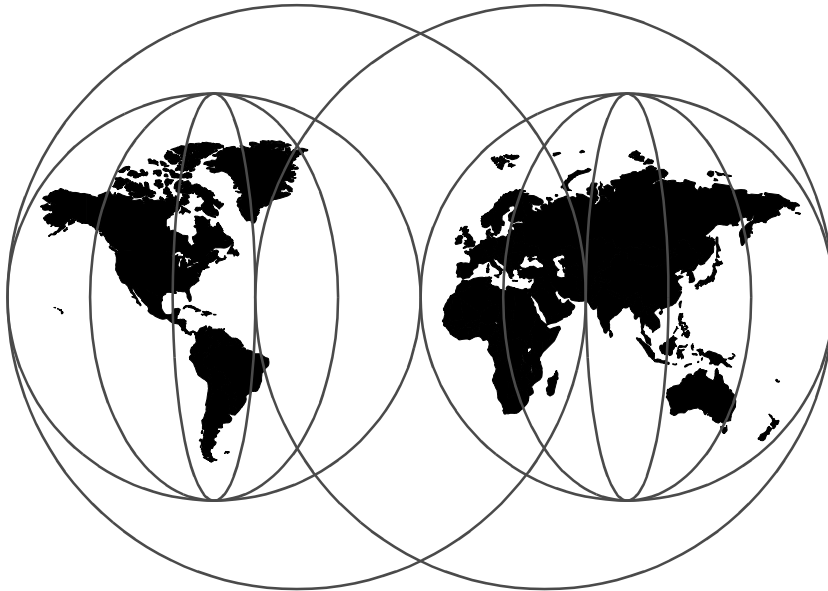# Lotus

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Lotus Domino R5 on IBM RS/6000: Installation, Customization, and Administration

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**Lotus Domino R5 on IBM RS/6000:
Installation, Customization,
and Administration**

April 1999

> **Take Note!**
>
> Before using this information and the product it supports, be sure to read the general information in Appendix E, "Special Notices" on page 363.

First Edition (April 1999)

This edition applies to Release 5.0 of Lotus Domino for use with the IBM RS/6000 AIX Operating System.

> **Note**
>
> This book is based on a pre-GA version of a product and may not apply when the product becomes generally available. We recommend that you consult the product documentation or follow-on versions of this redbook for more current information.

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Contents

Figures

xvii

Tables

xix

Preface

This redbook is unique in its detailed coverage of Lotus Domino Server R5 on the IBM RS/6000 AIX operating system platform. The Lotus Domino Server is functionally platform independent; that is, it will perform most of the same functions regardless of platform. Clearly, however, there are differences in the underlying operating systems' platforms.

This redbook is intended to help the technical professional who may have some, little, or no experience with AIX, UNIX, or Lotus Domino. The book examines in detail the installation and administration of Lotus Domino R5 on the IBM RS/6000 AIX platform. We have documented AIX functions, commands, and scripts that can greatly help administrators of all skill levels. It also covers administration tasks, the installation and use of the admin client, security, and Internet integration.

This redbook will give you the confidence to implement and maintain a successful installation of Lotus Domino Servers on the IBM RS/6000 AIX operating system.

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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Comments Welcome

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xxiii

Chapter 1. Introduction

This redbook deals with installing and administering Lotus Domino R5 on an IBM RS/6000 AIX platform. We documented our experience while working with Lotus Domino R5.

Lotus Domino R5 brings messaging, Internet integration, and scalability to a whole new level. The new Domino Server includes the latest innovations in Internet messaging with native support for all the major Internet standards, such as industry-leading support for Web applications, including Common Object Request Broker Architecture (CORBA) support and integration with Microsoft Internet Information Server (IIS). The Domino Server has increased reliability and scalability including improvements in performance, capacity, availability, and maximum database size. In addition, the server has a new administration interface with a task-oriented approach that makes Domino easier to deploy, use, and manage.

Lotus Domino R5 continues to support a wide variety of clients in addition to the traditional Notes clients. Messaging features are available to Web browsers and Internet mail clients, such as Post Office Protocol, Version 3 (POP3) and Internet Message Access Protocol, Version 4 (IMAP4) clients. Directory features are available to browsers and Lightweight Directory Access Protocol (LDAP) clients. Discussion features are available to browsers and Network News Transfer Protocol (NNTP) newsreader clients, and administration features are available to browsers as well as the Notes clients. Domino continues to be the best platform for designing dynamic Web applications. With the new Domino Designer R5, you can easily build a single application that looks and runs the same for both the Web and Notes clients.

The Lotus Notes R5 client gives you easy access to all the information that is important to you -- whether that information is personal (like your e-mail and calendar) or public (like your favorite Web sites and Internet newsgroups). The client includes a new browser-like user interface with a customizable *welcome* page for tracking your important daily information. It also includes improvements to the applications you use in your daily work, such as mail, calendar and scheduling, Web browsing, and discussions.

The Notes R5 client is server independent -- that is, you can use it with Domino R5 as well as other Internet-standard servers, such as the ones your Internet Service Provider (ISP) may use. For example, you can read and send messages to any Internet mail server, read and post topics to any Internet newsgroup, search any Internet directory, view HTML from any Web server, and use X.509 certificates for security. The best part is that you can

1

do all these things from within one, consistent interface without needing to know about the Internet standards involved. You simply do your work within the Notes interface, and Notes handles the rest for you.

The rest of this chapter briefly outlines the new features and enhanced functionality of Lotus Domino Server 5 and the various clients. It also describes the new concepts in R5 and the available platforms. The hardware and software we used while writing this book is also described.

1.1 What Is Lotus Domino R5?

Lotus Domino R5 is Lotus' next generation of Internet products that include Notes integrated Internet client and Domino server platform for messaging, collaboration, and Internet and Intranet applications. The Domino Designer is a Web and Intranet application development tool. Domino's integrated platform delivers messaging and collaborative solutions for the Internet. Several key services enable IT professionals to manage and run their messaging and Web application infrastructures easily and efficiently. The new R5 Domino Administrator makes it faster and easier for administrators to manage users, configure systems, optimize performance, all from an intuitive user interface.

The Lotus Domino R5 server builds on its already strong foundation for messaging and Web applications. The R5 enhancements are the next step in making Domino easy to use and a better fit for any sized organization.

Specific Lotus Domino R5 features include:

Internet Messaging and Directories
- Provide full-fidelity messaging for your users with native MIME and SMTP support
- Use the new Directory Catalog to save space and provide quick name lookups
- Use new LDAP features to authenticate users in external directories, customize the directory, and more

Expanded Web Application Services
- Design applications with CORBA-standard distributed objects, Java, or JavaScript
- Use Web clusters for high availability of Web services, expanded security options, and more
- Run Domino using the IIS HTTP services

Database Improvements
- Use transactional logging for faster restarts and data recovery
- Convert to the new on-disk structure (ODS) for better performance, data integrity, and more

Easier Administration
- Manage users, databases, and servers with the new Domino Administrator. It includes the Administration Process, a tool for analyzing what you need to do to decommission a server, topology maps, and integration hooks for third-party tools to appear on the registration interface.
- Migrate users from cc:Mail, Microsoft (MS) Mail, Exchange, or Windows NT with the redesigned user registration.
- New tools for server monitoring and message management.

1.2 What Is Lotus Notes R5?

The new Lotus Notes R5 interface is more intuitive and easier to use than ever. It provides a single integrated environment to manage e-mail, appointments, tasks, key contacts, and Web information. It gives you a *headlines* page that helps you stay on top of your most important priorities throughout the day. Lotus Notes R5 offers powerful, new knowledge management tools. Its bookmarks help get back to information quickly. It is state-of-the-art e-mail, calendaring, group scheduling, Web access, and information management -- all integrated in an easy-to-use and customizable environment. Lotus Notes R5 extends the lead in integrated collaboration clients with even more Internet support and a Web-style interface that adapts to your work style plus scores of other improvements to help you work smarter and be more productive.

The new look and feel of Lotus Notes R5 focuses on creating an environment that makes it easy for both new and existing users to access all of their information. This involved adding features that help new users, such as cc:Mail and Internet mail users, feel comfortable within the Notes mail interface as well as making other existing features, such as calendar and scheduling, easier to use. Underlying both of these areas is the client's total embrace of Internet standards; so, you can work with the information that matters to you regardless of where that data is stored or what protocol is used to deliver it.

Specific Lotus Notes R5 features include:

The New User Interface
- Use the new Welcome page for instant access to your mail, calendar, and more and customize it to track your important information.
- Create bookmarks for anything that you want to return to later, whether it is from Notes or the Internet.
- Navigate through open pages of information with tabs and Web-like universal navigation buttons.

Improved Applications
- Use new mail features, such as cc:Mail-like address headers, mail rules, easier mail archiving, and others.
- Get organized with enhanced Calendar and Scheduling features, such as tasks that follow you, improved calendar management, a Group calendar, and more.

Native Support of Internet Standards
- View Internet mail messages, Web pages, and newsgroups with full fidelity (because of MIME and HTML support) and security (using SSL, S/MIME, and X.509 certificates).
- Read and send messages from Internet mail servers (using POP3 or IMAP).
- Search any Internet directory (using LDAP).
- Read and post articles to any Internet newsgroup discussion (using NNTP).

1.2.1 Benefits of R5:

Some of the benefits of R5 are given below:

- Ease of use

  Notes makes it easy to find, sort, and manage all your work in a way that makes sense to you.

- Notes works your way

  You can personalize the new Headlines page or customize your Bookmarks so that the information you need is the information you see.

- Universal In-Box

  Notes support for Internet Protocols lets you manage all your e-mail from one place whether it's from your network or from an Internet account.

- One place for all information

  Notes is a truly integrated Internet client providing access to a world of information and helping you manage it with ease.

- Mobile support

  Whether you are in the office or on the road, you can stay connected. Notes synchronizes data with PCs, pagers, faxes, and popular hand-held devices.

- Easy to install and setup

  Simple install of software will get you right to work.

- A powerful tool for any infrastructure

  Current Notes users can upgrade quickly and easily to take advantage of all the enhancements in Notes and Domino R5.

1.2.2 New Lotus Notes R5 Client Interface

Notes unveils a dramatically new user interface designed to let you take advantage of the new power of Notes whether you are viewing Notes databases, contributing to a discussion group, reading mail from your ISP, or just surfing the Web. While the interface has changed, you can still use the legacy Notes Workspace from the previous releases of Notes.

Table 1. User Interface Features

UI Features	Description
Welcome page	Start on the Welcome page for all your important information. The Welcome page contains some basic tasks, and you can customize it to: Instant access to mail, calendar, and to-do lists Customize the page to see your latest mail messages and appointments at a glance Add your favorite Web sites or newsgroups Instant search of Web sites, local documents, or databases Notes Tour See What's New
Bookmarks	Create bookmarks for anything you want to return to later whether it's from Notes or the Internet.
Navigation	Navigate through open pages of infomration with tabs and Web-like universal navigation buttons.

The Welcome page looks like the example shown in Figure 1 below:
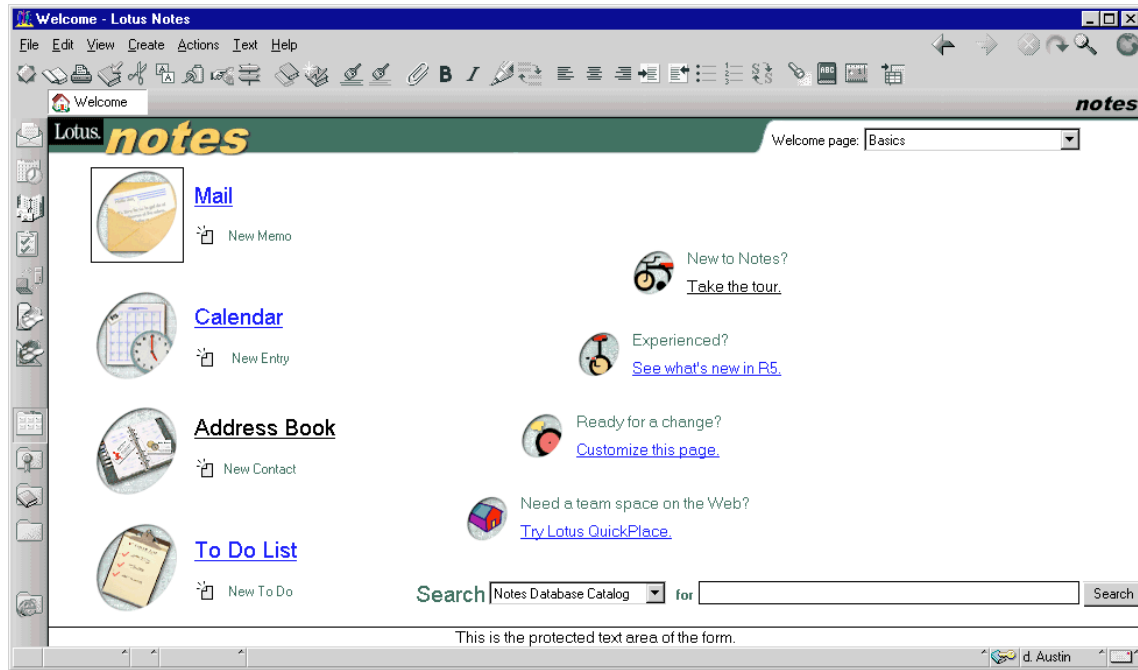
Figure 1. New Lotus Notes R5 Client Interface

1.3 Lotus Domino R5 Family of Servers and Clients

The Domino Server Family is an integrated messaging and Web application software platform for growing companies that need to improve customer responsiveness and streamline business processes.

The only solution built on an open, unified architecture, Domino is trusted by the world's leading companies to deliver secure communication, collaboration, and business applications. Lotus Domino R5 Servers set a new standard for rich Internet messaging, ease of administration, integration with backend systems, and reliability.

The Domino Server family is comprised of three core servers:

1. Domino R5 Mail Server

   The Domino Mail Server combines full support for the latest Internet mail standards with Domino's industry-leading messaging capabilities -- all in one manageable and reliable infrastructure.

2. Domino R5 Application Server

The Domino Application Server is an open, secure platform optimized to deliver collaborative Web applications that integrate your Enterprise systems with rapidly changing business processes.

3. Domino R5 Enterprise Server

The Domino Enterprise Server delivers all the functionality of the Domino Mail and Application Servers reinforced with clustering for the high availability and reliability required by mission-critical applications.

The Domino client family is comprised of three core clients:

1. Domino Administrator

Domino Administrator is the new administration client for Notes and Domino. It has a completely new interface with different navigation from the R4.x Administration panel.

2. Domino Designer

Domino Designer R5 is an integrated development environment. It enables developers to rapidly build secure Web applications that incorporate Enterprise data and streamline business processes.

3. Notes Client

The Notes Client provides the interface that allows a Lotus Notes user to access shared databases to read and send mail. The client user interface is dramatically enhanced in R5.

1.4 New Terminologies Used in Lotus Notes Release 5

With the advancement in technology, Lotus has introduced some new terms in the latest release as given below:

Directory Catalog
The Directory Catalog is a compressed version of one or multiple Domino Directories, which improves the speed of name lookups and name resolution for all organizations.

Domino Directory
The Public Address Book is now referred to as the Domino Directory.

Directory Assistance
The Master Address Book is now referred to as the Directory Assistance.

Domino Enterprise Connection Services
Lotus Domino R5 includes DECS for building live links between Domino pages and forms to data from relational databases

Byte-Range Serving
Allowing users to download files in sections rather than all at once.

Transactional Logging
Domino now allows for 24x7 online server backups and recovery support. So, you no longer need to shut down Domino servers in order to maintain them. A transactional log provides a sequential record of every operation that occurs (sequential writing on a disk is much faster than writing in various places on a disk). Logging helps to ensure complete data integrity for updates and enables you to perform incremental database backups.

Online, In-Place Compaction
This means that when you compact a database, the compaction occurs in-place meaning that your server does not require extra disk space. Also, users can continue to work in the database during the compaction.

Native Support
With support for native MIME content and native SMTP routing, Domino now integrates the features that previously required a separate message transfer agent (MTA). The native support means that conversions between a Notes format and an Internet format are no longer required.

Redesigned User Registration
The redesigned user registration allows you to easily register users from other directories whether those directories are from cc:Mail, MS Mail, Exchange, Windows NT, or another LDAP directory. Domino R5 also includes the registration API calls; so, you can integrate your own migration tools. When registering users, you can select to migrate people and groups from a foreign directory source.

1.5 Available Platforms

The new release of Lotus Domino Server elevates the standard for Enterprise messaging, groupware, and Web application development servers. It is available on all Lotus Domino Server platforms.

The following table is a summary of the various operating systems platforms that support Lotus Notes/Domino Release 5.0.

Table 2. Available Platforms for Release 5.0

Platform	Domino Server R5	Notes Client R5
UNIX (AIX V 4.3.1 or higher, HP-UX 11.0, Solaris/SPARC 2.6, Solaris/Intel 2.6)	Yes	No
OS/2 Warp Server V4.0	Yes	No
Windows 95/98	No	Yes
Windows NT Server 4.0 and Windows NT Workstation 4.0	Yes	Yes
Novell NetWare	No	No
Macintosh Power PC 7.6, 8.1	No	Yes
AS/400 V4R2	Yes	No
S/390 V2R6	Yes	No

1.5.1 AIX

The RS/6000 is known for its performance, innovative technology, and scalability. The RS/6000 family offers the broadest product line spanning from workstations to massive parallel servers and is the only IBM brand of server that delivers a full range of solutions for technical applications.

IBM's award winning UNIX implementation is AIX. Domino, coupled with the IBM RS/6000 hardware, is a highly scalable platform that will optimize network communications (TCP/IP leadership), security (SSL, LDAP, C2, IPSEC), and Java (leading Volcanomark) with award winning System Management and high availability system software (HACMP).

Lotus Domino servers are an integral part of the IBM Internet technology. The data managed by these servers must be highly available in a world where online information is the corner stone of business success. Domino is a Web server for highly interactive Internet and intranet applications. It is also the base for future Lotus Internet solutions.

IBM's RS/6000 provides new Internet and electronic commerce solutions for your business. New workstations and servers include Internet-ready systems that include Lotus Notes and state-of-the-art electronic commerce software

providing all the elements needed to get businesses up and running on the World Wide Web.

The newly announced RS/6000 servers and workstations make IBM a solid choice for engineers and scientists by offering outstanding graphics price/performance and a wide-range of power and expansion options.

IBM's Web-based solutions for customers seeking to establish electronic commerce capability include a family of POWERsolutions for AIX. It now includes options, such as IBM's Net.Commerce, which allows interactive browsing of merchants' catalogs and the greater security required for purchases made over the Internet.

The newly announced family of cost-effective uniprocessor and SMP workstations also makes IBM RS/6000 a wise decision for engineers and scientists. They meet customers' needs for high-performance systems at lower cost. Additions also include five graphics cards that provide customers a wide range of choices to meet their graphics needs from 2D to advanced 3D.

Environments, protocols, and hardware details for Lotus Domino R5 on RS/6000 is as given below :

Environment(s): AIX V4.3.1 or higher

Workstation: No

Server: Yes

Network protocols available for Server:

- NetWare IPX/SPX
- TCP/IP
- X.PC (supplied with Lotus Notes software)

Disk Space:

Installation or distribution directory: 160 MB minimum

Server data directory: 200 MB minimum

Swap Space: 256 MB minimum

Mail Database requirements: 50 MB - 100 MB per user

Memory Requirements:

Lotus Domino Server on AIX: 128 MB RAM minimum + 0.5 MB per concurrent user

1.6 Our Lotus Domino Server and Notes Workstation Environment

We have installed and set up Lotus Domino Servers and Notes Workstations in an environment with many different operating systems and networking protocols. Throughout the rest of this book, we will be explaining our installation in great detail. The following figure shows the various Lotus Domino Servers, Notes Workstations, and networking protocols that we have used.

The naming conventions used in for the test environment is as follows:

- Volume Group for domino data is *dominovg*
- Logical Volume for domino data is *dominodatalv*
- Logical Volume for domino binaries is *dominobinlv*
- File System for domino data is */server1*
- File System for Domino binaries is */usr/domino*
- Server name is *server1/ibm*
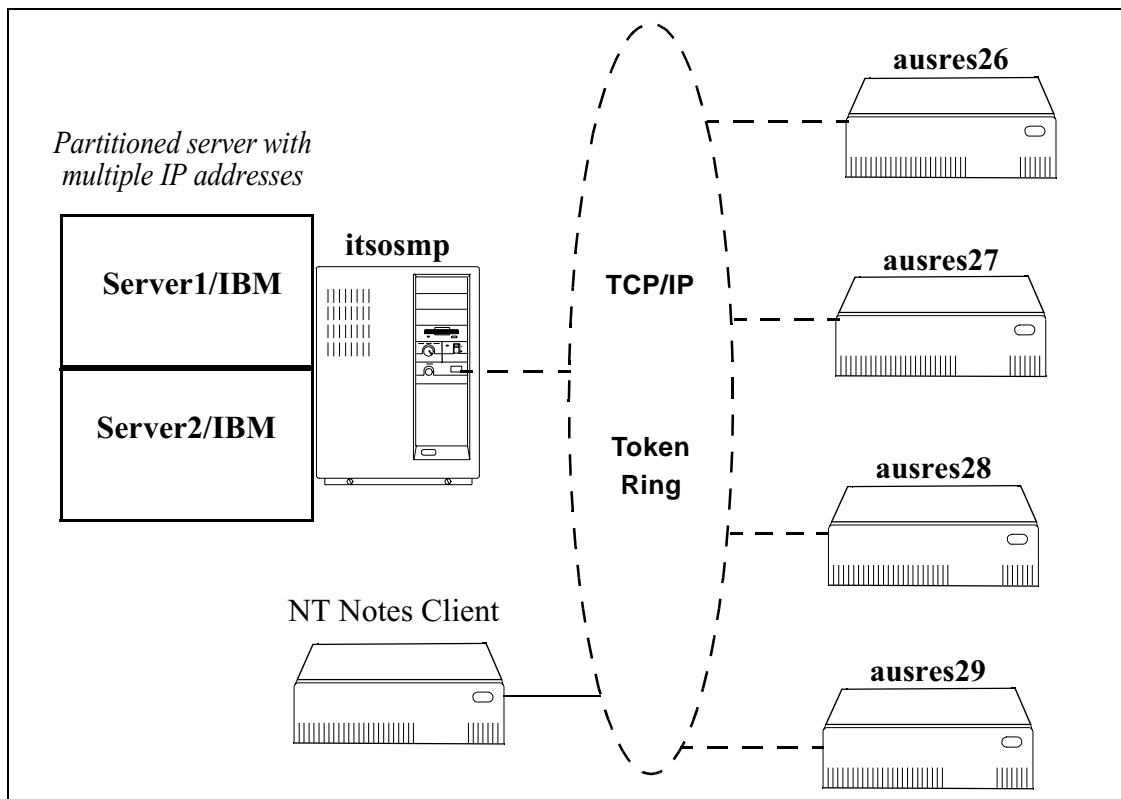
Figure 2. Lotus Domino Servers and Notes Workstations Environment in Our Lab

Chapter 2. Installing a Lotus Domino R5 Server

In order to install a Lotus Domino R5 Server, certain software, hardware, and system requirements must be met, the AIX environment must be prepared, and finally, the server software is installed. These topics will be discussed and illustrated in this chapter.

2.1 Hardware, Software, and System Requirements

Before installing a Lotus Domino R5 Server, make sure that the RS/6000 system meets the following hardware, software, and operating system requirements. The list below specifies the bare minimum requirements. Additional resources are required when taking into consideration the number of users, Domino applications, and server load.

- An IBM RS/6000 system.
- IBM AIX version 4.3.1 or higher with the IBM AIX operating system patches listed in Table 3 on page 17 and Table 4 on page 18. If you're not sure if you have these patches, refer to 2.2.3, "Step 3 - Check PTF Levels of Operating System Filesets" on page 16.
- A minimum of 128 MB of memory required.
- A minimum of 256 MB of paging space required. Please see 2.2.15, "Step 15 - Paging Space" on page 36 for more information.
- A minimum of 160 MB of disk space is required for the binaries.
- A minimum of 200 MB of disk space is required for the data files.
- A network adapter.
- You must have root access to the system.
- You must have a Web browser to configure the server.

To size a machine beyond the minimum requirements, a couple rules of thumb can be used. This information is provided since every environment is different, and your own requirements may differ.

- Add an additional .5 MB of memory per concurrent user anticipated on the system. Concurrent users is usually based on the total number of registered mail users for a particular server since it is possible to have all registered users concurrent at the same time.
- Add an additional 50 - 100 MB of disk space for each registered mail user.
- Add an additional processor per 1000 users.

15

• Add an additional network adapter per 1000 users.

2.2 Preparing the AIX Environment

Once you have met the requirements mentioned in the section above, you must complete each of the following steps before installing the server software. Since Domino server doesn't require a graphical desktop interface (CDE or X-windows) anymore, this chapter assumes that you are using a command line prompt interface (green screen) to perform the installation.

2.2.1 Step 1 - Log Into AIX as the Root User

Log in to your AIX system as the root user either from a login prompt or by using the command `su –` at the prompt if you are already logged in as another user.

```
$ su -
root's Password: ******
#
```

Figure 3. Log In as Root User

2.2.2 Step 2 - Check Your Default Path Environment Variable

Check your default path. Make sure that it includes `/usr/sbin`. Use the command `echo $PATH` to display your default path and make changes if necessary in the /etc/environment file.

```
# echo $PATH

/usr/dt/bin:/usr/bin:/etc:/usr/sbin:/usr/ucb:/home/ausres/bin:/opt/lotus/bin:/
usr/contrib/bin:/usr/prod/bin:/afs/austin/local/bin/:/usr/afs/bin:/sbin:.
#
```

Figure 4. Environment Path Query

2.2.3 Step 3 - Check PTF Levels of Operating System Filesets

Check to make sure you have the necessary operating system patches installed on your system. Use the command `lslpp –l <fileset>` to check the current level for a given fileset. An example of this command is given below. If you find a fileset that is not at the appropriate level, you must apply the PTF to bring it to the correct level. Refer to *http://service.software.ibm.com/support/rs6000* for PTF download information.

```
# lslpp -l bos.adt.include

   Fileset                     Level   State       Description
   -------------------------------------------------------------------------
Path: /usr/lib/objrepos
  bos.adt.include              4.3.1.1 COMMITTED   Base Application Development
                                                   Include Files
#
```

Figure 5. AIX Fileset Query

This table lists the current PFT requirements in order to install Lotus Domino R5. Refer to the latest copy of the *Lotus Domino Release Notes* for the most current PTF requirements.

Table 3. Patches for AIX Version 4.3.1

Patch Number (PTF / APAR)	Fileset	Version
U453875	X11.base.rte	4.3.1.1
U457544	xlC.rte	3.6.4.0
U456080	X11.base.lib	4.3.1.1
U456000	X11.compat.lib.X11R5	4.3.1.1
U456135	bos.adt.debug	4.3.1.1
U457438	bos.adt.include	4.3.1.3
U457423 (development only)	bos.adt.syscalls	4.3.1.1
U453878	bos.adt.prof	4.3.1.1
U456056	bos.net.nfs.client	4.3.1.1
U455978	bos.net.tcp.client	4.3.1.1
U456118	bos.rte.bind_cmds	4.3.1.1
U455998	bos.rte.commands	4.3.1.1
U456156	bos.rte.control	4.3.1.1
U456119	bos.rte.cron	4.3.1.1
U455981	bos.rte.install	4.3.1.1
U456098	bos.rte.libc	4.3.1.1
U456120	bos.rte.libpthreads	4.3.1.1

Patch Number (PTF / APAR)	Fileset	Version
U456138	bos.rte.lvm	4.3.1.1
U456152	bos.rte.shell	4.3.1.1
U455983	bos.sysmgt.smit	4.3.1.1
U457293	bos.up	4.3.1.3
U456091	bos.mp	4.3.1.3
U452653	devices.graphics.com	4.3.1.1

Table 4. Patches for AIX Version 4.3.2

Patch Number (PTF / APAR)	Fileset	Version
U461236	bos.up	4.3.2.1
U461454	bos.mp	4.3.2.1
U461854	bos.adt.prof	4.3.2.3
U461430	bos.rte.libc	4.3.2.3
U461941	bos.rte.libpthreads	4.3.2.1
U462006 (development only)	ibmcxx.include	3.6.4.1
U462007 (development only)	ibmcxx.cmp	3.6.4.2

2.2.4 Step 4 - Configure TCP/IP

Next, we must make sure that TCP/IP is configured correctly. For most systems, this is probably already done. If you're sure that TCP/IP is configured correctly, please skip to "Step 5 - Stop Daemons" on page 20. Otherwise, please continue with this step.

You should be familiar with TCP/IP and know the host name, TCP/IP address, network mask, domain name server (DNS) address, and the default gateway address of the RS/6000 you're working with. If you're not familiar with these terms, or you're missing some of the information, please contact your network administrator for assistance.

To set up TCP/IP, use the command `smitty tcpip` and press **Enter**.

```
# smitty tcpip
```

You will be presented with the TCP/IP menu. Select **Minimum Configuration & Startup** and press **Enter**.

```
                          TCP/IP

 Move cursor to desired item and press Enter.

   Minimum Configuration & Startup
   Further Configuration
   Use DHCP for TCPIP Configuration & Startup
   IPV6 Configuration



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

Figure 6. TCP/IP Configuration Screen

A popup list will appear. Select the desired network interface adapter from the list and press **Enter**. For our environment, we will select the token ring network interface.

```
              Available Network Interfaces

 Move cursor to desired item and press Enter.

   en0     Standard Ethernet Network Interface
   et0     IEEE 802.3 Ethernet Network Interface
   tr0     Token Ring Network Interface

 F1=Help               F2=Refresh            F3=Cancel
 F8=Image              F10=Exit              Enter=Do
 /=Find                n=Find Next
```

Figure 7. TCP/IP Network Interface Selection Screen

On the configuration screen, enter the hostname, internet address (TCP/IP address), network mask, name server (DNS), domain name, and the default gateway address then press **Enter**.

```
                        Minimum Configuration & Startup

  To Delete existing configuration data, please use Further Configuration menus

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

                                                      [Entry Fields]
 * HOSTNAME                                           [ausres29.ibm.com]
 * Internet ADDRESS (dotted decimal)                 [9.3.240.6]
   Network MASK (dotted decimal)                      [255.255.255.0]
 * Network INTERFACE                                   tr0
   NAMESERVER
           Internet ADDRESS (dotted decimal)          [9.3.240.2]
           DOMAIN Name                                 [ibm.com]
   Default GATEWAY Address                             [9.3.240.1]
   (dotted decimal or symbolic name)
   RING Speed                                          [autosense]          +
   START Now                                            no                   +



 F1=Help            F2=Refresh         F3=Cancel            F4=List
 F5=Reset           F6=Command         F7=Edit              F8=Image
 F9=Shell           F10=Exit           Enter=Do
```

Figure 8. TCP/IP Configuration Screen

If everything worked, you will see a screen similar to the one in Figure 9.
Press **F10** to exit the screen and return to the prompt.

```
                              COMMAND STATUS

 Command: OK            stdout: yes           stderr: no

 Before command completion, additional instructions may appear below.

 tr0
 ausres29.ibm.com
 inet0 changed
 tr0 changed
 inet0 changed



 F1=Help            F2=Refresh         F3=Cancel            F6=Command
 F8=Image           F9=Shell           F10=Exit             /=Find
 n=Find Next
```

Figure 9. TCP/IP Configuration Status Screen

2.2.5 Step 5 - Stop Daemons

There are some AIX daemons that will interfere with the operation of the
Lotus Domino server. Generally, you will find one or more of the following
daemons running on your RS/6000 system:

- sendmail
- httpd
- httpdlite

These daemons must be stopped in order to free up certain network ports that the Lotus Domino server will need. In order to check to see if you have any of these daemons running, use the command: `ps -ef | grep <daemon name>` Here's an example of this command:

```
# ps -ef | grep sendmail

   root  5692  4166   0 16:02:52     -  0:00 sendmail: accepting connections on port 25
   root 21278 22720   2 16:25:16  pts/0  0:00 grep sendmail

# ps -ef | grep httpd

   imnadm 20128     1   0 16:04:23     -  0:00 /usr/IMNSearch/httpdlite/httpdlite -r
/etc/IMNSearch/httpdlite/httpdlite.conf
   root 22078 22720   2 16:25:16  pts/0  0:00 grep sendmail

#
```

Figure 10. Show Active Daemons

As you can see from our example, we have both the `sendmail` and `httpdlite` daemons active on our RS/6000.

The easier of the two to stop is the `sendmail` daemon. Although the Domino installation will stop this for you, you must still disable the daemon from restarting upon boot. First let's stop the `sendmail` daemon by using the command: `stopsrc -s sendmail`

```
# stopsrc -s sendmail
0513-044 The stop of the sendmail Subsystem was completed successfully.
#
```

Figure 11. Stop Sendmail

Next, lets disable `sendmail` from restarting by using the command: `chrctcp -d sendmail`

```
# chrctcp -d sendmail
#
```

Figure 12. Disable Sendmail

You can verify that the `sendmail` daemon has indeed stopped by using the command: `ps -ef | grep sendmail`

```
# ps -ef | grep sendmail

    root 22978 22720   2 16:25:16  pts/0  0:00 grep sendmail
#
```

Figure 13. Show Active Daemons

As you can see, the `sendmail` daemon has stopped.

Next, we're going to stop and disable the `httpd` daemon. First you must get the process ID (PID) by using the command: `ps -ef | grep httpd`

```
# ps -ef | grep httpd

  imnadm 19870     1   0 11:02:42    -  0:00 /usr/IMNSearch/httpdlite/httpdlite -r
/etc/IMNSearch/httpdlite/httpdlite.conf
    root 22974  3916   2 11:33:22  pts/0  0:00 grep httpd
#
```

Figure 14. Show HTTPD's Process ID

In our example above, the `httpdlite` daemon is running under the PID of `19870`. To stop the daemon, you use the command: `kill -9 <process id>`

```
# kill -9 19870
```

Figure 15. Kill HTTPD

Next, you must disable the `httpd` daemon by commenting out the appropriate line in the `/etc/inittab` file. Using `vi`, edit the `/etc/inittab` file.

```
# vi /etc/inittab
```

After entering `vi`, you will see the following screen:

```
: @(#)49  1.28.2.7  src/bos/etc/inittab/inittab, cmdoper, bos430, 9737A_430 7/26
/94 16:27:45
: IBM_PROLOG_BEGIN_TAG
: This is an automatically generated prolog.
:
: bos430 src/bos/etc/inittab/inittab 1.28.2.7
:
: Licensed Materials - Property of IBM
:
: (C) COPYRIGHT International Business Machines Corp. 1989,1993
: 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
:
:  COMPONENT_NAME: CMDOPER
:
:  ORIGINS: 3, 27
:
:  (C) COPYRIGHT International Business Machines Corp. 1989, 1993
:  All Rights Reserved
:  Licensed Materials - Property of IBM
"/etc/inittab" 53 lines, 2364 characters
```

Figure 16. /etc/inittab in vi

Do a search for the `httpd` daemon line by using the `vi` command `/httpd` and press **Enter**. This command will appear at the bottom of the screen as you type.

```
: @(#)49  1.28.2.7  src/bos/etc/inittab/inittab, cmdoper, bos430, 9737A_430 7/26
/94 16:27:45
: IBM_PROLOG_BEGIN_TAG
: This is an automatically generated prolog.
:
: bos430 src/bos/etc/inittab/inittab 1.28.2.7
:
: Licensed Materials - Property of IBM
:
: (C) COPYRIGHT International Business Machines Corp. 1989,1993
: 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
:
:  COMPONENT_NAME: CMDOPER
:
:  ORIGINS: 3, 27
:
:  (C) COPYRIGHT International Business Machines Corp. 1989, 1993
:  All Rights Reserved
:  Licensed Materials - Property of IBM
/httpd
```

Figure 17. Search /etc/inittab Using vi Commands

After you press **Enter**, `vi` will search the `/etc/inittab` file for any line that contains `httpd` and then display that on the screen.

```
piobe:2:wait:/usr/lib/lpd/pio/etc/pioinit >/dev/null 2>&1  # pb cleanup
qdaemon:2:wait:/usr/bin/startsrc -sqdaemon
writesrv:2:wait:/usr/bin/startsrc -swritesrv
uprintfd:2:respawn:/usr/sbin/uprintfd
logsymp:2:once:/usr/lib/ras/logsymptom # for system dumps
pmd:2:wait:/usr/bin/pmd > /dev/console 2>&1 # Start PM daemon
diagd:2:once:/usr/lpp/diagnostics/bin/diagd >/dev/console 2>&1
dt:2:wait:/etc/rc.dt
cons:0123456789:respawn:/usr/sbin/getty /dev/console
imnss:2:once:/usr/IMNSearch/bin/imnss -start imnhelp >/dev/console 2>&1
httpdlite:2:once:/usr/IMNSearch/httpdlite/httpdlite -r
/etc/IMNSearch/httpdlite/httpdlite.conf >/dev/console 2>&1
imqss:2:once:/usr/IMNSearch/bin/imq_start >/dev/console 2>&1
```

Figure 18. Search Results for httpd

After the search, the cursor is located at the beginning of the line that
contains the startup information for the `httpd` daemon. To comment out this
line, you must insert a colon at the beginning of the line.

To insert the necessary colon, you use the `vi` command `i` to enter the insert
mode. Make sure the cursor is at the beginning of the line before you enter
the insert mode.

Once in the insert mode, type a colon and a space as shown in the example
below.

```
piobe:2:wait:/usr/lib/lpd/pio/etc/pioinit >/dev/null 2>&1  # pb cleanup
qdaemon:2:wait:/usr/bin/startsrc -sqdaemon
writesrv:2:wait:/usr/bin/startsrc -swritesrv
uprintfd:2:respawn:/usr/sbin/uprintfd
logsymp:2:once:/usr/lib/ras/logsymptom # for system dumps
pmd:2:wait:/usr/bin/pmd > /dev/console 2>&1 # Start PM daemon
diagd:2:once:/usr/lpp/diagnostics/bin/diagd >/dev/console 2>&1
dt:2:wait:/etc/rc.dt
cons:0123456789:respawn:/usr/sbin/getty /dev/console
imnss:2:once:/usr/IMNSearch/bin/imnss -start imnhelp >/dev/console 2>&1
: httpdlite:2:once:/usr/IMNSearch/httpdlite/httpdlite -r
/etc/IMNSearch/httpdlite/httpdlite.conf >/dev/console 2>&1
imqss:2:once:/usr/IMNSearch/bin/imq_start >/dev/console 2>&1
```

Figure 19. Edit /etc/inittab

When you're finished, press the **Escape** twice to leave the insert mode. Once
out of the insert mode, you will need to save your changes by using the `vi`
command `:wq` and press **Enter**. This command will appear at the bottom of
the screen as you type.

```
piobe:2:wait:/usr/lib/lpd/pio/etc/pioinit >/dev/null 2>&1  # pb cleanup
qdaemon:2:wait:/usr/bin/startsrc -sqdaemon
writesrv:2:wait:/usr/bin/startsrc -swritesrv
uprintfd:2:respawn:/usr/sbin/uprintfd
logsymp:2:once:/usr/lib/ras/logsymptom # for system dumps
pmd:2:wait:/usr/bin/pmd > /dev/console 2>&1 # Start PM daemon
diagd:2:once:/usr/lpp/diagnostics/bin/diagd >/dev/console 2>&1
dt:2:wait:/etc/rc.dt
cons:0123456789:respawn:/usr/sbin/getty /dev/console
imnss:2:once:/usr/IMNSearch/bin/imnss -start imnhelp >/dev/console 2>&1
: httpdlite:2:once:/usr/IMNSearch/httpdlite/httpdlite -r /etc/IMNSearch/httpdlit
e/httpdlite.conf >/dev/console 2>&1
imqss:2:once:/usr/IMNSearch/bin/imq_start >/dev/console 2>&1
~
~
~
~
:wq
```

Figure 20. Save /etc/inittab and Exit vi

After you press **Enter**, you will be back at the command prompt.

```
"/etc/inittab" 53 lines, 2366 characters
#
```

Figure 21. vi Exit Message

You can verify that the httpd daemon has indeed stopped by using the
command: ps -ef | grep httpd

```
# ps -ef | grep httpd
    root 22458 17030   2 12:40:11  pts/0  0:00 grep httpd
#
```

Figure 22. Show Active Daemons

As you can see, the httpd daemon has stopped.

2.2.6 Step 6 - Create AIX Groups

You must create an AIX group called notes for use during your Lotus Domino
server installation. To create this group, simply use the command mkgroup -A
notes.

```
# mkgroup -A notes
#
```

Figure 23. Create AIX Group

2.2.7 Step 7 - Create AIX Users

You must create an AIX user called notes. This AIX user will be the one that is logged in when the Domino server is running. If you plan to install partitioned servers (multiple instances on the same machine), you will need a different AIX account for each partition installed. For example, if you have four partitioned servers, you would probably have notes1, notes2, notes3, and notes4 as user accounts. In our example, we are only going to install a single server; so, we will simply create a user called notes. For more information on Domino server partitioning, please refer to Chapter 7, "Domino Enterprise Server" on page 159.

To create this user, simply use the command:

```
mkuser pgrp=notes groups='staff,notes' home='/server1' notes
```

```
# mkuser pgrp=notes groups='staff,notes' home='/server1' notes
#
```

Figure 24. Create AIX User

Next, we must assign a password to the new user by using the command:

```
pwdadm <user>
```

```
# pwdadm notes
Changing password for "notes"
notes's New password: *****
Enter the new password again: *****
#
```

Figure 25. Assign AIX User Password

You will be prompted for a new password. Enter the new password in and verify it. The password is now changed.

2.2.8 Step 8 - Create a Volume Group

The next step is to create a volume group for the Domino data directory. It is recommended that you store your data on a separate volume group by itself. This allows for easier backup and recovery or migration to another RS/6000 in case of a hardware failure.

To create a new volume group, make sure you have an unused disk installed and use the command: `smitty mkvg`

```
# smitty mkvg
```

The SMIT utility then displays the screen to create a new volume group. Enter a new volume group name. In our example, we will use the preferred name dominovg. Also select the physical volume to use in this new volume group. In our example, we will be using hdisk1. When the information has been entered, press **Enter**.

```
                             Add a Volume Group

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

                                                  [Entry Fields]
    VOLUME GROUP name                             [dominovg]
    Physical partition SIZE in megabytes          4                   +
  * PHYSICAL VOLUME names                         [hdisk1]            +
    Activate volume group AUTOMATICALLY           yes                 +
      at system restart?
    Volume Group MAJOR NUMBER                     []                  +#
    Create VG Concurrent Capable?                 no                  +
    Auto-varyon in Concurrent Mode?               no                  +


 F1=Help            F2=Refresh          F3=Cancel          F4=List
 F5=Reset           F6=Command          F7=Edit            F8=Image
 F9=Shell           F10=Exit            Enter=Do
```

Figure 26. Volume Group Configuration Screen

A pop up message will appear asking you to verify that you really want to create a new volume group. Press **Enter** again to create the volume group.

```
                     ARE YOU SURE?

 Continuing may delete information you may want
 to keep.  This is your last chance to stop
 before continuing.
      Press Enter to continue.
      Press Cancel to return to the application.

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

Figure 27. Volume Group Conformation Screen

If everything worked, you will see a screen similar to the one in Figure 28. Press **F10** to exit the screen and return to the prompt.

```
                      COMMAND STATUS

Command: OK           stdout: yes          stderr: no

Before command completion, additional instructions may appear below.

dominovg




F1=Help            F2=Refresh          F3=Cancel           F6=Command
F8=Image           F9=Shell            F10=Exit            /=Find
n=Find Next
```
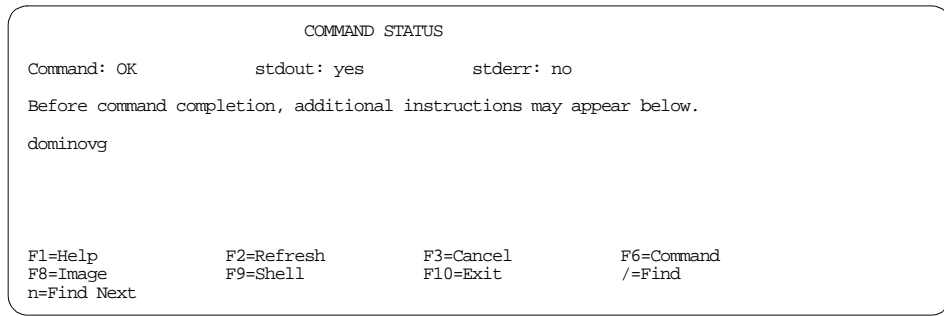
Figure 28. Volume Group Status Screen

2.2.9 Step 9 - Create a Logical Volume for the Domino Data Directory

Now that your new volume group has been created, you will create a logical volume for our Domino data directory. To do this, use the command: `smitty mklv`

smitty mklv

The SMIT utility then displays the screen to create a new logical volume. On this screen, type in the name of the volume group you just created and press **Enter.**

```
                    Add a Logical Volume

Type or select a value for the entry field.
Press Enter AFTER making all desired changes.

                                            [Entry Fields]
* VOLUME GROUP name                         [dominovg]      +




F1=Help            F2=Refresh          F3=Cancel           F4=List
F5=Reset           F6=Command          F7=Edit             F8=Image
F9=Shell           F10=Exit            Enter=Do
```
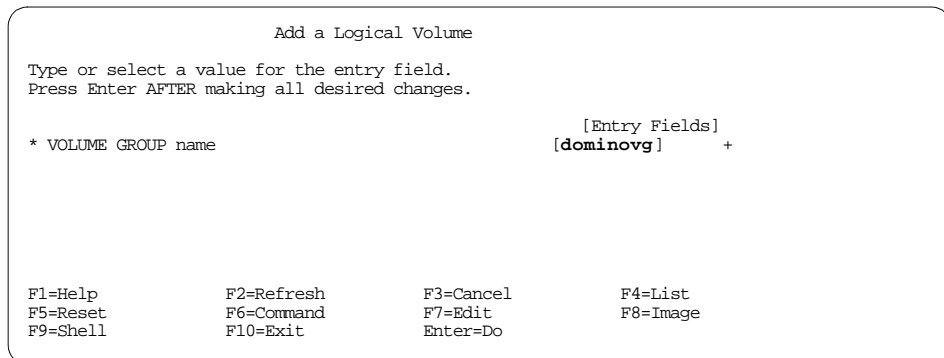
Figure 29. Logical Volume Configuration Screen

Next you will see the configuration screen for your new logical volume. Enter a new logical volume name. In our example, we will use the preferred name `dominodatalv`. Enter the total number of logical partitions to allocate for this logical volume. The minimum amount of space needed is 200 MB. Since our physical partition size is 4 MB, we specified 50 logical partitions in our example. Next change the position on the physical volume to *center*. This

improves system performance by reducing disk arm movement when accessing data. Also, change the range of the physical volume to *maximum*. This also improves system performance by making sure that the data is spread evenly across all disks in the volume group. When you have completed this screen, press **Enter**.

```
                              Add a Logical Volume

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

                                                  [Entry Fields]
   Logical volume NAME                            [dominodatalv]
 * VOLUME GROUP name                               dominovg
 * Number of LOGICAL PARTITIONS                    [50]                    #
   PHYSICAL VOLUME names                           []                      +
   Logical volume TYPE                             []
   POSITION on physical volume                     center                  +
   RANGE of physical volumes                       maximum                 +
   MAXIMUM NUMBER of PHYSICAL VOLUMES              []                      #
     to use for allocation
   Number of COPIES of each logical                1                       +
     partition
   Mirror Write Consistency?                       yes                     +
   Allocate each logical partition copy            yes                     +
     on a SEPARATE physical volume?
   RELOCATE the logical volume during              yes                     +
     reorganization?
   Logical volume LABEL                            []
   MAXIMUM NUMBER of LOGICAL PARTITIONS            [512]
   Enable BAD BLOCK relocation?                    yes                     +
   SCHEDULING POLICY for reading/writing           parallel                +
     logical partition copies
   Enable WRITE VERIFY?                            no                      +
   File containing ALLOCATION MAP                  []
   Stripe Size?                                    [Not Striped]           +




 F1=Help              F2=Refresh         F3=Cancel           F4=List
 F5=Reset             F6=Command         F7=Edit             F8=Image
 F9=Shell             F10=Exit           Enter=Do
```

Figure 30. Logical Volume Configuration Screen

If everything worked, you will see a screen similar to the one in Figure 31. Press **F10** to exit the screen and return to the prompt.

```
                        COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

dominodatalv




F1=Help              F2=Refresh           F3=Cancel            F6=Command
F8=Image             F9=Shell             F10=Exit             /=Find
n=Find Next
```

Figure 31. Logical Volume Status Screen

2.2.10 Step 10 - Create a Logical Volume for the Domino Binaries

Our next step will be to create a logical volume for our Domino binaries. To do this, use the command: `smitty mklv`

smitty mklv

The SMIT utility then displays the screen to create a new logical volume. On this screen, we'll use the recommended volume group `rootvg` for our new logical volume to keep our binaries on. Type `rootvg` and press **Enter**.

```
                     Add a Logical Volume

 Type or select a value for the entry field.
 Press Enter AFTER making all desired changes.

                                                [Entry Fields]
 * VOLUME GROUP name                            [rootvg]      +





 F1=Help            F2=Refresh           F3=Cancel            F4=List
 F5=Reset           F6=Command           F7=Edit              F8=Image
 F9=Shell           F10=Exit             Enter=Do
```

Figure 32. Logical Volume Configuration Screen

Next, you will see the configuration screen for your new logical volume. Enter a new logical volume name. In our example, we will use the preferred name `dominobinlv`. Enter the total number of logical partitions to allocate for this logical volume. The minimum amount of space needed is 160 MB. Since our physical partition size is 4 MB, we specified 40 logical partitions in our example. Next, change the position on the physical volume to *edge*. Since the binaries are only executed once at server startup, we place them on the outer most band of the disk. Also, change the range of the physical volume to

maximum. This also improves system performance by making sure that the data is spread evenly across all disks in the volume group. When you have completed this screen, press **Enter**.

```
                          Add a Logical Volume

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

                                                    [Entry Fields]
    Logical volume NAME                           [dominobinlv]
  * VOLUME GROUP name                              rootvg
  * Number of LOGICAL PARTITIONS                  [40 ]                 #
    PHYSICAL VOLUME names                         []                    +
    Logical volume TYPE                           []
    POSITION on physical volume                    edge                 +
    RANGE of physical volumes                      maximum              +
    MAXIMUM NUMBER of PHYSICAL VOLUMES            []                     #
      to use for allocation
    Number of COPIES of each logical               1                    +
      partition
    Mirror Write Consistency?                      yes                  +
    Allocate each logical partition copy           yes                  +
      on a SEPARATE physical volume?
    RELOCATE the logical volume during             yes                  +
      reorganization?
    Logical volume LABEL                          []
    MAXIMUM NUMBER of LOGICAL PARTITIONS          [512]
    Enable BAD BLOCK relocation?                   yes                  +
    SCHEDULING POLICY for reading/writing          parallel             +
      logical partition copies
    Enable WRITE VERIFY?                           no                   +
    File containing ALLOCATION MAP                []
    Stripe Size?                                  [Not Striped]         +




  F1=Help           F2=Refresh          F3=Cancel          F4=List
  F5=Reset          F6=Command          F7=Edit            F8=Image
  F9=Shell          F10=Exit            Enter=Do
```

Figure 33. Logical Volume Configuration Screen

If everything worked, you will see a screen similar to the one in Figure 34. Press **F10** to exit the screen and return to the prompt.

```
                          COMMAND STATUS

  Command: OK            stdout: yes          stderr: no

  Before command completion, additional instructions may appear below.

  dominobinlv




  F1=Help           F2=Refresh          F3=Cancel          F6=Command
  F8=Image          F9=Shell            F10=Exit           /=Find
  n=Find Next
```

Figure 34. Logical Volume Status Screen

2.2.11 Step 11 - Create a File System for the Domino Data Directory

Now that your logical volumes are created and ready, you need to create a new journaled file system (JFS) for your Domino data directory. To create the file system, use the command: smitty crjfslv

smitty crjfslv

The SMIT utility displays a menu for creating a journaled file system. Select **Add a Standard Journaled File System** and press **Enter**.

```
   Add a Journaled File System on a Previously Defined Logical Volume

 Move cursor to desired item and press Enter.

   Add a Standard Journaled File System
   Add a Compressed Journaled File System
   Add a Large File Enabled Journaled File System




 F1=Help              F2=Refresh           F3=Cancel            F8=Image
 F9=Shell             F10=Exit             Enter=Do
```
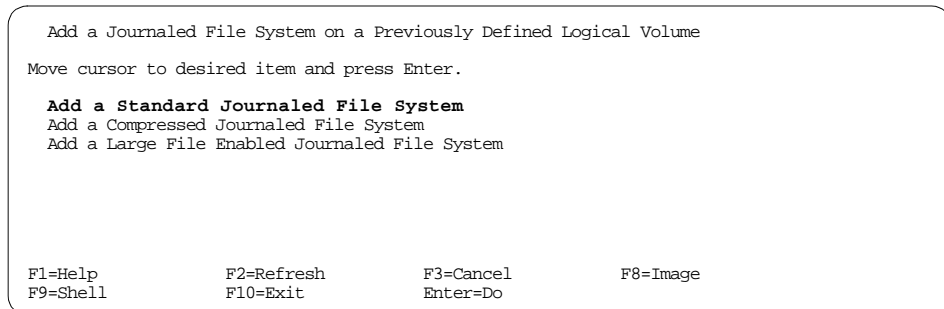
Figure 35. JFS Selection Screen

Next, you will see the configuration screen for the new file system. Select dominodatalv for the logical volume name. The mount point we are going to use in our example will be /server1. It is a good idea to name the mount point to something that will be descriptive to the server you are installing. For example, if the Domino server you're installing was called northeast, you would probably want to call your mount point /northeast. You then need to change the mount automatically at the system restart to yes. After you have finished, press **Enter**.

```
                   Add a Standard Journaled File System

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

                                             [Entry Fields]
 * LOGICAL VOLUME name                        dominodatalv          +
 * MOUNT POINT                                [/server1]
   Mount AUTOMATICALLY at system restart?     yes                   +
   PERMISSIONS                                read/write            +
   Mount OPTIONS                              []                    +
   Start Disk Accounting?                     no                    +
   Fragment Size (bytes)                      4096                  +
   Number of bytes per inode                  4096                  +
   Allocation Group Size (MBytes)             8                     +




 F1=Help             F2=Refresh          F3=Cancel          F4=List
 F5=Reset            F6=Command          F7=Edit            F8=Image
 F9=Shell            F10=Exit            Enter=Do
```

Figure 36. JFS Configuration Screen

If everything worked, you will see a screen similar to the one in Figure 37.
Press **F10** to exit the screen and return to the prompt.

```
                         COMMAND STATUS

 Command: OK            stdout: yes          stderr: no

 Before command completion, additional instructions may appear below.

 Based on the parameters chosen, the new /server1 JFS file system
 is limited to a maximum size of 134217728 (512 byte blocks)

 New File System size is 409600




 F1=Help             F2=Refresh          F3=Cancel          F6=Command
 F8=Image            F9=Shell            F10=Exit           /=Find
 n=Find Next
```

Figure 37. JFS Status Screen

2.2.12 Step 12 - Create a File System for the Domino Binaries

Your next step will be to create a new journaled file system (JFS) for your
Domino binaries. To create the file system, use the command: smitty crjfslv

smitty crjfslv

The SMIT utility displays a menu for creating a journaled file system. Select
Add a Standard Journaled File System and press **Enter**.

```
   Add a Journaled File System on a Previously Defined Logical Volume

Move cursor to desired item and press Enter.

 Add a Standard Journaled File System
 Add a Compressed Journaled File System
 Add a Large File Enabled Journaled File System




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

Figure 38. JFS Selection Screen

Next, you will see the configuration screen for the new file system. Select
dominobinlv for the logical volume name. The mount point we are going to use
in our example will be /usr/domino. This mount point is the preferred directory
for the Domino binaries. You then need to change the mount automatically at
system restart to yes. After you have finished, press **Enter**.

```
             Add a Standard Journaled File System

 Type or select values in entry fields.
 Press Enter AFTER making all desired changes.
                                            [Entry Fields]
 * LOGICAL VOLUME name                      dominobinlv        +
 * MOUNT POINT                              [/usr/domino]
   Mount AUTOMATICALLY at system restart?   yes                +
   PERMISSIONS                              read/write         +
   Mount OPTIONS                            []                 +
   Start Disk Accounting?                   no                 +
   Fragment Size (bytes)                    4096               +
   Number of bytes per inode                4096               +
   Allocation Group Size (MBytes)           8                  +



 F1=Help            F2=Refresh         F3=Cancel         F4=List
 F5=Reset           F6=Command         F7=Edit           F8=Image
 F9=Shell           F10=Exit           Enter=Do
```

Figure 39. JFS Configuration Screen

If everything worked, you will see a screen similar to the one in Figure 40.
Press **F10** to exit the screen and return to the prompt.

```
                         COMMAND STATUS

Command: OK           stdout: yes          stderr: no

Before command completion, additional instructions may appear below.

Based on the parameters chosen, the new /usr/domino JFS file system
is limited to a maximum size of 134217728 (512 byte blocks)

New File System size is 327680




F1=Help            F2=Refresh         F3=Cancel          F6=Command
F8=Image           F9=Shell           F10=Exit           /=Find
n=Find Next
```

Figure 40. JFS Status Screen

2.2.13 Step 13 - Mount the File Systems

After you create the file systems, you must then mount the new file systems.
To mount the file system, use the command: mount <file system>

```
# mount /usr/domino
# mount /server1
#
```

Figure 41. Mount File Systems

You can verify that the file systems are mounted by using the command mount
by itself. The mount command will display the file systems that are mounted.

```
# mount

  node       mounted          mounted over    vfs      date         options
-------- --------------- --------------- ------ ------------ ---------------
         /dev/hd4        /               jfs    Feb 01 08:11 rw,log=/dev/hd8
         /dev/hd2        /usr            jfs    Feb 01 08:11 rw,log=/dev/hd8
         /dev/hd9var     /var            jfs    Feb 01 08:11 rw,log=/dev/hd8
         /dev/hd3        /tmp            jfs    Feb 01 08:11 rw,log=/dev/hd8
         /dev/hd1        /home           jfs    Feb 01 08:12 rw,log=/dev/hd8
         /dev/lv00       /usr/vice/cache jfs    Feb 01 08:12 rw,log=/dev/hd8
         /dev/lv01       /var/dce        jfs    Feb 01 08:12 rw,log=/dev/hd8
         /dev/lv02       /var/dce/adm/dfs/cache jfs    Feb 01 08:12 rw,log=/dev
/hd8
         DFS             /...            dfs    Feb 01 08:13 rw
         AFS             /afs            afs    Feb 01 08:13 rw
         /dev/dominobinlv /usr/domino    jfs    Feb 01 10:50 rw,log=/dev/hd8
         /dev/dominodatalv /server1       jfs    Feb 01 10:50 rw,log=/dev/loglv00
#
```

Figure 42. Check Mounted File Systems

2.2.14 Step 14 - Change Ownership of the New File Systems

In order for the Domino server to run correctly, you must change the ownership of the file systems you created. To change the ownership, use the command: `chown -R <user>.<group> <file system>`

```
# chown -R notes.notes /server1
# chown -R notes.notes /usr/domino
#
```

Figure 43. Change Ownership of Directories

You can verify that the ownership has changed by using the command `ls -l` from the parent directory. To verify that the file system mounted at `/server1` has been changed, you would change to the parent directory, which, in this case, is the root directory and then use the command: `ls -l` To verify that the file system mounted at `/usr/domino` has been changed, you would change to the `/usr` directory and then use the command: `ls -l` The results should look similar to the screen below.

```
# cd /usr

# ls -l

total 240
drwxr-xr-x   7 root      system       512 Dec 21 08:04 IMNSearch
drwxr-xr-x   2 root      system       512 Dec 21 08:03 TT_DB
lrwxrwxrwx   1 root      adm            8 Dec 21 07:51 adm -> /var/adm
drwxr-xr-x   3 root      system       512 Jan 07 13:21 afs
lrwxrwxrwx   1 root      system        46 Jan 07 13:21 afsws -> /afs/austin/afs34
a.devtest.0198/rs_aix42/dest/
drwxr-xr-x   4 bin       bin        10752 Jan 07 14:17 bin
drwxr-xr-x   4 bin       bin          512 Dec 21 07:46 ccs
lrwxrwxrwx   1 root      system        51 Jan 08 08:03 contrib -> /.../austin.ibm
.com/fs/system/current/@sys/contrib/
drwxr-xr-x   6 root      system       512 Dec 21 08:04 docsearch
drwxr-sr-x   3 notes     notes        512 Feb 01 10:38 domino
```

Figure 44. Show Ownership of a Directory

2.2.15 Step 15 - Paging Space

You must make sure that you have enough paging space available in order for the Domino server to function properly. The simple rule of thumb is:

For systems below 512 MB of memory, use (2 * memory).

For systems above 512 MB of memory, use (1 * memory).

However, the recommended by-the-book formula is:

For systems below 256 MB of memory use, (2 * memory).

For systems above 256 MB of memory, use (512 MB + (memory - 256 MB) * 1.25).

In our example, our RS/6000 has 128 MB of memory. Using the by the book formula, we should have 256 MB of paging space.

To check the amount of paging space available on your system, use the command: `lsps -a`

```
# lsps -a

Page Space   Physical Volume   Volume Group    Size    %Used  Active  Auto  Type
hd6          hdisk0            rootvg          128MB       7    yes    yes    lv
#
```

Figure 45. Check Paging Space

From the screen above, you can see that our paging space is called `hd6`, and on our system, we have 128 MB of paging space. We need to add an additional 128 MB of paging space to meet the minimum requirement. We need to specify the additional space needed in physical partitions. To figure out how many physical partitions we will need, first we have to find out how large each of our physical partitions are. To identify the size of each physical partition located on the volume group, use the command: `lsvg <volume group>`

```
# lsvg rootvg

VOLUME GROUP:   rootvg           VG IDENTIFIER:  00ffffffdd543111
VG STATE:       active           PP SIZE:        4 megabyte(s)
VG PERMISSION:  read/write       TOTAL PPs:      515 (2060 megabytes)
MAX LVs:        256              FREE PPs:       121 (484 megabytes)
LVs:            12               USED PPs:       394 (1576 megabytes)
OPEN LVs:       11               QUORUM:         2
TOTAL PVs:      1                VG DESCRIPTORS: 2
STALE PVs:      0                STALE PPs:      0
ACTIVE PVs:     1                AUTO ON:        yes
MAX PPs per PV: 1016             MAX PVs:        32
#
```

Figure 46. Check Physical Partition Size

Our paging space happens to be in the volume group `rootvg` and each physical partition is 4 MB in size. To get the additional 128 MB of paging space needed, we would need 32 additional physical partitions to be added to our current paging space. To increase the size of the paging space, use the command: `chps -s<additional partitions> <paging space name>`

```
# chps -s32 hd6
#
```

Figure 47. Increase Paging Space Size

To verify that the change to the paging space has taken place, use the command: `lsps -a`

```
# lsps -a

Page Space   Physical Volume    Volume Group    Size   %Used  Active  Auto  Type
hd6          hdisk0             rootvg          256MB      4     yes   yes   lv
#
```

Figure 48. Check Paging Space

As you can see, we now have enough paging space for our system.

2.2.16 Step 16 - Check AIX Kernel Configuration

We also need to check the AIX kernel configuration for the maximum number of processes allowed per user and the maximum number of fixed licenses.

To check the current setting for the maximum number of processes allowed per user (maxuproc), use the command: `lsattr -El sys0 | grep maxuproc`

```
# lsattr -El sys0 | grep maxuproc

maxuproc     64            Maximum number of PROCESSES allowed per user
#
```

Figure 49. List Value of maxuproc

As you can see, in our example the value of maxuproc is `64`. This value must be a minimum of `128` or more. To increase or change the value, use the command: `chdev -l sys0 -a maxuproc=128`

```
# chdev -l sys0 -a maxuproc=128
sys0 changed
#
```

Figure 50. Change Value of maxuproc

To check the current setting for the maximum number of fixed licenses, use the command: `lslicense`

```
# lslicense

Maximum number of fixed licenses is 1.
Floating licensing is disabled.
#
```

Figure 51. List Value of Fixed Licenses

As you can see by our example, the value is 1. This value must be a minimum of 2 in order for Domino server to function properly. To increase or change the value, use the command: chlicense -u 2

```
# chlicense -u 2

chlicense: The system must be rebooted before the new number of
          fixed licenses will take effect.
#
```

Figure 52. Change Value of Fixed Licenses

If you make any changes to this value, you must reboot the system in order for the change to become effective.

2.2.17 Step 17 - Mounting the CDROM

The final step in preparing the AIX environment is to mount the CDROM that contains the Lotus Domino server install program. First, you have to make sure that a directory exists as a mount point. On our system, we will use /cdrom for our mount point, If you don't have a directory to use as a mount point such as /cdrom, you must create a directory using the mkdir /<directory> command.

```
# mkdir /cdrom
#
```

Figure 53. Make Directory for Mount Point

You can verify that the directory was created by using the command ls from the root directory.

```
# cd /

# ls

...           .sh_history   cdrom         lost+found   smit.script
.:            :             dev           lpp          tftpboot
.Xauthority   TT_DB         etc           mnt          tmp
.dt           afs           home          opt          u
.dtprofile    audit         image.data    sbin         unix
.profile      bin           krb5          server1      usr
.rgy_editrc   bosinst.data  lib           smit.log     var
#
```

Figure 54. Verify Directory Creation

Once a directory has been created for use as a mount point, you can then
mount the CDROM. Before you continue, you should take your Lotus Domino
CD and insert it into the CDROM drive at this time.

You will also need to know the name of the CDROM device. In most cases,
this will be cd0, but if you're not sure, or if you'd like to double check, use the
command: lsdev -C -c cdrom The name of the CDROM drive will be in the first
column.

```
# lsdev -C -c cdrom

cd0 Available 04-B0-00-3,0 SCSI Multimedia CD-ROM Drive
#
```

Figure 55. Check for CDROM Device Names

With the CD in the CDROM drive, mount the drive using the command: mount
-r -v cdrfs /dev/<device name> /<mount point>

```
# mount -r -v cdrfs /dev/cd0 /cdrom
#
```

Figure 56. Mount CDROM Device

You will receive no conformation that the CDROM has mounted, but you can
verify by changing to the /cdrom directory and do a directory listing.

```
# cd /cdrom

# ls

install    license.txt script.dat  sets        tools
#
```

Figure 57. Verify That the CDROM Mounted

You should see the directory listing of the CD if everything worked.

2.3 Installing the Lotus Domino Server

Installing the Lotus Domino server is a two part process. The first part is to install the software from the CD, and the second part is the basic configuration of the server. We will walk through the complete installation step by step.

2.3.1 Step 1 - Log Into AIX as the Root User

Log in to your AIX system as the root user either from a login prompt or by using the command `su -` at the prompt if you are already logged in as another user.

```
$ su -
root's Password: ******
#
```

Figure 58. Login as Root User

2.3.2 Step 2 - Run the Install Program from the CD

To start the install program, you need to change to the `/cdrom` directory and start the install program by typing `install` at the command prompt and then press **Enter**.

```
# cd /cdrom
# ./install
```

Figure 59. Start the Installation Program

2.3.3 Step 3 - Welcome Screen

The welcome screen is displayed. Press the **Tab** key to continue.

```
================================================================================
                          Domino Server Installation
================================================================================


    Welcome to the Domino Server Install Program.


    Type h for help on how to use this program.
    Press TAB to begin the installation.



    --------------------------------------------------------------------------------
    Type h for help
    Type e to exit installation
    Press TAB to continue to the next screen.
    --------------------------------------------------------------------------------
```

Figure 60. Welcome Screen

2.3.4 Step 4 - License Agreement Screens

The next screen to appear asks you to read the license agreement. Press the **Tab** key to continue to the next screen of the license agreement.

```
================================================================================
                          Domino Server Installation
================================================================================


    In order to proceed with the installation of the Domino Server,
    you must read and agree with the terms and conditions of the
    Lotus Domino/Notes Software Agreement.

    Press TAB to read the Lotus Domino/Notes Software Agreement.


    --------------------------------------------------------------------------------
    Type e to exit the Install program.
    Press ESC to return to the previous screen
    Press TAB to continue to the next screen.
    --------------------------------------------------------------------------------
```

Figure 61. License Agreement Screen 1

The second license agreement screen appears. Press the **Tab** key to continue to the next screen.

```
================================================================================
                          Domino Server Installation
================================================================================
LOTUS DOMINO AND NOTES BETA SOFTWARE AGREEMENT

IF YOU DO NOT AGREE WITH THESE TERMS AND CONDITIONS,
YOU MAY NOT INSTALL OR USE THE SOFTWARE.

1. Use.  Lotus Development Corporation ("Lotus") grants you the right to
install, copy and use this beta version of the Lotus Notes or Domino
software, and related documentation, (the "Software") solely for the
purpose of you  evaluating the Software and subject to the terms and
conditions of this Agreement.  This Agreement gives you the right to use
the Software for a period of ninety (90) days (the "Trial Period").  By
installing or using the Software, you agree to be bound by the terms and
conditions of this Agreement.

2. Obligations. You agree with Lotus that the Software and related
information is owned by Lotus and its suppliers, and that unless
otherwise specifically agreed by Lotus in writing, you:

        (a) shall not distribute, transfer, loan or otherwise provide the
Software to any third party, and shall not modify, reverse compile,
reverse engineer or disassemble the Software;
>>> Press any key to continue <<<
```

Figure 62. License Agreement Screen 2

The third license agreement screen appears. Press the **Tab** key to continue
to the next screen.

```
Software to any third party, and shall not modify, reverse compile,
reverse engineer or disassemble the Software;

        (b) shall not copy the Software other than as reasonably
necessary for your use in evaluating the Software;

        (c) shall not use or rely upon the Software for any purpose other
than your evaluation purposes, and you acknowledge the pre-release
nature of the Software and the possibility that the Software may not
operate as intended;

        (d) shall, at the expiration of the Trial Period (or earlier if
so requested by Lotus), promptly de-install and discontinue use of the
Software, and destroy all copies of the Software and all other materials
made available to you by Lotus under this Agreement (and any copies
thereof);

        (e) shall comply with all U.S. and foreign export regulations
applicable to the Software; and

        (f) shall not alter or remove Lotus' copyright and other
proprietary notices in the Software.

3. Evaluations. You may provide Lotus with evaluations, suggestions and
>>> Press any key to continue <<<
```

Figure 63. License Agreement Screen 3

The fourth license agreement screen appears. Press the **Tab** key to continue
to the next screen.

```
3. Evaluations. You may provide Lotus with evaluations, suggestions and
analysis of the Software.  Lotus shall have an unrestricted royalty-free
right to use any such information provided to Lotus.  You  may not
publish or provide to any third party the results of any benchmark or
other performance tests performed with the Software without first
obtaining Lotus' written consent.

4. No Warranty; No Support. Due to the pre-release nature of the
Software, the Software is provided "as is" and Lotus will not provide
any support or bug-fixes for the Software.  Additionally, Lotus does not
guarantee compatibility between the Software and any prior or future
versions of the Software.  Lotus makes no warranty, representation,
promise or guarantee, either express or implied, statutory or otherwise,
with respect to the Software.  LOTUS DISCLAIMS ALL WARRANTIES WITH
REGARD TO THE SOFTWARE, INCLUDING WITHOUT LIMITATION ALL
WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR
PURPOSE.  Some states or provinces do not allow the exclusion or
limitation of implied warranties, so the above exclusion or limitation
may not apply to you.

5. Limitation of Liability.  LOTUS SHALL HAVE NO LIABILITY FOR DIRECT,
INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR TORT DAMAGES
ARISING OUT OF USE OR PERFORMANCE OF THE SOFTWARE, EVEN IF
>>> Press any key to continue <<<
```

Figure 64. License Agreement Screen 4

The fifth license agreement screen appears. Press the **Tab** key to continue to
the next screen.

```
INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR TORT DAMAGES
ARISING OUT OF USE OR PERFORMANCE OF THE SOFTWARE, EVEN IF
LOTUS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.
Some states or provinces do not allow the limitation of liability for
incidental or consequential damages, so the above exclusion or limitation
may not apply to you.

6. Term. You may use the Software for the Trial Period, provided that
Lotus may terminate this Agreement at any time with or without cause.

7. No Obligation. Lotus is under no obligation to further develop the
Software or market the Software. Your participation in this evaluation
program shall not obligate you to purchase any software licenses from
Lotus.

8. U.S. Government Restricted Rights. The Software and accompanying
documentation are provided with RESTRICTED AND LIMITED RIGHTS. Use,
duplication, or disclosure by the U.S. Government is subject to
restrictions as set forth in FAR 52.227-14 (June 1987) Alternate
III(g)(3) (June 1987), FAR 52.227-19 (June 1987), or DFARS 52.227-7013
(c)(1)(ii) (June 1988), as applicable.  Contractor/Manufacturer is Lotus
Development Corporation, 55 Cambridge Pkwy., Cambridge, MA 02142. In the
event the Government seeks to obtain the Software pursuant to standard
commercial practice, this software agreement, instead of the noted
>>> Press any key to continue <<<
```

Figure 65. License Agreement Screen 5

The sixth license agreement screen appears. Press the **Tab** key to continue
to the next screen.

```
event the Government seeks to obtain the Software pursuant to standard
commercial practice, this software agreement, instead of the noted
regulatory clauses, shall control the terms of the Government's license.

9. Miscellaneous. You may not assign any rights or delegate any duties
or obligations under this Agreement without Lotus' prior written
consent.  You acknowledge that a violation of this Agreement may cause
irreparable harm to Lotus, and you agree that, in addition to any other
remedies provided by law, Lotus shall be entitled to seek injunctive
relief against any such violation without having to post a bond. This
Agreement supersedes all other prior agreements, oral or written, and
all other communications between us relating to this Software, and the
terms of Sections 3 through 9 shall survive the expiration or
termination hereof.  This Agreement shall be governed by and construed
in accordance with the laws of The Commonwealth of Massachusetts,
excluding its conflicts of laws rules.

IF YOU DO NOT AGREE WITH THE ABOVE TERMS AND CONDITIONS,
DO NOT INSTALL OR USE THE SOFTWARE.

If you accept the above terms and conditions press the accept button
below:

Press the Escape key to go back to the previous screen
  or
Press the Tab key to continue...
```

Figure 66. License Agreement Screen 6

And, the seventh and final license agreement screen appears. This screen
asks if you agree to the license agreement. The default answer is `yes`. Press
the **Tab** key to continue, or press the **Spacebar** to change to the answer to `no`
and press **Tab** to continue.

```
================================================================================
                         Domino Server Installation
================================================================================


    You may proceed with the installation only if you agree to the
    terms and conditions of the Lotus Domino/Notes Software Agreement.


--------------------------------------------------------------------------------
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
--------------------------------------------------------------------------------
>>> Do you agree to the terms of the license agreement ?  [Yes]
```

Figure 67. License Agreement Screen 7

2.3.5 Step 5 - Select the Type of Domino Server to Install

The next screen asks you which of the different types of Lotus Domino
servers you want to install. The default answer is `Domino Mail Server`. You are

going to install a standard Domino server. Press the **Spacebar** until you see
`Domino Server` between the brackets and press the **Tab** key.

```
================================================================================
                            Domino Server Installation
================================================================================


    Select the type of installation you want.



