

ULTRIX

**Guide to Sharing Software
on a Local Area Network**

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This guide describes software sharing and explains how to set up and maintain software sharing environments for Diskless Management Services (DMS) and Remote Installation Services (RIS).

digital equipment corporation
Maynard, Massachusetts

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About This Manual

This manual describes the Diskless Management Services (DMS) and the Remote Installation Service (RIS) utilities and environments. DMS is a utility for providing online operating system software to computers on a local area network. RIS is a utility for installing software kits across a network instead of by using locally-mounted distribution media.

New and Changed Information

This is a new manual. It replaces the following manuals that were supplied with previous ULTRIX releases:

- *Guide to Server Setup*
- *Guide to Diskless Management Services*
- *Guide to Remote Installation Services*

Chapter 1 is new introductory material. The remainder of the manual is a revised presentation of the information contained in the previous manuals. Certain technical inaccuracies have been corrected.

Audience

This manual is written for anyone using the DMS and RIS utilities, typically the system administrator. The manual assumes the following:

- Your hardware has been checked by you or by a Digital Field Service representative to ensure that it is working properly.
- You have read the owner's manuals supplied with your hardware.
- You know the location and function of the controls and indicators on your hardware.
- You understand how to load and unload the installation media and any disks needed during the installation.
- You know how to use ULTRIX software, including the License Management Facility.

All the examples in this manual assume that you are logged in as the superuser on the server system.

Organization

This manual comprises seven chapters, one appendix, a glossary, and an index. A brief description of the contents follows:

Chapter 1	Introduction and Architectural Overview	Introduces the concept of servers and clients. This chapter explains what a server is, what a client is, and how they work together. It also describes the basic architecture of the server/client environment for both DMS and RIS.
Chapter 2	Setup Preparation for Servers	Lists the formats in which distribution media are available, shows compatibility between versions of DMS, RIS, and the operating system, and describes the preliminary setup procedures that apply to both DMS and RIS.
Chapter 3	DMS Server Setup	Describes the procedure for setting up a DMS server, including allocating disk partitions and installing software, updating DMS areas, setting up default configurations, and managing client information.
Chapter 4	RIS Server Setup	Describes the procedure for setting up a RIS server, including installing and updating software.
Chapter 5	Management and Maintenance	Describes processes and procedures for maintaining and managing a DMS or RIS system, including adding, deleting, and modifying clients and clients' setups.
Chapter 6	DMS Troubleshooting	Provides information on troubleshooting problems with DMS clients.
Chapter 7	Customizing DMS clients	Describes how to customize DMS clients, with information on why and when customizing is appropriate.
Appendix A	Worksheets	Contains blank copies of the worksheets used in the installation process.

Related Documents

You should have the following documentation available:

- The hardware documentation for your system
- The *ULTRIX Release Notes*
- The *ULTRIX Reference Pages Section 8: Maintenance*
- *Guide to Disk Maintenance*
- *Guide to Installing ULTRIX*
- System and network management guides:
 - *Guide to the BIND/Hesiod Service*
 - *Guide to Ethernet Communications Servers*
 - *Introduction to Networking and Distributed System Services*
 - *Guide to the Network File System*
 - *Guide to the Yellow Pages Service*

- *Guide to System Shutdown and Startup*
- *Guide to Software Licensing*

Conventions

The following typographical conventions are used in this manual:

#	A number sign is the default superuser prompt.
UPPERCASE lowercase	The operating system differentiates between lowercase and uppercase characters. Literal strings that appear in text, examples, syntax descriptions, and function definitions must be typed exactly as shown.
macro	In text, this typeface is used to introduce new terms.
% cat	A regular constant-width typeface is used for code examples, system prompts in interactive examples, and names of commands and other literal strings in text. A bold constant-width typeface is used for typed user input in interactive examples and for routines in function definitions.
<i>filename</i>	In examples, syntax descriptions, and function definitions, this typeface indicates variable values.
cat file	In syntax definitions, a bold sans serif typeface is used for literal strings and a sloping sans serif typeface is used for variable values.
[] { }	In syntax definitions, brackets indicate items that are optional and braces indicate items that are required. Vertical bars separating items inside brackets or braces indicate that you choose one item from among those listed.
cat(1)	A cross-reference to a reference page includes the appropriate section number in parentheses. For example, a reference to <code>cat(1)</code> indicates that you can find the material on the <code>cat</code> command in Section 1 of the reference pages.

This chapter introduces the concept of software sharing. It also explains what software-sharing servers and clients are and how they work together.

1.1 What is Software Sharing?

A significant part of the cost of using software lies in the need for multiple copies of the same software to run on different machines and in the requirement for disk space to store the software. You can reduce this part of your software and hardware costs by sharing software between computers. When you share software, several of the computers in your local area network (LAN) use a single copy of a given piece of the software. You are not limited to sharing only one piece of software, however; you can share virtually all of your ULTRIX system software.

A **server** is a computer system that serves another system by sharing something that the other system wants or needs. The other system is called a **client**. A given server can serve one or many clients. Computers in a network can share disk space, lists of names, software kits, processing services, and other entities. For sharing software using Diskless Management Services (DMS) and Remote Installation Services (RIS), the server supplies software, software kits, and disk space for clients to use.

The DMS and RIS utilities allow you to share software in the following ways:

- DMS sets up a system in which you can save disk space by sharing the actual operating system software between computers. Without DMS, each computer has a copy of its operating system software on its own disk. With DMS, one computer, acting as a **DMS server**, stores the software in a special area (called the **DMS area**) on its disk. Other computers, called **DMS clients**, run by accessing the software across the LAN instead of from their own local disks. You can even set up DMS clients that have no disks of their own at all, using network access for users' files as well as for the system software.
- RIS sets up a system similar to the DMS system except that what is shared is one or more installable software kits instead of the actual operating system. With RIS, you can buy only one copy of a given kit. One computer, the **RIS server**, stores the kit in a special area (called the **RIS area**) on its disk. Other computers, called **RIS clients**, install the software onto their own disks by accessing it across the network instead of from locally-mounted distribution media.

The DMS and RIS utilities share architectural similarities; the primary differences are in the contents of their respective server disk areas. Table 1-1 lists the features and benefits of DMS and RIS.

Table 1-1: Features and Benefits of DMS and RIS

Feature	Benefit
Ease of use	Installation and setup of servers and clients are done by automated scripts, thereby simplifying the task of the server system administrator. Maintenance of the DMS and RIS areas is similarly straightforward. The system interface is the same regardless of system type.
Heterogeneity	Because DMS and RIS support both different hardware platforms and different software versions, they are adaptable to a wide variety of customer systems and requirements. The same software runs on VAX or RISC systems, and servers running a given version of the ULTRIX system can serve clients running the same version or an earlier version of the system. RISC servers can serve VAX clients, and VAX servers can serve RISC clients.
Media savings	DMS allows use of a single set of most files required by the clients, and RIS uses a single set of kit files for all clients. Disk space requirements are greatly reduced.
Centralized management	Because the DMS and RIS files reside on the server, the server's system administrator can perform most system management tasks. The involvement of individual users with the complexities of system management is reduced.

1.2 The Software Sharing Environment

The following components make up the environment for software sharing. These elements are essentially identical for either DMS or RIS; the two systems can coexist in the same LAN, using the same server or different servers.

- A server
The server can be any Digital-supported processor. Either a RISC server or a VAX server can serve both RISC and VAX clients. A single server can serve both DMS and RIS clients.
- A distribution device on the server
The distribution device can be an MT9 tape drive, a TK50, TK70, or TZ30 tape drive, an RA60 disk drive (VAX only), or a CDROM optical disc drive. You transfer the software subsets for one or more specific products and architectures from the distribution media to the DMS or RIS area on the server. Registered clients can then access the software.
- An Ethernet local area network (LAN)
You must set up the server and all client processors as hosts on the Ethernet. Clients use the Ethernet to access the server's DMS and RIS areas.
- Clients
DMS and RIS clients are members of the MicroVAX, VAXstation, DECstation, and DECsystem series of processors.

For both DMS and RIS, the server's system administrator performs a series of steps to configure the server for DMS or RIS use. Generally, the following procedure is required:

1. Install an ULTRIX system on the server.
2. Set up the Ethernet.
3. Set up the Network File System (NFS):
4. Create the file systems required for DMS or RIS, or both.
5. Install software into the DMS and RIS areas, as appropriate.
6. Register clients.

1.3 The DMS Server and Client

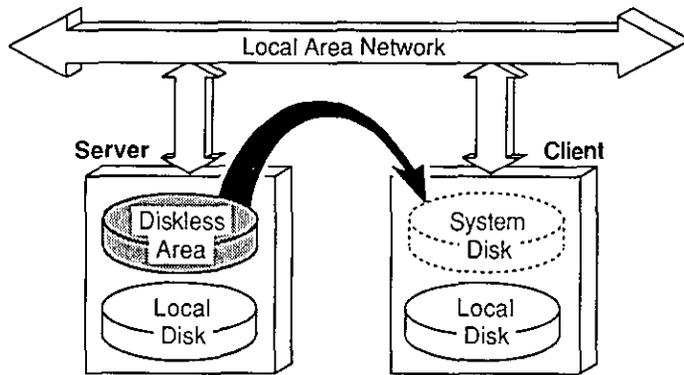
The DMS utility, called `dms`, manages the sharing of installed operating system software between computers in a local area network. In a DMS system, the server has a reserved disk area (the DMS area) set aside in addition to its normal disk space. In the DMS area are copies of the `usr` area; typically, there is one copy for use by all the clients of each type the server is to support. By sharing the `usr` area, you eliminate the need for disk space to hold a complete separate `usr` area for each of your computers. For RISC systems, this saving can be more than 150 megabytes (Mb) for each client.

In the DMS area, the server also maintains multiple copies of the root area, one for each client. Each copy is in a client root directory in the DMS area and is customized for the client in order to provide for differences between hardware platforms or environmental requirements such as the number of disks a system has. Each of the client root directories is client-private (or just **private**); this means that there is a directory for each client so that no conflict or confusion exists between clients. The server's DMS root and `usr` areas are made available to clients by means of a network file sharing system. For more information about the network file sharing system used by ULTRIX systems, refer to the *Guide to the Network File System*.

The server is a passive partner in the day-to-day operation of a DMS system. Beyond verifying clients' identities, vectoring their boot requests, and providing their system disk space, the server does not interact directly with the clients. The server can, if desired, support local timesharing users.

A DMS client's system disk space (root and `usr` areas) is physically connected to the server instead of to the client. The client accesses that disk area through a local area network connection with the server. Each DMS client is booted across the network from its private root area on the server. Once booted, the client continues to use its root files and `usr` files from the server's DMS area. These files appear to the client as if they were on local disks, as shown in Figure 1-1.

Figure 1-1: DMS Server and Client



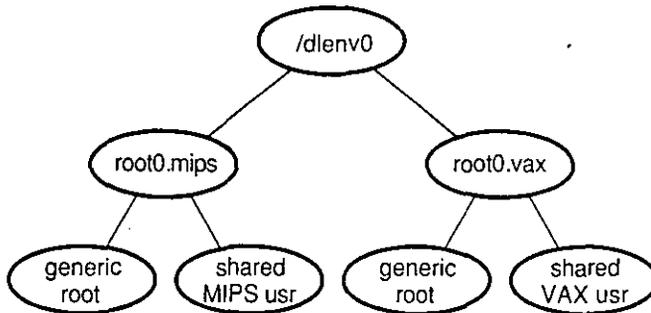
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A given client's file system can also contain layered products such as windowing or network software. As indicated in Figure 1-1, clients can have local disks if desired. In addition to local disks, they can import file systems from any other computer to which they have network access. Clients can use swap space either on the server or on local disks; swapping locally produces enhanced performance.

