was performed on any instance.
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -add {user derp rt}
Error: msgID=0x1131F383  ACL entry key is not valid.
sp3en0/ # spacl -a add -s ssp/sysctl -o etc/sysctl.acl -e user:derp -p at -n -v
spacl  -a add -s ssp/sysctl -o etc/sysctl.acl -e user:derp -p at -n -v
spacl:  0016-558 DCE ACL entry of type:key user:derp on DCE host sp3en0 not found.
spacl:  No add action was performed on any instance.
```

Displaying what the permissions mean for etc/sysctl.acl.

```
sp3en0/ # spacl -a permissions -s ssp/sysctl -o etc/sysctl.acl -n
{a {access: permission to access Sysctl resources}}
{c {control: permission to modify this acl}}
{t {test: permission to check access rights}}
```

The preceding examples touch on the notion of ACL permissions. Each DCE ACL object contains zero or more authorization entries. In DCE terms, each entry is comprised of two or three primary parts: privilege attribute (or entry type); the optional specific principal or group to whom the entry applies; the set of permissions associated with a privilege attribute (commonly referred to as permission bits). In different terms, an entry contains who/what has access to a resource and precisely how much authority the who/what has over a resource, not to mention over the ACL object itself.

The list of valid entry types (privilege attributes) and their permission bits that can appear in an ACL are defined by the designers and developers of an application. Sysctl supports fifteen (15) entry types and three (3) permission bits.

The permission bits are represented by a single character when a permission is granted, and by a "-" (dash) when it is not. Only entries that relate to SP administrator principals should have control ("c") authority. This level of authority grants a principal the ability to modify or delete existing entries, and to add new entries, to an ACL. c authority should be viewed as administrative control over the ACL object itself. Access authority ("a") grants access to the resources protected by the ACL. Test authority ("t") allows a principal to run DCE's acl check command against an ACL. (acl check returns to the principal entering the command the permissions granted by the ACL.)

In the example below, the principal dero has access to Sysctl resources protected by etc/sysctl.acl, but cannot alter the entries of etc/sysctl.acl. The principal, hosts/sp3en0/self, can alter the entries of the ACL but doesn't have access to Sysctl resources protected by etc/sysctl.acl. (Of course, with "c" authority the principal can change its own permission bits to include "a.") Principals that are members of the sysctl-users group (a group created by the book’s team) only have authority to check their access rights, while members of the spsec-admin group have administrative authority over the ACL object itself. Members of the sysctl-master group have the same access authority as the principal dero.

```
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{user dero a-t}
{user hosts/sp3en0/self -ct}
{group sysctl-users --t}
{group spsec-admin -c-}
{group sysctl-master a-t}
```

As the principal dero.

```
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user
tester1 a-t}

sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl | grep tester1
{user tester1 a-t}
```

As the principal, hosts/sp3en0/self

```
sp3en0/ # sysctl puts {Hello world.}
sysctl:  2501-122 puts: Insufficient Authorization.
sp3en0/ # sysctl checkauth -cmd puts
sysctl:  2501-131 checkauth: Authorization denied for object puts.
sp3en0/ # sysctl getauth -cmd puts
Object Name: puts
Object Type: command
Object Callback = {ACL}
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user hosts/sp3en0/self act}

sp3en0/ # sysctl puts {Hello world.}
Hello world.
```

Modifying an entry's permission bits with all dashes ("---") is the same as modifying the entry without explicitly specifying any permission bits. In the absence of an explicit dash or permission bit character, an implied "disallow" (deny) state is assumed, and a dash is added to the missing permission value, as shown in the following screen:

```
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{unauthenticated --t}
{user dero a-t}
{user hosts/sp3en0/self -ct}
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user dero ---}

sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change
{unauthenticated }

sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user hosts/sp3en0/self c}

sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{unauthenticated ---}
{user dero ---}
{user hosts/sp3en0/self -c-}
{group spsec-admin -c-}
{group sysctl-master a-t}
```

An attempt to add a permission other than the Sysctl defined set will result in an error, and the ACL entry will not be modified.

```
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user
hosts/sp3en0/self xct}
Error: msgID=0x1131F381  ACL entry is not valid.

sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change {user
hosts/sp3en0/self D}
Error: msgID=0x1131F381  ACL entry is not valid.
```

Sysctl DCE ACL objects support the following entry types (privilege attributes) and, if they appear in ACL, will be checked in the precedence order shown.

1. mask_obj
2. unauthenticated
3. user
4. group
5. other_obj
6. any_other
7. user_delegate
8. group_delegate
9. other_obj_delegate
10. any_other_delegate

The following entry types are also supported in the ACLs, but can only be added when at least two DCE cells have been configured for DCE intercell communication. The environment for this book did not include intercell configurations, so the entries are not shown in any preference order, or in relationship to the previous ordered list. They are included here for reference purposes only.

- foreign_user
- foreign_group
- foreign_other
- foreign_user_delegate
- foreign_group_delegate

The following ACL entry types are not valid for Sysctl DCE ACLs, and cannot be added under any conditions.

- user_obj

- group_obj
- user_obj_delegate
- group_obj_delegate

When an attempt is made to add entries for any unsupported entry types, or for foreign_* types when intercell communication has not be configured, error messages are returned, and the ACL is not altered. Likewise, when an attempt is made to add a DCE principal or group that does not exist in, or is not registered with, the current DCE cell, an error message will be displayed, and the ACL entry will not be modified.

```
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -add {user_obj t}
Error: msgID=0x1460101B  user_obj ACL entries not allowed in this ACL

sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -add
{foreign_user /.../itso_cell2/alien_dero t}
Error: msgID=0x1131F383  ACL entry key is not valid.
```

An error results when an invalid entry type is specified (the first field is interpreted as the entry type) or when the entry type appears outside of the curly braces:

```
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -change
{hosts/sp3en0/self -ct}
Error: msgID=0x1131F382  ACL entry type is not valid.

sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl -add user
{hosts/sp3n05/self cat}
Error: msgID=0x1131F008  Argument 'hosts/sp3n05/self cat' is not recognized
```

For most sites, the ACL entry types of user and group are probably sufficient. They provide the most flexibility while maintaining a high degree of control. Plus, it is intuitive to manage ACL contents along the lines of DCE users and groups, given their similarities to AIX user and group management concepts.

Entry types of mask_obj and *_delegate are somewhat esoteric, and are of limited value with respect to protecting Sysctl resources. Likewise, an unauthenticated entry is of little use when the Sysctl server is configured to accept only authenticated client requests. (The default configuration.)

The robustness of the ACL entry types (and their associated permission sets) provides a wide range of possibilities for access controls. But, as the possibilities increase, so does the complexity of effectively managing the access controls.

For more information about DCE ACLs, see the section about the `acl` command in the *IBM DCE for AIX Administrators Commands Reference*, and also consult the *IBM DCE for AIX Applications Development Guide -- Core Components*, Part 5. DCE Security Service, Chapter 26, "Authorization", for overviews and definitions of the DCE authorization protocol, ACL types, ACL entries, ACL permissions, and the DCE algorithms used in precedence checking. (It is recommended that SP administrators read all of the chapters under Part 5 because they examine general security concepts, such as identity, authentication, authorization, credentials, and auditing, as implemented in DCE security services.)

Displaying the out-of-box ACL entries of the default Sysctl ACLs.

```
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.acl
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.mmcmd.acl
{group spsec-admin -c-}
{group sysctl-mmcmd-services a-t}
{group sysctl-mmcmd a-t}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.vsd.acl
{group spsec-admin -c-}
{group sysctl-vsd-services a-t}
{group sysctl-vsd a-t}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/logmgt.acl
{group spsec-admin -c-}
{group sysctl-logmgt-services a-t}
{group sysctl-logmgt a-t}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.rootcmds.acl
{group spsec-admin -c-}
{group sysctl-cwsroot a-t}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/sysctl/etc/sysctl.pman.acl
{group spsec-admin -c-}
{group sysctl-pman a-t}
```

In contrast to dcecp acl commands, the PSSP `spacl` command is an excellent tool for SP administrators who are not familiar with DCE ACL objects and for those who wish to exploit spacl's "send ACL request to PSSP DCE security hosts only", thereby, reducing the need for the administrator to issue individual `dcecp` commands to all required hosts. (The PSSP manuals, *PSSP: Command and Technical Reference*, SA22-7351, and *PSSP: Administration Guide*, SA22-7348, covers spacl syntax, examples, and security information related to the use of the command.)

spacl also permits the administrator to work over SP node groups, lists, or ranges, and/or just the control workstation. (Node groups, lists, and ranges are implemented in the same way that they are supported in `splstdata` and `dsh` commands.

Plus, spacl operations are only focused on PSSP DCE ACL objects. In PSSP V3.2, there are only two PSSP services that implement DCE ACLs: Sysctl (ssp/sysctl) and Hardmon (ssp/hardmon).

Moreover, by default, spacl only displays the results from hosts that responded successfully to the ACL request, while any failed response, from one or more hosts, is displayed as a single "not all actions completed successfully" message. Adding the verbose flag, -v, to any `spacl` command displays all responses from the target hosts including the hosts for which an action was not successful.

```
sp3en0/ # spacl -a check -s ssp/sysctl -o etc/sysctl.acl
sp3n05: a-t
sp3n06: a-t
sp3en0: --t
spacl:  Not all check actions were performed successfully.

sp3en0/ # spacl -a check -s ssp/sysctl -o etc/sysctl.acl -v
spacl  -a check -s ssp/sysctl -o etc/sysctl.acl -v
sp3n05: a-t
sp3n06: a-t
spacl:  0016-557 DCE ACL object instance on DCE host sp3n07 not found.
sp3en0: --t
spacl:  Not all check actions were performed successfully.
```

As an alternative to the `spacl` command, an SP administrator can manage Sysctl DCE ACLs using PSSP's distributed remote shell command, `dsh`, in conjunction with DCE's `dcecp acl` commands. This is particularly useful for administrators who are familiar or comfortable with DCE `dcecp` commands and/or those that are comfortable with dsh. Unlike spacl, dsh can be used in conjunction with the dshbak program to collapse identical output from more than one host so that identical output is displayed only once. ACL query results that are not identical can be quickly identified along with their hosts.

Also, an administrator with root authority can take advantage of dsh's node, partition, or system-wide distribution points, root's access to the special DCE self-host (machine) principal credentials, and DCE's ability to substitute the results of TCL commands within a dcecp invocation, in order to use `dcecp acl` commands in the same manner as issuing PSSP or AIX administrative commands via dsh.

Specifically, the root user automatically has access to the DCE self-host (machine) principal credentials on a host. This is true for every SP node running DCE. So, by virtue of being a root user, root can issue a dsh out to all the nodes in the system and issue sysctl whatacls for each local host. When the `Sysctl` command is executed as root on a node, the Sysctl client uses the self-host principal credentials on that host to authenticate the request to the server. The whatacls results can then be collected into identical groups by piping the results of dsh to dshbak -c. In one pass, an administrator can see if Sysctl DCE ACLs differ on any set of hosts.

ACL objects are different on one host in the system.

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # dsh -avG "sysctl whatacls" | dshbak -c
HOSTS -------------------------------------------------------------------------
sp3n02
-------------------------------------------------------------------------------
etc/sysctl.acl
tcltime.acl
px-acl.acl
etc/sysctl.mmcmd.acl
etc/sysctl.vsd.acl
etc/logmgt.acl
etc/sysctl.rootcmds.acl
etc/sysctl.pman.acl

HOSTS -------------------------------------------------------------------------
spn05 sp3n06 sp3n09
-------------------------------------------------------------------------------
etc/sysctl.acl
etc/sysctl.mmcmd.acl
etc/sysctl.vsd.acl
etc/logmgt.acl
etc/sysctl.rootcmds.acl
etc/sysctl.pman.acl
```

Note

When Restricted Root Access (RRA) is enabled, this techique is only possible from the control workstation.

Another powerful aspect of dsh is its ability to forward the user's DCE credentials to another service. This is of particular interest to the SP administrator when the entries of a Sysctl DCE ACL must be manipulated on multiple hosts. To accomplish this through a single `dsh` command invocation, the administrator uses a DCE `dcecp` command and DCE `dcecp` command substitution.

An example of such an operation is presented and then examined in detail.

```
# dce_login -f sp_admin
...
# dsh -D -avG 'dcecp -c acl show /.:/subsys/ssp/[string trimleft \$_h hosts/]
/sysctl/etc/sysctl.acl' | dshbak -c
HOSTS -------------------------------------------------------------------------
spn05 sp3n06 sp3n09
-------------------------------------------------------------------------------
{group spsec-admin -c-}
{group sysctl-master a-t}

HOSTS -------------------------------------------------------------------------
sp3n02
-------------------------------------------------------------------------------
{user hosts/sp3en0/self act}
{user hosts/sp3n02/self act}
{group spsec-admin -c-}
{group sysctl-master a-t}
```

Note

When Restricted Root Access (RRA) is enabled, this techique is only possible from the control workstation.

As show in the example above, the administrator logs into DCE as sp_admin and requests that the credentials be marked forwardable. (This is for use with dsh.) dsh is then issued to the nodes that are the target of the DCE administrative command. dsh, in turn, issues an rsh to a specific host, which, in turn, runs the `dcecp` command on the target host.

The dcecp acl shown requires a DCE hostname, which is dynamically obtained and substituted through the use of DCE TCL commands. _h is called a DCE *convenience variable* and contains the DCE hostname on which a `dcecp` command is executed. The TCL code shown parses the variable from its hosts/{dce-host-name} format into a {dce-host-name}, which is the portion that is required in the acl `show` command.

Note

Even though the acl show command is used in this example, the same TCL code can be used in an acl modify command, as well as for other DCE acl commands.

The DCE services on the remote host will only permit an `acl` command to be executed by an authorized DCE principal. For DCE to authorize sp_admin, sp_admin's credentials must be forwarded from sp3en0 (the origination of the request) to each node in the system (the target hosts of the request). This is accomplished by specifying -D on the dsh invocation. dsh instructs the underlying `rsh` command to forward the user's credentials to the next command, `dcecp`, which then uses the credentials for authorization to the local DCE daemons. The results of dsh are piped to the program, dshbak -c, and are displayed in groups of identical results. As shown, the ACL entries of etc/sysctl.acl on sp3n02 are different than on the other nodes.

It is important to note that, for this command construction to work, the entire target command must be wrapped in single quotes (not double quotes), and the "$" (dollar sign) character must be preceded (escaped) with a backslash in order for the TCL code to be successful. These things are not problems but have to do with how UNIX shell environments interpret and handle certain characters.

Finally, this example assumes that root's /.k5login contains an entry for sp_admin; otherwise, the dsh attempt will fail due to authorization. Likewise, if sp_admin's DCE credentials were not obtained with a dce_login -f, the dsh -D command would fail because forwardable credentials could not be generated for the request. If sp_admin cannot obtain forwardable credentials at DCE login due to the forwardabletkt attribute of its account set to "no", then a DCE cell administrator needs to modify the sp_admin account and set the value to yes. By default, DCE principal accounts are created with the forwardabletkt attribute set to "yes", unless directed otherwise.

Here is an example of a DCE cell administrator changing the forwardabletkt attribute of an account. Account attributes cannot be modified via dcecp -c. They must be modified via an interactive dcecp> session or through a dcecp -s {script name} invocation.

```
sp3en0/ # dcecp -c account show dero5 | grep forward
{forwardabletkt no}
sp3en0/ # dcecp
dcecp> account modify dero -forwardabletkt yes
dcecp> quit
sp3en0/ # dcecp -c account show dero5 | grep forward
{forwardabletkt yes}
```

While the Tcl "[string trimleft \$_h hosts/]" part of the previous example looks esoteric, it actually ensures that the DCE hostname of the host on which dcecp is being executed is, in fact, the valid DCE hostname. If your site's DCE hostname and node hostname are identical, a simpler substitution can be used: [exec hostname] in place of [string trimleft \$_h hosts/].

```
sp3en0/ # dsh -avG 'hostname ; echo "------------" ; dcecp -c "puts [string
trimleft\$_h hosts/]"' | dshbak
HOST: sp3n02
-------------
sp3n02
------------
sp3n02
...
sp3en0/ # dsh -D -avG 'dcecp -c acl show /.:/subsys/ssp/[exec hostname]
/sysctl/etc/sysctl.acl' | dshbak -c
HOSTS -------------------------------------------------------------------------
spn05 sp3n06 sp3n09
-------------------------------------------------------------------------------
{group spsec-admin -c-}
{group sysctl-master a-t}
...
```

The SP administrator can also use the same substitution approach on single host invocations. The equivalent rsh invocation of the dsh command is also provided.

```
# dsh -D -w sp3n05 'dcecp -c acl show /.:/subsys/ssp/[exec hostname]/sysctl
/etc/sysctl.acl'
{group spsec-admin -c-}
{group sysctl-master a-t}

# rsh sp3n05 -f 'dcecp -c acl show /.:/subsys/ssp/[exec hostname]/sysctl
/etc/sysctl.acl'
{group spsec-admin -c-}
{group sysctl-master a-t}
```

Another way to issue a dcecp acl show for each ACL object known to a Sysctl server is to wrap a few commands in a script, push the script out to the desired hosts, and then run the script remotely (as needed). The prototype script below is a simple implementation of this idea. (A more robust version might include checking the Trusted Services authentication method setting for the string "dce" and checking the states of the Sysctl and DCE daemons.)

```
#!/bin/ksh
# Name: sysctl-acl-show
# Description: Simple prototype to issue dcecp acl show for all known Sysctl ACL objects.
set -A acllst `sysctl whatacls`
for wacl_obj in ${acllst[*]}
do
        echo "--> ACL entries for $wacl_obj ..."
        dcecp -c acl show /.:/subsys/ssp/[string trimleft \$_h hosts/]/sysctl/$wacl_obj
done
```

Combining elements from the previous examples (dsh, credentials forwardability, and authorization requirements) in conjunction with the prototype script yields the following.

```
sp3en0/ # dce_login -f sp_admin
...
sp3en0/ # pcp "-w sp3n05,sp3n06" /tmp/sysctl-acl-show /tmp/sysctl-acl-show
sp3en0/ # dsh -w sp3n05,sp3n06 "ls -l /tmp/sysctl-acl-show"
sp3n05: -rwxr--r--   1 root     system       304 Jan 15 07:50 /tmp/sysctl-acl-show
sp3n06: -rwxr--r--   1 root     system       304 Jan 15 07:50 /tmp/sysctl-acl-show
sp3en0/ # dsh -D -w sp3n05,sp3n06 "/tmp/sysctl-acl-show" | dshbak -c
HOSTS -------------------------------------------------------------------------
sp3n05           sp3n06
-------------------------------------------------------------------------------
--> ACL entries for etc/sysctl.acl ...
{group spsec-admin -c-}
{group sysctl-master a-t}
--> ACL entries for etc/sysctl.mmcmd.acl ...
{group spsec-admin -c-}
{group sysctl-mmcmd-services a-t}
{group sysctl-mmcmd a-t}
--> ACL entries for etc/sysctl.vsd.acl ...
{group spsec-admin -c-}
{group sysctl-vsd-services a-t}
{group sysctl-vsd a-t}
--> ACL entries for etc/logmgt.acl ...
{group spsec-admin -c-}
{group sysctl-logmgt-services a-t}
{group sysctl-logmgt a-t}
--> ACL entries for etc/sysctl.rootcmds.acl ...
{group spsec-admin -c-}
{group sysctl-cwsroot a-t}
--> ACL entries for etc/sysctl.pman.acl ...
{group spsec-admin -c-}
{group sysctl-pman a-t}
```

Sysctl DCE ACL manager

To access Sysctl DCE ACL objects requires an active Sysctl daemon whose DCE ACL manager is also running. By default, the Sysctl server's DCE ACL manager is automatically started when the server is initialized in a dce-enabled security mode (dce or dce:compat). The SP administrator cannot directly start or stop Sysctl's ACL manager.

When the ACL manager does not start properly, the following should be expected:

- An error is written to the Sycstl log (provided the server is started with its -ds flags)
- The Sysctl server cannot access the DCE ACL objects in its DCE ACL database.

- The Sysctl server may hang.

Likewise, the following commands may hang when directed to the Sysctl server whose ACL manager is not running:

- DCE dcecp ACL commands
- PSSP spacl (directed at Sysctl DCE objects)
- Sysctl aclcheck and whatacls

Some ACL manager problems are easily corrected. For example, if the local CDS client is not running at the time Sysctl starts, stop Sysctl, start the needed DCE clients, and then start Sysctl. Likewise, when the CDS master server is not running, when Sysctl starts (Sysctl will not be able to export its RPC bindings to the CDS), stop Sysctl, start the needed DCE servers, and then start Sysctl. Or, should the DCE client cache become corrupt on a host, stop Sysctl, stop the DCE clients, run the DCE clean_up.dce to clean-up the corruption, start the DCE clients, then start Sysctl.

Sysctl ACL Manager not started due to the local DCE clients not running. Sysctl client requests results in a *connection refused* message.

```
sp3n06/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n06
           Component                 Configuration State   Running State
Security client                          Configured         Not Running
RPC                                      Configured         Not Running
Directory client                         Configured         Not Running

The component summary is complete.

sp3n06/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                                   inoperative
sp3n06/ # startsrc -s sysctld -a '-d'
0513-059 The sysctld Subsystem has been started. Subsystem PID is 4508.
sp3n06/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                           4508    active
sp3n06/ # sysctl whoami -v
sysctl:  2501-018 Connection refused
sp3n06/ # cat /var/adm/SPlogs/sysctl/sysctld.log
...
Nov 21 13:20:09  Server starting (pid=4508)
Nov 21 13:20:10  svc_set_up_DCE: spsec_start_acl_mgr failed: 2502-606 DCE error in
rpc_ep_register: Connection request rejected (dce / rpc)
...
```

The corrective action is to stop Sysctl, start the DCE clients, and then start the Sysctl server.

```
sp3n06/ # stopsrc -s sysctld
0513-044 The sysctld Subsystem was requested to stop.
sp3n06/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                                   inoperative
sp3n06/ # start.dce
...
                 Component Summary for Host: sp3n06
           Component                 Configuration State   Running State
Security client                          Configured           Running
RPC                                      Configured           Running
Directory client                         Configured           Running
...
sp3n06/ # startsrc -s sysctld -a '-d'
0513-059 The sysctld Subsystem has been started. Subsystem PID is 25414.
sp3n06/ # sysctl whoami -v
DCE: /.../sp_cell/hosts/sp3n06/self
K4:
AIX: root
```

Sysctl ACL Manager not started due to the master CDS not running. Sysctl client requests result in a *Connection refused* message.

```
sp3n06/ # startsrc -s sysctld -a '-ds'
0513-059 The sysctld Subsystem has been started. Subsystem PID is 7728.
sp3n06/ # sysctl whoami
sysctl:  2501-018 Connection refused
sp3n06/ # vi /var/adm/SPlogs/sysctl/sysctld.log
...
Jan 23 10:33:42  <00000000> Server starting (pid=7728)
Jan 23 10:34:49  <00000000> svc_set_up_DCE: spsec_start_acl_mgr failed: 2502-606 DCE error
in rpc_ns_binding_export: Communications failure (dce / rpc)
...
```

The corrective action is to Stop Sysctl, start the DCE master CDS server, and then start the Sysctl server.

However, should the DCE ACL database files become corrupt, or should some files be deleted, the only corrective action is to stop Sysctl, delete the database files, and start Sysctl again so that it will re-create the database files with the default Sysctl ACL entries. (Refer to an earlier subsection for the default values.)

Unfortunately, this recovery destroys any custom modifications made to any of the ACL entries on that host. For example, if the SP administrator added the principal dero5 to etc/sysctl.acl, once Sysctl re-creates the database files, the dero5 entry no longer exists in etc/sysctl.acl.

Therefore, it is imperative to maintain accurate records that document the ACL entries for each Sysctl DCE ACL object on each host in the unlikely event that a local Sysctl database must be deleted and re-created due to corruption.

Note

Sysctl *does* re-create all ACL objects (even custom ACL objects) that are referenced by its /etc/sysctl.conf file at initialization time. However, as previously stated, it cannot populate the ACLs with any custom entries. Instead, the ACLs will be populated with the same default ACL entries as etc/sysctl.acl.

The following is an example of the steps needed for a Sysctl ACL database that had to be deleted and then re-created.

1. The state of things before the database corruption is this: One custom ACL, show-syscd-dce-info.acl, and two ACLs containing customer-changed entries.

```
sp3n06/ # sysctl whatacls
etc/sysctl.acl
show-syscd-dce-info.acl
etc/sysctl.mmcmd.acl
etc/sysctl.vsd.acl
etc/logmgt.acl
etc/sysctl.rootcmds.acl
etc/sysctl.pman.acl
sp3n06/ # dcecp -c acl show /.:/subsys/ssp/sp3n06/sysctl/etc/sysctl.acl
{user sec2 act}
{user sp_admin a-t}
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n06/ # dcecp -c acl show /.:/subsys/ssp/sp3n06/sysctl/show-syscd-dce-info.acl
{user sec2 act}
{user sp_admin a-t}
{group spsec-admin -c-}
{group sysctl-default a-t}
{group test-grp -c-}
sp3n06/ # sysctl show-syscd-dce-info
Sysctld DCE Identity Information for host [sp3n06] : Executed on Wed Jan 19 17:30:25 EST
2000
Principal identity = [/.../sp_cell/ssp/sp3n06/sysctl]
Cell identity      = [/.../sp_cell]
Credentials data via klist:
...
        Global Principal: /.../sp_cell/ssp/sp3n06/sysctl
...
Server: krbtgt/sp_cell@sp_cell
        valid 2000/01/19:16:15:32 to 2000/01/20:02:15:32
...
```

2. At some point after the corruption takes place, Sysctl client requests fail. Examining the log reveals that Sysctl's ACL manager didn't start during the server's last initialization.

```
sp3n06/ # sysctl whoami
sysctl:  2501-018 Connection refused
sp3n06/ # vi /var/adm/SPlogs/sysctl/sysctld.log
...
Jan 19 11:43:41  <00000000> Server starting (pid=21432)
Jan 19 11:43:41  <00000000> DEBUG: Signal 20 was caught.
Jan 19 11:43:42  <00000000> svc_set_up_DCE: spsec_start_acl_mgr failed: 2502-606 DCE error
in dce_db_open: Database open failure (dce / lib)
...
```

3. The corrective action is to Stop Sysctl, delete the ACL database files, and start Sysctl.

```
sp3n06/ # stopsrc -s sysctld
0513-044 The sysctld Subsystem was requested to stop.
sp3n06/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                                   inoperative
sp3n06/ # ls -l
total 48
-rw-r--r--   1 root     system      8192 Jan 19 17:29 db_acl
-rw-r--r--   1 root     system      8192 Jan 19 16:15 db_name
-rw-r--r--   1 root     system      8192 Jan 19 16:15 db_object
sp3n06/ # rm /var/sysctl/db_*
sp3n06/ # ls -l  /var/sysctl
total 0
sp3n06/ # startsrc -s sysctld -a '-ds'
0513-059 The sysctld Subsystem has been started. Subsystem PID is 23796.
sp3n06/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                           23796   active
sp3n06/ # ls -l /var/sysctl
total 48
-rw-r--r--   1 root     system      8192 Jan 19 17:34 db_acl
-rw-r--r--   1 root     system      8192 Jan 19 17:34 db_name
-rw-r--r--   1 root     system      8192 Jan 19 17:34 db_object
sp3n06/ # sysctl whoami
/.../sp_cell/sp_admin
```

The custom ACL entry definitions for show-syscd-dce-info.acl and etc/sysctl.acl are gone.

```
sp3n06/ # dcecp -c acl show /.:/subsys/ssp/sp3n06/sysctl/etc/sysctl.acl
{group spsec-admin -c-}
{group sysctl-master a-t}
sp3n06/ # dcecp -c acl show /.:/subsys/ssp/sp3n06/sysctl/show-syscd-dce-info.acl
{group spsec-admin -c-}
{group sysctl-default a-t}
```

Synchronizing Sysctl Kerberos V4 and DCE ACLs

There is no PSSP tool that synchronizes entries between Kerberos V4 and DCE ACLs. There are several reasons for this. First, the tool would not know if an entry in a Kerberos V4 ACL should automatically be a member of a DCE ACL. Second, there is no way to guarantee that there is a corresponding DCE principal for every Kerberos V4 principal. Third, given that Sysctl ACLs exist on a per-host basis, it is possible that the ACL entries between the control workstation and nodes, or among and between nodes, are, intentionally, not the same. Finally, given that Sysctl runs on all nodes in an SP system, and the nodes can be divided into multiple partitions, each running with a different security setting, one host may only have DCE ACLs while another host only has Kerberos Version 4 ACLs.

It is up to the SP administrator to ensure that the entry definitions between DCE and Kerberos V4 ACLs of the same name are synchronized. Likewise, the SP administrator must also synchronize DCE and Kerberos V4 ACLs among and between different hosts in the SP. However, as stated earlier, the PSSP `spacl` command is an excellent choice to synchronize all Sysctl DCE ACLs in a system, while the use of File Collections or pcp is an excellent way to refresh all Sysctl Kerberos V4 ACL files on the nodes.

In general, the requirement to change ACLs should be an infrequent one. (Notable exceptions are prototyping and test environments.) Given that ACLs are control points in the system, it is imperative that they remain as stable as possible. Still, the need to alter ACL contents at some point is a reality. One way to ensure that ACL management happens in a timely and controlled manner is to add *triggers* to AIX user account, Kerberos V4 principal, and DCE principal creation/deletion procedures. When a user account/principal is created, Sysctl ACL membership consideration should be part of that process. When a user account/principal is deleted, Sysctl ACL membership removal should be part of that process. This will keep ACL entries from becoming *stale* or invalid.

Hardmon

The system hardware monitor (Hardmon) allows authorized users to control and monitor the status of the SP system's frames, nodes, and switch via the SP supervisor subsystem. In addition to retrieving status information about the processors, the monitor allows authorized users to perform operations, such as controlling the power and the logical key switch position for a node processor.

Hardmon protects its resources, SP hardware (nodes and frames), through DCE group and DCE ACL memberships (in a dce only mode), Kerberos V4 ACL membership (in a compat only mode), or a combination of DCE and Kerberos V4 controls (in a dce:compat security mode).

There is one out-of-box Hardmon Kerberos V4 ACL file provided by PSSP: /spdata/sys1/spmon/hmacls. This is a plain text file.

There are five Hardmon DCE groups configured by PSSP services used to grant/deny access under a dce security mode. The groups can be displayed by issuing the following:

```
dcecp -c group cat | grep hm-
```

There are two out-of-box default Hardmon DCE ACLs provided by PSSP: hardmon and system. (Additional Hardmon DCE ACL objects can be created. Refer to the *PSSP Administration Guide*, SA22-7348, for complete details.)

Displaying Default Hardmon DCE ACLs

```
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/hardmon
{group spsec-admin -c-----}
{group hm-admin a------}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
```

Note

In order to successfully run the DCE `acl show` command against the default Hardmon DCE ACLs, the user's DCE credentials must have, at least, read authority to those ACLs; otherwise, the permission is denied. (The message returned from DCE says *permission not valid for this acl*, which means the DCE principal is not authorized to view the ACL.)

To facilitate this effort, it is recommended that a unique DCE principal be created for PSSP DCE administrative purposes and that it then be made into a member of the PSSP group, spsec-admin, created during PSSP DCE security installation and configuration. spsec-admin is automatically added as a member to the default Hardmon DCE ACLs at configuration time. In the previous example, the DCE principal, sp_admin, was created and added to various PSSP DCE groups, one of which is spsec-admin.

In the first sequence, a root user running in a dce-only security mode attempts to use s1term in write mode but is denied due to lack of DCE group membership in a required PSSP DCE group, hm-control.

After the cell administrator adds the DCE principal to the needed group, the user must destroy and create new DCE credentials in order to reflect the new membership. In the case of a root user holding the DCE self-host principal credentials, that is, the DCE machine principal context/identity, DCE (or just its security client, sec_cl) must be stopped and then started on the host (node or control workstation) in order for the self-host principal's credentials to reflect the new group membership. (User membership in DCE groups is reflected through the user's DCE credentials and is considered part of the user's ticket privilege attributes. The credentials, also called tickets, can only reflect group memberships that were in place at the time the user's credentials were created. Any group associations established after user credentials were generated will not be reflected until new credentials are created. For more information on DCE credentials (tickets) and their privilege attributes, refer to *IBM DCE Version 3.1 for AIX and Solaris: Administration Guide -- Core Components*, Chapter 31. “Creating and Maintaining Accounts”, subsection “Displaying Privilege Attributes and Tickets”.)

Once this takes place, the user can s1term out to a node in write mode. Note that in this example, Hardmon DCE ACLs do not play a role in the authorization of the user. Authorization is based solely on membership in a Hardmon DCE group.

```
sp3en0/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/dero
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # dcecp -c prin show dero | grep groups
{groups spsec-admin sdr-admin}
```

As a cell administrator, add the DCE principal dero to the hm-control group.

```
sp3en0/ # dcecp -c group list hm-control
/.../sp_cell/sp_admin
sp3en0/ # dcecp -c group add hm-control -member dero

sp3en0/ # dcecp -c group list hm-control
/.../sp_cell/sp_admin
/.../sp_cell/dero
```

As the DCE principal dero, the command still fails, even though dero was added to the hm-control group. The user must destroy the current credentials and create new ones.

```
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # kdestroy ; exit
sp3en0/ # dce_login dero
...
DCE LOGIN SUCCESSFUL
...
sp3en0/ # s1term -w 1 5
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
...
```

In the second sequence, a non-root user running in a dce:compat security mode attempts to use s1term (in write mode), but is denied because the user’s DCE principal is not a member of the PSSP DCE P group, hm-control, nor is the user’s Kerberos V4 principal in the hmacls file. After the SP administrator adds the user's Kerberos V4 principal to hmacls and issues the `hmadm setacls` command, the user can then issue s1term successfully. Note that the non-root user’s DCE principal membership has not changed.

```
sp3en0/ # whoami
dero
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero3
Principal:      dero-sec@ITSO.IBM.COM
sp3en0/ # dcecp -c prin show dero3 | grep groups
{groups test-grp}
sp3en0/ # grep dero-sec /spdata/sys1/spmon/hmacls
# echo $?
1
```

root adds the dero-sec principal to the hmacls file (writable by root only), and then issues hmadm setacls to update the Hardmon daemon's internal ACL table.

```
sp3en0/ # grep dero-sec /spdata/sys1/spmon/hmacls
1 dero-sec s
sp3en0/ # ls -l /usr/lpp/ssp/bin/hmadm
-r-xr-xr-x   1 bin      bin        31176 Dec 14 10:54 /usr/lpp/ssp/bin/hmadm
sp3en0/ # hmadm setacls
hmadm: 0026-641I The ADMIN command "setacls" was sent.
sp3en0/ # s1term -w 1 5
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
...
```

In the above example, the principal is added to hmacls with a persmission of `s`, the ability to read and write to a serial port (s1term). (There are other hmacls permissions. Refer to the *PSSP Administration Guide*, SA22-7348, for complete details.) Since hmacls is a file that only root can update, an SP administrator (or other root user) must make the needed changes.

Once hmacls is updated, the `hmadm setacls` command must be invoked so that the Hardmon daemon's internal ACL tables are updated to reflect the new hmacls entry. If this step is omitted, the daemon's tables will not be updated, and the user will not be able to issue s1term. However, to run hmadm with the setacls operand, the issuer of hmadm must have Kerberos V4 administrator credentials. (hmadm can be invoked by any user, but to run it with setacls requires a specific level of authorization - a Kerberos V4 administrative identity. The Kerberos V4 administrator ID is the ID defined as the primary authentication services administrator by the `setup_authent` command during compat installation and configuration. In this case, it was root.admin. Refer to the PSSP installation and administration guides for complete details.)

In this scenario, the administrative duties required both AIX root level authority and Kerberos V4 administrative authority. SP administrators may be one in the same. The same concept applies to SP administrators and DCE controls. Manipulating DCE organization, group, and ACL memberships requires DCE cell administration authority to varying degrees, while doing other SP administrative tasks requires root authority, such as issuing the AIX command startsrc. The SP administrators can be DCE administrators, or they can have their DCE principal grant the needed DCE administrative authority needed for PSSP DCE controls. Or, perhaps, the DCE cell administrator is an individual other than an SP administrator.

Another important aspect of this example is the way in which authorization is granted. Unlike the Hardmon dce-only example, membership in a Kerberos V4 ACL is required instead of membership in a particular PSSP DCE group. This is an important distinction in understanding the general differences between the dce and compat PSSP security modes for Hardmon.

Under a dce mode, DCE group membership and/or DCE ACL membership are the hurdles to overcome before authorization is granted. Under a compat mode, Kerberos V4 principal membership in hmacls, coupled with the permissions associated with the Kerberos V4 principal, are the control factors. And, in a dce:compat mode, should the DCE controls deny access, the compat (Kerberos V4) controls can grant access, provided the user meets the compat requirements, as the preceding example reveals.

Another way to view this contrast is the following: Kerberos V4 has no “group” structure. A Kerberos V4 principal exists within a Kerberos V4 realm. The ability to grant/deny access to these principals is based on whether or not they appear in hmacls, as shown in this last case. DCE, on the other hand, not only has principals, but a principal is a member of an organization and one or more groups. Within a DCE cell, multiple organizations and multiple groups may exist. As such, the ability to grant/deny access is based on one or more combinations of organization, group, and ACL memberships. The first Hardmon example demonstrated DCE group membership requirements. The next example demonstrates authorization based on Hardmon DCE ACL membership.

Principal dero attempts to run an hmcmds command but is denied due to authorization failures. dero is not a member of the DCE ACL, “system”, nor is the principal a member of the PSSP DCE group, hm-monitor. The principal also doesn't have permission to list the entries in the system ACL (via dcecp acl), or to list what hardware access permissions are granted to dero through hmgetacls. (In this example, the default Hardmon hardware DCE ACL, system, is the only ACL in use for all the resources in the system.)

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/dero
sp3en0/ # hmcmds -G flash 1:1
hmcmds: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # dcecp -c prin show dero | grep group
{groups none sdr-admin}
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      -  -  -  -
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
Error: msgID=0x17122025  permission not valid for this acl
```

The SP administrator adds dero to the system ACL, with v and t permissions. v allows dero to issue hmcmds commands, while t allows the principal to display the contents of the system ACL via dcecp and to list his/her ACL permissions with hmgetacls.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/hardmon/system -add {user dero tv}

sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
{user dero --v---t}
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
```

The dero principal can now run the hmcmds, hmgetacls, and dcecp acl commands successfully. (The principal does not have to obtain new DCE credentials to be recognized by Hardmon’s system ACL. This would only be required if the SP administrator added dero to the PSSP DCE group, hm-monitor.)

```
sp3en0/ # hmcmds -G flash 1:1
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
{user dero --v---t}
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      v  -  -  -
```

When the user has neither DCE credentials nor Kerberos V4 credentials, Hardmon cannot authenticate the user and, therefore, cannot authorize the user; so, the request is denied.

```
sp3en0/ # spmon -d
1.  Checking server process
    Process 22200 has accumulated 0 minutes and 7 seconds.
    Check successful

2.  Opening connection to server
spmon: 0026-064 You do not have authorization to access the Hardware Monitor.
```

In a dce:compat security mode, the user needs only one authenticated identity in order to be authorized by Hardmon ACL controls. As long as one identity is authenticated and authorized, no error messages are generated in response to the unauthenticated identity as shown next.

The user does not have a valid DCE identity but has a valid Kerberos V4 identity. The Kerberos V4 identity is authorized with "m" (monitor) permission in hmacls.

```
sp3en0/ # klist | grep lob ; k4list | grep pal:
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_9a965400)
Principal:      dero@ITSO.IBM.COM
sp3en0/ # spmon -d
1.  Checking server process
    Process 22200 has accumulated 0 minutes and 15 seconds.
    Check successful

2.  Opening connection to server
    Connection opened
    Check successful
...
5.  Checking nodes
------------------------------------ Frame 1 ----------------------------------
                      Host     Switch   Key     Env   Front Panel      LCD/LED
Slot Node Type  Power Responds Responds Switch  Error LCD/LED          Flashes
---- ---- ----- ----- -------- -------- ------- ----- ---------------- -------
  1     1  wide  on     yes      yes     N/A     no  LCDs are blank      no
  5     5  wide  on     yes      yes     N/A     no  LCDs are blank      no
...
```

Querying and managing Hardmon ACLs

Determining which users require access to Hardmon ACL protected resources is critical to ensuring the security and integrity of SP nodes and the control workstation. A well-defined policy that outlines which Hardmon resources are available to the user population is the first level of control. The second is a documented procedure that users follow to request access to Hardmon resources. Once it is determined that a user's DCE and/or Kerberos V4 principal will be added to, removed from, or changed within Hardmon ACLs, an SP administrator must then take the needed steps to manage Kerberos V4 and/or DCE ACLs. Managing Hardmon ACLs is achieved through the use of PSSP, DCE, and basic UNIX commands.