    --------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
    --------------------------------------------------------------------------------

>>> Select Setup type : [Domino Server           ]
```

Figure 68. Type of Domino Server Selection Screen

2.3.6 Step 6 - Select the Directory Location for the Domino Binaries

On the next screen, we need to select the directory location for the Domino
binaries. The default directory is `/opt/lotus`. We need to change this to
`/usr/domino`.

```
================================================================================
                            Domino Server Installation
================================================================================


    The program directory is the path where the Install program
    installs the Domino program files.  The Install program
    automatically adds "lotus" to the path.

    --------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press ENTER to edit a setting.
    Press TAB to accept a setting and continue to the next screen.
    --------------------------------------------------------------------------------

Current program directory setting : /opt/lotus
```

Figure 69. Directory Location for Domino Binaries Screen

To edit the directory, press **Enter,** type the new directory name, and press
Enter again.

```
================================================================================
                         Domino Server Installation
================================================================================


     The program directory is the path where the Install program
     installs the Domino program files.  The Install program
     automatically adds "lotus" to the path.


 --------------------------------------------------------------------------------
     Press ENTER to retain the current setting
        or
     Type a new setting and press ENTER.
 --------------------------------------------------------------------------------

 Current program directory setting : /opt/lotus

 New program directory setting      : /usr/domino
```

Figure 70. Change Directory Location Screen

The changed directory will be displayed on the screen. You will notice that the install program will append `lotus` to the end of the directory automatically. Press **Tab** to continue.

```
================================================================================
                         Domino Server Installation
================================================================================


     The program directory is the path where the Install program
     installs the Domino program files.  The Install program
     automatically adds "lotus" to the path.


 --------------------------------------------------------------------------------
     Type h for help.
     Type e to exit the Install program.
     Press ESC to return to the previous screen.
     Press ENTER to edit a setting.
     Press TAB to accept a setting and continue to the next screen.
 --------------------------------------------------------------------------------

 Current program directory setting : /usr/domino/lotus
```

Figure 71. Directory Location for Domino Binaries Screen

2.3.7 Step 7 - Setup for Partitioned Domino Servers

The next screen that appears asks if you want to install multiple instances or partitioned servers on this RS/6000. The default answer is `no`. In our example we will only install one Domino server but see 7.4, "Domino Server Partitioning" on page 162 for details on partitioning. Press **Tab** to continue.

```
================================================================================
                          Domino Server Installation
================================================================================


    You can run more than one Domino Server on a single computer
    at a time.  This feature is called Domino Partitioned Servers.



    --------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
    --------------------------------------------------------------------------------

 >>> Do you want to run more than one Domino Server on this computer ?  [No ]
```

Figure 72. Domino Partitioned Servers Screen

2.3.8 Step 8 - Select the Directory Location for the Domino Data

On the next screen, you need to select the directory location for the Domino data. The default directory is `/local/notesdata`. You need to change this to `/server1`.

```
================================================================================
                          Domino Server Installation
================================================================================

    The data directory is the path where the Install program
    installs the Domino data files.

    --------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press ENTER to edit a setting.
    Press TAB to accept a setting and continue to the next screen.
    --------------------------------------------------------------------------------

Current data directory setting : /local/notesdata
```

Figure 73. Directory Location for Domino Data Screen

To edit the directory, press **Enter,** type the new directory name, `/server1`, and press **Enter** again.

```
================================================================================
                         Domino Server Installation
================================================================================

    The data directory is the path where the Install program
    installs the Domino data files.

--------------------------------------------------------------------------------
    Press ENTER to retain the current setting
      or
    Type a new setting and press ENTER.
--------------------------------------------------------------------------------

Current data directory setting : /local/notesdata

New data directory setting      : /server1
```

Figure 74. Change Directory Location Screen

The changed directory will be displayed on the screen. Press **Tab** to continue.

```
================================================================================
                         Domino Server Installation
================================================================================

    The data directory is the path where the Install program
    installs the Domino data files.

--------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press ENTER to edit a setting.
    Press TAB to accept a setting and continue to the next screen.
--------------------------------------------------------------------------------

Current data directory setting : /server1
```

Figure 75. Directory Location for Domino Data Screen

2.3.9 Step 9 - Select AIX User

Next, select the appropriate AIX user. The default is notes, which, in this case, is the correct user. Press the **Tab** key to continue.

```
================================================================================
                        Domino Server Installation
================================================================================

    The Domino UNIX user is the UNIX user name which will own the
    Domino data files, and be used to run the Domino Server.


--------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press ENTER to edit a setting.
    Press TAB to accept a setting and continue to the next screen.
--------------------------------------------------------------------------------

Current UNIX user setting : notes
```

Figure 76. AIX User Selection Screen

2.3.10 Step 10 - Select AIX Group

Next, select the appropriate AIX group. The default is notes, which, in this case, is the correct group. Press the **Tab** key to continue.

```
================================================================================
                        Domino Server Installation
================================================================================

    The Domino UNIX group is the UNIX group name which will own the
    Domino data files.  The UNIX user that runs the Domino server
    must be a member of this group.

--------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press ENTER to edit a setting.
    Press TAB to accept a setting and continue to the next screen.
--------------------------------------------------------------------------------

Current UNIX group setting : notes
```

Figure 77. AIX Group Selection Screen

2.3.11 Step 11 - Configuration Review

The next screen that appears tells you that you have finished the configuration of the install program and that you are about to review the information you have entered. Press the **Tab** key to continue.

```
================================================================================
                          Domino Server Installation
================================================================================

    Your configuration of the Install program is complete.

    By continuing, the Install program will first allow
    you to review your configuration settings before
    beginning the installation.


    --------------------------------------------------------------------------------
    Type e to exit the Install program.
    Press ESC to return to the previous screen
    Press TAB to continue to the next screen.
    --------------------------------------------------------------------------------
```

Figure 78. Configuration Review Screen 1

The installation settings and configurations are displayed. If everything
displayed is correct, press the **Tab** key to start the installation. Otherwise,
press the **Escape** key to reconfigure.

```
================================================================================
                          Domino Server Installation
================================================================================
Installation settings:

    Installation type    : Domino Server

    Program directory     : /usr/domino/lotus
    Data directory        : /server1
    UNIX user name        : notes
    UNIX group name       : notes


Press the Escape key to re-configure the settings
  or
Press the Tab key to perform the installation...
```

Figure 79. Configuration Review Screen 2

2.3.12 Step 12 - File Installation Completed

You should see a screen similar to Figure 80., "File Installation Completed
Screen" on page 52 if the installation completed successfully.

```
Installing files...

The OS appears to have the correct patches.
Installing...

Installation successful.



Please be sure to log in as the appropriate UNIX user
before running Domino - Do not run as root.

#
```

Figure 80. File Installation Completed Screen

2.3.13 Step 13 - Logoff

You must completely logoff the system before starting the next step that
begins the configuration. Running the Domino server with a different user
other than the one we specified in 2.3.9, "Step 9 - Select AIX User" on page
49 is not a supported configuration.

To logoff, simply type `exit` and press **Enter**. Repeat this until you return to the
login prompt.

```
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login:
```

Figure 81. Login Prompt

2.3.14 Step 14 - Login

Log in as the user we specified in 2.3.9, "Step 9 - Select AIX User" on page
49.

```
AIX Version 4
(C) Copyrights by IBM and by others 1982, 1996.
login: notes
notes's Password: *****
********************************************************************************
*                                                                              *
*                                                                              *
*  Welcome to AIX Version 4.3!                                                 *
*                                                                              *
*                                                                              *
*  Please see the README file in /usr/lpp/bos for information pertinent to     *
*  this release of the AIX Operating System.                                  *
*                                                                              *
*                                                                              *
********************************************************************************
Last login: Thu Feb  4 09:52:26 CST 1999 on /dev/lft0

$
```

Figure 82. Login Screen

2.3.15 Step 15 - Change to the Data Directory

When you log in, you should already be in the Domino data directory. You can
display the current directory you are in by using the `pwd` command.

```
$ pwd
/server1
$
```

Figure 83. Display Current Directory

If you're in the wrong directory, use the command `cd /<data directory>` and
press **Enter**.

$ **cd /server1**

2.3.16 Step 16 - Start the HTTP Server Task for Server Configuration

Next, you will start the Domino HTTP task so you can configure the new
Domino server with your web browser. To start the HTTP task, type
`/opt/lotus/bin/http httpsetup` at the prompt and press **Enter**.

$ **/opt/lotus/bin/http httpsetup**

If everything worked, you will see a screen similar Figure 84., "HTTP Task
Server Configuration Startup Screen" on page 54.

Installing a Lotus Domino R5 Server **53**

```
02/04/99 11:31:11 AM  Created new log file as /server1/log.nsf
02/04/99 11:31:11 AM  Server setup mode entered. Please continue the setup
process by connecting to server with a browser on port 8081
02/04/99 11:31:13 AM  HTTP Web Server started
```

Figure 84. HTTP Task Server Configuration Startup Screen

2.3.17 Step 17 - Start the Web Browser

You should start your Web browser now: Either Netscape or Internet Explorer. The Web browser can be located on any machine. You do not have to install a Web browser on your RS/6000 to configure your Domino server. Point your Web browser to: `http://<IP address of the RS/6000>:8081/` In our example, the URL will be: `http://9.3.240.6:8081/`

2.3.18 Step 18 - Create a New Domino Server

You will see the first screen of the Domino server configuration on your Web browser. It's asking if this is the first server, or are you adding an additional server to an existing domain. In our example, this will be our first server. Make sure that `First Domino Server` is selected and press the **Next** button.
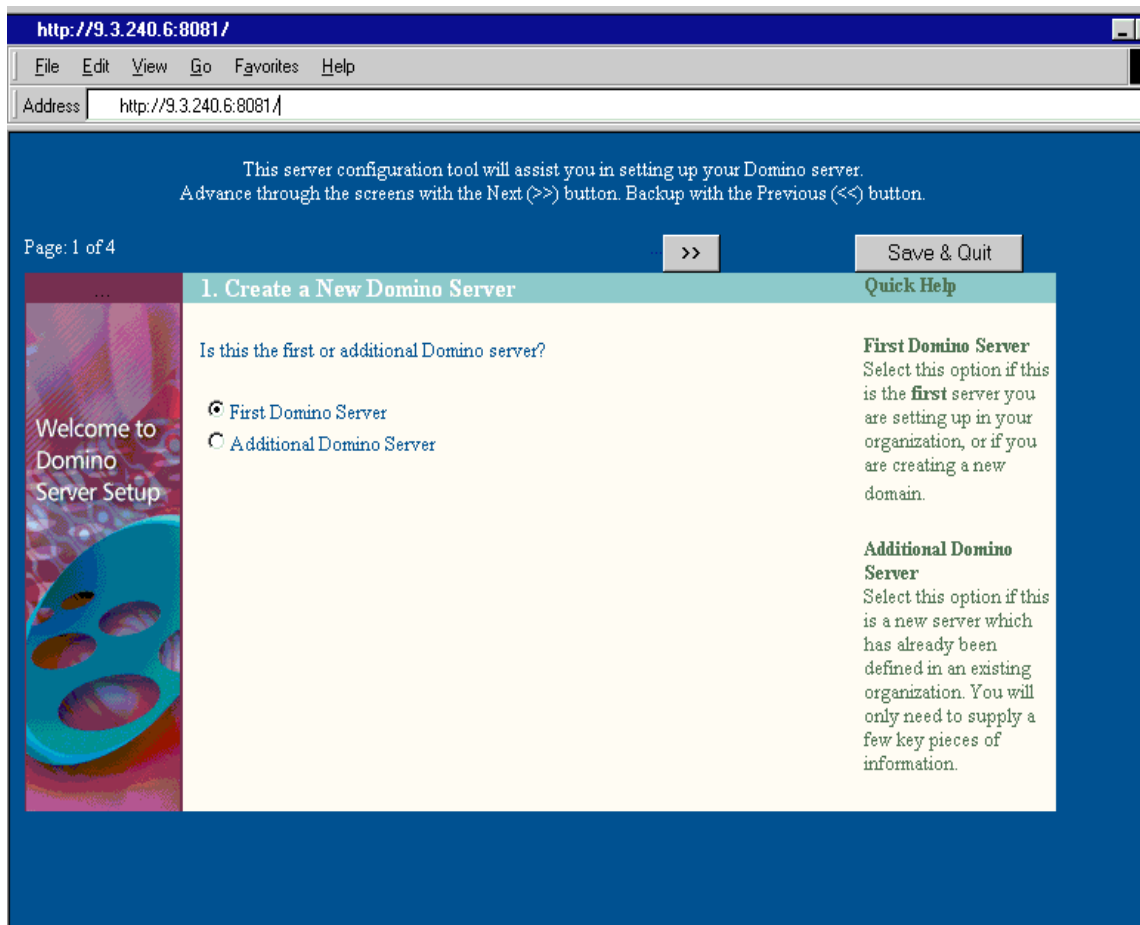
Figure 85. Create New Domino Server Screen

2.3.19 Step 19 - Server Audience

On the second screen, it is asking if any additional services need to be installed. The default choices are `Calendar Connector`, `Schedule Manager`, `Event Manager`, and `Statistics`. In our example, we are going to leave the default choices and press the **Next** button.
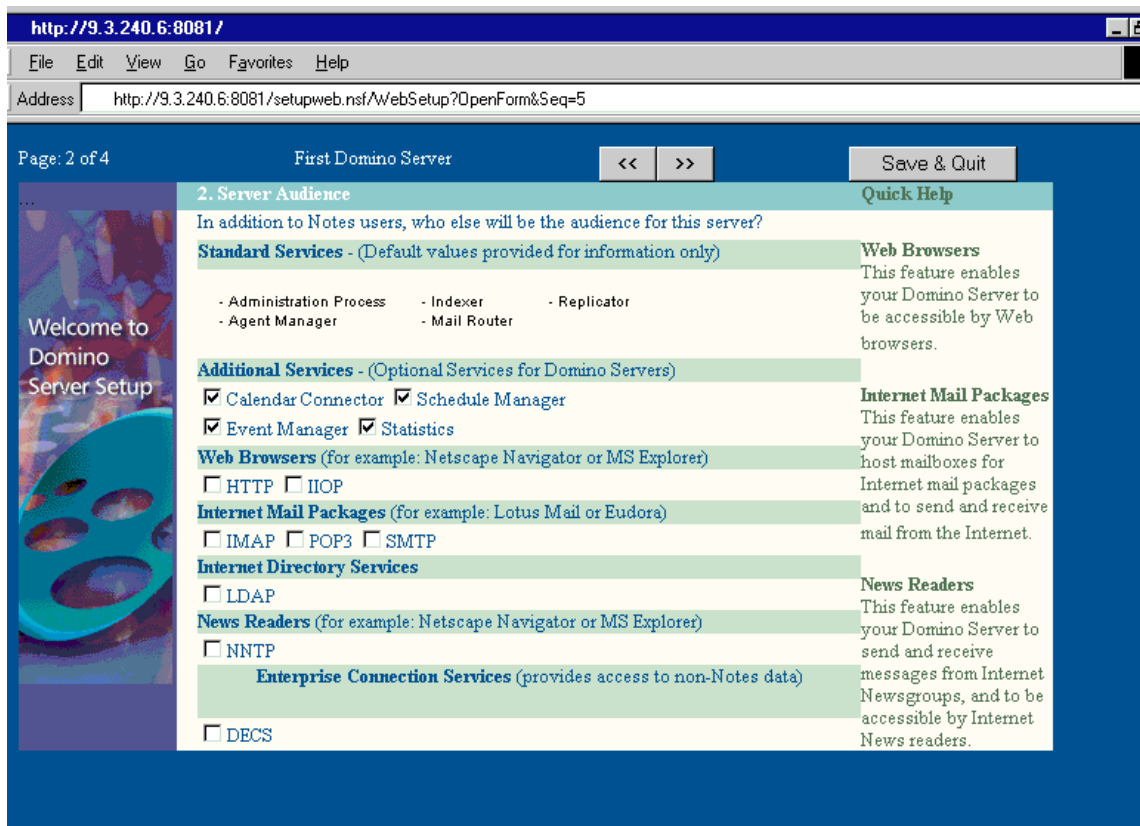
Figure 86. Server Audience Screen

2.3.20 Step 20 - Administration Settings

On the third screen, you need to specify the administrative information for the Domino server. This includes `organization name`, `domain name`, `certifier name`, `server name`, and the `administrators name`. For our example, the organization, domain, and certifier names are `ibm`. The country code is `us`. The server name is `ausres29`. Our administrator's name is `Domino Admin`. After entering this information, press the **Next** button.
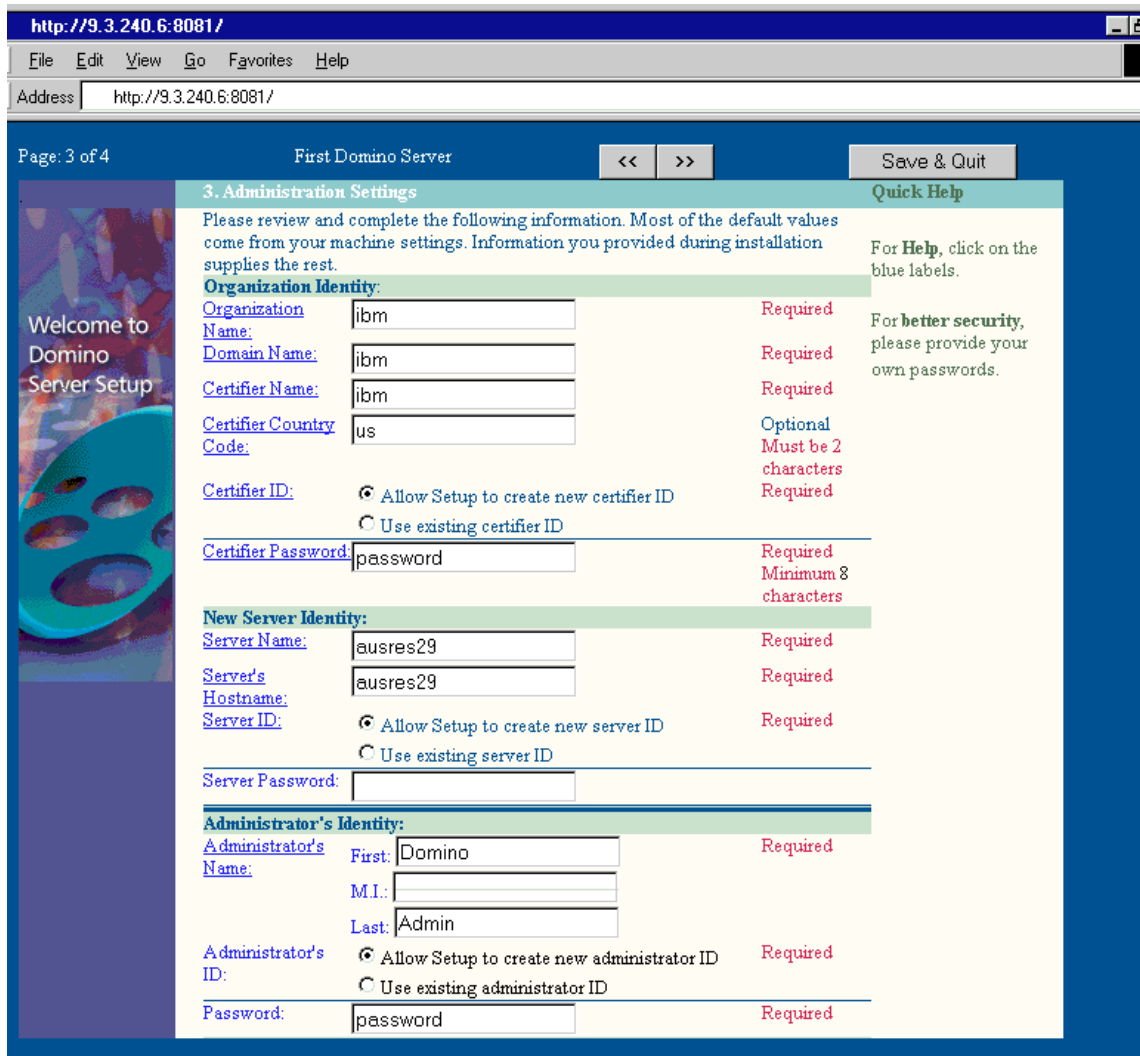
Figure 87. Administration Settings Screen

2.3.21 Step 21 - Network and Communication Settings

On the fourth screen we will configure the network ports. By default, the `Use all available ports` option is selected. Since we only have one port, we're going to leave the default selected and click the **Finish** button.
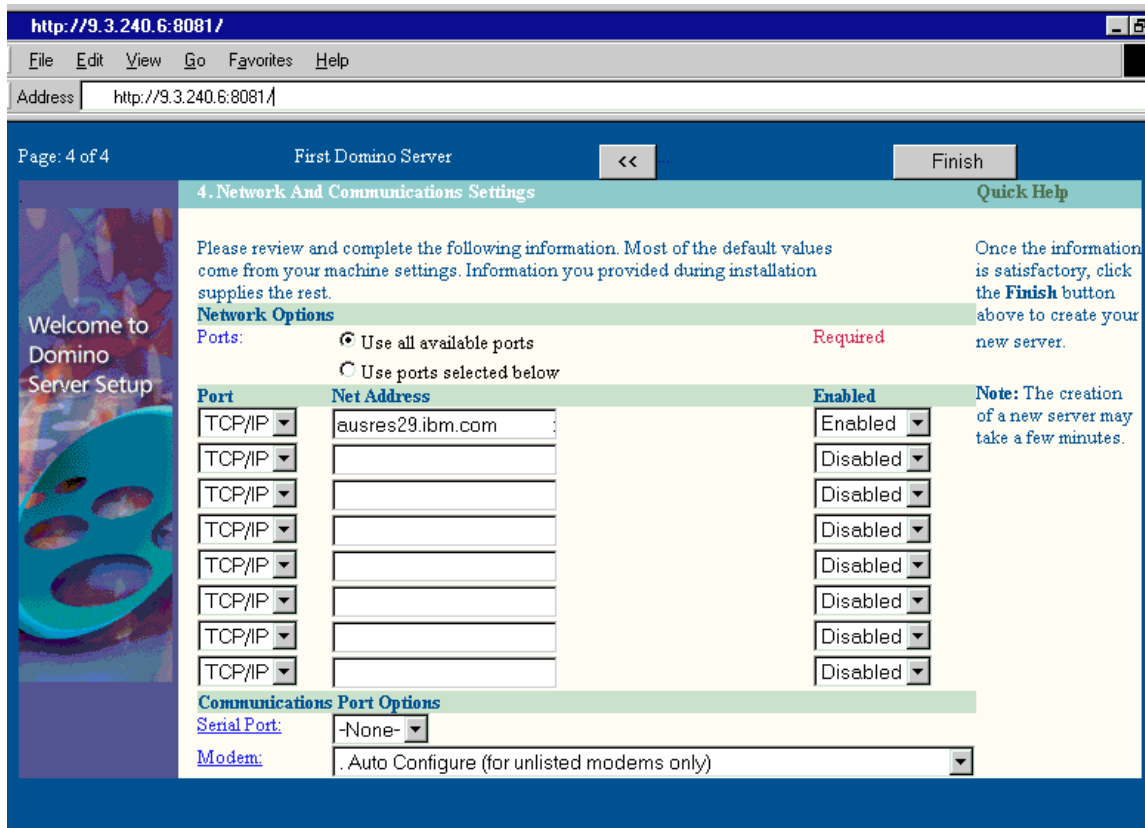
Figure 88. Network and Communications Settings Screen

2.3.22 Step 22 - Server Setup is Complete

Congratulations! The server setup is complete. The fifth and final screen displays the configuration and password information we gave in the above steps. After you have read the screen, click on the **Exit** button.

If you forget to click on the **Exit** button, the setup will not complete properly.
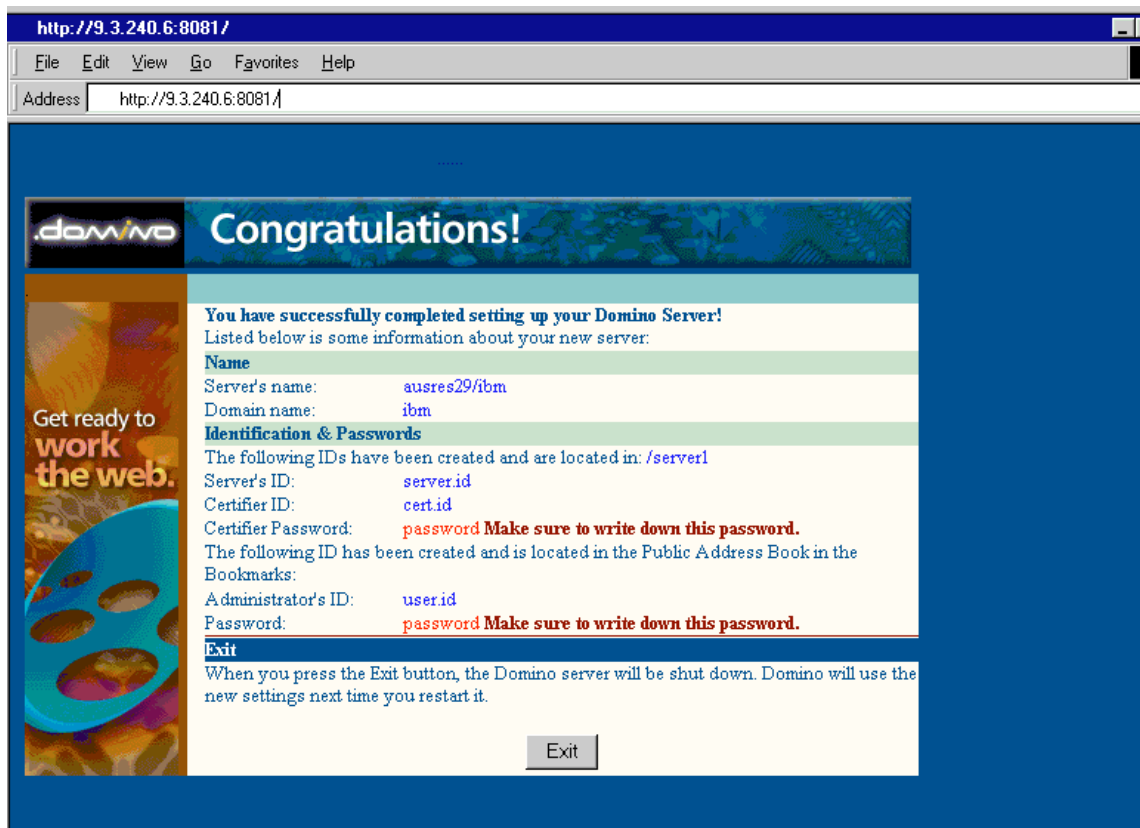
Figure 89. Server Setup Is Complete

2.3.23 Step 23 - Starting the Domino Server

To start the Domino server, make sure you are in the server data directory. In our example, this would be `/server1`. From that directory, use the command:
`/opt/lotus/bin/server`

```
$ /opt/lotus/bin/server
```

The server will start.

Reminder

Remember that you must start the Domino server while logged in as the user specified in 2.3.9, "Step 9 - Select AIX User" on page 49. Using any other user, including the root user, is an unsupported configuration and may cause unpredictable results.

2.4 Conclusion

In this chapter, we reviewed the hardware, software, and system requirements. We showed step by step instructions on how to prepare the AIX environment prior to installation of the Domino server. And, finally, we showed step by step instructions on how to do the Domino server installation.

Chapter 3. Upgrading from Domino R4.x to R5

Upgrading a Domino Server can be broken into two distinct levels; the first is to prepare for and install the later version of software onto the machine, the second is to exploit the features and functionality made available by that software.

The goal of a successful upgrade is to minimize downtime and disruption to the users of the existing Domino Servers while maintaining a similar or enhanced level of service.

Although this chapter will serve to guide the administrator in upgrade methodology and good practice, it cannot cover every eventuality since every installation will be different in some way.

With this goal in mind, much of the early preparation for the upgrade will involve testing and fine tuning the procedures through which the upgrade of the environment will be achieved. This will ensure that everyone involved in carrying out upgrades will be familiar with the procedures and will be aware of any specific issues that may be encountered within their own environment.

The upgrade process and its duration will be significantly different for each organization and are directly affected by the size of the current implementation and the resources available to perform the upgrades required in that environment.

3.1 Preparation

The key to a successful upgrade is careful planning and preparation. One of the earliest tasks will be to identify members of the project team and their associated roles and responsibilities. For small installations, the team may consist of one or two people, but in large enterprise installations, the teams will not only contain more members, but they may also be geographically dispersed. Everyone involved must be comfortable with the new software and the procedures that will be followed to carry out the upgrade. Training and testing in a separate test environment will be the key to achieving the required level of competence.

An upgrade schedule is important so that the project is properly co-ordinated, and everyone is kept informed of the current status and of the next stages. Users must be notified of impending changes to the servers that will affect them so that they are prepared for downtime, unless, of course, the resources are available to perform server upgrades during out-of-hours periods.

3.1.1 System Requirements

Prior to installation of the R5 server software, it is necessary to ensure that the server hardware and supporting software, such as the operating system, meet or exceed the specified requirements as defined in Chapter 2, "Installing a Lotus Domino R5 Server" on page 15. If the current system does not meet the new requirements, then to continue with the Domino Server upgrade those elements of the platform that do not meet these requirements must be upgraded first.

Note

It is important to remember that the AIX platform does not include a Notes or Administration client component. See Chapter 5, "Installing the Lotus Domino Administration Client" on page 125for details about installation of the Administration Client on other platforms.

During the planning stage, decisions may be taken to re-organize the current infrastructure design; server consolidation may be one result afforded by the increased performance of the R5 server and its ability to support more users per instance of the server than was the case with R4.x.

Where server consolidation is deemed appropriate, care must be taken that the platform has sufficient resources to cope with the intended number of additional users.

Should new servers, hardware, or software be required to meet these requirements, then the time taken to procure such items must be taken into consideration during the scheduling of the upgrades.

3.1.1.1 Additional Disk Space Considerations

For a new installation of an R5 Domino Server, the system requirements referenced in the previous section provide a good starting point in terms of the disk capacities required. However, when upgrading an existing server, some of the changes made to enhance the functionality of R5 increase the amount of disk space that will be needed not only for storing databases but also for core server processes.

1. Existing databases converted to the new R5 On-Disk Structure (ODS) will, in the majority of cases, take up a very similar amount of disk space as they do using the current R4 ODS. However, the index directories for databases that have full-text indexes will increase by approximately 50 percent.

2. New mail databases now have both Notes and web browser access functionality integrated into a single database design; a new empty mail database has a default size of approximately 5 MB as opposed to 2 MB for an R4.6 mail database.

3. The new R5 indexing algorithm now produces temporary working files while it is building or updating database and full-text indexes. The amount of space required for these files depends on the number and size of the databases hosted on the server. By default, the temporary files are created in the server data directory as specified by the operating system.

   For optimal performance of the indexing process, it is better to store the temporary files on a different physical disk to the Domino data directory.

   Indexing File Location

   To change the location in which temporary files are stored during indexing, specify

   ```
   View_Rebuild_Dir=/directoryname
   ```

   in the server's notes.ini file

   ---

4. The introduction of *Transaction Logging* creates another requirement for additional disk space that was not necessary with previous releases of the Domino Server. Instead of always writing data directly to the database, transaction logging allows for writing to a central location on disk that can be replayed against the databases intermittently to *commit* the actual changes to the data stored in the database. Once again, optimal performance is achieved if the transaction logs, known as the *Transaction Log Extent*, are located on a different physical disk to the Domino data directory so that writing to the logs and reading requests for databases do not compete with each other.

   Transaction Log Extent

   To change the location in which the transaction logs are stored, edit the server document as shown in Figure 90 on page 64 and change the value for the field `Log path` on the Transaction Logging tab.
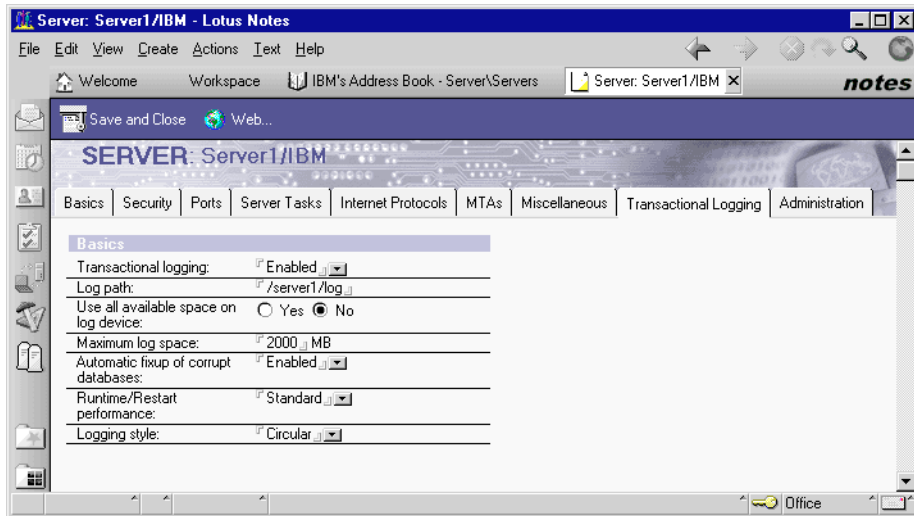
Figure 90. Changing the Location of the Transaction Log Extent

A minimum of 200 MB of free space must be available to enable transaction logging, but unlike view indexing, a maximum size can be stipulated for the Transaction Log Extent. The maximum size allowed is 4 GB, and with circular logging enabled, disk space is re-used by overwriting older log entries.

> **Recommendation**
>
> Since the transaction logs are critical to data integrity and maximum performance, it is also strongly recommended that the disk used to contain the Transaction Log Extent be mirrored and, if possible, connected to a separate disk controller than that used to service the Domino data directory.

Domino R5 can now support significantly larger databases than previous releases, and although currently certified up to 64 GB, there is no imposed maximum size. To take advantage of this capacity, the AIX file system in which the data directory is stored must be a *large file enabled journaled file system;* otherwise, the AIX-imposed maximum single file size limit of 2 GB will restrict the capabilities of the Domino Server.

3.1.1.2 Non-Domino Infrastructure Considerations

As the upgrade process inevitably requires that the server be shut down for a period of time, advantage is sometimes taken of this scheduled downtime to upgrade other elements of the platform, for example, to add an additional processor, extra disk space, or to change the network adapter card in the server.

The reason behind this recommendation is simply that should a problem occur with the server after upgrading the Domino Server software, the number of possible causes of the problem are reduced, and troubleshooting is a less complex task.

If changes such as these are required, then they should be done either before or after the Domino Server upgrade. By doing them before, it is possible to ensure that the existing environment continues to function correctly, and the Domino Server upgrade can be started with confidence that the current server is stable.

Alternatively, once the R5 upgrades are complete, and the environment is functioning correctly, the hardware changes can be started in the confidence that the new R5 environment is stable.

3.1.2 Planning the Order of Your Upgrade

As mentioned in 3.1, "Preparation" on page 61, a schedule is very important to maintain a structured approach to the upgrade process. The key to this schedule will be the order in which the elements of the infrastructure will be upgraded. The following is the recommended order in which to tackle the project.

1. Public Name and Address Book (NAB)

   Since the new public NAB, now called the *Domino Directory*, is designed to be backwardly compatible with earlier releases of software, the design can be upgraded on the existing servers prior to them having the R5 software installed. This is the most critical database in any Domino environment and is one of the main steps in the upgrade process. Having the new Domino Directory in operation before starting to install new software will give everyone confidence in the next stages of the project.

2. Servers

   Upgrading the servers before clients ensures that a user cannot request a service from a server that cannot be provided because the server is running an earlier release of the software.

   a. Hub Servers

      Hub servers generally exhibit two characteristics that make them prime candidates for upgrades early in the schedule. First, hub servers do not usually have any or many active users connected to them; so, a problem with the upgrade impacts the user community much less severely than a problem with an upgraded mail server. Secondly, they are typically small in number, are located centrally, and are managed by skilled administrators.

      Note

      If the first server upgraded is not the server designated as the Administration Server of the Domino Directory, then the server that is the Administration Server should be the next one to be upgraded.
      ---

   b. Mail and Application (Spoke) Servers

      Once the hub servers are upgraded and are performing satisfactorily, attention can be turned to the servers that make up the bulk of the infrastructure, and procedures can be fine tuned with any additional lessons learned. The mail and application (Spoke) servers may or may not be located centrally. Where they are remote, the team members responsible for carrying out upgrades should have achieved the necessary level of competency in the upgrade process. The testing and training stages of the project should be used to produce extensive documentation tailored to the specific environment.

   c. Other Servers

      Lastly, in terms of servers, those performing specific tasks utilizing add-in or 3rd party API products (such as gateways) can be

considered. Here there are some choices and possibly restrictions on what can be done. The server may have to be left alone to continue running the R4.x version until an R5 specific version of the add-in product is produced; or where there are no version specific dependencies, the server can be upgraded. Specific attention should be paid to these types of servers during the testing phase of the project to ensure that the add-in tasks or API programs perform as expected after the upgrade to R5.

3. Clients

   Although outside of the scope of this particular redbook, the clients should be upgraded once server upgrades have been completed.

   > **Note**
   >
   > The R5 setup program ignores an R3.x workspace and desktop.dsk file; so, an R3 to R5 upgrade will result in an empty bookmarks database.

4. Applications

   Finally, when all clients have been successfully upgraded, the process is completed by upgrading mail databases and applications to take advantage of the new features afforded by R5.

In practice, clients and applications can be upgraded in parallel with servers provided that the servers that a particular group of clients access have already been upgraded to R5.

3.1.3 Testing Your Upgrade Procedures

In order to achieve competence, understanding, and faith in the upgrade process, a significant amount of time must be allowed for testing and training. R5 contains many new features for both the administrator and end user, and prior to upgrading, the administrator must be comfortable with the way they will be required to work after the upgrade has been completed.

> **Recommendation**
>
> Build an isolated test environment, modeled exactly on the existing environment, with good backup and restore capabilities. Use at least two servers and two clients in this environment.
>
> Use this environment to also test application functionality and interoperability.

3.1.3.1 Defining A Test Environment

The simplest way to produce a test environment that exactly mimics the real live environment is to register and configure two additional servers in the existing public NAB and install two servers using the current releases of the operating system and Domino software in use on the production servers. This should produce two servers that have identical characteristics to the other servers in the domain. Replicate any critical applications that require testing onto these servers. Disconnect these servers from the live network and create an isolated private network through which they can communicate only with themselves. Once the servers are disconnected, all references to them can be removed from the live public NAB.

As mentioned in 3.1.2, "Planning the Order of Your Upgrade" on page 65, specialized servers running add-in or API tasks must also be considered. A test server utilizing these types of programs can be created in the same way as mentioned previously.

Install test clients, again with the same releases of software as are already in use, and connect them to the same test network.

Before testing begins, take a complete backup of the servers and clients. The upgrade process will undoubtedly be performed several, if not many, times in this environment, and a full restore is the quickest and easiest way to reset one of the systems to its original state.

Throughout the testing process, detailed documentation should be created that can be used to produce the final upgrade procedure. It is important not only to document the correct steps but also to record mistakes and problems in the process so that others reading the documentation are made fully aware of specific key points or pitfalls and to help in their understanding of why things are done in a particular way.

3.1.4 Consider Clustering

For servers that are particularly critical, or during the early stages of the upgrade project, clustering the server with an R4.6x server can be a very valuable way of providing standby resilience. By clustering the existing server with another running a well proven level of Domino software, users are protected from server crashes as their requests for data can be failed-over to the R4.x server until the problems with the R5 server are resolved.

3.1.5 Database Design Considerations

When the new version of the software is applied to the server, many of the existing templates that are shipped with Domino will be overwritten with newer versions.

An important exercise to undertake before the upgrade project commences is an audit of the databases on all of the servers in the domain. This will provide information to allow administrators to ensure that any design elements that have been changed are preserved when system database designs are updated.

Use should be made of the testing environment to ensure that the customizations are still necessary and that they work as expected with the new design. Some of the customizations may no longer be required as the needs they addressed may have been satisfied by new features of the standard R5 database designs.

The audit should record all databases that have been based upon any of the standard templates and any changes or customizations that have been made.

Recommendation

Make sure that design elements that are not to be changed by a design refresh or replace have the property: *Do not allow design refresh/replace to modify* enabled.

During this audit, administrators should also ensure that all database and template access control lists contain an entry for an appropriate administration group with manager access as all administration must now be done from remote clients. Agents could be written to *crawl* the server and return the required information in an appropriate format.

Recommendation

Make sure all databases and templates allow manager access to all users responsible for their administration.

Once the installation is completed, (see 3.3, "Installing the R5 Server Software" on page 79) the customized design elements can be re-applied using the audit list to check and track the changes that are required.

3.2 Pre-Installation Upgrade Requirements

The importance of backups during the upgrade project cannot be stressed too much. Refer to 10.4, "Backup and Recovery" on page 283 and subsequent sections for details regarding backing up the contents of the AIX filesystems.

Recommendation

Ensure that a complete backup is taken of any server prior to carrying out any of the upgrade procedures detailed in this chapter.

To reverse a software upgrade by restoring from backup will be significantly easier and less time consuming than having to re-install and configure original software.

Before actually installing new code on a server, there are some steps that can be taken to prepare for the install. As mentioned in 3.1.2, "Planning the Order of Your Upgrade" on page 65, the public NAB can be upgraded on all servers in the domain since it contains all of the information required by an R4.x or even R3.x server. Any new features or information added to the forms for use by an R5 server is ignored by servers running older releases of the software. The following sections detail the steps to upgrade the design of the public NAB and also changes that need to be made to the notes.ini file just prior to installation of the R5 software.

3.2.1 Upgrading the Public Name and Address Book

Upgrading the design of the public NAB is a straightforward task and is much the same as changing the design of any database. The test environment recommended in 3.1.3.1, "Defining A Test Environment" on page 68 should be used to perform a test upgrade from the R4.x design to the new R5 Domino Directory design. Once it is confirmed that the R4.x server will operate correctly with this new design, the production NAB can be upgraded as described below.

The new template for the R5 Domino Directory has the same filename, pubnames.ntf, and has the same template name, StdR4PublicAddressBook, as the existing NAB template. There are two possible ways to upgrade the design.

> **Note**
>
> Before attempting to upgrade to the Domino Directory, the first step must be to make a backup of both the existing public NAB and the template from which it inherits its design.

3.2.1.1 Replace the Existing R4.x NAB Template

This procedure assumes that the R5 template is present on an administrator's R4.x client machine and is ready to be placed on the servers and that the administrator has permission to overwrite the existing template on the chosen server.

1. Choose a server from which design changes will replicate to all other servers in the domain, usually a hub server.

2. Choose **File -> Database -> Open** from the Notes client menu and a dialog box similar to the one shown in Figure 91 will be displayed.
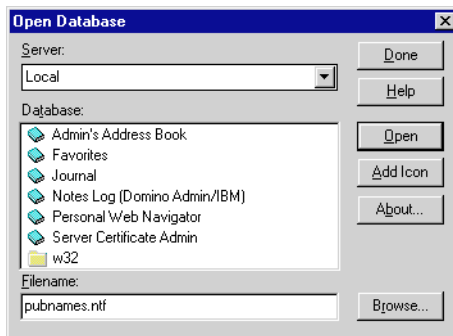
Figure 91. Adding the pubnames.ntf icon to the R4.x Desktop

3. Ensure that the entry in the box labelled `Server` is *Local*.

4. Press the **Tab** key twice so that the cursor moves to the input box labelled `Filename`.

5. Over-type any existing filename with: `pubnames.ntf`

6. Click on the **Add** Icon to place the icon on the current workspace and then click on the **Done** button to return to the workspace.

7. Click on the **template** icon once so that it is selected on the desktop.

8. Choose **File -> Replication -> New Replica** from the client menu and a `New Replica` dialog box similar to the one shown in Figure 92 will appear.
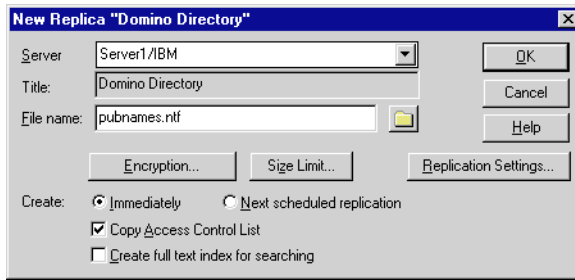
Figure 92. Creating a New Database Replica

9. Change the entry in the `Server` input box to match the server on which the new template will be replicated.

10. Ensure that the options for `Immediately` and `Copy Access Control List` are selected.

11. Click on the **OK** button and then confirm that you wish to replace the existing file named `pernames.ntf` as shown in Figure 93.
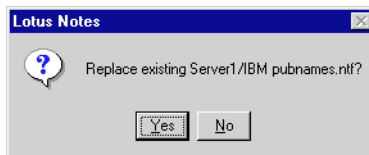
Figure 93. Replace the Existing pubnames.ntf Template

12. Click the **Yes** button to confirm replacement and complete the process of replacing the existing R4.x template with the new R5 one.

13. The decision can then be made to force replication to other servers or wait for scheduled replication to propagate the new template to the other servers in the domain.

14. The `Design` task will upgrade the NAB during its next scheduled execution on each server.

> **Note**
>
> If there are servers that should not have their NAB upgraded at this time, then before replacing pubnames.ntf, the replication of the template to these servers must be disabled or restricted. The template on the server to be left with an R4.x NAB can either have the option `Temporarily disable replication` selected in the Replication Settings dialog box, or the *access control list* of the templates should be modified to not allow any design changes to be propagated.

3.2.1.2 Replace the Existing R4.x NAB Design

As with the first method, this procedure assumes that the R5 template is present on an administrator's R4.x client machine and is ready to be used to replace the design of the existing NAB and that the administrator has permission to replace the design of the NAB on the chosen server.

1. Choose a server from which design changes will replicate to all other servers in the domain, usually a hub server.

2. Click on the **NAB** icon once so that it is selected on the desktop.

3. Choose **File -> Database -> Replace Design** from the Notes client menu and the Replace Database Design dialog box, shown in Figure 94, will be displayed.
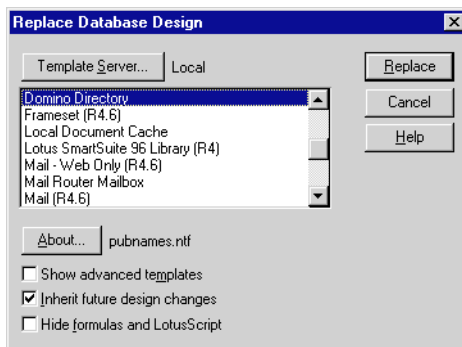
Figure 94. Replacing the Design of the Public NAB

4. Ensure that the entry in the box labelled `Template Server` is `Local`.

5. Scroll down the list of templates and select `Domino Directory`. The filename next to the About button should reflect the name of the template, usually `pubnames.ntf`.

6. The `Inherit future design changes` is selected by default.

> **Note**
>
> If you choose to `Inherit future design changes` at this point, then the R4.x pubnames.ntf template must be replaced on the servers to which this new design will replicate; otherwise, the design task will revert the design back to an R4.x NAB when it next executes.
>
> If you do not want to have to replace the template on all servers at this time, do not select `Inherit future design changes`.

7. Click the **Replace** button to continue, and the following warning will be displayed (see Figure 95).
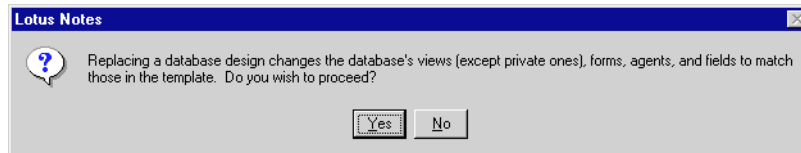
Figure 95. Replace Database Design Warning

8. Click on **Yes** to complete replacing the design.

9. A decision can then be made to force replication to other servers or wait for scheduled replication to propagate the new design.

3.2.2 Preserving Directory Design Customizations

The procedures detailed previously for updating the design of the NAB assume that a direct replacement for the standard design is required. In many environments, the design of the NAB may have been customized by administrators or application developers to support specific application or administration needs. Under these circumstances, a direct replacement is clearly not a good idea.

In the test environment, follow these steps to reproduce the design customizations that are still required to create a new customized template:

1. Create a backup of the existing NAB and template that contain the customizations.

2. Upgrade a test copy of the R4.x NAB with the standard R5 design.

3. Use this design on one of the test servers to verify that the server operates correctly.

4. Apply the customizations to this upgraded design.

5. Create a new R5 customized template from this database design, giving it a name other than pubnames.ntf to distinguish it from the original.

6. Use one of the methods described in 3.2.1, "Upgrading the Public Name and Address Book" on page 70 to upgrade the design using this new template. Wherever reference is made to pubnames.ntf, substitute the name given to the newly customized template.

To simplify the task of determining what elements have been added or removed from the design, they are listed for reference in Appendix B.17, "Domino Directory Design Changes" on page 356.

3.2.3 Administration During the Upgrade Period

Since the new R5, database designs make extensive use of a feature called tabbed tables. Administering forms that use this feature from an R4.x client is possible but difficult.

> **Recommendation**
>
> Administrators should have their clients upgraded to R5 in readiness for the start of the upgrade process so that they can view the database contents correctly and take advantage of the new features of the Administration Client (see Chapter 5, "Installing the Lotus Domino Administration Client" on page 125).

In addition the R5 software imposes some limitations in the creation and use of ID files. An R4.x client must be retained if either of the two following scenarios apply to the environment:

1. *New* ID files are required for use by an R3.x client

2. Flat (non-hierarchical) ID files are required, and *new* ones need to be created

However, R5 does fully support the maintenance of *existing* flat ID files. The renewal of existing flat certificates and the certification of new hierarchical ID files with a flat certificate are supported.

> **Recommendation**
>
> If the environment still uses flat ID files, consider moving to a hierarchical certification model for increased security, flexibility of access control, and simpler administration through use of the administration process.

3.2.4 Updating the Contents of the Domino Directory

When the Domino Directory is opened for the first time after upgrade, a form called the `Domino Directory Profile` will be presented that must be completed. This form is shown below, in Figure 96, as seen using an R5 client.
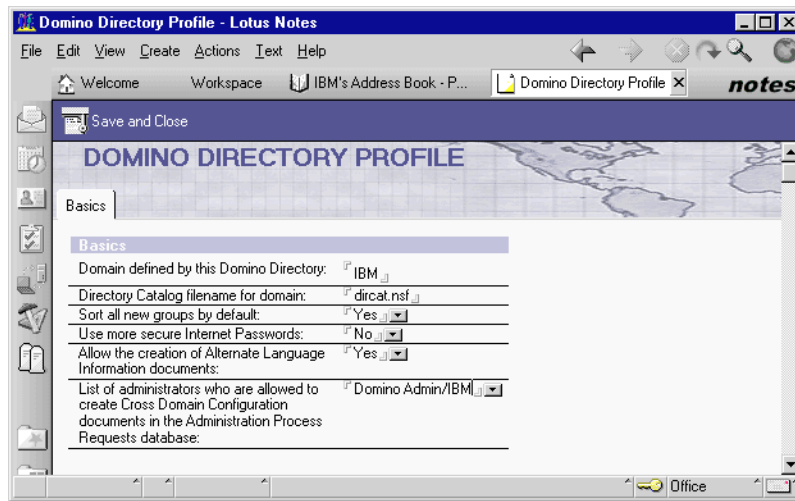
Figure 96. Editing the Domino Directory Profile

The fields and their meanings are listed in Table 5.

Table 5. Fields Used in the Domino Directory Profile

Field Name	Description
Domain defined by this directory	The Notes domain for this directory is completed automatically when the server is configured.
Directory catalog filename for domain	The filename of the directory catalog database if one is to be created.
Sort all new groups by default	Select **Yes** to automatically sort alphabetically the members of each new group created. Performance slows if **yes** is selected. Select **No** to have members displayed in the order in which they were added to the group. Member list can be sorted as needed.
Use more secure Internet passwords	Select **Yes** to use strong encryption for Internet passwords or **No** to use basic encryption.

Field Name	Description
Allow the creation of alternate language information	Select yes to allow creation of alternate language documents to be used in LDAP directory queries or no to prevent creation.

3.2.5 Modifying the NOTES.INI File

This procedure should be carried out once the server has been shut down and is ready to be upgraded.

Domino R5 no longer uses the *Report* task for statistics reporting and collection. The file statistics collection, once performed by Report, is now done by the Directory Catalog task instead. In addition, the *Collector* task is used to enable a server to collect its own statistics or to act as a central gathering server for others in the domain in the same way that servers could be designated collectors in R4.x.

To remove the Report task from the `notes.ini` file, enter the following commands at an AIX terminal command prompt:

```
# cd /server1
# vi notes.ini
```

Figure 97. Editing the notes.ini File

This will open the `notes.ini` file in the UNIX vi editor, see Appendix D, "Using UNIX's vi Editor" on page 361 for details of available commands for use in this editor.

Scroll down the file to the line that starts `ServerTasks=` as shown in Figure 98 on page 77.

```
EDITEXP23=Word for Windows 6.0,2,_XW4W,W4W49T/V0,.DOC,,2,
DDETimeout=10
$$$OpenSpecial=NotesNIC
$$$NotesNIC=CN=Home/OU=Notes/O=NET, welcome.nsf, Notes NIC Welcome, Notes Networ
k Information Center on the Internet
ServerTasks=Replica,Router,Update,Stats,AMgr,Adminp,Sched,CalConn,Event,Report
ServerTasksAt1=Catalog,Design
ServerTasksAt2=UpdAll,Object Collect mailobj.nsf
ServerTasksAt3=Object Info -Full
ServerTasksAt5=Statlog
:wq
```

Figure 98. Removing the Report Task from the notes.ini File

If one of the tasks listed along this line is *report,* then delete it from the line by moving the cursor to the `r` of report and press the **x** key, which should delete a letter at a time. Once the word is removed, save and exit the modified file by pressing the **Escape** key then type `:wq` (as shown above) and press **Enter**.

If any of the following entries exist in the notes.ini file, then they should also be removed:

- NSF_Buffer_Pool_Size=
- NSF_DbCacheMaxEntries=
- Server_Name_Lookup_Noupdate=
- Any other debugging parameters

Some other entries in the notes.ini file may be ignored by the R5 server. Many of these now have an equivalent setting option on a server configuration document and do not need to be listed explicitly in the notes.ini file. They will not impact server performance if left in the file, but they should be noted so that after upgrade the equivalent options can be completed in the relevant fields on the configuration forms.

By default, the Domino Server on AIX does not generate a core file in the event of a fatal error. To change this behavior, the value of the DEBUG_ENABLE_CORE environment variable should be set to 1.

Note

Using debug variables is not supported during normal server operation.They should only be used if requested to do so by Lotus Support.

3.2.6 Modifying AIX Environment Settings

For Domino R5 running on AIX, the value of the Notes_SHARED_DPOOLSIZE environment variable can be specified manually and is set in *bytes*. If it is not specified explicitly, then it is calculated automatically using the formula `(Physical RAM/2)/7`. The aim of this is to use no more than 50 percent of the physical RAM in the machine and to keep the number of shared memory segments at seven or less.

Recommendation

If the number of shared memory segments exceeds seven, then the value of the variable Notes_SHARED_DPOOLSIZE should be increased.

The Domino Server can use an absolute maximum of 10 shared memory segments with AIX 4.2.x or 11 if using AIX 4.3.

By increasing the value of Notes_SHARED_DPOOLSIZE, the number of segments required to allocate a specific amount of memory is reduced.

Note

In R5, to co-ordinate all variables in a central location, the Notes_SHARED_DPOOLSIZE parameter is now specified in the notes.ini file and not as an environment variable.

When upgrading, remove this variable from user profile or environment definition files and put it in the notes.ini of the server.

To check the current number of shared memory segments at an AIX terminal command prompt, type `ipcs` and press **Enter** (see Figure 99).

```
$ ipcs
IPC status from /dev/mem as of Mon Feb  8 10:21:51 CST 1999
T         ID    KEY        MODE        OWNER    GROUP
Message Queues:
q          0 0x4107001c -Rrw-rw----     root   printq
Shared Memory:
m          0 0x5805502e --rw-rw-rw-     root    system
m          1 0x00001a4c --rw-------     root    system
m          2 0x00000001 --rw-r--r--     root    system
m          3 0x4704028f --rw-r--r--   imnadm    imnadm
m          4 0x5804028f --rw-r--r--   imnadm    imnadm
m          5 0x4d04028f --rw-r--r--   imnadm    imnadm
m          6 0x4904028f --rw-r--r--   imnadm    imnadm
m          7 0x5004028f --rw-r--r--   imnadm    imnadm
m          8 0x45040296 --rw-rw-rw-   imnadm    imnadm
m          9 0x43040296 --rw-rw-rw-   imnadm    imnadm
m         10 0x42040296 --rw-rw-rw-   imnadm    imnadm
m         11 0x41040296 --rw-rw-rw-   imnadm    imnadm
m         12 0x44040296 --rw-rw-rw-   imnadm    imnadm
m         13 0xf800d000 --rw-rw----    notes     notes
Semaphores:
s          0 0x5805502e --ra-ra-ra-     root    system
s          1 0x4405502e --ra-ra-ra-     root    system
```

Figure 99. Checking Shared Memory Segment Details

Segments that have keys starting with `0xF8` are in use by the Domino Server. In Figure 99, only segment 13 is currently in use.

3.3 Installing the R5 Server Software

The upgrade installation of the R5 code can be performed over the existing installed release providing it is currently at release R4.1 or higher.

See Chapter 2, "Installing a Lotus Domino R5 Server" on page 15, for the specific details of installing the R5 software for AIX and the necessary pre-requisites for doing so.

> **Recommendation**
>
> To ensure the greatest level of stability and ease of upgrade, it is recommended that the current release of the code be brought up to the latest *Quarterly Maintenance Release* (QMR).
>
> For example, a server currently running base version R4.5 should be brought up to R4.5.7 through installation of the incremental install packages available from Lotus or for download from *http://www.notes.net*.

During the install, the program and data directories displayed by the install routine may not match the directory names in which the current program and data is stored. These must be changed as detailed below.

1. When prompted to supply the *program* directory, press **Enter** to change the setting.

2. Type in the new directory name to match the currently used program directory and press **Enter** to confirm as shown in Figure 100.

```
================================================================================
                        Domino Server Installation
================================================================================


    The program directory is the path where the Install program
    installs the Domino program files.  The Install program
    automatically adds "lotus" to the path.


--------------------------------------------------------------------------------
    Press ENTER to retain the current setting
      or
    Type a new setting and press ENTER.
--------------------------------------------------------------------------------

Current program directory setting : /opt/lotus

New program directory setting      : /usr/domino
```

Figure 100. Changing the Program Install Directory during Upgrade

3. When the new directory is displayed, press the **Tab** key to continue.

4. When prompted to supply the *data* directory, press **Enter** to change the setting.

5. Type in the new directory name to match the currently used data directory and press **Enter** to confirm as shown in Figure 101 on page 81.

```
================================================================================
                         Domino Server Installation
================================================================================

    The data directory is the path where the Install program
    installs the Domino data files.


    --------------------------------------------------------------------------------
    Press ENTER to retain the current setting
      or
    Type a new setting and press ENTER.
    --------------------------------------------------------------------------------

Current data directory setting : /local/notesdata

New data directory setting     : /server1
```

Figure 101. Changing the Data Install Directory during Upgrade

6. When the new directory is displayed, press the **Tab** key to continue.

Once the software has been installed, customizations must be re-applied to templates that come shipped with the product (see 3.1.5, "Database Design Considerations" on page 69).

Examples of such templates are listed below.

- pubnames.ntf
- admin4.ntf
- log.ntf

3.4 Restarting the Upgraded Server

There are other necessary tasks to carry out after the completion of the software installation both before and after restarting the new R5 server. These tasks are described in the following sections.

3.4.1 Upgrading MAIL.BOX

To take advantage of the new R5 ODS and performance enhancing features of the new R5 router mail box design, the mail.box file must be upgraded. Before the server is restarted, rename the file mail.box to mail.old.

For example, see Figure 102 on page 82, enter the following commands at an AIX terminal command prompt:

```
# cd /server1
# mv mail.box mail.old
```

Figure 102. Renaming MAIL.BOX

When the server is eventually restarted, it will create a new router mail box, mail.box. To improve performance and reduce disk space requirements, the database properties should be changed. This should be done using an administrator's R5 client who has access to change the properties of the new mail.box database.

1. Right-click on the server **mailbox** icon or bookmark.

2. Choose **Database -> Properties** from the popup menu to show the database properties.

3. Click the right-most tab in the infobox and select the three options as shown in Figure 103.
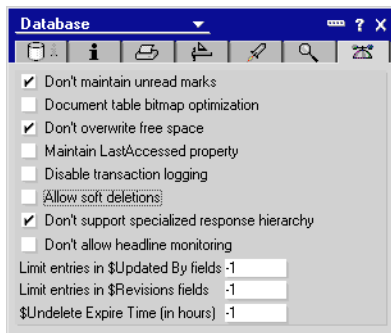
Figure 103. Setting Properties for the R5 Router Mailbox Database

Any messages that had not been transferred or routed before the server was shut down will still be in the old router mail box database, mail.old.

Once the server is restarted, it will be necessary to move the messages waiting in mail.old back into the router mail box, mail.box, so that they can be delivered or transferred.

Note

The steps shown below must be carried out using a Notes ID that has *manager* access to both the old router mail box, mail.old, and the new router mail box, mail.box.

The steps to achieve this are described below.

1. Start a Notes or Administration client and enter a password if prompted to do so.

2. Open the original mail router database, mail.old.

3. Select all of the messages in the *Mail* view.

4. Select **Edit -> Copy** from the client menu.

5. Close the mail.old database.

6. Open the new mail router database, mail.box.

7. Select **Edit -> Paste** from the client menu.

8. Once the mail has been delivered or transferred from the new mail.box, delete the original mail.old database.

3.4.2 Domino Directory Compaction and Indexing

Although the design of the Domino Directory was upgraded in a previous stage of the upgrade, see 3.2.1, "Upgrading the Public Name and Address Book" on page 70, and now that the server has the R5 software installed, some additional steps must be taken to complete this process.

To take advantage of the performance and new features of the R5 ODS, it is necessary to compact the Domino Directory database *twice*.

Note

The first compact upgrades the database structure to the R5 ODS. The second compact enables any database properties that have been chosen, such as *don't retain unread marks* or *allow soft deletions*.

Perform these steps at an AIX terminal command prompt before the server is restarted after the upgrade.

3.4.2.1 Compact and View Index Rebuild

1. Type `whoami` and press **Enter** to determine the name of the current user.

2. If the current user is not the user defined to run the Domino server, type `su - notes` and press **Enter** (where `notes` is the user defined to run the Domino server).

3. Enter the user's password and press **Enter**.

4. Type `cd /server1` and press **Enter** to move to the Domino data directory for the server.

5. Type `compact names.nsf` and press **Enter** to compact the directory database (see Figure 104).

```
$ whoami
ausres27
$ su - notes
notes's Password:
$ cd /server1
$ compact names.nsf
04/02/99 15:57:16     Compacting database names.nsf (IBM's Address Book)
04/02/99 15:57:26     Finished compacting names.nsf, 126K bytes recovered (3%)
04/02/99 15:57:26     Database compact process shutdown
```

Figure 104. Compacting the Domino Directory (names.nsf)

6. Type `compact names.nsf` and press **Enter** again to compact the directory database for the second time.

After the compact process has completed, the view indexes can be rebuilt so that they are already up-to-date prior to the server being restarted.

At the AIX terminal command prompt, type `updall names.nsf` and press **Enter** as shown in Figure 105 below.

```
$ updall names.nsf
04/02/99 15:58:39     Index update process started
04/02/99 15:59:01     Index update process shutdown
```

Figure 105. Updating names.nsf View Indexes

The server is now ready to be started.

Note

When the server restarts, it will still prompt to upgrade the design of the Address Book; however, since this will have been done prior to software installation, there is no need to perform this step again.

Press **N** to answer No to this question

3.4.3 Server Task and API Program Testing

Once the server has been started, the tasks that run outside of normal office hours or that are not core Domino server tasks should be manually loaded to ensure that they run satisfactorily.

Enter each of the following commands at the Domino server console followed by pressing **Enter** and ensure that the tasks start, do not produce any unexpected errors and then exit successfully.

- `load updall`
- `load design`
- `load catalog`

Note any error messages or problems that are encountered during this process.

Finally, load any other third party add-in or API tasks in the same way and check that they perform as expected.

3.5 Additional System Database Upgrades

To ensure that the new R5 servers in the environment have the necessary features they require to operate to the best of their ability. Some of the other system databases must be upgraded with new designs in a similar way to the way in which the Domino Directory is updated. The main databases are discussed in the following sections.

3.5.1 Administration Requests Database

Once the administration server of the Domino Directory has been upgraded, one of the next steps in the project should be to upgrade the design of the *Administration Requests* database, admin4.nsf, to take advantage of the new features.

Note

After the administration server is restarted and operational, upgrade the administration requests database on this server and then replicate to the other servers in the domain.

As with other elements, backwards compatibility is ensured so that the new design can be replicated to other servers in the domain that may not yet have been upgraded and that they will continue to operate successfully.

To enable a faster upgrade, outstanding requests should be processed prior to the database design upgrade.

1. Type `tell adminp process all` at the Domino server console and press **Enter** as shown in Figure 106

```
05/02/99 14:12:36      Periodic full text indexer terminating
05/02/99 14:17:40      Searching Administration Requests database.

> tell adminp process all
> 05/02/99 14:40:32      Checking for all requests to perform
```

Figure 106. Forcing Adminp to Process Outstanding Requests

Check the Administration Requests database to ensure that the outstanding
actions have been completed.

---- **Note** ----

The upgrade process can be performed with outstanding requests in the
database but may take longer to complete.

2. Shutdown the admin process on the server, type `tell adminp quit` at the
    Domino server console and press **Enter** (see Figure 107).

```
> tell adminp quit
05/02/99 14:50:48      Administration Process shutdown
```

Figure 107. Stopping the Adminp Task

3. From an administrator's client, replace the design of the database with the
    new template entitled *Administration Requests (R5.0)*

4. Allow or force the database to replicate to the other servers in the domain.

3.5.2 Directory Assistance Database

If the *Directory Assistance* database is used to provide multiple domain directory
support, then it should be upgraded.

To upgrade the design, do the following:

1. From an administrator's client, replace the design of the database with the
    new template entitled *Directory Assistance* with a filename of da50.ntf

2. Allow or force the database to replicate to the other servers in the domain.

3.5.3 Statistics and Events Database

As discussed in 3.2.5, "Modifying the NOTES.INI File" on page 77, the report
task is no longer used by R5, and therefore, some changes need to be made
in the configuration to specify statistics collection servers.

Instead of the report task, the server should load the *collect* task if it is to be used for either of the following scenarios:

- Local logging of its own statistics reports.
- It will collect remote statistics from other servers.

When the R5 server is restarted, the error shown in Figure 108 will be displayed on the console if the Statistics Reports database (statrep.nsf) has not been upgraded.

```
09/02/99 11:13:33     Event Dispatcher started
09/02/99 11:13:34       The server access view does not exist. Update the
Statistics Report template
```

Figure 108. Error on Event Task Startup after Server Upgrade

If the collect task is started on a server before the design of the Statistics and Events database (events4.nsf) has been upgraded, the error message shown in Figure 109 will be displayed.