1.3.1 The DMS Area

In addition to the server's normal disk area, a partition is reserved as the DMS area. In this partition, one or more **DMS environments** reside. Each DMS environment contains one or more **DMS root areas**; a root area exists for each general type of client to be supported, such as VAX or RISC processors.

Figure 1-2: Generalized DMS Environment



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Figure 1-2 shows a simplified illustration of a DMS environment. It shows one DMS environment, named /dlenv0, containing two **DMS root areas**, /dlenv0/root0.mips and /dlenv0/root0.vax. Each DMS root area contains a **generic root** directory for one type of processor, such as a VAX or a RISC processor, and a **shared usr** area.

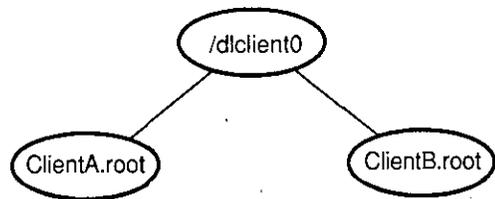
The generic root contains copies of the kernel and other primary system files. These copies can be in either **raw** form (exactly as supplied in the ULTRIX distribution kit) or in **prototype** form (partially modified by the server's system administrator), providing the "master copies" from which clients' root areas can be generated and individually tailored. Modifications can include the supplying of standard files such as a `printcap` file so that individual client users need not create their own.

The `usr` system contains common files that can be used without tailoring by all clients of a given type.

Each environment can also contain windowing software and other layered products. Each environment allows the server to provide DMS service to one of as many different combinations of software products and hardware architectures as are needed. To support a greater variety of different environments, improve performance, or support more clients than allowed by the size of `/dlenv0`, multiple `dlenvn` areas can be established in separate partitions.

A DMS **client area** for each individual client computer also resides in the DMS area. Figure 1-3 illustrates one client area, named `/dlclient0`.

Figure 1-3: DMS Client Area



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In the client area are multiple copies of the root area, each tailored from the appropriate generic root for an individual client computer. Each client's root area contains a customized kernel to support that client's actual system configuration, including central processor, system memory, and peripheral devices. Figure 1-3 shows two client root areas, named `ClientA.root` and `ClientB.root`. Each client sees its private root area and the shared `usr` area from the appropriate `dlenv` environment as local, although these areas are actually on the server and are accessed through the network file sharing system. See Figure 1-4.

As with the DMS environment area, multiple `dlclientn` areas can be established in different partitions.

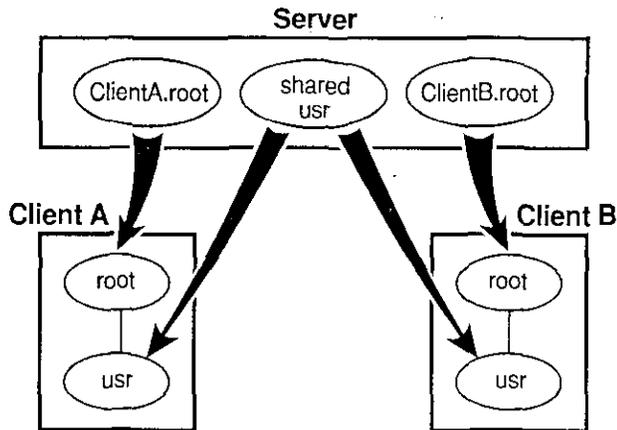
The server itself does not normally use any of the DMS area. System administrators can access the DMS area as required for maintenance and for installation or removal of layered products, but the area is not considered part of the server's own disk area.

1.3.2 Characteristics of a DMS Client

Only the server has access to the entire DMS area. Each DMS client owns the root area assigned to it on the server. This area's contents are uniquely tailored to the client, making it unnecessary to call upon the server for file arbitration or selection of the particular binaries the client can run.

Common system files residing in the `usr` area are shared among all the clients of a given type. Mounted with only read access for the clients, this shared area is protected from erroneous client activity. See Figure 1-4.

Figure 1-4: Client Views of the DMS Area



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In Figure 1-4, the small boxes represent what the clients think they see; the arrows show how the real disk areas on the server are mounted by the client to produce this view.

Clients can be timesharing systems or workstations. Because each client's root area is tailored specifically to the client's needs and contains the software the client can run, there is no interference between clients attempting to use identical resources that could, for example, have licensing restrictions based on the number of concurrent users.

Note

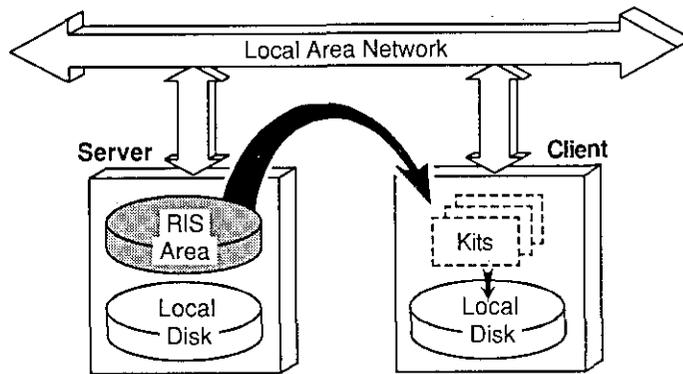
Although nominally a DMS client should be registered with a single server, clients can be registered with multiple servers. If you register a client with more than one server, you cannot control which server will respond when the client boots.

1.4 The RIS Server and Client

Remote Installation Services is a utility for installing software kits stored on a central computer system onto multiple computer systems in a local area network.

With RIS, the server has a reserved disk area set aside as the RIS area. In the RIS area are copies of software kits to be made available for installation onto clients. Figure 1-5 illustrates how the system works.

Figure 1-5: RIS Server and Client



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In the RIS area, the server also maintains information about each client system so that the client's administrator can install software kits without having to bother the server's administrator. Kit organization is managed so that different kits for a given product can be made available to provide for differences between hardware platforms. The server's RIS area is made available for read-only access to clients by means of a network file sharing system. (See the *Guide to the Network File System*.)

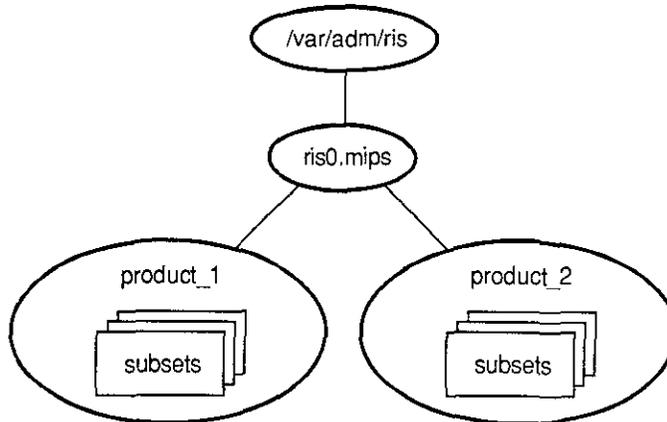
The server is a passive partner in the day-to-day operation of a RIS system. Beyond verifying clients' identities, verifying their kit load requests, and vectoring accepted requests, the server does not interact directly with the clients. The server can, if desired, support local timesharing users.

A RIS client installs software kits by copying the kit contents across the network from the server and then executing kit-specific scripts that control the installation process.

1.4.1 The RIS Disk Area

In addition to the server's normal disk area, a partition or area is reserved on the server to hold RIS software kits. This RIS area contains one or more **product environments**. Each product environment contains one or more software kits suitable for installation on a given hardware/software platform. See Figure 1-6 for a generalized illustration of the RIS area.

Figure 1-6: Generalized Illustration of the RIS Area



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Figure 1-6 shows a RIS area (named `/var/adm/ris`) containing one product environment, `ris0.mips`. A given environment is designated to contain products for a specific target platform; in Figure 1-6, the target platform is RISC processors. Multiple product environments can exist in a single RIS area. Each environment contains several product directories, each of which in turn contains several product kits, called **subsets**. For example, an area named `ris0.mips` could contain directories called `product_1`, `product_2`, `product_3`, and so on. Figure 1-6 shows two product directories. A listing of the `product_1` directory might show the following files:

```

# cd /var/adm/ris
# ls ris0.mips/product_1
ROOT          ULTDL400      ULTNFS400    ULTUMAIL400  UWSER400
ULTACCT400    ULTEXER400    ULTPASCAL400 ULTUUCP400   UWSX11400
ULTAFM400     ULTINET400    ULTPGMR400   ULTVAXC400   UWSXDEV400
ULTBASE400    ULTINTL400    ULTPRINT400  UWS3DFONT400 checksums
ULTBIN400     ULTKERB400    ULTRPCDEV400 UWSDECW400   instctrl
ULTBSC400     ULTMAN400     ULTRPCRT400 UWSFONT15400
ULTCOMM400    ULTMH400      ULTSCCS400   UWSFONT400
ULTDCMT400    ULTMOP400     ULTSEC400    UWSMAN400
  
```

In this example, `product_1` contains ULTRIX subsets together with installation and control information.

The RIS area also contains a directory in which each registered client is represented by a file that contains naming and TCP/IP addressing information for the client and server, and a list of the product directories the client is registered for. This information is used for verification and during the process of copying subsets from the server to a client for installation.

The server itself does not normally use any of the RIS area. System administrators can access the product area as required for maintenance and for installation or removal of product kits, but the area is not considered part of the server's own disk area.

1.4.2 Multiple RIS Areas on a Server

To enhance flexibility, you can establish multiple RIS areas in separate partitions. RIS areas on a given server can be exported to other servers using the Network File system (NFS). Servers that import such RIS areas can use them as if they were local, supplying the imported subsets to their own sets of clients. The *Guide to the Network File System* describes how to export and import file systems.

1.4.3 Characteristics of a RIS Client

A RIS client can install any of the software kits for which it is registered on the server. The installation procedure runs entirely on the client. When the necessary software is installed, the RIS client is an independent system and can run while the server is inoperative (unlike a DMS client, which relies on the server for its online operating software).

The primary operating system can be among the kits that are available. When it is desired to install the operating system itself, the client processor is booted across the network using a generic minimal kernel and file system, both of which are part of the software kit. The special kernel and file system become totally resident in the client's memory. Once booted, the client runs the same installation utility that is used to install kits on an already-running, configured platform; this utility, called `setld`, is contained in the memory-resident file system. (For more information about the `setld` utility, see the `setld(8)` reference page. After the installation is complete, the system is rebooted using the newly-installed software.

Note

Although usually a RIS client should be registered with a single server, clients can be registered with multiple servers. Usually, you would register a client with multiple servers if you did not have the complete set of installable kits on any single server in the network. When you register a client with more than one server, you can specify which server to connect to when you install software.

This chapter provides the information you need before you begin setting up a DMS or RIS server. This information includes:

- Descriptions of product compatibility
- Descriptions of the tasks you must do before installing DMS or RIS
- Names of distribution media and device special files
- Procedures for planning and calculating disk space requirements for DMS
- Information on registering clients with network naming services

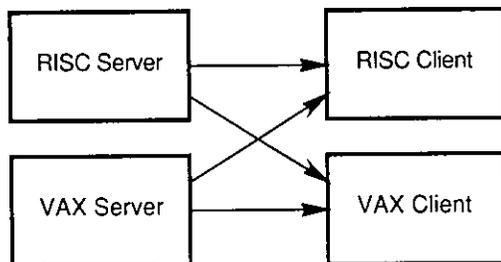
Note

Software licensing restrictions can affect your ability to run software in a shared environment. You must register the appropriate Product Authorization Keys (PAKs) for all software that uses the License Management Facility (LMF). See the *Guide to Software Licensing* for more information on LMF and software licensing.

2.1 Server/Client Compatibility

There are certain constraints on using different versions of the ULTRIX operating system in DMS and RIS environments. Figure 2-1 illustrates intermixing different hardware platforms.