All of the concepts presented in the “Querying and Managing Sysctl ACLs” subsection can be applied to Hardmon ACL objects. Limiting read/write access to Hardmon's Kerberos V4 ACL file and its DCE ACL objects is critical. Only SP administrator accounts (AIX, DCE, Kerberos V4) should have access to Hardmon's ACLs. Since Hardmon and Sysctl share the same ACL concepts, the Sysctl material is not repeated here for Hardmon. Refer to the Sysctl subsection for details and examples on why limiting access to ACLs is critical.

The remainder of this subsection focuses on the ACL tools and authorization items particular to Hardmon.

Hardmon ACL permissions

Hardmon's DCE and Kerberos V4 ACLs contain permission bits, which are nearly identical in meaning and presentation between its DCE and Kerberos V4 ACL types. This is in sharp contrast to Sysctl ACLs where permission bits exist only for its DCE ACLs.

Both Hardmon ACL types support the following permissions:

- a - permission to perform administrative functions
- v - permission to control hardware through the VFOP (virtual front panel operator) interface
- s - permission to open a serial connection (s1term)
- m - permission to monitor hardware state data

DCE ACLs support the following additional permissions:

- c - permission to modify ACL entries
- u - permission to update SP supervisor microcode
- t - permission to check access rights of an ACL

A microcode update permission bit is not supported in Kerberos V4 ACLs. However, *v* permission is needed in a Kerberos V4 ACL for microcode updates.

Hardmon Kerberos V4 ACL

The name of the PSSP shipped (default) Kerberos V4 ACL is /spdata/sys1/spmon/hmacls:

The ACL entries in this file reflect access to hardware on a per-frame basis.

There is one PSSP command to check if authorization permission exists in an ACL, one PSSP command to display the permissions associated with an ACL entry (denoted with "*"), and one PSSP command to instruct the Hardmon daemon to refresh its cached authorization tables (denoted with "**").

- `hmckacls`
- `* hmgetacls`
- `** hmadm` - Reads the Hardware Monitor access control list configuration file to update the daemon's internal ACL tables

`hmckacls` and `hmgetacls` are the only commands in the list that work with both Kerberos V4 and DCE ACLs. hmadm is only valid for use with Kerberos V4 ACLs.

hmadm has AIX permissions of 555 (-r-xr-xr-x), meaning any user can execute the command, but in order to send the setacls directive to Hardmon, the invoker must be authorized in hmacls with administrative permission. The hmadm setacls command instructs the Hardmon daemon to update its internal ACL tables by rereading the ACL configuration file, hmacls. When an SP administrator makes changes to hmacls, but doesn't issue hmadm setacls afterward, Hardmon will not be aware of the ACL changes.

The following screen shows a non-root user with valid Kerberos V4 credentials, but lacking proper Hardmon authorization:

```
/u/dero/ # k4list | grep pal:
sp_admin
/u/dero/ # grep sp_admin /spdata/sys1/spmon/hmacls ; echo $?
1
/u/dero/ # hmadm setacls
hmadm: 0026-614 You do not have authorization to access the Hardware
Monitor.
```

After the SP administrator adds sp_admin to hmacls (with the administrative permission "a") and issues hmadm setacls, the non-root user can issue hmadm setacls successfully.

```
/u/dero/ # k4list | grep pal:
sp_admin
/u/dero/ # grep sp_admin /spdata/sys1/spmon/hmacls ; echo $?
sp3en0 sp_admin a
0
/u/dero/ # hmadm setacls
hmadm: 0026-641I The ADMIN command "setacls" was sent.
```

Note

Users other than SP administrators should not have “a” authority to Hardmon because this level of authority grants the principal the ability to administer the Hardmon daemon. The daemon is used to monitor and control the SP hardware. The example merely illustrates that Hardmon Kerberos V4 ACLs control the grant/deny authority for hmadm setacls.

Like hmadm, hmckacls and hmgetacls have AIX permissions of 555 (-r-xr-xr-x), which means that any user can execute the command, but in order to use the commands, the invoker must have an authenticated Kerberos V4 identity and be authorized in hmacls.

Kerberos V4 principal is not in hmacls. Output contains all dashes in output.

```
sp3en0/ # k4list | grep pal:
Principal:      dero@ITSO.IBM.COM
sp3en0/ # grep dero /spdata/sys1/spmon/hmacls ; echo $?
1
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      -  -  -  -
```

The SP administrator adds the principal to hmacls and then issues hmadm setacls. Hardmon then recognizes the Kerberos V4 principal.

```
sp3en0/ # k4list | grep pal:
Principal:      dero@ITSO.IBM.COM
sp3en0/ # grep dero /spdata/sys1/spmon/hmacls
1 dero vs
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      v  s  m  -
```

In a dce:compat mode, where the invoker's DCE identity is not authorized to Hardmon or the DCE identity cannot be authenticated, hmgetacls and hmckacls will be authorized when the user's Kerberos V4 identity is in hmacls.

```
sp3en0/ # klist | grep lob ; k4list | grep pal:
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_9a94e400)
Principal:      dero@ITSO.IBM.COM
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      v  s  m  -
...
sp3en0/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero3
Principal:      dero@ITSO.IBM.COM
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      v  s  m  -
sp3en0/ # k4destroy
Tickets destroyed.
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      -  -  -  -
sp3en0/ # kdestroy
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      -  -  -  -
```

PSSP does not have a tool to add, delete, or modify the contents of hmacls. The SP administrator edits hmacls and makes the appropriate changes. The structure of the hmacls file, including definitions on how entries need to appear and additional information on permission bits, are documented in chapter 2 of the *PSSP: Command and Technical Reference*, SA22-7351.

Hardmon DCE ACLs

The names of the PSSP-shipped (default) DCE ACLs are:

- hardmon
- system

There are four PSSP commands and one DCE command used to manage, display, and check Hardmon DCE ACL objects.

- `acl` - DCE dcecp command that, in conjunction with its qualifiers (check, show, modify, et al.), allows authorized DCE principals to display and alter Hardmon ACL object entries.
- `hmckacls` - PSSP command that checks if an authorization permission exists in an ACL.
- `hmdceobj` - PSSP command that adds, deletes, and lists all hardware monitor DCE objects known to Hardmon.
- `hmgetacls` - PSSP command to display the permissions associated with an ACL entry.
- `spacl` - (SP ACL Management) PSSP command to display and alter PSSP DCE ACL object entries (for Hardmon and Sysctl) by authorized users. The command works only with PSSP DCE ACLs and does not create/delete ACL objects.

Hardmon DCE ACLs are not stored in an individual file, as is the case with its Kerberos V4 ACL file. The DCE ACL objects are part of a DCE ACL database that the Hardmon server manages. The database exists only on the control workstation and is, actually, made up of three files, db_acl, db_name, and db_object, which are stored under /spdata/sys1/spmon/hmdceacls. (These files are stored in a binary format and cannot be edited directly.) All Hardmon and dcecp client requests that view or modify the contents of an ACL object are actually performed through the Hardmon daemon's DCE ACL manager. The Hardmondaemon's DCE ACL manager is transparent to all client requests, including `dcecp acl` commands, but it is, ultimately, responsible for reading/writing the Hardmon DCE database files.

In order to effectively use the PSSP or DCE ACL management commands, some explanation of what a Hardmon DCE ACL object “looks like” is in order.

Whether `hmdceobj`, `hmgetacls`, `hmckacls`, `spacl`, or `dcecp` commands are used to access Hardmon DCE ACL objects, the objects are ultimately referenced as fully-qualified DCE Cell Directory Service (CDS) names consisting of the cell name (or the string /.: to denote the local cell), the CDS directory path for the

DCE RPC entry for the Hardmon server, and the object name itself. For Hardmon, the CDS path to the Hardmon server is always on the control workstation and is represented here as /.:/subsys/ssp/cwsDCEhostname/hardmon.

The object name, appended to the CDS path, is one of the two default Hardmon DCE object names that were listed earlier or taken from custom frame/slot definitions.

For example, a fully-qualified CDS name for a default Hardmon ACL object would be similar to /.:/subsys/ssp/DCEhostname/hardmon/system.

The common mistake when managing Hardmon ACLs through dcecp is to use only the DCE object name instead of the fully-qualified CDS name; system instead of /.:/subsys/ssp/cwsDCEhostname/hardmon/system. When managing Hardmon DCE ACLs via dcecp, using anything other than a fully-qualified name will result in an error.

Actually, this is only “mostly” true. A user with DCE cell administrator authority can actually manipulate the ACL of /.:/subsys/ssp/cwsDCEhostname/system through dcecp acl, provided the modifier *-entry* is specified. (spacl does not permit this type of access, however.) A Hardmon server stores its network location information in a server entry in the CDS. (Network location information is also referred to as RPC end-points in DCE terms.) The server entry in the CDS has the same name as the server itself, and an associated CDS ACL. The acl command’s -entry option is used to operate on the server entry ACL in CDS rather than the server’s ACL objects. In general, the SP administrator should never need to manipulate Hardmon's ACL entry in the CDS.

To be able to manage each of the Hardmon DCE ACL objects, the administrator's DCE principal must be a member of the PSSP DCE group, spsec-admin. To facilitate this effort it is recommended that a unique DCE principal be created for PSSP DCE administrative purposes, and then make this principal a member of the spsec-admin group. This group is created by the PSSP DCE security installation and configuration routines; spsec-admin is automatically added as a member to the default Hardmon DCE ACLs.

The Hardmon DCE ACL manipulation examples in this section were done by a DCE principal called sp_admin. sp_admin was added to the group spsec-admin. It was also added to the Hardmon group hm-control. Unless such a principal exists, the administrator will not be permitted to view or modify Hardmon DCE ACL objects.

Hierarchical DCE objects and ACLs

Hardmon allows authorized users to control and monitor the status of the SP system's frames, nodes, and switch via the SP supervisor subsystem. In addition to retrieving status information about the processors, the monitor allows authorized users to perform operations, such as controlling the power and the logical key switch position for a node processor.

Hardmon protects its resources - SP hardware (nodes and frames) - through DCE group and DCE ACL memberships (in a dce-only mode), Kerberos V4 ACL membership (in a compat only mode), or a combination of DCE and Kerberos V4 controls (in a dce:compat security mode).

The objects defined and controlled by the Hardmon daemon are the:

- system
- frame
- slot (containing hardware, such as a node or switchboard)
- Hardmon (system monitor daemon)

The system object is the initial object and is a container for the frame and slot objects. The monitor allows authorized users to perform monitor and control operations on frame and slot objects. The Hardmon daemon object represents the administration functions of Hardmon.

An ACL may be associated with each monitor object. A Hardmon administrator can grant access to monitor and control the system through the ACLs or through a combination of ACLs and group memberships.

The objects controlled by Hardmon are hierarchical; the system contains frames that contain slots (with nodes and switch processors). Administrators may not wish to manage the (potentially) hundreds or thousands of ACLs that may be required to specify user access for each frame, node, and switch processor in a system. Since the object structure is inherently hierarchical, the ACL associated with an object is the default for lower-level (child) objects if they don't have an overriding ACL. For example, if an ACL is associated with a frame, that same ACL would apply, by default, to all slots contained within that frame. However, if an ACL is associated directly with a slot, that ACL would be used to determine access for the slot.

With this hierarchical structure of objects and ACLs, each installation can determine the level of granularity to be used for specifying access to system monitor objects.

Hardmon DCE ACL management/query command examples

Listing all DCE objects known to hardmon as an authorized and unauthorized user.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
  frame1/slot1
  frame2/slot13
  frame4
  frame4/slot1
...
sp3en0/ # hmdceobj -q
hmdceobj: 0026-614 You do not have authorization to access the Hardware Monitor.
```

As sp_admin, display the permission bits of the system object via the `hmgetacls`, `dcecp`, and `spacl` commands in a system where there are no frame/slot DCE ACL objects defined.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
sp3en0/ # hmgetacls 1:1-1
  frame1/slot1      v  s  m  u
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
sp3en0/ # spacl -a show -s ssp/hardmon -o system -v
spacl  -a show -s ssp/hardmon -o system -v
sp3en0
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
spacl:  All show actions were performed successfully.
```

As sp_admin, display the permission bits of the frameX/slotY object via `hmgetacls`, `dcecp`, and `spacl` commands in a system where frame/slot DCE ACL objects are defined.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
  frame1/slot1
  frame2/slot13
  frame4
  frame4/slot1
sp3en0/ # hmgetacls 2:13
  frame2/slot13     v  s  m  u
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
# spacl -a show -s ssp/hardmon -o frame2/slot13 -v
spacl  -a show -s ssp/hardmon -o frame2/slot13 -v
sp3en0
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
spacl:  All show actions were performed successfully.
```

sp_admin adds user principal dero1 to only the frame2/slot13 ACL.

```
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13 -add
{user dero1 vsmt}

sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13
{user dero1 --vsm-t}
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}



{group hm-monitor-services ----m--}
```

DCE principal dero1 has no administrative authority over the Hardmon daemon, or the frame2/slot13 ACL object, but has s1term, VFOP, and monitor authority to the hardware in frame2/slot13, as well as test permission to the ACL object itself.

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/dero1
sp3en0/ # hmdceobj -q
hmdceobj: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # hmgetacls 2:13
  frame2/slot13     v  s  m  -
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13
{user dero1 --vsm-t}
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
sp3en0/ # hmdceobj -a -g none -p s 2:13
hmdceobj: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # dcecp -c acl modify /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13 -add
{group none s}
Error: msgID=0x17122025  permission not valid for this acl
sp3en0/ # dcecp -c acl perm /.:/subsys/ssp/sp3en0/hardmon/frame2/slot13
{a {access: permission to perform administrative functions}}
{c {control: permission to modify this acl}}
{v {hardmon: permission to control hardware through VFOP interface}}
{s {hardmon: permission to open a serial connection}}
{m {hardmon: permission to monitor hardware state data}}
{u {hardmon: permission to update SP supervisor microcode}}
{t {test: permission to check access rights}}
```

The PSSP command, `hmdceobj`, is an administrative command intended for SP administrators and not as a tool for general users. `hmdceobj -q` requires that the invoker's DCE principal be a member of the PSSP DCE group, hm-admin. This requirement is an `hmdceobj` command restriction. Only SP administrative DCE principals should have membership in the hm-admin group, considering that principals whose membership includes hm-admin have the authorization to add/delete/modify Hardmon DCE ACL objects.

Non-SP administrative DCE principals that require the ability to list the contents of a Hardmon ACL object should be added to the ACL object as an explicitly-named user entry with a permission of “t” only. Such principals are then authorized to issue a `dcecp acl show` command on the ACL contents, but have no authority to manipulate (or manage) the ACL's contents. Whether or not general users should have read authority to these objects should be evaluated carefully.

From one perspective general read access to the ACL objects does not compromise system integrity. They do not contain password data, user profile information, or access protocols. From another perspective, the objects do contain *sensitive* data in that they list the exact principals that do/do not have authorization to Hardmon resources. A hacker can use this information to scan for credential files that match specific principals, steal those credentials, and then attack resources that are accessible through Hardmon (depending on the stolen principal's membership in the ACLs).

While this might sound like an unrealistic scenario, keep in mind that some security compromises are clandestine, stealth attacks. “Closing” otherwise “open” data, like Hardmon ACL information, only helps to reduce risk points. Bottom line: If there's no legitimate reason to make data read accessible by general users, restrict it. In the end any data that can be gathered about a system can eventually be used to build attack profiles, for social engineering, and to map out possible system weaknesses.

Over all, the hmdceobj command is an important command for SP administrators when working in a dce-enabled security mode. (For complete details on the command, refer to the *PSSP: Command and Technical Reference*, SA22-7351.) In fact, it's the only interface available to the SP administrator that is capable of adding or deleting ACL frame, or frame/slot, objects to and from the Hardmon DCE ACL database. This is in sharp contrast to the Sysctl DCE ACL object creation/deletion functions, which are performed indirectly by the administrator.

It must be noted, however, that hmdceobj's ability to add an ACL entry is limited to the DCE group type only. That is, hmdceobj only allows the administrator to add DCE group entries in an ACL. All other valid ACL entry types must be added to an ACL object either through the DCE `dcecp acl` command, or the PSSP `spacl` command. Hardmon DCE ACL objects share the same set of valid ACL entry types as those of Sysctl. (Refer to an earlier subsection on Sysctl for complete details.)

Precisely how DCE Hardmon ACLs should be set-up in an SP system comes down to control versus manageability.

Hardmon DCE ACLs can apply to either a high-level system view (all nodes in all frames), or a granular frame/slot view (a particular node in a particular frame). The level of granularity needed depends on several things, not the least of which is the complexity of managing the ACLs. SP systems with many frames, or several administrators, may find it more logical to define Hardmon ACL objects in terms of frame/slot definitions for maximum access control, or to limit certain administrator principals to various sets of frame/slot definitions. If the system only contains a few frames (or one to two frames), or if there is only a small number of administrators (perhaps even one or two), building and managing Hardmon ACLs from a system-wide, non-granular view may prove to be the best approach.

Either way, the ability to move from system-wide ACLs to granular ACLs, or to collapse granular ACLs into a system-wide view is always possible. The bottom line is to make the ACLs fit the scope of the resources they protect while balancing them against manageability.

Hardmon DCE ACL Manager

To access Hardmon DCE ACL objects requires an active Hardmon daemon whose DCE ACL manager is also running. By default, the Hardmon server's DCE ACL manager is automatically started when the server is initialized in a dce-enabled security mode (dce or dce:compat). The SP administrator cannot directly start or stop Hardmon's ACL manager.

When the ACL manager does not start properly, an error is written to the currently active Hardmon log; the Hardmon server cannot access the DCE ACL objects in its DCE ACL database, and the following commands will generate DCE errors or SP Security Services errors: DCE `dcecp acl` commands, `PSSP spacl` (directed at Hardmon DCE objects), `hmdceobj`, `hmckacls`, and `hmgetacls`.

```
sp3en0/ # hmdceobj -q
0026-412 User cannot be authenticated on sp3en0.
  SP Security Services error code: 0.
  SP Security Services error message: hmdceobj: 0026-614 You do not have authorization to
access the Hardware Monitor.
sp3en0/ # hmgetacls 1:1-3
0026-412 User cannot be authenticated on sp3en0.
  SP Security Services error code: 0.
  SP Security Services error message: hmgetacls: 0026-614 You do not have authorization to
access the Hardware Monitor.
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/system
Error: msgID=0x1712201A  acl object not found
```

Some ACL manager problems are easily corrected. For example, if the local CDS client is not running at the time Hardmon starts, stop Hardmon, start the needed DCE clients, and then start Hardmon. Likewise, when the CDS master server is not running when Hardmon starts (Hardmon will not be able to export its RPC bindings to the CDS), stop Hardmon, start the needed DCE servers, and then start Hardmon. Or, should the DCE client cache become corrupt on the control workstation, stop Hardmon, stop the DCE clients, run the DCE command, `clean_up.dce`, to clean-up the corruption, start the DCE clients, and then start Hardmon. (Refer to the *Sysctl ACL Manager* section for corrective action examples.)

However, should the DCE ACL database files become corrupt, or if some files have been deleted, the only corrective action is to stop Hardmon, delete the database files, and start Hardmon so that it will re-create the database files with the default Hardmon ACL entries. (Refer to an earlier subsection for the default values.)

Unfortunately, this recovery destroys any custom modifications made to any of the ACL entries on that host. For example, if the SP administrator added the principal, dero5, to the hardmon ACL, once Hardmon re-creates the database files, the dero5 entry no longer exists in the hardmon ACL. Further, any frame or frame/slot ACL objects created by an SP administrator will not be re-created. Such objects, if they exist, are created exclusively by SP administrators.

Therefore, it is imperative that accurate records be maintained documenting the ACL entries for each Hardmon DCE ACL object (both default Hardmon DCE ACLs (hardmon and system) and any custom frame/slot ACLs) in the unlikely event that the Hardmon DCE ACL database must be deleted and re-created due to corruption.

The following is an example of a Hardmon ACL database that had to be deleted and then re-created.

Part 1: The state of things before the database corruption: One custom ACL, frame1/slot, and one default ACL, hardmon, containing customer-changed entries.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
  frame1/slot1
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/frame1/slot1
{user dero ----m--}
{group spsec-admin -c-----}
{group hm-control --vsmu-}
{group hm-control-services --vsmu-}
{group hm-monitor ----m--}
{group hm-monitor-services ----m--}
{group none ---sm--}
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/hardmon
{user dero4 ------t}
{user sp_admin ac----t}
{group spsec-admin -c-----}
{group hm-admin a------}
```

Part 2: At some point after the corruption takes place, Hardmon client requests fail. Examining the log reveals that Hardmon's ACL manager experienced a problem during the server's last initialization.

```
sp3en0/ # hmgetacls 1:1-1
0026-412 User cannot be authenticated on sp3en0.
  SP Security Services error code: 0.
  SP Security Services error message: hmgetacls: 0026-614 You do not have authorization to
access the Hardware Monitor.
sp3en0/ # vi /var/adm/SPlogs/spmon/hmlogfile.023
...
hardmon: 0026-801I Hardware Monitor Daemon started at Sun Jan 23 13:08:44 2000
hardmon: 0026-802I Server port number is 8435, poll rate is 5.000000 seconds
...
hardmon: 0026-893 SP Security Services Error. Sun Jan 23 13:10:01 2000
  SP Security Services error code: 1.
  SP Security Services error message: 2502-606 DCE error in dce_db_open: Database open
failure (dce / lib)
  DCE error code: 341839884. Major/Minor: 0/0.
  Failing DCE library subroutine: dce_db_open
  Failing System Call errno: 0.
hardmon: 0026-803I Entered main processing loop
00000038
hardmon: 0026-893 SP Security Services Error. Sun Jan 23 13:10:06 2000
  SP Security Services error code: 1.
  SP Security Services error message: 2502-606 DCE error in rpc_server_register_if:
Type already registered (dce / rpc)
  DCE error code: 382312545. Major/Minor: 0/0.
  Failing DCE library subroutine: rpc_server_register_if
  Failing System Call errno: 0.
...
```

Part 3: The corrective action is to Stop Hardmon, delete the ACL database files, and start Hardmon.

```
 sp3en0/ # stopsrc -s hardmon
 0513-044 The hardmon Subsystem was requested to stop.
 sp3en0/ # lssrc -s hardmon
 Subsystem         Group            PID     Status
  hardmon                                   inoperative
 sp3en0/ # rm /spdata/sys1/spmon/hmdceacls/db_*
 sp3en0/ # ls -l /spdata/sys1/spmon/hmdceacls
 total 0
 sp3en0/ # startsrc -s hardmon
 0513-059 The hardmon Subsystem has been started. Subsystem PID is 25794.
 sp3en0/ # lssrc -s hardmon
 Subsystem         Group            PID     Status
  hardmon                           25794   active
 sp3en0/ # ls -l /spdata/sys1/spmon/hmdceacls
 total 48
 -rw-r--r--   1 root     system      8192 Jan 23 13:35 db_acl
 -rw-r--r--   1 root     system      8192 Jan 23 13:35 db_name
 -rw-r--r--   1 root     system      8192 Jan 23 13:35 db_object
 sp3en0/ # hmgetacls 1:1-1
   frame1/slot1      v  s  m  u
```

The custom ACL, frame1/slot, no longer exists, and the default hardmon ACL no longer contains customer-changed entries.

```
sp3en0/ # hmdceobj -q
  system
  hardmon
sp3en0/ # dcecp -c acl show /.:/subsys/ssp/sp3en0/hardmon/hardmon
{group spsec-admin -c-----}
{group hm-admin a------}
```

Synchronizing Hardmon Kerberos V4 and DCE ACLs

There is no PSSP tool that synchronizes entries between Kerberos V4 and DCE ACLs. There are several reasons for this. First, the tool would not know if an entry in a Kerberos V4 ACL should automatically be a member of a DCE ACL. Second, there is no way to guarantee that for every Kerberos V4 principal, there is a corresponding DCE principal. Third, it is possible to create individual frame ACLs for either Kerberos V4 or DCE ACLs, but the existence of frame ACL controls in a dce security mode does not automatically imply their existence in a compat mode. Further, individual slot ACLs exist only in DCE ACL objects.

It is up to the SP administrator to ensure that the entry definitions between DCE and Kerberos V4 ACLs of the same name are synchronized, but given that Hardmon ACLs only reside on the control workstation, managing and maintaining synchronization between the two types of ACLs can be part of a well-defined process or procedural task.

In general, the requirement to change ACLs should be an infrequent one. (Two notable exceptions are prototyping and test environments.) Given that ACLs are control points in the system, it is imperative that they remain as stable as possible. Still, the need to alter ACL contents at some point is a reality. One way to ensure that ACL management happens in a timely and controlled manner is to add triggers to AIX user account, Kerberos V4 principal, and DCE principal creation/deletion procedures. When a user account/principal is created, Hardmon ACL membership consideration should be part of that process. When a user account/principal is deleted, Hardmon ACL membership removal should be part of that process. This will keep ACL entries from becoming “stale” or invalid.

8.2.3 Other events

"Other" events include anomalous events, such as a hung daemon, low paging space, a file system that reaches its storage capacity, or a severe time skew between hosts.

8.2.3.1 All PSSP services appear to be hung

When all PSSP services appear to be hung in a dce-enabled security mode, the DCE Security servers and/or DCE CDS servers may be down or not reachable.

A quick test to help determine if at least one Security server is reachable is to issue a dce_login on the host where all PSSP services appear hung. DCE Security servers that are down or unreachable will cause the dce_login to fail or may take up to eight minutes to actually log in. The longer it takes to receive a failed or successful login response, the more likely that some type of problem exists with respect to the DCE Security servers or to the local DCE configuration.

A quick test to help determine if at least one CDS server is reachable is to issue the `dcecp -c cdsli -world -C low` command on the host where all PSSP services appear hung. This command recursively lists all the directories in the CDS master server - provided the server can be reached.

Refer to Section 8.8, "DCE client/server problem determination" on page 390 for more information.

8.2.3.2 One PSSP daemon appears to be hung

In instances when a PSSP server hangs and there is no clear indication from server or system logs what caused the hang, the event should be logged, along with any relevant environmental data, and the logs should be saved. If the problem becomes persistent or begins to appear with greater frequency, a cause/effect profile may be established from the incident reports. Such events are rare, and a simple stop/start of the server usually corrects the anomalous situation.

Prior to "recycling" a server/service uses the AIX commands, `lssrc -s` or `lssrc -ls`, to obtain status on the server. Using -l requests that a subsystem send its current status in long form. Long status requires that a status request be sent to the subsystem; it is the responsibility of the subsystem to return the status. Some PSSP services, such as Hardmon, SDR, and Sysctl, do not support `-l` but do respond to `-s`.

Problem management lssrc -ls

```
sp3en0/ # lssrc -ls pman.sp3en0
...
Subsystem         Group            PID     Status
 pman.sp3en0      pman             41808   active

 Subsystem started at Thu Jan 13 12:22:04 EST 2000.
 Subsystem tracing is off.
 =========================================================
 Subscriptions not yet acknowledged by Event Management
 =========================================================
 =========================================================
 Subscriptions for which actions are currently being taken
 =========================================================
 =========================================================
 Subscriptions currently ready to be acted upon
 =========================================================
 ----------------- nodeSerialLinkOpen -----------------
 Currently ACTIVE
 DCE Principal: /.../sp_cell/sp_admin
 Kerberos V4 Principal: root.admin@ITSO.IBM.COM
 Client user root at sp3en0
 Resource Variable: IBM.PSSP.SP_HW.Node.serialLinkOpen
 Resource Identifier: NodeNum=9
 Expression: X==1
 Event response command: wall tty open on node $PMAN_IVECTOR
 Run command as user root.
 Command has run 0 times.
 Event SNMP Trap ID: 111111
 Event error log and syslog text: tty open on a node
 Rearm expression: X!=1
 Rearm event response command: wall tty close on node $PMAN_IVECT
 OR
 Run command as user root.
 Command has run 0 times.
 Rearm event SNMP Trap ID: 222222
 Rearm event error log and syslog text: tty close on a node
...
```

Host responds lssrc -ls

Note that the PSSP command, `hr query`, will return the same results.

```
# lssrc -ls hr.sp3en0
Subsystem         Group            PID     Status
 hr.sp3en0        hr               9492    active
   Number of known nodes = 18
   Number of up nodes    = 17
   Number of clients     = 0
   Operating mode        = heartbeat
   bind to IP address    = 192.168.3.130
   Security mode         = dce:compat
```

```
# lssrc -ls hats.c166s
Subsystem         Group            PID     Status
 hats.sp3en0      hats             50320   active
...
HB Interval = 1 secs. Sensitivity = 4 missed beats
  2 locally connected Clients with PIDs:
haemd( 42582) hagsd( 39740)
...
  Control Workstation IP address = 192.168.3.130
  Daemon employs no security
...
```

Several PSSP daemons that don't support `-l` but respond to `lssrc -s`

```
sp3en0/ # lssrc -ls hardmon
0513-005 The Subsystem, hardmon, only supports signal communication.
sp3en0/ # lssrc -s hardmon
Subsystem         Group            PID     Status
 hardmon                           17142   active
sp3en0/ # lssrc -ls sdr.sp3en0
0513-005 The Subsystem, sdr.sp3en0, only supports signal communication.
sp3en0/ # lssrc -s sdr.sp3en0
Subsystem         Group            PID     Status
 sdr.sp3en0       sdr              32648   active
sp3en0/ # lssrc -ls sysctld
0513-005 The Subsystem, sysctld, only supports signal communication.
sp3en0/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                           25882   active
```

Status information on all daemons under inted control

This can be obtained with one `lssrc -ls` command. Several resources under inetd control are critical to overall network communications.

```
sp3en0/ # lssrc -ls inetd
Subsystem         Group            PID     Status
 inetd            tcpip            6038    active

Debug         Not active

Signal        Purpose
 SIGALRM      Establishes socket connections for failed services.
 SIGHUP       Rereads the configuration database and reconfigures services.

 SIGCHLD      Restarts the service in case the service ends abnormally.

Service       Command                  Description              Status
 tftp         /usr/sbin/tftpd          tftpd -n                 active
 bootps       /usr/sbin/bootpd         bootpd /etc/bootptab     active
 spseccfg     /usr/lpp/ssp/bin/spseccfg spseccfg                 active
 cmsd         /usr/dt/bin/rpc.cmsd     cmsd 100068 2-5          active
 dtspc        /usr/dt/bin/dtspcd       /usr/dt/bin/dtspcd       active
 ttdbserver   /usr/dt/bin/rpc.ttdbserver rpc.ttdbserver 100083 1  active
 daytime      internal                                          active
 chargen      internal                                          active
 discard      internal                                          active
 echo         internal                                          active
 time         internal                                          active
 daytime      internal                                          active
 discard      internal                                          active
 echo         internal                                          active
 pcnfsd       /usr/sbin/rpc.pcnfsd     pcnfsd 150001 1-2        active
 sprayd       /usr/lib/netsvc/spray/rpc.sprayd sprayd 100012 1         active
 rwalld       /usr/lib/netsvc/rwall/rpc.rwalld rwalld 100008 1         active
 rusersd      /usr/lib/netsvc/rusers/rpc.rusersd rusersd 100002 1-2      active
 ntalk        /usr/sbin/talkd          talkd                    active
 exec         /usr/sbin/rexecd         rexecd                   active
 klogin       /usr/sbin/krlogind       krlogind                 active
 login        /usr/sbin/rlogind        rlogind                  active
 kshell       /usr/sbin/krshd          krshd                    active
 shell        /usr/sbin/rshd           rshd                     active
 ftp          /usr/sbin/ftpd           ftpd                     active
```

8.2.3.3 Low paging space

The amount of paging space required depends on the type of activities performed on the system. If paging space runs low, processes may be lost, and if paging space runs out, the system may panic. When a paging-space low condition is detected, follow local corrective action procedures.

For more information on paging space, refer to *AIX V4.3 System Management Concepts: Operating System and Devices*, SC23-4311, Chapter 8, “Paging Space and Virtual Memory”. For performance implications related to paging space, see the section on performance considerations of paging spaces in the *AIX Performance Tuning Guide*.

8.2.3.4 Cannot obtain DCE and/or Kerberos V4 credentials

When the /var or /var/dce directories become full, that is, when they run out of free file space to write new files or update existing files, attempts to log in to DCE will fail.

The error messages associated with this type of problem vary between the types of DCE login functions (PSSP-supplied or DCE commands), and whether the file system is “close to full” or full.

The AIX command, `df`, reveals 100 percent of /var is used, but 160 i-nodes are still free. Having some i-nodes remaining allows the creation of partial context credentials, though they are of no value.

```
sp3n06/ # df /var
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd9var       131072       160  100%     2471    16% /var
sp3n06/ # dsrvtgt ssp/sysctl
dsrvtgt: spsec_login_as_service: 2502-607 GSSAPI error in gssdce_login_context_to_cred:
The routine failed.
internal error in sec_login
sp3n06/ # dce_login sp_admin
Enter Password:
DCE LOGIN SUCCESSFUL
Warning: No password expiration or change processing can occur.
Cannot communicate with Registry Server: Registry server unavailable (dce / sec)
sp3n06/ # klist
No DCE identity available: No currently established network identity for this context
exists
(dce / sec)

Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_3f367300
Default principal: sp_admin@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/01/22:16:13:22 to 2000/01/23:02:13:22
Server: dce-rgy@sp_cell
        valid 2000/01/22:16:13:23 to 2000/01/23:02:13:22
Server: dce-ptgt@sp_cell
        valid 2000/01/22:16:13:23 to 2000/01/22:18:13:23
sp3n06/ # ls -l /opt/dcelocal/var/security/creds/dcecred_3f367300*
-rw-------   2 root     system      1317 Jan 22 16:13
/opt/dcelocal/var/security/creds/dcecred_3f367300
-rw-------   1 root     system       567 Jan 22 16:13
/opt/dcelocal/var/security/creds/dcecred_3f367300.data
-rw-------   1 root     system         0 Jan 22 16:13
/opt/dcelocal/var/security/creds/dcecred_3f367300.data.db
-rw-------   1 root     system         0 Jan 22 16:13
/opt/dcelocal/var/security/creds/dcecred_3f367300.nc
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
FILE:/opt/dcelocal/var/security/creds/dcecred_2f68c900
```

In the previous examples, notice that dce_login_noexec didn't generate any errors. However, since repeated dce_login_noexec commands consume free space in /var, it's just a matter of time before dce_login_noexec generates an error. Notice, too, that as additional dce_login_noexec commands are executed, the number of free i-nodes decreases.

```
sp3n06/ # df /var
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd9var       131072       160  100%     2476    16% /var
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
FILE:/opt/dcelocal/var/security/creds/dcecred_2f68c905
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
FILE:/opt/dcelocal/var/security/creds/dcecred_2f6aca00
sp3n06/ # df /var
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd9var       131072       144  100%     2491    16% /var
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
FILE:/opt/dcelocal/var/security/creds/dcecred_2f68c911
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
FILE:/opt/dcelocal/var/security/creds/dcecred_2f6aca09
sp3n06/ # dce_login_noexec sp_admin xxxxxxx
Unable to set context: internal error in sec_login (dce / sec)
sp3n06/ # df /var
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd9var       131072       136  100%     2499    16% /var
```

Eventually, all free space under /var that can be allocated will be consumed, and the error messages for all types of DCE login attempts will take the same form as shown here:

```
sp3n06/ # dce_login dero
Enter Password:
2000-01-22-16:19:45.767-05:00I----- dce_login ERROR sec login sec_login_pvt.c 7708
0x00000001 msgID=0x17122F61
open failed ; errno text : There is not enough space in the file system.
Unable to set context: Credentials cache I/O operation failed XXX (dce / krb)

sp3n06/ # dsrvtgt ssp/sysctl
2000-01-22-16:19:52.368-05:00I----- PID#12176 ERROR sec login sec_login_pvt.c 7708
0x00000001 msgID=0x17122F61
open failed ; errno text : There is not enough space in the file system.
dsrvtgt: spsec_login_as_service: 2502-606 DCE error in sec_login_set_context:
Credentials cache I/O operation failed XXX (dce / krb)

sp3n06/ # dce_login_noexec sp_admin xxxxxxx
2000-01-22-16:20:04.926-05:00I----- dce_login ERROR sec login sec_login_pvt.c 7708
0x00000001 msgID=0x17122F61
open failed ; errno text : There is not enough space in the file system.
Unable to set context: Credentials cache I/O operation failed XXX (dce / krb)
```

/var (or /var/dce) becoming full has implications beyond the inability of users and PSSP services to log in to DCE. One implication is that the CDS client on the host crashes. Also, stopping DCE servers when /var is full prevents DCE from writing any critical data to disk as part of its shutdown process.

```
sp3n06/ # stop.dce
Gathering current configuration information...
Stop of DCE Host, sp3n06, will now begin.
The Directory client is not running.
Stopping the Security client...
The Security client was stopped successfully.
Stopping RPC...
RPC was stopped successfully.
0x1131504a: A failure occurred during the copy of
/opt/dcelocal/var/dced/Hostdata.db to
/opt/dcelocal/var/dced/backup/Hostdata.stp.
0x11315a8e: A failure occurred while backing up the DCED database files.
Gathering component state information...

                 Component Summary for Host: sp3n06
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured         Not Running
Directory client                        Configured         Not Running

The component summary is complete.
Stop of DCE Host, sp3n06, was successful.
Stop completed successfully.
```

To correct the situation, either add more space to the file system, stop the DCE daemons on the host, and restart them. Or, stop the DCE daemons on the host, delete all DCE credentials files, run clean_up.dce, start DCE daemons, and stop/start all PSSP services on the host because their credentials have been destroyed, yet they still have environmental variable references to those files.

Note that using the DCE command, `rmxcred`, to delete credentials as an alternative to deleting the files is not likely to relieve the space problem. `rmxcred` only deletes expired credentials.

Unable to obtain Kerberos V4 credentials

By default, the Kerberos V4 credentials cache location is located under /tmp. (Users can redefine this location by specifying a different file path in their KRBTKFILE environment variable prior to logging in to Kerberos V4.) When /tmp becomes full (runs out of free file space to write new files or update existing files) attempts to log in to Kerberos V4 will fail.

The error messages relating to this type of problem do not vary between the types of Kerberos V4 login functions, nor do they vary depending on whether the file system is “close to full” or full.

```
sp3n09/ # df /tmp
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd3          131072         0  100%       96     1% /tmp
sp3n09/ # k4init root.admin
Kerberos V4 Initialization for "root.admin"
Password:
k4init: 2504-075 Can't write Kerberos V4 ticket file
sp3n09/ # /usr/lpp/ssp/rcmd/bin/rcmdtgt
rcmdtgt:  2502-052 Error getting service ticket for rcmd.sp3n09@ITSO.IBM.COM
2504-075 Can't write Kerberos V4 ticket file.
sp3n09/ # ksrvtgt rcmd sp3n09 /etc/krb-srvtab
ksrvtgt: 2504-075 Can't write Kerberos V4 ticket file
```

To correct the situation, add more space to the file system and/or delete all Kerberos V4 credentials files under /tmp (if this is the file system that is full). If all Kerberos V4 credentials files are deleted on the control workstation, the Hardmon daemon must be stopped and then started.

8.2.3.5 Time skew too great

Time is critical to normal security operations, not to mention other PSSP operations. Both DCE and Kerberos V4 have a low tolerance for time skews--five minutes to be exact. DCE and Kerberos V4 rely on credentials (tickets) and a certain time frame in which they are valid. If a DCE-enabled or Kerberos V4-enabled host has a time stamp difference of greater than five minutes between itself and its time server(s), credential creation on the host will not be possible, nor will other DCE and Kerberos V4 functions. Likewise, external requests attempting to remotely log in via AIX remote commands will be rejected. RSCT's Topology Services component may begin to see packets arriving out of chronological order and may cause RSCT to falsely detect that one of its peer nodes has failed. Other partition-related PSSP services will also be impacted.

The common configuration of an SP system provides all the nodes with the same time zone setting. But what about a more complex configuration with nodes running in different time zones; how do you synchronize them? It's not important how many time zones you run on your nodes because the time stamp is the same for all of them. What is important is the time setting. If the time set on the node differs from the time of its time server by more than five minutes, DCE and Kerberos V4 get into trouble decoding the authorization data because the time stamp is part of it.

DCE/k5 responses

The following screens show the various commands:

```
sp3n06/ # dce_login sp_admin
Enter Password:
Error - Clock skew too great (dce / krb)
sp3n06/ # dsrvtgt ssp/sysctl
dsrvtgt: spsec_login_as_service: 2502-606 DCE error in sec_login_valid_from_keytable:
Clock skew too great (dce / krb)
sp3n06/ # sysctl whoami -v
2000-01-22-20:53:54.869-05:00I----- PID#5080 ERROR gss authentication gssapi.c 4267
0x00000001 msgID=0x12862113
Can't get server ticket in gss_init_sec_ctx (14129025)
2502-603 You do not have DCE credentials.
Clock skew too great
sysctl:  2501-122 svcconnect: Insufficient Authorization.
sp3n06/ # dcecp -c acl show /.:/subsys/ssp/sp3n06/sysctl/etc/sysctl.acl
Warning: Not able to acquire initial login context.Error: msgID=0x14129025  Clock skew too
great
```

```
sp3n06/ # dcecp -c cell show
Warning: Not able to acquire initial login context.Error: msgID=0x14129025  Clock skew too
great
sp3n06/ # dcecp -c cdsli -world -C low
(get_objs):  Error enumerating directories under /.:
Clock skew too great (dce / krb)
(get_links):  Error enumerating objects under /.:
Clock skew too great (dce / krb)
(get_dirs):  Error enumerating directories under /.:
Clock skew too great (dce / krb)
Warning: Not able to acquire initial login context.Error: child process exited abnormally
```

In the /var/dce/svc/error.log, various types of messages relating to the time skew problem exist.