```
> 09/02/99 11:22:34     Collector started
09/02/99 11:22:34       Collector: Could not locate Server Statistics Collection
document for 'Server1/IBM' in the Statistics & Events Configuration database.
09/02/99 11:22:35       Collector shutdown
```

Figure 109. Error on Collect Task Startup after Server Upgrade

The database designs should be replaced with the updated R5 templates installed on the server. Refer to 3.1.5, "Database Design Considerations" on page 69 for information regarding the preservation of any design customizations that may have been used.

After the Statistics and Events database has been upgraded, *Server Statistics Collection* documents must be created or edited to ensure that statistics collection is performed properly. These can be found under the view named *Server Statistic Collection,* and there should be one document per server that will collect statistics.

3.5.3.1 Local Collection
To enable a server to collect its own statistics locally, it must be running the collect task, and it must have its own Statistics Server Collection document.

1. Edit or create a new document and fill in the fields on the form.

2. On the **Basics** tab, enter the name of the server in the Server field.

3. Choose **From the following servers** and select the same server name again as shown in Figure 110.
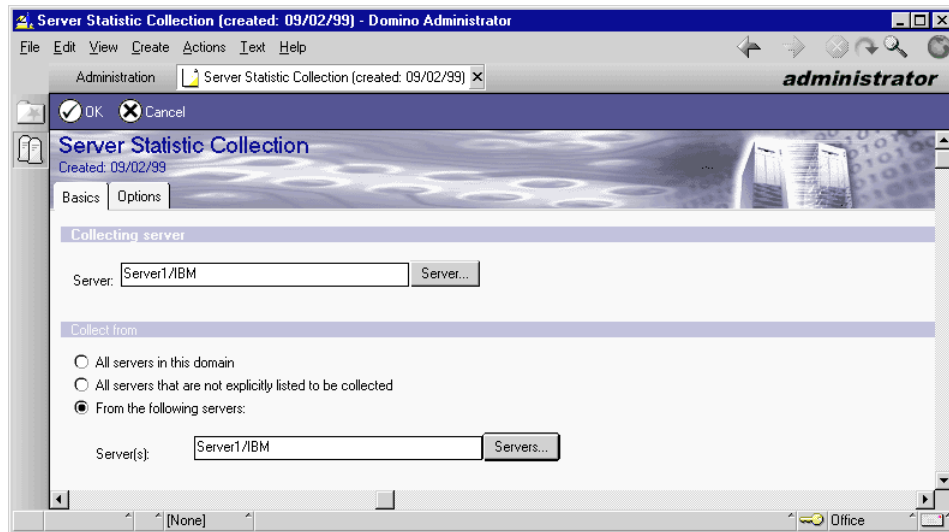
Figure 110. Specifying a Server to Collect Statistics

4. Switch to the **Options** tab.

5. Check the **Log statistics to a database** checkbox.

6. Enter the name of the statistics reporting database; it is usually statrep.nsf.

7. Enter the collection report and alarm interval values. Examples are shown in Figure 111 on page 89.
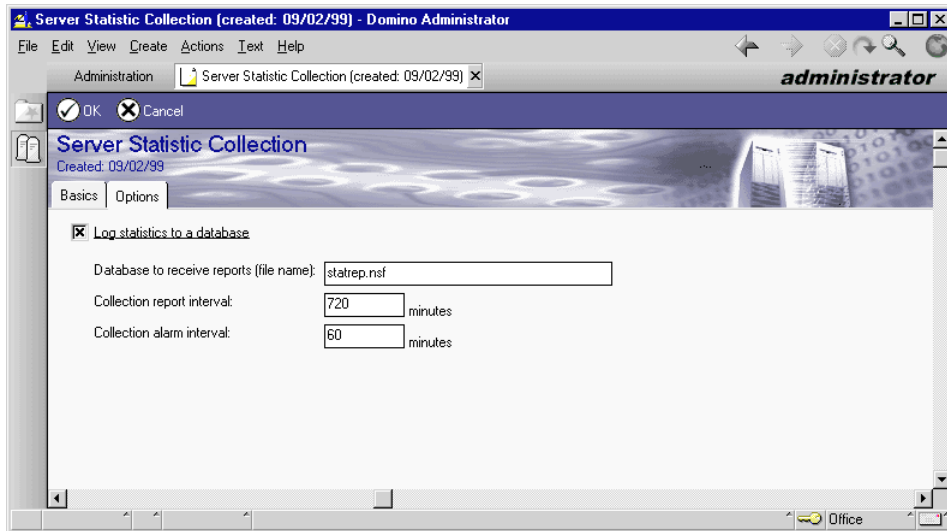
Figure 111. Specifying Statistics Collection Intervals

8. Save and exit the document.

3.5.3.2 Remote Collection

The concept of remote collection of statistics introduced in R4.5 is the same in R5. Once again, any server designated as a remote collector for other servers must be running the collect task, and it must have a Server Statistic Collection document.

A single server can be designated to collect from all other servers in the domain. It can be designated to collect from a specific list of servers, or it can also be designated to collect from all servers that are not already explicitly listed in another document.

3.5.3.3 Additional Monitoring Tools

Statistics and Event monitoring now includes the provision of timed probes for the server, mail, and TCP/IP services. These can be used to periodically check that the server and its services are available and responding to external requests.

The server access probe checks connectivity using *Notes Remote Procedure Calls* (NRPC) as made by Notes clients. The mail probe is used to test the routing connectivity between two defined servers by sending a probe message to a specific recipient on the chosen server at a given interval. Each of the TCP/IP services, such as HTTP or NNTP, can be probed to monitor availability.

When a probe fails, it generates an event that can be trapped and reported in one the usual ways, such as mail to administrators, log to database, or SNMP trap.

For more information on the changes to Statistics and Events, refer to the on-line *Lotus Domino R5 Administration Help* database.

3.6 Upgrading Domino Mail Topologies

The R5 mail router is fully backwardly compatible with previous releases of the server software. All servers can be upgraded to R5 with no changes required in the routing topology; however, to benefit from the new features, some changes will have to be implemented. These changes can be implemented on a server-by-server approach and do not all have to be made at the same time.

Although this section details steps for upgrading an existing SMTP MTA server, more information on the configuration of the SMTP routing functions can be found in Chapter 8, "Lotus Domino R5 and the Internet" on page 209.

3.6.1 Router Transfer and Delivery Options

After a server has had the R5 software installed, the router can be configured to perform tasks in parallel, multi-threading, to increase throughput of message transfer and delivery.

Firstly, multiple mail router mailboxes can be specified so that the router threads do not have to contend with each other for exclusive access to a single mail router database. To specify how many router mailboxes should be used on a server, edit the server configuration document and enter a number in the field labelled Number of mailboxes on the `Router/SMTP - Basics` tab of the table. An example is shown in Figure 112 on page 91.
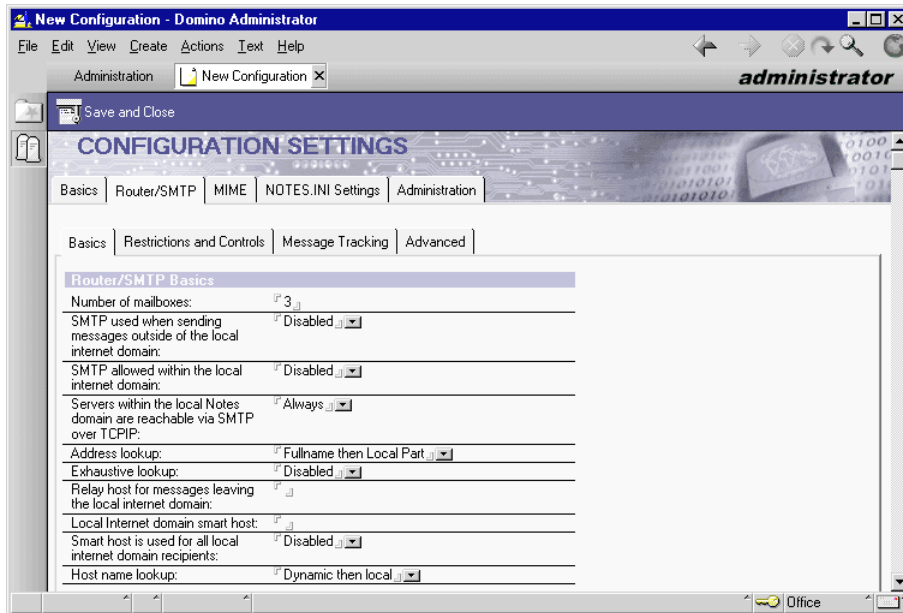
Figure 112. Increasing the Number of Router Mailbox Databases

When the server is restarted, additional databases named mail1.box, mail2.box, and so on will be created up to the value specified.

By default, Domino allows the router to use a maximum of one transfer thread per configured port. An administrator can override this default to increase the total number of threads available to the router for mail transfer to other servers.

To specify a different value, edit the field labelled Maximum transfer threads on the `Router/SMTP-Restrictions and Controls-Transfer Controls` tab of the server configuration document.

On the same tab, the field labelled `Maximum concurrent transfer threads` is used to specify how many of the total number of threads are allowed to execute concurrently. If this is not specified, the default will be the value of Maximum transfer threads divided by two. An example is shown in Figure 113 on page 92.
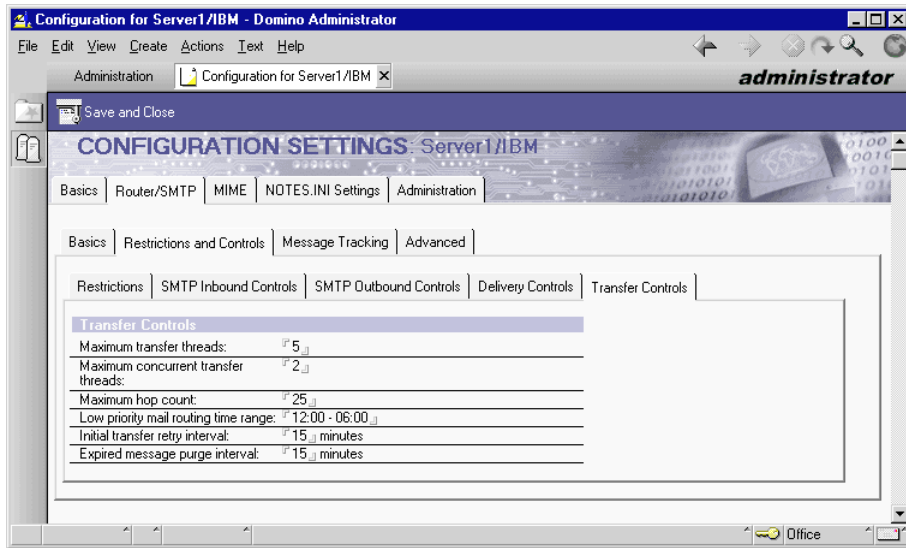
Figure 113. Increasing the Maximum Router Transfer Threads

With R5, the delivery process of the router also became multi-threaded. The default value is one. To change this value, edit the field labelled Maximum delivery threads on the `Router/SMTP-Restrictions and Controls-Delivery Controls` tab. An example is shown in Figure 114.
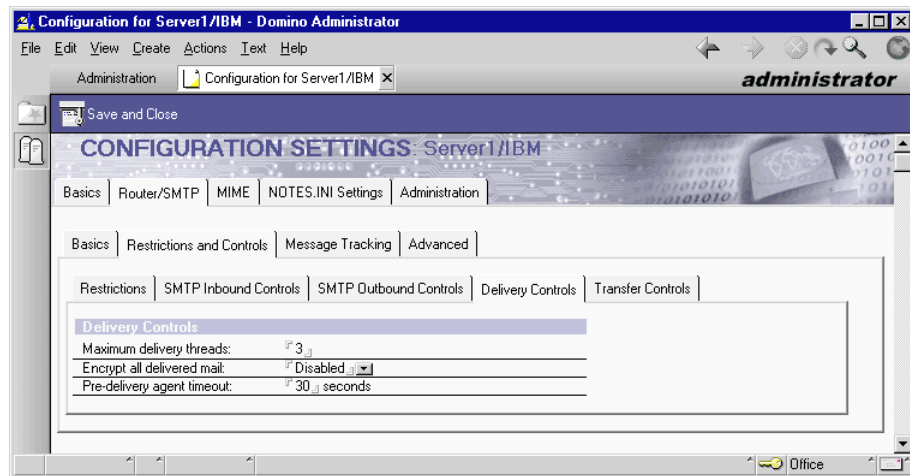
Figure 114. Increasing the Maximum Router Delivery Threads

The R5 router has many more controls available than the previous router or SMTP MTA. These can be implemented through fields on the server configuration document found in the `Router/SMTP-Restrictions and Controls` and associated tabs.

3.6.2 SMTP/MIME Considerations

The R5 router now supports native SMTP routing /delivery, and MIME format storage. When an R5 server routes a MIME message to an R4 server, it first converts it back to the *Compound Document* (CD) format, as the R4.x server does not understand native MIME, but it also attaches a copy of the full MIME content so that message fidelity is preserved should that message be required by a MIME-compliant client at a later stage.

In a mixed environment, to deliver a Notes CD format message, the R5 server utilizes the field Format preference for incoming mail on the **Mail** tab of the Person Document of a recipient to determine the user's message format preference (see 3.6.4.9, "Defining a User's Internet Mail Storage Options" on page 100). The R5 router then delivers a message to that user in the format indicated by that setting.

┌─ **Note** ───┐
│   │
│ Person documents in the Domino Directory must be updated for users with │
│ a MIME-compliant client, such as Notes R5, and for use with POP3/IMAP │
│ access protocols when accessing an R5 server.   │
│   │
└───┘

3.6.3 Considerations in a Mixed-Release Cluster

Should clustering be used to provide resilience during the upgrade process, then there are some important points to note especially if some clients and mail databases have been upgraded to R5 before all of the servers.

1. The R5 mail template uses features not available in releases of Domino prior to R4.6.3b; so, a client failing over to an R4.x server will have a reduced feature set and may even be subjected to error messages if the other cluster members are not running R4.6.3b.

2. R4 servers do not support soft deletions. The trash folder on an R4 server appears to contain all the documents in the mail file; and although this may be intimidating, it can be ignored.

3. R5 servers can deliver native MIME, but R4 servers cannot. Thus, when a Notes client fails over to an R4 server from an R5 server, MIME messages are converted to Notes format documents and appear different than when viewed on the R5 server.

4. Attempting to send a MIME message through an R4 server means that the message must be converted to Notes format with an attachment containing the original MIME.

5. Though failover is indicated in the Notes status bar at the bottom of the screen, this is not obvious, and a failover from an R5 to an R4 server may not be apparent. However, as noted above, there are changes in functionality between R5 and R4 in clusters.

Details of clustering Domino Servers can be found in 7.5, "Domino Server Clustering" on page 173.

3.6.4 Upgrading an SMTP MTA Server

Where SMTP MTA servers exist in a domain, other R5 servers not configured to route SMTP mail themselves will recognize and use the routing information in the Domino Directory to continue to route mail to the MTA for ongoing delivery outside of the local domain. This gives flexibility in terms of when MTA servers are upgraded; SMTP can be implemented all at once, gradually or not at all.

There are three main upgrade strategies for the MTA servers:

1. Leave the existing R4.x MTA in place until all other elements are upgraded

   This ensures a known level of service for SMTP traffic during the upgrade process; however, it does not allow other upgraded elements to take advantage of new features and imposes conversion processing for mail to be delivered to the R4.x MTA.

2. Replace all MTAs with R5 mail servers first.

   This allows immediate access to new R5 SMTP features and enhanced performance but still requires message conversion for mail routing to the other servers until they are upgraded.

3. Replace all MTAs with R5 mail servers during the system upgrade.

   In larger environments, this strategy allows the MTA servers to be upgraded at the same time as other servers in their vicinity to which they route the majority of their SMTP traffic.

4. Re-design the Internet messaging infrastructure.

In an R4.x messaging infrastructure, the nature of the SMTP implementation dictated that specific servers be designated to perform SMTP routing functions to locations outside of the local domain. With R5, this restriction is no longer necessary since all servers can route natively through some relay host, such as a virus scanning server or firewall. Once mail servers that used to route through the MTA have been upgraded, the MTA is no longer required and does not need to go through the upgrade process.

The following sections describe the stages through which an existing R4.x SMTP MTA server can be upgraded to a native R5 SMTP mail server.

Note

As noted earlier, ensure a full backup of the system is taken prior to commencing the upgrade process.

3.6.4.1 Disabling MTA Housekeeping

MTA housekeeping must be disabled. If this is left enabled, after housekeeping is performed, it will restart the MTA, and inbound/outbound transport will be available, which may contaminate work queues that have been cleared down ready for the upgrade. To disable housekeeping:

1. Open the server document in the Domino Directory

2. Click on the **MTAs** tab

3. Click on the **R4.x Internet Message Transfer Agent (SMTP MTA)** section header to expand the section

4. Change the value of the field Enable daily housekeeping to `Disable` as shown in Figure 115 on page 96 below.
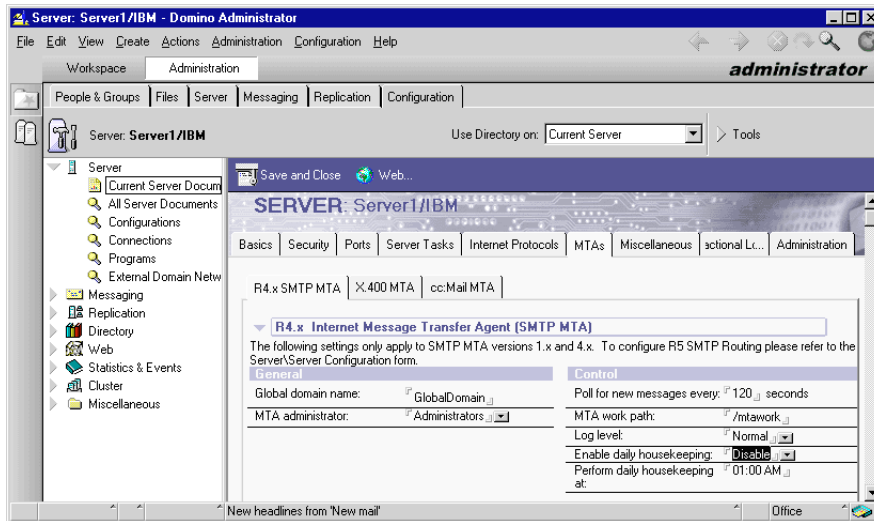
Figure 115. Disable MTA Daily Housekeeping Task

5. Save and close the document

3.6.4.2 Shutting Down the Router

Shutting down the router prevents any new messages being delivered from internal sources into the smtp.box database for processing. To stop the router, type `tell router quit` at the Domino server console and press **Enter** as shown in Figure 116.

```
> tell router quit
08/02/99 16:10:01    Router: Shutdown is in progress
08/02/99 16:10:01    Mail Router shutdown
```

Figure 116. Stopping the Mail Router

3.6.4.3 Shutting Down the Inbound Message Transport Task

To allow the work queues to be cleared of any messages prior to upgrade, the task that accepts inbound routing connections must be disabled. To do this, type `tell smtpmta stop inbound transport` at the Domino Server console and press **Enter** as shown in Figure 117.

```
> tell smtpmta stop inbound transport
08/02/99 16:15:05 SMTPMTA: isesctl Shutting down
08/02/99 16:15:05 SMTPMTA: iseshlr0 Shutting down
08/02/99 16:15:05 SMTPMTA: iseshlr0 Shutdown complete
08/02/99 16:15:05 SMTPMTA: isesctl Shutdwon complete
```

Figure 117.   Stopping the SMTPMTA Inbound Message Transport Task

3.6.4.4 Clearing Down the Work Queues

Using a Notes or Administration client, check the databases Outgoing SMTP Mail (smtp.box), SMTP Inbound Work Queue (smtpibwq.nsf), and SMTP Outbound Work Queue (smtpobwq.nsf) to ensure that all pending messages are processed by the MTA. Any dead messages can be ignored. They will not be routed, but it may be worthwhile noting details so that the sender or recipients can be notified later that they had a problem with those messages.

Once the queues are clear, the server can be shut down. Type `quit` at the Domino server console and press **Enter**.

3.6.4.5 Editing the NOTES.INI file

To remove the SMTPMTA task from the notes.ini file, enter the following commands at an AIX terminal command prompt:

```
# cd /server1
# vi notes.ini
```

Figure 118.   Editing the notes.ini File

This will open the notes.ini file in the UNIX vi editor. See Appendix D, "Using UNIX's vi Editor" on page 361 for details of available commands for use in this editor.

Scroll down the file to the line that starts `ServerTasks=` as shown in Figure 119 on page 98.

```
EDITEXP23=Word for Windows 6.0,2,_XW4W,W4W49T/V0,.DOC,,2,
DDETimeout=10
$$$OpenSpecial=NotesNIC
$$$NotesNIC=CN=Home/OU=Notes/O=NET, welcome.nsf, Notes NIC Welcome, Notes Networ
k Information Center on the Internet
ServerTasks=Replica,Router,Update,Stats,AMgr,Adminp,Sched,CalConn,SMTPMTA
ServerTasksAt1=Catalog,Design
ServerTasksAt2=UpdAll,Object Collect mailobj.nsf
ServerTasksAt3=Object Info -Full
ServerTasksAt5=Statlog
:wq
```

Figure 119. Removing the SMTPMTA Task from the notes.ini File

One of the tasks listed along this line is *smtpmta.* To delete it, move the cursor
to the s of smtpmta and press the **x** key which should delete a letter at a time.
Once the word is removed, save and exit the modified file by pressing the
Escape key, then type :wq (as shown above) and press **Enter**.

3.6.4.6 Installing the R5 Server Software
See Chapter 2, "Installing a Lotus Domino R5 Server" on page 15, for the
specific details of installing the R5 software for AIX and the necessary
pre-requisites of doing so.

Once the server software has been installed, the server must be restarted so
that documents in the Domino Directory can be configured using an
administration client.

3.6.4.7 Configuring SMTP on the Server Configuration Document
Edit the server configuration document for this server. If one does not already
exist for this server, then one must be created.

1. Start the administration client.

2. Select the required server from the bookmarks.

3. Click on the **Configuration** tab.

4. Open the server panel and click on **Configurations**.

5. Select the configuration document and press **Edit Configuration**. If one
   does not exist, then click **Add Configuration**. An existing document is
   shown in the view in Figure 120.
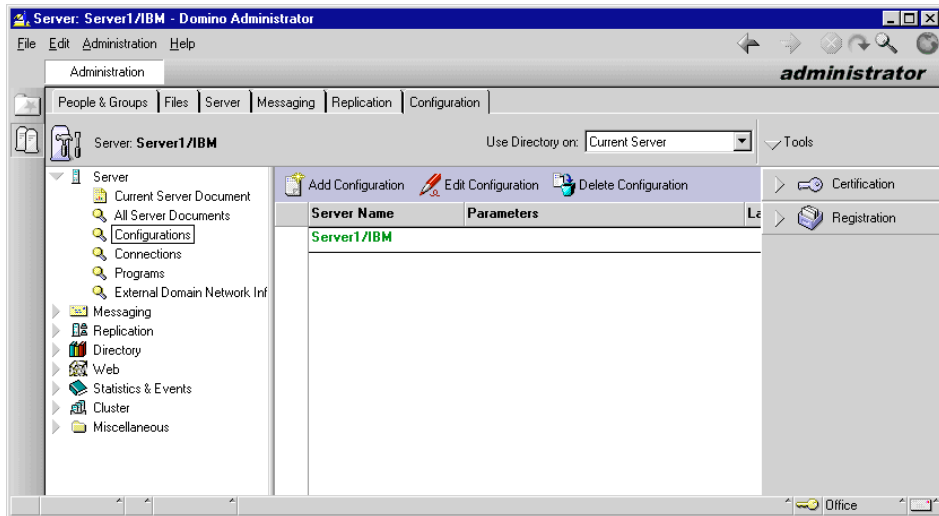
Figure 120. Adding or Editing a Server Configuration Document

6. Enter a group or server name in the field `Group` or `Server` name.

7. Complete all required fields found under the `Router/SMTP` and `MIME` tabs.

8. Save and close the document.

3.6.4.8 Enabling the SMTP Listener Task
To make the server's router aware that it is to accept incoming SMTP mail connections, the `SMTP listener` task must be enabled.

1. Edit the server document.

2. On the `Basics` tab, change the value of the SMTP listener task field to be `Enabled` as shown in Figure 121 on page 100.
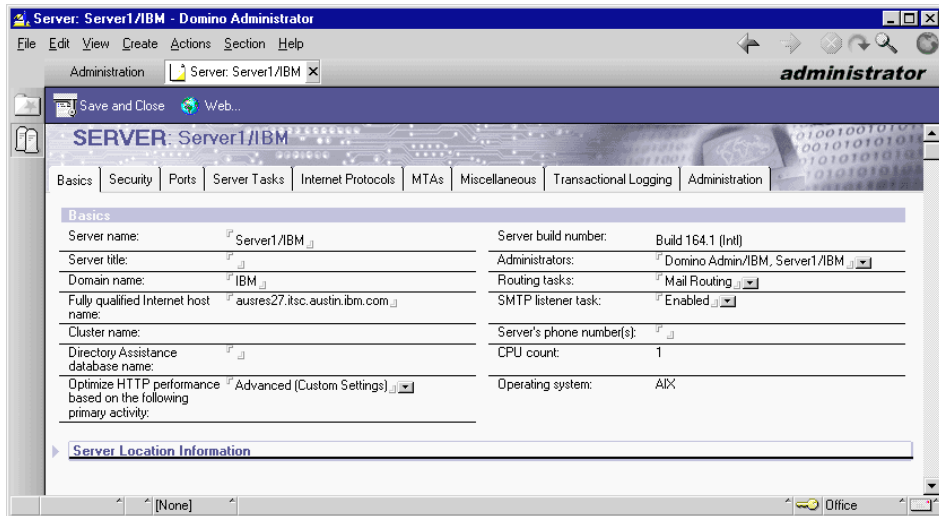
Figure 121. Enabling the SMTP Listener Task

3. Save and close the document.

4. Restart the server to ensure all configuration changes are invoked.

3.6.4.9 Defining a User's Internet Mail Storage Options

Each person document contains a field that the R5 router uses to determine whether a user prefers to receive messages in a Notes or MIME format.

Once a server is upgraded to R5, this field should be populated for all users who have their mail delivered on that server. To ensure they receive messages in the best format for the client that they are using, the choices are:

• No Preference
• Prefers MIME
• Prefers Notes Rich Text

3.6.4.10 Configuring Relay Host Information

In many R4.x MTA installations, the server is configured to relay all SMTP messages to a relay host which is, often a virus scanner or firewall. By entering a value in the field labelled `Relay host for messages leaving the local internet domain` on the server configuration document, the server will relay all SMTP mail that is bound for an address outside of the local domain to this host.

This directly replaces the SMTP connection document that used to specify a relay host.

In addition, a smart host can be specified in the field labelled `Local internet domain smart host` through which all messages are routed if the server cannot find a match for the recipient's address in the Directory, and the address is in the local internet domain. Examples are shown in Figure 122.
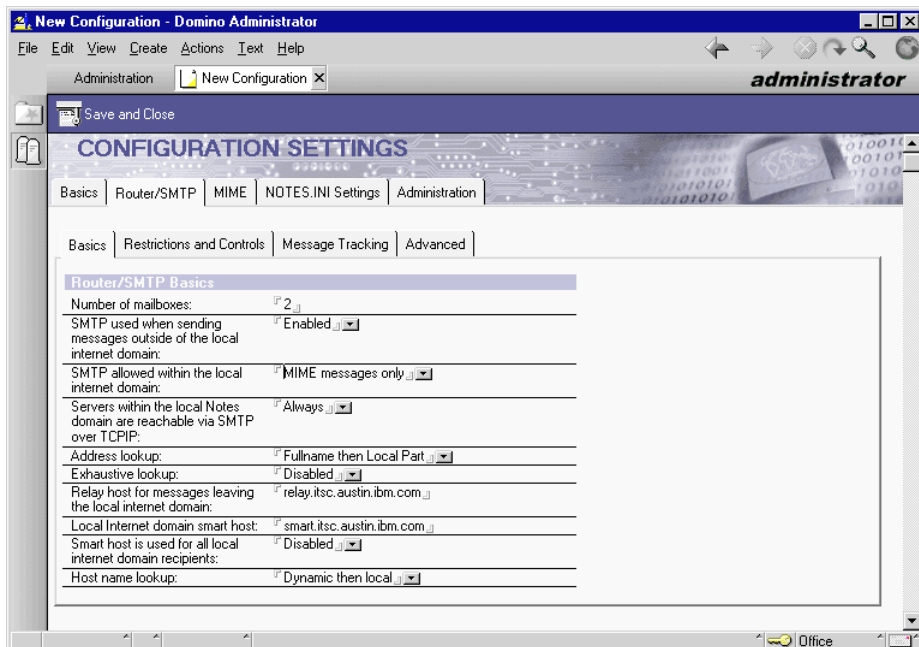
Figure 122. Setting a Relay Host and Smart Host for External SMTP Traffic

3.6.4.11 R4.x vs. R5 Configuration
The global domain documents that were used by R4 are still used by the R5 router to get information about the local internet domains for which it will process and route mail.

The foreign SMTP domain document is no longer required by an R5 router. Domain routing restrictions are specified on the `Restrictions and Controls` tab of the server configuration document.

The SMTP connection document is no longer required by an R5 router. Details of the relay host are specified on the `Router/SMTP- Basics` tab of the server configuration document.

The configuration settings specified in the `Internet Message Transfer Agent (SMTP MTA)` section of the server document are now either superseded by those available on the server configuration document or are no longer required by the R5 router.

For detailed descriptions of the fields used, refer to the document *Configuration in R4 vs. R5* in the *Lotus Domino R5 Administration Help* database.

3.7 Searching and Indexing

R5 introduces a brand new searching and indexing engine called *Global Text Retrieval* (GTR). An important point to note, as mentioned previously, is that full-text indexes are approximately 50 percent larger.

Indexes will be rebuilt automatically as databases are used; and since the changes have been implemented below the API level, earlier releases of the client and applications performing search functions will continue to function correctly.

Note

An administrator may run the *updall* task to update all databases indexes at the same time. The indexing process is very CPU intensive. If a server has many full-text indexes to rebuild, its performance will be degraded for a significant period of time; in which case, it may be desirable to perform this task out-of-hours with the server off-line.

Although the search indexes can be used by all releases of the client, users may come across an error during index rebuilding.

Note

If users attempt to search a database that is being updated from an R4 to an R5 full-text index, they will get an error message stating that they must wait for the indexing process to complete before they can search the database.

3.8 Recovering from a Failed Upgrade

Provided that a *full* backup of the server is taken prior to any upgrade work being started, then to recover from a failure in the upgrade process should be a relatively straightforward task.

If, however, for any reason a backup cannot be used to restore the original state of the server, then there are several things to consider.

If the compact task has been run on the R5 server, then all of the databases will have been converted to the R5 ODS. If the R4.x server software is re-installed, then it will not be able to read the contents of the databases. Prior to re-installing R4.x, the R5 version of the compact task must be used to revert back to the R4 ODS.

To do this, at an AIX terminal command prompt, do the following:

1. Type `whoami` and press **Enter** to determine the name of the current user.

2. If the current user is not the user defined to run the Domino server, type `su - notes` and press **Enter** (where `notes` is the user defined to run the Domino server).

3. Enter the user's password and press **Enter**.

4. Type `cd /server1` and press **Enter** to move to the Domino data directory for the server.

5. Type `compact -r` and press **Enter** to compact the directory database (see Figure 123).

```
$ whoami
ausres27
$ su - notes
notes's Password:
$ cd /server1
$ compact -r
```

Figure 123.   Reverting Databases Back from R5 to R4 ODS

Note

This process will only revert databases, not templates. If any templates have been manually compacted then the following command must be used to revert them back to the R4.x ODS:

```
compact <template>.ntf -r
```

where `<template>` is the first part of the template filename.

Also, templates on another server still running R4.x could be copied to this server to replace those that have been compacted.

To prevent this from happening unintentionally until confident that the server does not need to be downgraded back to R4.x, the following options may be considered:

- Disable the automatic running of the compact task.
- Rename databases to use a .ns4 extension.
- Disallow the creation of new or replica databases on the server.

Note

The above options limit the risk of a database being automatically changed to an R5 ODS, but they will not prevent an administrator with sufficient access rights from *manually* compacting from their workstation client.

Any changes made to the notes.ini file (see 3.2.5, "Modifying the NOTES.INI File" on page 77), should be reversed.

Chapter 4. Customizing AIX for Lotus Domino R5

This chapter details how to customize the Domino server environment by using AIX scripts to perform various administrative tasks, such as starting and stopping the Domino server.

Several examples are presented throughout this chapter. The following Lotus Domino Server configuration will be used for the examples:

- The Lotus Domino software is installed in a file system mounted on /usr/domino.
- The server is run as the AIX user `notes` and AIX group `notes`.
- The Domino server data directory is in another file system mounted on /server1.

The code and examples in this chapter were created assuming this configuration, and you will need to customize them to work properly in your environment. To do so, you will be required to know about administering AIX systems and Korn Shell scripts. Also environment variables that had to be defined in earlier releases of Notes have been moved to the notes.ini file. More details of environment settings can be found in 3.2.6, "Modifying AIX Environment Settings" on page 78.

4.1 Lotus Domino Server Startup

This section covers the following topics:

- How to start up the Lotus Domino Server manually from an AIX command line
- How to startup the Lotus Domino Server using a startup script
- How to start up the Lotus Domino Server on an AIX machine automatically at bootup

4.1.1 Lotus Domino Server Startup from AIX Command Line

These are the steps to start up the Lotus Domino Server on an AIX machine and view a server console:

1. Log in to the system as the `notes` user.

2. Change directory to `/server1` if your notes.ini is not in your path.

3. Type in the command: `server` if you have not already added the directory `/opt/lotus/bin` to your path statement.

4. You may need to type the Lotus Domino Server password.

This procedure will start the server, and you will be able to view the server console on a screen or window. If you kill this screen, the server will crash and will not respond to any requests. To recover from this situation, you have to kill the server and all the child processes and remove the corrupted shared memory and semaphores that they created. 12.1, "Cleaning Lotus Domino Processes" on page 327 contains an explanation about killing these processes and removing corrupted shared memories and semaphores. It also contains a script to achieve this.

4.1.2 Server Startup in Background

To run the server in the background, use the following command:

```
$ nohup /opt/lotus/bin/server <notes_data_directory> <<EOF &
> <Server_Password>
> EOF
```

Figure 124. Running the Lotus Domino Server in the Background

The server output will be directed to the file nohup.out. You will need to type your Lotus Domino Server password. If your server doesn't need a password, press **Enter**. If you wish to see the server output, you will have to read the nohup.out file. You can send commands to this server through the server remote console (see 4.4.1, "Shutting Down Lotus Domino Server on Server Console" on page 120).

> **Note**
>
> The Domino server should be started as a background task from either the /etc/inittab file or as a cron job to prevent unexpected task interruptions and hangs instead of using the `nohup` command.

The recommended way to start up a server is by using a startup script as given in the next section.

4.1.3 Starting the Lotus Domino Server Using a Startup Script

In case you wish to start the Lotus Domino Server in the background using a shell script, we give below the following two shell scripts to be executed for fully accomplishing the task. The scripts should be owned and executed by user notes. Hence, the scripts should have the right file permissions to be executable.

4.1.3.1 Defining the Environment

The script provided below defines essential parameters for use by other scripts.

```ksh
#!/bin/ksh
# Domino Application Server Environment Variable Script
# Licensed Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp 1994,1998
# All Rights Reserved.
# US Government Users Restricted Rights - Use, duplication or disclosure
# restricted by GSA ADP Schedule Contract with IBM Corp.
#######################################################################
# Description - env_domino
#
#       This script makes variable definitions that are common to
#       the start_domino, stop_domino scripts
#######################################################################

# This script is provided "As Is".

# Script Environment variables.

NOTES_USER=notes                       # AIX userid for this server
NOTES_PATH=/server1                    # Path for server data directory
NOTES_SERVER=noteserv                  # Name of Domino Server
OUTPUT_LOG=/tmp/$NOTES_SERVER.log      # Output file for server console
INPUT_FILE=$NOTES_PATH/$NOTES_USER.input  # Input file for server console
PATH=$NOTES_PATH:/opt/lotus/bin:$HOME/bin:$PATH# Ensure PATH is set for
scripts
```

4.1.3.2 Starting the Server

The following script starts the server in the background redirecting the console to $OUTPUT_LOG, and reading commands from $INPUTFILE. The size of the output log file will need to be monitored as it can grow big in size, so you may want to direct the output to /dev/null. The /dev/null special file provides character access to the null device driver. This device driver is normally accessed to write data to the bit bucket (when the data is to be discarded).

Note

The INPUT file allows any command to be issued to the Domino Server; so, this file should be treated accordingly, that is, hidden with the appropriate permissions to prevent unauthorized access to the server

---

Type the command `/(path where the script resides)/start_domino` to start the server.

```ksh
#!/bin/ksh -x
# Domino Server Start Script
# Licensed Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp 1994,1998
# All Rights Reserved.
# US Government Users Restricted Rights - Use, duplication or disclosure
# restricted by GSA ADP Schedule Contract with IBM Corp.
#######################################################################
# Description - start_domino
#
# This is a server startup script to start the Domino Server in background
# that gets command input from a file and pipes the output to another which
# can be monitored by administrators.
#
# The INPUT file allows any command to be issued to the Domino Server so
# this file should be treated accordingly ...hidden with the appropriate
# permissions to prevent unauthorized access to the server
#######################################################################

# This script is provided "As Is".

# Set Script Environment variables.

. /(path of dir where the script exists)/env_domino

# Script Logic

if (('id -u' == 0))
then
   print "Run the Domino Server as the $NOTES_USER user "
   exit
fi

#
# if you are using /etc/hosts for tcpip name resolution rather than a name
# server or NIS, then uncomment the following line:
#export NSORDER=bind,local,nis
#

if [ ! -x /opt/lotus/bin/server ] ; then
    echo "Cannot access server command - exiting"
    exit 1
fi
```

```
if [ ! -d $NOTES_PATH ] ; then
    echo "Cannot access notes data directory - exiting"
    exit 1
fi

NOTES_RUNNING=`ps -fu $NOTES_USER | grep /opt/lotus | grep -v grep `
if [[ -n $NOTES_RUNNING ]] ; then
    echo "Domino Server is already running - exiting"
    exit 1
fi

cd $NOTES_PATH
#
# Clean up if the Domino Server terminated abnormally earlier
#

rm -f ~notes.lck
mems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"m" '{ print
$2 }' | awk '{ print $1 }'`
sems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"s" '{ print
$2 }' | awk '{ print $1 }'`
for j in $mems;do if [ -n "$j" ] ; then ipcrm -m $j;fi;done
for j in $sems;do if [ -n "$j" ] ; then ipcrm -s $j;fi;done
#
# For servers using Notes passwords,
# replace the previous line with the following two lines.
#
cat .secure_hidden_passwd > $INPUT_FILE
echo "show server" >> $INPUT_FILE

cp -p  $OUTPUT_LOG $OUTPUT_LOG.`date +"%m%d%y_%H%M"`
#cp -p  $OUTPUT_LOG $OUTPUT_LOG.backup
print "Starting Domino for AIX ($NOTES_SERVER)"
/opt/lotus/bin/server < $INPUT_FILE > $OUTPUT_LOG 2>&1 &
```

4.1.4 Starting the Lotus Domino Server Automatically

To start up the Lotus Domino Server automatically after a reboot, you need to create an entry in the /etc/inittab file and a script to start up the server. In our example, the script is called start_domino, which is described in 4.1.3.2, "Starting the Server" on page 107. It will be in the directory /server1/bin. The output of the server will be moved into the /tmp directory.

Use the following procedure to implement our example.

1. Log in as the notes user, and do the following:

   • Create a directory called `bin`

```
$ mkdir -m 700 /server1/bin
```

- Move the file start_domino in the directory /server1/bin

```
$ mv start_domino /server1/bin
```

2. Log in as `root` to do the following:

- Type in the command below to create an entry in the /etc/inittab file for the Lotus Notes startup script to execute during machine startup

```
# /usr/sbin/mkitab "notes:2:once:/bin/su - notes -c
/server1/bin/start_domino #Domino Server Startup"
```

This is a one line command. This command will make the necessary changes to the inittab file.

Note

If you want to remove the above entry from /etc/inittab, use the command below. This is a one line command. This command will make the necessary changes to the inittab file.

```
# /usr/sbin/rmitab "notes:2:once:/bin/su - notes -c
/server1/bin/start_domino #Domino Server Startup"
```

After the next boot, the Lotus Domino Server will be started up automatically. If you want to start up the server without rebooting the machine, as the notes user type:

```
$ nohup /server1/bin/start_domino &
```

This a simple example. You can change this sample program to customize your logs and directories.

4.1.5 Using the AIX alog Facility

AIX provides a command called `alog`. This function allows the output from installp to be recorded in the log file /var/adm/ras/bosinstlog.

The characteristics of the new `alog` command are the following:

1. It is a circular logging program. It reads from stdin and writes to stdout and copies the information into a file that has a fixed size. The logging program writes to the file, and when it is filled, new entries will be written over the oldest ones. The output does not include any time stamps, and the logging program does not provide any concurrency control (for example, the synchronization of multiple processes trying to log the same file at the same time).

2. It is configurable. With `alog`, you can create or view log types, configure the log file size, verbosity, and location. The default path for the alog files is /var/adm/ras.

The `alog` command works with log files that are specified on the command line or with logs that are defined in the alog configuration database. Logs that are defined in the alog configuration database are identified by LogType. The File, Size, and Verbosity attributes for each defined LogType are stored in the alog configuration database with the LogType. You can add a new LogType to the alog configuration database using the `odmadd` command. You can change the attributes of LogType defined in the alog configuration database using the `alog` command.

Note

To use the alog facility, you need to have at least AIX 4.1.5, and the bos.rte.serv_aid fileset must be installed in the system. Without this, the alog facility won't work properly with Lotus Notes. You can use the command:

```
lslpp -l | grep bos.rte.serv_aid
```

to check if the fileset is installed in your system.

You also can run the following test to ensure that your alog version will work properly with Lotus Notes:

Run the command:

```
alog -f /tmp/test.log
```

Type some words and press **Enter**. The `alog` command echoes your input.

Suspend the `alog` command by pressing **Ctrl-Z** (stop signal).

Run the command:

```
alog -f /tmp/test.log -o
```

If it shows what you've typed, it is working. If it shows only what you've typed when you finish the previous `alog` command (you have to put it in the foreground again and press **Ctrl-D**), it won't work with Lotus Notes. The reason for this is that it outputs the messages to the log file only when its standard input is finished.

To use the `alog` command, you must:

- Create a log file definition in the Software Service Aids Attributes Object Class (SWservAt) of the host's Object Data Manager (ODM)

Note

Make user to backup the ODM.

- Modify the startup script to use the `alog` command.

The script configure.alog, given below, creates a log file definition (file name /server1/log/server.alog, file size 512 KB) and creates the inittab entry to start up the server.

It first tries to remove the old definitions, if there are any, with the `odmdelete` command. It then creates the log file ODM definition. The log name is notes, the file name is /server1/log/server.alog, and the file size is 512 KB.

It then removes any inittab entry that begins with notes (take care to not destroy your inittab) and creates the inittab to call the script /server1/bin/startup.alog.

```
#!/bin/ksh
#@(#) Configures Automatic Notes Startup.
# Script startup must be in ~notes/bin/startup

if [[ '/bin/id -u' != 0 ]]
then
  echo "Error: you must be root..." >&2
  exit 1
fi

LHOME=~notes
LOG=$LHOME/log/server.alog
SIZE=524288

# Deletes previous old odm for the log notes...
echo "Deleting previous ODM entries..."
/bin/odmdelete -o SWservAt -q 'attribute=alog_type AND deflt=notes'
/bin/odmdelete -o SWservAt -q attribute=notes_logname
/bin/odmdelete -o SWservAt -q attribute=notes_logsize
/bin/odmdelete -o SWservAt -q attribute=notes_logverb

# Define in ODM an alog for Domino Server with size 512K
echo "Defining new ODM entries..."
/bin/cat <<EOF | /bin/odmadd
SWservAt:
    attribute="alog_type"
    deflt="notes"
```

```
        value="notes"
SWservAt:
    attribute="notes_logname"
    deflt="$LOG"
    value="$LOG"
SWservAt:
    attribute="notes_logsize"
    deflt="$SIZE"
    value="$SIZE"
SWservAt:
    attribute="notes_logverb"
    deflt="1"
    value="1"
EOF

# Delete old inittab entries...
ENTRY=`/bin/awk -F: '$1 == "notes" {print}' /etc/inittab`
if [[ -n $ENTRY ]]
then
  echo Removing inittab entry: $ENTRY
  /usr/sbin/rmitab "$ENTRY"
fi

# Create the new one...
echo Creating inittab entry...
/usr/sbin/mkitab "notes:2:once:/bin/su - notes -c $LHOME/bin/startup.alog \
# Domino Server Startup"
```

The new script, startup.alog, is shown in Figure 125 on page 114. The difference is that this script redirects the standard output to the `alog` command instead of to the log file. Note that the server messages will appear in the host console. If you don't want this, redirect the alog standard output to /dev/null. You need to put the password of the user notes in the file named ~/bin/.notes.

```
#!/bin/ksh
#@(#) Starts up Lotus Domino Server...
#
. /etc/environment | /bin/alog -tnotes > /dev/console

NOTESPATH=/opt/lotus/bin
export PATH=$NOTESPATH:~/notesr4:$PATH
export LANG=C

echo "---------------------> `date` <---------------------" | \
    /bin/alog -tnotes > /dev/console
$NOTESPATH/server < ~/bin/.notes 2>&1 | \
    /bin/alog -tnotes > /dev/console &
```

Figure 125. Script to Start Up a Lotus Domino Server (startup.alog)

To view the log contents, use the command:

```
$ alog -tnotes -o
```

You also can use smitty to view the log. Run: smitty alog_show, type: notes in the Alog TYPE field and press **Enter** (Figure 126). Press **Enter** again, and the log file will be displayed.

```
  Show an Alog File

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

                                            [Entry Fields]
  Alog TYPE                                 notes
  Alog File NAME                            [/server1/log/server.alog]   /

F1=Help            F2=Refresh       F3=Cancel          F4=List
F5=Reset           F6=Command       F7=Edit            F8=Image
F9=Shell           F10=Exit         Enter=Do
```

Figure 126. Show an alog File

To change the file name, or the log size, run: smitty alog_change. Then type notes in the Alog TYPE field and press **Enter** (Figure 127 on page 115). To change the file name, type the new one in the Alog file NAME field. To change the file size, type the new one in the Alog file SIZE field. Note that if you change the file size, the prior log messages will be erased.

```
 Change / Show Characteristics of an Alog File

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

                                            [Entry Fields]
  Alog TYPE                                 notes
  Alog File NAME                            [/server1/log/server.alog] /
  Alog File SIZE                            [524288]                 #
  VERBOSITY                                 [1]                      #

F1=Help              F2=Refresh         F3=Cancel          F4=List
F5=Reset             F6=Command         F7=Edit            F8=Image
F9=Shell             F10=Exit           Enter=Do
```

Figure 127. Change / Show Characteristics of an alog File

4.2 Viewing the Domino Server Live Console

If the server has been started using the *start_domino* script, then you will not be able to view the Domino server console as the script starts the server in the background. Also, when a server crashes, the last few lines may not be logged to the notes log, and there may be instances when the log file gets corrupt. In such cases, being able to view the server live console is very useful. The script given below displays the Domino server console when executed and allows remote administrators to interact with the AIX Domino server console.

The scripts should be owned and executed by user notes. Hence, the scripts should have the right file permissions to be executable. Type the command /(path where the script resides)/notes_screen to view the Domino server console. The size of the output log file will need to be monitored as it can grow big in size.

```ksh
#!/bin/ksh
# (C) COPYRIGHT International Business Machines Corp. 1985, 1994
# All Rights Reserved
# Licensed Materials - Property of IBM
# US Government Users Restricted Rights - Use, duplication or
# disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
# Setup a few variables
# Who is running this script
Me=`whoami`
# What command is being run
```

```
FullCommand=$0
Command=`basename ${FullCommand}`

# Where is the Notes data directory
NotesDir="/server1"

# Where is the Notes INI file
NotesINI=${NotesDir}"/notes.ini"

# What directory should we log to
# NotesServerLogDir=${NotesDir}"/logs"

# What login owns the Notes server on this node
if [ -f ${NotesINI} ]
then
        NotesID=`ls -l ${NotesINI} | awk '{print $3}'`
else
        echo "${NotesINI} does not exist.  Cannot run notes here!"
        exit 1
fi

# Make sure we are running as the notes owner
if [ ${Me} != ${NotesID} ]; then
        su - ${NotesID} -c ${FullCommand}
        exit 0
fi

#data_dir=/server1
data_dir=${NotesDir}

# OUTPUT_LOG=${NotesServerLogDir}/server.log
OUTPUT_LOG=/tmp/ausres28.log
#INPUT_FILE=$data_dir"/profile/.notes"
INPUT_FILE=/server1/notes.input
CURRENT_TTY=`tty`

if [[ $# -gt 0 ]]; then
   echo "\nSyntax: ${Command}\n"
   echo "This program attaches to the Lotus Notes Server input and output"
   echo "streams so you may interact with the server."
   echo "\nUse ctrl-c to exit the monitor.\n"
   exit 1
fi

function stop_monitor
{
   echo ""
```

```
            echo "Exiting notes monitor..."
            echo ""
            kill -9 $TAILPID
            exit 0
}

PCOUNT=`fuser $OUTPUT_LOG 2>/dev/null | wc -w`
if [ $PCOUNT -lt 1 ]; then
    echo ""
    echo "The notes server does not appear to be started.  Monitor
terminating."
    echo ""
    exit 1
fi

trap "stop_monitor" 1 2 3

echo ""
echo "*******************************************************************"
echo "     To exit this monitor enter a <CTRL>-C"
echo "*******************************************************************"
echo ""

#tail -f $OUTPUT_LOG | sed 's/^\>/Notes Monitor>>/' >> $CURRENT_TTY &
tail -f $OUTPUT_LOG >> $CURRENT_TTY &
TAILPID=$!

while [ 1 -eq 1 ]
do
  CMD=""
  OPT=""
  read CMD OPT
  case $CMD in
      "cls") clear
             echo "" >> $INPUT_FILE ;;
      "CLS") clear
             echo "" >> $INPUT_FILE ;;
    "clear") if [[ "$OPT" = "log" || "$OPT" = "LOG" ]]; then
                 echo "Log cleared on `date`" > $OUTPUT_LOG
                 echo "" >> $OUTPUT_LOG
             fi
             echo "" >> $INPUT_FILE ;;
     "quit") echo "Are  you sure you want to shut down the Notes server ?
" >> $OUTPUT_LOG
             echo "enter the command  shutdown   if you mean it " >>
$OUTPUT_LOG
             echo "enter CNTL-C to exit this log session  " >> $OUTPUT_LOG
```

```
                          echo "" >> $OUTPUT_LOG ;;
      "QUIT")  echo "Are  you sure you want to shut down the Notes server ?
" >> $OUTPUT_LOG
                 echo "enter the command  shutdown   if you mean it " >>
$OUTPUT_LOG
                 echo "enter CNTL-C to exit this log session  " >> $OUTPUT_LOG
                 echo "" >> $OUTPUT_LOG ;;
      "exit")  echo "Are  you sure you want to shut down the Notes server ?
" >> $OUTPUT_LOG
                 echo "enter the command  shutdown   if you mean it " >>
$OUTPUT_LOG
                 echo "enter CNTL-C to exit this log session  " >> $OUTPUT_LOG
                 echo "" >> $OUTPUT_LOG ;;
      "EXIT")  echo "Are  you sure you want to shut down the Notes server ?
" >> $OUTPUT_LOG
                 echo "enter the command  shutdown   if you mean it " >>
$OUTPUT_LOG
                 echo "enter CNTL-C to exit this log session  " >> $OUTPUT_LOG
                 echo "" >> $OUTPUT_LOG ;;
      "?")    echo "If you want to shut down the Notes server ? " >>
$OUTPUT_LOG
                 echo "enter the command  shutdown   if you mean it " >>
$OUTPUT_LOG
                 echo "enter CNTL-C to exit this log session  " >> $OUTPUT_LOG
                 echo "otherwise just type a Notes server command " >>
$OUTPUT_LOG
                 echo "" >> $OUTPUT_LOG ;;
  "shutdown") echo "quit " >> $INPUT_FILE
                 echo "" >> $OUTPUT_LOG ;;
  "SHUTDOWN") echo "quit " >> $INPUT_FILE
                 echo "" >> $OUTPUT_LOG ;;
     "CLEAR") if [[ "$OPT" = "log" || "$OPT" = "LOG" ]]; then
                    echo "Log cleared on 'date'" > $OUTPUT_LOG
                     echo "" >> $OUTPUT_LOG
                 fi
                 echo "" >> $INPUT_FILE ;;
           *) echo $CMD $OPT >> $INPUT_FILE ;;
    esac
done
stop_monitor
```

4.2.1 AIX Command Line Access to the Server Console

You can also view the server console through the AIX command line access
to the server console.

A new command `cconsole` provides a way to access the server console from the command line. This feature is supported only in R5 for Unix platforms. More details of this can be found under 6.4.1, "Starting Domino Character Console" on page 154.

4.3 Monitoring Disk Space on File Systems on the Domino Server

A very important task that an administrator needs to perform is to check free disk space periodically on file systems. This process of checking disk space can be automated using the script given below and creating a crontab entry to run the script at a regular interval.

```
#!/bin/ksh
# Domino Application Server Disk Space Checking Script
# Licensed Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp 1994,1998
# All Rights Reserved.
# US Government Users Restricted Rights - Use, duplication or disclosure
# restricted by GSA ADP Schedule Contract with IBM Corp.
#########################################################################
# Description - This script sends an e-mail message to the administrator if
# the disk usage of a file system is above the warning threshold specified
# by the administartor
#########################################################################

# This script is provided "As Is".
# Run this script only in cron as local root.
#-----------------------------------------------------------
# servername and name of admin will need to be entered below
HOST=$servername
ADMIN=$name of admin"
DATE=$(date +"%b_%d")
LOG=/tmp/$(hostname).df
LOG_DIR=/tmp
att_mark=$1

echo ${att_mark:=90} >/dev/null 2>&1

df -k | tail +2 | sed "s/%//g" | sed "s/$/ $att_mark/" |
awk '
{($4 >= $8 ) ? warning="WARNING" :warning=""}

{printf("%-45s: %3s%s %s %s\n", $7,$4,"%","used",warning)} ' > $LOG #
contains all file systems

#-----------------------------------------------------------
```

```
# check some file systems
#----------------------------------------------------------
cat $LOG
if [ -s $LOG ]
 then          #check only /, *var*, /tmp, and /server1
  MESSAGE=$(grep WARNING $LOG | grep -E "/$|var|tmp$|server1")
  if [ $? = 0 ]
   then echo "$MESSAGE\n" | mail -s "CHECK_DF WARNING on Host $HOST" $ADMIN
  fi
 else echo "Could not check_df on ${HOST}" |mail -s "Could not check_df on
${HOST}" $ADMIN
 exit 1
fi

/usr/bin/rm $LOG
```

4.4 Lotus Domino Server Shut Down

This section covers the following topics:

- How to shut down the Lotus Domino Server on server console.
- How to shut down the Lotus Domino Server on remote console.
- How to shut down the Lotus Domino Server using AIX commands.
- How to shutdown the Lotus Domino Server using a shell script.

4.4.1 Shutting Down Lotus Domino Server on Server Console

If you are viewing the Lotus Domino Server console on a screen, just type the command `exit` or `quit`. It may take 10 seconds or more for the server to shut down.

4.4.2 Shutting Down Lotus Domino Server w/ Domino Administrator

Another way to shut down the server is to use the R5 Domino Administrator. Follow the steps mentioned below to start the Domino Administrator and shut down the server.

1. Choose **File->Tools -> Server Administration...** from the Lotus Notes Workspace screen to get the Domino Administration screen (Figure 128 on page 121).
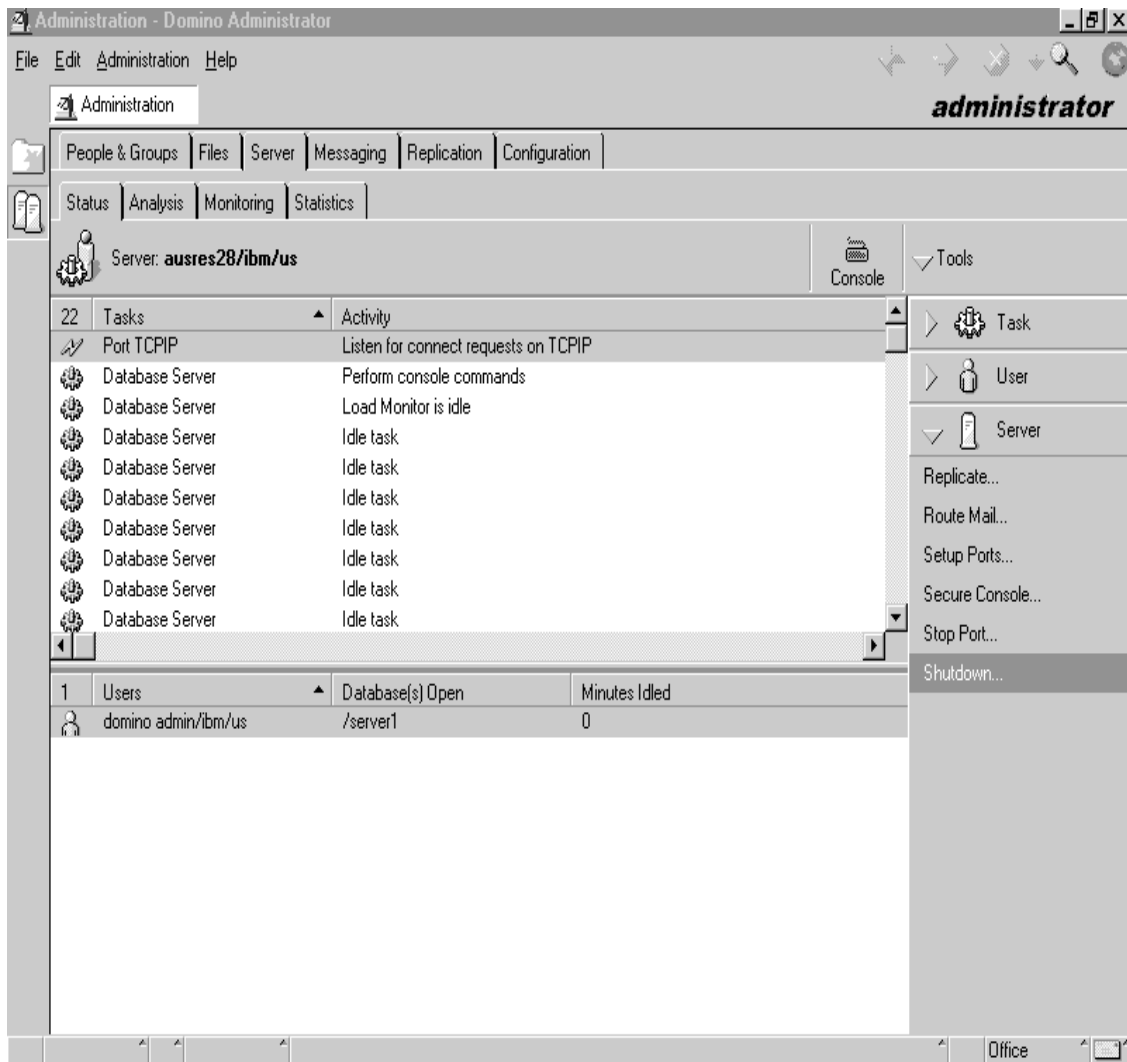
Figure 128. Lotus Notes - Domino Administrator

2. Choose the server you want to shut down and select **Tools -> Server -> Shutdown,** or from the menu bar, **Server -> Server -> Shutdown**.

3. You will be prompted to confirm the shutdown. If you want to shut down the server, click on the **Yes** button. This will shutdown the server.

4. The Domino Administrator will indicate that the server no longer responds.

> **Note**
>
> You can also use the remote console to shut down the server and send other console commands to a server. Refer to *Appendix F* in the *Lotus Notes Administrator's Guide* for additional information on server commands.

4.4.3 Shutting Down Lotus Domino Server Using an AIX Command

At the operating system level, log into the server as user notes, then you can use the command `server -q` to shut down the Lotus Domino Server (assuming the directory containing the installation binaries, /opt/lotus/bin, is already in your PATH statement).

> **Note**
>
> If the server is not responding, you have to kill (with -9 signal) the server and the child processes. You also have to clean the shared memory and semaphores used by the notes user. The script in Figure 293 on page 330 describes how to kill notes processes and clean shared memory and semaphores.

4.4.4 Shutting Down Lotus Domino Server Using Shell Script

In case you wish to stop the Lotus Domino Server using a shell script, we give below the following two shell scripts to be executed for fully accomplishing the task. The scripts should be owned and executed by user notes. Hence, the scripts should have the right file permissions to be executable. Type the command `/(path where the script resides)/stop_domino` to stop the Domino server.

4.4.4.1 Defining the Environment

This script defines essential parameters for use by the other scripts.

```
#!/bin/ksh
# Domino Application Server Environment Variable Script
# Licenced Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp 1994,1998
# All Rights Reserved.
# US Government Users Restricted Rights - Use, duplication or disclosure
# restricted by GSA ADP Schedule Contract with IBM Corp.
###########################################################################
# Description - env_domino
#
#       This script makes variable definitions that are common to
```

```
#       the start_domino, stop_domino scripts
######################################################################

# This script is provided "As Is".

# Script Environment variables.

NOTES_USER=notes                          # AIX userid for this server
NOTES_PATH=/server1                       # Path for server data directory
NOTES_SERVER=noteserv                     # Name of Domino Server
OUTPUT_LOG=/tmp/$NOTES_SERVER.log         # Output file for server console
INPUT_FILE=$NOTES_PATH/$NOTES_USER.input  # Input file for server console
PATH=$NOTES_PATH:/opt/lotus/bin:$HOME/bin:$PATH# Ensure PATH is set for
scripts
```

4.4.4.2 Stopping the Server

The script below is used to do a complete shutdown of a Domino server. If the server does not respond anymore, the script kills the server processes and cleans up system resources.

```
#!/bin/ksh -x
# Domino Server Stop Script
# Licenced Materials - Property of IBM
# (C) COPYRIGHT International Business Machines Corp 1994,1998
# All Rights Reserved.
# US Government Users Restricted Rights - Use, duplication or disclosure
# restricted by GSA ADP Schedule Contract with IBM Corp.
######################################################################
# Description - stop_domino
#
# This is the script to STOP the Domino Server which has been started using
# the corresponding script (start_domino).
# The script attempts to QUIT the server gracefully and waits 2 minutes.
#
# If Domino Server has not shut down by then, the plug is yanked.
# Depending on your environment, you may want to change this time-out
period.
######################################################################

