

**ULTRIX-32
Guide to Diskless
Management Services**

Order No. AA-MF01A-TE

ULTRIX-32 Operating System, Version 3.0

Digital Equipment Corporation


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About This Manual

This manual describes how to install and maintain your diskless server area using the diskless management services utility, dms.

Audience

The audience for this manual is anyone installing and maintaining the diskless server area. The manual assumes that:

- You, or a DIGITAL Field Service representative, have checked the hardware 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.

Organization

- | | |
|-----------|---|
| Chapter 1 | Overview of the Diskless Management Services
Describes the diskless server area and introduces the dms utility. |
| Chapter 2 | Diskless Management Services Setup Preparation
Describes the knowledge, information, and tasks required before you set up the diskless server area. |
| Chapter 3 | Diskless Server Setup
Describes how to partition a disk, install software into a diskless environment, and set up a default configuration for that server's clients. |
| Chapter 4 | Management and Maintenance
Describes how to add, modify, and delete diskless clients, and how to customize clients' setups. Tells how to manage diskless clients. |

Chapter 5 Troubleshooting

Describes how to perform troubleshooting operations in the diskless server area.

Related Documentation

The following suggests the order in which you should read the related documentation:

1. Hardware documentation

You should have on hand the hardware documentation associated with your processor, particularly the Owner's Manual. These manuals show you how to set up the processor and its additional devices. These manuals also supply valuable troubleshooting guidelines.

2. Release Notes

Before beginning the installation, you should read the current version of the Release Notes.

3. System and network management guides

Read the appropriate system and network management guides to help you prepare to install the diskless server area.

Conventions

The following conventions are used in this manual:

- | | |
|----------------|---|
| special | In text, each mention of a specific command, option, partition, pathname, directory, or file is presented in this type. |
| command(x) | In text, cross-references to the programmer's manuals include the section number in the manual where the command is documented. For example, see the <code>cat(1)</code> command in the <i>ULTRIX Reference Pages</i> . |
| example | In examples, computer output text is printed in this type. |
| example | In examples, user input is printed in this bold type. |
| # | This is the default superuser prompt. |
| >>> | This is the console subsystem prompt. |
| . | In examples, a vertical ellipsis indicates that not all of the lines of the example are shown. |
| . | |
| . | |

<KEYNAME> In examples, a word or abbreviation in angle brackets indicates that you must press the named key on the terminal keyboard.

Mbyte Throughout the text, the abbreviation Mbyte is used for megabyte. One megabyte equals 1,048,576 bytes.

Overview 1

A server processor provides diskless management services to client processors from a diskless server area. The diskless server area contains software that is available to registered client processors that are licensed to access that software.

Each client registered for a diskless server area is booted from the server and uses the software in the diskless server area as if that software were located on the client's processor. The diskless client has no system management responsibilities because the software remains located on the server, and system management operations are all performed on the server. This chapter presents an overview of the diskless management services and introduces the diskless management services utility, *dms*, for setting up and managing the diskless server area.

1.1 The Diskless Server's Environment

The environment for a diskless server area consists of the following components:

- A server
The server can be any DIGITAL supported processor except the MicroVAX 2000 and the VAXstation 2000, which are not supported servers. The software subset containing support for the maintenance operations protocol, MOP, must be installed in order for your system to be used as a server. See the *ULTRIX-32 Advanced Installation Guide* for software subset descriptions and dependencies.
- A distribution device on the server
The distribution device could be a tape drive, an RA60 disk drive, a TK50 tape cartridge drive, or a TK70 tape cartridge drive. You use the distribution device to transfer the software subsets for a specific product to the server's disk, where registered clients can access the software.
- The Ethernet
You must set up the server and all client processors as hosts on the Ethernet. Clients use the Ethernet to access the diskless server area.

- Clients

Each diskless client must have at least 6 Mbytes of memory. Diskless clients are members of the MicroVAX and VAXstation series of processors.

The supported processors in these series are:

MicroVAX II

MicroVAX 2000

MicroVAX 3300

MicroVAX 3400

MicroVAX 3500

MicroVAX 3600

VAXstation II

VAXstation II/GPX

VAXstation 2000

VAXstation 3100

VAXstation 3200

VAXstation 3500

1.2 Diskless Management Services Utility

The tool to set up the diskless server area and to register diskless clients is the Diskless Management Services utility, `dms`. You also use the `dms` utility to manage your client processors. See `dms(8)` in the *ULTRIX Reference Pages* for a summary of the `dms` functionality.

The `dms` utility supports default configurations for graphics devices and Ethernet hardware. Support for other devices requires customization.

Chapter 3 and Chapter 4 include descriptions of procedures performed using `dms`. Chapter 4 also contains descriptions of customizing a client's setup.

1.3 Order of Operations

The system manager on the server processor performs a series of procedures to configure the server for diskless management services. The procedures to set up a diskless server area follow, listed in the order in which they are performed:

- Allocate disk partitions and create the file systems required for diskless management services
- Install software
- Optionally, set up a default configuration to assign to each client registered for the diskless server area
- Register clients
- Boot clients from the server

Table 1-1 lists each operation required to set up a diskless server area in sequence and the name of the applicable dms utility option and manual method for each. It also lists the section of this guide that describes each procedure.

Table 1-1: Sequence of Operations Performed on the Server

Operation	DMS Menu Option	Manual Method
Partition disk & create file systems	Configure Server Set up Disk Partitions Section 3.1.1	chpt & newfs commands Section 3.1.2
Install ULTRIX-32 supported software	Configure Server/Install Software into an Environment Section 3.2.1	N/A
Install additional software, for example, the ULTRIX Worksystem Software Server Kit	Configure Server/Install Software into an Environment Section 3.2.2	N/A
Set up default client configuration	Configure Server/Set up Clients' Defaults Section 3.3	N/A
Register Clients	Add Client Processor Section 4.1	N/A
Boot clients	N/A	boot commands Section 4.2

1.4 Diskless Server Area File Systems

File systems and administrative files for diskless clients are located on the server. Each diskless server area contains two types of file systems:

- One or more `dlenv` file systems that contain the diskless environment. The components of a diskless environment are one or more common root directories, a portion of which is copied to each diskless client's area in the second type of file system, the `dlclient` file system. The `dlenv` file system also holds a shared software area within each common root area that contains the `usr` area, where read-only data files and executable files are located. When the client is booted from the server, this shared `usr` area is automatically mounted by each client registered to access that common root directory.
- One or more `dlclient` file systems, each of which contains machine-specific areas where a copy of each registered diskless client's portion of the common root directory, and, in some cases, the client's swap file are located.

Throughout this guide, the diskless server area file systems are designated `dlenv?` and `dlclient?`. The common root directories are designated `root?.vax`. The question mark (?) represents the number assigned to the specific file system or common root directory when it is installed. The portion of the common root directory that is copied to each registered client is designated `Clname.root`.

A server processor may have several diskless server areas. Each common `root?.vax` directory of each `dlenv` file system may contain a different set of software products to provide a distinct software environment for a group of licensed diskless clients to share. The files in the `usr` area of a particular `root?.vax` directory are shared by all the clients registered for that environment.

Creating separate file systems for each `dlenv?` and `dlclient?` component in your diskless server areas provides security by giving the server control over the degree of access to each diskless environment. This limits each registered client's access to its own `Clname.root` directory and to the shared `usr` area of its `root?.vax` directory, which is designated read only.

The components of each diskless server area may be on separate partitions of one disk or distributed on separate partitions of multiple disks. For example, a `dlenv` file system may be on a separate partition of one disk, and a `dlclient` file system on a separate partition of a second disk.

1.4.1 Directories

When you use the basic installation procedure to install an ULTRIX operating system on the server, or perform an advanced installation and choose the default file system allocation, the installation software creates the /usr/var directory. If you perform an advanced installation and do not choose the default file system allocation, you can allocate the var area as a separate file system.

You can install a diskless server area whether the var area is a directory under /usr or a separate file system. Throughout this guide, /var is assumed to be a separate file system.

After the software subset containing the maintenance operations protocol, MOP, has been installed, and you have created a dlenv file system and a dlclient file system, several subdirectories exist in the var area that make up the diskless server area directory structure. These subdirectories are shown in Table 1-2.

Table 1-2: Subdirectories Installed into the var Area on the Server

Subdirectory	Contents
/var/diskless/dms	client default parameter files
/var/diskless/defs	client system and configuration files
/var/diskless/clients	MOP registration packets (network downline load files)
/var/diskless/bin	dms executable files
/var/diskless/dlclient0	individual client root directories and swap files, for example, ClientA.root, ClientA.swap, ClientB.root, and ClientB.swap.
/var/diskless/dlenv0	common root areas, like root0.vax and root1.vax that contain shared usr areas that are mounted by each client and root directories propagated to clients.

Figure 1-1 illustrates the diskless server area setup. In this figure, solid boxes represent file systems, ellipses represent directories, and dashed boxes represent files.