```
2000-01-22-21:00:18.041-05:00I----- cdsclerk(14152) ERROR cds general clerk_bind.c 638
0x00000451 msgID=0x10D0AB70 Routine rpc_binding_set_auth_info(3rpc) failed : s
tatus = 336760869.
2000-01-22-21:00:18.085-05:00I----- cdsclerk(14152) ERROR cds general clerk_bind.c 638
0x00000451 msgID=0x10D0AB70 Routine rpc_binding_set_auth_info(3rpc) failed : s
tatus = 336760869.
2000-01-22-21:01:35.186-05:00I----- dced ERROR dhd secval sv_clientd.c 1500 0x00001c1e
msgID=0x113DB2BF Call to a sec_key_mgmt_xxx function failed, status=0x14129025
```

Attempting to rsh via k5 to a host with a time skew problem and from a host with a time skew problem.

```
sp3en0/ # rsh sp3n06 date
kerberos: Couldn't authenticate to the server: Server rejected authentication (during
sendauth exchange).
kerberos: Server returned error code 37 (Clock skew too great).
kerberos: Error text sent from the server Clock skew too great.
rshd: 0826-813 Permission is denied.
```

```
sp3n06/ # rsh sp3en0 date
kerberos: Couldn't get credentials for the server: Clock skew too great.
rshd: 0826-813 Permission is denied.
```

Starting an already-configured DCE client or attempting to run the local configuration portion of a DCE client when the time skew is too great results in the following:

```
sp3n14/ # cat /opt/dcelocal/etc/cfgdce.log
...
Authenticating as /.../c264dcecell/hosts/c78n01.ppd.pok.ibm.com/self.
0x11315021: Could not authenticate as /.../c264dcecell/hosts/c78n01.ppd.pok.ibm.com/self.
Clock skew too great
Authenticating as /.../c264dcecell/hosts/c78n01.ppd.pok.ibm.com/self.
0x11315021: Could not authenticate as /.../c264dcecell/hosts/c78n01.ppd.pok.ibm.com/self.
Clock skew too great
...
```

The corrective action for an already configured DCE client is to stop any DCE services that were able to start, run clean_up.dce, correct the time skew, and then start DCE.

The corrective action for a failed local client configuration is to stop DCE services that were configured (and started), unconfigure the local portion of the DCE client, unconfigure the administrative portion of the DCE client portion, correct the time skew, and then reconfigure the administrative and local portions of the client.

The CDS master server will crash when the time on a host is set to a value in the past. This results in a catastrophic CDS failure and is noted in the /var/dce/svc/fatal.log.

```
1999-11-15-17:04:38.714-05:00I----- cdsd(3178) FATAL cds server uid_lib.c 505 0x00000e0f
msgID=0x10D0A384 ts_new(): system time has gone backwards more than one minutes.
Exiting cdsd.
```

Kerberos V4/k4 responses

Various Commands

```
sp3n06/ # /usr/lpp/ssp/rcmd/bin/rcmdtgt
rcmdtgt:  2502-052 Error getting service ticket for
rcmd.sp3n06@ITSO.IBM.COM
2504-037 Kerberos V4 error: client and server clocks must be synchronized.
sp3n06/ # k4init root.admin
Kerberos V4 Initialization for "root.admin"
Password:
k4init: 2504-037 Kerberos V4 error: client and server clocks must be synchronized
sp3n06/ # sysctl whoami -v
2000-01-22-21:21:56.590-05:00I----- PID#19102 ERROR gss authentication gssapi.c 4001
0x00000001 msgID=0x128620FF
Could not retrieve default login context (171220ec)
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-603 You do not have Kerberos V4 credentials.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

Attempting to rsh via k4 to a host with a time skew problem and from a host with a time skew problem:

```
sp3en0/ # rsh sp3n09 date
krshd: Kerberos Authentication Failed.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
```

```
sp3n09/ # rsh sp3en0 date
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-037 Kerberos V4 error: client and server
clocks must be synchronized.
rshd: 0826-813 Permission is denied.
```

errpt entries

The AIX errpt log will also contain errors relating to a time skew from other PSSP services.

```
...
Resource Name:   hats.sp3en0
...
Description
Late in sending heartbeat
...
Detail Data
DETECTING MODULE
rsct,bootstrp.C,          1.129,1768
ERROR ID
.iUDALziKaWs.FqH.7VYQ7....................
REFERENCE CODE

A heartbeat is late by the following number of seconds
         349
```

8.3 DCE cell reconfiguration impacts

We will now cover the procedure for recovering PSSP DCE security services when a DCE cell is reconfigured

In an SP environment where PSSP is configured and running in a DCE security mode (either dce or dce:compat) and/or when the AIX remote command authentication methods for the SP include k5 (Kerberos V5), if the DCE cell into which PSSP is configured is unconfigured/reconfigured, all PSSP DCE-related services must also be unconfigured/reconfigured. This is due to DCE configuration dependencies established at the time PSSP was configured for DCE security.

Depending on the PSSP DCE security configuration in use, the level of disruption and interruption to PSSP services ranges from low to high when the DCE cell must be reconfigured. The greater the dependency on DCE, the greater the level of disruption and interruption to PSSP services.

The scenarios below cover four SP security configurations: compat/k5:k4:std, dce:compat/k5:k4:std, dce/k5:std, and dce/k5. The scenarios are based on single partition systems. SP systems running with multiple partitions can apply the individual scenarios to partition level security configurations within the system.

The inclusion of the AIX authentication method, std, is a choice in each scenario. All recovery steps are the same with or without std, except for the dce/k5:std scenario. dce/k5:std without std is the configuration dce/k5, which is handled as a separate scenario. (The steps for dce/k5:std and dce/k5 are slightly different.) Also, for the scope of the recovery procedures, the presence of std is taken to mean that a /.rhosts file was created by PSSP and exists in root's home directory. This point is critical for the recovery in a dce/k5:std environment and marks the difference between dce/k5:std and dce/k5 recovery.

All of the unconfiguration steps can be executed before the DCE cell is reconfigured. However, steps relating to PSSP DCE configuration routines must take place after the DCE cell has been reconfigured.

All actions are performed as a root user. Any dependencies on DCE cell administrator authority takes places during PSSP security installation and configuration.

8.3.1 compat/k5:k4:std

The level of disruption and interruption in a system running a compat/k5:k4:std security configuration is low, if not entirely transparent. PSSP reliance on DCE is only for remote command support (k5). And given that both k4 and std are enabled--and that in this scenario compat requires Kerberos V4 services to be configured for remote commands--PSSP remote command operations are successful via k4.

Unless stated otherwise, all work must be performed from the control workstation.

1. Change the control workstation AIX authentication methods so that they do not include k5.

```
sp3en0/ # splstdata -p
...
auth_install    k4
auth_root_rcmd  dce:k4:std
ts_auth_methods compat
auth_methods    k5:k4:std

sp3en0/ # chauthent -k4 -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node); do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host); do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # spsetauth -i k4
sp3en0/ # spsetauth -d k4 std
sp3en0/ # chauthpar -c k4 std
```

3. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -k4 -std"
```

4. Stop DCE services on each host and then unconfigure DCE services on each host. (The example reflects these steps being issued remotely through a `dsh` command. An alternative to this approach is to log in to each node where DCE is installed and run the commands locally.)

```
sp3en0/ # dsh -avG "stop.dce ; unconfigure.dce -config_type local -dependents -force all"
```

`all` unconfigures all configured components on the local machine. `-dependents` unconfigures dependent components. It specifies that any components that depend on those listed on the command line, in this case, all, should also be unconfigured. `-force` forces unconfiguration of components named on the command line, in this case, all, even if other components depend on their presence. This option should only be used in clean-up situations or recovery situations as this procedure covers. For more information about the DCE `unconfig.dce` command, refer to the *IBM DCE for AIX Administration Command Reference*.

5. Stop DCE services on the control workstation and then unconfigure DCE services on the control workstation.

```
sp3en0/ # stop.dce ; unconfigure.dce -config_type local -dependents -force all
```

Once the DCE cell is reconfigured and running, configure DCE services on the control workstation, and then refer to the *PSSP Planning Guide* and the *PSSP Installation and Migration Guide*, GA22-7347, to configure the rest of the SP for DCE/k5 use, in order to reestablish a compat/k5:k4:std security environment.

8.3.2 dce:compat/k5:k4:std

The level of disruption and interruption in a system running a dce:compat/k5:k4:std security configuration is medium to medium-high. PSSP will try to use DCE for its Trusted Services (SDR, Hardmon, Sysctl, and others) security calls and for k5 remote command support. It will take several minutes to fail-over from dce to compat when DCE Security and/or CDS master servers are not running, or when the DCE cell has been reconfigured from under the SP. As such, performance is impacted, and some PSSP functions will appear to “hang” during the failover period.

Given that both k4 and std are enabled and that, in this scenario, compat requires Kerberos V4 services to be configured for remote commands, PSSP remote command operations are eventually successful via k4.

Unless stated otherwise, all work must be performed from the control workstation. Any dependencies on DCE cell administrator authority takes places during PSSP security installation and configuration.

1. Change the control workstation AIX authentication methods so that they don't include k5.

```
sp3en0/ # splstdata -p
...
auth_install    dce:k4
auth_root_rcmd  dce:k4:std
ts_auth_methods dce:compat
auth_methods    k5:k4:std
sp3en0/ # chauthent -k4 -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node). Do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host). Do not include dce in ts_auth_methods (otherwise, Trusted Services will attempt to use DCE security services); do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # chauthpts -c compat
sp3en0/ # spsetauth -d k4 std
sp3en0/ # chauthpar -c k4 std
sp3en0/ # spsetauth -i k4
```

3. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -k4 -std"
```

Change the Trusted Services authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthts compat"
```

4. Stop DCE services on each host and then unconfigure DCE services on each host. (The example reflects these steps being issued remotely through a `dsh` command. An alternative to this approach is to log in to each node where DCE is installed and run the commands locally.)

```
sp3en0/ # dsh -avG "stop.dce ; unconfigure.dce -config_type local -dependents -force all"
```

`all` unconfigures all configured components on the local machine. `-dependents` unconfigures dependent components. It specifies that any components that depend on those listed on the command line, in this case, all, should also be unconfigured. `-force` forces unconfiguration of components named on the command line, in this case, all, even if other components depend on their presence. This option should only be used in clean-up situations or recovery situations as this procedure covers. For more information about the DCE unconfig.dce command, refer to the *IBM DCE for AIX Administration Command Reference*.

5. Stop DCE services on the control workstation and then unconfigure DCE services on the control workstation.

```
sp3en0/ # stop.dce ; unconfigure.dce -config_type local -dependents -force all
```

Once the DCE cell is reconfigured and running, configure DCE services on the control workstation and refer to the *PSSP Planning Guide* and *PSSP Installation and Migration Guide*, GA22-7347, to configure the rest of the SP for DCE/k5 use, in order to reestablish a dce:compat/k5:k4:std security environment.

8.3.3 dce/k5:std

The level of disruption and interruption in a system running a dce/k5:std security configuration is high. PSSP relies on DCE for its Trusted Services (SDR, Hardmon, Sysctl, and others) security calls and k5 remote command support. It will take several minutes for PSSP DCE calls to time-out when DCE Security and/or CDS master servers are not running, or when the DCE cell has been reconfigured from under the SP. In this scenario, there is no failover for Trusted Services. As such, PSSP functions will appear to "hang" before ultimately failing.

Given that std is enabled, PSSP remote command operations will be successful via std. However, since PSSP services will fail when its Trusted

Services security calls are made to DCE, the ability to issue remote commands is useful only in recovery situations.

Unless stated otherwise, all work must be performed on/from the control workstation. Any dependencies on DCE cell administrator authority take place during PSSP security installation and configuration.

Note

This recovery procedure leaves the SP at a minimum level of PSSP security. SP systems connected to the Internet, or to intranets that allow access from various points in your organization, should carefully evaluate whether or not to allow Internet/intranet access while the SP is running with the minimum level of security. The steps below are meant only to allow SP administrators to place the SP in a security state that permits it to be reconfigured with DCE and PSSP DCE services. These steps should be performed only after the DCE cell has been reconfigured and is available for PSSP DCE configuration.

1. Change the control workstation AIX authentication methods so that they don't include k5.

```
sp3en0/ # splstdata -p
...
auth_install    dce
auth_root_rcmd  dce:std
ts_auth_methods dce
auth_methods    k5:std
sp3en0/ # chauthent -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node); do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host); do not include dce in ts_auth_methods (otherwise, Trusted Services will attempt to use DCE security services); do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # spsetauth -i
sp3en0/ # spsetauth -d std
sp3en0/ # chauthpts -c
sp3en0/ # chauthpar -c std
```

3. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -std"
```

Change the Trusted Services authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthts"
```

4. Stop DCE services on each host and then unconfigure DCE services on each host. (The example reflects these steps being issued remotely through a `dsh` command. An alternative to this approach is to log in to each node where DCE is installed and run the commands locally.)

```
sp3en0/ # dsh -avG "stop.dce ; unconfigure.dce –config_type local –dependents –force all"
```

`all` unconfigures all configured components on the local machine. `-dependents` unconfigures dependent components. It specifies that any components that depend on those listed on the command line, in this case all, should also be unconfigured. `–force` forces unconfiguration of components named on the command line, in this case, all, even if other components depend on their presence. This option should only be used in clean-up situations, or recovery situations as this procedure covers. For more information on the DCE unconfig.dce command, refer to the *IBM DCE for AIX Administration Command Reference*.

5. Delete PSSP DCE key files and PSSP Sysctl DCE ACL databases. Normally, this would be done through the PSSP `rm_spsec` command, but this command requires that DCE services be functioning properly. The purpose of this section is to deal with the conditions where the DCE cell has either been unconfigured or is in the process of being unconfigured.
6. Note that the PSSP DCE configuration file, /spdata/sys1/spsec/spsec_overrides, is deleted as part of this process. This file will be re-created when the host is reconfigured for PSSP DCE services.

```
sp3en0/ # dsh -avG "rm -R /spdata/sys1/keyfiles/* ; rm /var/sysctl/db_* ; rm
/spdata/sys1/spsec/spsec_overrides"
```

7. Stop DCE services on the control workstation and then unconfigure DCE services on the control workstation.

```
sp3en0/ # stop.dce ; unconfigure.dce -config_type local -dependents -force all
```

8. Delete PSSP DCE key files and PSSP Sysctl and Hardmon DCE ACL databases. Normally, this would be done through the PSSP `rm_spsec` command, but this command requires that DCE services be functioning properly. Do not delete the /spdata/sys1/spsec/spsec_overrides file on the control workstation.

```
sp3en0/ # rm -R /spdata/sys1/keyfiles/* ; rm /var/sysctl/db_* ; rm /spdata/sys1/spmon/
hmdceacls/db_*
```

Once the DCE cell is reconfigured and running, configure DCE services on the control workstation and then refer to the *PSSP Planning Guide* and *PSSP Installation and Migration Guide*, GA22-7347, to configure the rest of the SP for DCE/k5 use, in order to reestablish a dce/k5:std security environment.

8.3.4 dce/k5

This procedure is similar to the dce/k5:std scenario, with one notable exception: std is not enabled in this scenario. This causes an extra step to be taken in order to access nodes remotely. Plus, it requires node cleanup be to executed serially (one after another), rather than in a distributed parallel manner (one command executed on all hosts from the control workstation). This will significantly increase the amount of time required to perform recovery.

The level of disruption and interruption in a system running a dce/k5:std security configuration is high. PSSP relies on DCE for its Trusted Services (SDR, Hardmon, Sysctl, and so on), security calls, and k5 remote command support. It will take several minutes for PSSP DCE calls to time out when DCE Security and/or CDS master servers are not running or when the DCE cell has been reconfigured from under the SP. In this scenario, there is no failover for Trusted Services. As such, PSSP functions will appear to “hang” before ultimately failing.

Given that std is not enabled, the ability to issue the remote command, `rsh`, or the PSSP remote parallel command, `dsh`, will be refused. This means that all recovery commands that must be run on a node require the SP administrator to use the PSSP command, `s1term`, to get into a node. (A telnet to the node will not be successfull since AIX on the node will only permit remote command processing through the k5 protocol, which is not available due to the state of the DCE cell. If std had also been enabled on the nodes, a telnet or rlogin would have been possible, even if the nodes lacked a /.rhosts file.)

> **Note**
>
> This recovery procedure leaves the SP at a minimum level of PSSP security. SP systems connected to the Internet (or to intranets that allow access from various points in your organization) should carefully evaluate whether or not to allow Internet/intranet access while the SP is running with the minimum level of security. The following steps are only meant to allow SP administrators to place the SP in a security state that permits it to be reconfigured with DCE and PSSP DCE services. These steps should be performed only after the DCE cell has been reconfigured and is available for PSSP DCE configuration.

1. Change the control workstation AIX authentication methods so that they do not include k5, but *do* include std.

```
sp3en0/ # splstdata -p
...
auth_install    dce
auth_root_rcmd  dce
ts_auth_methods dce
auth_methods    k5
sp3en0/ # chauthent -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node). Do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host). Do not include dce in ts_auth_methods (otherwise, Trusted Services will attempt to use DCE security services). Do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # spsetauth -i
sp3en0/ # spsetauth -d std
sp3en0/ # chauthpts -c
sp3en0/ # chauthpar -c std
```

3. For each node, s1term to the node and do the following: Change the AIX remote command authentication methods. Change the Trusted Services authentication methods. Create a /.rhosts file with control workstation only entries (this will permit rsh, rcp, dsh, telnet, and so on from the control workstation to the node). Stop DCE services, and then unconfigure DCE

services. Delete PSSP DCE key files and PSSP Sysctl DCE ACL databases (normally, this would be done through the PSSP `rm_spsec` command, but this command requires that DCE services be functioning properly).

The s1term in the example below uses the first node in the first frame. Repeat the process for all nodes in the system by substituting the correct s1term frame/slot data for each node. A /.rhosts file is created for root using the entries, sp3en0.itso.ibm.com root and sp3tr0.itso.ibm.com root. (These are the control workstation addresses on the SP system used during the creation of this book.)

```
sp3en0/ # s1term -w 1 1
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
...
sp3n01/ # chauthts ; chauthent -std
sp3n01/ # vi /.rhosts
...
sp3en0.itso.ibm.com root
sp3tr0.itso.ibm.com root
...
sp3n01/ # stop.dce ; unconfigure.dce –config_type local –dependents –force all
sp3n01/ # rm -R /spdata/sys1/keyfiles/* ; rm /var/sysctl/db_* ; rm
/spdata/sys1/spsec/spsec_overrides
```

`all` unconfigures all configured components on the local machine. `-dependents` unconfigures dependent components. It specifies that any components that depend on those listed on the command line, in this case all, should also be unconfigured. `–force` forces unconfiguration of components named on the command line, in this case, all, even if other components depend on their presence. This option should only be used in cleanup situations or recovery situations as this procedure covers. For more information about the DCE `unconfig.dce` command, refer to the *IBM DCE for AIX Administration Command Reference*.

The PSSP DCE configuration file, /spdata/sys1/spsec/spsec_overrides, is deleted as part of this process. This file will be re-created when the host is reconfigured for PSSP DCE services.

4. Stop DCE services on the control workstation and then unconfigure DCE services on the control workstation.

```
sp3en0/ # stop.dce ; unconfigure.dce –config_type local –dependents –force all
```

5. Delete PSSP DCE key files and PSSP Sysctl and Hardmon DCE ACL databases. Normally, this would be done through the PSSP rm_spsec command, but this command requires that DCE services be functioning properly. Do not delete the /spdata/sys1/spsec/spsec_overrides file on the control workstation.

```
sp3en0/ # rm -R /spdata/sys1/keyfiles/* ; rm /var/sysctl/db_* ; rm /spdata/sys1/spmon/
hmdceacls/db_*
```

Once the DCE cell is reconfigured and running, configure DCE services on the control workstation, and then refer to the *PSSP Planning Guide* and *PSSP Installation and Migration Guide*, GA22-7347, to configure the rest of the SP for DCE/k5 use, in order to reestablish a dce/k5 security environment.

8.4 Temporarily disabling dce/k5 when DCE is not available

This section describes a general procedure to disable the dce and/or k5 methods from PSSP use when DCE Security and CDS servers cannot be reached

For availability reasons, a DCE cell should contain at least one Security server replica (in addition to the master) and at least one CDS server replica (in addition to the master). (Refer to the *DCE Administration Guide -- Core Components* for information about creating and maintaining DCE server replicas.)

But even in highly-available environments, the possibility that a DCE host cannot contact needed DCE servers is a possibility. In an SP environment where PSSP is configured and running in a DCE security mode (either dce or dce:compat), and/or when the AIX remote command authentication methods for the SP include k5 (Kerberos V5), if the DCE cell into which PSSP is configured is experiencing networking problems, or the DCE master and replica servers are down or not available, all PSSP DCE-related services will be impacted by the outage.

Depending on the security configuration in use, the level of disruption and interruption to PSSP services ranges from low to high. The greater the dependency on DCE, the greater the level of disruption and interruption to PSSP services. PSSP dce and k5 authentication methods can be temporarily disabled until DCE cell services are restored to normal availability.

The scenarios below cover two SP security configurations: compat/k5:k4:std and dce:compat/k5:k4:std. Temporarily disabling dce and k5 in these configurations does not impact PSSP services, given that compat and k4 are enabled.

The security configurations, dce/k5:std and dce/k5, are not included because the temporary removal of dce and k5 from their configurations leaves the SP running with a minimum set of PSSP security controls. Systems configured with the highest levels of PSSP-supplied security are done so with the intent to run in a highly-secure environment. Anything less places the entire SP system at risk. In dce/k5:std and dce/k5 configurations, the normal operation of DCE cell services and the networking paths among and between DCE hosts are critical in ensuring proper SP operation. Dropping SP security to a minimum set of security controls when DCE cell services are impaired is not the safest approach. Instead, normal DCE cell operation should be reestablished as soon as possible.

In the scenarios covered, the inclusion of the AIX authentication method, std, was a configuration choice. All steps are the same with or without std present. Also, for the scope of the procedures, the presence of std is taken to mean that a /.rhosts file was created by PSSP and exists in root's home directory on each node.

Each scenario also includes steps on reinstating dce and k5 when DCE cell operations return to normal.

All actions are performed as a root user.

Node and control workstation DCE configurations, PSSP DCE ACL key files/ACL databases, and root's /.k5login file are not altered in any way by the following steps. The same holds true for the master DCE databases.

8.4.1 compat/k5:k4:std

The level of disruption and interruption in a system running a compat/k5:k4:std security configuration is low, if not entirely transparent. PSSP's reliance on DCE is only for k5 remote command support, and given that both k4 and std are enabled and that, in this scenario, compat requires Kerberos V4 services to be configured for remote commands, PSSP remote command operations are successful via k4.

Unless stated otherwise, all work must be performed from the control workstation.

1. Change the control workstation AIX authentication methods so that they do not include k5.

```
sp3en0/ # splstdata -p
...
auth_install    k4
auth_root_rcmd  dce:k4:std
ts_auth_methods compat
auth_methods    k5:k4:std

sp3en0/ # chauthent -k4 -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node); do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host); do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # spsetauth -i k4
sp3en0/ # spsetauth -d k4 std
sp3en0/ # chauthpar -c k4 std
```

3. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -k4 -std"
```

Once the DCE cell is operating normally, enable DCE/k5.

1. Change the partition's SDR security attributes so that they do include dce in auth_install and dce in auth_root_rcmd.

```
sp3en0/ # splstdata -p
...
auth_install    k4
auth_root_rcmd  k4:std
ts_auth_methods compat
auth_methods    k4:std

sp3en0/ # spsetauth -i dce k4
sp3en0/ # spsetauth -d dce k4 std
```

2. Change the AIX remote command authentication methods on the nodes to include k5.

```
sp3en0/ # dsh -avG "chauthent -k5 -k4 -std"
```

3. Change the control workstation AIX authentication methods and the SDR auth_methods to include k5.

```
sp3en0/ # chauthpar -c k5 k4 std
```

8.4.2 dce:compat/k5:k4:std

The level of disruption and interruption in a system running a dce:compat/k5:k4:std security configuration is medium to medium-high. PSSP will try to use DCE for its Trusted Services (SDR, Hardmon, Sysctl, and so on), security calls, and for k5 remote command support. It will take several minutes to fail-over from dce to compat when DCE Security and/or CDS master or replica servers are not running, are not reachable, or when the DCE cell has been reconfigured from under the SP. As such, performance is impacted, and some PSSP functions will appear to “hang” during the failover period.

Given that both k4 and std are enabled, and that, in this scenario, compat requires Kerberos V4 services to be configured for remote commands, PSSP remote command operations are successful via k4.

Unless stated otherwise, all work must be performed from the control workstation.

1. Change the control workstation AIX authentication methods so that they do not include k5.

```
sp3en0/ # splstdata -p
...
auth_install    dce:k4
auth_root_rcmd  dce:k4:std
ts_auth_methods dce:compat
auth_methods    k5:k4:std

sp3en0/ # chauthent -k4 -std
```

2. Change the partition's SDR security attributes so that they do not include dce in auth_install (otherwise, PSSP will try to install/configure/start DCE on a node). Do not include dce in auth_root_rcmd (otherwise, a /.k5login file will be generated on each host). Do not include k5 in auth_methods (otherwise, the k5 AIX remote command authentication method will be enabled on each host).

```
sp3en0/ # spsetauth -i k4
sp3en0/ # spsetauth -d k4 std
sp3en0/ # chauthpar -c k4 std
```

3. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -k4 -std"
```

4. Disable dce from the Trusted Services authentication methods in the SDR, on the control workstation, and on the nodes.

```
sp3en0/ # chauthpts compat
```

Once the DCE cell is operating normally, enable DCE/k5.

1. Change the partition's SDR security attributes so that they include dce in auth_install and dce in auth_root_rcmd.

```
sp3en0/ # splstdata -p
...
auth_install    k4
auth_root_rcmd  k4:std
ts_auth_methods compat
auth_methods    k4:std

sp3en0/ # spsetauth -i dce k4
sp3en0/ # spsetauth -d dce k4 std
```

2. Change the AIX remote command authentication methods on the nodes.

```
sp3en0/ # dsh -avG "chauthent -k5 -k4 -std"
```

3. Change the control workstation AIX authentication methods and the SDR auth_methods so that they include k5. Change the Trusted Services authentication methods in the SDR, on the control workstation, and on the nodes to include dce.

```
sp3en0/ # chauthpar -c k5 k4 std
sp3en0/ # chauthpts dce compat
```

8.5 DCE attributes and Per Node Key Management (PNKM)

PSSP Trusted Services enabled for DCE security are configured into a PSSP-defined DCE organization called spsec-services. PSSP configuration routines do not define explicit spsec-services organization policy data in DCE. As such, the organization is created with the default Security Registry policy data. In most cases, the default Registry policy consists of the least restrictive attributes permitted by DCE.

In particular, DCE's out-of-the-box password expiration date (pwdexpdate) attribute for the Registry is *none*, while its password lifetime attribute (pwdlife) is *unlimited*. (These attributes are considered part of the Registry's organization policy.) Therefore, when spsec-services is created in a DCE cell running with the DCE default values, spsec-services automatically inherits these attributes for its organization. In this case, the pwdexpdate and pwdlife values for spsec-services will be none and unlimited, respectively.

When PSSP DCE security is configured using the DCE out-of-box policy attributes, PSSP's DCE keyfile data will never expire, given the pwdexpdate value of none. To this end the Per Node Key Management daemon (on each PSSP DCE host) will wake-up, query the organizational pwdexpdate values of the keys it manages, determine that they are not ready to expire, and return to sleep.

Note

Per Node Key Management does not prune, or delete, keys from a keyfile. It only adds keys to a file.

When the organizational data of spsec-services is modified, such that keyfile data will expire at some point, the Per Node Key Management daemon will determine if keys must be updated, based on the pwdexpdate data retrieved, and update the key data if necessary.

PNKM will update key data in both the local keyfile and in the Registry, if a key is slated to expire within the next 24 hours. Only when the Registry update is successful will the local keyfile data be updated; otherwise, the local keyfile data is not updated. This ensures that the Registry data is not out-of-sync with the keyfile data. (The Registry stores only a single password, or key, unlike the keyfile, which can hold many versions of a key.)

8.5.1 DCE attributes that impact PNKM

There is a limited set of DCE Registry, DCE organizational, and DCE account attributes that impact whether or not a key can be managed.

In hierarchical order, they are:

- Registry level:
  - acctlife (DTS-relative time format | unlimited)
  - pwdexpdate (ISO-timestamp | none)
  - pwdlife (DTS-relative time format | unlimited)
- Organizational level:
  - acctlife (DTS-relative time format | unlimited)
  - pwdexpdate (ISO-timestamp | none)
  - pwdlife (DTS-relative time format | unlimited)
- Account level:
  - acctvalid (yes | no)
  - expdate (ISO-timestamp | none)

Also, there are two attributes for account data that are considered “Policy Attributes”; see the *DCE Commands Reference* for the account command. However, these two attributes, maxtktlife and maxtktrenew, do not impact Per Node Key Management's ability to manage a key. They should not be confused with organizational policy attributes. The account policy attributes only exist at an account level.

Note

Per Node Key Management only queries the organizational expiration data for the spsec-services organization. The attributes listed above are not queried or managed by Per Node Key Management. They are, however, DCE attributes that can impact Per Node Key Management's ability to manage keys.

At the organizational level the “policy” attributes are not displayed when the defaults are assumed. In this case, the attributes are replaced with the word “nopolicy”. nopolicy means that the default DCE values are used. The policy attributes will only be listed when one of the attributes is specifically modified.

Once the modification takes place, all the attributes are revealed as shown in the following screen:

```
# dcecp -c org show none -all
{fullname {}}
{orgid 12}
{uuid 0000000c-19fe-21d3-a402-0004ac493bac}
nopolicy
#
# # An attribute is changed. All attributes are revealed.
# dcecp -c org modify none -pwdexpdate none

# dcecp -c org show none -all
{fullname {}}
{orgid 12}
{uuid 0000000c-19fe-21d3-a402-0004ac493bac}
{acctlife unlimited}
{pwdalpha yes}
{pwdexpdate none}
{pwdlife unlimited}
{pwdminlen 0}
{pwdspaces yes}
```

8.5.2 Other factors that impact PNKM

Other factors that impact PNKM’s ability to manage keys are:

- The keyfile does not exist.
- The keyfile is zero (0) length.
- The keyfile contains malformed data.
- The Registry designated for writes (updates) is in read-only mode.
- The Registry that permits updates has been stopped (refer to the DCE `dcecp registry` command for more information).
- The Registry that permits updates is down or not reachable.
- secval has been deactivated on the DCE client host.
- DCE client services are not running.
- DCE client services have been unconfigured.
- DCE client services have been reconfigured improperly.
- The SP Security Services library is not available (there's a symbolic link from /usr/lib/libspsec.a to the actual library location; either may be missing).
- The PSSP supplied spsec_defaults and/or spsec_overrides is missing or corrupt.
- The keyfile does not contain an entry that matches the account's Registry entry.

- The keyfile exists, but all entries have been deleted.
- The keyfile contains the maximum number of key versions for a member. No additional key versions can be added until others are deleted.

8.5.3 Displaying DCE attributes

The following examples show how to display Registry, organization, and account attributes.

8.5.3.1 Registry

1. To display the master Security server, which should be the writeable Registry:

```
sp3en0/ # dcecp -c registry catalog -master
/.../sp_cell/subsys/dce/sec/sp3en0
```

2. To display an attribute list of the registry-wide attributes:

```
sp3en0/ # dcecp -c registry show /.../sp_cell/subsys/dce/sec/sp3en0 -attributes
{deftktlife 10:00:00.000I-----}
{hidepwd yes}
{maxuid 2147483647}
{mingid 100}
{minorgid 100}
{mintktlife 00:05:00.000I-----}
{minuid 100}
{version secd.dce.1.2.2}
```

3. To display only the registry-wide polices:

```
sp3en0/ # dcecp -c registry show /.../sp_cell/subsys/dce/sec/sp3en0 -policies
{acctlife unlimited}
{maxtktlife 00:00:00.000I-----}
{maxtktrenew 00:00:00.000I-----}
{pwdalpha yes}
{pwdexpdate none}
{pwdlife unlimited}
{pwdminlen 0}
{pwdspaces yes}
```

8.5.3.2 Organization

1. To display all the organizations in the current cell:

```
# dcecp -c org cat
sp3en0/ # dcecp -c org cat
/.../sp_cell/none
/.../sp_cell/spsec-services
/.../sp_cell/fvt-org
/.../sp_cell/nml-org
/.../sp_cell/dero
```

2. To display all attributes and policy values for an organization:

```
# dcecp -c org show spsec-services -all
{fullname {}}
{orgid 100}
{uuid 00000064-6c6b-21d3-8702-020701242741}
{acctlife unlimited}
{pwdalpha yes}
{pwdexpdate none}
{pwdlife unlimited}
{pwdminlen 0}
{pwdspaces yes}
```

This example shows the policy attributes of the organization because the organization was either configured with explicit attribute values or the attribute values were changed after the organization was created.

When no organizational attribute values are assigned at organization creation and no changes have been made to these values after the organization is created, the attributes are replaced with the word *nopolicy*. nopolicy means that the default DCE values are used as shown in the following screen:

```
# dcecp -c org show none -all
{fullname {}}
{orgid 12}
{uuid 0000000c-19fe-21d3-a402-0004ac493bac}
nopolicy
#
# # An attribute is changed. All attributes are revealed.
# dcecp -c org modify none -pwdexpdate none

# dcecp -c org show none -all
{fullname {}}
{orgid 12}
{uuid 0000000c-19fe-21d3-a402-0004ac493bac}
{acctlife unlimited}
{pwdalpha yes}
{pwdexpdate none}
{pwdlife unlimited}
{pwdminlen 0}
{pwdspaces yes}
```

8.5.3.3 Account

1. To display account attributes followed by account policies:

```
# dcecp -c account show ssp/sp3en0/css -all
{acctvalid yes}
{client yes}
{created /.../sp_cell/cell_admin 1999-09-16-15:17:07.000-04:00I-----}
{description {}}
{dupkey no}
{expdate none}
{forwardabletkt yes}
{goodsince 1999-09-16-15:17:07.000-04:00I-----}
{group spsec-services}
{home /}
{lastchange /.../sp_cell/cell_admin 1999-09-18-10:14:41.000-04:00I-----}
{organization spsec-services}
{postdatedtkt no}
{proxiabletkt no}
{pwdvalid yes}
{renewabletkt yes}
{server yes}
{shell {}}
{stdtgtauth yes}
{usertouser no}
nopolicy
```

The nopolicy value relates only to the policy attributes that exist at the account level, namely, maxtktlife and maxtktrenew. If these attributes are set for an account, the nopolicy value is replaced with the associated maxtktlife and/or maxtktrenew values.

8.6 Using PNKM to diagnose problems

The PNKM daemon, spnkeymand, can be executed from the command line by a root user to determine what keys the Per Node Key Management (PNKM) daemon is managing and their expiration values (where such data can be determined) and to report any detectable errors with key file states. Of particular interest to the SP administrator is using spnkeymand to assist in the diagnosis of problems on a node (or control workstation) running in a PSSP dce security mode (dce or dce:compat).

Should PSSP daemons/services fail or generate DCE error messages during processing in a dce security mode, PNKM's command line query option provides a way to determine the "health" of PSSP DCE keyfiles for which it manages. (Note that PNKM does not manage HATS DCE keyfiles.)

PNKM's query function uses each keyfile that it manages and attempts to log in to DCE with each keyfile. (It does not attempt to update the key in the

Registry or the local keyfile.) The message(s) reported by the results of the login attempt can provide valuable clues to the state of the keyfile itself or the ability to contact a DCE Registry in the cell.

Important

Per Node Key Management should not be used as the only diagnostic aid during problem determination. Since the scope of the diagnosis is a DCE-only query, this approach does not indicate run time problems with PSSP daemons, or run time problems with DCE.

Further, Per Node Key Management only queries the organizational expiration data for the spsec-services organization. Registry, organization, and account attributes discussed in the previous section are not queried or managed by Per Node Key Management. They are, however, DCE attributes that can impact Per Node Key Management's ability to manage keys.

For example, the account attribute, expdate, for the PSSP DCE service, spbgroot, can be set by a DCE cell administrator to expire in the near future, while its spsec-services organizational pwdexpdate attribute is set such that the account's password will never expire. The result of spnkeymand -l will return an expiration value of 0 (zero) for the account, meaning the password never expires, but the account will be locked out at the date specified by the account's expdate value, thereby, preventing Per Node Key Management from being able to log in as the service and manage the service's keys.

```
sp3en0/ # dcecp -c account show ssp/c166cw.ppd.pok.ibm.com/spbgroot | grep exp
{expdate 1999-12-29-07:00:00.000-05:00I-----}

sp3en0/ # spnkeymand -l | grep spbgroot
service=ssp/c166cw.ppd.pok.ibm.com/spbgroot expiration=0
```

So, it is important to keep in mind that using Per Node Key Management as a diagnostic aid is just that, an aid, and not the only course of action to be taken during problem determination.

Additionally, querying is done on a per-host basis, wherever spnkeymand is installed. The daemon does not have to be active or running for the query to take place. That is, lssrc -s spnkeyman does not have to return a state of operative. In fact, spnkeyman does not even have to be registered with AIX's SRC to use its query capability. However, the spnkeymand binary must be installed on the target host.

spnkeymand location after installation:

```
sp3en0/ # whence spnkeymand
/usr/lpp/ssp/bin/spnkeymand
sp3en0/ # ls -l /usr/lpp/ssp/bin/spnkeymand
-r-xr-x---   1 root     system     50966 Oct 20 12:29 /usr/lpp/ssp/bin/spnkeymand
```

Finally, the query can take place with or without the dce PSSP authentication method enabled.

8.6.1 Examples

Below are examples of data reported by spnkeymand queries.

Note that the expiration data retrieved from the Registry is displayed in raw integer format. An expiration equal to 0 (zero) indicates that key data will not expire. A value other than 0 indicates a specific date/time the key data in the DCE Registry will expire. The easiest way to determine a “human readable” format of the raw time is to query the spsec-services organizational attributes (with the -all flag), as shown previously.

However, should the results of the organizational query return 0 while a service is still experiencing problems, check the account attributes for the service or services, as well as PSSP and DCE run time logs.

The format of the query command is: `spnkeymand -l`.

1. On a node where DCE filesets do not exist, or DCE filesets exist, but DCE is not configured:

```
sp3n05/ # spnkeymand -l
spsec_start error for starting DCE session. err=0

No token returned spsec, DCE not installed or configured.
```

2. On a node where DCE filesets exist, DCE is configured, but PSSP has not been configured for use with DCE:

```
sp3n07/ # spnkeymand -l
spsec_keyman_get_expiration error for ppe/sp3n07/pmdv3. err=44
2502-618 The required keyfile was not found: /spdata/sys1/keyfiles/ppe/sp3n07/pmdv3
...
spsec_keyman_get_expiration error for ppe/sp3n07/dpcl. err=44
2502-618 The required keyfile was not found: /spdata/sys1/keyfiles/ppe/sp3n07/dpcl
...
spsec_keyman_get_expiration error for ssp/sp3n07/spbgroot. err=44
2502-618 The required keyfile was not found: /spdata/sys1/keyfiles/ssp/sp3n07/spbgroot
```

3. On a node where DCE filesets exist, DCE is configured, and PSSP has been configured for use with DCE:

```
sp3n05/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/spbgroot expiration=0
```

4. On a control workstation where DCE filesets exist and PSSP has been configured for use with DCE:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/spbgroot expiration=0
```

Note

For the remainder of the examples, DCE filesets exist, DCE is configured on the host, and the host has been configured for use with DCE.