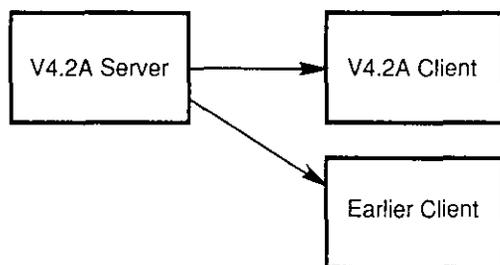
Figure 2-1: Processor Compatibility for DMS and RIS



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Figure 2-2 shows mixing different versions of the ULTRIX operating system.

Figure 2-2: ULTRIX Version Compatibility for DMS and RIS



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Configurations not shown in these two figures are not supported.

Note

“Earlier Client” systems (shown in Figure 2-2) must run ULTRIX Version 4.0 or higher. Operating system versions older than 4.0 are not supported by Version 4.2A servers.

2.2 Prerequisite Server Setup Tasks

Before you can begin to configure and install the DMS and RIS areas and software on the server, you must perform the following tasks:

1. Install an ULTRIX operating system.
2. Set up your Ethernet local area network (LAN).
3. Set up a network file sharing system (NFS).

2.2.1 Installing the ULTRIX Operating System on the Server

The *Guide to Installing ULTRIX* describes how to install the ULTRIX operating system on the server. It also contains lists of all the standard ULTRIX supported and unsupported software sets with subset names and descriptions of subset contents. Subset sizes are listed in the *Release Notes*. You need this information for installing the operating system itself as well as for installing DMS and RIS software.

In order for a system to be a DMS or RIS server, that system must have the subset containing the Maintenance Operations Protocol (MOP) installed. To install the MOP subset, you can:

- Perform an advanced installation and choose the MOP subset with the other subsets you install.
- Perform a basic installation and then, after the installation is complete, use the `setld` command. For example:

```
# setld -l /dev/rmt0h
```

For information on using the `setld` utility, refer to the `setld(8)` reference page.

2.2.2 Setting up a Local Area Network

You must connect the DMS or RIS server and all of the client processors to an Ethernet local area network (LAN). For instructions on setting up a LAN, refer to the *Introduction to Networking and Distributed System Services*.

2.2.3 Setting up a Network File System

The Network File System (NFS) must be set up before you install DMS. For instructions on setting up NFS, refer to the *Guide to the Network File System*. After you have installed NFS, make sure the following daemons are running:

- `portmap`
- `mouted`
- `nfsd`
- `biod`

These daemons must be started in the order listed; if you have installed NFS using the `nfssetup(8)` command, then `/etc/rc.local` will contain the startup commands in the correct order.

2.3 Distribution Media and Device Special File Names

Depending on your hardware, the ULTRIX distribution kit contains one of the media types listed in Table 2-1 or Table 2-2. The device special names for the various kits are also listed in the tables. In device special names, the characters `xx` represent a controller name such as `ra`, and the `n` is the unit number. Table 2-1 lists media types for RISC systems.

Table 2-1: RISC Distribution Media

Media Type	Distribution Media Label	Device Special File Name
TK50 cartridge tape for TK50, TK70, or TZ30 tape drives	ULTRIX/UWS V4.2A (RISC) SUPPORTED SUBSETS VOLUME 1	/dev/rmt.nh
	ULTRIX/UWS V4.2A (RISC) SUPPORTED SUBSETS VOLUME 2	
	ULTRIX/UWS V4.2A (RISC) UNSUPPORTED SUBSETS	
9-track (MT9) tape for TS05, TE16, TU45, TU77, TA78, TU78, TU79, TU80, TA81, TU81, or TU81E drives	ULTRIX/UWS V4.2A (RISC) SUPPORTED SUBSETS VOLUME 1	/dev/rmt.nh or /dev/rmt.nl
	ULTRIX/UWS V4.2A (RISC) SUPPORTED SUBSETS VOLUME 2	
	ULTRIX/UWS V4.2A (RISC) SUPPORTED SUBSETS VOLUME 3	
	ULTRIX/UWS V4.2A (RISC) UNSUPPORTED SUBSETS	
CDROM for RRD40 drive	ULTRIX/UWS V4.2A (RISC) SUPPORTED/UNSUPPORTED SUBSETS	/dev/rznc

Table 2-2 lists media for VAX systems.

Table 2-2: VAX Distribution Media

Media Type	Distribution Media Label	Device Special File Name
TK50 cartridge tape for TK50, TK70, or TZ30 drives or 9-track (MT9) tape for TS05, TE16, TU45, TU77, TA78, TU78, TU79, TU80, TA81, TU81, or TU81E drives	ULTRIX/UWS V4.2A (VAX) SUPPORTED SUBSETS	/dev/rmt.nh or /dev/rmt.nl
	ULTRIX/UWS V4.2A (VAX) UNSUPPORTED SUBSETS	
RA60 disk	ULTRIX/UWS V4.2A (VAX) SUPPORTED/UNSUPPORTED SUBSETS	/dev/xxnc
CDROM for RRD40 drive	ULTRIX/UWS V4.2A (VAX) SUPPORTED/UNSUPPORTED SUBSETS	/dev/rznc

2.4 Planning Disk Space for DMS

For DMS, you must calculate the amount of disk storage required before beginning, to ensure that you have enough space in the DMS areas that you will create and populate with the `dms` utility. DMS clients' system disk space is located on the

server in a DMS area. See Chapter 1 for a description of the DMS area's contents. Note that a given server can have multiple DMS areas, in which some of the files (notably the contents of the `usr` area) are duplicated. This necessary duplication imposes additional space requirements on the server.

Throughout this guide, the server file systems are designated `dlenvn` and `dlclientn`. The root directories can be either `rootn.mips` or `rootn.vax`; this guide's examples use `rootn.mips`. The letter *n* represents the number assigned to the specific file system or common root directory when it is installed. The client's private portion of the common root directory is designated `client-name.root`.

Disk space is required on the server for each DMS server area file system. The following sections provide guidelines for estimating the disk space you need.

2.4.1 Disk Space Required for the `dlenv` File System

Each common `rootn.mips` area contains at least the mandatory ULTRIX and ULTRIX Worksystem Software subsets. It can also contain other subsets and any additional software desired for the clients registered to access that area.

In addition, reserve the following:

- Enough space for any layered products, such as DECnet, that you plan to install at any time in the future
- An additional 15% of the required disk space to allow for file system administration tasks and file system information

Appendix A contains worksheets for calculating the amount of space you need for a single DMS area. Refer to the first of the two DMS server worksheets as you read the following example calculation.

Caution

Subset sizes in this example are for illustration only. The actual sizes for standard ULTRIX subsets are listed in the *Release Notes*; to determine the names of the subsets you want to install, refer to the descriptions in the *Guide to Installing ULTRIX*. Subset size information for layered products is included in the products' installation documentation.

Suppose that you have only RISC clients and that you want to install all of the standard supported and unsupported software plus one layered product. You need one DMS environment (`/dlenv0`). You refer to the appropriate documentation and find that the subsets you want are these:

Subsets	Size in Mb
All supported ULTRIX software subsets	150
All unsupported ULTRIX software subsets	36
One layered product subset	50

These subsets add up to 236 Mb. Allowing another 15% of this space (36 Mb) for file system administration and information, you arrive at a total size of 272 Mb for the `/dlenv0` area. Be sure to allow additional space for any other software products you plan to install later, remembering that these products' space requirements must be factored into the 15% overhead allocation.

2.4.2 Disk Space Required for the dclient File System

You must allow disk space in each `dclient` file system on the server for clients' root directories and, optionally, for clients' swap files or crash dump space, or both.

Use the following guidelines for your estimates:

- Allow a minimum of 10 Mb for each client's root area.
- If clients are to use space on the server for crash dumps, add an amount equal to each client's memory size plus its kernel size. If clients will dump to their local disks, this allowance is not needed.
- If any of the clients' swap files will be located on the server, allow three times each client's physical memory size. If space is tight, you can consider reducing this allowance on a per-client basis, to twice the client's memory size. Reducing the swap space decreases performance; the amount of degradation depends on the memory requirements of the applications users will run on a given client.
- Clients' volatile files, such as those in the `/tmp`, `/var/spool`, and `var/adm/crash` directories, are located in the `dclient` area and require space. A good figure to use for this extra space is 15 Mb per client.
- Clients that add files to their `client-name.root` areas use space.

The amounts of space required by individual clients will not all be the same, but you can simply add all the needed spaces together to arrive at the total requirement for the `dclient` area.

Appendix A contains worksheets for calculating the amount of space you need for a single DMS area. Refer to the second of the two DMS server worksheets as you read the following example calculation.

Caution

Memory sizes in this example are for illustration only. Use the actual sizes of your own systems for your calculations.

Suppose you have five clients, two with 16 Mb of memory and three with 8 Mb. You want all of your clients to use dump and swap space on the server. You will need the following space allowances:

Purpose	Clients × Space Each (Mb)	Totals (Mb)
Root area	5×10	= 50
Dump space (8-Mb clients)	$3 \times (8 + 2.5)$	= 31.5
Dump space (16-Mb clients)	$2 \times (16 + 2.5)$	= 37
Swap space (8-Mb clients)	$3 \times (8 \times 3)$	= 72
Swap space (16-Mb clients)	$2 \times (16 \times 3)$	= 96
User files	5×15	= 75
Total space required		= 361.5

This calculation does not allow for any additional space needed by clients that add files to their own root areas.

2.5 Client Registration

Before you can use DMS or RIS to serve a client, you must register the client both with the network naming server system and with the DMS or RIS server. Perform the following tasks to prepare to register clients:

- Obtain information about each client.
- Fill out a copy of the Client Setup Worksheet from Appendix A for each client.
- Register each client's host name and TCP/IP (Internet Protocol) address with the appropriate naming service server or servers.

2.5.1 Obtaining Information About Each Client

You need the following information about each processor you plan to register as a client:

- Host name

Caution

Only lowercase letters (a-z) and numbers are permitted in host names. The MOP protocol used to bootstrap DMS and RIS clients recognizes only the first six characters of the host name. A host name can contain more than six characters, but the first six characters must be unique. The name must begin with a letter, not a number.

- For DMS, the DMS environment and client areas you want to register the client in; for RIS, the RIS environments you want to make available to the client
- Whether the client is a RISC or a VAX processor
- The client's root (superuser) password
- Hardware Ethernet address

See the *Guide to Ethernet Communications Servers* for information about how to obtain hardware Ethernet addresses.

- Swap file location
- Swap device, if swapping on the client's local disk

Appendix A contains copies of a worksheet for recording all the information you need to register a DMS client. Much of this information is also needed for RIS registration, so you should fill out a copy of the worksheet for each of your DMS and RIS clients.

2.5.2 Registering Clients' Host Names and TCP/IP Addresses with Servers

If the host system is served by any of the following naming services, check with your site administrator to be sure that your clients are registered with the appropriate naming service servers:

- `/etc/hosts`
- Berkeley Internet Name Domain (BIND)
- Yellow Pages (YP)

You automatically place each client processor's host name and TCP/IP (Internet Protocol) address in the `/etc/hosts` file when you initially set up your LAN using the `netsetup` utility. The `netsetup` utility is described in the *Introduction to Networking and Distributed System Services* and in the `netsetup(8)` reference page.

You can also place the host name and TCP/IP address in the `/etc/hosts` file by using a text editor such as `vi`. The host name and TCP/IP address for each client processor must be unique.

See the *Guide to the Yellow Pages Service* for information about the Yellow Pages (YP) service. See the *Guide to the BIND/Hesiod Service* for information about the Berkeley Internet Name Domain (BIND) server.