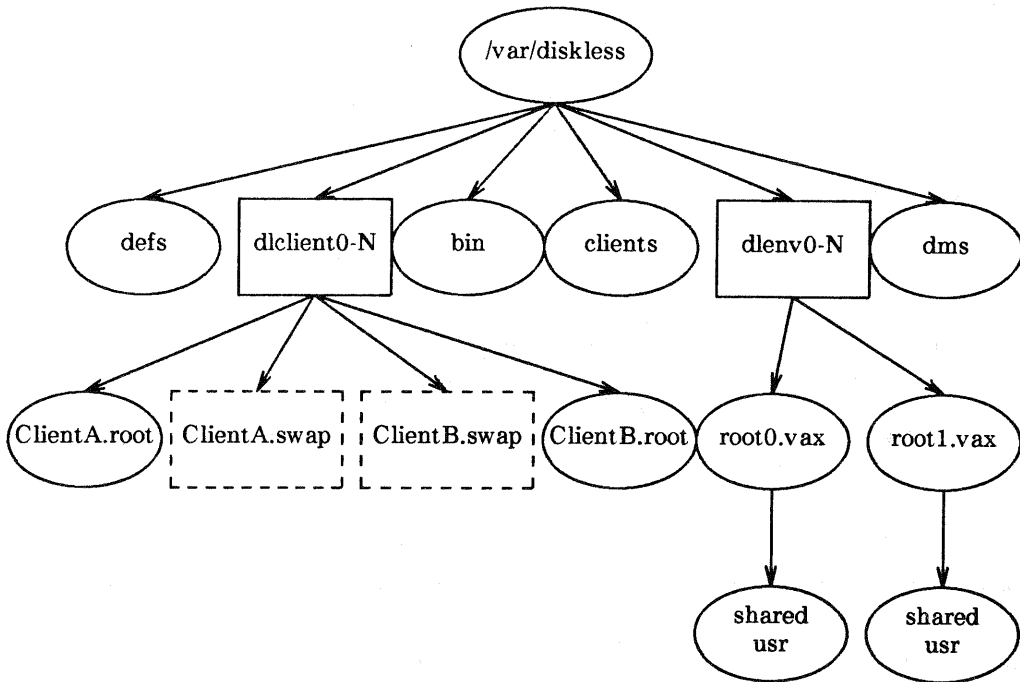


Figure 1-1: Diskless Server Area Directory Structure

1.4.2 Diskless Server Area from the Client's View

Only the diskless server has access to the entire `/var/diskless` directory structure. The diskless client has access only to the `shared usr` area that exists in the `root?.vax` for which it is registered in the `dlenv?` file system and to its own `Clientname.root` directory and swap file in the `dlclient?` file system. Figure 1-2 shows each client's view of the diskless server area and of its own root and `usr` area.

Diskless Server

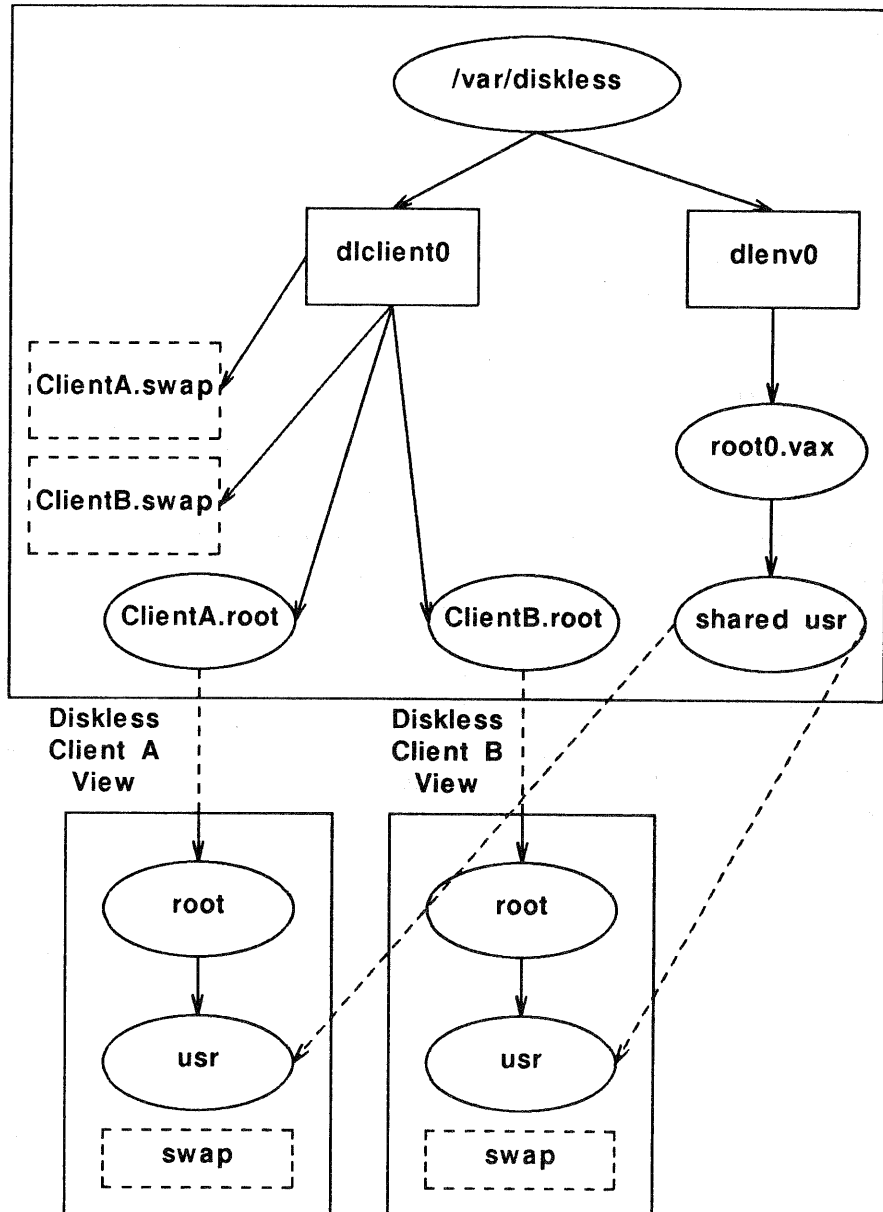


Figure 1-2: Client Views of the Diskless Server Area

The dashed lines indicate those areas that each client mounts when it is booted from the server. The two areas are the `root?.vax` directory in the

The solid lines around each client processor's view box indicate that from a client's view both `root` and `usr` seem to be located on the local machine. Users on the client processor access the software on the server just as they would if the software were actually located on the local processor.

1.5 Disk Space Required on the Server

Disk space is required on the server for each diskless server area file system. You can automate disk partitioning by using the `dms` utility to partition a disk that will be dedicated to a diskless server area.

Do not underestimate the disk space you need. If you underestimate the disk space required for the file systems, you must repartition your disk to provide the necessary space. Repartitioning a disk is a complex procedure and it overwrites existing software.

1.5.1 Disk Space Required for the `dlenv` File System

The recommended size range of the `dlenv` file system of each diskless environment is 35 to 100 Mbytes. Each common `root?.vax` area contains at least the ULTRIX-32 mandatory software subsets, plus whatever other supported subsets and additional software products are desired for clients who are registered to access that area.

The table that follows shows the approximate sizes of the software subsets for some ULTRIX products that you might want to install in one or more `root?.vax` areas.

Table 1-3: Approximate Disk Space Required

Software Subsets	Approximate Size in Mbytes
ULTRIX mandatory	25
All ULTRIX supported	45
All ULTRIX Worksystem	15
All ULTRIX unsupported	100

In addition, be sure to allow space for any other software products you plan to install.

Most users load all of the ULTRIX-32 supported software subsets, plus the ULTRIX Worksystem Software subsets. Those two products require about 60 Mbytes of disk space.

Throughout this guide, space recommendations are based on a diskless server area with one d1env file system with one root?.vax directory containing all the ULTRIX-32 supported software subsets and all the ULTRIX Worksystem Software subsets.

1.5.2 Disk Space Required for the dlclient File System

You must allow disk space on the server for each client's Cliname.root directory and, in some cases, swap file in the dlclient file system.

Consider these factors when you plan the space requirements of your diskless clients:

- The clients' volatile files, like those in the tmp directory, and volatile directories like var/spool and var/adm/crash are located in dlclient
- Customized clients require more space than clients linked to a default kernel
- Clients that add files to their Cliname.root areas use space

The recommended size for each client's root directory is 10 Mbytes. Add an amount equal to the client's memory size if the client will do a full crash dump over the network to the server.

The swap file should be 20 Mbytes or two times the client's memory size, whichever is greater.

You can estimate the space that different clients in a group require and spread that amount of space over the whole group when determining your dlclient? disk space requirements. For example, you might allocate 5 Mbytes for each client's root file system and 12 Mbytes for each client's swap file. Those allocations would require 85 Mbytes in the dlclient file system to support five diskless clients.