5. When spsec-services has pwdexpdate values of none:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

6. When spsec-services has an organization pwdexpdate of 1999-09-28-19:59:59:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=938563199
service=ppe/dpcl expiration=938563199
...
service=ssp/spbgroot expiration=938563199
```

7. When spsec-services has a pwdexpdate of none, but one of the PSSP services account's has expired, consider the following:

   The service's keyfile expired because its organization was changed from spsec-services to another organization. In this other organization the pwdexpdate value caused the keyfile to expire before Per Node Key Management could refresh the key data.

It is not recommended that the members of the PSSP spsec-services organization be moved to another DCE organization within the cell. Not only can this impact PNKM's ability to manage the key, but it can also impact the way PSSP services operate.

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
...
...
service=mmfs/mmfsd expiration=0
Function spsec_keyman_get_expiration failed for service rsct/rsct. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Password has expired (dce / krb)
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

8. When a keyfile does not exist, but PNKM contains it in its list of managed keys:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=44
2502-618 The required keyfile was not found: /spdata/sys1/keyfiles/ssp/sp3en0/css
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

9. When a keyfile exists, but is 0 (zero) length:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Key table file not found (dce / krb)
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

10. When a keyfile exists but contains malformed data:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Unsupported key table format version
number (dce / krb)
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

11.When a keyfile does not contain an entry that matches the corresponding account entry:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Requested key is unavailable (dce / sec)
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

12.When a PSSP account does not permit logins, due to its account acctvalid attribute being set to “no”, consider the following:

The acctvalid is an account attribute, not an organizational one. However, it does impact PNKM's ability to manage the key:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=1
2502-606 DCE error in sec_login_valid_from_keytable: account not valid for login (dce / sec)
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

13.When a PSSP service account's expdate has expired (that is, the expdate has passed), consider the following: The acctvalid is an account attribute, not an organizational one. However, it does impact PNKM's ability to manage the key.

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
service=ssp/switchtbld expiration=0
Function spsec_keyman_get_expiration failed for service ssp/css. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Client's entry in database has expired
(dce / krb)
service=ssp/pmand expiration=0
...
service=ssp/spbgroot expiration=0
```

14.When a PSSP service account's pwdvalid is set to “no”:

```
sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
service=ppe/dpcl expiration=0
...
...
...
service=ssp/switchtbld expiration=0
service=ssp/css expiration=0
service=ssp/pmand expiration=0
service=ssp/spmgr expiration=0
service=ssp/sp_configd expiration=0
service=ssp/spbgroot expiration=0
```

The pwdvalid is an account attribute, not an organizational one. It does not prohibit PNKM from logging in to the account.

However, the value of this attribute will cause an informational message to be displayed during dce_login time:

```
sp3en0/ # dce_login ssp/sp3en0/css -k /spdata/sys1/keyfiles/ssp/sp3en0/css
Password must be changed!
DCE LOGIN SUCCESSFUL
#
```

15.When a keyfile contains valid and malformed data, provided that the malformed data appears after the valid data, consider the following.

That is, provided the keyfile was created normally, the header format is valid, and the keyfile can be processed for reading and login purposes only.

When PNKM attempts to log in to DCE using this keyfile, the login will be successful. However, if the keyfile needs to be updated, the update will fail, due to the corruption of the keyfile format.

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # ls -l
total 72
-rw-------   1 root     system       294 Sep 17 19:01 css
...
-rw-------   1 root     system       314 Sep 17 19:01 spbgroot
-rw-------   1 root     system       302 Sep 17 19:01 spmgr
-rw-------   1 root     system       322 Sep 17 19:01 switchtbld
-rw-------   1 root     system       152 Sep 16 15:20 sysctl
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # date >> css
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # dcecp -c keytab show ssp/sp3en0/css
-keys
{uuid b4676996-6c6b-11d3-b13c-020701242741}
{annotation {}}
{storage /spdata/sys1/keyfiles/ssp/sp3en0/css}
...
{/.../sp_cell/ssp/sp3en0/css des 4 {00 00 00 00 00 00 00 00}}

sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # spnkeymand -l
service=ppe/pmdv3 expiration=0
...
service=ssp/css expiration=0
...
service=ssp/spbgroot expiration=0
...
```

16. When a DCE Registry cannot be contacted due to problems with the network interfaces, note the following: In this example, DCE client services (and PSSP services) had been running normally on a node. At some point during normal operations, the ethernet adapter went down.

```
sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
spsec_start error for starting DCE session. err=20
2502-600 Unable to get a hostname. Error 804400180 occurred.

No token returned spsec, DCE not installed or configured.

sp3n05/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured        Not Available
Directory client                        Configured        Not Available

The component summary is complete.

sp3n05/ # netstat -i
Name  Mtu   Network     Address           Ipkts Ierrs    Opkts Oerrs  Coll
lo0   16896 link#1                          7626     0     9033     0     0
lo0   16896 127         loopback            7626     0     9033     0     0
lo0   16896 ::1                             7626     0     9033     0     0
en0*  1500  link#2      10.0.5a.fa.13.af  10510649     0  7202128     0     0
en0*  1500  192.168.3   sp3n05            10510649     0  7202128     0     0
css0* 65520 link#3                        1565548     0  1431354     0     0
css0* 65520 192.168.13  sp3sw05.msc.itso.  1565548     0  1431354     0     0
```

An attempt to start DCE under these conditions will fail. The adapter must be brought back on line to restore proper function.

```
sp3n05/ # start.dce
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
0x11315021: Could not authenticate as hosts/sp3n05/self.
0x11315a03: The components on DCE host, sp3n05 did not start successfully.
0x113159fb: Start did not complete successfully.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured        Not Available
Directory client                        Configured        Not Available

The component summary is complete.
More information can be found in the configuration log:
/opt/dcelocal/etc/cfgdce.log.
```

17. When a DCE Registry cannot be contacted, due to problems with the pe_site file, consider the following: The DCE pe_site file plays an important role in the DCE client's ability to locate Security servers within the DCE cell. If the file is deleted or becomes corrupt after the DCE client

was initialized successfully, then spnkeymand -l will not return any errors because DCE has already established and cached the Security server location information. (As shown in the first example.)

However, if the pe_site file is missing or becomes corrupt during DCE client initialization, the DCE client will not start. When spnkeymand -l is issued under these conditions, it returns an error message stating that the *KDC* cannot be found. This is a prime indication that there is a problem relating to the pe_site file and that this problem has impaired DCE client services on the host. Since PSSP security services under a PSSP dce security mode relies on DCE client services, the pe_site problem impairs PSSP security services.

Either restore a valid pe_site file from a backup, or follow the corrective actions in the *DCE Problem Determination Guide*. If the file is to be restored from a back-up as root on the host stop DCE (via stop.dce), clean-up all DCE cache files (via clean_up.dce), and then start DCE (via start.dce).

Example 1:The pe_site does not exist, or is malformed, after the DCE clients have initialized successfully:

```
sp3n05/ # ls -l /etc/dce/security/pe_site
ls: 0653-341 The file /etc/dce/security/pe_site does not exist.

sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
service=ppe/pmdv3 expiration=0
...
service=ssp/spbgroot expiration=0

sp3n05/ # ls -l /etc/dce/security/pe_site
-rw-r--r--   1 root     system         0 Dec 19 13:46 /etc/dce/security/pe_site

sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
service=ppe/pmdv3 expiration=0
...
service=ssp/spbgroot expiration=0
```

Example 2: The pe_site does not exist, or is malformed, during DCE client initialization:

```
sp3n05/ # ls -l /etc/dce/security/pe_site
ls: 0653-341 The file /etc/dce/security/pe_site does not exist.

sp3n05/ # start.dce
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
Starting RPC...
RPC was started successfully.
0x11315a0c: Unable to obtain a binding for the Security client.
0x11315a03: The components on DCE host, sp3n05 did not start successfully.
0x113159fb: Start did not complete successfully.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured           Running
Directory client                        Configured         Not Running

The component summary is complete.
More information can be found in the configuration log:
/opt/dcelocal/etc/cfgdce.log.

sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
spsec_keyman_get_expiration error for ppe/pmdv3. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
spsec_keyman_get_expiration error for ppe/dpcl. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
...
spsec_keyman_get_expiration error for ssp/spbgroot. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
```

18. When the DCE cell does not contain a running Security Serverl, consider the following: The results of this query are identical to the situation where DCE client services were started without a valid pe_site file. However, there is one major--and significant--difference between the two results. In this case the spnkeymand -l may take over 15 minutes to complete, because each PNKM DCE login attempt has to time-out. The login time-out value is an internal DCE value and cannot be tailored by PNKM. If spnkeymand -l is taking several minutes to process (and fail) a login attempt, CTRL+C and investigate the matter further.

Note

If all DCE Security Servers are down in the current cell, or not reachable due to network problems, services other than PNKM will also experience problems.

```
sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
spsec_keyman_get_expiration error for ppe/pmdv3. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
spsec_keyman_get_expiration error for ppe/dpcl. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
...
spsec_keyman_get_expiration error for ssp/spbgroot. err=1
2502-606 DCE error in sec_login_valid_from_keytable: Cannot find KDC for requested realm (dce / krb)
```

19.When the DCE clients on a host are down, note the following: This is another case where `spnkeymand -l` will not reveal a problem, since a DCE login does not require DCE client services to be running on a host. DCE only requires that a DCE Security Server be reachable in read mode to perform a login.

However, it is worth showing the results of `spnkeymand -l` under conditions where DCE client services are not running, if only to present a case for the need to use techniques other than PNKM in order to diagnose problems.

```
sp3n05/ # /usr/lpp/ssp/bin/spnkeymand -l
service=ppe/pmdv3 expiration=0
...
...
...
service=ssp/spbgroot expiration=0

sp3n05/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured         Not Running
Directory client                        Configured         Not Running

The component summary is complete.
sp3n05/ #
```

8.7 Recovering from a missing or corrupt PSSP DCE keyfile

PSSP Trusted Services keyfiles are stored under the main path, /spdata/sys1/keyfiles/.

The keyfiles are created during PSSP security installation and configuration in a dce security mode (dce or dce:compat), and, under normal conditions, this directory will exist and will contain the following directories:

```
sp3en5/spdata/sys1/keyfiles/ # ls -l
total 40
drwxr-xr-x   3 root     system       512 Oct 26 13:04 LoadL/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 mmfs/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 ppe/
drwxr-xr-x   4 root     system       512 Oct 26 13:06 rsct/
drwxr-xr-x   3 root     system       512 Oct 26 13:04 ssp/
```

Under each of these directories will be another directory. The name of this directory is that of the DCE hostname of a node or the control workstation:

```
sp3en5/spdata/sys1/keyfiles/ssp/ # ls -l
total 32
drwxr-xr-x   2 root     system       512 Nov 17 12:29 sp3en5
```

Under the DCE hostname directory will be the PSSP DCE keyfile(s) for a given service or services:

```
sp3en5/spdata/sys1/keyfiles/ssp/sp3en5/ # ls -l
total 64
-rw-------   1 root     system       298 Oct 27 23:43 css
-rw-------   1 root     system       382 Oct 27 23:43 pmand
-rw-------   1 root     system       407 Oct 27 23:44 sp_configd
-rw-------   1 root     system       397 Oct 27 23:44 spbgroot
-rw-------   1 root     system       382 Oct 27 23:43 spmgr
-rw-------   1 root     system       407 Oct 27 23:43 switchtbld
-rw-------   1 root     system       152 Oct 26 12:22 sysctl
```

8.7.1 Keyfile differences

The keyfiles on the control workstation and on the nodes differ in two ways:

1. On the control workstation, the ssp/ directory will contain at least two subdirectories. In addition to the DCE hostname directory, a second directory will appear, and it will be named the same as the SP default partition. If more than two subdirectories exist, their names will correspond to the names of the remaining PSSP partitions.

   The ssp/{partition name} subdirectories contain a DCE keyfile for each sdrd in the system.

   The example below relates to a system running with three partitions, secsys1, secsys2, and secsys3.

```
sp3en0spdata/sys1/keyfiles/ssp/sp3en0/ # ls -l
total 32
drwxr-xr-x   2 root     system       512 Nov 17 12:29 sp3en0/
drwxr-xr-x   2 root     system       512 Oct 26 12:21 secsys1/
drwxr-xr-x   2 root     system       512 Oct 26 12:22 secsys2/
drwxr-xr-x   2 root     system       512 Oct 26 12:22 secsys3/
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # cd secsys1
sp3en0/spdata/sys1/keyfiles/ssp/secsys1/ # ls -l
total 8
-rw-------   1 root     system       112 Oct 26 12:22 sdr
```

2. There are keyfiles that will only appear on the control workstation. These keyfiles are for sdr and hardmon, as shown here:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # ls -l
total 64
-rw-------   1 root     system       298 Oct 27 23:43 css
-rw-------   1 root     system       154 Oct 26 12:21 hardmon
-rw-------   1 root     system       382 Oct 27 23:43 pmand
-rw-------   1 root     system       407 Oct 27 23:44 sp_configd
-rw-------   1 root     system       397 Oct 27 23:44 spbgroot
-rw-------   1 root     system       382 Oct 27 23:43 spmgr
-rw-------   1 root     system       407 Oct 27 23:43 switchtbld
-rw-------   1 root     system       152 Oct 26 12:22 sysctl
```

Note

Even if the SP system is not configured for LoadLeveler, POE, GPFS, or an SP switch, PSSP DCE keyfiles are created for these services, including a css keyfile for use with PSSP switch services/commands. This does not pose a security exposure because the keyfiles can only be read and used by a root ID, and are valid only within the scope of their associated applications.

8.7.2 Missing keyfile example

In the event that a PSSP DCE keyfile does not exist in its expected location, it can be determined whether the keyfile was removed (deleted) from the host or not created during the installation and configuration process.

On the host where the DCE PSSP keyfile is missing, run create_keyfiles in verbose mode. If the command is being run for keyfiles specific to the control workstation, ensure that the -c flag is specified on the `create_keyfiles` command.

If the keyfile did exist but was deleted, an attempt to create a new keyfile will fail because the local DCE service will already contain a DCE keytab object for the missing keyfile.

In the example below, sysctl is the missing keyfile.

```
sp3en0/.../keyfiles/ssp/sp3en0/ # The keyfile catalog contains an entry for sysctl
sp3en0/.../keyfiles/ssp/sp3en0/ # dcecp -c keytab cat
/.../sp_cell/hosts/sp3en0/config/keytab/self
/.../sp_cell/hosts/sp3en0/config/keytab/LoadL/sp3en0/GSmonitor
...
/.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # The physical sysctl keyfile is missing
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ ls -l
total 48
-rw-------   1 root     system       223 Oct 27 23:38 css
-rw-------   1 root     system       229 Oct 27 23:38 pmand
-rw-------   1 root     system       244 Oct 27 23:38 sp_configd
-rw-------   1 root     system       238 Oct 27 23:38 spbgroot
-rw-------   1 root     system       244 Oct 27 23:38 switchtbld
```

Attempt to re-create the missing keyfile:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # create_keyfiles -v
Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_keys" subroutine ...
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/GSmonitor already exists.
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Kbdd already exists.
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/Master already exists.
...
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/spbgroot already exists.
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/switchtbld already exists.
Running "do_keytab_work" subroutine ...
Creating keytab object, "ssp/sp3en0/sysctl" and randomizing keys.

***********************************************************
/usr/lpp/ssp/bin/create_keyfiles: 0016-511 The dcecp command below
returned non-zero return code.
/opt/dcelocal/bin/dcecp -c keytab create ssp/sp3en0/sysctl -storage
/spdata/sys1/keyfiles/ssp/sp3en0/sysctl -data
{ ssp/sp3en0/sysctl plain 1 "svc_pwd_was_here" }
Command output is:
Error: msgID=0x113DB0CE  Cannot create object; already exists
```

8.7.3 Re-creating missing keyfile

To re-create the missing keyfile with a random password value, perform the following steps:

1. As root (which has access to the DCE self-host principal credentials) on the host with the missing key, delete the missing keyfile's DCE keytab object:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # Remove the sysctl keytab object from the local
catalog
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ dcecp -c keytab delete
/.:/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ dcecp -c keytab cat | grep sysctl
```

2. After the keytab object is deleted, the principal and account must be deleted and re-created, which requires cell administrator authority.

   From another DCE host in the same cell, such as the control workstation, log in as the cell administrator, and delete the principal and account.

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
# dcecp -c principal delete ssp/sp3en0/sysctl

# # Verify that the entries are gone:
# dcecp -c principal show ssp/sp3en0/sysctl
Error: msgID=0x1712207A  Registry object not found
# dcecp -c account show ssp/sp3en0/sysctl
Error: msgID=0x1712207A  Registry object not found
```

   Re-create the principal and account. If it is being run on the control workstation, ensure that the -c flag is specified.

```
config_spsec

This command requires cell administrator authority. Continue? (y/n) y


Please enter cell administrator id to be added to ACL admin group: cell_admin


Your cell administrator password is required to create accounts.
Please enter your cell administrator password:
```

   Verify that the principal and account were re-created.

```
# dcecp -c prin show ssp/sp3en0/sysctl
{fullname {}}
{uid 1883}
{uuid 0000075b-9dcd-21d3-9c00-0004ac493bac}
{alias no}
{quota unlimited}
{groups spsec-services}
# dcecp -c account show ssp/sp3en0/sysctl -all
{acctvalid yes}
{client yes}
{created /.../sp_cell/cell_admin 1999-11-18-10:30:41.000-05:00I-----}
...
{lastchange /.../sp_cell/cell_admin 1999-11-18-10:30:41.000-05:00I-----}
{organization spsec-services}
...
```

3. On the host where the keyfile is missing, create a new keyfile.

   Run the PSSP script, create_keyfiles, in verbose mode as root holding the self-host principal credentials.

   Messages regarding already existing keyfiles are expected. If the `create_keyfiles` command is being run for keyfiles specific to the control workstation, ensure that the -c flag is specified:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # create_keyfiles -v
Running "check_prereqs" subroutine ...
Checking state of DCE ...
Running "parse_defaults" subroutine ...
Parsing spsec_defaults file ...
Running "parse_overrides" subroutine ...
Running "create_keys" subroutine ...
Keyfile /spdata/sys1/keyfiles/LoadL/sp3en0/GSmonitor already exists.
...
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/spbgroot already exists.
Keyfile /spdata/sys1/keyfiles/ssp/sp3en0/switchtbld already exists.
Running "do_keytab_work" subroutine ...
Creating keytab object, "ssp/sp3en0/sysctl" and randomizing keys.
```

   Verify that the keyfile physically exists and is in the keytab catalog:

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ ls -ltr
total 48
-rw-------   1 root     system       148 Oct 30 13:02 css
-rw-------   1 root     system       152 Oct 30 13:02 pmand
-rw-------   1 root     system       162 Oct 30 13:02 sp_configd
-rw-------   1 root     system       158 Oct 30 13:02 spbgroot
-rw-------   1 root     system       162 Oct 30 13:02 switchtbld
-rw-------   1 root     system       154 Nov 18 11:25 sysctl
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # dcecp -c keytab cat | grep sysctl
/.../sp_cell/hosts/sp3en0/config/keytab/ssp/sp3en0/sysctl
```

4. Verify that keyfile can be used to log in to DCE. As root, use the PSSP `dsrvtgt` command to verify this.

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # dsrvtgt ssp/sysctl
FILE:/opt/dcelocal/var/security/creds/dcecred_68408200
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # export
KRB5CCNAME=FILE:/opt/dcelocal/var/security/creds/dcecred_6840820>
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/ssp/sp3en0/sysctl
```

dsrvtgt can be used with other PSSP service/principal name pairs. (Refer to the `dsrvtgt` command reference for details.)

5. In this example, the sysctl keyfile was re-created. To ensure that the sysctld (daemon) can use the new keyfile, stop sysctld (if it is not already stopped), and then start sysctld. (sysctld shouldn't have any problems using the new keyfile, given that the dsrvtgt validation in the previous step was successful.)

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # startsrc -s sysctld -a '-d'
0513-059 The sysctld Subsystem has been started. Subsystem PID is 21636.
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # lssrc -s sysctld
Subsystem         Group            PID     Status
 sysctld                           21636   active
```

Now, verify that sysctld is working with the dce method. (In this example, the command was issued in a dce-only environment.)

```
sp3en0/spdata/sys1/keyfiles/ssp/sp3en0/ # sysctl whoami -v
DCE: /.../sp_cell/hosts/sp3en0/self
K4:
AIX: root
```

For other PSSP services whose keyfiles were re-created, run the appropriate client commands against those services. Review the output of the commands and their corresponding server logs for normal processing indications (responses and entries) in a dce mode.

8.8 DCE client/server problem determination

This purpose of this section is to show the types of DCE client/server problems that can arise in an SP system.

8.8.1 DCE clients cannot communicate with DCE servers

There is a variety of circumstances under which clients cannot communicate with DCE servers.

8.8.1.1 Point-to-point connection checks

- Verify that the host or hosts running the DCE master servers respond to AIX ping -R requests from the client host, and vice versa.
- Verify that the AIX `traceroute` commands to the master servers complete successfully, and vice versa.
- In addition to the AIX `ping` command, the DCE `cell ping` command pings the machines running the DCE master and replica Security, CDS and DTS servers. (If a server is unavailable, its name is listed in the output of the command.)

  All Security and CDS servers are reachable and running:

  ```
  sp3n05/ # dcecp -c cell ping
  DCE services available.
  ```

  CDS servers cannot be contacted:

  ```
  sp3en0/ # dcecp -c cell ping -replicas
  Error: msgID=0x10D0A3EC  Unable to communicate with any CDS server
  ```

  Security server cannot be contacted:

  ```
  sp3en0/ # dcecp -c cell ping
  Error: msgID=0x1131F2FD  Registry server '/.../sp_cell/subsys/dce/sec/sp3en0' is not
  available.
  ```

  In the following, the CDS server was not available and generated a slightly different error message than the previous check done on a different host.

  ```
  sp3n05/ # dcecp -c cell ping -replicas
  Error: msgID=0x16C9A016  Communications failure
  ```

  The following response is a good indication that Security and CDS servers are not running anywhere in the cell:

  ```
  sp3n05/ # dcecp -c cell ping -replicas
  Warning: Not able to acquire initial login context.Error: msgID=0x1  Unknown message number 0x00000001
  ```

8.8.1.2 Things to check

Check the following on a DCE client machine:

- Verify that all configured DCE clients are running.

  DCE clients that are configured and should be running but are not running, should be started. In particular, the core DCE client services, RPC, Security, and CDS, should all be running:

```
sp3n05/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/hosts/sp3n05/self

sp3n05/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                 Configuration State   Running State
Security client                          Configured         Not Running
RPC                                      Configured           Running
Directory client                         Configured           Running

The component summary is complete.

sp3n05/ # start.dce sec_cl
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
RPC is already running.
Starting the Security client...
The Security client was started successfully.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                 Configuration State   Running State
Security client                          Configured           Running
RPC                                      Configured           Running
Directory client                         Configured           Running

The component summary is complete.
Start of DCE Host, sp3n05, was successful.
Start completed successfully.
```

- Verify that file system(s) that DCE requires is/are not full, that is, at 100 percent capacity (/var or /var/dce; /var/dce/directory):

```
sp3en0/ # df
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           65536     24352   63%     2970    19% /
/dev/hd2         2457600    158400   94%    33142    11% /usr
/dev/hd9var       131072     60264   55%      687     5% /var
/dev/hd3          131072     87696   34%      637     4% /tmp
/dev/hd1           32768     31632    4%       24     1% /home
/dev/spdata     16384000  10088800   39%    14794     1% /spdata
/dev/lv02          98304     77712   21%      234     2% /var/dce
/dev/lv03          98304     93040    6%       29     1% /var/dce/directory
```

If one or more of the required file systems is full, DCE will stop responding. To correct this situation, alleviate the space constraint problem, stop DCE, run clean_up.dce, and then start DCE:

- Verify that secval is running. secval refers to the security validation service.

  The security validation service (secval) has the following major functions:

  - It maintains a login context for the host's self-identity, which includes periodic changes to the DCE self-host's key (password)
  - It validates and certifies to applications, usually login programs, that the DCE security daemon, secd, is legitimate

  Clients (including remote clients, local servers, host logins, and administrators) all need the security validation service to make sure that the secd process being used by the host is legitimate. The security validation service establishes the link in a trust chain between applications and secd so that applications can trust the DCE security mechanism.

  The secval `status` and `ping` commands are used to determine:

  - The ping operation validates the credentials returned by a security service. This operation is rarely invoked but can be used to verify that secd is trusted. The operation returns 1 if the credentials are valid and 0 if they are not.
  - The status operation checks for an active secval. The status operation returns 1 if the security validation service is enabled and 0 if it is not.

  The secval `activate` command activates a security validation service. If the service is already enabled, an error is returned but does not impact secval processing. This operation returns an empty string on success.

```
sp3n05/ # dcecp -c secval status
1
sp3n05/ # dcecp -c secval ping
1
sp3n05/ # dcecp -c secval deactivate

sp3n05/ # dcecp -c secval status
0
sp3n05/ # dcecp -c secval ping
1
sp3n05/ # dcecp -c secval activate

sp3n05/ # dcecp -c secval status
1
sp3n05/ # dcecp -c secval activate
Error: msgID=0x113DB2BC  secval service already enabled
```

One of the impacts of secval not being active is that the self-host (machine) principal's DCE context will eventually expire. When this occurs, dced processing on the client machine is impacted. In fact, the security client, dced, terminates after the self-host context expires.

The example below shows how an expired self-host identity looks via klist, how a secval activate fails under this state, and, finally, how starting the security client reestablishes the self-host identity.

Normal self-host credentials.

```
sp3n05/ # date
Tue Dec 21 14:20:20 EST 1999
sp3n05/ #  klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3n05/self
...
Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_ffffffff
Default principal: hosts/sp3n05/self@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 1999/12/21:08:40:59 to 1999/12/21:18:40:59
Server: dce-rgy@sp_cell
        valid 1999/12/21:08:41:00 to 1999/12/21:18:40:59
...
sp3n05/ #  dcecp -c secval status
0
```

Expired self-host credentials.

```
sp3n05/ # klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3n05/self
...
Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_ffffffff
Default principal: hosts/sp3n05/self@sp_cell
#sp3n05/ #
```

Reestablishing self-host context.

```
sp3n05/ # dcecp -c secval activate
Warning: Not able to acquire initial login context.Error: msgID=0x16C9A0E7  Authentication
ticket expired

sp3n05/ # show.cfg
Gathering component state information...

               Component Summary for Host: sp3n05
          Component                Configuration State   Running State
Security client                        Configured        Not Running
RPC                                    Configured          Running
Directory client                       Configured          Running

The component summary is complete.

sp3n05/ # start.dce sec_cl
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
...
Start of DCE Host, sp3n05, was successful.
Start completed successfully.

sp3n05/ # klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3n05/self
...
Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_ffffffff
Default principal: hosts/sp3n05/self@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 1999/12/21:17:33:02 to 1999/12/22:03:33:02
...
```

- In the event that the self-host principal's credentials become corrupt or are unusable, they can be re-created by stopping and then starting the Security client. Note that attempting to refresh the credentials via a secval deactivate and secval activate sequence will fail given that the credentials are corrupt.

```
sp3n05/ # klist
No DCE identity available: No currently established network identity for this context exists
(dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_0)

sp3n05/ # dcecp -c secval deactivate
Error: msgID=0x17122033  operation on acl not authorized

sp3n05/ # stop.dce sec_cl
Gathering current configuration information...
Stop of DCE Host, sp3n05, will now begin.
...
Stop of DCE Host, sp3n05, was successful.
Stop completed successfully.

sp3n05/ # start.dce sec_cl
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
...
Start of DCE Host, sp3n05, was successful.
Start completed successfully.

sp3n05/ # klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3n05/self
...
Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_ffffffff
Default principal: hosts/sp3n05/self@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 1999/12/27:15:40:53 to 1999/12/28:01:40:53
...
```

- Verify that the pe_site file exists and is correct.

  The pe_site file is located in /etc/dce/security/pe_site and is stored in plain text. The contents of the file are in a required DCE format but can be edited with a text editor.

  The easiest method for updating the pe_site file is through the `dcecp` command, `secval update`, which is issued by root as the self-host principal. (The command is issued on the host where the pe_site file is to be updated.)

  The `secval update` command will create a valid pe_site when the file does not exist; when the existing file is: zero (0) length, corrupt, or does not contain a valid IP address to a Security server in the cell (but is otherwise properly formatted).

  For the last case, `secval update` will create a valid pe_site file, but it may take several minutes for the process to complete. (It needs to dynamically locate a security server in the cell.) Under normal conditions, the secval update process only takes seconds.

If, for some reason, secval update does not complete successfully, a pe_site from another host within the cell can be copied to the problem host. This file copy alternative is quicker than restoring the pe_site file from a back-up, which may be a requirement under conditions where the situation is critical. However, simply copying the file from another source might not solve the problem.

If the DCE cell is running with master and replica Security servers, and the contents of the pe_site differ radically from host-to-host due to security server "weighting" (see the "Preferred Security Server Replica" section of the book, *DCE Administration Guide--Core Components*, for details), then the copied pe_site file might not contain an address that is reachable from the problem host. However, this would only be an issue where pe_site files differ radically between DCE hosts within the same cell. For a cell running with a pe_site that is identical among machines (regardless of the number of Security servers they contain), copying the pe_site from another host to a problem host is not an issue.

In most circumstances, though, the `secval update` command is the quickest and most reliable approach.

```
sp3n05/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/hosts/sp3n05/self

sp3n05/ # cd /etc/dce/security
```

In the next example, the pe_site does not contain a valid Security server IP address. The `secval update` command does re-create the file properly, but it takes over two minutes for the local DCE client to locate a Security server. Normally, it only takes seconds to update the file.

```
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 16
-rw-r--r--   1 root     system       158 Dec 21 12:20 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
/.../sp_cell 4b66bc00-4842-11d3-a5a0-12348c2d4a7f@ncacn_ip_tcp:192.168.3.133[]
/.../sp_cell 4b66bc00-4842-11d3-a5a0-12348c2d4a7f@ncadg_ip_udp:192.168.3.133[]
sp3n05/opt/dcelocal/etc/security # time dcecp -c secval update

real    2m38.34s
user    0m0.26s
sys     0m0.22s
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 16
-rw-r--r--   1 root     system       158 Dec 21 12:22 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncacn_ip_tcp:192.168.3.130[]
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncadg_ip_udp:192.168.3.130[]
```

In this example, pe_site is already valid but is being refreshed to pick up any recent changes.

```
sp3n05/opt/dcelocal/etc/security # time dcecp -c secval update

real    0m0.47s
user    0m0.15s
sys     0m0.26s
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 16
-rw-r--r--   1 root     system       158 Dec 21 12:27 pe_site
```

In this example, the pe_site file does not exist.

```
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 0
sp3n05/opt/dcelocal/etc/security # time dcecp -c secval update

real    0m0.49s
user    0m0.23s
sys     0m0.21s
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 8
-rw-r--r--   1 root     system       158 Dec 21 12:29 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncadg_ip_udp:192.168.3.130[]
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncacn_ip_tcp:192.168.3.130[]
```

In this example, pe_site is zero (0) length.

```
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 0
-rw-r--r--   1 root     system         0 Dec 21 12:30 pe_site
sp3n05/opt/dcelocal/etc/security # time dcecp -c secval update

real    0m0.54s
user    0m0.25s
sys     0m0.20s
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 8
-rw-r--r--   1 root     system       158 Dec 21 12:30 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncacn_ip_tcp:192.168.3.130[]
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncadg_ip_udp:192.168.3.130[]


-In this example pe_site does not contain any valid data.

sp3n05/opt/dcelocal/etc/security # ls -ltr
total 8
-rw-r--r--   1 root     system        29 Dec 21 12:34 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
Tue Dec 21 12:34:52 EST 1999
sp3n05/o
```

In this example, pe_site does not contain any valid data.

```
sp3n05/opt/dcelocal/etc/security # ls -ltr
total 8
-rw-r--r--   1 root     system        29 Dec 21 12:34 pe_site
sp3n05/opt/dcelocal/etc/security # cat pe_site
Tue Dec 21 12:34:52 EST 1999
sp3n05/opt/dcelocal/etc/security # time dcecp -c secval update

real    0m0.65s
user    0m0.28s
sys     0m0.18s
sp3n05/opt/dcelocal/etc/security # cat pe_site
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncadg_ip_udp:192.168.3.130[]
/.../sp_cell 4b66bc00-9842-11d3-a5a0-02608c2d4a7f@ncacn_ip_tcp:192.168.3.130[]
```

- When DCE is installed and configured on a system without first creating a separate /var/dce file system, which means DCE was configured into /var, creating and mounting a /var/dce file system after the fact will prevent DCE from initializing properly. To correct the problem, unmount /var/dce, remove the file system (to avoid this problem in the future), run `clean_up.dce`, and then start DCE.

  The file, /etc/filesystems, will contain a stanza for /var/dce in this scenario. The AIX command, `lsfs` (without any flags), will display and format the entries in /etc/filesystems.

lsfs, used in conjunction with the egrep command, can narrow the results down specifically to DCE-related filesystems.

Note

Installing DCE filesets and then creating and mounting a /var/dce file system results in the same error as creating and mounting the file system after DCE had been installed and configured. This is due to symbolic links in the file system created during fileset installation.

```
sp3n05/ # mount -v'jfs' /var/dce
sp3n05/ # df | grep dce
/dev/lv01          98304     95144    4%       17     1% /var/dce
sp3n05/ # start.dce
0x11315069: An error occurred creating the file /opt/dcelocal/tmp/cfgdce.sem.
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.
Starting RPC...
0x11315a06: Unable to start RPC.
0x11315a03: The components on DCE host, sp3n05 did not start successfully.
0x113159fb: Start did not complete successfully.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                 Configuration State   Running State
Security client                          Configured         Not Running
RPC                                      Configured         Not Running
Directory client                         Configured         Not Running

The component summary is complete.
More information can be found in the configuration log:
/opt/dcelocal/etc/cfgdce.log.
sp3n05/ # klist
No DCE identity available: No currently established network identity for this
context exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_0)
sp3n05/ # unmount /var/dce
sp3n05/ # df | grep /var/dce
sp3n05/ # clean_up.dce
Cleaning up old and possibly corrupted DCE files.
Clean up completed successfully.
sp3n05/ # start.dce
Gathering current configuration information...
Start of DCE Host, sp3n05, will now begin.

Start of DCE Host, sp3n05, was successful.
Start completed successfully.
sp3n05/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3n05/self
sp3n05/ # rmfs /var/dce
rmlv: Logical volume lv01 is removed.
```

- Creating a /var/dce file system and then mounting it on a system already running with DCE configured into the /var file system will immediately disable DCE processing, and DCE will seem to “disappear” from the file system entirely.

  To correct the situation, unmount the /var/dce file system, and then remove the logical volume from the system. As soon as /var/dce is unmounted, DCE will be available.

  Before mounting /var/dce:

```
sp3n05/ # df
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           65536     50648   23%     1212     8% /
/dev/hd2          917504      9192   99%    15908    14% /usr
/dev/hd9var       131072     94848   28%      443     3% /var
/dev/hd3          262144    252224    4%       39     1% /tmp
/dev/hd1            8192      7840    5%       18     2% /home

sp3n05/ # ls -l /var/dce
total 12
drwxr-xr-x   4 root     system       512 Nov 11 18:06 adm
drwxr-xr-x   4 root     system       512 Nov 11 18:06 audit
...
drwxr-xr-x  11 root     system       512 Dec 19 17:21 security
...
drwxr-xr-x   2 root     system       512 Nov 11 18:06 web

sp3n05/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                 Configuration State   Running State
Security client                          Configured          Running
RPC                                      Configured          Running
Directory client                         Configured          Running

The component summary is complete.
```

  After mounting /var/dce:

```
sp3n05/ # mount -v'jfs' /var/dce

sp3n05/ # df
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           65536     50648   23%     1212     8% /
...
/dev/lv01          98304     95144    4%       17     1% /var/dce

sp3n05/ # ls -l /var/dce
total 8
drwxrwx---   2 root     system       512 Dec 21 20:38 lost+found

sp3n05/ # show.cfg
0x11315069: An error occurred creating the file /opt/dcelocal/tmp/cfgdce.sem.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured           Running
RPC                                     Configured           Running
Directory client                        Configured           Running

The component summary is complete.

sp3n05/ # dcecp -c secval ping
Error: msgID=0x16C9A093  Name service unavailable

sp3n05/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_0)
```

After unmounting /var/dce.

```
sp3n05/ # unmount /var/dce

sp3n05/ # ls -l /var/dce
total 12
drwxr-xr-x   4 root     system       512 Nov 11 18:06 adm
drwxr-xr-x   4 root     system       512 Nov 11 18:06 audit
...
drwxr-xr-x  11 root     system       512 Dec 19 17:21 security
...

sp3n05/ # dcecp -c secval ping
1

sp3n05/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3n05/self
```

- When DCE is installed and configured into a /var/dce file system, should /var/dce not get mounted after an AIX reboot, DCE will not start. Also, DCE files and directories will seem to have “disappeared” from the file system until the file system is mounted.

To correct this situation, mount /var/dce, and then start DCE. To avoid this problem in the future, have the /var/dce file system automatically mounted at boot time.

The file, /etc/filesystems, will contain a stanza for /var/dce in this scenario. The AIX command, `lsfs`, (without any flags) will display and format the entries in /etc/filesystems.

lsfs, used in conjunction with the `egrep` command, can narrow the results down specifically to DCE-related filesystems.

```
sp3n05/ # show.cfg
0x11315069: An error occurred creating the file /opt/dcelocal/tmp/cfgdce.sem.
Gathering component state information...

                 Component Summary for Host: sp3n05
           Component                Configuration State   Running State
Security client                         Configured         Not Running
RPC                                     Configured         Not Running
Directory client                        Configured         Not Running

The component summary is complete.
sp3n05/ # df|grep dce
sp3n05/ # ls -l /var/dce
total 0
sp3n05/ # lsfs | egrep "VFS|dce"
Name            Nodename   Mount Pt              VFS   Size    Options    Auto Accounting
/dev/lv02       --         /var/dce              jfs   98304   rw         no   no
sp3n05/ # mount /var/dce
sp3n05/ # df
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           65536     10584   84%     2041    13% /
...
/dev/lv02          98304     92776    6%      127     2% /var/dce
sp3n05/ # ls -l /var/dce
total 104
drwxr-xr-x   4 root     system       512 Nov 15 14:36 adm
...
dsp3n05/ # start.dce
Gathering current configuration information...
...
Start of DCE Host, c94n01.ppd.pok.ibm.com, was successful.
Start completed successfully.
sp3n05/ # lsfs | egrep "VFS|dce"
Name            Nodename   Mount Pt              VFS   Size    Options    Auto Accounting
/dev/lv01       --         /var/dce              jfs   98304   rw         no   no
sp3n05/ # chfs -A'yes' /var/dce
sp3n05/ # lsfs | egrep "VFS|dce"
Name            Nodename   Mount Pt              VFS   Size    Options    Auto Accounting
/dev/lv01       --         /var/dce              jfs   98304   rw         yes  no
```

Check the following on the DCE master server machine(s):

- Verify that all configured DCE master servers are running.

  DCE servers that should be running, but are not, should be started. In particular, the core DCE servers, Security, and CDS, should be running.

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3en0/self

sp3en0/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3en0
           Component                 Configuration State   Running State
Security Master server                   Configured           Running
Security client                          Configured           Running
RPC                                      Configured           Running
Initial Directory server                 Configured         Not Running
Directory client                         Configured           Running

The component summary is complete.

sp3en0/ # start.dce cds_svr
Gathering current configuration information...
Start of DCE Host, sp3en0, will now begin.
RPC is already running.
The Security Master server is already running.
The Security client is already running.
The Directory client is already running.
Starting the Initial Directory server...
The Initial Directory server was started successfully.
Gathering component state information...

                 Component Summary for Host: sp3en0
           Component                 Configuration State   Running State
Security Master server                   Configured           Running
Security client                          Configured           Running
RPC                                      Configured           Running
Initial Directory server                 Configured           Running
Directory client                         Configured           Running

The component summary is complete.
Start of DCE Host, sp3en0, was successful.
Start completed successfully.
```

- Verify that the file systems DCE requires are not full, that is, 100 percent capacity (/var or /var/dce, or /var/dce and /var/dce/directory).
- IP Forwarding is enabled properly (if in use).
- Network interfaces are up and functioning properly.
- Verify that all needed file systems are mounted.

  The file, /etc/filesystems, will contain a stanza for /var/dce and /var/dce/directory, one for the Security server (/var/dce), and one for the

CDS server (/var/dce/directory). The AIX command, `lsfs` (without any flags), will display and format the entries in /etc/filesystems.

lsfs, used in conjunction with the egrep, can narrow the results down specifically to DCE-related file systems as shown here. A value of *yes* under the *Auto* column indicates that the file system is automatically mounted at boot time. (Refer to the earlier "DCE client machine" subsection for examples of how to set a file system to be automatically mounted at boot time.)

```
sp3n05/ # lsfs | egrep "VFS|dce"
Name            Nodename   Mount Pt               VFS   Size    Options    Auto Accounting
/dev/lv02       --         /var/dce               jfs   98304   rw         yes  no
/dev/lv03       --         /var/dce/directory     jfs   98304   rw         yes  no
```

8.8.2 General DCE checkpoints

Some of the following items are condensed adaptations of the material found in Chapter 3. "Problem Determination" of the *IBM DCE for AIX Problem Determination Guide*. The reader is encouraged to refer to that guide for complete details, additional DCE items to be checked, and associated examples.