# This script is provided "As Is".

# Set Script Environment variables.

. /(path of dir where the script exists)/env_domino

# Script Logic
```

```
print "Stopping Domino for AIX ($NOTES_SERVER)"
print " ... waiting for shutdown to complete"
echo " quit " >> $INPUT_FILE
#
#
#
count=0
NOTES_RUNNING=`ps -fu $NOTES_USER | grep /opt/lotus | grep -v grep `
while [[ -n $NOTES_RUNNING ]] ; do
sleep 10
count=`expr $count + 1`
echo " ... waiting "$count"0 seconds"
#
# Terminate Domino Server if still running
#
if [ $count -eq 13 ] ; then
   echo "Domino Server is still running after 2 minutes"
   echo " ... now for the ungraceful method"
   for i in `ps -fu $NOTES_USER | grep lotus | grep -v grep | awk '{ print
$2 }'`; do
     kill -9 $i
   done
   mems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"m" '{
print $2 }' | awk '{ print $1 }'`
   sems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"s" '{
print $2 }' | awk '{ print $1 }'`
   for j in $mems;do if [ -n "$j" ] ; then ipcrm -m $j;fi;done
   for j in $sems;do if [ -n "$j" ] ; then ipcrm -s $j;fi;done
   echo "Domino Server ($NOTES_SERVER) TERMINATED"
   exit
fi
NOTES_RUNNING=`ps -fu $NOTES_USER | grep /opt/lotus | grep -v grep `
done
#
echo "Domino for AIX ($NOTES_SERVER) shutdown completed"
```

Chapter 5. Installing the Lotus Domino Administration Client

The Administration Client is a brand new task-oriented administration client that brings all of the tools and information required to administer a Domino infrastructure within easy reach.

The various areas of concentration are segregated in a tabbed interface to aid in navigation and speed of access. This chapter will detail the requirements and procedures for the installation of the client on an administrator's workstation.

Although the new R5 administration client is very different to the administration panel of an R4.x client, backwards compatibility was a major design goal to enable the new administration client to be used successfully in a mixed server environment.

> **Note**
>
> Although backwards compatibility is achieved, not all of the new features will work when used against an R4.x server, and, in some cases, errors may be experienced.

5.1 System Requirements

Since there is no client support for AIX in R5, the details given in this chapter will relate to the installation of the administration client on the Win32 platform.

The Win32 platform clients require the following machine specification:

- An Intel Pentium processor or higher
- Win95/98: 16 MB RAM minimum, 32 MB+ recommended
- Win NT: 24 MB RAM minimum, 32 MB+ recommended
- Minimum of 150 MB free disk space for full install

5.2 Pre-Installation Steps

As with any software upgrade, the first and most important step is to back up important client files. The main ones are listed in Table 6.

Table 6. Backing Up Important Client Files

Files	Default Location
Notes configuration (notes.ini)	Windows directory - e.g. C:\WINNT

Files	Default Location
Desktop configuration (desktop.dsk)	Notes data directory - e.g. C:\NOTES\DATA
Personal address book (names.nsf)	Notes data directory - e.g. C:\NOTES\DATA
User ID files (*.id)	Notes data directory - e.g. C:\NOTES\DATA
Local databases (*.nsf)	Notes data directory - e.g. C:\NOTES\DATA
Local templates (*.ntf)	Notes data directory - e.g. C:\NOTES\DATA
Local database directory links (*.dir)	Notes data directory - e.g. C:\NOTES\DATA

5.3 Client Software Installation

The client installation has four options:

1. Install all clients
2. Install the Notes client
3. Install the Domino Administrator
4. Install the Domino Designer

Before starting to install the client, decide whether to install the single administration client or all clients on the machine.

Recommendation

In a Win32 server environment, where the administration client can be installed on the server, a *Domino Administrator only* installation is relevant.

In an AIX server environment, the administration client must be run from an administrator's workstation, and since the administrator is also a user (and will usually require designer capabilities), it is easier to install all clients in one go using the *Install all clients* option.

The following steps should be followed to perform the installation of the client software:

1. For a client upgrade, *move* the existing notes.ini file from the Windows directory into the Notes data directory.

2. Click **Start -> Run** from the Start menu and type `x:\.....\setup.exe` in the dialog box and then press **Enter** (where `x:` is the drive letter of the CD-ROM).

3. Click **Next** and then click **Yes** to accept the license agreement.

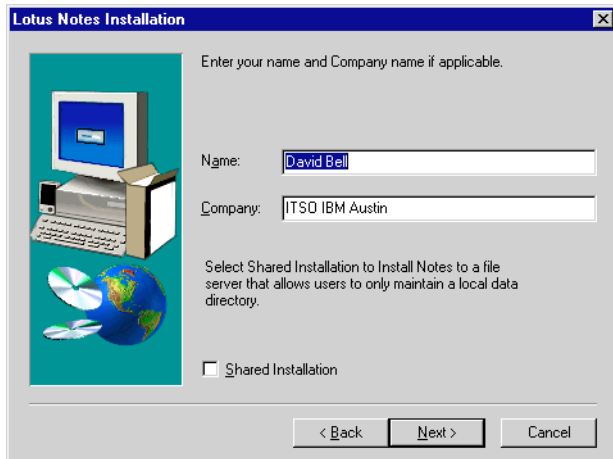4. Confirm or type in Name and Company details, see Figure 129.

Figure 129. Set or Edit User Name and Company Details

5. This is assumed to be a local install on a workstation, not a shared fileserver installation, so ensure the `Shared Installation` option is not selected and click **Next**.

6. Set the Notes program and data directories. If they are incorrect, click the appropriate **Browse** button and choose the required directory, then click **Next** to continue; see Figure 130.
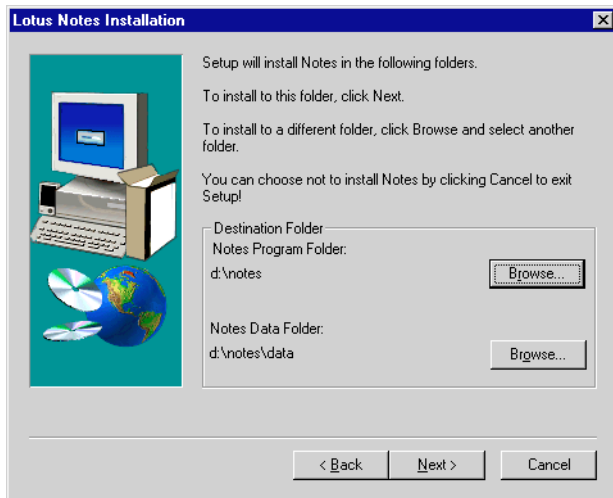

Figure 130. Choosing Client Program and Data Directories

7. Select either **All Clients** or **Domino Administrator**, see Figure 131.
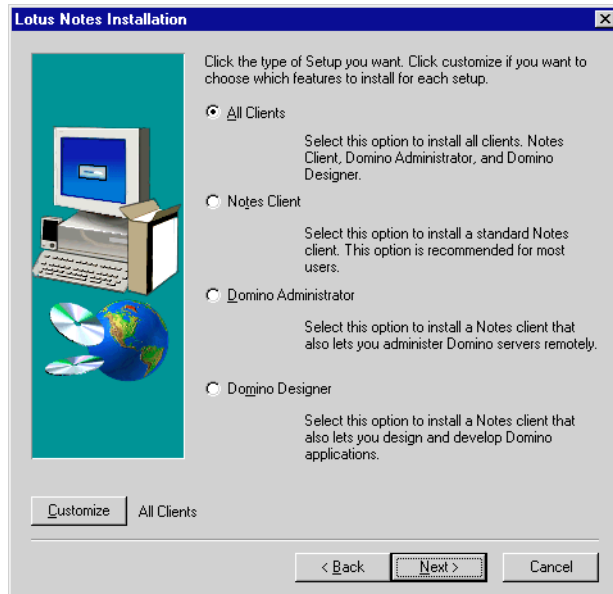
Figure 131. Choosing the Client Installation Type

8. To customize the installation options, click on the **Customize** button, see
   5.3.1, "Customizable Installation Options" on page 129 for further details.

9. Click **Next** to continue.

10.Choose an existing program folder for the application icons or type in a
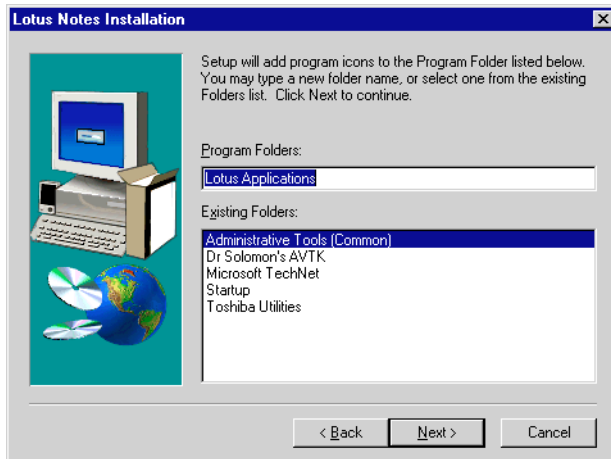   new one and click **Next**; see Figure 132.

Figure 132. Choosing a Folder for the Client Program Icons

11. Click **Next** to begin the installation of the files.

12. Once installation is complete, restart the workstation if prompted to do so.

5.3.1 Customizable Installation Options

During the installation, an option is presented to customize the items that will be installed with the clients. The list of customizable options depends on whether the All Clients or Domino Administrator install option is chosen. Figure 133 shows some of these options.
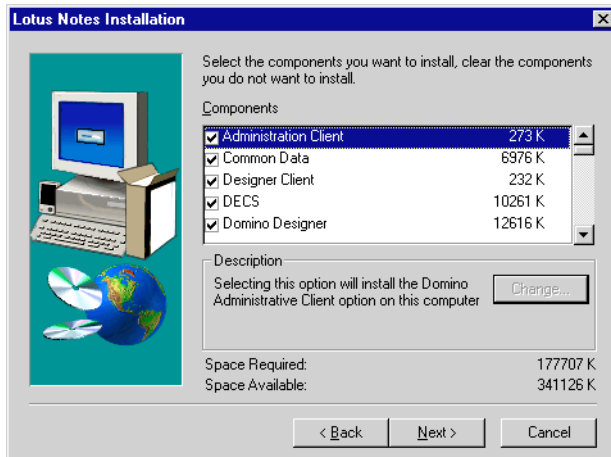

Figure 133. Customizing Client Installation Options

A tick in the box to the left of the option name means that the option will be installed. It may be made up of sub-options, and when clicking on an option, the Change button is either available or greyed out depending on whether the current option has customizable sub-options. When clicking on the **Change** button, a dialog box is shown, see Figure 134, containing the sub-options that can be selected or de-selected as required.
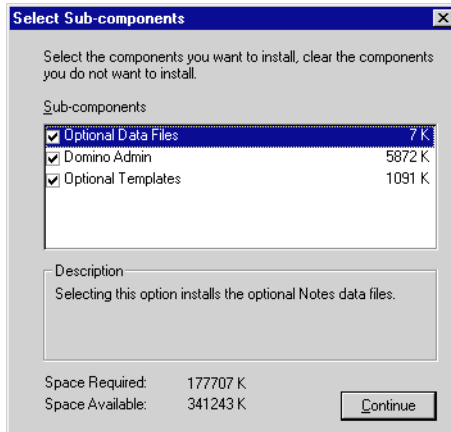

Figure 134. Changing Sub-Components of an Install Option

A description of the install options and their sub-components is shown in Table 7.

Table 7. Client Installation Components

Component Name	Sub-Component Names
Administration Client	<None>
Common Data	Optional Data Files Domino Admin Optional Templates
Designer Client	<None>
DECS	DECS
Domino Designer	Domino Designer Data
Help	Administration Guided Tour Designer Guided Tour Administration Help Client Help Designer Help Client Guided Tour

Component Name	Sub-Component Names
Migration Tools	cc:Mail Client Migration Tools cc:Mail Admin Migration Tools Calendar Client Migration Tools Eudora Client Migration Tools Organizer Migration Groupwise 4 Admin Migration Groupwise 4 Client Migration Groupwise 5 Admin Migration Groupwise 5 Client Migration Netscape Admin Migration Netscape Client Migration Exchange Admin Migration Exchange Client Migration MS Mail Admin Migration MS Mail Client Migration LDIF Admin Migration NT Admin Migration
Notes Data Files	Required Data Files Modem Command Scripts Icons Readme
Notes Minder	<None>

Component Name	Sub-Component Names
Notes Program Files	Extended Viewers Required Program Files Java Support Network Drivers JIT Debugger Import Export Engine Client Mail MS Office Main Integration Windows System Files
NT Client Single Logon	Uninstaller System Files
Shared Install	<None>
Spell Checker	International Directories Chinese Spell Checker English Dictionaries

5.3.2 Client Configuration

The installation may have been performed over an existing client configuration, or it may be a brand new setup where there was no previous Notes client on the machine. There are additional steps that must be carried out if the machine did not have a previous release of the client already installed.

5.3.3 Configuration of New Client

Follow this procedure to perform client setup once the installation of the files is complete:

1. Click **Start -> Programs -> Folder Name -> Lotus Domino Administrator**.

2. The client will present the Lotus Notes Client Configuration wizard welcome screen, see Figure 135, click on **Next** to continue.
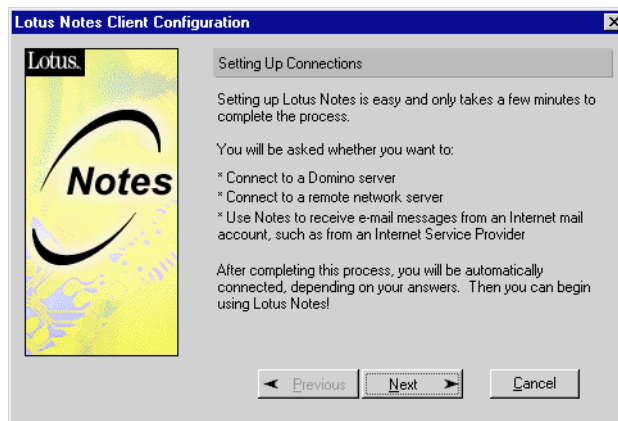
Figure 135. The Client Configuration Wizard

3. Select the **I want to connect to a Domino server** option and then click **Next**; see Figure 136.
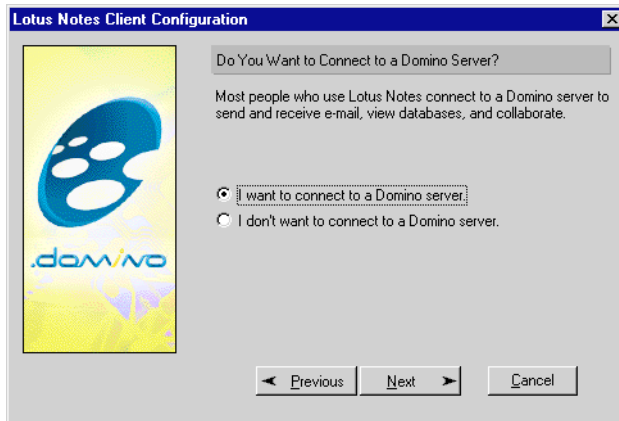
Figure 136. Choosing to Connect to a Domino Server

Select the **Set up a connection to a local area network (LAN)** option and then click **Next**; see Figure 137.
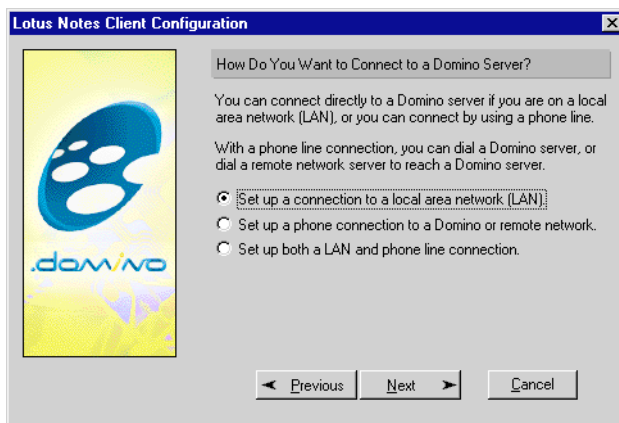

Figure 137. Choosing to Connect through a LAN

4. Type in the name of the server to make the initial connection. See Figure 138 for an example server Server1/IBM. and then click **Next**.
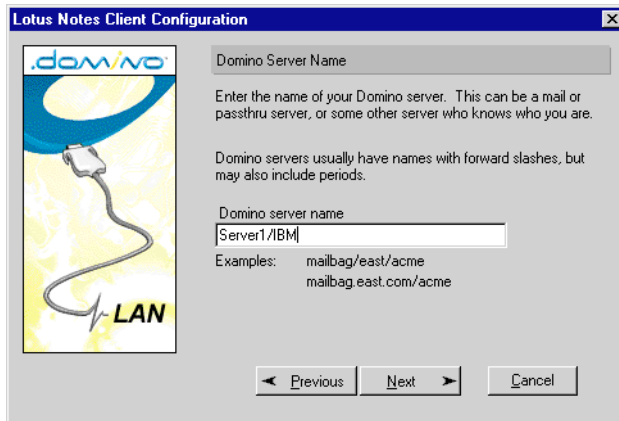
Figure 138. Enter the Server Name

5. Specify whether the Notes ID file has been provided in a file, used in this example, or is stored in the Domino Directory.

6. Type in the filename (use the Browse button if necessary to locate the file) or the user name. See Figure 139 for an example of user.id and then click **Next**.
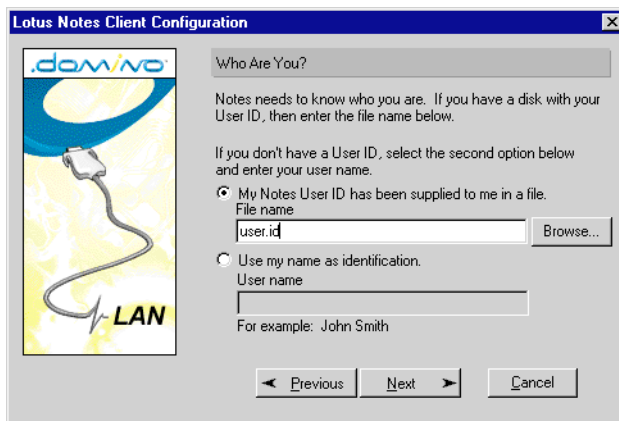

Figure 139. Specifying the User ID File During Client Setup

7. Enter the password for the ID file specified in step 6 and click **OK**.

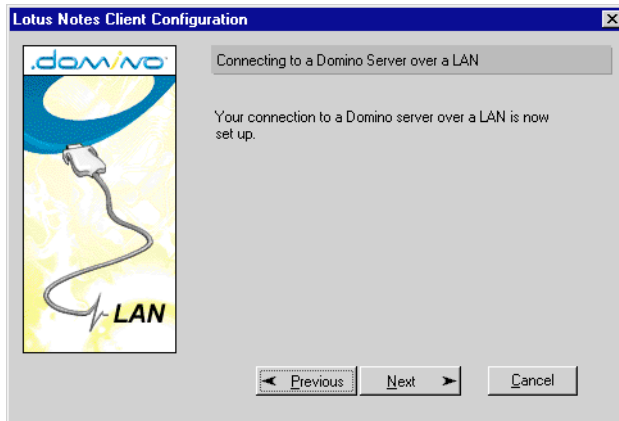8. Click **Next** to continue; see Figure 140.

Figure 140. Completed Client Connection Definition

9. Choose whether an Internet mail account is required; See Figure 141 for an example where no Internet account will be set up.
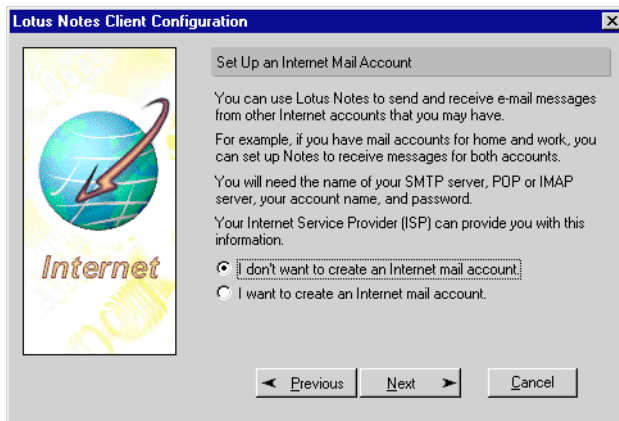

Figure 141. Choosing Not to Create an Internet Mail Account

10. The Client Configuration Wizard is now complete; See Figure 142. Click **Finish** to end the wizard and complete the configuration.
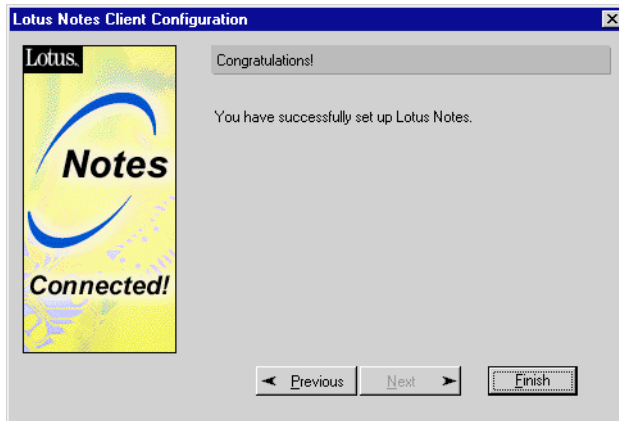
Figure 142. Completing the Client Configuration Wizard

11. A progress indicator, shown in Figure 143, will be displayed showing the percentage of setup tasks complete.
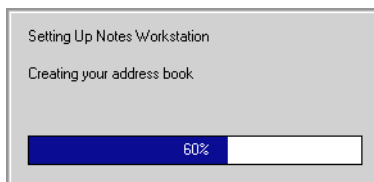

Figure 143. Client Setup Progress Indicator

12. When the setup is complete, click **OK** to close the last dialog box.

The remaining stages of configuration are the same whether it is a new installation or an upgrade of an existing client. Please refer to the following section for details of these common steps.

5.3.4 Configuration of an Upgraded Client

All of the settings from a previous notes.ini file will be preserved. When the administration client is started for the first time, it will prompt for the current ID's password, and then the following stages must be completed:

1. A bookmark database will be created automatically to store references to servers in the domain; see Figure 144.
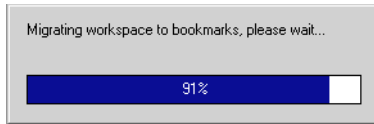
Figure 144. Creating the Bookmark Database

2. The Administration Client Splash screen will be displayed, see Figure 145, that has a link called Show me the new R5 Domino Administrator that goes to pages of information relating to new functions and features of the administration client.

Figure 145. The Administration Client Welcome Screen

3. To stop this screen from displaying each time the administration client is started, click the option **Don't show this help screen again** at the bottom of the page.

4. To close the splash screen click on the cross on the right-hand side of the window tab labelled **Temporary Splash**; see Figure 146.
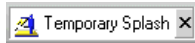
Figure 146. Closing the Administration Client Splash Screen

5. The initial pane of the bookmarks is blank. To see the servers in the domain, click on the bookmark tab that looks the one shown in Figure 147.

Figure 147. Administration Client Servers Bookmark Icon

6. This will display the main bookmark view of the servers in the domain, as shown in Figure 148.
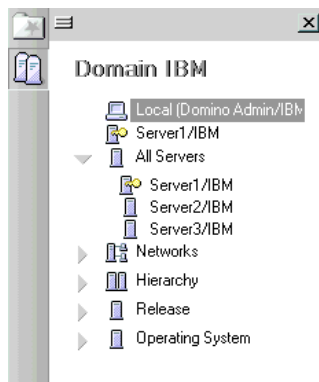
Figure 148. The Administration Client Server Bookmarks

7. To populate the Favorites bookmark pane, right click the mouse on one of the servers displayed, and from the popup menu, click on **Add Server to Favorites** as shown in Figure 149.
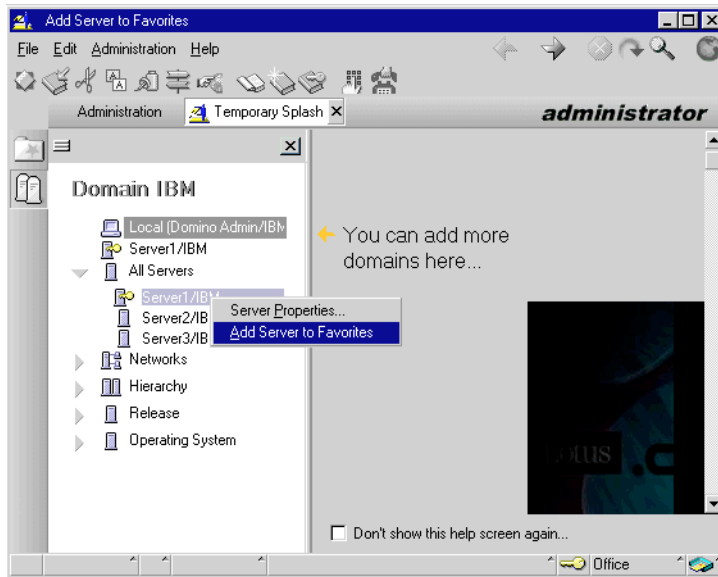
Figure 149. Adding a Server to Bookmark Favorites

8. To customize the administration preferences, click on **File -> Preferences -> Administration Preferences** on the client menu; see Figure 150.
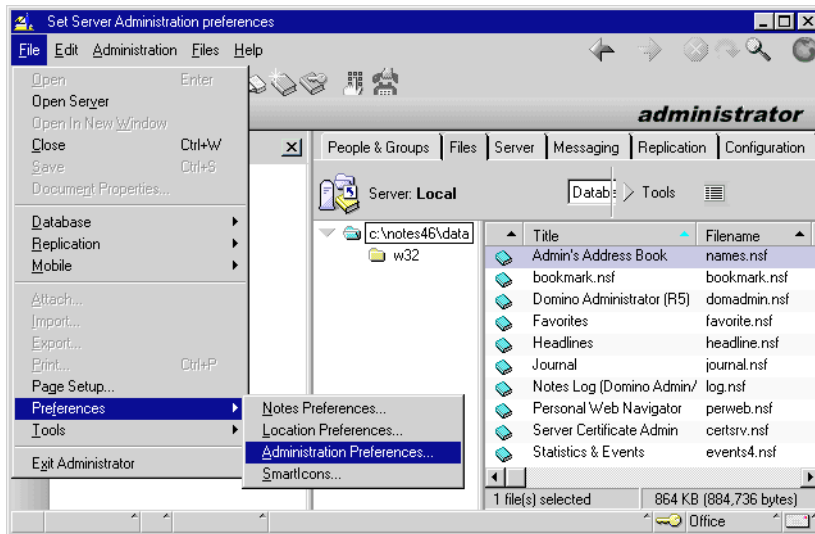
Figure 150. Setting Administration Client Preferences

9. The first panel displayed is `Basics`, see Figure 151, and shows details of the domains to be managed. Additional domains other than the current specified can be added here along with specific client locations that should be used for each of those domains.

10. The Directory server field entry determines which server the client will query for directory details about that domain.
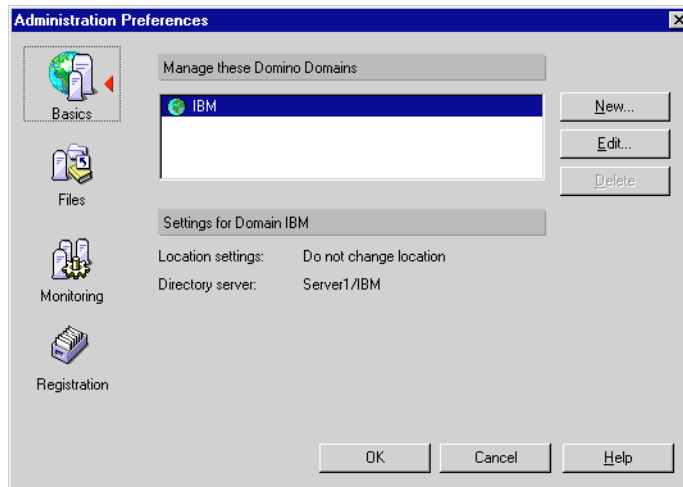
Figure 151. Administration Preferences - Basics

11. Click on the **Files** icon to display a panel where the columns of the file display can be customized and ordered as shown in Figure 152.
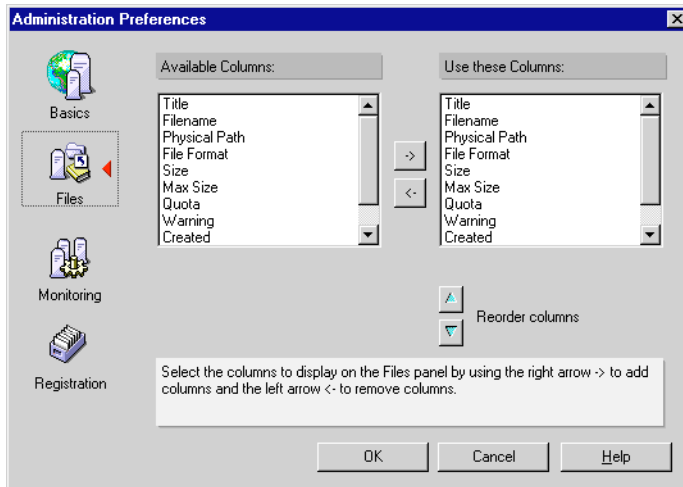
Figure 152. Administration Preferences - Files

12. Click on the **Monitoring** icon to configure specific monitoring details, see Figure 153, such as the amount of local memory to use to store monitoring information. In addition, servers can be defined to be monitored on a per location document basis.
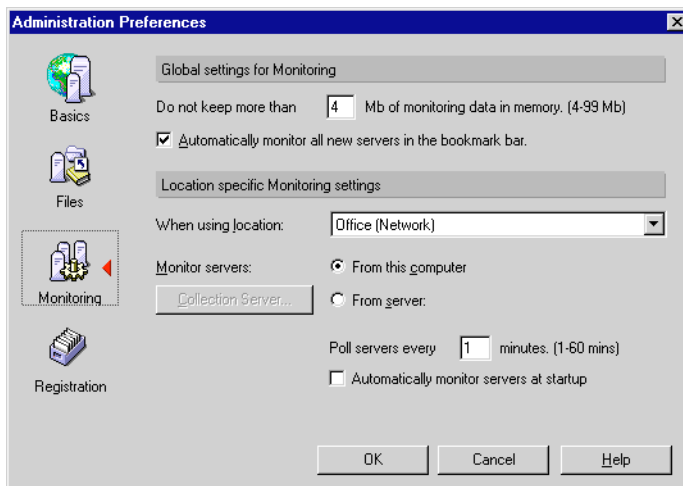
Figure 153. Administration Preferences - Monitoring

13. Click the **Registration** icon to configure standard registration details, such as registration server and certifier as shown in Figure 154. These will be used as defaults for future registration actions.
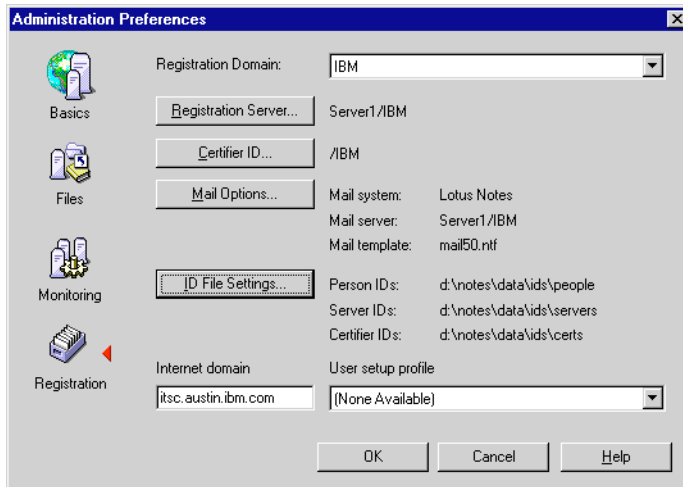
Figure 154. Administration Preferences - Registration

Once these preferences are completed, the client is ready for use to manage and monitor the Domino infrastructure.

Additional materia, such as details of specific settings and features, can be found in the on-line database entitled *Lotus Domino R5 Administration Help*.

Chapter 6. Simple Admin Tasks

In this chapter, we will describe some simple administration tasks, such as creating a new user ID and registering a new server.

For the majority of administration tasks, you have to launch the Domino Administrator first.

6.1 Choose Other Server in Domino Administrator

One of the most simple administration tasks, and one you will do a lot of times, is choosing a server in your Domino Administrator.

6.1.1 Select Server

If you want to change the current server, click on the icon on the left side of Domino Administrator showing two servers; see Figure 155.

Figure 155. Server Icon

A new window will pop up0 showing all servers categorized in different views.
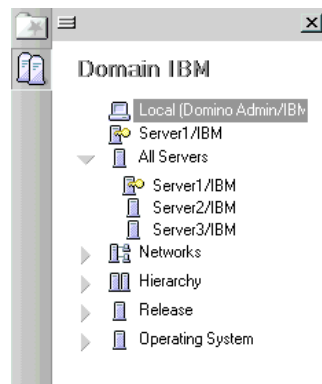
Figure 156. Listing of All Servers in the Domain

Select the server you want to make changes to in the Domino Directory by clicking on the server name.

6.1.2 Refresh Server List

If you have added a server, and the new server is not in the list, or if the server icon is not shown, you have to refresh the server list. You do this by selecting **Administration -> Refresh Server List**. You have to choose between **Current Domain** and **All Configured Domains**. The server list will now be refreshed and the icon shown.

6.2 Registering a User

As in the previous notes release, you can register one person at a time or read many user details from a file. In Lotus Domino R5, you can also import users from other directory servers. Only the registration of a single user is described in this chapter.

To register a person, follow these steps:

1. In Domino Administrator, choose the desired server.

2. Click on **People & Groups**.

3. Open the Menu **Tools -> People** on the right side and click on **Register...**.

4. Choose certifier and enter the certifier password.

5. There are two options: basic and advanced registrations as shown in Figure 157. In the normal panels, you can enter Name, Password, and the groups.
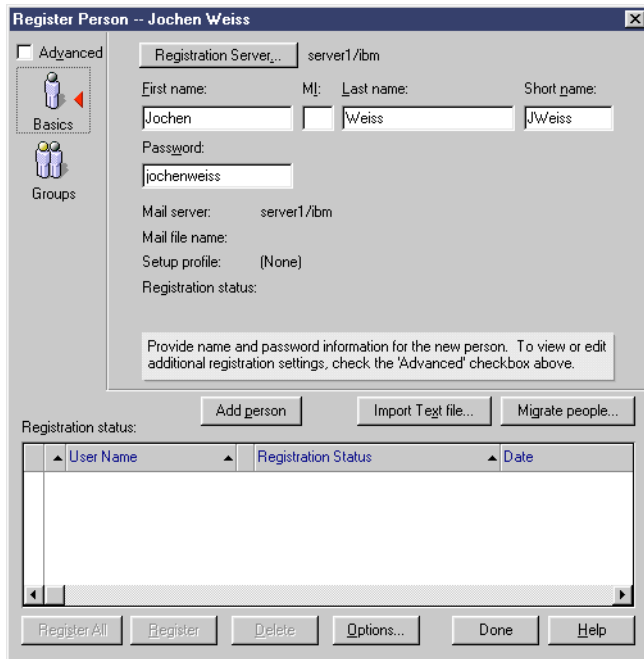
Figure 157. User Registration

If you select the **Advanced** checkbox, you have more options for each user as shown in Figure 158.
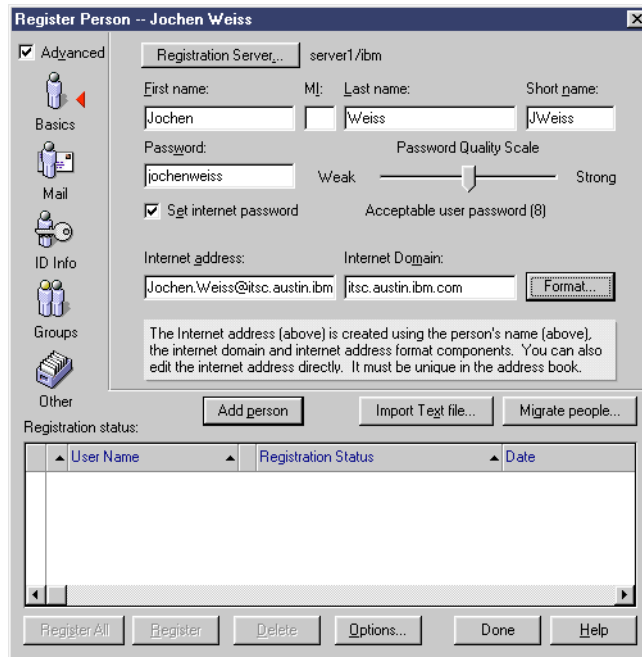
Figure 158. User Registration - Advanced Options

Because it is most likely that you are using the advanced options, we will only describe these.

a. Basics Section:

- First, you should check the registration server and change it if needed.

- Next, you should enter first and last name.

- Choose the Password Quality. Longer passwords are more secure. eight characters is a good choice if you want to use the password as the Internet password as well.

- Enter the password.

- Check **Set Internet password** if the user will have access to the Domino Server through the browser client.

- Enter the Internet address or choose how to create it by pressing the **Format...** button. First and last name separated by a dot is a widespread mail-user name.
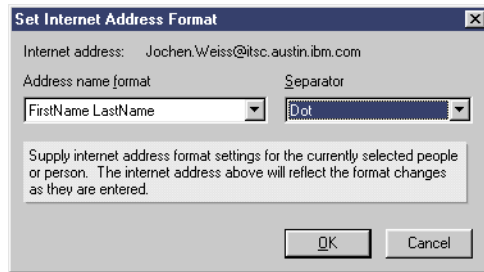
Figure 159. Set Internet Address Format

    b. Mail section:

- First you should choose the **Mail system**. If you choose **Other Internet** or **Other**, you have to enter the forwarding address.

- Choose the Mail server.

- Choose the Mail file template.

- Change the Mail file name.

- Choose the access permissions for the mail file.

- Set the database quotas and warning threshold if you want to use this feature.

- Choose whether to create the mail database during registration or later in the background.
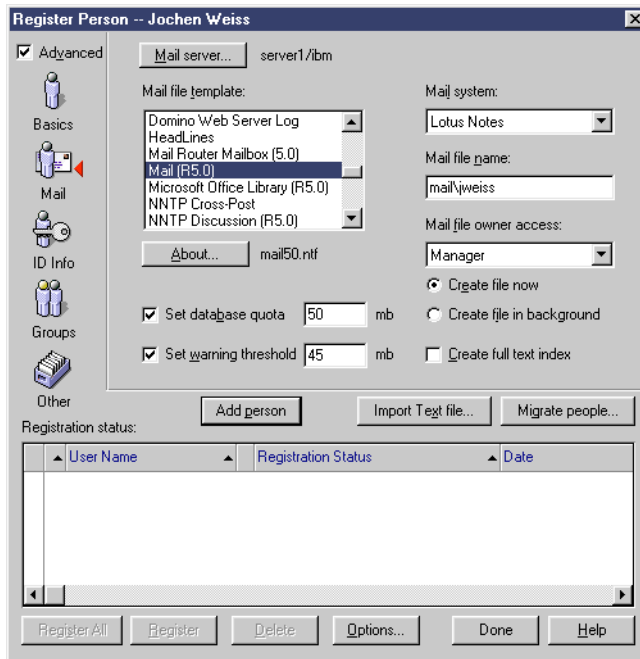
Figure 160. User Registration - Mail Section

    c. ID Info section:

- Choose the Certifier ID first.
- Choose the Security type and the certificate expiration date.
- Choose where the created ID file should be stored.

Note

If you only want to create a POP3 or IMAP mail user, deselect both locations for storing the user ID. In this case, no Notes Certificate will be created for the user ID.
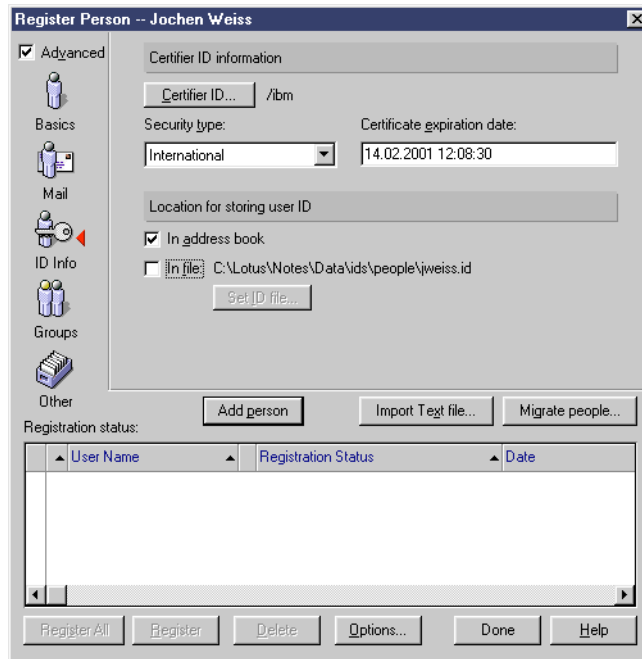
Figure 161. User Registration - ID Info Section

    d. Groups section:

- Choose the groups the user should belong to.

    e. Click on the **Other** section:

- If you have created a User Setup Profile, you can choose it here.

- Enter additional user information such as **Location**, **Local Administrator**, and **Comment**.

- If you have created an alternate name language you can add an alternate name here. For more information about the feature please refer to the *Lotus Domino R5 Administration Help* database.

- If you have a mixed AIX and Windows NT environment, you can register this person in Windows NT by selecting **Add this person to Windows NT** and entering the Windows NT user name and the Windows NT group.
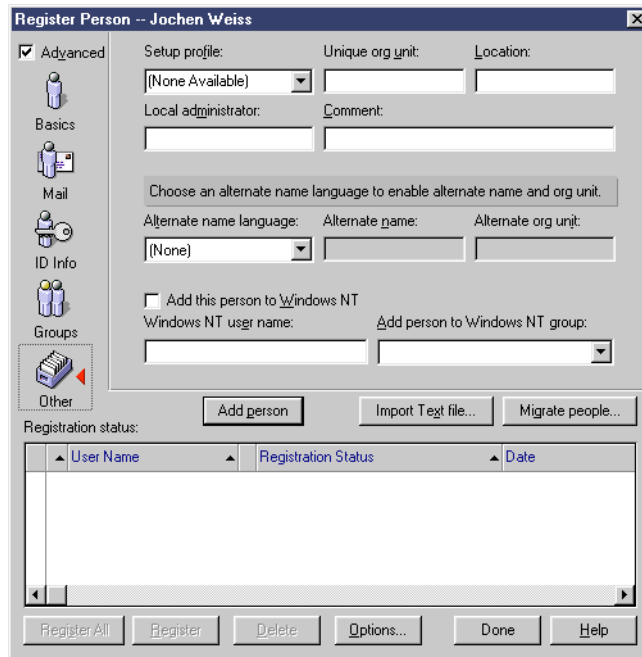
Figure 162. User Registration - Other Section

6. Press the **Add Person** button.

7. If you want to add more people, go back to Step 5 on page 144. All user details will be added to the `Registration Status` window.

8. Press **Options** to set the `Advanced Person Registration Options`. These are:

   • Do not continue on registration errors.

   • Keep successfully registered people in the queue.

   • Try to register queued people with error status.

   • Allow registration of previously registered people.

   • Don't prompt for a duplicate person (skip registration or update existing entry).

   • Don't prompt for a duplicate mail file (skip registration, generate unique mail file name, or replace existing mail file).
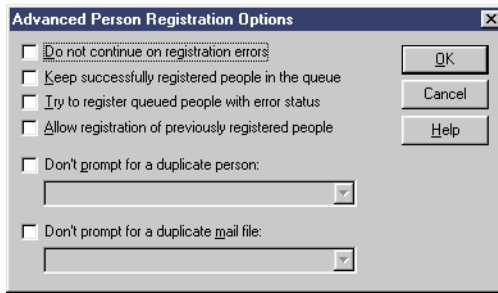
Figure 163. Advanced Person Registration Options

9. Press **Register** if you want to register only the selected person, or press **Register All** if you want to register all persons listed in the registration queue. The following dialog box should signal the end of the registration process.
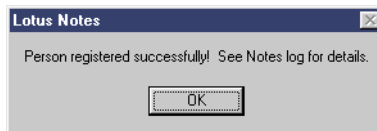
Figure 164. Person Registered Successfully Dialog Box

If you need more information about registering people please refer to the *Lotus Domino R5 Administration Help* database.

6.3 Registering a Domino Server

If you want to install an additional Domino server you have to register it first. Follow the steps below to register a new Domino server.

1. Start Domino Administrator.

2. Choose the desired registration server.

3. Choose the **Configuration** tab.

4. Select **Server** in the left column. This is shown in Figure 165.
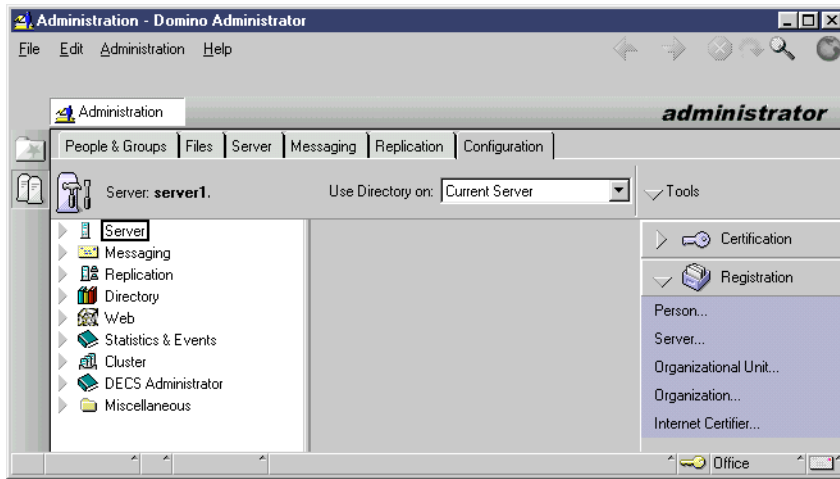
Figure 165. Prepare for Domino Server Registration

5. Choose **Tools -> Registration -> Serve**r.

6. Enter the password for the current certifier ID.

7. Verify the Registration Server.

8. Select the correct Certifier ID if the current one is not correct.

9. Select the Security Type.

10.Enter the Certificate expiration date.
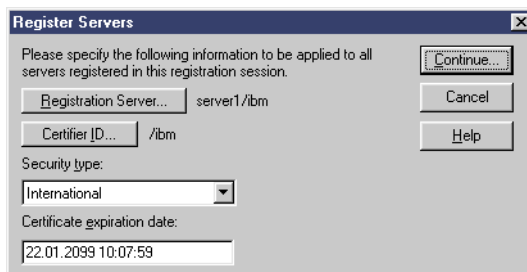
Figure 166. Register a Domino Server

11.Press **Continue**.

12.In the `Basics` section:

- Enter the Server Name.
- Set the password and the password quality.

- Enter the Domain name.
- Enter the Administrator name.
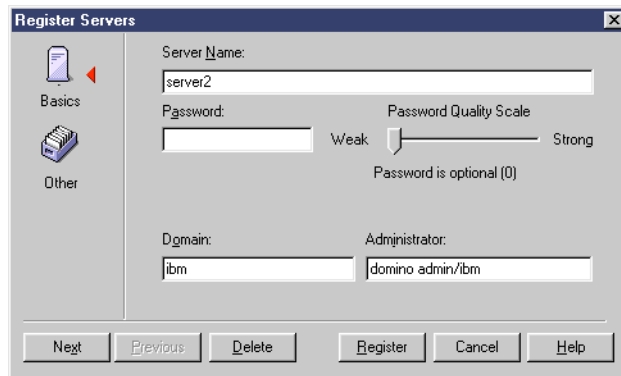
Figure 167. Register a Domino Server - Basics Section

13.In the `Other` section:

- Enter the server title.
- Enter the network name.
- Enter the local administrator.
- Select whether to store the ID file in the Domino Directory or in the local file system. Storing the ID file in the local file system is more secure, but you have to give the ID file to the user for setup.
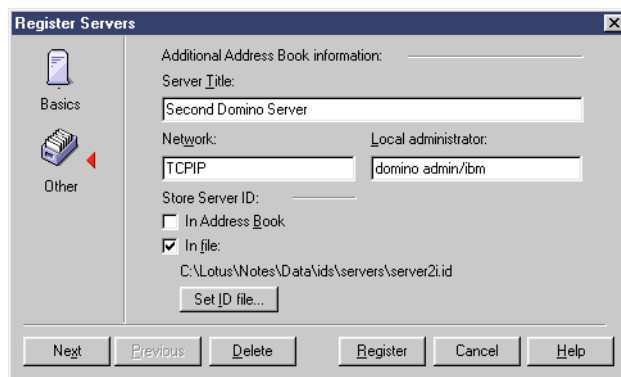
Figure 168. Register a Domino Server - Other Section

14.If you want to register another server, press **Next** and repeat starting from Step 12 on page 152.

15. Press **Register**.

16. After successfully registering the new Domino Server, a dialog box will be shown. Press **No** to end the registration process.
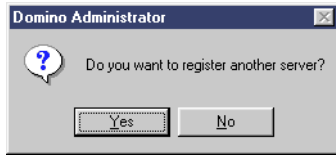
Figure 169. End of Registration Process

Now, you can install the new Domino server.

6.4 The Domino Character Console

The Domino Character Console is a new Domino feature. It is only available on UNIX platforms.

6.4.1 Starting Domino Character Console

The Domino Character Consol is started by changing the current directory to the Notes data directory and running `/opt/lotus/bin/cconsole`. The following table shows the command line switches.

Table 8. Domino Character Console Command Line Switches

Switch	Result
-f	Enter the path and filename of the Notes ID to be used
-i	Allow warnings to be ignored, no response required
-l	Start console with live display already activated

For example, to start the console and specify the admin.id as the user ID file so that there is no prompt, you would type:

```
/opt/lotus/bin/cconsole –f /server1/admin.id
```

and then press **Enter**. Please make sure that the ID file has appropriate file permission. Your notes user has to have read and write permissions.

6.4.2 Commands

In addition to the usual Domino Server console commands, the character console supports a few extra.

Table 9. Domino Character Console Commands

Command	Result
done	Exit the console and leave server running
live on	Enable live display of console activity
live off	Disable live display of console activity

Part 2. Customization and Administration

157

Chapter 7. Domino Enterprise Server

In July of 1998, the Domino Advanced Services license ceased to exist and was incorporated into the Domino Enterprise Server (DES) offering. The logical features provided by the DES license remain unchanged; however, R5 provides additional functionality in some areas.

The Domino Enterprise Server features consist of:

- Partitioning: See 7.4, "Domino Server Partitioning" on page 162
- Clustering: See 7.5, "Domino Server Clustering" on page 173
- Billing: See 7.6, "Domino Server Billing" on page 201

The Domino Enterprise Server enables sites to exploit Lotus Domino and Lotus Domino service providers to make their service more reliable and scalable, better manageable and secure, and allows for more detailed and customized usage tracking for billing their services.

For details regarding high availability and scalability in this book, refer to Chapter 11, "High Availability, Scalability, RS/6000 SP" on page 317.

Additional material on Clustering and Partitioning can be found in the following locations:

- The redbook *High Availability and Scalability with Domino Clustering and Partitioning on AIX* (SG24-5163-00)
- The Domino Cluster Zone at `http:/www.lotus.com/cluster.`
- The following Iris Today articles at `http://www.notes.net`
  - *Workload Balancing with Domino Clusters (Michael Kistler - IBM)*
  - *Fine Points of Configuring a Domino Cluster (Michael Kistler - IBM)*
  - *The Domino Internet Cluster Manager (Lori Fucarile - Lotus)*

7.1 Domino Enterprise Server Lab Environment

Table 10 shows the naming conventions used for the partitioned servers running in the lab environment on the host itsosmp.itsc.austin.ibm.com.

Table 10. Partitioned Server Lab Parameters

Partition	Domino Server Name	AIX Account Name	Data Directory Names
1	Server1/IBM	notes1	/server1
2	Server2/IBM	notes2	/server2

Figure 170 shows the lab environment that was used for testing server partitioning and the relevant server details.
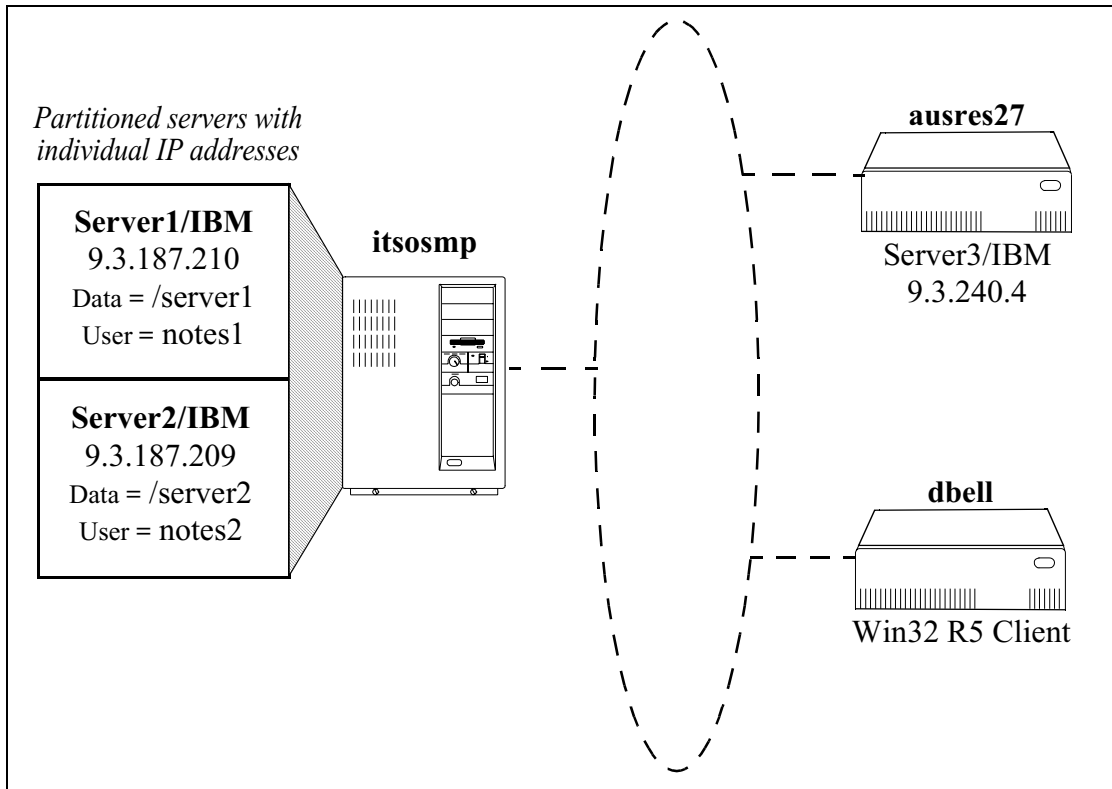
Figure 170. Partitioned Server Lab Environment

7.2 File System Requirements

The creation of logical volumes and file systems has already been covered in detail in the following sections of this redbook:

- 2.2.9, "Step 9 - Create a Logical Volume for the Domino Data Directory" on page 28
- 2.2.11, "Step 11 - Create a File System for the Domino Data Directory" on page 32
- 2.2.13, "Step 13 - Mount the File Systems" on page 35
- 2.2.14, "Step 14 - Change Ownership of the New File Systems" on page 36

The only additional requirements relate to the use of multiple partitioned Domino Servers on a single physical machine.

Since each partitioned server requires its own data directory file system, the procedures detailed in the sections of the redbook listed above must be repeated for *each* partitioned server prior to the start of any software installation so that the multiple required file systems are generated.

7.3 Domino Enterprise Server Installation

All of the enterprise features are installed at the same time by selecting a particular type of server installation. This preliminary step is defined here as it is a common prerequisite to all of the configurations discussed later in the chapter. In effect, some configuration may be required before this step is reached, for instance, in setting up multiple file systems for partitioned servers.

The installation steps are described in detail in Chapter 2, "Installing a Lotus Domino R5 Server" on page 15; so, only details that differ from a standard installation are shown in this section.

After the license agreement has been accepted, the next question asks which type of server installation is required. Press the **Spacebar** until the selection is `Domino Enterprise Server` (Figure 171) and then press the **Tab** key.

```
==============================================================================
                        Domino Server Installation
==============================================================================


    Select the type of installation you want.


------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
------------------------------------------------------------------------------

>>> Select Setup type : [Domino Enterprise Server]
```

Figure 171. Selecting the Domino Enterprise Server Installation Type

Choosing this option ensures that the additional program and data files needed for the Domino Enterprise Server features are installed.

7.4 Domino Server Partitioning

This section covers the installation and configuration of multiple Domino Servers on a single machine. Partitioned servers share the same binary files, and hence, run at the same version but have individual data directories that allow for independent configuration of resources.

There are several reasons for implementing partitioned servers.

1. To reduce operating system and hardware limiting factors.

   Multiple Domino partitions make more efficient use of server resources than a single server instance as certain processes can be run in parallel.

2. Segregation of server tasks on a single machine.

   For example, a mail server and application server can have individually tuned tasks but run on the same hardware.

3. Segregation of independent user communities.

   For example, hosting multiple Domino domains or Domino-hosted web sites on a single machine.

4. Independent operation of services and resources.

   Partitions operate independently and do not have any effect on each other.

This allows an administrator the flexibility to treat each partitioned server as though it were a separate system.

7.4.1 Planning a Partitioned Server Deployment

The following are basic guidelines to help plan a partitioned server deployment:

- The limit of six supported partitioned servers on one system has been removed in Domino R5; available system resources is the limiting factor.

- Partition identifiers are based on the server data directory names and these should be unique especially in an HACMP-managed environment.

- Each additional partitioned server should have an additional 128 MB of memory; depending on the expected number of concurrent users, it may be necessary to increase this value.

- A minimum of 200 MB disk space for each separate data directory must be allocated.

- As a rule of thumb, use one or two Central Processing Units (CPUs) per partition but not more than one partition per CPU in any one system.

- Use the TCP/IP protocol as this is the only supported configuration for Domino Enterprise Server R5 services.

- Partitioned servers can share a single network interface card or can use multiple network interface cards. 7.4.4, "Configuring TCP/IP for Partitioned Servers" on page 168.

- Each partitioned server requires disk space for its own Lotus Domino data directory file system.

- A partitioned server may be a member of a cluster; however, it is recommended that the other Lotus Domino servers in the cluster be located on other systems.

7.4.2 Installing Partitioned Servers

After choosing to install a Domino Enterprise Server, as shown in 7.3, "Domino Enterprise Server Installation" on page 161, the following additional steps must be carried out.

1. At the question `Do you want to run more than one Domino Server on this computer ?` press the **Spacebar** to change the answer to `Yes` and then press **Tab**.

```
==============================================================================
                       Domino Server Installation
==============================================================================


    You can run more than one Domino Server on a single computer
    at a time.  This feature is called Domino Partitioned Servers.


    ------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
    ------------------------------------------------------------------------

>>> Do you want to run more than one Domino Server on this computer ?  [Yes]
```

Figure 172. Choosing to Run Multiple Server Partitions

2. Press the **Enter** key to edit the number of data directories and type in the number required (one per partition) and then press **Enter**.

```
================================================================================
                        Domino Server Installation
================================================================================


     Each Domino Partitioned Server requires its own data directory.

     How many Domino Partitioned Server data directories
     would you like to install ?



     --------------------------------------------------------------------------
     Press ENTER to retain the current setting
       or
     Type a new setting and press ENTER.
     --------------------------------------------------------------------------

 Number of data directories current setting : 5

 Number of data directories new setting     : 2
```

Figure 173. Setting the Number of Server Partitions

3. Press **Tab** to continue.

4. The install routine will then ask whether to generate data directory path names automatically. The default is Yes.

Recommendation

Manually specify the data directories since file system mount points will already have been created and may not match the default names.

Consider associating the name of the server with the mount point of the file system for clarity and ease of administration.

---

5. Press the **Spacebar** to change the answer to No and then press **Tab**.

```
==============================================================================
                          Domino Server Installation
==============================================================================

    The install program can generate path names for the individual
    data directories by appending the numbers 1 through 2 to a
    base path name you supply.

    If you do not want the path names to be generated, you will be
    prompted for them each individually.

    ------------------------------------------------------------------------------
    Type h for help.
    Type e to exit the Install program.
    Press ESC to return to the previous screen.
    Press the Spacebar to change the setting until you get the one you want.
    Press TAB to accept a setting and continue to the next screen.
    ------------------------------------------------------------------------------

>>> Do you want install to generate the pathnames for you ? [No ]
```

Figure 174. Choosing To Manually Generate Partitioned Data Directory Names

---

Note

The file used to identify the partition number for the server,
.sgf.notespartition, is no longer used in R5. Instead, the partition name is
based upon the data directory name; so, data directory names should be
unique.

For example, a data directory name of /server1 generates a partition
identifier of `.server1`.

---

6. A default path will be presented. Press **Enter** to edit this and type in the
   required name, for example `/server1`, and then press **Enter**.

```
===============================================================================
                          Domino Server Installation
===============================================================================


      Enter the pathname for data directory 1 of 2.



    -------------------------------------------------------------------------------
      Press ENTER to retain the current setting
        or
      Type a new setting and press ENTER.
    -------------------------------------------------------------------------------

Current path : /local/notesdata

New path     : /server1
```

Figure 175. Changing the Name of the Partitioned Data Directory

7. Press **Tab** to continue.

8. Repeat steps 6 and 7 for each partitioned server until all directory names have been entered. Notice the screen display in Figure 175 shows how many data directories have been entered and the total number being installed.

9. Continue the installation process as normal noting that only one AIX user account can be specified at this time. The first of the set of accounts created specifically for the purpose (see 2.2.7, "Step 7 - Create AIX Users" on page 26) should be used.

10.Manual configuration is required once the install routine has completed; see 7.4.3, "Manual Configuration of File Ownership" on page 167 for details.

11.At the final review screen (Figure 176 on page 167), review the data directory names listed to ensure that they are unique.

```
==============================================================================
                         Domino Server Installation
==============================================================================
Installation settings:


    Installation type    : Domino Enterprise Server


    Program directory     : /usr/domino/lotus
    Data directories      : /server1
                             /server2
    UNIX user name        : notes1
    UNIX group name       : notes



Press the Escape key to re-configure the settings
  or
Press the Tab key to perform the installation...
```

Figure 176. Reviewing Installation Settings for Partitioned Servers

12. Once satisfied that this is correct, press **Tab** to perform the installation.

7.4.3 Manual Configuration of File Ownership

Since the install routine allows only one user account to be specified, all partitioned data directories are installed with reference to this one account.

Recommendation

For ease of administration, for example, identification of the owner of processes, each partitioned server should run using a different UNIX user account name.

The ownership of each set of data files must be changed except for those in the first data directory. The ownership of the files in the first data directory should be set correctly using the user name specified during install. In this example, it was notes1.

To change the ownership of subsequent data directories, use the `chown` command. For example, to change the ownership of all files in `/server2` to be `notes2:notes`, enter the following command at an AIX command prompt and then press **Enter**.

```
chown -R notes2:notes /server2/*
```

This will change all files in `/server2` and any subdirectories located under that file structure.

7.4.4 Configuring TCP/IP for Partitioned Servers

There are two ways to configure partitioned servers for TCP/IP network access. You can:

- Use unique IP addresses--one unique IP address for each partitioned server (recommended).
- Use unique TCP/IP port numbers--one unique port number for each partitioned server that shares an IP address.

7.4.4.1 Using Unique IP Addresses

By using unique IP addresses, all TCP/IP services can be accessed through standard port numbers, for example, each POP server can be accessed through port 110. Multiple IP addresses can be defined on one Network Interface Card (NIC), or each IP address can be assigned to a single NIC depending on the network topology and capacity required.

For the purposes of the lab environment, multiple IP addresses were bound to a single token-ring network adapter.

1. Assign a unique IP address to each partitioned server; see Figure 170 on page 160.

   Use the `ifconfig` command to assign additional IP address aliases to the chosen network adapter. For example, to assign the IP address 9.3.187.209 to the token ring card in `itsosmp.itsc.austin.ibm.com`, type the following command at an AIX command prompt while logged in as the root user:

   ```
   ifconfig tr0 alias 9.3.187.209 netmask 255.255.255.128
   ```

   where the netmask parameter is the required IP subnet mask.

2. Type `ifconfig tr0` and press **Enter** to confirm that the alias has been assigned (Figure 177).

```
[root@itsosmp:] / # ifconfig tr0
tr0: flags=e0a0043<UP,BROADCAST,RUNNING,ALLCAST,MULTICAST,GROUPRT,64BIT>
        inet 9.3.187.210 netmask 0xffffff80 broadcast 9.3.187.255
        inet 9.3.187.209 netmask 0xffffff80 broadcast 9.3.187.255
```

Figure 177. Checking Network Interface IP Address Assignments

3. Make sure that name resolution is set up properly, either using DNS or client hosts files, so that the planned server name can be resolved to the correct IP address.

4. Make sure that all IP addresses map to the correct network interface card.

5. Use the hostname of each server as its server name during Lotus Domino Server setup. For example, for the partitioned server with the hostname `server1.itsc.austin.ibm.com`, use the server name server1/ibm.

6. Edit the notes.ini file of each partitioned server to include the line

   ```
   TCPIP_TcpIpAddress=0,IPaddress:1352
   ```

   where `TCPIP` is the port name as specified in the server document of the Domino Directory in the Network Configuration section, and `IPddress` is the TCP/IP address of the specific partitioned server.

7. For example, for the server server1/ibm:

   ```
   TCPIP_TcpIpAddress=0,9.3.187.210:1352
   ```

   and for server2/ibm, the newly added alias from the example in step 1:

   ```
   TCPIP_TcpIpAddress=0,9.3.187.209:1352
   ```

8. Edit the server document in each partitioned server Domino Directory to include the host names in the Network Configuration section of the server's document.

7.4.4.2 Using Unique TCP/IP Port Numbers

You can use TCP/IP port mapping to configure multiple partitioned servers to share the same network interface card and the same IP address. TCP/IP port mapping requires that you assign a unique IP port number to each partitioned server that shares the IP address, and assign one of these servers to be the port mapper server.

The port mapper server's role is to dispatch (map) incoming IP requests to the appropriate server. It must be running for the partitioned servers that share its IP address to receive new connections from workstations. If the port mapper server is down, new sessions cannot connect. Existing sessions, however, remain connected. Also, each client maintains a cache of recent server connections requiring redirection by the port mapper. This means the clients can still reach other partitioned servers if the requested server connection information is in the cache.

To provide higher availability for partitioned servers, you can set up the first partitioned server to function only as a listener/port mapper (not a customer server). This reduces the chance of failure by the first partitioned server but causes additional overhead as you need one partition only for port mapping.

To reduce resource use for a dedicated port mapper server, you can remove all the ServerTasks from your notes.ini to minimize the number of server processes. You can also remove large databases (such as the help database)

from the data directory for this server. Do not remove the Domino Directory from this server.

Note

Port mapping works only for Notes to Domino NRPC communication; it does not work for the Internet protocols, such as HTTP and LDAP. Each of these services must be configured through the server document to use unique non-standard TCP/IP port numbers. These port numbers must then be made available to users wishing to connect clients to those services.

For details of how to configure using TCP/IP port numbers refer to the *Lotus Domino R5 Administration Help* database.

7.4.5 Considerations for Internet Server Tasks

On a partitioned server, you have to specify additional parameters for the tasks HTTP, IMAP4, POP3, LDAP, NNTP, and for the SMTP MTA.

7.4.5.1 Considerations for HTTP

If you plan to use the HTTP task for multiple partitions, you have to ensure that each server responds only to requests for its own particular IP address. This is achieved by enabling a technique called *binding* where each server is told explicitly to only accept requests for a specified host name or IP address.

For each partitioned server, edit the server document and then perform the following steps.

1. Switch to the **Internet Protocols-HTTP** tab.

2. Enter the IP address or fully qualified host name of the server in the field labelled Host name(s).

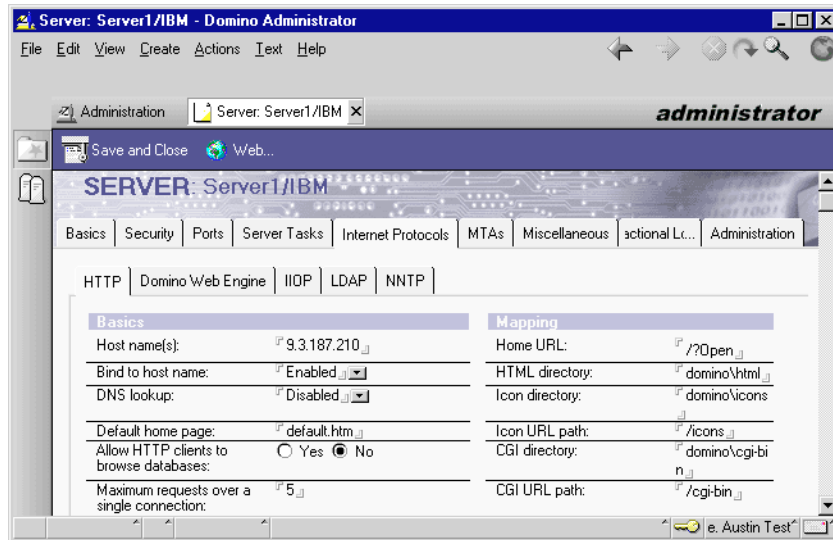3. Change the value of the field Bind to host name to `Enabled`.

Figure 178. Enabling Bind to Host Name for HTTP Task

4. If the HTTP task is running, then stop it and restart it to enable the change.

7.4.5.2 Considerations for IMAP4, POP3, NNTP and LDAP

If there are multiple network adapters in the server, the following entries must be added to the notes.ini file for these tasks to run in a partitioned server environment for the respective protocol:

- `IMAPAddress=<IP address or fully qualified hostname>`
- `LDAPAddress=<IP address or fully qualified hostname>`
- `NNTPAddress=<IP address or fully qualified hostname>`
- `POP3Address=<IP address or fully qualified hostname>`

7.4.6 Starting and Stopping Partitioned Servers

Each server must be started in such a way that it runs with a unique AIX user account identifier and uses its own data directory.

If each AIX user has a separate .profile file defining a unique PATH
environment variable, then it is safe to edit each .profile and add the
particular Domino Server data directory for that user to the path statement.

If a generic profile is used by all AIX user accounts,then *do not* add any data
directories to this path.

If the server startup is performed through a scripted startup routine, as in
4.1.3, "Starting the Lotus Domino Server Using a Startup Script" on page
106, then each server must have its own unique script.

Create one script per server and ensure that the correct user account and
data directory are referenced in each script.

7.4.6.1 Handling a Partitioned Server Failure

Partitioned server shutdowns and failures do not affect other partitioned
servers that run on the same computer. If one server shuts down, the others
continue to run. The setting `KillProcess=1` should be present in the notes.ini
file of each partitioned server (or in a server configuration document)
enabling automatic clean up of all of the processes associated with a
partitioned server. With this default setting, you can restart a failed partitioned
server without restarting the machine, but you have to make sure to clean up
the interprocess communication resources (shared memory and
semaphores) before restarting the server. See 12.1, "Cleaning Lotus Domino
Processes" on page 327 for more details.

By running each partition with a separate AIX user account, finding
processes, shared memory, and semaphores relating to a specific server is
a much simpler task.

7.4.7 Tuning Partitioned Server Memory Usage

The parameter NSF_Buffer_Pool_Size may or may not have been specified
for a machine running a single server partition. In R5, it is recommended that
it is not specified manually for single instance servers. It should always be
specified for partitioned servers as the physical memory in the machine has
to be shared between multiple servers instead of just one.

> **Recommendation**
>
> Use the following formula to calculate the value of NSF_Buffer_Pool_Size that should be specified for each partitioned server:
>
> *(Physical RAM / No. of partitions) / 4*

Figure 179. Specifying NSF_Buffer_Pool_Size for Partitioned Servers

7.5 Domino Server Clustering

Multiple Domino Enterprise Servers can be interconnected to provide high availability, scalability, and load balancing to Lotus Notes users and browser clients (HTTP and HTTPS requests). This is achieved by placing multiple replicas of some or all databases onto different servers within the cluster. Subsequently, transparent failover or load balancing can redirect the open request for a database on a broken or overloaded server to another member of the cluster. These clustered servers should be interconnected through a sufficiently high-data transfer bandwidth network to allow for the tight real-time synchronization between the databases in the cluster; in LAN environments, a minimum of LAN speed but usually up to FDDI, ATM or FastEthernet; in RS/6000 SP environments, the SP switch is commonly used.

> **Note**
>
> A common misconception is that there is an upper limit of six member servers in any one cluster. This is not a hard limit, but a guide, and can be exceeded provided that the server resources and server-to-server network interconnections can support the synchronization traffic.
>
> However, a cluster with more than six member servers is not officially supported by Lotus.

While clustering affords the benefits discussed below, it is important to remember that it adds extra complexity to the domain and additional administrative responsibilities that are not apparent in non-clustered environments.

The main advantages of clustering are:

- High availability

  See Chapter 11, "High Availability, Scalability, RS/6000 SP" on page 317 and the redbook *High Availability and Scalability with Domino Clustering on AIX* (SG24-5163) for more information.

- Scalability - growing the cluster to accommodate more users

  The clustering strategy also offers the advantage of gradual, scalable growth. It is easy to add another server to the cluster to share the growing workload. Clusters allow for a heavily used database to be distributed over several servers to balance the client requests. Replication in a cluster provides almost real-time synchronization of databases; however, some caveats do apply (see 7.5.2, "Cluster Replication versus Scheduled Replication" on page 175). As a cluster scales to contain more servers, an administrator can migrate users from one machine in the cluster to another. But, keep in mind to plan your requirements carefully and do consider the overhead clustering causes as well as the additional administration effort.

- Load balancing within the cluster

  Clustering allows for the efficient use of server resources and better user response times. An administrator can balance the workload across all servers in the cluster by adjusting the availability threshold of each server. Through its load balancing and failover capabilities, the cluster software shifts users attempting to access a database on a loaded (busy) cluster member to a tightly synchronized replica on an available cluster member. It will not shift users that already have a database opened at that server.

7.5.1 How Many Servers Should a Cluster Contain?

A requirement to cluster many servers usually results in the question:

Should you have a small number of large clusters (five or six servers) or a large number of small clusters (two or three servers) ?

While there is no easy way to say one or the other, and no hard and fast rules apply, take the following consideration into account.

If a server in a cluster fails, then its workload must be absorbed by its peers in the cluster. For a two node cluster, this means that each server must have the capacity to handle an additional 50 percent workload, or, in other terms, they each run normally at 50 percent of their capacity. This is wasteful of resources. For a cluster of six servers, each of the other five servers need only cope with an additional 20 percent workload; so, they can in fact run at 80 percent of their total capacity under normal conditions.

This argument also applies to disk capacity since each database needs at least one other replica in the cluster to make it highly available.

7.5.2 Cluster Replication versus Scheduled Replication

There are some important feature differences between the event-driven cluster replicator and the usual schedule-driven replicator.

7.5.2.1 Cluster Replicator Caveats

The following is a list of reasons for configuring regular schedule-driven replication in addition to running the cluster replicator task.

- Although it is possible to disable cluster replication for databases, more than likely they will still need to replicate but not in real-time. For example, template updates still need to replicate.

- Cluster replication events are held in memory only, and if a source server is shutdown before *pushing* these changes to other members, then the real-time replication event is lost. No data is lost, but the change will not propagate until the next *scheduled* replication.

- Cluster replication ignores all selective replication formulas due to the overhead of computing what may turn out to be a complex formula. As a result, *all* changes are replicated whether they match a selective replication formula or not. The standard replicator may then revert these changes back to honor the replication formula being used.

> **Note**
>
> Design elements, deletions, and access control list settings enabled or disabled through the *Advanced* section of a database's replication settings dialog box are implemented as a selective replication formula.
>
> Cluster replication will propagate *all* design, deletions, and ACL changes regardless of these settings.

- The cluster replicator pushes changes to other servers that have a replica of the changed database, but it does not update other replicas on its own server. A situation may arise where a server hosts more then one replica of a database, and it may seem perfectly reasonable to have two replicas on a server if one is a selective replica. In this scenario, scheduled replication must be used to keep the two replicas synchronized.

> **Note**
>
> When there are multiple replicas of a database on a server, the Cluster Manager uses "failover by pathname to select the replica for a user to open in a failover situation. So, if there are multiple replicas of a database on a server, make sure path names (directory path and file name) are consistent on all servers in the cluster.

- In R4.x, when one of the servers in a cluster fails, the cluster replicators on the other servers queue replications that must be pushed to that server and periodically check for the server to become active again. In Domino R5, the cluster replicator detects servers rejoining the cluster much more rapidly, usually within a minute or two, and so the delay in updates to a failed server that may have been noticed in an R4.x environment should no longer be an issue.

Regular and frequent scheduled replication is the solution to all of the above issues.

Recommendation

Enable scheduled replication 24 hours a day, seven days a week at an interval of 60 minutes.

Each time a server starts, it performs any due or overdue replications. With a replication set for every 60 minutes and always enabled, if a cluster server has been down for more than 60 minutes, when it restarts, it immediately replicates with the other servers in the cluster.

Finally, to allow clients to experience a consistent set of database features regardless of the server they access in the cluster. The cluster replicator and the scheduled replicator both propagate private folders.

Note

Private folders can only be accessed by the creator or a server within a cluster. Only servers defined by a *server* or *server group* entry type in the database ACL can access and replicate the private folders within the database.

7.5.2.2 Replication with Servers Outside of the Cluster
One of the benefits of Domino clusters is that they can help simplify a replication topology, and at the same time, improve its reliability and performance. This is because Domino allows you to configure a server outside the cluster to effectively replicate with all servers in the cluster using a single Server Connection document that specifies the server outside the cluster as the source and the cluster name as the target server of the replication. When a server replicates with a cluster, any databases on the server that also have a replica on any server in the cluster will replicate. Databases do not have to be on the same server in the cluster. If more than one replica of a database exists in the cluster, Domino replicates with one

replica, and cluster replication propagates the changes to the other replicas. The server that initiates the replication does not have to be a Domino Enterprise Server but must be running Release 4.6.3b or higher.

Replication with a cluster is also more reliable since Domino replicates with any server in the cluster that has a replica of the database. So, if one server in the cluster is unavailable, replication can continue as normal as long as all databases on the unavailable server also reside on another server in the cluster. Furthermore, when replicating with a cluster, Domino uses its workload balancing mechanisms to choose the target servers so that replication performs as quickly as possible.

7.5.3 Domino R5 Clustering Enhancements

Enhancements have been made to the operation of R5 clustered servers to support the following features not previously available:

- Failover and load balancing for Web clients
- Free-time calendaring and scheduling lookup
- *Synchronous* new mail agents that execute regardless of host server
- Type-ahead addressing and address resolution
- Synchronised unread marks across cluster replicas

7.5.4 Private LAN Configuration

By configuring the servers in a cluster to communicate through a separate dedicated network segment, three benefits are immediately realized.

1. Maximized bandwidth availability, solely for the use of the cluster servers.

2. Client-server and server-server traffic are isolated and have dedicated adapter cards.

3. Redundancy of connectivity within the cluster since each server has two physical network connections.

Note

If the configured port for intra-cluster communication becomes unavailable, then the servers can use information from the Domino Directory to determine a backup port on which to continue communication.

A typical configuration would consist of each server having two network adapter cards, each connected to a separate network segment (Figure 180). Each cluster member must use an identical set of ports.
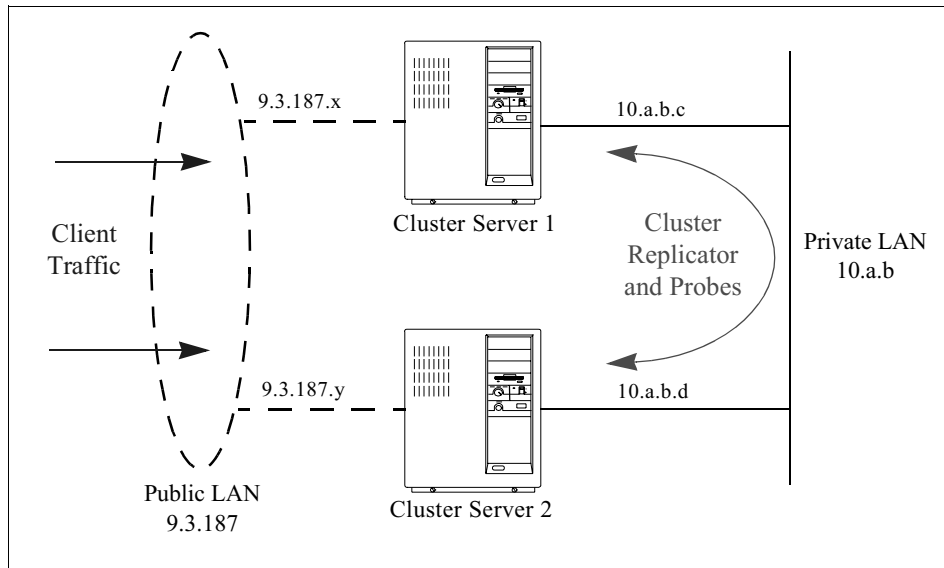

Figure 180. Dual Network Cluster Server Connectivity

The IBM RS/6000 SP is particularly well suited for this type of server configuration since the intra-cluster traffic between server nodes can be directed over the SP's internal High Performance Switch (HPS). Current implementations of this switching architecture give a bi-directional throughput of 300 MBytes/sec. The only external LAN traffic is then communication between a client and server.

Each adapter should be configured with its own individual IP address and be connected to the appropriate network segment.

The following steps can be carried out to set up the second network segment for use by the clustered Domino Server.

1. Start the administration client and select the cluster server from the bookmarks.

2. Click on the **Server** tab.

3. Click on the **Server** tools pane on the right hand side and an entry labelled `Setup Ports` should be visible as shown in Figure 181.
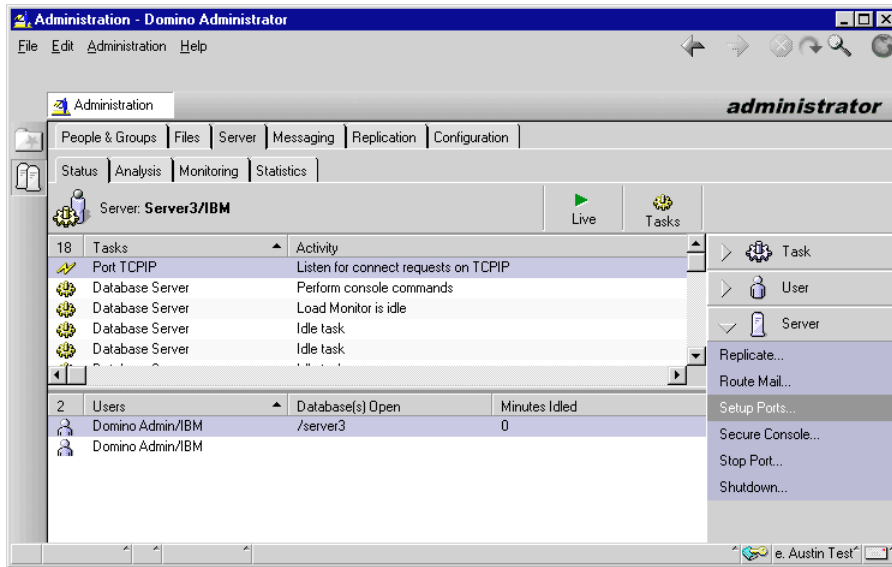
Figure 181. Setting Up a New Server Port

4. The familiar port configuration dialog box should be displayed as shown in Figure 182.
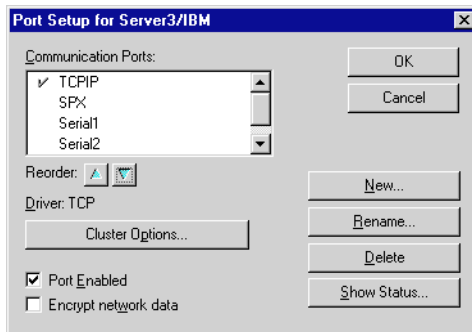

Figure 182. Server Port Configuration

5. Click on **New**, type in a name for the port, for example `Cluster`, and choose the **TCP** protocol and then click **OK**.
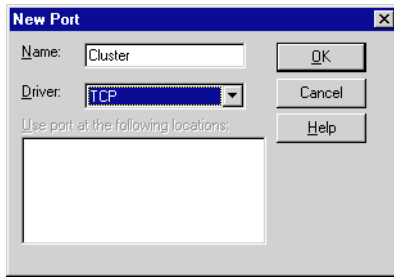
Figure 183. Creating a New Network Port

6. Click **OK** again and then a new port definition will be made in the notes.ini file on the server.

7. Edit the notes.ini file for each server and add the following lines (examples shown are based on Figure 180 on page 178 and using ports named TCPIP and Cluster):

```
TCPIP_TcpIpAddress=0,9.3.187.x:1352
Cluster_TcpIpAddress=0,10.a.b.c:1352
Server_Cluster_Default_Port=Cluster
```

8. Edit the server document.

9. Click on the **Ports** tab.

10. Enter the name of the new port (example `Cluster`), a Notes Named Network entry (example Cluster Network), and the IP address.
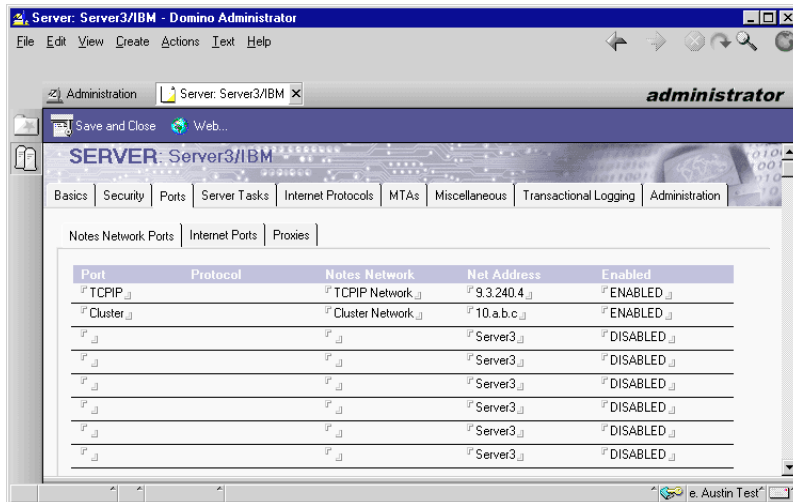
Figure 184. Adding a Cluster Port Entry on the Server Document

11. Close and save the document.

12. The server must be restarted for this port change to take effect.

13. Once the server is started, issue the `show cluster` command at the Domino Server console to ensure that the cluster replicator is using the specified port for cluster traffic. Check the port name at the end of the line starting `Server cluster default port`.

```
> show cluster
Cluster Information
 Cluster name: ITSO, Server name: Server3/IBM
 Server cluster probe timeout: 1 minute(s)
 Server cluster probe count: 220
 Server cluster default port: Cluster
 Server availability threshold: 0
 Server availability index: 100 (state: AVAILABLE)
 Cluster members (2)...
        server: Server4/IBM, availability index: 100
        server: Server3/IBM, availability index: 100
```

Figure 185. Output of the Show Cluster Command

7.5.5 Configuration of a Cluster

The conceptual ideas behind clustering are discussed in detail in other redbooks and articles mentioned at the beginning of this chapter; so, only R5 specific configuration methods will be described here.

7.5.5.1 System Requirements

The following points should be observed prior to setting up servers for clustering:

1. Prepare for the cluster by ensuring consistent protocol usage on existing servers; only TCP/IP is supported in R5.

2. Determine database distribution in the cluster and acquire sufficient storage for the existing and new servers. You would replicate application databases for load balancing and/or high availability and mail databases only for high availability.

3. Ensure each server was installed with the *Domino Enterprise Server* installation type (see 7.3, "Domino Enterprise Server Installation" on page 161). Servers do not have to have the same Lotus Domino version, but they must be part of the same domain.

4. Make sure that an *Administration Server* is specified in the Advanced section of the access control list of the Domino Directory before trying to create a cluster.

5. In a private LAN configuration, ensure that appropriate network adapter cards have been installed, configured, and connected to the correct network segments.

Note

In a mixed-release cluster, all R4.x servers must be upgraded to R4.6.3b as this will be the required minimum for clustering with R5 servers.

7.5.5.2 Creating the Cluster

Using an administration client, open the replica of the Domino Directory database on the server specified as the Administration Server for the domain.

Recommendation

Using the replica of the Domino Directory on the server designated as the Administration Server means that requests do not have to be replicated between servers in the Administration Requests database before they can be actioned.

The following procedure can now be executed to generate the cluster.

1. Click on the **Configuration** tab.

2. Expand the `Server` section in the left-hand pane.

3. Click on **All Server Documents**.

4. Highlight (select) the servers that will be in the cluster that you are about to create.

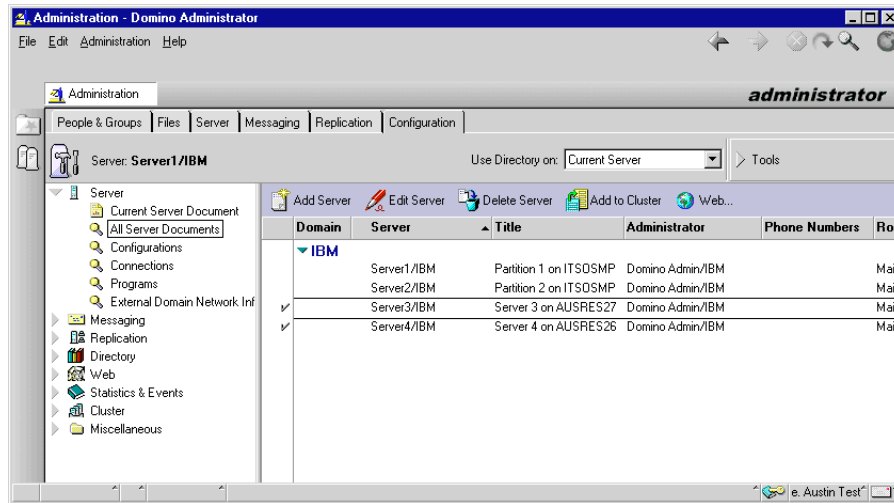5. Click on the **Add to Cluster** action button (see Figure 186).

Figure 186. Selecting Servers to Create a Cluster

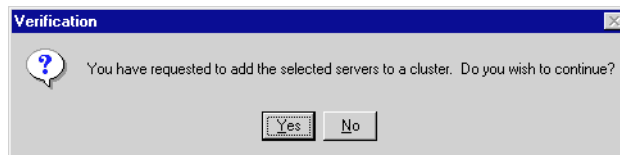6. Confirm that the action should continue by clicking **Yes** in the Verification dialog box (Figure 187).

Figure 187. Confirm Creation of a Cluster

7. For new clusters choose the *****Create New Cluster** option and click **OK** or choose the appropriate existing cluster name (Figure 188).
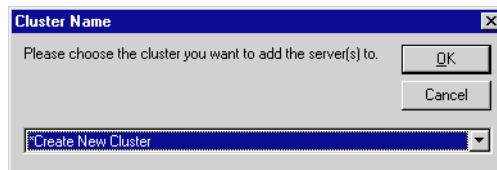

Figure 188. Choosing or Adding a Cluster Name

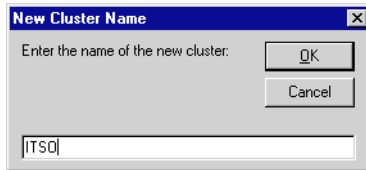8. Type in the name of the cluster and click **OK** (Figure 189).

Figure 189. Creating a New Cluster Name

9. Decide whether the cluster should be created immediately or through the administration process and click the appropriate button as shown in Figure 190.
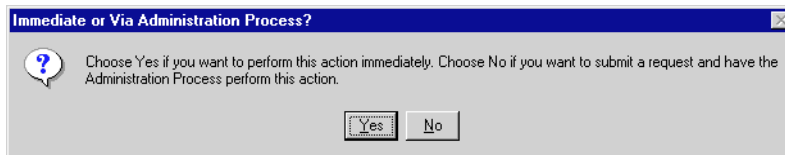

Figure 190. Create Cluster Immediately or through Administration Process

10. If the choice in step 9 was **Yes**, then a confirmation dialog, such as that shown in Figure 191, should be displayed when the process is completed.
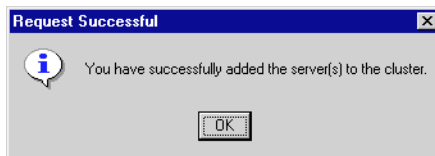

Figure 191. Confirmation of Cluster Creation

11. If the choice in step 9 was **No,** then a dialog box, such as that shown in Figure 192, should be displayed, and the following extra steps are needed.
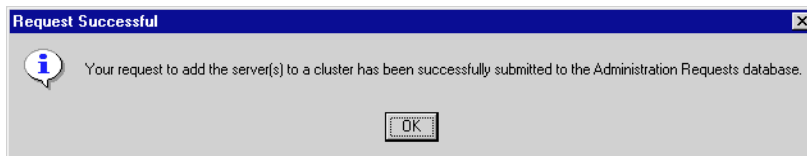

Figure 192. Confirm Submission of Admin Request to Create Cluster

12.Opening the Administration Requests database should reveal an *Add Server to Cluster* document for each server selected. An example is shown in Figure 193.
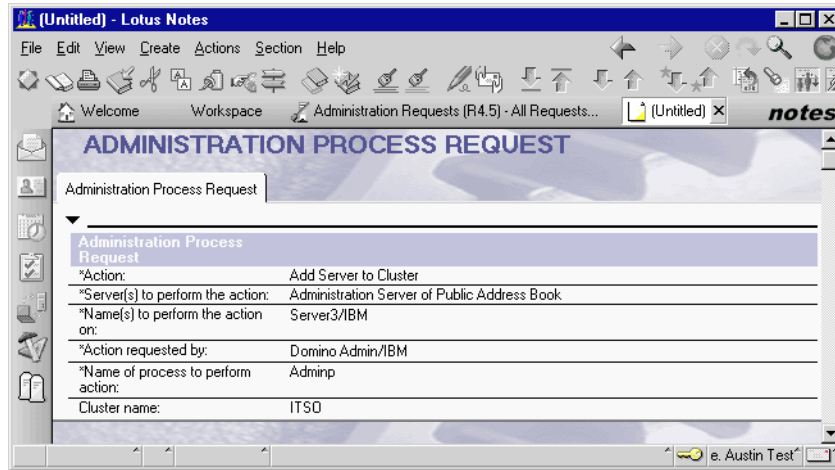

Figure 193. Add Server to Cluster Administration Request

13.When the changes in the Domino Directory replicate to the servers who are now members of the cluster. The *Cluster Administration* task, `cladmin`, is started on each server.

14.Then the *Cluster Directory* task, `cldbdir`, will start and create the Cluster Directory Database (cldbdir.nsf). Example server console output is shown in Figure 194.