1.6 Default Configuration Files

The diskless software includes several default configuration files for building clients' kernels. When a client is registered, the correct kernel is assigned to it according to the client's processor and graphics device types.

You can create customized configuration files for clients, build kernels, and provide a copy of the customized kernel to the client. See the Guide to System Configuration File Maintenance for information about configuration files and Section 4.7.1 for information about customized kernels.

1.7 Diskless Clients with Disks

A client processor with a disk can act as a diskless client. For example, clients may locate swap files and data files on their local disks. Such a client requires a kernel built from a configuration file that is customized with the appropriate entries to access its local disk.

See the Guide to System Configuration File Maintenance for information about editing configuration files. Refer to Section 4.7 for an example of customizing a kernel.

Diskless Management Services Setup Preparation 2

This chapter describes how to prepare to set up your diskless server area. The chapter describes how to:

- Gather prerequisite information
- Set up ULTRIX network services on the server
- Plan the server configuration
- Plan client registrations.

2.1 Gathering Prerequisite Information

As the system manager at the server, you should:

- Know your superuser password. The setup procedure requires you to type this password.
- Make sure that your clients are licensed for all the software that they access in the diskless server area.

2.2 Setting Up ULTRIX Network Services on the Server

Perform the following tasks before you start the dms setup preparation:

- Install an ULTRIX operating system on the server
- Set up a local area network
- Set up a network file system

2.2.1 Installing an ULTRIX Operating System on the Server

The Basic Installation Guide for your processor explains how to install an ULTRIX operating system. The *ULTRIX-32 Advanced Installation Guide* tells you how to perform an advanced installation. It also provides a table that lists supported software subset sizes.

The subset containing the maintenance operations protocol, MOP, must be installed if your system is to be a server.

To load the subset containing MOP, either perform an advanced installation or use the `setld` command after the basic installation is complete. For example:

```
# setld -a /dev/rmt0h ULMOP030
```

For more information, refer to `setld(8)` in the *ULTRIX Reference Pages*.

2.2.2 Setting Up a Local Area Network

You must connect the `dms` server and all of your client processors to the Ethernet. See the Guide to Networking for instructions on how to set up a local area network (LAN).

If you run the network data base Yellow Pages (YP) service on the server, the `dms` utility sets up each diskless client to run YP. See the Guide to the Yellow Pages Service for information about YP.

Do not run the `ypsetup` utility on diskless client processors.

If your diskless server is also any type of Berkeley Internet Name Domain (BIND) server, the `dms` utility sets up each diskless client to run BIND using the diskless server as the client's BIND server also. See the Guide to the BIND Service for information about BIND.

Do not run the `bindsetup` utility on diskless client processors.

If you are running both the YP and the BIND services on the diskless server, the diskless client's `/etc/svcorder` file contains `yp`, `bind`, and `local`, in that order, by default.

2.2.3 Setting Up a Network File System

The network file system (NFS) must be set up before you install a diskless server area. See the Guide to the Network File System for instructions on how to set up NFS.

Do not run the `nfsetup` utility on diskless client processors. The `dms` utility sets up diskless clients for NFS.

2.3 Planning the Server Configuration

Perform the following tasks to prepare to configure a diskless server:

- Make sure your disk is already formatted if you plan to use `dms` to allocate disk partitions
- Plan the disk allocation
- Plan your diskless server area software installation
- Plan the clients' defaults

- Identify the distribution media
- Obtain the full pathname of the device special file name or mount point for the distribution media
- Refer to the DMS Clients' Defaults Setup Checklist, located at the end of this chapter

2.3.1 Formatting the Disk

If you plan to use the `dms` utility to allocate disk partitions, your disk must be formatted. DIGITAL formats disk packs for most processors before they are shipped. See your Owner's Manual for information about your disk.

2.3.2 Planning the Disk Allocation

You can install both the shared and client-specific portions of each diskless server area on one disk. Or, you can spread a diskless server area over multiple disks. For example, one disk can contain the `dlenv` file system. Another disk can contain the `dlclient` file system.

Spreading diskless server areas over multiple disks may improve system performance because client access is not concentrated on one disk.

2.3.2.1 Partitioning a Disk with DMS – You can use the `dms` utility to partition your disk and set up the file systems necessary for a diskless server area. The utility sets up `dlenv` and `dlclient` file systems in consecutive order, starting with `dlenv0` and `dlclient0`. These file systems must be in place before you can install software subsets into a diskless server area using `dms`.

If the disk is already in use, remember to back up any data you want to restore before you partition the disk using `dms` because the whole disk will be overwritten.

A description of partitioning disks with `dms` is included in Chapter 3.

2.3.2.2 Manually Partitioning a Disk – You can use the `chpt` utility to find available disk space and to rearrange partitions on a disk you are using for both the diskless server area and other processing. See the Guide to System Disk Maintenance for information about estimating size and changing disk partitions.

You can create the `/var/diskless/dlenv?` and `/var/diskless/dlclient?` file systems using `newfs`. The question mark (?) represents the number you assign to each file system for each diskless server area. See the Guide to System Disk Maintenance for information about estimating size and changing disk partitions.

A description of partitioning disks manually is included in Chapter 3.

2.3.3 Planning Diskless Server Area Software Installation

When you install software into a diskless server area, you install software products in the `dlenv` file system and select kernels to be built. Software is installed into one or more common `root?.vax` areas.

It is recommended that you install all the software you want in each diskless environment at one session. Start with your `ULTRIX-32` supported software subsets, then install any additional software products that clients will share. This avoids having to update clients registered for that diskless environment.

See the *ULTRIX-32 Advanced Installation Guide* for a description of `ULTRIX-32` software subsets and their sizes. In addition, see the documentation provided with your other software products to decide which subsets to install. If all the software you want will not fit into the `dlenv` file system, consider mounting another disk.

Make sure that you allow enough space for all the software you plan to install in all the common `root?.vax` areas when you allocate disk space for the `dlenv` file system.

2.3.4 Planning the Clients' Defaults

Plan the default setup for the diskless clients that will use this server. Refer to the `DMS Clients' Defaults Setup Checklist` at the end of this chapter for a list of the defaults you can specify.

2.3.5 Identifying the Distribution Media

See the bill of materials for the distribution media types and associated labels for your products.

2.3.6 Obtaining the Device Special File Name or Mount Point

Obtain the full path for the device special file name or mount point associated with your software distribution media. The device special file name points to the device on which you mount the media containing the software subsets. The mount point is the file system on which you mount the software when the distribution media is an `RA60` disk.

Table 2-1 lists possible distribution media and, where applicable, the device special file name for each. The first column lists the distribution media type, the second column lists the full pathname for the device special file or mount point, and the last column contains the `DIGITAL` name for the distribution media.

The question mark (?) in the device special file name represents the unit number of the distribution device. For example, if the distribution device is a TU81 unit 0, then the device special file name is `dev/rmt0h`.

Table 2-1: Device Special File Names

Media Type	Device Special File Name	DIGITAL Name
RA60 disk	Full pathname of mount point	RA60
TK50 tape cartridge	<code>/dev/rmt?h</code>	TK50, TK70
9-track magnetic tape	<code>/dev/rmt?h</code>	TS05, TU80 TU45, TE16 TU77
	<code>/dev/rmt?l</code>	TU81, TU81E TU78, TU79

2.4 Planning Client Registrations

Perform the following tasks to prepare to register diskless clients:

- Obtain information about each client.
- Place each client's host name and IP address in `/etc/hosts`
- Fill out the DMS Client Setup Worksheet, located at the end of this chapter

2.4.1 Obtaining Information About Each Client

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

- Host name, which can contain up to 32 characters.
- Superuser password.
- Processor and graphics device type.

The possible processors and graphics device combinations are listed in Table 2-2.

Table 2-2: Processor and Graphics Device Combinations

Processor	Possible Graphics Device
VAXstation II	monochrome
VAXstation II/GPX	color
VAXstation II/GPX (multi-station)	color
VAXstation 2000	monochrome
VAXstation 2000	color
VAXstation 3000 series	monochrome
VAXstation 3000 series	color
VAXstation 60	color
MicroVAX II	no graphics
MicroVAX 2000	no graphics
MicroVAX 3000 series	no graphics

- **Hardware Ethernet address**
See the Guide to Ethernet Communications Servers for information about hardware Ethernet addresses.

2.4.2 Placing Clients' Host Names and IP Addresses in /etc/hosts

You automatically place each client processor's host name and Internet Protocol (IP) address in the /etc/hosts file when you initially set up your LAN using the netsetup utility. The netsetup utility is described in the Guide to Networking.

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

Note

If the host system is being served by the Yellow Pages (YP) service, see the Guide to the Yellow Pages Service for information about modifying and propagating a host file.

If the host system is a Berkeley Internet Name Domain (BIND) server, see the Guide to the BIND Service for information about modifying and propagating a host file.