- DCE Health Check
  - Verify that all the necessary processes and files are running on servers and clients.
  - Check the DCE error and fatal logs to see what errors have occurred.
  - Check the functionality of the DCE core servers. This includes CDS servers, security servers, and application server entries in CDS and Security databases.
- Check Your DCE Identity
  - Be aware of the fact that the root user on AIX does not automatically have more permissions in DCE than another DCE principal. Only if you are root and do not log in to DCE do you inherit machine principal and credentials, which have limited permissions in the DCE environment.
  - Check the expiration of your credentials (via klist). Expired credentials have limited authority in a DCE environment.
  - When in doubt, refresh the credentials by logging back in to DCE, or issuing a kinit for an already established context. Refer to an earlier subsection for steps on "refreshing" the self-host principal credentials.
- Check the Security Services

  - A slow or congested network adds some additional response time.
  - Are all of the Security Server replicas working; are they accessible by the client system?
- Check CDS Services
  - The quickest, most thorough check for CDS is to list all directories and objects in the CDS namespace, via cdsli -world -C low.
  - Use the `cdscp show cell` command to display information about the CDS Servers. It displays condensed output, including the IP addresses of the master and replica CDS Servers.
  - The `dcecp cdscache show` operation displays address information about a clearinghouse and servers stored in the local cache of the machine. By getting an answer from this command, the assumption is that the cache on the local machine is valid.
- Check Access Permissions
  - Resources in DCE, such as directories and objects, have Access Control Lists (ACLs) associated with them. Error messages pointing to ACL problems usually include a clue in the text saying, for example, that a user does not have enough access permissions to do a specific operation.
  - The PSSP Sysctl and Hardmon services protect resources in a dce security mode via PSSP DCE group memberships and DCE ACLs.
- Time Skew
  - If the time skew between the DCE client and the DCE master servers is greater than five minutes, the servers will reject the client requests until time is brought within a five minute tolerance. The DCE *Problem Determination* guide provides a set of suggested corrective steps for this situation.

8.9 Other DCE problem determination tips

The following sections contain additional DCE problem determination tips.

8.9.1 DCE /etc/dce/cfg.dat file

During the local portion of the DCE configuration process (as opposed to the admin portion of the configuration), DCE creates the file, /etc/dce/cfg.dat. This file contains the results of the local configuration attempt.

The /etc/dce/cfg.dat file contains two fields that relate to:

1. The DCE component, as specified by the DCE short name (this is also the name used with the DCE commands config.dce, unconfig.dce, start.dce, and stop.dce). Refer to the *DCE Administration Commands Reference* for a complete list of DCE component short names.
2. A numeric value indicating the state of the DCE component:

   0 = not configured
   1 = partially configured
   2 = configured

By inspecting the contents of this file, the last known configuration state of a DCE host can be determined. Note, however, that the data in this file doesn't provide any indication of the current operational state of DCE services on host, for example, running, not running, unknown, and so on. Use the `show.cfg` command to determine both the configured and operational states of DCE services on a host.

The contents of this file should not be manually altered because DCE uses the data for various operations.

If you're wondering, "I shouldn't alter the contents of this file. I should use show.cfg to find out the configuration and operational states of a DCE host. Why should I even care about this file?", here's the answer: It is one more item that can be checked during DCE problem determination. Plus, an SP administrator can extract the configuration state of DCE clients on all nodes in the system in a quick, clean way.

The examples below show what /etc/dce/cfg.dat looks like for client configurations in fully-configured, partially-configured, and unconfigured states, and for fully-configured Security and CDS servers.

8.9.1.1 Fully-configured client

Fully-configured DCE client: rpc, cds_cl, and sec_cl. DFS and DTS (Distributed Time Service) components are not installed. This is representative of the "core" DCE client components. DTS and DFS clients are not required for a minimum DCE client configuration.

```
sp3n06/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n06
           Component                 Configuration State   Running State
Security client                          Configured           Running
RPC                                      Configured           Running
Directory client                         Configured           Running

The component summary is complete.

sp3n06/ # cat /etc/dce/cfg.dat
dced:rpc 2
dced:sec_cl 2
cdsadv 2
```

8.9.1.2 Partially-configured DCE client

The following display shows a partially-configured DCE client:

```
sp3n08/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n08
           Component                 Configuration State   Running State
Security client                            Partial          Not Running
RPC                                      Configured           Running

The component summary is complete.

sp3n08/ # cat /etc/dce/cfg.dat
dced:rpc 2
dced:sec_cl 1
```

On a host where DCE has been unconfigured or for a host where DCE file sets are installed but DCE is not configured, /etc/dce/cfg.dat does not exist:

```
sp3n10/ # show.cfg
Gathering component state information...

                           Component Summary
           Component                 Configuration State   Running State
No DCE or DFS components are configured.

sp3n010/ # cat /etc/dce/cfg.dat
cat: 0652-050 Cannot open /etc/dce/cfg.dat.
```

8.9.1.3 DCE Security and CDS servers

A host where fully-configured DCE Security and CDS servers are running:

```
sp3en0/ # show.cfg
Gathering component state information...


                 Component Summary for Host: c264n07.ppd.pok.ibm.com
           Component                Configuration State   Running State
Security Master server                   Configured          Running
Security client                          Configured          Running
RPC                                      Configured          Running
Initial Directory server                 Configured          Running
Directory client                         Configured          Running

The component summary is complete.

sp3en0/ # cat /etc/dce/cfg.dat
dced:rpc 2
secd 2
dced:sec_cl 2
cdsadv 2
cdsd 2
```

8.9.1.4 Using dsh to display /etc/dce/cfg.dat

When using dsh -avG in conjunction with dshbak -c to display the configuration state of DCE clients on all nodes in the system, consider the following:

dsh -avG will work over all nodes in the system, regardless of their partition association. The dshbak program collapses identical output from more than one host so that identical results are displayed only once. Results that are not identical can be quickly identified, along with their hosts.

In this example, node sp3n10's DCE configuration is in a partial state. Its RPC client is fully-configured (as indicated by the 2), but its Security client is only partially configured (as indicated by the 1). Due to the partial state of the Security client, the CDS client was never configured, as indicated by the absence of an entry for the CDS client. (If some level of CDS client configuration had taken place, it would have been represented by a cdsadv entry.)

```
sp3en0/ # dsh -avG "cat /etc/dce/cfg.dat" | dshbak -c
HOSTS -----------------------------------------------------------------------
sp3n02 sp3n04 sp3n06
-----------------------------------------------------------------------------
dced:rpc 2
dced:sec_cl 2
cdsadv 2

HOSTS -----------------------------------------------------------------------
sp3n08
-----------------------------------------------------------------------------
dced:rpc 2
dced:sec_cl 1
```

8.9.2 DCE CDS client configuration failure

When a CDS client configuration (local portion) takes 60 minutes to fail, it is, usually, an indication that the CDS server TCP/IP hostname is not specified or is incorrect. (The local portion of the CDS client configuration takes place after a successful DCE admin configuration for the same client.)

The /opt/dcelocal/etc/cfgdce.log will contain many entries for the message, *Requested entry does not exist*.

```
...
Waiting up to 60 minutes for the directory server.
dir list: /.:
msgID=0x10D0A3F4  Requested entry does not exist
dir list: /.:
msgID=0x10D0A3F4  Requested entry does not exist
dir list: /.:
msgID=0x10D0A3F4  Requested entry does not exist
....
```

The DCE configuration looks like the following:

```
sp3n12/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n12
           Component                 Configuration State   Running State
Security client                          Configured           Running
RPC                                      Configured           Running
Directory client                           Partial          Not Running

The component summary is complete.

sp3n12/ # cat /etc/dce/cfg.dat
dced:rpc 2
dced:sec_cl 2
cdsadv 1
```

The DCE Problem Determination guide for message 0x10D0A3F4 states that the requested CDS entry does not exist or the DCE configuration does not have any permissions to the entry.

But, the entry (directory) does exist and the permissions to the directory would allow the sp3n12 self-host principal to update items in this directory. This can be validated by doing the following:

```
sp3en0/ # dcecp -c dir list /.:/hosts
...
/.../sp_cell/hosts/sp3n10 /.../sp_cell/sp3n12 ...
...
sp3en0/ # dcecp -c dir show /.:/hosts/sp3n12
{RPC_ClassVersion {01 00}}
{CDS_CTS 1999-10-26-15:32:34.581043100/00-04-ac-49-3b-ac}
{CDS_UTS 2000-02-03-12:25:25.355094100/00-04-ac-49-3b-ac}
{CDS_ObjectUUID 918a40ba-8bba-11d3-a615-0004ac493bac}
{CDS_Replicas
 {{CH_UUID dd665e96-8bb1-11d3-a615-0004ac493bac}
  {CH_Name /.../sp_cell/sp3en0_ch}
  {Replica_Type Master}
...
{CDS_ReplicaVersion 3.0}
sp3en0/ # dcecp -c acl show /.:/hosts/sp3n12
{unauthenticated r--t---}
{user cell_admin rwdtcia}
{user hosts/sp3en0/cds-server rwdtcia}
{user hosts/sp3n12/self rwdtcia}
{group subsys/dce/cds-admin rwdtcia}
{group subsys/dce/cds-server rwdtcia}
{any_other r--t---}
```

If the CDS server was not running, or if it did not contain the entry that is supposedly missing, the dcecp commands we just used would have failed. Had the ACL permissions been incorrect, the entry for "user hosts/sp3n12/self" would have been absent or lacked modify/write/insert permissions.

The problem is that since the client configuration is taking place on one subnet and the CDS server is on another subnet, and the CDS client configuration process wasn't explicitly told where the CDS server was located, the *Requested entry does not exist* message is actually correct. After all, if the CDS server can't be located, the entry it is looking for does not exist. (A more appropriate message would be to indicate that the CDS server could not be contacted.)

So, the actual problem is that the DCE CDS client configuration program cannot locate the CDS, not that the entry does not exist or that its permissions are invalid.

To correct the problem, rerun the local DCE configuration for only the CDS client and explicitly specify the TCP/IP hostname where the CDS server is running.

8.9.3 *DCE local configuration - Unable to get key version*

During the local portion of client configuration, DCE builds the machine's self-host principal key file based on the detected number of network interfaces.

If a host contains several network interfaces, such as ethernet, token ring, and ATM, the DCE local configuration will attempt to create in its key file a host/ and ftp/ pair for each interface. At a minimum, the self-host key file will contain at least one host/ and ftp/ pair, and they relate to the DCE hostname that the machine was configured under.

For example, host sp3n06 was configured with DCE hostname sp3n06, and the TCP/IP hostname of sp3n06.itso.ibm.com:

```
sp3n06/ # show.cfg
Gathering component state information...

                 Component Summary for Host: sp3n06
           Component                Configuration State   Running State
Security client                         Configured           Running
RPC                                     Configured           Running
Directory client                        Configured           Running

The component summary is complete.
```

The self-host key file contains host/ and ftp/ entries for sp3n06.

```
sp3n06/ # dcecp -c keytab show self
{uuid 00096565-4301-1d77-9108-0000c09ce054}
{annotation {Host Principal Keytab}}
{storage /krb5/v5srvtab}
{/.../sp_cell/hosts/sp3n06/self des 1}
{/.../sp_cell/hosts/sp3n06/self des 2}
{/.../sp_cell/host/sp3n06 des 1}
{/.../sp_cell/host/sp3n06 des 2}
{/.../sp_cell/ftp/sp3n06 des 1}
{/.../sp_cell/ftp/sp3n06 des 2}
```

The multiple key versions (1 and 2) exist because part of DCE's client configuration is to automatically generate a new key version (password) immediately, that is, it changes its password immediately.

In general, there are only two cases when DCE cannot place in its key file host/ and ftp/ entries for interfaces other than the one specified as the TCP/IP hostname.

- The interface was down and could not be detected at the time the DCE configuration ran.

  The solution is to initialize all needed interfaces on the host so that they're detected as "up" by netstat -i, then run kerberos.dce -type local. Both steps must be done as root. Even if multiple interfaces must be initialized, only one invocation of kerberos.dce is required.

- The admin portion of the configuration was not performed for an interface.

  The solution is to run the kerberos.dce -type admin {interface name} command for the missing interface(s), then run kerberos.dce -type local on the host. Running kerberos.dce with the admin flag will prompt the invoker for a DCE cell administrator password. The local flag requires the invoker to be root. Even if multiple kerberos.dce -type admin {interface name} commands must be run, only one invocation of kerberos.dce is required.

In the following example, sp3n06 is configured as a DCE client. It contains multiple network interfaces, ethernet, and CSS, but only the ethernet interfaces appear in the DCE self-host key file.

```
sp3n06/ # netstat -i
Name  Mtu   Network     Address            Ipkts Ierrs    Opkts Oerrs  Coll
lo0   16896 link#1                          899423     0   901388     0     0
lo0   16896 127         loopback            899423     0   901388     0     0
lo0   16896 ::1                             899423     0   901388     0     0
en0   1500  link#2      10.0.5a.fa.1b.12  13846170     0  8497041     0     0
en0   1500  192.168.3   sp3n06            13846170     0  8497041     0     0
css0  65520 link#3                         1786998     0  1729152     0     0
css0  65520 192.168.13  sp3sw06.msc.itso.  1786998     0  1729152     0     0
sp3n06/ # dcecp -c keytab show self
{uuid 00096565-4301-1d77-9108-0000c09ce054}
{annotation {Host Principal Keytab}}
{storage /krb5/v5srvtab}
{/.../sp_cell/hosts/sp3n06/self des 1}
{/.../sp_cell/hosts/sp3n06/self des 2}
{/.../sp_cell/host/sp3n06 des 1}
{/.../sp_cell/host/sp3n06 des 2}
{/.../sp_cell/ftp/sp3n06 des 1}
{/.../sp_cell/ftp/sp3n06 des 2}
```

The DCE configuration log, /opt/dcelocal/etc/cfgdce.log, contains the following errors relating to the CSS interface.

```
...
Configuring the Security client...
0x113155fd: Unable to get the next valid key version number.
0x113155ff: Unable to add a key table entry for the principal,
host/sp3sw06.msc.itso.ibm.com.
0x113155fd: Unable to get the next valid key version number.
0x113155ff: Unable to add a key table entry for the principal,
ftp/sp3sw06.msc.itso.ibm.com.
Starting the Security client...
The Security client was started successfully.
...
```

There are no Registry accounts for the host/sp3sw06.msc.itso.ibm.com and ftp/sp3sw06.msc.itso.ibm.com, because kereberos.dce -type admin was not run for the CSS interface.

```
sp3n06/ # dcecp -c account show {host/sp3sw06 ftp/sp3sw06}
Error: msgID=0x1712207A  Registry object not found
```

Run kerberos.admin for the CSS interface, and then check that host/ftp accounts were created:

```
sp3n06/ # kerberos.dce -type admin -ip_name sp3sw06
Gathering current configuration information...
Enter password for principal cell_admin:
Creating accounts for sp3sw06.msc.itso.ibm.com.
kerberos.dce completed successfully.
sp3n06/ # dcecp -c account show {host/sp3sw06.msc.itso.ibm.com ftp/sp3sw06.msc.itso.ibm.com}
{acctvalid yes}
{client yes}
{created /.../sp_cell/cell_admin 2000-02-03-14:52:07.000-05:00I-----}
...
{acctvalid yes}
{client yes}
{created /.../sp_cell/cell_admin 2000-02-03-14:52:07.000-05:00I-----}
...
```

Run kerberos.dce -type local, and then check that the self-host key file contains new host/ftp entries for the CSS interface:

```
 sp3n06/ # kerberos.dce -type local
 Gathering current configuration information...
 Creating keytab: host/sp3n06.
 0x11315670: The keytab host/sp3n06 already exists.
 Creating keytab: ftp/sp3n06.
 0x11315670: The keytab ftp/sp3n06 already exists.
 Creating keytab: host/sp3sw06.msc.itso.ibm.com.
 Creating keytab: ftp/sp3sw06.msc.itso.ibm.com.
 kerberos.dce completed successfully.
 sp3n06/ # dcecp -c keytab show self
 {uuid 00096565-4301-1d77-9108-0000c09ce054}
 {annotation {Host Principal Keytab}}
 {storage /krb5/v5srvtab}
 {/.../sp_cell/hosts/sp3n06/self des 1}
 {/.../sp_cell/hosts/sp3n06/self des 2}
 {/.../sp_cell/host/sp3n06 des 1}
 {/.../sp_cell/host/sp3n06 des 2}
 {/.../sp_cell/ftp/sp3n06 des 1}
 {/.../sp_cell/ftp/sp3n06 des 2}
 {/.../sp_cell/host/sp3sw06.msc.itso.ibm.com des 1}
 {/.../sp_cell/host/sp3sw06.msc.itso.ibm.com des 2}
 {/.../sp_cell/ftp/sp3sw06.msc.itso.ibm.com des 1}
 {/.../sp_cell/ftp/sp3sw06.msc.itso.ibm.com des 2}
```

The *already exists* messages are expected since the key file already contains entries for these interfaces. Each time kerberos.dce -type local is invoked, it dynamically builds a list of active interfaces on a host and then attempts to create key file entries for all items in the list. DCE doesn't modify entries that already exist; so there's no harm in running kerberos.dce -type local. (Refer to the *DCE Administration Commands Reference* for complete details on kerberos.dce.).

Fortunately, PSSP V3.2 installation and configuration routines perform kerberos.dce -type admin for all needed interfaces stored in the SDR (at the time of PSSP installation and configuration).

When network interfaces are added to SP nodes after PSSP DCE installation and configuration has taken place, The second solution on the preceding page can used to add the needed entries to the DCE Registry and the self-host key files.

8.10 DCE and Kerberos V4 credentials

DCE and Kerberos V4 credentials, also referred to as "tickets", are an important part of PSSP security. PSSP Trusted Services, AIX remote commands, and DCE commands all support DCE credentials, while only PSSP Trusted Services and AIX remote commands support Kerberos V4 credentials. Credentials, or just creds, establish your identity. It is information that defines *who you are*.

An identity is established by authenticating to some service that provides you with a way to prove who you are to other services or applications. (This would be akin to obtaining a driver's license and presenting it to someone to prove your identity.)

It is possible that a single SP user can have up to three identities at any given time: AIX, DCE, and Kerberos V4. (This is true for both SP administrators and non-administrators.)

In the case of AIX, this is the AIX user ID/group ID pair assigned at the creation of the ID and established with each AIX login. When a user successfully logs in to a system with a valid user ID and password, the AIX user ID/group ID pair is established for the user by AIX. Once logged in to AIX, a user can change to another AIX identity by issuing the AIX `su` command and supplying the appropriate password.

AIX user IDs are managed across an SP system through PSSP-supplied software or through customer supplied controls.

A DCE identity is the unique DCE principal name within a specific DCE cell. A DCE identity is established after an AIX user successfully issues a dce_login. (For AIX/DCE integrated login environments, a separate dce_login is not required to establish an initial DCE principal identity. A DCE identity is established as part of the AIX login.) A DCE cell administrator creates DCE user principals and accounts based on the site's user policies. Once logged in as a DCE principal, a user can change to another DCE identity by issuing a dce_login for another principal name and supplying the appropriate password.

PSSP installation and configuration provides scripts that will create PSSP-specific DCE principals/accounts, groups, and organizations for use by PSSP Trusted Services when the services run under a dce security configuration (dce or dce:compat).

All DCE principals and accounts are managed by the DCE cell administrator. PSSP does not supply management routines for DCE principals, accounts, groups, or organizations. Management of these DCE items is covered extensively by DCE administrative facilities.

As with DCE, to establish a Kerberos V4 principal identity, an AIX user must issue a successful `k4init` command. (Refer to Chapter 3, “Managing and Using SP Security Services”, subsection "Integrating Login For Kerberos V4 with AIX," in the *PSSP: Administration Guide*, SA22-7348, for details on how to set-up the AIX/PSSP Kerberos V4 integrated login.) PSSP installation and configuration scripts create specific Kerberos V4 principals used by PSSP services in a compat security configuration (compat or dce:compat). An SP administrator creates additional Kerberos V4 principals based on the site's user policies and requirements. Once logged in as a Kerberos V4 principal, a user can change to another Kerberos V4 principal by issuing a k4init for another principal name, and supplying the appropriate password.

All Kerberos V4 principals are managed by the SP administrator. PSSP provides a Kerberos V4 administrative facility to manage its database of principals.

In the case of DCE and Kerberos V4 credentials, the state of the held credentials at the time of command execution will impact whether or not PSSP services or AIX secure remote command services will respond to the request. (Examples of DCE and Kerberos Version 4 credential states are covered elsewhere in this chapter.)

Valid credentials are considered to be credentials that are not expired, not corrupt or malformed, and are in the credentials structure recognized by a service that has been coded to accept a particular credential type.

8.10.1 Credentials cache locations

The following sections contain examples of both DCE and Kerberos V4 credential cache location problems, tips, and corrective actions.

8.10.1.1 DCE

All DCE credential caches (also called ticket caches) reside in the directory, /opt/dcelocal/var/security/creds/. This location cannot be changed by the user at the time of DCE login. Each /opt/.../dcecred_XXXXXXXX file stores the tickets issued to a particular DCE principal (XXXXXXXX is an eight-digit hexadecimal number). A dcecred_XXXXXXXX file is created by invoking dce_login (or dce_login_noexec), the PSSP command dsrvtgt, or through an AIX/DCE integrated login to AIX. Only the user who invoked dce_login has read/write permission to the file. (For complete information on the dcecred_XXXXXXXX files refer to the *DCE Administration Commands Reference*, dcecred_* Files.)

dce_login and AIX/DCE integrated login automatically sets the environment variable, KRB5CCNAME (which stands for "Kerberos Version 5 credentials cache name"), to a location of the format:

FILE:/opt/dcelocal/var/security/creds/dcecred_XXXXXXXX

The `dce_login` command runs the shell specified in the AIX SHELL environment variable. Each time a dce_login is issued, the user is placed in a new shell environment (a subshell hereafter). The `dce_login_noexec` command does not run a new shell.

```
sp3n05/u/dero/ # env KRB5CCNAME
KRB5CCNAME: A file or directory in the path name does not exist.
sp3n05/u/dero/ #  dce_login dero1
Enter Password:
DCE LOGIN SUCCESSFUL
$ env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_bf462800
```

dce_login_noexec and dsrvtgt return to the invoker of the string FILE:/opt/dcelocal/var/security/creds/dcecred_XXXXXXXX , and the user must set KRB5CCNAME manually. To use the `dsrvtgt` command as shown in the example below, the user must be root. (Refer to the *PSSP Command and Technical Reference* for complete details on `dsrvtgt`.)

```
sp3en0/ # dce_login_noexec dero1
Enter Password:
FILE:/opt/dcelocal/var/security/creds/dcecred_bf70a200
sp3en0/ #  export KRB5CCNAME=FILE:/opt/dcelocal/var/security/creds/dcecred_bf70a200
sp3en0/ #  env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_bf70a200
sp3en0/ #  dsrvtgt ssp/sysctl
FILE:/opt/dcelocal/var/security/creds/dcecred_2180be00
sp3en0/ #  export KRB5CCNAME=FILE:/opt/dcelocal/var/security/creds/dcecred_2180be00
sp3en0/ #  env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_2180be00
```

Special DCE cache locations

The /opt/dcelocal/var/security/creds/dcecred_ffffffff ticket cache is special. It stores the tickets for the local machine's principal, known in the DCE Registry as hosts/{dce_hostname}/self. This is commonly referred to as the self-host or machine principal identity.

The root user on a machine automatically has access to these credentials and, therefore, appears as the DCE entity self-host until reauthenticating as a different DCE principal. A root user who has not reauthenticated will share the dcecred_ffffffff ticket cache with other root processes using the machine's self-host identity, such as dced and other root processes that do not explicitly issue a DCE login. root users must be careful not to inadvertently destroy the self-host ticket cache (by issuing kdestroy -f or by deleting the actual credential files). When the self-host context is destroyed, local DCE services will be impacted significantly. The self-host credential context can be re-created by stopping and then starting the DCE services on the host.

Also, note that a root user does not have to set KRB5CCNAME to have access to the dcecred_ffffffff credentials. By virtue of being root, client commands that support DCE credentials know that in the absence of a set KRB5CCNAME variable, check for root credentials at /opt/dcelocal/var/security/creds/dcecred_ffffffff.

```
sp3en0/ # whoami
root
sp3en0/ # env KRB5CCNAME
KRB5CCNAME: A file or directory in the path name does not exist.
sp3en0/ # klist
DCE Identity Information:
        Global Principal: /.../sp_cell/hosts/sp3en0/self
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
        Principal: 00000066-9842-21d3-a500-02608c2d4a7f hosts/sp3en0/self
...
Identity Info Expires: 2000/02/04:13:40:17
Account Expires:       never
Passwd Expires:        never

Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_ffffffff
Default principal: hosts/sp3en0/self@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/02/04:03:40:17 to 2000/02/04:13:40:17
...
sp3en0/ # sysctl whoami
/.../sp_cell/hosts/sp3en0/self
```

/tmp/krb5cc_UID is the form of the cache file created when the DCE `kinit` command is invoked in the absence of a DCE login context. UID is the UNIX ID of the local user who invoked `kinit`.

```
sp3n06/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_36586)
sp3n06/u/dero/ # kinit dero1
Enter Password:
sp3n06/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
Ticket cache: /tmp/krb5cc_36586
Default principal: dero1@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/02/04:11:59:42 to 2000/02/04:21:59:42
```

`kinit` is most commonly used to refresh an already established DCE context--one that was created by a DCE login. In fact, DCE credentials created by issuing only a `kinit` command are not considered valid by PSSP services, since there's no DCE context associated with the credentials. However, the credentials may be used with AIX remote commands under k5.

```
sp3n06/u/dero/ # sysctl whoami
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
sysctl:  2501-122 svcconnect: Insufficient Authorization.
sp3n06/u/dero/ # rsh sp3n05 date
Fri Feb  4 12:10:51 EST 2000
sp3n06/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
Ticket cache: /tmp/krb5cc_36586
Default principal: dero1@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/02/04:11:59:42 to 2000/02/04:21:59:42
Server: host/sp3n05@sp_cell
        valid 2000/02/04:12:07:51 to 2000/02/04:21:59:42
```

Deleting/removing DCE credentials

By default DCE credentials are not automatically deleted from a system when a user exits a DCE spawned shell, or exits AIX. Unless a host's AIX log out functions have been customized to delete user DCE credentials upon exit, the credentials remain in the /opt/dcelocal/var/security/creds/ directory. Even when user credentials expire, the physical files remain.

The DCE command, `kdestroy`, deletes user credential files from the system. kdestroy doesn't unset KRB5CCNAME if it's set. If KRB5CCNAME is not set, the location /tmp/krb5cc_UID is referenced.

```
sp3n06/ # dce_login dero1
Enter Password:
DCE LOGIN SUCCESSFUL
sp3n06/ # env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_67642a00
sp3n06/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero1
...
Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_67642a00
...
sp3n06/ # kdestroy
sp3n06/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_67642a00)
sp3n06/ # env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_67642a00
```

```
sp3n06/ # kinit dero1
Enter Password:
sp3n06/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
Ticket cache: /tmp/krb5cc_202
Default principal: dero1@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/02/04:12:17:29 to 2000/02/04:22:17:29
sp3n06/ # env KRB5CCNAME
KRB5CCNAME: A file or directory in the path name does not exist.
sp3n06/ # kdestroy
sp3n06/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_202)
```

DCE provides a command, `rmxcred`, that purges expired credentials. This command will not remove individual tickets from caches that happen to contain both expired and unexpired tickets. However, it does delete credentials that represent failed DCE login attempts.

Note that `rmxcred` only deletes credentials located in the DCE credentials directory, /opt/dcelocal/var/security/creds. (The `kinit` command permits a user to specify a cache location other than the DCE default.)

Credentials removal is subject to other criteria controlled by the command-line options of rmxcred. (Refer to the *DCE Administration Commands Reference* for complete command details.)

Further, only a root user can invoke this command.

As a general rule, `rmxcred` should be run periodically to help control DCE credentials buildup. It can be added to cron and invoked automatically.

Depending on the number of credentials files in /opt/.../creds, rmxcred may take several minutes to complete. DCE has to open and inspect all credentials files to determine if they are valid candidates for removal.

```
sp3en0/ # rmxcred
rmxcred: End of credential cache reached (dce / krb) while retrieving a ticket

Rmxcred done: Removed 150 credentials files

sp3en0/ # rmxcred

Rmxcred done: Removed 0 credentials files
```

When the file system that /opt/dcelocal/var/dce/security/creds resides in becomes full, issuing `rmxcred` can generate some error messages during its processing, though it will delete credentials that match removal criteria.

```
rmxcred: No credentials cache file found (dce / krb) (ticket cache /opt/dcelocal
/var/security/creds/dcecred_b93c5d01)
rmxcred: No credentials cache file found (dce / krb) (ticket cache /opt/dcelocal
/var/security/creds/dcecred_5f1eb601)
rmxcred: End of credential cache reached (dce / krb) while retrieving a ticket
rmxcred: End of credential cache reached (dce / krb) while retrieving a ticket
```

8.10.1.2 Kerberos V4

Kerberos V4 credential caches (also called ticket caches) are stored in the ticket file specified by the user's KRBTKFILE environment variable. If the KRBTKFILE variable is not set, the user's ticket is stored in the /tmp/tktUID file, where UID is the user identification number. Kerberos V4 credentials can be stored in any location for which the user has read/write access. A Kerberos V4 credential file is created by invoking the PSSP commands, `k4init`, `rcmdtgt`, or `ksrvtgt`, or through an AIX/PSSP Kerberos V4 integrated login. Only the user that invoked `k4init`, `rcmdtgt`, or `ksrvtgt`, or logged in via integrated Kerberos V4, has read/write permission to the file. (root notwithstanding, of course.) For complete information on PSSP Kerberos V4 credentials and cache locations, refer to the *PSSP: Administration Guide*, SA22-7348.

Note that both `rcmdtgt` and `ksrvtgt` require that KRBTKFILE be set prior to command invocation. Only a root user can successfully execute `rcmdtgt` and `ksrvtgt`. These commands are not intended for end-users. They were specifically designed for use by PSSP processes running as background tasks that require Kerberos V4 credentials during run time. As such, examples of the use of these commands are not included here. For more information on `rcmdtgt` and `dsrvtgt`, refer to the *PSSP Command and Technical Reference*, SA22-7351.

```
sp3n06/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # env KRBTKFILE
KRBTKFILE: A file or directory in the path name does not exist.
sp3n06/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # k4init dero
Kerberos V4 Initialization for "dero"
Password:
sp3n06/u/dero/ # env KRBTKFILE
KRBTKFILE: A file or directory in the path name does not exist.
sp3n06/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 13:33:54  Mar  5 13:33:54  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
```

```
sp3n06/u/dero/ # export KRBTKFILE=./dero-kv4
sp3n06/u/dero/ # env KRBTKFILE
./dero-kv4
sp3n06/u/dero/ # k4list
Ticket file:    ./dero-kv4
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # k4init dero
Kerberos V4 Initialization for "dero"
Password:
sp3n06/u/dero/ # k4list
Ticket file:    ./dero-kv4
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 13:35:24  Mar  5 13:35:24  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
```

```
sp3n06/u/dero/ # export KRBTKFILE=./kv4creds/itso/kv401
sp3n06/u/dero/ # env KRBTKFILE
./kv4creds/itso/kv401
sp3n06/u/dero/ # k4init dero
Kerberos V4 Initialization for "dero"
Password:
sp3n06/u/dero/ # k4list
Ticket file:    ./kv4creds/itso/kv401
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 13:39:37  Mar  5 13:39:37  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
```

root and Kerberos V4 cache locations

In the absence of an explicitly set KRBTKFILE variable, a root user on a machine will share the /tmp/tkt0 ticket cache with all other root users and processes that have not explicitly set their own instances of KRBTKFILE. root users that destroy the /tmp/tkt0 ticket cache (by issuing k4destroy or deleting the file) impact all other root processes accessing /tmp/tkt0. A safe practice is to always set KRBTKFILE when obtaining Kerberos V4 credentials. This protects against another root user inadvertently deleting your root level Kerberos V4 credentials.

Deleting/removing Kerberos V4 credentials

By default, Kerberos V4 credentials are not automatically removed (deleted) from a system. Unless a host's AIX log-out functions have been customized to delete user Kerberos V4 credentials upon exit, the credentials remain in either /tmp or the location specified in KRBTKFILE. Even when user credentials expire, the physical files remain.

The PSSP command, `k4destroy`, deletes user credential files from the system. `k4destroy` does not unset KRBTKFILE if it is set. If KRBTKFILE is not set, the location, /tmp/tktUID, is referenced.

```
sp3n08/u/dero/ # k4list
Ticket file:    ./kv4creds/itso/kv401
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 13:39:37  Mar  5 13:39:37  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
sp3n08/u/dero/ # env KRBTKFILE
./kv4creds/itso/kv401
sp3n08/u/dero/ # k4list
Ticket file:    ./kv4creds/itso/kv401
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 13:39:37  Mar  5 13:39:37  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
sp3n08/u/dero/ # k4destroy
Tickets destroyed.
sp3n08/u/dero/ # env KRBTKFILE
./kv4creds/itso/kv401
sp3n08/u/dero/ # k4list
Ticket file:    ./kv4creds/itso/kv401
k4list: 2504-076 Kerberos V4 ticket file was not found
```

```
sp3n08/u/dero/ # env KRBTKFILE
KRBTKFILE: A file or directory in the path name does not exist.
sp3n08/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  4 14:05:56  Mar  5 14:05:56  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
sp3n08/u/dero/ # k4destroy
Tickets destroyed.
sp3n08/u/dero/ # env KRBTKFILE
KRBTKFILE: A file or directory in the path name does not exist.
sp3n08/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found
```

There is no Kerberos V4 equivalent of the DCE command, `rmxcred`. SP administrators must determine a site policy that defines how expired Kerberos V4 credentials files are handled. One approach is to run a cron job that periodically deletes all tkt* files from /tmp that match AIX non-root user IDs on the system. Simply deleting all credentials under /tmp that match tkt* is not a good solution. It would delete root's /tmp/tkt0, the cache files of PSSP services actively using credentials, and any other Kerberos V4 credentials in use.

8.10.2 Typical credential states

The following examples show what typical (normal) DCE and Kerberos V4 credentials look like and how the AIX remote command, `rsh`, and the PSSP command, `sysctl`, react to the state of the credentials.

All examples take place in a security environment of dce:compat/k5:k4:std.

DCE credentials were created by issuing a dce_login. Corrective actions that state *exit out of the DCE subshell* refer to exiting the shell environment created when dce_login was issued.

8.10.2.1 DCE and Kerberos V4 credentials are valid

Consider the following example in which DCE and Kerberos V4 credentials are valid:

```
sp3en0/u/dero/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero
        Cell:      4b6608a0-9842-11d3-a5a0-02608c2d4a7f /.../sp_cell
...

Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_59c0b300
Default principal: dero@sp_cell
Server: krbtgt/sp_cell@sp_cell
        valid 2000/02/04:14:42:43 to 2000/02/05:00:42:43
...

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  3 17:24:37  Mar  4 17:24:37  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
sp3en0/u/dero/ # rsh sp3n06 hostname
sp3n06
sp3en0/ # sysctl whoami -v
DCE: /.../sp_cell/dero
K4:  dero@ITSO.IBM.COM
AIX: dero
```

Note that the *Warning: Identity information is not certified* message at the top of the credentials display is normal and does not impact how PSSP Trusted Services and AIX remote commands view the credentials. Only root users can obtain DCE credentials that are “certified”. For more information about certified DCE credentials, refer to the *DCE Administration Commands Reference*.

8.10.2.2 Neither DCE nor Kerberos V4 credentials exist

Consider the following example in which neither DCE nor Kerberos V4 credentials exist:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_36586)

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3en0/u/dero/ # rsh sp3n06 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-603 You do not have Kerberos V4 credentials.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action to obtain new credentials is to issue dce_login and k4init.

After obtaining valid DCE and Kerberos V4 credentials, they are destroyed (deleted) through their respective credentials destroy commands:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_cabc1d00)

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3en0/u/dero/ # rsh sp3n06 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-603 You do not have Kerberos V4 credentials.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action to obtain new credentials is to exit out of the DCE subshell, and issue `dce_login and k4init`.

8.10.2.3 Expired DCE and Kerberos V4 credentials

Consider the following example in which DCE and Kerberos V4 credentials are expired:

```
sp3en0/u/dero/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero1
...

Kerberos Ticket Information:
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_caee2000
Default principal: dero1@sp_cell

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
Principal:      dero@ITSO.IBM.COM

  Issued          Expires         Principal
Feb  3 17:33:36  Feb  3 17:38:36  krbtgt.ITSO.IBM.COM@ITSO.IBM.COM
sp3en0/u/dero/ # rsh sp3n06 date
kerberos: Couldn't get credentials for the server: Ticket expired.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-605 Your DCE credentials have expired.
Authentication ticket expired
2502-605 Your Kerberos V4 credentials have expired.
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to obtain new credentials, and issue `kdestroy` and `k4destroy`. Exit out of the DCE subshell, and issue `dce_login` and `k4init`.

8.10.3 Atypical credential states

The following examples show what atypical (abnormal) DCE and Kerberos V4 credentials look like and how the AIX remote command, `rsh`, and the PSSP command, `sysctl`, react to the state of the credentials.

This includes corrupt and malformed credentials, invalid cache locations, and attempting to access the credentials cache owned by another user.

Credentials rarely, if ever, get into a malformed or corrupt state on their own. They are usually tampered with by the credentials owner. Keep in mind that credentials are represented as AIX files owned by a user. The user has full read/write authority to those files. Users should not intentionally corrupt their credentials or, otherwise, directly manipulate them. PSSP services and AIX remote command services that require valid user credentials will reject a client’s request when accompanied by corrupt or malformed credentials.

(PSSP and AIX will not view the user as authenticated, that is, the user will be seen as unauthenticated. DCE, however, accepts unauthenticated client requests. Only DCE permits very basic `dcecp` command support for unauthenticated users.)

Likewise, using invalid credential cache locations or attempting to access (use or steal) credentials owned by another user result in authentication failures and are promptly rejected by PSSP and AIX services.

All examples take place in a security environment of dce:compat/k5:k4:std.

DCE credentials were created by issuing a dce_login. Corrective actions that state *exit out of the DCE subshell* refer to exiting the shell environment created when dce_login was issued.

8.10.3.1 Credential variables reference non-existent locations

Consider the following example in which credentials' variables reference non-existent locations:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: Credential cache name malformed (dce / krb) while getting default ccache

sp3en0/u/dero/ # k4list
Ticket file:    junk
k4list: 2502-007 Can't find realm of ticket file: 2504-079 Bad Kerberos V4 ticket file
format
sp3en0/u/dero/ # rsh sp3n06 date
kerberos: Couldn't get credentials for the server: Unsupported credentials cache format
version number.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-079 Bad Kerberos V4 ticket file format.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos V4 error in krb_mk_req: 2504-079 Bad Kerberos V4 ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to exit out of the DCE subshell. Unset KRB5CCNAME and KRBTKFILE. Set KRBTKFILE to a valid location or use the /tmp/tktUID default location. Issue `dce_login` and `k4init`.

8.10.3.2 Credentials variables reference zero-length file locations

Consider the following example in which credentials variables reference zero length file locations:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: Credential cache name malformed (dce / krb) while getting default ccache

sp3en0/u/dero/ # k4list
Ticket file:    junk
k4list: 2502-007 Can't find realm of ticket file: 2504-079 Bad Kerberos V4 ticket file
format
sp3en0/u/dero/ # rsh sp3n06 date
kerberos: Couldn't get credentials for the server: Unsupported credentials cache format
version number.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-079 Bad Kerberos V4 ticket file format.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ #  sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos V4 error in krb_mk_req: 2504-079 Bad Kerberos V4 ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to exit out of the DCE subsell. Unset KRB5CCNAME and KRBTKFILE. Set KRBTKFILE to a valid location or use the /tmp/tktUID default location, and issue `dce_login` and `k4init`.

8.10.3.3 Credentials variables reference files not in a valid format

Consider the following example in which credentials variables reference files not in a valid format:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: Credential cache name malformed (dce / krb) while getting default ccache

sp3en0/u/dero/ # k4list
Ticket file:    junk
k4list: 2502-007 Can't find realm of ticket file: 2504-079 Bad Kerberos V4 ticket file
format
sp3en0/u/dero/ # rsh c166n01 date
kerberos: Couldn't get credentials for the server: Unsupported credentials cache format
version number.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-079 Bad Kerberos V4 ticket file format.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos V4 error in krb_mk_req: 2504-079 Bad Kerberos V4 ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to issue `kdestroy` and `k4destroy`. Exit out of the DCE subsell. Unset KRB5CCNAME and KRBTKFILE. Set KRBTKFILE to a valid location or use the /tmp/tktUID default location, and issue `dce_login` and `k4init`.

8.10.3.4 Credentials variables reference zero-length locations

The following example is the second variation:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: Unsupported credentials cache format version number (dce / krb) while setting
cache flags (ticket cache /opt/dcelocal/var/security/creds/dcecred_d1224300)

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2502-007 Can't find realm of ticket file: 2504-079 Bad Kerberos V4 ticket file
format
sp3en0/u/dero/ # rsh c166n01 date
kerberos: Couldn't get credentials for the server: Bad format in credentials cache.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-079 Bad Kerberos V4 ticket file
format.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos V4 error in krb_mk_req: 2504-079 Bad Kerberos V4 ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

Corrective action is to issue `kdestroy` and `k4destroy`. Exit out of the DCE subsell. Unset KRB5CCNAME and KRBTKFILE. Set KRBTKFILE to a valid location or use the /tmp/tktUID default location, and issue `dce_login` and `k4init`.

8.10.3.5 Credentials variables reference files not in a valid format

The following example is the second variation:

```
sp3en0/u/dero/ # klist
DCE Identity Information:
        Warning: Identity information is not certified
        Global Principal: /.../sp_cell/dero1
...

