Universal Clustering Problem Determination Guide

- Explains how to identify the components involved in a problem
- Offers ideas about how to approach universal cluster problems
- Chapters are self-contained for independent use

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Preface

Problem determination and problem solving on the RS/6000 SP and clusters can be difficult because the malfunction may imply the movement of several components within AIX and PSSP. Problem determination on the RS/6000 universal cluster is part of the daily tasks of a system administrator. Although the RS/6000 universal cluster is a very stable platform, the manner in which distributed and parallel environments are intermixed may cause certain problems that cannot be easily solved by someone with only AIX experience.

This redbook gives a comprehensive explanation of certain RS/6000 SP and cluster components and provides the reader with tools and procedures that can be used for problem isolation and problem solving in a cluster environment.

This redbook is oriented to RS/6000 SP and cluster professionals who install, configure, and administer universal cluster systems. Several procedures are outlined and tested, along with the explanation for the causes of common SP and cluster problems.

This universal clustering guide is the perfect companion for the RS/6000 SP and clusters product manuals when you need to identify and solve system problems.

The redbook does not guarantee success, but it certainly takes you one step closer. This redbook describes each cluster component and helps you understand how they are related to one another. It gives a comprehensive explanation of processes occurring within the SP system and provides an approach to diagnosis and problem solving.

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, Austin Center.

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Special notice

This publication is intended to help the RS/6000 SP and clusters technical community when troubleshooting software problems. The information in this publication is not intended to substitute the PSSP Diagnosis Guide, GA22-7350 or any other problem determination documentation provided by RS/6000 hardware, AIX software, or PSSP software. See the PUBLICATIONS section of the IBM Programming Announcement for RS/6000 information about what publications are considered to be product documentation.
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Problem determination essentials

This chapter will set the stage for rest of this book. Here, we highlighted important planning tasks that are often overlooked and lead to problems that can be avoided. Some pro-active actions have been introduced to minimize the frequency of problem occurrences.

In this chapter, we define the problem determination process and introduce the PD (problem determination) methodologies that can be used in conjunction with the available tools. The problem determination tools are discussed in subsequent chapters.
1.1 Problem determination

There are two levels of the problem determination process:

- Take pro-active actions to minimize the occurrence of problems.
- Define clear problem determination methodologies to address problems that do occur.

1.2 Proactive actions

Although this book primarily addresses the steps you need to take when the problems have indeed occurred, we would also like to highlight some areas that, if planned for properly, can minimize the frequency of problems.

Remember that your SP is a non-static entity. It keeps changing its state over time as you install/relocate new hardware, install new LPPs, upgrade the software level, etc. You are required to have clear change management policies to apply new changes to your system. If not planned properly, there is always a potential that the change will introduce some hardware/software incompatibility or co-existence issue and lead to a problem.

People commonly assume that planning is required only at the time of initial installation. In reality, you need to practice to check on the hardware/software compatibility every time you plan a change.

In the following sections, you will find basic areas that you should review at the time of initial installation and again when applying changes to your system. This practice will minimize the frequency of problems.

1.2.1 There is no substitute for good planning

The importance of good planning cannot be overstated. Typically small to medium sites do not pay due attention to site planning activities. As previously mentioned, good site plan, installation plan, and subsequently change management policies can avoid many potential problems.

The latest versions of installation planning guides are available at:

We recommend that you download, read and comply with the following guides:

- RS/6000 SP Planning Volume 1, Hardware and Physical Environment, GA22-7280
1.2.2 Comply with the configuration rules

The SP platform offers three types of nodes based on their form factor: Thin, wide and high nodes. It is important that your configuration comply with the node placement rule for switch connectivity. Remember, not all node combinations are allowed in a switch environment. Pay particular attention to the switch configuration rules if you are relocating nodes on an existing SP.

For example, if you have a frame of eight thin nodes and four wide nodes, you cannot attach an additional node on the expansion frame, even though you still have four free ports available on your switch. This is because PSSP treats this frame as an all thin nodes frame and, therefore, four ports on the switch are wasted in this scenario.

**Important:** This is only applicable on the SP Switch.

The configuration rules have been discussed in detail in the following books:

- RS/6000 SP Planning Volume 1, Hardware and Physical Environment, GA22-7280
- Chapter 9, “Configuration rules and topologies,” RS/6000 SP Cluster: The Path to Universal Clustering, SG24-5374-01

Next, we provide a quick overview to cross-check your node placement in a switch environment.

**When a switch frame has homogenous nodes**

If a switch frame has all thin, wide, or high nodes, the expansion frame can be added as shown in Figure 1-1 on page 4. The switch nodes’ number offset are the numerals shown in the node position.
Switch frame has nodes of heterogeneous form factor

Some sites may contain nodes of different form factors shared on a common switch. Such situations require that the rule defined in Figure 1-1 be adhered to in adding expansion frames.

Figure 1-2 on page 5 provides an example of eight thin and eight high nodes mixed over a switch and utilizing all the available switch ports by using expansion frame. The switch node offsets are shown in the respective node location.
1.2.3 Use a supported control workstation

The SP control workstation provides a single point of system management. However, it is important to note that not all RS/6000 or pSeries servers are supported to work as a control workstation. A list of the latest supported control workstations is presented in Figure 1-3 on page 6. Refer to the latest edition of RS/6000 SP Planning Volume 1, Hardware and Physical Environment, GA22-7280 for the most recent list.

Attention: pSeries 620 model 6F1, pSeries 660 model 6H1 and RS/6000 Model H80 are only supported on a twisted pair ethernet.
1.2.4 Software levels and dependencies

The software compatibility matrix is often referenced and complied during the installation and planning phase. However, when a site upgrades software to a newer version, software compatibility issues are often overlooked and can cause problems in the operation of the SP.

Software compatibility and dependencies must be crossed-checked every time you plan to upgrade to a new version. Upgrading the level of one software component may also require an upgrade to other existing software components on your SP.
We recommend that you install the latest PTFs on your system. This can potentially avoid a problem that is fixed in the latest available PTFs. Table 1-1 on page 7 lists the IBM LPPs supported for different AIX and PSSP releases.

**Note:** If you are running multiple levels of AIX and PSSP on your SP, ensure that the control workstation is running the highest level of AIX and PSSP.

### Table 1-1  IBM LPP’s per supported PSSP and AIX release

<table>
<thead>
<tr>
<th>PSSP and AIX</th>
<th>IBM LPP’s</th>
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<td>PSSP 3.2</td>
<td>▶ LoadLeveler 2.2, 2.1</td>
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<tr>
<td>AIX 4.3.3</td>
<td>▶ PE 3.1</td>
</tr>
<tr>
<td></td>
<td>▶ ESSL 3.1</td>
</tr>
<tr>
<td></td>
<td>▶ PESSL 2.1</td>
</tr>
<tr>
<td></td>
<td>▶ GPFS 1.3, 1.2, 1.1</td>
</tr>
<tr>
<td></td>
<td>▶ HACMP/ES and HACMP 4.3</td>
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<td></td>
<td>▶ HACMP with HAGEO or GeoRM 2.1</td>
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<td>▶ ESSL 3.1</td>
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<td></td>
<td>▶ GPFS 1.2, 1.1</td>
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<td>▶ HACMP/ES and HACMP 4.3</td>
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<td>PSSP 2.4</td>
<td>▶ LoadLeveler 2.2, 1.3</td>
</tr>
<tr>
<td>AIX 4.2.1 or 4.3.3</td>
<td>▶ PE 2.3</td>
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<tr>
<td></td>
<td>▶ PESSL 2.1</td>
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<tr>
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<td>▶ GPFS 1.1</td>
</tr>
<tr>
<td></td>
<td>▶ RVSD 2.1.1</td>
</tr>
<tr>
<td></td>
<td>▶ HACMP/ES and HACMP 4.2</td>
</tr>
</tbody>
</table>

**Note:** Prior to PSSP 3.1, IBM Recoverable Virtual Shared Disk was a separate LPP. The High Availability Control WorkStation and the Performance Toolbox Parallel Extensions components were priced features. They are now optional components that you receive with PSSP.
1.2.5 Verify the AIX and PSSP level for your hardware

Some customers, typically medium to large sized businesses, have multiple SP systems installed at their site and may relocate hardware (such as an adapter or the entire node) from one SP to another. However, this increases the chances of hardware and software incompatibility. A node working fine on one SP system may not work on the other, as the second system might not be running the required level of software.

To avoid this type of problem, always cross-check compatibility issues every time you add new hardware to your SP. If you are running an old PSSP and AIX version, you may need to apply new PTFs, or sometimes even need to completely upgrade the software.

Table 1-2 shows AIX and PSSP support for different node types.

<table>
<thead>
<tr>
<th>AIX/PSSP</th>
<th>120 MHZ Thin</th>
<th>135 MHZ Wide</th>
<th>160 MHZ Thin</th>
<th>200 MHZ High</th>
<th>332 MHZ Thin</th>
<th>332 MHZ Wide</th>
<th>POWER 3 Thin</th>
<th>POWER 3 Wide</th>
<th>POWER 3 High</th>
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</thead>
<tbody>
<tr>
<td>AIX 4.2.1 PSSP 2.4</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AIX 4.3.1 PSSP 2.4</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AIX 4.3.2 PSSP 3.3</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>N</td>
</tr>
<tr>
<td>AIX 4.3.3 PSSP 3.3.1</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>AIX 4.3.3 PSSP 3.2</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>AIX 4.3.3 PSSP 3.3.1</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

A = Available; factory- and field-orderable
S = Supported
N = Not supported
1.2.6 Migration and coexistence of AIX and PSSP levels

Existing SP users must be fully aware of available migration paths when they upgrade to a newer versions of AIX and PSSP. Only certain migration paths are possible. Table 1-3 lists the currently supported migration path for AIX and PSSP.

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSSP 2.4 and AIX 4.2.1 or 4.3.3</td>
<td>PSSP 3.2 and AIX 4.3.3</td>
</tr>
<tr>
<td>PSSP 3.1.1 and AIX 4.3.3</td>
<td>PSSP 3.2 and AIX 4.3.3</td>
</tr>
</tbody>
</table>

Coexistence of different levels of software running in a single SP must be verified. Older versions of AIX and PSSP had software co-existence restrictions. Table 1-4, lists the supported combination of AIX and PSSP.

<table>
<thead>
<tr>
<th>Product</th>
<th>AIX 4.1.5</th>
<th>AIX 4.2.1</th>
<th>AIX 4.3.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSSP 3.2</td>
<td>N</td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>PSSP 3.1.1</td>
<td>N</td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>PSSP 2.4</td>
<td>N</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

S = Supported
N = Not supported

Note:
- AIX V4.2.1 with PSSP V2.4 is required for low cost models with high nodes. The low-cost models include tall and short frames with 8-port switch, and short frames without a switch.
- A single 332 MHz thin node in a drawer is supported only by AIX V4.3.2 with PSSP V3.1.
- 375 MHZ POWER3 SMP Nodes (features 2056 and 2057) are not supported on AIX 4.3.2 with PSSP 3.1.
1.3 Problem determination methodologies

The keys to the problem determination process are understanding the symptoms and identifying the causes of symptoms. However, this is easier said than done. Particularly in a distributed environment, such as an SP or a cluster, the root cause of the problem may not be local and can be difficult to locate.

There are six basic steps required to identify and resolve a problem in a smart, systematic way:

**Defining the problem**

The first and most important step is to correctly define the problem. Find out the problem symptoms and a complete description of the error messages generated by the system. Also check whether the problem can be regenerated and study the actions that led up to the problem.

A good starting point is to refer to the *Parallel System Support Programs for AIX Diagnosis Guide, Version 3 Release 2, GA22-7350-02* and *Parallel System Support Programs for AIX Messages Reference, Version 3 Release 2, GA22-7352*.

**Isolating the problem**

Different problems may have the same symptoms, but different causes. Determine the origin of the problem. Do some basic checking to roughly identify the cause. This may allow you to determine whether the problem is general to the entire system or is isolated to a well-defined component. Take a *global to local* approach where, in a step by step process, you can narrow down the problem causes and eventually pin-point the root cause.

For example, think of a problem where you cannot mount a directory on a node that was exported from the control workstation. Follow the steps below as a guideline to isolate the problem:

- Check to see if the `mount` command syntax is correct.
- Are you mounting to a valid directory?
- Verify that the directory exported has the correct access permission for the node.
- Are there any security issues with Kerberos and acl files?
- Do you have the same problems on all nodes or is it specific to this node only?

The important concept is to approach the problem in a systematic way so that you can isolate it to a single component.
Check to see if the problem has occurred before
If your site keeps documentation of problem history, then checking this documentation would be of help in this step. It is easy to address a problem effectively if you have dealt with a similar problem before. This is particularly true for site-specific problems, where certain combinations of hardware, software, and procedure triggers a problem.

Generate action plan - use all resources
While troubleshooting a problem, you need to adopt an intuitive approach; try to utilize all the resources and tools available to you. Before proceeding to the actual problem, cross check that all the hardware and software prerequisites have been met. There is no substitute for experience; the more you know about your site, the better it is. Never overlook the bigger picture of your environment. The major hindrance in the problem determination process is having a narrow view of the problem and limited knowledge of the overall environment.

AIX and PSSP provide a number of tools that will simplify the problem determination process. These tools are described in Chapter 2, “Problem determination tools” on page 13. If all tools fail, you need to be aware of the procedure to escalate the problems to your local IBM center for resolution.

Take corrective measures
Once the problem is defined and the root cause is identified, corrective steps are required. Often the problem is with some specific procedure that could be corrected, or a defect is found that requires the application of PTFs or a software or hardware upgrade.

Document the problem for the future
This area is generally overlooked, but it proves significantly important when expediting the resolution of future problems.

Typically, you should record the following information;

- Problem description
  - Problem symptoms
  - Description of error message or error codes
- Action or procedure that led up to the problem
- Applications running at that time
- Type of hardware used
- Software level including version, release, and service level
- Result of any corrective action, especially the one that failed and caused problems on the system
- Actual problem resolution with comments
- Number assigned to the problem, if you contacted IBM support
Chapter 2. Problem determination tools

In this chapter, we introduce a wide range of tools available with AIX and PSSP.

First, the AIX and PSSP log management is discussed in detail. The purpose of these logs and their relevance with respect to the associated problem is discussed in detail. The commands and files related to AIX, BSD and SP-specific logs are also introduced, wherever necessary. The AIX error notification facility is explained with an example to help you write your own notification procedures.

Tools such as diag, trace, dump, invscout, and service agent are also covered to facilitate the problem determination process.

The SP problem management subsystem (PMAN) is introduced to help you manage problems on the SP. Key components of PMAN including pmand, pmanrmd, pmandef and sp_configd are explained in good detail. An example is provided to help you write your own event monitor.

Last, but not least, SP perspectives are discussed with respect to problem determination. We introduce event perspective and hardware perspective and elaborate them with a real-life example to demonstrate their usability.
2.1 PD tools

When you encounter a problem on your SP, the logical starting point is to review the error message and survey the relevant error logs.

In this section, we will discuss the various tools available for problem determination on the SP. These tools are provided to help you diagnose and fix the problems that can occur on the RS/6000 SP.

To learn about the available tools, we recommend you refer to, along with this redbook, the following books:

- Parallel System Support Programs for AIX Diagnosis Guide, Version 3 Release 2, GA22-7350
- Parallel System Support Programs for AIX Messages Reference, Version 3 Release 2, GA22-7352

The following problem determination tools available on the RS/6000 SP will be discussed in detail in the next sections.

- Log management facility
  - AIX error logging facility
  - BSD error logs (syslogd)
  - PSSP specific error logs
- AIX trace facility
- AIX system dump facility
- The `diag` command
- Service Director
- Electronic service agent
- The `invscout` command
- Problem management subsystem
  - `pmand`
  - `pmanrmd`
  - `pmandef`
  - `sp_configd`
- SP Perspective
  - Hardware Perspective
  - Event Perspective
2.1.1 Error logs

The error logs provide a good starting point for the problem determination process. Useful details, such as error type, time stamp, error description, type and nature of the problem can be extracted from the logs. You can then create an action plan to troubleshoot the problem.

The RS/6000 SP uses the AIX and the BSD error log to report errors. IBM-specific software components generally use the AIX facility. BSD error logging is needed to support the public domain software included in PSSP, such as NTP and file collection. AIX includes the BSD error logging facility as a standard feature.

Beside errors and information being logged into the AIX error log, PSSP subsystems write to their own log files. Most of the SP log files are located in the /var/adm/SPlogs directory.

Appendix A, “SP Logs” on page 269 provides a list of all logs managed by PSSP.

2.1.2 Log management

The SP nodes and the control workstation (CWS) are also independent AIX systems where you can locally run the AIX specific error log commands, such as errpt and errclear. However, a mechanism is required to manage a variety of error logs that are spread over several nodes, from a central location, regardless if they are AIX-, BSD-, or PSSP-specific logs.

In order to run AIX error log and BSD syslog parallel (SP-specific) commands to generate parallel log reports, proper authorization is required. The error log management functions are provided in the ssp.sysman install option of the IBM Parallel System Support Programs for AIX.

The SP error log management consists of:

- SMIT panel interfaces
- A set of external commands
  - splm for general log viewing, archiving, and service collection
  - psyslrept for generating reports of BSD syslog log files
  - psyslcre for trimming BSD syslog log files
  - penotify for creating, removing, or displaying Error Notification Objects
- Sysctl-based server functions
The log management primary access is available through the `smit splogmgt` command. Figure 2-1 provides the output of the smit log management screen.

```
RS/6000 SP Log Management

Move cursor to desired item and press Enter.

AIX Error Log
Syslog
General Log Viewing
Archive Logs
Collect Logs for Service

F1=Help             F2=Refresh          F3=Cancel           F8=Image
F9=Shell            F10=Exit            Enter=Do
```

Figure 2-1  SMIT splogmgt command

Log management functions are built upon the sysctl facility, which uses SP security services. Configuring the log management is different when using DCE or Kerberos V4.

**Configuring log management with DCE authentication**

When using DCE authentication, a log management use can obtain authorization by using the `dce_login` command with a DCE principal that is a member of the sysctl-logmgt group. The user can also be authorized by some other entry added to the DCE ACL in the `/etc/logmgt.acl` file by an SP security administrator who is a member of the spsec-admin group.
Configuring log management with Kerberos V4 authentication

When using Kerberos V4 authentication, the user needs to issue the `k4init` command to be identified to the SP authentication services. The user can now generate parallel AIX Error Log and BSD syslog reports and view any logs. All other log management commands additionally require that the user be defined as a principal in the `/etc/logmgt.acl` file. All users defined in this file must also be placed in the authentication database as a principal (PSSP Kerberos V4 or AFS).

Example 2-1 provides a sample of the `/etc/logmgt.acl` file:

```
Example 2-1   /etc/logmgt.acl

#ac1#
# This sample acl file for log management commands contains
# a commented line for a principal
_PRINCIPAL root.admin@HPSSL.KGN.IBM.COM
# for trimming SPdaemon.log by cleanup.logs.ws
_PRINCIPAL rcmd.k7s
_PRINCIPAL root.admin@MSC.ITSO.IBM.COM
```

Configuring sysctl for log management

The log management server functions executed by Sysctl are located in `/usr/lpp/ssp/sysctl/bin/logmgt.cmds`. During system installation, an include statement for this file is added to the default Sysctl configuration file `/etc/sysctl.conf`. If you use an alternate Sysctl configuration file, you must update the file with a statement to include the logmgt.cmds file. In addition, you must restart the sysctld daemon to pick up this change.

2.1.3 AIX error logging facility

All problem determination tools available through standard AIX are also available for SP nodes and the Control Workstations (CWS). However, being a distributed, clustered environment, new parallel external commands and SMIT panels have been added to facilitate the AIX log management on SP.

AIX provides facilities and tools for error logging, system trace, and system dump. Most of these facilities are included in the bos.rte fileset within AIX and, therefore, are installed on every node and CWS automatically. However, some additional tools are included in an optionally installable package, bos.sysmgmt.serv_aid, which should be installed on your nodes and CWS.
The AIX error logging facility records hardware and software failures or informational messages in the /var/adm/ras/errlog. By analyzing this log, you would know what went wrong, when, and possibly why. While executing the AIX log management commands, you can specify whether the command should be executed on all nodes or a particular node. The default is the local node. Figure 2-2 provides the SMIT menu which is resulted from `smit sperrlog` command.

From this screen, apart from generating the AIX error report, a variety of other tasks can also be performed.

<table>
<thead>
<tr>
<th>AIX Error Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move cursor to desired item and press Enter.</td>
</tr>
<tr>
<td>Generate an Error Report</td>
</tr>
<tr>
<td>Show Characteristics of the Error Log</td>
</tr>
<tr>
<td>Change Characteristics of the Error Log</td>
</tr>
<tr>
<td>Clean the Error Log</td>
</tr>
<tr>
<td>Add a Notification Object</td>
</tr>
<tr>
<td>Remove a Notification Object</td>
</tr>
<tr>
<td>Show a Notification Object</td>
</tr>
<tr>
<td>Add an Error Template</td>
</tr>
<tr>
<td>Remove an Error Template</td>
</tr>
<tr>
<td>Show an Error Template</td>
</tr>
</tbody>
</table>

F1=Help            F2=Refresh          F3=Cancel           F8=Image
F9=Shell            F10=Exit            Enter=Do

If you choose Generate an Error Report option, the SMIT will present several other options to filter the error log output. Figure 2-3 on page 19 provides an example of the AIX error log generated on the CWS using the default options.
The following is a brief explanation of the title headers that appear in the summary or detailed output of the AIX error log:

- **IDENTIFIER** is the error ID.
- The **errpt -t** command will display all possible types of errors that can be logged by the AIX logging facility.
- **TIMESTAMP** format is mmddhhmmyy where:
  - mm represent the month
  - dd is the day
  - hh is hour on 24-hour clock
  - mm represent the minute
  - yy is for the year
The `errpt -s mmdhhmmyy -e mmdhhmmyy` command will display all errors logged during the starting and ending time specified.

- **T** represents the type of error. The possible values are:
  - PERM for permanent errors
  - INFO for information
  - TEMP for temporary errors
  - UNKN for unknown error types
  - PEND for imminent errors
  - PERF for performance

The command `errpt -T PERM` will display all the errors of a permanent type in the AIX error log.

Note that, in the summary output of the AIX error log, you will only see one letter for the error type. For example, P for permanent error (instead of PERM).

- **C** represents the error class. The possible values are:
  - H for hardware
  - S for software
  - U for undetermined

- **RESOURCE NAME** describes the subsystem name.

- **DESCRIPTION** provides a brief description of the error available in the error log template.

A more comprehensive and detailed output could be generated by using the `errpt -a` command on a selected node (or use the `smit perrpt` command and select the detailed output option). This command typically generates a long list, displaying details about all the logged errors. To focus on a specific error, issue the command `errpt -a -j 95A9DAD0`, where 95A9DAD0 is the error identifier. Example 2-2 provides detail output of the previous selected error.

**Example 2-2  Detail output of selected error**

```
LABEL:          TS_NODEUP_ST
IDENTIFIER:     95A9DAD0
Date/Time:       Mon Jul  2 01:56:02 EDT
Sequence Number: 1625
Machine Id:      000354784C00
Node Id:         sp4en0
Class:           O
Type:            INFO
```
Resource Name: hats.sp4en0

Description
Remote down nodes came back up

Probable Causes
Remote nodes powered on
Remote nodes re-booted
Previous network problems corrected

User Causes
Remote nodes powered on by user
Remote nodes rebooted by user
:Remote nodes rebooted by user

Recommended Actions
Verify that remote nodes are up

Detail Data
DETECTING MODULE
rsc.t.connect.C, 1.60,1580
ERROR ID
6EfReJo0mn.Ev.79BOAG.e.1...................
REFERENCE CODE
6ZW0YW/AV.Ev.WrsOAG.e.1...................
File containing up node numbers and associated REFERENCE CODE
/var/adm/ffdc/dumps/hats.23750.20010702.015602

The Detail Data section of the detail output error log provides a DETECTING MODULE string that identifies the software component, module name, module level, and the defective line. This information can help you isolate the software module that might have caused the problem.

The errdemon daemon keeps the log file updated based on information and errors logged by subsystems through the erlog facility, or through the errsave facility, if they are running at kernel level. In either case, the errdemon daemon adds the entries in the error log on a first-come-first-served basis.

2.1.4 Managing the AIX error log

You can continue to use standard AIX error log commands by supplement them with the dsh command in a cluster environment. To take a snapshot of the error log from all the nodes and centralize them on CWS, execute the following command:

#dsh -a errpt -s 0215133001 >/var/adm/ras/ALL.0215133001.log
This command will accumulate error logs of all nodes on the CWS, starting from
FEB 15 2001 at 13:30 hours. The format of the -s flag is mmddhhmmyy (month,
day, hour, minute, and year). The name and location of this file is arbitrary.

You can invoke \texttt{smit} fastpath parallel commands to manage AIX error logs on
selected nodes or on the CWS using the SP log management feature.

\textbf{Attention:} The fastpath invocation to generate an error report menu is: \texttt{smit perrpt}

\textbf{Trimming the AIX error log}
By using the following command, you can trim or completely clean the entries in
the error logs on selected nodes.

\texttt{smit perrclear}

\textbf{Show characteristics of AIX error Log}
The fastpath invocation to show the characteristics menu of the error log is:

\texttt{smit perrdemon_shw}

\textbf{Change characteristics of AIX error log}
The fastpath invocation to change characteristics for the error log is:

\texttt{smit perrdemon_chg}

\textbf{Important:} Keep at least 4 MB for the error log.

\subsection*{2.1.5 AIX error notification}
PSSP provides facilities for log monitoring and error notification. This differs from
the standard AIX notification in the sense that, although it uses the AIX
notification method, it also provides a global view of your system. You can, for
example, create a monitor for your AIX error log on all your nodes at once with a
single command or with a few clicks of mouse.

Error notification objects are ODM objects held in the class ernotify. They are
used by the AIX error notification facility to invoke methods upon occurrence of
an error event. Fields in the ernotify class are matched with the fields in the error
template for selection. If an error is logged matching the selection criteria defined
in a notification object, the method associated with that object is invoked.

You can add, remove, and show notification objects in parallel on the SP system.
Chapter 2. Problem determination tools

The fastpath invocation to Add a Notification Object menu is:

```
smit padd_en
```

The fastpath invocation to Remove a Notification Object menu is:

```
smit prem_en
```

The fastpath invocation to Show a Notification Object menu is:

```
smit pshw_en
```

From the command line, use `penotify -f show` to add, remove, or show error notification objects in parallel on the SP.

---

**Important:** No parallel log management command, including `penotify` will be executed without proper authorization. You need to add your PRINCIPLE in the `/etc/logmgt.acl` file, as shown in Example 2-1 on page 17.

---

Chapter 4, “Using the AIX Error Log Notification Facility” of the *PSSP: Diagnosis Guide*, GA22-7350, provides good examples of setting up the notification methods.

**Error notification example**

You can setup error notification to inform you when a specific error occurred or, more intuitively, you can get an alert even before the error become a real problem. This can be done if you monitor the error type PEND for all pending errors.

It is a good idea to trap errors both on nodes and on the CWS. To do so, you can add an appropriate error notification object in the ODM. The following list defines an error notification that will send an e-mail to root when an error type PEND occurs:

1. Set up a work directory to hold the script that runs when the error occurs:

   ```
   #mkdir /<work_directory>/objects
   #mkdir /<work_directory>/methods
   ```

2. Create a script that runs when the error occurs, as in Example 2-3 on page 24.

   **Tip:** Do not forget to provide the scripts with running privileges (+x).
Example 2-3  Script that runs when an error occurs

```bash
#!/bin/ksh

# Run errpt to get the fully expanded error report for the error that was just written and redirect to a unique tempfile with the PID of this script.
errpt -a -l $1 >/tmp/tempfile.$$ 

# Mail the fully expanded error report to root@controlworkstation
# This could be anywhere in the network.
# root@controlworkstation is the user and hostname that the administrator wants to be notified at.
mail root </tmp/tempfile.$$ 
```

3. Create a new errnotify object in the ODM.

Make a script with the new entries as shown in Example 2-4.

**Important:** Save the errnotify ODM objects with the command:

```bash
# cp /etc/objrepos/errnotify /etc/objrepos/errnotify.bkp
```

Example 2-4  errnotify entries for PEND errors

```bash
errnotify:
en_name = "errnot.PEND.obj "
en_persistenceflg =1
en_type = "PEND"
en_method = "/<work_directory/methods/errnot.sh $1 "
errnotify:
en_name = "errnot.pend.obj "
en_persistenceflg =1
en_type = "pend"
en_method = "/<work_directory/methods/errnot.sh $1 "
errnotify:
en_name = "errnot.Pend.obj "
en_persistenceflg =1
en_type = "Pend"
en_method = "/<work_directory/methods/errnot.sh $1 "
```
4. Add the entries to the odm database.

    #odmadd /<work_directory/objects/odmadd.txt

An e-mail similar to Example 2-5 on page 25, will be sent to root whenever an error type PEND occurs.

**Example 2-5  E-mail sent to root when an error occurs**

```
LABEL:TS_NODEDOWN_EM
IDENTIFIER:4D9226A5
Date/Time:Fri Feb 16 18:37:37
Sequence Number:12232
Machine Id:000504936700
Node Id:sp6en0
Class:U
Type:PEND
Resource Name:hats.sp6en0
Resource Class:NONE
Resource Type:NONE
Location:NONE
VPD:
Description
Remote nodes down
Probable Causes
Remote nodes powered off
Remote nodes crashed
Networking problems render remote nodes unreachable
Remote nodes removed from configuration after refresh
Topology Services daemon on remote nodes stopped
User Causes
User powered off remote nodes
Remote nodes removed from configuration after refresh
Recommended Actions
Confirm that this is desirable
Failure Causes
Remote nodes crashed
Lost connection to remote nodes due to network problems
Remote nodes hang
Recommended Actions
Get system dump from remote nodes.Re-boot remote nodes
Clear networking problems
Re-start Topology Services daemon on remote nodes
Contact IBM Service if problem persists
Detail Data
```
Useful ODM commands
To view the recently created errnotify objects in the ODM database, enter:

```
#odmget -q "en_name =errnot.PEND.obj " errnotify
#odmget -q "en_name =errnot.pend.obj " errnotify
#odmget -q "en_name =errnot.Pend.obj " errnotify
```

To delete the recently created errnotify objects, enter:

```
#odmdelete -o errnotify -q "en_name =errnot.PEND.obj "
#odmdelete -o errnotify -q "en_name =errnot.pend.obj "
#odmdelete -o errnotify -q "en_name =errnot.Pend.obj "
```

To spread this process across the nodes, follow these steps:

1. Repeat step 1 with the `dsh -a` command:
   
   ```
   #dsh -a mkdir /<work_directory>/objects
   #dsh -a mkdir /<work_directory>/methods
   ```

2. Change the script to send an e-mail to root@MACN (CWS) so you have only one e-mail to look at. Copy the script from the MACN (CWS) to the nodes:
   
   ```
   #pcp -a /<work_directory>/methods/errnot.sh
   ```

3. Copy the script with the ODM entries to the nodes:
   
   ```
   #pcp -a /<work_directory>/objects/odmadd.txt
   ```

4. Repeat the `odmadd` to all nodes with the `dsh -a` command:
   
   ```
   #dsh -a odmadd /<work_directory>/objects/odmadd.txt
   ```

**Important:**

Remember to save the errnotify ODM with the command:

```
#dsh -a cp -p /etc/objrepos/errnotify /etc/objrepos/errnotify.bkp
```

### 2.1.6 BSD error logging

The BSD syslog is a well known and widely implemented error logging facility. PSSP exploits the syslog mostly for information reporting as opposed to error reporting.
The syslogd daemon, which logs the errors, is configured with a file to determine the destination of the incoming messages. The default configuration file is /etc/syslog.conf. The BSD syslog errors are classified by the facility that is issuing the error, and by the error's priority value. Based on the priority values, entries in the configuration file determine the destination for each error message. Destinations can be a file, user ID, or the syslogd daemon on another machine. We suggest that error messages be logged locally rather than forwarded to a remote syslog because of the increased network traffic. File collections can be used to maintain consistent configuration of the syslog facility.

For a list of these facilities and priority values, refer to the syslogd in the *IBM AIX Commands Reference Volume 1*, SBOF-1877.

**Format of the syslog file**

The format of a syslog output file is:

`MMM DD HH:MM:SS node_name resource[pid]: msg`

Where:

- `MMM DD HH:MM:SS` is the timestamp (month day hour:minute:second).
- `node_name` is name of the node where the error has occurred.
- `resource` is the name of the failing system.
- `pid` is optionally logged process ID of the failing resource.
- `msg` is a free form error message.

Errors logged by SP components will contain in the message section, the following additional information pertaining to the logging resource:

- `LPP` LPP name.
- `Fn` filename.
- `SID` SID_level_of_the_file.
- `L#` Line number or function.

**Useful commands**

The SMIT fastpath command to access the Syslog general menu is:

`smit spsyslog`

The SMIT fastpath invocation to generate a Syslog report menu is:

`smit spsyslrlpt`
From the command line: To report to local node all records logged by the FTP for all syslog log files on nodes in the current system partition:

```
psyslrpt -a -r ftp
```

From the command line: To report all records that were logged to files selected for the daemon and user facilities starting on March 3, and to report records to the local node from nodes host1 and host2.

```
psyslrpt -w host1,host2 -f user,daemon -s 03030000
```

**Tip:** The size of syslog log files is not configurable and will continue to grow until manually trimmed. You must perform regular trimming of syslog file to avoid a file system full condition.

The fastpath invocation to trim syslog log files menu is:

```
smit spsyslclr
```

From the command line: To trim all records older than 30 days from the log file /var/adm/msgs on the local node.

```
psyslclr -y 30 -l /var/adm/msgs
```

From the command line: To trim all records from all log files found in the alternate syslog configuration file /etc/syslog.conf.

```
psyslclr -g /etc/syslog.conf -y 0
```

**Attention:** If the syslogd daemon is stopped during the trimming process, use the -g option to restart it with either the default configuration file or an alternate file.

The `psyslclr` command can be added as a crontab entry for performing scheduled syslog trimming. On the control workstation, `psyslclr` is used to trim daemon facility messages older than six days. This is done in /usr/lpp/ssp/bin/cleanup.logs.ws, which runs from the control workstation's crontab file.

### 2.1.7 SP log files

Beside errors and information being logged into the AIX error log, most of the PSSP subsystems write to their own log files where, usually, you will find the information you need for problem isolation and problem determination.
Although some components run only on the CWS (such as SDR daemon, host respond daemon, and switch admin daemon), others, such as the switch daemon, run only on the nodes. This needs to be taken into the consideration while searching for error logs. Appendix A, “SP Logs” on page 269 provides a complete list of SP logs and their locations.

PSSP log files are located in the /var/adm/SPlogs directory whereas RSCT log files are located in the /var/ha/log directory. In addition there are few miscellaneous logs files that can be found in the /tmp and /var/sysman/log/* directory.

**Important:** Considering that the /var file system is holding the majority of the log files, it is important to monitor the size of this file system. Refer to the *IBM RS/6000 SP: Planning, Volume 2, Control Workstation and Software Environment*, GA22-7281 for file system disk space requirements.

### 2.1.8 The /var/adm/SPlogs directory

This is the prime location for important SP logs. The contents of /var/adm/SPlogs directory on CWS is listed in Figure 2-4 on page 30.
Figure 2-4 /var/adm/SPlogs - directory view on CWS

```
[root@sp4en0]:/var/adm/SPlogs> ls -l

total 560
-rw-r--r--   1 root     system         1310 Jul 16 14:11 CSS_test.log
-rw-r--r--   1 root     system           83 Mar 16 11:51 SDR_test.log
drwxr-xr-x   2 bin      bin             512 Jul 16 01:04 SPconfig
-rw-r--r--   1 root     system       271003 Jul 16 14:16 SPdaemon.log
-rw-r--r--   1 root     system          253 Mar 07 21:04 SYSMAN_test.log
drwxrwxrwx   2 bin      bin             512 Mar 01 19:16 auth_install
drwxr-xr-x   2 root     system           512 May 27 13:14 auto
drwxrwxrwx   2 root     system           512 May 29 00:00 cs
drwxr-xr-x   2 bin      bin             512 May 27 12:21 csd
drwxr-xr-x   2 root     system           512 May 28 12:53 css
drwxr-xr-x   4 root     system           512 May 27 12:12 css0
drwxr-xr-x   4 root     system           512 May 27 12:12 css1
drwxr-xr-x   2 root     system           512 May 10 00:00 filec
drwxr-xr-x   2 bin      bin             512 May 27 12:12 get_keyfiles
drwxr-xr-x   2 root     system           512 May 27 12:12 jm
-drwx------   2 root     system           512 Mar 01 12:09 kerberos
drwxr-xr-x   2 bin      bin             512 Jun 03 00:00 kfservers
drwxr-xr-x   2 root     system           512 May 27 13:14 pman
drwx------   2 root     system           512 Jun 04 00:00 sdr
-drwxr-xr-x   2 root     system           512 May 27 12:12 spmgr
drwxr-xr-x   8 bin      bin             512 Jul 16 00:00 spmon
drwxrwxrwx   2 root     system           512 May 27 12:12 st
drwxr-xr-x   2 bin      bin             512 Mar 01 12:01 sysctl
```
Figure 2-5  /var/adm/SPlogs - directory view on of a node

The structure of /var/adm/SPlogs directory on a node is presented in Figure 2-5.

We now review the subdirectories in /var/adm/SPlogs and discuss the differences between the logs available on the nodes and on the CWS.

SPconfig

The SPconfig subdirectory has information on VPD data. On the CWS, you have information from all the nodes. The information in this directory is created using the /usr/lpp/ssp/install/bin/save_config command. The save_config command, when run on a node, creates files locally and then copies them to the CWS. When executed on CWS, it collects information from the /var/adm/SPlogs/SPconfig directory of all nodes and copies them locally in the /var/adm/SPlogs/SPconfig directory of CWS. It is therefore recommended to run save_config first on nodes and then on the CWS.

The following is a brief explanation of the log files present in this directory.

nn.lpp.levels

The file name is pre-fixed by the node number (nn=0 for CWS). It is the output of ls1pp command for the ssp.basic and ssp.css component. It only provides the base level information, even if you have a different modification applied. We recommend that you run the 1s1pp -1 command when requiring the levels of PSSP.
**nn.lscfg**
This file contains the output of the `lscfg` command from the node and CWS. Where nn is the node number suffix.

**nn.umlc**
This file is a result of a combination of the `lsvpd` and `/usr/lpp/diagnostics/bin/umlc` commands. All files are prefixed with node number. In a node, you see only its own files.

**auth_install**
The auth_install subdirectory has one file named `log`. This file has log information from the `spauthconfig` and `updauthfiles` commands. `spauthconfig` is invoked from `/etc/rc.sp`, so it runs on every reboot. The `updauthfiles` command is called upon from within the `spauthconfig` command. When DCE authentication method is used, the `rm_spsec` command is logged in the log file.

**auto**
The auto subdirectory contains a file called auto.log, which has information from the automount daemon.

**cs**
The cs subdirectory has information on the `cstartup` and `cshutdown` commands. The log files have the following format:

```
cshut.<timestamp>.<pid>
cstart.<timestamp>.<pid>
```

This directory is available only on the CWS.

**csd**
The csd subdirectory contains information about IBM Recoverable Virtual Shared Disk (RVSD) subsystem. There are two important files in this directory:

1. vsd.log: Summary of actions from RVSD.
2. vsd.debuglog: Detailed information of actions from RVSD.
CSS

CSS is a comprehensive directory containing important files related to the switch. Table 2-1 provides a list of files in /var/adm/SPlogs/css directory and their location.

**Table 2-1  Files included in css directory**

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>cable_miswire</td>
<td>Information about cable miswire from nodes.</td>
<td>Primary node</td>
</tr>
<tr>
<td>cssadm.debug</td>
<td>Detailed information about the Switch admin daemon. It is in chronological order. Take a look at the time near the error.</td>
<td>CWS</td>
</tr>
<tr>
<td>cssadm.stderr</td>
<td>Standard error output from the switch admin daemon.</td>
<td>CWS</td>
</tr>
<tr>
<td>cssadm.stdout</td>
<td>Standard output for switch admin daemon.</td>
<td>CWS</td>
</tr>
<tr>
<td>daemon.log</td>
<td>Standard output for SP Switch2 daemon.</td>
<td>Nodes</td>
</tr>
<tr>
<td>daemon.stderr</td>
<td>Standard error output for fault service daemon (Worm) for the SP Switch.</td>
<td>Nodes</td>
</tr>
<tr>
<td>daemon.stdout</td>
<td>Standard output for fault service daemon (Worm) for the SP Switch.</td>
<td>Nodes</td>
</tr>
<tr>
<td>dist_topology.log</td>
<td>Error messages when the primary node distributes the topology file across all nodes.</td>
<td>Primary node</td>
</tr>
<tr>
<td>dtbx_failed.trace</td>
<td>Trace file about diagnostic for the SP Switch adapter.</td>
<td>Node</td>
</tr>
<tr>
<td>dtbx.trace</td>
<td>Information about diagnostic for the SP Switch adapter.</td>
<td>Node</td>
</tr>
<tr>
<td>dtbxworm.stderr</td>
<td>Standard error output for messages from adapter diagnostics.</td>
<td>Nodes</td>
</tr>
<tr>
<td>Eclock.log</td>
<td>Information from all <em>Eclock</em> commands.</td>
<td>CWS</td>
</tr>
<tr>
<td>Ecommands.log</td>
<td>Information from all <em>Ecommands</em> issued.</td>
<td>CWS</td>
</tr>
<tr>
<td>Emonitor.log</td>
<td>Information from all <em>Emonitor</em> commands.</td>
<td>CWS</td>
</tr>
<tr>
<td>Emonitor.Estart.log</td>
<td>Information from <em>Estart</em> command issued by the <em>Emonitor</em> daemon.</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Eunpart.file</td>
<td>Information from an <em>Eunpartition</em> operation.</td>
<td>Primary node</td>
</tr>
<tr>
<td>fs_daemon_print.file</td>
<td>Trace file of fault service daemon messages.</td>
<td>Nodes</td>
</tr>
<tr>
<td>File</td>
<td>Description</td>
<td>Location</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>fit</td>
<td>All information from a Switch fault. This file is very useful in problem determination. Always look at the time of the error to try to understand what happened.</td>
<td>Nodes</td>
</tr>
<tr>
<td>logevnt.out</td>
<td>stdout and stderr of the Event Management Resource Monitor and Methods.</td>
<td>CWS</td>
</tr>
<tr>
<td>msdg.log</td>
<td>SP Switch and SP Switch2 advanced diagnostics Message Daemon log.</td>
<td>CWS</td>
</tr>
<tr>
<td>out.top</td>
<td>Information about the current topology file.</td>
<td>Primary node</td>
</tr>
<tr>
<td>rc.switch.log</td>
<td>Information about the initialization of the SP Switch support code. This is another good file to start looking at.</td>
<td>Nodes</td>
</tr>
<tr>
<td>router.log</td>
<td>Log from switch router generation.</td>
<td>Nodes</td>
</tr>
<tr>
<td>router_failed.log</td>
<td>Error information when a problem is detected from a router generator.</td>
<td>Nodes</td>
</tr>
<tr>
<td>spd.trace</td>
<td>SP Switch advanced diagnostics tests and architecture components log.</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>spd_gui.log</td>
<td>SP Switch advanced diagnostic GUI log.</td>
<td>CWS</td>
</tr>
<tr>
<td>summlog</td>
<td>Summary of entries in AIX error log for all nodes. Entries in the log have the following fields, which are separated by blanks: Timestamp: MMDDhhmmYYYY Node: Reliable hostname Snap: If Y there is snap capture else N Partition name Index: AIX error log sequence number Label: AIX error log label.</td>
<td>CWS</td>
</tr>
<tr>
<td>summlog.out</td>
<td>stdout and stderr for the CSS logging daemon's Event Management client.</td>
<td>CWS</td>
</tr>
<tr>
<td>topology.data</td>
<td>Status of the current network topology.</td>
<td>Primary node</td>
</tr>
<tr>
<td>worm.trace</td>
<td>Worm trace file from switch initialization.</td>
<td>Primary node</td>
</tr>
</tbody>
</table>
css0 and css1

There are two subdirectories in /var/adm/SPlogs called css0 and css1, one for each switch adapter. These directories are available only in PSSP 3.2 or later release. These directories have two more subdirectories p0 and p1, for each port of the switch adapter. This structure is located on the nodes and all information is for the SP Switch2 only. Table 2-2, list the files within this structure. The level column can assume two values:

1. Adapter: The file is located in /var/adm/SPlogs/cssX, where X is the adapter ID (0 or 1).
2. Port: The file is located in /var/adm/SPlogs/cssX/pY, where X is the adapter ID (0 or 1), and Y is the port ID (0 or 1).

Table 2-2  New structure of SP Switch2 logs

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>cadd_dump.out</td>
<td>Output of the cadd_dump command. This file is a dump from the adapter device driver message buffer.</td>
<td>Adapter</td>
</tr>
<tr>
<td>ifcl_dump.out</td>
<td>Output of the ifcl_dump command. This file is a dump from the adapter device driver IP message buffer.</td>
<td>Adapter</td>
</tr>
<tr>
<td>col_dump.out</td>
<td>Output of the col_dump command. This file is a dump from the microcode trace buffer.</td>
<td>Adapter</td>
</tr>
<tr>
<td>odm.out</td>
<td>Contains the following output for each adapter:</td>
<td>Adapter</td>
</tr>
<tr>
<td></td>
<td>/bin/odmget -q &quot;attribute=adapter_status&quot;PdAt</td>
<td>Adapter</td>
</tr>
<tr>
<td></td>
<td>/bin/odmget -q &quot;attribute=adapter_status&quot;CuAt</td>
<td>Adapter</td>
</tr>
<tr>
<td>spdata.out</td>
<td>Output of the following commands:</td>
<td>Port</td>
</tr>
<tr>
<td></td>
<td>/usr/lpp/ssp/css/splstdata -f -G</td>
<td>Port</td>
</tr>
<tr>
<td></td>
<td>/usr/lpp/ssp/css/splstdata -s -G</td>
<td>Port</td>
</tr>
<tr>
<td></td>
<td>/usr/lpp/ssp/css/splstdata -n -G</td>
<td>Port</td>
</tr>
<tr>
<td></td>
<td>/usr/lpp/ssp/css/splstdata -b -G</td>
<td>Port</td>
</tr>
<tr>
<td>netstat.out</td>
<td>Output of the following commands:</td>
<td>Adapter</td>
</tr>
<tr>
<td></td>
<td>netstat -I css0</td>
<td>Adapter</td>
</tr>
<tr>
<td></td>
<td>netstat -m</td>
<td>Adapter</td>
</tr>
<tr>
<td>scan_out.log</td>
<td>The TBIC, which is a chip on the SP Switch2 adapter, is scanned into this file and saved as part of the snapshot by the css.snap script. The scan_save.log is for the previous TBIC scan.</td>
<td>Adapter</td>
</tr>
<tr>
<td>scan_save.log</td>
<td></td>
<td>Adapter</td>
</tr>
</tbody>
</table>
The /var/adm/SPlogs/filec, located on the nodes, contains information about the `supper` command. Basically, you see two files in the following format:

1. sup<date>.<time>: The output of the `supper` command.
2. sup<date>.<time>r: The actions performed by the `supper` command.

**get_keyfiles**

The /var/adm/SPlogs/get_keyfiles directory, located on the nodes, contains the file `get_keyfiles.log` which has the output of the last `get_keyfiles` command issued.
jm
The /var/adm/SPlogs/jm directory contains information regarding the resource manager. The file jmd_out contains the messages of the Resource Manager, and the file jm_err contains the errors from the Resource Manager.

kerberos
The /var/adm/SPlogs/kerberos file contains information about Kerberos Version 4 authentication. Table 2-3 list the files in this directory.

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>admin_server.syslog</td>
<td>This file contains information about the authentication database administration daemon.</td>
<td>Primary authentication server</td>
</tr>
<tr>
<td>kerberos.log</td>
<td>This is the log of the primary authentication server.</td>
<td>Primary authentication server</td>
</tr>
<tr>
<td>kerberos.slave_log</td>
<td>This is the log of the secondary authentication server.</td>
<td>Secondary authentication server</td>
</tr>
<tr>
<td>kpropd.log</td>
<td>This file contains the log of the authentication database propagation daemon.</td>
<td>Secondary authentication server</td>
</tr>
</tbody>
</table>

kfserver
The kfserver subdirectory contains information about srvtab files. In kfserver.log, you can find messages generated from the transfer of the srvtab files to the nodes. The regserver.log file has the messages generated by the registration process for the kfserver program.

pman
The pman subdirectory contains messages generated by the problem management daemon. On the nodes, the file is called pmand.log; whereas, on CWS it is referred to as pmand.<partition_name>.log.

sdr
Information about the sdr daemon is kept in the sdr subdirectory. On CWS, there are two files:
1. SDR_config.log; contains configuration messages from SDR.
2. srdlog.<partition>.<pid>; contains error messages from the sdr daemon.
On the nodes there is only the SDR_config.log file.