2.4.3 Referring to the DMS Clients' Defaults Setup Checklist

The DMS Clients' Defaults Setup Checklist is a checklist of the information you need to set up diskless clients' defaults on the server. Refer to this worksheet when you choose the option, Set up Clients' Defaults, from the dms utility Configure Server Menu, which is described in Chapter 3. The defaults you set up are used as default choices when you add a diskless client using dms.

DMS Clients' Defaults Setup Checklist

This information is used as default choices when registering diskless clients. You will be asked to choose the following during the client registration procedure:

- Common root directory to be copied for clients
- File system to contain clients' root directories
- Swap file location (on clients' disks or on the server)
- File system to contain clients' swap files and swap file size in 1/2-Mbyte increments
- Full, partial, or no memory dump across the network for clients
- For a partial dump, Mbytes to dump in 1/2-Mbyte increments
- Default client processor type
- Whether default is to link clients to a default kernel, or to copy the kernel

Figure 2-1: DMS Clients' Defaults Setup Checklist

2.4.4 Filling Out the DMS Client Setup Worksheet

Use the DMS Client Setup Worksheet to record the information you need to set up a client processor using the `dms` utility option, Add Client Processor, which is described in Chapter 4. Fill out a worksheet for each diskless client processor you plan to add.

DMS Client Setup Worksheet	
If you used the <code>dms</code> utility Configure Server Menu option, Setup Clients' Defaults, you can use some or all of the default values when you register diskless clients.	
1. Enter the client's host name as it appears in the <code>/etc/hosts</code> file:	_____
2. Enter the client's hardware Ethernet address:	_____
3. Other information you need about each client:	
• Common root directory to be copied	
• File system to contain client's root directory	
• Root password	
• Swap file location (on server or local)	
• Swap file directory name, if located on the server	
• Swap file size, if swap file is located on the server	
• Full, partial, or no memory dump across network for client	
• Processor type	
• Link to a default kernel, or get a copy of the default kernel	

Figure 2-2: DMS Client Setup Worksheet

Diskless Server Setup 3

This chapter describes how to use the dms Configure Server Menu options to configure a diskless server. The instructions tell you how to perform the following tasks:

- Partition a disk
- Install software into a diskless server area
- Set up clients' defaults
- Rebuild diskless default kernels

3.1 Partitioning a Disk

You can use the dms utility to partition your disk for a diskless server area. The utility creates the file system, `dlenv?`, for the diskless clients' root? and sharable `usr` area, and the file system, `dlclient?`, for each diskless client's root and swap areas. The question mark (?) represents the number corresponding to the file systems for each diskless server area.

You can also allocate disk space and create the file systems necessary for a diskless server area manually, using the `chpt` and `newfs` commands.

This section includes instructions for each method of allocating disk space and creating the necessary file systems.

3.1.1 Partitioning a Disk Using dms

This section describes how to use the dms utility Configure Server Menu option, Set up Disk Partitions, to partition your disk and set up the file systems necessary for a diskless server area. Be sure to back up any data on your disk before using dms. The program overwrites all data on the disk.

Your disk must be formatted before you partition the disk. DIGITAL formats disk packs for most processors before they are shipped. See your Owner's Manual for information about your disk.

In the sample session that follows, a new, formatted disk is used.

1. Log in and become the superuser. For example:

```
login: manager
password:
# su
password:
```

Enter your root password, which does not appear on the screen.

2. Type the following at the system prompt:

```
# /etc/dms
```

A message appears reminding you that all users who are going to access the diskless server area must be licensed to use that software. It then asks you to type your superuser password:

```
Licensing Message
```

```
To continue please enter the superuser password:
```

If you type an invalid superuser password, the dms utility returns you to the system prompt. If you type a valid superuser password, a message appears that explains what documentation you should read.

3. A diskless management services menu appears. Invoke the Configure Server Menu by typing c:

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

```
Configure Server Menu      => c
Add Client Processor       => a
Remove Client Processor    => r
Modify Client Parameters   => m
List Configurations Menu   => l
Exit                       => e
```

```
Enter your choice: c
```

A menu like this appears:

```
Set up Disk Partitions           => d
Install Software into an Environment => i
Set up Clients' Defaults          => s
Rebuild Kernels                   => k
```

```
Enter your choice:
```

4. Enter d to invoke the disk partitioning utility.

A message appears saying that the utility will partition a disk and create the file systems necessary for a diskless environment. The

5. A prompt asks if you want to continue. Enter y to continue, and the prompt for the device special file name appears.

6. Enter the device special file name. For example:

Enter the device special file name of the "c" partition of the desired disk, for example /dev/rra2c: /dev/rra3c

7. A message like this appears:

Press RETURN when /dev/rra3c is ready.

Confirm that the device is ready, then press the RETURN key.

8. A display appears, ending with a message and prompt like the following:

Please select one of the following uses for this disk:

1) Both dlenv and dlclient areas are to reside on this disk.

2) Only a dlenv area is to reside on this disk.

3) Only a dlclient area is to reside on this disk.

Enter your selection:

Enter the number corresponding to your selection. In this example, the system manager chooses to have both areas on this disk:

Enter your selection: 1

9. A message appears saying that each client requires a swap file and a root area. The message also says that distributing swap files and root areas over multiple disks increases performance and may allow more space for additional diskless clients.

10. The next message says that each diskless client is allocated a swap file. The message is followed by a prompt for you to type the swap file size.

Enter the swap file size you want. The recommended swap file size is 20 Mbytes or two times the client's memory size, whichever is greater.

11. A message appears saying that a root directory is propagated to each diskless client. The recommended root size is 10 Mbytes. The message is followed by a prompt for you to type the propagated root area size.

Enter the root area size.

12. A message appears saying how much space is available on the disk you selected. This message is followed by a message giving the recommended size and the recommended size range of the shareable

usr portion of the dlenv file system. A prompt asks you to type the sharable usr area size.

Enter the size of the shared usr area, which must be large enough to include all of the root?.vax directories you plan to install. For example:

Enter the sharable usr area size in Mbytes: 60

The dms utility creates the dlenv? file system. Messages appear as files are checked.

13. A prompt asks you to type the number of clients you want to support on this disk. A message gives the range available.

Enter the maximum number of diskless clients you plan to serve. If you choose too small a number, you may not be able to add all the diskless clients you want.

14. A message appears saying how many clients will be supported. The dms utility creates the dlclient? file system. Messages appear as files are checked.

15. When partitioning is complete, a display similar to this appears:

This is your new disk configuration:

Partition d contains the dlenv area.
Partition e contains the dlclient area.
Partition f contains the available space,
if more than 20 Mbytes remain.

Disk partitioning is completed.

16. If you chose to have only a part of the diskless environment, for example, only the dlenv? file system, on the first disk you partitioned with dms, run the program again and designate another disk to partition. Choose the next area you want when the prompt appears requiring you to select the area to reside on the current disk.

You can use this procedure to partition as many disks and create as many dlenv and dlclient file systems as you need. Then you can install the software subsets your diskless clients will use in the diskless server area.

3.1.2 Partitioning a Disk Manually

This section includes instructions for allocating disk space and creating the necessary file systems for a diskless server area manually.

Partition your disk and create the file systems for diskless management services manually only if you cannot dedicate a disk to the diskless area. If you must partition your disk manually, be sure to read the Guide to System Disk Maintenance and refer to the `chpt(8)`, `newfs(8)`, `fsck(8)`, and `mount(8)` commands in the *ULTRIX Reference Pages* before you begin.

Follow this procedure to set up a diskless server area manually:

1. Decide how much space you need for the file systems. Allow adequate space for the `dlenv?` file system, depending on the number of `root?.vax` areas you plan to have and on the software products each `root?.vax` area will contain. Allow adequate space in the `dlclient?` file system for each client you plan to register.
2. Use the `df` command to list the current mounted file systems and to see the amount of free space available on each file system. For example:

```
% df
```

The command produces a display similar to this:

Filesystem	total	kbytes	kbytes	percent	
node	kbytes	used	free	used	Mounted on
/dev/ra2a	7415	5711	963	86%	/
/dev/ra2h	194550	89368	85727	51%	/usr
/dev/ra2g	38175	11852	22506	34%	/usr/users

3. Become the superuser and use the `chpt` command with the `-q` option to see the current size of disk partitions. For example:

```
# chpt -q /dev/rra2c
```

The display depends on the type of disk, but it is similar to this:

```
/dev/rra2c
Current partition table:
partition  bottom          top          size          overlap
a          0                15883       15884         b,c,d,g,h
b          0                0           0             a,c,d,g,h
c          0                891071     891072         a,b,d,e,f,g,h
d          0                128255     128256         a,b,c,g,h
e          128256          577151     448896         c
f          577152          891071     313920         c
g          0                0           0             a,b,c,d,h
h          0                0           0             a,b,c,d,g
```

If there are partitions free which meet your size requirements, go to step 7.