```
02/03/99 11:18:39     Cluster Database Directory started
02/03/99 11:18:42     Opened session for Server3/IBM (Build 164)
02/03/99 11:18:42     Starting replication with server Server3/IBM
02/03/99 11:18:42     Unable to replicate cldbdir.nsf
02/03/99 11:18:44     Pulling names.nsf from Server3/IBM names.nsf
02/03/99 11:18:48     Finished replication with server Server3/IBM
02/03/99 11:18:52     Created database Cluster Database Directory: cldbdir.nsf
02/03/99 11:18:55     Cluster Replicator started
02/03/99 11:18:58     Finished initialization of Cluster Database Directory
02/03/99 11:18:58     Replicating Cluster Database Directory with Server3/IBM
02/03/99 11:18:59     Opened session for Server3/IBM (Build 164)
02/03/99 11:18:59     Starting replication with server Server3/IBM
02/03/99 11:18:59     Pulling cldbdir.nsf from Server3/IBM cldbdir.nsf
02/03/99 11:19:00     Finished replication with server Server3/IBM
02/03/99 11:19:08     Cluster Administration Process shutdown
```

Figure 194. Cluster Directory Task Startup

15. The entries `cldbdir` and `clrepl` will be added automatically to the `ServerTasks=` line of the notes.ini file so that they start automatically on each server restart.

16. Before continuing, stop the cluster replicator `clrepl` and cluster directory `cldbdir` tasks on each member server of the new cluster with the commands `tell clrepl quit` and `tell cldbdir quit`, respectively.

The cluster creation is now complete, but there are some additional tasks that must be carried out to improve the operation of the cluster. These should be done before allowing the servers to replicate but are not critical.

7.5.5.3 Modifying the Contents of the Cluster Directory Database

When the cluster directory manager task creates the cluster directory database (cldbdir.nsf), it populates it with every database (*.nsf) and template (*.ntf) it can find in the server's data structure.
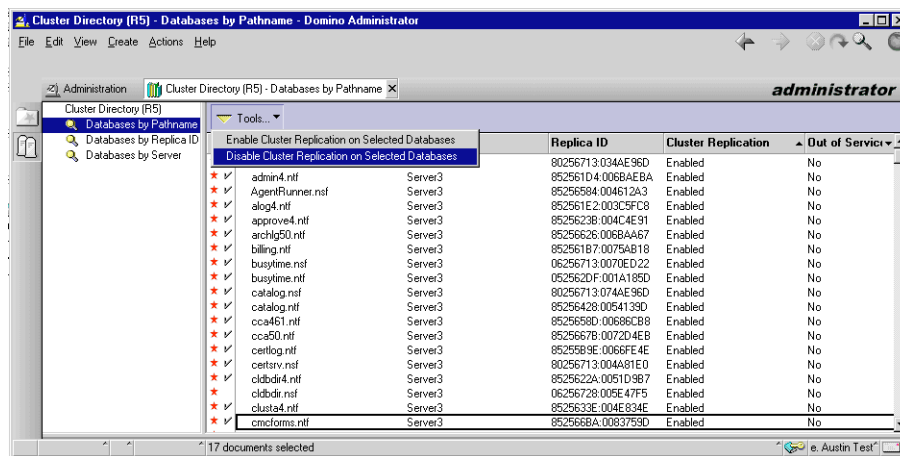

Figure 195. A New Cluster Directory Database

Many databases and templates do not need to be replicated in real-time, and if they are left enabled, impose an overhead (albeit a small amount per database) on the operation of the cluster.

The cluster directory databases are *replicas* on each server in any given cluster, and hence, each server replica will contain a list of all databases and templates on all servers available on the clustered servers once the servers have replicated with each other.

7.5.5.4 Removing a Server From a Cluster

Using an administration client, open the replica of the Domino Directory database on the server specified as the Administration Server for the domain.

The following procedure removes a server from a cluster:

1. Click on the **Configuration** tab.

2. Expand the `Cluster` section in the left-hand pane.

3. Click on `Clusters`.

4. Highlight (select) the servers that will be removed from the cluster.

5. Click on the **Remove from Cluster** action button (see Figure 196).
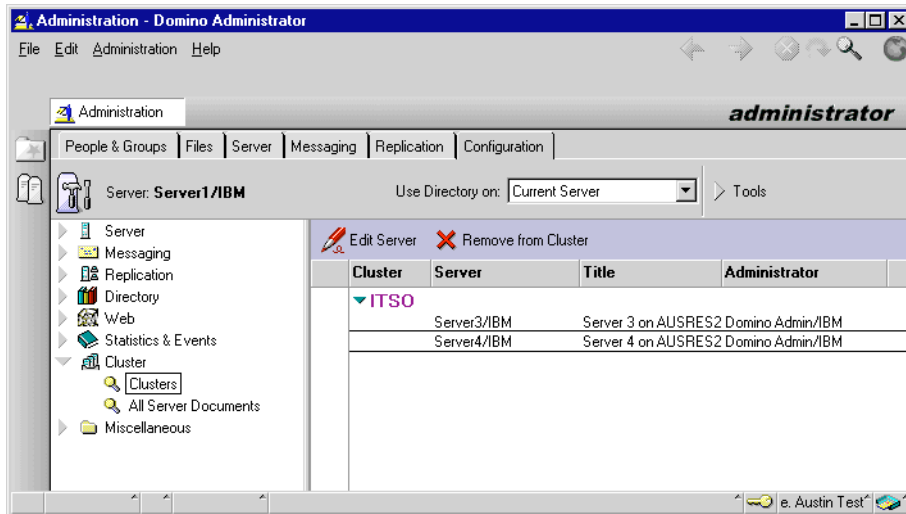
Figure 196. Removing a Server from a Cluster

6. Confirm that the action should continue by clicking **Yes** in the Verification dialog box.
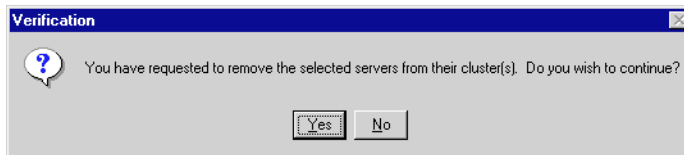
Figure 197. Confirm Removal of Server from Cluster

7. Decide whether the server should be removed immediately or through the administration process and click the appropriate button as shown in Figure 198.
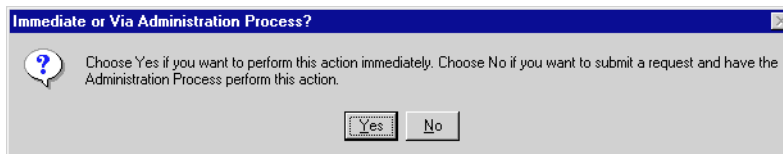
Figure 198. Remove Cluster Immediately or through Administration Process

8. If the choice in step 7 was **Yes**, then a confirmation dialog like that shown in Figure 199 should be displayed when the process is completed.
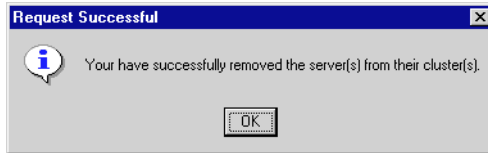
Figure 199. Successful Removal of Server from Cluster

9. If the choice in step 7 was **No,** then a dialog box, such as that shown in Figure 200, should be displayed.

Figure 200. Submission of Admin Request to Remove Server from Cluster

10.The cluster processes `clrepl` and `cldbdir` will be stopped on the server, and the entries removed from the `ServerTasks=` line in notes.ini.

11.The database entries in the Cluster Directory database (cldbdir.nsf), for databases on the server being removed, will be purged from the replica copy on the least busy of the remaining cluster servers.

12.The local Cluster Directory database will be deleted from the server that is being removed from the server.

7.5.6 NOTES.INI File Settings

There are several notes.ini variables that are required to tune or modify the behaviour of clustered servers.

Table 11 shows the relevant notes.ini variables and their purpose.

Table 11. Clustering Specific notes.ini Variables

Variable Name	Purpose
Server_Cluster_Default_Port	The default port on which to send/receive all intra-cluster server-to-server communications.
Server_Restricted	Disable acceptance of new client connection requests.
Server_MaxUsers	In a load-balancing scenario, set a limit to the number of concurrent client connections to the server.

Variable Name	Purpose
Server_Availability_Threshold	A threshold set to determine when a server is considered busy; new requests will fail over to another cluster member when the threshold is reached.
MailClusterFailover	Enable router delivery failover to another replica of a user's mail database when the home server is unavailable.
RTR_Logging	Enable cluster replication event logging.

Details of specific values can be found in the *Lotus Domino R5 Administration Help* database.

7.5.7 Mail Delivery Failover

Mail cluster failover is a process that allows a router on one server to deposit mail into a replica of a user's mail database that resides on a clustered server other than the home server specified in a person document.

To achieve this, the field Cluster failover on the Router/SMTP-Advanced-Controls tab of a server configuration document must be set. An example is shown in Figure 201.
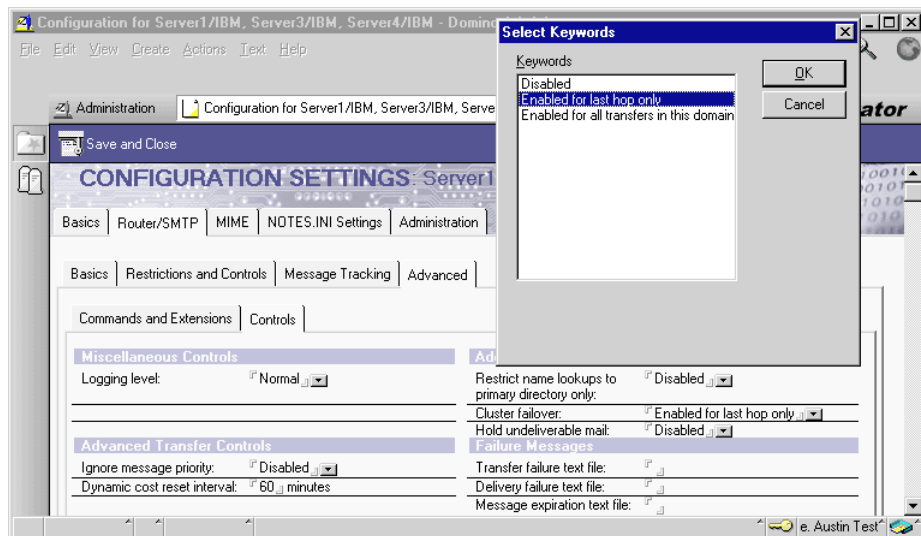

Figure 201. Enabling Mail Cluster Failover

This configuration document must be set for all members of the cluster and for all servers that route mail to servers in the cluster. For example, a mail

routing hub may not be a member of a cluster, but since it may route mail for delivery to clustered servers, it must also have a configuration document to enable failover. The default value is `Enabled for last hop only` and allows a router to fail over delivery on the final hop of a message route only. To always allow fail over at any point in the routing of a message, the setting `Enabled for all transfers in this domain` should be used instead.

7.5.8 Calendaring and Scheduling Support

In previous releases of Domino, when a client failed over to a server other than the home server, it was not possible to perform a free-time lookup for any user when their home server was unavailable, because the only copy of the busy time database containing their information existed on that failed server.

With Domino R5, a version of the free time database that can be replicated between cluster members resolves the problem so that full calendar scheduling support can be provided in times of particular server failure.

When the schedule manager task `sched` starts up on a server that has become a member of a cluster, a new busy time database is created that can be replicated across cluster members. If an original busytime.nsf database exists, then this is deleted first, and the information is recreated in the new database.

Note

The new cluster-wide free time database has a filename of clubusy.nsf.

The reverse process is executed when a server is removed from a cluster. The `sched` task deletes the clubusy.nsf database and recreates a standard busytime.nsf. Each of the servers remaining in the cluster purge the deleted information from their replica copies of clubusy.nsf.

7.5.9 The Internet Cluster Manager (ICM)

The ICM is the task that manages failover and load balancing of Web client requests for data stored on clustered Domino Enterprise Servers. ICMs can be deployed in four main configurations; a single ICM inside or outside of the cluster or multiple ICMs inside or outside of the cluster.

Each ICM is dedicated to one and only one cluster; however, one cluster can be supported by multiple ICM's and the ICM server must belong to the same domain as the cluster.

The ICM can be used to broker client requests in a mixed-release cluster; however, since R4.x Domino Servers cannot reference the ICM in the URLs they return. Load balancing of requests cannot be achieved. When a client is redirected to a cluster member that is not R5, all subsequent requests for data will be sent to that server until failover or redirection to another server through a specific URL link occurs. Individual requests will not be load balanced across the other member servers in a mixed release cluster.

The characteristics of the ICM are end-to-end security and authentication. Whatever authentication method is required for access to protected data served through HTTP or SSL connections, the ICM will preserve those connection types. All requests to the ICM are anonymous; that is, there is no authentication between the Web client and the ICM. Once the ICM has received a request and has decided where that request can be best fulfilled, it sends a redirection response code and target server details back to the Web client, and a connection is made directly between the client and the specified server. At this point, any authentication controls maintained by the target clustered server will be obeyed.

Although no authentication exists between the client and ICM, the transport of requests between the two can be protected through SSL encryption.

Since no authentication takes place at the ICM, protecting it from unauthorized access is best served by implementing a firewall.

7.5.9.1 ICM Outside of the Cluster
Figure 202 shows the way that a server running the ICM task can front-end traffic destined for clustered Web servers. As was said previously, multiple servers running the ICM could be used with incoming requests being balanced between them using techniques such as round-robin DNS (where the same hostname is used for all instances of the ICM).
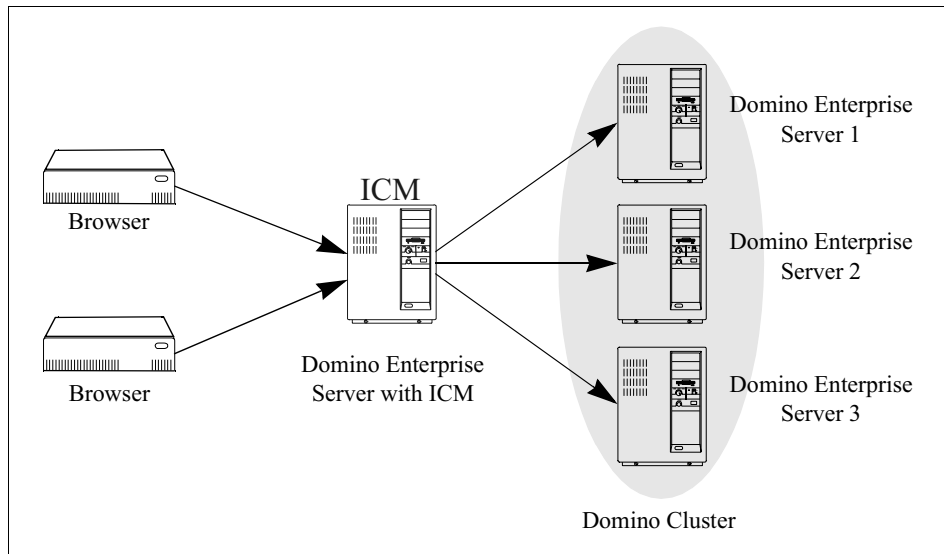
Figure 202. Running the ICM Outside the Cluster

In this scenario, the server is running solely to provide the ICM, and by removing all redundant services (such as the mail router and schedule manager), the server will be able to concentrate its resources into responding to Web client requests.

Note

Remove all unnecessary tasks from a server dedicated to running an ICM task to improve stability and performance of the server.

7.5.9.2 ICM Inside the Cluster

Figure 203 shows the way that a server that is already a member of a cluster can host the ICM task. Once again, multiple cluster members could be configured to run the ICM with incoming requests being balanced between them using techniques such as round-robin DNS.
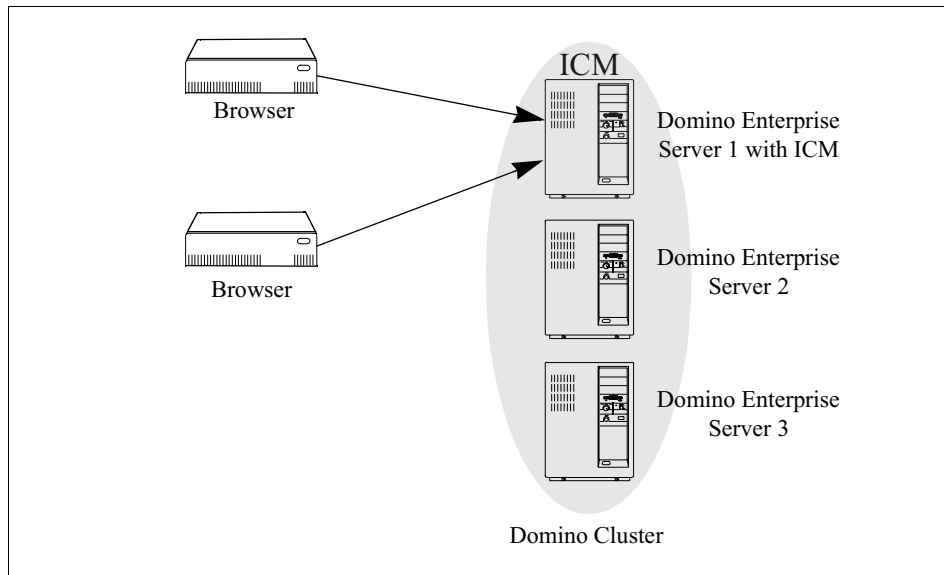
Figure 203. Running the ICM Inside the Cluster

7.5.9.3 Configuring a Server to Provide ICM Services

Whether the ICM server is inside or outside of the cluster, the configuration is essentially the same. Differences will be highlighted where appropriate.

Start the administration client and select the server that will run the ICM from the bookmarks:

1. Click on the **Configuration** tab.

2. Click on the **Server** section in the left-hand pane.

3. Edit the server document.

4. Click on the **Server Tasks-Internet Cluster Manager** tab, and the form shown in Figure 204 on page 195 will be visible.
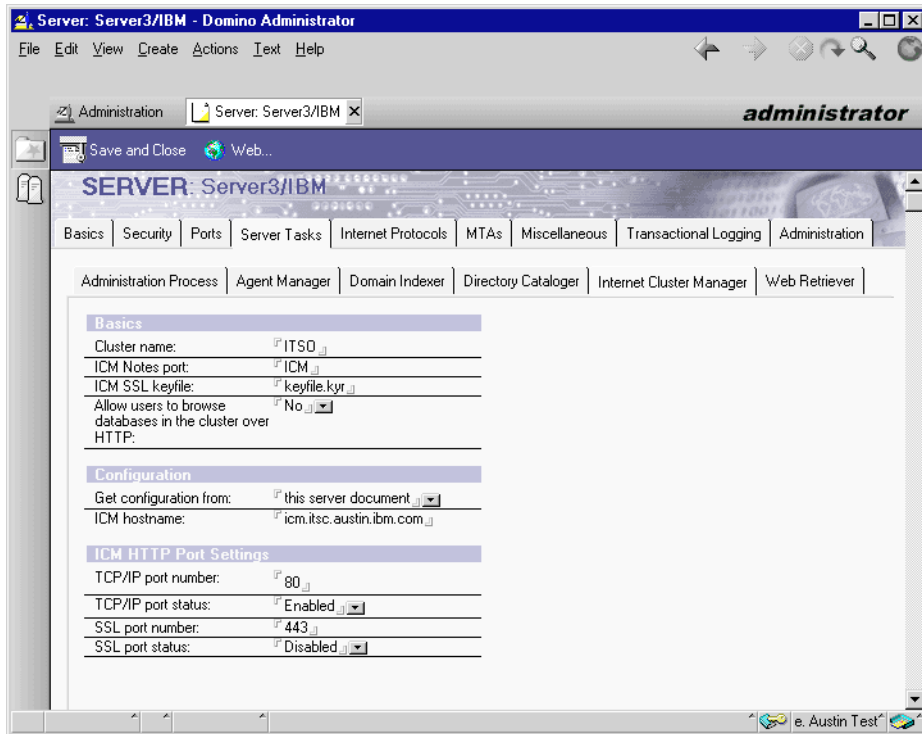
Figure 204. Configuring ICM in the Server Document

5. In the Cluster name field, enter the name of the cluster that this ICM will support (if the server is a member of the cluster, this can be left blank).

6. If the ICM will share the IP address of the server, then skip to step 10.

7. Create a new Notes port definition, with a name of ICM for example, in a similar way to that described in steps 1-12 of 7.5.4, "Private LAN Configuration" on page 177.

8. Add the following entry in the notes.ini file:

   ```
   ICM_TcpIpAddress=0,a.b.c.d
   ```

   assuming the new port name created in step 7 was ICM.

9. Enter the Notes port name in the field ICM Notes port.

10.If SSL connections are required, specify the keyring file name in the ICM SSL keyfile field.

11.Ensure that browsing is not allowed.

12. Choose whether the ICM for this server should use `this server document` for its configuration or whether it should use `another server document`.

> **Note**
>
> At first glance, this may seem a strange option to provide. Why would an ICM on this server not use its own server document?
>
> The reason for allowing the ICM on one server to use the configuration of another ICM is so that multiple ICMs serving one cluster can share the same configuration more easily.

13. If the option **another server document** is chosen, then the form will present a field named `Obtain ICM configuration` in which a server name should be entered.

14. Enter the fully-qualified hostname that clients will use to connect to the ICM. This can either be a registered DNS name (recommended) or an IP address.

15. The TCP/IP port number need only be changed if the ICM is running on a cluster member that already has HTTP enabled, and no spare IP address is available. See 7.4.4.1, "Using Unique IP Addresses" on page 168 for details regarding assigning IP address aliases, as the same method applies as was used to install partitioned servers.

> **Recommendation**
>
> Providing the ICM with its own IP address is much simpler than sharing a single IP address, as standard TCP/IP port definitions can be used.
>
> If a separate IP address is assigned to the ICM task, ensure that the HTTP task is bound to its specific IP address only (see 7.4.5.1, "Considerations for HTTP" on page 170 for details on setting this up).
>
> This is not an issue when the ICM is running on a dedicated server outside of the cluster.

16. Unless all traffic between clients and the ICM requires encryption, the field TCP/IP port status should be left `enabled`.

17. To specify a non-standard SSL port number (where a single IP address may be in use, and the HTTP server already uses SSL) enter a new port number in the SSL port number field.

18. Change the SSL port status field value to `enabled` if SSL is required between client and the ICM.

19.Close and save the server document.

20.Edit the notes.ini file of the server on which the ICM will run.

21.Add the entry `ICM` to the end of the `ServerTasks=` line.

7.5.10 Monitoring Cluster Processes

General information about a server in a cluster can be found using the `show cluster` command at the server console. Details of the cluster name, availability thresholds, and other other servers in the cluster are shown. An example of this has already been seen in Figure 185 on page 181.

Logging of cluster replication events is disabled by default since they are, by nature, large in volume. Logging should be turned on only when problems are suspected, and tracking information is required.

To enable logging, add the line `RTR_Logging=1` to the notes.ini file of the server to be logged.

7.5.10.1 Cluster Servers

To determine whether the intra-cluster (server-to-server) traffic is performing at optimum levels, use the statistics shown in Table 12. They do not appear on the normal cluster statistics reports but can be seen using the `show stat` command on the server console.

Table 12. Intra-Cluster Traffic Statistics

Statistic Name	Description
Replica.Cluster.Successful	Number of successful replications since server startup.
Replica.Cluster.Unsuccessful	Number of unsuccessful replications since server startup.
Replica.Cluster.SecondsOnQueue.Avg	Average time in seconds that database spent on work queue.
Replica.Cluster.SecondsOnQueue.Max	Maximum time in seconds that database spent on work queue.
Replica.Cluster.WorkQueueDepth	Current number of databases awaiting replication by the cluster replicator.
Replica.Cluster.WorkQueueDepth.Avg	Average work queue depth since server startup.
Replica.Cluster.WorkQueueDepth.Max	Maximum work queue depth reached since server startup.

The value indicated by Replica.Cluster.SecondsOnQueue.Avg shows the average amount of time taken for changes made on this server to be pushed to the other cluster members. A value of 60 or less means all changes are reaching the other servers within one minute of the change occurring.

The Replica.Cluster.WorkQueueDepth.Avg depends upon the number of databases on the server and the volatility of the data contained in them. Typically, this value should be consistently below 15, and values higher than this may indicate that the network bandwidth is restricting the server's ability to push changes to the other cluster members.

If the cluster servers are not using a separate private network for intra-cluster replication, then moving to this topology should resolve this problem.

When load-balancing is implemented in a cluster, the statistics shown in Table 13 can be monitored to determine whether the workload is well balanced.

Table 13. Workload Balancing Statistics

Statistic Name	Description
Server.AvailabilityIndex	The current value of the availability index.
Server.Cluster.OpenRedirects.LoadBalance.Successful	Number of times a busy server successfully redirects to another server.
Server.Cluster.OpenRedirects.LoadBalance.Unsuccessful	Number of times a busy server unsuccessfully redirects to another server.
Server.Cluster.OpenRequest.ClusterBusy	Number of times a busy server tries to redirect a request when all other servers are busy.
Server.Cluster.OpenRequest.LoadBalanced	Number of times a client tried to open a database on this server when the server was busy.

7.5.10.2 ICM Servers

The statistics shown in Table 14 can be used to monitor the general use and performance of the ICM task.

Table 14. General ICM Statistics

Statistic Name	Description
ICM.Command.Total	The number or URL commands received.
ICM.Command.Unknown	The number of unrecognized URL commands.

Statistic Name	Description
ICM.Command.Redirects.Successful	Number of successful client redirects to a cluster member.
ICM.Command.Redirects.Unsuccessful	Number of unsuccessful client redirects to a cluster member.
ICM.Command.Redirects.ClusterBusy	Number of client requests received when all cluster members were busy.
ICM.Command.Redirects.Per1Hour.Total	Number of requests received in the past hour.
ICM.Command.Redirects.Per1MinuteTotal	Number of requests received in the past minute.
ICM.Command.Redirects.Per5MinutesTotal	Number of requests received in the past five minutes.
Statistic Name	Description

7.5.11 Managing Databases in a Cluster

Within the administration, clients choose the server to work with from the bookmarks and then select the **Files** tab to display the databases and templates on the chosen server.

The following steps change the characteristics of one or more databases:

1. Select the files from the list using the *Shift* or *Ctrl* keys as appropriate to make multiple selections.

2. Right-click the mouse on one of the selected files.

3. Click on **Cluster** from the popup menu as shown in Figure 205.
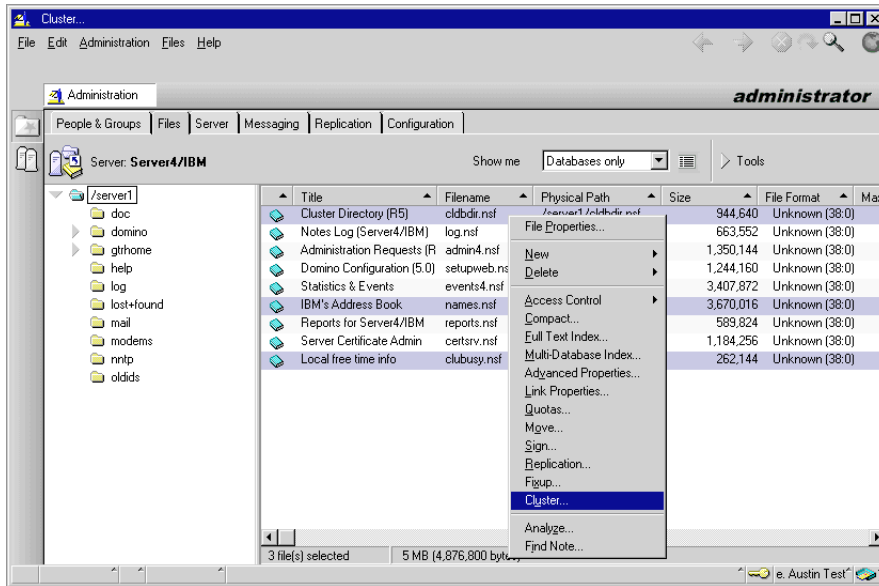
Figure 205. Selecting Databases for Cluster Management

4. Choose the appropriate action from the Cluster Management dialog box, an example is shown in Figure 206, and then click **OK** to carry out the action.
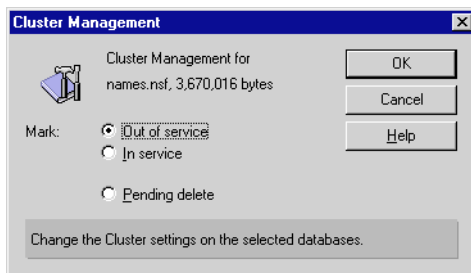
Figure 206. Choosing a Cluster Management Action

The available options are:

• Out of Service

  The database cannot be accessed, and client requests are failed over to another replica in the cluster.

• In Service

  To make a previously out of service database available again.

- Pending Delete

  Mark database for deletion only after all active user sessions have completed.

7.6 Domino Server Billing

The billing activity of a server provides an enterprise with additional data to enable it to perform several tasks.

- Charge for usage of servers.
- Monitor usage trends.
- Conduct resource planning.

When enabled, the server collects client and server activity information and places the information in the *billing message queue*. Periodically, the billing process takes this data and writes it to disk creating records that can be reviewed and used for the tasks described above.

The billing process on a Domino Enterprise Server consists of two major components:

1. Lotus Domino Server enabled for billing: The server provides billing information according to seven billing classes (see below).

2. The Lotus Domino `billing` task collects the information provided by the server and generates billing records stored either in a database (billing.nsf), a binary file (billing.nbf), or both.

7.6.1 Billing Classes

The `BillingClass` setting in notes.ini controls which of the seven allowed billing classes are to be tracked as shown in Table 15 below.

Table 15. Billing Classes

Billing Class	Tracks
Session	When users and servers start or end sessions with a billing server, and when network-related activities such as document creation and editing, occur during the session. It also includes client-initiated replication and mail events.
Database	When users and servers open and close databases and duration of use including mail delivery events.
Document	Read and write activity for specified documents. The document form must contain a hidden field named $ChargeRead or $ChargeWrite that has a cost value in it.

Billing Class	Tracks
Replication	When a billing server initiates replication with another server. It does not include cluster replication events.
Mail	When the mail router on a billing server transfers mail to another server.
Agent	When users and servers run server-based agents on the billing server, as well as the execution time of the agents, but does not include agents executed on Web servers.
HTTPRequest	When a billing server responds to a Web browser request.

See the *Lotus Domino R5 Administration Help* database for further details.

7.6.2 Enabling the Billing Process

To enable billing on a server, either the notes.ini file can be edited directly, or the settings shown below can be specified through the `NOTES.INI Settings` tab of a server configuration document.

- `ServerTasks=...,Billing`

  To enable the billing task at server startup

- `BillingClass=<all or some of the classes defined in Table 15>`

  The list of billing class events that are to be tracked

- `BillingAddInWakeup=seconds <default = 60>`

  How often the billing tasks processes items in the billing message queue

---
Note

This value must be greater than the value specified for `BillingAddinRuntime`.

- `BillingAddInRuntime=seconds <default = 10>`

  The amount of time that the billing task will execute after wakeup

- `BillingSuppressTime=minutes <default = 15>`

  The frequency of record stamping during session and database activities if those classes are specified by `BillingClass`

- `BillingAddInOutput=value`

Determines where the records will be stored or displayed according to the following table.

Table 16. Locations for Billing Records

Value	Location
1	Notes database (billing.nsf)
2	Server console
3	Notes database and server console
8	Binary file (billing.nbf)
9	Both database and binary file
10	Binary file and server console
11	Database, binary file and server console

As an example, assume we want billing to be active for Mail, Replication and Web, and to start generating records every 10 minutes for 2 minutes and log to a binary file, we would specify in notes.ini:

```
ServerTasks=...,Billing
BillingClass=Mail,Replication,HttpRequest
BillingAddInWakeup=600
BillingAddInRuntime=120
BillingAddInOutput=8
```

7.6.3 Optimizing Billing Performance

During times of peak usage, if system performance is an issue, reduce the frequency with which the server posts session and database activity information on the billing message queue by *increasing* the `BillingSuppressTime` parameter.

In addition, the billing load can be reduced by running the billing task less frequently (increase `BillingAddInWakeup`) and/or shortening the amount of execution time that it is allowed (reducing `BillingAddInRuntime`).

Finally, multiple billing tasks can execute in parallel to transfer records from the billing message queue to the chosen storage location. For example, to enable two billing tasks to run on a server, specify the following line in notes.ini:

```
ServerTasks=......,Billing,Billing
```

7.6.4 Sample Billing Records

This section contains samples from the billing.nsf database only, since the binary file billing.nbf cannot be displayed. Notes API programs must be used to produce reports based on the contents of the binary file.

The standard billing database does not provide any totalling across documents listed in the views of the database. For better analysis, records should be categorized and totalled to provide at-a-glance totals and sub-totals of relevant numeric indicators, such as document read and write charges.

7.6.4.1 Session Billing

Session billing collects information of the data volume of a certain user session that indicates who has transferred how many bytes.

Figure 207. Sample Session Billing Document

7.6.4.2 Database Billing

Database billing delivers two types of records (DBOpen and DBClose), which allow tracking of how long a database has been in use by a certain user and how long it has taken to actually perform the open and close actions.

Figure 208. Sample Database Billing Document

7.6.4.3 Document Billing

Document billing shows a read or write charge associated with documents that contain either the $ChargeRead or $ChargeWrite hidden fields.

Figure 209. Sample Document Billing Document

Note

The value stored in $ChargeRead or $ChargeWrite is interpreted as whole currency units.

For example, assuming a currency denomination of US dollars, a numeric value of ten in these fields is translated and displayed as $10.00 in the views of the billing database.

7.6.4.4 Replication Billing

Replication billing offers information on which servers exchanged data during replication, how much data for which database, and when the replication occurred.

Figure 210. Sample Replication Billing Document

7.6.4.5 Mail Billing

Mail billing indicates which mail has been routed where, who created it, the size, and the recipient.

Figure 211. Sample Mail Billing Document

7.6.4.6 Agent Billing

Agent billing allows tracking of the time an agent executed on the server, which database it acted on, and who started the agent.

Agent Billing

Basics	
Billing record type:	Agent
Billing class:	Agent
Server name:	CN=Server1/O=IBM
Timestamp:	23/02/99 13:49:47

Session Information	
User name:	Domino Admin/IBM
Elapsed run tiime:	550 ms
Flags:	Public Agent
Agent name:	Test Agent Billing
Database name:	mail/dadmin.nsf

Figure 212. Sample Agent Billing Document

7.6.4.7 HTTP Request Billing

HTTP Request billing provides extensive information about which objects have been retrieved from the Web server, the time elapsed to fulfill the request, the user who retrieved the data, the number of bytes retrieved, and the IP address of the client system.

HTTP Request Billing

Basics

Billing record type:	HttpRequest
Billing class:	Http
Server name:	CN=Server1/O=IBM
Timestamp:	23/02/99 11:45:31

Http Request Information

Date/Time:	23/Feb/1999:11:45:31 +0600
Remote machine address:	9.3.199.13
Authenticated user:	-
Status code:	304
Content length:	0
Content type:	
Request:	GET /names.nsf/85255ed5006cafef85 2556d4006ca21c?OpenView HTTP/1.1
Browser:	Mozilla/4.0 (compatible; MSIE 4.01; Windows NT)
Referer:	http://9.3.187.210/names.nsf
Server Address:	9.3.187.210
Elapse Time (ms):	30

Figure 213. Sample HTTP Request Billing Document

Chapter 8. Lotus Domino R5 and the Internet

The tasks described in this chapter are mostly not RS/6000 specific. Therefore, only the major topics are described to provide a general overview and to help you get them up and running. We will not go deep into all the Internet features except if there is something RS/6000 specific, but we will provide references that will help you getting into details.

8.1 Lotus Domino Web Server

One of the major tasks of Lotus Domino R5 is the HTTP task. It brings together the world of Lotus Notes and the World Wide Web. The HTTP task can be used to publish Lotus Notes databases to the Internet. It can also be used like a simple HTTP daemon, which means you can use publish flat HTML files to the Internet, and it can also run Client Gateway Interface (CGI) scripts or programs.

> **Note**
>
> Whenever running the HTTP task on a Lotus Domino R5 server, remember that all databases on this server can be accessed through the Internet unless they are protected.
>
> You will have to make sure that the ACLs of all databases are set appropriately. You should add the Anonymous user to every database and assign the appropriate access permission to this user.

Whenever you want to change the settings of the Domino Web Server, you have to follow these steps first:

1. Start the Domino Administrator.

2. Choose the Server you want to reconfigure. If you do not know how to choose a server, please refer to 6.1, "Choose Other Server in Domino Administrator" on page 143.

3. Choose the **Configuration** tab.

4. Choose **Server -> All Server Documents**.

5. Double click on the Domino Server you want to change or select the server and click on **Edit Server**.
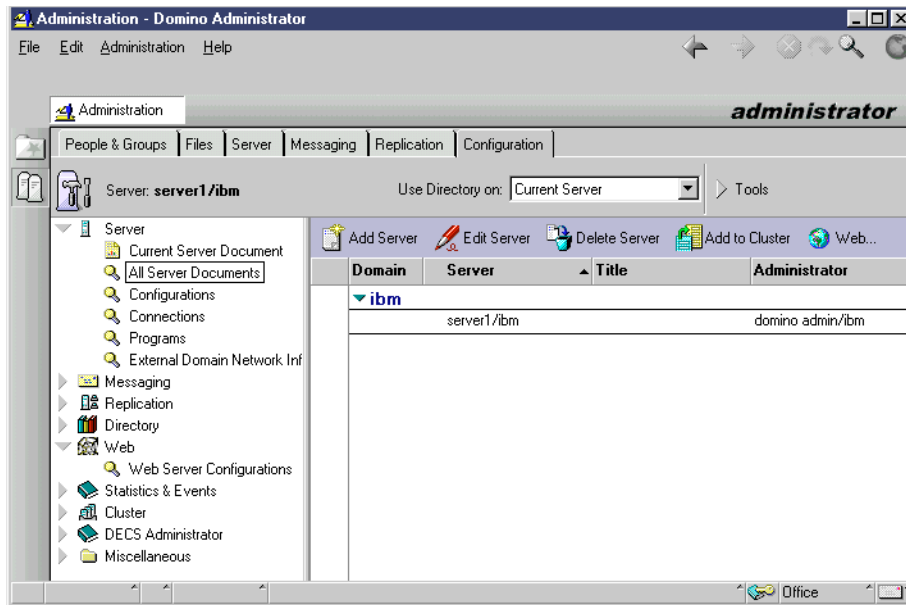
Figure 214. Web Server Configuration

8.1.1 Setting up a Domino Web Server

To setup a Domino Web server click on **Ports -> Internet Ports** in the server document. The `Web` tab should be selected by default. In the section `SSL settings`, you can choose the key file and other SSL settings. We will cover all security related topics in 9.5, "Secure Sockets Layer (SSL)" on page 259.

To enable the Web server, you have to choose the TCP/IP ports you want your server to use. It is best to use the default port 80 for the non-secure Web server and port 443 for the secure Web server. The secure server will not run until you create a server certificate.

Next you should go to `Internet Protocols -> HTTP`. In this section, you should at least make the following changes:

- `Enable logging to` log files or to Domlog.nsf if you want to create statistics telling you about, for example, who, how much, and which pages were accessed on your Web server.

- If you have chosen Log files, then you have to choose a **Directory for log files**. We recommend to create a logical volume for the log files. If you have a lot of hits on your Web server, you might get several megabytes of

log files per day. You should also choose which log files you want to be written. If you do not need, for example, the agent log, just empty the field.

- In the `Mapping` section, you should customize the `Home URL`. It should be either a notes database or an HTML file.

Figure 215. HTTP Server Setup

If you need further information, please refer to the *Lotus Domino R5 Administration Help* data base.

8.1.2 Starting, Stopping, and Refreshing the Domino Web Server

There are two ways to start the Domino Web server. You can start it by entering `load http` at the server console, or you can start it at Lotus Domino
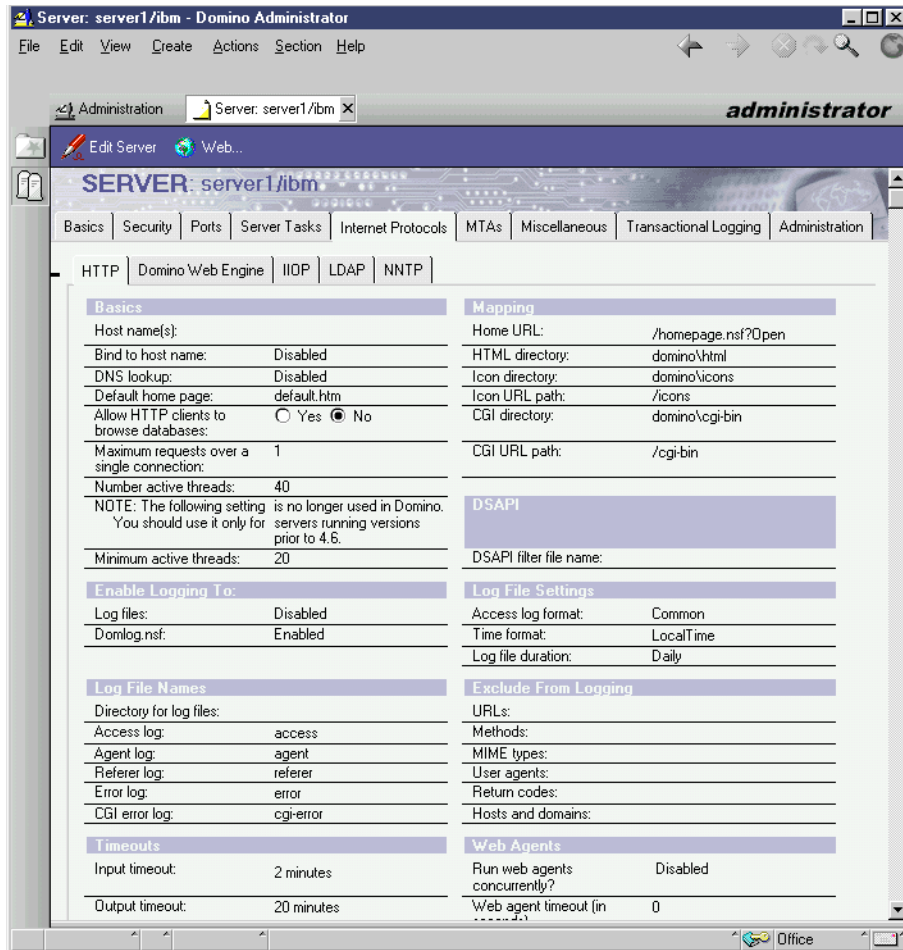
R5 start-up by adding it to the ServerTasks in notes.ini. By default, the HTTP task is added to the notes.ini file.

To stop the Web server, enter `tell http quit` at the server console or remove `http` from the ServerTasks in notes.ini and restart the Domino server.

Type `tell http restart` at the server console to refresh the Web server.

8.1.3 Lotus Domino Virtual Web Servers

Starting with Lotus Domino R5, all Web server settings are made in the Domino Directory. Select the server document and choose **Action -> Web** and the appropriate sub panel. While there is a database template for creating a domino configuration database domcfg.nsf as in the previous versions, you should use the domino directory to do so. If you need any information about how to use domcfg.nsf, please refer to the redbook *Lotus Domino Release 4.6 on IBM RS/6000*, SG24-4694-02.

There are some enhancements to the configuration of Web servers you might have missed in the previous versions. Now you can:

1. Create Virtual Servers and Host

2. Create URL Mappings and Redirections

   - URL to URL
   - URL to Directory
   - Redirection URL to URL

3. Create File Protection

4. Create Realm

The difference between a virtual server, and a virtual host is that virtual servers have different IP addresses and different hostnames while virtual host are using the same IP address but different hostnames.

Prior to installing a virtual server, you have to change the network setup, and prior to installing a virtual host, you have to change your DNS settings (see 8.1.3.2, "Changing DNS Setup" on page 213). Although both types could co-exist, you should either use virtual servers or virtual hosts.

8.1.3.1 Network Setup

Assuming the basic IP setup has already been done using the network interface `tr0`, you now have to add additional IP addresses to be used by your virtual server. This has to be done with the `ifconfig` command, which may be placed into the file /etc/rc.net to be automatically activated on system

start-up. The screen shot below refers to this setup. The network interface `tr0` now has three IP addresses.

```
# hostname
itsosmp
# host itsosmp
itsosmp.itsc.austin.ibm.com is 9.3.187.210
#/usr/sbin/ifconfig tr0 alias 9.3.187.220 netmask 255.255.255.0
#/usr/sbin/ifconfig tr0 alias 9.3.187.221 netmask 255.255.255.0
# netstat -i
Name  Mtu    Network        Address            Ipkts Ierrs    Opkts Oerrs  Coll
lo0   16896  link#1                              4049     0     4049     0     0
lo0   16896  127            localhost            4049     0     4049     0     0
lo0   16896  ::1                                 4049     0     4049     0     0
tr0   1500   link#2         10.0.5a.c9.7c.f1   468252     0   315434     0     0
tr0   1500   9.3.1          itsosmp.itsc.aust  468252     0   315434     0     0
tr0   1500   9.3.1          itsosmp1.itsc.aust 468252     0   315434     0     0
tr0   1500   9.3.1          itsosmp2.itsc.aust 468252     0   315434     0     0
#
```

Figure 216. IP Aliasing

8.1.3.2 Changing DNS Setup

There is one very good reason to use multiple machine names instead of multiple IP addresses. You can run out of IP addresses, but you will never run out of names.

The normal way of getting the DNS settings updated will be writing a note to the DNS administrators. However, you might be your own DNS administrator. Go to the directory containing the DNS files and open the DNS data file. The only thing you have to do is to go to the entry for your machine running Lotus Domino R5 and add one line for each alias name. Do not forget to update the Serial number in the first line of your data file. Without this update, the changes won't take effect even after you restart the DNS server.

```
itsosmp in A 9.3.187.210
;these are the names used for virtual Web servers
itsosmp1 in CNAME itsosmp
itsosmp2 in CNAME itsosmp
```

Figure 217. DNS Entry for Name Aliasing

Restart the DNS server using the command `refresh -s named`.

If you do not use DNS on your network, you have to change the /etc/hosts file on any system that might want to access the virtual Web server. You will have

to add the alias name to the line assigning an IP address to your Domino
server.

```
# this is the old entry
#9.3.187.210 itsosmp
# added virtual Web server names
9.3.187.210 itsosmp1 itsosmp2
```

Figure 218. Setting Alias Names in /etc/hosts File

8.1.3.3 Create Virtual Servers or Hosts

If you want to create a Virtual Server or Host, you have to select **Actions ->
Web -> Create Virtual Servers** from menu bar. Now you will be asked
whether you want to create a Virtual Host or a Virtual Server (see Figure
219).
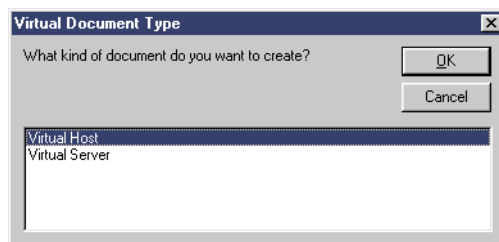
Figure 219. Creating Virtual Host

Choose **Virtual Host**. Creating a virtual server is pretty much the same
except you will be asked for the IP address instead of the hostname.
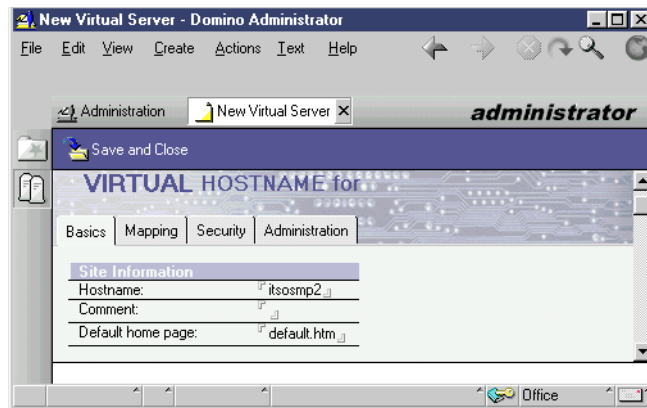
Figure 220. Virtual Server

In the `Mapping` tab, you can specify the path names mapping to the HTML directory, the Icon directory, the CGI directory, and the home URL. This tab is the same for both server types.
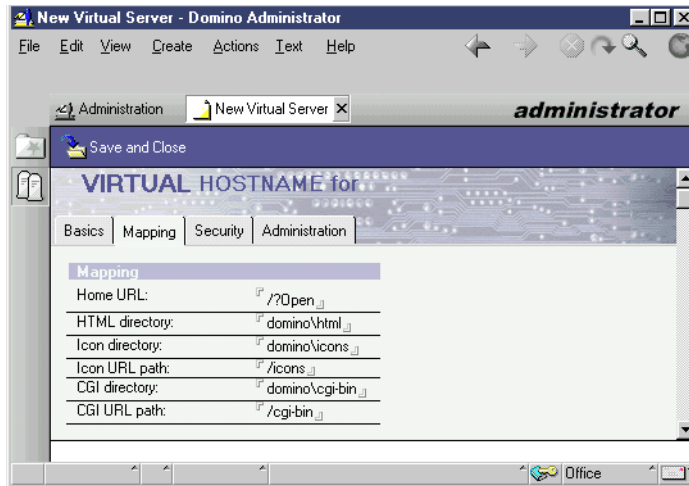
Figure 221. Virtual Server Mapping

The `Security` tab lets you make some security settings for your virtual servers. You can decide if Name and password and/or anonymous authentication can be used. You can also customize the SSL settings. For more information, please refer to 9.5, "Secure Sockets Layer (SSL)" on page 259.
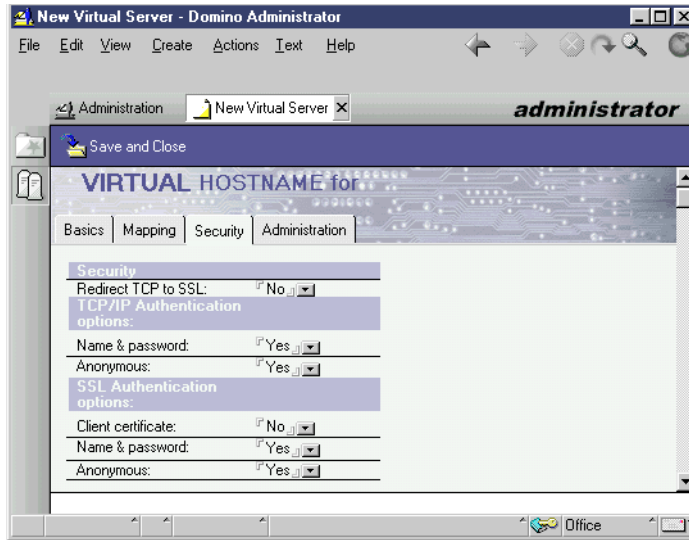
Figure 222. Virtual Server Security

8.1.3.4 Create URL Mappings

There are three different types of URL Mappings. Depending on your choice, you will get three or four tabs to configure the Mapping.

1. URL to URL mapping enables you to define an alias name for URL paths. For example, you could map `/gifs` to `/images`.
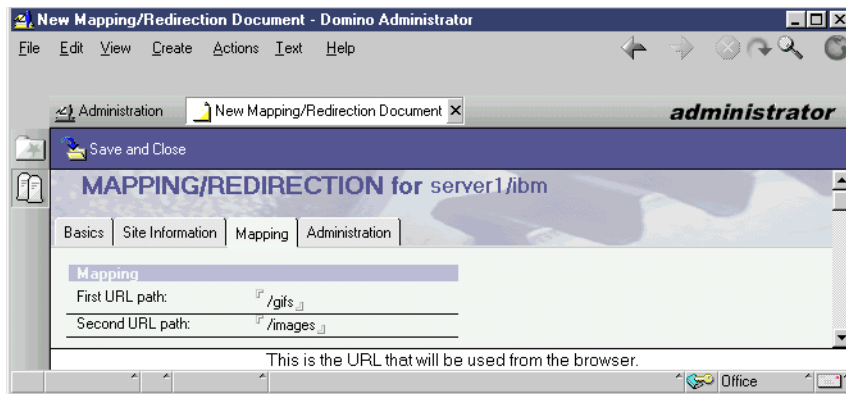
Figure 223. URL to URL Mapping

2. URL to Directory Mapping: This enables you to specify which URL path should be mapped to which real directory on your server. For example, if

you have all the images you are using in your Web pages in a directory `/web/images`, you have to create a directory mapping `/web/images` to `/gifs` to be able to access these pictures through the Internet.
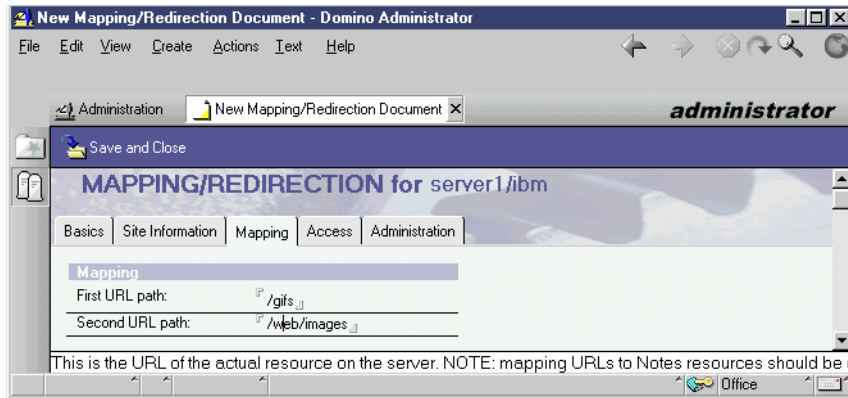
Figure 224. URL to Directory Mapping

3. Redirection URL to URL. Using this, you can move pages to a different server without making the old URL invalid.
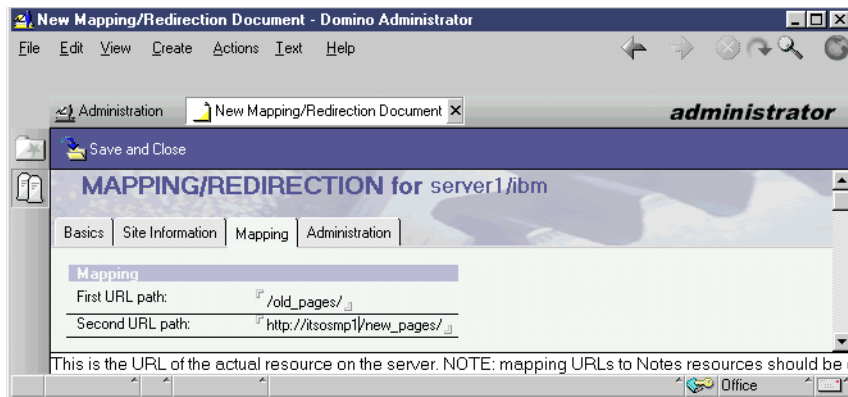
Figure 225. Redirection URL to URL

In each choice, you have to specify in the `Site Information` tab which virtual server is affected by this mapping. In the `Mapping` tab, you have to specify the actual mapping.

If you have defined a URL to directory mapping, you will also have to specify if your data can only be read or if it should be executable.

8.1.3.5 Create File Protection

One of the things really missing in Domino Release 4.x is the ability to protect flat files. In Lotus Domino R5, this can be done by choosing **Actions -> Web -> Create File Protection**. This ability might be needed in mixed environments where you have some data in the Notes databases and other data in flat files. These protection settings apply to all Web servers on a Lotus Domino R5 server.
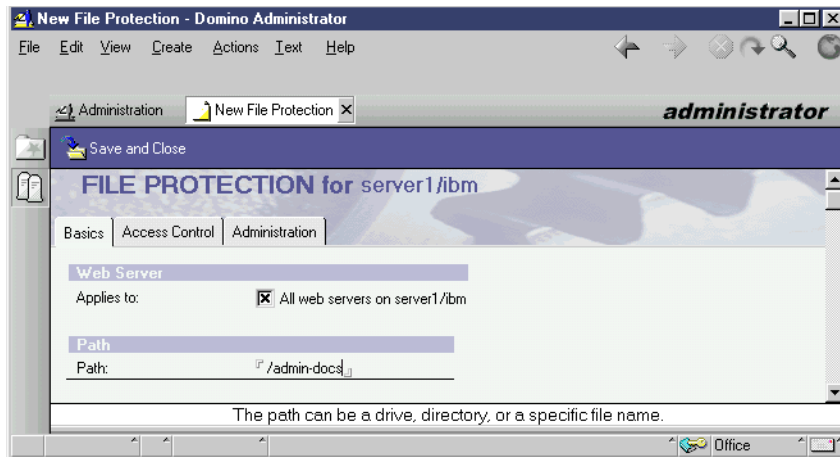
Figure 226. File Protection - Basic Setting

You can only grant access to users specified in the server's Domino Directory, even if you are allowed to enter any user. You assign these permissions by pressing the **Set/Modify Access Control List** button in the `Access Control` tab.

Figure 227. Access Control for File Permissions

There are three access levels you can assign to a user:

1. Read/Execute access (GET method)

2. Write/ Read/ Execute access (POST and GET method)

3. No Access
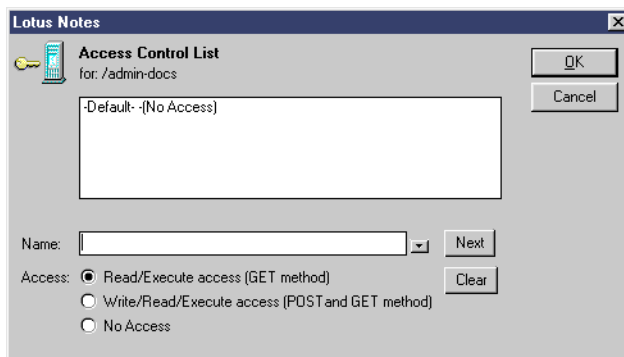
Figure 228. Access Control List for File Protection

In the Name field, you can specify the user name by typing or by using the Domino Directory lookup. After assigning the appropriate access permission, you have to press the **Next** button to apply this user to the Access Control List. To remove a user, click on the name and press **Clear**.

8.1.3.6 Create Realm

Also new in Lotus Domino R5 is the ability to set a realm in the browser authentication dialog. The browser uses the realm to determine which credentials (username and password) to send with the URL for subsequent requests. If you want to grant users access to different directories without having to reauthenticate, you should define a realm for them. You do this by choosing **Actions -> Web -> Create Realm**.
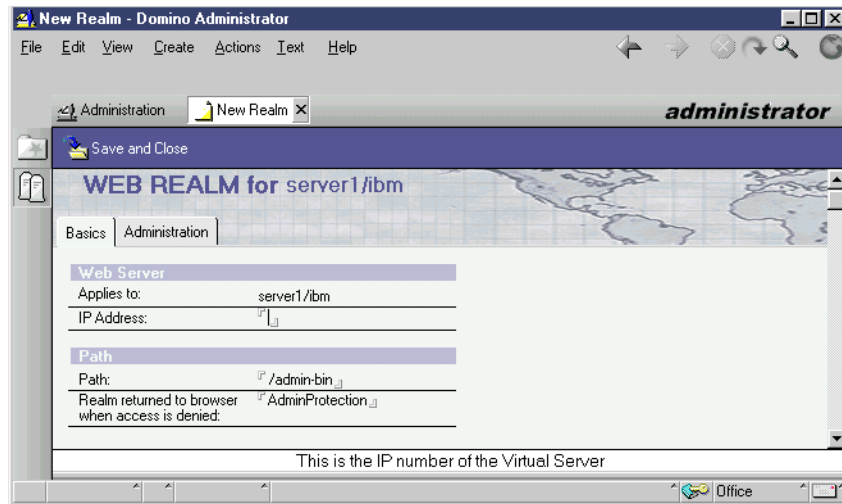
Figure 229. Creating a Realm

8.1.3.7 Domino Web Server Application Programming Interface

The Lotus Domino R5 http task provides a C API for writing extensions. It's called Domino Web Server Application Programming Interface (DSAPI). Using DSAPI, you can evaluate events that occur in the Web server. For example, an authentication request or access to a URL. DSAPI programs are built as shared libraries. A DSAPI program runs using the server id. This means it has the same access permission granted to the Lotus Domino R5 server. DSAPI is available on all server platforms. For further information, please refer to the *Release Notes: Domino Server R5* database in the doc directory of each Lotus Domino R5 server.

8.2 Internet Cluster Manager

To use the Internet Cluster Manager, you will have to set up the Domino Enterprise Server. All you need to know about it is covered in 7.5.9, "The Internet Cluster Manager (ICM)" on page 191.

8.3 Server Web Navigator

The Server Web Navigator could be compared to a Proxy server. A Notes client can access Web pages through the Server Web navigator without having access to the Internet itself. The Server Web Navigator loads a Web page from the Internet and stores it in a Notes database called web.nsf that is automatically created at the first start of the Web retrieving process. If a client requests a page that is already in web.nsf, the Server Web Navigator sends it directly to the client.

There are two options to start the Server Web Navigator. You can run the command `load web` at the server console, or you simply add `web` to the notes.ini `ServerTasks` line. It will automatically be started at each Lotus Domino R5 server restart.

To stop the Server Web Navigator simply enter `tell web quit` at the console.

If you want to connect to servers on the Internet through a firewall, you have to specify a proxy or socks server. You can do this from the Domino Administrator by clicking on the **Configuration** tab and opening the Server document for Web Navigator server. Choose the **Ports -> Proxies** tab. Please keep in mind not to use IP addresses in the `No proxy for these hosts and domains` section. You can use wildcards. For example, `*.ibm.com` would mean that all addresses in the domain ibm.com will be accessed directly.
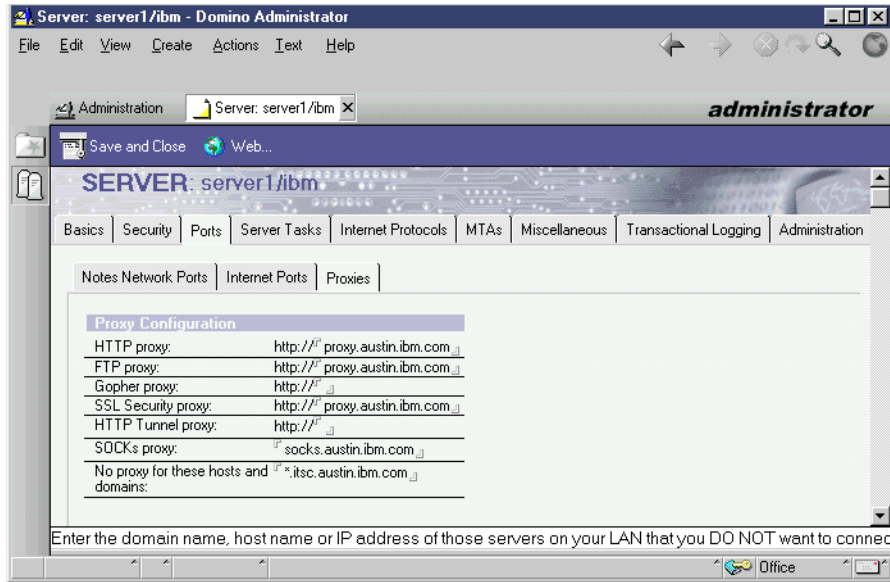
Figure 230. Server Proxy Settings

8.4 Lotus Domino R5 Web Administration Tools

You can administer your Lotus Domino R5 server using a normal Web browser by accessing the Web Administrator's database (webadmin.nsf). Lotus Domino R5 creates this database at the first start of the `http` task. Domino assigns a unique replica ID to this database. It, therefore, cannot be replicated between servers. The Web Administrator uses several system databases. If one database is missing, the Web Administrator does not show the associated command.

Perform the following setup steps:

1. Add the names of the Lotus Notes users or group going to administer the server to the access control list (ACL) of webadmin.nsf as Managers with the ServerAdmin, ServerMonitor, DatabaseAdmin, FileRead, and FileModify roles.

2. Add the names of the Lotus Notes users or group going to administer the server from a browser field in the `Security` tab of the server document in the Domino Directory.

3. Add the names of the Lotus Notes users going to administer the server to the `Run restricted LotusScript agents` field in the Agent Manager section of the server document in the Domino Directory.

4. Make sure that each User has an Internet Password set in their Person document.

5. You can further refine access to the Web Administration tool by allowing administrators to access only a subset of the available Web Administration commands by modifying the ACL.

Figure 231 shows an example of what the Web Administration pages look like.
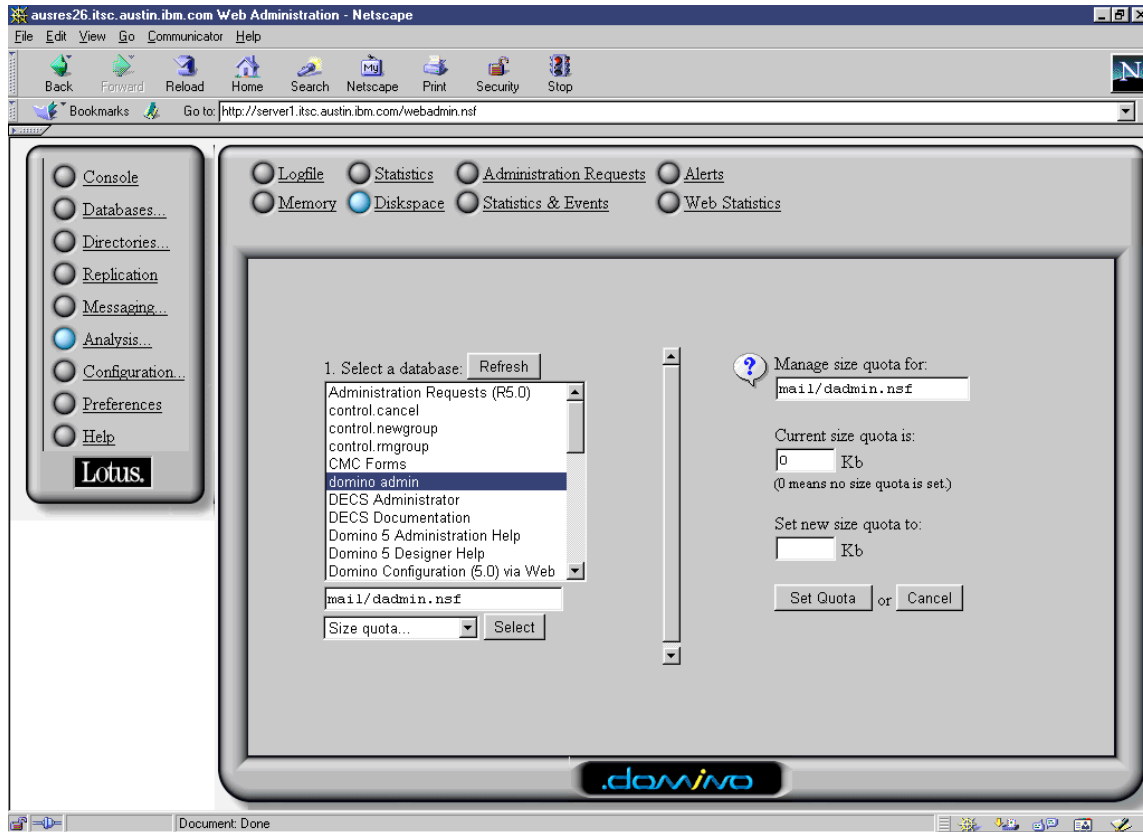
Figure 231. Web Administration Example

> **Note**
>
> When entering your user ID in the Web browser authentication window, you have to enter your Common Name, or your fully qualified name, but not your shortname. For example, our administrative user has been named domino admin. He might authorize as domino admin/ibm or domino admin, but not as dadmin.

8.5 Messaging

One of the major changes between Lotus Domino Release 4.x and R5 took place in the messaging component. Starting with Lotus Domino R5, the Simple Mail Transfer Protocol (SMTP) and the Multipurpose Internet Mail Extension (MIME) are native to Notes. There is no special SMTP message transfer agent (SMTP MTA) any more. If you selected SMTP during the Lotus Domino R5 server setup, you are ready to send messages to the Internet.

8.5.1 Setting up Notes Messaging

If you are running a stand-alone Domino Server, and you have selected SMTP at server installation, you are able to send mail to other users on your server and Internet mails to any Internet host you can reach on your network.

If you are sending a mail through SMTP, the Domino Server looks up the user's Person record in the Domino Directory for the Internet Mailing address. If there is no Internet Address specified, Domino can be configured to create the Internet address as Domino 4.6 servers did.

If you have not configured the SMTP at server installation, the following chapter will tell you how to do it manually. After making the described changes, you should either shut down your server or stop and restart the router task to activate the changes.

To stop the mail router task, type in `tell router quit` at the server console. To restart the task, type in `load router` at the server console.

> **Note**
>
> To send and receive messages from the Internet, you need to have a domain name server (DNS) up and running. Mail exchange (MX) records for your Internet Domain Name(s) and Address (A) records for your mail server have to be specified.

8.5.1.1 Setting up Internet Mailing

This chapter shows you:

- How to setup Internet Mailing manually.

- How to block so called SPAM mails.

- How to control who can route documents over a given size.

There are four things you have to configure:

1. Enabling SMTP Ports

   In order to be able to send and receive SMTP messages, the adequate mail ports have to be enabled.

   a. Start Domino Administrator.

   b. Select the desired server.

   c. Click on **Configuration** tab.

   d. Select **Servers -> Current Server Document.**

   e. Click on **Edit Server** to open the Server document.

   f. Choose **Ports -> Internet Ports -> Mail.**

   g. Enable SMTP inbound and outbound mail on port 25 (default mail port).
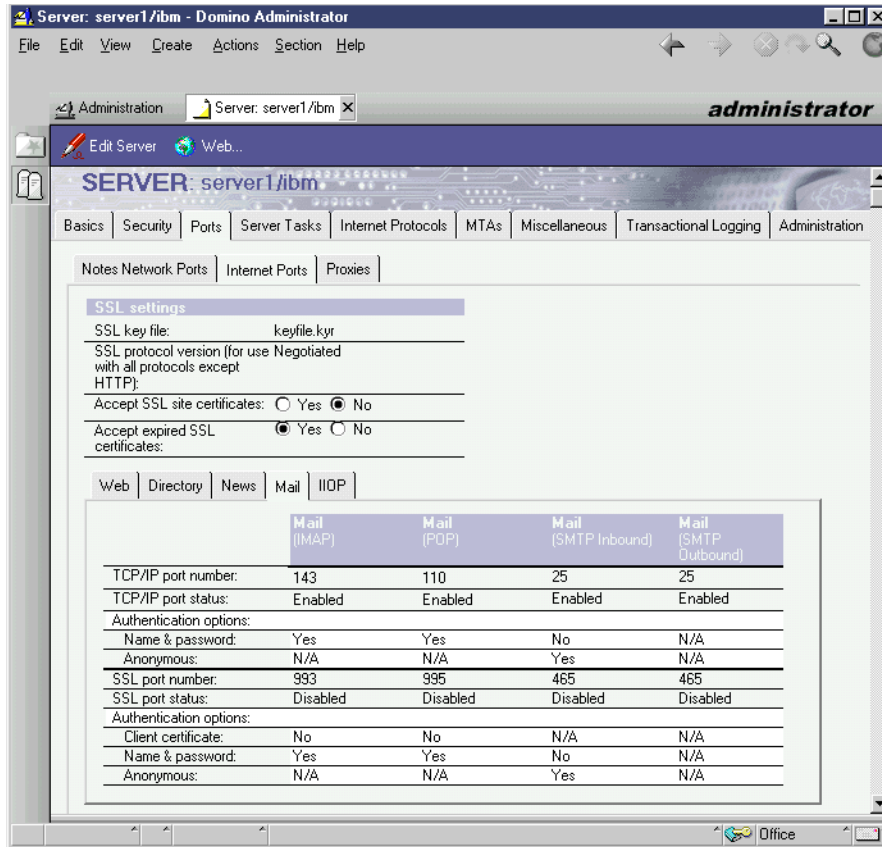
Figure 232. Configuring Internet Mail Ports

2. Enabling SMTP Listener

    The SMTP listener is a task that checks for incoming SMTP messages.
    These messages can originate from any Internet host or another Domino
    Server in your domain. If you want to receive any inbound mail, this task
    must be running.

    a. Start Domino Administrator.

    b. Select the desired server.

    c. Click on **Configuration** tab.

    d. Select **Servers -> Current Server Document**.

    e. Click on **Edit Server** to open the Server document.

    f. Choose the **Basics** tab.

g. Enable the **SMTP listener task** in the right column.

h. Save and Close the Server document.
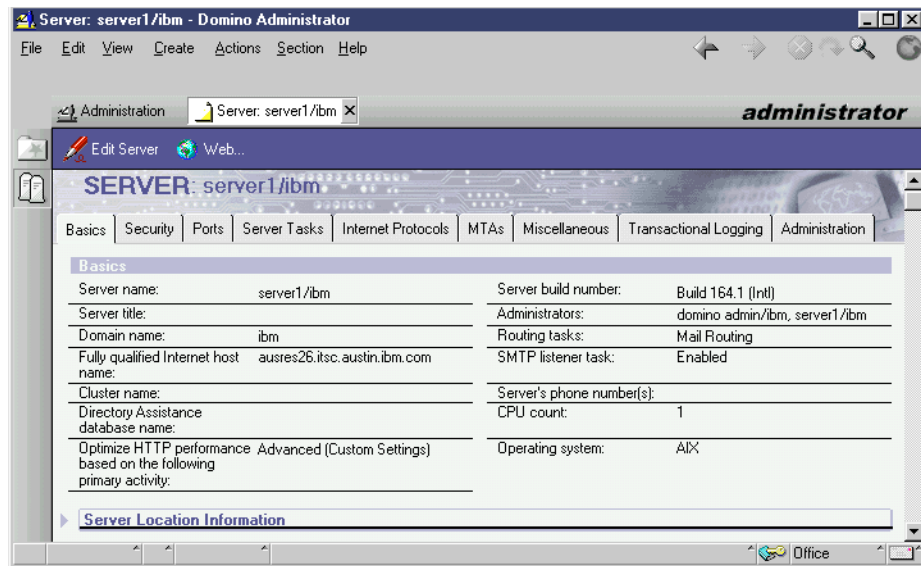
Figure 233. Enabling SMTP Listener Task

3. Enabling SMTP Outbound Messages

In order to be able to send mail to Internet addresses, you have to enable outbound routing. If you do not enable SMTP outbound traffic on all your Domino servers, you have to specify foreign SMTP domain document and Foreign SMTP connection document (see *Lotus Domino 5 Administration Help* for more information).

a. Start Domino Administrator.

b. Select the desired server.

c. Click on **Configuration** tab.

d. Choose **Messaging -> Configurations.**

e. Select your server and click on **Edit Configuration** button.

f. Choose the **Router/SMTP** tab.

g. In the `Basics` tab:

- Enable **SMTP used when sending messages outside of the local Internet domain.**

- Choose whether you want mails within your local Internet domain sent by SMTP or not (see Step 4 on page 229).

- Add a relay host. This might be needed if your network is protected by a firewall to be able to send mail to the Internet.
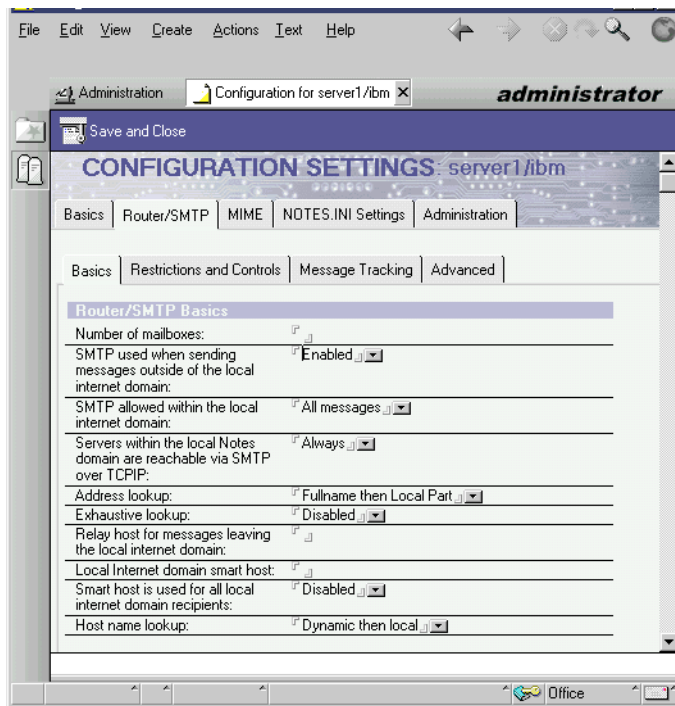
Figure 234. Messaging Settings - Basic Tab

h. In the `Restrictions and Controls` tab, you can enter many restrictions for SMTP mailing. You should consider to use the following restrictions.

- In the `Restrictions` tab, set the **maximum message size**.

- If you have problems with large amounts of unwanted mail from certain hosts, you can block these hosts in the `SMTP Inbound Controls` tab. You should enter these host in the field `Deny connections` from the following SMTP Internet hostnames/IP addresses. But, you should keep in mind that all mail from these hosts will be blocked, even those you might want to receive.

- In 9.6, "Restricting SMTP Server Access" on page 259 you will find information about how to avoid someone using your server for mail relaying and other topics concerning mail security.
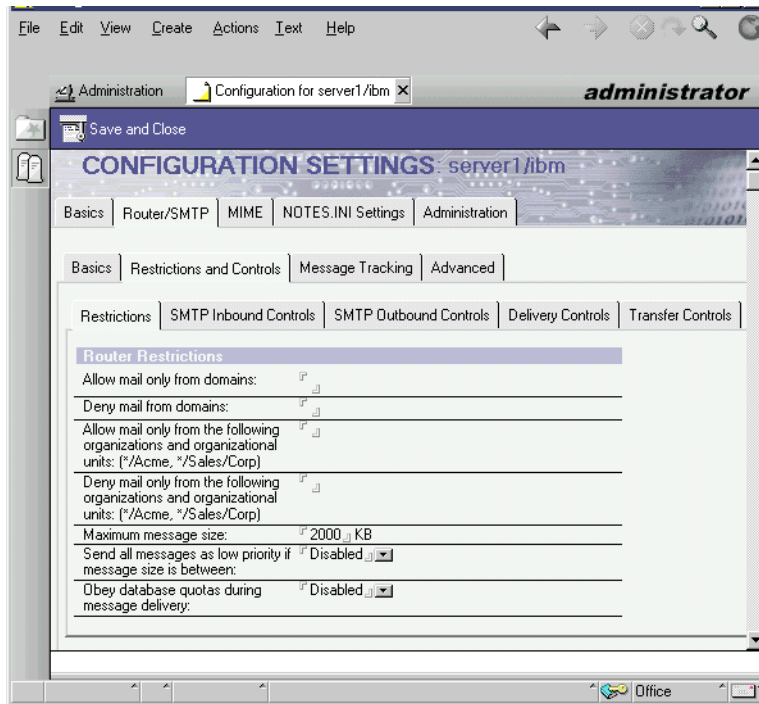
Figure 235. Messaging Settings - Restrictions and Control Tab

4. Enabling SMTP routing

> If you enable SMTP routing, mail between users within a local Notes domain can be sent using SMTP instead of traditional Notes mail routing. SMTP routing has to be enabled if you want to send mail to the Internet.

> To enable SMTP routing:

a. Start Domino Administrator.

b. Select the desired server.

c. Click on **Configuration** tab.

d. Choose **Messaging -> Configurations.**

e. Select you server and click on **Edit Configuration** button.

f. Choose the **Router/SMTP -> Basics** tab.

g. Enable **SMTP allowed within the local Internet domain** by selecting:

- **All messages**, if you want all messages to be sent through the SMTP.

- **MIME messages only**, if you want only MIME messages sent through the SMTP.

h. Save and Close the document.
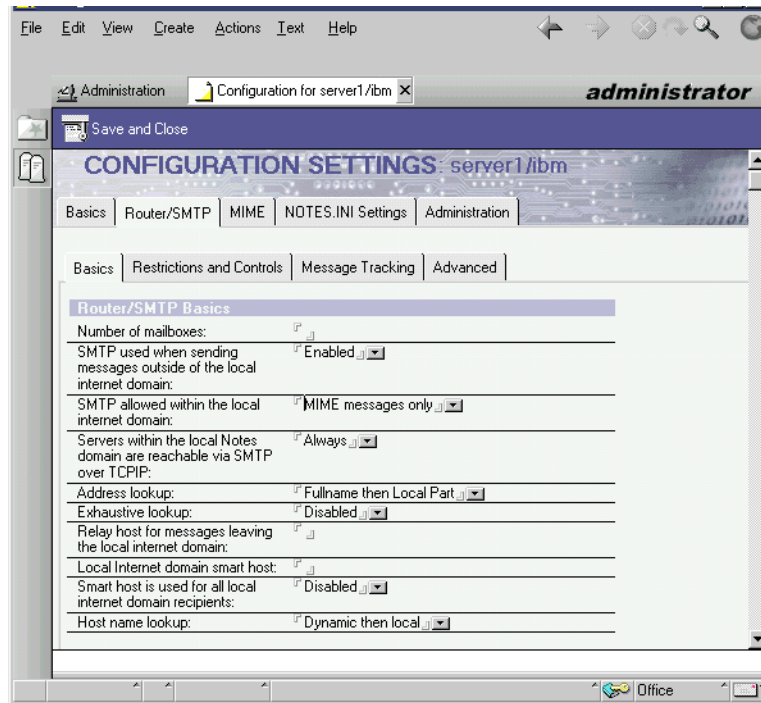
Figure 236. Enable SMTP Routing

8.5.2 POP and IMAP

Post Office Protocol Version 3 (POP3) and Internet Message Access Protocol Version 4 (IMAP4) are two wide spread Internet protocols used for e-mail messaging. POP3 allows clients, such as Netscape, Eudora Pro, or Microsoft Internet Explorer to retrieve mail from a host server. IMAP4 allows even more advanced messaging manipulation. While POP3 can only be used for off-line reading after download from the server, IMAP4 allows both off-line and on-line reading of messages. IMAP4 also permits manipulation of remote message folders in a way that is functionally equivalent to local message folders. Netscape Navigator and Microsoft Outlook 98 are examples of IMAP4 clients.

Since Lotus Domino Release 4.6, mail can be read using POP3 and IMAP4 clients. Starting with Lotus Domino R5, the mail stored in a mail database

does not have to be converted to be MIME compliant. Now MIME is a native feature. This saves time, but the most important difference to the previous version is that there is no loss of fidelity.

8.5.2.1 Starting and Stopping the POP3/IMAP Servers

There are four options for starting the Internet Mail servers.

- If you selected POP and/or IMAP when you installed Lotus Domino, the respective server task(s) will be automatically activated.

- If you want POP3 and/or IMAP4 enabled or disabled at next server start you will have to change the settings in the server document. Open the server document and go to `Ports -> Internet Ports -> Mail`. In this server document tab, you can also change the TCP/IP port used.

- If you did not select POP and/or IMAP when you installed Lotus Domino, you may start it manually using one of the following commands on the server console:

    ```
    load pop3
    ```

    for POP3, or

    ```
    load imap
    ```

    for IMAP4.

- To start the POP and IMAP server tasks automatically at Lotus Domino Server start-up, add POP3 and/or IMAP to the `ServerTasks` entry in notes.ini. For example:

    ```
    ServerTasks=POP3, IMAP, REPLICA,...
    ```

    You can verify that your Internet Mail server(s) are running by executing the command `show tasks` at the server console. The output should include a few lines similar to these:

    ```
    POP3 Server    Listen for connect requests on TCP/IP port 110
    POP3 Server    Control task
    IMAP Server    Listen for connect requests on TCP Port:143
    IMAP Server    Control task
    ```

    To shut down the Internet Mail servers, you have two options:

- Shut down manually by executing one of the following commands at the server console:

    ```
    tell pop3 quit
    ```

    for POP3, or

    ```
    tell IMAP quit
    ```

    for IMAP4.

- Deactivate the automatic start-up by removing POP3 and/or IMAP from the `ServerTasks` entry in notes.ini and then restart the Lotus Domino Server.

8.5.2.2 Preparation for an Internet Mail Client

If you want to prepare for an Internet mail client, who is not already a Lotus Notes user, and therefore, has neither a Notes mail database nor a person document, you have to create them using the new user wizard (see 6.2, "Registering a User" on page 144) or manually:

Note

If you are using the new user wizard to create the person document and the Notes mail database, deselect both locations for storing the user ID in the ID Info section.

---

1. Create a Lotus Notes mail file:

   a. Log into the Domino Administrator as an administrative user.

   b. Choose **File -> Database -> New...**

   c. In the Server field, select a Lotus Domino Server that is running the POP3 or IMAP4 server.

   d. In the title field, enter the title of the client's mail file, for example, `Jochen's Mail`

   e. In the File name field, enter a path name and file name for the mail file, for example, `mail/jweiss.nsf`.

   f. Select the template `Mail (R5.0)`.

   g. Click on **OK**.
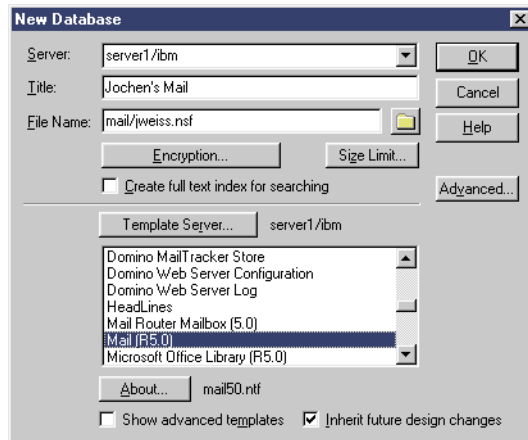
Figure 237. Create New Mail Database

2. Create a Person document:

   a. Log into the Domino Administrator as an administrative user.

   b. Open the **Domino Directory.**

   c. Choose your registration server. If you don't know how to select the registration server, please read 6.1, "Choose Other Server in Domino Administrator" on page 143.

   d. Click on the **People & Groups** tab.

   e. Select **People.**

   f. Choose **Add Person.**

   g. Complete the **Basics** tab:

      • Enter a first name, middle initial, and last name. Lotus Domino uses this to display the user's name in the People view of the Domino Directory.

      • In the User name field, enter the hierarchical name for the client.

      • In the Short name field, enter a string (without spaces), which is unique in your domain (for example, not equal to any other First, Last, or Short name in the Domino Directory). This will be used as the Internet mail client user name. You may choose the first character of the First name followed by the Last name, for example, jweiss.

• In the HTTP password field, enter the password the Internet mail client will use to log on to the server. Lotus Domino scrambles the password. This field is required.
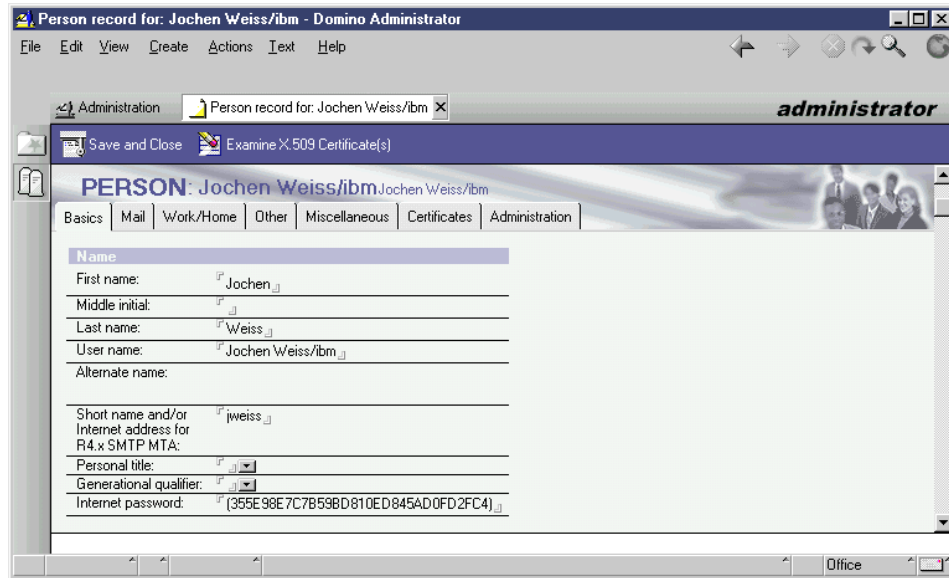
Figure 238. Person Document - Basic Tab

h. Complete the Mail tab:

- • In the Mail system field, select **POP or IMAP**.

- • In the Domain field, enter the Lotus Domino domain of the Internet mail server.

- • In the Mail server field, enter the name of the Internet mail server.

- • In the Mail file field, enter the path to the client's mail file on the Internet mail server relative to the Lotus Domino data directory. For example, enter `mail/jweiss.nsf`.

- • In the Internet address field, enter the Internet address specified in the POP3 or IMAP client.

- • In the Internet message storage field, choose **Prefers MIME**.

- • In the Encrypt incoming mail field in the Misc section, you must select **No** since Internet mail clients cannot receive encrypted mail.
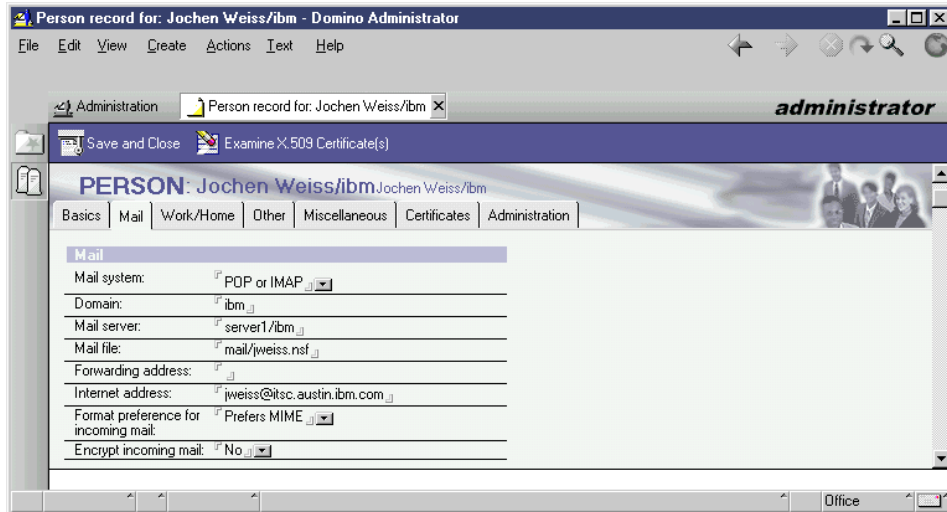
Figure 239. Person Document - Mail Tab

To make preparations to allow existing Lotus Notes mail users to access their mail from POP3 or IMAP4 clients, specify a password in the HTTP password field of their existing Person documents. Also, configure the Internet mail clients so that mail is not automatically removed from the server since, otherwise, they cannot be read from the Lotus Notes client after retrieving them through the Internet mail client.

8.5.2.3 Enabling a Mail Database for IMAP access

If you want to use IMAP to access your mails, the mail database template has to be based on the Lotus Domino R5 mail template mail50.ntf. The mail database has to be prepared for IMAP by using the server console command:

```
load convert –m mail/jweiss.nsf
```

The option `–m` indicates conversion for use of IMAP. `mail/jweiss.nsf` is a sample path and mail database name. You can also use wildcards to specify the mail database name. By adding `*` `mail50.ntf` to the command, the database template is upgraded to the Lotus Domino R5 mail template.

For information about how to setup a POP3 or a IMAP4 Client please refer to redbook *Lotus Domino Release 4.6 on IBM RS/6000*, SG24-4694-02.

8.6 NNTP

Network News Transfer Protocol (NNTP) is an Internet protocol for reading and distributing Network News or newsgroups. It is used both for client-server connections and for communications between servers. It is an alternative to setting up a mailing list using direct mail to distribute messages. Such remailing is inefficient when the number of subscribers grows beyond a dozen or so people. What you really want is efficient, centralized storage of messages that people can access if and when they need them. NNTP provides means for distribution, inquiry, retrieval, and posting of news articles using a reliable stream client-server model. NNTP is designed so that news articles need only be stored on one host while subscribers on other hosts may read news articles over TCP/IP connections, thereby, minimizing the disk and CPU resources necessary on the client hosts.

The following NNTP features are supported by Lotus Domino R5.

- Support for Notes Release 4.6 clients and above, standard newsreader clients, and Web browser clients
- Support for USENET newsgroups that are distributed across the Internet
- Support for private newsgroups for use within your organization
- Distribution of news articles using NNTP feeds to and from other NNTP servers
- Security for servers, including the security features
  - Anonymous access
  - Basic authentication
  - Secure Sockets Layer (SSL) encryption and authentication
- Archiving of newsgroup articles

8.6.1 Starting and Stopping a NNTP Server

There are three options for starting the NNTP server:

- If you selected NNTP when you installed Lotus Domino, the NNTP server task will be automatically activated.
- If you did not select NNTP when you installed Lotus Domino, you may start it manually using the following command at the server console:

      load nntp

- To start the NNTP server task automatically at Lotus Domino Server start-up, add NNTP to the `ServerTasks` entry in notes.ini. For example:

      ServerTasks=NNTP, REPLICA, ROUTER, UPDATE, ...

You can verify that the NNTP server is running by using the command `show` `tasks` at the server console. The output should include a few lines similar to these:

```
NNTP Server        Scheduler
NNTP Server        Listen for connect requests on TCP Port:119
NNTP Server        Control task
```

To shut down the NNTP server, you have two options:

- Shut it down manually by executing the command `tell nntp quit` at the server console.

- Deactivate the automatic start-up by removing NNTP from the `ServerTasks` entry in notes.ini and then restart the Lotus Domino Server.

8.6.2 Configuring Newsfeeds

Lotus Domino R5 has four types of newsfeeds: Accept, Push, Pull, and Push-Pull. A push newsfeed allows your Lotus Domino Server to connect to a remote NNTP server and send new articles to that server. A pull newsfeed connects to a remote NNTP server and requests new articles from that server. A pull-push newsfeed will copy articles in both directions. If you want another NNTP server to be able to initiate a push newsfeed to your server, you need to set up an accept newsfeed. Please refer to the Lotus Domino R5 documentation for more information.

Note

Prior to configuring a newsfeed, you have to contact your Internet newsfeed provider or the administrator of the remote news server. The newsfeed won't work unless the remote administrator permits it.

To connect to another news server, you have to create a connection document in the server's Domino Directory. In Domino Administrator, click on **Configuration -> Server -> Connections Documents**. Select the server running the NNTP task. Click on **Add Connection**.
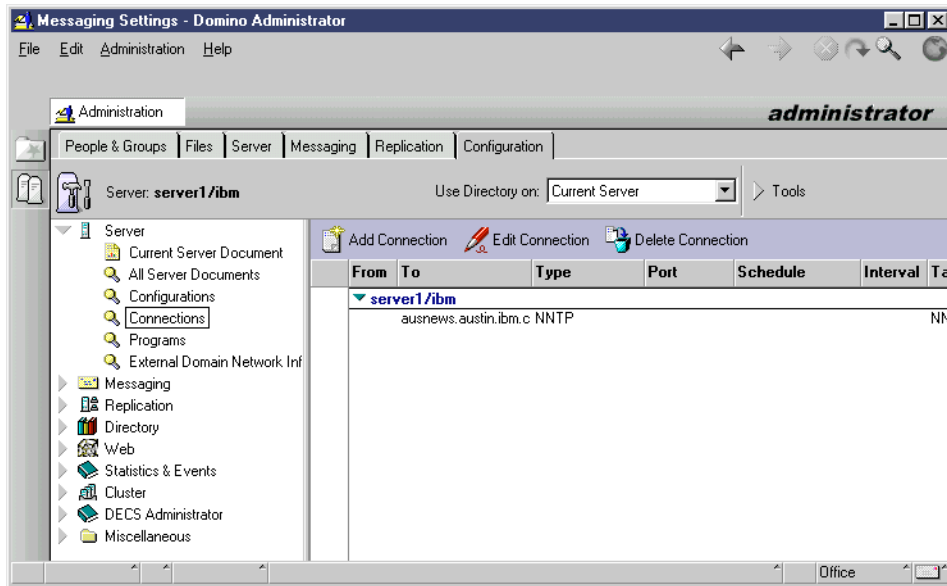
Figure 240. Adding NNTP Connection

On the `Basics` tab, you have to specify the `Connection type` as `News/NNTP Feed` and the Destination server, which is the news server you want to connect (see Figure 241).
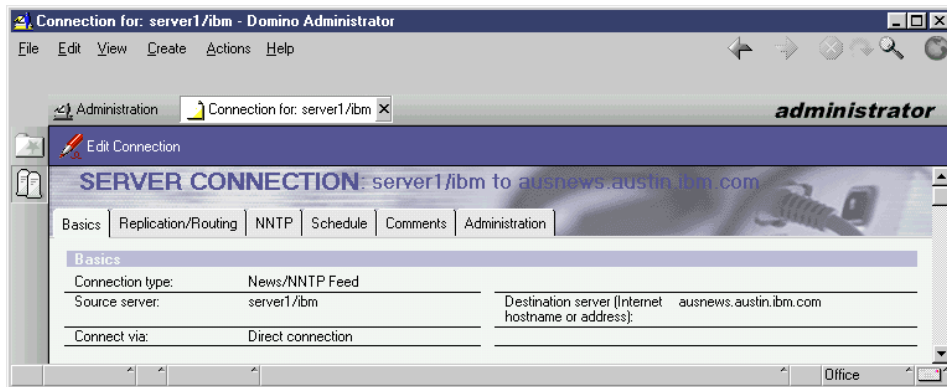
Figure 241. NNTP Server Connection - Basic Tab

Next you have to click on the **NNTP** tab. Here you choose the **News feed type**, the `Authentication` as agreed with the administrator of the remote news server, whether you want your server to create new newsgroups automatically or not, and the names of the remote newsgroups you want to be

downloaded to your news server. You can use wildcards to specify the newsgroups, e. g. *. or ibm.*.
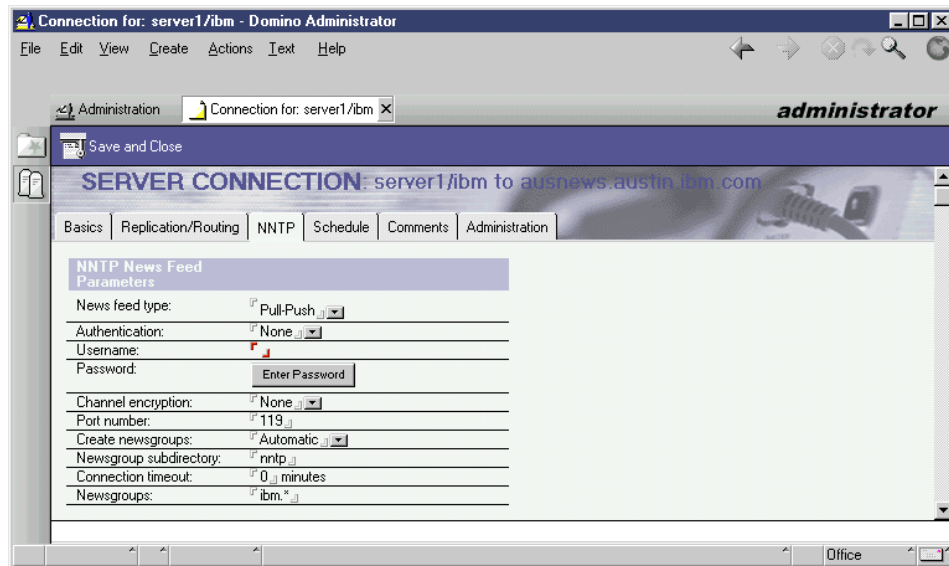
Figure 242. NNTP Server Connection - NNTP Tab

That's all you need for the first set-up of the newsfeed.

Notes

Access control lists for newsgroups are not distributed through an NNTP newsfeed. If you include private newsgroups in a newsfeed, you must trust the remote NNTP server to enforce the access control policy. To enforce access control for private newsgroups within your organization, you should use Lotus Domino replication instead of an NNTP newsfeed.

8.6.3 Creating a Newsgroup

A newsgroup on a Lotus Domino R5 server is a Notes database created using the NTTP Discussion template in the nntp directory. Make sure that the userid you are using is allowed to create new databases. Follow these steps to create a newsgroup itso.redbooks.aix.domino on server1/ibm.

1. Start Domino Administrator.

2. Choose **File -> Database -> New**.

3. In the Server field, select `server1/ibm`.

4. In the file name field, enter **nntp/itso.redbooks.aix.domino.nsf**.

5. Select server **server1/ibm** as the template server and highlight the template NNTP Discussion (R5.0). Your dialog box should now look similar to the one below.
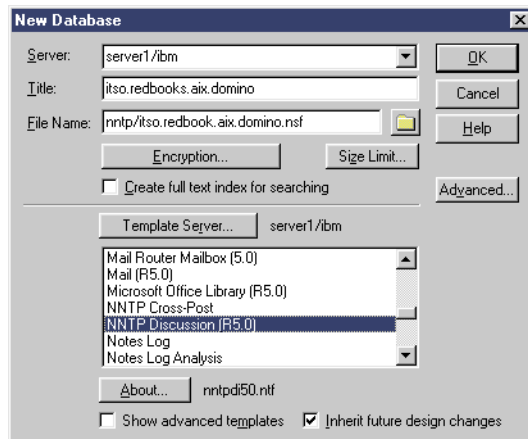
Figure 243. Create a Newsgroup Database

6. Click **OK** to create the database. It might take a little while before you see the next window.

7. The next window you should see is the Database Profile window for the database you just created (see Figure 244). There might also be an About... window popping up, but it is safe to close it down. Verify that the settings are the ones you entered when you created the database. The Database Profile Editor field will be filled in with the creator of the database. You might want to add people or groups to this field. By checking Private, you make it a private newsgroup. Private newsgroups can be moderated or not. When you're done, click on **Save and Close**.
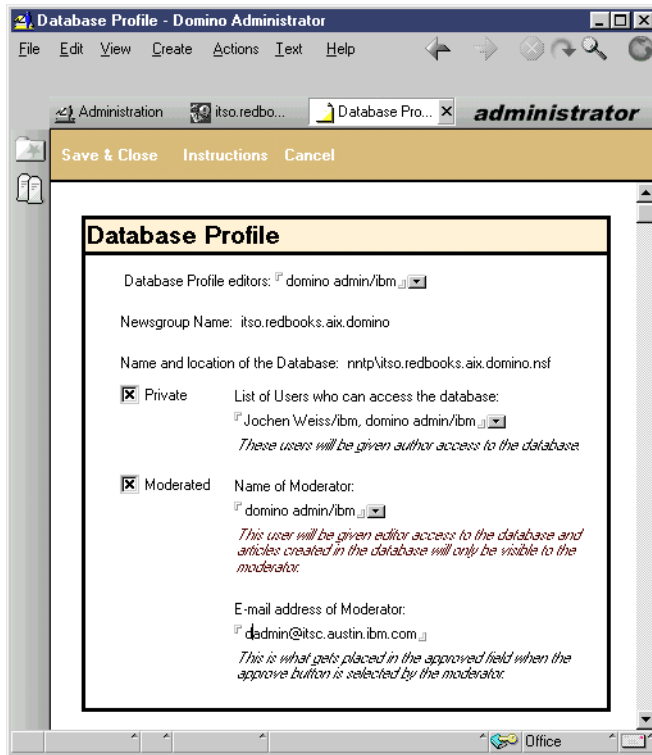
Figure 244. Newsgroup Database Profile

Congratulations! Your newsgroup has been created, and you can start posting news articles to it. If the NNTP server task is running, NNTP clients can also connect and post news articles at this time.

Note

The newsgroup may not be visible to NNTP clients and remote NNTP servers for up to two hours. To make the newsgroup immediately visible, type `tell nntp quit` and then `load nntp` to stop and then restart the NNTP server.

8.7 LDAP

The Lightweight Directory Access Protocol (LDAP) is an Internet standard protocol that has evolved to meet the needs of sharing information in a directory between computers that might be on different networks using different operating systems and different applications. LDAP is quickly

gaining wide acceptance as the directory access method of the Internet and is, therefore, also becoming strategic within corporate intranets. It is being supported by a growing number of software vendors and included in a growing number of software applications.

8.7.1 Lotus Domino R5 and LDAP

Lotus Domino R5 LDAP service supports the following features:

- LDAP v3 and v2
- Different access protections including anonymous access to specified fields, user and password authentication, SSL and X.509 certificates, and others
- Support of third-party LDAP clients
- Use of LDAP clients to add, delete, and modify directory entries
- Schema publishing and customization
- Searches based on alternate languages

8.7.2 Installation and Configuration

The Lotus Domino R5 LDAP server task is automatically installed when you install Lotus Domino R5. There is no need to install additional software to enable Lotus Domino to function as an LDAP server. There is also very little extra configuration needed. The following is a quick overview of the steps involved in turning Lotus Domino into an LDAP server.

1. Configure LDAP server security including who is authorized to access the directory and whether or not to encrypt and sign transfers.
2. Create full-text index of the Domino Directory on the server that runs the LDAP service.
3. If you are using more than one Global Domain, specify which one the LDAP service should use to form Internet addresses.
4. Load Domino LDAP task.
5. Configure LDAP clients to connect to LDAP server.
6. (Optional) Customize the default LDAP service configuration.
7. Check if the LDAP service is set-up correctly.

These are the steps you have to perform to configure your LDAP task:

1. Start Domino Administrator.
2. Select the desired server.

3. Click on **Configuration** tab.

4. Select **Servers -> Current Server Documents.**

5. Click on **Edit Server** to open the Server document.

6. Choose **Ports -> Internet Ports -> Directory.**

7. Set the LDAP port (it is best to keep the default port), enable the service, and choose the appropriate authentication options.
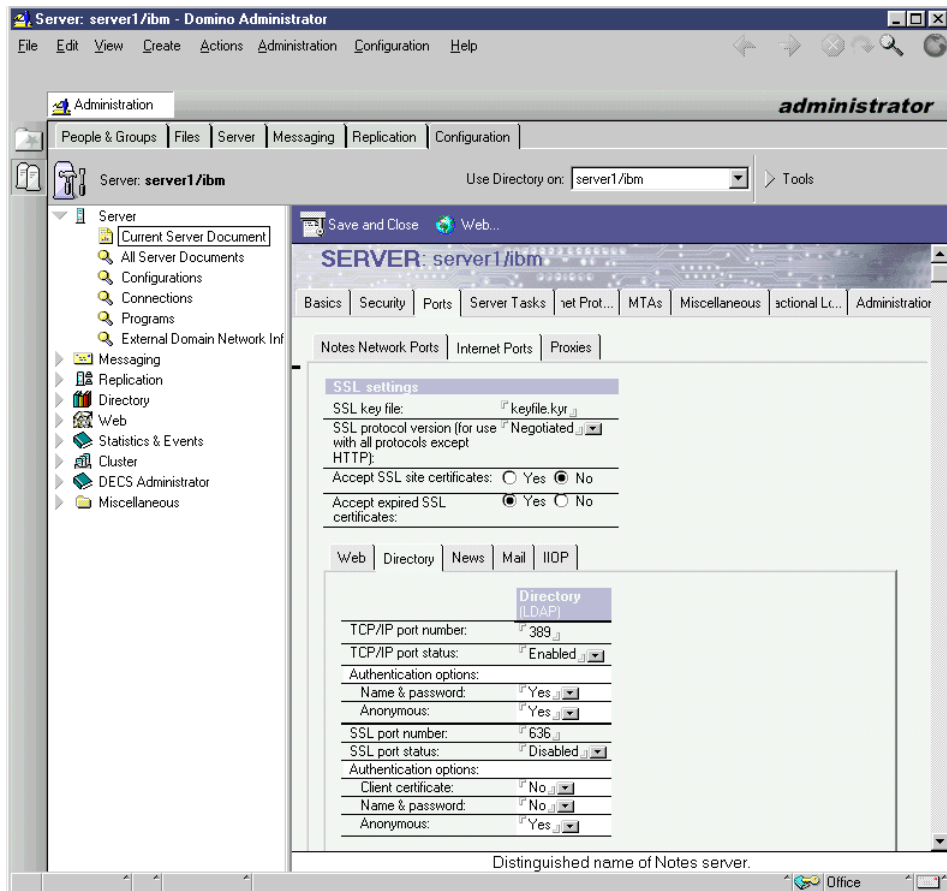
Figure 245. LDAP Configuration

8.7.3 Starting and Stopping the LDAP Server Task

There are three options for starting the LDAP server:

1. If you selected LDAP when you installed Lotus Domino, the LDAP server task will be automatically activated.

2. If you did not select LDAP when you installed Lotus Domino, you may start it manually using the following command at the server console:

```
load ldap
```

3. To start the LDAP server task automatically at Lotus Domino Server start-up, add LDAP to the `ServerTasks` entry in notes.ini. For example:

```
ServerTasks=LDAP, REPLICA, ROUTER, UPDATE, ...
```

You can verify that the LDAP server is running by using the command `show tasks` at the server console. The output should include a few lines similar to these:

```
LDAP Server          Listen for connect requests on TCP Port:389
LDAP Server          Control task
```

To shut down the LDAP server, you have two options:

1. Shut it down manually by executing the command `tell ldap quit` at the server console.

2. Deactivate the automatic start-up by removing LDAP from the `ServerTasks` entry in notes.ini and then restarting the Lotus Domino Server.

The show tasks console command should now show no more LDAP entry.

Chapter 9. Security

Security of AIX and Lotus Domino are each very extensive topics and cannot be completely covered in this redbook. However, it should be noted that, to ensure maximum security, the features of both must be considered and configured appropriately. Weaknesses in one or the other may lead to a security breach since both are open standards-based environments providing many possible types of local and remote access.

It is important to remember that both physical access to the machine and remote access through the network are equally important to the protection of the data stored therein.

This chapter does not discuss all of the possible security implications or the methods by which attacks can be prevented but is intended to point out the main areas for consideration and how better security might be achieved.

The redbook *Lotus Domino Release 4.6 on IBM RS/6000*, SG24-4694-02 should be referenced for the majority of the material that has not changed from previous releases of the server.

9.1 AIX File System Security

All file system objects (including files, directories, special files, link files, symbolic link files, and pipes) have security mechanisms associated with them. The most commonly used is the access control list (ACL), but the following additional ways of controlling file security can be used:

Base ACLs   Specifies the permissions for the owner, group, and others. These permissions are controlled through the `chmod` command.

Extended ACLs   Provides finer access control than the base ACLs.

Status of Extended ACLs
                          The extended ACL must be enabled for a file system object; otherwise, the extended ACL is ignored.

Owner ID   This is the user ID of the owner of the file system object. Only this user ID has the permissions granted for the owner of the object.

Group ID   This is the ID of the group associated with the object. Only members of this group have the permissions granted for the group associated with the object.

245

Sticky bit	If the sticky bit is set for a directory, only the owner of the directory or the owner of a file can delete or rename a file within that directory. This can be set with the `t` flag with the `chmod` command.
TCB bit	If the TCB bit is set for a file system object, it identifies that object as part of the Trusted Computing Base (TCB).
umask	The umask environment parameter specifies the default permissions for any file or directory created.
Status of the file system	A file system can be mounted with read/write or read-only permissions.

Follow these guidelines when dealing with file system objects:

- In general, do not use extended ACLs. For most systems, base ACLs are sufficient for administration. If you do need the extra security control provided by extended ACLs, use them only when necessary and in an organized manner. Maintaining relevant entries in many extended ACLs can become very time-consuming. Also, do not use extended ACLs at all if you are in a heterogeneous network because they are only recognized by AIX systems.

- Use the *sticky bit* on directories where everyone has write permissions. For example the /server1/notesr4/mail directory for Lotus Domino.

- Protect user .profile files with 740 permissions.

- Do not let users have write access to system directories.

- Do not change permissions on any files or directories installed as part of the system. Changing those permissions affects system integrity.

9.1.1 Validating the User Environment

The commands `pwdck`, `usrck`, and `grpck` can be executed by root or any user in the security group to clean up after a change to the user configuration. Because they run with root permissions, they give administrative users the ability to make necessary changes to the /etc/security/passwd file in a controlled way without knowing the root password.

The `usrck` command verifies the validity of the user definitions in the user database files by checking the definitions for ALL the users or for the users specified by the user parameter. You must select a flag to indicate whether the system should try to fix erroneous attributes.

All the options for `pwdck`, `usrck`, and `grpck` are as follows:

-n reports errors but does not fix them.
-p fixes errors but does not report them.
-t reports errors and asks if they should be fixed.
-y fixes errors and reports them.

9.1.2 Documenting Security Policy and Setup

The documentation on security policy is a very important part of the system security. It is used to:

- Identify the different types of users and what data they will need to access.
- Organize groups around the type of work that is to be done.
- Organize ownership of data to fit with the group structure.
- Set save-text (SVTX) on shared directories.
- Remember that UNIX/AIX has no concept of application ownership.

AIX security, in itself, only controls access to the system and its files and directories. Once an additional application (for example, Lotus Domino) is installed, you must further the application security by using tools within Lotus Domino. This last function cannot be provided for by AIX.

9.1.3 Network File System Security

The Network File System (NFS) is widely know as being a security risk. We strongly recommend not to use NFS on any server running Domino Servers. You should disable NFS if it is installed. If you have to use NFS for whatever reason, please read 9.1.3.2, "NFS Export Security" on page 247.

9.1.3.1 Disabling the NFS Daemons

To stop the NFS daemons and remove their /etc/inittab entry, execute the following command as root user:

```
/usr/sbin/rmnfs -B
```

All NFS daemons will be stopped immediately. No NFS daemons will be started after system restart.

9.1.3.2 NFS Export Security

When using NFS, never export a read-write file system without restricting the hosts' access. You have to specify the hosts that are allowed to mount the file system. If you don't, all the hosts connected to your IP network will be able to mount your file system. This might be your LAN, your company, or possibly the entire Internet depending on your site's setup.

You have to pay attention to the groups and user numbers of your file system while exporting it. If you are exporting a file system with files owned by a regular user, ensure that, on the machines that mount this file system, the same user exists with the same user ID.

For example, an NFS server exports a file system with files owned by a user with user ID 210. A host mounts this file system and has another local user with the same ID. This local user will own these files and will be able to do anything with them. This means, of course, that you must trust the remote host completely. A user with root access to the remote host could easily create users with UIDs matching those on the exported file system, and, thereby, gain read or write access to the files.

9.2 AIX Security Checklist

The following list is intended to serve as a basic reminder of the most important things to keep in mind when trying to secure your AIX server. It is not a detailed list; however, AIX security is a very large topic, and we can only begin to scratch the surface in this redbook. Don't believe that this list tells you everything that you need to know about AIX security because it doesn't. Also, when designing secure AIX servers, new issues will appear as well as new methods to deal with those new issues. Keep this in mind, and you are well on your way to achieve AIX security awareness.

- Keep your servers and server consoles physically protected (locked away) and restrict access to as few people as possible.
- If you are on the Internet, set up router filters or firewalls to minimize the number of services accessible from outside your domain.
- Examine carefully the services offered by inetd and the portmapper. Eliminate any that aren't explicitly needed. A Lotus Domino Server will probably need a minimum of AIX services; most can be disabled. Use an inetd wrapper if you can, if, for no other reason, than to log the sources of connections to your host. This will help you to detect and prevent network attacks.
- Protect your root account as well as you can. Restrict root access to one, or very few, persons.
- Disable root network logins.
- Don't run NIS unless it's absolutely necessary. Use NFS as little as possible.
- Never export NFS filesystems unrestricted to the world. Specify fully-qualified host names when exporting. Export file systems read-only when possible.

- Fortify and protect Lotus Domino Servers. Don't allow any regular AIX user accounts on these hosts. If you need an AIX server where many users will use the Lotus Notes client, set up a separate server for that task.
- Use shadow passwords and the password restriction parameters in AIX to disallow poor passwords. Enable password check methods to ensure good user passwords. Disable or delete unused/dormant system or user accounts.
- Force users to change their passwords every once in a while. Don't overdo it, however. If users need to change their passwords too often, they tend to write them down instead of memorizing them. The root password is an exception to this rule. Change it often and make sure it is safe.
- Install all AIX security patches as soon as possible on all of your hosts.
- Eliminate trust relationships unless there is an absolute need for it. Create a cron job to remove .rhosts files that have not been authorized.
- Check your log files regularly. They are your key to uncovering any attempts to compromise system security.
- Use all available tools that can help you check your system. There are many good tools in the Public Domain that you can use.
- Keep abreast of current literature and security tools; communicate to others about security problems and incidents. Read security newsgroups and subscribe to the various security mailing lists on the Internet. You can find a subscription Web page at:
  `http://www.rs6000.ibm.com/resource/maillist.html`.

There are many resources on the Web relating to AIX security. We can't list all of them here, but a very good starting point for finding information is:
`http://www.ers.ibm.com/security-links/index.html`.

9.3 System Security

In order to make your server as secure as possible you should limit the access to the system. This also includes physical access to the server.

- Place your server in a special room with access for only a few people.
- Always secure the server console.
- Make full system backups regularly.
- Make backups of your data at least once or twice a day (for example, by using ADSM).
- Store backup tapes in other locations (never in server room) and lock them away.
- Consider using an Uninterruptible Power Supply (UPS).

- Only create administrative user accounts.
- Limit Telnet access to the server.
- Limit FTP access to the server.
- Do not use sendmail.
- Do not use NFS (see 9.1.3, "Network File System Security" on page 247).
- Do not run HTTP daemons.

9.3.1 Telnet Security

You should limit the number of users who have telnet access. You can disable telnet and `rlogin` for a user using SMIT.

Execute `smitty user` in a root shell. Select **Change / Show Characteristics of a User** and press **Enter**. Enter the name of the user or function key 4 (`F4`) and select the user and press **Enter**. Change the settings `Another user can SU TO USER?`, `User can LOGIN?` and `User can LOGIN REMOTELY?` to `false`. You do this by selecting the setting and pressing the Tab key until `false` is shown. Now your screen should look like this:

```
                 Change / Show Characteristics of a User

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

 [MORE...4]                                      [Entry Fields]
   Group SET                                    [notes]              +
   ADMINISTRATIVE GROUPS                        []                   +
   ROLES                                        []                   +
   Another user can SU TO USER?                  false               +
   SU GROUPS                                    [ALL]                +
   HOME directory                               [/server1]
   Initial PROGRAM                              [/usr/bin/ksh]
   User INFORMATION                             []
   EXPIRATION date (MMDDhhmmyy)                 [0]
   Is this user ACCOUNT LOCKED?                  false               +
   User can LOGIN?                               false               +
   User can LOGIN REMOTELY?                      false               +
   Allowed LOGIN TIMES                          []
   Number of FAILED LOGINS before               [0]                  #
 [MORE...32]

 F1=Help            F2=Refresh         F3=Cancel          F4=List
 F5=Reset           F6=Command         F7=Edit            F8=Image
 F9=Shell           F10=Exit           Enter=Do
```

Figure 246. Change User Characteristics

Press **Enter** to make the changes. Now remote login through Telnet. The rlogin is now disabled for this user.

> **Note**
>
> Even if you disable login and remote login for a user, FTP access is still possible.

9.3.2 FTP Security

If you want to restrict access to your server you should also disable the FTP access. If you disable access through the Telnet and rlogin, FTP access is normally still possible. There are several ways to disable FTP access.

1. If you do not need FTP access at all, disable FTP completely.

2. You can also disable FTP access to a certain user only, but you can do this only if Telnet access for this user is also disabled. There are two methods of doing this:

   - Redo the steps described in 9.3.1, "Telnet Security" on page 250 and also set `Is this user ACCOUNT LOCKED?` to `True`. Now neither Telnet, rlogin, nor FTP access is possible.

   - Edit the file /etc/passwd using vi while logged on as root. You have to change the line containing the user. For example, change the exclamation mark in the line

     `notes:!:201:201::/server1:/usr/bin/ksh`

     to `NOLOGIN`. It should look like this:

     `notes:NOLOGIN:201:201::/server1:/usr/bin/ksh`

     You do this by placing the cursor on the exclamation mark, type `cw` and enter `NOLOGIN:`. Press **Escape** to enter command mode. Enter `:wq` to write and close the file. For information about vi, please refer to Appendix D, "Using UNIX's vi Editor" on page 361.

9.3.3 AIX User Accounts

A separate user account should be created for each Domino Server instance, and each of these user names should be a member of the notes group only.

All currently active users are logged in /etc/utmp. The commands `who` and `who /etc/utmp` show all the currently logged in users. All user logins are logged to /var/adm/wtmp. The command `who /var/adm/wtmp` shows all user logins since the creation of the log file. The administrator can track all login sessions by viewing these logs.

9.4 Domino Server Protection

Many of the security features are unchanged in R5. Details are provided regarding changes that have been implemented.

After installation, a Domino Server has relaxed security against access by Notes clients assuming that they already have legitimate ID files or browser clients. It is up to the administrator to ensure that all necessary precautions are undertaken to harden the server before making access available.

Recommendation

To ensure that all security mechanisms are covered, disable all access and then re-enable only the specific areas of access that are known to be required.

Having to remember to enable a feature is much less of a risk than having to remember to disable one as security may already have been breached.

9.4.1 Access During Domino Server Setup

The http httpsetup task can be loaded on the server to provide access for an administrator to perform server setup since there is no client for AIX that can be executed locally on the machine.

Once the setup forms have been completed in the setupweb.nsf database with details, such as domain, certifier name, server name, and administrator name, they are submitted to the server for the setup task to process.

Note

The field details from the form are sent in *clear text* format to the server; so, ID names and password details are vulnerable during this time.

One last concern is that the administrator may use FTP to retrieve copies of newly created certifier, server, or administrator ID files. Using an unsecured FTP session means that the contents of the ID files are vulnerable to network sniffers during transit between the server and the receiving machine.

9.4.2 Domino Server Access and Network Connectivity

The following sections of the Security tab of the server document should be reviewed and configured appropriately to limit initial access to the server

through Notes or Web browser clients or the execution of agents on the server.

1. Security Settings
2. Server Access
3. Web Server Access

   Web Server Access is a new configuration setting available on the server document. It contains a field named Web server authentication that allows the administrator to choose what type of names will be accepted during name and password authentication. Figure 247 on page 254 shows this field near the top right of the form beside the Security Settings section.

   The following table describes the options and their meanings.

Table 17. Web Server Authentication Definitions

Settings	Results
More name variations with lower security	User can enter any of the following and Domino will try to match it in the Domino Directory: Last name First Name Short name Alternate name Common name Full hierarchical name Alias names Soundex number
Fewer name variations with higher security	Users can enter only one of the following names: Common name Full hierarchical name Alias name Alternate name

   By restricting the number of available entries, a hacker is less likely to find a match by guessing a user name.

4. Passthru Use
5. Agent Restrictions
6. IIOP Restrictions

   The inclusion of support for CORBA-based application communication between applets and the Web server requires a level of security. This is implemented in a similar fashion to the familiar agent restrictions from previous releases.

The options Run restricted Java/Javascript and Run unrestricted Java/Javascript can be found in the IIOP Restrictions section of the Security tab on the server document.
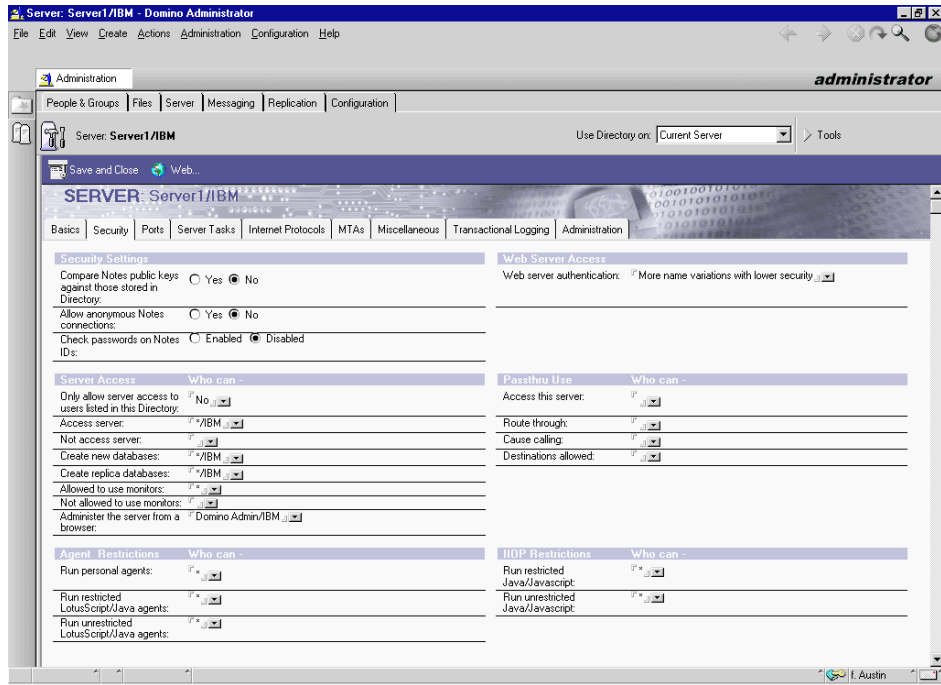
Figure 247. Restricting Server Access and Execution of Java/JavascriptApplets

---

Note

These fields should be populated with the appropriate groups to restrict access and provide easy administration.

To restrict access through Internet standard protocols, the following sections of the Ports-Internet Ports tab should be considered:

- HTTP (Web)
- SSL

It is now possible to specify the SSL ciphers that the server will accept when negotiating an SSL connection with a client. These can be found in the SSL ciphers field of the SSL Security section of the Ports-Internet Ports-Web tab of the server document.
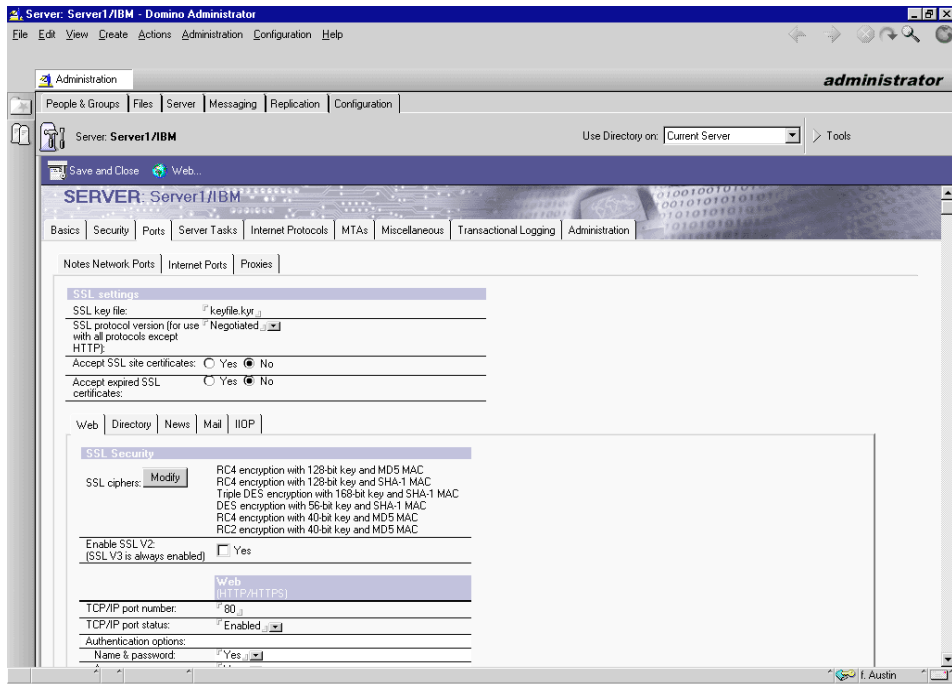
Figure 248. Setting Available SSL Cipher Types

- LDAP (Directory)

  Domino R5 allows authenticated LDAP users to add, delete, or modify entries in the Domino Directory provided they have at least author access and are members of the UserCreator and UserModifier roles. However, at this time, no popular commercially available LDAP clients are capable of supporting this feature.

- NNTP (News)
- IMAP (Mail)
- POP (Mail)
- SMTP Inbound/Outbound (Mail)
- IIOP (Inter-Application Object Communication)

  The IIOP ports for normal and SSL connectivity can be found on the Ports-Internet Ports-IIOP tab of the server document.
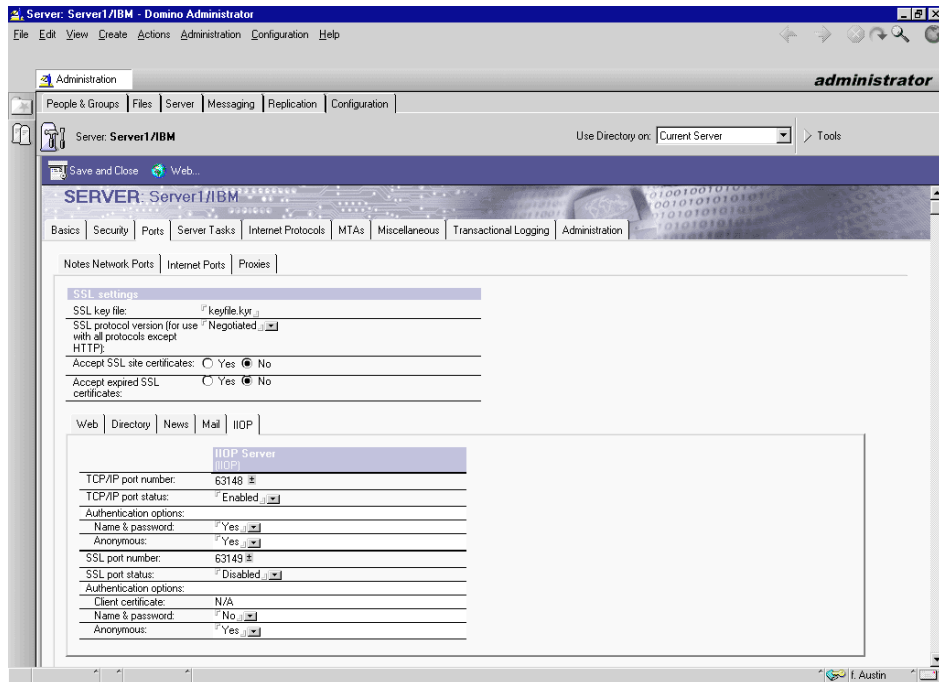
Figure 249. Setting TCP/IP Port Information for IIOP Communication

9.4.3 Database Access Controls

Once the actual connections to the server have been restricted, access to the data in the databases and applications on the server must be considered.

In R5, all of the familiar database security measures remain unchanged.

First of all, the contents of the server should not be visible. To prevent this, disable the Allow HTTP clients to browse databases option on the Internet Protocols-HTTP tab of the server document.

The following areas of database access control must then be reviewed and set for *all databases and templates* on the server:

* An *Anonymous User* entry in the ACL with appropriate access level
* A default ACL access level of *No Access*
* Appropriate use of *Read public documents* and *Write public documents in* the ACL
* An appropriate Maximum Internet Name & Password access level

As discussed previously in Chapter 8, "Lotus Domino R5 and the Internet" on page 209, R5 introduces a mechanism for protecting native HTML files that

may be served by the HTTP Web server task to browser clients. The user or group entries used in a protection document must belong to the Domino Directory and do not have any correlation with UNIX filesystem security settings. Provided that the UNIX user account under which the server executes has appropriate access to the files and directories involved, then the Domino Server exerts control over the remote usage of the files.

9.4.4 Session-Based Web Client Authentication

With Domino R5, Web client access can be session-based, like a Notes client sessions, and allow the server to track session details. This allows the server to provide additional functionality not normally available with standard user name and password authentication:

- Customized HTML login page
- Default logout time period expiration
- Programmed logout through URL
- Maximum Web client user sessions

The implementation of the session tracking uses cookies; so, this type of access can only be supported by clients that support the use of cookies.

Note

Servers accessed by round-robin DNS cannot support the use of session-based Web authentication as they cannot maintain the session details in memory.

To enable session-based authentication for browser clients, it is necessary to edit the server document and switch to the Internet Protocols-Domino Web Engine tab, and in the HTTP Sessions section, set the Session authentication field to Enabled. The Idle session timeout and Maximum active sessions are also configured in this section.
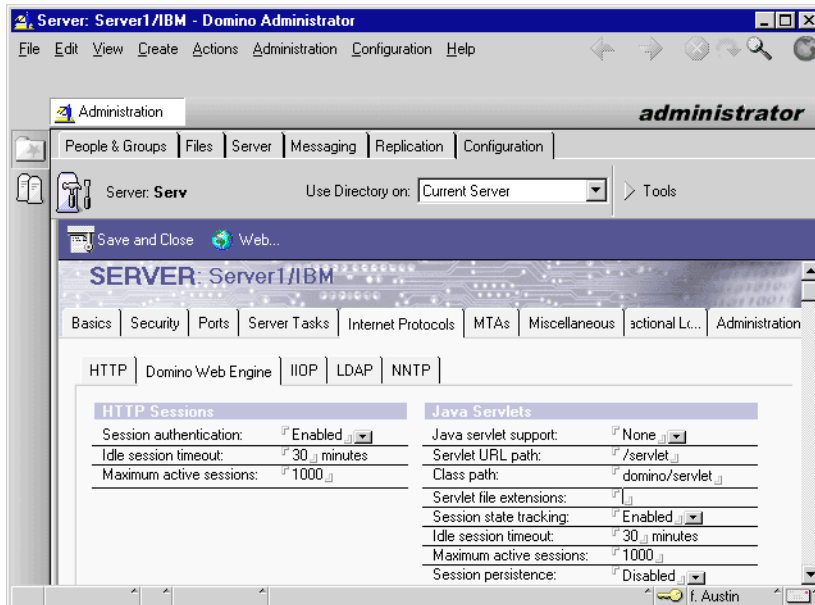
Figure 250. Enabling Web Client Session-Based Authentication

9.4.5 Access through the Internet Cluster Manager

One of the main changes in R5 is the support of clustered servers for Web client access using the Internet Cluster Manager. The ICM supports both standard and SSL connections, and details of the configuration can be found in Chapter 7, "Domino Enterprise Server" on page 159.

It is important to note that the ICM itself accepts only anonymous unauthenticated requests from browser clients and then redirects those requests to one of the available servers. At this point, the target server security settings govern the extent of the access allowed to the browser client and the nature of the authentication options available.

Note

Since the ICM does not authenticate requests, protecting it through controlled access must be achieved with the use of a firewall especially if it is used to provide access to the Internet community.

9.5 Secure Sockets Layer (SSL)

Much of the SSL support in R5 is the same as that for the Domino R4.6 Server. This section will only describe changes or additional functions.

9.5.1 SSL and the Internet Cluster Manager

As mentioned previously, the ICM can handle requests for SSL connections to the clustered servers that it serves. Once a client has connected to a server in the cluster, subsequent requests will be handled by that server unless the requested information is not available or the server fails. In this case, the ICM will redirect requests to another server in the cluster that can provide the necessary resources.

If the user had not previously authenticated on the new server, then they will be required to do so. However, if the connection was over SSL and both client and server support SSLv3, then establishing a new SSL connection is automatic.

9.6 Restricting SMTP Server Access

More and more companies rely on working mail systems, but not every company is aware of the threats caused by the connection of their mail system to the Internet. Unsolicited Commercial Email (UCE), widely know as "Spam" mail, could cause a mail server to slow down or even crash. There are two types of Spam mails.

The first uses your mail server to send mails to many other mail users who are normally not registered at your server. This type of Spam mail could slow down your mail server. If you are paying your Internet Service Provider (ISP) by Megabytes of transferred data, this could cost you a lot of money. You should also be aware that the receiver of the Spam mails could make your company responsible for the damage the Spam mails caused on their mailing system. This is also know as mail relaying.

Note

If you want to restrict the mail server access to certain IP address ranges, you have to enclose the IP range in square brackets. For example, if you want to enable all IP addresses in the range 9.3.240.0 to 9.3.240.255 you have to enter [9.3.240.*].

The second type is actually receiving these large volumes of mail. Large numbers of Spam mails could cause your mail system to run out of disk space and, therefore, prevent it from delivering any other mails. This type of mail is referred to as Spam mails in this book.

9.6.1 Mail Relaying

The Domino mailing system has several options you can use to prevent others from using your mail server for mail relaying. But, you have to be very careful using these restrictions. You might disable some of your own servers or clients.

Figure 251 shows how you can restrict sending mails to machines within a DNS domain.
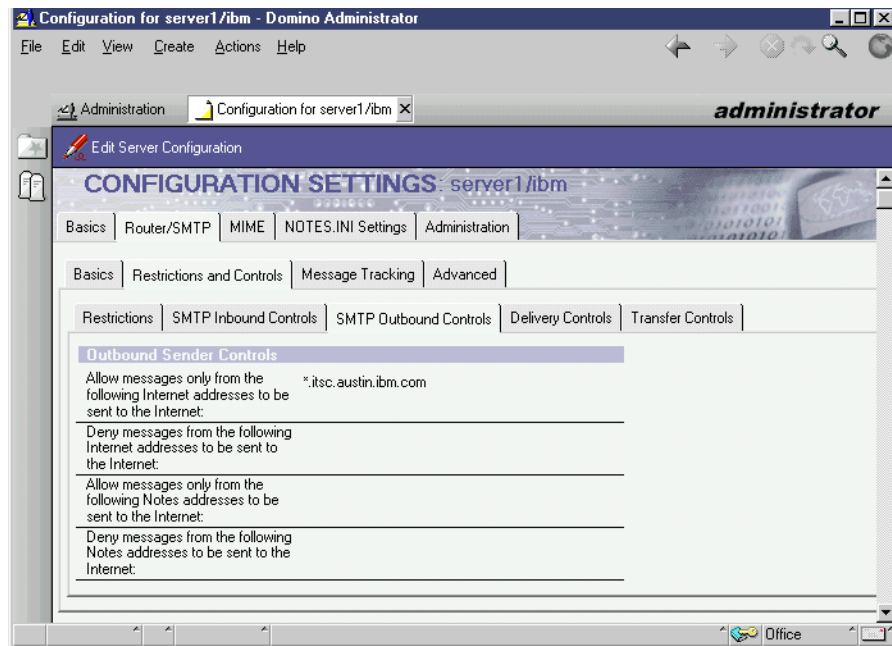
Figure 251. Mail Relaying - Outbound Control

9.6.2 Mail Spamming

If your company is receiving a lot of unwanted mail from a certain mail domain, you can disable this domain. But, you have to be aware that you might block mail you want to receive too. To deny mail form a certain mail domain, follow these steps:

1. Start the Domino Administrator

2. Select the desired server

3. Click on the **Configuration** tab

4. Select **Messaging > Configuration**

5. Select your mail server

6. Click on **Edit Configuration** to open the Server document

7. Choose **Router/SMTP > Restrictions and Controls > SMTP Inbound Controls**

8. Enter the SMTP domain you want to prevent from sending mails to your server in the field **Deny connections from the following SMTP Internet hostnames/IP addresses**

Figure 252 on page 262 shows how to prevent hosts in the DNS domain mainz.ibm.com from sending mails to server1/ibm.
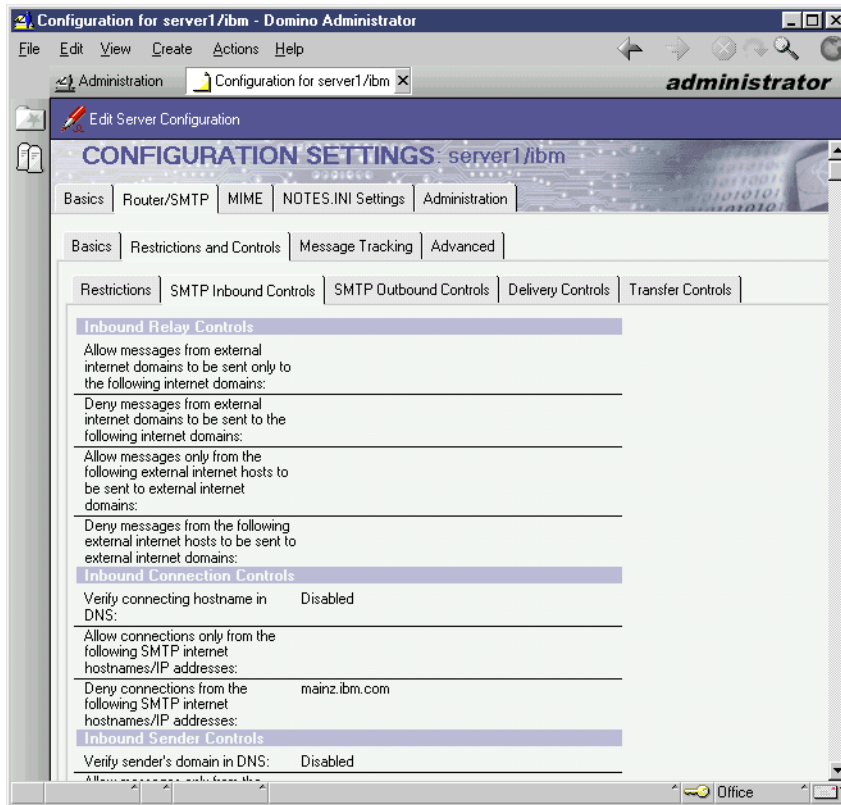
Figure 252. SMTP Inbound Control - Deny SMTP Domain

9.7 Domino Server Character Console

The Domino Server is usually started as a background process on the AIX platform, which means that the standard server console window is not visible.

As mentioned in 6.4, "The Domino Character Console" on page 154, R5 provides a local console access program so that an administrator working locally or from a remote terminal can enter console commands.

Making a console available in this way introduces some security issues that must be considered.

When the CConsole program is started, the administrator must specify which Notes user ID file to use and must then enter the password for that ID.

It also checks to see if the Domino Server is active on the same physical machine and, if it is not, the console program shuts down. If the server fails, then the console may not exit automatically in which case the administrator must type `done` and press **Enter** to close it manually.

Running cconsole from a remote client, using telnet or a remote X-display, introduces a security risk as it means that the server must accept Telnet and remote login sessions.

The risks can be reduced by using the available tools appropriately.

Note

Only run the character console program locally on the Domino Server.

Use the Domino Administration client functions for remote access to the console.

Chapter 10. Lotus Domino R5 Advanced Administration on AIX

This chapter outlines how to set up a modem connection between a Domino server on AIX and a remote Domino server. It also covers one of the most important tasks in Lotus Domino administration, backup and recovery. We will focus mainly on the tools that come with AIX, but we will also provide a quick overview on other means of backing up your Lotus Domino System.

10.1 Configuring Remote Servers to Communicate through Dialup

For servers and remote servers to communicate properly, one or more modems are required to be connected to serial communications ports. Domino serial communication ports use the X.PC protocol driver, which is the protocol used for dialup modem connections. The X.PC protocol driver is installed automatically when you install a Domino server. The following sections explain how to set up the AIX system so that the Lotus Domino Server can communicate with a remote Domino server using the X.PC protocol. You will need to set up both servers as per the instructions provided in the following sections.

10.1.1 Setting Up the AIX Server's Communication Port

The steps to setup a communication port (tty) are as follows:

1. Log on to the AIX machine as root.

2. Make sure that there is at least one free serial port physically available (serial1, serial2).

3. Type `smitty tty` to view the tty configuration menu (Figure 253 on page 266).

```
                                      TTY

 Move cursor to desired item and press Enter

   List All Defined TTYs
   Add a TTY
   Move a TTY to Another Port
   Change / Show Characteristics of a TTY
   Remove a TTY
   Configure a Defined TTY
   Generate Error Report
   Trace a TTY


 F1=Help              F2=Refresh           F3=Cancel            F8=Image
 F9=Shell             F10=Exit             Enter=Do
```
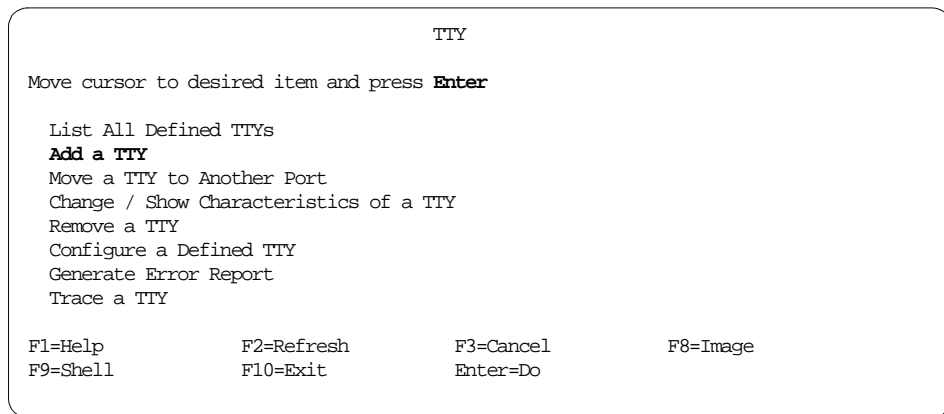
Figure 253. Smitty's TTY Screen

4. Select **Add a TTY** to add a new serial device to the system's configuration, and press **Enter**.

```
                                    TTY Type

    Move cursor to desired item and press Enter.

      tty rs232 Asynchronous Terminal
      tty rs422 Asynchronous Terminal

    F1=Help                 F2=Refresh              F3=Cancel
    F8=Image                F10=Exit                Enter=Do
    /=Find                  n=Find Next
```
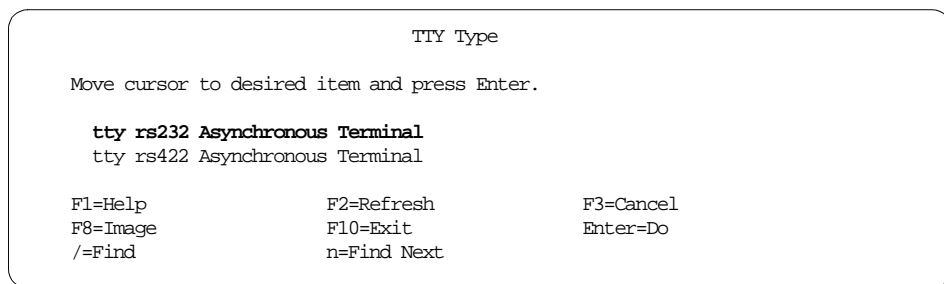
Figure 254. Smitty's Select the TTY Port Type

5. Select **tty rs232 Asynchronous Terminal** (Figure 254) for an asynchronous connection to the modem, and press **Enter**.

```
                                  Parent Adapter

    Move cursor to desired item and press Enter.

      sa0 Available 01-G0 Standard I/O Serial Port 1
      sa1 Available 01-H0 Standard I/O Serial Port 2

    F1=Help                 F2=Refresh              F3=Cancel
    F8=Image                F10=Exit                Enter=Do
    /=Find                  n=Find Next
```

Figure 255. Smitty's Select the Serial Adapter

6. Select **sa0 Available 01-G0 Standard I/O Serial Port 1** (Figure 255 on page 266) and press **Enter**.

Note

You should select either serial port1 or serial port2. If you have a multi-IO adapter in your system, check if the serial device has full rs232 capability.

```
                              Add a TTY

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

[TOP]                                              [Entry Fields]
  TTY type                                       tty
  TTY interface                                  rs232
  Description                                    Asynchronous Terminal
  Parent adapter                                 sa0
* PORT number                                    [s1]                  +
  Enable LOGIN                                    disable              +
  BAUD rate                                      [38400]               +
  PARITY                                         [none]                +
  BITS per character                             [8]                   +
  Number of STOP BITS                            [1]                   +
  TIME before advancing to next port setting     [0]                  +#
  TERMINAL type                                  [dumb]
  FLOW CONTROL to be used                        [xon]                 +
  OPEN DISCIPLINE to be used                     [dtropen]             +
  STTY attributes for RUN time                   [hupcl,cread,brkint,icr> +
  STTY attributes for LOGIN                      [hupcl,cread,echoe,cs8,>
  LOGGER name                                    [
  STATUS of device at BOOT time                  [available]           +
  TRANSMIT buffer count                          [16]                 +#
  RECEIVE trigger level                          [3]                  +#
  STREAMS modules to be pushed at OPEN time      [ldterm,tioc]         +
  INPUT map file                                 [none]                +
  OUTPUT map file                                [none]                +
  CODESET map file                               [sbcs]                +

  POSIX special control characters:

  INTERRUPT character                            [c]
  QUIT character                                 [
  ERASE character                                [h]
  KILL character                                 [u]
  END OF FILE character                          [d]
  END OF LINE character                          [
  2nd END OF LINE character                      [
  DELAY SUSPEND PROCESS character                [y]
[MORE ..]
```
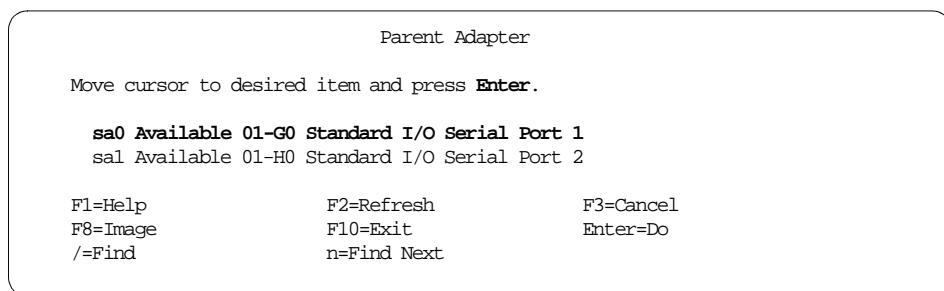
Figure 256. Settings of the TTY

7. As shown in Figure 256, you need to enter the `PORT number` (you can press **F4** for selection) and also the `BAUD rate` for the connection to the modem, and press **Enter**.

Note

The `Enable LOGIN` must be set to `disable`; otherwise, X.PC will not work correctly!

`SMITTY` will return the following `COMMAND STATUS` (Figure 257) if the device was created successfully:

```
                        COMMAND STATUS

Command: OK            stdout: yes            stderr: no

Before command completion, additional instructions may appear below.

tty0 Available
F1=Help             F2=Refresh          F3=Cancel           F6=Command
F8=Image            F9=Shell            F10=Exit            /=Find
n=Find Next
```

Figure 257. Command Status OK of Creating a TTY

Alternatively, you can type the following command, for example, using serial port #1, to add and configure a `tty`.

```
mkdev -c tty -t tty -s rs232 -p sa0 -w s1 -a speed=38400
```

8. Check if the device exists by typing:

```
ls -la /dev/tty<X>
```

`/dev/tty<X>` is the `tty` that will be returned after entering the previous command or noted by the `COMMAND STATUS` screen. For our system, `X = 0`. Enter:

```
ls -la /dev/tty0
```

Output is as shown in Figure 258.

```
crw-rw-rw-  1 root    system   16,  0 Feb 05 16:53 /dev/tty0
```

Figure 258. Output of the Command ls -la /dev/tty0

On the AIX platform, Domino communicates through the device file `/dev/cua<N>`, where `<N>` corresponds to the Notes port number.

9. If `/dev/cua<N>` does not exist on your system, link `/dev/cua<N>` to the previous configured asynchronous port. For example, to specify port number <N> = 1 and using `tty0`, type:

```
ln -s /dev/tty0 /dev/cua1
```

10. Enter `ls -la /dev/cua1` (Figure 259).