**spacs**
The login control messages, on the nodes, are stored in the
/var/adm/SPlogs/spacs/spacs.log file.

**spmgr**
The /var/adm/SPlogs/spmgr directory stores information about extension nodes, such as the 9077 SP Switch Router. The spmgrd.log is maintained by the spmgrd daemon.

**spmon**
The spmon directory is located on the CWS. The Table 2-4 shows the spmon directory structure.

*Table 2-4  spmon logs*

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>hmlogfile.&lt;julian-date&gt;</td>
<td>hardmon initialization and error messages. When the hardmon starts to respawn, this is a good log to look at.</td>
</tr>
<tr>
<td>nc/nc.&lt;frame&gt;.&lt;node&gt;</td>
<td>Messages from the nodecond command. We recommend you run tail -f in this file during the install/migration, diagnostic, and maintenance processes.</td>
</tr>
<tr>
<td>nfd/nfd.&lt;frame&gt;.log.&lt;julian-date&gt;</td>
<td>Netfinity daemon information.</td>
</tr>
<tr>
<td>s70d/s70d.&lt;frame&gt;.log.&lt;julian-date&gt;</td>
<td>Messages from the hardware monitor s70d daemon.</td>
</tr>
<tr>
<td>splogd/splogd.&lt;pid&gt;</td>
<td>Contains the PID of the splogd daemon.</td>
</tr>
<tr>
<td>splogd.state_changes.&lt;timestamp&gt;</td>
<td>Changes reported by the splogd daemon.</td>
</tr>
<tr>
<td>ucode/ucode_log.&lt;frame.node&gt;</td>
<td>Microcodes download messages when using the smit supervisor command.</td>
</tr>
<tr>
<td>spmon_ctest.log</td>
<td>Output of the spmon_ctest command.</td>
</tr>
<tr>
<td>spmon_itest.log</td>
<td>Output of the spmon_itest command.</td>
</tr>
</tbody>
</table>

**st**
The information and error messages from the Job Switch Resource Table and Services is in the /var/adm/SPlogs/st/st_log file on the nodes.
sysctl
Information about the Sysctl server is kept in /var/adm/SPlogs/sysctl/sysctld.log file both on nodes and the CWS.

sysman
The sysman subdirectory is useful during installation, migration and customization of nodes. Table 2-5 lists its contents.

Table 2-5 sysman subdirectory log files

<table>
<thead>
<tr>
<th>File</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>mirror.out</td>
<td>Contains AIX error messages when mirroring a volume group the SP volume group commands.</td>
<td>MACN (CWS), nodes</td>
</tr>
<tr>
<td>&lt;node&gt;.config.log.&lt;pid&gt;</td>
<td>Contains messages from the pssp_script command. This command runs during the installation/migration and customization of the nodes. When you have a node that was set to customize and does not return automatically to disk, check this file to see what happened.</td>
<td>Nodes</td>
</tr>
<tr>
<td>&lt;node&gt;.configb.log.&lt;pid&gt;</td>
<td>The pssp_script commands calls the psspfb_script, which uses this file as output. It is also very useful for installation/migration and customization problems.</td>
<td>Nodes</td>
</tr>
<tr>
<td>&lt;node&gt;.console.log</td>
<td>All the console messages for the node.</td>
<td>MACN (CWS), nodes</td>
</tr>
<tr>
<td>spfbcheck.log</td>
<td>Output of the spfbcheck command that runs after installation/migration or when the node is set to customize.</td>
<td>Nodes</td>
</tr>
<tr>
<td>SYSMAN_test.log</td>
<td>The /var/adm/SPlogs/SYSMAN_test.log file contains information and error messages from the SYSMAN_test command.</td>
<td>MACN (CWS), nodes</td>
</tr>
<tr>
<td>unmirror.out</td>
<td>Contains AIX error messages when unmirroring a volume group the SP volume group commands.</td>
<td>MACN (CWS), nodes</td>
</tr>
</tbody>
</table>
CSS_test.log
The /var/adm/SPlogs/CSS_test.log file contains the output of the CSS_test
command. It is useful for debugging purposes. This file resides only on the CWS.

SDR_test.log
The SDR_test.log file contains the output of the SDR_test command on both
nodes and the CWS. This file is located in the /var/adm/SPlogs directory.

SPdaemon.log
There is general information about system daemons and hardware errors in the
/var/adm/SPlogs/SPdaemon.log file. This file resides both on nodes and the
CWS.

2.1.9 RSCT log files
The information from the RSCT daemons is stored in the /var/ha directory. The
following are the important log files:

hags
The var/ha/log/hags* files contain information collected from the hags daemon.
The files have following two formats:
1. hags.<partition>_<node>_<incarnation>._<partition> on the CWS
2. hags_<node>_<incarnation>._<partition> on the nodes.

To find out the active hags file, execute ls -1tr hags* command and check the
last updated file as shown in Example 2-6.

Example 2-6 Determining the active hags log file

# cd /var/ha/log
/var/ha/log # ls -1tr hags*
-rw-r-r-- 1 root system 675838 Nov 02 11:14 hags.sp3en0_0_14.sp3en0
-rw-r-r-- 1 root system 5065 Nov 02 11:15 hagsglsm.default.sp3en0.0_14
-rwxr-xr-x 1 root system 5065 Nov 02 11:15 hagsglsm.default.sp3en0.0_14
-rwxr-xr-x 1 root system 8716 Nov 02 11:15 hags.default.sp3en0.0_15
-rwxr-xr-x 1 root system 8716 Nov 02 11:15 hags.default.sp3en0.0_15
-rw-r-r-- 1 root system 467013 Feb 15 10:04 hagsglsm.sp3en0_0_14.sp3en0.bak
-rwxr-xr-x 1 root system 635601 Feb 26 10:39 hags.sp3en0_0_15.sp3en0.bak
-rwxr-xr-x 1 root system 149613 Feb 26 14:49 hagsglsm.sp3en0_0_14.sp3en0.bak
-rw-r-r-- 1 root system 164547 Feb 26 14:50 hags.sp3en0_0_15.sp3en0.bak
-rwxr-xr-x 1 root system 6659 Feb 26 14:50 hagsglsm.default.sp3en0_0_15
-rwxr-xr-x 1 root system 7876 Feb 26 14:50 hags.default.sp3en0_0_16
Based on the `date` command, we see that hags.sp3en0_0_17.sp3en0 is the active log file.

**hagsglsm**

The hagsglsm daemon stores its trace and log information in the 
/var/ha/log/hagsglsm* files. The format of the files is as follows:

1. hagsglsm.<partition>_<node>_<incarnation>.<partition> on the CWS.
2. hagsglsm_<node>_<incarnation>.<partition> on the nodes.

To determine the active log, follow the procedure in Example 2-6 on page 40, and look for the latest hagsglsm log file.

**haem**

The activity log for the haem daemon is in the /var/ha/log/em.default.<partition> file. This file reside on nodes and on CWS.

**hats**

The hats daemon stores its information in the 
/var/ha/log/hats.<dd>.<hhmmss>.<partition-name> file, where dd specifies the day the daemon gets started and hhmmss represents the start time in hours, minutes, and seconds. Use the procedure described in Example 2-6 on page 40 to determine the active log file.

**Note:** Remember to change hags to hats.

The topology information from the hats startup is collected in the 
/var/ha/log/hats.<partition-name> file.
haem
Messages from the hardmon resource monitor are stored in the
/var/ha/run/haem.<hostname>/IBM.PSSP.hmrmd/IBM.PSSP.hmrmd_log.<julian-
date> file.

2.1.10 Miscellaneous log files

The following are two important log files that do not reside on the locations
mentioned in the previous section:

- When the file_collection is set to true in the environment, the command
  filec_config is called during install_cw and during the installation of the
  nodes. The logs for this command is maintained in the /var/sysman/logs/*
directory.

- The setup_server command creates the file /tmp/spot.out.<PID> (when the
  SPOT is being created). The file /tmp/spot.update.out.<PID> contains
  information about the update of the SPOT. Both files are useful in determining
  problems that occur during setup_server procedure.

2.1.11 The trace facility

Tracing is a cumbersome process and it requires commitment and dedication to
understand the trace report. Although the base system (bos.rte) includes minimal
services for trace, you still need to install bos.sysmgt.trace, an optional
installable component, to activate the trace daemon and generate trace reports.

Tracing works in a two-step mode: You turn on trace on selected subsystems
and/or calls, and then you analyze the trace file through report tools.

The events that can be included or excluded from the tracing facility are listed in
the /usr/include/sys/trchkid.h header file. They are called hooks and subhooks.
With these hooks, you can specify to the tracing facility the specific event you
want to trace. For example, you could generate a trace for all CREAT calls, which
include file creation.

The smit trace command provides a user friendly interface to the trace facility.
The trace menu provides the option Manage Event Group, which lets you
manipulate the event listed in /usr/include/sys/trchkid.h. Figure 2-6 on page 43
shows the SMIT menu for trace.
2.1.12 The system dump facility

AIX generates a system dump when a severe error occurs. A system dump can also be initiated by users with root authority. It creates a snapshot of your system's memory contents.

A system dump can help in determining what took the machine out of order. A good system dump in the right hands can point to the faulty component.

A system dump is a copy of selected areas of the kernel. These areas contain information about the processes and routines running at the moment of the crash. However, while it is easier for the operating system to keep this information in memory-address format, the output is not so friendly to humans. Therefore, for a good system dump analysis, you need the table of symbols. It is a good practice to send the copy of /unix, along with the system dump, to IBM centers.

To learn more about tracing, refer to Chapter 11, “Trace Facility” in AIX V4.3 Problem Solving Guide and Reference, SC23-4123.
There are four possible ways to initiate a system dump:

1. If the software service aid package is installed

   If you have `bos.sysmgmt.serv_aid` installed on your system, you can use the command line or SMIT to initiate a system dump.

   You can initiate a system dump with the `sysdumpstart` command. Issue the `sysdumpdev -l` command to verify the current dump device. The `sysdumpdev` can also be used to changed the dump device. Alternatively, use the `smit dump` fastpath to get to the dump screen. Figure 2-7 shows the system dump options available through SMIT.

2. If the software service aid package is NOT installed

   If you do not have `bos.sysmgmt.serv_aid` installed, you can use one of the following methods to initiate a system dump:

3. Using the reset button

   Start a system dump with the reset button by following the directions in the list below. This procedure works for all system configurations and will work in circumstances where other methods for starting a dump will not.
– Turn your machine’s mode to service position or set always allow system dump to true. This can be done by selecting the always allow system dump option on the SMIT dump menu as shown in Figure 2-7 on page 44. By default, this option is set to false.

– Press the reset button.

This will write the dump information to the primary dump device.

4. Using special key sequences

You may start a system dump with special key sequences by doing the following:

– Turn your machine’s mode switch to the service position, or set always system dump to true. This can be done by selecting the always allow system dump option on the SMIT dump menu as shown in Figure 2-7 on page 44. By default this option is set to false.

– Press the CTRL+ALT+1 key sequence to write dump information to primary dump device. Use CTRL+ALT+2 key sequence to write the dump information to the secondary dump device.

Important: You can start a system dump by this method only on the native keyboard.

For more information on AIX system dumps, refer to Chapter 12, “System Dump Facility,” in AIX V4.3 Problem Solving Guide and Reference, SC23-4123.

2.1.13 The alog command

The alog command provides another important tool to reference the logs specified in the alog configuration database. It also works with log files that are specified on the command line. The alog command reads the standard input, writes to standard output, and copies the output into a fixed-size file.

By default, the following logs are available:

- boot
- bosinst
- nim
- console
- dumpsymp
The bootlog, for example, helps you view the messages appear during the boot process. The alog is a circular log and when this file is full (you can always change the size of the log), new entries are written over the oldest existing entries. Depending on the size of the file, you can log multiple boot records.

The logs are kept in /var/adm/ras directory. Use the following command to view bootlog.

```
alog -o -f bosinstlog
```

Alternatively, you can use the smit alog fastpath command to manipulate the alog options.

A new log type sample could be added to the alog configuration database by creating the alog.add file in ODM database. To learn more about alog; refer to The AIX Commands Reference, Volume 1, SBOF-1877.

### 2.1.14 Hardware diagnostic – the diag command

Not all problems are software related. If you are facing a problem, it could well be caused by some fault in the hardware; a disk may have dirty blocks and causing read/write errors, a tape drive is failing intermittently during the backup, a network adapter might have failed completely and caused problems in communication with other systems, etc.

The diag command provides a variety of hardware diagnostics on your system. It is the starting point to run a wide choice of tasks and service aids. Most the tasks and services aids available through this command are platform specific. Example 2-7 provides a complete list of tasks and services available through the diag command.

**Example 2-7  Tasks and service aids available through diag command**

<table>
<thead>
<tr>
<th>Run Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Diagnostic Run Time Options</td>
</tr>
<tr>
<td>Display Service Hints</td>
</tr>
<tr>
<td>Display Previous Diagnostic Results</td>
</tr>
<tr>
<td>Display Hardware Error Report</td>
</tr>
<tr>
<td>Display Software Product Data</td>
</tr>
<tr>
<td>Display Configuration and Resource List</td>
</tr>
<tr>
<td>Display Hardware Vital Product Data</td>
</tr>
<tr>
<td>Display Resource Attributes</td>
</tr>
<tr>
<td>Change Hardware Vital Product Data</td>
</tr>
<tr>
<td>Format Media</td>
</tr>
<tr>
<td>Certify Media</td>
</tr>
<tr>
<td>Display Test Patterns</td>
</tr>
<tr>
<td>Local Area Network Analyzer</td>
</tr>
<tr>
<td>Add Resource to Resource List</td>
</tr>
</tbody>
</table>
Delete Resource from Resource List
SCSI Bus Analyzer
Download Microcode
Display or Change Bootlist
Periodic Diagnostics
Backup and Restore Media
Disk Maintenance
Configure Dials and LPFkeys
Add or Delete Drawer Config
Create Customized Configuration Diskette
Update Disk Based Diagnostics
Configure ISA Adapter
AIX Shell Prompt (Online Service Mode only)
Display or Change Multiprocessor Configuration
   Enable and disable individual processors
Display or change BUMP Configuration
   Update the flash EPROM with a new binary image
   Display or change diagnostic modes
   Display or change remote phone numbers and modem configurations
Display or Change Electronic Mode Switch
Process Supplemental Media (Standalone Mode only)
Generic Microcode Download
Run Error Log Analysis
Service Aids for Use with Ethernet
Update System Flash (RSPC)
Configure Ring Indicate Power-On (RSPC)
Configure Service Processor (RSPC)
Save or Restore Service Processor Configuration (RSPC)
Display Machine Check Error Log (RSPC)
7135 RAIDiant Array Service Aids
SCSI Device Identification and Removal
SCSD Tape Drive Service Aid
Escon Bit Error Rate Service Aid
SSA Service Aid
PCI RAID Physical Disk Identify
Configure Ring Indicate Power On Policy (CHRP)
Configure Surveillance Policy (CHRP)
Configure Reboot Policy (CHRP)
Configure Remote Maintenance Policy (CHRP)
Save or Restore Hardware Management Policies (CHRP)
Display Firmware Device Node Information (CHRP)
Spare Sector Availability
7318 Serial Communication Network Server
Update System or Service Processor Flash (CHRP)
Display System Environmental Sensors (CHRP)
Display Checkstop Analysis Results
Analyze Adapter Internal Log
Flash SK-NET FDDI Firmware
The `diag` command can be invoked from the command line or through the fastpath `smit diag` screen. Figure 2-8 shows the initial menu, which appears when you execute the `diag` command. Further selections can be made through this screen.

![Figure 2-8 diag command initial selection screen](image)

**FUNCTION SELECTION**

801002

Move cursor to selection, then press Enter.

**Diagnostic Routines**

- This selection will test the machine hardware. Wrap plugs and other advanced functions will not be used.

**Advanced Diagnostics Routines**

- This selection will test the machine hardware. Wrap plugs and other advanced functions will be used.

**Task Selection (Diagnostics, Advanced Diagnostics, Service Aids, etc.)**

- This selection will list the tasks supported by these procedures.

- Once a task is selected, a resource menu may be presented showing all resources supported by the task.

**Resource Selection**

- This selection will list the resources in the system that are supported by these procedures. Once a resource is selected, a task menu will be presented showing all tasks that can be run on the resource(s).

F1=Help     F10=Exit     F3=Previous Menu

**2.1.15 Service Director**

Service Director is a separately installable program product and is offered as a part of the IBM warranty or IBM maintenance service package for no additional charge. Due to entitlement checking at the IBM server, machines not on IBM warranty or under service agreement can take benefit from this service.

Service Director is a widely used product, but is now functionally replaced by a Java based electronic service agent. However, Service Director is still supported and available from IBM. We encourage you move to the electronic service agent.
Functions provided by Service Director

The Service Director application can automatically report hardware related problems to IBM through a modem on a local server. It can also automatically perform problem analysis on those issues before calling for the service. This level of Service Director supports all classic RS/6000, pSeries and SP systems. Classic RS/6000 refers to machines that have concurrent diagnostics installed. Some of the PCI-based PowerPC machines had diagnostics on CD-ROM and were not concurrent.

Service Director aids system errors to be dynamically monitored and analyzed; no customer intervention is required. Service Director event log can further facilitate error analysis for some errors once the service representative is onsite. Customers' hardware error logs can now be reduced, as errors are being maintained within the Service Director event.

The Service Director performs following functions:

- Automatic problem analysis
- Manual creation of problem reports
- Automatic customer notification
- Automatic problem reporting
  - Service calls placed to IBM without operator intervention
  - Vital Product Data (VPD) reported to IBM
- Common focal point for service interface
- Problem-definable threshold levels for call placement
- Reduced hardware error logs
- High-availability cluster multiprocessing (HACMP) support for full fallback; includes high-availability
- High availability cluster workstation (HACWS) for SP
- Simple and complex environment support with minimum analog lines

Note: Service Director and Service Agent require remote dialing and support infrastructure which is not implemented in all the countries. Check with your local IBM representative for the availability of this service in your country.
Service Director components
Service Director contains three major components:

Product Support Application (PSA)
The PSA determines appropriate error disposition, then captures and passes information required to resolve any problem identified on a particular product or option to the analysis engine.

Analysis Routine
The analysis routine within Service Director schedules the execution of the PSAs. They can be configured to run constantly or on a specific time schedule. When the analysis routine runs, it monitors errors or events identified by a PSA. Errors or events are logged. Depending on customer configured options, the analysis routine can automatically notify, for example, customer's system administrator, and also automatically transmits the hardware errors and associated problem information, to IBM support center for remote analysis and action. If necessary, an IBM service representative is sent to the customer site with the parts needed to correct the problem reported.

Display Routine
The display function is the user's interface to Service Director for RS/6000. It provides a structured view of problem management information.

How to get the Service Director code
Service Director code can be obtain by the following ways:

- SD is delivered with any new RS/6000 SP machine.
- Your IBM service sales representative can get it for you.
- SD may be obtained from:

2.1.16 Electronic Service Agent
The electronic Service Agent (SA) is no-charge software that resides on your system to monitor events and transmit event data to the IBM service center. The customers within a warranty period or with a valid service agreement can take advantage of this tool.

Service Agent also helps you prepare for imminent errors, such as an increasing number of bad sectors on the hard disk. This information assists in shortening the service turnaround time. In some cases, IBM may notify a customer of an impending error and provide a resolution prior to an outage.
Information collected through Service Agent will be made available to IBM service support representatives when they are helping to answer questions or diagnosing problems.

**Note:** Service Director or Service Agent requires remote dialing and support infrastructure which is not implemented in all countries. Check with your IBM representative for the availability of this service.

**Electronic service agent – components**
The following are three major components of ESA infrastructure:

1. **IBM Service Agent Server (SAS)**
   - The Service Agent Server (SAS) is located at the IBM service center. It is the machine to which your computer(s) sends information that is stored, analyzed, and acted upon by IBM.

2. **Gateway machine**
   - The gateway machine is a customer system where Service Agent is installed using the svcagent.installp files. The gateway is located at a customer site and provides a central database and processes for communication with the IBM service center, via a modem.

3. **Forwarder**
   - It is a system interface defined to gateway a database as a client or interface that forwards requests to or from other client machines. Typically, you can have several forwarders and one gateway.

**Electronic service agent – functions**
The following basic functions are available through the electronic service agent:

- Automatic problem analysis.
- Problem-definable threshold levels for error reporting.
- Automatic problem reporting; service calls placed to IBM without intervention.
- Automatic customer notification.
- Commonly viewed hardware errors; you can view hardware event logs for any monitored machine on the network from any Service Agent host user interface.
- High-availability cluster multiprocessing (HACMP) support for full fallback; includes high-availability cluster workstation (HACWS) for SP.
- Network environment support with minimum telephone lines for modems.
Electronic service agent – working principle
The Service Agent code is installed on the host by using the Service Agent user interface. Once installed, they are registered with the IBM Service Agent Server (SAS).

During the registration process, an electronic key is created that becomes part of your resident Service Agent program. This key is used each time Service Agent places a call for service. The IBM Service Agent Server checks the current customer service status from the IBM entitlement database; if this reveals that you are not on a warranty or maintenance agreement, then the service call is refused and posted back via e-mail notification.

Service Agent is not designed to arbitrarily pick up just any general information without it having been programmed to do so. There is some data that Service Agent does bring to IBM to help with problem resolution. In some cases, this information may very likely be used by IBM for other purposes. This information consists of the problem or error information itself and Vital Product Data (VPD) or Inventory data.

If concerned about sensitivity of data, you can review the actual data that is being sent to IBM by using the Service Agent User Interface and take actions and prevent data transmission to IBM service center. Today the only data, besides error information, being sent to IBM is Vital Product Data (VPD), which is generated by either the lscfg command or the new invscout program. You can run one of these commands on a system and determine if this information is of a sensitive nature or not.

2.1.17 Electronic service agent prerequisites
The following describes the list of prerequisites for electronic service agent:

- AIX Version 4.1 or above with concurrent diagnostic installed.
- PSSP 1.2 or above.
- Java 1.1.6 to 1.3 on all monitored machines. Java for AIX 4.3.3 is shipped and installed with base AIX. You can obtain Java from IBM service representatives for releases below 4.3.3.
- A serial port for modem connectivity is required on gateway servers. A TTY (0 - 16) device must be available and configured on the gateway.
- An asynchronous modem with a minimum communications speed of 9600 baud and error correction (in the United States) is required. The modem is required in order to call IBM Service Agent Server (SAS). For security reasons, only outbound calls are required by Service Agent, so the auto answer capability of the modem should be disabled. IBM ships the following
modem types for use with Service Agent on some products: 7852 Model 400, 7857-017 or 7858-336.

- On your gateway server, ensure that the bos.net.ppp fileset is installed and configured to support the Point-to-Point Protocol (PPP). This is only required if a modem is to be used for error reporting to IBM.

Electronic service agent in SP/Cluster environment
Electronic service agent in SP or cluster environment differ from basic RS/6000 and pSeries service agent in the following two ways:

1. In an SP or in SP-attached server environment, the CWS (or SA Gateway) must be set to Machine Type (M/T) 9076.
   - The nodes are added using the Add SP Nodes function
2. In the CES environment, the servers are added using the Add machines function.
   - In the model type enter C80. This information is used to create a proper RETAIN record at IBM. With the C80 information the RETAIN call is forwarded to the correct queue monitored by CES skilled people.

Note: For the performance reason, sometime it is not recommended to install the SA Gateway on CWS.

How to obtain electronic service agent code
The following URL could be used to download the ESA code:

2.1.18 Inventory scout (invscout)
The inventory scout is a tool that contains microcode discovery service and, in SP/CES environment, Vital Product Data (VPD) capture service. These two services are made possible through a new AIX command `invscout`, and a new daemon, invscoutd.

Functions provided by invscout command
The following are the basic functions performed by the `invscout` command:

1. Scouts the user's system for microcode levels and compares it with an IBM database of the latest levels. When used with web-based microcode discovery service, an HTML report is generated that includes links to the latest level of microcode for the system, should it find the currently installed level is at a lower level.
In case of SP and CES systems, customers will not be given a link to the latest microcode. Instead, the user will be directed to Contact CE to obtain the new level of microcode.

In the HTML report for RS/6000 systems, a link will be provided to the README of the latest level of microcode.

2. Gathers Vital Product Data (VPD) from the user’s machine and, when used with web-based VPD capture service, uploads it to the IBM MRPD database at the plant. The VPD will be useful in determining the correct components to ship when a Miscellaneous Equipment Specification (MES) upgrade is ordered. At this time, only SP VPD data will be stored in the MRPD database. All other RS/6000 systems are targeted to work with MRPD by the end of 2001.

Inventory scout runs on AIX V4.1.5 or higher and can be invoked by Java applets or be run from the command line. The last level of inventory scout is 1.2.0.1.

**How to obtain the invscout code**

The `invscout` and `invscoutd` are included in the 10/00 AIX 4.3.3 update and AIX 5.0 releases. You do not need to be at one of these levels to use this command/daemon and services. These can also be obtained from the following internet service links:

- Microcode Discovery Service
  
  [http://techsupport.services.ibm.com/rs6k/mds.html](http://techsupport.services.ibm.com/rs6k/mds.html)

- VPD Capture Service
  
  [http://techsupport.services.ibm.com/rs6k/vcs.html](http://techsupport.services.ibm.com/rs6k/vcs.html)

2.1.19 Problem management subsystem

The problem management subsystem (pman) provides an infrastructure for recognizing and acting on problem events in your SP system. This infrastructure is based on an event management application that provides configurable access to event management client and resource monitor function without the necessity of writing programs to use the event management APIs. The problem management subsystem is available on PSSP 2.2 or later version.

The pman subsystem consists of four major components:

1. `pmand`
2. `pmanrmd`
3. `pmandef`
4. `sp_configd`
In the following sections we will cover pman functions in detail and provide an example to explain how pman works.

### 2.1.20 pmand

The pmand daemon is a client of event management; it can be configured to register for event management events and perform actions when those events do occur. Event management provides access to events throughout an SP system partition; therefore, pmand can monitor and react to events on the node on which it is running, as well as on all other nodes in the system partition and CWS.

When you install your system, a pmand daemon is automatically configured on each node in a system partition. Additionally, there is a pmand daemon running on the control workstation for each system partition in the SP system. When running on a node, the pmand daemon:

- Monitors events occurring on the node on which the daemon is running.
- Monitors events on all other nodes in the system partition.
- Monitors events not associated with a node, such as frame events, as supplied by event management.

There are no restrictions on what a pmand daemon can monitor:

- Any number of pmand daemons can monitor and act on a single event.
- A single pmand daemon can monitor any number of events locally or remotely.
- A single pmand daemon can monitor the same event multiple times. All actions associated with all event registrations are taken by the daemon when the event occurs.

Each pmand daemon has access to events on the node on which it is running, as well as to the other nodes in the system partition. The access to the events is provided by event management, which can, due to its distributed nature, monitor resource variables throughout the system partition and generate events based on the values of these resource variables. Figure 2-9 on page 56 provides an example of how event management communicates with local and other remote pmand daemons.
When an event, which any of the pmand daemons has subscribed to, occurs (whether that event is local or remote), all the pmand daemons registered for it will perform the actions they are configured for (if any). Because pmand is a daemon, its subscriptions to events are persistent. This means the daemon continues to subscribe to events even after the process or user who created the subscription has gone away. A system administrator, for example, can set up automated operations with unattended monitoring and recovery actions.

**Controlling pmand**

The pmand daemon is under the System Resource Controller (SRC) and can be controlled by the following commands:

- To start pmand on a node:
  
  ```
  startsrc -s pman
  ```

- To start pmand on a CWS:
  
  ```
  startsrc -s pman.system_partition_name
  ```

- To stop pmand on a node.
  
  ```
  stopsrc -s pman
  ```

- To stop pmand running on a control workstation.
  
  ```
  stopsrc -s pman.system_partition_name
  ```

- To refresh pmand
  
  ```
  refresh -s pman
  ```

The refresh command causes pmand to update its internal configuration from the SDR and start pairing actions with events as specified by the pmandef command.
If a pmand refresh occurs, all currently monitored events get unregistered and the configuration information is reread from SDR. The SDR contains persistent information, so that a refresh results only in configuration changes that have been put into the SDR. If you have not deleted or modified a configuration record for a particular event, refreshing the daemon results in reregistering for the same event. For example:

- To refresh pmand on the control workstation:
  ```
  refresh -s pman.system_partition_name
  ```

- To receive status on pmand daemon running on a node:
  ```
  lssrc -ls pman
  ```

- To check the status of pmand running on control workstation:
  ```
  lssrc -ls pman.system_partition_name
  ```

These commands provide the following status information:

- When pmand was started.
- When pmand was last refreshed.
- Whether tracing (debug mode) is on or off. When debug mode is on, all SRC requests and all events are logged to the `/var/adm/SPlogs/pman` directory.
- Events for which registrations are as yet unacknowledged.
- Events for which actions are currently being taken.
- Events currently ready to be acted on by this daemon.

### 2.1.21 pmanrmd

The pmanrmd daemon is a resource monitor daemon that provides resource variables to event management services. When you install SP, a pmanrmd daemon is automatically configured on each node in a system partition. Additionally, there is a pmanrmd daemon running on the control workstation for each system partition in the SP system.

The problem management subsystem provides 16 resource variables; IBM.PSSP.pm.User_state1 through IBM.PSSP.pm.User_state16. These are predefined resource variables that have been set aside for system administrators to create their own resource monitors.

A resource monitor that you create through problem management is a command that gets executed repeatedly by the pmanrmd daemon at a specific interval. The standard output from the command is supplied to the event management subsystem as the value for the resource variable. You can then use the pmandef command to subscribe to events for that resource variable.
The resource variable name, resource monitor command, sampling interval, and list of nodes for which the resource monitor is defined, are stored in the SDR. The `pmanrmdloadSDR` command is used to store those definitions in SDR.

You define your resource monitor to the pmanrmd daemon by doing the following:

1. Make a copy of the `/spdata/sys1/pman/pmanrmd.conf` sample configuration file. Example 2-8 lists the content of system provided sample file.

```
Example 2-8 /spdata/sys1/pman/pmanrmd.conf sample configuration file

* IBM_PROLOG_BEGIN_TAG
* This is an automatically generated prolog.
*
* Licensed Materials - Property of IBM
*
* (C) COPYRIGHT International Business Machines Corp. 1996,2000
* All Rights Reserved
*
* US Government Users Restricted Rights - Use, duplication or
* disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
*
* IBM_PROLOG_END_TAG

* "@(#)70   1.8   src/ssp/pman/pmanrmd.conf, probmgmt, ssp_rlyn, rlynt500
10/19/99 23:02:28"

* Problem Management resource monitor configuration file.
*
* This will run a user script resource monitor every 1 minutes and
* place the stdout of the monitor into event management as a resource
*
* This will run a user script resource monitor every 1 minutes and
* place the stdout of the monitor into event management as a resource
* variable when it runs. It will run on the CWS only.
*
*TargetType=NODE_LIST
*Target=CWS
*Rvar=IBM.PSSP.pm.User_state1
*SampInt=60
*Command=/u/joe/checker
*
* This will provide a resource monitor that will run every 10 minutes
* and will provide the most recently changed file in the /etc directory.
* It runs on all the nodes that belong to the SERVERS node group.
*
*TargetType=NODE_GROUP
*Target=SERVERS
```
**Chapter 2. Problem determination tools**

2. Edit your copy of the configuration file. Provide the following:

- The name of the resource variable (for example, IBM.PSSP.pm.User_state1)
- The resource monitor command
- A sampling interval (in seconds)
- The nodes number on which to run the resource monitor command

**Attention:** When typing commands in the pmanrmd.conf file, be aware that the command string of the pmrmCommand line will get enclosed in single-quotes and the Korn Shell rules apply to it. Keep in mind that a single quote cannot occur within single quotes. If a command contains single quotes, each must be replaced by the four characters "\" (single quote, backslash, single quote, single quote). For example: Command="mount \ awk \"\"(print $3)\"\" \ tail -l"

The marks between awk and tail are single quotes, the others are double quotes.

3. Loading the configuration information into the SDR by using the pmanrmdloadSDR command.

4. Stopping and restarting the pmanrmd daemon on the nodes that are affected by this change:

   On the control workstation:
   ```
   stopsrc -s pmanrm.syspar_name
   startsrc -s pmanrm.syspar_name
   ```
   where syspar_name is the name of system partition.

   On the node:
   ```
   stopsrc -s pmanrm
   startsrc -s pmanrm
   ```

2.1.22 *pmandef* – creating problem management subscriptions

The *pmandef* command provides a mechanism for creating problem management subscriptions for *pmand* daemon to event management services. The *pmandef* command provides:

- Registration for event management events (full file systems, disk drive failures, etc.).

- Actions to take when management events are triggered. For example:
  
  - Running a command
  - Issuing an SNMP trap
  - Write to the AIX error log and the BSD syslog facilities

The *pmandef* command also provides the following functions:

- Activating a problem management subscription
- Deactivating a problem management subscription
- Querying a problem management subscription
- Removing a problem management subscription

Users interface with PMAN through the *pmandef* command, which is restricted to authorized users only. A user needs to have a Kerberos principal, and this principal needs to be listed in the `/etc/sysctl.pman.acl` file. Example 2-9 provides a listing of this file.

To learn more about the *pmandef* command, refer to *PSSP: Command and Technical Reference, Volume 1*, SA22-7351.

**Example 2-9** Sample `/etc/sysctl.pman.acl` file

```
# acl#

# These are the kerberos principals for the users that can configure
# Problem Management on this node. They must be of the form as indicated
# in the commented out records below. The pound sign (#) is the comment
# character, and the underscore (_) is part of the "_PRINCIPAL" keyword,
# so do not delete the underscore.

#_PRINCIPAL root.admin@MSC.ITSO.IBM.COM
#_PRINCIPAL root.admin@PPD.POK.IBM.COM
#_PRINCIPAL joeuser@PPD.POK.IBM.COM

```

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In this case, the Kerberos principal, root.admin@MSC.ITSO.IBM.COM realm is authorized to use the PMAN subsystem on this node. Make sure you have authorization on every other node where you want to use this facility.

**Important:** Make sure you stop and start the Sysctl SRC subsystem every time you modify this file.

For more information on `pmandef` command, refer to *Parallel System Support Program for AIX: Command and Technical Reference, Volume 1*, SA22-7351.

### 2.1.23 Using pmandef command – an example

You can use `pmandef` to specify a command to run when a specified event or re-arm event occurs. In Example 2-10, `pmandef`, running on node 5, causes the command `echo program has stopped >/tmp/myevent.out` to execute on node 5 whenever the number of processes named `mycmd`, owned by user `bob`, on node 12 becomes 0 (the event). When this number increases back to 1 (the re-arm event), the command `echo program has restarted >/tmp/myrearm.out` runs on node 5.

**Example 2-10  pmandef — output received on the node issuing the command**

```bash
[root@sp4n05]:/> pmandef -s Program_Monitor \  
> -e 'IBM.PSSP.Prog.pcount:NodeNum=12;ProgName=mycmd;UserName=bob:X@0==0'\  
> -r  
> -c "echo program has stopped >/tmp/myevent.out" \  
> -C "echo program has restarted >/tmp/myrearm.out"
```

You can specify to run commands on a node other than the one from which the `pmandef` was issued. Example 2-11 on page 62 causes the command to run on nodes 1, 2, 3 and 7, whenever `bob`'s program dies or gets restarted on any of nodes 1, 2, 3, 4, 5 or 13. If `bob`'s program dies on node 4, then the command `/usr/local/bin/start_recovery` runs on nodes 1, 2, 3 and 7. Any number of commands can run simultaneously.
Example 2-11  Output received on nodes other than the node issuing the command

```
[root@sp4n05]:/> pmandef -s example \
-e 'IBM.PSSP.Prog.pcount:NodeNum=1-5,13;ProgName=mycmd;UserName=bob:X@0==0'\ 
-r "X@0>0" -c /usr/local/bin/start_recovery \ 
-C /usr/local/bin/stop_recovery -n 1-3,7
```

You can specify a timeout, in seconds, for each command. The minimum timeout that can be specified is 10 seconds. If the command has not exited before the specified timeout, the command gets killed.

The environment variables used by the pmandef command

The problem management subsystem makes all of the contents of an event management notification available in the command's environment when the command is run. Example 2-12 on page 62 provides a list of the variables obtained from the event management notification environment.

Example 2-12  pmandef command environmental variable

**PMAN_HANDLE**

The name that identifies this subscription to the Problem Management subsystem. This name was given as the argument of the -s flag to pmandef.

**PMAN_PRINCIPAL**

The name of the Kerberos V4 principal that owns this subscription, if one exists.

**PMAN_DCEPRINCIPAL**

The name of the DCE principal that owns this subscription, if one exists.

**PMAN_RVNAME**

The Event Management resource variable.

**PMAN_IVECTOR**

The Event Management resource identifier.

**PMAN_PRED**

Either the Event Management expression or rearm expression, depending on whether this is an event or rearm event.

**PMAN_TIME**

The time that the event was reported to the Problem Management subsystem.

**PMAN_LOCATION**

The node number of the node on which the event was generated, usually (but not always) the node on which the event occurred.

**PMAN_RVTYPE**

One of long, float or sbs, depending on whether the type of the resource variable value is a long integer, a floating point value or a Structured Byte String. Note: If the PMAN_RVTYPE is either long or float, then the resource variable value is stored in PMAN_RVVALUE, and PMAN_RVVALUE is to be interpreted as type PMAN_RVTYPE.
If PMAN_RVTYPE is sbs, then the resource variable value is composed of one or more structure elements. There is no PMAN_RVVALUE environment variable. Instead there is a separate environment variable for each element, and the PMAN_RVCOUNT environment variable defines the number of elements. For example, if there are 3 structure elements within the Structured Byte String, the PMAN_RVCOUNT will be 3, and there will be 3 separate environment variables for the 3 structure elements: PMAN_RVFIELD0, PMAN_RVFIELD1 and PMAN_RVFIELD2. Each of these 3 environment variables contains a name=value pair, where name is the structure element name, and value is the structure element value.

In Example 2-13 on page 64, the `pmandef` command requests the `/usr/local/bin/recovery_cmd` to run on node 12 when the number of processes named mycmd, owned by root, on nodes 9, 10, or 11 becomes zero. If mycmd program terminates on node 10, the command `/usr/local/bin/recovery_cmd` runs on node 12, and the following environment variable values are included in its environment:

- **PMAN_HANDLE** (Program_Monitor)
- **PMAN_PRINCIPAL** (root.admin@MSC.ITSO.IBM.COM)
- **PMAN_DCEPRIN** (/.../test_dcecell/cell_admin)
- **PMAN_RVNAME** (IBM.PSSP.Prog.pcount)
- **PMAN_IVECTOR** (ProgName=mycmd;UserName=bob;NodeNum=10)
- **PMAN_PRED** (X@0==0)
- **PMAN_TIME** (Thu Aug 22 00:42:08 1996)
- **PMAN_LOCATION** (10)
- **PMAN_RVTYPE** (sbs)
- **PMAN_RVCOUNT** (3)
- **PMAN_RVFIELD0** (CurPIDCount=0)
- **PMAN_RVFIELD1** (PrevPIDCount=1)
- **PMAN_RVFIELD2** (CurPIDList=)

This information could be used by any command. Two utilities that report this information are provided as part of the Problem Management subsystem:

- `notify_event`
- `log_event`

These commands are provided to get you started. You may want to write more sophisticated commands.
Example 2-13  pmandef - environment variables example

pmandef -s example \n-e 'IBM.PSSP.Prog.pcount:NodeNum=9-11;ProgName=mycmd;UserName=root:X@0==0' \n-c "/usr/local/bin/recovery_cmd" -n 12

Obtaining problem management access

The pmandef command is built upon the Sysctl facility, which uses the SP security services to provide authorized users, which may include both root and non-root users with the ability to create, modify, and delete problem management subscriptions.

How a user is authorized to access problem management depends on which SP trusted services authentication methods have been enabled.

When Kerberos V4 or compatibility is the only authentication method enabled, access to problem management is protected by the /etc/sysctl.pman.acl file by adding their Kerberos V4 principals to the /etc/sysctl.pman.acl file.

When no authentication method is enabled, access to problem management is protected by the /etc/sysctl.pman.acl text file. You can choose to authorize all or none un-authenticated users to access the problem management subsystem. You cannot authorize individual unauthenticated users to access the PMAN.

For further details refer to:


Authorizing event response actions

After the pmand daemon receives notification that an event has occurred, and before it performs the action for that event, the pmand daemon checks to see whether the subscription owner is authorized to perform the requested action on the node where it is running. If the requested action is the execution of a command, the subscription owner must have AIX remote commands access to the node as the target user. The target user is, by default, the same user who has issued the pmandef -s command to create the subscription. A different user can be specified to the pmandef command by using the -U flag.
The underlying principal is that the pmand daemon will execute a command in response to an event only if the subscription owner has the ability to execute the same command by other means. If the user can log in to the node as the target user and execute the command directly from the command line, or at least run the command as the target user by invoking the `rsh` command from a remote node, then no extra privileges can be gained from using problem management. The only thing the end user gains is the automation of responses to events within the SP system.

How event response authorization takes place is dependant on the type of the subscription's ownership and the AIX remote command authentication methods enabled by the system administrator.

The steps that pmand uses to determine whether the subscription owner is authorized to run a command as the requested target user on the local node are listed below in the order they are checked.

- If the subscription contains a DCE principal, and if Kerberos V5 is enabled as an AIX remote command authentication method, then the subscription owner can be authorized if the DCE principal's underlying Kerberos V5 principal has been listed in the target user's `$HOME/.k5login` file.
- If the subscription contains a Kerberos V4 principal, and if Kerberos V4 is enabled as an AIX remote command authentication method, then the subscription owner can be authorized if the Kerberos V4 principal has been listed in the target user's `$HOME/.klogin` file.
- If no SP trusted services authentication methods are enabled, if the subscription contains both source AIX user name (the user who issued the `pmandef -s` command to create the subscription) and source host name (the node where the `pmandef -s` command was issued), and if the standard UNIX is enabled as an AIX remote command authentication method, then the subscription owner can be authorized if the source AIX user name and source host name combination have been listed in the target user's `$HOME/.rhosts` file. If this step also fails, the subscription owner is not authorized, so the event response is not executed.

When the action to be performed is an entry in the AIX error log and BSD syslog or the generation of an SNMP trap, all of the preceding rules apply, except the target user is always root, regardless of which target user is contained in the subscription. This restricts these actions to system administrators.
Authorization checking for AIX error log and BSD syslog actions and SNMP trap actions are done separately from authorization checking for command execution actions. Therefore, if a subscription requests that a command executes, for instance, as `joeuser` and an SNMP trap gets generated in response to an event, the command authorization check will use `joeuser` as the target user, while the SNMP trap authorization check will use `root` as the target user.

For further details read the sections:


**Querying the problem management subscription information**

Use the `pmanquery` command to query the SDR for a description of a problem management subscription. The `pmanquery` command provides detail of the subscription information in raw format, which can then be used by other applications. The following example queries all subscriptions:

```bash
[root@sp4en0]:/> pmanquery -n all -k all -p all -U all -H all
```

For more information on `pmanquery`, refer to Parallel System Support Programs for AIX, Command and Technical Reference, Volume 1, SA22-7351.

**Monitoring default events**

The problem management subsystem provides a set of default events to be monitored in the `/usr/lpp/ssp/install/bin/pmandefaults` script. This script contains a series of `pmndef` commands that request an event notification to be mailed to root on control workstation when the specified event occurs. These are events that would interest many system administrators. Events are defined for all nodes in the current system partition and all events are monitored from the control workstation. The list of events includes:

- The `/var` file system is more than 95 percent full.
- The `/tmp` file system is more than 90 percent full.
- An error log record of type PERM has been written to the AIX Error Log.
- The inetd daemon has terminated.
- The sdrd daemon has terminated (control workstation only).
- The sysctld daemon has terminated.
- The hrd daemon has terminated (control workstation only).
- The fsd daemon has terminated (nodes only).
The /usr/lpp/ssp/install/bin/pmandefaults script is a suggested starting point for configuring the problem management subsystem on your SP system. You can choose to run the script as is, or you can make your own copy of the script and modify it to suit your needs, or you can choose not to run the script at all.

**Logging an event using the pmandef command**

You can specify that pmand write event notification information, along with some optional specified text, to the AIX error log and BSD syslog facilities. In Example 2-14 whenever the file system associated with the mylv logical volume and the myvg volume group on node 11 becomes more than 95% full, the text "file system is almost full" gets written to the AIX error log and BSD syslog facilities on node 11 (via the -h local option).

**Example 2-14  pmandef - logging an event with user supplied text**

```
import g:\pm\example\pmandef

pmandef -s Filesystem_Monitor
  -e 'IBM.PSSP.aixos.FS.%totused:NodeNum=11;VG=myvg;mylv:X>95' \
  -l "filesystem is almost full" -h local
```

#### 2.1.24 sp_configd (SNMP proxy agent)

With this daemon, PMAN can send simple network management protocol (SNMP) traps to SNMP managers to report predefined conditions. The ability to issue an SNMP trap in response to an event allows you to report problem events occurring in your SP system to a network manager, such as Tivoli Netview, existing on a remote node (a network manager application is not supplied with the SP).

The problem management subsystem provides an SP SNMP proxy agent, sp_configd, (sometimes referred to as subagent daemon) that runs on the control workstation and every SP processor node. The SP proxy agent provides the following functions:

- A Management Information Base (MIB)
- The SNMP GET (Requests the SNMP agent to retrieve the value of the specified variable and return it to the manager) and GET NEXT commands that allow data in the MIB to be accessed by a network manager application
- Creation and transmittal of SNMP traps to a network manager application when any of the following events occur on the node on which the SP proxy agent is running:
  - A cold start trap is issued when the agent is activated
  - An enterprise-specific trap is issued when an entry with an "alert=true" attribute is written in the AIX error log
An enterprise-specific trap is issued when user-specified event is detected within event management services

**Example of an SNMP trap issued for an event management event**

Below is an example on how an SNMP trap could be collected and send to the SNMP manager, such as Tivoli Netview.

1. Use the `pmandef` command to subscribe to an event management event and specify that an SNMP trap be issued for that event.

In Example 2-15, whenever the filesystem associated with the mylv logical volume and the myvg volume group on node 10 gets more than 95% full, an SNMP trap will be generated on the control workstation.

**Example 2-15  Generating SNMP trap**

```bash
pmandef -s Filesystem_Monitor / -e'IBM.PSSP.aixos.FS%totused:NodeNum=10;VG=myvg;LV=mylv:X>95' / -t 1234 -n 0
```

2. The `pmand` subscribes to the event as specified in the `pmandef` command.
   The event must occur on the local node on which `pmand` is running.

3. The `pmand` writes the contents of the event manager subsystem-supplied event response and the user-specified event configuration information into a FIFO file

4. The `sp_configd` reads the data and creates an SNMP trap from it

5. The `sp_configd` sends the trap to the SNMP managers specified in the `/etc/snmpd.conf` file on the node.

6. You specify a particular trap ID in the configuration information for an event manager event.

### 2.1.25 Monitoring an error condition using PMAN – test case

Now you know that the PMAN subsystem provides 16 resource variables for user-defined events. In this section, we use one of these variables to monitor a specific condition where PSSP does not provide a resource variable.

In this example, you will setup PMAN to get a notification on the console screen each time there is an authentication failure for remote execution. The remote shell daemon (rshd) logs these errors to the `/var/adm/SPlogs/SPdaemon.log`. A monitor could be created to search for the specific error created in this log.
First, identify the error that gets logged into this file every time somebody tries to execute a remote shell command without the proper credentials. Destroy the Kerberos ticket using `kdestroy` and execute, for example, the `rsh` command. Observe the error log for error entry, as below:

```
Feb 27 14:30:16 sp3n01 rshd[17144]: Failed krb5_compat_recvauth
Feb 27 14:30:16 sp3n01 rshd[17144]: Authentication failed from sp3en0.msc.itso.ibm.com: A connection is ended by software.
```

From this, we see that `Authentication failed` seems to be a nice string to look for. The idea here is to notify the operator (console) that there was a failed attempt to access this machine through the remote shell daemon.

However, there is a small problem to solve. If we are going to check this log file every few minutes, how do we know whether the log entry is new or was already reported? Fortunately, the way user-defined resource variables work is based on strings. The standard output of the script you associate with a user-defined resource variable is stored as the value of that variable. This means that if we print out the last `Authentication failed` entry every time, the variable value will change only when there is a new entry in the log file.

Let's create the definition for a user-defined variable. To do this, PMAN needs a configuration file that has to be loaded to the SDR by using the `pmanrmdloadSDR` command.