Kerberos Ticket Information:
klist: Unsupported credentials cache format version number (dce / krb) while setting
cache flags (ticket cache /opt/dcelocal/var/security/creds/dcecred_d1224300)

sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt36586
k4list: 2502-007 Can't find realm of ticket file: 2504-079 Bad Kerberos V4 ticket file
format
sp3en0/u/dero/ # rsh c166n01 date
kerberos: Couldn't get credentials for the server: Unsupported credentials cache
format
version number.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-079 Bad Kerberos V4 ticket file
format.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-607 GSSAPI error in gss_init_sec_context: The routine failed.
Unsupported credentials cache format version number
2502-608 Kerberos V4 error in krb_mk_req: 2504-079 Bad Kerberos V4 ticket file format
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to issue kdestroy and `k4destroy`. Exit out of the DCE subsell. Unset KRB5CCNAME and KRBTKFILE. Set KRBTKFILE to a valid location or use the /tmp/tktUID default location, and issue `dce_login` and `k4init`.

8.10.3.6 Referencing files owned by others

Non-root user’s credentials variables reference files that are owned by the root user.

```
sp3en0/u/dero/ # ls -l /tmp/tkt0
-rw-------   1 root     system       371 Feb 04 15:41 /tmp/tkt0
sp3en0/u/dero/ # ls -l /opt/dcelocal/var/security/creds/dcecred_ffffffff
-rw-------   1 root     system     14501 Feb 04 16:42 /opt/dcelocal/var/security/creds/dcecred_ffffffff
sp3en0/u/dero/ # export KRBTKFILE=/tmp/tkt0
sp3en0/u/dero/ # env KRBTKFILE
/tmp/tkt0
sp3en0/u/dero/ # export KRB5CCNAME=FILE:/opt/dcelocal/var/security/creds/dcecred_ffffffff
sp3en0/u/dero/ # env KRB5CCNAME
FILE:/opt/dcelocal/var/security/creds/dcecred_ffffffff
sp3en0/u/dero/ # k4list
Ticket file:    /tmp/tkt0
k4list: 2504-077 Can't access Kerberos V4 ticket file

sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: Credentials cache file permissions incorrect (dce / krb) while setting cache flags
 (ticket cache /opt/dcelocal/var/security/creds/dcecred_ffffffff)
sp3en0/u/dero/ # rsh c166n01 date
kerberos: Couldn't get credentials for the server: Credentials cache file permissions
incorrect.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-077 Can't access Kerberos V4 ticket file.
rshd: 0826-813 Permission is denied.

sp3en0/u/dero/ # sysctl whoami -v
2502-603 You do not have DCE credentials.
No currently established network identity for this context exists
2502-608 Kerberos V4 error in krb_mk_req: 2504-077 Can't access Kerberos V4 ticket file
sysctl:  2501-122 svcconnect: Insufficient Authorization.
```

The corrective action is to unset KRBTKFILE and KRB5CCNAME. Issue `dce_login` and `k4init`.

8.11 AIX and PSSP remote commands

An important part of SP administration is the ability to remotely manage nodes from a central host, commonly, the control workstation. Much of PSSP's remote administration relies on the use of PSSP distributed remote parallel commands, such as `dsh`, `pcp`, and `pexscr`, and the AIX secure remote commands, `rsh` and `rcp`. In fact, most PSSP remote parallel commands ultimately issue an AIX `rsh` or `rcp` to perform the actual host-to-host communication. (There are other AIX secure remote commands in addition to `rsh` and `rcp`, namely, `telnet`, `ftp`, and `rlogin`. Only `rsh` and `rcp` are used in PSSP scripts. As such, the scope of AIX secure remote command discussion is limited to these two commands.)

The notion of remote command processing is not new to PSSP or AIX. Remote command processing has been a part of UNIX since its earliest implementations and continues to play a critical role in systems management and administration. Further, remote command processing is not limited solely to administrative duties, nor is it limited to root users. It is available to all users in the system, regardless of group memberships or intended roles. Both AIX and PSSP make remote command processing available to all users in a system. A non-root user has as much access to the PSSP `dsh` command and the AIX `rsh` command as a root user.

But, like many things in the computer arena, remote command processing is not without its security implications. By their very definition, remote commands provide the ability for a user on host X to remotely access host Y. Host X and host Y can be a continent apart, but as long as host Y allows the user from host X to access the system, the user can run programs, stop and start servers, and do anything that is permitted in a standard UNIX shell environment (provided the user has the proper authority, of course).

However, the real issue is not one of access to the commands themselves, but the requirements and controls that are a necessary part of using the commands. Just because remote command processing is supported in AIX and PSSP does not mean that a non-root user can suddenly run root-only programs. It simply means that the authentication and authorization concepts discussed earlier in the chapter also apply to the remote commands, but in terms of AIX authentication and authorization, which should not be confused with PSSP Trusted Services authentication and authorization.

Of particular concern to the SP administrator is how root level remote command processing is handled throughout the SP. From authentication considerations to access control lists (authorization files), knowing how AIX secure remote commands and PSSP remote parallel commands work (at a high level) and how to recover from error conditions relating to remote command processing is essential to effective SP administration.

8.11.1 Documentation/reference materials

Understanding and exploiting AIX and PSSP remote commands is all at once straightforward and slightly complicated. It is strongly recommended that SP administrators review the following documentation in order to see the entire *remote command picture* in the SP.

8.11.1.1 AIX documentation

Consult the following AIX documentation:

- *System User's Guide: Communications and Networks: Communicating with Other Systems and Users*
- *System User's Guide: Communications and Networks: TCP/IP Facilities, Terminology, and Application*
- *User's Guide: Communications and Networks, Understanding the Secure Rcmds*
- *User's Guide: Communications and Networks, Customizing TCP/IP Features, subsection "Using a .k5login File"*
- *User's Guide: Communications and Networks, Chapter 3. Transmission Control Protocol/Internet Protocol (TCP/IP) Overview*
- The *Commands Reference* for the following: inetd, krshd, rcp, rsh, and rshd.
- *The Communications Technical Reference, Volume 2*, for the following subroutines: kvalid_user and rcmd.

The Files Reference for the following: .rhosts, /etc/hosts, /etc/hosts.equiv, /etc/inetd.conf, /etc/resolv.conf, and /etc/services.

8.11.1.2 DCE documentation

In the *IBM DCE for AIX, Administration Commands Reference*, look up the dce_login, kinit, kdestroy, and dcecred_* files.

8.11.1.3 PSSP documentation

See Chapter 5, “Remote Execution of SP Commands” of the *PSSP: Administration Guide*, SA22-7348.

In the *PSSP: Command and Technical Reference*, SA22-7351, look up the commands, `chauthpar`, `dsh`, `dshbak`, `dsrvtgt`, `k4destroy`, `k4init`, `k4list`, `pcp` (and other `p*` commands), and `rcmdtgt`.

Consult Chapter 2, “RS/6000 SP Files and Other Technical Information”, of the *PSSP: Command and Technical Reference*, SA22-7351, for the .klogin file.

Consult Chapter 6, “Planning for Security” of the book, *RS/6000: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281.

8.11.1.4 Kerberos V5 documentation

The Kerberos FAQ, available at the following Web site:

`http://www.faqs.org/faqs/kerberos-faq/general/`

8.11.2 About the AIX authentication methods

Used directly by AIX remote commands (`rcp`, `rsh`, and so on) and indirectly by PSSP remote parallel commands that exploit AIX remote commands to achieve their functionality, such as `dsh` and `pcp`.

8.11.2.1 Partition level settings

1. Methods = k5, k4, std, and *none* (where none means that no authentication method is set; note that the SP requires and enforces that at least one AIX authentication method be enabled.)
2. SDR attribute value = auth_methods
3. SDR class value = Syspar
4. To query the AIX authentication methods stored in the SDR, for all partitions in the system, issue: `splstdata -p`

8.11.2.2 Local host settings

1. methods = k5, k4, std, and *none* (where "none" means that no authentication method is set; note that the SP enforces at least one AIX authentication method be set.)
2. Methods are stored on the local host in the ODM, in the file CuAt, under /etc/objrepos. (CuAt is also the name of the object class.)

8.11.2.3 Failover flow

The precedence ordering of the AIX authentication methods is the SP enforced order of k5:k4:std. When k5 processing fails, k4 processing is attempted. When k4 fails, std processing is attempted. When std fails, no further attempts are made at completing the remote command request.

In the case where two authentication methods are set, such as k5:k4, when k5 fails, k4 is attempted. When k4 fails, no further attempts are made at completing the remote command request.

The same holds true for the case where a single authentication method is set, such as k4. When k4 fails, no further attempts are made at completing the remote command request.

8.11.2.4 Querying the AIX methods

Use the following commands to query the AIX methods:

- Partition Level: `lsauthpar` (PSSP command)
- Local Host: `lsauthent` (AIX command)

8.11.3 About the remote command protocols

This section covers the remote command protocols, K5, K4, and std.

8.11.3.1 k5

The k5 method uses the Kerberos V5 protocol, implemented through Kerberos V5 libraries supplied by the Distributed Computing Environment (DCE) LPP, the AIX operating system, and DCE credentials, which are upgraded to Kerberos V5 format for use with remote commands.

k5 enablement and use requires that IBM DCE for AIX v2.2.0.1 or later be installed and configured on AIX v4.3.1 or later. (Refer to the PSSP V3.2 release documentation for the required levels of AIX and DCE with respect to PSSP V3.2 security.) Note that at the time this book was created, k5 support on AIX is only valid with IBM DCE for AIX. MIT's Kerberos V5 package cannot be used in place of IBM DCE for AIX.

The $HOME/.k5login file is used for authorization when k5 is enabled.

All DCE credential caches (also called ticket caches) reside in the directory /opt/dcelocal/var/security/creds/. This location cannot be changed by the user at the time of DCE login.

Each /opt/dcelocal/var/security/creds/dcecred_XXXXXXXX file stores the tickets issued to a particular DCE principal (XXXXXXXX is an eight-digit hexadecimal number). A dcecred_XXXXXXXX file is created by invoking `dce_login` (or `dce_login_noexec`), the PSSP command, `dsrvtgt`, or through an AIX/DCE integrated login to AIX. Only the user who invoked `dce_login` has read/write permission to the file. (For complete information on the dcecred_XXXXXXXX files, refer to the dcecred_* Files section of the *DCE Administration Commands Reference*.)

dce_login and AIX/DCE integrated login automatically set the environment variable, KRB5CCNAME, which stands for *Kerberos Version 5 credentials cache name*, to a location of the format:

FILE:/opt/dcelocal/var/security/creds/dcecred_XXXXXXXX.

The /opt/dcelocal/var/security/creds/dcecred_ffffffff ticket cache is special. It stores the tickets for the local machine's principal, known in the DCE Registry as hosts/{dce_hostname}/self. This is commonly referred to as the self-host or machine principal identity.

The root user on a machine automatically has access to these credentials and, therefore, appears as the DCE entity self-host until reauthenticating as a different DCE principal. A root user who has not reauthenticated will share the dcecred_ffffffff ticket cache with other root processes using the machine's self-host identity, such as dced and other root processes that do not explicitly issue a DCE login. root users must be careful not to inadvertently destroy the self-host ticket cache (by issuing `kdestroy -f` or by deleting the actual credential files). When the self-host context is destroyed, local DCE services will be impacted significantly. The self-host credential context can be re-created by stopping and then starting the DCE services on the host.

Also, note that a root user does not have to set KRB5CCNAME to have access to the dcecred_ffffffff credentials. By virtue of being root, client commands that support DCE credentials know that, in the absence of a set KRB5CCNAME variable, you should check for root credentials at /opt/dcelocal/var/security/creds/dcecred_ffffffff.

8.11.3.2 k4

The k4 method uses the Kerberos V4 protocol, implemented through a Kerberos V4 compatibility library (supplied by and shipped only with PSSP), and Kerberos V4 credentials. The Kerberos V4 compatibility library is /usr/lib/libspk4rcmd.a.

The $HOME/.klogin file is used for authorization when k4 is enabled.

Kerberos V4 credential caches (also called ticket caches) are stored in the ticket file specified by the user's KRBTKFILE environment variable. If the KRBTKFILE variable is not set, the user's ticket is stored in the /tmp/tktUID file, where UID is the user identification number. Kerberos V4 credentials can be stored in any location for which the user has read/write access. A Kerberos V4 credential file is created by invoking the PSSP commands, `k4init`, `rcmdtgt`, or `ksrvtgt`, or through an AIX/PSSP Kerberos V4 integrated login. Only the user that invoked `k4init`, `rcmdtgt`, or `ksrvtgt`, or logged in via integrated Kerberos V4, has read/write permission to the file (root notwithstanding, of course). For complete information on PSSP Kerberos V4 credentials and cache locations, refer to the *PSSP: Administration Guide*, SA22-7348.

Note that both `rcmdtgt` and `ksrvtgt` require that KRBTKFILE be set prior to command invocation. Only a root user can successfully execute `rcmdtgt` and `ksrvtgt`. These commands aren't intended for end-users. They were specifically designed for use by PSSP processes running as background tasks that require Kerberos V4 credentials to be obtained during run time. As such, example usage of these commands is not included here. For more information on rcmdtgt and dsrvtgt, refer to the *PSSP Command and Technical Reference*, SA22-7351.

Note

Only the AIX remote commands, `rsh` and `rcp`, use Kerberos V4 processing. All other AIX remote commands DO NOT use the k4 method. (They simply ignore it.) PSSP remote commands, such as `dsh` and `pcp`, use the k4 method when enabled, because these commands exploit `rsh` and `rcp`, respectively.

8.11.3.3 std

The std method uses IP-based *authentication*, which is implemented through the operating system. There are no credentials or tickets, such as those used with k5 and k4.

The $HOME/.rhosts file is used for authorization when std is enabled.

8.11.3.4 none

none means that all AIX remote commands are disabled and cannot be used. This, in turn, means that those PSSP remote commands that implement their functionality through the exploitation of AIX remote commands are, effectively, *disabled*.

8.11.4 AIX remote command message summary

The type and quantity of AIX authentication methods that are enabled impact the style and quantity of error and informational messages returned to stderr (standard error). The greater the number of authentication methods enabled, the larger the number of possible error messages returned to stderr.

Likewise, the greater the number of authentication methods enabled, the greater the possibility that errors will be returned for some protocols but that the remote command will ultimately be successful. This is due to the different types of protocol authentication and/or authorization possibilities.

In general:

- Messages that start off with “kerberos:” relate to Kerberos V5 in some way (which may or may not relate to a DCE problem).
- Messages that start off with "spk4" relate to the Kerberos V4 compatibility library (installed by PSSP).
- Messages that start off with just remote command descriptors, as in krshd:, telnetd:, rshd:, rcp:, or start off with a hostname followed by some type of text, such as *{hostname_here}: A remote host refused an*

attempted connect operation, relate to a base AIX remote command service or some facet supplied by a base AIX remote command service.

- The rcp return code will be 0 (zero) if the command worked and a non-zero value if it did not. This can be used to tell if the copy worked or not.
- The rsh return code will be 0 (zero) if the rsh itself did not have a problem and a non-zero value if it did experience a problem. Whether the command called by the rsh is or is not successful cannot be determined by the rsh return code. The only way to determine if the called command failed is to scan the output of stderr.

Caveats:

- Not all AIX remote command messages have associated 7 digit message codes.
- All spk4* messages have associated seven digit message codes.
- kerberos: (k5 related) messages can appear after leading krshd:, telnetd:, and other messages.
- Messages can relate to authentication or authorization conditions, where the former relates to k5, k4, and std, while the latter relates to the authorization files, .k5login, .klogin, and .rhosts.
- Given that remote commands are designed to failover from one authentication method to the next, if more than one method is enabled, it is possible to receive messages from k5, k4, and std processing for a single remote command attempt. The order in which the messages are returned relate to the order in which the authentication methods are set (on the client's host).

8.11.5 AIX and PSSP remote commands

The following are AIX remote commands:

- `rsh`
- `rcp`
- `telnet`
- `ftp`
- `rlogin`

The following are PSSP remote commands (Items in parentheses denote other command dependencies.):

- `dsh (rsh)`

- pcp (dsh; rsh; rcp)
- pexec (dsh; rsh)
- pexscr (dsh; rsh)
- p-cat (dsh; rsh)
- pfind (dsh; rsh)
- pls (dsh;rsh)
- pmv (dsh; rsh)
- ppred (dsh; rsh)
- pps (dsh; rsh)
- prm (dsh; rsh)

8.11.6 Remote command client and server must share a protocol

The AIX authentication methods for remote commands (both AIX and PSSP remote commands) must share at least one method in common if the client and server are to communicate.

Remote command client requests will fail when the client and the server do not share at least one AIX authentication method in common. For example, if the client is running in a k5 only mode, then the server must be running in a mode that includes k5 (as in k5 (only), k5:k4, or k5:k4:std). An example of a disjoint set of authentication methods between a client and a server is when the client is running in a k4-only mode and the server is running in a k5-only mode.

A disjoint set of AIX authentication methods occurs under the following conditions:

- In a multi-partition environment where each partition is running a different security mode
- In a single partition environment where the AIX authentication methods on a host (node or the control workstation) are changed to something other than the system-wide security settings

There are two ways to query the authentication methods in the partition to determine if methods are disjoint:

The first is to use the `lsauthpar -v` command to compare the current partition's SDR values against each of the nodes in the partition. (In a one partition system, this is equivalent to testing the entire system.) `lsauthpar` automatically reads from the SDR the authentication methods for the partition and compares a node's values to the SDR values. (When the partition name is not specified by the issuer, the current partition is assumed.) For each host with a disjoint set of methods a *discrepancy* message is displayed.

```
sp3en0/ # lsauthpar -v
Remote command authentication methods for the partition: k4:std
No discrepancies were found.

sp3en0/ # lsauthpar -v
Remote command authentication methods for the partition: k5:k4:std
krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
lsauthpar: 0016-314 On sp3n15 the remote command authentication methods are incorrectly
set to "k4:std".
```

The second way is to use the `dsh -a` command to query the local authentication methods on each host (in the current partition) and pipe the results to dshbak -c (dsh -avG will work over all nodes in the system, regardless of their partition association.) The dshbak program collapses identical output from more than one host so that identical results are displayed only once. Unlike the `lsauthpar -v` command, the administrator must know the authentication methods for the current partition and visually compare the node results to this value. Further, if environmental variables that control the set of nodes over which dsh will operate (WCOLL, SP_NAME) include nodes that span partitions, the results will indicate a discrepancy where one might not actually exist. Conversely, if the environment variables include a subset of nodes within a partition, the results will not indicate a true view of the entire partition.

Using dsh to display the authentication methods on a set of nodes

The dsh WCOLL variable is set and points to a file containing only a subset of nodes within the system. splstnodes reveals all the node names in the system.

```
sp3en0/ # env WCOLL
/3-node-group
sp3en0/ # cat /3-node-group
sp3n01
sp3n06
sp3n09
sp3en0/ # dsh -a "lsauthent" | dshbak -c
HOSTS ------------------------------------------------------------------------
sp3n06
------------------------------------------------------------------------------
Kerberos 5
Standard Aix

HOSTS ------------------------------------------------------------------------
sp3n01  sp3n09
------------------------------------------------------------------------------
Kerberos 5
Kerberos 4
Standard Aix
sp3en0/ # splstnodes -s reliable_hostname reliable_hostname
reliable_hostname
sp3n01
sp3n05
...
sp3n15
```

Knowing exactly which nodes within the system, or within a partition, are disjoint (if any) with respect to AIX authentication methods is critical for normal security operations. Using the `lsauthpar -v` command is the easiest and most reliable way of gathering that information. Corrective actions can then be taken depending on the type of disjoint environment.

8.11.6.1 Multiple partitions with different security modes

There is no corrective action for this case, in the sense of correcting a problem, since it is an AIX requirement that for its client/server processes to communicate, they must share at least one AIX authentication method in common. (This is equivalent to humans speaking a common language in order to communicate verbally.) Multiple partitions do not have to be enabled for the same set of authentication methods.

The example set for a multi-partition environment assumes three partitions, sp3en0, sp3sp1, and sp3sp2, where each partition is enabled for a different set of AIX authentication methods.

In the first example, the commands are issued from the control workstation out to the nodes, and all attempts are successful. The control workstation contains the union of all the AIX authentication methods in the SP, given that the control workstation must be able to communicate with each node in the system. Note that the control workstation can contain more AIX authentication methods than the union of the AIX authentication methods of the SP. For example, if the union of all AIX authentication methods in the SP is k5:k4, the control workstation can have k5:k4:std, with k5:k4 being the minimum set of methods. This allows the SP administrator to tailor which remote command requests are satisfied by the control workstation for external-to-the-SP host requests in environments where such remote access to the control workstation is required.

In the second set of examples, the commands are issued from a node in one partition to nodes in other partitions. Some of the requests are successful because a common AIX authentication method is shared, while other requests are not successful because a method is not shared.

For the scope of these examples, the following partition security methods (including AIX authentication methods), along with a node name in each partition, were in place. The data was extracted from the `splstdata -p` command.

```
Syspar: sp3en0
-------------------------
ts_auth_methods dce:compat
auth_methods    k5:k4
node            sp3n01

Syspar: sp3sp1
-------------------------
ts_auth_methods compat
auth_methods    k4
node            sp3n04

Syspar: sp3sp2
-------------------------
ts_auth_methods dce
auth_methods    k5
node            sp3n03
```

Control workstation to nodes example - k5:k4 to a k4 node, a k5:k4 node, and a k5 node

The rsh client request from the k5:k4 control workstation to nodes at various authentication method settings is successful because the client shares at least one method in common with each host. Error messages returned by the remote daemon are for failed remote command protocol attempts and are not failures of the commands actually issued on the remote hosts.

Security configuration and user's credential identities

```
sp3en0/ # lsauthent ; klist | grep lob ; k4list | grep pal:
Kerberos 5
Kerberos 4
        Global Principal: /.../sp_cell/hosts/sp3en0/self
Principal:      root.admin@ITSO.IBM.COM
```

rsh to a k5:k4-enabled node:

```
sp3en0/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
```

rsh to a k4-enabled node:

```
sp3en0/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
sp3n04
Kerberos 4
```

rsh to a k5-enabled node:

```
sp3en0/ # rsh sp3n03 "hostname -s ; lsauthent"
sp3n03
Kerberos 5
```

The protocol error message going from k5:k4 to k4 is expected given that the client tried to communicate with the remote server via k5 first. Once that attempt failed. the client and server communicated via k4.

Node-to-node example #1: k5:k4 to a k5 node and to a k4 node

The rsh client request from a k5:k4 node to a k4 node is successful, as is the k5:k4 to k5 node request. Error messages returned by the remote daemon are for failed remote command protocol attempts only. The commands to be run on the remote host were, ultimately, executed because a common authentication method between client and server was found.

```
sp3n01/ # lsauthent ; klist | grep lob ; k4list | grep pal:
Kerberos 5
Kerberos 4
        Global Principal: /.../sp_cell/hosts/sp3n01/self
Principal:      root.admin@ITSO.IBM.COM
sp3n01/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
sp3n04
Kerberos 4
sp3n01/ # rsh sp3n03 "hostname -s ; lsauthent"
sp3n03
Kerberos 5
```

The protocol error message going from k5:k4 to k4 is expected since the client tried to communicate with the remote server via k5 first. Once the k5 attempt failed, the client and server communicated via k4.

Node-to-node example #2: k4 to a k5 node and to a k5:k4 node

The rsh client request from a k4 node to a k4 node is successful while the k4 to k5 node request is denied. For failed rsh attempts, error messages returned by the remote daemon are for failed remote command protocol attempts. The commands to be run on the remote host were never executed, due to the disjoint authentication methods between client and server.

```
sp3n04/ # lsauthent ; k4list | grep pal:
Kerberos 4
Principal:      root.admin@ITSO.IBM.COM
sp3n04/ # rsh sp3n03 "hostname -s ; lsauthent"
krshd: Kerberos Authentication Failed.
spk4rsh: 0041-004 Kerberos rcmd failed: rcmd protocol failure.
sp3n04/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
```

The protocol error message going from k4 to k5 is expected since the client and server do not share a common method. The commands to be run on the remote host are not attempted.

The protocol error message going from k4 to k5:k4 is expected since the client only tried to communicate with the remote server via k4.

Node-to-node example #3. k5 to a k5:k4 node and to a k4 node.

The rsh client request from a k5 node to a k5:k4 node is successful, while the k5 to k4 node request is denied. For failed rsh attempts, error messages returned by the remote daemon are for failed remote command protocol attempts. The commands to be run on the remote host were never executed due to the disjoint authentication methods between client and server.

```
sp3n03/ # lsauthent ; klist | grep lob
Kerberos 5
        Global Principal: /.../sp_cell/hosts/sp3n01/self
sp3n03/ # rsh sp3n01 "hostname -s ; lsauthent"
sp3n01
Kerberos 5
Kerberos 4
sp3n03/ # rsh sp3n04 "hostname -s ; lsauthent"
krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
```

The protocol error message going from k5 to k4 is expected since the client and server do not share a common method. The commands to be run on the remote host were never executed due to the disjoint authentication methods between client and server.

To establish communication between the client and server, the security settings of one (or both) partitions must be changed to include a common method. This is accomplished through PSSP administrative commands that either enable or disable AIX authentication methods.

Removing an authentication method from a partition. (SDR entry and nodes):

```
sp3en0/ # lsauthpar -p sp3en0
Kerberos 5
Kerberos 4
sp3en0/ # chauthpar -p sp3en0 k5
sp3en0/ # lsauthpar -p sp3en0
Kerberos 5
```

Adding an authentication method to a partition. (SDR entry and nodes):

```
sp3en0/ # lsauthpar -p sp3sp1
Kerberos 4
sp3en0/ # chauthpar -p sp3sp1 k5 k4
sp3n04: krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
sp3n06: krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
sp3en0/ # lsauthpar -p sp3sp1
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n04 "hostname ; lsauthent"
sp3n04
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n06 "hostname ; lsauthent"
sp3n06
Kerberos 5
Kerberos 4
```

Attempt to add an authentication method to a partition, but the required software to support the method is not installed:

```
sp3en0/ # lsauthpar -p sp3sp2
Kerberos 5
sp3en0/ # chauthpar -p sp3sp2 k5 k4
chauthpts: 0016-349 You cannot enable k4, because the partition has not been configured for
Kerberos V4 use.
sp3en0/ # lsauthpar -p sp3sp2
Kerberos 5
```

Enabling authentication methods requires that the required security software is already installed in the target partition. Note, however, that there are no such restrictions when disabling authentication methods that are already set.

In an environment where the software is not already installed for the partition, the attempt to set PSSP authentication methods for the partition will fail as shown. In the event of such a failure, refer to the *PSSP: Administration Guide*, SA22-7348, for the steps needed to install the required security code on the nodes, then rerun the command.

Likewise, in a coexistence environment where SP nodes include Version 3.2 and pre-3.2 PSSP levels, attempting to disable an AIX authentication method that is required to be compatible with previous levels of PSSP is not permitted as shown in the following example:

```
sp3en0/ # chauthpar -p sp3coexist k5 std
chauthpar: 2545-047 The set "k5:std" is not valid; k4 must be included since there is at
least one node in the partition running a
PSSP code level prior to 3.2.0.0.
```

8.11.6.2 Methods do not match system or partition level values

In the case of disjoint AIX authentication methods on one host only, the corrective action is for the SP administrator to bring that host's AIX authentication methods in line with the partition settings. This is accomplished through PSSP or AIX administrative commands in one of three ways:

Issue `chauthpar -f {methods list}` from the control workstation:

```
sp3en0/ # lsauthpar
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 4
sp3en0/ # chauthpar -f k5 k4
sp3n05: krshd: Kerberos 5 Authentication Failed: This server is not configured to support
Kerberos 5.
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
Kerberos 4
```

or rsh the `chauthent {methods list}` command to the host:

```
sp3en0/ # lsauthpar
Kerberos 5
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
Kerberos 4
sp3en0/ # rsh sp3n05 "chauthent -k5"
sp3en0/ # rsh sp3n05 lsauthent
Kerberos 5
```

or log in to the node, and issue the `chauthent {methods list}` command locally.

Except for logging in to the node, the PSSP commands needed to set AIX authentication methods locally are shown in the rsh portion of the previous example.

The first approach is the PSSP preferred synchronization method. The other approaches should be used under conditions where `chauthpar` fails.

However, should the chauthpar fail, the chances that the rsh approach will work are low, given that chauthpar exploits the PSSP `dsh` command, which, in turn, exploits `rsh`. If chauthpar fails due to an `rsh` failure, the `rsh` alone will most likely fail. (Issuing an individual `rsh` command to each host over which chauthpar will operate is an excellent way to help identify any problems with the state of AIX authentication method settings within the system.)

Given that chauthpar ultimately issues a chauthent on hosts for which the underlying `rsh` was successful, chauthpar and chauthent will experience a failure (will not set methods as requested) under the following conditions:

- /tmp is full (chauthent comments/uncomments rshd and rlogind entires in /etc/inetd.conf, based on the inclusion or absence of -std in chauthent, and uses /tmp to hold a copy of the file it has modified). The error message received is:

```
sp3en0/ # chauthent -k4 -std
chsubserver: error in updating /etc/inetd.conf
chsubserver: error in updating /etc/inetd.conf
```

- The required software for a method is not installed on the host:

```
sp3n09/ # chauthent -k5 -k4 -std
Kerberos 4 permitted on SP node only.
Kerberos 5 requires DCE version 2.2 or greater.
```

- The order of the methods is incorrect, or the methods are invalid:

```
sp3en0/ # chauthent -std -k5 -k4
Invalid authentication method or ordering of methods
```

When neither chauthpar nor rsh/chauthent are successful, logging in to the node and changing the methods locally is the only course of synchronization action, short of rebooting the node, and is less disruptive than rebooting a node. (Node login may take the form of telnet, rlogin, s1term (in write mode), ssh, or other processes that open a terminal session to a node.)

8.11.7 AIX and PSSP remote command debug tips/checklist

There are several general items that can be checked when debugging a failed remote command event. The following list includes items that may relate only to one protocol. For example, checking to see if DCE is running on the client and target hosts makes sense only for k5 processing.

While the majority of items focus on rsh and rcp specifically and, by extension, to dsh and pcp, the same techniques can be applied to other AIX remote commands and PSSP remote parallel commands:

- Ensure that the AIX authentication methods are set properly between the client and target hosts.
- Ensure that the authorization files are populated properly on the target host.
- Ensure that the user has valid credentials. Expired, destroyed, or non-existent credentials result in errors. The commands, `klist` (for DCE) and `k4list` (for Kerberos V4), should be used to determine that state of currently-held credentials.
- If AIX remote command daemons are started through inetd, check that inetd is running on the target host. Also, check the inetd configuration for statements relating to the remote command daemons to ensure that inetd has been configured to start the daemons. Further, use lssrc -t {subserver name} to determine if the remote command daemon is currently active on the remote host.
- If AIX remote command daemons are not usually started through inetd, check that they are running/active on the target host.
- Ensure that the DCE daemons on the target host are configured properly.
- Ensure that the DCE master servers are running and reachable from the client and target hosts.
- Ensure that the Kerberos V4 daemons are running and reachable from the client and target hosts.
- For k5 processing, ensure that /etc/krb5.conf contains one or more valid security server entries for the current cell.
- For k5 processing, ensure that the remote host's self-host principal key file contains entries for all adapters on the host. The key file is /krb5/v5srvtab.
- For k4 processing, ensure that /etc/krb.conf contains one or more valid Kerberos V4 server entries for the current realm.
- Ensure that the time skew between the client and target hosts is not greater than five minutes.
- Check the return code of the `rcp` or `rsh` command (via echo $?).
- Check environment variables that impact the behavior of PSSP remote commands and AIX remote commands. (When set incorrectly, the remote commands will fail.) In the absence of explicitly-set variables, ensure that default values are being retrieved properly from the environment. This

includes the variables, KRBTKFILE, KRB5CCNAME, SP_NAME, WCOLL, and K5MUTE.

- Ensure that entries in the authorization files do not end with blank spaces. That is, for any given entry in an authorization file (where one line equals an entry), that entry cannot have spaces after the final alphanumeric character. Functions that parse the authorization files attempt to match the contents of the file to a user's AIX or credentials ID. Blanks at the end of a line will not match the user data and will result in an authorization failure. The same is true when the line begins with leading blanks or spaces.
- A pound sign ("#") in the first column of an authorization file is treated as a comment.
- Check that the following files contain correct data: /etc/hosts, /etc/hosts.equiv, /etc/resolv.conf.

8.11.8 The .k5login file demystified

Consult the "Using a .k5login File" subsection of the “Customizing TCP/IP Features” chapter of the *AIX User's Guide: Communications and Networks* for a general explanation of the format of the entries that appear in a .k5login.

.k5login entries contain DCE principal/cell entries in Kerberos V5 format. The entries are not kept in DCE principal name format. Specifically, the entries are of the form, principal_name@cell_name, where principal_name is a DCE principal name and may include valid DCE principal characters, such as the slash ("/"), and where cell_name is the name of the cell to which the principal belongs.

For example, here are two DCE principal names in the ITSO DCE cell:

```
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3en0/self
...
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/dero
```

`klist` displays a DCE principal name in its *global* form, which means fully-qualified DCE names. Short-names and cell-relative representations are not shown.

Both principals in the above example are in the cell sp_cell. The name of the first principal is hosts/sp3en0/self, and the second principal is dero.

Their Kerberos V5 equivalent forms of the DCE principals are hosts/sp3en0/self@sp_cell and dero@sp_cell, respectively.

To generate a Kerberos V5 principal/cell form from a DCE Global Principal name, the following approach is valid. Everything after /.../{cell_name} is the principal_name. Everything between /.../ and the next / (slash) is the cell_name.

Here are some translation examples. The Global Principal names were taken from the results of the `dcecp -c` principal catalog command:

```
/.../sp_cell/ssp/sp3n13/sysctl                ssp/sp3n13/sysctl@sp_cell
/.../sp_cell/ssp/sp3n14/sysctl                ssp/sp3n13/sysctl@sp_cell
/.../sp_cell/itso1                            itso1@sp_cell
/.../sp_cell/host/sp3sw06.msc.itso.ibm.com    host/sp3sw06.msc.itso.ibm.com@sp_cell
/.../sp_cell/ftp/sp3sw06.msc.itso.ibm.com     ftp/sp3sw06.msc.itso.ibm.com@sp_cell
/.../sp_cell/hosts/sp3n16.msc.itso.ibm.com/self   hosts/sp3n16.msc.itso.ibm.com/self@sp_cell
```

The DCE `klist` command also displays the Kerberos V5 form of the current DCE identity. It is the `Default principal:` line in the output.

```
sp3en0/ #  klist
DCE Identity Information:
...
        Global Principal: /.../sp_cell/dero
...
Ticket cache: /opt/dcelocal/var/security/creds/dcecred_64d85300
Default principal: dero@sp_cell
Server: krbtgt/sp_cell@sp_cell
...
```

Keep in mind that the .k5login file should only contain DCE principal/cell entries that have the ability to issue remote commands and for which remote command authorization should be granted. .k5login is, after all, an access control list (ACL). Placing an entry in this file grants that particular identity access to your account.

The PSSP installation and configuration and subsequent PSSP Systems Management routines give the SP administrator the ability to generate the .k5login file for root. When the administrator elects to have PSSP services generate root's .k5login file, it will populate the file with all the self-host principal entries found in the DCE Registry that also correspond to nodes in the SP where DCE is installed and configured, plus an entry for each node instance of the PSSP DCE principal spbgroot. PSSP doesn't just add all self-host entries found in the DCE Registry, since there are likely to be self-host entries for non-SP hosts in the same DCE cell. Furthermore, if a .k5login file exists for root at the time PSSP routines are requested to generate a root level .k5login file, PSSP preserves existing entries in the file and only adds SP-related entries that do not exist in the file.

Example of a PSSP-generated .k5login for root on the control workstation:

```
sp3en0/ # cat .k5login
hosts/sp3en0/self@sp_cell
ssp/sp3en0/spbgroot@sp_cell
hosts/sp3n01/self@sp_cell
ssp/sp3n01/spbgroot@sp_cell
hosts/sp3n05/self@sp_cell
ssp/sp3n05/spbgroot@sp_cell
hosts/sp3n06/self@sp_cell
ssp/sp3n06/spbgroot@sp_cell
...
```

For sites that support intercell communication (two or more DCE cells that are registered with one another) and want to exploit k5 remote command support between their DCE cells, administrators must manually add intercell principals to root's .k5login where desired. Given that all nodes in an SP that are configured for PSSP DCE Trusted Services *must* be configured into the same DCE cell, including the control workstation's DCE configuration, PSSP code has no way of determining which principals from foreign DCE cells are valid for inclusion in root's .k5login file. (Doing anything else could introduce security exposures.)

8.11.9 Zero length authorization files

A 0 (zero) length AIX remote command authorization file has the net effect of denying access to any user, even if the user's AIX ID is the same on both the source and target hosts, and/or the user's Kerberos V4 or DCE principal credential identities are the same as the AIX user ID. Note that telnet and rlogin requests under this condition prompt for the user ID and password.

Keep in mind that AIX remote command authorization files are access control lists (ACLs); so, it makes perfect sense to refuse remote command requests when the authorization files are 0 length or to prompt for a user ID and password even when the AIX ID is the same on both the source and target hosts. (For details on how AIX grants remote command access for the k5 and std protocols, refer to the following AIX documentation: *AIX Commands Reference V4.3*, SBOF-1877, for the `rsh` command and the krshd and rshd daemons; the *AIX V4.3 Technical Reference*, SBOF-1878, for the kvalid_user Subroutine.)

The following examples demonstrate how 0 length authorization files impact rsh processing. In all cases, both the source (client) host and target host have the following AIX authentication methods enabled: k5, k4, and std. (The same type of results are produced when only one or two methods are enabled.) The non-root AIX user, dero, exists on both the source and target hosts, and even though a non-root user was chosen for the examples, the same rules apply to a root user. However, since root has access to the special DCE self-host credentials, a non-existent or 0 length .k5login file will generate an authorization failure instead of a *kerberos:...No credentials cache file found* error message.

The first four examples reveal the behavior of rsh when the authorization files do not exist. This provides a baseline for the examples where the authorization files are 0 length:

```
sp3n06/u/dero/ # ls .k5login ; ls .klogin ; ls .rhosts
ls: 0653-341 The file .k5login does not exist.
ls: 0653-341 The file .klogin does not exist.
ls: 0653-341 The file .rhosts does not exist.
```

dero doesn't have DCE or Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist ; k4list
No DCE identity available: No currently established network identity for this context exists
(dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_36586)
Ticket file:    /tmp/tkt36586
k4list: 2504-076 Kerberos V4 ticket file was not found

sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.
```

The first two error messages are expected, given that the user lacks DCE and Kerberos V4 credentials. These errors have nothing to do with the state of the .k5login and .klogin files.

The rshd failure message is due to the absence of a .rhosts file.

dero has valid DCE credentials, but no Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero1
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # rsh sp3n08 date
krshd: Kerberos Authentication Failed: User dero1@sp_cell is not authorized to login to
account dero.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.
```

The dero1@sp_cell authorization failure is expected. The user has valid DCE credentials, but when krshd attempts to authorize the user, the authorization fails due to the absence of the authorization file, and the fact that the DCE principal name (ID) doesn't match the AIX user name (ID).

The second failure is due to the user's lack of Kerberos V4 credentials. This error has nothing to do with the state of the .klogin file.

The rshd failure message is due to the absence of a .rhosts file.

dero has valid DCE and Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero1
Principal:      dero1@ITSO.IBM.COM
sp3n06/u/dero/ # rsh sp3n08 date
krshd: Kerberos Authentication Failed: User dero1@sp_cell is not authorized to login to
account dero.
krshd: Kerberos Authentication Failed: User dero1.@ITSO.IBM.COM is not authorized to login
to account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
rshd: 0826-813 Permission is denied.
```

The dero1@sp_cell authorization failure is expected. The user has valid DCE credentials, but when krshd attempts to authorize the user, the authorization fails due to the absence of the authorization file, and the fact that the DCE principal name (ID) doesn't match the AIX user name (ID). The situation is the same for the k4 attempt.

The rshd failure message is due to the absence of a .rhosts file.

dero has valid DCE and Kerberos V4 credentials, and the name of the principal in the credentials matches that of the AIX user ID (dero):

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero
Principal:      dero@ITSO.IBM.COM
sp3n06/u/dero/ # rsh sp3n08 date
Tue Feb 22 15:36:41 EST 2000
sp3n06/u/dero/ # kdestroy
sp3n06/u/dero/ # klist | grep lob
klist: No credentials cache file found (dce / krb) (ticket cache
/opt/dcelocal/var/security/creds/dcecred_b12cbb00)
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
Tue Feb 22 15:34:31 EST 2000
```

The first rsh is successful because the DCE principal name matches the name of the AIX ID. After the DCE credentials are destroyed (kdestroy), the second rsh attempt is successful because the Kerberos V4 principal name matches the name of the AIX ID.