```
lrwxrwxrwx   1 root     system          9 Feb 05 16:54 /dev/cua1 -> /dev/tty0
```

Figure 259. Output of the Command ls -la /dev/cua1

10.1.2 Setting Up the Modem on Lotus Domino Server for AIX

The following steps are required to correctly set up a modem for use on a Domino Server for AIX.

1. Install the modem on the server communications port and ensure that the operating system recognizes the port.

2. From any client workstation, click on **File -> Tools -> Server Administration** to launch the Domino Administrator.

3. From the Servers pane, select the server on which to set up the port. You can set up a port remotely for servers that do not have a client, for example, UNIX or OS/2.

4. From the Tools pane, click **Server -> Setup Ports**
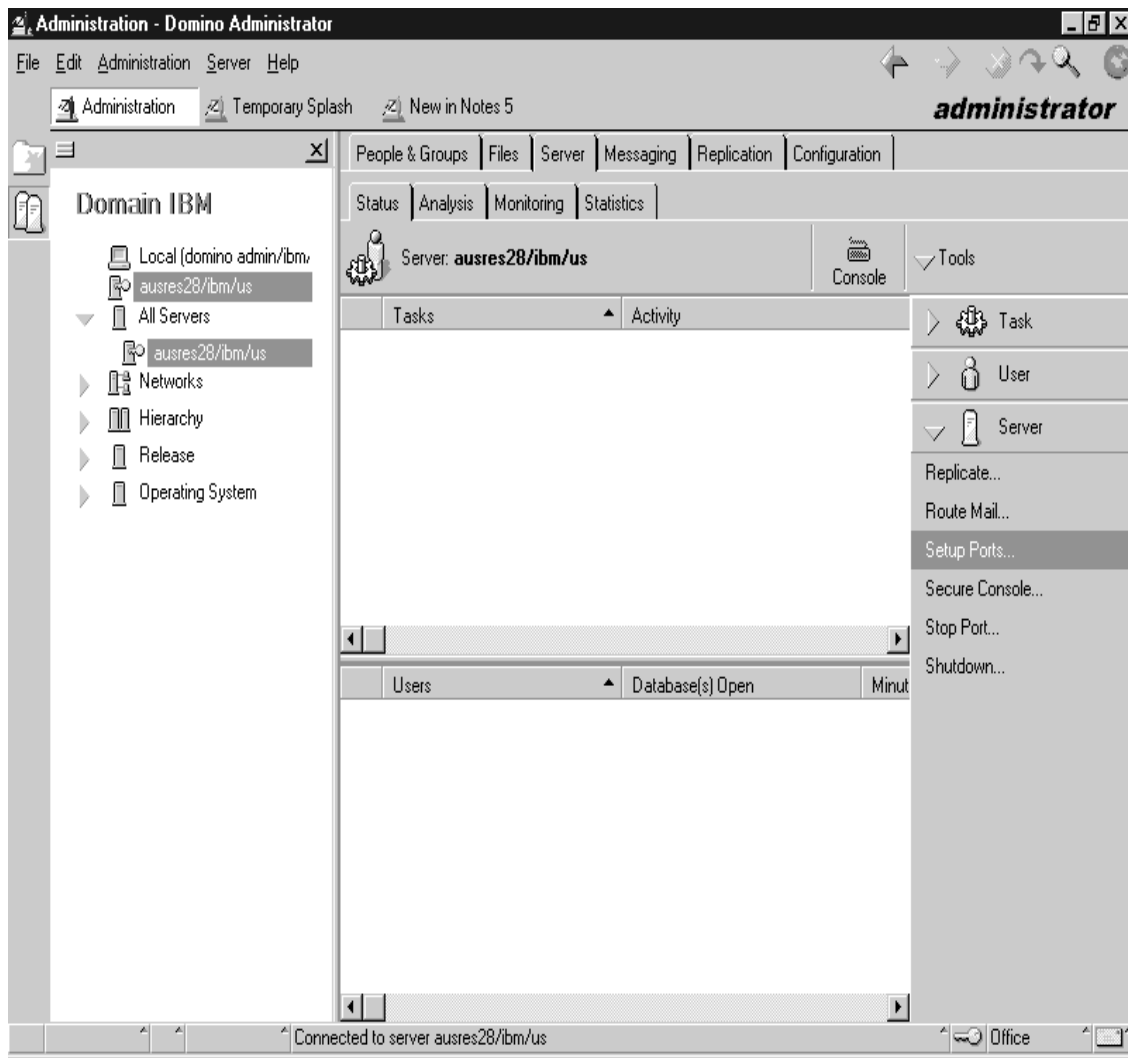
Figure 260. Setting Ports Using the Domino Administrator

5. The screen in Figure 261 on page 271, displays port setup information for the server that you specified. Select the name of the port on which you installed the modem. If the communication port name does not exist, select **New**, type the name of the communication port on which you installed the modem, select **XPC** for the driver, and then click **OK**.

Figure 261. Port Setup for Server

6. (Optional) Select **Encrypt network data** to secure data sent to or received by the server. Click on **Port Enabled** to enable the port.

7. Select **portname Options**, where `portname` is the name of the port whose settings you want to change. In our example, it is `serial1`. Then scroll through **Modem Types** to select the type of modem you are setting up.
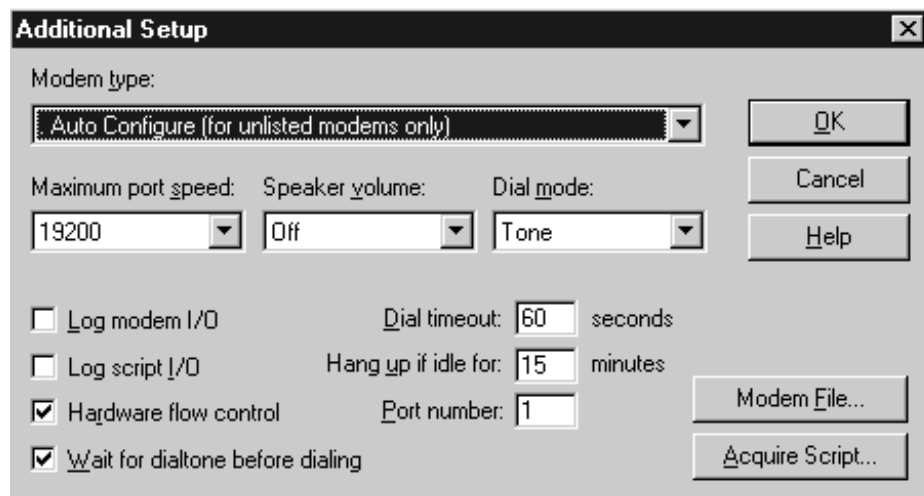
Figure 262. Modem Configuration Screen

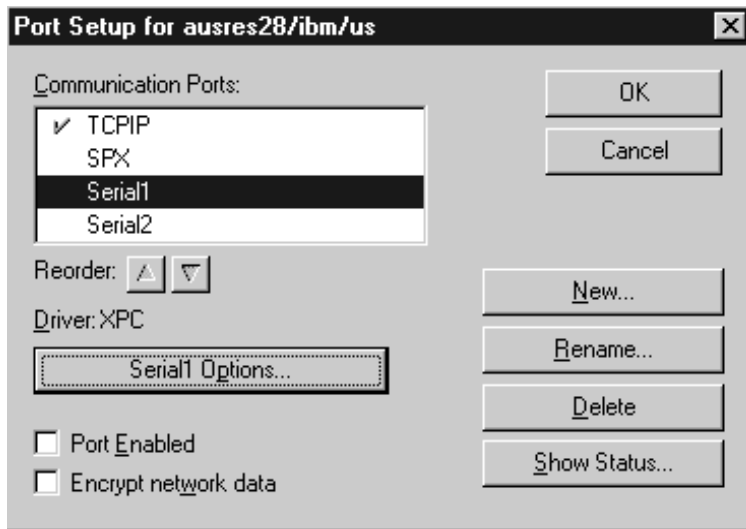8. Modify default port settings if you want. The default port settings work in most situations.

9. Select the Modem type in as shown in Figure 262 (the default is `Auto Configure`).

    If you don't know your modem type, or if your modem is not on the list, try `Auto Configure`. The Auto Configure modem command file (auto.mdm) checks the modem's speed and then selects the appropriate generic modem command file.

    For more information, review the template.mdm file in the data directory of the server under the directory modems.

10. Select the maximum port speed (default is 19200). Be aware of the configuration of the TTY.

    • The maximum port speed is the maximum speed at which the communication port on the computer sends data to the modem and receives data from the modem.

    • The modem carrier speed is the speed at which modems communicate with one another.

    • The modem carrier speed may be lower than the port speed.

    • When using a null modem, the maximum port speed selected on both computers must be identical.

11. Select a volume from the Speaker Volume field (the default is Off). Selections are Low, Medium, or High.

12. Select a dial mode in the Dial mode field (the default is Tone).

13. Log modem I/O (the default is deselected).

14. Select Log modem I/O to record information about the modem connection in the Notes Log if you suspect a problem with the modem.

15. Log script I/O (the default is deselected).

    Select Log script I/O if you are using modem scripts and want to record asynchronous script file responses and replies in the Notes Log. Use this option if you suspect a problem with a modem script file.

16. Hardware flow control (default is selected for all operating systems except UNIX).

    If you do not select **Hardware flow control**, the modem may generate cyclic redundancy check (CRC) errors and retransmissions. CRC is a form of error detection that Domino uses to ensure that data is transferred correctly. Deselect **Hardware flow control** if the modem doesn't support flow control.

17. Wait for dial tone before dialing (the default is selected).

18. Dial timeout field (the default is 60 seconds).

19. Hang up if idle (the default is 15 minutes).

    This field refers to the amount of time the modem waits before hanging up if there is no data passing through the connection. On a port that workstation users dial into, you might want to specify a longer idle time then the default since users may need more time to read or compose long documents. Domino uses the lower of the settings on the calling and answering computers.

20. Port number (the default is the number one through five, entered in the Communication Port field). On an AIX system, specify a port number N that matches the /dev/cuaN device file that you linked to the asynchronous port.

21. If you need to make changes to the modem file, click on **Modem File...**.
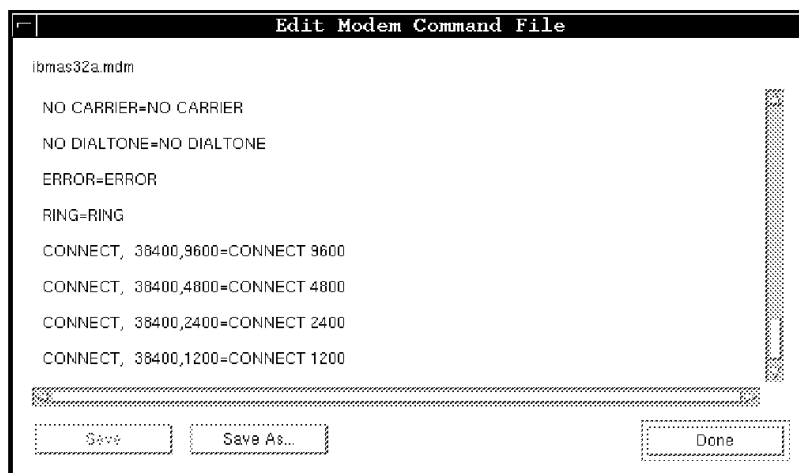
Figure 263. Edit Modem Command File

22. Edit the modem file and click **Done** (Figure 263).

   Modem command files have the file extension mdm. If your modem, or if the default modem command file auto.mdm does not work, Notes provides the Generic All-Speed Modem File, gen_all.mdm, which you can modify. For information on modem command files and instructions on modifying them, please read the template.mdm file. The modem files exist in the Domino data directory under *modems*.

23. To associate an acquire script with the current port, select **Acquire Script**; select a script file to use, and click on **OK**.

24. To check the connection status, click on **Show Status...**, as shown in Figure 261 on page 271. You will get the following output: (Figure 264 on page 275)

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ┌─┐                        Serial1 Port Status                          │
├─────────────────────────────────────────────────────────────────────────┤
│                                                                           │
│  Counts since the beginning of the last connection:                      │
│                                                                           │
│       0  User messages sent                                              │
│       0  User messages received                                         │
│       0  User bytes sent                                                │
│       0  User bytes received                                            │
│       0  Retransmitted packets                                          │
│       0  CRC errors detected                                            │
│       0  Port errors detected                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│            ┌──────────────┐          ┌──────────────┐                   │
│            │     Copy      │          │    Cancel     │                  │
│            └──────────────┘          └──────────────┘                   │
└─────────────────────────────────────────────────────────────────────────┘
```
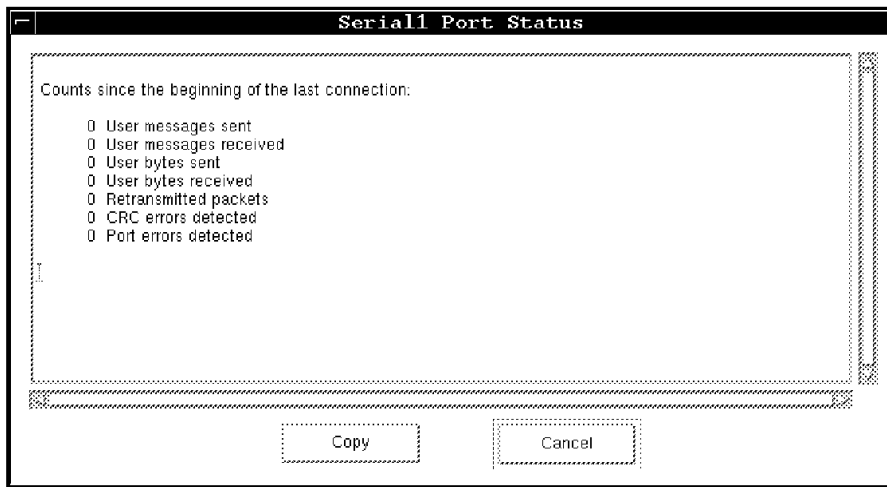
Figure 264. Show Status of Connection

Notes also records the information for the communication port in the Miscellaneous Events and Phone Calls views of the Notes Log, log.nsf.

Table 18 explains the entries in the Notes Log:.

Table 18. Name and Description as Shown in the log.nsf Database

Name	Description
Bit per second connection (port speed)	The speed at which the server's port is communicating with the modem.
Bit per second connection (carrier speed)	The speed at which the server's modem is communicating with the other modem.
Currently active sessions	The number of users or servers currently connected to the server.
User messages sent	The number of transmit requests issued by the user for one or more packets.
User messages received	The number of transmit requests issued by the sender for one or more packets.
User bytes sent	The number of bytes sent from this port.

Name	Description
User bytes received	Number of bytes received on this port.
Retransmitted packets	The number of packets retransmitted because of errors. Use this statistic to check remote transmissions. A high number (more than one per minute) indicates a problem that will adversely affect performance. Use Hardware flow control, if supported, or choose a lower port speed.
CRC errors detected	The number of cyclic redundancy check (CRC) errors. The CRC errors mean that the CRC included in the frame is not consistent with the actual number of bits in the frame. Such errors slow transmission speed.
Port errors detected	Port errors on this port indicates operating system port driver buffer overflow or possible parity errors.

25. Click on **Cancel** (Figure 264 on page 275).

26. Click on **OK** (Figure 262 on page 272).

27. Click on **OK** (Figure 261 on page 271).

28. Restart the Domino Server so that Domino listens to incoming phone calls on the port.

    You may see other messages on the server console after starting the server if Log modem I/O and Log script I/O are enabled as in Figure 262 on page 272. The Notes log on the server will contain lines as shown below.

```
27/02/99 00:44:29    Serial2: Send to Modem:  ATE0V1 (2400 bits per second)
27/02/99 00:45:34    Serial2: Send to Modem:  +++ (4800 bits per second)
27/02/99 00:45:35    Serial2: Send to Modem:  ATE0V1 (4800 bits per second)
27/02/99 00:46:40    Serial2: Send to Modem:  +++ (9600 bits per second)
27/02/99 00:46:42    Serial2: Send to Modem:  ATE0V1 (9600 bits per second)
27/02/99 00:47:47    Serial2: Send to Modem:  +++ (19200 bits per second)
27/02/99 00:47:48    Serial2: Send to Modem:  ATE0V1 (19200 bits per second)
27/02/99 00:48:53    Serial2: Send to Modem:  +++ (1200 bits per second)
27/02/99 00:48:54    Serial2: Send to Modem:  ATE0V1 (1200 bits per second)
27/02/99 00:49:09    Searching Administration Requests database.
27/02/99 00:49:59    Serial2: Send to Modem:  +++ (2400 bits per second)
27/02/99 00:50:00    Serial2: Send to Modem:  ATE0V1 (2400 bits per second)
```

```
27/02/99 00:51:05    Serial2: Send to Modem:  +++ (4800 bits per second)
27/02/99 00:51:07    Serial2: Send to Modem:  ATE0V1 (4800 bits per second)
27/02/99 00:52:11    Serial2: Send to Modem:  +++ (9600 bits per second)
27/02/99 00:52:12    Serial2: Send to Modem:  ATE0V1 (9600 bits per second)
27/02/99 00:53:17    Serial2: Send to Modem:  +++ (19200 bits per second)
27/02/99 00:53:19    Serial2: Send to Modem:  ATE0V1 (19200 bits per second)
27/02/99 00:54:09    Searching Administration Requests database.
27/02/99 00:54:24    Serial2: Send to Modem:  +++ (1200 bits per second)
27/02/99 00:54:25    Serial2: Send to Modem:  ATE0V1 (1200 bits per second)
27/02/99 00:55:30    Serial2: Send to Modem:  +++ (2400 bits per second)
27/02/99 00:55:31    Serial2: Send to Modem:  ATE0V1 (2400 bits per second)
```

10.1.3 Connecting to Remote Servers

To replicate databases and exchange mail, servers must connect to each other. To help establish connections through a dialup modem, you need to create connection documents in the Domino Directory. A Connection document establishes a connection and specifies how and when servers connect to replicate and exchange mail.

Most connection documents have two parts: A network part and a schedule part. The network part defines the connection: Which server to connect to and how that connection is made. The schedule part determines when to perform activities, such as replication and routing to a particular server. Information in the network part is used whenever connecting to a specified server whether or not the connection is related to any task defined in the schedule part.

Mail routing between a pair of servers requires one connection document on each server because mail routing between servers works in only one direction unless they are in the same notes named network. For example, Server A needs a connection document to route mail to Server B, and Server B needs a connection document to route mail to Server A.

10.2 Using PPP to Set Up Communication on the AIX Server

The asynchronous Point-to-Point Protocol (PPP) subsystem provides a standard method for transporting multiprotocol datagrams over point-to-point media.

1. Log on to the AIX machine as `root`.

2. Use the `lslpp -l bos.net.ppp` command to check if the following software is installed:

```
bos.net.ppp        4.3.2.0  COMMITTED  Async Point to Point Protocol
```

> **Note**
>
> You must have installed at least AIX 4.1.4 or greater.

3. Create a TTY. Please refer to 10.1.1, "Setting Up the AIX Server's Communication Port" on page 265, Step 1 on page 265 through Step 7 on page 268. The only parameter you have to change is the Enable LOGIN field. This option must be set to `share`. Check also if the BAUD rate is correct.

4. Create a PPP user to give a PPP client access to your system by typing the following command:

   `mkuser gecos="PPP client user" pppuser.`

> **Note**
>
> You may add a separate user ID and password for each remote PPP client.

5. Define a password for user `pppuser` by issuing the command `pwdadm pppuser`

6. Confirm and change the password by typing the following from the lowest login shell:

   `login pppuser`

7. Add the following line in the .profile file located in $HOME:

   `exec /usr/sbin/pppattachd server 2>/dev/null`

8. Change user ID back to `root` by typing:

   `su - root`

9. To configure the Asynchronous Point-to-Point Protocol, use the SMIT fastpath: `smitty ppp` (Figure 265 on page 279).

```
                                PPP

 Move cursor to desired item and press Enter.


   Link Control Configuration
   PPP IP Interfaces
   PAP  Authentication
   CHAP Authentication
   Start PPP
   Stop PPP






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

```
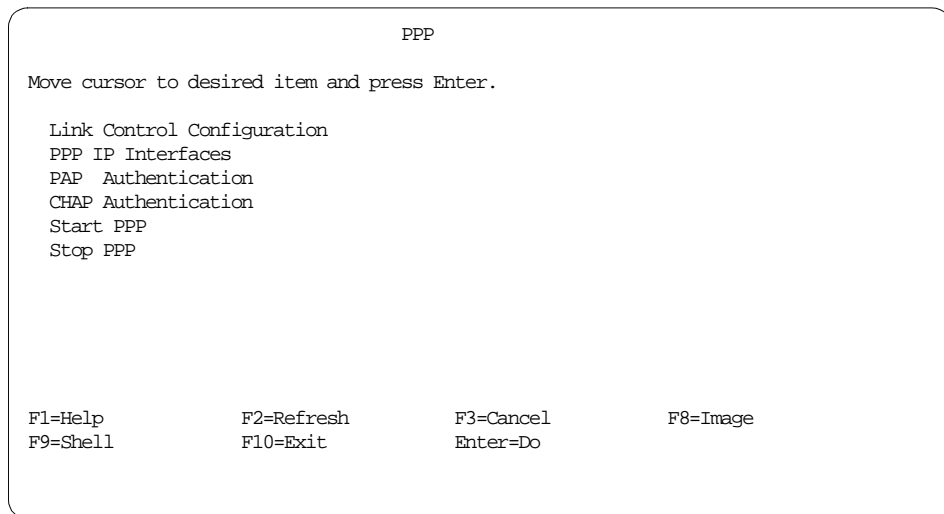
Figure 265. Smitty's PPP Screen

10.Select **Link Control Configuration** to configure the link control stored in
   the file /etc/ppp/lcp_config, and press **Enter**.

```
                      Link Control Configuration

 Move cursor to desired item and press Enter.

   Add a Link Configuration
   Change / Show a Link Configuration
   Remove a Link Configuration




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

```
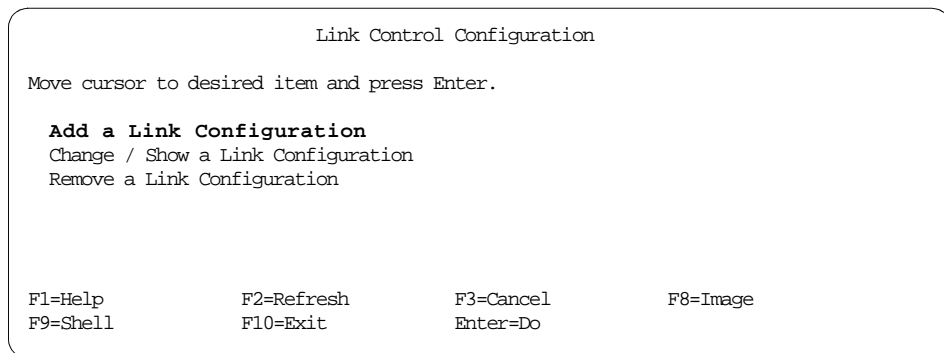
Figure 266. Smitty's PPP Link Control Configuration Screen

11.To create a new file, /etc/ppp/lcp_config, select **Add a Link Configuration**
   as shown in Figure 266, and press **Enter**.

```
                           LINK Configuration

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

 [TOP]                                          [Entry Fields]
   PPP subsystem name                           [domino_ppp_entry]
   max server connections                       [8]                    #
   max client connections                       [2]                    #
   max demand connections                       [8]                    #
   max ip interfaces                            [8]                    #
   max async hdlc attachments                   [8]                    #
   mru                                          []                     #
   async character map                          []                     X
   transmit async character map                 []                     X
   negotiate MRU                                yes                    +
   negotiate magic number                       yes                    +
   negotiate async map                          yes                    +
   negotiate protocol compression               yes                    +
   negotiate address control compression        yes                    +
 [MORE...7]

 F1=Help            F2=Refresh        F3=Cancel          F4=List
 F5=Reset           F6=Command        F7=Edit            F8=Image
 F9=Shell           F10=Exit          Enter=Do
```

Figure 267. Smitty's PPP Link Configuration Screen

12. Enter a name without spaces into the PPP subsystem name field as
    shown in Figure 267. This name will identify the system to PPP and has no
    meaning to any other interface, such as IP. The first 20 bytes must be
    unique.

13. Enter the number of clients that can access this machine in the max server
    connections field.

14. Enter the maximum number of servers that can be accessed through client
    connections on this machine into the max client connections field.

15. Enter the maximum number of demand connections in the max demands
    connections field.

16. To define the maximum number of allowed TCP/IP interfaces, enter a
    number not greater than the total maximum number of server and client
    connections into the field max ip interfaces.

17. Enter the maximum number of concurrent asynchronous PPP sessions,
    both client and server, that can be active into the max ip interfaces field.
    The value cannot be greater than the total maximum number of server and
    client connections.

18. All other fields on the LINK Configuration panel are optional. If you do not have a deeper knowledge of PPP and a complete understanding of the options, you can leave them set to the default.

19. Press **Enter** to create the link configuration file.

    The file /etc/ppp/lcp_config in our example will look like this:

```
server_name domino_ppp_entry
lcp_server 8
lcp_client 2
lcp_demand 8
num_if 8
num_hdlc 8
```

Figure 268. PPP Link Configuration File /etc/ppp/lcp_config

20. Press **F3** twice to return to smitty's first menu (Figure 265 on page 279).

21. To create the PPP IP Interfaces, select **PPP IP Interfaces** as shown in Figure 265 on page 279, and press **Enter**.

```
                       PPP IP Interfaces

 Move cursor to desired item and press Enter.

   Add a Server Interface
   Change / Show a Server Interface
   Remove a Server Interface
   Add a Demand Interface
   Change / Show a Demand Interface
   Remove a Demand Interface




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

Figure 269. Smitty's PPP IP Interfaces Screen

22. To create a new server interface, select **Add a Server Interface** as shown in Figure 269, and press **Enter**. The file /etc/ppp/if_conf will be created for you.

```
                         PPP IP Configuration

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

                                                 [Entry Fields]
  Local IP address                             [9.3.16.243]
  Starting Remote IP address                   [9.244.8.110]
  Number of addresses                          [8]
  Netmask                                      [255.255.255.0]



F1=Help              F2=Refresh       F3=Cancel           F4=List
F5=Reset             F6=Command       F7=Edit             F8=Image
F9=Shell             F10=Exit         Enter=Do
```

Figure 270. Smitty's PPP IP Configuration

23. Enter the IP address of your current system into the Local IP address field.

24. Enter the first remote IP address into the Starting Remote IP address field. If you enter more than one into the Number of addresses field, this address will be the first IP address, and the following remote IP addresses will always be incremented by one.

Note

Please be aware that all remote IP addresses must be unique for a given local (server) IP address.

---

25. As mentioned before, you can define more that one remote IP address. You may specify only one if you desire a single interface. The value of the Number of addresses field should not exceed the value specified in the /etc/ppp/lcp_config file for max server connections. Do not specify zero (0) for this field.

26. Press **Enter** to accept the settings.

    The /etc/ppp/if_conf file in our example will look like this:

```
interface
server
local_ip 9.3.16.243
remote_ip 9.244.8.110
netmask 255.255.255.0

interface
server
local_ip 9.3.16.243
remote_ip 9.244.8.111
netmask 255.255.255.0
   .
   .
   .
   .
   .
   .
interface
server
local_ip 9.3.16.243
remote_ip 9.244.8.116
netmask 255.255.255.0

interface
server
local_ip 9.3.16.243
remote_ip 9.244.8.117
netmask 255.255.255.0
```

Figure 271. PPP IP Configuration File (/etc/ppp/ip_conf)

27.To start PPP, return to smitty's first menu by pressing **F3** twice (Figure 265 on page 279). Select **Start PPP**, accept the defaults, and press **Enter**. The PPP subsystem will then be up and running.

10.3 SLIP Remote Communication Method to Use with an AIX Server

You can also use SLIP, the Serial Line Internet Protocol, a protocol that TCP/IP uses when operating through a serial connection. (IBM TCP/IP for DOS V 2.1.1, OS/2 Warp Connect and AIX support SLIP.) For further information on how to set up and configure SLIP, please refer to the appropriate TCP/IP product manual(s).

10.4 Backup and Recovery

Performing regular backups is critical. Back up Lotus Domino Servers often to protect from data loss. This is a very laborious task that needs your attention daily. For your assistance, there are many good tools that come with AIX.

We will present several ways to back up your Lotus Domino servers in this chapter. You are free to choose the one solution that will best suit your environment. When choosing your backup plan, remember that the goal of all backups is to minimize server downtime. When one or more servers are down and you have hundreds, or maybe thousands, of users waiting for Lotus Domino to come back on-line, you will find that you don't have time for lengthy recovery procedures or many mistakes. Make sure to have a well documented recovery plan.

Note

Don't make the mistake of storing your recovery plan as only a Lotus Notes database. At the time you need it, it might be unavailable. Keeping an up-to-date hardcopy physically near the Lotus Domino Server is a good idea.

When setting up your backup environment, it is also crucial to know for certain that it is functional. A backup is not a backup unless you have tested your recovery plan. It is a good idea to test out backup as well as recovery before taking the Lotus Domino Server into production. When in production, make sure to make a recovery test every six months or so.

Assuming that the server was installed as described in 2.2, "Preparing the AIX Environment" on page 16, you need to back up the following directories and files.

/usr/domino/lotus

This is the Lotus software file system. You need to back it up only before you install new Lotus software or an upgrade in this directory. If resources allow, it is recommended that you include this file system in your regular backups.

/server1

This is the file system that contains the Lotus Domino Server data-like databases, the templates, the mail files, and others. This file system may require one or more daily backups if your organization produces a lot of data. Be aware that with the procedures described in this chapter, you must shut down your Lotus Domino Server software before you make a backup.

notes.ini, server.id, cert.id, user.id

Keep a copy of these files on a floppy disk in a secure place. They are present in the Lotus Domino Server data directory (/server1).

> **Note**
>
> Do not rely on replication as your only backup method. Corrupted, damaged, or accidentally changed databases can replicate, and all replicas may become damaged.

In this chapter, we discuss the following examples:

- How to back up only one server.
- How to back up a server that contains user data.
- How to back up more than one server.

For our examples, we will assume that a backup server exists with two identical tape units. In order to make examples easier to understand, the capacity of these tape units are assumed to be sufficient for all of your backup needs. These tape units may be 4 mm DAT, 8 mm Exabyte, or maybe DLT depending on the size of the data to be backed up. In our case, the device names will be /dev/rmt0 and /dev/rmt1.

Additionally, it is also assumed that you have installed the scripts from 4.1.3, "Starting the Lotus Domino Server Using a Startup Script" on page 106 for starting the server in the background. This is normally required when running Lotus Domino on AIX in a production environment. In scripts and examples, we will assume that these scripts are installed in the directory /server1/bin.

All the examples here can be used in small organizations with some work and customization. For a larger organization, consider using a professional backup tool like the IBM ADSTAR Distributed Storage Manager Solution (ADSM). There is a redbook on using IBM ADSM to back up Lotus Notes; *Using ADSM to Back Up Lotus Notes*, SG24-4534.

10.5 Server Backup Using AIX Native Tools

The `backup` and `restore` commands are the native AIX tools for backups that will be used in this section. These tools are capable of incremental backup, but since a Lotus Notes database is one file, the modification of one document in a huge database will change the file, and, thereby, force a backup of the entire file. Obviously, it would be more economical to be able to make an incremental backup of the database saving only the modified documents. Refer to 10.8, "Advanced Backup Solutions" on page 303 for backup solutions that can make incremental backups of Lotus Notes databases at the document level.

10.5.1 Stopping and Starting the Database Server

To ensure the integrity of a Lotus Domino Server backup using native AIX tools, the server should be stopped, and the file system where it resides preferably unmounted. It is not necessary to unmount the file system if you know that there are no users on the server and that no process will work with the server file system during the backup. If you are uncertain, unmount the file system before the backup.

The details for starting and stopping a server using scripts is described in 4.1.3, "Starting the Lotus Domino Server Using a Startup Script" on page 106.

10.5.2 How to Back Up the Lotus Domino Software File System

You have to back up the /usr/domino/lotus file system only after you install the new Lotus software or perform an upgrade.

If you have a local tape on the system, you can use the `backup` command.

1. Insert a blank and unprotected media in the tape unit.

2. Log in as `root`.

3. Enter the following command to set the tape block size:

```
# /usr/sbin/chdev -l rmt0 -a block_size=1024
```

> **Note**
>
> Change the `rmt0` to your tape unit name; you can use other block sizes than 1024. You can list your system's tape names with the following command:
> ```
> lsdev -C -c tape
> ```

4. Before running a file system backup, you should check the file system integrity. Run the command:

```
# fsck /usr/domino/lotus
```

Always run the `fsck` command on file systems after a system malfunction. Corrective actions may result in some loss of data. The default action for each consistency correction is to wait for the operator to enter `yes` or `no`. If you do not have write permission for an affected file system, the `fsck` command defaults to a `no` response in spite of your actual response.This command will report the problems you may have. If you have any problems, you must unmount the file system and run `fsck` again to correct the problem, and then remount it. For additional information, please refer to the fsck AIX manual page by typing in the command: `man fsck`.

Alternatively, you can also find relevant documentation, including a commands reference for AIX, at:
`http://www.rs6000.ibm.com/resource/aix_resource/Pubs/` on the World Wide Web.

5. If /usr/domino/lotus is a file system, enter:

```
# backup -u -0 -f /dev/rmt0 /usr/domino/lotus
```

This command will perform a level 0 file system backup by i-node.

> **Note**
>
> • Change `rmt0` to the name of your tape unit.
>
> • To ensure the data integrity of the backup when performing a backup by i-node, you must unmount the file system before doing the backup. Don't forget to remount it again after the backup.

If it is not a file system, you can use the following commands:

```
# cd /usr/domino/lotus
# find . -print | backup -i -v -f /dev/rmt0
```

This creates a backup by file name on the tape. Invoked this way, the `backup` command needs a list of files and directories to backup. The `find` command, as used above, lists the entire directory structure starting at the current directory.

6. If you need to copy the backup tape, just insert the target tape in the tape unit, `rmt1`, and enter the command:

```
# tcopy /dev/rmt0 /dev/rmt1
```

In this example, `rmt0` is the source tape unit, and `rmt1` is the target tape unit. Don't forget to set the block size for `rmt1` to be the same as for `rmt0`.

See 10.5.5.1, "Restoring Files with Restore" on page 293 for information on restoring backups. Also see the manual pages for a detailed explanation of the commands `find`, `tcopy`, `backup`, and `restore`. To get an explanation of any AIX commands, type: `man <command>`. For example, you can get an explanation of `backup` by typing in the command:

```
man backup
```

Alternatively, you can also find relevant documentation, including a commands reference for AIX, at:
`http://www.rs6000.ibm.com/resource/aix_resource/Pubs/` on the World Wide Web.

10.5.3 How to Back Up Only One Server

It is very important to have a backup schedule. The AIX `backup` command offers 10 different levels (0 through 9) of incremental backup. Level 0 is the full backup. On the other levels, all the files that have been changed since the last lower-level backup are backed up.

For our example, we will use the following backup schedule:

Weekly Full Backup (Level 0)
This should be performed every Wednesday. The full backup tape will be copied for security reasons. The second copy from this tape can be stored in a secure place in another building, for example.

Incremental Daily Backup (Level 5):
This should be performed on Monday, Tuesday, Thursday, Friday, and Saturday.

To implement this schedule, we will use the script `backtape` given below and the AIX `crontab` facility. The `cron` and `crontab` commands give you the ability to schedule commands to be executed at given times. Please refer to the `crontab` manual page if you are not familiar with `crontab`.

Simple Script to Back Up Lotus Notes Data
The following is an example of the Simple Script to back up Lotus Notes data:

```ksh
#!/bin/ksh
#@(#) backtape Lotus Notes backup procedure
#
# Usage: backtape [-copy] <level> <tape0> <tape1>
#
COPY=NO
FS=/server1

# Display error message and exits
Error () {
  echo "Usage: backtape [-copy] <level> <tape0> <tape1>"
  echo "Example: backtape 5 rmt0 rmt1" >&2
  exit 1
}

NARGS=$#
# Test for the copy option
[[ $1 = -copy ]] && { COPY=YES ; shift ; let NARGS=${NARGS}-1 ; }
# Test the number of flags, must be 3
[[ $NARGS -ne 3 ]] && Error
```

```
LEVEL=$1
TAPE0=$2
TAPE1=$3


echo "Backup level $LEVEL, tape0 $TAPE0, tape1 $TAPE1, copy=$COPY"
echo "Started on `date` on server `uname -n`"


# These tape attributes applies to the 8mm 2.3/5GB tapes
# Check for the attributes that applies to your tape
echo "\nChanging the attributes of $TAPE0..."
/usr/sbin/chdev -l $TAPE0 -a block_size=1024 -a mode=yes -a extfm=yes


# We have to rewind the tape
echo "\nRewinding the tape $TAPE0..."
/bin/tctl -f /dev/$TAPE0 rewind


# Stop the Lotus Domino server
echo "\nStopping the Lotus Domino server..."
$FS/bin/stop_domino


# Make the system backup of the $FS
echo "\nMaking backup level $LEVEL of $FS on $TAPE0..."
/usr/sbin/sync
/usr/sbin/sync
/usr/sbin/backup -u -$LEVEL -f /dev/$TAPE0 $FS


# Restart the Lotus Domino server
echo "\nRestarting the Lotus Domino server..."
$FS/bin/start_domino


# Making the tape copy...
if [[ $COPY = YES ]]
then
  # These tape attributes apply to the 8mm 2.3/5GB tapes
  # Check for the attributes that applies to your tape
  echo "\nChanging the attributes of $TAPE1..."
  /usr/sbin/chdev -l $TAPE1 -a block_size=1024 -a mode=yes -a extfm=yes


  # We have to rewind the tapes
  echo "\nRewinding the tape $TAPE0 for copy..."
  /bin/tctl -f /dev/$TAPE0 rewind
  echo "\nRewinding the tape $TAPE1 for copy..."
  /bin/tctl -f /dev/$TAPE1 rewind


  # Make the copy
  echo "\nMaking the copy of $TAPE0 on $TAPE1..."
  /bin/tcopy /dev/$TAPE0 /dev/$TAPE1
```

```
  # Ejecting the tape
  echo "\nEjecting $TAPE1..."
  /bin/tctl -f /dev/$TAPE1 offline
fi

# Ejecting the tape
echo "\nEjecting $TAPE0..."
/bin/tctl -f /dev/$TAPE0 offline

echo "\nEnd of the backup program..."
```

This script will back up the file system /server1 to the specified device (rmt0 or rmt1) using the backup command then makes a copy of the backup tape, if specified (using the command tcopy), and finally ejects the backup tape(s) (using the command tctl).

To implement the backup schedule, you have to add the lines shown in Figure 272 to the root crontab. As root, run the command: crontab -e and add the lines at the end of the file.

The first line is only a comment to remember the crontab file fields. The second line implements the Monday, Tuesday, Thursday, and Friday daily incremental level 5 backup on rmt0. The third one implements the Saturday backup on rmt1. The last one is the weekly full backup that is made on rmt0 and copied to rmt1.

```
#minute  hour  day_of_month  month  weekday  command
0 23 * * 1,2,4,5 /server1/scripts/backtape 5 rmt0 rmt1 2>&1 | /bin/mail -s "Backup
root
0 23 * * 6 /server1/scripts/backtape 5 rmt1 rmt0 2>&1 | /bin/mail -s "Backup level
0 23 * * 3 /server1/scripts/backtape -copy 0 rmt0 rmt1 2>&1 | /bin/mail -s "Full Ba
```

Figure 272. Crontab for the Backtape Script

The backup operator will need five tapes (one for each day of the week) for the level 5 backup. These five tapes may be labeled with the weekday name and reused weekly. So, for example, on Monday the operator inserts the Monday tape in rmt0, and on Friday the Friday tape is inserted in rmt0 and the Saturday tape is inserted in rmt1.

For each week, two tapes will be needed for the full backup. They have to be labeled with the backup date. On Wednesday, the operator will have to insert the backup tape in rmt0 and the copy tape in rmt1. On Thursday, the tapes

must be backed up and the copy sent to another place. In the table given below, there is an example of the backup schedule and tape labels.

Table 19. Backup Schedule and Tape Labels

Weekday	Tape Labels	
	Tape rmt0	Tape rmt1
Monday	Monday level 1	n/a
Tuesday	Tuesday level 1	n/a
Wednesday	MM/DD/YY level 0	MM/DD/YY level 0 copy
Thursday	Thursday level 1	n/a
Friday	Friday level 1	Saturday level 1

Another decision that needs to be made is how long you want to keep these tapes. For example, you can keep the backup tapes for the last year. For the most recent three months, you keep all the weekly backups. For the previous nine months, older tapes can be reused.

Note

You must be careful when storing tapes for a long time because they maintain the data integrity only for a defined time period (generally one to two years). You also must be careful about reusing tapes.

10.5.4 Backing Up a Server That Contains User Data

If you have a file system that contains all of the user data directories on the Lotus Domino Server, just replace the lines shown in Figure 273 in the script backtape with the lines shown in Figure 274 on page 292.

```
# Make the system backup of the $FS
echo "\nMaking backup level $LEVEL of $FS on $TAPE0..."
/usr/sbin/sync
/usr/sbin/sync
/usr/sbin/backup -u -$LEVEL -f /dev/$TAPE0 $FS
```

Figure 273. Lines to Be Removed

```
# Make the system backup of the /server1
echo "\nMaking backup level $LEVEL of /server1 on ${TAPE0}.1..."
/usr/sbin/sync
/usr/sbin/sync
/usr/sbin/backup -u -$LEVEL -f /dev/${TAPE0}.1 /server1
# Make the system backup of the /home
echo "\nMaking backup level $LEVEL of /home on ${TAPE0}.1..."
/usr/sbin/sync
/usr/sbin/sync
/usr/sbin/backup -u -$LEVEL -f /dev/${TAPE0}.1 /home
```

Figure 274. Lines to Be Added

You will have the same backup schedule for the users' data file system using the same tapes.

To restore the data of the /server1 file system, run the `restore` command (see 10.5.5.1, "Restoring Files with Restore" on page 293). To restore the data of the /home file system, you must use the `tctl` command to advance the tape. With the `restore` command, specify the `-f` flag to indicate a non-rewinding device. The commands below list the table of contents of the /home file system backup. They assume the backup tape is available at the unit `rmt0`.

```
# tctl -f /dev/rmt0 rewind
# tctl -f /dev/rmt0.1 fsf 1
# restore -T -f /dev/rmt0.1
```

10.5.5 Restoring Data from Tape

To restore a whole file system, first ensure you have an empty and error-free file system before restoring the data from tape to it. Then, you will have to use the `restore` command.

To restore a database that is stored on tape or in a file, you must use the `restore` command. This command copies the database files you select from the tape to the hard disk. You can copy the backup file over the damaged file to restore the whole database or use one of the following tips to manage at the document level.

- To preserve the new documents added since the last backup, restore the backup to a different directory, move it to the databases directory using a new file name, then copy and paste the new documents from the live database to the backup. Delete the live database, and rename the backup to the original name.

- To restore a single, damaged, or deleted document, you must restore the backup of the whole database with a new file name and copy the

document from the backup to the live database. Following this, delete the backup database from the hard disk.

10.5.5.1 Restoring Files with Restore

The `restore` command extracts files from archives created with the `backup` command. To check a backup tape, you can use the `restore` command with the `-T` flag: `restore -T -f /dev/rmt0`. This command produces a list of all backed up files.

For example, if you lost the /server1 file system, to recover it on the last backup, you must take the appropriate actions (for example, remove the old files, remove the file system and create a new one, and so on) until you have an empty, mounted, and error-free file system in /server1. After that, as `root`:

1. Change directory to /server1. This is very important.

2. First restore the last full backup:

   a. Make sure that your media (the tape or the file) is available.

   b. Run the command:

   ```
   # restore -x -v -f <device name>
   ```

   If you are using the tape, use /dev/rmt0.1. You may need to run the `tctl` command. Use the `tctl` command when you have made more than one backup on a single tape. If you are using a file archive, use its name.

   c. When the system prompts with the message

   ```
   Specify the next volume number:
   ```

   press **1** and **Enter**, and the restoration proceeds.

   d. When the system prompts with the message

   ```
   Do you want to set the owner or the mode for the current
           directory? [ yes or no ]
   ```

   answer `yes` to set the owner and the mode for the /server1 directory.

3. If you have performed incremental backups since the last full backup, restore only the last incremental one. Insert the correct tape, or specify the new file name, and run the same command as above. Be sure to be in the /server1 directory, and run the same `restore` command.

If you want to restore only some files, restore them to a temporary directory, and then move them into place using the `mv` command. For example, as `root`, do the following:

1. Create a temporary directory, /server1/restore.

2. Change the owner and group of this directory to notes.

3. Change the current directory to /server1/restore.

4. Make the archive media available as described above.

5. Run the command:

   ```
   # restore -i -f <filename>
   ```

6. Use the `-i` flag subcommands to list the files. Select the ones you want and restore them.

   Given below is an example to restore the file, names.nsf (Domino Directory database). What you need to type is highlighted.

Script for restoring the names.nsf file

```
# mkdir -m 750 /server1/restore
# chown notes.notes /server1/restore
# cd /server1/restore
# restore -i -f /dev/rmt0.1
Please mount volume 1 on /dev/rmt0.1.
        Press the Enter key to continue.

restore > ls
.:
 .Xpdefaults    .sh_history    notesr4/
 .profile       log/           scripts/

restore > cd server1
restore > ls
./server1:
 .notes4000     certlog.ntf    doclibm4.ntf    mail/          readme.nsf
 admin4.nsf     cluster.ncf    events4.ntf     mail.box       reserve4.ntf
 admin4.ntf     dba4.ntf       help4.nsf       mail4.ntf      server.id
 alog4.ntf      dblib4.ntf     helplt4.nsf     mailbox.ntf    statrep.ntf
 approve4.ntf   desktop.dsk    journal4.ntf    modems/        unix/
 cache.dsk      discuss4.ntf   log.nsf         names.nsf      user.id
 catalog.nsf    doc/           log.ntf         notes.ini      web.ntf
 catalog.ntf    doclib4.ntf    loga4.ntf       pernames.ntf   ~console.tmp
 cert.id        doclibl4.ntf   lotusen1.dic    pubnames.ntf   ~notes.lck

restore > add names.nsf
restore > extract
You have not read any media yet.
Unless you know which volume your file or files are on, you should start
with the last volume and work towards the first volume.
Specify the next volume number: 1
Do you want to set the owner or the mode for the current
```

```
        directory? [ yes or no ] yes
restore > quit
# pwd
/server1/restore
# ls
server1
# cd server1
# ls
names.nsf
# mv names.nsf /server1
# cd ..
# rmdir server1
#
```

10.6 Backup and Recovery of the AIX System

It is very important to do a full system backup from the AIX server machine at least weekly. You will need to have a tape unit locally attached to each server you want to back up.

You can take a system backup to a file on a backup server, but you will need to set up a Network Install Manager (NIM) environment to be able to restore the AIX system from this file.

To take a system backup, you need the bos.sysmgt.sysbr fileset installed in your system. You can use the command `lslpp -l bos.sysmgt.sysbr` to see if this file set is installed on your system. The `mksysb` command only backs up the rootvg volume group. If you have other Volume Groups, you can use the `smitty savevg` command.

10.6.1 Backing Up the AIX System

In this redbook, we show only the minimal procedure to do a system backup for the rootvg volume group. Please refer to the *AIX Version 4.3 Installation Guide*, SC23-4112 for more information about the system backup.

To backup the system:

1. Log in as `root`.

2. Mount all file systems (in the rootvg) you want to back up. Refer to the `mount` command for details.

> **Note**
>
> The `mksysb` command does not back up file systems mounted across an
> NFS network.

3. Enter the `smitty mksysb` command. The Back Up the System screen, as
   shown in Figure 275, appears

```
                        Back Up the System

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

                                                 [Entry Fields]
     WARNING:   Execution of the mksysb command will
                result in the loss of all material
                previously stored on the selected
                output medium. This command backs
                up only rootvg volume group.

 * Backup DEVICE or FILE                          [/dev/rmt0]
   Create MAP files?                               no
   EXCLUDE files?                                  no
   List files as they are backed up?              no
   Generate new /image.data file?                 yes
   EXPAND /tmp if needed?                          yes
   Disable software packing of backup?            no
   Number of BLOCKS to write in a single output   []
      (Leave blank to use a system default)

 F1=Help           F2=Refresh        F3=Cancel         F4=List
 F5=Reset          F6=Command        F7=Edit           F8=Image
 F9=Shell          F10=Exit          Enter=Do
```

Figure 275. Back Up the System

   a. Press **F4** in the `Backup DEVICE or FILE` field and choose the tape for the
      backup.

   b. Select **yes** on the `EXPAND /tmp if needed?` field.

   c. Insert the tape in the unit, and press **Enter**.

> **Note**
>
> - The `mksysb` command will create a bootable tape on an ISA-bus (Industry Standard Architecture) machine, but not *every* ISA-bus machine will boot from tape. To determine if your system will boot from tape, run the command: `bootinfo -e`. If a `0` is returned, it will not boot from tape, and you must boot from CD-ROM to install your mksysb tape.
>
> - The mksysb tapes that are created on ISA-bus machines will not boot Micro Channel-based uniprocessor or Micro Channel-based symmetric multiprocessor machines, and mksysb tapes made from Micro Channel-based uniprocessor and Micro Channel-based symmetric multiprocessor machines will not boot on ISA-bus machines.

10.6.2 Restoring the AIX System Backup

In this redbook, we show only the minimal procedure to restore the system from the backup tape. Please refer to the *AIX Version 4.3 Installation Guide*, SC23-4112, for more information about the system backup.

To restore the system:

1. Insert the backup tape (write protected) in the tape unit.
2. Shut down and power-off the system.
3. Put the system key in the Service position, if there is a key.
4. Power on the system.
5. After several minutes, `c31` is displayed in the LED. Choose the system console.

After this, turn the key to the normal position (when asked) and follow the installation menus.

10.7 Other Native AIX Backup Tools

Instead of the commands `backup` and `restore`, you may choose between several other tools for backup. Each of these tools have advantages and disadvantages over the others. One reason to choose another tool might be that your site is already using `tar` or `cpio` for other backups. It might then make sense to look into using the same tool for your Lotus Domino Server as well. In this section, we will give a quick overview of the other tools you may choose from. If you need more information, please refer to the man pages of the respective command.

10.7.1 tar

tar (Tape Archiver) is a traditional AIX tool that has been around since the early days. As the name suggests, it archives files and puts them on a tape. The `tar` command works with the usual AIX files; so, it is not really restricted to archiving to tape. You can put your archives on almost anything that is a file in AIX. Basically, it is a very simple tool. All it really does is to take one or more files and directories and archives them into one single file. Nothing more, nothing less. There is no compression or encryption involved as in some other tools. If you want compression, for instance, you have the option of adding that after the archive is created.

It is possible to exchange the `backup` and `restore` commands that we have used so far with `tar`. This might be preferable if there is a mixed environment at your site, and the other hosts on your network don't support the `backup` and `restore` commands. If you choose to do this, there are a few things to be aware of. First of all, unlike `backup`, `tar` can only back up files by file name. This is not really a problem, just different. Also, `tar` does not read files to back up from standard input. You must add the files and the directories to the command line when invoking `tar`. However, if you specify directories on the command line, `tar` will search those directories recursively; so, normally, you only need to specify one or a few. Finally, `tar` has some restrictions on file names, sizes, and attributes. For example, `tar` does *not* back up ACLs.

> **Note**
>
> The `tar` command does not normally perform any translations of file and directory names. Therefore, if you specify absolute path names when you back up files or directories, they will also appear at the very same location if you extract them later potentially overwriting an old file. A good rule of thumb is to always try to use relative path names with `tar`. A relative path name is a path name that does not begin with the character `/`.

If you want to back up the directory (or file system), /usr/domino/lotus to tape device /dev/rmt0 using `tar`, you could use the following sequence of commands (note that the `tar` command ends with a space and a period):

```
# cd /usr/domino/lotus
# tar -cvf /dev/rmt0 .
a .
a ./notes
a ./notes/5000
a ./notes/5000/ibmpow
a ./notes/5000/ibmpow/Notes.jar 401 blocks.
a ./notes/5000/ibmpow/icsclass.jar 447 blocks.
a ./notes/5000/ibmpow/getgroup 67 blocks.
a ./notes/5000/ibmpow/amgr 357 blocks.
a ./notes/5000/ibmpow/chronos 68 blocks.
a ./notes/5000/ibmpow/notes 28984 blocks.
...
```

Figure 276. tar Command to Back Up /usr/domino/lotus

To list the entire archive, you would use `tar -tvf /dev/rmt0`, and to extract the entire archive to the current directory, you would use `tar -xvf /dev/rmt0`. Be advised that, when extracting files, `tar` will overwrite any existing files with the archived version if a file with the same name exists.

The `tar` command isn't really able to create archives on remote hosts, but if your file system is on one host, and the tape device on another, and they can talk to each other over a network, you can use the following trick to copy your archive to the remote host. First of all, the root user on the local host must be trusted as root on the remote host; that is, the local machine name must be in the file /.rhosts on the remote host. Then, to back up the local directory /usr/domino/lotus to the remote tape unit /dev/rmt0, you would use the following commands. In this example, the remote host with the tape unit is called `noteserv`.

```
# cd /usr/domino/lotus
# tar -cvf . | remsh noteserv "dd bs=1024 of=/dev/rmt0"
```

> **Note**
>
> - This trick will only work with a remote host running AIX or some other version of UNIX.
> - Depending on the OS and the tape unit on the remote host, you might need to give a different block size. See the user manuals for the OS in question.

The `tar` command has many more options worth exploring that are beyond the scope of this book.

10.7.2 cpio

The name `cpio` comes from the intended use of the command: CoPy files In and Out of archives. Just like `tar`, `cpio` has been around since the beginning of AIX. The `cpio` command differs from `backup` and `tar` by only working with the standard input and output of the shell. You must use shell redirection to send a `cpio` archive to permanent storage. To specify the files to be archived or extracted, you must supply them on the standard input of `cpio`. It may sound difficult, but it really isn't. It also gives you great flexibility in how you want to list filenames and where to store the archive. Just like `tar`, `cpio` does not compress or encrypt the archived files, but it is very easy to add with other commands.

You may want to choose `cpio` for your backups if you are on a mixed environment network, or if your site already uses `cpio` for regular backups. The `cpio` command has similar restrictions on file name, size, and attributes to `tar`. The main difference is that `cpio` takes file names on standard input instead of the command line.

Note

The `cpio` command does not normally perform any translations of file and directory names. Therefore, if you specify absolute path names when you back up files or directories, they will also appear at the very same location if you extract them later potentially overwriting an old file. A good rule of thumb is to always try to use relative path names with `cpio`. A relative path name is a path name that does not begin with the character `/`.

If you want to back up the directory (or file system) /usr/domino/lotus to tape device /dev/rmt0 using `cpio`, you could use the following sequence of commands:

```
# cd /usr/domino/lotus
# find . –print | cpio –ovB > /dev/rmt0
.
notes
notes/5000
notes/5000/ibmpow
notes/5000/ibmpow/Notes.jar
notes/5000/ibmpow/icsclass.jar
notes/5000/ibmpow/getgroup
notes/5000/ibmpow/amgr
notes/5000/ibmpow/chronos
...
```

Figure 277. cpio Command to Back Up /usr/domino/lotus

To list the entire archive, you would use `cpio –itvB < /dev/rmt0`, and to extract the entire archive to the current directory, you would use `cpio –idumvB < /dev/rmt0`. Be advised that, when extracting files, `cpio` will overwrite any existing files with the archived version if a file with the same name exists.

For storing the archive on a remote tape unit, it is possible to use a trick similar to the one we used for `tar` in 10.7.1, "tar" on page 298. The same restrictions on network connectivity and trust relationship applies to `cpio`. For example, to back up the local directory /usr/domino/lotus to the remote tape unit /dev/rmt0 you would use the following commands. In this example, the remote host with the tape unit is called `noteserv`.

```
# cd /usr/domino/lotus
# find . –print | cpio –ovC2 | remsh noteserv "dd bs=1024 of=/dev/rmt0"
```

--- **Note** ---

- This trick will only work with a remote host running AIX or some other version of UNIX.
- Depending on the OS and the tape unit on the remote host, you might need to give a different block size. See the user manuals for the OS in question.

The `cpio` command has many more options worth exploring that are beyond the scope of this book. For more information, refer to the `cpio` manual page. Alternatively, you can also find relevant documentation, including a commands reference for AIX, at;
`http://www.rs6000.ibm.com/resource/aix_resource/Pubs/` on the World Wide Web.

10.7.3 savevg/restvg

If you followed the installation instructions in Chapter 2, "Installing a Lotus Domino R5 Server" on page 15, you have a good setup for using the commands `savevg` and `restvg` to back up your Lotus Domino Server. These two commands are significantly different from the ones we've described so far since they back up an entire volume group not just files or filesystems. However, this also means that you can't perform incremental backups, nor can you backup or restore individual files or filesystems. (It is, however, possible to recover single files from a `savevg` backup using the `restore` command. See 10.5.5.1, "Restoring Files with Restore" on page 293 for more information.) These tools make it really quick for you to restore your system after a disk crash. They do not, however, provide very good help if you've accidentally removed a file and want to recover just that single file.

With `savevg` and `restvg`, you have the option, just like with `tar` and `cpio`, to save the backup to tape, a regular file on disk, or any other AIX supported file. It is not, however, possible to use the remote remsh trick above with `savevg`. Your only option, if you can't save the backup locally, is to save the backup file to an NFS server or some other shared file system.

If you have a volume group dominovg that contains the logical volumes noteslv and notesdatalv, then you can use the following command to back up both your server file system and your Lotus Domino software file system. It is assumed that the directory or file system /backup exists and can hold dominovg in its entirety. Remember to shut down your Lotus Domino Server before starting the backup.

```
# savevg -f/backup/savevg-dominovg-980731 -v dominovg

Creating list of files to back up.
Backing up 2366 filesBacking up to /backup/savevg-dominovg-980731.
Cluster 51200 bytes (100 blocks).
Volume 1 on /backup/savevg-dominovg-980731
a         70 ./tmp/vgdata/vgdata.files
a       2569 ./tmp/vgdata/dominovg/filesystems
a       2707 ./tmp/vgdata/dominovg/dominovg.data
a          0 ./server1
a          0 ./server1/lost+found
a        391 ./server1/.profile
a        654 ./server1/.sh_history
a          0 ./server1/
a          0 ./server1/unix
a        406 ./server1/unix/123.bmp
a         28 ./server1/unix/123.mac
```

Figure 278. savevg Command To Back Up Dominovg

To restore the backup in the previous example, you would use:

```
# restvg -f/backup/savevg-dominovg-980731 -q
```

to restore `dominovg` to the same physical volume that it came from, or

```
# restvg -f/backup/savevg-dominovg-980731 -q hdisk1
```

to restore it to the physical volume `hdisk1`. You can specify more than one physical volume if you wish.

The commands `savevg` and `restvg` have many more options worth exploring that are beyond the scope of this book. For more information, refer to the `savevg` and `restvg` manual pages. Alternatively, you can also find relevant documentation, including a commands reference for AIX, at: `http://www.rs6000.ibm.com/resource/aix_resource/Pubs/` on the World Wide Web.

10.8 Advanced Backup Solutions

If you have a large installation of Lotus Domino with many hosts, and/or high demands of availability, you may want to consider using a more advanced backup solution. Some of these solutions can give you easier administration, on-line backup of your databases, and shorter recovery time in case of a system failure. They may also give you the opportunity to use multiple tape devices and tape libraries on several servers throughout your network.

10.8.1 Backup of More Than One Server

If you have a small number of servers, you can implement local backups for each of them as described in 10.5.3, "How to Back Up Only One Server" on page 288.

Another idea is to make the backups on a host with enough disk space or to use the `rdump` command to back up to a remote tape. You will find a simple implementation of these two methods in the following subsections.

10.8.1.1 Backup on Disk

If you have a host with enough disk space and tape units, you can make it a backup server. First, you have to create the file system(s) for backups and, after that, export it/them through NFS or AFS.

Next, mount the backup file system on the servers you want backed up and change the script backtape to make the backups to files instead of on tapes. The updated script is presented in Figure 279 on page 305.

On the backup server, you need to back up the backup file system(s) to one or more tapes. This can be done using the `backup` command.

This sample environment will be used for our discussion on backup:

- The backup server will be called noteserv. This is also a Lotus Domino Server. The /backup is the backup file system.
- There are two other Lotus Domino Servers, called ah1610a and ah1610b. Both use NFS to mount the /backup file system from noteserv.

The new version of the `backtape` script is in Figure 279 on page 305. It is called `backfile`.

```ksh
#!/bin/ksh
#@(#) backfile Lotus Notes backup procedure
#
# Usage: backfile <level>
#
FS=/server1
LEVEL=$1
FILE=/backup/`/bin/uname -n`/backup.$LEVEL.`/bin/date '+%y%m%d.%w'`

echo "Backup level $LEVEL, file $FILE"
echo "Started on `date` on server `uname -n`"

# Remove the old file for the last week.
echo "\nRemoving old backup files..."
/bin/ls -la /backup/`/bin/uname -n`/backup.$LEVEL.*.`/bin/date '+%w'`

/bin/rm -f /backup/`/bin/uname -n`/backup.$LEVEL.*.`/bin/date '+%w'`

# Stop the Lotus Domino server
echo "\nStopping the Lotus Domino server..."
$FS/bin/stop_domino

# Make the system backup of the $FS
echo "\nMaking backup level $LEVEL of $FS on $FILE..."
/usr/sbin/backup -u -$LEVEL -f $FILE $FS

# Restart the Lotus Domino server
echo "\nRestarting the Lotus Domino server..."
$FS/bin/start_domino

echo "\nEnd of the backup program."
```

Figure 279. Modified Script to Back Up on Files (backfile)

This script makes the backup on the file
/backup/<hostname>/backup.<level>.<date>.<weekday> where:

<hostname>	is the machine host name.
<level>	is the level of the backup. In our example, it will be 0 or 5.
<date>	is the date of the backup in the format: YYMMDD (year, month, day).
<weekday>	is the number of the weekday, beginning with 0 (Sunday) and ending with 6 (Saturday).

It also removes the old backup files for the same weekday. The backup operator must be sure that the copy to the tapes is working well. This is a critical part of this backup environment.

In order to set up the backup environment, the following steps are required:

1. Create the /backup file system on noteserv. Remember, it must be large enough to hold all the backup files. Running `smitty crjfs`, you can create the file system. You have to specify the size of the file system, specify the mount point name (/backup), and ask for the automatic mount after the system restart. If you want, you can use a compressed file system.

2. Mount the new file system: `mount /backup`.

3. Export this file system to the machines you want to back up and do one of the following:

   a. Give the client machines write access to the backup file system.

   b. Export the file system and allow the hosts to have root access to the client machines.

   c. Give 1777 permission to the directories that the client machines must write to.

   The `smitty` fastpath for exporting a file system is `mknfsexp`.

4. Create a directory for each machine you want to back up. In our example, the directories /backup/noteserv, /backup/ah1610a, and /backup/ah1610b have to be created. These directories need permissions 1777 if you haven't exported the /backup file system with the hosts allowed root access option to the client hosts.

5. Copy the script backfile to the /server1/scripts directory of all hosts.

6. Mount the /backup file system on ah1610a and ah1610b. Use `smitty mknfsmnt` and complete the fields as follows:

```
                    Add a File System for Mounting

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

[TOP]                                              [Entry Fields]
* PATHNAME of mount point                          [/backup]                  /
* PATHNAME of remote directory                     [/backup]
* HOST where remote directory resides              [noteserv]
  Mount type NAME                                  []
* Use SECURE mount option?                         no                    +
* MOUNT now, add entry to /etc/filesystems or both?  both                +
* /etc/filesystems entry will mount the directory  yes                   +
   on system RESTART.
* MODE for this NFS file system                    read-write            +
* ATTEMPT mount in foreground or background        background            +
  NUMBER of times to attempt mount                 []                         #
  Buffer SIZE for read                             []                         #
  Buffer SIZE for writes                           []                         #
  NFS TIMEOUT. In tenths of a second               []                         #
[MORE...21]

F1=Help              F2=Refresh          F3=Cancel            F4=List
F5=Reset             F6=Command          F7=Edit              F8=Image
F9=Shell             F10=Exit            Enter=Do
```

Figure 280. Mount the Remote /backup File System Using smitty

7. Create the crontab entries shown in Figure 281 on all hosts:

```
#minute  hour  day_of_month  month  weekday  command
0 23 * * 0,1,2,4,5,6 /server1/scripts/backfile 5 2>&1 | /bin/mail -s "Backup level5"
root
0 23 * * 3 /server1/scripts/backfile 0 2>&1 | /bin/mail -s "Full Backup" root
```

Figure 281. Crontab for the Backtape Script

In this case, the level 5 backup is done every day except Wednesday when the full backup is done. This script must be present in the /server1/scripts directory for all the servers you want to back up. Also, the crontab lines must be present. Note, the backup server needs to run this script because it is a Lotus Domino Server too.

8. The backup server needs another script (See Figure 282 on page 308) to handle the backup files and copy them to the tapes. Put this script in /server1/scripts on noteserv.

```
#!/bin/ksh
#@(#) dumpfiles:  Dump the backup files to
the tape.
# It must run on thursday night, after the operator confirm
# the success of the full backup from wednesday.
# Usage: dumpfiles
#

echo "dumpfiles: started on `date` on server `uname -n`"

# These tapes attributes applies to the 8mm 2.3/5GB tapes
# Check for the attributes that applies to your tape
echo "\nChanging the attributes of rmt0..."
/usr/sbin/chdev -l rmt0 -a block_size=1024 -a mode=yes -a extfm=yes

# We have to rewind the tape
echo "\nRewinding the tape rmt0..."
/bin/tctl -f /dev/rmt0 rewind

#
# Make the backup of the /backup file system
#
cd /backup
find . -print | backup -q -f/dev/rmt0

# Ejecting the tape
echo "\nEjecting rmt0..."
/bin/tctl -f /dev/rmt0 offline

echo "End of the backup..."
```

Figure 282. Script to Dump Backup Files to Tape (dumpfiles)

9. Create the crontab entry shown in Figure 283 on noteserv:

```
#minute  hour  day_of_month  month  weekday  command
0 17 * * 4 /server1/scripts/dumpfiles 2>&1 | /bin/mail -s "Dumpfiles" root
```

Figure 283. Crontab for the Dumpfiles Script

The script dumpfiles copies all the data in the /backup file system to a
tape. It must end before the Thursday backup begins.

To recover a file, if it is an old backup that is on tape, you have to copy it back
to the hard disk and then use the restore command as described in 10.5.5.1,
"Restoring Files with Restore" on page 293. To copy it to your hard disk,

create a temporary directory, for example, /backup/tmp, and make it your current directory (using `cd /backup/tmp`). Then, use the `restore` command to extract the files you want.

To list the contents of the tape, you can use the following:

```
# restore -T -q -f/dev/rmt0
./noteserv
./noteserv/backup.5.960215.4
./noteserv/backup.5.960216.5
./noteserv/backup.5.960217.6
./noteserv/backup.5.960218.0
./noteserv/backup.5.960219.1
./noteserv/backup.5.960220.2
./noteserv/backup.0.960214.3
./noteserv/backup.0.960221.3
...
```

Figure 284. List Contents of Tape

to extract the level 0 file from 2/21/96:

```
# cd /backup/tmp
# restore -x -q -f/dev/rmt0 ./noteserv/backup.0.960221.3
x ./noteserv/backup.0.960221.3
```

Figure 285. Extract the Level 0 File

10.8.1.2 Backup Using rdump

Using the `rdump` command, you can use another machine tape for performing backups. The host with the tape will be called tape server, and the others will be called clients.

To use this command, the client machines must have root .rhosts access to the tape server machine. In our example, the tape server will be noteserv, and the clients will be ah1610a and ah1610b. The /.rhosts file for noteserv is shown in Figure 286:

```
ah1610a.itsc.austin.ibm.com root
ah1610b.itsc.austin.ibm.com root
```

Figure 286. The /.rhosts File for the Tape Server noteserv

Lotus Domino R5 Advanced Administration on AIX   **309**

The group and other users can't have any access to this file.

Let's again modify the backtape script as given below.

Script to backup several hosts (backhosts):

```
#!/bin/ksh
#@(#) backhosts Lotus Notes backup procedure
#
# Usage: backhosts [-copy] <level> <tape0> <tape1>
#
COPY=NO
FS=/server1
SERVER=noteserv
HOSTS="noteserv ah1610a ah1610b"

# Display error message and exits
Error () {
  echo "Usage: backhosts [-copy] <level> <tape0> <tape1>"
  echo "Example: backhosts 5 rmt0 rmt1" >&2
  exit 1
}

NARGS=$#
# Test for the copy option
[[ $1 = -copy ]] && { COPY=YES ; shift ; let NARGS=${NARGS}-1 ; }
# Test the number of flags, must be 3
[[ $NARGS -ne 3 ]] && Error

LEVEL=$1
TAPE0=$2
TAPE1=$3

echo "Backup level $LEVEL, tape0 $TAPE0, tape1 $TAPE1, copy=$COPY"
echo "Started on `date` on server `uname -n`"

# These tapes attributes applies to the 8mm 2.3/5GB tapes
# Check for the attributes that applies to your tape
echo "\nChanging the attributes of $TAPE0..."
/usr/sbin/chdev -l $TAPE0 -a block_size=1024 -a mode=yes -a extfm=yes

# We have to rewind the tape
echo "\nRewinding the tape $TAPE0..."
/bin/tctl -f /dev/$TAPE0 rewind

# Stop the Lotus Domino server
echo "\nStopping the Lotus Domino server"
```

```
$FS/bin/stop_domino

for HOST in $HOSTS
do
  if [[ $HOST != $SERVER ]]
  then
    # Make the system backup of the $HOST:$FS
    echo "\nMaking backup level $LEVEL of $HOST:$FS on $TAPE0..."
    rsh $HOST /usr/sbin/sync
    rsh $HOST /usr/sbin/sync
    # The values of density (-d 6250) and tape length (-s 33000)
    # refers to the 8mm 2.3GB
    rsh $HOST /usr/sbin/rdump -d 6250 -s 33000 -u -$LEVEL \
        -f ${SERVER}:/dev/${TAPE0}.1 $FS
  else
    /usr/sbin/sync
    /usr/sbin/sync
    # Make the system backup of the $HOST:$FS
    echo "\nMaking backup level $LEVEL of $HOST:$FS on $TAPE0..."
    /usr/sbin/backup -u -$LEVEL -f /dev/${TAPE0}.1 $FS
  fi
done

# Restart the Lotus Domino server
echo "\nRestarting the Lotus Domino server..."
$FS/bin/start_domino

# Making the tape copy...
if [[ $COPY = YES ]]
then
  # These tape attributes apply to the 8mm 2.3/5GB tapes
  # Check for the attributes that apply to your tape
  echo "\nChanging the attributes of $TAPE1..."
  /usr/sbin/chdev -l $TAPE1 -a block_size=1024 -a mode=yes -a extfm=yes

  # We have to rewind the tapes
  echo "\nRewinding the tape $TAPE0 for copy..."
  /bin/tctl -f /dev/$TAPE0 rewind
  echo "\nRewinding the tape $TAPE1 for copy..."
  /bin/tctl -f /dev/$TAPE1 rewind

  # Make the copy
  echo "\nMaking the copy of $TAPE0 on $TAPE1..."
  /bin/tcopy /dev/$TAPE0 /dev/$TAPE1

  # Ejecting the tape
  echo "\nEjecting $TAPE1..."
```

```
   /bin/tctl -f /dev/$TAPE1 offline
fi

# Ejecting the tape
echo "\nEjecting $TAPE0..."
/bin/tctl -f /dev/$TAPE0 offline

echo "\nEnd of the backup program."
```

This script performs a remote shell on the client machines to do the remote backup. On the client machines, you will need the /.rhosts file (Figure 287) to permit noteserv to perform the remote shell.

```
noteserv.itsc.austin.ibm.com root
```

Figure 287. /.rhosts File for the Clients

The crontab entry on the tape server (noteserv) is shown in Figure 288.