PSSP provides a template for this configuration file. It is located in the `/spdata/sys1/pman` directory on the CWS. Let's make a copy of this file and edit it:

```
TargetType=NODE_RANGE
Target=0-5
Rvar=IBM.PSSP.pm.User_state1
SampInt=60
Command=/usr/local/bin/Guard.pl
```

In this file, you can define all 16 user-defined variables (there must be one stanza per variable). In this case, we have defined the `IBM.PSSP.pm.User_state1` resource variable. The resource monitor (pmanrmd) will update this variable every 60 seconds as specified in the sample interval (`SampInt`). The value of the variable will correspond to the standard output of the `/usr/local/bin/Guard.pl` script. Example 2-16 describes this script.

```
Example 2-16   /usr/local/bin/Guard.pl script

#!/usr/lpp/ssp/perl5/bin/perl

my $logfile="/var/adm/SPlogs/SPdaemon.log";
my $lastentry;
```
open (LOG,"cat $logfile") ||
    die "Ops! Can't open $logfile: $!
"

while (<LOG>) {
    if(/Authentication failed/) {
        $lastentry = $_;
    }
}

print "$lastentry";

The script prints out the Authentication failed entry from the log file. If there is no new entry, the old value is the same as the new value, so we have to create a monitor that gets notified every time the value of this variable changes. Let's take a look at the monitor's definition:

```sh
# /usr/lpp/ssp/bin/pmandef -s authfailed 
-e 'IBM.PSSP.pm.User_state1:NodeNum=0-5:X@0!=X@P0' 
-c "/usr/local/bin/SaySomething.pl" \ 
-n 0
```

This command defines a monitor, through PMAN, for the IBM.PSSP.pm.User_state1 resource variable. The expression X@0!=X@P0 means that if the previous value (X@P0) is different from the current value (X@0), then the variable has changed. This special syntax is due to the fact that these user-defined variables are structured byte strings (SBSs), so to access the value of this variable you have to index this structure. However, these variables have only one field, so only index 0 is valid.

You can get a complete definition of this resource variable (and others) by executing the following command:

```bash
[sp5en0:]#/usr/lpp/ssp/bin/pmandef -s authfailed 
-e 'IBM.PSSP.pm.User_state1:NodeNum=0-5:X@0!=X@P0' 
-c "/usr/local/bin/SaySomething.pl" \ 
-n 0
```

This gives you a good explanation along with examples of how to use it.

Now that we have subscribed our monitor, let's see what the /usr/local/bin/SaySomething.pl listed in Example 2-17, does:

```perl
#!/usr/lpp/ssp/perl5/bin/perl
$cwsdisplay = "sp4en0:0";
$term="/usr/dt/bin/aixterm";
$cmd="/usr/local/bin/SayItLoud.pl";
$title=qq/"Warning on node $ENV{'PMAN_LOCATION'}"/;
```
\$msg = \$ENV\{'PMAN_RVFIELD0'\};
\$bg = "red";
\$fg = "white";
\$geo = "60x5+200+100";

\$execute = qq/\$term -display \$cwsdisplay -T \$title -geometry \$geo -bg \$bg -fg \$fg -e \$cmd \$msg/;

system(\$execute);

This script opens a warning window with a red background notifying the operator (on node 0, the CWS) about the intruder.

The script /usr/local/bin/SayItLoud.pl displays the error log entry (the resource variable value) inside the warning window. Let's take a look at this script:

#!/usr/lpp/ssp/perl5/bin/perl

print "@ARGV\n";
print "-------- Press Enter --------\n";
<STDIN>

Now that the monitor is active, let's try to access one of the nodes. We destroy our credentials (**kdestroy** command) and then try to execute a command on one of the nodes:

```
[sp5en0:/]# kdestroy
[sp5en0:/]# dsh -w sp5n01 date
sp5n01: spk4rsh: 0041-003 No tickets file found. You need to run "k4init".
sp5n01: rshd: 0826-813 Permission is denied.
dsh: 5025-509 sp5n01 rsh had exit code 1
```

After a few seconds (a minute at most), we receive the warning window, shown in the warning message at the CWS illustrated in Figure 2-10.

![Figure 2-10 User-defined resource variables – Warning window example](image-url)
The example shown here is very simple. It is not intended to be complete, but instead, to illustrate the use of these user-defined resource variables.

2.1.26 SP perspectives

The SP perspectives provide access to a set of applications, each with a graphical user interface (GUI). The perspectives applications enable you to perform monitoring and system management tasks for your SP system by directly manipulating icons that represent system objects.

The perspectives launch pad is started using the `perspectives` command, which resides in the `/usr/lpp/ssp/bin` directory. Other perspectives applications, such as the event perspective or hardware perspective, can be started from the launch pad. If you are launching perspectives remotely, be sure that the DISPLAY environment variable is set to the machine that you want to display the SP Perspective. Also, be sure that you are permitted to display to that machine by running the `xhost` command.

Following two perspectives tools are useful for monitoring the system status and detecting problem situations:

- Event perspective
- Hardware perspective

Each perspectives application provides its own unique capabilities. For the purposes of problem monitoring and determination, we recommend that the SP event perspective be used to monitor conditions of interest for the SP system. When SP event perspective indicates that a hardware failure condition exists, the SP hardware perspective should be used to examine the current status of the system hardware and obtain more detailed information about the hardware problem.

2.1.27 Event perspective

Event perspective provides a graphical interface to event management and the problem management subsystems. Through this interface, you can create monitors for triggering events based on defined conditions and generate actions by using the problem management subsystem when any of these events are triggered.
Using the SP event perspective, you can create event definitions that tell the system to let you know automatically when changes that are important to you have occurred in your SP system; when a node goes down or becomes unreachable, when system is close to running out of paging space, when there's something wrong with the switch – these are the kinds of things you want to know about, and these are the kinds of things that you can have the system automatically tell you about when you use the SP event perspective.

When you create an event definition, you specify a condition that defines the state of a system resource and then you identify the specific resources that you want the system to monitor. You can also specify that you want the system to respond to the event by displaying a notification on your screen and/or take an action to in response to that event. Finally, you activate the event definition by registering it.

To effectively use this perspective, you must understand the following terminology:

**Condition**
Conditions are the circumstances within the system that are of interest to the system administrator. Conditions can be created, viewed, and modified through the conditions pane in the SP Event Perspective. To specify a condition, the system administrator must provide the necessary components to form the condition, including an event expression and, optionally, a re-arm expression.

A set of predefined event definitions can be loaded to let you quickly and easily set up monitoring for events that are commonly of interest. Some of these predefined events are; the status of nodes and frames, the usage of paging space and file systems, etc. You may use the predefined event definitions and conditions as is, or use them as templates for creating new event definitions and conditions. You can also create a new condition from a large list of resource variables included with PSSP.

**List of predefined event definitions**
The following is a list of predefined event definitions:
- errLog nodePowerLED
- fileSystems
- frameControllerNotResponding
- framePowerOff
- hostResponds
- keyNotNormal
- LCDhasMessage
Re-arm expressions
The re-arm expression indicates when the SP Event Perspective should consider the event to have stopped. For example, a file system is considered almost full when space utilization reaches 90% of the capacity. The system administrator may want to consider the condition to exist until the space utilization drops to 87%. The event expression would then be set to 90% and the re-arm expression to 87%. As with the event expression, the system administrator can indicate an action to take when the re-arm expression occurs, such as deactivating reserve resources that had been activated when the event occurred.

Event expression
A relational expression that specifies the circumstances under which an event is generated.

Event definition
An association made by the system administrator between a condition and a response to the presence of that condition.

Registration
The activation of an event definition. By registering an event definition, the system administrator instructs the perspectives to begin monitoring for the condition and to take the associated action if the condition should occur.

Once the user registers the event definition, the action will be run whenever the event or re-arm expression occurs. This is independent of whether the event perspective is active at the time of event or re-arm expression occurs.
Event
A change in the state of a system resource. For the purposes of this discussion, an event is more narrowly defined as the presence of the condition within the system.

2.1.28 Using the event perspective – a case study

The following case study provides processes to analyze the problem and procedures to correct it.

Case:
You are required to monitor free space of /tmp file system on all the nodes. A notification is required when file system utilization reaches over 90%; the condition will remain true until file system utilization goes below 70%, at which point file system utilization is considered to be normal and the condition will be reset. However, at any point in time, if the utilization again crosses the 90% mark, a new notification is required.

Solution
Let's begin by defining the condition that could be monitored by the event manager. You cannot create a monitor before defining the condition. Follow the steps.

1. Defining the condition
Since we need to monitor the file system utilization, let's first identify the resource variable representing the file system's full condition. If one is not already available, you will be required to create your own. Luckily, PSSP provides several commonly used pre-defined variables, so let's check them out first.

You can either use the `haemqvar` command to find out about those pre-defined variables, or use the perspectives panels (select show details in creating a condition pane). The variable format is IBM.PSSP.Membership.Node.State. To list all variables related to a file system (IBM.PSSP.aixos.FS class), run the following command:

\[\text{# haemqvar -d IBM.PSSP.aixos.FS "" ""}\]

The above command, among others, will list IBM.PSSP.aixos.FS.%totused variable with a description of Used space in percent. Further information can be obtained by running the `haemqvar` command on this variable, as follows.

\[\text{# haemqvar "IBM.PSSP.aixos.FS" IBM.PSSP.aixos.FS.%totused ""}\]
Now we know that IBM.PSSP.aixo.FS.%totused is the variable we want. Run the perspectives command and make condition pane active (by clicking once in the pane). Now choose Actions -> Create to get to create condition pane as shown in Figure 2-11.

![Figure 2-11 Defining a condition pane](image)

The following data has been entered in this pane:

**Name**
Use any arbitrary (but meaningful) string to name your condition. filesystem_space_condition.
Description
This Provides a description to tell more about the condition. It serves a good documentation purpose in the long run. Monitoring the file system full condition casestudy is the description used in this example.

Select a resource variable – resource variable classes
This lists all the pre-defined resource variable provided with PSSP. Select IBM.aixos.FS resource variable for this example.

Select a resource variable – resource variable names
Within a resource class, select the resource variable of your choice. Choose IBM.PSSP.aixos.FS.%totused in this example.

Show details
If chosen, this will provide more details about IBM.PSSP.aixos.FS.%totused resource variable. The information here is equivalent to the haemqvar "IBM.PSSP.aixos.FS" IBM.PSSP.aixos.FS.%totused "*> output. Since you already have executed this command and are aware of the resource variable, you do not need this option in this example.

Event expression
Set event expression to >90.

Re-arm expression
Set re-arm expression to <70.

You will now be able to see your defined condition in the condition pane, among several others conditions.

2. Define an event definition
Now that the condition has been defined, you need to create a monitor for this condition. Make event definition as your active pane and select Actions -> Create to display pane as shown in Figure 2-12 on page 79.

Provide the data to the relevant fields as follows:

Event definition name
Provide any arbitrary name. Use filesystem_space_monitor for this example.

Condition - name
From the scroll bar, select your previously defined condition, filesystem_space_monitor.
**Resource ID elements and their values**
The following list describes the resource ID elements and their values:

▸ **LV**
  - Element LV can take possible values of all the logical volumes known to the system. Since we need to monitor /tmp our choice is hd3.

  **Tip:** Use the `df` command to find out relationship between the file system and the logical volume.

▸ **NodeNum**
  - Determine the nodes where the conditions will be tested. Scroll bar menu will list all the node number for the selection. Click on the wild-card element values to select all the nodes.

▸ **VG**
  - This element take values of all VGs defined to the system. Select rootvg for this example.
Figure 2-12  Create Event Definition - Pane

Once all the information has been filled out, you can create the monitor by clicking the Create button. For this example, we have not selected any special action, so only a window notification will be displayed when the condition evaluates true. However, you may add actions to your monitor by selecting the Actions tab on the right-hand side of the monitors pane.

The new monitor has been defined and is displayed in the events pane.
3. Testing the defined event
To test the new monitor, we fill up /tmp in one of the nodes by using the `dd` command as follows:

```
$ dd if=/dev/zero of=/tmp/file
```

Once the file system is over 90% full, we will receive a notification at the Control Workstation's display.

The re-arm events and notifications work in a similar way. To trigger the re-arm event (X < 70), we remove the file from the /tmp file system. The re-arm event notification and the notification windows are very similar to the ones we just saw.

For a detailed discussion of event perspective and monitors, refer to *SP Perspectives: A New View of Your SP System*, SG24-5180.

2.1.29 Hardware perspective
The RS/6000 SP hardware Perspective provides a view of your entire RS/6000 SP system at one place. You can modify your view of system elements (by adding panes) and perform actions on the system via the graphical toolbar and window menus.

The hardware perspective tells you about the current status of various types of SP hardware objects. To launch, click on the hardware perspective icon from the main perspective pane. Figure 2-13 on page 81 provides a view of hardware perspectives that has switch and frame panes added to the default view.

Unlike the SP event perspective, the SP hardware perspective does not permit the user to associate an action with the presence of a condition. Users that wish to automate a response to a specific system condition should use the SP event perspective. Also, the SP hardware perspective only monitors conditions while it is active. If the perspective is shut down, any monitoring of a hardware status is also shut down.
Examining the hardware objects
To examine the current status of a hardware device, select the hardware device by single-clicking on the device's icon in the particular pane.

Open the device's notebook by single clicking the notebook icon (leftmost icon) in the toolbar at the top of the perspective window. This displays a new window (notebook) that contains the device's current status, settings, and monitored conditions. This is useful for examining a node's LED values, its responsiveness to the network and the switch, its network configuration, and other information.
For further assistance in using the notebook to view hardware status, consult the perspective’s online help. To access this help, click on the Help button from the SP hardware perspective display and select the Tasks. Assistance in viewing hardware status is available in the viewing hardware attributes topic.

Opening a notebook for multiple entities (such as a series of nodes) can be time-consuming. The SP hardware perspective offers an alternative method for displaying this information in table form. To switch from the icon to table view in a pane, first select your hardware object (by clicking once on the icon) than click on the icon on the right of the toolbar, which shows a table and an icon.

**Hardware objects managed by hardware perspective**

The following objects can be managed by the SP hardware perspective.

- **System partition, nodes and CWS pane**
  - From this pane, actions can be taken and conditions can be monitored for CWS, nodes and system partitions.
  - The CWS, system and partition pane enables you to do aggregate monitoring on a system-wide or partition-wide basis.
  - You can also use this pane to set the currently active system partition in which you wish to work.
  - This pane enables you to monitor the control workstation and view any of its attributes.

- **Node pane**
  - The nodes pane displays all nodes configured in the current system or system partition.
  - Nodes are represented according to their type (thin, wide, or high) which reflect the number of frame slots that they occupy.
  - SP-attached server is not physically contained in an SP frame, but functions as a logical node. It is displayed in the nodes pane outside a frame.

- **Frame and switches pane**
  - The frames and switches pane allows you to control frame and switch hardware and do aggregate monitoring on a frame basis.
  - Frame and switch attributes can be viewed via the notebook function.
  - From this pane, actions can be taken and conditions can be monitored.

- **Node group**
  - The Node Groups pane enables you to view and manage a collection of nodes at one time.
You can create node groups according to many attributes, including:

- The type of work performed on the nodes
- Departmental use of those nodes
- Node types

From this pane, actions can be taken and conditions can be monitored for node groups.

- Netfinity nodes
  - The Netfinity nodes pane displays all netfinity nodes configured in the current system or system partition.

**Hardware perspective - monitor**

From the perspective main pane you can select Hardware: Monitor for three important conditions. This is in essence a customized view of three selected hardware objects and conditions (hostresponds, switchrespnds and nodespower), also available through the hardware perspective.

Figure 2-14 on page 84 provides an example of the hardware monitor. You can instantly observe the problems on node 1 and node 13.
2.1.30 Command line tools

PSSP provides command-oriented tools for system administration in addition to graphical tools for system administration and monitoring. These tools require no special workstation capability or high-speed connection, making them usable by almost any terminal type in any mode of access. Use these tools when examining system status through a modem connection or through a node’s S1 serial port. The tools discussed in this section are documented in greater detail in Parallel System Support Programs for AIX: Command and Technical Reference,
Several commands are useful for monitoring the system status and detecting problem situations:

- `spmon`
- `hmmon`
- `df`
- `dsh`
- `lsps`
- `lssrc`

**spmon command**

The `spmon` command requires user to have specific authorizations. To learn how a user can acquire these authorizations, see Chapter 20, "Using the SP System Monitor" in *Parallel System Support Programs for AIX: Administration Guide, SA22-7348*.

The `spmon` command permits the user to control and monitor SP hardware resources through a command-line interface without requiring a graphics-capable terminal or high-speed connection. The `spmon` command does not provide the capability to examine software status (such as paging space, file system space, or software subsystem activity). The `spmon` command provides a predefined system query to check the most basic problem conditions within the SP system.

To perform a basic diagnostic check on the entire SP system, issue the `/usr/lpp/ssp/bin/spmon -G -d | more` command from the control workstation:

**Example 2-18  spmon output**

1. Checking server process
   Process 6204 has accumulated 360 minutes and 24 seconds.
   Check successful

2. Opening connection to server
   Connection opened
   Check successful

3. Querying frame(s)
   1 frame
   Check successful
4. Checking frames

<table>
<thead>
<tr>
<th>Controller Slot 17</th>
<th>Switch Power</th>
<th>Clocking A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame responds</td>
<td>Switch</td>
<td>Power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>yes</td>
<td>yes</td>
<td>on</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Checking nodes

<table>
<thead>
<tr>
<th>Slot</th>
<th>Node Type</th>
<th>Power</th>
<th>Responds</th>
<th>Switch</th>
<th>Key</th>
<th>Env</th>
<th>Front Panel</th>
<th>LCD/LED</th>
<th>Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>no</td>
<td>N/A</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>N/A</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Note that these tests are numbered. This makes it easy to detect if a test was omitted. The results of this command indicate potential problems if any of the following conditions exist:

- The command does not run.
- The command does not perform all five verification checks.
- The fourth test indicates that the frame’s controller is not responding, the switch power is not on, or any of the power supplies are listed as off.
- The fifth test indicates any abnormal conditions: a node’s power is off, the host responds does not read yes, an environment failure is indicated, or the LCD or LED of the node is not blank (but not flashing).
- The fifth test indicates that the node’s LCDs or LEDs are flashing. This indicates that a system dump was attempted.
- The fifth test indicates that the node is not responding to the switch device.

**hmmon command**

The `hmmon` command provides hardware monitoring functions similar to the `spmon` command. In addition, the `hmmon` command provides detailed hardware information about frames and switches. The `hmmon` command provides the capability to monitor frame and switch status as well as node status. This command is intended to be a general-purpose SP hardware monitor. Although it has access to more SP information than the `spmon` command, it does not have access to some of the node-specific information that the `spmon` command does. The `hmmon` command does not provide a predefined system query, which is available through the `spmon` command.
**dsh command**

The *dsh* (distributed shell) command permits the user to issue a command locally, for selected remote nodes and view the results on the local node. Using *dsh*, you can issue the commands listed previously on any SP node from a single location. This removes the need to login to each node individually. Like the *spmon* command, users must have specific authorization to use the *dsh* command.

**df command**

The *df* command is an AIX command that examines the current status of file systems, such as current file system size and current available space within these file systems. While this command is designed to examine the AIX system on which it is issued, it can be invoked remotely with the *dsh* and *rsh* commands to acquire this information for all nodes on SP. Three file systems are of particular importance for all SP nodes:

- **/spdata**
  
  This directory contains configuration information for PSSP software and also contains copies of information from the SDR. By default, this directory resides in the / (root) file system. Insufficient space in this file system can result in failures in PSSP software, especially those dependent on the SDR for proper operation. As a rule of thumb, you should ensure that this file system has at least 5% of its capacity available at any time. One highly recommended method for avoiding space problems for the /spdata directory is to create a separate file system for this directory.

- **/var**
  
  This file system contains AIX system logs, such as error logs and user access logs. It also contains logs maintained by PSSP software for serviceability purposes. Some of these logs are never cleared except by explicit system administrator actions. If left unattended, they can grow to consume all available space. As a rule of thumb, you should ensure that 10 MB of space is available within this file system at all times. If the file system reaches this threshold, consider either extending the file system's capacity with the *chfs* command, or examine the file system to determine where the space is being consumed and remove unwanted files.

- **/tmp**
  
  This file system is used by various user level applications, software products, and PSSP programs for temporary storage. Some legacy PSSP applications use this file system to store trace logs used for serviceability purposes. Some applications may inadvertently leave temporary files in the /tmp file system, or these applications may terminate before removing these files. Insufficient
space in /tmp can cause PSSP software to fail. As a rule of thumb, you should ensure that at least 8 MB of space is available in this file system at any time; 8 MB is the amount of space the snap command will require if the system has to produce a dump to be sent to the IBM Support Center.

**lsps command**
The `lsps` command provides an instant assessment of the currently available paging space for an AIX system. As with the `df` command, the `lsps` command provides information for the AIX system on which it runs. Using the `lsps` command with the `dsh` or `rsh` command, you can obtain the assessment for all nodes in your SP.

**lssrc command**
The `lssrc` command provides information for software services currently installed on an AIX system. Using `lssrc`, you can determine if a software service is active or inactive. Use this command in cases where a software service does not appear to be responding to requests for service on a specific node. To check software service status on multiple nodes, use this command through the `dsh` or `rsh` commands.

### 2.1.31 Useful sites

Table 2-6 lists sites that can prove useful in problem diagnosis and resolution process.

<table>
<thead>
<tr>
<th>Table 2-6 Useful sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IBM Redbooks</strong></td>
</tr>
<tr>
<td><a href="http://www.redbooks.ibm.com/">http://www.redbooks.ibm.com/</a></td>
</tr>
<tr>
<td><strong>AIX manuals</strong></td>
</tr>
<tr>
<td><a href="http://www.rs6000.ibm.com/resource/aix_resource/Pubs/index.html">http://www.rs6000.ibm.com/resource/aix_resource/Pubs/index.html</a></td>
</tr>
<tr>
<td><strong>PSSP manuals</strong></td>
</tr>
<tr>
<td><strong>APARs and PTFs</strong></td>
</tr>
<tr>
<td><a href="http://techsupport.services.ibm.com/rs6000/fixes">http://techsupport.services.ibm.com/rs6000/fixes</a></td>
</tr>
<tr>
<td><strong>Forums</strong></td>
</tr>
<tr>
<td><a href="http://techsupport.services.ibm.com/rs6000/forums">http://techsupport.services.ibm.com/rs6000/forums</a></td>
</tr>
<tr>
<td><strong>General AIX technical documents</strong></td>
</tr>
<tr>
<td><a href="http://techsupport.services.ibm.com/rs6000/techKnow">http://techsupport.services.ibm.com/rs6000/techKnow</a></td>
</tr>
<tr>
<td><strong>Main entry for IBM support page</strong></td>
</tr>
<tr>
<td><a href="http://techsupport.services.ibm.com/eserver/support">http://techsupport.services.ibm.com/eserver/support</a></td>
</tr>
</tbody>
</table>
Installation

In this chapter, we step through the common problems that are encountered during the universal cluster installation process. Each section within this chapter references a step within the installation process. In addition to this, each section contains problems and solutions that could be encountered during installation.
3.1 Overview of the installation process

To successfully set up and configure a clustered system, we suggest that the *Installation and Migration Guide*, GA22-7347-02 be followed. The installation guide includes procedures for command line, SMIT menus and perspectives. In this chapter, we have focused on the command line methodology. Problem determination of a script is much easier to debug than a simple icon on a perspective screen.

3.1.1 Setup of the CWS

Use the following steps to configure the CWS:

1. Update root’s $PATH to include the SP-specific executable.
2. Ensure that the bos.net and perfagent.tools are installed on the system.
3. Connect the frames to the CWS.
5. Configure and tune the network adapters on the CWS.
6. Ensure the System Resource Controller (SRC) is active.
7. Increase the maximum number of runnable processes per user to 256.
8. Tune network options.
9. Create additional file systems for /spdata.
10. Create additional file systems for /tftpboot.
11. Create the directory structures needed under /spdata.
12. Copy the AIX LPP images to their lppsource directory.
13. Copy the PSSP installation images to the pssplpp directory structure.
14. Copy a basic mksysb images to the images subdirectory.
15. Install PSSP on the CWS.
16. Enter site environment variables.
17. Set Authentication Methods for AIX remote commands on the CWS.
18. Initialize Kerberos.
19. Set the authentication method for SP trusted services on the CWS.
20. Obtain authentication credentials.
21. Run install_cw.
3.1.2 Enter Information into the SDR

The following steps describe the process to enter information into the SDR:
1. Enter Frame Information and Reinitialize the SDR.
2. Update the state of the supervisor microcode.
3. Enter the required node information.
4. Acquire the hardware ethernet addresses.
5. Configure additional adapters for nodes.
6. Configure initial host names for the nodes.
7. Setup security capabilities required on nodes.
8. Enable authentication methods for AIX remote commands.
9. Enable authenticating methods for SP trusted services.
10. Start system partition-sensitive subsystems.
11. Enter volume group information for nodes into the SDR.
12. Change the default network tunable values.
13. Modify script.cust and tuning.cust files.
15. Set the clock source for all switches.
16. Verify the switch primary and primary backup nodes.
17. Configure control workstation as a Boot Install Server (setup_server).

3.1.3 Power on and install nodes

To install the nodes, follow the next steps:
1. Network boot nodes.
2. Verify node installation.
3. Run verification test on all nodes.
4. Start the optional switch.
5. Tune network adapters on the nodes.
6. Run post installation procedures on the nodes.
3.2 Prepare the control workstation

This section describes the problems you might encounter during the installation of the control workstation. Improper configuration of the control workstation can cause problems that might not be apparent until after the system is in production. There is no substitute for proper planning prior to the installation process. However, even the best plan can run into a fair share of unforeseen problems along the way. This section will outline some of the potential problems and pitfalls that might occur while preparing the control workstation.

3.2.1 Failures when installing PSSP filesets on the CWS

Prior to installing the PSSP code, there are two requisites that are often overlooked. This causes the missing requisite failures, as shown in Figure 3-1.

The fileset bos.mp 4.3.3.10 can be downloaded from:

http://techsupport.services.ibm.com/rs6k/fixdb.html

The fileset for perfagent.tools 2.2.32.0 is located on the AIX 4.3.3 media.

MISSING REQUISITES: The following filesets are required by one or more of the selected filesets listed above. They are not currently installed and could not be found on the installation media.

<table>
<thead>
<tr>
<th>Fileset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bos.mp 4.3.3.10</td>
<td># Fileset Update</td>
</tr>
<tr>
<td>perfagent.tools 2.2.32.0</td>
<td># Base Level Fileset</td>
</tr>
</tbody>
</table>

GROUP REQUISITES: The dependencies of one or more of the selected filesets listed above are defined by a group requisite. A group requisite must pass a specified number of requisite tests. The following describe group requisite failures for filesets that you selected. (See the "Requisite Failure Key" below for details of group member failures.)

At least 1 of the following:
- At least 2 of the following:
  - ~ rsct.basic.rte 1.2.0.0
  - ~ ssp.basic 3.2.0.0

Figure 3-1 Failures on the CWS
3.2.2 Configure the RS-232 ports

Each frame within the universal cluster will require a RS-232 port on the control workstation. This port is used for the console (`s1term`) communications link to the nodes within each frame. In addition to this port, a second port is needed for nodes that are not housed within an SP frame (SP-attached servers). The second port takes over the function of the frame supervisor card.

Frame connected to wrong tty port

Each frame has a RS-232 serial connection to the serial port on the CWS, RAN or eight-port break-out-box on the control workstation. It is important to document which port is connected to each frame. We recommend connecting the ports in frame number order to avoid confusion.

Some SP-attached servers (S70, S7A, S80 and S85) utilize a SAMI port as well as the serial port for connectivity to the control workstation. The connection for the SAMI should be the lower of the two tty addresses. It is necessary to document this information as it is needed in later installation steps.

The spframe command times out

If the `spframe` command does not find the frame on the tty devices specified, the command will time out, as shown in Figure 3-2.

```
# spframe -r yes 1 1 /dev/tty1
0513-059 The hardmon Subsystem has been started. Subsystem PID is 18026.
hmcmds: 0026-6031 Number of slots expected to be in state "setid": 0.
hmcmds: 0026-6041 Number of slots currently in state "setid": 0.
hmcmds: 0026-6031 Number of slots expected to be in state "on": 0.
hmcmds: 0026-6041 Number of slots currently in state "on": 0.
0513-059 The splogd Subsystem has been started. Subsystem PID is 27106.
hmreinit: 0037-262 The logging daemon timed out while attempting to connect to the hardware.
```

*Figure 3-2  spframe time out*

A quick look at the following errpt output shows a few possible reasons for this timeout to occur.
Attention: The timeout here does not occur within the spframe script, but in hmreinit/splogd. If the same problem exists, you won’t see a timeout from the command `spframe -r no 1 1 /dev/tty1`, but you will see it when you run `hmreinit`.

```
| LABEL:          | SPMON_MSG100_ER |
| IDENTIFIER:     | 4CE5A08         |
| Date/Time:      | Sat Jul 14 21:48:17 |
| Sequence Number:| 53               |
| Machine Id:     | 000354794C00    |
| Node Id:        | sp5en0          |
| Class:          | H               |
| Type:           | PERM            |
| Resource Name:  | sphwlog         |
| Resource Class: | NONE            |
| Resource Type:  | NONE            |
| Location:       | NONE            |

Description
LINK ERROR

Probable Causes
CABLE
SYSTEM MICROCODE

Failure Causes
CABLE LOOSE OR DEFECTIVE
SYSTEM MICROCODE

Recommended Actions
CHECK CABLE AND ITS CONNECTIONS
CHECK FOR CORRECT MICROCODE FIX

Detail Data
DETECTING MODULE
LPP=PSSP,Fn=splogd.c,SID=1.16.1.33,L#=1363, DIAGNOSTIC EXPLANATION
0026-100 Failure; Frame 1:0; controllerResponds; Frame supervisor does not respond.
```

Figure 3-3  spframe frame supervisor does not respond errpt output
The errpt output shown in Figure 3-3 gives two possible explanations for the timeout:

- Cable and its connections
- Microcode level
In addition to the two recommended actions listed in the errpt output, be sure to check that:

- The correct serial port is defined to the tty devices specified.
- The correct tty port has been selected.
- The frame supervisor card is functioning correctly.

For an SP-attached server that requires the SAMI interface, the `spframe` command is a bit more complex, as the additional tty port needs to be defined. The tty port that is defined as the SAMI should be the lower of the two tty devices connected to the attached server as shown in Figure 3-4.

The switch node number will also need to be entered into the `spframe` command. This may be any valid switch node number that is not in use by another node. Consider a system with two frames and two switches with 30 thin nodes as shown in Figure 3-5. In this example, there are two switch nodes available (sn30 and sn31). In this particular setup we picked switch node 31 to assign to the S-80 leaving switch node30 to be used as a thin, wide or an SP-attached node.

*Figure 3-4 tty attachments*
In a switchless SP system, SP-attached nodes must also be given a switch node number. We recommend that when adding an SP-attached node into a switchless system, place a hypothetical switch into each frame to determine which switch node number would be available, if such a switch or group of switches exist. This method will yield a valid switch node number that could also be used if the system is converted to a switched system in the future.

**Incorrect baud rate for tty**

The baud rate for all rs232 connections should be set to 9600. The hardmon daemon will change this to 19200 for the serial terminal connections. However, hardmon does not change this value to 19200 for the SAMI interface. By allowing the hardmon daemon to make this change, rather than manually changing the rate of the device, the SAMI connections will remain at 9600. This is important, as the SAMI interface is not functional at 19200 baud.

### 3.2.3 Creation of optional spdataavg volume group

Although this is not a necessary step, it may be useful for larger universal clusters to create an additional volume group for the /spdata directory structures. Within this volume group, the following file systems can be utilized:

- /spdata
3.2.4 setup_authent failure

After the PSSP installation, the first test to ensure that the installation was successful is setup_authent. This command will conduct the first SDRChangeAttrValues command on the system as shown in Figure 3-6.

```bash
# setup_authent
/usr/lpp/ssp/bin/SDRChangeAttrValues: 0025-004 Item specified for query, insertion or deletion was not found.#
```

Figure 3-6  setup_authent fails due to SDR failure

If a problem is encountered at this stage, check the output of the `lslpp -l ssp*` command as in Figure 3-7.

<table>
<thead>
<tr>
<th>Fileset</th>
<th>Version</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ssp.authent</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Authentication Server</td>
</tr>
<tr>
<td>ssp.basic</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP System Support Package</td>
</tr>
<tr>
<td>ssp.cediag</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP CE Diagnostics</td>
</tr>
<tr>
<td>ssp.clients</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Authenticated Client</td>
</tr>
<tr>
<td>ssp.css</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Communication Subsystem</td>
</tr>
<tr>
<td>ssp.docs</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP man pages and PDF files and ssp.gui</td>
</tr>
<tr>
<td>ssp.gui</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP System Monitor Graphical</td>
</tr>
<tr>
<td>ssp.ha_topsvcs.compat</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>Compatability for ssp.ha and ssp.topsvcs clients</td>
</tr>
<tr>
<td>ssp.jm</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Job Manager Package</td>
</tr>
<tr>
<td>ssp.perlpkg</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP PERL Distribution Package</td>
</tr>
<tr>
<td>ssp.pman</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Problem Management</td>
</tr>
<tr>
<td>ssp.ptpegui</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Performance Monitor</td>
</tr>
<tr>
<td>ssp.public</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>Public Code Compressed</td>
</tr>
<tr>
<td>ssp.spmgr</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Extension Node SNMP Manager</td>
</tr>
<tr>
<td>ssp.st</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>Job Switch Resource Table</td>
</tr>
<tr>
<td>ssp.sysctl</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Sysctl Package</td>
</tr>
<tr>
<td>ssp.sysman</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>Optional System Management</td>
</tr>
<tr>
<td>ssp.tecad</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP HA TEC Event Adapter</td>
</tr>
<tr>
<td>ssp.tguides</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP TaskGuides</td>
</tr>
<tr>
<td>ssp.top</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Communication Subsystem</td>
</tr>
<tr>
<td>ssp.top.gui</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP System Partitioning Aid</td>
</tr>
<tr>
<td>ssp.ucode</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>SP Supervisor Microcode</td>
</tr>
<tr>
<td>ssp.vsdgui</td>
<td>3.2.0.0</td>
<td>COMMITTED</td>
<td>VSD Graphical User Interface</td>
</tr>
</tbody>
</table>

Figure 3-7  Check PSSP filesets on the CWS.
The output of the `lslpp` command shows that the fileset for the PSSP software were installed. When installing the PSSP software as in any installation, make sure to keep a log file of the output from the installation commands or the `smit.log` file. Investigation of the installation log shows a very interesting situation. Note that in Figure 3-8, there is a new subserver that has appeared, called wombat. For some unknown reason the system has started a subserver that is not a part of the PSSP code.

```
Performance Toolbox Parallel Extensions 'usr' setup complete.
0513-036 The request could not be passed to the inetd subsystem.
Start the subsystem and try your command again.
spdmctrl: 2516-468 The refresh of the inetd daemon failed. Refresh this
daemon manually.
0513-065 The spdm Subserver has been added.
0513-124 The wombat subserver has been started.
ptpegroup: 2516-311 The user group 'perfmon' already exists.
ptpeconf: SPDM object class exists in the System Data Repository.
ptpeconf: SPDM_NODES object class exists in the System Data Repository.
ptpeconf: Successful completion.
Performance Toolbox Parallel Extensions 'root' setup complete
Filesets processed: 30 of 31 (Total time: 9 mins 4 secs).
installp: APPLYING software for:
        ssp.ptpegui 3.2.0.0
```

Figure 3-8  What is wombat?

**Note:** As you were driving down the installation path, where did the wombat come from?

Upon additional investigation, it was determined that there is an entry for wombat in the `/etc/services` file as shown in Figure 3-9 on page 100.
This entry in the /etc/services file for wombat is due to an application that has port 10000 hard coded into the software. There is now a port conflict between the application’s wombat entry and the HA services entry in the /etc/service file. To resolve port conflicts for the HA daemons, we recommend the following procedure:

- Un-install the PSSP code
- Remove the entry in /etc/service for wombat
- Re-install the PSSP software

### Figure 3-9  What is wombat doing in /etc/services?

<table>
<thead>
<tr>
<th>Service</th>
<th>Protocol</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>isode-dua</td>
<td>tcp</td>
<td>17007</td>
</tr>
<tr>
<td>isode-dua</td>
<td>udp</td>
<td>17007</td>
</tr>
<tr>
<td>dtspc</td>
<td>tcp</td>
<td>6112</td>
</tr>
<tr>
<td>spseccfg</td>
<td>tcp</td>
<td>6681</td>
</tr>
<tr>
<td>sysctl</td>
<td>tcp</td>
<td>6680</td>
</tr>
<tr>
<td>sysctl</td>
<td>udp</td>
<td>16680</td>
</tr>
<tr>
<td>hardmon</td>
<td>tcp</td>
<td>8435</td>
</tr>
<tr>
<td>sdr</td>
<td>tcp</td>
<td>5712</td>
</tr>
<tr>
<td>sdrprot</td>
<td>tcp</td>
<td>1712</td>
</tr>
<tr>
<td>spmgrd-trap</td>
<td>udp</td>
<td>162</td>
</tr>
<tr>
<td>supfilesrv</td>
<td>tcp</td>
<td>8431</td>
</tr>
<tr>
<td>kfcli</td>
<td>tcp</td>
<td>32802</td>
</tr>
<tr>
<td>wombat</td>
<td>udp</td>
<td>10000</td>
</tr>
</tbody>
</table>

### 3.3 Entering Universal Cluster SDR Information

This section describes the steps to enter SDR information for the Universal cluster.

#### 3.3.1 SP ethernet information

While entering the SP ethernet information, ensure that the entries for the netmask, duplex, ethernet speed and ethernet type are correct. In our system, we were using a coax BNC network and our settings are shown in Figure 3-10 on page 101.
Also keep in mind that the addresses must be resolvable. If the hostname is not resolvable, there will be an error, as shown in Figure 3-11. To correct this, verify the /etc/hosts file entries and ensure that the correct hostname is being used.

3.3.2 Obtain the Ethernet hardware address

The following command will acquire the hardware address for node number 9:

[root@sp5en0]: sphrdwrad -l 9

Acquiring hardware ethernet address for node 9 from /etc/bootptab.info
Using /etc/bootptab.info file
If the hardware address is already known for the adapters in the system, then the entries may be placed into the /etc/bootptab.info file. This file has the following characteristics, as shown in Figure 3-12.

```
# cat /etc/bootptab.info
1 02608CF57A7C
5 02608C2D4CA5
9 02608C2D63E2
13 02608CF518A4
```

Figure 3-12  /etc/bootptab.info file

/etc/bootptab.info file problems
If a bootptab.info file exist, then the script that obtains the hardware address of the node will not boot the node to acquire the hardware address. This can be helpful in saving time, as system reboots can be time consuming. However, if the bootptab.info file has become corrupted, or the entries in the file are incorrect, then the correct hardware address may never be acquired.

To remedy this problem, we suggest that the /etc/bootptab.info file be removed or the name changed. This will allow the node to be booted and the hardware address acquired. We suggest the following two steps:

1. Rename the file by issuing the command `mv /etc/bootptab.info /etc/bootptab.info.bak`.
2. Re-acquire the hardware address as shown in Figure 3-13.

```
[root@sp5en0:/spdata/sys1/install/images] spherdwr 1 1 4
  Acquiring hardware Ethernet address for node 5
  Acquiring hardware Ethernet address for node 9
  Acquiring hardware Ethernet address for node 13
  Hardware ethernet address for node 5 is 02608C2D4CA5
  Hardware ethernet address for node 9 is 02608C2F90B3
  Hardware ethernet address for node 13 is 02608CF518A4
```

Figure 3-13  Output from spherdwrad

The following command will acquire the hardware address for node number 9:
```
[root@sp5en0:/spdata/sys1/install/images] spherdwr -1 9
  Acquiring hardware ethernet address for node 9 from /etc/bootptab.info
```
3.3.3 Adding additional Network Adapters into the SDR

Enter all the network interfaces for each node into the SDR. If the system has HACMP configured on some nodes, then enter the adapter hostname information for the boot address and standby address. Allow HACMP to configure the service address when the cluster daemons have started.

When entering information for the CSS0 adapter, do not enter a value for the Ethernet Adapter Type (Duplex or Ethernet Speed) as this will cause a failure as shown in Figure 3-14.

```
COMMAND STATUS
Command: failed   stdout: yes   stderr: no

Before command completion, additional instructions may appear below.

spadaptrs: 0022-002 You have specified an invalid number of arguments.
Usage: spadaptrs [-s {yes | no}]
[-t {bnc | dix | NA | tp | fiber}]
[-r {4 | 16}]
[-d {full | half | auto}]
[-f {10 | 100 | 1000 | auto}]
[-a {yes | no}][-n {yes | no}]
[-o {ip address[,ip address ...]}]
{start_frame start_slot {node_count | rest} | 
-l <node_list> | -N node_group}
adapter_name starting_ip_address netmask
```

Figure 3-14 css0 configuration failed in SMIT

You will not be able to clear the entries for these field in SMIT. Therefore, exit pressing the F3 key, open the menu again, and re-try with the correct parameters, as shown in Figure 3-15 on page 104.
3.3.4 SP volume group information

The following section provides information on the SP volume group characteristics important during problem determination on an SP system.

Create volume group information

It is important to understand the directory structure in which the spmkvgobj and spchvgobj commands are referencing. There are expectations for files to exist in predetermined directory structures. If the files do not exist, the command will fail. For more detail information on the spdata directory structure, refer to Figure 3-16 on page 105.
Flags in the spmkvgobj and spchvgobj commands

Table 3-1 displays the flags that are used with the spmkvgobj and spchvgobj commands. Each of these flags are represented in the smitty menu, as shown in Figure 3-17 on page 106.

Table 3-1  Flags used with the spmkvgobj and spchvgobj commands

<table>
<thead>
<tr>
<th>Flag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-r</td>
<td>Volume Group Name (For example, rootvg)</td>
</tr>
<tr>
<td>-h</td>
<td>Physical Volume List (For example, hdisk0)</td>
</tr>
<tr>
<td>-c</td>
<td>Number of Copies of Volume Group</td>
</tr>
<tr>
<td>-n</td>
<td>Boot Server</td>
</tr>
<tr>
<td>-i</td>
<td>Network Install Image Name; must be located in /spdata/sys1/install/images</td>
</tr>
</tbody>
</table>
The SDR is expecting this image to be in the following directory:
/spdata/sys1/install/images

If the file is not there, then an error will occur as shown in Figure 3-18 on page 107.
Figure 3-18  `spmkvgobj` failed due to the install image not existing

A quick look at the `/spdata/sys1/install/images` directory shows that the name is not `bos.obj.433.ssp`, but instead is `bos.obj.ssp.433`.

If there is already volume group information in the SDR for the node, then an error such as the one shown in Figure 3-19 will occur. This is simple to rectify with the use of the `spchvgobj` command with the same options as used in the `spmkvgobj` command.

Figure 3-19  Failure due to the volume group already existing

The volume group can also be modified with smitty as shown in Figure 3-20.
3.3.5 Validate switch primary and primary backup nodes

Figure 3-21 on page 108 shows a failure occurred while validating both nodes. This is normal at this point of the installation as there are no nodes yet installed. If there are nodes installed (and they are functional), then see Chapter 6, “SP switches” on page 233 for switch problem determination procedures.

```plaintext
# Eprimary 1 -backup 13
Eprimary: 0028-206 Warning: Cannot ping the oncoming primary node: sp5n01.
Eprimary: Eprimary will continue.
Eprimary: 0028-207 Warning: Cannot ping the oncoming primary backup node: sp5n13.
Eprimary: Eprimary will continue.
```

Figure 3-21 Eprimary failures
3.4 Setup_server

The SDR provides the information setup_server needs to configure NIM on the Boot Install Server (BIS). The setup_server script is divided into Perl wrappers each of which is an independent script. The use of wrappers assist in the problem determination of setup_server. The name of the wrappers are listed in Table 3-2 on page 110 by the order by which setup_server calls them.
Table 3-2  The wrappers of setup_server

<table>
<thead>
<tr>
<th>Wrapper</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>services_config</td>
<td>Checks the site environment information</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/install/bin</td>
<td></td>
</tr>
<tr>
<td>setup_cws</td>
<td>Checks to see if this is the CWS ensures krb files exist /etc/krb-srvtab /etc/krb.conf /etc/krb.realms</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td>Performs all kerberos updates on the CWS required for each node</td>
</tr>
<tr>
<td></td>
<td>Creates and/or updates CWS files</td>
</tr>
<tr>
<td>delnimmast</td>
<td>If the node parsed is a NIM master then unconfigure it.</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>delnimclient</td>
<td>Undefines the client node on the master</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mknimmast</td>
<td>Creates the NIM masters</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>create_krb_files</td>
<td>Creates the krb-srvtab file on CWS copies krb-srvtab to BIS (if necessary) created /spdata/sys1/k4srvtab</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mknimint</td>
<td>Creates the NIM network objects.</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mknimres</td>
<td>Created the NIM resources</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mknimclient</td>
<td>Creates the NIM client definitions</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mkconfig</td>
<td>creates /tftpboot/&lt;hostname&gt;.config_info used for node customization</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>mkinstall</td>
<td>creates /tftpboot/&lt;hostname&gt;.install_info used for installation and customization</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>export_clients</td>
<td>exports the pssplpp filesystem to clients</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
<tr>
<td>allnimres</td>
<td>Adds entries into /etc/boottab if needed allocates NIM resources to clients</td>
</tr>
<tr>
<td>Location: /usr/lpp/ssp/bin</td>
<td></td>
</tr>
</tbody>
</table>
3.4.1 The flow of the setup_server command

The following flowcharts in Figure 3-22 and Figure 3-23 on page 112 describe the flow for the `setup_server` and `services_config` commands, respectively.
Figure 3-23 services_config flowchart
3.4.2 services_config

This script is invoked by /etc/rc.sp to set up designated services on the nodes, and by setup_server to set up services on the boot/install server.

It reads the SDR information stored in the SP object class and checks which services will be run on the node. Then, it calls the appropriate service configuration scripts. The possible services to invoke are the following:

- NTP
- Print management
- User management
- AMD
- File collection
- Accounting

Command Syntax:

```
services_config
```

This command has no input parameters.

The general flow and logic for services_config is shown in Figure 3-23 on page 112.

3.4.3 setup_CWS

The setup_CWS script reads the information from the SDR, checks prerequisites, and updates Kerberos files to reflect CWS and node network interface names. It then makes a setup of CWS-specific items.

Command Syntax:

```
setup_CWS [-h]
```

This command has no input parameters.

The general flow and logic for setup_CWS is shown in Figure 3-24 on page 114.
3.4.4 delnimmast

This wrapper deletes the NIM master definition, that is, nodes that were configured as NIM master are unconfigure, and the NIM filesets (master and SPOT filesets) are deleted from them.
Command syntax:

delnimmast -l <node_number_list>

where: <node_number_list> is the list of nodes to un-define as NIM master. Node number 0 refers to the CWS.

The general flow and logic for the delnimmast command is shown in Figure 3-25.

3.4.5 delnimclient

The delnimclient script deletes the NIM client definitions from the NIM master. It searches for the nodes passed from the command line, resets these nodes, deallocates the NIM resources that were allocated to them, and then removes their client definitions on the NIM master.

Command syntax:

delnimclient -h | -l <node_number_list> | -s <server_node_list>
-h Display command syntax.
-l <node_number_list> - The list of node numbers to remove as NIM clients. Node number 0 (the CWS) is not allowed.
-s <server_node_list> - > The list of server (NIM master) nodes on which to delete all clients that are no longer defined as boot/install clients in the SDR.
The general flow and logic for the delnimclient script is shown in Figure 3-26 on page 116.

![Figure 3-26  delnimclient flowchart](image)

### 3.4.6 mknimmast

This wrapper creates a NIM master. To do this, the NIM master filesets (bos.sysmgmt.nim.master and bos.sysmgmt.nim.spot) must be installed. The node is configured as a NIM master by using the `nimconfig` command.

Command syntax:

```
mknimmast -h | -l <node_number_list>
-h Display command syntax.
```

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-l <node_number_list> - List of node numbers to define as NIM masters. Node number 0 indicates the CWS.

General flow and logic for mknimmast is shown in Figure 3-27.

![Figure 3-27 mknimmast flowchart](image)

### 3.4.7 mknimint

This wrapper defines a new Ethernet network and interface objects on the NIM master (boot/install server). On the CWS, any network not previously defined are defined, and NIM interfaces are added. On a boot/install server that is not the CWS, all Ethernet network adapters and interfaces of the node are defined in the NIM master. Also, all CWS Ethernet and Token-Ring adapters and interfaces are defined. The CWS networks and interfaces are added to the boot/install server because there are resources, such as lppsource (which have the CWS as resource server), which the nodes have to access.

To serve a resource from the CWS to a client that is not on the same subnet as the CWS, routing is required. Routing is done by the mkimclient wrapper.
If mknimint is executed on a boot/install server that is not the CWS, it creates the CWS as a NIM client for the boot/install server, thus, making this server able to access the resources on the CWS.

Command syntax:

```
mknimint -h | -l <node_number_list>
-h Display command syntax
-l <node_number_list> List of node numbers to define as NIM masters. Node 0 is the CWS.
```

The general flow and logic for mknimint is shown in Figure 3-28.
3.4.8 mknimres

This wrapper creates NIM resources that are needed for operations on the nodes. Depending on the value of the bootp_response field from SDR, the resources that are needed in the processes with the given bootp_response, and do not currently exist, will be created.

mknimres checks the Rstate attribute of resource objects, and if it is not ready for use, they will be removed (exception on boot resource).