This chapter describes how to use the `dms` utility to configure a DMS server. The instructions tell you how to:

- Allocate disk partitions using `dms`
- Establish a new DMS server area, including the installation of software
- Install software into an existing DMS area

3.1 Allocating Disk Partitions

You use the `dms` utility to allocate disk partitions for a DMS server area. The utility allocates disk partitions for the file system `dlenvn` that will contain the DMS clients' `rootn.mips` and shareable `usr` area and for the file system `dlclientn` that will contain each DMS client's root and swap areas. See Chapter 1 for a description of the naming conventions for DMS areas.

This section describes how to use the `dms` utility to set up the file systems necessary for a DMS server area.

The DMS area must be in a disk partition separate from the server's own file systems. If you want to repartition your disk before setting up the DMS server area file systems, use the `chpt` utility. See the *Guide to Disk Maintenance* and the `chpt(8)` Reference Page.

Use the following procedure to set up the file systems for a DMS server area:

1. Invoke the `dms` utility by typing the following command at the system prompt:

```
# /etc/dms
```

2. The Diskless Management Services menu appears. Choose the Create Diskless Area on Disk option by typing `c` at the prompt. For example:

```
DISKLESS MANAGEMENT SERVICES (DMS) UTILITY MENU

a - Add Client Processor
m - Modify Client Parameters
r - Remove Client Processor
l - List Registered Clients
s - Show Products in Diskless Environments
i - Install Software
c - Create Diskless Area on Disk
k - Kernel Rebuild or Copy
e - Exit
```

Type your choice: `c`

3. The Diskless Area Setup menu appears. Choose `d` to set up a DMS environment or `c` to set up a DMS client area. For example:

Diskless Area Setup Menu

d - Diskless Environment Setup
c - Diskless Client Setup
r - Return to previous menu

Enter your choice: **d**

4. A prompt asks for the disk and partition that you want to use. The prompt is different for a DMS environment or a DMS client area. For example, suppose you have chosen to set up a DMS environment:

Enter disk and partition you want to use for the DMS environment.
For example, /dev/rralg: **/dev/rra0d**

5. After you select the disk and partition, a message tells you how much space the partition you chose contains. A prompt asks if this is enough space for your DMS area. For example:

There are approximately 67 Mbytes on /dev/rra0d. Is this partition large enough to contain the software you intend to install? (y/n) {}: **y**

6. If there is enough space, answer **y** to the prompt. A message tells you where the file system will be placed and mounted. If you answer **n**, the utility returns to the area setup menu.

Caution

Any existing file systems on the named partition will be destroyed and their contents lost. The `dms` utility prompts you for confirmation before continuing.

7. If you choose to continue, informational messages appear as the disk partition is allocated. When the allocation is complete, the main DMS menu reappears.

Repeat this procedure to allocate as many disk partitions as you need for both DMS environments and DMS client areas.

3.2 Installing Software in a New DMS Server Area

After you create the DMS server area file systems `dlenvn` and `dlclientn`, you use the `dms` utility to install software into the `dlenv` file system. Install all the software you plan to use in this DMS server area before you begin registering clients to use this area. If you need to install more software at a later date, refer to Section 3.3.

Perform the installation procedures described in this section to install the software into a new `rootn.mips` area.

1. If your distribution media is RA60 or CDROM, use a `mount` command like the following before starting the utility:

```
# mount -r /dev/rz4c /mnt
```

This example uses a CDROM drive that is unit 4 on a DECstation 3100; if your drive is a different unit, substitute the correct unit name. For supported software, the device special name will be either `/mnt/RISC/BASE` or `/mnt/VAX/BASE`, depending on the architecture of the clients to be served.

2. Invoke the `dms` utility and choose the `Install Software` option from the menu (illustrated in Section 3.1) by typing `i` at the prompt.
3. A menu offers the installation options available. Choose option 1, `Install Operating System to New Area`:

Diskless Area Software Installation Menu:

- 1 Install Operating System to New Area
- 2 Add Software to Existing Area
- 3 Return to Previous Menu

Enter your choice: 1

A message confirms that you have chosen to install the operating system to a new area.

4. If there is more than one `dlenvn` file system available, a menu lists the possible file systems. For example:

These are the available file systems to contain the environment:

- 1 /dlenv0
- 2 /dlenv1

Enter your choice []: 1

5. A prompt asks for the full pathname of the device special file name or mount point for the distribution media. Enter the required information. The following example shows how to mount the 9-track magnetic tape labeled "ULTRIX V4.n/ULTRIX WS V4.n SUPPORTED (RISC) VOLUME 1" on a TU81 tape drive, unit 0:

Enter the device special file name or the path of the directory where the software is located, for example, `/dev/rmt0h: /dev/rmt01`

6. If your distribution media is tape, the utility asks you to confirm that the tape is mounted and on line. Type `y` when the tape is ready.
7. The `dms` utility lists the mandatory software subsets, which will be installed automatically. It then lists optional subsets for the product you are installing. Select the optional subsets that you want from the list. If you want all of the optional subsets, enter the number corresponding to the selection `All of the Above`.
8. The utility lists the subsets that you have chosen to install and asks you to confirm your choice. If the subsets listed are the ones that you want, type `y`. If you type `n`, the list of optional software subsets is displayed again, and you can select the subsets that you want.

Messages appear as each subset that you selected is installed and verified.

Depending on the number of subsets you have chosen, this process can take an hour or more. If you are installing from MT9 tapes, the utility prompts you to install the next volume at the appropriate time.

Once you have set up the DMS areas and registered clients, the clients can access those areas suited to their needs. Client registration is discussed in Chapter 5.

3.3 Installing Additional Software Products

You can install ULTRIX unsupported software subsets and Digital layered products that are compatible with the ULTRIX `setld` utility into the DMS server area. To install additional software products, invoke the `dms` utility again and choose the `Install Software` option.

Caution

Make sure no DMS clients that mount the `usr` area of the target `/dlenv/rootn.mips` area are running when you install an additional software product, or their `usr` area may change unpredictably and cause destruction of software or data or both.

Some layered products can fail to install correctly due to certain incompatibilities with the `setld` utility. If you are trying to install a product and receive an error exit before the `setld` menu is presented, set the `STL_NOACTM` environment variable to a value of 1 and retry the installation.

The following sample session illustrates the installation of ULTRIX Worksystem Software into `/dlenv0/root0.mips`.

1. If your distribution media is RA60 or CDROM, mount the media as shown in Section 3.2.
2. Invoke the `dms` utility and choose the `Install Software` option from the menu (illustrated in Section 3.1) by typing `i` at the prompt.
3. The software installation menu (illustrated in Section 3.2) appears. Choose option 2, `Add Software to Existing Area`. A message confirms that you have chosen to install the operating system to an existing area.
4. When the prompt asking if you are installing ULTRIX supported software appears, type `n`.
5. A message appears listing the existing DMS environments and prompting you to choose one of the listed environments:

```
You have chosen to install additional software into an existing
DMS environment.  These are the available installation
directories:
```

1. `/dlenv0/root0.mips`
2. `/dlenv0/root1.mips`
3. `/dlenv0/root0.vax`

```
Enter your choice [ ]: 1
```

6. A prompt asks for the full pathname of the device special file name or mount point for the distribution media. Enter the required information as explained in Section 3.2.
7. If your distribution media is tape, the utility asks you to confirm that the tape is mounted and on line. Type `y` when the tape is ready.
8. The `dms` utility lists the mandatory software subsets, which will be installed automatically. It then lists optional subsets for the product you are installing. Select the optional subsets that you want from the list. If you want all of the optional subsets, enter the number corresponding to the selection `All of the Above`.

9. The utility lists the subsets that you have chosen to install and asks you to confirm your choice. If the subsets listed are the ones that you want, type `y`. If you type `n`, the list of optional software subsets is displayed again, and you can select the subsets that you want.

Messages appear as each subset that you selected is installed and verified. Depending on the number of subsets you have chosen, this process can take an hour or more. If you are installing from MT9 tapes, the utility prompts you to install the next volume at the appropriate time.

10. If DMS clients are registered to share this area, a prompt asks if you want to update the `client_name.root` directories of those clients. Enter `yes` or `y` to keep the DMS clients in a consistent state.

Repeat the installation procedures for each `rootn.mips` or `rootn.vax` area you plan to set up.

This chapter describes how to use the `ris` utility to configure a RIS server. The instructions tell you how to:

- Establish a new RIS server environment using `ris`
- Install software kits in existing RIS environments

4.1 Creating a New RIS Area

You use the `ris` utility to create a new RIS environment and install software kits there. This section describes these processes. Once you have created a RIS environment and installed the first software kits there, you can install more kits in that environment or create other environments as you need them. Installing additional software into an existing RIS environment is described in Section 4.2. You can register clients for a given RIS environment at any time after the environment exists, but you must modify their registrations if you want to make new software available to them later.

Perform the installation procedures described in this section to create a new `risn.mips` environment and install the first software kit into it.

1. If your distribution media is RA60 or CDROM, use a `mount` command like the following before starting the utility:

```
# mount -r /dev/rz4c /mnt
```

This example uses a CDROM drive that is unit 4 on a DECstation 3100; if your drive is a different unit, substitute the correct unit name. For supported software, the device special name will be either `/mnt/RISC/BASE` or `/mnt/VAX/BASE`, depending on the architecture of the clients to be served. For unsupported software, the name will be `/mnt/RISC/UNSUPPORTED` or `/mnt/VAX/UNSUPPORTED`.

2. Invoke the `ris` utility by typing the following command at the system prompt:

```
# /etc/ris
```

3. The Remote Installation Services menu appears. Choose the `Install Software` option by typing `i` at the prompt. For example:

```
REMOTE INSTALLATION SERVICES (RIS) UTILITY MENU
```

```
a - Add Client
r - Remove Client
s - Show Products in Remote Installation Environments
m - Modify Client
i - Install Software
e - Exit
```

```
Type your choice: i
```

4. A menu offers the installation options available. Choose option 1:

RIS Software Installation Menu:

- 1 Establish a New Area
- 2 Add Software to Existing Area
- 3 Return to Previous Menu

Enter your choice: 1

A message confirms that you have chosen to create a new RIS environment. The `ris` utility will create a new RIS environment and assign the appropriate name to it.

5. A prompt asks for the full pathname of the device special file name or mount point for the distribution media. Enter the required information. The following example shows how to mount the 9-track magnetic tape labeled "ULTRIX V4.n/ULTRIX WS V4.n SUPPORTED (RISC) VOLUME 1" on a TU81 tape drive, unit 0:

Enter the device special file name or the path of the directory where the software is located, for example, `/dev/rmt0h: /dev/rmt01`

6. If your distribution media is tape, the utility asks you to confirm that the tape is mounted and on line. Type `y` when the tape is ready.
7. The utility lists the mandatory and optional software subsets that you can select. Select the subsets that you want from the list.
8. The utility lists the subsets that you have chosen to install and asks you to confirm your choice. If the subsets listed are the ones that you want, type `y`. If you type `n`, the list of subsets is displayed again, and you can reselect the subsets that you want.

When you confirm your selections, the `ris` utility installs the subsets. A message announces completion of the installation. The name of the new RIS environment is displayed:

The new environment is in `/var/adm/ris/ris0.mips`.

The main `ris` menu then reappears.

Once you have set up the RIS areas and registered clients, the clients can access those areas suited to their needs. Client registration is discussed in Chapter 5.

4.2 Installing Additional Software Products

You can install additional ULTRIX software subsets and Digital layered products that are compatible with the ULTRIX `setld` utility into a RIS environment. To install additional software products, mount disk media if necessary. Then invoke the `ris` utility again and choose the `Install Software` option.

The following sample session illustrates the installation of subsets into `ris0.mips`:

1. From the menu of installation options, choose option 2.
2. A message appears listing the existing RIS environments and prompting you to choose one of the listed environments:

You have chosen to add a new product into an existing environment.