```
#minute  hour  day_of_month  month  weekday  command
 0 23 * * 1,2,4,5 /server1/scripts/backhosts 5 rmt0 rmt1 2>&1 | /bin/mail -s "Backup level 5" root
 0 23 * * 6 /server1/scripts/backhosts 5 rmt1 rmt0 2>&1 | /bin/mail -s "Backup level 5" root
 0 23 * * 3 /server1/scripts/backhosts -copy 0 rmt0 rmt1 2>&1 | /bin/mail -s "Full Backup" root
```

Figure 288. Crontab for the Backtape Script

Note that only one tape is required to perform all the backups. This can be done with the non-rewinding device; the tape name ends with "a .1".

In order to restore the files, you will need to run the `tctl` command to position the tape on the right backup. In our case, to restore the noteserv files, you don't need to run `tctl` because it is the first backup. To restore the ah1610a backup, you need to advance to the second backup:

```
# tctl -f /dev/rmt0 rewind
# tctl -f /dev/rmt0.1 fsf 1
```

The first command rewinds the tape. On the second, it is very important to put the `.1` at the end of the tape name. This command advances the tape to the second backup. To access the ah1610b backup, enter:

```
# tctl -f /dev/rmt0 rewind
# tctl -f /dev/rmt0.1 fsf 2
```

The `restore` command is described in 10.5.5.1, "Restoring Files with Restore" on page 293.

10.8.2 ADSM

ADSTAR Distributed Storage Manager (ADSM) is an IBM product that can give you much more than the native AIX tools. Together with the ADSMConnect Agent for AIX, the Notes Agent, you get access to the following features:

- Perform incremental backups of Lotus Notes databases at the document level backing up only those documents that have changed since the previous backup.
- Recover individual documents in a database that have previously been backed up by the Domino Agent.
- Recover individual documents that have been deleted from a Lotus Notes database.
- Recover an entire Lotus Notes database.
- Perform an incremental restore function by merging changed documents into a previously restored database.
- On-line backup of a Lotus Notes database; that is, you can still use the database while backing it up.
- Backup and recovery of access control lists.
- Point in time recovery, meaning that you can restore your Lotus Domino Server to the state at a certain point in time.
- Centralized backup of all Lotus Domino Servers.

When ADSM and the Domino Agent is installed, performing a backup is very simple. The following is a transcript of a sample backup session:

```
# dsmnotes incr \*
ADSTAR Distributed Storage Manager
ADSMConnect Agent for Lotus Notes - Version 2.1.7
(C) Copyright IBM Corporation, 1990, 1997, All Rights Reserved.
Backing up database: /server1/busytime.nsf
Documents sent: 40
Documents sent: 80
Documents sent: 96
Documents deleted: 5
Backing up database: /server1/catalog.nsf
Documents sent: 29
Backing up database: /server1/log.nsf
Documents sent: 15
Documents deleted: 5
Backing up database: /server1/names.nsf
Documents sent: 40
Documents sent: 53
Documents deleted: 5
Summary:
Database: /server1/busytime.nsf
Documents backed up: 96, documents deleted: 5
Database: /server1/catalog.nsf
Documents backed up: 29, documents deleted: 0
Database: /server1/log.nsf
Documents backed up: 15, documents deleted: 5
Database: /server1/names.nsf
Documents backed up: 53, documents deleted: 5
Total number of documents backed up: 193
Total number of documents deleted: 15
Total number of bytes sent: 2210.5 KB
ANS09001 dsmnotes completed
```

Figure 289. Transcript of a Sample Backup Session Using ADSM

Recovery is also very simple. For example, this is the command that you would type on the command line to recover a single database that already exists on your server: `dsmnotes restore /server1/names.nsf -merge=yes`.

For detailed installation and usage instructions, please refer to the Redbook on using ADSM with Lotus Notes, *Using ADSM to Back Up Lotus Notes*, SG24-4534. There is also a spot on the IBM Web site for ADSM.You find it at the following address:
`http://www.storage.ibm.com/software/adsm/adsmhome.htm`.

10.8.3 Legato NetWorker

If you are currently using Legato NetWorker for backups on your system, you might be interested in using the Legato NetWorker BusinesSuite Module for

Lotus Notes to back up your Lotus Domino Server (the Notes Module). You will need to have the Legato NetWorker server software already installed on your system. With the Notes Module, you gain the following features in addition to what NetWorker normally offers:

- Perform incremental backups of Lotus Notes databases at the document level backing up only those documents that have changed since the previous backup.

- Recover individual documents in a database that have previously been backed up by the Notes Module.

- Recover individual documents that have been deleted from a Lotus Notes database.

- Recover an entire Lotus Notes database.

- On-line backup of a Lotus Notes database; that is, you can still use the database while backing it up.

- Point in time recovery, meaning that you can restore your Lotus Domino Server to the state at a certain point in time.

- Centralized backup of all Lotus Domino servers.

It is beyond the scope of this book to describe installation and operation of Legato NetWorker and the Notes Module. For more information on these products, contact Legato Systems, Inc., or see their Web site at:
`http://www.legato.com/.`

Chapter 11. High Availability, Scalability, RS/6000 SP

This chapter provides an overview regarding the various high availability and scalability issues related to Lotus Domino and the RS/6000 as well as the RS/6000 SP. For information about the RS/6000 SP, refer to 11.3, "Scalability and RS/6000 SP" on page 322. It does not provide a detailed description regarding all these issues, but it is a good starting point for getting familiar with these topics.

In general, you have to cover different areas of availability to provide high availability for a Lotus Domino Server. Each area is addressed by certain features or solution packages.

1. System availability:

   • Addressed by hardware features, such as redundant components, fault tolerant components, service processor, and service director.

2. Data availability:

   • Addressed by operating system or hardware (RAID, AIX LVM, Lotus Domino replication); if data is not available by these mechanisms, you have to take care about restoring from a backup.

3. Service availability:

   • Addressed by Domino Enterprise Server (application failover and loadbalancing) for mail and application databases:

      • Focused on application errors.

      • Client view: Client does not reach their database.

   • Addressed by HACMP (restart of service in case the system is no longer available on another system):

      • Focused on hardware or operating system errors.

      • Server view: System is not working properly.

11.1 RS/6000 and AIX Issues

This section addresses high availability issues related to the RS/6000.

11.1.1 RS/6000 and AIX Basics

Depending on the model you are using for your Lotus Domino Server, different areas of hardware availability are covered. Redundant components, such as fans and power supplies, hot pluggable disks, and the ability for

remote maintenance by using a service processor (see 12.1.2, "Service Processor" on page 352), or the service director are features that make administration tasks a lot easier. For a closer look on these features, you might want to have a look at the system documentation books at: `http://www.rs6000.ibm.com/resource/pubs.html`; other valuable sources are the following redbooks:

- *RS/6000 SP Monitoring: Keeping It Alive,* SG24-4873

- *RS/6000 Models E30, F40, F50 and H50 Handbook,* SG24-5143

Within AIX, there are a couple of features that support the availability of the server and the application service. The most important regarding the Lotus Domino Server are:

- Dynamic kernel reconfiguration
- Logical Volume Manager (LVM)
- Journaled filesystems
- Automatic reboot after crash

The URL `http://www.rs6000.ibm.com/library` is a good starting point to get familiar with AIX and the RS/6000. You can also access the complete software documentation for AIX Version 4.3 at: `http://www.rs6000.ibm.com/resource/aix_resource/pubs`.

11.1.2 Service Processor

The service processor allows you to access your system remotely even without an active AIX. The service processor monitors the status of the system and sends a message to a remote site if a hardware or operating system problem is detected. The service processor enables remote power control, reset, and boot features. It also enables remote maintenance and diagnostic activities including console mirroring. Using a RS/6000 with a service processor is ideal for customers with geographically distributed computing environments that need to be serviced and monitored remotely.

The service processor enables or contributes to the following RAS functions among others:

- Integrated system environmental monitoring/alerting included as standard including AC/DC voltage, fan speed, and temperature sensing.

- Early Power Off Warnings (EPOW), error log analysis, and alert.

- Auto-dial out, call IBM Service Center capability. The system objective is to predict a potential component failure and automatically dispatch an IBM service representative to take preventive maintenance measures to avoid

an outage. The system may also call the IBM Service Center in the event of a critical failure.

- Integrated system monitoring enhances failure error logging, analysis and alert. It can be programmed by the system administrator to re-boot after experiencing the following conditions:

  - AC power restored (after a power loss)

  - Hardware checkstop failures

  - Machine check interrupt

  - Operating system hang or failure

For a detailed description of a service processor, go to: `http://www.rs6000.ibm.com/resource/hardware_docs`. There you will find various manuals and guides.

11.1.3 RS/6000 HA50 Cluster Server

The RS/6000 High Availability Cluster Server - HA50 is a special package-priced solution with options for applications, services, and financing; it is not a new server model. The HA50 consists of currently marketed products:

- H50 Enterprise Servers

- 7133 Serial Disk System

- HACMP cluster software

- AIX operating system

Designated applications are featured solutions with the HA50. The applications (and the providers) are selected as focus segments. The featured application solutions include HA50 specific implementation guides and scripts, available from IBM, to simplify the planning and installation of an HA50 cluster. One of the applications currently featured is Lotus Domino Release 4.6.

The application scripts are executable start/stop failover scripts and are tested for compatibility with the specific application and the HA50. Implementation guides describe the scripts and provide assistance for planning and installation. The scripts and implementation guides are available from a central IBM repository and can be downloaded through the Internet by IBM Global Services (IGS), Business Partner, or customer service personnel from the IBM Web site at: `http://www.rs6000.ibm.com/HA50scripts`.

11.2 Middleware Issues

On top of RS/6000 and AIX, you may apply some high availability solutions.

11.2.1 HACMP

HACMP works in conjunction with Lotus Domino and provides failover of service to another system. A common scenario is to run the nodes at lower than full capacity so that spare resources are available to cope with services failed over from a crashed node. Using this method provides hot failover, and under normal circumstances, all nodes are doing useful work; whereas, other hardware clustering mechanisms may require a redundant spare node, on which to failover services, that is not usually active. This wastes resources that could be usefully employed.

For a detailed discussion, please refer to:

- *High Availability and Scalability with Domino Clustering and Partitioning on AIX*, SG24-5163

Background information about HACMP for both RS/6000 single server and SP systems is provided by:

- *RS/6000 SP HA Infrastructure*, SG24-4838
- *Implementing High Availability on RISC/6000 SP*, SG24-4742
- *High Availability on the RISC System/6000 Family*, SG24-4551

11.2.2 Lotus Domino Clustering

As discussed in 7.5, "Domino Server Clustering" on page 173, Domino Enterprise Servers provide for high availability of your Lotus Domino service. This section provides rough guidelines on how to decide on which of the two clustering methods to use. For a detailed discussion, please refer to the redbook *High Availability and Scalability with Domino Clustering and Partitioning on AIX*, SG24-5163.

The decision to use Domino clustering or HACMP or a combination of both has to be made individually based on your specific needs.

The decision may be based on the technical restrictions or on your preference for one environment. Available skills may also be taken into account during the decision making process. There are no technical reasons why both cannot be used to complement each other to support specific scenarios.

Table 20 shows some scenarios and constraints that may be used to guide the decision.

Table 20. Selecting a Clustering Technology

Lotus Domino Server Functionality	Preferred Solution	Rationale
Mail	HACMP or Domino	Domino Enterprise Servers support mail user failover, free-time lookup, and shared mail. Either can be used.
Mail Router	HACMP or Domino	Mail delivery failover is supported at last hop or all hops in the routing path. Either can be used.
Application	Domino	For load balancing and failover of applications.
External Domain Replication	HACMP	Domino clustering can support only servers in a single domain.
Internet	HACMP or Domino running Internet Cluster Manager	Domino clustering now supports failover of HTTP/HTTPS requests when used with the Internet Cluster Manager.

From the implementation point of view, you should be aware of the main differences regarding the data handling.

- HACMP would restart the defined services on another physical system (node) using the same data of the original system used (by acquiring the volumegroup from a shared disk array). For a Lotus Domino Server, that means restarting the server and running fixup on all databases that were open at the time of the takeover.

- Domino Enterprise Server clustering provides real-time replication during normal operation to maintain replicas of the data available on another system. In the event of a crash on a heavily loaded system, outstanding synchronization events may not be actioned before the crash. If that should happen, slight differences between the databases on the original system and the replica databases would result until the crashed server is brought on-line again and standard scheduled replication re-synchronizes the changes.

- With HACMP, even if the end user is working in an already opened database at the time of the service outage, the end user will be able to save their work afterwards, transparently, as HACMP has taken over the original IP address. Domino Enterprise Server clustering failover occurs only when opening a database.

11.3 Scalability and RS/6000 SP

The most important point about scaling in a Lotus Domino environment is, as always, the proper design of your implementation. As soon as you have identified your Lotus Domino topology in terms of server instances, you have different possibilities to scale your installation. Again, the detailed scalability issues for your environment have to be identified individually, and you have to pick the approach that is right for you.

Scaling in terms of faster hardware on the same server is possible by adding additional memory and additional CPUs or additional network cards depending on your scaling needs. Therefore, if you expect growth during the lifetime of your server, you should start with an SMP system or with an SMP node in an RS/6000 SP. Remember that more than two CPUs are exploited best when running more than one Lotus Domino Server instance on the system (see 7.4, "Domino Server Partitioning" on page 162).

If you reach the limits of your single server, you must add an additional system. You could either use Domino Enterprise Server and/or HACMP to provide for high availability, as discussed in 11.2.2, "Lotus Domino Clustering" on page 320 and 7.5, "Domino Server Clustering" on page 173.

If you need more systems, you should plan in time for a RS/6000 SP since management of multiple servers would be much easier. If you know your scaling needs from the start, it would be wise to start with a one or two-node SP instead of starting with single boxes. If you want to use clustering right from the start, consider the SP High Performance Switch as the proper connection solution for the servers. You would follow the same procedure as described in 7.5.4, "Private LAN Configuration" on page 177, but instead of a second LAN adapter, use the IP address of the switch in setting up your port definitions.

Providing a scalable Web server solution could use the combination of Domino Enterprise Server clustering plus the Internet Cluster Manager task for directing Web clients to an appropriate server. The ICM provides loadbalancing between servers for HTTP and HTTPS requests. See 7.5.9, "The Internet Cluster Manager (ICM)" on page 191.

11.3.1 RS/6000 SP: Planning

If you are going to install a Lotus Domino Server in a SP system, you should know some specifics of the software and the hardware of the RS/6000 SP. For a good starting point to get familiar with software and hardware of RS/6000 SP systems, refer to the new redbook *Inside the RS/6000 SP,*

SG24-5145. As the Scalable Parallel (SP) system is one of the most successful products within the RS/6000 family, this redbook provides a comprehensive and detailed look at the different components that make up this system. It also includes the history and evolution of the SP.

In general, running Lotus Domino on the SP is the same as on a cluster of distinct servers, from the point of view of the application, but you have to consider the system administration advantages of the RS/6000 SP as a foundation for your Lotus Domino Servers. You can also use all the information provided so far in this redbook about Lotus Domino on the RS/6000 SP. Major points to consider, especially for the combination of Lotus Domino and RS/6000 SP, are:

- Use of the High Performance Switch as a separate network for Domino cluster communications.

- Use of the High Performance Switch as a network for backup/restore purposes. If you have a large number of registered mail users, or high volumes of application data, you must carefully plan your backup/restore to fit into the timeframe available.

- Use of the High Performance Switch in conjunction with a network routing node to gain network bandwidth advantages on connecting many clients instead of multiple network adapters per node.

The central source of information about how to implement Lotus Domino Servers using the RS/6000 SP is currently available at the IBM Web site: `http://www.rs6000.ibm.com/resource/technology/notesSPcfg`.

This location provides information about:

- Planning the hardware
- Planning SP Lotus Domino Servers
- Planning SP AIX users
- Planning disk space and configuration
- Planning networks for Lotus Domino Servers
- Planning Lotus Domino High Availability on the RS/6000 SP

Even if you are starting a small Lotus Domino implementation on your SP system, follow these recommendations. It will simplify the growth of your Lotus Domino environment in your SP system.

11.3.2 RS/6000 SP: Installation

After planning your installation, install Lotus Domino on the SP as usual (see Chapter 2, "Installing a Lotus Domino R5 Server" on page 15).

1. Make sure the hardware is installed correctly and that each node meets the requirements for a Lotus Domino Server as described in 2.1, "Hardware, Software, and System Requirements" on page 15.

2. Make sure AIX and Parallel System Support Program (PSSP) are installed on all nodes; see 2.1, "Hardware, Software, and System Requirements" on page 15 and check with the current release notes of Lotus Domino for the needed PTFs. Lotus Domino on a RS/6000 SP needs the same PTFs as a standalone server.

3. Make sure your network connectivity is configured correctly (multiple IP addresses for the switch interfaces if you use partitioning or network routes). The server names you are going to use must be resolvable both by the servers and the clients. For details about multiple IP addresses and partitioning, see 7.4.4, "Configuring TCP/IP for Partitioned Servers" on page 168. Basic network setup is described in 2.2.4, "Step 4 - Configure TCP/IP" on page 18.

4. Make sure paging space is large enough for your environment as described in 2.2.15, "Step 15 - Paging Space" on page 36. There are no special requirements over those for a standalone server.

5. Make sure a user notes with group notes exists on every node where Lotus Domino is going to be installed. It does not have to be a login user, but it is used for file ownership of the server code. Details about creating a user can be found in 2.2.7, "Step 7 - Create AIX Users" on page 26.

6. For each server instance, create a user ID and make it a member of group notes.

7. Create the filesystem /usr/domino on each node where the Lotus Domino Server code is to be installed owned by user notes; see 2.2.10, "Step 10 - Create a Logical Volume for the Domino Binaries" on page 30 and 2.2.12, "Step 12 - Create a File System for the Domino Binaries" on page 33.

8. Create Volume Groups and filesystems, as planned, for each server instance owned by the appropriate user from step 5. A good naming convention is to create the filesystem with the server instance name. So, each filesystem for each server instance will have a different name. See 2.2.9, "Step 9 - Create a Logical Volume for the Domino Data Directory" on page 28 and 2.2.11, "Step 11 - Create a File System for the Domino Data Directory" on page 32.

9. Modify each user's profile as usual for a notes server user and specify the Domino binaries and data directory on the path.

10. Install the Lotus Domino Server executable code on all nodes through the Lotus Domino installation process. If you have the installation CD on the

SPs control workstation, you can install to multiple hosts at the same time if required. You do not have to modify the file .rhosts since the control workstation has access to the nodes anyway.

11.Configure each server instance by starting the *http httpsetup* setup task; see the details starting with 2.3.14, "Step 14 - Login" on page 52 and finishing with 2.3.22, "Step 22 - Server Setup is Complete" on page 58.

12.Perform further setup and administration of Lotus Domino as usual.

11.4 Further Information on High Availability and Scalability

As already pointed out several times, the redbook *High Availability and Scalability with Domino Clustering and Partitioning on AIX,* SG24-5163, provides valuable additional information on these topics. It gives a comprehensive explanation about the different ways of making a Lotus Domino Server highly available. It describes the Lotus Domino Clustering technology as well as the standard HACMP implementation for AIX and RS/6000 SP.

The redbook will help you to plan, install, and configure a highly available Lotus Domino Server using Lotus Domino Clustering and Partitioning as well as HACMP technology including the special version developed for the RS/6000 SP.

Within the six chapters of the book, you will find a good deal of information about what environment will better fit your needs for high availability and scalability as well as detailed examples for implementing those different environments.

Chapter 12. Troubleshooting

Some potential problems and solutions are presented in this chapter. Please also take a careful look at "Things you need to know->Platforms and requirements" in *Release Notes: Domino Server R5* supplied on the Lotus Domino Server CD.

A good source for known problems regarding Lotus Domino is the Lotus Notes Knowledge Base. It is used by Lotus Support to collect known problems. If you work for IBM, you can access it on the intranet at: `http://w3.ncs.ibm.com/lkb.nsf`. If you are a Lotus Business Partner, please check with Lotus on how to access it. In general, you might want to go to: `http://www.support.lotus.com` and perform a search.

For RS/6000 related topics, it is worth visiting: `http://www.rs6000.ibm.com/support` and `http://service.software.ibm.com/support/rs6000`.

12.1 Cleaning Lotus Domino Processes

If a Domino Server should crash, you may have trouble restarting it. This is caused by corrupted shared memory and semaphores that the program does not clean. Even if you do not have trouble after a crash, it is a good practice to clean up before restarting any process. In order to clean up after a crash, you basically have three steps to perform:

1. Kill all processes of the server that failed.

2. Remove the associated Inter-Process Communication (IPC) resources, which are:

   • Shared memory segments
   • Semaphores

3. Remove the file ~notes.lck (located in the Domino data directory).

How do you do it manually?

Assume the Lotus Domino Server has been running with the userid notes:

1. Identify the processes to kill by issuing:

   `ps -ef | grep notes`

   (Assuming `notes` is the AIX account be used to run server).

2. Do a `kill -9` on all suspicious processes either as user root or user notes.

The following screen shot shows an example of a list of processes you might see after issuing the `ps` command. The screen below shows how to end the first Lotus Domino process. Preferably, you should use scripts to do the cleanup (see Figure 293 on page 330).

```
# ps -ef|grep notes
   notes 12886 25566   2 13:58:29  pts/2 24:24 /opt/lotus/notes/latest/ibmpow/pop3
   notes 22190 18848   0   Feb 04  pts/2  0:00 -ksh
   notes 22570 22190   0 13:57:15  pts/2  0:00 sh /opt/lotus/bin/server
   notes 23272 25566   1 13:57:34  pts/2 11:25 /opt/lotus/notes/latest/ibmpow/replica
   notes 23870 26372   2 13:57:48  pts/2 12:34 /opt/lotus/notes/latest/ibmpow/amgr -e 1
   notes 24584 25566   2 13:58:04  pts/2 30:23 /opt/lotus/notes/latest/ibmpow/event
   notes 24936 25566   0 13:58:09  pts/2 11:41 /opt/lotus/notes/latest/ibmpow/stats
   notes 25332 25566   1 13:57:39  pts/2 13:07 /opt/lotus/notes/latest/ibmpow/update
   notes 25566 22570   1 13:57:16  pts/2 129:09 /opt/lotus/notes/latest/ibmpow/server
   notes 26188 25566   0 13:57:59  pts/2 13:05 /opt/lotus/notes/latest/ibmpow/sched
   notes 26372 25566   0 13:57:44  pts/2 12:49 /opt/lotus/notes/latest/ibmpow/amgr
   notes 27728 25566   0 13:58:44  pts/2 13:44 /opt/lotus/notes/latest/ibmpow/decs
   notes 28032 25566   1 13:58:14  pts/2 14:51 /opt/lotus/notes/latest/ibmpow/http
   notes 28566 25566   0 13:58:39  pts/2 36:22 /opt/lotus/notes/latest/ibmpow/nntp
   notes 29532 25566   0 13:57:54  pts/2 11:24 /opt/lotus/notes/latest/ibmpow/calconn
   notes 29996 25566   0 13:58:54  pts/2 12:51 /opt/lotus/notes/latest/ibmpow/maps
   notes 30238 25566   1 13:58:24  pts/2 24:29 /opt/lotus/notes/latest/ibmpow/imap
   notes 30686 25566   0 13:58:34  pts/2 15:55 /opt/lotus/notes/latest/ibmpow/ldap
   notes 30826 25566   2 13:57:49  pts/2 19:37 /opt/lotus/notes/latest/ibmpow/adminp
    root 31346  3522   0 10:59:51  pts/1  0:00 grep notes
   notes 33114 25566   0 13:57:29  pts/2 12:54 /opt/lotus/notes/latest/ibmpow/router
   notes 34396 25566   1 13:59:00  pts/2 26:02 /opt/lotus/notes/latest/ibmpow/smtp
   notes 34826 22354   0   Feb 16  pts/5  0:00 -ksh
   notes 36238 25566   1 13:58:19  pts/2 25:28 /opt/lotus/notes/latest/ibmpow/diiop
# kill -9 12886
```

Figure 290. Sample Process Screen

Note

Be careful when you are using the `kill` command. In general, the Notes processes have the path /opt/lotus/notes/latest/ibmpow. If you are *absolutely sure* that only the Lotus Domino processes have been run under the userid notes, you could do the following:

```
su - notes
kill -9 -1
```

Never run this command as root user.

After killing the processes, you have to remove the corrupted shared memory and semaphores. With the command `ipcs`, you can list them. With `ipcrm`, you can remove them. You have to identify the items to remove by looking at those belonging to the appropriate user (OWNER=notes in our example) and having the KEY started with `0xf80`. Sometimes, there are also KEYs starting with 0x01, 0x02 or 0x03. See Figure 291 on page 329 for a sample of output and Figure 292 on page 329 on how to remove the IPC resources with their ID.

```
$ ipcs
IPC status from /dev/mem as of Thu Feb 18 11:09:12 CST 1999
T         ID     KEY          MODE        OWNER     GROUP
Message Queues:
q          0 0x4107001c -Rrw-rw----    root    printq
Shared Memory:
m          0 0x580518df --rw-rw-rw-    root    system
m          1 0x00001a4c --rw-------    root    system
m          2 0x00000001 --rw-r--r--    root    system
m          3 0x47040813 --rw-r--r--    imnadm    imnadm
m         12 0x4404081a --rw-rw-rw-    imnadm    imnadm
m    2621453 0xf800d000 --rw-rw----    notes     notes
m         15 0x0d052168 --rw-rw-rw-    root    system
Semaphores:
s          0 0x580518df --ra-ra-ra-    root    system
s          1 0x440518df --ra-ra-ra-    root    system
s     131074 0x00001a4c --ra-------    root    system
s          3 0x620520df --ra-r--r--    root    system
s    2621459 0xf800d000 --ra-ra----    notes     notes
s    2621460 0xf800d001 --ra-ra----    notes     notes
s    2621461 0xf800d002 --ra-ra----    notes     notes
s    2621462 0xf800d003 --ra-ra----    notes     notes
s    2621463 0xf800d004 --ra-ra----    notes     notes
s    2621464 0xf800d005 --ra-ra----    notes     notes
s    2621465 0xf800d006 --ra-ra----    notes     notes
s    2097178 0xf800d007 --ra-ra----    notes     notes
s     786459 0xf800d008 --ra-ra----    notes     notes
$
```

Figure 291. Output of ipcs Command

```
$ ipcrm -s 2621459
$ ipcrm -s 2621460
$ ipcrm -s 2621461
$ ipcrm -s 2621462
$ ipcrm -s 2621463
$ ipcrm -s 2621464
$ ipcrm -s 2621465
$ ipcrm -s 2097178
$ ipcrm -s 786459
$ ipcrm -m 2621453
$
```

Figure 292. Removing of IPC Resources

Figure 293 on page 330 shows a sample script that tries to kill all Notes
processes and remove the semaphores and shared memory. It is only
provided to show the principles; use at your own risk.

Be sure to adjust the environment variables at the beginning to suit your
environment.

```
#!/bin/ksh
NOTES_USER=notes # AIX userid for this server
NOTES_PATH=/server1 # Path for server data directory
PATH=$NOTES_PATH:/opt/lotus/bin:$HOME/bin:$PATH # Ensure PATH is set for scripts

count=0
NOTES_RUNNING=`ps -fu $NOTES_USER | grep /opt/lotus | grep -v grep `
while [[ -n $NOTES_RUNNING ]] ; do
sleep 10
count=`expr $count + 1`
echo " ... waiting "$count"0 seconds"
#
# Terminate Domino Server if still running
#
if [ $count -eq 13 ] ; then
    echo "Domino Server is still running after 2 minutes"
    echo " ... now for the ungraceful method"
    for i in `ps -fu $NOTES_USER | grep lotus | grep -v grep | awk '{ print $2 }'`; do
      kill -9 $i
    done
    mems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"m" '{ print $2 }'|\
        awk '{ print $1 }'`
    sems=`ipcs | grep $NOTES_USER | awk '{ print $1 $2 }' |  awk -F"s" '{ print $2 }' |\
        awk '{ print $1 }'`
    for j in $mems;do if [ -n "$j" ] ; then ipcrm -m $j;fi;done
    for j in $sems;do if [ -n "$j" ] ; then ipcrm -s $j;fi;done
    echo "Lotus Domino R5 TERMINATED"
    exit
fi
NOTES_RUNNING=`ps -fu $NOTES_USER | grep /opt/lotus | grep -v grep `
done
#
echo "Domino for AIX ($NOTES_SERVER) shutdown completed
```

Figure 293. Clean Lotus Notes Processes Script - Killnotes

12.2 Monitoring File System Space

Assume your Lotus Domino Server data directory is installed in the filesystem /server1. You can monitor the filesystem use with the command df. Other file systems that must be verified are /, /var,/tmp, and /usr.

```
$ df -k /server1
Filesystem    1024-blocks    Free %Used    Iused %Iused Mounted on
/dev/dominodatalv    204800    13700  94%      840    2% /server1
$
```

When you receive a file system full message, or when you want to increase the file system size before this error occurs, do the following as root:

1. Verify if you have space in the volume group that contains the file system you want to increase. Checkout the volume group by issuing lsvg dominodatalv.

```
# lslv dominodatalv
LOGICAL VOLUME:    dominodatalv        VOLUME GROUP:   dominovg
...
# lsvg dominovg
VOLUME GROUP:   dominovg              VG IDENTIFIER:  00615151cb0638ff
VG STATE:       active                PP SIZE:        4 megabyte(s)
VG PERMISSION:  read/write            TOTAL PPs:      258 (1032 megabytes)
MAX LVs:        256                   FREE PPs:       158 (632 megabytes)
LVs:            2                     USED PPs:       100 (400 megabytes)
OPEN LVs:       2                     QUORUM:         2
TOTAL PVs:      1                     VG DESCRIPTORS: 2
STALE PVs:      0                     STALE PPs:      0
ACTIVE PVs:     1                     AUTO ON:        yes
MAX PPs per PV: 1016                  MAX PVs:        32
```

In this case, we have 632 MB available in the dominovg volume group.

2. Run the command `smitty chjfs`.

3. Select the file system you want to increase in size. In our example, `/server1`.

4. Type the new size (you can only increase the size) in the SIZE of file system (in 512-byte blocks) field. For example, the /server1 file system would be changed to 300 MB by entering 600000 in that field.

5. Instead of step 2 to 4, you could just type

   `crfs -a size=300000 /server1`

   or

   `crfs -a size=+190400`

   [190400 = (600000 - (204800*2); 204800 from df -k above]

   If you need more space than is left in the volume group, you can acquire a new hard disk for the server and add it to the volume group. All of this filesystem handling is standard practice with AIX but may be new to someone used to PC-based operating systems.

   In 4.3, "Monitoring Disk Space on File Systems on the Domino Server" on page 119, a script that monitors the disk space is described.

12.3 Increasing Paging Space

Paging space may affect the performance of your Lotus Domino Server. If paging space runs low, you may loose processes or cause a system panic. If you did not increase your paging space during the installation of the Domino Server as described in 2.2.15, "Step 15 - Paging Space" on page 36, we will show you how to do it in this chapter.

The size of the paging space is by default set to the size of the physical memory. If you want to increase the size of the default paging space (you can't decrease), do the following as `root`:

1. Run the command `smitty chps`, and select **hd6**.

```
   Change / Show Characteristics of a Paging Space

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

                                                 [Entry Fields]
   Paging space name                             hd6
   Volume group name                             rootvg
   Physical volume name                          hdisk0
   NUMBER of additional logical partitions       [4]                          #
   Use this paging space each time the system is yes                          +
           RESTARTED?


 F1=Help             F2=Refresh         F3=Cancel          F4=List
 F5=Reset            F6=Command         F7=Edit            F8=Image
 F9=Shell            F10=Exit           Enter=Do
```

Figure 294. Change/Show Characteristics of a Paging Space

2. Enter the *number* of additional logical partitions you want (Figure 294). Be sure to enter the right number of partitions based on your volume group's Physical Partition (PP) size. With the `lsvg` command, you can see the logical partition size:

```
# lsvg rootvg |grep SIZE
VG STATE:      active               PP SIZE:      4 megabyte(s)
#
```

In the above example, the hd6 paging space size will be increased by 16 MB.

Alternatively, you can add another paging space to the system either in a different volume group or just on a different disk for performance reasons, or on the same disk if you think of decreasing paging space again later on. A paging space can be added by doing the following steps:

1. Run the command `smitty mkps` and make appropriate selections or just enter `mkps -s'4' -n -a dominovg`.

   This would add an additional paging space size of 4 partitions in dominovg for immediate use.

2. To list the total paging space, you can use the command `lsps -a`.

```
# lsps -a
Page Space  Physical Volume   Volume Group    Size    %Used  Active  Auto  Type
paging00    hdisk1            dominovg        16MB    26     yes     yes   lv
hd6         hdisk0            rootvg          128MB   51     yes     yes   lv
#
```

Figure 295. List Paging Space

To remove an active paging space, change its characteristics so that it is not configured at the subsequent system restarts (`smitty chps` or `chps` command). On the next system restart, the paging space is not active, and it can be removed.

12.4 Accessing a Server in a Different TCP/IP Domain

If you want to access a Domino Server in a different TCP/IP domain, your Domino Server (for example server1/ibm) has to be able to translate the Lotus Domino Server name of the second server (for example Jupiter/Mainz) into a valid TCP/IP address (for example jupiter.mainz.ibm.com). Table 21 shows the TCP/IP and the Lotus Domino Names. The two servers or organization certifiers have to be cross-certified if they do not share the same certification hierarchy.

Table 21. Client and Server Names

Server Location	TCP/IP Name	Lotus Domino Name
Local	server1.itsc.austin.ibm.com	server1/ibm
Remote	jupiter.ncs.mainz.ibm.com	jupiter/Mainz

The following sections explain two different methods of achieving this either from within Lotus Notes or from within the network layer.

12.4.1 Setup within Lotus Notes

To setup a connection between two servers in different Domains, you have to add a Server Connection Document.

1. Start the Domino Administrator.

2. Choose the desired server.

3. Choose **Configuration -> Connections**.

4. Select your server.

5. Click on **Add Connection**.

6. In the *Basics* tab:
    - Choose the Connection type **Local Area Network**.
    - Check the *Source Server* name.
    - Enter the **Source domain**.
    - Select the LAN port **TCPIP.**
    - Enter the **Destination Server** name.
    - Enter the **Destination domain**.
    - Enter the **Optional network address**.

7. If needed, customize the settings in the *Replication/Routing* and the *Schedule* tab.

8. *Save and Close* the Server connection document.
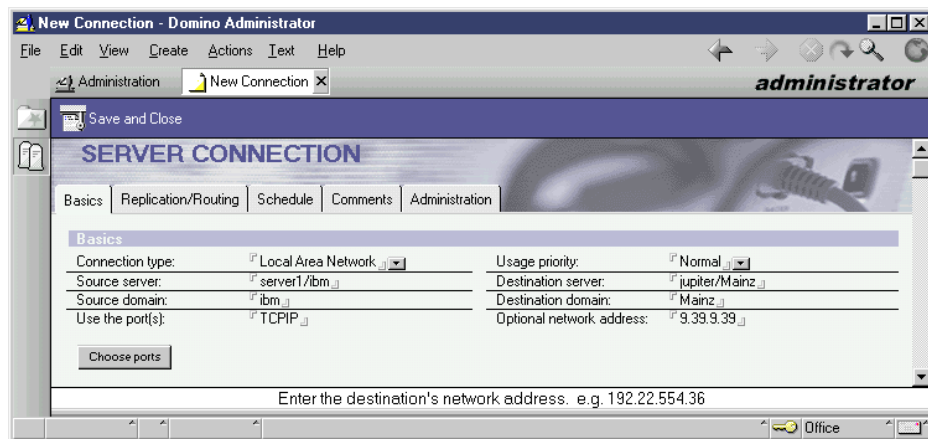
Figure 296. New Server Connection - Basic Tab

Now server1/ibm can connect to jupiter/Mainz.

12.4.2 Setup on the Network Layer

If you are not using a server connection document, you must have an alias for the server name in question (jupiter), which can be resolved by TCP/IP name resolution. If you are using the /etc/hosts file, you have to add to it a line, such as the one in Figure 297:

```
9.3.240.214              jupiter.ncs.mainz.ibm.com    jupiter
```

Figure 297. Host Names Line

If you are using NIS, ask your NIS administrator to add a line (such as the one in Figure 297 on page 334) to the host's file. He/she should add the address line to his/her host's file and propagate it to the NIS hosts map.

If you are using Domain Name Server (DNS), you can ask your DNS administrator to add to the local Name server an alias for your Lotus Domino Server name pointing to your TCP/IP complete server name. If you don't have a machine with the same name as your server name in your domain (in our example, if the machine jupiter.ncs.mainz.ibm.com does not exist), you can add a search tag to the /etc/resolv.conf file of your Domino Server machine. Note that if you have a search tag, you have to remove the domain tag.

In our example, the original /etc/resolv.conf would look like this:

```
nameserver      9.3.240.2
domain  itsc.austin.ibm.com
```

The new resolv.conf would look like this:

```
nameserver      9.3.240.2
search    itsc.austin.ibm.com ncs.mainz.ibm.com
```

You can have up to eight domains added to the search list.

12.5 Errors at Startup of HTTP Task

If you are running partitioned servers and more than one has the HTTP task active, you have to change the http task settings.

1. Open the Domino Administrator.

2. Select the desired server.

3. Choose **Configuration -> Web -> Web Server Configuration**.

4. Select the Domino Server you want to change.

5. Choose **Internet Protocols -> HTTP**.

6. Enter the host name.

7. *Enable* bind to host name.

8. *Save and Close* the Document.
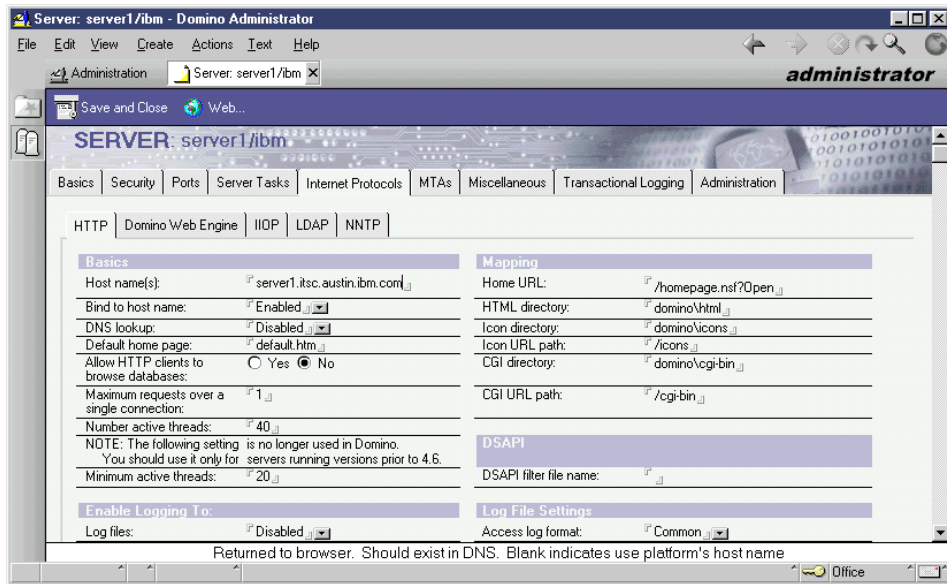
Figure 298. HTTP Server Basic Settings

Afterwards, stop the HTTP task from the server console (`tell http quit`) and restart it (`load http`). You may want to have a look at the file domino.cnf in the servers data directory afterwards; it now contains two lines like this:

```
bindspecific yes
hostname itsosmp.itsc.austin.ibm.com
```

This combination allows each servers HTTP task to listen on the specific port built by hostname:port without the need to have different port numbers per server.

Note

The error you get on start-up of Lotus Domino's http task, if another http daemon is already running, normally looks like:

```
19/02/99 11:38:27   HTTP Socket bind error, hostname/ip ausres26.itsc.austin.ibm.com
19/02/99 11:38:27   HTTP server: Could not bind port 80. Port may be in use
19/02/99 11:38:27   HTTP Web Server shutdown
```

Appendix A. Hints and Tips

We have collected some useful pieces of information that made our lives easier during our residency here at the International Technical Support Organization at IBM in Austin, Texas. The information provided here pertains to Lotus Domino Server R5 and AIX version 4.3.1 or higher.

A.1 Installation and Upgrade

These hints and tips pertain to the installation and upgrade process of Lotus Domino Server.

A.1.1 Backup, Backup, Backup

Ensure that a complete backup is taken of any server prior to any upgrade. To reverse a software upgrade by restoring from a backup will be significantly easier and less time consuming than having to re-install and re-configure the original software.

A.1.2 Upgrade Order Not Chaos

The recommended order in which to tackle upgrading from Domino 4.6 to Domino R5 is:

1. Public Name and Address Book (NAB)
2. Hub servers
3. Mail and application servers
4. Other servers
5. Client software
6. Application design

A.1.3 HTTP Web Setup

It is a good idea to make a backup copy of the file called websetup.nsf that is located in your server's data directory after you have finished installing the software from the CD. If there isn't a backup copy of this file, and the http setup fails for whatever reason, the only course of action is to delete the installation and reinstall from the CD. If there is a backup copy of this file, then simply copy the backup over the original file and run the http setup again.

A.1.4 The Domino Directory

In our testing environment, we found it necessary to manually compact the Domino Directory (names.nsf) twice in order to make use of the ODS

database format. This was true for upgrades as well as new installations. To compact the Domino Directory, make sure the server has been stopped, change to the Domino data directory (/server1), and use the command `compact names.nsf`. Do this twice and restart the server. Remember, you must run this command as the notes user. Do not run the compact command as the root user.

A.1.5 Database Design

Make sure that the design elements of a database that are not to be changed by a design refresh or design replace have the property `Do not allow design refresh/replace to modify` enabled.

A.2 AIX Operating System

These hints and tips pertain to the AIX operating system.

A.2.1 PATH Environment Variable

In 2.2.2, "Step 2 - Check Your Default Path Environment Variable" on page 16, we discussed the requirements for the PATH environment variable in AIX. Something that should be considered is adding /opt/lotus/bin to the PATH environment variable as well. Although this is not a requirement, it simplifies having to type long commands with their directory. For example with /opt/lotus/bin added to the PATH environment variable, the administrator could just type `server` from the Domino data directory instead of having to type `/opt/lotus/bin/server`.

A.3 Disks

These hints and tips pertain to installing and configuring disks on a RS/6000 system.

A.3.1 Directory Names and Mount Points

When installing a new Domino server, it is recommended that the Domino data directory names be the same as the server names. This is very important in a partitioned environment. For example, if a company had a RS/6000 system with three partitioned servers, and the server names were Grape, Tomato, and Orange, the data directories should be called /grape, /tomato, and /orange. This makes for easier administration both in Domino and AIX.

A.3.2 Recommendations for Large Files

In 2.2.11, "Step 11 - Create a File System for the Domino Data Directory" on page 32 and 2.2.12, "Step 12 - Create a File System for the Domino Binaries" on page 33, we discussed how to create a Journaled File System (JFS) for the Domino binaries and data files. The physical file size limitation of a standard JFS is 2 GB, but Lotus Domino Server R5 allows file sizes up to 64 GB. To allow Domino to fully utilize its storage capacity, the data directory must be stored on a Large File Enabled Journaled File System instead of a Standard Journaled File System.

A.3.3 Volume Groups, Logical Volumes, and File Systems

In Chapter 2, "Installing a Lotus Domino R5 Server" on page 15, we explained how to set up volume groups, logical volumes, and file systems for the Domino server. In our example, we placed the entire data directory in a single file system within a single volume group. For best performance, multiple file systems and multiple volume groups that span no more than one to two disk drives should be used. Creating separate file systems for the data directories, mail directories, and application directories on separate disk drives greatly improves I/O performance. For Domino mail servers, use multiple mail directories, such as /data/mail1, /data/mail2, /data/mail3. Each directory should be a separate file system and on a different disk drive to maximize performance.

A.3.4 Striping Versus Spreading

Striping is a technique for spreading a logical volume across several disk drives so that I/O capacity can be used in parallel when accessing data. The primary objective of striping is very high performance reading and writing of large sequential files. For randomly accessed files, striping may not be effective. Domino performs frequent small random disk accesses; therefore, striping provides no benefit. The best solution is to simply spread the file systems associated with the Domino data directories across as many drives as possible. This will help balance the I/O requests over multiple drives; however, this does not ensure that I/O will be completely balanced across all drives. Spreading will give you the capability to relocate heavily used files to other less utilized file systems, thus, balancing the I/O.

A.3.5 Mirroring Versus RAID 5

Mirroring outperforms RAID 5 for reads and writes but costs more for the disk. This does not consider cache or interconnection technology that can also make a difference. Nor does it consider full stripe writes that avoid the RAID 5 write penalty. It only considers the bandwidth of the actual disks. The

recommendation is to use mirroring for more flexibility and control of file locations and to use RAID 5 for more capacity with fewer drives.

A.3.6 Transaction Logs

Since the transaction logs are critical to data integrity and maximum performance, it is strongly recommended that the disk used to contain the Transaction Log Extent be mirrored and, if possible, connected to a separate disk controller than that used to service the Domino data directory.

A.4 Server Partitioning and Clustering

These hints and tips pertain to Lotus Domino Server partitioning and clustering.

A.4.1 Partitioned Servers

When installing partitioned servers, we recommend manually specifying the data directories since the file system mount points will already have been created and may not match the default names generated by the install program. Consider associating the name of the server with the mount point of the file system for clarity and ease of administration.

A.4.2 Partition Number

The file used to identify the partition number for the server, .sgf.notespartition, is no longer used in R5. Instead, the partition name is based upon the data directory name. For example, a data directory name of /server1 generates a partition identifier of .server1.

A.4.3 AIX Owner - Partitioned Servers

For ease of administration, each partitioned server should be run using a different AIX user account name. The ownership of each set of data files must be changed except for those in the first data directory. The ownership of the files in the first data directory should be set correctly using the user name specified during the install. To change the ownership of subsequent data directories, use the command `chown -R <user>.<group> /directory`. For example:

```
# chown -R notes2.notes /server2
```

This will change all files in the directory /server2 and any subdirectories located under that file structure.

A.5 Domino Configuration

These hints and tips pertain to configuring Lotus Domino Server.

A.5.1 Domino Server Security

To ensure that all security mechanisms are covered, disable all access and then re-enable only the specific areas of access that are required. Having to remember to enable a feature is much less of a risk than having to remember to disable one as security may already have been breached.

A.5.2 Flat Versus Hierarchical

If your server environment still uses flat ID files, consider moving to a hierarchical certification model for increased security, flexibility of access control, and simpler administration through the use of the administration process.

A.5.3 Router/SMTP Configuration

Remember, when adding a configuration document for the Router/SMTP configuration settings through the Domino Administrator, to enclose any TCP/IP addresses in square brackets. For example [5.34.67.100] or [5.34.67.*]. If the square brackets are omitted, the TCP/IP address will be ignored.

A.6 Client Configuration

These hints and tips pertain to configuring the Lotus Notes client software.

A.6.1 Client Software

In a WIN32 server environment, where the administration client can be installed on the server, a Domino Administrator Only installation is relevant. In an AIX server environment, the administration client must be run from an administrator's workstation, and since the administrator is also a user, it is easier to install all clients on the workstation using the Install All Clients option.

A.6.2 Change the Default Home Page

The default home page is set to the Welcome database (bookmark.nsf) when the R5 client is installed. This default can be changed by right clicking on any bookmark listed in the Favorite Bookmarks or Databases folders and selecting **Set Bookmark as Home Page**.

A.7 Notes.ini Settings

These hints and tips pertain to various parameters in the notes.ini file.

A.7.1 Notes_SHARED_DPOOLSIZE

In Domino R5 the Notes_SHARED_DPOOLSIZE parameter is now specified in the notes.ini file and not as an AIX environment variable. When upgrading from Domino 4.6, remove this variable from the user .profile or environment definition files. Only manually specify this in the notes.ini file when the number of shared memory segments exceeds seven. See 3.2.6, "Modifying AIX Environment Settings" on page 78 for more information.

A.7.2 NSF_Buffer_Pool_Size

The parameter NSF_Buffer_Pool_Size may or may not have been specified for a machine running a single partitioned server. In Domino R5, it is recommended that it not be specified for a single server. However, it should always be specified for partitioned servers as the physical memory in the machine has to be shared between multiple servers. Use the formula ((physical memory / number of partitions) / 4) to figure out a good starting value to be specified in each server's notes.ini file.

A.7.3 View_Rebuild_Dir

For optimal performance of the indexing process, it is better to store the temporary files that are used on a different physical disk not on the same disk as the Domino data directory. To change the location in which temporary files are stored during indexing, specify `View_Rebuild_Dir=/directoryname` in the server's notes.ini file.

A.8 Server Console

These hints and tips pertain to Lotus Domino Server console commands.

A.8.1 CConsole Administration

Consider registering a user ID specifically for this purpose that does not have access to databases. Should the ID file be copied from the file system and the password compromised, it will be of limited use. If a specific user ID is not created, then consider creating a separate administration group to contain users allowed to use the AIX remote console, and add this group name to the field on the server document in addition to the existing entries. Relevant users can then be specified as being able to use remote console but do not

obtain the same access privileges to databases that existing administrators may have.

A.8.2 Running a Batch File of Console Commands

Several console commands can be executed using a single command that calls a batch file. To do this, simply create a text file in AIX that has a list of server console commands you want to execute and save that file in the Domino data directory. Each command should be on a separate line, and the name of the batch file can be anything. Once the file has been created, the batch file is ready to be executed from the server console window. The syntax for the command is `< batchfilename`. This is very useful for administrators who may perform a series of console commands over and over again. This batchfile can also be executed from a scheduled server program document in the Domino Directory.

A.9 Miscellaneous Items

These hints and tips pertain to miscellaneous items that just didn't fit anywhere else.

A.9.1 Easter Eggs

Although this isn't really anything useful, we thought it was kind of nice to include it anyway. We ran across two easter eggs in the Lotus Notes R5 client. Please don't try these using the beta version of the client because it wasn't functioning correctly. To view the easter eggs, start the R5 client and then click on the **Help** pull down menu and select **About**. When the R5 logo appears, type one of the these two phrases, and the easter egg will begin.

- `super.human.software`
- `start`

Appendix B. Lotus Domino R5 - New Features and Enhancements

Lotus has continually enhanced the Notes and Domino products over the past year. Notes/Domino R5 provides updated and broader adherence to industry Internet and messaging standards. Listed below are details of what is new in Release R5.

B.1 Networks Features

Features related to Networks are as listed below.

Administration

- Ability to track connections for IMAP, LDAP, SMTP and NNTP servers, added statistics, and connection status information
- Ability to start and stop Notes network and dialup ports through the console command (`START/STOP PORT <portname>`)
- Added more trace information to help diagnose connectivity problems, including `TRACE` server console command
- Ability to log and monitor passthru connections

Connectivity

- Connection configuration wizard in Location document
- Able to connect to Notes servers using TCP host names or abbreviated name
- Automatic importing of network addresses from other domains (such as external, remote, or foreign) by expanding the Notes
- Name Service - Enhanced server search process by leveraging the improved Notes Name Service
- NDS lookup modified to locate Domino servers within the users' login NDS context
- Ability to dial international calls without having to wait for the dial tone

Mobile

- Integrated remote LAN support for IMAP, LDAP, POP3, NNTP, and outbound SMTP connections for Notes clients/workstations.
- Notes workstation can now be setup using dial-up networking.
- Added new command async scripting language to allow interactive dialogs during script execution.

Performance

- Server networking model was re-architected for high performance and scalability.

Security

- IMAP, LDAP, SMTP, and NNTP servers now support 128-bit session encryption (with SSL) for use with export limited Internet clients (requires Verisign Global Server IDs).

B.2 Language Features

Features related to language are as listed below.

- Users can now automatically recompile their LotusScript through a C API without manually using the IDE.
- JavaScript is now available on client platforms (Win32 and Macintosh) so that it can be used for applications that need to support both browsers and Notes clients.
- Allows any page embedded with JavaScript to trigger and manipulate plug-ins and Java applets loaded on the page and allows applets and plug-ins to communicate back to JavaScript code.
- The Notes client and the Designer IDE now support Java for edit/compile as well as other languages. The InfoPane can now be used to browse Java and NOI classes.
- LotusScript enhancements including additional built-in functions to manipulate Notes text lists; a 2 pass compiler allows forward references.
- LotusScript code can now be up to 64 K possibly removing some of the need for libraries and allowing long strings.
- LotusScript International Thai Support.

B.3 Messaging Features

Features related to messaging are as listed below.

- Send MIME without conversion - The R5 Notes Client can compose, edit, and send messages in either MIME or CD formats. The R5 mail router now routes MIME without conversions, which improves fidelity and performance.
- Notes RPC, POP3, and IMAP Native MIME integration - No need for format conversions when messages are sent/received over Notes RPC, POP3, or IMAP protocols. MIME is now a first class native Notes format.
- Directory Catalog support on server - This allows you to store a compact collection of all the directory information in your company. With this feature, most name lookups can be resolved on your home server without

the presence of all the directories for your enterprise. The Directory Catalog is very compact. You can store a million entries in less than 120 megabytes.

- Mobile Directory Catalog - You can store an entire enterprise-worth of compressed directory information on your desktop/laptop.
- Native SMTP - You no longer need the Lotus SMTP MTA. Notes is now fully SMTP compliant and can intelligently choose whether to route mail using SMTP or Notes RPC.
- Native Internet addressing - You can now use Internet addresses to address mail to your Notes clients.
- LDAP V3.
- LDAP add, delete, modify.
- Router MIME conversion - The R5 router can assume the role of the Lotus SMTP MTA for servicing R4.x systems that need to connect to the Internet.
- Router controls and message quotas - This allows you to control spam mail from entering your enterprise. It also allows you to control what size messages can be sent. For example, you can ensure that very large messages get a low priority and are only transmitted during certain times of the day, such as late at night.
- Namelist creation for external authorization - This allows you to plug in foreign LDAP directories to your Directory Assistance database, and then use those foreign databases to authenticate HTTP clients. This also means that you don't have to put your HTTP users in the Domino Directory.
- Calendar gateway - Allow a calendar gateway to be specified in a non-adjacent domain record.
- NAMELookup to LDAP mapping - This is useful for existing SDK users of NAMELookup that don't want to rewrite their code to work with LDAP client APIs.
- Pull Router - This allows your mail router to pull mail *on a schedule* from other routers.
- Schema publishing for LDAP - This is useful for customers who want to use LDAP to access a Notes directory.
- LDAP Language Tags - This allows multiple language versions of your directory entries.
- Domino Directory Extensible Schema and Binary attribute support - These APIs support adding and removing schema extensions to directory forms.
- LDAP Schema publishing - Publishing Domino Directory objects over LDAP.
- LDAP Schema checking - Checking LDAP writes against the associated directory objects schema (through the associated form) to verify attributes.

B.4 Security Features

Features related to security are as listed below.

- Password Quality Testing - Administrators can now specify one of five password quality levels. The higher the level, the more complex the passphrase needs to be, and the more difficult it is for an unauthorized user to guess the IDs passphrase.
- Lost Password Recovery - Allows administrators to recover an ID file if a user loses, damages, or forgets the password for the ID.
- Alternate name support - The alternate name feature allows administrators to assign a primary name and an alternate name to users and certifiers.
- S/MIME (secure MIME) signed mail - signing and verification of signatures, using x.509 certificates.

B.5 Administration Features

Features related to administration are as listed below.

- New Domino Administrator - Task-based, graphical server administration client.
- New install - Separate installation of the Domino Administrator client using industry-standard InstallShield.
- Move User - Drag and drop users in the People & Groups tab of the Domino Administrator to move them from one home server to another.
- NT User migration application enhancements.
- Server Monitoring - Real time server monitoring and troubleshooting tool displays the status and availability of Notes servers and services.
- Single copy object store admin - New view in LOG.NSF that shows who is using space in your shared mail files.
- Improved user registration and migration - including the ability to migrate users from other messaging systems (including cc:Mail, MS Mail, and Exchange) during user registration.
- NT service for partitioned servers - You can run partitioned servers as NT services.
- Decommission server analysis - The Decommission Sever Analysis tool enables administrators to consolidate existing servers and take existing servers out of service permanently.
- Administration process enhancements - Extensibility - third-parties can enhance and extend the admin process, cross-domain features, moving a user's mail file.

- Exchange to Notes migration tool - The Administration portion of the tool is complete. The end user tool for migrating local and personal data will be available in a later Beta build.
- MS Mail to Notes migration tool.
- cc:mail to Notes migration tool.
- Organizer 2.x to Notes migration tool.
- Graphical view of server statistics.
- HTTP clusters/ICM.
- OS clusters (support for Wolfpack).
- Global database routing.
- Internet addressing tool.
- NT single log-on.
- Third-party integration - Third-party vendors of migration tools can plug into our new Domino Upgrade Services SPI and have their tools tightly integrated with Domino Administrator.
- Domino Upgrade Services - A Service Provider Interface (SPI).
- Integrate Mail and TCP service monitoring - You can monitor the health of all of your Internet protocol servers, such as HTTP, IMAP, LDAP, NNTP.
- Message Tracking - The ability to see where a message is during routing
- Topology Maps - Graphically display your messaging and replication topologies.

B.6 Programmability Features

Features related to programmability are as listed below.

- Domino Enterprise Connection Services (DECS) - A new forms-based technology in Domino that provides the capability to integrate live data from enterprise systems natively into Domino applications.
- CORBA - Access Notes/Domino services from a browser. CORBA and CORBA remote interfaces allow you to place a custom applet on a form and have that applet access the Notes Object Model in both the Notes client and a browser.
- View enhancements for backend classes.
- LSXBE enhancements (various backend classes).
- Rich text enhancements for backend classes.
- Synchronous new mail agents.
- Reduce latency in agent manager.
- New API to limit agent runtime.
- Remote API to limit agent runtime.
- Expose Profile documents.
- Super catalog - Now the catalog has more information.

- Two-port listener - Allows SSL & non-SSL version of IIOP at the same time.
- Java libraries.
- IIOP libraries.
- Date/Time zone - Synchronized between Domino/Notes and OS (Win95/NT).

B.7 Database Features

Features related to databases are as listed below.

- Transactional logging and recovery - When enabled, this provides atomic transactions for all Domino API functions. It provides full database integrity and a replacement of Database Fixup on system restart with high-speed transaction roll forward/rollback from transaction logs along with support for backup and recovery APIs.
- New database options - A set of options you can specify on database creation to provide higher performance and functionality for specific uses. For example, unread marks can be disabled for individual databases to avoid the sometimes substantial overhead of maintaining unread marks for all users of the database.
- Anti-delete - Deleted item recovery. This provides the ability to restore deleted notes for a designer-specified amount of time by accessing them in a special view type. By setting the *soft delete* database option, and by creating this view, mistakenly deleted documents can be retrieved simply and quickly.
- 32GB database support on NT and Unix.
- Full backup API - This is an API for backup vendors.

B.8 UNIX Features

Features related to UNIX are as listed below.

- Telnet into Server Console - This allows the administrator to remotely attach to their server consoles in a secure way and administer their Domino servers.
- Ultra-Sparc Inst Set Utility - This takes advantage of some Ultra-Sparc instructions (if available) to enhance performance on these boxes.
- AIX Atomic Changes - Allows performance improvements by changing some of the low-level atomics on the AIX platform.
- Solaris MMAP Memory - Uses memory mapping for some resources to speed access and improve performance.

- Posix Async I/O - Increases the performance/scalability by using Async I/O to make our handling of thread resources more efficient on the UNIX platforms.
- Auto Restart Enhancements - This provides various improvements to the auto-recovery feature.
- Batch Console Commands - This allows console commands to be batched and executed on one or many Domino servers.
- Consolidated Config Data - This simplifies the multiple sources of configuration data by allowing it to be stored in a single place.
- Script Driven Install - This allows the users to provide an install script that can then completely automate the install process.

B.9 Client Navigation and General Features

Features related to client navigation and general features are as listed below.

- Microsoft Office Mail integration - Uses Notes with your Microsoft Office Mail.
- Internet Explorer V4 integration - IE4 support built right into Notes.
- Desktop mail integration Table enhancements - more formatting options including HTML formatting.
- Table programmability.
- Highlighter Text - Highlights text as if you were using a highlighter pen.
- Stylesheet support in editor.
- New KeyView Viewers for Win32 platforms - More file types supported.
- Print Preview (W32) - You can now click the **Preview** button from the Print dialog to view your document before printing.
- Alarms - Visual notifications that you can display even when Notes isn't running. Plus, audible notifications allow you to choose your own alarm sound.
- Removal of mail license type.
- Tabs for windows - New tabs allow you to switch windows in Notes with just one click.
- Top level window support.
- Universal navigation buttons and navigation history - Back, Forward, Stop, Refresh, Search, and Go. These buttons, similar to those in popular Web browsers, appear at the top-right corner of the main window.
- Find/Replace dialog box - More ease of use features including the new *Wrap around* option. When the search has reached the bottom of the document, Wrap around sends it back to the top to continue searching.
- File Open dialog box - Enhanced File Open and Database Open that allows you to read about and bookmark a database without opening it.

- Import/Export (INSO) - Import lets you convert files from another application into a form that Notes can use; export lets you convert a Notes document or view into a form that another application can use.
- Drag/Drop into Bookmarks - Uses drag and drop to create a bookmark of a database, document, Web page, newsgroup, or folder.
- Bookmarks view replace desktop - Enhanced navigation lets you view and manage your databases.
- Just-In-Time encrypting of Mobile Directory Catalog.
- Undelete of documents - Allows you to easily retrieve deleted documents.
- Embedded calendar control - Easy-to-use, graphical aid to calendar navigation.
- Internet Certificates - Can obtain Internet certificates as well as Notes certificates.
- ID File recovery - If you misplace your password, you can get a recovery password by contacting your Administrator.
- Notes Minder - Runs in your operating system task bar allowing you to receive new mail notification and calendar and scheduling reminders without running Notes.
- Online Help Enhancements - New format, layout, and ease-of-use in a separate window.
- Text flow in editor - Text flows from one-column to the next, also in tables.

B.10 Client Template Features

Features related to client templates are as listed below.

- Bookmark template - Notes version
- Headlines template - Notes version
- Personal journal - Notes version
- Personal Address Book - Notes version
- Calendaring and Scheduling - Repeating meeting fixes
- Calendaring and Scheduling - Tasks behave as Calendar entries
- Mail template - Notes version
- Reservation template - Notes version only
- Discussion - Notes and Web version
- Document library - Notes and Web version
- Team Room - Notes and Web version

B.11 Server Template Features

Features related to the sever template are as listed below.

- Search template - search form - Notes and Web version

• Search site template - Notes and Web version

B.12 Client Protocols Features

Features related to client protocols are as listed below.

- LDAP search for Personal Address Book
- LDAP configuration
- HTML rendering
- Authentication of Internet protocols
- LDAP Picklist support
- Applet/Bean persistence
- Type-down addressing
- Convert HTML to CD
- IMAIL Asyncronous folder/viewer operators LDAP (FC except for UTF8, 2nd pass lookup, fix references)
- Type-ahead re-implemented
- IMAIL setup
- Deployment (setup) improvements
- HTML parsing
- Universal Inbox
- IMAIL folders
- MIME import/rendering
- MIME export
- IMAIL POP3 support
- NNTP driver
- IMAIL API
- IMAP
- IMAP replication

B.13 Designer Features

Features related to the designer are as listed below.

- New Designer client.
- Imagemaps - Web-standard clickable images that you can edit directly on forms and pages.
- Outlines - Hierarchical navigation and organizational tools.
- Framesets - Frameset editor for building framesets for use in your client and browser apps; many types of links can have frame targets set on them. Design elements can be auto-launched into a frameset to maintain the look of your application.

- HTML Support - Rich text content and can be stored as HTML and edited WYSIWYG. Many more HTML attributes can be manipulated WYSIWYG.
- Context-sensitive Help events - Application designers can provide formulas to execute when a user hits F1, and new commands make finding help easy.
- Design Synopsis - The Design Synopsis has been overhauled to provide much more information in a more useful way.
- Native images - Images can now be stored in their native form (JPEG, GIF) and can be displayed or served directly in that form. Animated GIFs work as well.
- New design lists - Application developers get a more useful list of design elements with more information about each design element displayed.
- Preview in multiple browsers - You can now preview your application in any of your browsers with handy buttons available for the browsers you have installed.
- Non-scrollable editor regions - The top of a form can be marked as a non-scrolling region that stays visible at the top of the user's window.
- Tabbed tables - Tables can now be used to build multipanel user interfaces with a variety of mechanisms for changing the panel on display.
- Recursive tables - Tables can be nested within tables to build more sophisticated layouts.
- Field improvements.
  - Fields can now be sized directly.
  - Fields can be blended into the form better.
  - The tab order of fields can be set.
  - Native controls (combo boxes, for example) can be used as fields.
  - Password-style fields.
  - Much more sophisticated date and currency fields
- Pages - Simple pages can be created as design elements without working with forms.
- Shared actions - Actions can be shared across design elements much like subforms or shared fields.
- Embedded Views - Embedded views are now supported by the Notes client and have more power. You can compute a single category to display, and you can control the number of lines to display on the Web.
- Improved IDE - It's easier to see your programmable objects, the functions available to you, and how to use them.
- Java libraries.
- IIOP libraries.
- Hidden field generation.
- JavaScript - The Designer understands JavaScript. All the JavaScript events are scriptable in the IDE in the Designer.

- New Links - Links can now be created to named design elements to provide more powerful and flexible navigation through your app.
- LotusScript front end classes enhancements.
- Image and Java Applet Resources.
- Embedded calendar control - Easy-to-use.
- Graphical aid to calendar navigation.
- User interface applets - New applets provide views, outlines, action bars and styled-text editing in web browsers.

B.14 Applet Features

Features related to applets are as listed below.

- View Applet
- Outline Applet
- Rich Text Editor Applet
- Action Bar Applet

B.15 Web Server Features

Features related to the Web server are as listed below.

- Domino Web Server API (DSAPI) - A C API for writing Web server extensions for custom authentication, logging, and so on.
- HTTP server clusters - Supports Web access among a cluster of Web servers.
- Domino for IIS - Domino's Web application engine can be used as an extension to Microsoft's Internet Information Server (IIS) on Windows NT.
- Java Servlet upgrade - Support for the Java Servlet API Specification version 2.0 published by Sun Microsystems, Inc. Version 2.0 adds new interfaces for cookies and HTTP sessions.
- HTTP-based server setup - Domino server setup for OS/2 and UNIX platforms is now done through a Web browser connected to the Web server.

B.16 Support for Domino Designer Features

Features related to the support for the Domino Designer are as listed below.

- Nested and tabbed tables.
- Pages.
- Outlines.
- Framesets.
- Imagemaps.

- JavaScript events.
- Shared actions.
- View, outline, and rich text applets.
- Native images.
- Image and applet resources.
- CORBA applet support.
- MIME content support.
- File system ACLs can set access controls for files and directories that are accessed through the Web server.
- Management and logging enhancements - Can reload HTTP configuration without restarting the server. Can specify time intervals for log files: monthly, weekly, daily, and so on.
- Byte range serving - Support for byte range requests. Allows restart of file downloads and byte range serving for Adobe Acrobat (PDF) files.
- Last-modified headers - Domino now sends Last-Modified headers with almost all HTTP responses greatly improving a browser's ability to cache responses locally.
- Multilingual databases - The Web server now supports the language properties of design elements in multilingual databases. The server chooses the most appropriate version of a design element based on the HTTP Accept-Language header sent by a browser.

B.17 Domino Directory Design Changes

The following table lists the main changes made to the design of the Domino Directory database.

Table 22. Design Changes to the R5 Domino Directory

New Server Views
External Domain Network Information Holiday Web Configurations
New People Views

New Server Views
Alternate Language Information $ExternalDomainNetworkAddress $ExternalDomainConfigurations $ExternalDomainServerConfigurations $Holidays $LDAPCN $LDAPG $LDAPS $PeopleGroupsByLang $PeopleGroupsByCorpHier $PeopleGroupsByPhonetic $RegisterGroups
Deleted Views
$ACLMonitor $RepMonitors $Thresholds $NamesFieldLookup (if all clients are R4.5x or higher)
New Forms
External Domain Network Configuration Configuration Settings (was Domain Configuration) Holiday (AlternateLanguageInformation) (ExternalDomainNetworkAddress) (FileProtection) (FileProtectionDialog) (Mapping) (VirtualServer) ($MessageSettings) (InternetMail)

Appendix C. Licensing

The Domino Server Family is based on a singular architecture; so, you can choose the server that best meets your current needs and upgrade later. There are three servers available:

- The Domino Mail Server
- The Domino Application Server
- The Domino Enterprise Server

There are also four Notes Client Licenses available:

- Notes for Messaging
- Notes for Collaboration
- Domino Designer
- Domino Application Studio

The Domino Servers and Notes Clients are supported on the following platforms.

Table 23. Available Platforms for Release 5.0

Platform	Domino Server Release 5	Notes Client Release 5
UNIX (AIX V 4.3.1 or higher, HP-UX 11.0, Solaris/SPARC 2.6, Solaris/Intel 2.6)	Yes	No
OS/2 Warp Server V4.0	Yes	No
Windows 95/98	No	Yes
Windows NT Server 4.0 and Windows NT Workstation 4.0	Yes	Yes
Novell NetWare	No	No
Macintosh Power PC 7.6, 8.1	No	Yes
AS/400 V4R2	Yes	No
S/390 V2R6	Yes	No

For more details, please refer to: `http://www.lotus.com`, any Local Lotus Office, or Lotus Business Partner.

Appendix D. Using UNIX's vi Editor

For those new to UNIX's `vi` editor, below is a list of useful commands to help when using `vi`.

Table 24. Useful vi Commands

Command	What Does It Do?
`0 (zero)`	Move to the beginning of line.
`$`	Move to end of line.
`/search_string`	Search forward for next line containing *search_string*.
`?search_string`	Search backward for next line containing *search_string*.
`A`	Append text, in insert mode, at end of line.
`a`	Append text, in insert mode, after current cursor position.
`^b`	Move up one screen.
`B`	Move to previous space-delimited word.
`b`	Move to previous word.
`Backspace`	Move left one character.
`C`	Change to end of current line.
`cw`	Change word.
`^d`	Move down half a screen.
`D`	Delete until end of line.
`dw`	Delete word.
`dd`	Delete line.
`ESC`	Leave insert mode and return to command mode.
`^f`	Move forward on screen.
`G`	Move to the last line of the file.
`nG`	Move the nth line of the file.
`h`	Move left one character.
`I`	Insert text at beginning of line.
`i`	Insert text before the current character.

Command	What Does It Do?
j	Move down one line.
k	Move up one character.
l	Move right one character.
n	Repeat last search.
O	Open new line for insertion above current line.
o	Open new line for insertion below current line.
Return	Move to start of next line.
^u	Move up half a page.
U	Undo any changes to current line.
u	Undo last changes made to file.
W	Move forward one space delimited word.
w	Move forward one word.
x	Delete the current character.
:q	Quit vi and return to the shell.
:q!	Quit vi and return to the shell without saving any changes made to the file.
:w	Write the changed file to disk.

Appendix E. Special Notices

This publication is intended to help the Lotus Notes systems administrator to install, set up, and administer Lotus Domino R5 in an IBM RS/6000 AIX operating system environment. The information in this publication is not intended as the specification of any programming interfaces that are provided by Lotus Domino. See the PUBLICATIONS section of the IBM or Lotus Programming Announcement for Lotus Domino R5 for more information about what publications are considered to be product documentation.

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363

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Appendix F. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

F.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see "How to Get ITSO Redbooks" on page 369.

- *Lotus Domino Release 4.6 on IBM RS/6000: Installation, Customization, and Administration,* SG24-4694
- *High Availability and Scalability with Domino Clustering and Partitioning on AIX*, SG24-5163
- *Implementing High Availability on RISC/6000 SP*, SG24-4742
- *High Availability on the RISC System/6000 Family*, SG24-4551
- *RS/6000 SP High Availability Infrastructure*, SG24-4838
- *RS/6000 SP Monitoring: Keeping It Alive*, SG24-4873
- *Understanding LDAP*, SG24-4986
- *Using ADSM to Back Up Lotus Notes,* SG24-4534
- *RS/6000 Models E30, F40, F50, and H50 Handbook*, SG24-5143

F.2 Redbooks on CD-ROMs

Redbooks are also available on the following CD-ROMs:

CD-ROM Title	Collection Kit Number
System/390 Redbooks Collection	SK2T-2177
Networking and Systems Management Redbooks Collection	SK2T-6022
Transaction Processing and Data Management Redbook	SK2T-8038
Lotus Redbooks Collection	SK2T-8039
Tivoli Redbooks Collection	SK2T-8044
AS/400 Redbooks Collection	SK2T-2849
RS/6000 Redbooks Collection (HTML, BkMgr)	SK2T-8040
RS/6000 Redbooks Collection (PostScript)	SK2T-8041
RS/6000 Redbooks Collection (PDF Format)	SK2T-8043
Application Development Redbooks Collection	SK2T-8037

F.3 Other Publications

These publications are also relevant as further information sources:

- *Lotus Domino R5 Administration Help, (help/help5_admin.nsf)*
- *Lotus Notes R5 Client Help, (help/help5_client.nsf)*
- *Notes Installation Guide for Servers, (doc/srvinst.nsf)*
- *Workstation Install Guide, (doc/wrkinst.nsf)*
- *Notes Migration Guide, (doc/migrate.nsf))*
- *Release Notes: Domino Server R5, (help/readme.nsf)*
- *SMTP MTA Administration Guide, (smtpag.nsf)*
- *AIX V4.3 Installation Guide*, SC23-4112
- *IBM Internet Connection Server for AIX, Users Guide*, SC31-8194
- *AIX Performance Tuning Guide*, SC23-2365
- *AIX Version 4 System Management Guide: Communications and Networks*, SC23-2526

F.4 World Wide Web Publications

The following World Wide Web online information can be used for further reference:

- The Domino Cluster Zone, `http://www.lotus.com/cluster`
- *Lotus Notes Internet Cookbook for Release 4*, `http://NS.notes.net/cookbook/cbook.htm`
- Iris Today Articles, `http://www.notes.net`
  - *Workload Balancing with Domino Clusters*
  - *Fine Points of Configuring a Domino Cluster*
  - *The Domino Internet Cluster Manager*

How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

- **Redbooks Web Site** `http://www.redbooks.ibm.com/`

    Search for, view, download or order hardcopy/CD-ROM redbooks from the redbooks web site. Also read redpieces and download additional materials (code samples or diskette/CD-ROM images) from this redbooks site.

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369

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List of Abbreviations

ACL	Access Control List	DES	Domino Enterprise Server
ADSM	ADSTAR Distributed Storage Manager	DLT	Digital Linear Tape
AFS	Andrew File System	DNS	Domain Name System
AIX	Advanced Interactive eXecutive	DOS	Disk Operating System
APAR	Authorized Program Analysis Report	DRT	Delivery Report Task
		DSAPI	Domino Web Server API
API	Application Programming Interface	ECL	Execution Control List
ASCII	American Standard Code for Information Interchange	E Pow	Early Power Off Warning
		FDDI	Fiber Distributed Data Interface
ATM	Asynchronous Transfer Mode	FTP	File Transfer Protocol
CAPI	Common ISDN Application Programming Interface	GID	Group ID
		GIF	Graphical Interchange Format
CD	Compact Disk	GTR	Global Text Retrieval
CDE	Common Desktop Environment	HACMP	High Availability Clustered Multi-Processing
CGI	Common Gateway Interface	HPS	High Performance Switch
CORBA	Common Object Request Broker Architecture	HTML	Hypertext Markup Language
CPU	Central Processing Unit	HTTP	Hypertext Transfer Protocol
CRC	Cyclic Redundancy Check	IBM	International Business Machines Corporation
DAS	Domino Advanced Services	ICM	Internet Cluster Manager
DAT	Digital Audio Tape	IGS	Information Gateway Service
DCE	Distributed Computing Environment	IMAP	Internet Message Access Protocol
DECS	Domino Enterprise Connection Services	IMAP4	IMAP, Version 4

IIOP	Internet Inter-Orb Protocol	*NIF*	Not in File
IIS	Internet Information Server	*NIM*	Network Install Manager
IND	Interactive Network Dispatcher	*NIS*	Network Information System
I/O	Input/Output	*NLM*	NetWare Loadable Module
IP	Internet Protocol	*NNTP*	Network News Transfer Protocol
IPC	Inter-Process Communication	*NRK*	Notes Recovery Kit
IPX	Internetwork Packet eXchange	*NRPC*	Notes Remote Procedure Call
ISA	Industry Standard Architecture	*ODBC*	Open Database Connectivity
ISDN	Intergrated-Services Digital Network	*ODM*	Object Data Manager
ISP	Internet Service Provider	*ODS*	On-Disk Structure
ITSO	International Technical Support Organization	*OLE*	Object Linking and Embedding
JPEG	Joint Photographic Experts Group	*OU*	Organizational Unit
LAN	Local Area Network	*PAB*	Public (Name and) Address Book
LDAP	Lightweight Directory Access Protocol	*PCL*	Printer Control Language
LIPS	Lightweight Internet Person Schema	*POP3*	Post Office Protocol Version 3
LVM	Logical Volume Manager	*PP*	Physical Partition
MB	Megabytes	*PPP*	Point-to-Point Protocol
MIME	Multipurpose Internet Mail Extensions	*PRPQ*	Programming Request for Price Quotation
MTA	Message Transfer Agent	*PSSP*	Parallel System Support Programs
MX	Mail Exchanger	*PTF*	Program Temporary Fix
NAB	Name and Address Book	*PTPE*	Performance Toolbox Parallel Extensions
NFS	Network File System	*PTX*	Performance Toolbox
NIC	Network Interface Card	*QMR*	Quarterly Maintenance Release

RAID	Redundant Array of Inexpensive Disks	*TCB*	Trusted Computing Base
RAM	Random Access Memory	*TCP/IP*	Transmission Control Protocol/Internet Protocol
RAS	Reliability, Availability, Serviceability	*TTY*	Teletypewriter
RDBM	Relational Database Manager	*UCE*	Unsolicited Commercial Email
RFC	Request For Comments	*UDP*	User Datagram Protocol
RISC	Reduced Instruction Set Computing	*UID*	User ID
RPC	Remote Procedure Call	*UPS*	Uninterrupted Power Supply
SACL	Server Access Control Lists	*URL*	Uniform Resource Locator
SCSI	Small Computer system Interface	*USENET*	USErs' NETwork
SLIP	Serial Line Internet Protocol	*VM*	Virtual Memory
S/MIME	Secure MIME	*VMM*	Virtual Memory Manager
SMIT	System Management Interface Tool	*WAN*	Wide Area Network
SMP	Symmetric Multi-Processing	*WWW*	World Wide Web
SMTP	Simple Mail Transfer Protocol		
SNMP	Simple Network Management Protocol		
SP	Scalable Parallel		
SPI	Service Provider Interface		
SPX	Sequenced Packet eXchange		
SSA	Serial Storage Architecture		
SSL	Secure Sockets Layer		
SVTX	Save Text		
SWservAt	Software Service Aids Attributes Object Class		
TAR	Tape Archiver		

Index

Symbols

A

B

375

383

ITSO Redbook Evaluation

Lotus Domino R5 on IBM RS/6000: Installation, Customization, and Administration
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