Command syntax:

```
mknimres -h | -l <node_number_list>
   -h Display command syntax.
   -l <node_number_list> List of node numbers to be defined as NIM masters. Node 0 is the CWS.
```

The general flow and logic for mknimres is shown in Figure 3-29.

![mknimres flowchart](image-url)
3.4.9 mknimclient

This wrapper creates NIM client definitions on the boot/install server. It searches for the processor type of a client (UP/MP) and the platform type (RS6K/chrp). The information about processor type and platform is used in the definition of the client, so that when creating the boot images for the nodes, it can construct the correct one. If the client node is not on the same subnet as the CWS, the mknimclient command builds the client routes to the CWS so that the node can use the lppsource.

Command syntax:

```
mknimclient -h | -l <node_number_list>
```

- `-h` Display command syntax.
- `-l <node_number_list>` List of node numbers to define as NIM clients. Node 0 (the CWS) is not allowed.

The general flow and logic for mknimclient is shown in Figure 3-30.
3.4.10 mkconfig

This wrapper creates the /tftpboot/<reliable_hostname>.config_info files for every node that has bootp_response not set to disk. These files are used when running pssp_script. The information is retrieved from the SDR for every node with bootp_response not set to disk.

This data is used in creating the config_info files. This mkconfig wrapper uses reliable hostnames for creation of the files. The general flow and logic for the mkconfig wrapper is shown in Figure 3-31.
3.4.11 mkinstall

This wrapper creates the /tftpboot/<hostname>.install_info file for each node with bootp_response not set to disk. These files, like the config_info files, are used by pssp_script. The mkinstall wrapper retrieves site environment data from the SP SDR class. It gets the node information, and if the node bootp_response is not set to disk, the existing /tftpboot/<hostname>.install_info file is removed and a new install_info file is created for the node.

The general flow and logic for the mkinstall wrapper is shown in Figure 3-32.

![Figure 3-32 mkinstall flowchart](image-url)
3.4.12 export_clients

This wrapper ensures that the required directories (pssplpp, images, lppsource, SPOT, and others) are exported from a NIM master to its clients. This command must be run on the NIM master.

Command syntax:

```
export_clients [-h]
```

This command has no input parameters.

The general flow and logic for export_clients is shown in Figure 3-33.

![export_clients flowchart](image)

3.4.13 allnimres

This wrapper allocates all necessary NIM resources to a client, depending on the client bootp_response in the SDR. This includes executing the `bos_inst` command for allocation of the boot and nimscript resources. When this command is done, nodes are ready for netboot/install, diagnostics, or maintenance. If a
node bootp_response is set to “disk” or “customize”, then all NIM resources are deallocated from the node. The general flow and logic for the allnimres wrapper is shown in Figure 3-34 on page 125. The bootp_response values available in PSSP are:

- install
- customize
- disk
- maintenance
- diag
- migrate
Figure 3-34  allnimres flowchart

allnimres

Check boot response for node

Is current resource allocation correct?

YES

NO

Reset the node
nim -Fo reset <node>

Another node?

YES

NO

Deallocate all resources from the node
nim -Fo deallocate -a subclass=all <node>

Allocate resources
nim -o bos_inst -a no_client_boot=yes -a source=mksysb <node>

No allocation to be done

Install

Allocate resources
nim -o bos_inst -a yes <node>

Customize

Allocate resources
nim -o bos_inst -a yes <node>

Disk

Allocate resources
nim -o bos_inst -a yes <node>

Maintenance

Allocate resources
nim -o bos_inst -a yes <node>

Migrate

Allocate resources
nim -o bos_inst -a yes <node>

perform a bos_inst operation
nim -o bos_inst -a no_client_boot=yes -a source=mksysb <node>

End

perform a bos_inst operation
nim -o bos_inst -a no_client_boot=yes <node>

End

perform a bos_inst operation
nim -o bos_inst -a no_client_boot=yes <node>

End

perform a bos_inst operation
nim -o bos_inst -a no_client_boot=yes <node>
3.4.14 unallnimres

This wrapper deallocates all NIM resources to a list of boot/install clients. The general flow and logic for unallnimres is shown in Figure 3-35.

Command syntax:
unallnimres -l <list_of_nodes>

![Diagram of unallnimres flow chart]

3.4.15 Site Environment errors

The following section describes possible site environment errors in your cluster.

**Node data information invalid**

Prior to running setup_server, all nodes which are physically installed into the system must have valid entries in the SDR.

Take, for example, a case in which the node information has been entered into the SDR for nodes 5, 9, and 13. However, in this specific example, the SDR information has not yet been entered for node1.
This configuration will lead to an immediate failure in setup_server shown in
Example 3-1.
Example 3-1 Reliable hostname not configured in the SDR
# setup_server
setup_server: 0016-014 Problem found while querying SDR for reliable
hostnames. SDR Return Code 2.
setup_server: Processing incomplete (rc= 2).

Check the reliable hostname in the SDR with the splstdata command as shown
in Example 3-2.
Example 3-2 Check the reliable_hostname
# splstdata -n
List Node Configuration Information
node# frame# slot# slots initial_hostname reliable_hostname
----- ------ ----- ----- ----------------- ----------------1
1
1
4
““
““
5
1
5
4
sp5n05
sp5n05
9
1
9
4
sp5n09
sp5n09

Note that there are no entries for the initial_hostname or the reliable_hostname
for node1. Correct this by entering the information in the SDR.
Another problem that is encountered when node data is not entered into the SDR
is shown in Example 3-3.
Example 3-3 setup_server fails
mknimres: Copying /usr/lpp/ssp/install/config/bosinst_data_migrate.template to
/spdata/sys1/install/pssp/bosinst_data_migrate.
0042-001 nim: processing error encountered on "master":
0042-001 m_mk_lpp_source: processing error encountered on "master":
0042-154 c_stat: the file or directory
"/spdata/sys1/install/default/lppsource" does not exist
mknimres: 0016-375 The creation of the lppsource resource named
lppsource_default
had a problem with return code 1.
setup_server: 0016-279 Problem of internally called command:
/usr/lpp/ssp/bin/mknimres; rc= 2.
Tickets destroyed.
setup_server: Processing incomplete (rc= 2).

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Once again there is incomplete information in the SDR for node 1. After the `spframe` command is run, the `lppsource` placed in the SDR is the default. However, in this installation, the `lppsource` directory is under a subdirectory in `/spdata/sys1/install/aix433`. To correct this situation, enter the appropriate `lppsource` information for node1 into the SDR and then re-run `setup_server`.

**PSSP filesets missing**

The `mknimres` script ensures that the pssp files exist in `/spdata/sys1/install/pssplpp/PSSP-3.2` directory. See Example 3-4 for the output of the error that occurs in `setup_server` when these files do not exist.

*Example 3-4  Sample error output from setup_server*

```
mknimres: Successfully created the bosinst_data resource named prompt on
mknimres: Successfully created the lpp_source resource named mknimres:
Successfully created the mksysb resource named mksysb_1 from dir
/spdata/sys1/install/images/bos.obj.ssp.433 on sp5en0.
mknimres: 0016-395 Could not get size of pssplpp PSSP-3.2
files on control workstation, return code of 1, missing files are
/spdata/sys1/install/pssplpp/PSSP-3.2/pssp.installp.
setup_server: 0016-279 Problem of internally called command:
/usr/lpp/ssp/bin/mknimres; rc= 2.
Tickets destroyed.
setup_server: Processing incomplete (rc= 2).
```

When this error occurs, first check for the presence of this file:

```
# cd /spdata/sys1/install/pssplpp/PSSP-3.2
```

*Example 3-5  Checking for the missing files*

```
# ls
.toc
(3) rsct.clients.1.2.0.0.I
  (1) ssp.3.2.0.0.I
      ssp.vsdgui.3.2.0.0.I
      ptpe.3.2.0.0.I
  (4) rsct.core.1.2.0.0.I
      ssp.hacws.3.2.0.0.I
      vsd.3.2.0.0.I
  (2) rsct.basic.1.2.0.0.I
      spimg.3.2.0.0.I
      ssp.ptpegui.3.2.0.0.I
```

In Example 3-5, the output of the `ls` command shows that four files are missing from this directory structure. The four files have been numbered in Example 3-5 to illustrate our discussion. These files are:

1. pssp.installp
2. rsct.basic
3. rsct.clients
4. rsct.core

Attention: The four files are not quite missing. The files are there, but they first need to be renamed by following step 15.2 in Chapter 2 of the Parallel System Support Programs for AIX Version 3 Release 2: Installation and Migration Guide, GA22-7347.

Invalid hardware address for a node
Each node must have a valid hardware address in the SDR. setup_server does not check to ensure that the address is the actual address on the node but rather that the address is within valid parameters. Example 3-6 shows the output of setup_server on a system with such a configuration. To correct this problem, acquire the hardware address for the node in question and re-run setup_server (see step 35 in the Installation and Migration Guide for PSSP 3.2, GA22-7347).

Example 3-6 Invalid hardware address for a node

setup_server: Running services_config script to configure SSP services. This may take a few minutes...
0513-044 The /usr/sbin/xntpd Subsystem was requested to stop.
rc.ntp: Starting NTP daemon (xntpd)
mknimres: Copying /usr/lpp/ssp/install/config/bosinst_data_prompt.template to /spdata/sys1/install/pssp/bosinst_data_prompt.
mknimres: Copying /usr/lpp/ssp/install/config/bosinst_data_migrate.template to /spdata/sys1/install/pssp/bosinst_data_migrate.
mknimres: Creating the SPOT resource spot_aix433.
mknimres: The SPOT resource named spot_aix433 was successfully created on sp5en0.
mknimclient: 0016-416 The SDR contains an invalid hardware Ethernet address for node 1 (sp5n01). Correct the value using the sphyrdwrad comma
and try again.

3.5 Node installation
The following section describes boot install server (BIS) installation as well as problems encountered while installing nodes.
3.5.1 Optional boot install server installation

When creating a boot install server (BIS), it is important to remember that the BIS network is to be an independent network from the spnet_en0 network as shown in Example 3-36 on page 131. The BIS must also act as a router between these two networks.

The procedure to define a node as a BIS is accomplished by defining the node as the BIS for another node with the `spchvgobj` command. After changing the boot install server for the node, the boot response should be set to either install or customize. After this scenario is set up and `setup_server` is run on the CWS, the node will be defined as a boot install server.

This procedure will also require that `setup_server` be run on the node being defined as the BIS.

When problems occur during the installation over a BIS, verify the following has been completed:

- BIS is a TCP/IP Router.
- IP forwarding is set to on BIS nodes.
- Route has been established from the CWS to nodes that will be installed via the BIS.
- Make sure that rootvg has enough space for the necessary file systems `setup_server` will create on the BIS.
The trouble with tuples

When setup_server ran on the BIS, an error related to the incorrect number of tuples was encountered, as shown in Figure 3-37 on page 132.
Figure 3-37   The trouble with tuples

This error references the IP address and subnet of the ethernet and token ring adapters on the node that is becoming the BIS, as well as the CWS. To correct this problem, check:

1. IP addresses are valid for each interface on the BIS and CWS.
2. Subnets are valid on both the CWS and BIS.
3. lsattr -El (en0, en1, en1, tr0, etc...).
4. odmget -q name=en0 CuAt.
5. Remember to check for every adapter that shows up in netstat that is either an en(x) or a tr(x) distinction.

File systems place on the BIS Node

When the BIS node runs setup_server the wrapper mknimres creates three file systems that are placed in rootvg. Plan to have the necessary disk space available to rootvg to house the AIX lppsource, spot(s),and pssplpp files. If the space is not available, mknimres will display an error. This space must be in rootvg and not placed into a separate file system. Do not make these file systems on your own or mknimres will fail to create the necessary file systems due to the mount point already existing. Figure 3-38 on page 133 shows the logical volumes and file systems created on the BIS.
3.5.2 Network interface not supported when allocating SPOT

This error, as shown in Example 3-39, indicates that the spot has no information for the network adapter on the node. This is not always a true statement and can sometimes be rectified by resetting the SPOT.

```
export_clients: File systems exported to clients from server node 9.
0042-001 nim: processing error encountered on "master":
0042-058 m_alloc_spot: unable to allocate "spot_aix433" to "sp5e1n13" because it does not support the network interface type of that client
```

Figure 3-39 Network interface not supported

Figure 3-40 conducts a forced reset of the SPOT with the spot_name being spot_aix433.

```
# nim -Fo reset spot_aix433
```

Figure 3-40 Nim reset

If the force reset of the SPOT does not clear this error, then you will need to verify that the lpp for the adapter is actually in the SPOT lppsource. If it is not, then you can either add it to the lppsource directory and recreate the SPOT, or update the spot with the additional lpp files needed.

When setup_server runs on the new BIS, it creates NIM classes on the node for the new NIM master and its clients. Output of the 1snim -1 shows that a new network interface, if2, is defined as shown in Figure 3-41. The reason for this is that the BIS needs to be able to route information from the CWS to the boot install server's client nodes.
3.5.3 LED 231 - 239 in nodecond and ping test successful

The following section describes what LED 231 - 239 means when working on your cluster. Figure 3-42 shows BOOTP hangs while installing a node.

If the BOOTP hangs, check the /etc/bootptab file as shown in Figure 3-43.
Figure 3-43   Checking /etc/bootptab file

Check the /etc/bootptab file for potential problems when node installation cycles at LED code 239 and 231. These LEDs usually indicate a network problem. However, if a new network card is being used for the en0 interface, then there is a chance that the bootptab file did not get updated with the new information. At the end of this file, each node is listed along with their boot parameters.

Under each node, there is a hardware address listed. Notice that, in Figure 3-43, the hardware address (ha) is 02608CE8F1.

In comparison, Figure 3-44 shows that the hardware address that is being used is 02608C2d49.

```
#      T180 -- (xstation only) -- enable virtual screen
sp5n01:bf=/tftpboot/sp5n01:ip=192.168.5.1:ht=ethernet:ha=02608CF57A7C:sa=192.168.5.150:sm=255.255.255.0:
sp5n13:bf=/tftpboot/sp5n13:ip=192.168.5.13:ht=ethernet:ha=02608CE8F1:sa=192.168.5.150:sm=255.255.255.0:
sp5n09:bf=/tftpboot/sp5n09:ip=192.168.5.9:ht=ethernet:ha=02608C2D08D7:sa=192.168.5.150:sm=255.255.255.0:
sp5n05:bf=/tftpboot/sp5n05:ip=192.168.5.5:ht=ethernet:ha=02608CE8F1:sa=192.168.5.150:sm=255.255.255.0:
```

```
~
```

Figure 3-44   BOOTP packets being sent

A quick check of the actual hardware adapter shows that slot 0/5 is the correct slot. Therefore, the /etc/bootptab file has the wrong information.
Manually update this file to reflect the correct hardware address and restart the node installation. The node should then be able to receive the BOOTP packets as shown in Figure 3-45.

```
STARTING SYSTEM (BOOT)

Booting . . . Please wait.

Ethernet: Slot 0/5, BNC / modular Jacks
Hardware address ................................. 02608C2D4CA5

.... Packets Sent Packets Received
BOOTP 00002 00001
TFTP 08392 08391
<< 299 >>
```

*Figure 3-45  BOOTP success*

**Tip:** Updating the /etc/bootptab file will not solve this problem permanently. setup_server will recreate this file the next time the node is to be installed by obtaining the incorrect MAC address from the SDR. A more permanent solution is to update the SDR with the correct address and also update the NIM definition.

### 3.5.4 Manual node conditioning

The following example is for node 9 in frame 1:

1. Power the node off by invoking:
   ```
   spmon -p off node9
   ```
2. Set the key to service by invoking:
   ```
   spmon -k service node9
   ```
3. Check to ensure that the key is in service position by issuing (see Figure 3-46 on page 137):
   ```
   spmon -d
   ```
4. Power on the node
   `spmon -p on [targetnode]`

5. Open a writable tty connection to the node by executing:
   `s1term -w 1 9`

6. Wait for the MAINTENANCE MENU as shown in Figure 3-47.

**Note:** The maintenance menu looks different for CHRP (Common Hardware Reference Platform) and RS/6000 MCA nodes.

---

**Figure 3-46  Nodes installed but no host responds**

### Table: MAINTENANCE MENU

<table>
<thead>
<tr>
<th>Slot</th>
<th>Node Type</th>
<th>Power</th>
<th>Responds</th>
<th>Switch</th>
<th>LCD/LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>on</td>
<td>autojn</td>
<td>normal</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>high</td>
<td>off</td>
<td>yes</td>
<td>normal</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>high</td>
<td>off</td>
<td>yes</td>
<td>service</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>high</td>
<td>off</td>
<td>yes</td>
<td>normal</td>
</tr>
</tbody>
</table>

```
[root@sp5en0]:/
```

---

**Figure 3-47  Maintenance menu**
7. Select option 6 SYSTEM BOOT.

8. Select option 1 from the SYSTEM BOOT menu as shown in Figure 3-48 on page 138.

```
SYSTEM BOOT
0> BOOT FROM LIST
1> BOOT FROM NETWORK
2> BOOT FROM SCSI DEVICE
```

*Figure 3-48  Boot from the network*

9. This will bring up the system boot menu as shown in Figure 3-49. Choose option 1 to Select BOOT (Startup) Device.

```
MAIN MENU
1. Select BOOT (Startup) Device
2. Select Language for these Menus
3. Send Test Transmission (PING)
4. Exit Main Menu and Start System (BOOT)
```

*Figure 3-49  Conducting the ping test*

10. Select the BOOT (Startup) Device as in Figure 3-50.
**SELECT BOOT (STARTUP) DEVICE**
Select the device to BOOT (Startup) this machine.

**WARNING:** If you are using a Token-Ring adapter without Autosense data rate capability, the selection of an incorrect data rate can result in total disruption of the Token-Ring network.

"===>" Shows the selected BOOT (startup) device

1. Use Default Boot (Startup) Device
2. Ethernet: Slot 0/3, 15-pin connector
3. Ethernet: Slot 0/3, BNC / modular Jacks
4. Ethernet: Slot 1/1, 15-pin connector

Page 1 of 2

88. Next Page of Select BOOT (Startup) Device Menu
99. Return to Main Menu

*Figure 3-50  Select the boot device*
11. In Figure 3-50 on page 139, we select option 3 to use the Ethernet adapter in Slot 0/3:

- This will prompt you to set or change network addresses as shown in Figure 3-51.
- Enter in the appropriate information for the client and the server’s IP address. It should not be necessary to enter a gateway address.

<table>
<thead>
<tr>
<th>SET OR CHANGE NETWORK ADDRESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select an address to change</td>
</tr>
<tr>
<td>Currently selected BOOT (startup) device is:</td>
</tr>
<tr>
<td>Ethernet: Slot 0/3, BNC / modular Jacks</td>
</tr>
<tr>
<td>Hardware address ................................. 02608C2D63E2</td>
</tr>
<tr>
<td>1. Client address ........................................ 000.000.000.000 (address of this machine)</td>
</tr>
<tr>
<td>2. BOOTP server address ............... 000.000.000.000 (address of the remote machine you boot from)</td>
</tr>
<tr>
<td>3. Gateway address ............................... 000.000.000.000 (Optional, required if gateway used)</td>
</tr>
</tbody>
</table>

97. Return to Select BOOT (Startup) Device Menu (SAVES addresses)
99. Return to Main Menu (SAVES addresses)

*Figure 3-51 Enter client and BOOTP server’s IP*

12. After setting the IP addresses, there should now be an entry for the client and BOOTP server similar to Figure 3-52 on page 141.
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13. Enter 99 to return to the Main Menu

14. To verify that the hardware is connected correctly conduct the ping test.
   Select option 3 as shown in Figure 3-53.

   MAIN MENU

1. Select BOOT (Startup) Device
2. Select Language for these Menus
3. Send Test Transmission (PING)
4. Exit Main Menu and Start System (BOOT)

   Figure 3-53  Send ping test

15. Verify that the IP address and correct if necessary. Then choose option 4 to start the ping test, as shown in Figure 3-54 on page 142.
SEND TEST TRANSMISSION (PING)

A test to see if the machine at the origin address can communicate, thru the network, with the machine at the destination address.

Currently selected BOOT (startup) device is:
Ethernet: Slot 0/3, BNC / modular Jacks
Hardware address ..................................... 02608C2D63E2

Select an address to change or select "4" to begin the test.

1. Origin address                                      192.168.005.009
2. Destination address                                 192.168.005.050
3. Gateway address                                     000.000.000.000
    (Optional, required if gateway used)
4. START PING TEST

99. Return to Main Menu

Figure 3-54   Verify all entries are correct

SENDING TEST TRANSMISSION

Test transmission sent . . .

Please wait . . . This test may take up to 15 seconds.

Figure 3-55   Ping test output

TEST TRANSMISSION (PING) RESULTS

FAILED TEST transmission

97. Return to Send Test Transmission screen.
99. Return to Main Menu

Type the number for your selection, then press "ENTER"
(Use the "Backspace" key to correct errors)

Figure 3-56   Ping test failed
16. If the ping test is unsuccessful, as shown in Figure 3-56 on page 142, then a network problem exist. Check the following:

- Are the network connections good?
- Does BNC network has the proper 50 Ohm termination?
- Is the IP address being used for the BOOTP server correct?
- Is there a functional route between the BOOTP server and the client node?
- Is the network adapter on the client node functioning?
- Is the network connected to the correct adapter on the BOOTP server and the client node? This is a likely problem if the node has multiple network adapters installed.

17. After the problem is resolved you should receive a successful ping test, as seen in Figure 3-57.

18. Exit out of the menus selecting 99 to return to the main menu.
19. Press 4 to continue booting and the following screen will appear.

```
TEST TRANSMISSION (PING) RESULTS
SUCCESSFUL TEST. Transmission sent and received.

97. Return to Send Test Transmission screen.
99. Return to Main Menu

Type the number for your selection, then press “ENTER” (Use the “Backspace” key to correct errors)
```

Figure 3-57 Ping test successful

```
STARTING SYSTEM (BOOT)
To get a NORMAL boot, turn the key on your system unit to “NORMAL” and press “ENTER” to continue booting.

99. Return to Main Menu
```

Figure 3-58 Press Enter to being system boot
20. It is important at this step to remember that a writable s1term is being utilized during manual node conditioning. Press the enter key to continue booting.

21. As soon as the booting process begins, make sure to close the s1term (ctrl-x) otherwise the BOOTP process will hang.

22. Open a non-writable console via the command `s1term 1 9` to make sure that the network installation is proceeding correctly (see Figure 3-59 for the TFTP progress).

<table>
<thead>
<tr>
<th></th>
<th>Packets Sent</th>
<th>Packets Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOTP</td>
<td>00001</td>
<td>00001</td>
</tr>
<tr>
<td>TFTP</td>
<td>08392</td>
<td>08391</td>
</tr>
<tr>
<td>&lt;&lt; 299 &gt;&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 3-59  TFTP successful*

23. Monitor the installation as shown in Figure 3-60 and Figure 3-61.

<table>
<thead>
<tr>
<th>Installing Base Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you used the system key to select SERVICE mode, turn the system key to the NORMAL position any time before the installation ends.</td>
</tr>
<tr>
<td>Please wait...</td>
</tr>
<tr>
<td>Approximate Elapsed time</td>
</tr>
<tr>
<td>% tasks complete  (in minutes)</td>
</tr>
<tr>
<td>68  6  82% of mksysb data restored.</td>
</tr>
</tbody>
</table>

*Figure 3-60  Installing BOS*
Figure 3-61  overmounting /

Monitor the installation as shown in Figure 3-62. The NIM customization shows LED U-84.

<table>
<thead>
<tr>
<th>Approximate % tasks complete</th>
<th>Elapsed time (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>10</td>
</tr>
</tbody>
</table>

Over mounting /.

Figure 3-62  NIM customization
After the Network Install Manager customization has ended, the system will reboot as shown in Figure 3-63.

3.5.5 Network Install Manager (NIM)

The following section provides an overview of the Network Installation Manager (NIM).

Overview of NIM
Within the SP environment, the utilization of NIM is largely hidden in the setup_server. This isolates the configuration and customization on NIM resources to the information which is stored within the SDR. While conducting problem determination of a cluster installation, it is helpful to have a good understanding on how NIM interacts with the setup_server process.

NIM objects used in a SP environment are the same as in a typical RS/6000 environment and as such utilize the same version of NIM. However, there are some constraints associated with the way the SP environment utilizes NIM.
The nodes within the cluster are defined as stand-alone machines as highlighted in the output of the `lsnim` command. These standalone machines must utilize the SP administrative LAN (spnet_en0) network for their installation. Individuals familiar with NIM on the classical RS/6000 platform might state that additional networks such as a public LAN or token-ring could be utilized as a NIM installation network, however, this is not supported. Additionally, the group resource is not used in the SP environment.

In the SP environment, NIM installs via a pull from the node in which the bootp response is requested from the node during a network boot (nodecond). The push method is not supported in the SP infrastructure.

```
# lsnim
master               machines       master
boot                 resources       boot
nim_script           resources       nim_script
spnet_en0            networks       ent
psspscript           resources       script
prompt               resources       bosinst_data
noprompt             resources       bosinst_data
migrate              resources       bosinst_data
lppsource_aix433     resources       lpp_source
mksysb_1             resources       mksysb
spot_aix433          resources       spot
sp5n05               machines       standalone
sp5n09               machines       standalone
sp5n13               machines       standalone
sp5n01               machines       standalone
```

*Figure 3-64  Output of the lsnim command*

In the following sections, the shared product object tree (SPOT) is mentioned as part of the common problems associated with NIM.

SPOT is a directory that contains AIX code and is equivalent in content to the `/usr` file system. The way in which setup_server creates the SPOT is via the `lppsource` that is defined as the NIM resource `lpp_source`.

**Common problems associated with NIM**

The following scenarios describe common problems associated with NIM.

**HANG with LED 605**

This LED code indicates that the node being installed is unable to identify the boot device.
At this step the node has received the boot images and booted into the BIOS mode. The problem has occurred in the configuration of the network object SP administrative LAN (spnet_en0) in NIM. To correct this problem, ensure that the device driver to support the network is in the SPOT resource. As the SP system is using only a limited number of adapters for the spnet_en0 network, this is an unlikely problem. Validate that the system is using a SP supported network adapter.

**Hang with the LED 608**

This LED code indicates that the NIM client was not able to get the `<node_name>.install_info` file from the SPOT server. The node will continue to retrieve this information.

This file is kept in the `/tftpboot` file system and needs to have a permission setting of 644 with the owner being root:system. If the file does not exist, then make sure the node is set to install and rerun setup_server to regenerate these files.

**Hang with the LED 611**

This LED indicates that the node was unable to mount the resources necessary via NFS from the CWS or BIS. Validate the following:

- Check that NFS is running on the CWS/BIS with the `lssrc -s nfsd` command.
- Verify that the resources necessary have been exported correctly.
- If you have included the latest fixes in the resource `lpp_source`, make sure that you:
  - Create a new `lpp_source` without the additional fixes.
  - Allocate the `lpp_source` to the node in question.
  - Create a new SPOT for the `lpp_source`.
  - Reinstall the node.
- Incorrect routing can cause this hang as well. Verify that the default route can reach the CWS.
- Run NIM in debug mode; see, “Enable NIM debug mode” on page 151.

**Hang with LED 613**

Route is incorrectly defined for the SP administrative LAN (spnet_en0) network in the NIM database.
To verify the route that NIM should be using check the SDR entries as shown in Figure 3-65. Not that the entry for node 9 has a different default route than the other nodes. Nodes 1, 5 and 13 install fine and have the spnet_en0 interface as their default route whereas node 9 has assigned an internal network interface as the default route. However, the network that supports this default route does not include the CWS. Therefore, the entry in the SDR will need to be modified to allow for a routable network to the CWS.

```
# SDRGetObjects Node node_number default_route
node_number default_route
  5 192.168.5.150
  9 192.168.25.1
  13 192.168.5.150
  1 192.168.5.150
```

Figure 3-65  Check the default route in the SDR

**Hang with LED u90**

If node installation appears to hang during NIM customization on LED code u90 as in Figure 3-66, check the authentication methods by using the `lsauthent` command, as shown in Figure 3-67 on page 150.

```
5. Checking nodes
------------------------ Frame 1
------------------------
 LCD/LED Switch Key Env Front Panel
 Slot Node Type Power Responds Responds Switch Error LCD/LED Flashes
 1     1 high off no notcfg service no Stand-By  no LCD2 is blank
 5     5 high on no notcfg normal no    no u90   no LCD2 is blank
 9     9 high on no notcfg normal no    no u90   no LCD2 is blank
13    13 high on no notcfg normal no    no u90   no LCD2 is blank

# shutdown -Fr
```

Figure 3-66  Node install hangs on u90
Note that, in Figure 3-68, the output only shows Kerberos V4 as the authentication method. This is a problem for the installation of the nodes, as the nodes do not have Kerberos authentication credentials until after node customization. Therefore, the authentication will need to be changed to add standard AIX to the authentication method and the node re-installed.

```
# lsauthent
Kerberos 4

Figure 3-67  Output of lsauthent command
```

```
chauthent -k4 -std

# lsauthent
Kerberos 4
Standard Aix
#

Figure 3-68  Change authentication to Kerberos V4 and standard AIX
```

**Node installed AIX but not PSSP code and LED is blank**

If a node installation has apparently completed but the PSSP code has not installed on the node and host response in “no”, check the /spdata/sys1/install/pssplpp/<PSSP_version> directory. Ensure that file permissions of 2755 with owner root:system

If the file permissions are not set correctly then the installation of the PSSP code will fail. This can be verified by NFS mounting this PSSP-3.2 directory on the node manually and attempting a installation over the NFS mount point. Output of such an installation is shown in Figure 3-69 on page 151.

Change the permission on the files and either re-install or customize the node in question.
If the permissions are correct, check that the instructions listed in Chapter 2, step 15.2 (see Figure 3-70) from *Update the Image Table of Contents in the Installation and Migration Guide, GA22-7347* were followed correctly. The instructions state to:

```
cd /spdata/sys1/install/pssplpp/PSSP-3.2
mv ssp.3.2.0.0.I pssp.installp
mv rsct.basic.1.2.0.0.I rsct.basic
mv rsct.clients1.2.0.0.I rsct.clients
mv rsct.core.1.2.0.0.I rsct.core
```

If you copy these file rather than re-naming them, setup_server will terminate with the rc=0 and does not check for this condition. Therefore, the effects are not seen until the very end of the installation procedure. This specific problem occurs when the LEDs are blank giving little indication as to what went wrong.

To correct this problem remove the unnecessary nodes and re-install them.

**Enable NIM debug mode**

To enable NIM debugging, perform the following steps on the boot/install server:

1. Confirm that the NIM resource object is not allocated.
If the alloc_count is not 0, there are machine objects allocated to this resource object. To list what machine object is allocated to the SPOT, issue the command:

```
# lsnim -a spot
sp5n09:
    spot = spot_aix433
```

This output indicates that the machine object for node sp5n09 is allocated to the SPOT. Check the boot response for this node and, if it is not set to disk, then change the boot response to disk to unallocate the machine group from the SPOT resource.

```
# splstdata -b
List Node Boot/Install Information

<table>
<thead>
<tr>
<th>node#</th>
<th>hostname</th>
<th>hdw_enet_adr</th>
<th>srvr response</th>
<th>install_disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>sp5n01</td>
<td>02608CF57A7C</td>
<td>0 disk</td>
<td>hdisk0</td>
</tr>
<tr>
<td>5</td>
<td>sp5n05</td>
<td>02608C2D4CA5</td>
<td>0 disk</td>
<td>hdisk0</td>
</tr>
<tr>
<td>9</td>
<td>sp5n09</td>
<td>02608C2D63E2</td>
<td>0 install</td>
<td>hdisk0,hdisk1</td>
</tr>
<tr>
<td>13</td>
<td>sp5e1n13</td>
<td>02608CF518A4</td>
<td>9 install</td>
<td>hdisk0</td>
</tr>
</tbody>
</table>

# spbootins -r disk -l 9
# lsnim -a alloc_count spot_aix433
spot_aix433:
    alloc_count = 0
```

Figure 3-71  Perform these tasks prior to setting NIM to debug mode

Once the boot response has been set back to disk and setup_server has run successfully, the machine object class should be no longer allocated to the NIM SPOT resource. Note that, in Figure 3-71, node 13 also has a boot response of install. However, this node's boot install server is node9, which is not allocated to the same SPOT resource as node9. Therefore, node13's boot response does not need to be changed to install at this time. If the nodes boot response has been changed to disk, setup_server ran successfully and the machine object is still allocated to the SPOT, then run the following commands to force a reset of the machine object and then deallocate the machine from the SPOT as shown in Figure 3-72 on page 153.

```
nim -Fo reset <machine_object>
nim -o deallocate -a spot=<spot_object> <machine_object>
```
Chapter 3. Installation

After no NIM objects are allocated to the SPOT, NIM debug mode may be
enabled.

nim -o check -a debug=yes <spot_object>

In our test example, we ran the command to place NIM into the debug mode and
then verified that debug was set in NIM, as shown in Figure 3-73.

Figure 3-72  Deallocate resources from SPOT if necessary

Figure 3-73  Enabling NIM debug mode
Now, you need to ensure that any nodes that need to have a boot response of install are set back to the install mode and then run setup_server to reallocate the machine objects to the NIM SPOT.

Make note of the output from the `lsnim -l` command and record the information from the enter_dbg attribute. The output from the enter_dbg attribute will be needed for the trap instruction interrupt of the manual conditioning procedure. Using Figure 3-73 as an example, you drop the 0x part proceeding the eight digit hex entry of 0026a794, which is the number that need to be recorded as part of the trap interrupt entry.

To follow the steps for manual node conditioning, see Section 3.5.4, “Manual node conditioning” on page 136.

Once the trap instruction interrupt is displayed on the s1term, enter the required information as shown in Figure 3-74 on page 155.
Figure 3-74  NIM debug trap instructions

When the trap instruction debug prompt occurs, enter information in the following format:

```
st <Enter_dbg_Vaule> 2
>0> st 0026a794 2
>0> go
```
The **st** is to store the information, `<Enter_dbg_vaule>` is the eight-digit hex number gathered from the `lsnim -1 <spot>` command and the **2** indicates to print the output of the debug to the tty. After entering the string **st 0026a794 2** and pressing Enter, refer to Figure 3-74 on page 155; you will see a second prompt with the word “go” after it. When this appears, press Enter again. The debug process will then begin.

**Tips:**

1. Once the debug process begins you can temporarily halt it with Ctrl-S and resume with Ctrl-Q.

2. If the process seems to hang on LED c58, press Ctrl-Q to continue.

After debugging has completed the boot image will need to be rebuilt in non-debug mode; use the following command to achieve this:

```bash
nim -Fo check SPOTname
```

From our example this would be:

```bash
nim -Fo check spot_aix433
```

**Note:** NIM commands and their responses are recorded. Look for errors associated with command invocation, error associated with file set installation, and errors associated with NIM related activities. For more information on NIM debugging, refer to Chapter 7, “Diagnosing NIM problems” in *Parallel System Support Programs for AIX: Diagnosis Guide Version 3 Release 2, GA22-7350.*

### 3.6 pssp_script

After the installation of a node, `/usr/lpp/ssp/install/pssp_script` is run. This script is called by NIM and is run before the node reboots, at which time the RAM file system is in place. It installs required LPPs and does post-PSSP installation setup. Additional adapter configuration is performed after reboot by the `psspfb_script`.

The flow of the `pssp_script` is shown in Figure 3-75 on page 157.
If `pssp_script` fails or hangs, then check the log files in `/var/adm/SPlogs/sysman`. The `pssp_script` will create a series of files in this directory if the files created have the name NODE rather than the `<node_name>` as a prefix.

**Figure 3-75  setup_server flowchart**
Security

This chapter discusses the security options available in the universal cluster and provides troubleshooting information for the cluster security services. It addresses the following topics:

- Available security options
- Changes in the installation process
- Debugging information
- Case studies
4.1 Available security options

Starting with PSSP 3.2, more flexibility has been added in installing and configuring the authentication services, aiming to better accommodate the security requirements needed in different environments. The security options can now be differentiated for remote commands and for trusted services. A feature has been added to restrict root remote command access within the SP and changes have been operated in the way the server keys are transferred from the CWS to nodes. Because of the new choices available, deciding for the initial or subsequent security options for a SP system requires a good planning and understanding of the relationship between the SP components, the local requirements and the selected security methods.

The security on the SP system is a two-step process. First, the system needs to authenticate the user or service, that is, to check its security credentials using specific mechanisms. In the second stage, assuming that the authentication has been successfully completed, the user or service is granted certain rights, based on an authorization mechanism.

The following four security attributes of the Syspar class in the SDR are available:

- **auth_install**: Set of authentication methods to be installed on nodes in the partition.
- **auth_root_rcmd**: Authorization methods used for root access to AIX remote commands.
- **ts_auth_methods**: Set of active SP trusted services authentication methods for the partition.
- **auth_methods**: Set of active AIX remote command authentication methods for the partition.

The previous attributes can be examined using the `SDRGetObjects Syspar` or `splstdata -p` commands, as shown in Example 4-1. The settings are valid for the selected partition (SP_NAME variable needs to be set, or the default partition is assumed).

```bash
Example 4-1  splstdata output
```

```bash
# splstdata -p | grep auth
auth_install    k4
auth_root_rcmd  k4
ts_auth_methods compat
auth_methods    k4:std
```

For authentication, PSSP allows the use of three mechanisms:

- Kerberos V5, provided by DCE.
4.1.1 Choosing the authentication option

Based on the security requirements in your environment, you have the choice of using one of the following mechanisms: DCE, Kerberos 5, Kerberos 4, and standard AIX. Here is how those mechanisms deal with authentication and authorization:

**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.

**Kerberos V4**
The authentication method is implemented through the Kerberos daemon on the master security server (typically, the 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.

**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.

If your environment is isolated and runs scientific applications, using standard AIX security might be a good choice, but most commercial environments need a more sophisticated security mechanism, for example, the one based on Kerberos. DCE is a framework that offers more than security services and is more difficult to manage than Kerberos 4, which is delivered with PSSP. We recommend, unless you use more DCE facilities than security, using Kerberos 4 for authentication.

4.1.2 Using Restricted Root Access (RRA)

One of the advantages of the SP cluster versus standalone systems is the ability to control and manage all nodes from a central location, the CWS. In order to achieve that, several SP system components use remote commands (rcp and rsh) to run commands or copy files within the SP complex. Those remote commands run as root, which implies that gaining root access on any node in the SP will automatically grant root access on any other node, including the CWS. In certain server consolidation implementations, it is not desirable to have a single root user across the entire SP system. Beginning with PSSP 3.2, a feature called restricted root access (RRA) is available to limit the use of rsh and rcp within the SP. With RRA enabled, rcp and rsh is only allowed from the CWS to nodes. Nodes are no longer automatically authorized to rcp and rsh to other nodes or CWS. Instead, when the PSSP software on the nodes needs to execute rcp or rsh commands, the task is executed by sysctl, using the partition-wide selected authentication methods and its specific authorization mechanism.

When RRA is activated, remote commands authorizations are re-configured such that:

- When run as a root process on the control workstation, 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 control workstation 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 control workstation or to any other node within the SP system. PSSP will no longer create authorization file entries on the control workstation or nodes that grant a root process on a node remote command access.
RRA can be activated with any of the three authentication mechanisms: DCE, Kerberos V4 and AIX.

4.1.3 Using a secure remote command process

In choosing a remote command process, consider that the PSSP code should be able to issue secure rcp and rsh without being prompted for a password or passphrase.

4.2 Security services implementation

The security settings discussed in the preceding paragraphs can be selected and implemented at the time of PSSP installation, or can be modified on an existing system.

The initial versions of PSSP were using their own “kerberized” commands of rcp and rsh. Starting with AIX V4.3.1, the rcp and rsh commands provided by the operating system are able to use Kerberos V4 or Kerberos V5 (if DCE is enabled) for authentication. The AIX commands are located in the /usr/bin directory. For compatibility reasons, the remote commands used in the versions of PSSP older than 3.1 are now symbolic links to the AIX commands:

- /usr/lpp/ssp/rcmd/bin/rcp -> /usr/bin/rcp
- /usr/lpp/ssp/rcmd/bin/remsh -> /usr/bin/rsh
- /usr/lpp/ssp/rcmd/bin/rsh -> /usr/bin/rsh

4.2.1 Security software installation

From the available authentication methods, only the DCE filesets can be optionally installed. Kerberos V4 is part of PSSP code, and Standard AIX security is part of AIX. If Kerberos V4 is selected, the Kerberos V4 configuration files will be installed.

To use DCE and/or Kerberos V5, you have to do the following before you begin to install and configure PSSP:

1. Obtain the server software and licenses.
2. Have AIX installed and operating on the control workstation.
3. Have the DCE core server software installed, configured, and operational.
4. Have the control workstation operational in the DCE cell as a client or a server.
5. Place the DCE client software in the lppsource file on the control workstation.
At installation time, you have the choice of selecting the authentication method(s) to be installed on the nodes. For more information refer to Chapter 2, Step 39 “Select Security Capabilities Required on Nodes” of the Parallel System Support Programs for AIX: Installation and Migration Guide, GA22-7347.

The `auth_install` attribute

At installation time, you have the choice of selecting the authentication methods to be installed on the nodes in the partition in the Chapter 2, Step 39 “Select Security Capabilities Required on Nodes” of the Parallel System Support Programs for AIX: Installation and Migration Guide, GA22-7347.

The command used is `spsetauth`. For example, to select Kerberos V4 to be configured in the sp3en0 (default) partition see Example 4-2.

```
Example 4-2  Setting the auth_install attribute

sp3en0:> spsetauth -p sp3en0 -i k4
sp3en0:> SDRGetObject Syspar auth_install
auth_install
k4
```

The `spsetauth` command, when used with the `-i` flag, sets the `auth_install` attribute in the Syspar SDR class. Based on this attribute, the `spauthconfig` command installs and/or configure the nodes during the installation or customization process.

4.2.2 AIX local security settings for remote command authentication

When a remote command is called, it issues the `get_auth_method()` system call in the `libauthm.a` library, which returns the list of authentication methods enabled in AIX on the system. The following options are available and can be checked with the `lsauthent` command:

- Kerberos V5
- Kerberos V4
- Standard AIX

The authentication methods are tried in the order returned by the `lsauthent` command. If the first authentication method fails, the second authentication method will be used, and so on until all available authentication methods are exhausted. The methods are stored in the ODM on the local node.
4.2.3 PSSP partition level security settings for remote command authentication

For a standalone AIX system, you would set the order of precedence for authenticated commands with the command `chauthent`. However, PSSP maintains its own security settings in the SDR, at system partition level, in the `auth_methods` attribute of the Syspar class.

The `auth_methods` attribute

The available methods for remote commands, reflected in the `auth_methods` attribute of the Syspar class are:

- **k5**
  Specifies that the Kerberos Version 5 authentication method is to be made active for this partition. To activate k5, DCE needs to be installed and configured for the partition.

- **k4**
  Specifies that the Kerberos Version 4 authentication method is to be made active for this partition. To activate k4, Kerberos 4 needs to be installed and configured for the partition.

- **std**
  Specifies that the Standard AIX authentication method is to be made active for this partition.

To query the partition-level enabled authentication methods use:

- `splstdata -p`
- `SDRGetObjects Syspar auth_methods`

To change the partition-level enabled authentication methods, use the `chauthpar` command.

Because the propagation of settings to running nodes is performed using the AIX `rsh` command to execute `chauthent`, the CWS and the nodes must have at least one common remote command authentication method active in order for propagation to succeed. When this is not the case, propagation can only be completed by the local root user running `chauthent` or `spauthconfig` on each node (or by a re-boot). The same applies to nodes that are not running, or are otherwise inaccessible, when this command is executed.

In order to be able to activate an authentication method, the software that enables that method needs first to be installed and configured. This is done with the `spsetauth -i` command. See Section 4.2.1, “Security software installation” on page 163 for more info.

Notes:
1. If the authentication methods enabled for use by SP Trusted Services (see “Authentication methods for SP trusted services” on page 168) includes DCE, the authentication methods enabled for use by the AIX remote commands must include Kerberos V5.

2. If the authentication methods enabled for use by SP Trusted Services includes compatibility, the authentication methods enabled for use by the AIX remote commands must include Kerberos V4.

3. You must activate the Kerberos Version 4 authentication method if any node in the partition is running a level of PSSP earlier than Version 3.2.

**Attention:** The chauthpar should be the sole tool to control the active authentication methods for remote commands on the SP.

**Initial system installation setup**

At installation time, the partition-level setting for remote command authentication is done in Chapter 2, Step 46, “Enable Authentication Methods for AIX Remote Commands” in the *PSSP: Installation and Migration Guide*, GA22-7347.

Example 4-3, shows how to enable Kerberos V4 and Standard AIX at the partition level.

*Example 4-3 Enabling the authentication methods for remote commands*

```bash
# chauthpar -c -p sp3en0 -v k4 std
The remote command authentication methods for this host are currently k4:std
The authentication methods by partition are currently

  sp3en0  k4
The partition to be modified is sp3en0
The auth_methods attribute of the partition has been set to k4:std
```

The `-c` flag specifies that the command is to operate only on the control workstation, changing settings in the System Data Repository (SDR) and in AIX as required, without attempting to make any changes on the nodes in the partition. This is what you want at installation time, when the nodes are not installed yet.

The `-p` flag allows you to specify the system partition. When not used, the SP_NAME variable will define the current partition. When SP_NAME is not set, the default partition is assumed.

The `-v` flag is useful for debugging purposes, as it returns verbose output from the command.
The shown command sets the SDR auth\_methods attribute in the Syspar class. At installation time, the setting is propagated to the nodes by the `spauthconfig` command.

### 4.2.4 Authorization methods for remote root access

Once one or more authentication methods are configured, the authorization for the root user to issue remote commands is controlled on each individual host by the authorization files. The PSSP code maintains the authorization files at partition level, using the `updauthfiles` command. The authorization files are:

- `.rhosts` for standard AIX authentication
- `.klogin` for Kerberos 4 authentication
- `.k5login` for DCE authentication

Selecting the desired settings is done at installation time in Chapter 2, Step 43, “Select Authentication Methods for AIX Remote Commands” in the [PSSP: Installation and Migration Guide, GA22-7347](#).

For example, to select Kerberos V4 type authorization files for the sp3en0 partition and verify the result, use the command shown in Example 4-4.

**Example 4-4  Selecting the authorization methods for remote root commands**

```
sp3en0:> spsetauth -p sp3en0 -d k4
sp3en0:> SDRGetObjects Syspar auth\_root\_rcmd
auth\_root\_rcmd
k4
```

The `auth\_root\_rcmd` attribute

The `spsetauth` command, when used with the `-d` flag, updates or sets the `auth\_root\_rcmd` attribute in the SDR Syspar class. Based on this attribute, the `updauthfiles` command updates or creates (if necessary) the `.k5login`, `.klogin`, and `.rhosts` files on the control workstation and on all nodes in the system for which DCE, Kerberos 4, or Standard AIX are defined as Authentication Methods. The `updauthfiles` command runs at node boot time and is called by the `/etc/rc.sp` script.

The `updauthfiles` command can also be used to rebuild the authorization files on a running system.
Manually editing the authorization files

Some applications, like HACMP, require the addition of customized entries in the authorization files. Because HACMP on SP is supported with enhanced (Kerberos V4) and with standard security, we will discuss the .rhosts and .klogin files.

- **.rhosts**: Do not place any entry between the following two lines:

  ```
  # Updated by updauthfiles script
  # End of generated entries by updauthfiles script
  ```

  If you do, each time the `updauthfiles` command runs (for example at reboot), the added entries are overwritten.

- **.klogin**: The behavior is different based on the RRA setting. See also Section 4.2.7, "Implementing RRA" on page 172 for RRA setup information.

  - **RRA inactive**: Any manually added entry on nodes is overwritten by the `updauthfiles` command, which remote copies the authorization files from the CWS. The customized entries on the CWS are preserved. Because authorization files are identical across the SP, if you need any special entries, like for the godm principal in HACMP, you need to add them on the CWS.

  - **RRA active**: In this case, only the rcmd principal from the CWS is automatically added. However, for HACMP you might want to add more entries in the .klogin files. The `updauthfiles` command does not automatically remove the customized entries in the .klogin file when RRA is active.

**Attention**: An entry in .klogin without a corresponding entry in the Kerberos database does not provide any authorization, because the authentication process for the corresponding principal fails.

### 4.2.5 Authentication methods for SP trusted services

The SP System Monitor command-line interface, the SP Perspectives graphical user interfaces, the PSSP remote execution facilities `dsh` and `sysctl`, and other SP trusted services all use authentication services. The possible combinations of authentication methods to be enabled for mutual authentication by SP trusted services within each SP system partition are:

**Tip**: If using Kerberos for authentication, do not select `std` as the last method for auth_root_rcmd. It creates the .rhosts files on the nodes, in which case the root user can issue remote commands even when not authenticated by Kerberos.
The compatibility method lets the SP trusted services use whatever means of authentication they used before PSSP 3.2. Some used Kerberos V4 with access control lists, some had their own independent means, some simply required root access, and some did not require authentication.