Select the remote installation environment:

```
1 /var/adm/ris/ris0.mips
  ULTRIX V4.2A/ULTRIX WS V4.2A MANDATORY SUPPORTED (RISC)
```

```
2 /var/adm/ris/ris0.vax
  ULTRIX V4.2A/ULTRIX WS V4.2A SUPPORTED (VAX)
```

Enter your choice: 1

3. A prompt asks for the full pathname of the device special file name or mount point for the distribution media. Enter the required information as explained in Section 4.1.

4. If your distribution media is tape, the `ris` utility asks you to confirm that the tape is mounted and on line. Type `y` when the tape is ready.

If your distribution media is CDROM, the utility asks whether you want to extract the software physically into the RIS environment or create a symbolic link between the RIS environment and the CDROM. For example:

Choose one of the following options:

```
1 Extract software from /mnt/RISC/BASE
2 Create symbolic link to /mnt/RISC/BASE
```

Enter your choice: 1

5. The `ris` utility lists the mandatory and optional software subsets that you can select. Select the subsets that you want from the list.

6. The utility lists the subsets that you have chosen to install and asks you to confirm your choice. If the subsets listed are the ones that you want, type `y`. If you type `n`, the list of subsets is displayed again, and you can select the subsets that you want.

When you confirm your selections, the `ris` utility installs the subsets. A message announces completion of the installation. The main `ris` menu then reappears.

Repeat the installation procedures for each additional group of subsets you want to install.

4.3 Using an NFS-Mounted RIS Area

You can use an NFS mount point to install software from a RIS area that you import from another machine. For example, if `tigris` has a CDROM disc containing the ULTRIX RISC supported subsets mounted on `/mnt` and listed in the `/etc/exports` file on `tigris`, the system administrator on `jaguar` could NFS-mount that CDROM with the following command:

```
# mount tigris:/mnt/RISC/BASE /mnt'
```

Once the CDROM is mounted, `jaguar`'s system administrator can use the utility to install software from it as if it were local to `jaguar`.

This chapter describes how to use the `dms` and `ris` utilities to manage the DMS and RIS environments and clients. The instructions tell you how to:

- Add a client
- Boot a client
- Modify a client
- Remove a client
- List registered DMS clients
- Show products in the server's DMS and RIS areas
- Rebuild or copy kernels for DMS clients
- Create links to the `/usr/hosts` directory for DMS clients
- Use the `dms` and `ris` databases to manage multiple clients
- Perform some `dms` and `ris` functions directly from the command line
- Maintain the server's DMS and RIS areas

5.1 Adding a DMS Client

The information you need to answer the prompts in the procedure for adding a DMS client is contained in the Client Setup Worksheet; there are several copies of this worksheet in Appendix A. You should fill out a worksheet for each client you want to add before you run `dms` to add clients.

Use the following procedure to add a client processor:

1. Invoke the `dms` utility and choose the Add Client Processor option by typing `a` at the prompt:

```
DISKLESS MANAGEMENT SERVICES (DMS) UTILITY MENU
```

```
a - Add Client Processor
m - Modify Client Parameters
r - Remove Client Processor
l - List Registered Clients
s - Show Products in Diskless Environments
i - Install Software
c - Create Diskless Area on Disk
k - Kernel Rebuild or Copy
e - Exit
```

Enter your choice: `a`

2. If there are multiple `/dlenv n` areas, or if more than one `root n .mips` directory has been installed in this DMS server area, a menu lists the

environments into which you can install the new client. Each environment can contain different software subsets. Choose the desired environment. For example:

Select the DMS environment:

- 1 /dlenv0/root0.mips
- 2 /dlenv0/root0.vax
- 3 /dlenv1/root0.mips

Enter your choice : 1

A message indicating that you have chosen to add a client processor appears.

3. A prompt asks if you want to continue with the procedure for adding a client processor.
4. After you confirm that you want to continue, a prompt asks for the client's host name.

Caution

Only lowercase letters (a-z) and numbers are permitted in host names. The MOP protocol used to bootstrap DMS and RIS clients recognizes only the first six characters of the host name. A host name can contain more than six characters, but the first six characters must be unique. The name must begin with a letter, not a number.

Enter the client's host name. For example:

Enter the client processor's host name: **bergal**

If the client processor's host name has not been registered with the appropriate naming service servers, the utility displays an error message and repeats the prompt:

5. A prompt asks for the hardware Ethernet address for the client. For example:

Enter the client processor's hardware Ethernet address, for example, 08-00-2f-03-f5-08: **08-00-2B-03-05-8B**

If you do not enter the address in the correct format, the utility displays an error message and repeats the prompt.

Caution

Except for checking the format of the number you enter, the `ris` utility does not verify its validity.

6. If clients are already registered for the DMS environment, a message appears asking if you want to duplicate an existing client's environment for the client you are adding. If you type `y`, the `dms` utility lists the available client environments.

If you choose to duplicate an existing client environment, the following items are copied to the new client's environment:

- The root area
- The kernel
- The device special file directory
- The `/etc/hosts` file

- The /usr area mount point
- Swap file information

A prompt asks you to confirm the configuration you have chosen.

7. If you choose not to duplicate an existing environment for the client you are adding, a prompt asks you to select the name of the file system to contain the new client's root directory. Enter the number corresponding to the file system that you want. For example:

Select the name of the file system to contain the client's root directory:

```
1 /dlclient0
2 /dlclient1
```

Enter your choice []: 1

If a *client_name.root* directory for the client already exists, dms asks if you want to overwrite that directory.

8. A prompt asks you to select the client's swap file location. The swap file can be either on the client, if it has a disk available, or on the server. Enter the number corresponding to your selection.
9. If the swap file location chosen is on the client, a prompt asks for the device special file name for the swap partition. After you enter the device special file name, a prompt for confirmation appears.

If the swap file location chosen is on the server, a prompt asks for the swap file size. The recommended swap size is three times the client's physical memory size. If disk space is limited, you can reduce this allowance to twice the memory size. Enter the desired size, in megabytes. For example:

Select the client's swap file size: 32

A message informs you that the client's swap file is being created. In this example, a swap file of 32 Mb is created.

10. A menu offers a choice of crash dump options. See the *Guide to System Crash Recovery* for a description of the crash dump process. Enter the letter corresponding to your choice. For example:

The following crash dump options are available:

```
n - no dump
f - full dump
```

Enter your choice []: f

In this example, a full dump is chosen for this client.

11. A prompt asks for the root password to be used on the client processor. A second prompt asks you to enter the password again for confirmation.
12. System information is displayed as files are created for the DMS client. When the client registration procedure is complete, the dms menu appears.
13. Notify the user of each client when registration is complete. Tell the client users to boot across the network. See Section 5.2 for basic information about booting a client. Detailed information is in the *Guide to System Shutdown and Startup*.

5.2 Booting a DMS Client

The first time a new DMS client is bootstrapped, it loads the generic kernel and sets up to use space on the server for swapping over the network. It then looks for a special file named `/etc/dmsinit`. Existence of this file signals the client to build a new kernel; the client does so, using information in the file. (The `dmsinit` file contains timezone information, the client's system name, and the designated swap location.) Messages appear giving instructions about how to install the new kernel and how to set the default boot command. When the new kernel is built, the client removes the `dmsinit` file.

If you specified swapping on the local disk when you registered the client, the client will swap locally beginning the next time it is bootstrapped.

5.2.1 Booting RISC DMS Clients

The booting procedure differs depending on what type of RISC processor the client is. This section illustrates the procedure for a DECstation 3100. Refer to the *Guide to System Shutdown and Startup* for detailed information about how to boot your particular RISC processor.

The user on a DECstation 3100 client processor can set the boot path environment variable by using a command sequence with the following syntax:

```
setenv bootpath mop(n)
```

The value of *n* depends on the number of network interfaces the client has set up.

On a DECstation 3100 client processor with a single network interface, the user types the following command sequence to set the boot path environment variable and boot the system:

```
>> setenv bootpath mop(0)  
>> auto
```

Once the boot path environment variable is set, the user simply types `auto` to boot the processor.

5.2.2 Booting VAX DMS Clients

Different VAX systems use different boot command syntaxes. The following examples show the boot commands for some VAX clients.

For a VAXstation 2000:

```
>>> b esa0
```

For a VAXstation II/GPX:

```
>>> b xqa0
```

Refer to the *Guide to System Shutdown and Startup* for detailed information about how to boot your particular VAX processor.

5.3 Booting a RIS Client

Booting a RIS client involves one of two processes:

- Booting a client normally

Because RIS clients are normally self-sufficient systems, the usual process for booting a RIS client is the same as the process for booting any other system; see *Guide to Installing ULTRIX* for information about booting ordinary systems.

- Booting a client to install the ULTRIX operating system

If you are installing the ULTRIX operating system itself on a new system, as described in Section 1.4.3, you must boot the machine across the network in the same way as when booting a DMS client. See Section 5.2.1 and Section 5.2.2. Note that the client must be registered with RIS before you can install the operating system.

5.4 Adding a RIS Client

Although the Client Setup Worksheet in Appendix A is for DMS clients, much of the information you need to answer the prompts in the procedure for adding a RIS client is also contained in the worksheet. There are six copies of this worksheet in Appendix A. You should fill out a worksheet for each client you want to add before you run `ris` to add clients.

Use the following procedure to add a client processor:

1. Invoke the `ris` utility by typing the following command at the system prompt:

```
# /etc/ris
```

2. The Remote Installation Services menu appears. Choose the Add Client Processor option by typing `a`:

```
REMOTE INSTALLATION SERVICES (RIS) UTILITY MENU
```

```
a - Add Client
r - Remove Client
s - Show Products in Remote Installation Environments
m - Modify Client
i - Install Software
e - Exit
```

```
Enter your choice: a
```

A message indicating that you have chosen to add a client processor appears.

3. A prompt asks if you want to continue with the procedure for adding a client processor.
4. After you confirm that you want to continue, a prompt asks for the client's host name.

Caution

Only lowercase letters (a-z) and numbers are permitted in host names. The MOP protocol used to bootstrap DMS and RIS clients recognizes only the first six characters of the host name. A host name can contain more than six characters, but the first six characters must be unique. The name must begin with a letter, not a number.

Enter the client's host name. For example:

Enter the client processor's host name: **bergal**

If the client processor's host name has not been registered with the appropriate naming service servers, the utility displays an error message and repeats the prompt.

5. A prompt asks for the hardware Ethernet address for the client. For example:

Enter the client processor's hardware Ethernet address, for example, 08-00-2f-03-f5-08: **08-00-2B-03-05-8B**

If you do not enter the address in the correct format, the utility displays an error message and repeats the prompt.

Caution

Except for checking the format of the number you enter, the `ris` utility does not verify its validity.

6. The `ris` utility lists the available environments for which you can register the new client. Select the environment you desire. For example:

Select the remote installation environment to which this client is to be added:

- 1 /var/adm/ris/ris0.mips
ULTRIX V4.0/ULTRIX WS V4.0 SUPPORTED (RISC)
- 2 /var/adm/ris/ris0.vax
ULTRIX V4.0/ULTRIX WS V4.0 SUPPORTED (VAX)

Enter your choice []: **1**

7. The utility lists the products available in the chosen environment. Choose the products you want this client to be able to install. For example:

Select one or more products for the client to install from /var/adm/ris/ris0.mips:

Product	Description
1	ULTRIX 4.0/ULTRIX WS V4.0 SUPPORTED (RISC)

Enter your choice, for example, 1 2: **1**

After you make your selections, a message appears showing your choice and requesting confirmation. For example:

You chose the following products:

1 ULTRIX 4.0/ULTRIX WS V4.0 SUPPORTED (RISC)

Is that correct (y/n)? [y]:

8. When you confirm your choice, a message similar to the following appears:

`bergal` has been added.

5.5 Modifying a Client

This section describes how to modify parameters for either a DMS client or a RIS client.

The procedure for modifying a DMS client processor's registration information is much like the procedure for adding a client processor, described in Section 5.1. See the Client Setup Worksheet for a list of the DMS registration information you can modify.