The next four examples reveal the behavior of rsh when the authorization files are 0 length.

```
sp3n06/u/dero/ # touch .k5login ; touch .klogin ; touch .rhosts
sp3n06/u/dero/ # ls -l .k5login ; ls -l .klogin ; ls -l .rhosts
-rw-r--r--   1 dero     usr            0 Feb 15 2000  .k5login
-rw-r--r--   1 dero     usr            0 Feb 15 2000  .klogin
-rw-r--r--   1 dero     usr            0 Feb 15 2000  .rhosts
```

1. dero doesn't have DCE or Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_36586)
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.
```

The first two error messages are expected, given that the user lacks DCE and Kerberos V4 credentials. These errors have nothing to do with the state of the .k5login and .klogin files.

The rshd error is an authorization failure from the std protocol, because the .rhosts file is 0 (zero) length.

2. dero has valid DCE credentials, but no Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero1
k4list: 2504-076 Kerberos V4 ticket file was not found
sp3n06/u/dero/ # rsh sp3n08 date
krshd: Kerberos Authentication Failed: User dero1@sp_cell is not authorized to login to
account dero.
spk4rsh: 0041-003 No tickets file found.  You need to run "k4init".
rshd: 0826-813 Permission is denied.
```

The dero1@sp_cell authorization failure is expected. The user has valid DCE credentials, but the .k5login file is 0 (zero) length; so, when krshd attempts to authorize the user, the authorization fails due to the *no match found* condition.

The spk4rsh error is expected because the user lacks Kerberos V4 credentials. This error has nothing to do with the state of the .klogin file.

The rshd error is an authorization failure from the std protocol because the .rhosts file is 0 (zero) length.

3. dero has valid DCE and Kerberos V4 credentials:

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero1
Principal:      dero@ITSO.IBM.COM
sp3n06/u/dero/ # rsh sp3n08 date
krshd: Kerberos Authentication Failed: User dero1@sp_cell is not authorized to login to
account dero.
krshd: Kerberos Authentication Failed: User dero.@ITSO.IBM.COM is not authorized to login
to account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
rshd: 0826-813 Permission is denied.
```

The dero1@sp_cell authorization failure is expected. The user has valid DCE credentials, but the .k5login file is 0 (zero) length; so, when krshd attempts to authorize the user, the authorization fails due to the *no match found* condition. Likewise, for the k4 attempt.

The rshd error is an authorization failure from the std protocol because the .rhosts file is 0 (zero) length.

4. dero has valid DCE and Kerberos V4 credentials, and the name of the principal in the credentials matches that of the AIX user ID (dero):

```
sp3n06/u/dero/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero
Principal:      dero@ITSO.IBM.COM
sp3n06/u/dero/ # rsh sp3n08 date
krshd: Kerberos Authentication Failed: User dero@sp_cell is not authorized to login to
account dero.
krshd: Kerberos Authentication Failed: User dero.@ITSO.IBM.COM is not authorized to login to
account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
rshd: 0826-813 Permission is denied.
```

Even though the principal name in the credentials matches that of the AIX user ID, authorization is denied due to the 0 (zero) length .k5login and .klogin files.

The rshd error is an authorization failure from the std protocol because the .rhosts file is 0 (zero) length.

PSSP scripts that allow the SP administrator to create AIX remote command authorization files for root do not create 0 length files under normal conditions. Remote commands are an important part of PSSP, and having 0 length authorization files for root would seriously impact the administrator's ability to manage and maintain an SP.

Once a host's authorization files are set to 0 length the SP administrator can still telnet or rlogin to the host to reset the authorization files, provided the correct root user ID and password are supplied.

8.11.10 Using s1term to log in to a node

There are two states related to AIX remote command processing that will prevent the root user (and other users) from accessing a node through remote commands. One: There are no AIX authentication methods set on the node. Two: The user's authorization files are all 0 (zero) length.

Depending on the type of remote command used (`rsh`, `telnet`, `ftp`, and so on), the error message relating to the aforementioned states is different.

No AIX authentication methods are set on the node.

```
sp3en0/ # rsh sp3n05 date
sp3n05: A remote host refused an attempted connect operation.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
sp3n05: A remote host refused an attempted connect operation.

sp3en0/ # rlogin sp3n05
sp3n05: A remote host refused an attempted connect operation.

sp3en0/ # telnet sp3n05
Trying...
Connected to sp3n05
Escape character is '^]'.
telnetd: No authentication methods enabled.
Connection closed.
```

The corrective action is as follows: As root, on the control workstation, open up an s1term session in write mode to the node. Log in to the node and issue `chauthent` with the needed AIX authentication methods.

However, in order to issue `s1term` successfully, the SP administrator must be conscious of the Trusted Services authentication methods settings of the control workstation.

In the first sequence, a root user running in a dce-only security mode attempts to use s1term in write mode but is denied due to a lack of DCE group membership in the PSSP DCE group, hm-control.

After the cell administrator adds the DCE principal to the needed group, the user must destroy and create new DCE credentials in order to reflect the new membership. In the case of a root user holding the DCE self-host principal credentials, that is, the DCE machine principal context/identity, DCE (or just its security client, sec_cl) must be stopped and then started on the host (node or control workstation) for the self-host principal's credentials to reflect the new group membership. (User membership in DCE groups is reflected through the user's DCE credentials and is considered part of the user's ticket privilege attributes. The credentials, also called tickets, can only reflect group memberships that were in place at the time the user's credentials were created. Any group associations established after user credentials were generated will not be reflected until new credentials are created. For more information on DCE credentials (tickets) and their privilege attributes, refer to Chapter 31. Creating and Maintaining Accounts, subsection "Displaying Privilege Attributes and Tickets" of the *IBM DCE Version 3.1 for AIX and Solaris: Administration Guide -- Core Components*.

Once this takes place, the user can then *s1term* out to a node in write mode and change the AIX authentication methods accordingly:

```
sp3en0/ # whoami ; klist | grep lob
root
        Global Principal: /.../sp_cell/dero
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # dcecp -c prin show dero | grep groups
{groups spsec-admin sdr-admin}
```

As a cell administrator, add the DCE principal dero to the hm-control group:

```
sp3en0/ # dcecp -c group list hm-control
/.../sp_cell/sp_admin
sp3en0/ # dcecp -c group add hm-control -member dero

sp3en0/ # dcecp -c group list hm-control
/.../sp_cell/sp_admin
/.../sp_cell/dero
```

As the DCE principal dero, the command still fails, even though dero was added to the hm-control group. The user must destroy the current credentials and create new ones:

```
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # kdestroy ; exit
sp3en0/ # dce_login dero
...
DCE LOGIN SUCCESSFUL
...
sp3en0/ # s1term -w 1 5
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
...
sp3n05/ # chauthent -k5 -k4 -std
sp3n05/ #
```

In the second sequence, a non-root user running in a dce:compat security mode attempts to use s1term (in write mode), but is denied because the user’s DCE principal is not a member of the PSSP DCE P group, hm-control, nor is the user’s Kerberos V4 principal in the hmacls file. After the SP administrator adds the user's Kerberos V4 principal to hmacls and issues the `hmadm setacls` command, the user can issue `s1term` successfully. Note that the non-root user’s DCE principal membership has not changed.

```
sp3en0/ # whoami
dero
sp3en0/ # s1term -w 1 5
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0/ # klist | grep lob ; k4list | grep pal:
        Global Principal: /.../sp_cell/dero3
Principal:      dero-sec@ITSO.IBM.COM
sp3en0/ # dcecp -c prin show dero3 | grep groups
{groups test-grp}
sp3en0/ # grep dero-sec /spdata/sys1/spmon/hmacls
# echo $?
1
```

root adds the dero-sec principal to the hmacls file (writable by root only) and then issues `hmadm setacls` to update the Hardmon daemon's internal ACL table:

```
sp3en0/ # grep dero-sec /spdata/sys1/spmon/hmacls
1 dero-sec s
sp3en0/ # ls -l /usr/lpp/ssp/bin/hmadm
-r-xr-xr-x   1 bin      bin        31176 Dec 14 10:54 /usr/lpp/ssp/bin/hmadm
sp3en0/ # hmadm setacls
hmadm: 0026-641I The ADMIN command "setacls" was sent.
sp3en0/ # s1term -w 1 5
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
...
```

In the above example, the principal is added to hmacls with a persmission of s, the ability to read and write to a serial port (s1term). (There are other hmacls permissions. Refer to the *PSSP: Administration Guide*, SA22-7348, for complete details.) Since hmacls is a file that only root can update, an SP administrator (or other root user) must make the needed changes.

Once hmacls is updated, the `hmadm setacls` command must be invoked so that the Hardmon daemon's internal ACL tables are updated to reflect the new hmacls entry. If this step is omitted, the daemon's tables will not be updated, and the user will not be able to issue s1term. However, to run hmadm with the setacls operand, the issuer of hmadm must have Kerberos V4 administrator credentials. (hmadm can be invoked by any user, but to run it with setacls requires a specific level of authorization - a Kerberos V4 administrative identity. The Kerberos V4 administrator ID is the ID defined as the primary authentication services administrator by the `setup_authent` command during compat installation and configuration. In this case, it was root.admin. Refer to the PSSP installation and administration guides for complete details.)

In this scenario, the administrative duties required both AIX root level authority and Kerberos V 4 administrative authority. SP administrators may be one in the same. The same concept applies to SP administrators and DCE controls. Manipulating DCE organization, group, and ACL memberships requires varying degrees of DCE cell administration authority, while doing other SP administrative tasks, such as issuing the AIX command, `startsrc`, requires root authority. The SP administrator can be a DCE administrator or have his/her DCE principal granted the necessary DCE administrative authority for PSSP DCE controls. Or, perhaps, the DCE cell administrator is an individual other than an SP administrator.

0 (zero) Length Remote Command Authorization Files:

```
sp3en0/ # sp3n05 date
krshd: Kerberos Authentication Failed: User hosts/sp3en0/self@sp_cell is not authorized to
login to account root.
krshd: Kerberos Authentication Failed: User root.admin@ITSO.IBM.COM is not authorized to
login to account root.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
rshd: 0826-813 Permission is denied.

sp3en0/ # rlogin sp3n05
krlogind: Kerberos Authentication Failed: User hosts/sp3en0/self@sp_cell is not authorized
to login to account root.
root's Password:
Connection closed.

sp3en0/ # telnet sp3n05
Trying...
Connected to sp3n05
Escape character is '^]'.
[ Kerberos V5 refuses authentication because hosts/sp3en0/self@sp_cell ]
...
telnet (sp3n05)
...
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
```

Perform the following corrective action: Telnet into the node and restore the files to their required states. The PSSP command, `updauthfiles`, can be used to populate the authorization files with PSSP-required entries.

8.11.11 The AIX K5MUTE variable

AIX provides the K5MUTE environment variable to suppress remote command protocol error messages. (Messages written by rsh, rcp, telnet, and so on to stderr.) When K5MUTE is set to a value other than 1 (one) or when K5MUTE is not set, all protocol error messages encountered are displayed.

When K5MUTE is set to 1, protocol error messages are suppressed provided that at least one protocol attempt is successful. If all protocol attempts fail when K5MUTE is set to 1, the user receives all error messages. (This information is useful for troubleshooting.)

Note

By default, AIX does not set K5MUTE in a user's shell environment.

K5MUTE behaves the same way for both root and non-root users.

At least one protocol is successful with K5MUTE not set - K5MUTE set to a value other than 1:

```
sp3n06/u/dero/ # env K5MUTE
K5MUTE: A file or directory in the path name does not exist.
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
krshd: Kerberos Authentication Failed: User dero.@ITSO.IBM.COM is not authorized to login
to account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
Tue Feb 22 15:55:18 EST 2000
sp3n06/u/dero/ # export K5MUTE=0 ; env K5MUTE
0
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
krshd: Kerberos Authentication Failed: User dero.@ITSO.IBM.COM is not authorized to login
to account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
Tue Feb 22 15:55:44 EST 2000
```

K5MUTE set to a value of 1, and at least one protocol is successful:

```
sp3n06/u/dero/ # env K5MUTE
K5MUTE: A file or directory in the path name does not exist.
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
krshd: Kerberos Authentication Failed: User dero.@ITSO.IBM.COM is not authorized to login
to account dero.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: rcmd protocol failure.
Tue Feb 22 15:55:18 EST 2000
sp3n06/u/dero/ # export K5MUTE=1 ; env K5MUTE
1
sp3n06/u/dero/ # rsh sp3n08 date
Tue Feb 22 15:57:14 EST 2000
```

Protocol attempts are not successful, and K5MUTE is set to a value of 0 or a value of 1.

```
sp3n06/u/dero/ # export K5MUTE=0
sp3n06/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
rshd: 0826-813 Permission is denied.
sp3n06/u/dero/ # export K5MUTE=1
sp3n06/u/dero/ # rsh sp3n08 date
rshd: 0826-813 Permission is denied.
kerberos: Couldn't get credentials for the server: No credentials cache file found.
spk4rsh: 0041-011 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired:.
```

8.11.11.1 Separating protocol messages using dshbak

The following is an example of the results of a single dsh execution in an SP environment running with multiple partitions at different AIX authentication method levels and various coexistence hosts running with previous levels of AIX and PSSP.

The results shown are normal. There are no problems with dsh, rsh, DCE, AIX, or PSSP. In fact, the reason all these messages exist is the fact that all the different aspects of AIX authentication methods are occurring at once.

The example actually could have appeared worse had dshbak -c not been used in conjunction with dsh. Due to the nature of piping, all the errors from dsh are directed to stderr (standard error) and appear ahead of and out of the stream of the dshbak-filtered results. In short, all the errors come first, then all the non-errors appear in their collected form at *the end*. Had the filter not been used, the non-error results would have been nestled in with all the error results.

Of course, the K5MUTE variable could have been set to suppress error messages when at least one protocol attempt to a host was successful. But keep in mind that when all protocol attempts to a host fail, all error messages are returned to the user. Using the dshbak -c filter is a good choice even when K5MUTE is set to suppress error messages.

The dsh was issued from the control workstation by an SP administrator to all the nodes in all partitions.

```
sp3en0/ # dsh -D -avG "chauthent -k5 -k4 -std ; lsauthent" | dshbak -c
sp3n11: kerberos: Couldn't get credentials for the server: Server not found in
Kerberos database.
sp3n11: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
sp3n11: Kerberos 4 permitted on SP node only.
sp3n11: Kerberos 5 requires DCE version 2.2 or greater.
sp3n12: kerberos: Couldn't get credentials for the server: Server not found in
Kerberos database.
sp3n12: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
sp3n12: rshd: 0826-813 Permission is denied.
sp3n15: kerberos: Couldn't get credentials for the server: Server not found in
Kerberos database.
sp3n15: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
sp3n15: rshd: 0826-813 Permission is denied.
...
sp3n05: kerberos: Couldn't get credentials for the server: Server not found in
Kerberos database.
sp3n05: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
sp3n05: ksh: chauthent:  not found.
sp3n05: ksh: lsauthent:  not found.
sp3n06: kerberos: Couldn't get credentials for the server: Server not found in
Kerberos database.
...
sp3n10: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
...
sp3n13: spk4rsh: 0041-004 Kerberos rcmd failed: 2504-032 Kerberos ticket expired.
dsh:  5025-509 sp3n13 rsh had exit code 1
...
dsh:  5025-509 sp3n15 rsh had exit code 1
dsh:  5025-509 sp3n12 rsh had exit code 1
HOSTS --------------------------------------------------------------------------
sp3n11 sp3n12 sp3n15 sp3n09
--------------------------------------------------------------------------------
Kerberos 5
Kerberos 4
Standard Aix

HOSTS --------------------------------------------------------------------------
sp3n01 sp3n06 sp3n11
--------------------------------------------------------------------------------
Kerberos 4
Standard Aix
```

```
sp3en0/ # dsh -avG "lsauthent" | dshbak -c
sp3n09: krshd: Kerberos Authentication Failed: User sp_admin@sp_cell is not authorized to
login to account root.
sp3n09: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n11: kerberos: Couldn't authenticate to the server: A connection is ended by software..
sp3n11: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n11: rshd: 0826-813 Permission is denied.
sp3n01: krshd: Kerberos Authentication Failed: User sp_admin@sp_cell is not authorized to
login to account root.
sp3n01: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n02: krshd: Kerberos Authentication Failed: User sp_admin@sp_cell is not authorized to
login to account root.
sp3n02: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n05: kerberos: Couldn't authenticate to the server: Bad sendauth version was sent.
sp3n05: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n05: ksh: lsauthent:  not found.
sp3n04: kerberos: Couldn't get credentials for the server: Server not found in Kerberos
database.
sp3n04: spk4rsh: 0041-004 Kerberos V4 rcmd failed: 2504-032 Kerberos V4 ticket expired.
sp3n04: rshd: 0826-813 Permission is denied.
...
dsh:  5025-509 sp3n04 rsh had exit code 1
dsh:  5025-509 sp3n11 rsh had exit code 1
HOSTS -------------------------------------------------------------------------
sp3n01 sp3n08 sp3n09
...
-------------------------------------------------------------------------------
Kerberos 5
Kerberos 4
Standard Aix

HOSTS -------------------------------------------------------------------------
sp3n10 sp3n12
-------------------------------------------------------------------------------
Kerberos 4
Standard Aix

HOSTS -------------------------------------------------------------------------
sp3n16
-------------------------------------------------------------------------------
Kerberos 5
Standard Aix
```

8.11.12 Additional DCE/k5 AIX remote errors

The remainder of this section contains various AIX rsh protocol error messages and recommended corrective actions related to DCE/k5. (Similar errors would be generated for the remaining remote commands.) Keep in mind that the corrective actions are general recovery recommendations. Your site's policy and procedures should be considered before applying any of the recommendations.

Remote command examples that appeared earlier in this section are not repeated here. Likewise, impacts to rsh commands related to credentials states, time skew between hosts, and file-system-full problems are presented in other sections of this chapter and not repeated here. (These sections also contain Kerberos V4 remote command errors.)

8.11.12.1 Server not found

The following screen shows the *Server not found* error message:

```
sp3en0/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: Server not found in Kerberos database.
...
sp3en0/ # klist | grep sp3n08
sp3en0/ #
```

Table 19 lists the possible causes of the *Server not found* error message and the corrective actions to be taken.

Table 19. Causes and corrective actions for the “Server not found” message

Possible causes	Corrective actions
The target host does not appear in the DCE database. The client could not obtain a service ticket for the host.	Run the DCE administrative configuration for the host, followed by the DCE local configuration on the target host. Enable the AIX k5 method on the target host. See the DCE Administration Commands Reference for the config.dce command, the *AIX Commands Reference* for the `chauthent` command, and the *PSSP: Command and Technical Reference*, SA22-7351 for the `chauthpar` command.

8.11.12.2 Connection is ended by software

The following screen shows the *Connection is ended by software* error message:

```
sp3en0/ # rsh sp3n08 date
kerberos: Couldn't authenticate to the server: A connection is ended by software..
...
sp3en0/ # klist | grep sp3n08
Server: host/sp3n08@sp_cell
```

Table 20 lists the possible causes of the *Connection is ended by software* message and the corrective actions to be taken.

Table 20. Causes and corrective actions for the "Connection ended by software" message

Possible cause	Corrective action
The target host appears in the DCE database but does not have DCE configured locally or k5 enabled. The client obtained a service ticket for the host.	Run DCE local configuration on the target host. Enable the AIX k5 method on the target host. See the DCE Administration Commands Reference for the config.dce command, the AIX Commands Reference for the chauthent command, and the *PSSP: Command and Technical Reference*, SA22-7351, for the chauthpar command.
The target host's DCE configuration is incomplete; specifically, the DCE Security client is only partially configured.	Correct the problem that prevented the DCE Security client from configuring and then complete the local portion of the DCE client configuration. See the *DCE Problem Determination Guide*.
DCE is installed, configured, and running on the target host, but its self-host key file, /krb5/v5srvtab, is missing.	Restore the DCE host's /krb5/v5srvtab from the most recent backup. If the key file cannot be restored from a recent backup, the DCE client must be unconfigured (local and administrative), then reconfigured (local and administrative).

Note

If PSSP DCE services were installed and configured on the host then PSSP DCE services must be unconfigured and reconfigured for the host via rm_spsec. Refer to the *PSSP: Administration Guide*, SA22-7348, and the *PSSP: Command and Technical Reference*, SA22-7351, for details.

8.11.12.3 Bad sendauth

The following screen shows the *Bad sendauth* error message:

```
sp3en0/ # rsh sp3n08 date
kerberos: Couldn't authenticate to the server: Bad sendauth version was sent.
...
```

Table 21 lists the possible causes of the *Bad sendauth* error message and the corrective actions to be taken.

Table 21. Causes and corrective actions for the "Bad sendauth" message

Possible causes	Corrective actions
The target host appears in the DCE database, has DCE installed, but not configured, and the k5 method is enabled. (AIX allows the k5 method to be enabled, provided that the needed DCE file sets are installed on the host. AIX does not determine whether or not DCE is actually configured or running before allowing k5 to be enabled.)	Disable the k5 authentication method on the target host; run the DCE local configuration on the target host, and then enable the AIX k5 method. Or, disable the k5 method if DCE is not to be configured on the host. See the *DCE Administration Commands Reference* for the `config.dce` command, the *AIX Commands Reference* for the `chauthent` command, and the *PSSP: Command and Technical Reference*, SA22-7351, for the `chauthpar` command.
The target host's /etc/krb5.conf file does not exist or is invalid.	As root on the target host, issue the DCE commands, `kerberos.dce -type local` and `dcecp -c secval krb5update -cellname {cellname}`. Refer to the *DCE Administration Commands Reference* for the `kerberos.dce` and `dcecp secval` commands.

8.11.12.4 Server not configured for Kerberos 5

The following screen shows a *Server not configured for Kerberos 5* error message:

```
sp3en0/ # rsh sp3n08 date
krshd: Kerberos 5 Authentication Failed: This server is not configured to support Kerberos
5.
...
```

Table 22 lists the possible causes of the *Server not configured for Kerberos 5* error message and the corrective actions to be taken.

Table 22. Causes and corrective actions for the "Server not configured for Kerberos 5" message

Possible causes	Corrective actions
The target host appears in the DCE database and has DCE installed, configured, and running, but the k5 method is not enabled.	Enable the k5 authentication method on the target host. See the *AIX Commands Reference* for the `chauthent` command and the *PSSP: Command and Technical Reference*, SA22-7351, for the `chauthpar` command.
The target host does not have k5 enabled, and the DCE client services are not running.	Start DCE and then enable the k5 authentication method on the target host. See the *DCE Administration Commands Reference*, the *AIX Commands Reference* for the `chauthent` command, and the *PSSP: Command and Technical Reference*, SA22-7351, for the `chauthpar` command.

8.11.12.5 Error code 60 - Key version

The following screen shows the *Error code 60* error message:

```
sp3en0/ # rsh sp3n08 date
kerberos: Couldn't authenticate to the server: Server rejected authentication (during sendauth exchange).
kerberos: Server returned error code 60 (Generic error (see e-text)).
kerberos: Error text sent from the server Key version number for principal in key table is
incorrect.
...
```

Table 23 lists possible causes of the *Error code 60* error message and the corrective actions to be taken.

Table 23. Causes and corrective actions for the "Error code 60" message

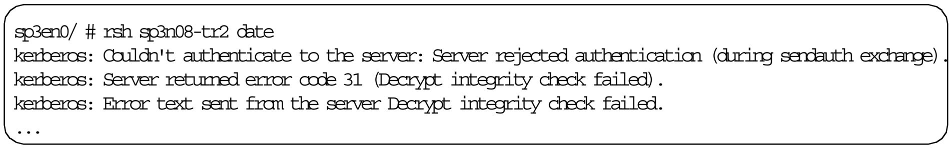
Possible cause	Corrective action
The administrative DCE client configuration was reexecuted for an already configured DCE host.	The DCE client must be unconfigured locally only, then reconfigured locally. See the DCE *Administration Commands Reference* for the `unconfig.dce` command.

Note

If PSSP DCE services were installed and configured on the host then PSSP DCE services must be unconfigured and reconfigured for the host via rm_spsec. Refer to the PSSP *Administration Guide* and *Command and Technical Reference* for details.

8.11.12.6 Error code 31 - integrity check failed

The following screen shows the *Error code 31 - integrity check failed* error message:



```
sp3en0/ # rsh sp3n08-tr2 date
kerberos: Couldn't authenticate to the server: Server rejected authentication (during sendauth exchange).
kerberos: Server returned error code 31 (Decrypt integrity check failed).
kerberos: Error text sent from the server Decrypt integrity check failed.
...
```

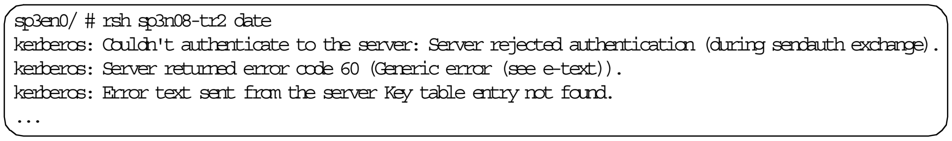
Table 24 lists the possible causes of the *Error code 31 - integrity check failed* error message and the corrective actions to be taken.

Table 24. Causes and corrective actions for the "Error code 31 - integrity check failed" message

Possible causes	Corrective actions
A network interface adapter was added to a host after the host had been configured with DCE and enabled with k5, and neither the DCE administrative nor local configuration routines were run for the interface.	The DCE cell administrator must run the DCE `kerberos.dce -type admin` command for the interface; then, root on the target host must issue the DCE command, `kerberos.dce -type local`. This will create the needed entries in the DCE Registry and the target host's /krb5/v5srvtab, respectively. Refer to the *DCE Administration Commands Reference* for the `kerberos.dce` command.

8.11.12.7 Error code 60 - Key table

The following screen shows the *Server returned error code 60* error message:



```
sp3en0/ # rsh sp3n08-tr2 date
kerberos: Couldn't authenticate to the server: Server rejected authentication (during sendauth exchange).
kerberos: Server returned error code 60 (Generic error (see e-text)).
kerberos: Error text sent from the server Key table entry not found.
...
```

Table 25 lists the possible causes of the *error code 60* error message and the corrective actions to be taken.

Table 25. Causes and corrective actions for the "error code 60" message

Possible causes	Corrective actions
A network interface adapter was added to a host after the host had been configured with DCE and enabled with k5, but only the administrative portion of the DCE configuration for the interface was completed. (The sp3n08-tr2 hostname appears in the DCE database, but doesn't exist in the target host's self-host (/krb5/v5srvtab) key file.)	As root on the target host issue the DCE command "kerberos.dce -type local". This will create the needed entries in /krb5/v5srvtab. Refer to the DCE *Administration Commands Reference* for the kerberos.dce command.

8.11.12.8 Cannot contact KDC

The following screen shows a *Cannot contact any KDC* error message:

```
sp3en0/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: Cannot contact any KDC for requested realm.
...
```

Table 26 lists the possible causes of the *Cannot contact any KDC* message and the corrective actions to be taken.

Table 26. Causes and corrective actions for the "Cannot contact any KDC" message

Possible causes	Corrective actions
The DCE /etc/krb5.conf file on the client's DCE host doesn't exist or doesn't contain a valid DCE Security server entry.	As root on the client host issue the DCE commands, `kerberos.dce -type local` and `dcecp -c secval krb5update -cellname {cellname}`. Refer to the *DCE Administration Commands Reference* for the `kerberos.dce` and `dcecp secval` commands.
The DCE Security server referenced in the client host's /etc/krb5.conf is not running.	Start the needed DCE Security server. Refer to the *DCE Administration Commands Reference* for the `start.dce` command.

8.11.12.9 Connect operation refused

The following screen shows a *connect operation refused* error message:

```
sp3en0/ # rsh sp3n08 date
sp3n08: A remote host refused an attempted connect operation.
...
```

Table 27 lists the possible causes of a *connect operation refused* message and the corrective actions to be taken.

Table 27. Causes and corrective actions for a “connect operation refused” message

Possible causes	Corrective actions
The target host's AIX krshd daemon is not running.	Start the krshd daemon on the target host. The krshd daemon is usually registered with AIX's System Resource Controller (SRC) with a service name of *kshell* and controlled by the super daemon, inetd. Verify that the inetd daemon is functioning properly and has a definition for kshell in its /etc/inetd.conf file. When krshd is controlled by inetd, krshd is considered a subserver. This distinction is important because a subserver requires the use of the *-t* flag in `startsrc`, `stopsrc`, and `lssrc` commands, versus the commonly used *-s* flag, which stands for subsystems. (As in `stopsrc -s sysctld`; `startsrc -s sysctld`; `lssrc -s sysctld`.) Refer to the *AIX Commands Reference* for details on the SRC commands, inetd, krshd, and /etc/inetd.conf.
The target host's AIX operating system or TCP/IP subsystems are experiencing problems.	Run your site's operating system and TCP/IP subsystem diagnostic and recovery procedures on the target host.
There are no AIX authentication methods enabled on the remote host.	As root on the target host enable the correct set of AIX authentication methods. Refer to the AIX *Commands Reference* for the chauthent command and the PSSP *Command and Technical Reference* for the chauthpar command.

8.11.12.10 Matching credential not found

The following screen shows a *Matching credential not found* error message:

```
sp3en0/u/dero/ # rsh sp3n08 date
kerberos: Couldn't get credentials for the server: Matching credential not found.
...
```

Possible cause(s) - The user issued a DCE `kinit` command instead of a dce_login, and provided the incorrect password for the DCE user ID, as shown in the following screen:

```
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
klist: No credentials cache file found (dce / krb) (ticket cache /tmp/krb5cc_36586)
sp3en0/u/dero/ # kinit dero
Enter Password:
kinit: Client not found in Kerberos database (dce / krb) while getting initial credentials
sp3en0/u/dero/ # klist
No DCE identity available: No currently established network identity for this context
exists (dce / sec)

Kerberos Ticket Information:
Ticket cache: /tmp/krb5cc_36586
Default principal: dero@sp_cell
```

Corrective action(s) - Issue the DCE `kdestroy` command, and then issue `dce_login` with the needed principal. Refer to the *DCE Administration Commands Reference* for the `kdestroy` and `dce_login` commands.

`kinit` results in an error when issued by a root user holding DCE self-host principal credentials:

```
sp3en0/ # whoami
root
sp3en0/ # env KRB5CCNAME
KRB5CCNAME: A file or directory in the path name does not exist.
sp3en0/ # klist | grep lob
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # kinit fvt_admin
Can't change existing principal information with kinit
Current information is for /.../sp_cell/hosts/sp3en0/self
```

8.11.12.11 Error getting forwardable credentials

The following screen shows the *Error getting forwardable credentials* error message:

```
sp3en0/ # rsh sp3n08 -f date
kerberos: Error getting forwardable credentials.
...
```

Table 28 lists the possible causes of the *Error getting forwardable credentials* message and the corrective actions to be taken.

Table 28. Causes and corrective actions for an "Error getting forwardable credentials" message

Possible causes	Corrective actions
The user's DCE credentials are not marked forwardable. The -f or -F flag on AIX remote commands requests that the credentials be marked forwardable.	Issue the DCE `kinit -f` command to obtain DCE credentials that can be forwarded. Note that the DCE self-host principal's credentials are not permitted to be forwardable by design. Also, for a user to obtain credentials marked forwardable, the user's DCE account must have the forwardable attribute set to yes (the forwardabletkt attribute). If this attribute is set to no, the kinit -f (or a dce_login -f) will fail. The DCE cell administrator can change an account's attributes provided site policy permits the forwarding of DCE credentials. Refer to the *DCE Administration Commands Reference* for the `kinit`, `dce_login`, and `account` commands and for details on the forwardable attribute of DCE accounts.

Note

A target host that has k5 enabled but does not have its DCE client services running will not cause a k5 protocol failure when it receives a k5 remote command request. DCE/k5 authentication services do not require that the DCE client services be running on the target host to authenticate the incoming client request. However, a DCE Security server must be reachable and running for the authentication routines to be successful.

8.12 How to clean up a failed DCE node installation or customization

This procedure shows you how to clean up a failed installation or customization of a node when the PSSP security state is set to dce.

You should first determine exactly where and why the node installation failed by examining the logs in /var/adm/SPlogs/sysman and the /var/adm/SPlogs/auth_install/log on the node. In the latter log, search for the string *spauthconfig*. After locating the string, the following questions need to be answered:

- Were the DCE file sets installed? If not, perhaps they were not found in the expected directory, /spdata/sys1/install/aix433/lppsource.
- Were the DCE clients successfully configured and started? The DCE command, `show.cfg`, shows the current state of the clients.
- If the clients have not been configured at all, the node can simply be reinstalled without doing any of the steps in Section 8.12.1 through Section 8.12.4. If a reinstall is not required, the security configuration can be completed by performing Step 11 in Section 8.12.4.
- If the DCE clients are configured and running, but not all PSSP services are running, check /spdata/sys1/keyfiles on the node. If this directory has no subdirectories or the subdirectories are empty, create_keyfiles has not been run successfully. Start the DCE removal process at Section 8.12.1, step 2. However, if the keyfiles exist, start at Step 1 of Section 8.12.1.
- If spauthconfig completed successfully without errors, you should consider fixing any subsequent install failures without reinstalling the node. For example, perhaps a customize would fix the problems.

When configuring nodes as DCE clients, PSSP takes advantage of the DCE split configuration option. With this option, the DCE client node is first configured on the DCE master server by the cell administrator (the admin-only part). Later, the configuration is completed on the node by root (the local-only part). You will follow this same model for unconfiguring and reconfiguring the node: unconfigure the node (local-only), unconfigure the node (admin-only), reconfigure the node (admin-only), reconfigure the node (local-only).

In this procedure, our DCE cell name is sp_cell, and the DCE administrative principal is cell_admin.

Note

This entire procecure must be followed whenever a node configured for DCE is reinstalled. In contrast, a node configured for DCE may be customized at any time, without following this procedure.

8.12.1 Unconfigure the node (local-only)

Perform the following steps to unconfigure the node (local-only):

As *root* on the node:

1. Unconfigure the PSSP additions to DCE for the node, such as the keytab objects and the keyfiles:

```
sp3n05/ # /usr/lpp/ssp/bin/rm_spsec -v -t local
...
```

2. Unconfigure the node in DCE:

```
sp3n05/ # unconfig.dce -config_type local all
...
Unconfiguration completed successfully.
```

3. Get a listing of any additional network interfaces on the node, such as css0 and tr0. You will need this information later to remove the host and ftp principals for those interfaces from DCE.

```
sp3n05/ # netstat -i 2>&1 | tee /tmp/host_and_ftp_prins_to_remove
Name    Mtu      Network       Address          ...
lo0     16896    link#1                         ...
lo0     16896    127           loopback         ...
lo0      6896    ::1                            ...
en0      1500    link#2        10.0.5a.fa.13.af ...
en0      1500    192.168.3     sp3n05           ...
css0    65520    link#3                         ...
css0    65520    192.168.13    sp3sw05          ...
```

8.12.2 Unconfigure the node (admin-only)

As cell_admin on the control workstation, perform the following steps to unconfigure the node (admin-only):

1. Unconfigure the PSSP additions to DCE for the node, such as the SP Trusted Services principals, groups, organizations, and accounts:

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep Global
   Global Principal: /.../sp_cell/cell_admin
sp3en0/ # rm_spsec -v -t admin sp3n05
...
```

The DCE hostname in `rm_spsec` must appear as it does in the DCE database.

2. Unconfigure the node in DCE:

```
sp3en0/ # unconfig.dce -config_type admin all \
> -dce_hostname sp3n05 -host_id sp3n05
...
Unconfiguration completed successfully.
```

3. Remove from DCE the host and ftp principals for the additional network interfaces on the nodes:

```
sp3en0/ # dcecp -c prin cat | grep -E "host|ftp" | grep 05
/.../sp_cell/host/sp3sw05
/.../sp_cell/ftp/sp3sw05
sp3en0/ # dcecp -c prin delete { /.:/host/sp3sw05 /.:/ftp/sp3sw05 }
sp3en0/ #
```

Note

They are listed in the */tmp/host_and_ftp_prins_to_remove* file you created on the node.

8.12.3 Reconfigure the node (admin only)

As cell_admin on the control workstation, perform the following steps to reconfigure the node (admin-only):

1. Re-create the DCE hostname for the node and verify that they were added to the SDR:

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep Global
    Global Principal: /.../sp_cell/cell_admin
sp3en0/ # create_dcehostname

sp3en0/ # splstdata -n | pg
                 List Node Configuration Information

node# frame# slot# slots initial_hostname  reliable_hostname dce_hostname
default_route   processor_type processors_installed description
----- ------ ----- ----- ----------------- ----------------- ----------------- -
-------------- -------------- -------------------- ---------------
...
5      1     5     1 sp3n05        sp3n05        sp3n05
...
```

2. As rooton the control workstation, reconfigure the node in DCE (DCE admin config only). You would be prompted for the DCE cell administrator’s password. In the following command output screen, the password prompt is not shown.

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # setupdce -v
...
Configuration of DCE Host, sp3n05, will now begin.
Configuring the Security client...
Security client configuration is complete.
Configuring the Directory client...
Directory client configuration is complete.
Configuration of DCE Host, sp3n05, was successful.

Configuration completed successfully.
```

3. As cell_admin on the control workstation, reconfigure the PSSP additions to DCE for the node, such as the SP Trusted Services principals, groups, organizations, and accounts:

```
sp3en0/ # dce_login cell_admin
Enter Password:
DCE LOGIN SUCCESSFUL
sp3en0/ # klist | grep Global
   Global Principal: /.../sp_cell/cell_admin
sp3en0/ # config_spsec -v
...
```

4. As *root*on the control workstation, update the authorization files (.k5login, .klogin, .rhosts) for AIX remote commands on the control workstation:

```
sp3en0/ # exit
sp3en0/ # klist | grep Global
        Global Principal: /.../sp_cell/hosts/sp3en0/self
sp3en0/ # updauthfiles
sp3en0/ #
```

Note

It is not uncommon for the `updauthfiles` command to take several minutes to execute.

8.12.4 Reconfigure the node (local-only)

5. Reconfigure the node in DCE including the PSSP portion, which includes the keytab objects and the keyfiles:

```
sp3n05/ # /usr/lpp/ssp/bin/spauthconfig
sp3n05/ # tail -f /var/adm/SPlogs/auth_install/log
...
```

Appendix A. How Kerberos works

(Reprinted from the redbook *The RS/6000 SP Inside Out*, SG24-5374)

Kerberos

Also spelled Cerberus, the watchdog of Hades, whose duty was to guard the entrance (against whom or what does not clearly appear) ... It is known to have had three heads.

- Ambrose Bierce, The Enlarged Devil's Dictionary

Kerberos is a trusted third-party authentication system for use on physically insecure networks. It allows entities communicating over the network to prove their identity to each other while preventing eavesdropping or replay attacks. Figure 33 on page 485 shows the three parties involved in the authentication. The Kerberos system was designed and developed in the 1980's by the Massachusetts Institute of Technology (MIT), as part of the Athena project. The current version of Kerberos is Version 5, which is standardized in RFC 1510, The Kerberos Network Authentication Service (V5).

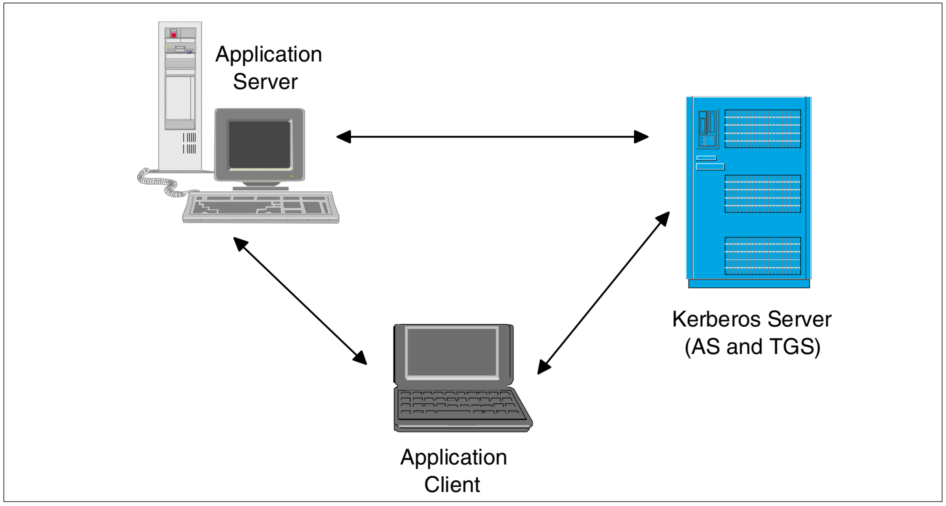


Figure 33. Partners in a Third-Party Authentication

Kerberos provides two services to Kerberos *principals* (users or services): an Authentication Service (AS) and a Ticket-Granting Service (TGS). Principals can prove their identity to the AS by a single sign-on, and will get a

Ticket-Granting Ticket (TGT) back from the AS. When one authenticated principal (the client) wants to use services of a second authenticated principal (the server), it can get a *Service Ticket* for this service by presenting its TGT to the Kerberos TGS. The Service Ticket is then sent from the client to the server, which can use it to verify the client's identity.