The authentication methods for SP trusted services can be set at host level or at partition level. At node level, the `chauthts` command is used. As with the authentication methods for remote commands, the recommended command to be used if the one that acts at the partition level (`chauthpts`). The `chauthpts` command first checks whether the specified option is consistent with the other security settings at SP level, then uses the `rsh` command to execute the `chauthts` on nodes.

If the partition-level `chauthpts` command fails for some nodes when it is run from the CWS, then the `chauthts` command must be run locally on each failed node.

### The ts_auth_methods attribute

At installation time, the authentication method for the SP trusted services is selected in Chapter 2, Step 47 of the PSSP: Installation and Migration Guide, GA22-7347.

The command in use is `chauthpts`. The Example 4-5 shows the command output in verbose mode, for the sp3en0 (default) partition.

**Example 4-5   Setting the authentication methods for SP Trusted Services on the CWS**

```bash
sp3en0:> chauthpts -c -p sp3en0 -v compat
The trusted services authentication methods for this host are currently
The authentication methods by partition are currently

    sp3en0  compat

The partition to be modified is sp3en0
The trusted services authentication methods for this host are now set to compat
```

The `-c` flag operates the change on the CWS only and updates the `ts_auth_methods` attribute of the Syspar class in the SDR. This flag is used at system installation time.
The `-f` flag attempts to propagate the change to the nodes using `rsh`. This flag is used when changes need to be operated on a running system. The output in this case is shown in Example 4-6.

**Example 4-6  setting the authentication methods for SP Trusted Services in the partition**

```
sp3en0:> chauthpts -f -p sp3en0 -v compat
The trusted services authentication methods for this host are currently compat
The authentication methods by partition are currently

sp3en0  compat
The partition to be modified is sp3en0
The chauthpts command was executed successfully on node sp3n05
The chauthpts command was executed successfully on node sp3n06

...............................................................
The chauthpts command was executed successfully on node sp3n12
The chauthpts command was executed successfully on node sp3n13
The chauthpts command was executed successfully on node sp3n14
The chauthpts command was executed successfully on node sp3n15
0513-095 The request for subsystem refresh was completed successfully.
```

If an un-installed method is selected, the command reports an error, as shown in the Example 4-7.

**Example 4-7  Incorrect use of chauthpar command**

```
sp3en0:> chauthpts -c -p sp3en0 -v dce
chauthpts: 0016-349 You cannot enable dce, because the partition has not been configured for DCE use.
```

To query the authentication methods used by the SP Trusted Services, use one of the following commands as in Example 4-8.

**Example 4-8  Quering the authentication methods for SP Trusted Services**

```
sp3n06:> lsauthts
Compatibility
sp3n06:> lsauthts
Compatibility
sp3n06:> splistdata -p | grep auth
auth_install    k4
auth_root.rcmd  k4
ts_auth_methods compat
auth_methods    k4:std
sp3n06:> SDRGetObjects Syspar ts_auth_methods
ts_auth_methods
compat
```
4.2.6 The kfserver and the server key files

In the PSSP versions earlier than 3.2, the server key files (/etc/krb-srvtab) files were transferred from the CWS to the nodes via the SP Ethernet. In order to make this transfer more secure, starting with PSSP 3.2, the serial line is used for that purpose. On the CWS, the server keys are still created by the setup_server command, but placed in a different directory, /spdata/sys1/k4srvtabs.

The install_cw command adds the following line to the /etc/inetd.conf file, so that kfserver runs as a sub-server of inetd:

    kfcli stream tcp nowait root /usr/lpp/ssp/install/bin/kfserver kfserver

The kfserver script is run by inetd upon request from a node for its Kerberos V4 srvtab file. When the client connects to the server, kfserver queries the socket for the node's IP address requesting its srvtab file. kfserver locates the srvtab file and sends it over the s1term in write mode.

On the node side, the server-key file transfer is initiated by the get_keyfiles script. This program stops all getty processes and removes the "cons" entry from inittab so that it cannot restart until this command is completed. get_keyfiles sends a request to the control workstation and listens on /dev/tty0 for keyfiles. Keyfiles are sent in a uuencoded format over s1term by the control workstation. This program will uudecode the keyfile to its original format and place it in the /spdata/sys1/k4srvtabs directory of the node. Once the keyfile transfer is completed, the "cons" entry is added back to inittab, and inittab is refreshed.

The get_keyfiles script is invoked during node installation or customization, by the psspfb_script. The get_keyfiles command can also be used to transfer the server-key files from the CWS, in case they become corrupted on the nodes.

The log files are located in the /var/adm/SPlogs/kfserver directory on the CWS for the kfserver script, respectively /var/adm/SPlogs/get_keyfiles/get_keyfiles.log on the nodes, for the get_keyfiles command.

An example of how the logs look like during the transfer of the key files follows in Example 4-9 and Example 4-10.
Example 4-9  Log file from the get_keyfiles command on node

sp3n06:> cat get_keyfiles.log

************************************************
* Beginning of logging for -- get_keyfiles
*** Thu Jul 12 14:33:22 EDT 2001
Parsing operands
Removing cons (getty) entry from inittab
Finding getty process
Getting my node number
Sending request for keyfile
Setting up the socket
Opening temporary keyfile for writing
get_keyfiles: 2545-113 KF_PORT was not set - trying port 32801
Connecting to port 32801
Opening /dev/tty0
Waiting for keyfile
Uudecoding the keyfile
Adding cons (getty) entry to inittab
Closing files and socket connection

************************************************
*** End of logging for -- get_keyfiles
*** Thu Jul 12 14:33:30 EDT 2001

Example 4-10  Kfserver log on CWS

sp3en0:> cat kfserver.log.20816

************************************************
* Beginning of logging for -- kfserver
*** Thu Jul 12 14:33:27 EDT 2001

Received request from node 6
Uuencoding keyfile /spdata/sys1/k4srvtabs/sp3n06-new-srvtab
Sending keyfile to /dev/tty0 on sp3n06

************************************************
*** End of logging for -- kfserver

4.2.7 Implementing RRA

RRA can be turned on by changing the restrict_root_rcmd attribute to true in the SP_Restricted SDR class. This can be achieved by using the Site environment SMIT panel or by using the spsitenv command. This command performs the following:

- Checks prerequisites for RRA.
Updates the restrict_root_rcmd attribute.

Runs setup_CWS, which calls upauthfiles on the CWS.

Acquires security credentials and uses dsh to run the upauthfiles command on all active nodes.

In RRA mode the remote commands principals used in scripts (rcmd.<interface>) are not automatically authorized to remotely access from nodes to CWS or from node to node. Remote commands, such as the rcmd principal, can only be executed from CWS to nodes. All the PSSP commands that use rsh or rcp check the restrict_root_rcmd attribute each time remote access is required. They will automatically use the sysctl method if RRA is enabled.

When RRA is enabled, the upauthfiles command removes all known SP-generated entries in the remote command authorization files and adds the following entries for each method specified by the auth_root_rcmd attribute:

- Standard AIX: /.rhosts is modified to contain only:
  - cwnname
  - Additional CWS interface names

- Kerberos V4: /.klogin is modified to contain only:
  - rcmd.cwnname@realm

- Kerberos V5: /.k5login is modified to contain only:
  - ssp/cwnname/spbgroot@ realm
  - hosts/cwnname/self@ realm

**RRA limitations**

RRA has the following limitations:

- All nodes and CWS need at least PSSP 3.2 in order to activate RRA.

- No VSD/GPFS node are allowed. 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 control workstation 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. When restricted root access is enabled, the common PSSP root access required by VSD and GPFS is disabled.

- Boot/install servers are not automatically supported by PSSP when RRA is enabled. If multiple boot install servers are required, manual authorizations and configuration changes must be made by the customer.
HACWS: Some manual operations may be required to maintain consistent authorization and configuration files between the CWS and backup CWS when using HACWS and RRA is activated.

Certain Ecommands and system management commands only run from the CWS when RRA is enabled. See IBM RS/6000 SP: Planning, Volume 2, Control Workstation and Software Environment, GA22-7281 for a complete list of such commands.

HACMP: HACMP nodes make use of rsh and rcp to synchronize the HACMP ODM and to run c-spoc commands. In Enhanced Security mode, Kerberos 4 is used as authentication and authorization method. This mode requires modifications to the SP Kerberos 4 settings, which can be achieved by using the HACMP provided cl_setup_kerberos script. When RRA is enabled, the actions performed by cl_setup_kerberos script are no longer possible due to its rsh and rcp requirements from a node to the control workstation. Without using cl_setup_kerberos, the synchronization capability can be enabled by editing the /.klogin files on the HACMP nodes, explicitly allowing both systems to have root access to each other, and by manually adding the HACMP principals to the Kerberos V4 database.

**sysctl**

sysctl is an authenticated client-server application that runs commands with root privileges on nodes. It is implemented by the **sysctl** server daemon running with root privileges on all nodes and CWS. When a **sysctl** client connects to a **sysctl** server, two processes need to successfully complete before executing the request: authentication and authorization.

**Sysctl authentication** Sysctl servers come 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 editing the server's configuration file, /etc/sysctl.conf, and then restarting the server. However, that this is not a recommended way to run a Sysctl server because it takes away the first tier of Sysctl protection. The authentication is done using the methods specified in the ts_auth_methods attribute in the SDR Syspar class and should be a combination of Kerberos V5 and Kerberos V4, with Kerberos V4 as the last method in the list.

**Sysctl authorization** After a the server authenticates the client, it determines whether the client is authorized to execute the requested **sysctl** command. 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. Sysctl ACLs come in two formats: Kerberos V4 ACLs, used in compat mode, and DCE ACL objects, used in dce mode. Note that a sysctl server can run under a combined dce:compat mode, case when the ACLs are checked in the same order. If the DCE ACL authorization succeeds, the Kerberos V4 ACL is no longer checked.

**Sysctl use with no ts_auth_methods attribute selected**

When no authentication method is set up, the trusted services use what is called the NONE/std method. This, in reality, is not an authentication method. It merely describes the fact that no authentication method has been set on the node for SP Trusted Services. When NONE/std method is used, sysctl behaves in a special manner. Although NONE/std implies that no authentication method is set on the node, sysctl authenticates and authorizes clients using their AIX identity.

Sysctl ACLs support two types of entries that implement the authorization of clients: _principal and _other_unauth. The _principal entry has an identity of form <user_name>@<host_name>, where <host_name> is the fully qualified host name of the node. The _other_unauth entry does not have any identity. The authorization policy can be described as follow: when the identity of the client can be matched with one _principal entry’s identity, then access is permitted. If no match can be found, sysctl looks for the _other_unauth entry. If not found, the client is denied access. If found, the client is allowed permission. The _other_unauth entry is being used only for NONE/std. When an authentication method (for this discussion, compat) is set on the node and the client fails authentication, access is denied outright, regardless of the _other_unauth entry being present in the sysctl ACL file or not.

The following ACLs need to be modified in such an environment:

- On the CWS only:
  - /etc/sysctl.haem.acl
  - /etc/sysctl.install.acl
  - /etc/sysctl.rootcmds.acl
- On all the nodes:
  - /etc/logmgt.acl

For more information about Sysctl, see the **sysctl** and **sysctld** man pages, and the Sysctl online help.
Sysctl invocation in RRA mode

As an example of Sysctl use in RRA mode, we present the spauthconfig command. For the sake of simplicity, we deal with compat mode for the ts_auth_methods class. The spauthconfig script, among other things, remote copies the /etc/krb.conf and /etc/krb.realms from the CWS to nodes. But as the nodes are not allowed to remote copy files from CWS in RRA mode, sysctl is used instead. The sequence is as follows:

- Node executes /bin/ksrvtgt root SPbgAdm to get a Kerberos ticket as root.SPbgAdm principal.
- Node calls the client command to be executed by the sysctl server on the CWS: /usr/lpp/ssp/bin/sysctl -L -h $cw_name update_krb_files. This is a sysctl procedure contained in the install.cmds module.
- The sysctl daemon on the CWS authenticates the root.SPbgAdm principal and then checks the ACL file /etc/sysctl.install.acl for the authorization to use the update_krb_files sysctl command.
- Because the ACL contains the _PRINCIPAL root.SPbgAdm line, the sysctl daemon on the CWS executes the request by getting a rcmd principal ticket-granting-ticket and pushing the files to the node.

Note: If you plan to use the firstboot.cust script in RRA mode, see the /usr/lpp/ssp/samples/firstboot.cust sample.

Troubleshooting security problems in RRA mode

For exemplification, consider the following scenario in a RRA environment:

Server keys are changed on a node, using the ksrvutil change command as in Example 4-11. We kill the get_keyfiles process, in order to allow the psspfb_script to continue.

Example 4-11 Changing the server keys

sp3n09 > klist -srvtab
Server key file: /etc/krb-srvtab
Service Instance Realm Key Version
-----------------------------------------
rcmd sp3n09 SP3EN0 2
root SPbgAdm SP3EN0 3
sp3n09 > ksrvtgt root SPbgAdm
sp3n09 > klist
Ticket file: /tmp/tkt10704
Principal: root.SPbgAdm@SP3EN0

Issued Expires Principal
Jul 24 09:46:38 Never krbtgt.SP3EN0@SP3EN0
sp3n09 > kinit root.admin
Kerberos V4 Initialization for "root.admin"
Password:
sp3n09 > ksrvutil change
Principal: rcmd.sp3n09@SP3EN0; version 2
Changing to version 3.
Key changed.
Principal: root.SPbgAdm@SP3EN0; version 3
Changing to version 4.
Key changed.
Old key file in /etc/krb-srvtab.old.

Because the SPbgAdm principal is included in the server key on the node, its key
version is changed on the node and in the Kerberos database. See
Example 4-12. Notice also that the ksrvtgt command fails.

Example 4-12   Key versions on the CWS
sp3en0 > lskp root.SPbgAdm
root.SPbgAdm       tkt-life: Unlimited key-vers: 4 expires: 2037-12-31 23:59
sp3en0 > ksrvutil list
Version  Principal
  3  hardmon.sp3en0@SP3EN0
  3  rcmd.sp3en0@SP3EN0
  3  hardmon.sp3cws@SP3EN0
  3  rcmd.sp3cws@SP3EN0
  3  root.SPbgAdm@SP3EN0
sp3en0 > ksrvtgt root SPbgAdm
ksrvtgt: 2504-062 Incorrect Kerberos V4 password

A different node is set to customize and when pssp_script runs on it, it hangs
while running the get_keyfiles command. This is happening because the
kfserver on the CWS can no longer use the s1term, as it uses the ksrvtgt root
SPbgAdm command to get a ticket-granting ticket, making use of the local
/etc/krb-srvtab file to provide a Kerberos password. The root.SPbgAdm has now
different key versions in the local /etc/krb-srvtab and in the Kerberos database,
so the password provided by the node does not match the one stored in the
database. See Example 4-13 on page 178 for the kfserver errors.
Example 4-13   Kfserver errors

sp3en0 > cat /var/adm/SPlogs/kfserver/kfserver.log.25342

************************************************
* Beginning of logging for -- kfserver
*** Mon Jul 23 18:44:49 EDT 2001

Recieved request from node 12
Uuencoding keyfile /spdata/sys1/k4srvtabs/sp3n12-new-srvtab
ksrvtgt: 2504-062 Incorrect Kerberos V4 password
Sending keyfile to /dev/tty0 on sp3n12
sp3en0 >

At some point, the psspfb_script attempts to get a ticket-granting ticket as root.SPbgAdm, in order to use the `sysctl` complete_node command. But as the key versions differ in the local /etc/srvtab and in the Kerberos database, the command fails. See the Example 4-14 for the psspfb_script output.

Example 4-14   psspfb_script output

+ + /usr/lpp/ssp/bin/SDRGetObjects -Gx SP_Restricted restrict_root_rcmd
  RestrictRSH=true
+ RestrictRSH=true
+ [[ true = true ]]
+ /bin/ksrvtgt root SPbgAdm
ksrvtgt: 2504-062 Incorrect Kerberos V4 password
+ rc=62
+ [[ 62 -ne 0 ]]
+ /usr/lpp/ssp/bin/spmsg_basic sminstall sminstall.cat emsg893 $pn: 0016-893
  Failed to obtain rcmd ticket; rc=$rc. Continuing. psspfb_script 62
  psspfb_script: 0016-893 Was not successful to obtain rcmd ticket; rc=62.
  Continuing.+ print
+ /usr/lpp/ssp/bin/sysctl -L -h sp3en0 complete_node sp3n12 12 hdisk0
  bos.obj.ssp.433
  sp3en0: sysctl: 2501-122 complete_node: Insufficient Authorization.

To fix the problem, re-create the server keys on the CWS, for the CWS and for the node to be customized as in Example 4-15.

Example 4-15   Replacing the server keys on the CWS and node

sp3en0 > ksrvutil delete
Principal: hardmon.sp3en0@SP3EN0; version 3
Delete this key? (yes,no) [yes] no
Keeping this key.
Principal: rcmd.sp3en0@SP3EN0; version 3
Delete this key? (yes,no) [yes] no
Keeping this key.

Principal: hardmon.sp3cws@SP3EN0; version 3
Delete this key? (yes,no) [yes] no
Keeping this key.

Principal: rcmd.sp3cws@SP3EN0; version 3
Delete this key? (yes,no) [yes] no
Keeping this key.

Principal: root.SPbgAdm@SP3EN0; version 3
Delete this key? (yes,no) [yes] yes
Deleting this key.
Old key file in /etc/krb-srvtab.old.
sp3en0 > ext_srvtab -n SPbgAdm
Generating 'SPbgAdm-new-srvtab'....
sp3en0 > cat SPbgAdm-new-srvtab >>/etc/krb-srvtab
sp3en0 > rm SPbgAdm-new-srvtab
sp3en0 > ksrvutil list
Version Principal
 3 hardmon.sp3en0@SP3EN0
 3 rcmd.sp3en0@SP3EN0
 3 hardmon.sp3cws@SP3EN0
 3 rcmd.sp3cws@SP3EN0
 4 root.SPbgAdm@SP3EN0
sp3en0 > export KRBTKFILE=/tmp/tkt$$
sp3en0 > ksrvtgt root SPbgAdm
sp3en0 > kdestroy
Tickets destroyed.
sp3en0 > ksrvutil -f ./sp3n12-new-srvtab list
Version Principal
 1 rcmd.sp3n12@SP3EN0
 1 godm.sp3n12@SP3EN0
 1 rcmd.sp3n12@SP3EN0
 1 root.SPbgAdm@SP3EN0
sp3en0 > lskp rcmd.sp3n12
rcmd.sp3n12          tkt-life: Unlimited key-vers: 1  expires: 2037-12-31 23:59
sp3en0 > ksrvutil -f ./sp3n12-new-srvtab delete

Principal: rcmd.sp3sw12@SP3EN0; version 1
Delete this key? (yes,no) [yes] no
Keeping this key.

Principal: godm.sp3n12@SP3EN0; version 1
Delete this key? (yes,no) [yes] no
Keeping this key.
Principal: rcmd.sp3n12@SP3EN0; version 1
Delete this key? (yes,no) [yes] no
Keeping this key.

Principal: root.SPbgAdm@SP3EN0; version 1
Delete this key? (yes,no) [yes] yes
Deleting this key.
Old key file in ./sp3n12-new-srvtab.old.
sp3en0 > ksrvutil -f ./sp3n12-new-srvtab add
Name: root
Instance: SPbgAdm
Realm: SP3EN0
Version number: 4
New principal: root.SPbgAdm@SP3EN0; version 4
Is this correct? (yes,no) [yes] yes
Password:
Verifying, please re-enter Password:
Key successfully added.
Would you like to add another key? (yes,no) [yes] no
Old key file in ./sp3n12-new-srvtab.old.
sp3en0 > ksrvutil -f ./sp3n12-new-srvtab list
Version  Principal
  1     rcmd.sp3sw12@SP3EN0
  1     godm.sp3n12@SP3EN0
  1     rcmd.sp3n12@SP3EN0
  4     root.SPbgAdm@SP3EN0

In conclusion, it is a good practice to verify if the key versions for the root.SPbgAdm principal are identical on the nodes and in the Kerberos database.

4.3 Troubleshooting

The following publications provide information about the SP Security Services:

- IBM RS/6000 SP: Planning, Volume 2, Control Workstation and Software Environment, GA22-7281
- PSSP: Installation and Migration Guide, GA22-7347
- PSSP: Diagnosis Guide, GA22-7350
- PSSP: Messages Reference, GA22-7352
- PSSP: Administration Guide, SA22-7348
- PSSP: Command and Technical Reference, SA22-7351
When troubleshooting security services, try to get a detailed description of the symptom, and if possible, reproduce the problem. Take a look at the logs and at the error messages and consult the Messages Reference. Find out about your security configuration. Determine the authentication and authorization methods in use. Keep track of the actions taken and be prepared to revert the changes made to the system.

4.3.1 Security-related log files

The SP security components use the following files:

- `/var/adm/SPlogs/auth_install/log`
  Contains the progress and completion status of the PSSP security configuration scripts.

- `/var/adm/SPlogs/get_keyfiles/get_keyfiles.log`
  On the nodes, it contains the output of the `get_keyfiles` command.

- `/var/adm/SPlogs/kfserver`
  Directory on the CWS containing the output of the `kfserver` command.

- `/var/adm/SPlogs/kerberos/kerberos.log`
  Kerberos log, when it runs as primary authentication server.

- `/var/adm/SPlogs/kerberos/kerberos_slave.log`
  Kerberos log, when running as a secondary authentication server.

- `/var/adm/SPlogs/sysctl`
  Directory containing the `syslogd` output.

For a list of DCE daemons logs, refer to IBM DCE for AIX, Version 3.1: Administration Guide - Core Components, LK3T-4401.

4.3.2 Debugging krshd

When debugging remote commands and Kerberos V4 is the authentication mechanism in use, the AIX syslog can be used to capture the krshd messages.

To use syslog, on the target system:

1. Create your log file using the `touch` command. The file must exist before syslog will write to it.

2. Edit the `/etc/syslog.conf` file and add the line:

```
*.debug file_name
```

Where `file_name` is your log file, with the full path name specified.
3. Refresh the syslog subsystem to start logging, by issuing these commands:
   - `stopsrc -s syslogd`
   - `startsrc -s syslogd`

   On the source host, issue the command you are trying to debug. On the target host, check your log file for krshd or kerberos errors. Remember to un-configure the `/etc/syslog.conf` file when you are done and to refresh the syslogd daemon.

   **Tip:** To see all the error messages produced by remote commands, ensure that `K5MUTE=0`.

### 4.3.3 Case studies

The following case studies are only examples of how to approach an error in the SP security services. Fixing the problems in the presented case studies may also be achieved in different ways from the one shown in this chapter. The case studies presented do not cover all problems that could arise related to security. For a complete list of possible problems, see the *Parallel System Support Programs for AIX Diagnosis Guide, GA22-7350-02*.

**krshd:** Kerberos authentication failed

Symptom: The remote commands from the CWS to one node fail with the error message in Example 4-16 on page 182.

*Example 4-16  Kerberos authentication failure*

```bash
sp3en0:> rsh sp3n06 date
krshd: Kerberos Authentication Failed.
rshd: 0826-813 Permission is denied.
```

After configuring syslog on sp3n06 as in “Debugging krshd” on page 181, the messages from krshd are shown in Example 4-17.

*Example 4-17  krshd output*

```bash
sp3n06:> tail -f /var/adm/syslog.log
Jul 14 14:03:57 sp3n06 syslogd: restart
Jul 14 14:04:04 sp3n06 krshd[11950]: Failed krb5_compat_recvauth
Jul 14 14:04:04 sp3n06 krshd[11950]: Authentication failed from sp3en0: Unknown code krb5 205
```

So far, the error cause remains undetermined, so we check the Kerberos tickets. We acquire new tickets to ensure we eliminate error causes. The actual commands used are shown in Example 4-18.
Example 4-18 Checking kerberos tickets

sp3en0:> kdestroy
Tickets destroyed.
sp3en0:> kinit root.admin
Kerberos V4 Initialization for "root.admin"
Password:
sp3en0:> klist
Ticket file: /tmp/tkt29494
Principal: root.admin@SP3EN0

<table>
<thead>
<tr>
<th>Issued</th>
<th>Expires</th>
<th>Principal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul 14 14:10:09</td>
<td>Aug 13 14:10:09</td>
<td>krbtgt.SP3EN0@SP3EN0</td>
</tr>
</tbody>
</table>

sp3en0:> rsh sp3n06 date
krshd: Kerberos Authentication Failed.
rshd: 0826-813 Permission is denied.
sp3en0:> klist
Ticket file: /tmp/tkt29494
Principal: root.admin@SP3EN0

<table>
<thead>
<tr>
<th>Issued</th>
<th>Expires</th>
<th>Principal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul 14 14:10:09</td>
<td>Aug 13 14:10:09</td>
<td>krbtgt.SP3EN0@SP3EN0</td>
</tr>
<tr>
<td>Jul 14 14:10:16</td>
<td>Aug 13 14:10:16</td>
<td>rcmd.sp3n06@SP3EN0</td>
</tr>
</tbody>
</table>

sp3en0:>

We notice that after issuing the command, a service ticket for the node has been acquired, but the error persists. We investigate the following components, as shown in Example 4-19.

- /etc/krb.realms
- .klogin
- /etc/krb.conf
- Authentication and authorization settings
- Server keys versions on node and in the Kerberos database

Example 4-19 Checking kerberos components

sp3n06:> grep -E "sp3en0|sp3n06" /etc/krb.realms
sp3en0 SP3ENO
sp3n06 SP3ENO
sp3n06:> grep sp3en0 .klogin
rcmd.sp3en0@SP3ENO
sp3n06:> cat /etc/krb.conf
SP3ENO
SP3ENO sp3en0 admin server
sp3n06:> splistdata -p | grep auth
auth_install k4
auth_root_rcmd k4
ts_auth_methods compat
auth_methods k4:std
sp3n06:> splidata -e | grep restrict
restrict_root_rcmd false
sp3n06:> tauthent
Kerberos 4
Standard Aix
sp3n06:> klist -srvtab
Server key file: /etc/krb-srvtab
Service Instance Realm Key Version
------------------------------------------------------
rcmd sp3sw06 SP3EN0 1
rcmd sp3n06 SP3EN0 1
root SPbgAdm SP3EN0 1
sp3en0:> lskp rcmd.sp3n06
rcmd.sp3n06 tkt-life: Unlimited key-vers: 1 expires: 2037-12-31 23:59
sp3n06:> ksrvutil -k list
Version Key Principal
1 01010101 01010101 rcmd.sp3sw06@SP3EN0
1 01010101 01010101 rcmd.sp3n06@SP3EN0
1 f72a1f70 fb794fbb root.SPbgAdm@SP3EN0

The keys displayed on the node by the ksrvutil -k list command do not look normal, so we create new server keys for the node, using the following steps, as in Example 4-20 on page 184:

1. Delete the existing server key file on the CWS.
2. On the CWS, change node responds to customize.
3. Run setup_CWS to get the new server keys created in the /spdata/sys1/k4srvtabs directory.
4. Check the server keys.

Example 4-20 Building new server keys

sp3en0:> rm /spdata/sys1/k4srvtabs/sp3n06-new-srvtab
sp3en0:> spbootins -r customize -1 6 -s no
sp3en0:> setup_CWS
setup_CWS: 2545-105 kfcl1 service is already defined in /etc/inetd.conf
add_principal: 2502-037 rcmd.sp3n06 already exists in database.
add_principal: 2502-037 rcmd.sp3sw06 already exists in database.
setup_CWS: Control Workstation setup complete.
sp3en0:> ls -l /spdata/sys1/k4srvtabs/sp3n06-new-srvtab
-r-------- 1 root system 86 Jul 14 14:44
/spdata/sys1/k4srvtabs/sp3n06-new-srvtab
sp3en0:> klist -file /spdata/sys1/k4srvtabs/sp3n06-new-srvtab -srvtab
Server key file: /spdata/sys1/k4srvtabs/sp3n06-new-srvtab

<table>
<thead>
<tr>
<th>Service</th>
<th>Instance</th>
<th>Realm</th>
<th>Key Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>rcmd</td>
<td>sp3sw06</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
<tr>
<td>rcmd</td>
<td>sp3n06</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
<tr>
<td>root</td>
<td>SPbgAdm</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
</tbody>
</table>

sp3en0:> ksrvutil -k -f /spdata/sys1/k4srvtabs/sp3n06-new-srvtab list

<table>
<thead>
<tr>
<th>Version</th>
<th>Key</th>
<th>Principal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01010101 01010101</td>
<td>rcmd.sp3sw06@SP3EN0</td>
</tr>
<tr>
<td>1</td>
<td>01010101 01010101</td>
<td>rcmd.sp3n06@SP3EN0</td>
</tr>
<tr>
<td>1</td>
<td>f72a1f70 fb794ffbf</td>
<td>root.SPbgAdm@SP3EN0</td>
</tr>
</tbody>
</table>

At this point, we notice that the server key file created on the CWS has the same wrong keys. So we suspect a Kerberos database corruption, so we delete and re-add the rcmd principals for the node in cause, like shown in Example 4-21 on page 185.

5. Delete from the Kerberos database the rcmd principals for the node.
6. Delete the server key from the CWS.
7. Repeat steps 3 and 4. setup_CWS re-adds the principals to Kerberos.
8. Change back the node response to disk.
10. On the node, run get_keyfiles.
11. Copy the server key to the /etc/krb-srvtab.

Example 4-21 Correcting the kerberos database

sp3en0:> rmkp rcmd.sp3n06
Confirm removal of principal rcmd.sp3n06? (yes or no): yes

sp3en0:> rmkp rcmd.sp3sw06
Confirm removal of principal rcmd.sp3sw06? (yes or no): yes

sp3en0:> rm /spdata/sys1/k4srvtabs/sp3n06-new-srvtab

sp3en0:> setup_CWS
setup_CWS: 2545-105 kfcl1 service is already defined in /etc/inetd.conf
setup_CWS: Control Workstation setup complete.

sp3en0:> lskp | grep 06
rcmd.sp3n06          tkt-life: Unlimited key-vers: 1  expires: 2037-12-31 23:59
rcmd.sp3sw06         tkt-life: Unlimited key-vers: 1  expires: 2037-12-31 23:59

sp3en0:> ksrvutil -k -f /spdata/sys1/k4srvtabs/sp3n06-new-srvtab list

<table>
<thead>
<tr>
<th>Version</th>
<th>Key</th>
<th>Principal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ba3eb045 1aae671f</td>
<td>rcmd.sp3sw06@SP3EN0</td>
</tr>
<tr>
<td>1</td>
<td>10dad5bf eac7fd49</td>
<td>rcmd.sp3n06@SP3EN0</td>
</tr>
<tr>
<td>1</td>
<td>f72a1f70 fb794ffbf</td>
<td>root.SPbgAdm@SP3EN0</td>
</tr>
</tbody>
</table>

sp3en0:> spbootins -r disk -l 6 -s no
sp3en0:> kinit root.admin
Kerberos V4 Initialization for "root.admin"
Password:

sp3n06:> get_keyfiles sp3n06-new-srvtab sp3en0
Parsing operands
Removing cons (getty) entry from inittab
Finding getty process
Getting my node number
Sending request for keyfile
Uudecoding the keyfile
Adding cons (getty) entry to inittab
sp3n06:> cp /spdata/sys1/k4srvtabs/sp3n06-new-srvtab /etc/krb-srvtab
sp3n06:> ksrvutil -k list

Version Key Principal
1 ba3eb045 1aae671f rcmd.sp3sw06@SP3EN0
1 10dad5bf eac7fd49 rcmd.sp3n06@SP3EN0
1 f72a1f70 fb794ff70 root.SPbgAdm@SP3EN0

Now we can successfully issue a remote command from the CWS to the node.

telnetd: No authentication methods enabled
Consider the following example: Issuing telnet to a node returns the message in Example 4-22. The SDR settings are shown in Example 4-23.

Example 4-22  telnet error message

# tn sp3n06
Trying...
Connected to sp3n06.
Escape character is '^T'.
telnetd: No authentication methods enabled.
Connection closed.

Example 4-23  SDR settings

# SDRGetObjects Syspar auth_methods
auth_methods
k4
# lsauthent
Kerberos 4
Standard Aix

So, the partition has only k4 enabled, which is wrong because standard AIX should also be configured. We try to change it back, as shown in Example 4-24.
Example 4-24  Changing the auth_methods attribute

```
# chauthpar  -c -p sp3en0 -v k4 std
The remote command authentication methods for this host are currently k4:std
The authentication methods by partition are currently

    sp3en0  k4
The partition to be modified is sp3en0
The auth_methods attribute of the partition has been set to k4:std
# chauthpar  -f -p sp3en0 -v k4 std
The remote command authentication methods for this host are currently k4:std
The authentication methods by partition are currently

    sp3en0  k4:std
The partition to be modified is sp3en0
The chauthent command was executed successfully on node sp3n01
The chauthent command was executed successfully on node sp3n05
sp3n06: sp3n06: A remote host refused an attempted connect operation.
sp3n06: spk4rsh: 0041-011 Kerberos V4 rcmd failed:  :krshd: Kerberos
      Authentication Failed.
sp3n06: ...
dsh:  5025-509 sp3n06 rsh had exit code 4
chauthpar: 0016-226 A dsh problem has occurred on node sp3en0 (sp3n06). The
      return code value is 1.
...........................................................................
The chauthent command was executed successfully on node sp3n15
```

Now we notice that, on node sp3n06, the `rsh` command fails.

The only way of getting to the node is via the serial line. Use `s1term -w frame#`
`slot#` to access the node and issue the commands shown in Example 4-25.

Example 4-25  Node accessed via serial line

```
sp3n06:> lsauthent
Kerberos 4
sp3n06:> klist -srvtab
Server key file:  /etc/krb-srvtab
Service         Instance        Realm      Key Version
------------------------------------------------------
root            SPbgAdm         SP3EN0          1
sp3n6:> cat .klogin
root.admin@SP3EN0
rcmd.sp3en0@SP3EN0
root.SPbgAdm@SP3EN0
```

sp3n6:>
```
root.admin@SP3EN0
rcmd.sp3en0@SP3EN0
root.SPbgAdm@SP3EN0
```
We notice that the only authentication method in use is Kerberos 4. But as there is no service key for the rcmd.sp3n06 principal, the remote command from the CWS fails. We also notice that both the .rhosts and .klogin authorization files are in place.

Checking the auth_root_rcmd attribute in the SDR returns the output shown in Example 4-26.

Example 4-26  Node auth_root_rcmd attribute

```
sp3n06:> SDRGetObjects Syspar auth_root_rcmd
auth_root_rcmd
k4:std
```

Both authorization methods, k4 and std are configured, so that explains why both .klogin and .rhosts are present.
Next step, we take the following actions to solve the problem:

- Correct the settings on the CWS.
- Create the new server keys for the node and copy them to the node. The easiest way is by setting the node response to customize and then running the `pssp_script` on the node, or by rebooting the node.

The actual commands are presented in Example 4-27.

Example 4-27  Operations on the CWS

```
sp3en0:> splstddata -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 983230416,8126720,0
auth_install   k4:std
auth_root_rcmd k4:std
ts_auth_methods compat
auth_methods   k4:std

sp3en0:> spsetauth -p sp3en0 -d k4  
sp3en0:> splstddata -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 983230416,8126720,0
auth_install   k4:std
auth_root_rcmd k4
```
ts_auth_methods compat
auth_methods k4:std

sp3en0:> spbootins -r customize -l 6 -s no
sp3en0:> setup_server

..........................
setup_server: Processing complete (rc= 0).

**Tip:** Do not run pssp_script on the node from a serial line window because get_keyfiles, which transfers the server keys from the CWS, needs exclusive access to the serial line.

We have two choices to run the pssp_script without using the serial line for that:

1. Manually update the AIX authentication methods with the `chauthent` command, close the serial session, then `telnet` to the node from the CWS.
2. Reboot the node and close the serial connection.

The first option is used. After running pssp_script on the node, we check the server keys and the authorization files. The rcmd.sp3n06 principal has its own key in /etc/krb-srvtab and only the .klogin authorization file is present. See Example 4-28 for the actual commands.

**Example 4-28  Node verification**

```
sp3n06:> klist -srvtab
Server key file: /etc/krb-srvtab

<table>
<thead>
<tr>
<th>Service</th>
<th>Instance</th>
<th>Realm</th>
<th>Key Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>rcmd</td>
<td>sp3sw06</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
<tr>
<td>rcmd</td>
<td>sp3n06</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
<tr>
<td>root</td>
<td>SPbgadm</td>
<td>SP3EN0</td>
<td>1</td>
</tr>
</tbody>
</table>

sp3n06:> lsauthent
Kerberos 4
Standard Aix

sp3n06:> ls -l .klogin .rhosts
ls: 0653-341 The file .rhosts does not exist.
-rw-r--r-- 1 root system 285 Jul 11 15:46 .klogin
```
Chapter 5. RS/6000 Cluster Technology (RSCT)

This chapter applies to RSCT Version 1 Release 2 and provides a brief overview of the RSCT subsystems and problem determination techniques that assist in keeping the cluster stable.

In this chapter we discuss problem determination on the following:
- Topology Services (TS)
- Group Services (GS)
- Event Management (EM)
5.1 RS/6000 Cluster Technology (RSCT) overview

RSCT is a distributed group of subsystems, running across multiple nodes or machines, that communicate with each other through multiple networks to provide high availability, online monitoring and automatic recovery actions. This distributed group of subsystems, known as a stack, runs in a single partition on the RS/6000 SP. There may be more than one partition per SP but each RSCT stack is separate from the other.

The three principal components of the RSCT stack are:
1. Topology Services (TS)
2. Group Services (GS)
3. Event Management (EM)

This infrastructure is represented pictorially, as shown in Figure 5-1.

Figure 5-1 RSCT infrastructure
A HACMP/ES domain is also shown in this figure, which you can see contains another RSCT stack of subsystems. These stacks are independent of each other and although the problem determination of the RSCT stack in the HACMP environment is similar, it is not the intent of this book to detail the differences.

Refer to the following IBM Redbooks for more information about HACMP/ES:
- *HACMP Enhanced Scalability Handbook*, SG24-5328
- *HACMP/ES Customization Examples*, SG24-4498
- *HACMP Enhanced Scalability: User-Defined Events*, SG24-5327

5.2 Topology Services (TS)

Topology Services (TS) is the lowest level of the RSCT subsystems. It provides and maintains connectivity and availability information about the nodes and network adapters. Most problems are automatically recovered without intervention; however, often to understand or isolate a problem in a higher level of the RSCT system you need to examine the state of Topology Services.

5.2.1 TS overview

Topology Services is a distributed subsystem of the IBM RS/6000 Cluster Technology (RSCT) software on RS/6000 systems. The RSCT software provides a set of services that support high availability on your SP system. Other services in the RSCT software are the Event Management and Group Services distributed subsystems. These three distributed subsystems operate within a domain. A domain is a set of RS/6000 machines upon which the RSCT components execute and, exclusively of other machines, provide their services. On an SP system, a domain is a system partition. Note that a machine might be in more than one RSCT domain; the control workstation is a member of each system partition, and, therefore, a member of each RSCT domain. When a machine is a member of more than one domain, there is an executing copy of each RSCT component per domain.

Topology Services provides other high availability subsystems with network adapter status, node connectivity information, and a reliable messaging service. The adapter status and node connectivity information is provided to the Group Services subsystem upon request, Group Services then makes it available to its client subsystems. The Reliable Messaging Service, which takes advantage of node connectivity information to reliably deliver a message to a destination node, is available to the other high availability subsystems.
This adapter status and node connectivity information is discovered by an instance of the subsystem on one node, participating in concert with instances of the subsystem on other nodes, to form a ring of cooperating subsystem instances. This ring is known as a heartbeat ring, because each node sends a heartbeat message to one of its neighbors and expects to receive a heartbeat from its other neighbor. Actually each subsystem instance can form multiple rings, one for each network it is monitoring. Usually, each subsystem monitors two rings; the SP Ethernet and the SP switch. This system of heartbeat messages enables each member to monitor one of its neighbors and to report to the heartbeat ring leader, called the Group Leader, if it stops responding. The Group Leader, in turn, forms a new heartbeat ring based on such reports and requests for new adapters to join the membership. Every time a new group is formed, it lists which adapters are present and which adapters are absent, making up the adapter status notification that is sent to Group Services.

In addition to the heartbeat messages, connectivity messages are sent around all rings. Connectivity messages for each ring will forward its messages to other rings, so that all nodes can construct a connectivity graph. It is this graph that determines node connectivity and defines a route that Reliable Messaging would use to send a message between any pair of nodes that have connectivity.

Upon the startup of the Topology Services daemon, the initial configuration information is supplied from the SDR. This is used to build a Machine List file, and adapter groups are established and a topology table (connectivity and availability table) is built. This in turn is used to build the Network Connectivity Table (NCT) in shared memory, and this information is passed via the Reliable Messaging subsystem to Group Services (GS) as a client of Topology Services. This process flow is shown in Figure 5-2 on page 195.
To manage the changes in heartbeat rings, the following roles are defined within Topology Services:

Group Leader (GL): The node whose adapter has the highest IP address; it proclaims the group and handles join requests and death notifications, coordinates with group members, and distributes connectivity information. The GL node will not necessarily be the same for the different heartbeat rings.

Crown Prince: The second highest IP address; detects the death of the Group Leader and takes over the GL role.

Mayor: Picked by the Group Leader to broadcast messages to the group members in a given subnet.

Generic: Any other member of the group, who monitors the heartbeat message from its neighbor and informs the Group Leader if there is a problem.
All of these roles are dynamic; they are continuously re-evaluated and reassigned.

5.2.2 What to use to diagnose Topology Services problems

The log files created by the TS daemon (hatsd) on the Group Leader, within each heartbeat ring contain the most relevant and main information in case of problems with TS.

**Note:** With the introduction of First Failure Data Capture (FFDC) in PSSP 3.2, it is no longer expected that users do debugging using the HATS logs. The idea is to use lssrc and the error log entries. See Chapter 23, “Topology Services” in the *Parallel System Support Programs for AIX: Diagnosis Guide*, GA22-7350 for more information on debugging approach used.

**TS service log glossary**

To understand the TS logs you need to understand some of the more cryptic terms that are used throughout the logs.

- **PTC**
  - Prepare to commit. Message sent by GL to ring members.

- **Offset**
  - Network ring: [0] for SPether [1] for SPswitch. When the logs refer to adapter 0 it is referencing the SPether ring.

- **Tunstable**
  - Time-of-day when the instability timer was set. The main purpose is to ensure Group Services only receives a single “node” event. This is set when the initial group is formed and reset each time group membership changes.

- **TifUnstableSetNCT**
  - Related to previous timer, if this timer expires node membership is recomputed to form a valid NCT.

- **NCT**
  - Network connectivity table.

- **Refresh Quiesce Interval**
  - Time period between a request for a refresh and actual changes to the hatsd data structures.

- **Refresh Propagation Interval**
  - Time period for how often propagation messages will be sent.

- **Tunables**
  - Settings that apply to the hatsd. Some values come from the SDR class TS_Config others come from the daemon itself.
**Issrc -ls**

The TS subsystem is managed by the SRC, and since it does not use signals as its communication method we can get current status information by using the `lssrc -ls` command. We discuss this output in Example 5-1 on page 197.

**Tip:** The output will be in English for all RSCT versions currently on the field.

**Example 5-1  Issrc -ls (on the CWS)**

```
[3:root@sp3en0:/home/root] # lssrc -ls hats.sp3en0
Subsystem         Group            PID     Status
hats.sp3en0      hats             17440   active
Network Name   Indx Defd Mbrs St Adapter ID      Group ID
SPether        [ 0]   13   13  S 192.168.3.130  192.168.3.130
SPether        [ 0] en0           0x43465891      0x43507660
HB Interval = 1 secs. Sensitivity = 4 missed beats
2 locally connected Clients with PIDs:
  haemd( 27040) hagsd( 32462)
Configuration Instance = 983230443
Default: HB Interval = 1 secs. Sensitivity = 4 missed beats
Control Workstation IP address = 192.168.3.130
Daemon employs no security
Data segment size: 6707 KB. Number of outstanding malloc: 346
User time 953 sec. System time 1157 sec.
Number of page faults: 40. Process swapped out 0 times.
Number of nodes up: 13. Number of nodes down: 0.
```

Section 1 tells us the hatsd process id (PID), running on the CWS, and that it is active, or at least the socket connection is still open. The process could be hung.

**Tip:** If you see any output at all from the `lssrc -ls` command, then the daemon cannot be hung, since all output from the `lssrc -ls` command is provided by the daemon itself. The “process could be hung” statement is valid for the `lssrc -s` command, but not for the `lssrc -ls` command.

Section 2 contains information about the heartbeat rings. This is the CWS so only the SPether network is present.

- Indx: Number used for the ring. [0] is for SPether [1] is for SPswitch.
- Defd: Number of nodes defined in this ring.
- Mbrs: Active members of this ring.
- St: State of the ring (S: stable, U: unstable, D: down).
Adapter ID: The IP address of the adapter in this ring and a hexadecimal number used by TS to determine the instance number for the current node.

Group ID: The IP address of the Group Leader of this ring and a hexadecimal number to determine the instance number of the group.

Section 3 shows the tunables for this specific ring. In this instance, they are set at the default.

Section 4, corresponds to the InstanceNumber of the machines.lst file and the contents of the machines.inst file.

To review these files you can run:

- # SDRRetrievalFile hats.machines.lst /tmp/machines.lst
- # SDRRetrievalFile hats.machines.inst /tmp/machines.inst
- Or look in the /var/ha/run/<syspar_name>/machines.lst file

The last portion of the output covers:

- The CWS IP address.
- The Security Setting of the hatsd (we will discuss this later in the chapter).
- The hatsd process CPU time in user and system space.
- The number of page faults and the number of times the process has been swapped out.
- The number of nodes either reachable (up) or not (down).

**Attention:** The configuration instance changes every time the subsystem is refreshed.

Now we look at the output of **lssrc -ls hats** on a node, see Example 5-2.

**Example 5-2  lssrc -ls (on a node)**

```
[0:root@sp3n10:/]# lssrc -ls hats
Subsystem    Group    PID   Status
hats         hats     8544    active
Network Name  Indx  Defd  Mbrs  St   Adapter ID      Group ID
SPether       [ 0]  13   13  S  192.168.3.10    192.168.3.110
SPether       [ 0] en0          0x4350763f      0x43507660
HB Interval = 1 secs. Sensitivity = 4 missed beats
SPswitch      [ 1] css0         0x435076ed      0x4350770e
HB Interval = 1 secs. Sensitivity = 4 missed beats
  2 locally connected Clients with PIDs:
haemd(  7004) hagsd(  9988)
```
Configuration Instance = 983230443
Default: HB Interval = 1 secs. Sensitivity = 4 missed beats
Control Workstation IP address = 192.168.3.130
Daemon employs no security
Data segment size: 6764 KB. Number of outstanding malloc: 383
User time 40 sec. System time 52 sec.
Number of page faults: 130. Process swapped out 0 times.
Number of nodes up: 13. Number of nodes down: 0

Section 1 shows us the other ring being the [1] SPswtich network. Note that the Defd members show 12, as the CWS is not a member of this ring. Also the Mbrs, the active members of the ring only show as 11. One adapter in the SPswitch ring is not communicating. The Group Leader of the SPswitch ring is the highest IP address of the ring.

SDRGetObjects

SDRGetObjects host_responds is used for confirmation of the host_responds attribute in the host_responds class of the SDR. Shown in Example 5-3.

Example 5-3   SDRGetObjects host_responds
[root@sp4en0]:/> SDRGetObjects host_responds
node_number  host_responds
            1
            5

Note: The information flow from Topology Services to the SDRGetObjects host_responds is as follows: Topology Services (ethernet adapter membership) to Group Services to Event Management to host responds (hr) daemon to finally the SDR host_responds object.

SDRGetObjects TS_Config shows the tunable parameters of the hats daemon.

Example 5-4   SDRGetObjects TS_Config
# SDRGetObjects TS_Config

hatstune

This provides a easier interface to change the SDR attributes of the TS_Config class. A Usage screen shot is shown in Example 5-5 on page 200. The flags not directly related to the TS_Config tunable parameters are:

-d This resets all the tunable parameters to their default.
-v  This displays the current values.
-r  This refreshes hatsd after the tunable parameters are successfully set.
-h  Help screen.

**Note:** The command `hastune` was introduced in PSSP 3.2 as a replacement for making direct changes to TS_Config SDR class using the command `SDRChangeAttrValues`. HATS tunable parameters can be set by changing SDR attributes of certain SDR objects. `hastune` performs consistency checking on the tunable values.

- `hastune` must be executed on the CWS (and not at the nodes) when used to change tunable values.

For more information on the `hastune` command, refer to Parallel System Support Programs for AIX: Command and Technical Reference, Volume 1, SA22-7351.

---

**Example 5-5  hastune -h**

```
# hastune
Usage:
    hastune [-f frequency] [-s sensitivity] [-p priority] [-l log_length]
              [-m pin_object] [-r]
    hastune -d [-r]
    hastune -v
    hastune -h
```

A listing of the TS_Config class is shown in Example 5-4 on page 199. You could use the `SDRChangeAttrValues` instead of the `hastune` command with the disadvantage that no consistency checking is done.