To modify a client's entry, run the `dms` utility and choose the `Modify Client Parameters` option. The `dms` utility displays a list of available environments. Choose the one in which the client you want to modify is registered. The utility then lists the clients registered in that environment. Choose the client you want to modify. As the modification procedure progresses, the client's current entry for each type of information appears in square brackets at each prompt. Press the RETURN key to keep the current entry or after typing new information to change the entry.

If you change the swap file location, or if the swap file is located on the local disk and you change the partition on which it resides, the client must be rebooted so that it can build a new kernel. This process is described in Section 5.2.

If you change the swap file size or location, the software recreates the swap file.

After you type your answer to the last prompt, the client modification is complete and the `dms` menu appears.

You can modify a RIS client's Ethernet address and RIS environment information and the list of products the client can install. To modify a client's entry, run the `ris` utility and choose the `Modify Client` option. You are given a list of registered clients. Choose the one you want to modify. The remainder of the modification procedure is much like the procedure for adding a client, illustrated in Section 5.4.

5.6 Removing a Client

The procedure for removing a client is identical for DMS and RIS. To remove a client, follow these steps:

1. Invoke the `dms` or `ris` utility and choose the `Remove Client Processor` option (DMS) or the `Remove Client` option (RIS) by typing `r`. The following example illustrates removing a RIS client:

```
REMOTE INSTALLATION SERVICES (RIS) UTILITY MENU
```

```
a - Add Client
r - Remove Client
s - Show Products in Remote Installation Environments
m - Modify Client
i - Install Software
e - Exit
```

```
Enter your choice: r
```

A message appears indicating that you have chosen to remove a client processor.

2. A list of existing environments appears. Select the environment in which the client to be removed is registered, as indicated by its Client Setup Worksheet. A list of clients registered for that environment appears.

3. A prompt asks you to specify the name of the client that you want to remove.
For example:

```
You have chosen to remove a client from the remote installation services.  
Type the name of the client processor you want to  
remove: profun
```

If you type an invalid name, an error message appears.

After you specify a valid client processor, the utility prompts for verification. For example:

```
Remove profun? (y/n) [n]: y
```

When you type *y* to confirm your choice, the utility deletes the client's registration. For DMS clients, the following additional items are removed:

- The *client_name.root* directory
- The swap file
- The entries from */etc/exports* (described in Section 6.1)
- The MOP database entry

When removal is complete, the utility returns you to its main menu.

5.7 Listing DMS Clients

You can use the *dms* utility's *List Registered Clients* option to see a list of the clients registered in a given *rootn.mips* area. This option also allows you to view a specific client's configuration information. The following example shows a listing of clients for a server with only one *rootn.mips* area:

1. Invoke the *dms* utility and choose the *List Registered Clients* option from the menu (illustrated in Section 5.1) by typing *1* at the prompt. If there are no registered clients, the message *No registered clients* appears. If there are clients registered, the utility lists them.
2. If there are clients registered, the *dms* utility then asks if you want to see a specific client's configuration. For example:

```
Do you want to see the configuration for one of these clients?  
If no, press RETURN.
```

```
If yes, enter the client's host name: bergal
```

```
Copied root area:      /dlenv0/root0.mips  
bergal's root area:   /dlclient0/bergal.root  
bergal's usr area:    /dlenv0/root0.mips/usr  
Swap file:            /dlclient0/bergal.root/dlclient/swap  
Swap file size:      32 Mbytes  
No crash dumping
```

```
Ethernet Address:    08-00-2B-03-05-8B  
Internet Address     (128.45.1.126)
```

5.8 Showing Products in Server Areas

You can view a list of the current products in a given DMS server area by invoking the *dms* or *ris* utility and choosing the *Show Products in Diskless Server Areas* option (DMS) or the *Show Products in Remote*

Installation Environments option (RIS) by typing `s`. A display similar to this appears:

Show Products in Diskless Server Areas:

```
1 /dlenv0/root0.mips
   ULTRIX Worksystem Software V4.0 (RISC)
```

5.9 Rebuilding or Copying DMS Clients' Kernels

You can use the `dms` utility's Kernel Rebuild or Copy option either to rebuild a client's kernel or to copy one client's kernel to another client.

Rebuild the kernel if you add devices or if the client's kernel object code is changed for any reason. When you specify rebuilding a kernel, `dms` replaces the client's customized kernel with the generic kernel. The client will build itself a new custom kernel the next time it is booted, as described in Section 5.2.

Caution

When you copy one client's kernel to another client, make sure that both clients' configurations and architectures are identical.

Use the following procedure to rebuild or copy a kernel:

1. Invoke the `dms` utility and choose the Kernel Rebuild or Copy option from the menu (illustrated in Section 5.1) by typing `k` at the prompt.
2. A list of DMS environments appears. Select the environment you want.
3. A menu like the following appears:

```
1 Kernel Rebuild
2 Kernel Copy from another client.
```

Enter your choice:

4. A list of clients registered for that environment appears. Select the client whose kernel you want to rebuild or to copy.

5.10 Creating Links to the /usr/hosts Directory

Normally, each ULTRIX system on a network has a `/usr/hosts` directory in which are links to the names of other host systems. (Do not confuse this directory with the `/etc/hosts` file.) System users who have accounts on other systems can log in to another system simply by entering the name of the desired system instead of having to enter the `rlogin` command. These links are created by the `/usr/hosts/MAKEHOSTS` command.

In the DMS environment, the `/usr/hosts` directory is a subdirectory of the shared `/usr` area. Because the `/usr` area has read-only permissions for DMS clients, client users cannot run the `MAKEHOSTS` command. The server's system administrator must create links to the `/usr/hosts` directory for DMS clients.

To create the links for clients registered for a RISC environment, type the following command:

```
# /usr/hosts/MAKEHOSTS /dlenv?/root?.mips/usr/hosts
```

To create the links for clients registered for a VAX environment, type the following command:

```
# /usr/hosts/MAKEHOSTS /dlenv?/root?.vax/usr/hosts
```

The question marks (?) in these commands are single-character wildcards; using them enables you to generate links for all clients of a given type with a single invocation of the MAKEHOSTS command.

5.11 Using dms and ris from the Command Line

In addition to running `dms` or `ris` interactively and going through the menu steps, you can also run the utilities from the command line to perform the following functions:

- Add DMS or RIS clients
- Remove DMS or RIS clients
- Build DMS clients' kernels
- List DMS clients and their configurations
- Show products in a DMS or RIS environment

The following sections describe how to use the `dms` and `ris` utilities directly from the command line.

5.11.1 Adding RIS Clients Manually

You can add a single RIS client by invoking the `ris` utility with its `-a` option. Additional options supply the Ethernet address, path, and product list. The syntax of the command is this:

```
/etc/ris -a clientname -h Ethernet-address -p path,product]
```

For example:

```
# /etc/ris -a bergal -h 08-00-2B-03-05-8B -p ris0.mips,product_1
```

You cannot add DMS clients in this fashion.

5.11.2 Adding Multiple Clients Manually

The `dms` and `ris` utilities generate database files automatically when you register the first client for either service. Every time you add, delete, or modify a client using either utility interactively, the utility updates its database file.

Instead of running `dms` or `ris` interactively several times to several clients, you can edit the respective database files manually and then add the new clients by running the utility from the command line.

The pathname for the DMS database file is `/usr/DMS/dmsdb`. Each record in the DMS database has the following format:

```
hostname:Ethernet_address:common_area:client_root:swap:dump
```

If the client's swap file is located on the server, the number of megabytes the client can swap appears in the swap field. If the swap file is located on the client's local

disk, the swap device location appears in the swap field. The dump field contains either `f` for a full dump over the network or `n` for no dump over the network.

For example, the database file entry for `bergal` with the swap file on the local disk and full network dump might look like the following:

```
bergal:08-00-2B-03-05-8B:/dlenv0/root0.mips:/dlclient0:rz0b:f
```

For RIS, the database pathname is `/var/adm/ris/clients/risdb`. Each record in the RIS database has the following format:

```
hostname:Ethernet_address:path,product[,product...]
```

For example, the database file entry for `bergal` might look like the following:

```
bergal:08-00-2B-03-05-8B:ris0.mips,product_1
```

You can edit the appropriate database file to add information for several clients and then register the clients by using a `dms` or `ris` command line with the `-a` option and a list of client names.

In the example that follows, the system administrator adds two DMS clients after editing `/usr/DMS/dmsdb`. The file contains the following entries before editing:

```
bergal:08-00-2B-03-05-8B:/dlenv0/root0.mips:/dlclient0:rz0b:f
profun:08-00-2B-03-09-8B:/dlenv0/root0.vax/dlclient1:rz0b:f
```

The administrator uses a text editor to add entries to the file. After being edited, the file looks like this:

```
bergal:08-00-2B-03-05-8B:/dlenv0/root0.mips:/dlclient0:rz0b:f
erlang:08-00-6A-03-05-2B:/dlenv0/root0.mips:/dlclient0:rz3b:f
profun:08-00-2B-03-09-8B:/dlenv0/root0.vax/dlclient1:rz0b:f
overly:08-00-4B-03-09-3B:/dlenv0/root0.vax:/dlclient1:rz0b:f
```

Then the administrator enters the following command to register the new clients:

```
# /etc/dms -a erlang overly
```

Note

Adding DMS clients in this way does not set superuser passwords for the clients. Tell each of the new clients' users to use the `passwd(1)` command to enter a superuser password immediately after logging into the client.

You add RIS clients in the same way that you add DMS clients; the only difference is in the contents of the database records.

5.11.3 Removing DMS or RIS Clients Manually

You can use a `dms` or `ris` command line to remove several clients. For example:

```
# /etc/dms -r overly profun
```

5.11.4 Building DMS Client Kernels Manually

You can use a `dms` command line to build kernels for several clients. For example:

```
# /etc/dms -k pastry overly profun
```

When you build kernels in this fashion, each client must be rebooted so that it can build itself a new kernel.

5.11.5 Listing DMS Clients Manually

You can use a `dms` command line to list all the registered clients. For example:

```
# /etc/dms -l
```

You can also use a `dms` command line to list the parameters assigned to specific clients. For example:

```
# /etc/dms -l pastry overly profun
```

5.11.6 Showing Products Manually

You can use a `dms` or `ris` command line to show the products installed in each server area. For example:

```
# /etc/dms -s
```

Show Products in DMS Server Areas:

```
1 /dlenv0/root0.mips
   ULTRIX Worksystem Software V4.0 (RISC)
```

5.12 Maintaining the DMS Environment

This section contains information about maintaining the DMS server area. Perform these tasks as required.

5.12.1 Controlling Root File System Growth

The `df` command shows how much disk space is in use. Use this command to monitor the file growth in each client's root directory. If clients use too much space, performance is adversely affected. See `df(1)` in the *ULTRIX Reference Pages*. You should monitor disk usage periodically, depending on the amount of use your systems receive.

5.12.2 Listing Installed Software Subsets

Use the `setld` command to find out which software subsets are installed into a particular `rootn.mips` area. For example, the following command produces a list of the subsets that have been installed into the common `client_name.root` area of `dlenv0`:

```
# setld /dlenv0/root0.mips -i
```

Refer to setld(8) in the *ULTRIX Reference Pages* for more information.

5.12.3 Removing Subsets

Use the setld command to remove software subsets from a common root*n*.mips area. For example, if you had installed the On-Line Manual Pages subset, ULTMAN425, and now wanted to remove it, you would use a command like this:

```
# setld /dlenv0/root0.vax -d ULTMAN425
```

This command removes the subset from /dlenv0/root0.vax.

Note

If the subset placed files in /dlclient0/root0.vax, the product may not be fully removed from that directory.