This section describes the protocol that Kerberos uses to provide these services, independently of a specific implementation. A more detailed rationale for the Kerberos design can be found in the MIT article *Designing an Authentication System: a Dialogue in Four Scenes* available from the following URL: `ftp://athena-dist.mit.edu/pub/kerberos/doc/dialogue.PS`

A.1 Kerberos keys and initial setup

To encrypt the messages which are sent over the network, Kerberos uses a *symmetric* encryption method, normally the Data Encryption Standard (DES). This means that the same key is used to encrypt and decrypt a message, and consequently the two partners of a communication must share this key if they want to use encryption. The key is called *secret key* for obvious reasons: it must be kept secret by the two parties, otherwise the encryption will not be effective.

This approach must be distinguished from *public key* cryptography, which is an *asymmetric* encryption method. There, two keys are used: a *public key* and a *private key*. A message encrypted with one of the keys can only be decrypted by the other key, not by the one which encrypted it. The public keys do not need to be kept secret (hence the name "public"), and a private key is only known to its owner (it is not even to the communication partner as in the case of symmetric cryptography). This has the advantage that no key must be transferred between the partners prior to the first use of encrypted messages.

With symmetric encryption, principals need to provide a password to the Kerberos server before they can use the Kerberos services. The Kerberos server then encrypts it and stores the resulting key in its database. This key is the shared information that the Kerberos server and the principal can use to encrypt and decrypt messages they send each other. Initially, two principals who want to communicate with each other do not share a key, and so cannot encrypt their messages. But since the Kerberos server knows the keys of all the principals, it is called a *trusted third party* and can securely provide a common session key to the two parties.

Obviously, the initial passwords have to be entered securely, if possible at the console of the Kerberos server machine. They might also be generated by the

Kerberos server (especially if the principal is a host or service). In that case they must be securely transferred to the principal which stores (or remembers) them.

A.2 Authenticating to the Kerberos server

If a principal (typically a user) wants to use Kerberos services, for example because it wants to use an application service which requires Kerberos authentication, it first has to prove its identity to the Kerberos server. This is done in the following way:

A command to sign on to the Kerberos system is issued on the application client, typically `kinit` or `k4init`. This command sends an authentication request to the Kerberos server, as shown in Figure 34 on page 487. This contains the type of service that is requested (here, the client wants to get service from the Ticket-Granting Service), the client's (principal's) name, and the IP address of the client machine. This request is sent in plain text. Note that the principal's password is not sent in this packet, so there is no security exposure in sending the request in plain text.

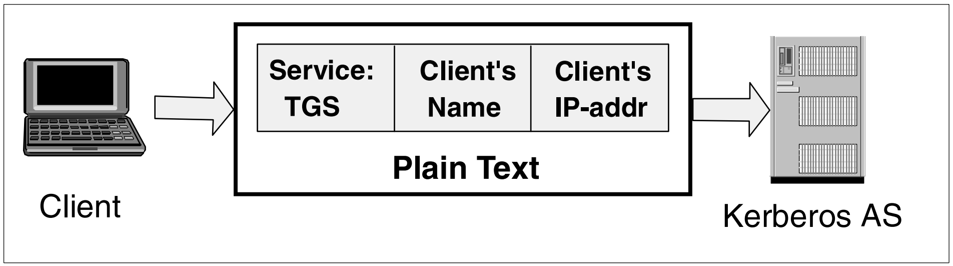


Figure 34. Client's Authentication Request

The request is processed by the Authentication Server. Using the client's name, it looks up the corresponding key in the Kerberos database. It also generates a random *session key* to be shared by the client and the TGS, which will be used to encrypt all future communication of the client with the TGS. With this information, the AS constructs the Ticket-Granting Ticket for the client, which (as all Kerberos tickets) contains six parts:

1. The service for which the ticket is good (here, the TGS)
2. The client's (principal's) name
3. The client machine's IP address
4. A timestamp showing when the ticket was issued

5. The ticket lifetime (maximum 21.25 hours in MIT K4, 30 days in PSSP K4, configurable in K5)
6. The session key for Client/TGS communications

This ticket is encrypted with the secret key of the TGS, so only the TGS can decrypt it. Since the client needs to know the session key, the AS sends back a reply which contains both the TGT and the session key, all of which is encrypted by the client's secret key. This is shown in Figure 35 on page 488.

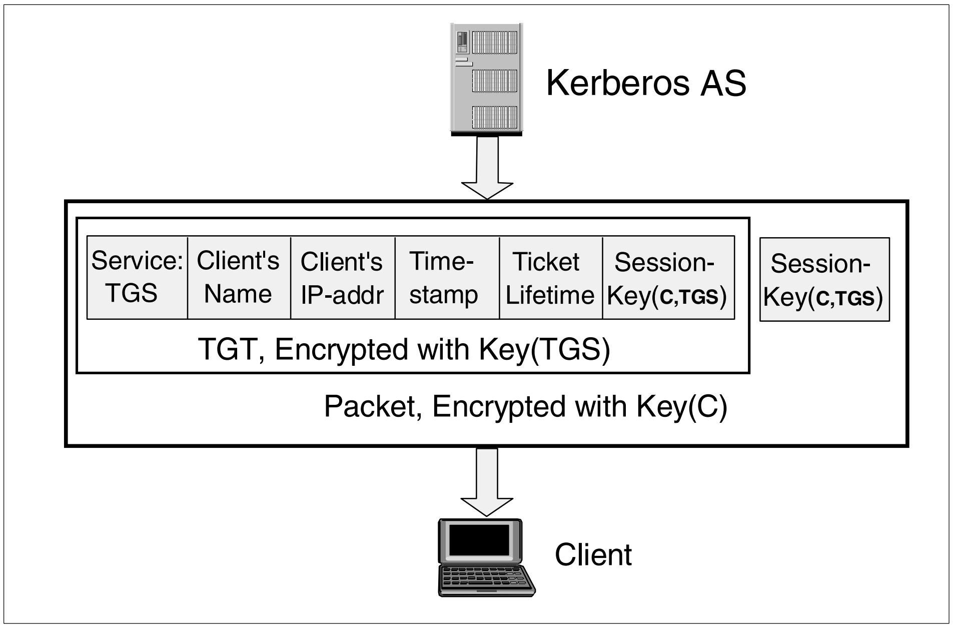


Figure 35. Authentication Server's Reply: TGT

Now the sign-on command prompts the user for the password, and generates a DES key from the password using the same algorithm as the Kerberos server. It then attempts to decrypt the reply message with that key. If this succeeds, the password matched the one used to create the user's key in the Kerberos database, and the user has authenticated herself. If the decryption failed, the sign-on is rejected and the reply message is useless. Assuming success, the client now has the encrypted Ticket-Granting Ticket and the session key for use with the TGS, and stores them both in a safe place. Note that the authentication has been done locally on the client machine, the password has not been transferred over the network.

A.3 Authenticating to an application server

If the client now wants to access an application service which requires Kerberos authentication, it must get a service ticket from the Ticket-Granting Service. The TGT obtained during the Kerberos sign-on can be used to authenticate the client to the TGS; there is no need to type in a password each time a service ticket is requested.

If the client sent only the (encrypted) TGT to the Kerberos TGS, this might be captured and replayed by an intruder who has impersonated the client machine. To protect the protocol against such attacks, the client also generates an *authenticator* which consists of three parts:

1. The client's (principal's) name
2. The client machine's IP address
3. A timestamp showing when the authenticator was created

The authenticator is encrypted with the session key that the client shares with the TGS. The client then sends a request to the TGS consisting of the name of the service for which a ticket is requested, the encrypted TGT, and the encrypted authenticator. This is shown in Figure 36.

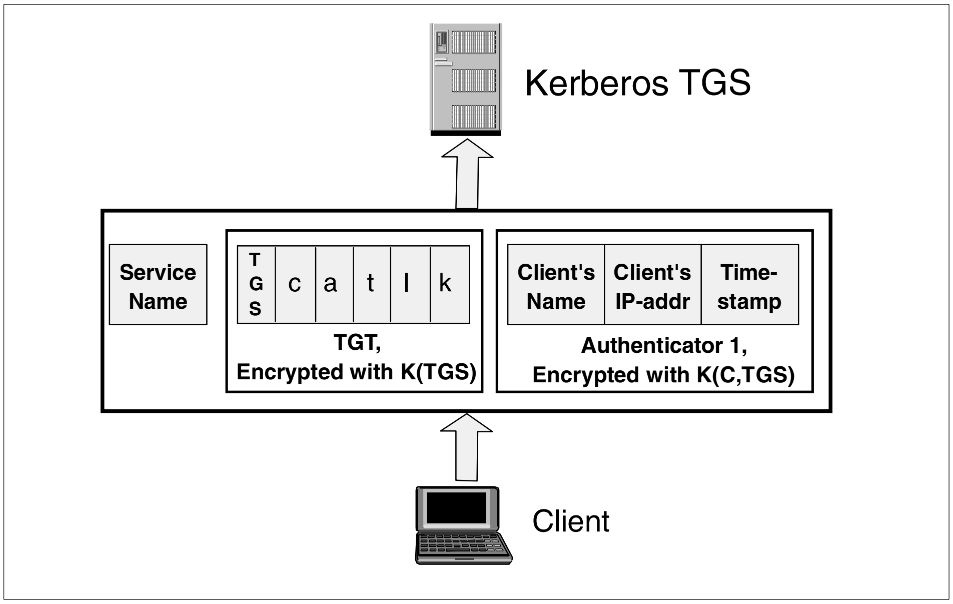


Figure 36. Client's Service Ticket Request

The Ticket-Granting Server can decrypt the TGT since it is encrypted with its own secret key. In that ticket, it finds the session key to share with the client. It uses this session key to decrypt the authenticator, and can then compare the client’s name and address in the TGT and the authenticator.

If the timestamp that the TGS finds in the authenticator differs from the current time by more than a prescribed difference (typically 5 minutes), a ticket replay attack is assumed and the request is discarded.

If all checks pass, the TGS generates a service ticket for the service indicated in the client’s request. The structure of this service ticket is identical to the TGT described in A.2, “Authenticating to the Kerberos server” on page 487. The content differs in the service field (which now indicates the application service rather than the TGS), the timestamp, and the session key. The TGS generates a new, random key that the client and application service will share to encrypt their communications. One copy is put into the service ticket (for the server), and another copy is added to the reply package for the client since the client cannot decrypt the service ticket. The service ticket is encrypted with the secret key of the service, and the whole package is encrypted with the session key that the TGS and the client share. The resulting reply is shown in Figure 37. Compare this to Figure 35 on page 488.

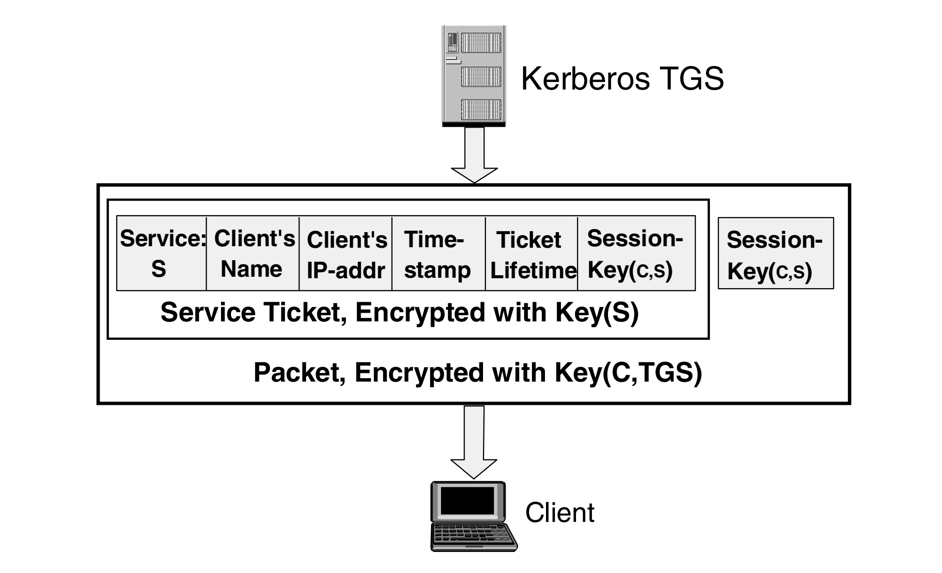


Figure 37. Ticket Granting Service’s Reply: Service Ticket

The client can decrypt this message using the session key it shares with the TGS. It then stores the encrypted service ticket and the session key to share with the application server, normally in the same *ticket cache* where it already has stored the TGT and session key for the TGS.

To actually request the application service, the client sends a request to that server which consists of the name of the requested service, the encrypted service ticket, and a newly generated authenticator to protect this message against replay attacks. The authenticator is encrypted with the session key that the client and the service share. The resulting application service request is shown in Figure 38. Note the resemblance to the request for Ticket-Granting Service in Figure 36 on page 489.

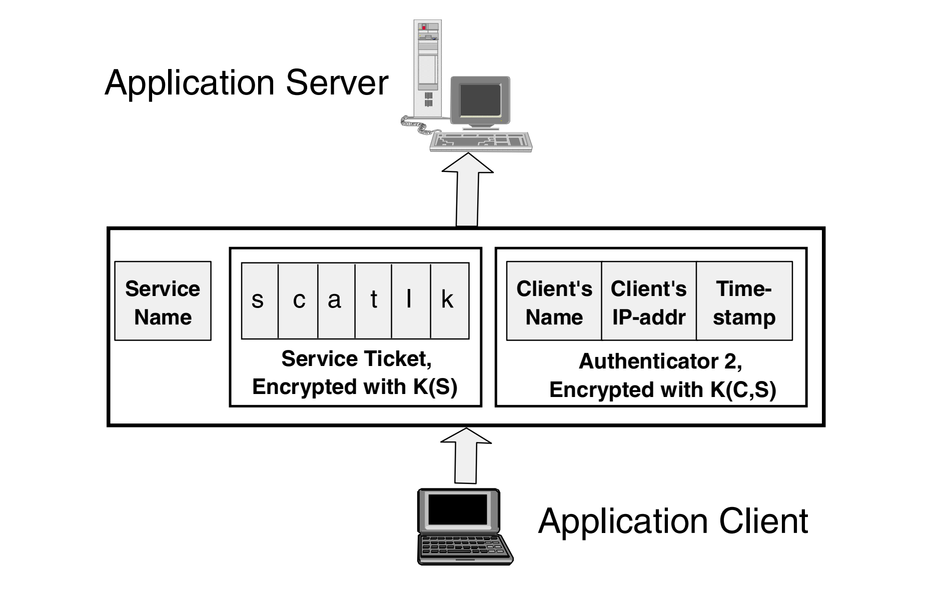


Figure 38. Client's Application Service Request

The application server decrypts the service ticket with its secret key, uses the enclosed session key to decrypt the authenticator, and checks the user's identity and the authenticator's timestamp. Again, this processing is the same as for the TGS processing the service ticket request. If all checks pass, the server performs the requested service on behalf of the user.

Attention

Authorization: Kerberos is only responsible for authenticating the two partners. Any authorization mechanism must be enforced by the application itself.

If the client required mutual authentication (that is, the service has to prove its identity to the client), the server could send back a message which is encrypted by the session key it shares with the client, and an application-dependent contents that the client can verify. Since the service can only know the session key if it was able to decrypt the service ticket, it must have known its secret key and so has proven its identity.

Appendix B. Security command and tool reference

This appendix provides a quick reference for the security commands and tools discussed in this redbook.

bffcreate Creates installation image files in backup format.

cdsli -cworld Recursively lists the namespace of cells:

- -c specifies a clearinghouse
- -w specifies a long listing
- -o specifies an object
- -r indicates to list entries recursively
- -l specifies a link
- -d specifies a directory

chauthpar [-c | -f] -p <syspar> [k5][k4][std]
Enables the active remote command authentication methods for a system partition.

chauthpts [-c | -f] -p <syspar> [dce][compat][ ]
Enables the active trusted services authentication methods for a system partition.

chauthent [-k5][-k4][-std][ ]
Changes the configured authentication methods for the rcmds on the system. If none of the flags are set, the rcmds will be disabled from functioning.

chauthts [dce][compat][ ]
Enables the active authentication methods for trusted services on a host.

chpesite Updates the contents of the /opt/dcelocal/etc/security/pe_site file on a host.

config_spsec [-c][-v]
Configures SP Services into the DCE database. Services which use DCE as an authentication method are required to have certain information entered in the CDS clearinhouse and the Security registry to perform client/server authentication.

create_dcehostname
Populates the System Data Repository (SDR) with DCE hostnames for each node in a partition set to use DCE.

create_keyfiles [-c][-v]
Creates DCE keytab objects and stores them into specified keyfiles on the local file system. Services which use DCE as an authentication method will use these key files to log into DCE.

dcecp -c The DCE Control Program, which is used to perform the following DCE management tasks:

- **cell show** - Displays information about the servers and hosts in the cell.
- **account catalog** - Lists the accounts in the cell.
- **group catalog** - Lists the groups in the cell.
- **keytab catalog** - Lists the keytabs in the cell.
- **organization catalog** - Lists the organizations in the cell.
- **principal catalog** - Lists the principals in the cell.
- **principal delete { /.:/host/<node> /.:/ftp/<node> }** - Removes the host and ftp principals that were configured for each of the additional network adapters in the nodes.

dce_login Validates the DCE principal identity and obtains the principal network credentials. (In other words, the command used to log in to DCE.)

inutoc Creates a .toc (table of contents) file for directories that have backup format file install images.

install_cw Completes the installation of system support programs in the control workstation.

k4destroy Destroys Kerberos 4 authentication tickets.

kdestroy Destroys Kerberos 5 authentication tickets.

k4list Lists currently held Kerberos 4 authentication tickets.

klist Lists currently held Kerberos 5 authentication tickets.

lsauthent Lists the authentication methods currently configured on the system.

lsauthpar Lists the remote command authentication methods that are active for the system partition.

lsauthpts Lists the trusted services authentication methods that are active for the system partition.

lsauthts Lists the authentication methods used by trusted services on the local host.

node_number
Obtains the node number attribute for a node from the ODM.

rm_spsec -v -t admin <nodename>
Removes configuration from DCE service principals and keyfiles. When admin is specified, the flag removes the local keyfiles and keytab objects for DCE servers.

rm_spsec -v -t local
Removes configuration from DCE service principals and keyfiles. When local is specified, the flag removes the local keyfiles and keytab objects for the host.

savebase Saves information about base-customized devices in the Device Configuration database onto the boot device.

SDRArchive
Archives the entire contents of the System Data Repository (SDR), except for the archives directory, for later retrieval.

SDRGetObjects Syspar
Sends contents of attributes in specified object (Syspar) to standard output.

setclock Sets the time and date for a host on a network.

setup_authent
Sets up a workstation to use SP authentication services (Kerberos 4).

setupdce -c cell_admin -l /.:/lan-profile
Creates DCE Security and CDS entries for SP nodes: specifies the DCE ID with cell administration authority and the DCE lan profile path.

setupdce -v -u -s <master_security_server> -d <initial_cds_server>
Creates DCE Security and CDS entries for SP nodes: specifies the DCE Master Security server and Initial CDS server, and updates the SDR with their hostnames.

setup_server
Configures a node or control workstation as a boot/install server.

show.cfg Displays the DCE and DFS components configured on the local machine and returns information about the configuration state and the running state.

spacs_cntrl
Controls interactive access to SP nodes.

spauthconfig
Installs and configures a node based on selected authentication methods. The command (called from `/etc/rc.sp` and `psspfb_script`) runs each time a node boots.

spbootins Enters boot/install configuration data for a node or series of nodes in the System Data Repository (SDR)

splstdata -e
Displays the configuration data from the System Data Repository (SDR) or system information for each node. The -e option displays environment information including: DCE cell name, DCE Security Master server name, and DCE CDS Master server name.

splstdata -n
Displays the configuration data from the System Data Repository (SDR) or system information for each node. The -n option displays node information including: DCE hostname for each node.

splstdata -p
Displays the configuration data from the System Data Repository (SDR) or system information for each node. The -p option displays partition information including: SDR Security Attribute settings (auth_install, auth_root_rcmds, ts_auth_methods, and auth_methods).

spnkeymand -l
Queries the SP Per Node Key Management daemon and displays the status of the SP Trusted Services keytab files.

spnkeyman_start
Conditionally starts the SP Per Node Key Management daemon on the control workstation, node, or standalone workstation. The command runs locally on the host where the daemon is to be started.

spsetauth -i -p <syspar> [dce][k4][std]
Sets the authentication methods to be installed on the control workstation and in the partition. The -i option specifies the install setup.

spsetauth -d -p <syspar> [dce][k4][std]
Sets the authentication methods to be installed on the control workstation and in the partition. The -d option specifies the authorization setup.

start.dce Starts the DCE components configured on the local machine.

stop.dce Stops the DCE components configured on the local machine.

sysctl whoami -v

Returns values of all authenticated identities of the sysctl client.

unconfig.dce -config_type admin all -dce_hostname <node> -host_id <node>

Stops DCE and unconfigures the specified DCE components. Admin unconfiguration is used by the cell administrator on any machine within the cell to update the CDS namespace and the Security registry about changes in the cell.

unconfig.dce -config_type local all

Stops DCE and unconfigures the specified DCE components. Local unconfiguration is used by the root user on the machine being unconfigured to stop the daemons and delete the appropriate files.

updauthfiles

Updates or creates the authorization files (.k5login, .klogin, and .rhosts) on the control workstation and on all the nodes in the system based on the setting of the auth_root_rcmd security attribute.

Appendix C. Using the additional material

This redbook also contains additional material in CD-ROM or diskette format, and/or Web material. See the appropriate section below for instructions on using or downloading each type of material.

C.1 Using the CD-ROM or diskette

The diskette that accompanies this redbook contains the following:

File name	*Description*
aixsetsec.ksh	This script does some security settings for you. It disables a number of services, depending on the system it runs on. You will need to adapt the script to prevent it from disabling services that you require. It checks for world-writable files and directories.
cds-replicate.ksh	Replicates an entire CDS server.
con_user.ksh	Example script to control access for DCE users.
getmail.ksh	Can be run from cron on the CWS and starts sendmail on the nodes to collect mail. When using this script, you can disable sendmail.
itcs204.ksh	Prepares a system for the IBM ITCS204 standard.
runtrip.ksh	A secure way of running tripwire on the nodes. Only use it on the CWS when it runs in secure mode, otherwise you need an external security server.
script.cust	Example script.cust customization file.

C.1.1 System requirements for using the CD-ROM or diskette

The following system configuration is recommended for optimal use of the diskette:

Hard disk space:	1.5 MB minimum
Operating System:	Any UNIX

C.1.2 How to use the diskette

You can extract the contents of the diskette by issuing the following command after inserting the diskette into its drive:

```
tar -xvf /dev/rfd0
```

C.2 Locating the additional material on the Internet

The CD-ROM, diskette, or Web material associated with this redbook is also available in softcopy on the Internet from the IBM Redbooks Web server. Point your Web browser to:

ftp://www.redbooks.ibm.com/redbooks/SG245521

Alternatively, you can go to the IBM Redbooks Web site at:

ibm.com/redbooks

Select the **Additional materials** and open the directory that corresponds to the redbook form number.

Appendix D. Special notices

This publication is intended to help an RS/6000 SP Specialist who wants to implement the new IBM Parallel System Support Programs (PSSP 3.2) security infrastructure to make an RS/6000 SP system as secure as desirable. The information in this publication is not intended as the specification of any programming interfaces that are provided by IBM AIX and PSSP software products. See the Publications section of the IBM Programming Announcement for the products mentioned in this redbook for more information about what publications are considered to be product documentation.

References in this publication to IBM products, programs or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent program that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program or service.

Information in this book was developed in conjunction with use of the equipment specified, and is limited in application to those specific hardware and software products and levels.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to the IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact IBM Corporation, Dept. 600A, Mail Drop 1329, Somers, NY 10589 USA.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The information contained in this document has not been submitted to any formal IBM test and is distributed AS IS. The use of this information or the implementation of any of these techniques is a customer responsibility and depends on the customer's ability to evaluate and integrate them into the customer's operational environment. While each item may have been reviewed by IBM for accuracy in a specific situation, there is no guarantee that the same or similar results will be obtained elsewhere. Customers attempting to adapt these techniques to their own environments do so at their own risk.

Any pointers in this publication to external Web sites are provided for convenience only and do not in any manner serve as an endorsement of these Web sites.

The following terms are trademarks of the International Business Machines Corporation in the United States and/or other countries:

IBM
IBM.COM
LoadLeveler
Netfinity
OS/2
PAL
Redbooks
Redbooks Logo
RS/6000
SP
System/390
TCS

The following terms are trademarks of other companies:

Tivoli, Manage. Anything. Anywhere.,The Power To Manage., Anything. Anywhere.,TME, NetView, Cross-Site, Tivoli Ready, Tivoli Certified, Planet Tivoli, and Tivoli Enterprise are trademarks or registered trademarks of Tivoli Systems Inc., an IBM company, in the United States, other countries, or both. In Denmark, Tivoli is a trademark licensed from Kjøbenhavns Sommer - Tivoli A/S.

C-bus is a trademark of Corollary, Inc. in the United States and/or other countries.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States and/or other countries.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States and/or other countries.

PC Direct is a trademark of Ziff Communications Company in the United States and/or other countries and is used by IBM Corporation under license.

ActionMedia, LANDesk, MMX, Pentium and ProShare are trademarks of Intel Corporation in the United States and/or other countries.

UNIX is a registered trademark in the United States and other countries

Appendix E. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

E.1 IBM Redbooks

For information on ordering these publications see “How to get IBM Redbooks” on page 509.

- *Administering IBM DCE and DFS Version 2.1 for AIX and OS/2 Clients*, SG24-4714
- *DCE and DFS Performance Tuning and Problem Determination on AIX and OS/2 Warp*, SG24-4949
- *DCE Cell Design Considerations*, SG24-4746
- *Elements of Security: AIX 4.1*, GG24-4433
- *IBM Certification Study Guide: RS/6000 SP*, SG24-5348
- *Inside the RS/6000 SP*, SG24-5145
- *RS/6000 SP: Problem Determination Guide*, SG24-4778
- *RS/6000 SP System Performance Tuning*, SG24-5340
- *Security on the Web Using DCE Technology*, SG24-4949
- *The RS/6000 SP Inside Out*, SG24-5374

E.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at `ibm.com/redbooks` for information about all the CD-ROMs offered, updates and formats.

CD-ROM Title	**Collection Kit Number**
IBM System/390 Redbooks Collection	SK2T-2177
IBM Networking Redbooks Collection	SK2T-6022
IBM Transaction Processing and Data Management Redbooks Collection	SK2T-8038
IBM Lotus Redbooks Collection	SK2T-8039
Tivoli Redbooks Collection	SK2T-8044
IBM AS/400 Redbooks Collection	SK2T-2849
IBM Netfinity Hardware and Software Redbooks Collection	SK2T-8046
IBM RS/6000 Redbooks Collection	SK2T-8043
IBM Application Development Redbooks Collection	SK2T-8037
IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

E.3 Other resources

The following publications are also relevant as further information sources:

- *Administrative Core Services*, SC23-2730
- *AIX System User's Guide: Communications and Networks*, GC23-2523
- *AIX V4.3 Network Information Services (NIS and NIS+) Guide*, SC23-4310
- *AIX V4.3 System Management Concepts: Operating System and Devices*, SC23-4311
- *AIX V4.3 Technical Reference*, SBOF-1878
- *AIX Version 4.3 System Management Guide: Communications and Networks*, SC23-4127
- *AIX Version 4.3 System Management Guide: Operating System and Devices*, SC23-4126
- *Building Internet Firewalls*, D. Brent Chapman, Elizabeth D. Zwicky, Deborah Russell, published 1995 by O'Reilly & Associates, ISBN 1-5659-2124-0
- *Firewalls and Internet Security: Repelling the Wily Hacker*, published 1994 by Addison-Wesley Pub Co, ISBN 0-2016-3357-4
- *IBM DCE for AIX*, *Administration Reference*, SC23-2732
- *Information Warfare and Security*, Dorothy E. Denning, published 1998 by Addison-Wesley Pub Co, ISBN 0-2014-3303-6
- *Kerberos: A Network Authentication System*, Brian Tung, published 1999 by Addison-Wesley Pub Co, ISBN 0-2013-7924-4
- *Practial Unix and Internet Security*, Simson Garfinkel, Gene Spafford, published 1996 by O'Reilly & Associates, ISBN 1-5659-2148-8
- *PSSP Administration Guide*, SA22-7348
- *PSSP: Command and Technical Reference*, SA22-7351
- *PSSP Diagnosis Guide*, GA22-7350
- *PSSP: Installation and Migration Guide*, GA22-7347
- *RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281
- *The Art of War*, Sun Tzu, James Clavell (Editor), published 1989 by Delacorte Press, ISBN 0-3852-9216-3
- *Understanding DCE*, Ward Rosenberry, David Kenney, Gerry Fisher, published 1992 by O'Reilly & Associates, ISBN 1-5659-2005-9

E.4 Referenced Web sites

The following Web sites are also relevant as further information sources:

- `http://www.ssh.org`
- `http://www.bull.com`
- `http://www.postfix.org`
- `http://www.cerias.purdue.edu/coast/satan.html`
- `http://www.ssh.org`
- `http://all.net`
- `http://wuarchive.wustl.edu/packages/security/TAMU/`
- `http://www.faqs.org/faqs/kerberos-faq/general/`
- IBM Redbooks:
  `http://www.redbooks.ibm.com/`
- Designing an Authentication System: a Dialogue in Four Scenes:
  `http://web.mit.edu/kerberos/www/dialogue.html/`
- Trusted Computing System Evaluation Criteria (TCSEC) Rainbow Series Library:
  `http://www.radium.ncsc.mil/tprep/library/rainbow/index.html/`
- Information Technology Security Evaluation Criteria (ITSEC) Assurance Level Criteria:
  `http://www.itsec.gov.uk/`
- Wietse Venema's (author of tcp_wrapper) tools and papers:
  `http://sneezy.ice.ntnu.edu.tw/os/unix/security/`
- The Admin guide to cracking by Dan Farmer and Wietse Venema:
  `http://www.cerias.purdue.edu/coast/satan-html/docs/admin_guide_to_cracking.html/`
- The Internet Assigned Numbers Authority:
  `http://www.iana.org/`
- Large archive of SMIT installable freeware:
  `http://www.bull.de/pub`
- Secure Shell hompage:
  `http://www.ssh.org`
- Computer Emergency Response Team:
  `http://www.cert.org`

- IBM emergency response team:
  `http://www.ers.ibm.com`
- Postfix homepage, replacement for sendmail:
  `http://www.postfix.org`
- Fred Cohen’s page, programmer of the Deception Toolkit:
  `http://all.net`
- Chaos Computer Club (partly German):
  `http://www.ccc.de`
- Security information, large download area with hacker tools and security tools:
  `http://packetstorm.securify.com`
- This is a *security* site, not a hacker site:
  `http://www.attrition.org`
- Top 50 *security* sites:
  `http://www.cyberarmy.com/t-50/index.shtml`
- Kerberos FAQs:
  `http://www.faqs.org/faqs/kerberos-faq/general/`

How to get IBM Redbooks

This section explains how both customers and IBM employees can find out about IBM Redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

- **Redbooks Web Site** **ibm.com**/redbooks

  Search for, view, download, or order hardcopy/CD-ROM Redbooks from the Redbooks Web site. Also read redpieces and download additional materials (code samples or diskette/CD-ROM images) from this Redbooks site.

  Redpieces are Redbooks in progress; not all Redbooks become redpieces and sometimes just a few chapters will be published this way. The intent is to get the information out much quicker than the formal publishing process allows.

- **E-mail Orders**

  Send orders by e-mail including information from the IBM Redbooks fax order form to:

	e-mail address
In United States or Canada	pubscan@us.ibm.com
Outside North America	Contact information is in the “How to Order” section at this site: http://www.elink.ibmlink.ibm.com/pbl/pbl

- **Telephone Orders**

United States (toll free)	1-800-879-2755
Canada (toll free)	1-800-IBM-4YOU
Outside North America	Country coordinator phone number is in the “How to Order” section at this site: http://www.elink.ibmlink.ibm.com/pbl/pbl

- **Fax Orders**

United States (toll free)	1-800-445-9269
Canada	1-403-267-4455
Outside North America	Fax phone number is in the “How to Order” section at this site: http://www.elink.ibmlink.ibm.com/pbl/pbl

This information was current at the time of publication, but is continually subject to change. The latest information may be found at the Redbooks Web site.

IBM Intranet for Employees

IBM employees may register for information on workshops, residencies, and Redbooks by accessing the IBM Intranet Web site at http://w3.itso.ibm.com/ and clicking the ITSO Mailing List button. Look in the Materials repository for workshops, presentations, papers, and Web pages developed and written by the ITSO technical professionals; click the Additional Materials button. Employees may access MyNews at http://w3.ibm.com/ for redbook, residency, and workshop announcements.

IBM Redbooks fax order form

Please send me the following:

Title	**Order Number**	**Quantity**

First name Last name

Company

Address

City Postal code Country

Telephone number Telefax number VAT number

□ Invoice to customer number

□ Credit card number

Credit card expiration date Card issued to Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.

Glossary

access control. The process of making access to system resources available only to authorized principals.

access control list (ACL). A list of principals and the type of access assigned to each.

ACL. Access Control List.

AFS. A distributed file system that uses Kerberos authentication and includes authentication services that can be used by an SP system.

AIX. Advanced Interactive Executive.

API. Application Programming Interface.

assurance. A measure of confidence that the features and design of a system accurately enforce the system's security policy.

authentication. The process of a principal proving the authenticity of its identity.

authentication database. A set of files containing the names and authentication information of all principals within a realm. An authentication realm has one primary database and may have multiple secondary databases. Secondary databases are backup copies of the primary database and may be provided to improve performance or availability.

authenticator. An authentication protocol string created each time authentication occurs and sent with the ticket to the server. It contains a time-stamp encrypted in the session key that can reliably show that the authentication request actually came from the client identified in the ticket.

authorization. The granting of access rights to a principal.

CDS. Cell Directory Service.

cell. An independently-administered collection of file server and client machines running AFS. An AFS cell is equivalent to a Kerberos realm.

client. A process requesting a service.

CPU. Central Processing Unit.

credentials. A protocol message, or part of one, containing a ticket and an authenticator supplied by a client and used by a server to verify the client's identity. The message can contain additional information used by the server to verify its identity to the client.

CSS. Communication Subsystem (SP Switch).

CWS. Control Workstation.

Data Encryption Standard (DES). The secret-key (also known as "private-key") encryption algorithm that is used by Kerberos.

DCE. Distributed Computing Environment.

DES. Data Encryption Standard.

DFS*.* Distributed File System.

Distributed Computing Environment (DCE). Software designed and developed through the Open Group. AIX DCE is an implementation of DCE for AIX RS/6000 systems.

discretionary access control. A means of restricting access to objects based on the identity of the principal.

DNS. Domain Name Service.

domain. A collection of systems over which an administrator exercises control.

DTS. Distributed Time Service.

GB. gigabytes.

Generic Security Service API (GSSAPI). Is an X/OPEN standard interface for mechanism-independent authentication in a distributed system.

GSSAPI. Generic Security Service API.

IBM*.* International Business Machines Corporation.

identification. The process of stating the identity of a principal; no proof as to the authenticity of the identity is implied.

instance. A qualifier for a principal name. For services, an instance represents a particular occurrence of the server. For users, an instance allows a single user to assume additional (or alternate) roles with different authority.

ITSO. International Technical Support Organization.

Kerberos. A mechanism for providing mutual authentication of two principals using a trusted third party in a distributed environment.

Kerberos V4. The fourth version of the Kerberos authentication mechanism from the Massachusetts Institute of Technology (MIT). Used in pre-PSSP3.2 SP systems for authentication within some administrative services.

Kerberos V5. The fifth version of the Kerberos authentication mechanism from MIT. Kerberos V5 is not protocol-compatible with prior versions of Kerberos. Kerberos V5 is used as the basis of distributed service authentication within DCE.

key. A value used to encrypt protocol strings used for authentication. The private keys of principals are stored in the authentication database. Session keys are contained (encrypted) in tickets and other protocol strings.

key management. The process of periodically changing the key associated with a server's DCE principal to prevent the key from expiring and, thus, disabling the service.

Kerberos master key. The key derived from the Kerberos Master Password supplied initially by the administrator when the primary SP authentication server is created. This key is saved in the **/.k** file, which the Kerberos daemons read instead of prompting for a password. It can also be read by certain database utility commands for the same purpose.

Kerberos master password. The password the administrator supplies when initializing the primary authentication server.

LAN. Local Area Network.

LDAP. Lightweight Directory Access Protocol.

MB. megabytes.

MIT. Massachusetts Institute of Technology.

MPP. Massively Parallel Processors.

mutual authentication. The process of two principals proving their identities to each other.

NFS. Network File System.

NTP. Network Time Protocol.

object. An entity that contains or receives information; access to an object potentially implies access to the information it contains. Examples of objects are files, jobs, queues, nodes, and users.

OSF. Open Software Foundation

per-node key management. The process of providing key management on each node in an SP system.

principal. A user, an instance of a server, or an instance of trusted client code whose identity is to be authenticated.

PSSP. Parallel System Support Programs.

PV. Physical Volume.

realm. A domain that shares an authentication database and servers. There is a single name space for principal name/instance pairs within a realm. A realm is also a logical collection of clients and servers registered in the database.

RPC. Remote Procedure Call.

RSCT. RS/6000 Cluster Technology (IBM).

RVSD. Recoverable Virtual Shared Disk (IBM).

SCSI. Small Computer System Interface.

SDR. System Data Repository (IBM SP).

security policy. The set of rules that determines how a system manages, protects, and distributes sensitive information.

server. A process providing a service - the entity to whom the client's identity must be proven. A server is trusted code. In general, a server runs as a separate process. However, the attribute of being a server is merely a role that a process assumes. In some instances, code that is traditionally part of a server may assume the role of a client.

service. The name of a principal whose identity is assumed by a server for purposes of authentication. Multiple servers can use the same service name.

server key file (also known as a **srvtab**). A file containing the names and private keys of the local instances of services. It is accessible only to processes that run under the UID of the user owning the server daemons. On an SP system, all services run as root.

session key. A temporary key supplied by an authentication server to clients and servers and used to encrypt parts of authentication protocol messages. Its lifetime is the same as the ticket with which it is created.

SMIT. System Management Interface Tool (IBM AIX).

sniffing. Listening to traffic on a network.

spoofing. A system that falsely presents itself as another system on the network.

SSA. Serial Storage Architecture.

ticket. An encrypted protocol message used to pass the identity of a user from a client to a server. Tickets are created by the Kerberos authentication server and cached in disk files on the client's system.

ticket-granting-ticket. The initial ticket obtained by a user. It is used by client programs to obtain additional tickets for authentication with application services.

trusted service. A service that is responsible for enforcing some part of the system’s security policy.

Index

IBM Redbooks review

Your feedback is valued by the Redbook authors. In particular we are interested in situations where a Redbook "made the difference" in a task or problem you encountered. Using one of the following methods, **please review the Redbook, addressing value, subject matter, structure, depth and quality as appropriate.**

- Use the online **Contact us** review redbook form found at **ibm.com**/redbooks
- Fax this form to: USA International Access Code + 1 914 432 8264
- Send your comments in an Internet note to redbook@us.ibm.com

Document Number **Redbook Title**	SG24-5521-00 Exploiting RS/6000 SP Security: Keeping It Safe
Review	
What other subjects would you like to see IBM Redbooks address?	
Please rate your overall satisfaction:	O Very Good O Good O Average O Poor
Please identify yourself as belonging to one of the following groups:	O Customer O Business Partner O Solution Developer O IBM, Lotus or Tivoli Employee O None of the above
Your email address: The data you provide here may be used to provide you with information from IBM or our business partners about our products, services or activities.	O Please do not use the information collected here for future marketing or promotional contacts or other communications beyond the scope of this transaction.
Questions about IBM's privacy policy?	The following link explains how we protect your personal information. **ibm.com**/privacy/yourprivacy/

IBM

Redbooks

Exploiting RS/6000 SP Security: Keeping It Safe

Exploiting RS/6000 SP Security:

Keeping It Safe

Learn PSSP 3.2 security features step by step

Discover time-saving troubleshooting tips

Explore additional security tools

This IBM Redbook explains how to exploit the enhanced security features of PSSP 3.2. It walks you through installing, configuring, administering, and troubleshooting security technologies ranging from standard AIX, Kerberos 4, and DCE/Kerberos 5 to Restricted Root Access and beyond.

The PSSP security services were designed and implemented to minimize the complexities often associated with security features, especially during their installation and configuration phases. Given the nature of security, and considering its pervasiveness and global scope, it is critical to get it right. To that end, this redbook provides extensive coverage of problem determination and troubleshooting techniques to help you ensure that your implementation is sound.

In addition to the new PSSP 3.2 security features, this redbook discusses additional tools and techniques with which to enhance the security of your SP environment.

DISKETTE
INCLUDED

SG24-5521-00 ISBN 0738419494