**hatsctrl**

The `hatsctrl` script is not usually executed from the command line. It is normally called by the `syspar_ctrl` command during installation of the system, and partitioning or repartitioning of the system.

The `hatsctrl` script provides a variety of controls for operating the Topology Services subsystem:

- Adding, starting, stopping, and deleting the subsystem.
- Cleaning or deleting the subsystem from all system partitions. This does not remove the SDR entries.
- Unconfiguring the subsystems from all system partitions. This removes the SDR entries.
- Turning tracing on and off.
- Refreshing the subsystem.

### 5.2.3 Topology Service logs and other useful information

Refer to the following logs and files for useful problem determination infrastructure:

- **AIX Error Log**: Entries for Topology Services are usually from the SRC master process and are related to starting or stopping the SRC subsystem. The tables in the *PSSP 3.2 Diagnosis Guide, Diagnosing Topology Services Problems*, GA22-7350 provide Error Labels and Error IDs, as well as an explanations and details.

**Note**: The error log entries for HATS are always created by the HATS daemon itself, unless the daemon is killed or core dumps.

- **/var/ha/log/hats.<syspar>**: This is the log file for the hats script errors called by the SRC master. There will be multiple log files on the CWS if there are multiple system partitions.

**Note**: The hats script controls the operations of the Topology Services subsystem, builds the machines.lst file, and then invokes the daemon.

- **/var/ha/log/hats.<DOM>.<HHMMSS>.<syspar>**: Where `<DOM>` is the day of the month that the daemon was started. This file is created by the hats daemon, if the hats script fails the reason, you would not see this file, and the reason should be in the hats.<syspar> file. The most relevant information will be on the node that is the Group Leader.

- **/var/ha/run/hats.<syspar>**: The Topology Services daemon current working directory. If the TS daemon abnormally terminates, the core file will be here, named core.<DOM>.<HHMMSS>.<syspar>.

- **/var/ha/soc/hats/server_socket.<syspar>**: This is the socket file used for intranode communication.

- **/var/ha/run/hats.<syspar>/machine.lst**: This contains all the IP addresses for all the supported networks. This is the information originally obtained from the SDR, verified and compared back against the SDR, if they are different this file will replace the one in the SDR.
5.3 Group Services (GS)

Group Services (GS) is a client of Topology Services, and is the next level in the RSCT structure. GS provides coordination and synchronization services to client subsystems, such as Event Management (EM) and Recoverable Virtual Shared Disk (RVSD).

Refer to the following IBM publications for more information about Group Services:

- *Parallel System Support Programs for AIX: Diagnosis Guide*, GA22-7350
- *RSCT Group Services: Programming Cluster Applications*, SG24-5523

5.3.1 GS overview

GS runs as a distributed daemon (hagsd) running on all nodes in a system partition, communication between the nodes is through the Reliable Messaging Library. On the CWS there will be one instance of the hagsd daemon running for each system partition. The GS structure is shown in Figure 5-3 on page 203.
GS clients are either providers, processes that join the group, or subscribers, that monitor the group. The group state, is maintained by the GS subsystem consisting of a group membership list, a list of the providers, and a group state value, this is controlled by the providers. Subscribers do not appear in the group membership lists, they are known to the GS subsystem but not by the providers. The client subsystems connect to GS and form groups by using the Group Services API (GSAPI).

Any provider in a group can initiate a change to the group state, by either joining or leaving the group. Changes to the group state are serialized, that is the change must complete before another change can start.

GS establishes a single group namespace across a SP partition. Each SP partition would be a separate namespace and can have more than one group within that namespace. To keep track of the changes to the client groups GS nominates a nameserver (NS), this is not the same as a DNS nameserver. The
nameserver, if all nodes are booted at once, will be the node with the lowest IP address. If there is a GS daemon already running within a namespace, then it will be the NS and will remain so taking responsibility for tracking group state changes.

5.3.2 What to use to diagnose Group Services problems

The following commands can be utilized to diagnose GS problems:

**I ssr c -ls**

The GS subsystem is also managed by the SRC, and since it does not use signals as its communication method we can get current status information by using the `lssrc -ls` command, we will discuss the output in Example 5-6.

Example 5-6  lssrc -ls hags.sp5en0

```
# lssrc -ls hags.sp5en0
Subsystem         Group            PID     Status
hags.sp5en0       hags             14670   active
2 locally-connected clients. Their PIDs:
16312(hagsglsmd)  25212(haemd)
HA Group Services domain information:
Domain established by node 5
Number of groups known locally: 2
Group name         Number of providers Number of local providers/subscribers
cssMembership      3           0           1
ha_em_peers        4           1           0
```

Section 1 tells us the GS nameserver for this domain, node 5. Remember, although the GS nameserver would be the lowest IP address, if the nameserver is already established then other nodes join with the existing nameserver.

Section 2 shows the two groups in the domain. The number of providers are the nodes that can effect change to the group status. Since we are showing output on the CWS we see one local subscriber to the `cssMembership` group, the CWS does not have a switch adapter but wants to know the status of this group.

Let us briefly describe the slightly different output show in Example 5-7.

Example 5-7  lssrc -ls hags.sp5en0 (problem)

```
# lssrc -ls hags.sp5en0
Subsystem         Group            PID     Status
hags.sp5en0       hags             27662   active
2 locally-connected clients. Their PIDs:
5832(haemd)       20078(hagsglsmd)
```
Section 1 shows us that hagsd is active but the domain has not been established yet. Waiting a couple of minutes would normally allow the groups to be established but if there is a problem and the command times out check that hatsd is running.

**hagsns**

The `hagsns` command will also show information regarding the nameserver. Let's run `hagsns -s hags.sp5en0` on the CWS as in Example 5-8.

**Example 5-8**   `hagsns -s hags.sp5en0`

```
# hagsns -s hags.sp5en0
HA GS NameServer Status
NodeId=0.4, pid=24706, **domainId=5.14**, NS established, CodeLevel=PSSP-3.2(DRL=5)
NS state=kCertain, protocolInProgress=kNoProtocol,
outstandingBroadcast=kNoBcast
Process started on Jul 22 14:49:38, (0:12:26) ago. HB connection took (0:0:36).
Initial NS certainty on Jul 22 14:50:42, (0:11:21) ago, taking (0:0:27).
Our current epoch of certainty started on Jul 22 14:50:42, (0:11:21) ago.
Number of UP nodes: 4
List of UP nodes:  0 5 9 13
```

The `domainId=5.14` shows us that node 5 is the nameserver and that the hagsd has been started 14 times.

More information is shown if run on the nameserver. Let's run the same command on the nameserver, node5, Example 5-9.

**Example 5-9**   `hagsns -s hags (on GL nameserver)`

```
# /usr/sbin/rsct/bin/hagsns -s hags
HA GS NameServer Status
**NodeId=5.14**, pid=15108, **domainId=5.14**, NS established,
CodeLevel=PSSP-3.2(DRL=5)
NS state=kBecomeNS, protocolInProgress=kNoProtocol,
outstandingBroadcast=kNoBcast
Process started on Jul 22 13:31:48, (1:36:40) ago. HB connection took (0:0:0).
Initial NS certainty on Jul 22 13:32:34, (1:35:55) ago, taking (0:0:45).
Number of UP nodes: 4
List of UP nodes:  0 5 9 13
```

List of known groups:
1.1 ha_em_peers: GL: 9 seqNum: 10 theIPS: 5 9 13 0 lookupQ:
2.1 cssMembership: GL: 13 seqNum: 9 theIPS: 5 9 13 0 lookupQ:

We get the extra information of known groups in this GS domain showing the node numbers, theIPS, that are interested in the group.

hagsctrl
This is the script that is called by syspar_ctrl, which would be the normal way of invoking this command. However, calling this script from the command line provides a variety of controls for separately operating the Group Services subsystems:

- Adding, starting, stopping, and deleting the subsystems.
- Deleting them from all system partitions.
- Unconfiguring the subsystems from all system partitions.
- Turning tracing on and off.

5.3.3 Group Services logs & other useful information
The following list comprises GS logs and other useful information for problem determination:

- AIX Error Log: Entries for Group Services are usually from the SRC master process and are related to starting or stopping the SRC subsystem. The tables in the PSSP 3.2 Diagnosis Guide, Diagnosing Group Services Problems, GA22-7350 provide Error Labels and Error IDs, an explanation and details of each.
- /var/ha/log/hags.<syspar>: Which contains the standard out and standard error as the hags script is called from the SRC. Once the script completes it renames the file /var/ha/log/hags.default.<syspar_nodenum_instnum>.
- /var/ha/log/hags.default.<syspar_nodenum_instnum>: This is the renamed /var/ha/log/hags.<syspar> file, it contains output from the initial start of the daemon.
- /var/ha/log/hags_nodenum_instnum.syspar : This file holds current information about all the GS daemon's activities.
- /var/ha/soc/hagsdsocket.<syspar_name>, The socket files are used to communicate between GS clients and the daemon.
- /var/ha/lck/hags.tid.<syspar>: The lock file directory is used to ensure a single running instance of the Group Services daemon, and to establish an instance number for each invocation of the daemon.
5.4 Event Management (EM)

Event Management (EM) is the top level of the RSCT subsystems, it is a client of Group Services. It provides a monitoring service of client requested system resources, such as file systems, processes, CPUs, and notifies those clients when certain conditions are met. It runs as a daemon, haemdm. The functional flow is shown in Figure 5-4.

5.4.1 EM overview

By monitoring the state of the resource conditions against the client system resources, the client is notified in advance of any event that can cause a possible system failure. Thus, using this information is useful in trying to recover from any events that can possibly cause system failures in advance of the problem. An example would be detecting a file system on a node starting to fill up, communicating this to the client and the client (such as pmand) then taking action to make available space in the monitored file system.
There are three components of EM:

1. Resource Monitors, which keep track of information related to system attributes, transform this information to resource variables and communicate them to the EM subsystem.

2. The EM subsystem communicates between the Resource Monitors and the EM clients. It receives and keeps track of information from the Resource Monitors, as well as tracking information for which the EM clients have expressed an interest in.

3. The EM client acts upon information regarding system resources. An EM client can be an application or a subsystem.

The Event Management Configuration Database (EMCDB) holds all the definitions of the resource monitors and the resource variables which are written to the SDR. It is a binary file that is created from the EM SDR classes.

5.4.2 What to use to diagnose Event Management problems

This section describes commands used to diagnose EM problems.

Issrc
There is a lot of information that is listed by the `ls -ls` command. We have left some parts out of the full listing. Let’s look at the main sections of some typical output, shown in Example 5-10.

Example 5-10  `ls -ls haem.sp5en0`

```
# ls -ls haem.sp5en0
Subsystem         Group            PID     Status
haem.sp5en0      haem             11984   active

No trace flags are set

Configuration Data Base version from SDR:

995996645,800126650,0

Daemon started on Tuesday 07/24/01 at 13:44:28
 Daemon has been running 0 days, 23 hours, 6 minutes and 22 seconds
 Daemon connected to group services: Yes
 Daemon has joined peer group: Yes
 Daemon communications enabled: Yes
 Daemon security: None
 Peer count: 2
 Peer group state:

995996645,800126650,0

NOSEC
```
This small section of the `lssrc -ls` listing shows us quite a lot of information.

- That the haem daemon is alive and for how long it has been active.
- The instance value of the Event Management Configuration Database (EMCDB) from the SDR. This should be compared with the information shown in the Peer group state. If there is a mismatch all the EM daemons will have to be stopped, the group dissolved and reformed for a new EMCDB to be generated and used.
- Also shown are the connections between the GS daemon, the group, and communications to the EM clients are working.
- Whether security is in place for the EM daemons and how many peers are in the group.

This next portion of the `lssrc -ls` output, in Example 5-11, shows the file descriptors (FD) and the process ids (PIDS) of the local clients connected.

**Example 5-11  lssrc -ls haem.sp5en0 (local client information)**

<table>
<thead>
<tr>
<th>LCID</th>
<th>FD</th>
<th>PID</th>
<th>Start Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>11</td>
<td>14696</td>
<td>Tuesday 07/24/01 13:44:55</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>20106</td>
<td>Tuesday 07/24/01 13:44:56</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>30806</td>
<td>Tuesday 07/24/01 13:45:45</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>30806</td>
<td>Tuesday 07/24/01 13:45:45</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>30646</td>
<td>Wednesday 07/25/01 13:42:51</td>
</tr>
</tbody>
</table>

In our listing these local clients are: hrd (14696); pmnd (20106); sp_configd (30806) and sphardware (30646).

This part, in Example 5-12, shows the resource monitors connected to EM.

**Example 5-12  lssrc -ls haem.sp5en0 (resource monitor information)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Inst</th>
<th>Type</th>
<th>FD</th>
<th>SHMID</th>
<th>PID</th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM.PSSP.CSSLogMon</td>
<td>0</td>
<td>C</td>
<td>-1</td>
<td>-1</td>
<td>-2</td>
<td>00/00</td>
</tr>
<tr>
<td>IBM.PSSP.SDR</td>
<td>0</td>
<td>C</td>
<td>-1</td>
<td>-1</td>
<td>-2</td>
<td>00/00</td>
</tr>
<tr>
<td>IBM.PSSP.Switch</td>
<td>0</td>
<td>S</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>00/00</td>
</tr>
<tr>
<td>IBM.PSSP.harmld</td>
<td>0</td>
<td>S</td>
<td>19</td>
<td>1572867</td>
<td>10812</td>
<td>01/01</td>
</tr>
<tr>
<td>IBM.PSSP.harmpd</td>
<td>0</td>
<td>S</td>
<td>18</td>
<td>-1</td>
<td>9428</td>
<td>01/01</td>
</tr>
<tr>
<td>IBM.PSSP.hmrmd</td>
<td>0</td>
<td>S</td>
<td>20</td>
<td>-1</td>
<td>13148</td>
<td>01/01</td>
</tr>
<tr>
<td>IBM.PSSP.pmanrmd</td>
<td>0</td>
<td>S</td>
<td>14</td>
<td>-1</td>
<td>-2</td>
<td>00/00</td>
</tr>
<tr>
<td>Membership</td>
<td>0</td>
<td>I</td>
<td>-1</td>
<td>-1</td>
<td>-2</td>
<td>00/00</td>
</tr>
<tr>
<td>Response</td>
<td>0</td>
<td>I</td>
<td>-1</td>
<td>-1</td>
<td>-2</td>
<td>00/00</td>
</tr>
<tr>
<td>aixos</td>
<td>0</td>
<td>S</td>
<td>13</td>
<td>1572866</td>
<td>-2</td>
<td>00/02</td>
</tr>
</tbody>
</table>
This shows the resource monitor names and what type of connection (C: Client, S: Server, I: Internal). An internal EM file descriptor (FD), shared memory ID (SHMID), and whether the resource monitor is locked or not based on the counters (starts and successful connections) shown. A resource may become locked if a monitor cannot be started and remain running or there have been too many connections being lost.

The major portion, not shown, relates to internal EM counters, which may be used by IBM support.

**haemctrl**
The haemctrl script, called normally by the syspar_ctrl command, provides a variety of controls for operating the EM subsystem.

- Adds, starts, stops, and deletes the subsystem.
- Deletes the subsystem from all system partitions.
- Unconfigures the subsystem from all system partitions.
- Turns tracing on and off.
- Refreshes the subsystem.

### 5.4.3 Event Management Logs & other useful information

The following list comprises EM logs and other useful information for problem determination:

- `/var/ha/log/em.default.<syspar_name>`: This file contains any error messages that cannot be written to the error logging subsystem.
- `/var/ha/log/em.trace.<syspar_name>`: This file contains trace output from the EM daemon.
- `/var/ha/log/em.msgtrace.<syspar_name>`: This file contains message trace output from the EM daemon.
- `/var/ha/log/em.loadcfg.<syspar_name>`: A log of any errors that occurred while creating the EMCDB.
- `/var/ha/log/em.mkgroup`: A log of any errors making the haemrm group.
- `/var/ha/log/em.mkdir`: A log of any errors creating the `/var/ha/lck/haem` and `/var/ha/soc/haem` directories.
- `/var/ha/run/haem.<syspar_name>`: Runtime information and core files will be stored here.
- `/var/ha/soc` and `/var/ha/soc/haem`: Contain Unix domain sockets.
PSSP 3.2 Diagnosis Guide, Diagnosing Event Management Problems, GA22-7350. Unlike TS and GS daemons there are only two error templates used. Other components, such as Resource Monitors, may log to the error subsystem as well. The important information is in the Detail Data Field of the error message.

5.5 Putting all the elements together

RSCT is a multi layered set of distributed subsystems operating across multiple nodes or SP attached systems in a clustered environment. Given the complex environments that can exist, RSCT is reasonably robust being able to correct a lot of problems and conditions without intervention, or where a serious problem exists, to work around the problem and keep operating in a reduced capacity.

Given this complexity we look to start problem determination, with the RSCT subsystems operating correctly, before we look to other conditions which may be causing problems. Start at the bottom layer, Topology Services (hats), confirming it is properly configured and working before looking at the group services (hags) subsystem and finally at the event management (haem) subsystem.

Problems in RSCT can be caused by many other factors besides the RSCT subsystems themselves, some of which we list here.

- Networking issues
  - Name resolution.
  - Intermediate nodes without ipforwarding = 1.
  - Communication adapters not working.
  - Wrongly configured communication adapters.
  - Netmasks incorrectly set.
  - Congestion, not allowing or delaying heartbeats.
  - Network outages, including router problems
  - Routing problems
  - ARP-related problems
  - Broadcast addresses incorrectly set

- Configuration problems
  - Node not defined in the SDR.
  - Duplicate or incorrect entries in the SDR.
  - Wrong IP address or MAC address in SDR.
– SDR daemon not running.
– Using the wrong instance number (adapter ID or group ID) in hatsd.
– Missing entries in /etc/inetd.conf.

▶ General problems
  – hardmon subsystem is not running.
  – Node powered off.
  – /var filesystem is 100% full.
  – Time difference too great between the CWS and the nodes.

▶ Resource Starvation
  – The CPU is overloaded.
  – Not enough memory.

5.6 Case studies

Probably the most common problem with RSCT reported by customers is no host_responds. This can be caused by many different things since host_responds (hrd) depends on a multitude of components working properly together.

**Attention:** The case study does not mention HAGS. It is assumed that HAGS is working properly. HAEM is a client for HAGS, so HAEM will not work if HAGS does not work correctly.

Chapter 22, “Topology Services” in the *Parallel System Support Programs for AIX: Diagnosis Guide*, GA22-7350, provides valuable debugging information. Topology Services debugging using the log files is very tricky, and requires much more knowledge of the protocols. We recommend trying to debug problems as much as possible using the AIX error log, and the Topology Services user log.

5.6.1 No host_responds (single node)

Description: Customer calls saying they have lost host_responds on node5. We start checking the system for host_responds as shown in Example 5-13 on page 213. Notice that some output lines from Example 5-13 have been omitted.
**Example 5-13  Checking for host_responds**

[root]:sp5en0 > spmon -d

5. Checking nodes

<table>
<thead>
<tr>
<th>Slot</th>
<th>Node</th>
<th>Type</th>
<th>Power</th>
<th>Switch</th>
<th>Key</th>
<th>Env</th>
<th>Front Panel</th>
<th>LCD/LED</th>
<th>LCD/LED Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>off</td>
<td>no</td>
<td>notcfg</td>
<td>service</td>
<td>no</td>
<td>Stand-By</td>
<td>LCD2 is blank</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>high</td>
<td>on</td>
<td>no</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
</tr>
</tbody>
</table>

**Note:** The customer has turned node1 off. So we will ignore it.

So we have switch_responds but not host_responds on node5.

Let's start looking by checking that the hatsd daemon is running on node5 as shown in Example 5-14.

**Example 5-14  Checking for the hatsd daemon**

[root]:sp5en0 > dsh -w node5 lssrc -s hats
node5: Subsystem Group PID Status
node5: hats hats 15772 active

[root]:sp5en0 > dsh -w node5 lssrc -ls hats
node5: Subsystem Group PID Status
node5: hats hats 15772 active

node5: SPether [ 0] 5 1 U 192.168.5.5 192.168.5.5
node5: SPether [ 0] en0 0x436342b1 0x436342b1
node5: SPswitch [ 1] 3 3 S 192.168.15.5 192.168.15.13
node5: SPswitch [ 1] css0 0x43632b76 0x43632b76

**Section 1**

**Note:** The customer has turned node1 off. So we will ignore it.

**Section 2**

**Note:** The customer has turned node1 off. So we will ignore it.

**Section 3**

Node5: Configuration Instance = 995987196
Node5: Default: HB Interval = 1 secs. Sensitivity = 4 missed beats
Node5: Control Workstation IP address = 192.168.5.150
Node5: Daemon employs no security
Node5: Data segment size: 6933 KB. Number of outstanding malloc: 265
Node5: User time 33 sec. System time 26 sec.
Node5: Number of page faults: 4. Process swapped out 0 times.
Section 1 shows how the problem is with the SPether heartbeat ring, node5 is in a singleton group.

Section 2 shows us that the SPswitch ring is operating normally. Remember node1 is turned off.

Section 3. Is the configuration instance correct? We'll check on the CWS as shown in Example 5-15.

Example 5-15 Checking the configuration instance

```
[root]:sp5en0 > lssrc -ls hats.sp5en0
Subsystem         Group            PID     Status
hats.sp5en0      hats             32722   active
Network Name   Indx Defd Mbrs St Adapter ID      Group ID
SPether        [ 0]    5    3  S 192.168.5.150   192.168.25.13
SPether        [ 0] en0          0x4361d7fb      0x43632bab
HB Interval = 1 secs. Sensitivity = 4 missed beats
2 locally connected Clients with PIDs:
haemd( 34602) hagsd( 32030)
Configuration Instance = 995987196
Default: HB Interval = 1 secs. Sensitivity = 4 missed beats
Control Workstation IP address = 192.168.5.150
Daemon employs no security
Data segment size: 8981 KB. Number of outstanding malloc: 196
User time 125 sec. System time 152 sec.
Number of page faults: 1089. Process swapped out 0 times.
Number of nodes up: 4. Number of nodes down: 1.
Nodes down : 1
```

Section 1 shows that the GL of the SPether ring is 192.168.25.13. We'll check the machines.lst as shown in Example 5-16 to confirm who this is and if this is the same file as on the other nodes. We will only look at the en0 section to save some space.

Section 2 tells us the same configuration instance is being used.

Example 5-16 Checking the machines.lst for en0

```
root]:sp5en0 > grep en0 /var/ha/run/hats.sp5en0/machines.lst
0 en0 192.168.5.150
  1 en0 192.168.5.1
  5 en0 192.168.5.5
  9 en0 192.168.5.9
13 en0 192.168.25.13
```
So node13 is the GL for the SPether ring. Talking with the customer, they have node9 as a boot install server for node13 so en0 is on a different network to the other nodes en0 interfaces. The host_responds has been working previously without a problem. Let's look at the hats log on node5 as shown in Example 5-17 to see what it thinks is happening.

Example 5-17  Checking the hats log on node5

```
[root]:sp5n05:/var/ha/log > ls -lrt hats*
-rwxr-xr-x   1 root     system      1942 Jul 24 13:45 hats.sp5en0.3
-rw-rw-rw-   1 root     system    306374 Jul 27 05:58 hats.24.134553.sp5en0.bak
-rw-rw-rw-   1 root     system      6418 Jul 27 17:08 hats.24.134553.sp5en0.en_US
-rw-rw-rw-   1 root     system  287166 Jul 27 17:08 hats.24.134553.sp5en0
-rw-rw-rw-   1 root     system      2857 Jul 28 17:14 hats.27.170854.sp5en0.en_US
-rw-rw-rw-   1 root     system  45380 Jul 28 17:14 hats.27.170854.sp5en0
```

Note: We only show some of the relevant hats log to save space.

```
[root]:sp5n05:/var/ha/log > view hats.27.170854.sp5en0
.

07/27 17:09:02:hatsd[0]: Received a PTC request from (192.168.25.13:0x4361d7cf) in group (192.168.25.13:0x4361d86c).
07/27 17:09:02:hatsd[1]: Node Connectivity Message stopped on adapter offset 1.
07/27 17:09:02:hatsd[0]: Received a COMMIT BROADCAST request from (192.168.25.13:0x4361d7cf) in group (192.168.25.13:0x4361d86c).
07/27 17:09:02:hatsd[0]: Other group:
  0 (192.168.5.5:0x4361d86b)  1 (192.168.5.9:0x4361a44b)
  2 (192.168.5.150:0x4361d7fb)  3 (192.168.25.13:0x4361d7cf)
07/27 17:09:02:hatsd[0]: Sending a COMMIT BROADCAST ACK response to (192.168.25.13:0x4361d7cf).
07/27 17:09:02:hatsd[0]: Received a COMMIT request from (192.168.25.13:0x4361d7cf) in group (192.168.25.13:0x4361d86c).
07/27 17:09:02:hatsd[0]: Stable Time = (996268142.605674) seconds.
07/27 17:09:02:hatsd[0]: Joining Adapters = 3: 8044
07/27 17:09:02:hatsd[0]: Stable Time = (996268142.605674) seconds.
07/27 17:09:02:hatsd[0]: Reached reachable nodes (1 hop) : 0 5-13(4)
07/27 17:09:02: - (0) - send_node_connectivity() CurAdap 0
07/27 17:09:02: - (1) - send_node_connectivity() CurAdap 1
07/27 17:09:02:hatsd[0]: Sending a COMMIT ACK response to (192.168.5.5:0x4361d86b).
07/27 17:09:02:hatsd[0]: Sending adapter [Hb_Join] notifications.
07/27 17:09:02:hatsd[0]: Sending adapter [Hb_New_Group] notifications.
```
So we see that node5 was indeed a member of the SPether ring. As we continue checking further down in the log file (almost 24 hours later) as shown in Example 5-18.

Example 5-18  Checking the log file 24 hours later

07/28 17:04:22:hatsd[0]: Missed Heartbeats = 1.
07/28 17:04:24:hatsd[0]: Missed Heartbeats = 2.
07/28 17:04:25:hatsd[0]: GROUP_PROCLAIM message from address 192.168.25.13
  (defined: 192.168.25.13) rejected: adapter still is in my group.
07/28 17:04:26:hatsd[0]: Missed Heartbeats = 3.
07/28 17:04:28:hatsd[0]: Missed Heartbeats = 4.
07/28 17:04:28:hatsd[0]: Adapter (192.168.5.9:0x4361a44b) is dead.
07/28 17:04:28:hatsd[0]: Notifying leader (192.168.25.13:0x4361d7cf) of death.
  FFDC id [---].
07/28 17:04:30:hatsd[0]: GROUP_PROCLAIM message from address 192.168.25.13
  (defined: 192.168.25.13) rejected: adapter still is in my group.
07/28 17:04:30:hatsd[0]: Missed Heartbeats = 5.
07/28 17:04:30:hatsd[0]: Notifying leader (192.168.25.13:0x4361d7cf) of death.
  FFDC id [---].
07/28 17:04:32:hatsd[0]: Missed Heartbeats = 6.
07/28 17:04:32:hatsd[0]: Netmon program returned. Local adapter is UP
07/28 17:04:32:hatsd[0]: Notifying leader (192.168.25.13:0x4361d7cf) of death.
  FFDC id [---].
07/28 17:04:34:hatsd[0]: Missed Heartbeats = 7.
07/28 17:04:34:hatsd[0]: Notifying leader (192.168.25.13:0x4361d7cf) of death.
  FFDC id [---].
07/28 17:04:35:hatsd[0]: GROUP_PROCLAIM message from address 192.168.25.13
  (defined: 192.168.25.13) rejected: adapter still is in my group.
07/28 17:04:36:hatsd[0]: Missed Heartbeats = 8.
07/28 17:04:36:hatsd[0]: Broadcasting DISSOLVE GROUP message to group.
07/28 17:04:36:hatsd[0]: Received a DISSOLVE_GROUP message from
  (192.168.5.9:0x4361d86b) in group (192.168.25.13:0x4361d86c).
07/28 17:04:36:hatsd[0]: DISSOLVE_GROUP message from a group member,
  Dissolving!!!
07/28 17:04:36:hatsd[0]: Received a BAD MESSAGE message from
  (192.168.5.9:0x4361a44b) in group (192.168.25.13:0x436328d4).
07/28 17:04:36: hatsd[0]: Received a BAD MESSAGE message from (192.168.5.150:0x4361d7fb) in group (192.168.25.13:0x436328d4).
07/28 17:04:36: hatsd[0]: Re-initializing..................
07/28 17:04:37: - (0) - init_group() node_idx = 0
07/28 17:04:37: hatsd[0]: Dead Adapters = 3: 8044
07/28 17:04:38: hatsd[0]: My New Group ID = (192.168.5.5:0x436328e5) and is Unstable.
    My Leader is (192.168.5.5:0x4361d86b).
    My Crown Prince is (192.168.5.5:0x4361d86b).
    My upstream neighbor is (192.168.5.5:0x4361d86b).
    My downstream neighbor is (192.168.5.5:0x4361d86b).
    I am (192.168.5.5:0x4361d86b).
07/28 17:04:38: hatsd[0]: Netmon program returned. Local adapter is UP
07/28 17:04:40: hatsd[0]: Received a Group Proclaim from (192.168.25.13:0x4361d7cf) in group (192.168.25.13:0x436328d4).
07/28 17:04:40: hatsd[0]: Sending JOIN request to (192.168.25.13:0x4361d7cf)[0:0:0:0:0] in group (192.168.25.13:0x436328d4).
07/28 17:04:50: check_state_3p hatsd[0]: 2523-097 JOIN time has expired. PROCLAIM message was sent by (192.168.25.13:0x4361d7cf).
07/28 17:04:50: hatsd[0]: Received a Group Proclaim from (192.168.25.13:0x4361d7cf) in group (192.168.25.13:0x436328d4).

Node5 is having problems communicating with other members of the SPether group, although it is receiving messages, so it dissolved the group, formed a singleton group, and attempted to rejoin unsuccessfully. Let's look at the error log on node5 as shown in Example 5-19.

Example 5-19 Checking the error log in node5

| LABEL:          | TS_NODEDOWN_EM          |
| IDENTIFIER:     | 4D9226A5                |
| Date/Time:      | Sat Jul 28 17:05:19     |
| Sequence Number:| 180                     |
| Machine Id:     | 00010023A400            |
| Node Id:        | sp5n05                  |
| Class:          | U                       |
| Type:           | PEND                    |
| Resource Name:  | hats.sp5en0             |
| Resource Class: | NONE                    |
| Resource Type:  | NONE                    |
| Location:       | NONE                    |
| VPD:            |                         |
| Description     | Remote nodes down       |

Chapter 5. RS/6000 Cluster Technology (RSCT) 217
Probable Causes
Remote nodes powered off
Remote nodes crashed
Networking problems render remote nodes unreachable
Remote nodes removed from configuration after refresh
Topology Services daemon on remote nodes stopped

User Causes
User powered off remote nodes
Remote nodes removed from configuration after refresh

Recommended Actions
Confirm that this is desirable

Failure Causes
Remote nodes crashed
Lost connection to remote nodes due to network problems
Remote nodes hang

Recommended Actions
Get system dump from remote nodes. Re-boot remote nodes
Clear networking problems
Re-start Topology Services daemon on remote node
Contact IBM Service if problem persists

Detail Data
DETECTING MODULE
rsct,connect.C,           1.56,1475
ERROR ID
.ZOWYB/DYmMv.9sf.3I.e.z...................
REFERENCE CODE
File containing down node numbers and associated REFERENCE CODE
/var/adm/ffdc/dumps/hats.15998.20010728.170519

**Attention:** The TS_NODEDOWN_EM entry is related to “node reachability” as opposed to “adapter membership group.” For example, if you have problems with the SP Ethernet but the SP switch is still working fine, then you will NOT get the TS_NODEDOWN_EM entry.

Looking at the Probable Causes section, we can eliminate the remote nodes being powered off or hung. Let’s check if we have a network problem. What network adapters do we have in node5? See Example 5-20.

**Example 5-20  Checking for network adapters**
Let's check the routes on node5.

Example 5-21 Checking node5 communication with node13

This does not succeed but does confirm that en1 is the path to communicate with node13. So we have a problem with en1 on node5 and need to have this fully diagnosed. While we are waiting for the H/W to be checked we can still alleviate the host_responds problem. We know the default route from node5 is through the CWS and that is a part of the SPether ring. Let's detach the en1 interface on node5.
Now we refresh the hatsd daemon on node5.

**Attention:** The `hatsctrl -r` command should never be issued on a node. It needs to be issued from the CWS. Also, the `hatsctrl -r` command only needs to be invoked when there is a change in the overall topology, such as:

- Adding or removing a node.
- Adding or removing an adapter.
- Changing the address of an adapter.

Adapters going up or down do not warrant calling `hatsctrl -r`.

```bash
[root]:sp5en0:/var/ha/log > /usr/sbin/rsct/bin/hatsctrl -r
0513-095 The request for subsystem refresh was completed successfully.
```

And we check the spmon -d on the CWS as shown in Example 5-22.

**Example 5-22  spmon -d on the CWS**

```bash
[root]:sp5en0 > spmon -d
```

5. Checking nodes

<table>
<thead>
<tr>
<th>Slot</th>
<th>Node Type</th>
<th>Power</th>
<th>Responds</th>
<th>Responds</th>
<th>Switch</th>
<th>Key</th>
<th>Env</th>
<th>Front Panel</th>
<th>LCD/LED</th>
<th>Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>off</td>
<td>no</td>
<td>notcfg</td>
<td>service</td>
<td>no</td>
<td>Stand-By</td>
<td>LCD2 is blank</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Host_responds is back because we are routing the SPether heartbeat traffic through the 192.168.5.xxx network. To configure host_responds, issue the command `netstat -rn`, as shown in Example 5-23.

**Example 5-23  Configuring the host_responds**

```bash
[root]:sp5n05:/var/ha/log > netstat -rn
```

<table>
<thead>
<tr>
<th>Destination</th>
<th>Gateway</th>
<th>Flags</th>
<th>Refs</th>
<th>Use</th>
<th>If</th>
<th>PMTU</th>
<th>Exp</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>192.168.5.150</td>
<td>UGc</td>
<td>0</td>
<td>0</td>
<td>en0</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Section 1 shows us network traffic for 192.168.25.13 will now use the gateway 192.168.5.9.

5.6.2 No host_responds (all nodes)

Action: Customer shuts down the SP cluster for software maintenance and rebooted.

Description: Customer calls saying they have lost host_responds on all nodes. See Example 5-24 to check for signs of host_responds in the SP cluster.

Example 5-24 Checking for host_responds on the SP cluster

Let's look at the lssrc -ls hats from one of the nodes, as shown in Example 5-25.

Example 5-25 Checking for hats on one of the nodes

Note: The customer has turned node1 off. So we'll ignore it.
We see two heartbeat rings have successfully been formed but node0 (CWS) is down. Let’s look at the `lssrc -ls hats.sp5en0` output on the CWS.

```
[root]:sp5en0 > lssrc -ls hats.sp5en0
0513-085 The hats.sp5en0 Subsystem is not on file.
```

Let's check what RSCT subsystems are running on the CWS as shown in Example 5-26.

**Example 5-26 Checking for other RSCT subsystems**

```
[root]:sp5en0 > lssrc -a|grep ha
hardmon                           28670   active
hags.sp5en0      hags             23172   active
hagsg1sm.sp5en0  hags             35376   active
haem.sp5en0      haem             27858   active
haemaixos.sp5en0 haem             30446   active
```

So only hats.sp5en0 appears to not be running. We have the customer run `/usr/lpp/ssp/bin/syspar_ctrl -D` on the nodes and the CWS to stop and remove the RSCT subsystems from the SRC, then run the command shown in Example 5-27 on the CWS to add and start the subsystems. We only show the errors produced in Example 5-27.

**Example 5-27 Starting the RSCT subsystems**

```
[root]:sp5en0 > syspar_ctrl -A
```
hatsctrl: 2523-638 Cannot set port number into /etc/services

syspar_ctrl: 0022-233 SP_NAME=sp5en0 /usr/sbin/rsct/bin/hatsctrl -a
   returned with a unsuccessful return code, rc = 1.

0513-085 The hats.sp5en0 Subsystem is not on file.

syspar_ctrl: 0022-233 SP_NAME=sp5en0 /usr/sbin/rsct/bin/hatsctrl -s
   returned with a unsuccessful return code, rc = 1.

syspar_ctrl: 0022-234 Add failed, calls to underlying control scripts returned
   with unsuccessful return codes.

So the problem appears to be adding the port number for the hatsd into
/etc/services file. Let's check that there is a port assigned in the SDR as shown in
Example 5-28.

Example 5-28   Checking for port assignment in the SDR

```
[root]:sp5en0 > SDRGetObjects Syspar_ports
subsystem    port
hats          10000
spdmd         10004
hags          10001
haem          10002
```

Example 5-28 looks good. Let's look at the /etc/services file. We only show the
lines we are interested in. See Example 5-29.

Example 5-29   /etc/services file contents simplified

```
wombat-monitor  10000/udp
hags.sp5en0     10001/udp
haem.sp5en0     10002/udp
haemd           10003/tcp
spdmd           10004/tcp
```

The subsystem wombat-monitor is using the udp port 10000 that was assigned
to the hats.sp5en0 subsystem. This was apparently added as a monitoring
program by the network administration people with a hard coded udp port
number in the application.

Let's stop and delete the RSCT subsystems again on the CWS (syspar_ctrl -D)
and clean out the SDR port number for the hats.sp5en0 and reassign another
port using the /usr/sbin/rsct/bin/hatsctrl script options. See Example 5-30.
Example 5-30  Working with the RSCT subsystems

[root]:sp5en0 > hatsctrl -u

[root]:sp5en0 > SDRGetObjects Syspar_ports
subsystem    port
spdmd             10004
hags              10001
haem              10002

[root]:sp5en0 > hatsctrl -a
0513-071 The hats.sp5en0 Subsystem has been added.

[root]:sp5en0 > SDRGetObjects Syspar_ports
subsystem    port
spdmd             10004
hags              10001
haem              10002
hats              10005

Now let's add and start the RSCT subsystems again, first on the CWS and then on the nodes, so the new SDR configuration will be picked up by all the nodes. Example 5-31 shows the SP cluster with host_responds. Node 1 has been off for this exercise.

Example 5-31  Checking for host_responds

[root]:sp5en0 > spmon -d.

----------------------------------- Frame 1 ----------------------------------
<table>
<thead>
<tr>
<th>Slot</th>
<th>Node</th>
<th>Type</th>
<th>Power</th>
<th>Responds</th>
<th>Responds</th>
<th>Switch</th>
<th>Key</th>
<th>Front Panel</th>
<th>LCD/LED</th>
<th>Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>off</td>
<td>no</td>
<td>notcfg</td>
<td>service</td>
<td>no</td>
<td>Stand-By</td>
<td>LCD2 is blank</td>
<td>no</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>LCDs are blank</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

5.6.3  Changing CWS hostname (spmon -d broken)

Action: A customer wants to change the CWS hostname, not the IP address.
Description: We followed the procedure found in Appendix F of the *Parallel System Support Programs for AIX: Administration Guide*, SA22-7348, but found that we could not connect to the frame. Refer to Example 5-32 for more details on the problem.

**Example 5-32  hostname change problem**

```
[root@cws5en0 : ] /usr/dt/bin > spmon -d
1. Checking server process
   Process 23632 has accumulated 0 minutes and 5 seconds.
   Check successful

2. Opening connection to server
   Connection opened
   Check successful

3. Querying frame(s)
   spmon: 0026-064 You do not have authorization to access the Hardware Monitor.
   spmon: 0026-059 Could not query frames.
```

**Note:** Are the RSCT subsystems (hats, hags) running?

```
[root@cws5en0 : ] /etc > lssrc -a | grep ha
   hardmon                           23632   active
```

**Note:** The RSCT subsystems are not running. Let's add and start them up.

```
[root@cws5en0 : ] /etc > syspar_ctrl -A
   The required function fails because SDR is not running correctly.
   syspar_ctrl: 0022-233 SP_NAME=cwsen0 /usr/sbin/rsct/bin/hatsctrl -a
   returned with a unsuccessful return code, rc = 1.
   hagsctrl: 2520-203 Cannot determine syspar name.
```

**Note:** Let's check the error log.

```
[root@cws5en0 : ] /usr/dt/bin > errpt -a
```

---

```
LABEL:          HR_MESSAGE_ER
IDENTIFIER:     DE79DE5B
Date/Time:       Fri Jul 13 15:02:46
Sequence Number: 7476
Machine Id:      000354794C00
Node Id:         sp5en0
Class:           S
```
Type: PERM
Resource Name: hr

Description
INTERNAL ERROR: ERROR STRING

Probable Causes
SOFTWARE PROGRAM

Failure Causes
SOFTWARE PROGRAM

Recommended Actions
- NO FURTHER ACTION REQUIRED UNLESS PROBLEM PERSISTS
- RESTART SOFTWARE SUBSYSTEM
- CONTACT YOUR LOCAL IBM SERVICE REPRESENTATIVE
- REFER TO PRODUCT DOCUMENTATION FOR ADDITIONAL INFORMATION

Detail Data
DETECTING MODULE
LPP=PSSP,Fn=hr.c,SID=1.11.1.25,L#=1524,
ERROR DATA
hrd: 2505-292 (cwsen0) Could not obtain authorization methods for trusted services. Do not use DCE.
2502-600 An error occurred getting a hostname.

Note: What is in the SDR?

Wrong syspar_name
[root@cws5en0]:/etc> SDRGetObjects Syspar syspar_name ip_address code_version
syspar_name  ip_address code_version
 cwsen0  192.168.5.150 PSSP-3.1.1

Note: What is written in the Syspar class of the SDR?

SDR has right syspar_name
[root@cws5en0]:/spdata/sys1/sdr/partitions/192.168.5.150/classes> cat Syspar
1=cws5en0 2=192.168.5.150 3=default
4=/spdata/sys1/syspar_configs/lnsb0isb/config.16/layout.1/syspar.1.5=PSSP-3.1.1
6=995062303,518021059,0 7=k4 8=k4:std 9=k4:std 10=compat
**Note:** The syspar_name value in the SDR is correct but the syspar_name shown in the SDRGetObjects is incorrect. It would seem a typographical error was made but then corrected to the SDR class without refreshing the SDR daemon.

**Solution:** Reset the SDR.

```
[root@cws5en0]:/etc> sdr reset
0513-044 The sdr.cws5en0 Subsystem was requested to stop.
0513-059 The sdr.cws5en0 Subsystem has been started. Subsystem PID is 5704.
```

**Note:** Check host_responds.

```
[root@cws5en0]:/etc> spmon -d
1. Checking server process
   Process 20648 has accumulated 0 minutes and 6 seconds.
   Check successful

2. Opening connection to server
   Connection opened
   Check successful

3. Querying frame(s)
   1 frame
   Check successful

4. Checking frames
   This step was skipped because the -G flag was omitted.

5. Checking nodes

   ----------------------------------- Frame 1 ----------------------------------
<table>
<thead>
<tr>
<th>Slot</th>
<th>Node Type</th>
<th>Power</th>
<th>Responds</th>
<th>Responds</th>
<th>Switch</th>
<th>LCD/LCD</th>
<th>Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no LCDs are blank</td>
<td>no</td>
</tr>
<tr>
<td>5</td>
<td>5 high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no LCDs are blank</td>
<td>no</td>
</tr>
<tr>
<td>9</td>
<td>9 high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no LCDs are blank</td>
<td>no</td>
</tr>
<tr>
<td>13</td>
<td>13 high</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no LCDs are blank</td>
<td>no</td>
</tr>
</tbody>
</table>

**Note:** Confirm by SDRGetObjects. All looks okay now.