This chapter contains information to assist you in troubleshooting problems with your DMS system:

- Server files and processes to check if a client is having trouble booting the system
- A description of the events that occur when a DMS client crashes

6.1 Server Areas to Check for Client Booting Problems

If a DMS client has trouble booting, you can check several aspects of server operation to ensure that the server's end of the network connection is functioning properly:

- Recent entries in the `/usr/spool/mqueue/syslog` file should contain the sequence of MOP transmissions and specify any problems that occurred during the client booting process.
- The network daemons may not be running on the server. This condition is reported by the client with a crash message like this:

```
panic mountrpc: cannot NFS mount file
```

If this message appears on the client, check to make sure that the following daemons are running on the server:

- portmap
- mountd
- nfsd
- biod

Type the following command on the server to see if the daemons are running:

```
# ps aux | egrep "portmap|mountd|nfsd|biod"
```

Process status will appear for any of those daemons that are running. (A line will also appear showing your `egrep` command.)

If the daemons are not all running, you must start the inoperative ones. See Section 2.2.3 for further information.

- The client's directories may be exported improperly. You can determine if this is the case by examining entries in the server's `/etc/exports` file:
 - If the client boots to single-user mode but will not boot to multiuser mode, make sure that the appropriate `/usr` file system and `dlclientn` root area have entries in `/etc/exports`.

Proper `/etc/exports` entries should look similar to these:

```
/dlenv0/root0.mips/usr -o -r=0 bergal
/dlclient0/bergal.root -r=0 bergal
```

The contents of these entries are described under `exports(5)` in the *ULTRIX Reference Pages*.

- The client may be trying to use the wrong kernel. Use the `getnode` command to identify the pathname of the kernel that the client tried to boot. Refer to `getnode(8)` in the *ULTRIX Reference Pages*.

6.2 Client Crash Description

When a client set up for crash dumps over the network crashes, the following sequence occurs:

1. The client processor tries to dump the contents of its memory to the server using the Maintenance Operations Protocol (MOP). This is the same protocol used when a client boots.
2. A message like this appears on the client's console:
Network Dumping ...
3. A core dump file is generated. This file is located in the client's `/var/adm/crash/vmcore` directory. The MOP dumping procedure may take several minutes to complete, depending on how much traffic there is on the network.
4. When the contents of the client's memory have been dumped, the client automatically reboots using its default boot setting. See the client's hardware documentation for information about setting boot parameters.
5. The default `/etc/rc.local` file on the client checks on booting to see if a core dump file exists. If so, `/etc/rc.local` calls the `/etc/savecore` program. This program transforms the `vmcore` image into a format that can be debugged.
6. The `vmunix` image is copied from the `root` directory to the directory specified in the `savecore` line of the `/etc/rc.local` file. For example:
`/etc/savecore -f /usr/adm/crash/vmcore /usr/adm/crash`
7. After the `savecore` program completes its activity, two files, `vmunix.n` and `vmcore.n`, are added to the directory specified. The `n` in these filenames reflects the next available number; for example, if `vmcore.0` and `vmunix.0` files exist, the new files are named `vmcore.1` and `vmunix.1`. See `savecore(8)` in the *ULTRIX Reference Pages* for further information.

The client user should notify the system manager on the server when a crash occurs so that the cause of the crash can be investigated by examining the saved dump files.

You can customize a DMS client's setup to provide enhanced services to the client user. You can also rebuild a client's kernel manually. This chapter describes how to:

- Configure clients so users can use the `rwwho` and `ruptime` commands
- Set up to allow client users to read mail
- Change a client's `/etc/crontab` to prevent inadvertent deletion of formatted reference pages
- Reconfigure a client's kernel manually

7.1 Setting Up to Use the `rwwho` and `ruptime` Commands on a Client

The `rwwho` daemon is a server that maintains and updates network status information for the `rwwho(1c)` and `ruptime(1c)` commands. By default, `rwwho` is started by a command in each client's `/etc/rc.local` file. The daemon is run with the `-b` option, which sets broadcast-only mode. In broadcast-only mode, the daemon generates information for other systems to use but does not receive any information from other systems. Running `rwwho` in broadcast-only mode enhances DMS client performance. See `rwwho(8c)` in the *ULTRIX Reference Pages* for more information about the daemon.

If you want to use the `rwwho` or `ruptime` command on a DMS client, you must NFS mount the server's `/var/spool/rwho` directory to the client's `/var/spool/rwho` directory. The following procedure describes how to set up both the server and the client so that you can use `rwwho` and `ruptime` on a DMS client:

1. Add a line like the following to the server's `/etc/exports` file:

```
/var/spool/rwho -o
```

This line makes the exported directory available to any system on the network. To limit the export to specific clients, include the clients' names on the line, like this:

```
/var/spool/rwho -o bergal profun
```

See the *Guide to the Network File System* and `exports(5nfs)` in the *ULTRIX Reference Pages* for more information.

2. Add a line like the following to the client's `/etc/fstab` file:

```
/var/spool/rwho@tigris:/var/spool/rwho:ro:0:0:nfs:bg:
```

In this example, the server is named `tigris`. For an explanation of the contents of this line, refer to `fstab(5)` in the *ULTRIX Reference Pages* and to the *Guide to the Network File System*.

3. After you have edited these two files, you can mount the `/var/spool/rwho` directory by either rebooting the client or manually executing a `mount` command on the client:

```
# mount /var/spool/rwho
```

7.2 Setting Up to Allow Client Users to Read Mail

This section describes two methods for setting up a DMS client to read electronic mail on the server. The first method is recommended when multiple users log in to the client processor. The second method is recommended when only a single user will be logging in to the client processor.

In the examples used in the two sections that follow, the user is named `rjones`, the client processor is named `bergal`, and the server processor is named `tigris`.

7.2.1 Reading Mail from a Client with Multiple Users

If the DMS client has multiple users logging in, the recommended method is to have all mail forwarded to the server.

This method requires no change on the server unless it is necessary to create accounts there for the client users. On the client, each user creates a file to direct the forwarding of mail. For example:

```
bergal:/var/spool/mail/rjones.forward
```

The contents of the file look like this:

```
rjones@tigris
```

If this file exists, all mail sent to `rjones@bergal` will be redirected to `rjones`'s account on `tigris`. To read mail, `rjones` uses the `rlogin` command to log into `tigris` and read mail. For example:

```
$ rlogin tigris
:
:
% mail
```

7.2.2 Reading Mail from a Client with a Single User

If the DMS client has a single user logging in, the recommended method for reading mail is one that makes mail appear to be present on the local processor even though it is located on the server. This method requires changes on both the server and the client.

Follow this procedure as the server's superuser:

1. Create a directory with a pathname like the following:
`/var/spool/mail/username`. This directory will contain the user's mail messages. For example:

```
# mkdir /var/spool/mail/rjones
```

2. Export the mail directory to the client machine by adding a line similar to the following to the `/etc/exports` file:

```
/var/spool/mail/rjones bergal
```

Normally, the `/var` directory and all its subdirectories are exported with read-only permission to clients. Adding this line to the `/etc/exports` file permits the named client to write into the specified directory.

Follow this procedure as the client's superuser:

1. Create a directory to serve as the mount point for the server's mail directory. For example:

```
# mkdir /var/spool/mail/rjones
```

2. Add the appropriate line to the `/etc/fstab` file. For example:

```
/var/spool/mail/rjones@tigris:/var/spool/mail/rjones:rw:0:0:nfs:bg,soft:
```

The contents of this entry are described under `fstab(5)` in the *ULTRIX Reference Pages*.

3. Mount the mail directory by rebooting the client or by manually executing a `mount` command on the client:

```
# mount /var/spool/mail/rjones
```

4. Set the `MAIL` environment variable in the user's `.login` file (if the user is using `csh`) or `.profile` file (if the user is using `sh`, `sh5`, or `ksh`) to `/var/spool/mail/$USER/$USER`. For example: `rjones`, who is a `csh` user, would add a line like this:

```
setenv MAIL /var/spool/mail/rjones/rjones
```

After logging out and logging in again, or after setting the `MAIL` variable manually, the user can then enter the `mail` command to read mail on the client system.

7.3 Preventing Inadvertent Reference Page Deletion

The default `/etc/crontab` file installed on DMS clients examines local (ufs-mounted) `/usr/man/catn` directories (if these directories exist), and deletes formatted reference pages that have not been accessed in 28 days. To disable this feature, edit the `/etc/crontab` file and either delete or comment out the following line. The backslash in this display indicates line continuation and does not exist in the `/etc/crontab` file:

```
15 2 1 * * for i in /usr/man/cat[1-8]; do df $i | grep -s /dev && \
find $i -type f -atime +28 -a -exec rm {} ; ; done
```

7.4 Reconfiguring Client Kernels

After you have set up your DMS system, you may find that you need to change a client's configuration; for example, you may add disks or memory to the client. You can reconfigure a client's kernel either by using the `dms` utility's `Kernel Rebuild` or `Copy` option or by building the kernel manually. In a DMS environment, you must build client kernels under the `/sys` directory. Regardless of

which method you use to rebuild the kernel, you must edit the client's configuration file before performing the rebuild. Information about editing the configuration file can be found in the following documents:

- *Guide to Configuration File Maintenance*
- *Guide to Ethernet Communications Servers*
- *Guide to IBM Terminal Emulation for VAX Processors*
- *Guide to Kerberos*

The configuration file's pathname has the following syntax:

```
/sys/conf/architecture/HOSTNAME
```

The architecture can be either `mips` (for RISC systems) or `vax`. For example, if `bergal` is a RISC system, its configuration file is `/sys/conf/mips/BERGAL`.

7.4.1 Building a New Kernel

Refer to Section 5.9 for instructions on rebuilding a kernel with the `dms` utility.

After you have edited the configuration file, you can build the new kernel manually with commands like the following:

```
# cd /sys/conf/mips
# doconfig -c BERGAL
```

(If the client is a VAX processor, the configuration file is located in the `/sys/conf/vax` directory.)

The `doconfig` command displays messages indicating its progress and identifying the location of the new kernel. See the *Guide to Configuration File Maintenance* for information on using the newly built kernel.

7.4.2 Changing the Swap Location

To change the swap location, you must edit the client's copy of the `/etc/netblk.c` program. The following sample section of `netblk.c` indicates the lines to be edited with callouts:

```
#include <sas/mop.h>
struct netblk  nblk={
    "tigris",
    0x802d010c, "bergal", 0x802d0180, 0x802d01ff, 0xffffffff00,
    1      \*(Cs
    5,
    40     \*(Cs
    0      \*(Cs
    "/var/var/diskless/dlclient9/bergal.root",
    "/var/var/diskless/dlclient9/bergal.root/dlclient/swap",  \*(Cs
    ""
};
```

In the preceding example, the client is configured for swapping across the network and for no network dump. The following list describes the configuration changes that must be made to configure it for dumping to a local disk:

- 1 This line configures the client for swapping across the network. Change the 1 to a zero (0) to configure for swapping on a local disk.

- ② This line specifies the size of the swap space on the server. A value of 40 allocates 20 Mb of swap space. Change this value to zero to inhibit allocation of swap space on the server.
- ③ This line configures the client for no crash dumping across the network. Change this value to -1 to specify a full dump.
- ④ This line specifies the client's swap location on the server. To specify local swapping, change this string to the name of the local disk partition to be used.