4. Unmount all file systems on the disk you are going to partition.
5. For safety, back up the file systems on the disk before continuing.
6. Use `chpt` to partition the disk, following the procedure described in the Guide to System Disk Maintenance. Be sure to allow enough space for the areas that must be restored, if any. Make sure the partitions you are going to use do not overlap.
7. Use the `newfs` command to create the file systems. You must run `newfs` on any partition that has been changed in size or offset.
8. Use the `fsck` command to check the newly created file systems. Refer to the Guide to System Crash Recovery for information about the `fsck` command.
9. Edit your `/etc/fstab` file to mount the new file systems on their specified mount points. The `fstab` entries are similar to the following:

```

/dev/ra3d:/var/diskless/dlenv0:rw:1:4:ufs::
/dev/ra3g:/var/diskless/dlclient0:rw:1:5:ufs::

```

If you relocated or repartitioned any file systems, update those entries in `fstab` to specify the new locations.

10. Create the directories that will be used as mount points for the new diskless file systems. For example:

```

# mkdir /var/diskless/dlenv0
# mkdir /var/diskless/dlclient0

```

11. Make sure all your file systems are mounted.
12. Edit the `/etc/exports` file to include the exported diskless file systems. The entries are similar to these:

```

/var/diskless/dlenv0 nobody -n -o -r=0
/var/diskless/dlclient0 nobody -n -r=0

```

Specifying `nobody` means that no one can mount the exported diskless file systems manually. The `-n` option prevents a client from accessing the next higher level in the directory structure, relative to its root directory. The `-o` option makes the file systems read only, and `-r=0` maps the client's root access to the server's root user identification.

3.2 Installing Software Subsets into a Diskless Server Area

After you complete the disk partitioning procedure and create the diskless server area file systems `dlenv0` and `dlclient0`, use the `dpkg` utility to install

software into the dlenv file system and build the kernels necessary for clients who will be registered to access this diskless server area. Install all the software you plan to use in this diskless server area before you begin registering clients.

Each time you install the ULTRIX-32 mandatory software subsets, a new common root?.vax area is created. Perform the installation procedures described in the next two sections to set up root?.vax areas with different products. Then, licensed clients may access those areas suited to their needs.

You can install the ULTRIX Worksystem Software Server Kit, ULTRIX unsupported software subsets, and DIGITAL layered products that are compatible with the ULTRIX-32 V3.0 setld utility into the diskless server area. These additional software products can only be installed to existing root?.vax areas. See the documentation provided with your additional software products.

Note

Use only the ULTRIX Worksystem Software Server Kit to install ULTRIX Worksystem Software into a diskless server area. A server with either ULTRIX-32 Version 2.2 or ULTRIX Worksystem Software Version 1.1 software cannot serve clients with ULTRIX-32 Version 3.0 or ULTRIX Worksystem Software Version 2.0 software.

3.2.1 Installing ULTRIX-32 Supported Software Subsets

In the sample session that follows, the system manager installs all the ULTRIX-32 supported software subsets into one common root?.vax area, /var/diskless/dlenv0/root0.vax, of a diskless server area. You would perform this procedure again to set up multiple common root?.vax areas that contain different software subsets. The second set of ULTRIX-32 supported software subsets would be installed in /var/diskless/dlenv0/root1.vax.

1. Invoke dms and select the Configure Server Menu option from the DMS menu.
2. When the Configure Server Menu appears, type i to select the Install Software into an Environment option.
3. A prompt asks if you are installing ULTRIX-32 supported software. In the following example, the system manager is installing the ULTRIX-32 supported software:

```
Are you installing ULTRIX-32 supported software? (y/n) [n]: y
```

A message appears saying that you have chosen to install a new diskless environment.

4. If there is more than one `dlenv?` file system available, a menu appears listing the possible file systems. For example:

```
These are the possible file systems to contain the environment:  
1      /var/diskless/dlenv0  
2      /var/diskless/dlenv1
```

Enter your choice []: 1

5. A message like the following appears automatically if there is only one file system available, or after you enter the number corresponding to your choice of file system if there is more than one available:

The environment is `/var/diskless/dlenv0/root0.vax`.

6. A prompt asks for the full pathname of the device special file name or mount point for the distribution media.

Enter the device special file name or mount point of your distribution media.

In the following example, the system manager plans to mount the 9-track magnetic tape labeled `ULTRIX-32 V3.0 SUPPORTED MT9` on a TU81 tape drive, unit 0:

```
Enter the full path associated with the software distribution kit  
device or mount point [no default]: dev/rmt0h
```

A message tells you to press the RETURN key after you mount the software distribution media. Make sure the device is on-line and ready.

After you press the RETURN key, another message appears to make sure that you have loaded the media. The message asks you to type `y` when you are ready:

```
Press RETURN after you mount the media on the  
software distribution device.  
Loading software subsets to the var directory.  
Please make sure your installation tape is mounted and on-line  
Ready (y/n)? y
```

7. A message appears listing the software subsets that are mandatory and will be installed automatically, followed by a list of optional software subsets for the product you are installing.

Select the optional software subsets that you want from the list. If you want all of the optional software subsets, enter the number corresponding to the selection, All of the Above.

8. A message appears listing the subsets that you have chosen to install and asking you to confirm your choice.

If the software 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 software subset that you selected is installed and verified. This may take an hour if you select all of the software subsets.

9. When the subset installation is complete, a message appears asking you to select the kernels you want to build as default kernels for the different types of client processors supported.

If you have clients whose kernels were built using ULTRIX Worksystem Software Version 1.1 software, do not build kernels for them during this part of the installation. Install the ULTRIX Worksystem Software Server Kit as additional software, and build kernels for those clients during that installation procedure.

Answer y or n to build kernels corresponding to the types of client processors you plan to register. For example:

Which kernels do you want to build?

SETEVAX applies to the following processor types:
MicroVAX 2000 non-graphics

Build SETEVAX kernel? (y/n) [n]: y

A message appears saying that kernel building is occurring and that it may take several hours. Messages appear as the kernels are built.

Note

The ULTRIX File System (UFS) is not needed for diskless workstations. Ignore the message warning that UFS is not configured.

10. As each kernel is configured, a message similar to this appears:

```
* * * The new configured kernel is in  
/var/diskless/dlenv0/root0.vax/sys/SETEVAX.dlconf/vmunix * * *
```

Each kernel you build can be either linked or copied to applicable processors which you register as diskless clients.

3.2.2 Installing Additional Software Products

You can install the ULTRIX Worksystem Software Server Kit, ULTRIX unsupported software subsets, and DIGITAL layered products that are compatible with the ULTRIX-32 V3.0 setld utility into the diskless server area.

Note

Use only the ULTRIX Worksystem Software Server Kit to install ULTRIX Worksystem Software into a diskless server area. A server with either ULTRIX-32 Version 2.2 or ULTRIX Worksystem Software Version 1.1 software cannot serve clients with ULTRIX-32 Version 3.0 or ULTRIX Worksystem Software Version 2.0 software.

To install additional software products, invoke the dms utility again and select the Configure Server Menu option, Install Software into a Diskless Environment. For example, you might install a different set of optional software subsets to /var/diskless/dlenv0/root0.vax.

Make sure no diskless clients which mount the usr area of this common root?.vax area are running when you install an additional software product, or their usr area may change.

In the sample session that follows, the system manager installs ULTRIX Worksystem Software into /var/diskless/dlenv0/root0.vax.

1. When the prompt asking if you are installing ULTRIX-32 supported software appears, type n.

A message like this appears:

```
You have chosen to install software into an
existing diskless environment.
```

2. If there is more than one installed root?.vax directory in the diskless server area, choose the appropriate directory from the menu that lists existing root?.vax directories. For example:

These are the possible installation directories:

1. /var/diskless/dlenv0/root0.vax
2. /var/diskless/dlenv0/root1.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 device special file name or mount point of your distribution media

4. If your distribution media is tape, a message appears asking you to confirm that the tape is mounted and on line.
If your distribution media is tape, confirm that the tape is mounted and on line, then type y.
5. A message appears listing the software subsets that are mandatory and will be installed automatically, followed by a list of optional software subsets for the product you are installing.
6. Select the optional software subsets that you want from the list. If you want all of the optional software subsets, enter the number corresponding to the selection, All of the Above.
7. A message appears listing the subsets you have chosen to install and asking you to confirm your choice.
If the software subsets listed are the ones you want, type y. If you type n, the list of optional software subsets is displayed again, and you can select the subsets you want.
Messages appear as each software subset you selected is installed and verified.
8. If a kernel must be built for the software product you just installed, you are asked which kernels you want updated with this product. For example,

```
Which of the following kernels do you want
to build with the product just installed?:
```

You should build all the default kernels so that all types of clients can use the installed software. In this example, the system manager chooses to build a kernel for the VAXstation 2000 color monitor:

```
SESGVAX applies to the following processor types:
VAXstation 2000          color
```

```
Build SESGVAX kernel? (y/n) [y]: y
```

Be sure to build kernels for any client processors whose existing kernels were built using ULTRIX Worksystem Software Version 1.1 software.