```
[root@cws5en0]:/etc> SDRGetObjects host_responds
```
5.7 Security for RSCT

The RSCT components are a part of the SP Trusted Services and the authentication methods used depend on the attributes set in the Syspar class of the SDR (ts_auth_methods). RSCT is able to work with all of the security environments, DCE (Kerberos Version 5), Kerberos Version 4, and Standard AIX. Should you wish to run your system at the DCE (Kerberos Version 5) level, then all nodes within the partition need to be running PSSP 3.2. For a more detailed explanation of the security settings and their interdependencies, please refer to Chapter 4, “Security” on page 159.

Restricted root access (RRA) has some implications for EM and some of the clients that depend on the RSCT subsystems, these are mainly to do with `rcp` and `rsh`. As an example, the EMCDB is normally copied via `rcp` to the nodes, this must now be run as a `sysctl` command under the Kerberos principle SPbgAdm. For a fuller explanation please refer to Chapter 4, “Security” on page 159.

5.8 Information collection for support

Here is a list of tools utilized for information collection:

**phoenix.snap**

This is a service tool and not a PSSP command, therefore, there is no documentation in the PSSP Command Reference Guides. It is supplied as part of RSCT and is a information collection tool used to assist in the analysis of problems. It can be run on a node or on the CWS and must be run by the root user.

When run on a node it will only collect information about that node.

The output will be archived and compressed in the created directory, `/tmp/phoenix.snapOut`. Successful collection will show similar output to the following:

```
[0:root@sp3n14:/]home/root # /usr/sbin/rsct/bin/phoenix.snap
phoenix.snap version 1.7, args:
```
I am node 14 hostname sp3n14 running PSSP-3.2 and AIX 4.3.3.0

Determining if there is enough space in /tmp/phoenix.snapOut
compressed file will be about 919821 bytes
phoenix.snap requires about 5518928 bytes
Think we have enough space.

Send file /tmp/phoenix.snapOut/phoenix.snap.node14.07151429.out.tar.Z to
the RS6000/SP service team

When run without flags on the CWS, phoenix.snap will collect information from
the Topology Services Group Leader and the Group Services Nameserver,
storing the information on the CWS in the /tmp/phoenix.snapOut directory as an
archive file all.<timestamp>.tar containing the archived, compressed files from
the different nodes.

Other flags that can be used are:

- The -d flag directs the phoenix.snap output to another specified directory.
- The -p flag is used to specify a partition name, the default is ALL. Valid only
  on the CWS.
- The -x 1 flag can be used to determine if there is enough space in the default
directory.
- The -l hostlist | ALL flag can be used only on the CWS directing phoenix.snap
to gather information from the listed nodes. The parameter -l ALL would
gather information about all the nodes, this should not be used on large
systems unless space is not a problem.

Manual collection of data

Sometimes collecting data from all nodes in a large SP clustered environment
may not be practical. If it is not feasible, collect the following files or output:

- errpt -a > /tmp/error.log
- /usr/lpp/ssp/bin/lsauthpts -c
- /usr/lpp/ssp/bin/splstdata -p
- /usr/lpp/ssp/bin/splstdata -n
- lssrc -a

Topology Services

Collect data from at least the following nodes:
- The group leader (GL) on the all network rings. This is the node with the highest IP address in the ring. If you can identify that is is only one ring that is experiencing problems, then collect data only from that GL.
- The downstream neighbor of the node that has the problem. This is the node with the next lower IP address. The node with the lowest IP address has the GL as its downstream neighbor.
- The CWS and the node that has the problem.

- `lssrc -ls` command. On the nodes run `lsrc -ls hats`; on the CWS run `lsrc -ls hats.<syspar_name>`.
- The last ten files from `/var/ha/log` that are shown from `ls -lrt hats*`.
- SDRGetObjects SP cw_ipaddr
- SDRGetObjects TS_Config
- SDRGetObjects Adapter
- SDRRetrieveFile hats.machines.lst /tmp/machines.output
- SDRGetObjects host_responds
- netstat -r -n
- netstat -in
- netstat -m
- netstat -D

**Group Services**
Collect data from at least the following nodes:
- Node or nodes that have the problem.
- GS nameserver.
- CWS.

- On a node collect the `/usr/sbin/rsct/bin/nlssrc -c -ls hags` output.
- On the CWS collect the `/usr/sbin/rsct/bin/nlssrc -c -ls hags.<syspar_name>` output.
- The last ten files from `/var/ha/log` that are shown from `ls -lrt hags*`.
- SDRGetObjects GS_Config.

**Event Management**
Collect the following files or output from the failing nodes and the CWS:
- `/etc/hosts`
- `/etc/resolv.conf`
5.9 Useful references

The following manuals contain useful information for problem determination:

- http://www.rs6000.ibm.com/support/sp
- /usr/sbin/rsct/README/rsct.basic.README
- PSSP 3.2 Administration Guide, SA22-7348
- PSSP 3.2 Diagnosis Guide, GA22-7350

There are several manuals available that are detailed references to RS/6000 Cluster Technology (RSCT), such as:

- RSCT: Group Services Programming Guide and Reference, SA22-7355
- RSCT Group Services: Programming Cluster Applications, SG24-5523
- RS/6000 SP Cluster: The Path to Universal Clustering, SG24-5374
Chapter 6. SP switches

In this chapter, we provide a hardware and software overview and we try to guide you through possible switch problems. This chapter is not a complete description of how to install and work with the switch network, but at least we will show some ways of avoiding possible problems. We give you quick APAR overviews of common SP Switch/SP Switch2 related software problems. The following books are still the common entry points for fixing problems:

- PSSP Diagnosis Guide V3.2, GA22-7350
- PSSP Messages Reference V3.2, GA22-7352
- Understanding and using the SP Switch, SG24-5161
- RS/6000 SP System Service Guide, GA22-7442
- RS/6000 SP; SP Switch Service Guide, GA22-7443
- RS/6000 SP, SP Switch2 Service Guide, GA22-7444
- IBM 9077 SP Switch Router: Get Connected to the SP Switch, SG24-5157
- PSSP Version 3 Survival Guide, SG24-5344
In this section we tried to gather common problems to provide you with some direction when you have problems with your switch. See Table 6-1 for a quick start to solving switch problems.

Table 6-1   SP switches start table

<table>
<thead>
<tr>
<th>What are you looking for?</th>
<th>Where to go</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP Switch and SP Switch2 information</td>
<td>Go to “SP switches overview” on page 235</td>
</tr>
<tr>
<td>SDR related switch problems</td>
<td>Go to “SDR related switch problems” on page 250</td>
</tr>
<tr>
<td>Diagnostic tools and routines</td>
<td>Go to “Diagnostic tools and routines” on page 244</td>
</tr>
<tr>
<td>Switch problems fixed by PSSP APARs</td>
<td>Go to “Worm daemon problems - fixed by APARs” on page 258</td>
</tr>
<tr>
<td>Node Problems on the switch</td>
<td>Go to “Node problems on the switch” on page 252</td>
</tr>
<tr>
<td>SP Switch problems</td>
<td>Go to “SP Switch problems” on page 262</td>
</tr>
<tr>
<td>Multiple switches problems</td>
<td>Go to “Multiple switches problems” on page 265</td>
</tr>
<tr>
<td>SP Switch2 problems</td>
<td>Go to “SP Switch2 problems” on page 266</td>
</tr>
<tr>
<td>9077 GRF problems</td>
<td>Go to “9077 GRF overview and problems” on page 267</td>
</tr>
</tbody>
</table>

Several of the following sections have tables that illustrate common SP Switch related problems that are fixed by PSSP APARs. You will find the description of the failure, temporary fix, if available, and the APAR number. The fixes apply to PSSP 3.1.1 and 3.2. Older PSSP levels are not covered, but using the latest PTFs for PSSP will minimize the possibility of those software related errors. See also Appendix C, “Software maintenance strategy” on page 285.
6.1 SP switches overview

There are now two kinds of switches available for the current SP systems and SP-attached servers. The SP Switch (SPS) provides connectivity to withdrawn Microchannel Nodes and current PCI Nodes. This also includes the SP-attached servers (7017 S7A, S80, S85 and p680). The SP Switch2 provides higher performance, but is only available for PCI High Nodes. With the SP Switch2, we have better diagnostic capabilities and improved system reliability, availability and serviceability (RAS).

Restriction: SP Switch2 is not compatible with the SP Switch or the older HiPS (High Performance Switch). They cannot coexist in the same SP System.

6.1.1 SP Switch and SP Switch2 boards

Regardless if the switch board is a SP Switch or SP Switch2, it has components like the switch chips, supervisor card, power supplies, and cooling fans. There are several other hardware components used to make the switch board work, but, from the outside, it looks just like a black box with a power switch on the front and 32 connectors on the rear.

Sixteen ports are used for switch to node connections and 16 ports are used for switch-to-switch connections. The SP Switch, see Figure 6-1 on page 236, has specially assigned switch-to-node ports and switch-to-switch ports. You have to put Node1 (N1) to port J7. There is also an eight-port switch available for connectivity of eight nodes maximum.

The SP Switch2 gives us the possibility to plug nodes into any available node port on the switch and switches to any available switch-to-switch port. This gives us one more advantage; we can avoid possible misplugging while connecting the nodes.
The heart of each switch board is the switch chip. There are eight switch chips on each board, and they have eight connectors each for sending and receiving data simultaneously. Each switch chip is interconnected with other chips through bi-directional redundant paths. Four chips are used for node communication and four chips are used for communication to switches in other frames. With the SP Switch2, we have no more master clocking, like we had on HiPS and the SP Switch. The SP Switch2 is designed to have multiple clock sources in the system. Instead of having a clock selection logic, the SP Switch2 has a separate oscillator for each switch chip.

**Important:** The SP Switch has a fixed Switch Node number to frame/slot combination. Also, the switch to switch connections have fixed ports. SP Switch2 does not have a fixed combination. You can connect any node to any switch port on an SP Switch2. Even if the node does not change its physical location, it can be connected to a different switch chip and port.
See Example 6-1 for the `splstdata -s` output for a SP Switch2 system; it shows that there is no clock input used for the SP Switch2.

**Example 6-1  SP Switch2 splstdata -s output (cutout)**

```
switch# frame# slot# switch_partition# switch_type clock_input switch_name swi
------- ------ ----- ----------------- ----------- ----------- ------------ ---
1      1    17                 1         132 0 SP_Switch2 0
2     10     2                 1         132 0 SP_Switch2 0
3     10     4                 1         132 0 SP_Switch2 0
```

-> see here ^ all clock inputs are 0

**Note:** On an SP Switch, you need a Switch configured as the master clock. That does not apply to an SP Switch2, where multiple clock sources are used. This could be a possible reason for error when using a SP Switch and the clock setting is not configured properly.

There is another enhancement on the SP Switch2. The JTAG interface is added to provide several supervisor function enhancements. The supervisor can use this interface now to write initialization data to the switch chips and read error information back from the switch chips.

**Tip:** To avoid problems with the switch board, ensure the following:

- If you have multiple SP Switches connected together check for a valid clock setting (not needed for SP Switch2).
- For SP Switches ensure that all cable connections are following the cabling rules. (see *SP Installation and relocation Guide*, GA22-7441).

### 6.1.2 SP Switch and SP Switch2 Adapters

For the current PSSP 3.2 Level we have SP Switch and SP Switch2 adapters available. There is no more HiPS support. Figure 6-2 on page 238 shows you the history and the future of Switch adapters.
Here is an overview of the current available adapters:

- **SP Switch Adapter (F/C 4020)**
  This adapter is used for the MCA nodes.

- **SP Switch MX Adapter (F/C 4022)**
  This adapter is used for 332 MHz PCI nodes.

- **SP Switch MX2 Adapter (F/C 4023)**
  This adapter is used for POWER3 SMP PCI Nodes and requires AIX V4.3.2 with APAR IX85409 or later with PSSP V3.1 (select F/C 9431).

- **SP Switch Router Adapter (F/C 4021)**
  This adapter is used for the 9077 SP Switch Router.
• IBM RS/6000 SP System Attachment Adapter (F/C 8396)

This adapter is used to connect a 7017-S70, S7A, S80, S85. This adapter must be installed in slot #10 of the primary I/O drawer and slots #9 and #11 must remain empty. The adapter is also used for 7026 Models H80, M80, 6H0, 6H1.

**Note:** SP Switch Adapter (FC 4020), SP Switch MX Adapter (FC 4022) and SP Switch MX2 Adapter can co-exist in an SP configuration. Applications will run faster with only SP Switch MX2 adapters in an SP system than with mixed SP Switch MX and MX2 Adapters.

The new SP Switch2 needs the following Adapter for the POWER3 High Node:

• SP Switch2 Adapter (F/C 4025)

This feature needs an SP Switch2 Interposer (F/C 4032).

In every SP node there is a SP Switch or SP Switch2 Adapter. The data sent from another node connected to the switch board goes through the switch chips, through the cable to the switch adapter, where the node can use the data. Figure 6-3 illustrates an overview of the logical structure of a SP Switch adapter card.

![Figure 6-3  Overview of logical structure of an SP Switch adapter](image)

On an SP Node, the data will be sent and received through memory areas called *windows*. When user space protocol is used for the data transfer, the application puts the data in windows. The SP Switch2 there also provides user space super packets. To achieve the full bandwidth of the SP Switch2, Super Packets are
needed for sending large datagrams into the switch network. The data will be collected by the switch adapter microcode from the windows using the DMA engine of the adapter. After that another DMA engine on the adapter moves data to and from the switch chip.

The route tables are stored in the SRAM of the adapter. Responsible for the correct routing information for outgoing and incoming data packets is the microcode. This is the same for both SP Switch and SP Switch2. Based on the information provided by the primary node the fault service daemon creates the routing tables and updates it continuously for the adapter.

For more detailed information please refer to one or both of the following books: *Understanding and Using the SP Switch*, SG24-5161 and *RS/6000 SP Systems Handbook*, SG24-5596-01.

### 6.1.3 SP switches initialization

We are now talking about the switch initialization. Generally for both current Switch Types the initialization can be divided into three sections:

1. The switch adapter gets configured in the nodes.
2. The fault service daemon starts up on the nodes.
3. The `Estart` command is issued on the Control Workstation (CWS) or the switch admin daemon starts the switch automatically.

We want to give you a short overview of the things that are happening during initialization. During the boot phase, the cgfmg is performing several actions. First of all, the css0 device is defined in the ODM CuDv class. The adapter's location itself is then verified and /dev/css0 is created in the /dev directory. When this is done, the device driver (cssdd3) is loaded, as well as the adapter dependent microcode. Assuming that everything is finer, the adapter device becomes the available state in the ODM CuDv class.

Finally, the adapter runs the Power on self test (POST) and, when everything is successful, the ODM CuAt class will be updated with the adapter status css_ready, as shown in Example 6-2 on page 241.

The fault service daemon, better known as the WORM, will then be started by the `rc.switch` script executed in the initiat file.

**Note:** Before you start the switch, the host responds must be yes. Check this with the `spmon -d` command.
Example 6-2  Adapter status

```
[root@sp6en0] / SDRGetObjects switch_responds
node_number switch_responds autojoin isolated adapter_config_status sw
    1            1            1            0 css_ready    ""           ""
    3            1            1            0 css_ready    ""           ""
```

The fault service daemon takes care of several actions:

- Breadth first search: Explore the network, initialize it, find and report cable miswires.
- Generate routes and enable error reporting back to the Primary node.
- Send topology file only to nodes that need it (primary backup for example).
- Send database updates to all nodes.
- Send the KLOAD_ROUTE command to all nodes. The nodes will calculate routes and download the route tables to the adapters.

Since PSSP 3.1, there is a switch admin daemon called cssadm. This daemon monitors the nodes and switch adapter events and responds with an automatic \texttt{Estart}, if required.

6.1.4 How and when the switch initialization is invoked

The following scenarios provide information on when and how the switch initialization is invoked:

- Whenever an \texttt{Estart} command is issued.
- When \texttt{Eunfence} or \texttt{Efence} command fail with certain errors.
- When a switch scan fails.
- When the primary backup node takes over as primary node.

For more details about the switch and its initialization, please refer to one of the following publications: \textit{PSSP 3 Survival Guide}, SG24-5344 or the \textit{PSSP Diagnosis Guide}, GA22-7350.
6.2 SP switches diagnostics

We have two areas to diagnose for problems in the SP Switch and the SP Switch2: Software and hardware. Problems with the software and hardware prerequisites may manifest themselves as errors in the SP switches. You must consider both components as possible sources of errors. The following list describes the SP Switch and the SP Switch2 software and hardware prerequisites:

1. System Data Repository (SDR) component of PSSP, running on the control workstation.
2. Ethernet component of AIX: For SP Switch2 operation, there must be at least one connection between the control workstation and the primary node. SP Switch2 Time-Of-Day (TOD) recovery depends on an ethernet connection to all the nodes.
3. Group services hags and Topology services hats components of PSSP
4. SP system security services. Principal and group names for DCE entities use the default SP chosen names. These may not be the actual names on the system if you have overridden them using the spsec_overrides file.
5. SP Switch and SP Switch2 hardware monitor and control: hardmon component of PSSP.
6. Switch Fault Service: The Fault Service daemon (FSD) component of the SP Switch2 has to be operating on each node that is on the SP Switch2. When the daemon dies, the protocols (such as IP) are closed on this node. This is different than operation of the SP Switch. For the SP Switch, when the FSD dies, the protocols continue, only SP Switch recovery is not available.
7. Switch time of day (TOD): initiated and recovered by the emasterd daemon component of SP Switch2 software. This daemon runs on the control workstation and is responsible for selecting a suitable Master Switch Sequencer Node that maintain the switch TOD. When the daemon dies the switch TOD dies.

SP Switches themselves have internal subsystem components that are used for diagnostics. See Table 6-2 on page 242. For a detailed description, please refer to PSSP Diagnosis Guide V3.2, GA22-7350.

Table 6-2  Software subsystems differences between SP switches

<table>
<thead>
<tr>
<th>Subsystem components</th>
<th>SP Switch</th>
<th>SP Switch2</th>
</tr>
</thead>
<tbody>
<tr>
<td>worm</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ecommands</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>css</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
The SP Switch log and temporary files are located in the /var/adm/SPlogs/css directory. The SP Switch2 log and temporary files are organized in a directory hierarchy. Next to each directory the specified file level is given.

See Table 6-3 for the file hierarchy.

**Table 6-3  SP Switch2 log and temporary file hierarchy**

<table>
<thead>
<tr>
<th>Directory</th>
<th>File level</th>
</tr>
</thead>
<tbody>
<tr>
<td>/var/adm/SPlogs/css</td>
<td>node</td>
</tr>
<tr>
<td>/var/adm/SPlogs/css0</td>
<td>adapter</td>
</tr>
<tr>
<td>/var/adm/SPlogs/css0/p0</td>
<td>port</td>
</tr>
</tbody>
</table>

**Note:**
- css - for global node level log files
- css0 - for adapter level log files (the 0 ins css0 is the adapter ID)
- css0/p0 - for port level log files (the 0 in p0 is the port number within the adapter)

First of all, view the AIX errorlog for isolating SP Switch/SP Switch2 or adapter errors. For switch related problems, login to the primary node. The `primary` command lists the primary node by node number. In cases where the primary node failed, there will be no primary. In this case, login to the node listed under oncoming primary. In cases where the SP Switch/SP Switch2 continued working, it may have replaced the primary node several times. If you cannot locate the primary node using the `primary` command, you can locate the primary node by looking inside the log files.
6.2.1 Diagnostic tools and routines

To diagnose problems on the switch or switch network we have some very useful
tools available. Please refer to PSSP: Command and Technical Reference,
SA22-7351 and PSSP Diagnosis Guide V3.2, GA22-7350 for more information.

Note: DO NOT run the commands/procedures on operational nodes

Adapter Error Log Analyzer (ELA)

When you suspect that the SP Switch or SP Switch2 adapter is not functioning
properly, you can run the extended diagnostics. Adapter ELA is invoked on
switch nodes to diagnose problems that occurred on the node. The command to
run the adapter ELA directly is: `diag -d css0 -A` (Advanced diagnostics) or `diag
-d css0 -d` (automatic POST tests).

CSS_test

This command verifies that the installation and configuration of the
communications subsystem of the SP system completed successfully. It also
makes an IP test for all nodes. A return code of 0 shows that the test completed
without errors, 1 indicates a error occurred. In the /var/adm/SPlogs directory you
will find the log file called CSS_log. See Example 6-3 for an example of this
command.

Example 6-3  CSS_test output with some failing nodes

```bash
[0:root@sp3n14:/]# CSS_test

CSS_test: CSS Installation Verification Test started on
-------------------------------------------------------------------------------
CSS_test: Beginning Ethernet IP test of the nodes in partition sp3en0.
CSS_test: Following failed Ethernet IP test - deleting from subsequent tests:
sp3n13
-------------------------------------------------------------------------------
CSS_test: Show LPP ssp.basic installation levels:  (lslpp -Lq ssp.basic)

<table>
<thead>
<tr>
<th>-Node-</th>
<th>-LPP Name-</th>
<th>-Installation Level-</th>
</tr>
</thead>
<tbody>
<tr>
<td>sp3n01:</td>
<td>ssp.basic</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>sp3n05:</td>
<td>ssp.basic</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>sp3n06:</td>
<td>ssp.basic</td>
<td>3.2.0.11</td>
</tr>
<tr>
<td>sp3n07:</td>
<td>ssp.basic</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>sp3n08:</td>
<td>ssp.basic</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>sp3n09:</td>
<td>ssp.basic</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>sp3n10:</td>
<td>rshd: 0826-826 The host name for your address is not known.</td>
<td></td>
</tr>
</tbody>
</table>
```

Note: DO NOT run the commands/procedures on operational nodes
sp3n10: rshd: 0826-826 The host name for your address is not known.
sp3n11: ssp.basic 3.2.0.7
sp3n12: ssp.basic 3.2.0.11
sp3n14: ssp.basic 3.2.0.7
sp3n15: ssp.basic 3.2.0.7
sp3n14: ssp.basic 3.2.0.7

CSS_test: Show LPP ssp.css installation levels: (lslpp -Lq ssp.css)

-Node- -LPP Name- -Installation Level-
sp3n01: ssp.css 3.2.0.6
sp3n05: ssp.css 3.2.0.6
sp3n06: ssp.css 3.2.0.11
sp3n07: ssp.css 3.2.0.6
sp3n08: ssp.css 3.2.0.6
sp3n09: ssp.css 3.2.0.6

sp3n10: rshd: 0826-826 The host name for your address is not known.

sp3n11: ssp.css 3.2.0.6
sp3n12: ssp.css 3.2.0.11
sp3n14: ssp.css 3.2.0.6
sp3n15: ssp.css 3.2.0.6

CSS_test: Show inconsistent ssp.css files for relevant nodes: (lppchk)

-Node- -File Name- -Actual Size- -Expected Size-

CSS_test: Beginning Switch IP test of the nodes in partition sp3en0.

CSS_test: Following nodes failed Switch IP test:
sp3sw01 (192.168.13.1)
sp3sw06 (192.168.13.6)
sp3sw07 (192.168.13.7)
sp3sw10 (192.168.13.10)
sp3sw14 (192.168.13.14) <-this node is fenced


mult_senders_test

This command stresses the communication over the switch in order to detect the node that is injecting damaged packets in the network. It is located in the /usr/lpp/ssp/bin/spd directory.
The `mult_senders_test` command is useful when diagnosing intermittent communication problems. You can specify the senders and receiver nodes, but neither the primary nor the secondary can be used as senders or receivers. You must have four or more nodes to run this test.

**switch_stress**

This command runs stress tests on a single switch chip. It determines if the chip fails under stress conditions. This command sends and receives data across the chip, but the primary and the secondary nodes do not participate in the test. You must have four or more nodes to run this test. Example 6-4 shows the `switch_stress` command. It is located in the `/usr/lpp/ssp/bin/spd` directory.

**Attention:** This command causes heavy load and possible performance degradation when used. These nodes cannot run parallel applications during this test. Please refer to *PSSP: Command and Technical Reference*, SA22-7351 for more information.

**Example 6-4 switch_stress command**

```
sp3en0 > switch_stress -s 13
Test initialization might take several minutes. Please wait...
Switch Chip Stress Test is about to start. Please wait...
```

```
Time      Node  Pers.    Messages
-----------------------------------------
08:58:54      5    P    2548-421 Loading the scst_test library
08:58:54      5    P    2548-451 Starting SP Switch Diagnostic Framework.
08:58:54      5    P    2548-250 Port#0 of the switch chip is disabled; will not be tested
08:58:54      5    P    2548-250 Port#1 of the switch chip is disabled; will not be tested
08:58:54      5    P    2548-250 Port#2 of the switch chip is disabled; will not be tested
08:58:54      5    P    2548-250 Port#3 of the switch chip is disabled; will not be tested
08:58:54      5    P    SCST is going to test switch chip#13
08:58:54      5    P    2548-452 New model was initialized successfully. modelID = 1.
08:58:54      5    P    Start iteration# 1 for ports 4, 5
sp3en0 > 08:58:54      5    P    Assistant node device ids are: 14, 6
```
Chapter 6. SP switches

08:58:55    6    S    2548-421 Loading the scst_test library
08:58:55    14   S    2548-421 Loading the scst_test library
08:58:55    6    S    2548-451 Starting SP Switch Diagnostic Framework.
08:58:55    14   S    2548-451 Starting SP Switch Diagnostic Framework.
08:59:45    5    P    2548-274 Iteration <4,5>: HAL packets: sent 1661410,
lost 9363. Switch chip failure count:   0
08:59:46    5    P    Start iteration# 2 for ports 4, 6
08:59:47    5    P    Assistant node device ids are: 14, 7
08:59:47    7    S    2548-421 Loading the scst_test library
08:59:47    7    S    2548-451 Starting SP Switch Diagnostic Framework.
09:00:46    5    P    2548-274 Iteration <4,6>: HAL packets: sent 1661410,
lost 3294. Switch chip failure count:   0
09:00:47    5    P    Start iteration# 3 for ports 4, 7
09:00:47    5    P    Assistant node device ids are: 14, 12
09:00:47    12   S    2548-421 Loading the scst_test library
09:00:47    12   S    2548-451 Starting SP Switch Diagnostic Framework.
09:01:37    5    P    2548-274 Iteration <4,7>: HAL packets: sent 1661410,
lost 1289. Switch chip failure count:   0
09:01:38    5    P    Start iteration# 4 for ports 5, 6
09:01:38    5    P    Assistant node device ids are: 6, 7
09:02:25    5    P    2548-274 Iteration <5,6>: HAL packets: sent 1661410,
lost 6268. Switch chip failure count:   0
09:02:26    5    P    Start iteration# 5 for ports 5, 7
09:02:26    5    P    Assistant node device ids are: 6, 12
09:03:13    5    P    2548-274 Iteration <5,7>: HAL packets: sent 1661410,
lost 5905. Switch chip failure count:   0
09:03:14    5    P    Start iteration# 6 for ports 6, 7
09:03:14    5    P    Assistant node device ids are: 7, 12
09:04:02    5    P    2548-274 Iteration <6,7>: HAL packets: sent 1661410,
lost 10024. Switch chip failure count:   0
09:04:03    5    P    The model has finished
09:04:03    5    P    2548-272 Model results summary: switch chip errors: 0
on the tested chip, 0 total
09:04:03    6    S    2548-455 Going to terminate SP Switch Diagnostic
Framework.
09:04:03    14   S    2548-455 Going to terminate SP Switch Diagnostic
Framework.
09:04:03    7    S    2548-455 Going to terminate SP Switch Diagnostic
Framework.
09:04:03    12   S    2548-455 Going to terminate SP Switch Diagnostic
Framework.
09:04:03    5    P    2548-273 Model results summary: HAL packets: sent
9968460, lost 36143
09:04:03    5    P    2548-274 Iteration <4,5>: HAL packets: sent 1661410,
lost 9363. Switch chip failure count:   0
09:04:03    5    P    2548-274 Iteration <4,6>: HAL packets: sent 1661410,
lost 3294. Switch chip failure count:   0
09:04:03    5    P    2548-274 Iteration <4,7>: HAL packets: sent 1661410,
lost 1289. Switch chip failure count:   0
wrap_test
This command tests the physical link between the ports of the switch. It is located in the /usr/lpp/ssp/bin/spd directory. To run this command, the node must be fenced. It opens a Java console that guides you through the test. It is necessary to have two wrap plugs to test both the port and the cable. If you need the wrap plugs, please contact your IBM Hardware Support Center.

SP Switch External Clock Diagnostics
To verify if an external clock is operational on a node, we have a command called read_tbic. This command is located in the /usr/lpp/ssp/css/diags directory. Verify the operation of the external clock with the following steps:

1. Login to the suspected node as root.
2. Issue the following command as Example 6-5.

Example 6-5 External clock diagnostics

```
[0:root@sp3n14:/]# /usr/lpp/ssp/css/diags/read_tbic -s
TBIC status register : 12000000
```

3. Look at bits 3 and 4 (bits are numbered from left to right, starting with 0). Here the status register shows 12XXXXXX.

<table>
<thead>
<tr>
<th>bits</th>
<th>01234567</th>
</tr>
</thead>
<tbody>
<tr>
<td>status</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>00010010</td>
</tr>
</tbody>
</table>

4. In this case, either bits 3 or 4 are OFF (equals zero). This means the external clock is not operational at this node (the node was fenced).

5. A running node will show a Trail Blazer Interface Chip (TBIC) status register like 78XXXXXX.

<table>
<thead>
<tr>
<th>bits</th>
<th>01234567</th>
</tr>
</thead>
<tbody>
<tr>
<td>status</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>01110000</td>
</tr>
</tbody>
</table>
6. In this case, both bits 3 and 4 are ON (equal to one), the external clock is operational on the node.

**css_cdn script - stopping the worm**

This is a short and very useful script to kill the fault service daemon (FSD or WORM) without checking for the process ID. The script is very useful for terminating the worm daemon. This command is undocumented, but the mechanism works because the script looks for the process ID of the WORM and terminates this process. The script takes about eight seconds to complete, then the command prompt comes back. The script is located here:

```
/usr/lpp/ssp/css/css_cdn
```

You will get no message when the command is executed on the desired node. See Example 6-6 on page 249.

**Example 6-6  The use of css_cdn on simply one node**

```
0:root@sp3n09:/]#/usr/lpp/ssp/css # ps -ef |grep fault
  root  35094   4942   1 16:55:41 pts/0  0:00 grep fault
  root  36368      1   0 16:55:35      -  0:00
/usr/lpp/ssp/css/fault_service_Worm_RTG_SP -r 8 -b 1 -s 4 -p 3 -a TB3 -t 28
0:root@sp3n09:/]#/usr/lpp/ssp/css # /usr/lpp/ssp/css/css_cdn
0:root@sp3n09:/]#/usr/lpp/ssp/css # ps -ef |grep fault
  root  14876   4942   1 16:56:02 pts/0  0:00 grep fault
0:root@sp3n09:/]#/usr/lpp/ssp/css #
```

---

### 6.3 Switch problems – what can happen

Basically all problems occurring on an SP system with an SP Switch or SP Switch2 should be handled in the [SP Switch Service Guide](#), GA22-7443, [SP Switch2 Service Guide](#), GA22-7444, and the [Parallel System Support Program for AIX: Diagnosis Guide](#), GA22-7350. Further problem determination may require you to contact your local IBM support team.

**Attention:** Use SDRArchive before performing ANY SDR changes do an SDRArchive.

There are several problems that look strange and are not easy to debug. Hardware related switch problems are caused by improper seated cables or even defective adapters. SP Switch board defects are rather rare. Many of the problems that are not so easy to fix are very often fixed by APARs or complete
PSSP PTF sets; see Appendix C, “Software maintenance strategy” on page 285 for more details. However, some of the software related problems occur pretty often, and we try to gather some of the solutions for easier and faster problem determination in this chapter.

6.4 SDR related switch problems

This part of the chapter will show some case studies and possible SDR related problems that can cause switch problems.

SDR modified due to wrong command usage

It is possible that a PSSP command was not used correctly or that even the SDR gets a problem without even using a specific modification to the system. Some of these problems can cause strange behaviors on an SP System with an SP Switch or SP Switch2. We try to gather some of these common problems to give you a fast way to solve the problem.

All node_number entries in switch_responds are the same

Let's assume that a customer was trying to change the isolated flag in the switch_responds class from 1 to 0 for a particular node because there was already a SDR mismatch. The right command usage would be

```
SDRChangeAttrValues switch_responds node_number==1 isolated=1
```

However, a moment without full concentration can cause something like this:

```
SDRChangeAttrValues switch_responds node_number=1 isolated=1
```

Using the = instead of the appropriate == can cause severe problems. Using one equal sign will affect ALL nodes, not just the desired node_number 1. Example 6-7 shows an operational switch respond output before we entered the incorrect SDRChangeAttrValues command.

**Example 6-7 SDRGetObjects switch_responds**

<table>
<thead>
<tr>
<th>node_number</th>
<th>switch_responds</th>
<th>autojoin</th>
<th>isolated</th>
<th>adapter_config_status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1 css_ready</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0 css_ready</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0 css_ready</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>0 css_ready</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
<td>0 css_ready</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>

Now the wrong usage of the SDRChangeAttrValues command would cause the output shown in Figure 6-8 on page 251.
Example 6-8  All node_number entries are the same now

<table>
<thead>
<tr>
<th>node_number</th>
<th>switch_responds</th>
<th>autojoin</th>
<th>isolated</th>
<th>adapter_config_status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>css_ready</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>css_ready</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>css_ready</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>css_ready</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>css_ready</td>
</tr>
</tbody>
</table>

The good thing is that the switch network itself is still working. In our example, aping will work successfully, but a `spmon -d` will show a positive switch_responds only for node1.

How to fix this SDR mismatch

Assuming that a recent SDRArchive was made of the SDR, it would be no big deal to make this problem disappear. From the archive you can extract just the class file switch_responds, as shown in Figure 6-9 on page 251.

**Note:** You must know the partition’s name.

Example 6-9  Extract the switch_responds class from archive

```bash
tar -xvf backup.01193.1453.SDR_config
/spdata/sys1/sdr/partition/192.168.3.130/switch_responds
and the file switch_responds will look good again:

```
"""# /spdata/sys1/sdr/partitions/192.168.3.130/classes # pg switch_responds
1=1 2=0 3=1 4=1 5=css_ready
1=5 2=1 3=1 4=0 5=css_ready
1=6 2=1 3=1 4=0 5=css_ready
1=7 2=1 3=1 4=0 5=css_ready
1=8 2=1 3=1 4=0 5=css_ready
```

Now that the file switch_responds is in the right place, we need to stop the sdr daemon now to make this change valid. Otherwise, an `Estart` would cause the same error to occur again. Use the following steps to start and stop the DRD daemon:

1. Stop the SDR daemon by issuing the `stopsrc -g sdr` command.
2. Verify that the switch_responds is working properly.
3. Start the SDR daemon by issuing the `startsrc -g sdr` command.

The `SDRGetObjects switch_responds` will look similar to Example 6-7 on page 250.
The following is a useful list, with the steps required to fix an SDR switch related problem:

- Do a SDRArchive (as often as possible).
- Replace the corrupted/defective switch_responds file from the SDRArchive.
- If no archive was done the file switch_responds can be modified by hand (it is fine on small systems but intensive on big systems).
- Stop the sdr subsystem with `stopsrc -g sdr`.
- Start the sdr subsystem with `startsrc -g sdr`.

### 6.5 Node problems on the switch

In some cases, only one node is affected with switch problems and some of the problems are not easy to find in the regular PSSP Diagnosis guide.

**Single node not on the switch – WORM is dead**

In some cases, only one node is affected with switch problems and some of the problems are not easy to find in the regular PSSP Diagnosis guide.

<table>
<thead>
<tr>
<th>Slot</th>
<th>Node Type</th>
<th>Power</th>
<th>Host Switch</th>
<th>Key</th>
<th>Envelope</th>
<th>Front Panel</th>
<th>LCD/LED</th>
<th>Flashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>high</td>
<td>on</td>
<td>yes</td>
<td>autojn</td>
<td>normal</td>
<td>no</td>
<td>no</td>
<td>LCDs are blank</td>
</tr>
<tr>
<td>5</td>
<td>thin</td>
<td>on</td>
<td>yes</td>
<td>yes</td>
<td>normal</td>
<td>no</td>
<td>no</td>
<td>LEDs are blank</td>
</tr>
</tbody>
</table>

**Tip:** There are some reasons why the switch adapter may not be css_ready or the fault service daemon (WORM) won't start.

- /dev/css0 is corrupted
- /var file system is full
- Cable connection from the switch adapter to the switch board is bad
- Adapter POST has failed - see adapter status diag_fail

You noticed that a node is no longer communication over the switch network. So `spmon -d` was executed to verify the switch responds. See Example 6-10 on page 252.

Example 6-10  `spmon shows switch responds autojoin`

...
We found that node 1 has autojoin for its switch responds. We are now able to see also the changed status in the out.top file that is located on the primary node and the switch responds output provided from the SDRGetObjects switch_responds command. See Example 6-11, “out.top and SDRGetObjects output” on page 253.

Example 6-11  out.top and SDRGetObjects output

... format 1 16 18
# Node connections in frame L01 to switch 1 in L01
s 15 3  tb3 0 0 E01-S17-BH-J7 to E01-N1 -4 R: device has been rem
s 15 2  tb3 1 0 E01-S17-BH-J8 to Exx-Nxx -4 R: device has been rem
s 16 0  tb3 2 0 E01-S17-BH-J26 to Exx-Nxx -4 R: device has been re
s 16 1  tb3 3 0 E01-S17-BH-J25 to Exx-Nxx -4 R: device has been re
...

now look at SDRGetObjects

[2:root@sp3en0:]/home/root # SDRGetObjects switch_responds
node_number  switch_responds autojoin isolated adapter_config_status sw
1            0            1            1 css_ready    ""           
5            1            1            0 css_ready    ""           
6            1            1            0 css_ready    ""           
7            1            1            0 css_ready    ""           
8            1            1            0 css_ready    ""           
9            1            1            0 css_ready    ""           
10           1            1            0 css_ready    ""           
11           1            1            0 css_ready    ""           
12           1            1            0 css_ready    ""           
13           1            1            0 css_ready    ""           
14           1            1            0 css_ready    ""           
15           1            1            0 css_ready    ""           

We also find errorlog entries on the failing node. The errorlog shows a Switch Fault Service Daemon Terminated. See Example 6-12, “errorlog output” on page 253.

Example 6-12  errorlog output

[tty0:root@sp3en0:]/home/root # errpt | pg
IDENTIFIER TIMESTAMP  T C RESOURCE_NAME  DESCRIPTION
BEE2FB4A   0711133901 U U hats.sp3en0    Contact with a neighboring adapter losr
E8817142   0711133901 P S Worm            Switch Fault Service Daemon Terminated
6E0A114  0711133901 P S Worm  Switch daemon received SIGTERM

the detailed errorlog looks like:

[TTY0:root@sp3n01:/home/root # errpt -a | pg
LABEL:        SP_SW_FSD_TERM_ER
IDENTIFIER:   E8B17142

Date/Time:       Wed Jul 11 13:39:50
Sequence Number: 545
Machine Id:      00091276A400
Node Id:         sp3n01
Class:           S
Type:            PERM
Resource Name:   Worm

Description
Switch Fault Service Daemon Terminated

Probable Causes
SYSTEM I/O BUS
Switch adapter failure
Switch clock signal missing

Failure Causes
SYSTEM I/O BUS
Switch cable faulty

    Recommended Actions
    Run adapter diagnostics

Detail Data
DETECTING MODULE
PSSP,fs_daemon_init.c, 1.46,1158
ERROR ID
.03LUczax6Hv.nsB//A.e.z...................
REFERENCE CODE
/SV/...ax6Hv.UgB//A.e.z...................

---------------------------------------------------------------------------
LABEL:        SP_SW_SIGTERM_ER
IDENTIFIER:   6E0A1114

Date/Time:       Wed Jul 11 13:39:50
Sequence Number: 544
Machine Id:      00091276A400
Node Id:         sp3n01
Class:           S
Type:            PERM
Resource Name: Worm

Description
Switch daemon received SIGTERM

Probable Causes
Another process sent a SIGTERM

User Causes
Operator ran Eclock
Operator ran rc.switch on node and switch daemon was restarted
User program sent SIGTERM

Recommended Actions
Run rc.switch to restart switch daemon

Detail Data
DETECTING MODULE
PSSP, fs_daemon_init.c, 1.46, 980
ERROR ID
.I2e0l/ax6Hv.pw3//A.e.z...............5
REFERENCE CODE
/SV/...ax6Hv.uf0//A.e.z...............5
PID of process sending SIGTERM
15742
Name of process sending SIGTERM
ksh

The easiest way to go is to restart the WORM daemon on the failing node. Right now there is no WORM daemon running. So we issue the rc.switch command to restart the daemon. See Example 6-13, “rc.switch” on page 255. If it still fails please REFER to the PSSP Diagnosis Guide V3.2 GA22-7350.

Example 6-13  rc.switch

[tty0:root@osp3n01:/home/root # ps -ef |grep fault
  root 17756 15742 4 13:46:37 0 0:00 grep fault

[tty0:root@osp3n01:/home/root # /usr/lpp/ssp/css/rc.switch
"adapter/mca/tb3"
/etc/inittab entry specified as once for the fault service daemon.

look now:
[tty0:root@osp3n01:/home/root # ps -ef |grep fault
  root 17344 1 0 13:47:05 - 0:00 /usr/lpp/ssp/css/fault_service_W
  root 17794 15742 2 13:48:01 0 0:00 grep fault

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After issuing the \texttt{rc.switch} command the WORM daemon started again and so the node was able to join the switch network again automatically (node was set to autojoin). In a case where the node is fenced you need to unfence the node either with the \texttt{Eunfence} command or through the smit menus.

**SP Switch adapter has diag_fail**

The SP Switch adapter usually has the status \texttt{css_ready}. You can check this status with the \texttt{SDRGetObjects switch\_responds} command or look at the \texttt{/var/adm/SPlogs/css/rc.switch.log} file. See Example 6-14 on page 256.

**Example 6-14 Adapter config status sample**

```
[2:root@sp3en0:]/home/root # SDRGetObjects switch_responds
node_number switch_responds autojoin isolated adapter_config_status sw
  1  0  1  1 css\_ready "" ""
  5  1  1  0 css\_ready "" ""
...
```

When a adapter is failing the diags it shows \texttt{diag\_fail}. This status can be steady and the adapter can really be defective. If the node was powered on before the switch board was powered on and the switch adapter in the node has received no clock signal this can cause a \texttt{diag\_fail} status. This can occur during a install. In this case the worm daemon will not start while rc.switch is running. The \texttt{diag\_fail} status especially in a install phase is no defect of the adapter. To fix this problem we can do the following (ensure that switch board is powered on):

1. Reboot the node(s)
2. Reconfigure the adapter. This will require stopping any processes that could hold the css0 device, for example hats. The commands to be issued are:
   
   ```
   * stopsrc -s hats
   * /usr/lpp/ssp/css/ucfgtb3 -l css0 -v
   * /usr/lpp/ssp/css/cfgtb3 -l css0 -v
   * startsrc -s hats
   ```

   **Note:** if there are other processes, including application processes, holding onto the css0 device, they must be stopped as well.

If the status is still \texttt{diag\_fail} and there is no other solution possible you should contact your local IBM Support to analyze the problem and probably exchange the adapter hardware if needed.
Multiple nodes are not rejoining the switch

During a planned power off of several switch attached nodes are not able to rejoin the switch network via the \texttt{Estart} command. See Example 6-15.

\textbf{Example 6-15}  \textit{Estart fails for several nodes - flt output and out.top}

\begin{verbatim}
flt output:
04/03/01 15:59:34 (i) : 2510-744 Estart initiated.
04/03/01 15:59:34 CSswitchInit: Switch network Initialization Started!
04/03/01 15:59:35 (e) handlePh1SwSvcResponse: 2510-919 Bad Device Signature detected. Device id = 100050.
04/03/01 15:59:35 (n) DisableChip: 2510-798 Disabling Switch chip - device_id = 100050
04/03/01 15:59:36 (e) handlePh1SwSvcResponse: 2510-919 Bad Device Signature detected. Device id = 100057.
04/03/01 15:59:36 (n) DisableChip: 2510-798 Disabling Switch chip - device_id = 100057
04/03/01 15:59:55 CSswitchInit: Switch network Initialization Ended!
04/03/01 16:00:02 (i) init_on_startup_msg: The Primary backup is node testnode.itso.ibm.com
04/03/01 16:00:03 (i) init_on_startup_msg: Switch initialization completed successfully!
\end{verbatim}

\begin{verbatim}
out.top output:
E17-S17-BH-J31 to E17-N9
E17-S17-BH-J32 to E18-N9
E17-S17-BH-J18 to Exx-Nxx -4
L: device has been removed from network - faulty (link has been removed from network - not connected)
E17-S17-BH-J17 to Exx-Nxx -4
L: device has been removed from network - faulty (link has been removed from network - not connected)
E17-S17-BH-J33 to E17-N13
E17-S17-BH-J34 to E18-N13
E17-S17-BH-J16 to Exx-Nxx -4
L: device has been removed from network - faulty (link has been removed from network - not connected)
E17-S17-BH-J15 to Exx-Nxx -4
L: device has been removed from network - faulty (link has been removed from network - not connected)
\end{verbatim}
Due to the fact that a power off was performed on these nodes it is unlikely that all adapters or switch ports are defective. First of all the cables should all be reseated and checked for proper connection. Then we do the following:

- **Equiesce** (to disable switch error recovery and primary node takeover).
- Either run `dsh -a /usr/lpp/ssp/css/css_cdn` from the CWS (will kill WORM on all nodes in that partition) or simply `/usr/lpp/ssp/css/css_cdn` on the node itself.
- Power cycle the switch board off/on. This is useful due to the fact that switch ports can be in undefined state and no soft reset can change the status.
- Either run `dsh -a /usr/lpp/ssp/css/rc.switch` on the CWS or `/usr/lpp/ssp/css/rc.switch` on each node itself.
- Run Estart.

After following these steps the nodes are back on the switch network and everything is running fine again.

**Worm daemon problems - fixed by APARs**

Some problems that you perhaps see on the SP Switch are probably already fixed by a PTF Set or just APAR. We wont list all available APARs available for PSSP in this section but we want to focus on some important software bugs that occur more often. You can search the APAR Database at: http://techsupport.services.ibm.com/rs6000/aix/CAPARdb. See Table 6-4.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no.</th>
</tr>
</thead>
</table>
| Switch went to down   | **ORIGINATING DETAILS:**
                        | flt file shows the errors:
                        | 2510-898 unable to access SDR to get the list of auto-join nodes rc= -1.
                        | 2510-195 The fault service daemon got a SIGTERM signal.
                        | **RESPONDER SUMMARY:**
                        | Closed the window so the child process will exit on SIGTERM without resetting the adapter.
                        | **RESPONDER CONCLUSION:**
<pre><code>                    | There is a small window where the primary forks a child process and an SDR test is run where a SIGTERM to the child will result in the child call the standard SIGTERM handler and reset the adapter. | IY17438 |
</code></pre>
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Service Daemon (FSD) response time</td>
<td><strong>ORIGINATING DETAILS:</strong> fsd response time&lt;br&gt;<strong>RESPONDER SUMMARY:</strong> When a node is heavily loaded, the switch daemon can be delayed processing certain packets. In some cases, the node is dropped from the switch.&lt;br&gt;<strong>RESPONDER CONCLUSION:</strong> The packet processing code in the fault service daemon has been changed to improve processing time.</td>
<td>IY17579</td>
</tr>
<tr>
<td>Primary daemon core dumps in CSRECOVERY</td>
<td><strong>RESPONDER SUMMARY:</strong> This problem was caused by an array in switch recovery overflowing and wiping out pointers and other variables. The array now has one element assigned to each chip and node in the system, eliminating the overflow condition.&lt;br&gt;<strong>RESPONDER CONCLUSION:</strong> Switch recovery was changed to have a fixed array containing error reset information. The previous array was coded to 100 entries. If more than 100 resets were pending then the array would overflow, and pointers to other structures would be wiped out. This would cause segmentation faults. The new arrays have one element for each switch chip/node in the system, so the overflow will not occur.</td>
<td>IY18011</td>
</tr>
<tr>
<td>Nodes drop off the switch with ucode: Link1_Bad_Svc_Packet</td>
<td><strong>ORIGINATING DETAILS:</strong> Nodes drop of the switch, logging UCODE: Link1 Bad Svc Packet, 5:35&gt;Port 0 CRC Err&lt;br&gt;<strong>RESPONDER SUMMARY:</strong> Device driver was interrogating service buffer error packet incorrectly and reporting the error on the wrong link. The result is that the fault service daemon will ignore the packet instead of taking correct recovery action&lt;br&gt;<strong>RESPONDER CONCLUSION:</strong> Device driver now reports correct link for a service buffer error to the fault service daemon.</td>
<td>IY15593</td>
</tr>
<tr>
<td>Symptom</td>
<td>Description</td>
<td>APAR fix no.</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
</tbody>
</table>
| Node crash on detach of css0 interface      | **ORIGINATING DETAILS:** A node crash can occur when detaching the css0 interface; e.g.: `/usr/lpp/ssp/css/ifconfig css0 detach`  
**LOCAL FIX AS REPORTED BY ORIGINATOR:** A delete of the interface may suffice instead of detaching the interface.  
**RESPONDER SUMMARY:** A node crash can occur when the css0 interface is detached as follows: `/usr/lpp/ssp/css/ifconfig css0 detach`  
**RESPONDER CONCLUSION:** The switch IP kernel extension, if_is, has been changed to prevent a node crash when detaching the css0 interface. | IY16055      |
| Switch responds green, IP stops working on a node after recovery | **ORIGINATING DETAILS:** A secondary nodes failed to respond to node initialization in time packets and were taken off the switch. However, the switch responds bit (switch_responds) was not set. The node’s fault_service_daemon shows the error: Stuck TBIC interrupt - reinitializing adapter.  
**LOCAL FIX AS REPORTED BY ORIGINATOR:**  
**RESPONDER SUMMARY:** When a node is being isolated from the switch, transient errors can occur before the adapter is fully disabled. These can appear as hot interrupts and cause the adapter to be refreshed and not reset.  
This leaves IP in an inconsistent state. If the node is being isolated during initialization switch responds will not be updated.  
**RESPONDER CONCLUSION:** Transient errors that do not clear when a node is being isolated from the switch will be treated as link errors. | IY12824      |
Eunfence appears successful but has failed due to no primary backup nodes

**ORIGINATING DETAILS:**
When the switch primary node tries to unfence a node, there must be an existing backup node for the fence to work properly, but the switch logs can indicate that such a fence is successful, and the SDR switch_responds Class can incorrectly show the node unfenced. The logs and SDR should show the fence failed. We should also log when the primary can’t choose a backup node because there is no other node running the same code version as the primary.

**RESPONDER SUMMARY:**
Eunfence may appear successful but may actually fail if there is no operational primary backup node. In a system with dependent nodes, a backup candidate may be rejected if its PSSP level (as determined by the SDR code_version attribute in the Node class) is not the same as the primary node’s code_version.

**RESPONDER CONCLUSION:**
The fault_service daemon will attempt to unfence the node even if there is no operational backup. In the pick_backup() function of the Worm, the backup candidate’s eligibility test was changed: in a system with dependent nodes, the backup candidate must be at PSSP-2.3 or higher (as indicated by the SDR code_version attribute in the Node class).

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no.</th>
</tr>
</thead>
</table>
| Eunfence appears successful but has failed due to no primary backup nodes | **ORIGINATING DETAILS:**
When the switch primary node tries to unfence a node, there must be an existing backup node for the fence to work properly, but the switch logs can indicate that such a fence is successful, and the SDR switch_responds Class can incorrectly show the node unfenced. The logs and SDR should show the fence failed. We should also log when the primary can’t choose a backup node because there is no other node running the same code version as the primary.

**RESPONDER SUMMARY:**
Eunfence may appear successful but may actually fail if there is no operational primary backup node. In a system with dependent nodes, a backup candidate may be rejected if its PSSP level (as determined by the SDR code_version attribute in the Node class) is not the same as the primary node’s code_version.

**RESPONDER CONCLUSION:**
The fault_service daemon will attempt to unfence the node even if there is no operational backup. In the pick_backup() function of the Worm, the backup candidate’s eligibility test was changed: in a system with dependent nodes, the backup candidate must be at PSSP-2.3 or higher (as indicated by the SDR code_version attribute in the Node class). | IY12826 |
Here we describe SP Switch related problems. The SP Switch has the possibility to recover automatically from node and switch clock problems. For this function there is the cssadm daemon available. The cssadm daemon is started in the /etc/inittab file on the control workstation (CWS). The SRC subsystem name for the daemon is swtadm. This SRC subsystem is not running on a SP Switch system. Basically only the node switch recovery is enabled. You can modify the following file and add the line Switch 1 to /spdata/sys1/ha/css/cssadm.cfg. See Example 6-16.

**Example 6-16 /spdata/sys1/ha/css/cssadm.cfg file on CWS**

```
sp3en0 > pg cssadm.cfg
# IBM_PROLOG_BEGIN_TAG
# Licensed Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp. 1998
# All Rights Reserved
# US Government Users Restricted Rights - Use, duplication or
```

### 6.6 SP Switch problems

Here we describe SP Switch related problems. The SP Switch has the possibility to recover automatically from node and switch clock problems. For this function there is the cssadm daemon available. The cssadm daemon is started in the /etc/inittab file on the control workstation (CWS). The SRC subsystem name for the daemon is swtadm. This SRC subsystem is not running on a SP Switch system. Basically only the node switch recovery is enabled. You can modify the following file and add the line Switch 1 to /spdata/sys1/ha/css/cssadm.cfg. See Example 6-16.
If you want to have no switch clock recovery, you have to explicitly change the value to Switch 0. After you modified the /spdata/sys1/ha/css/cssadm.cfg file you have to stop and restart the subsystem using the following commands:

```bash
▶ stopsrc -s swtdadm
▶ startsrc -s swtdadm
```

Now we can also enable the SP Switch power monitoring recovery. Therefore, you need to modify the /spdata/sys1/spmon/hmthresholds file. See Example 6-17 on page 263.