The same sample section of `netblk.c` follows, edited to configure the client for local swapping and a full network dump. The callout-marked lines indicate the changes described in the preceding list.

```
#include <sas/mop.h>
struct netblk nblk={
"tigris",
    0x802d010c, "bergal", 0x802d0180, 0x802d01ff, 0xffffffff00,
    0,      \*(Cs
    5,
    0      \*(Cs
    -1     \*(Cs
    "/var/var/diskless/dlclient9/bergal.root",
    "rz0b", \*(Cs"
    ""
};
```

After you have edited the `netblk.c` program, follow this procedure:

1. Enter a command like the following to recompile the `netblk.c` program:


```
# cc -c netblk.c
```

2. If you are changing the swap location from the server to the client, enter a command like this to remove the swap area on the server:

```
# rm /dev/swap
```

If you are changing the swap location from the client to the server, issue a command with the following syntax:

```
/var/diskless/make_swap /dev/swap (swap-size*2)
```

See Section 2.4.2 for detailed information about allocating swap space. The following example specifies a value of 60 to create a 30 Mb swap file (30 Mb × 2):

```
# /var/diskless/make_swap /dev/swap 60
```

3. If the `make_swap` command executed successfully (moving swap from client to server), type a command like the following to replace the old kernel with the new kernel:

```
# mv ./vmunix /vmunix
```

4. Halt and reboot the client system. See the *Guide to System Shutdown and Startup* for information about booting.

This appendix contains copies of each of the worksheets used for setup of the DMS server and client. There are two copies of each of the server worksheets and six copies of the client worksheet. The worksheets are printed on only one side of the page so you can use them as needed. To keep all your calculations together, use the back side of each worksheet for additional notes or for calculating the numbers you insert into fields on the worksheet. The following worksheets are included:

- Disk space allocation for `dlenvn` area
- Disk space allocation for `dlclientn` area
- Individual client information

Disk Space Required for Diskless Server Installation (1 of 2)

This worksheet is for calculating the amount of space required for a single /dlen v_n file system. If you want multiple /dlen v_n areas, you must prepare a separate sheet for each area. Each area has a number; the first is /dlen v_0 , the second is /dlen v_1 , and so on. Fill in the number of this /dlen v_n area on the next line.

Disk Space for the /dlen v ___ File System

Using the appropriate subset size information, follow these steps to find how much space you need for a /dlen v_n area.

1. Decide which subsets you want to install, add up their sizes in megabytes, and enter the sums here. Subset names and descriptions are in the *Guide to Installing ULTRIX*; names and sizes are in the *Release Notes*.

Supported RISC subset space: _____ Mb

Supported VAX subset space: _____ Mb

Unsupported RISC subset space: _____ Mb

Unsupported VAX subset space: _____ Mb

2. Decide what layered products you want to install, add up their sizes, and enter the sums here. The sizes are included in the products' Software Product Descriptions (SPDs).

RISC layered product space: _____ Mb

VAX layered product space: _____ Mb

3. Add up the sizes from steps 1 and 2 to arrive at the amount of space your diskless files will require.

Subtotal: _____ Mb

4. Allocate an additional 15% of the space from step 3 for file system administration and other information. Enter that amount here.

15% overhead space: _____ Mb

5. Add together the amounts of space from steps 3 and 4. The total is the amount of space you should allocate for this /dlen v_n area.

Total space for /dlen v_n file system: _____ Mb

Disk Space Required for Diskless Server Installation (1 of 2)

This worksheet is for calculating the amount of space required for a single /dlen v_n file system. If you want multiple /dlen v_n areas, you must prepare a separate sheet for each area. Each area has a number; the first is /dlen v_0 , the second is /dlen v_1 , and so on. Fill in the number of this /dlen v_n area on the next line.

Disk Space for the /dlen v File System

Using the appropriate subset size information, follow these steps to find how much space you need for a /dlen v_n area.

1. Decide which subsets you want to install, add up their sizes in megabytes, and enter the sums here. Subset names and descriptions are in the *Guide to Installing ULTRIX*; names and sizes are in the *Release Notes*.

Supported RISC subset space: _____ Mb

Supported VAX subset space: _____ Mb

Unsupported RISC subset space: _____ Mb

Unsupported VAX subset space: _____ Mb

2. Decide what layered products you want to install, add up their sizes, and enter the sums here. The sizes are included in the products' Software Product Descriptions (SPDs).

RISC layered product space: _____ Mb

VAX layered product space: _____ Mb

3. Add up the sizes from steps 1 and 2 to arrive at the amount of space your diskless files will require.

Subtotal: _____ Mb

4. Allocate an additional 15% of the space from step 3 for file system administration and other information. Enter that amount here.

15% overhead space: _____ Mb

5. Add together the amounts of space from steps 3 and 4. The total is the amount of space you should allocate for this /dlen v_n area.

Total space for /dlen v_n file system: _____ Mb

Disk Space Required for Diskless Server Installation (2 of 2)

This worksheet is for calculating the amount of space required for a single `/dlclient n` file system. If you have multiple `/dlclient n` areas, you must prepare a separate sheet for each one. Each area has a number; the first is `/dlclient0`, the second is `/dlclient1`, and so on. Fill in the number of this `/dlclient n` area on the next line.

Disk Space for the `/dlclient__` File System

Using the appropriate memory size information for your clients, follow these steps to find how much space you need for a `/dlclient n` area.

1. To allow 10 megabytes for each client's root area, multiply the number of clients by 10.

Number of clients (____) \times 10 = _____ Mb

2. If your clients will dump across the network, using dump space on the server, allow space for each client. A full dump requires space equal to the client's memory size plus the size of the kernel. For each client, use this formula:

Memory size + 2.5

For example, an 8-Mb client would require 10.5 Mb of space. Add these values for all your clients and enter that sum here.

Clients' dump space: _____ Mb

3. If your clients will use swap space on the server, each client requires three times the client's memory size. For each client, use this formula:

Memory size \times 3

For example, swap space for an 8-Mb client would require $8 \text{ Mb} \times 3$, or 24 Mb. Add these values for all your clients and enter that sum here.

Clients' swap space: _____ Mb

4. Allocate an additional 15 Mb per client for user files. Multiply the number of clients by 15 and enter that value here.

Number of clients (____) \times 15 = _____ Mb

5. Add the above figures. The total is the amount of space you should allocate for this `/dlclient n` area.

Total space for `/dlclient n` file system: _____ Mb

Disk Space Required for Diskless Server Installation (2 of 2)

This worksheet is for calculating the amount of space required for a single /dlclientn file system. If you have multiple /dlclientn areas, you must prepare a separate sheet for each one. Each area has a number; the first is /dlclient0, the second is /dlclient1, and so on. Fill in the number of this /dlclientn area on the next line.

Disk Space for the /dlclient__ File System

Using the appropriate memory size information for your clients, follow these steps to find how much space you need for a /dlclientn area.

1. To allow 10 megabytes for each client's root area, multiply the number of clients by 10.

Number of clients (____) \times 10 = _____ Mb

2. If your clients will dump across the network, using dump space on the server, allow space for each client. A full dump requires space equal to the client's memory size plus the size of the kernel. For each client, use this formula:

Memory size + 2.5

For example, an 8-Mb client would require 10.5 Mb of space. Add these values for all your clients and enter that sum here.

Clients' dump space: _____ Mb

3. If your clients will use swap space on the server, each client requires three times the client's memory size. For each client, use this formula:

Memory size \times 3

For example, swap space for an 8-Mb client would require 8 Mb \times 3, or 24 Mb. Add these values for all your clients and enter that sum here.

Clients' swap space: _____ Mb

4. Allocate an additional 15 Mb per client for user files. Multiply the number of clients by 15 and enter that value here.

Number of clients (____) \times 15 = _____ Mb

5. Add the above figures. The total is the amount of space you should allocate for this /dlclientn area.

Total space for /dlclientn file system: _____ Mb

Client Setup Worksheet

This worksheet is for recording the information you need to set up a single DMS client using the dms utility's Add Client Processor menu option. If you want multiple clients, you must prepare a separate sheet for each client. You can also use this sheet to record information for RIS clients. Fill in the client's system name (host name) on the next line.

Registration Information for Client _____

Enter the required information in the blanks in the following list:

Type of client processor

VAX

RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes

No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Client Setup Worksheet

This worksheet is for recording the information you need to set up a single DMS client using the dms utility's Add Client Processor menu option. If you want multiple clients, you must prepare a separate sheet for each client. You can also use this sheet to record information for RIS clients. Fill in the client's system name (host name) on the next line.

Registration Information for Client _____

Enter the required information in the blanks in the following list:

Type of client processor

VAX RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Client Setup Worksheet

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Registration Information for Client _____

Enter the required information in the blanks in the following list:

Type of client processor

VAX

RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes

No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Client Setup Worksheet

This worksheet is for recording the information you need to set up a single DMS client using the dms utility's Add Client Processor menu option. If you want multiple clients, you must prepare a separate sheet for each client. You can also use this sheet to record information for RIS clients. Fill in the client's system name (host name) on the next line.

Registration Information for Client _____

Enter the required information in the blanks in the following list:

Type of client processor

VAX

RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes

No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Client Setup Worksheet

This worksheet is for recording the information you need to set up a single DMS client using the dms utility's Add Client Processor menu option. If you want multiple clients, you must prepare a separate sheet for each client. You can also use this sheet to record information for RIS clients. Fill in the client's system name (host name) on the next line.

Registration Information for Client _____

Enter the required information in the blanks in the following list:

Type of client processor

VAX RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Client Setup Worksheet

This worksheet is for recording the information you need to set up a single DMS client using the dms utility's Add Client Processor menu option. If you want multiple clients, you must prepare a separate sheet for each client. You can also use this sheet to record information for RIS clients. Fill in the client's system name (host name) on the next line.

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Enter the required information in the blanks in the following list:

Type of client processor

VAX

RISC

The client's hardware Ethernet address in the form of six two-character groups separated by minus signs. For example, 08-00-2f-03-f5-08

The client's TCP/IP network address. For example, 254.1.5.126

The name of the diskless root area for this client (/dlenvn/rootn.mips or /dlenvn/rootn.vax)

The name of the dlclientn area for this client

The client's root password

The client's swap file location (server or local)

Swap file size, if the swap file will be on the server

Swap device, if the swap file is on a disk local to the client. For example, rz0b

Memory dump across the network for this client?

Yes

No

Duplicate an existing client configuration for this client? If yes, enter the name of the existing client.

Glossary

This glossary defines terms and concepts related to software sharing.

client

A computer system that uses resources provided by another computer, called a server.

client area

In DMS, an area containing a single client's custom-tailored root files, including the operating system kernel.

DMS area

A reserved disk area physically connected to a DMS server, containing one or more DMS environments in which are stored clients' operating system software.

DMS client

A computer system whose system disk area is physically connected to a DMS server rather than to the client itself and is accessed across the network by the client.

DMS environment

A portion of a DMS area, containing software to support one or more specific types of client hardware platforms; for example, RISC and VAX processors. A DMS environment contains one or more DMS root areas, one for each type of client platform.

DMS root area

A portion of a DMS environment, configured to support a single type of client hardware platform; for example, RISC processors. One root area is required for each type of client that is to be supported.

DMS server

A computer system that serves other computers by providing online operating system software for them to run; the software is stored on disks belonging to the server and is accessed across the network by the clients.

generic root

In DMS, a portion of the DMS environment that contains system software in a generic form, ready to be copied for tailoring to fit an individual client's requirements.

private area

In DMS, a portion of the DMS area that is reserved for the exclusive use of a single client. The private area contains the client's custom-tailored copy of certain operating system software files, including the kernel.

product environment

In RIS, a portion of the RIS area containing a set of software kits that are intended for installation on a particular client type, such as RISC processors.

prototype

In DMS, refers to files that have been modified by the server's system administrator so that they contain information pertaining to a given site, such as `printcap` entries. See **raw**.

raw

In DMS, refers to files that are exactly as supplied in the ULTRIX distribution kit. See **prototype**.

RIS area

A reserved disk area physically connected to a RISC server, containing one or more product environments in which are stored installable software kits.

RIS client

A computer system that has permission to install software across the network by accessing kits stored in the server's RIS area.

RIS server

A computer system that serves other computers by providing software kits operating system software for them to install; the software is stored on disks belonging to the server and is accessed across the network by the clients.

server

A computer system that serves one or more other computers, called clients, by providing a resource to them.

subset

An installable software kit module that is compatible with the ULTRIX `setld` software installation utility.

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