**Example 6-17 /spdata/sys1/spmon/hmthresholds file**

```plaintext
...  
# 0x81 0x00 0xff .700 0xff .700 0xff 43.2 52.8 43.2 52.8 0x00 45.0 2.97 3.63
# Software thresholding disabled
# 0x81 0x00 0xff .700 0xff .700 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff
# Software thresholding enabled to detect a switch master oscillator failure.
# PS1_POWERGOOD set to low threshold at .700
# PS2_POWERGOOD set to low threshold at .700
# In order to enable the thresholding to detect a switch master oscillator failure the following line should replace the default thresholds that follow the "DO NOT change these values......" line. Please be sure you understand the purpose of these thresholds by reading the documentation concerning the switch admin daemon (cssadm).
# Set to 0x00 for defect 47883

```plaintext
# 0x81 0x00 0xff .700 0xff .700 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff
# +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
# DO NOT change these values without contacting IBM Support.
# +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

```plaintext
0x81 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff 0x00 0xff
...```

Simply replace the last line shown with the line that is in grey. The line sets two values to.700 instead of 0x00. To enable the changes you need to restart the hardmon:

```bash
▶ stopsrc -s hardmon
```
**Tip:** css.snap runs automatically. Delete the old *.css.snap.tar files from the /var/adm/SPlogs/css directory of the primary node. Otherwise the snap files get too big.

Table 6-5 shows the General APAR fixes for switch problems.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no</th>
</tr>
</thead>
</table>
| Eclock -c on a 5nsb 0lsb system creates a corrupted clock topology file | **ORIGINATING DETAILS:**
Eclock -c on a 5nsb 0lsb system creates a corrupted clock topology file. If this file is used with Eclock -f most likely no errors will result but when Estart is run: If the Eprimary is in the first frame, only the 1st frame will initialize. If the Eprimary is in any other frame, nothing will initialize. This causes the most serious problem when a customer runs: Eclock -c /etc/SP/Eclock.top.5nsb.0lsb.0 Subsequent Eclock -f and Eclock -d will use this invalid file.

**LOCAL FIX AS REPORTED BY ORIGINATOR:**
If you suspect the default
/etc/SP/Eclock.top.5nsb.0lsb.0 has been overwritten, you can verify it by looking in the file for the line: This Eclock topology file was generated by Eclock (-c option) If it has been create by Eclock you can copy a good topology from /usr/lpp/ssp/config.

**RESPONDER SUMMARY:**
Customers encountered problems running Eclock -a. In one case, Eclock -a was issued using a topology file created by the Eclock -c option, but Eclock -c does not generate alternate settings since they do not reside in the SDR. In another case, the specified alternate topology number did not exist in the topology file. In both cases, Eclock completed but used the wrong jack information.

**RESPONDER CONCLUSION:**
Changes were made to the Eclock command:
- The Eclock -a, -f or -d commands will check to see if the topology file was created by Eclock and issue information message 0028-069: File <xxxx> was created by the Eclock -c option". Eclock processing continues. - If the Eclock -a command is issued and the topology number specified cannot be found in the topology file, error message 0028-069 will be issued: "Invalid clock topology number <nn> specified." Eclock will exit with an error return code. | IY12801 |
Multiple switches problems

When you have a system with multiple switch boards and this system is a SP Switch machine the clock settings need to be set. The most common problem seen on multiple switch systems is a wrong clock setting. This does not apply to the SP Switch2. SP Switch2 does not need to set a clock.

The following is a checklist which you can use for solving SP Switch problems:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no</th>
</tr>
</thead>
<tbody>
<tr>
<td>rc.switch fails with other than LANG=En_US</td>
<td>ORIGINATING DETAILS:</td>
<td>IY14449</td>
</tr>
<tr>
<td></td>
<td>In the Subject PMR Japan states that rc.switch fails when specify LANG=Ja_JP in /etc/environment. J. Pfau has recreated this problem on c676n05 with German language support. rc.switch is failing when executing /usr/sbin/lsdev and checking for adapter state of&quot;css_ready&quot;. Since we are not En_US the css_ready state is not in english. RESPONDER SUMMARY: rc.switch fails with messages 0028-202 and 0028-192 if the locale is not set to English (C, en_US, or En_US). The messages in /var/adm/SPlogs/css/rc.switch.log are:0028-202 Device driver configuration failed for adapter css0 0028-192 rc.switch failed RESPONDER CONCLUSION: The failing command is /usr/sbin/lsdev -C -l css0</td>
<td></td>
</tr>
</tbody>
</table>

Note: The Eclock command is disruptive for switch operations. Eclock will interrupt all activities on the switch and applications using the switch will fail. SP Switch2 does not need a clock setting.

The following is a checklist which you can use for solving SP Switch problems:

- Use SDRGetObjects Switch to check the clock setting. See Example 6-18.
- Use also splstda -s to verify the clock settings.
- Check for switched off switch boards.
- Use Eclock -d and then Estart to re initialize clock/switch.
- Perform a Power off/on of the switch board when you encounter many uninitialized on Board connections in the out.top file.
Example 6-18  SDRGetObjects Switch

switch_number frame_number slot_number switch_partition_number switch_type
  1  1  17  1  129 0
1 SP_Switch 0 no ""
  2  2  17  1  129 3
1 SP_Switch 1 no ""
  3  3  17  1  129 3
1 SP_Switch 1 no ""
  4  4  17  1  129 3
1 SP_Switch 1 no ""
  5  5  17  1  129 4
1 SP_Switch 2 no ""

6.7 SP Switch2 problems

The SP Switch2 has several improved self recovery mechanisms and diagnostic routines (emasterd, cssadm). But there are a few things that can happen. From a hardware point of view there is to mention the interposer card that is used for each cable connection to the switch board. This switch interposer card is hot swappable and has to be ordered for each new connection used on SP Switch2. This can be the first problem. Like cable misplugging failures in the past on all nodes also a not properly seated interposer card can cause problems.

Table 6-6 shows a sample APAR fix for an SP Switch2 problem.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
<th>APAR fix no</th>
</tr>
</thead>
<tbody>
<tr>
<td>emasterd takes a long time (up to 20 minutes) to establish the emaster on a large system</td>
<td><strong>RESPONDER SUMMARY:</strong> On large SP Switch2 systems, the assignment of a new MSS node can take several minutes; this is too long a time for the system to be deprived of a synchronized switch clock. <strong>RESPONDER CONCLUSION:</strong> Changes were made to emasterd to speed-up MSS failover on large systems.</td>
<td>IY18326</td>
</tr>
</tbody>
</table>
6.8 9077 GRF overview and problems

The Lucent 9077 GRF SP Switch router is a router that can be attached to the SP Switch through a Switch adapter. The GRF is able to provide a very fast routing from different networks (ATM, FDDI, GIGABIT Ethernet and more) through the Switch adapter to the SP Switch. The dependent node (that is how the GRF is named on the SP) is only able to connect to the SP Switch and there is no SP Switch2 attachment possible. There are also some restrictions, differences between a standard SP node and a dependent node:

- The fault service daemon runs on all switch nodes in the RS/6000 SP, but not on the dependent node. Therefore, the dependent node does not have the full functionality of a normal RS/6000 SP Switch node.
- The dependent node requires the SP Switch’s primary node to compute its switch routes. Therefore, the primary node must have at
least PSSP 2.3 installed, otherwise the dependent node cannot work with the RS/6000 SP.

- In the RS/6000 SP, SP Switch nodes occasionally send service packets from one node to the next to keep track of status and links. Sometimes these packets are sent indirectly through another switch node. As the dependent node is not a standard RS/6000 SP Switch node, it cannot be used to forward service packets to other nodes.

Please refer to the redbook *IBM 9077 SP Switch Router: Get Connected to the SP Switch*, SG24-5157, for more information.

**CWS does not communicate with GRF through SNMP**

In this case the cause of the problem was perhaps simple, but the result was not so pleasant. Please see Table 6-7 for the sample case study.

<table>
<thead>
<tr>
<th>Table 6-7</th>
<th>GRF problem</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem description</strong></td>
<td></td>
</tr>
<tr>
<td>GRF configuration is correct,(de0 interface in GRF, and SDR in CWS), but snmp is not able to send the IOSTB3 configuration to the GRF.</td>
<td></td>
</tr>
<tr>
<td>- “/var/adm/SPlogs/spmgr/spmgr.log” file shows:</td>
<td></td>
</tr>
<tr>
<td>EXCEPTIONS: Dependent node 08 managed by the SNMP agent host SPROUTER is not configured in the SDR</td>
<td></td>
</tr>
<tr>
<td>- “SDRGetObjects DependentNode” command gives:</td>
<td></td>
</tr>
<tr>
<td>node_number switch_node_number switch_chip_port switch_chip</td>
<td>31 15 3 8</td>
</tr>
<tr>
<td>reliable_hostname management_agent_hostname extension_node_id</td>
<td>sprouter.mop.ibm.com sprouter.mop.ibm.com 08</td>
</tr>
<tr>
<td>de0 interface was defined as follow in CWS in /etc/hosts file</td>
<td></td>
</tr>
<tr>
<td>&quot;192.168.253.200 SPROUTER SPROUTER.mop.ibm.com&quot;</td>
<td></td>
</tr>
<tr>
<td>This was the root cause of the problem</td>
<td></td>
</tr>
<tr>
<td><strong>Solution</strong></td>
<td></td>
</tr>
<tr>
<td>The right definition must be:</td>
<td></td>
</tr>
<tr>
<td>&quot;192.168.253.200 SPROUTER.mop.ibm.com SPROUTER&quot;</td>
<td></td>
</tr>
<tr>
<td>So the answer to the following command:</td>
<td></td>
</tr>
<tr>
<td>&quot;host 192.168.253.200&quot;</td>
<td></td>
</tr>
<tr>
<td>is</td>
<td></td>
</tr>
<tr>
<td>&quot;SPROUTER.mop.ibm.com is 192.168.253.200,Aliases: SPROUTER&quot;</td>
<td></td>
</tr>
<tr>
<td>then the primary name will fit the hostname defined in SDR.</td>
<td></td>
</tr>
</tbody>
</table>
The SP System uses a variety of logs. Some of them reside on the MACN (CWS), and some reside only on the SP nodes. Others reside on both.

Table A-1 on page 270 summarizes and show the location of the SP specific logs to use when diagnosing SP problems. The abbreviation CWS, stands for control workstation is used to represent both CWS and the management and control node (MACN).

Your IBM Support Center representative may ask you to provide information from these logs.
<table>
<thead>
<tr>
<th>Type of Message</th>
<th>Log File Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output of the <code>phoenix.snap</code> tool. See <code>phoenix.snap</code> Dump.</td>
<td><code>/tmp/phoenix.Snap/all.timestamp.tar.Z</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Output of the <code>SDR_test</code> command when run without root authority</td>
<td><code>/tmp/SDR_test.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Standard AIX error log entries including the SP Switch</td>
<td><code>/var/adm/ras/errlog</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Error messages and verbose messages from security programs</td>
<td><code>/var/adm/SPlogs/auth_install/log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Automounter messages</td>
<td><code>/var/adm/SPlogs/auto/auto.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Messages from the <code>cstart</code> command</td>
<td><code>/var/adm/SPlogs/cs/cstart.timestamp.pid</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Messages from the <code>cshutdown</code> command</td>
<td><code>/var/adm/SPlogs/cs/cshut.timestamp.pid</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Details of recovery actions for the IBM RVSD function</td>
<td><code>/var/adm/SPlogs/csd/vsd.debuglog</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Summary of recovery actions for the IBM RVSD function</td>
<td><code>/var/adm/SPlogs/csd/vsd.log</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Trace output of <code>pssp_script</code>, which performs the post install customization</td>
<td><code>/var/adm/SPlogs/css/$nim_client_shr.config.log</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Switch cable miswire information</td>
<td><code>/var/adm/SPlogs/css/cable_miswire</code></td>
<td>Primary node</td>
</tr>
<tr>
<td>SP Switch2 adapter diagnostics messages</td>
<td><code>/var/adm/SPlogs/css0/colad.trace</code> (See SP Switch2 Log and Temporary File Hierarchy)</td>
<td>nodes</td>
</tr>
<tr>
<td>Messages from the <code>css.snap</code> script</td>
<td><code>/var/adm/SPlogs/css/css.snap.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Switch admin daemon messages</td>
<td><code>/var/adm/SPlogs/css/cssadm.debug</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Switch admin daemon messages (stdout)</td>
<td><code>/var/adm/SPlogs/css/cssadm.stdout</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Switch admin daemon messages (stderr)</td>
<td><code>/var/adm/SPlogs/css/cssadm.stderr</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Type of Message</td>
<td>Log File Name</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Fault service daemon messages for the SP Switch2</td>
<td>/var/adm/SPlogs/css/daemon.log</td>
<td>Nodes</td>
</tr>
<tr>
<td>Fault service daemon messages (stderr) for the SP Switch</td>
<td>/var/adm/SPlogs/css/daemon.stderr</td>
<td>Nodes</td>
</tr>
<tr>
<td>Fault service daemon messages (stdout) for the SP Switch</td>
<td>/var/adm/SPlogs/css/daemon.stdout</td>
<td>Nodes</td>
</tr>
<tr>
<td>System error messages that occurred while distributing the topology file to the nodes.</td>
<td>/var/adm/SPlogs/css/dist_topology.log</td>
<td>Primary node</td>
</tr>
<tr>
<td>Trace of SP Switch adapter diagnostics failures</td>
<td>/var/adm/SPlogs/css/dtbx_failed.trace</td>
<td>Nodes</td>
</tr>
<tr>
<td>SP Switch adapter diagnostics trace information</td>
<td>/var/adm/SPlogs/css/dtbx.trace</td>
<td>Nodes</td>
</tr>
<tr>
<td>Messages from adapter diagnostics (stderr)</td>
<td>/var/adm/SPlogs/css/dtbxworm.stderr</td>
<td>Nodes</td>
</tr>
<tr>
<td>Log from the <strong>Eclock</strong> command</td>
<td>/var/adm/SPlogs/css/Eclock.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Log from all Ecommands issued</td>
<td>/var/adm/SPlogs/css/Ecommands.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Log from the <strong>Emonitor</strong> command</td>
<td>/var/adm/SPlogs/css/Emonitor.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Result of <strong>Estart</strong> commands issued by the <strong>Emonitor</strong> daemon</td>
<td>/var/adm/SPlogs/css/Emonitor.Estart.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Trace of last Eunpartition operation</td>
<td>/var/adm/SPlogs/css/Eunpart.file</td>
<td>Primary node</td>
</tr>
<tr>
<td>Trace file of fault service daemon messages</td>
<td>/var/adm/SPlogs/css/fs_daemon_print.file</td>
<td>Nodes</td>
</tr>
<tr>
<td>Switch fault information</td>
<td>/var/adm/SPlogs/css/flt</td>
<td>Nodes</td>
</tr>
<tr>
<td>stdout and stderr of the Event Management Resource Monitor and Methods</td>
<td>/var/adm/SPlogs/css/logevnt.out</td>
<td>CWS</td>
</tr>
<tr>
<td>SP Switch and SP Switch2 advanced diagnostics Messages Daemon log</td>
<td>/var/adm/SPlogs/css/msdg.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Type of Message</td>
<td>Log File Name</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Description of problems that arise while switch is initializing</td>
<td>/var/adm/SPlogs/css/out.top</td>
<td>Primary node</td>
</tr>
<tr>
<td>Initialization messages from the SP Switch support code</td>
<td>/var/adm/SPlogs/css/rc.switch.log</td>
<td>Nodes</td>
</tr>
<tr>
<td>Log from switch router generation</td>
<td>/var/adm/SPlogs/css/router.log</td>
<td>Nodes</td>
</tr>
<tr>
<td>Output log from switch router generation when it detects a failure</td>
<td>/var/adm/SPlogs/css/router_failed.log</td>
<td>Nodes</td>
</tr>
<tr>
<td>SP Switch advanced diagnostics tests and architecture components log</td>
<td>/var/adm/SPlogs/css/spd.trace</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>SP Switch2 advanced diagnostics tests and architecture components log</td>
<td>/var/adm/SPlogs/cssX/pY/spd.trace, where X and Y are variable. See SP Switch2 Log and Temporary File Hierarchy.</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>SP Switch advanced diagnostics GUI log</td>
<td>/var/adm/SPlogs/css/spd_gui.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Summary records for events logged to AIX error log on nodes.</td>
<td>/var/adm/SPlogs/css/summlog</td>
<td>CWS</td>
</tr>
<tr>
<td>stdout and stderr for the CSS logging daemon's Event Management client</td>
<td>/var/adm/SPlogs/css/summlog.out</td>
<td>CWS</td>
</tr>
<tr>
<td>Current state of the switch network, details about attached nodes and the topology file</td>
<td>/var/adm/SPlogs/css/topology.data</td>
<td>Primary node</td>
</tr>
<tr>
<td>Worm trace file from switch initialization</td>
<td>/var/adm/SPlogs/css/worm.trace</td>
<td>Primary node</td>
</tr>
<tr>
<td>SP Switch2 log files. See SP Switch2 Log and Temporary File Hierarchy.</td>
<td>/var/adm/SPlogs/css0/*</td>
<td>Primary node</td>
</tr>
<tr>
<td>SP Switch2 log files. See SP Switch2 Log and Temporary File Hierarchy.</td>
<td>/var/adm/SPlogs/css1/*</td>
<td>Primary node</td>
</tr>
<tr>
<td>Results of the last CSS verification test</td>
<td>/var/adm/SPlogs/CSS_test.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Type of Message</td>
<td>Log File Name</td>
<td>Location</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Output of the <code>supper</code> command</td>
<td><code>/var/adm/SPlogs/filec/supdate.time</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Actions supper performs when updating file collections</td>
<td><code>/var/adm/SPlogs/filec/supdate.timer</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Messages generated by the last <code>get_keyfiles</code> command issued</td>
<td><code>/var/adm/SPlogs/get_keyfiles/get_keyfiles.log</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Kerberos V4 authentication database administration daemon</td>
<td><code>/var/adm/SPlogs/kerberos/admin_server.syslog</code></td>
<td>Primary authentication server</td>
</tr>
<tr>
<td>Kerberos V4 primary authentication server log</td>
<td><code>/var/adm/SPlogs/kerberos/kerberos.log</code></td>
<td>Primary authentication server</td>
</tr>
<tr>
<td>Kerberos V4 secondary authentication server log</td>
<td><code>/var/adm/SPlogs/kerberos/kerberos.slave_log</code></td>
<td>Secondary authentication server</td>
</tr>
<tr>
<td>Kerberos V4 authentication database propagation daemon</td>
<td><code>/var/adm/SPlogs/kerberos/kpropd.log</code></td>
<td>Secondary authentication server</td>
</tr>
<tr>
<td>Messages generated by transfer of srvtab files to nodes</td>
<td><code>/var/adm/SPlogs/kfserver/kfserver.log.PID</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Messages generated by registration process for the kfserver program</td>
<td><code>/var/adm/SPlogs/kfserver/regserver.log</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Messages generated by the Problem Management daemon</td>
<td><code>/var/adm/SPlogs/pman/pmand.log</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Messages generated by the Problem Management daemon</td>
<td><code>/var/adm/SPlogs/pman/pmand.partition.name.log</code></td>
<td>CWS</td>
</tr>
<tr>
<td>System Data Repository configuration messages</td>
<td><code>/var/adm/SPlogs/sdr/SDR_config.log</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Output of the <code>SDR_test</code> command when run with root authority</td>
<td><code>/var/adm/SPlogs/SDR_test.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>System Data Repository error messages</td>
<td><code>/var/adm/SPlogs/sdr/sdrdlog.partition.pid</code></td>
<td>CWS</td>
</tr>
<tr>
<td>Login control messages</td>
<td><code>/var/adm/SPlogs/spacs/spacs.log</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>Type of Message</td>
<td>Log File Name</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>SP configuration Vital Product Data directory</td>
<td>/var/adm/SPlogs/SPconfig/*</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Vital Product Data output for the node</td>
<td>/var/adm/SPlogs/SPconfig/node number.umcl</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td><code>lsconfig -v</code> command output</td>
<td>/var/adm/SPlogs/SPconfig/node number.lscfg</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Messages generated by system daemons, including hardware errors</td>
<td>/var/adm/SPlogs/SPdaemon.log</td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>SP extension node messages</td>
<td>/var/adm/SPlogs/spmgr/spmgrd.log</td>
<td>CWS</td>
</tr>
<tr>
<td>Hardware Monitor initialization and error messages</td>
<td>/var/adm/SPlogs/spmon/hmlogfile.julian_date</td>
<td>CWS</td>
</tr>
<tr>
<td>Node conditioning messages</td>
<td>/var/adm/SPlogs/spmon/nc/nc.frame.node</td>
<td>CWS</td>
</tr>
<tr>
<td>Netfinity daemon (nfd) messages</td>
<td>/var/adm/SPlogs/spmon/nfd/nfd.frame.log.julian-date</td>
<td>CWS</td>
</tr>
<tr>
<td>Hardware Monitor s70d daemon error messages</td>
<td>/var/adm/SPlogs/spmon/s70d/s70d.frame.log.julian_date</td>
<td>CWS</td>
</tr>
<tr>
<td>Activity of the logging daemon (splogd).</td>
<td>/var/adm/SPlogs/spmon/splogd.debug</td>
<td>CWS</td>
</tr>
<tr>
<td>Contains the PID of the logging daemon, (splogd).</td>
<td>/var/adm/SPlogs/spmon/splogd/splogd.pid</td>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
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<td>CWS</td>
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<tr>
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<td>Nodes</td>
</tr>
<tr>
<td>Sysctl server log messages</td>
<td>/var/adm/SPlogs/sysctl/sysctld.log</td>
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<td>Type of Message</td>
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<td>----------------</td>
</tr>
<tr>
<td>AIX error messages from mirroring a root volume group using SP volume group commands</td>
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<tr>
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<td>Nodes</td>
</tr>
<tr>
<td>Informational and error messages from the SYSMAN_test command</td>
<td><code>/var/adm/SPlogs/SYSMAN_test.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>hags internal trace and log file</td>
<td><code>/var/ha/log/hags*</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>hagsglsm internal trace and log file</td>
<td><code>/var/ha/log/hagsglsm*</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Event Management activity log</td>
<td><code>/var/ha/log/em.default.partition-name</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Trace information for the topology services daemon</td>
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<td>CWS, nodes</td>
</tr>
<tr>
<td>Information from the topology services startup script</td>
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</tr>
<tr>
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</tr>
<tr>
<td>filec_config command log, no longer in use</td>
<td><code>/var/sysman/logs/*</code></td>
<td>Nodes</td>
</tr>
<tr>
<td>SP SNMP Agent messages</td>
<td><code>/var/tmp/SPlogs/spmgr/spgrd.log</code></td>
<td>CWS, nodes</td>
</tr>
<tr>
<td>Type of Message</td>
<td>Log File Name</td>
<td>Location</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>SP TaskGuide activity messages (exit values, stdout and stderr from commands run by SP TaskGuides)</td>
<td>TaskGuide_name.timestamp.tglog View these logs through the SP TaskGuides themselves.</td>
<td>SDR system files</td>
</tr>
</tbody>
</table>
Migration

In this appendix, we discuss migration issues related to PSSP and AIX code on the CWS and nodes.
Migration aspects in the Universal Cluster

This appendix does not cover in detail the migration steps for AIX or PSSP. For a complete list of steps and supported migration paths, consult the *PSSP Installation and Migration Guide*, GA22-7347-02 and Chapter 5.2 *RS/6000 SP Cluster: The Path to Universal Clustering*, SG245374. Instead, we provide some guidance in approaching the migration activities.

From a software management perspective, the Universal Cluster can be viewed as a collection of nodes, sharing a common software repository, located on the boot/install servers (BIS). Each BIS is a network installation manager (NIM) master for the nodes it serves. In an environment with more than one BIS, the CWS makes NIM resources (lppsource) available to the other BIS and initiates NIM operations on them.

In a PSSP environment, the migration aspects refer both to AIX and PSSP. Before planning for a migration, check the product documentation and the Read Me First document, for the supported combinations of PSSP and AIX levels.

When dealing with migration topics, the term upgrade is sometimes used to refer a change in the modification level of the software product. An example would be when migrating from AIX 4.3.2 to 4.3.3, or when applying a new Maintenance Level (ML) to AIX (for example 4330-07_AIX_ML). This operation is performed using the smit update_all menu and does not require a network boot. As opposed to the mentioned change of AIX modification level, a release migration operation (like from AIX 4.2.1 to AIX 4.3.3) involves a network boot via NIM (or from installation media, for standalone systems).

The following topics need to be considered when planning for migration:

- AIX level and ML on the CWS. This needs to be correlated with the minimum AIX level required by the PSSP code.
- AIX level and ML of the lppsource. For each AIX release and modification levels, there is an individual lppsource, for example: /spdata/sys1/install/aix433/lppsource, /spdata/sys1/install/aix432/lppsource. At the creation time, the lppsource may include a certain AIX ML. Each lppsource directory has a corresponding NIM lpp_source resource.
- AIX level of the SPOT. The SPOT location is hard-coded in the setup_server script. There is a SPOT for each AIX level, located in the same directory as its corresponding lppsource directory. The SPOT is created by the setup_server script from the lppsource repository. It is a NIM resource and is maintained using NIM commands. The AIX ML of the SPOT is same as of the lppsource from which it was created. If you upgrade the lppsource, you should do the same with the SPOT.
- PSSP level on the CWS. There is a single PSSP level, which also provides support for the nodes with lower PSSP levels.

- PSSP level in the pssplpp repository. There is an individual directory in the /spdata/sys1/install/pssplpp directory for each PSSP level present in the cluster. For example, if you have PSSP 3.1.1 and 3.2 nodes, you would have two directories, PSSP-3.1.1 and PSSP-3.2, each containing the release-specific software. When a node is installed, customized or migrated, the `pssp_script` selects the right pssplpp subdirectory base on the values in the SDR. If the pssplpp repository contain fixes, the fixes are also installed on the nodes.

- AIX levels on nodes.

- PSSP levels of the nodes.

**Important**: The CWS needs to be at the latest levels of PSSP and AIX used in the cluster.

Usually there is a single version of AIX and PSSP used across the cluster at the time of the initial system installation. The CWS, lppsource, SPOT, and nodes are at the same maintenance level of AIX and the PSSP level is common on CWS and nodes. During the system exploitation phase, when the nodes host production applications, things are no longer so straightforward. If the Universal Cluster is used for server consolidation, chances are that the different applications in use are not certified for the same release or maintenance levels of AIX and PSSP. Under those circumstances, software maintenance becomes a more challenging tasks, because it has to address the following problems:

- Some nodes in the cluster need to run the latest AIX and PSSP levels, thus requiring the CWS to be updated at these levels.

- A production node should be able to be restored at any time with the exact levels of AIX and PSSP used for the initial installation. If during the time elapsed since the initial installation, software is updated in the pssplpp and lppsource repositories, the node will be reinstalled with newer levels of PSSP and AIX. This could lead to application failures due to the different system code.

- A node customization is performed, for example, to change an adapter IP address. During the node customization process, the `pssp_script` picks up the latest version of PSSP in the pssplpp repository, as well as the latest releases for some AIX software, like:
  - `peragent.server` or `peragent.tools`
  - `bos.rte.tty`
  - `devices.sio.sa.diag`
Each computing site defines its own policy to address the described issues. Here are only a few recommendations:

- Before making changes to production systems, test them on non-production machines. If possible, create a testing environment similar to the one used in production.
- Before you place the PSSP and RSCT updates in the pssplpp repository, keep them in a separate directory and do the updates from the CWS and on a test node. Only apply the fixes, do not commit them.
- Maintain a single standard, minimal install image (mksysb) per release/modification level of software. Example: bos.obj.ssp.432, bos.obj.ssp.433. Use customization scripts to configure the nodes and to install additional software.
- Any AIX corrective service (PTFs) applied to the mksysb image must also be placed in the lppsource directory and the Shared Product Object Tree (SPOT) must be updated.

Debugging migration problems

There are two instances when the node migration is performed with the help of PSSP software:

1. When AIX is migrated from one release to another (e.g., from 4.2.1 to 4.3.3). Usually, in such cases the PSSP level changes too. This task is performed by setting the node response to migrate and uses the NIM to network boot the node and to perform the AIX migration. The PSSP migration is done by the pssp_script, allocated by the NIM to the node as invoked by NIM as the script resource.

2. When only PSSP level is migrated. The node response is set to customize, using the spbootins command. The PSSP migration is accomplished by the pssp_script. Note that you need to copy the pssp_script from the CWS to the node and execute it.

See Example B-1 on page 281 for a list of resources allocated for two sample nodes. The node response set with the spbootins command is:

Node sp3n12 customize
Node sp3n11 migrate
Example: B-1  Allocated NIM resources

sp3en0 > lsnim -l sp3n12
sp3n12:
    class          = machines
    type           = standalone
    platform       = rs6k
    netboot_kernel = up
    if1            = spnet_en0 sp3n12 10005AFA0AB5 ent
    cable_type1    = bnc
    Cstate         = ready for a NIM operation
    prev_state     = ready for a NIM operation
    Mstate         = currently running

sp3en0 > lsnim -l sp3n11
sp3n11:
    class          = machines
    type           = standalone
    platform       = rs6k
    netboot_kernel = up
    if1            = spnet_en0 sp3n11 10005AFA147C ent
    cable_type1    = bnc
    Cstate         = BOS installation has been enabled
    prev_state     = ready for a NIM operation
    Mstate         = currently running
    boot           = boot
    bosinst_data   = 11_migrate
    lpp_source     = lppsource_aix433
    nim_script     = nim_script
    script         = psspscript
    spot           = spot_aix433
    control        = master

When NIM is involved, debugging the migration process is similar to debugging a node installation. See the Chapter 3, “Installation” on page 89 for details. Debugging the node customization process starts with a look at the psspscript and psspfb_script logs, located in the /var/adm/SPlogs/sysman directory.

PSSP level migration debugging example

Scenario: A node is migrated from PSSP 3.1.1 to PSSP 3.2. We follow the procedure described in PSSP: Installation and Migration Guide, GA22-7347, starting with step 4. For the sake of simplicity, we assume that AIX is already at the desired level, so we skip steps 1 to 3. When running the psspscript on the node, we notice that the command hangs and the node’s LED shows c69.
The Example B-2 shows the output of the psspfb_script.

Example: B-2  psspfb_script output

============================================================================
psspfb_script: = Setting up authentication environment... =
                      =
+ OIFS=
+ IFS=
+ /etc/methods/showled 0xc69
+ K4FILES=/spdata/sys1/k4srvtabs
+ [[ ! -d /spdata/sys1/k4srvtabs ]]
+ sname=sp3n12
+ typeset -l sname
+ /bin/rm /spdata/sys1/k4srvtabs/sp3n12-new-srvtab
+ I> /dev/null 2>& 1
+ [[ -f /usr/lpp/ssp/bin/get_keyfiles ]]
+ /usr/lpp/ssp/bin/get_keyfiles sp3n12-new-srvtab 192.168.3.130
Parsing operands
Removing cons (getty) entry from inittab
Finding getty process
Terminating process Name=/usr/sbin/getty PID=7590
Getting my node number
Sending request for keyfile

The psspfb_script log file shows that the get_keyfiles script is causing the problems. The output of the get_keyfiles script is in the /var/adm/SPlogs/get_keyfiles/get_keyfiles.log file and is shown in Example B-3.

Example: B-3  get_keyfiles output

**************************************************************
*  Beginning of logging for -- get_keyfiles
Parsing operands
Removing cons (getty) entry from inittab
Finding getty process
Getting my node number
Sending request for keyfile
Setting up the socket
Opening temporary keyfile for writing
Connecting to port 32801
Opening /dev/tty0

**************************************************************
We also look on the CWS for the kfserver log file, located in the
/var/adm/SPlogs/kfserver directory, and shown in Example B-4. From the server
side, it appears that the key files are sent to the node. Actually, the files do not
get to the node, and the node keeps waiting for them.

**Example: B-4  kfserver output**

*************************************************************************
* Beginning of logging for -- kfserver
Recieved request from node 12
Uuencoding keyfile /spdata/sys1/k4srvtabs/sp3n12-new-srvtab
Sending keyfile to /dev/tty0 on sp3n12
*************************************************************************
***  End of logging for -- kfserver

A good starting point is to kill the hanging process, in order to allow the
setup_server to complete as described in the Example B-5 on page 283.

**Example: B-5  Finding the get_keyfiles PID**

sp3n12 > ps -ef |grep key
    root 122082  51244   2 17:03:49 pts/0  0:00 grep key
    root 126232 130574   0 16:44:08 pts/0  0:00 perl
/usr/lpp/ssp/bin/get_keyfiles sp3n12-new-srvtab 192.168.3.130
sp3n12 > kill 126232

Next we run the get_keyfiles command manually, but the process hangs again.
We then run it in debug mode (perl -d). We find that the script hangs while
executing the kfcli subroutine, which creates a socket connection to the CWS
and waits to receive the srvtab file. We interrogate the sockets on the node and
CWS and get the output shown in Example B-6 on page 283.

**Example: B-6  netstat output**

sp3n12 > netstat -an |grep 32801
tcp4  79  0 192.168.3.12.38345  192.168.3.110.32801  CLOSE_WAIT
sp3en0 > netstat -an |grep 32801
tcp4  0  0 192.168.3.130.32801  192.168.3.12.38345  FIN_WAIT_2
tcp4  0  0  *.32801  *.47957  LISTEN
We also have a look at the kfserver program code, running on the CWS as a inetd subserver. We notice that, for Kerberos 4 authentication, the kfserver uses the s1term command to send the srvtab file to the node, as root.SPbgAdm principal. We know that, in order to use s1term, a principal needs to be in the ACL of the hardmon service. The existing ACL is shown in Example B-7.

Example: B-7  hardmon ACL

```
sp3en0 > cat hmacls
sp3en0 root.admin a
sp3en0 rcmd.sp3en0 a
sp3en0 hardmon.sp3en0 a
1 root.admin vsm
1 rcmd.sp3en0 vsm
1 hardmon.sp3en0 vsm
sp3en0 root.SPbgAdm a
```

We test the permissions of the root.SPbgAdm principal. We notice the lack of authorization, so we add the appropriate line to the ACL file. Now the s1term command works. See Example B-8 for the commands output.

Example: B-8  Adding hardmon ACL authorization

```
sp3en0 > /bin/ksrvtgt root SPbgAdm
sp3en0 > hmgetacls 1:12
  frame1/slot12   -   -   -   -
sp3en0 > s1term -w 1 12
s1term: 0026-614 You do not have authorization to access the Hardware Monitor.
sp3en0 > echo "1 root.SPbgAdm vsm" >> /spdata/sys1/spmon/hmacls
sp3en0 > hmadm setacls
hmadm: 0026-641I The ADMIN command "setacls" was sent.
sp3en0 > hmgetacls 1:12
  frame1/slot12 v s m -
```

We now retry the get_keyfiles command on the node and this time it runs well. The problem was with the authorization for the root.SPbgAdm to access the serial line and was caused by the missing entry in the hardmon ACL.
Software maintenance strategy

This appendix describes the philosophy of, and the differences between, AIX maintenance levels and PSSP PTF sets. We introduce the following topics:

- The process for obtaining PTFs.
- Find the problems that PTFs address.
- Practical system administration.
Overview

PSSP and AIX packaging follows the convention of dividing the system software into *filesets*, each of which can contain a group of logically related files. Each fileset can be separately installed and updated. Changes to fileset levels are tracked by version, release, maintenance, and fix levels, known as VRMF (e.g., ssp.basic 3.2.0.11 - Version 3, Release 2, Maintenance level 0, Fix level 11). Application of filesets will increment a component of VRMF. This maintenance strategy can be summarized as “upward only,” and ensures a fix cannot be created for a lower level that is not already contained in a higher level.

Maintenance levels (sometimes called Modification levels) increment the (M) portion of VRMF. When this is done, the fix level (F) portion is reset to zero for the affected filesets. Maintenance levels contain an accumulation of changes from all previous fix and maintenance levels. Binary compatibility is preserved within a version and release.

Program Temporary Fixes (PTFs) are a fileset update, at a specific VRMF, to correct or prevent a particular problem. They increment the (F) portion of VRMF. This is known as corrective service. Corrective service is the application of one or more PTFs to correct a specific problem.

PTFs apply to all previous maintenance levels of the same version and release. They are cumulative, in other words, if we apply the fileset ssp.basic at fileset level 3.2.0.10, we encompass all fixes made for the ssp.basic fileset at levels 3.2.0.9, 3.2.0.8, and below.

A PTF may exist at a later maintenance level than the customer has on their system. It is part of the design of AIX maintenance that customers can install PTFs from higher maintenance levels. Remember, it is not required that a system be updated to the latest maintenance level just to install a PTF. Prerequisites may exist that ensure that additional fileset updates for a particular PTF are included.

An Authorized Program Analysis Report (APAR) is a description of a problem and it’s resolution. An APAR will consist of one or more PTFs and it will have a status of Open or Closed on the IBM Support databases.

- **Open**: The problem has been identified and described but the defect code for resolution is still being developed or tested.
- **Closed**: The defect resolution code is available, there may be a short delay while the code is packaged and shipped to distribution sites.


Why should you bother with PTFs

If your system is stable, performance is good and customers are happy, then there may be no reason to install new filesets. However, as system workloads change, new applications are installed, new users added, or extra nodes installed, circumstances may change. Some threshold or timing tolerance may be crossed that, seemingly, no amount of tuning or administration can rectify. It may be that this is a known problem that is already resolved. Often, problems discovered internally by IBM, are never experienced by customers because the circumstances are so unique. But testing, which does not stop just because a product is shipped, has shown there is potential for the problem to occur.

PTFs are developed either because there has been a problem found or there is extra functionality, such as extra trace facilities or better debug output (among other things). A request for a PTF to be included in a PSSP set or AIX maintenance level can come from IBM support on behalf of customers or from IBM development.

Preventative maintenance is of a benefit to customers and IBM. It reduces the possibility of rediscovering and diagnosing problems that have already been fixed, and reduces the number of fileset updates that may have to be installed for corrective service. The larger the size of an update, the greater the amount of time will be required to apply the corrective service update. Thus, more exposure to unforeseen problems with the application may exist.

AIX recommended maintenance levels

A distinction needs to drawn between the maintenance portion of VRMF and recommended maintenance levels; the application of a recommended maintenance package does not increment any portion of the VRMF.

Maintenance levels, as described by VRMF, can be determined by the command, `oslevel`, as shown in Example C-1.

```
Example: C-1   oslevel

[8:root@sp3en0:/]# oslevel
4.3.3.0
```

AIX recommended maintenance packages are a collection of PTFs applied on top of an AIX maintenance level. They have been tested as a unit and have enough exposure to be recommended for release as preventative maintenance.
A new flag (-r) has been created for the `oslevel` command and can now be used to show what the complete recommended maintenance level is on a system. The output shows the highest level at which all filesets, comprising a recommended maintenance level, are found as shown in Example C-2.

Example: C-2  `oslevel -r`

```
[8:root@sp3en0:]/ # oslevel -r
4330-04
```

A more verbose way, to show the same information, and also show all system applied recommended maintenance, is shown in Example C-3.

Example: C-3  `instfix -i | grep AIX_ML`

```
[8:root@sp3en0:]/ # instfix -i | grep AIX_ML
  All filesets for 4.3.1.0_AIX_ML were found.
  All filesets for 4.3.2.0_AIX_ML were found.
  All filesets for 4.3.3.0_AIX_ML were found.
  All filesets for 4330-02_AIX_ML were found.
  All filesets for 4330-03_AIX_ML were found.
  All filesets for 4330-04_AIX_ML were found.
  Not all filesets for 4330-05_AIX_ML were found.
  All filesets for 4330-01_AIX_ML were found.
  Not all filesets for 4330-06_AIX_ML were found.
  Not all filesets for 4330-07_AIX_ML were found.
  Not all filesets for 4330-08_AIX_ML were found.
```

The `instfix` command can also be used to determine if a specific recommended maintenance package is installed (in this example, 4.3.3.0-08), enter:

```
instfix -ik 4330-08_AIX_ML
```

To determine which filesets need updating for the system to reach the 4.3.3.0-08 level, enter:

```
instfix -ciqk 4330-08_AIX_ML | grep ":::
```

AIX recommended maintenance levels may be rolled out approximately every eight to twelve weeks.
PSSP PTF sets

**Important:** PSSP PTF sets are not the same as AIX recommended maintenance levels.

PSSP PTF sets are collections of fixes. They include the latest level of PSSP filesets as of the build date shown; refer to Table 6-8 for an example.

If your system is stable, you may want to hold the PSSP PTF set level a couple levels behind the most current. As an example, if PSSP PTF set 10 is the latest available, then run your system on PSSP PTF set 8. Of course, this may not be possible, as some later PTFs may be important for stable operations or corrective maintenance.

PSSP PTF sets may be rolled out approximately every six to eight weeks.

<table>
<thead>
<tr>
<th>PTF</th>
<th>File Set Name</th>
<th>File Set Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>U478551</td>
<td>ssp.basic</td>
<td>3.2.0.10</td>
</tr>
<tr>
<td>U478552</td>
<td>ssp.clients</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>U478550</td>
<td>ssp.css</td>
<td>3.2.0.10</td>
</tr>
<tr>
<td>U478548</td>
<td>ssp.docs</td>
<td>3.2.0.5</td>
</tr>
<tr>
<td>U478549</td>
<td>vsd.cmi</td>
<td>3.2.0.4</td>
</tr>
<tr>
<td>U478543</td>
<td>vsd.rvsd.rvsdd</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>U478542</td>
<td>vsd.rvsd.scripts</td>
<td>3.2.0.7</td>
</tr>
<tr>
<td>U478546</td>
<td>vsd.vsdd</td>
<td>3.2.0.9</td>
</tr>
<tr>
<td>U478558</td>
<td>rsct.basic.rte</td>
<td>1.2.0.10</td>
</tr>
<tr>
<td>U478560</td>
<td>ppe.pedb</td>
<td>3.1.0.6</td>
</tr>
<tr>
<td>U478547</td>
<td>ppe.poe</td>
<td>3.1.0.10</td>
</tr>
<tr>
<td>U478559</td>
<td>LoadL.full</td>
<td>2.2.0.9</td>
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<td>U478553</td>
<td>mmfs.base.cmds</td>
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Where to get a PTF

Fixes can be ordered by APAR or PTF number. Ordering PTFs on physical media from your support center may incur a fee.

For internet connected customers, the URL listed below is the site for downloading AIX or PSSP fixes without a fee. Here, you can search the database by APAR number, fileset name, PTF number or APAR abstract:

http://techsupport.services.ibm.com/rs6k/fixdb.html

A good system administration practise is to order the latest AIX recommended maintenance level and PSSP PTF set level and have it available should it be needed.

PTF system administration

Important: Your CWS must be at or above the highest level of any filesets on any of the nodes.

- Always take a current mksysb backup of your CWS and verify it as good. If you have separate volume groups on the CWS do a savevg of these and verify them as well.
- Read the README files shipped with the PTFs. Check for prerequisites or corequisites before applying PTFs.
- Ensure with your application vendor that they have verified support of the applications with these PTF levels.
- Do a preview install before installing and check the output fully for potential issues before actual installation.
- Always apply to the CWS first and test thoroughly before any work on the nodes or attached servers.
- Take another mksysb of the CWS.

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Appendix C. Software maintenance strategy

- Copy AIX PTFs to the /spdata/sys1/install/<aix_level>/lppsource using the bffcreate command. If you use another command, do not forget to run inutoc within the directory to rebuild the .toc file.
- Copy PSSP PTFs to the /spdata/sys1/install/pssplpp/<pssp_version> directory and rebuild the .toc file.
- Preview any PTFs updates and then update the SPOT using the /spdata/sys1/install/<aix_level>/lppsource directory. If any maintenance needs to be done to the nodes the new SPOT will be used.
- Take a current mksysb backup of a test node.
- Login to the test node and mount the /spdata/sys1/install/<aix_level>/lppsource directory from the CWS if updating AIX. For PSSP mount the /spdata/sys1/install/pssplpp/<pssp_version>.
- After applying the PTFs take another mksysb backup, storing it on the CWS in the /spdata/sys1/install/images/ directory.
- Thoroughly test the node.
- Store the new mksysb_name of the node into the SDR so the next install of the test node will use the updated image.

Useful URLs

The following list of URLs may provide useful information during problem determination:

- http://techsupport.services.ibm.com/rs6k/sp/status/
  PSSP APAR reports by version detail, the status of reported problems, the contents of PSSP PTF sets, and a description of them.
- http://techsupport.services.ibm.com/rs6000/techKnow
  This will provide information about Open/Closed APARs.
- http://techsupport.services.ibm.com/rs6000/fixes
  Download URL for fixes, maintenance levels, microcode.
- http://www.rs6000.ibm.com/support/sp/sp_secure/readme/
  For the latest README files for the SP subsystems.
- http://techsupport.services.ibm.com/rs6000/notification
  Subscribe to e-mail notifications on product fixes, security alerts, service announcements, and more.
Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 295.

- *RS/6000 SP Cluster: The Path to Universal Clustering*, SG24-5374
- *SP Perspectives: A New View of Your SP System*, SG24-5180
- *HACMP Enhanced Scalability Handbook*, SG24-5328
- *HACMP/ES Customization Examples*, SG24-4498
- *HACMP Enhanced Scalability: User-Defined Events*, SG24-5327
- *RSCT Group Services: Programming Cluster Applications*, SG24-5523
- *Understanding and Using the SP Switch*, SG24-5161
- *IBM 9077 SP Switch Router: Get Connected to the SP Switch*, SG24-5157
- *PSSP Version 3 Survival Guide*, SG24-5344
- *RS/6000 SP Systems Handbook*, SG24-5596

Other resources

These publications are also relevant as further information sources:

- *IBM RS/6000 SP: Planning Volume 1, Hardware and Physical Environment*, GA22-7280
- *IBM RS/6000 SP: Planning Volume 2, Control Workstation and Software Environment*, GA22-7281
- *AIX V4.3 Problem Solving Guide and Reference*, SC23-4123
Referenced Web sites

These Web sites are also relevant as further information sources:

- Web site for the latest installation planning guides

- AIX manuals

- PSSP manuals

- APARs and PTFs
  [http://techsupport.services.ibm.com/rs6000/fixes](http://techsupport.services.ibm.com/rs6000/fixes)

- Forums
  [http://techsupport.services.ibm.com/rs6000/forums](http://techsupport.services.ibm.com/rs6000/forums)

- General AIX technical documents
  [http://techsupport.services.ibm.com/rs6000/techKnow](http://techsupport.services.ibm.com/rs6000/techKnow)

- Main entry for IBM support page
  [http://techsupport.services.ibm.com/eserver/support](http://techsupport.services.ibm.com/eserver/support)

- RS/6000 SP support page
  [http://www.rs6000.ibm.com/support/sp](http://www.rs6000.ibm.com/support/sp)
How to get IBM Redbooks

Search for additional Redbooks or Redpieces, view, download, or order hardcopy from the Redbooks Web site:

ibm.com/redbooks

Also 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.

IBM Redbooks collections

Redbooks are also available on CD-ROMs. Click the CD-ROMs button on the Redbooks Web site for information about all the CD-ROMs offered, as well as updates and formats.
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## Abbreviations and acronyms

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<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>CWS</td>
<td>Control Work Station</td>
</tr>
<tr>
<td>DMA</td>
<td>Direct Memory Access</td>
</tr>
<tr>
<td>FSD</td>
<td>Fault Service Daemon</td>
</tr>
<tr>
<td>GRF</td>
<td>Goes Really Fast</td>
</tr>
<tr>
<td>IBM</td>
<td>International Business Machines Corporation</td>
</tr>
<tr>
<td>ITSO</td>
<td>International Technical Support Organization</td>
</tr>
<tr>
<td>LPP</td>
<td>Licensed Program Product</td>
</tr>
<tr>
<td>MCA</td>
<td>Micro Channel Architecture</td>
</tr>
<tr>
<td>PCI</td>
<td>Peripheral Component Interface</td>
</tr>
<tr>
<td>PID</td>
<td>Process Identifier</td>
</tr>
<tr>
<td>PTF</td>
<td>Program Temporary Fixes</td>
</tr>
<tr>
<td>rcp</td>
<td>Remote copy</td>
</tr>
<tr>
<td>rsh</td>
<td>Remote shell</td>
</tr>
<tr>
<td>SDR</td>
<td>System Data Repository</td>
</tr>
<tr>
<td>SPOT</td>
<td>Shared Product Object Tree</td>
</tr>
<tr>
<td>SPS</td>
<td>SP Switch</td>
</tr>
<tr>
<td>SRC</td>
<td>System Resource Controller</td>
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<td>TOD</td>
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Universal Clustering Problem Determination Guide
Universal Clustering
Problem Determination
Guide

Problem determination and problem solving on the RS/6000 SP and clusters can be difficult because the malfunction may imply the movement of several components within AIX and PSSP. Problem determination on the RS/6000 universal cluster is part of the daily tasks of a system administrator. Although the RS/6000 universal cluster is a very stable platform, the manner in which distributed and parallel environments are intermixed may cause certain problems that cannot be easily solved by someone with only AIX experience.

This redbook gives a comprehensive explanation of certain RS/6000 SP and cluster components and provides the reader with tools and procedures that can be used for problem isolation and problem solving in a cluster environment. This redbook is oriented to RS/6000 SP and cluster professionals who install, configure, and administer universal cluster systems. Several procedures are outlined and tested, along with the explanation for the causes of common SP and cluster problems.

This universal clustering guide is the perfect companion for the RS/6000 SP and clusters product manuals when you need to identify and solve system problems.