9. A message like the following appears when the kernel has been built:

```
* * * The new configured kernel is in
      /var/diskless/dlenv0/root0.vax/sys/SESGVAX.dlconf/vmunix * * *
```

If any clients had links to kernels that were just updated, they will now be linked to the updated kernel.

If you had clients registered for this `root?.vax` directory and they were not linked to a default kernel, you will now be asked whether to copy the corresponding updated default kernel to those clients.

10. If diskless clients are registered to share this area, a prompt asks if you want to update the `Cliname.root` directories of those clients.

Enter `yes` to keep the diskless clients in a consistent state.

Repeat these installation procedures for each `root?.vax` area you plan to set up.

3.3 Setting Up Clients' Defaults

After you complete the disk partitioning procedure and have installed all the software products desired into a diskless environment, use the `dms` utility Configure Server Menu option, Set up Clients' Defaults, to set up the default configuration for diskless clients who will be registered for this diskless server area. The default values you set during this procedure are the default values that appear in square brackets, [], when you register diskless clients using the `dms` option, Add a Client, or if you choose the Set up Clients' Defaults option again to change the defaults.

3.3.1 Setting Up a Default Client `fstab` File

You can create a default `fstab` file that can be copied each time a client is added. Use this default `fstab` file to let clients mount other file systems, like `user` areas, from the server. Place your default `fstab` file in `/var/diskless/defs/fstab`. Refer to the Guide to System Environment Setup and to `fstab(8)` in the *ULTRIX Reference Pages* for information about `fstab` files.

The `dms` utility checks each client's root directory and corresponding `usr` area against each mount point listed in the default `fstab` file. If any mount points do not exist, the `dms` utility creates the necessary directories. When the client is next booted, all the file systems listed in its `fstab` file are mounted.

In the following example, the system manager on `tigris` creates a one-line, default `fstab` file to let clients mount the `users` directory from that server:

```
/usr/users@tigris:/usr/users:rw:0:0:nfs:soft,bg,nosuid:
```

Entries in the `fstab` file must be exported from the server. This requires an entry in the server's `/etc/exports` file. Refer to the Guide to the Network File System and to `exports(8)` in the *ULTRIX Reference Pages* for more information.

In the following example, the system manager has added the line `/usr/users` to the existing `/etc/exports` file on `tigris` to ensure that the `fstab` file is exported properly to all clients:

```
/usr/users
/var/diskless/dlclient0 -n -r=0 nobody
/var/diskless/dlenv0 -n -o -r=0 nobody
```

Specifying `nobody` means that no one can mount the exported diskless file systems manually. The `-n` option prevents a client from accessing the next higher level in the directory structure, relative to its root directory. The `-o` option makes the file systems read only, and `-r=0` maps the client's root access to the server's root user identification.

3.4 Rebuilding Diskless Default Kernels

You can use the `dms` utility `Configure Server Menu` option, `Rebuild Kernels`, to build kernels that were not built during installation of a `root?.vax` area. This option lets you build default kernels for diskless clients that are to be added, but whose processor types do not match any of the default kernels built previously. Only the default kernel configurations provided with the diskless software can be built with this option.

The example that follows describes the steps required to build the default kernel for a multi-station `VAXstation II/GPX`:

1. Invoke `dms` and select the `Configure Server Menu` option.
2. When the `Configure Server Menu` appears, type `k` to select the `Rebuild Kernels` option.
3. A message like this appears:

```
    You have chosen to build kernels only.
```

If there is more than one `root?.vax` directory available, a menu appears listing the possible directories.

4. A message like the following appears automatically if there is only one directory available, or after you enter the number corresponding to your choice of directory if there is more than one available:

```
    Which kernels do you want to build?
```

5. Type y at the prompt to build each kernel you want. For example:

```
QEVD2VAX applies to the following processor types:
      VAXstation II/GPX
      multi-station      color
```

```
Build QEVD2VAX kernel? (y/n) [n]: y
```

A message appears saying that kernel building is occurring and that it may take several hours. Messages appear as the kernels are built.

Note

The ULTRIX File System (UFS) is not needed for diskless workstations. Ignore the message warning that UFS is not configured.

6. As each kernel is configured, a message similar to this appears:

```
* * * The new configured kernel is in
      /var/diskless/dlenv0/root0.vax/sys/QEVD2VAX.dlconf/vmunix * * *
```

Each kernel you build can be either linked or copied to applicable processors which you register as diskless clients.

If you already added clients and tried to link or copy a default kernel that had not been built to those clients, a message like this appeared:

```
WARNING: No default kernel exists. The client
will not be able to boot diskless without one.
```

Invoke the dms utility again and use the Modify Client Parameters option to link the appropriate clients to the kernels you rebuilt.

Management and Maintenance 4

This chapter describes how to manage and maintain the diskless environment and how to manage diskless clients. The instructions tell you how to perform the following tasks:

- Add a client.
- Boot a client.
- Modify a client.
- Remove a client.
- List a configuration.
- Read mail on a client.
- Customize a client's setup.
- Maintain the diskless server area.

4.1 Adding a Client

To add a client processor:

1. Log in and become the superuser. For example:

```
login: manager
password:
# su
password:
```

Enter your root password, which does not appear on the screen.

2. Type the following at the system prompt:

```
# /etc/dms
```

A message appears reminding you that all users who are going to access the diskless server area must be licensed to use that software. It then asks you to type your superuser password:

```
Licensing Message
```

```
·
·
·
```

```
To continue please enter the superuser password:
```

If you type an invalid superuser password, the dms utility returns you to the system prompt. If you type a valid superuser password, a message appears that explains what documentation you should read.

3. Select the Add Client Processor option by typing a:

DISKLESS MANAGEMENT SERVICES (DMS) UTILITY MENU

```
Configure Server Menu      => c
Add Client Processor       => a
Remove Client Processor    => r
Modify Client Parameters   => m
List Configurations Menu   => l
Exit                       => e
```

Enter your choice []: a

A message appears indicating that you have chosen to add a client processor. The message also supplies some additional information.

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

Enter the host name from the DMS Client Setup Worksheet. For example:

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

If you did not enter the client processor's host name in the /etc/hosts file, the dms utility displays an appropriate error message and repeats the prompt.

If the server is also a BIND server the name you enter must include the BIND server's domain name, for example:

tigris.dec.com

If the BIND server's domain name is not included, a message appears telling you how to specify the client's host name for BIND.

6. The next prompt asks you to type the hardware Ethernet address for the client. See the worksheet you filled out in Chapter 2 for the correct entry.

In this example, the system manager specifies the hardware Ethernet address for the client bergalt:

Enter the client processor's hardware Ethernet address, for example, 00-AE-F2-00-38-05 []: **08-00-2B-03-05-8B**

7. If more than one root?.vax directory has been installed in this diskless server area, a prompt appears asking you to select the name of the root?.vax directory to copy for this client's Cliname.root directory. Each of these root?.vax directories may contain different software subsets. If only one root?.vax area has been installed, the prompt does not appear and the existing root?.vax directory is assigned automatically.

If the prompt appears, enter the number corresponding to the root?.vax directory that you want. In this example, the system manager selects 1:

Select the root directory to copy for the client:

```
1      /var/diskless/dlenv0/root0.vax
2      /var/diskless/dlenv0/root1.vax
```

Enter your choice [1]: 1

8. A prompt asks you to select the name of the file system to contain that 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      /var/diskless/dlclient0
2      /var/diskless/dlclient1
```

Enter your choice [1]: 1

If a Cliname.root directory for the client already exists, you are asked if it should be overwritten.

A message appears saying that the client's root directory is being copied. The message also says that the copy might take up to 30 minutes to complete.

9. A prompt asks for the root password to be used on the client processor.

After you enter the password, a prompt asks you to enter the password again for confirmation.

10. A prompt asks you to choose the swap file location, which can be either on the client, if it has a disk available, or on the server.

Enter the number corresponding to your selection.

If the swap file location you chose is on the client processor, you must build a customized kernel so that the client can use its local disk as a swap device. See Section 4.7 for information about customizing clients.

11. If the swap file location chosen is on the server, a prompt asks you to select the name of the file system to contain the client's swap file.

Enter the number corresponding to the file system you want. In the following example, the system manager chose the default by pressing <RETURN>:

```
Select name of the file system to contain the swap file:
```

```
1      /var/diskless/dlclient0
2      /var/diskless/dlclient1
```

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

12. If the swap file location chosen is on the server, a prompt asks for the swap file size in 1/2-Mbyte increments. The recommended swap size is 20 Mbytes or twice the size of the client's main memory, whichever is greater.

Enter the number you want. In the example that follows, the system manager enters 40 for an 20-Mbyte swap file size:

```
Select the client's swap file size in 1/2-Mbyte increments.
for example, enter 32 for an 16-Mbyte swap file [17]: 40
```

A message appears saying that the client's swap file is being created.

13. A prompt asks whether you want the client to crash dump across the network. See the Guide to System Crash Recovery for a description of the crash dump process.

Enter the letter corresponding to your choice. In the example that follows, the system manager chooses a full dump for the client:

```
Do you want the client to dump across the network to tigris?
Enter n (no dump), f (full dump), or p (partial dump) [n]: f
```

If a partial dump is chosen, a prompt asks how much, in 1/2-Mbyte increments, to dump across the network. A full dump is approximately equal to client memory size.

14. A table appears listing possible processors and their graphics device types.

Enter the number corresponding to the client processor. In this example, the system manager chooses the VAXstation II/GPX by accepting the default:

Select the processor type for this client:

1	VAXstation II/GPX	color
2	VAXstation II/GPX (multi-station)	color
3	VAXstation II	monochrome
4	MicroVAX II	no graphics
5	VAXstation 2000	color
6	VAXstation 2000	monochrome
7	MicroVAX 2000	no graphics
8	VAXstation 3200/3500	color
9	VAXstation 3200/3500	monochrome
10	MicroVAX 3500/3600	no graphics
11	MicroVAX 3300/3400	no graphics
12	VAXstation 3100	color
13	VAXstation 3100	monochrome

Enter your selection [2]:

15. System information is displayed as files are created for the diskless client. If a default kernel corresponding to the processor type you selected has not been built, a message like this appears:

```
WARNING: No default kernel exists. The client
will not be able to boot diskless without one.
```

If the warning appears, you can either invoke the dms utility again and select the Rebuild Kernels option from the Configure Server Menu and build the appropriate default kernel, or you can give the client a customized kernel.

If the default kernel has already been built, a message like this appears:

The next question asks if you want this client linked to a default kernel.

It is recommended that you answer yes to save disk space.

If you answer no, each client gets a separate copy of a default kernel.

Answering no also allows the client to use a customized kernel.

Answer yes if the client will not use a customized kernel and if you want to save disk space. Answer no to give the client a copy of the default kernel. Choosing no also ensures that MOP is set up correctly, if you plan to have the client boot a customized kernel.

In the following example, the system manager accepts the default:

```
Link to a default kernel? (y/n) [y]:
```

16. A prompt asks if you want to add another client. If you type no, the dms utility returns you to the system prompt. In this example, the system manager decides to add more clients:

```
Do you want to add another client processor to the
directory (y/n)? [n]: y
```

The dms utility displays the prompts asking you to type the information required to register a client.

4.2 Booting a Client

A client is booted over the network from a diskless server.

If the client is a VAXstation 2000 or MicroVAX 2000 processor, the user types this command:

```
>>> b esa0
```

If the client is any other supported client processor, the user types this command:

```
>>> b xqa0
```

The first time a client boots successfully after being registered for a new or updated root?.vax area, installation verification scripts run on subsets that were installed. If the verification executes without error, the verification procedure is not repeated the next time the client is booted.

Once the client processor is booted, users access software in the diskless environment on the server as if that software were located on the diskless client processor.

4.2.1 Changing a Client's Boot Server

By default, a diskless client that is registered on multiple servers is booted from the first server to answer the MOP request for a downline load. If a client prefers to be booted from a particular server, the client can be removed from other servers, or the hardware Ethernet address of the client can be changed on all but the preferred server to disable MOP service. Changing the first two digits of the hardware Ethernet address to 00 in the client's registration causes MOP not to acknowledge the request for downline load when that client boots.

You can use the modify option of the dms utility to change the hardware Ethernet address. You can also use the address command to change the

hardware Ethernet address. Refer to `addnode(8)` in the *ULTRIX Reference Pages*.

In the sample procedure that follows, the client, `bergalt`, which is registered on the servers `wizard` and `tigris`, prefers to boot from `wizard`. The system manager on the server `tigris` logs in as `superuser`, then changes the hardware Ethernet address of `bergalt` using the `addnode` command, as follows:

```
# addnode bergalt -h 00-00-2b-02-f3-06
```

After disabling MOP service for `bergalt` by changing the hardware Ethernet address on `tigris`, `bergalt` can reboot from `wizard`.

4.3 Modifying a Client

The procedure for modifying a client processor's registration information is like the procedure for adding a client processor. See the *DMS Client Setup Worksheet* for a list of the registration information you can modify.

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.

A summary of the procedure for modifying a client follows:

1. Invoke the `dms` utility and select the `Modify Client Processor` option by typing `m`:

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

```
Configure Server Menu      => c
Add Client Processor       => a
Remove Client Processor    => r
Modify Client Parameters   => m
List Configurations Menu  => l
Exit                       => e
```

```
Enter your choice: m
```

A message appears indicating that you have chosen to modify a client processor. The message also supplies some additional information.

2. A prompt asks you to enter the host name of the client to be modified. In this example, the client is `bergalt`.

```
Enter the name of the client to be modified: bergalt
```

3. The next prompt asks you to type the hardware Ethernet address for the client.

4. If there is more than one choice, a prompt asks you to select the name of the file system to copy for the client's `Clipname` root

5. A prompt asks you to select from a list the name of the directory to contain the the client's `Clname.root` directory.

If you change the name of the directory, a prompt appears asking if you want to remove the client's `Clname.root` directory from the old directory.

6. If a new `Clname.root` directory was selected, a prompt asks for the root password for the client processor. After you type the password, a prompt asks you to type the password again for confirmation.
7. A prompt asks for the swap file system location. If the swap file is located on the server, prompts ask for the name of the directory to contain the swap file and the swap file size in 1/2-Mbyte increments. If you change the swap file size or location, the software recreates the swap file.
8. A prompt asks whether the client can crash dump across the network.
9. A prompt asks you to select the client's processor type.
10. A message appears about linking the client to a default kernel rather than giving the client a separate copy of the kernel, followed by a prompt like this:

```
Link to a default kernel? (y/n) [y]:
```

After you type your answer to the last prompt, the client modification is complete. The system prompt appears.

4.4 Removing a Client

To remove a client:

1. Log in and become the superuser. For example:

```
login: manager
password:
# su
password:
```

Enter your root password, which does not appear on the screen.

2. Type the following at the system prompt:

```
# /etc/dms
```

A message appears reminding you that all users who are going to access the diskless server area must be licensed to use that software. It then asks you to type your superuser password:

```
Licensing Message
```

```
To continue please enter the superuser password:
```

If you type an invalid superuser password, the dms utility returns you to the system prompt. If you type a valid superuser password, a message appears that explains what documentation you should read.

3. Select the Remove Client Processor option by typing r:

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

```
Configure Server Menu    => c
Add Client Processor     => a
Remove Client Processor  => r
Modify Client Parameters => m
List Configurations Menu => l
Exit                     => e
```

```
Enter your choice: r
```

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

4. A prompt appears asking you to specify the name of the client that you want to remove. In the following example, the system manager removes the client called profundo:

```
You have chosen to remove a diskless client. This will
remove the client's root directory and swap file.
```

```
Enter the host name of the client processor to be removed:
profundo
```

If you type an invalid name, an appropriate error message appears, and the prompt repeats.

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

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

When you type y to confirm your choice, the dms utility deletes that client's Clname.root directory and swap file, removes its entries from /etc/exports, and removes the client from the MOP database. When removal is complete, a message like this appears, followed by the

4.5 Listing Configurations

You can use the List Configurations Menu to see the registered clients for a common root?.vax area or the current configuration for an individual client. Select the dms option, List Configurations Menu, by typing l. A menu like this appears:

```
List Configurations Menu
```

1. List by Environment
2. List a Client
3. Exit

```
Enter your choice:
```

If you choose option 1, a table listing diskless server area pathnames appears. The display is similar to this:

```
Possible Environments:
```

- 1 /var/diskless/dlenv0/root0.vax
- 2 /var/diskless/dlenv0/root1.vax

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

Enter the number corresponding to the pathname of the environment you want, and a list of clients served from that diskless server area is displayed. If no diskless clients are registered for that environment, the word none appears. The List Configurations Menu reappears.

In the example that follows, the system manager selects the List a Client option, and a display like this appears:

```
Registered Clients:
```

```
bergalt  
erlang  
maestro  
notturmo  
profundo
```

```
Enter the client's host name:
```

If there are no registered clients, the message No registered clients appears. The system manager selects bergalt, and a display like this appears:

```
Copied root area:          /var/diskless/dlenv0/root1.vax
bergalt's root and usr area: /var/diskless/dlclient0/bergalt.root
                             /var/diskless/dlenv0/root1.vax/usr
Swap file:                 /var/diskless/dlclient0/bergalt.swap
Swap file size:           12.0 Meg
Kernel Type:              SESMVAX
                             kernel is not linked
Ethernet Address:         08-00-2f-03-f5-08
Internet Address:        (128.45.40.22)
Full crash dumping
```

You can continue listing configurations, or enter 3 to exit.

4.6 Reading Mail on a Client

This section describes two methods for setting up a diskless client to read electronic mail on a 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 bergalt, and the server processor is named tigris.

4.6.1 Reading Mail from a Diskless Client with Multiple Users

If the diskless client has multiple users logging in, the recommended method is to have all mail forwarded to the server machine. The users on the client use the rlogin command to log in to the server to read their mail.

This method requires no change on the server and minor changes on the client.

Each user on the client machine creates a file to contain the forwarded mail. For example:

```
bergalt:/usr/spool/mail/rjones.forward
```

The contents of the file look like this:

```
rjones@tigris
```

When users on the client processor want to read their mail, which is located on the server, they use the rlogin command. For example, rjones types commands like these from bergalt:

```
$ rlogin tigris
```

```
% mail
```

4.6.2 Reading Mail from a Diskless Client with a Single User

If the diskless 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 at the server machine:

1. Become the superuser.
2. Create a directory with a pathname like the following:
/usr/spool/mail/\$USER. This directory will contain the user's mail messages. For example:

```
# mkdir /usr/spool/mail/rjones
```

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

```
/usr/spool/mail/rjones bergalt
```

Follow this procedure at the client machine:

1. Become the superuser.
2. Remotely mount the mail directory, /usr/spool/mail/\$USER. For example:

```
$ mount tigris:/usr/spool/mail/rjones /usr/spool/mail/rjones
```

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

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

4. Set the MAIL environment variable in the user's file to /usr/spool/mail/\$USER/\$USER. For example: rjones would add a line like this:

```
setenv MAIL /usr/spool/mail/rjones/rjones
```

The user types a command like this to read mail:

```
$ mail
```


4.7 Customizing a Client's Setup

This section describes how to customize a diskless client's setup. The instructions tell you how to perform the following tasks:

- Customize kernels.
- Share a customized kernel.
- Set up clients' remote home directories.

4.7.1 Customizing Kernels

Customized kernels can be created either by the system manager on the server or by a user on a client processor. This section gives instructions for creating a customized kernel at each location.

4.7.1.1 Customizing a Client's Kernel on the Server Processor - The system manager on the server can create customized configuration files and build kernels for clients. Customized kernels let clients boot their systems using their own kernels.

If you plan to have a client boot a customized kernel, indicate that you do not want to link to a default kernel when you use the `dms` options, `Add a Client` or `Modify a Client`. Then, be sure to put a copy of the customized kernel in the client's root area.

When you install a software product that builds kernels into a common `root?.vax` area, you are asked if you want to copy a new kernel for each client. Answer no for clients with customized kernels so that their kernels are not overwritten.

Become the superuser on an inactive server to perform the procedure for customizing a kernel. The client processor should be shut down.

Make appropriate entries in the client's configuration file and build a kernel from the edited file. Refer to the *Guide to System Configuration File Maintenance* for information about the default configuration file and manually building a kernel.

You must also create the correct device special files in the client's `/dev` directory, using the `MAKEDEV` script. See `MAKEDEV(8)` in the *ULTRIX Reference Pages* for more information.

The following example shows the procedure for customizing a kernel for a client called `bergalt`, a VAXstation II/GPX with a disk, which chooses to locate the swap area on its local disk. The system manager on the server would follow these steps to provide an edited configuration file and build a customized kernel:

1. Change to the directory where the default configuration files are located:

```
# cd /var/diskless/dlenv0/root0.vax/usr/sys/conf
```

2. Copy the default configuration file for a VAXstation II/GPX to a file with a different name, for example, myown.conf:

```
# cp QEQDVAX.dlconf myown.conf
```

3. Locate the line in the file, myown.conf, that specifies the kernel image. The line in the default configuration for the VAXstation II/GPX looks like this:

```
config vmunix root on qe0
```

4. Edit the line for the customized configuration to specify the swap device at the new location on the client's disk. The swap device corresponds to the disk to which you want to swap. On a VAXstation II/GPX, this is rd0b in the normal configuration.

The line in myown.conf looks like this after editing:

```
config vmunix root on qe0 swap on ra0b
```

5. Locate the section of myown.conf that contains controller specifications. Controller specifications are described in the Guide to System Configuration File Maintenance:

```
adapter uba0 at nexus ?
device qe0 at uba0 csr 0174440 vector qeintr
device qd0 at uba0 csr 0177400 flags 0x0f vector qddint qdaint qdi
int
```

6. Add lines like these to the controller specification section:

```
controller uda0 at uba0
controller uq0 at uda0 csr 0172150 vector uqintr
disk ra0 at uq0 drive 0
```

```
scs_sysid 1
```

The controller specification section of myown.conf looks like this after editing:

```
adapter    uba0    at nexus ?
device     qe0     at uba0 csr 0174440          vector qeintr
device     qd0     at uba0 csr 0177400 flags 0x0f vector qddint qdaint qdi
int
controller uda0    at uba0
controller uq0    at uda0 csr 0172150 vector uqintr
disk       ra0     at uq0  drive 0

scs_sysid  1
```

7. Build the new kernel from myown.conf, following the procedure for manually building kernels described in the Guide to System Configuration File Maintenance.
8. Run dms, choosing either the Add Client Processor option for a new client or the Modify Client Processor option, if the client is already registered. When the prompt appears for you to choose the swap file location, enter 0 to indicate the swap file is to be located on the client.
9. When the prompt appears for you to choose whether to link the client to a default kernel, choose not to link to a default kernel. A copy of a default kernel is given to the client. A copy of the default kernel is needed for proper setup of the MOP database, and is overwritten by the customized kernel later in this procedure.
10. Change to the directory where the kernel files are located. For example,

```
# cd /var/diskless/dlenv0/root0.vax/usr/sys
```

11. Copy the kernel built from myown.conf to the client's Cliname.root directory, giving the file an appropriate name. For example,
12. Use the MAKEDEV script to create a device special file for the swap device, ra0, in the client's Cliname.root directory on the server. For example:

```
# cd /var/diskless/dlclient0/bergalt.root/dev
# MAKEDEV ra0
```

The kernel built from myown.conf specifies that bergalt's swap file is located on its local disk.

The client bergalt can now be booted

4.7.1.2 Customizing a Client's Kernel on the Client Processor – This procedure lets a client create a customized kernel on the client machine. The following requirements must be met before a customized kernel can be created on a client machine:

- There must be 6-10 Mbytes free in the client's root directory
- The client must have been set up with a copy of the default kernel rather than a link.

Follow this procedure to create a customized kernel at the client processor:

1. Become the superuser.
2. Remove the /sys directory, using a command like the following:

```
# rm /sys
```
3. Create a new /sys directory, using a command like the following:

```
# mkdir /sys
```
4. Change to the directory, /usr/sys, where the binary kernel images are located, using a command like the following:

```
# cd /usr/sys
```
5. Use the tar command to copy the binary kernel images to the new /sys directory, using a command like the following:

```
# tar cf - [a-z]* BINARY.vax |(cd /sys; tar xvpf - )
```

Change to the directory, /sys/conf, where the configuration files are located, using a command like the following:

```
# cd /sys/conf
```
6. Create a configuration file, for example, CUSTOM, following the manual procedure described in the Guide to System Configuration File Maintenance.
7. Change to the /sys directory, using a command like the following:

```
# cd ..
```
8. Create a directory with the same name as the configuration file, for example:

```
# mkdir CUSTOM
```

9. Change back to the directory containing the configuration files, using a command like this:

```
# cd conf
```

10. Build the new kernel, using a command like the following:

```
# config CUSTOM
```

Change to the directory you created with the same name as the configuration file. For example:

```
# cd ../CUSTOM
```

11. Use the `make` command to build the kernel. Start the procedure using a command like this:

```
# make depend
```

Complete the `make` operation and direct the output to the `makelog` file, using a command like the following:

```
# make >& makelog &
```

12. Check the `makelog` file for error messages. If `make` executes successfully, type a series of commands like the following to save the old kernel and to try to boot the new kernel:

```
# cp /vmunix /vmunix.sav  
# cp vmunix /vmunix  
# /etc/reboot
```

If the new kernel does not boot (for example, because a panic occurs) ask the system manager on the server to copy `vmunix.sav` from your `root` area in the `dlclient?` file system to give you a valid kernel from which to boot. For example, if you were client `bergalt`, the system manager would use commands like the following:

```
# cd /var/diskless/dlclient0/bergalt.root  
# cp vmunix.sav vmunix
```

4.7.2 Sharing a Customized Kernel

You may want several diskless clients to use the same customized kernel. For example, several diskless clients that have disks may want to access their local disks.

When you register the clients that will share the customized kernel, link each of them to the same default kernel.

Follow this procedure to let clients share a customized kernel:

1. Become the superuser.
2. Change to the directory where the kernel files are located:

```
# cd /var/diskless/dlenv0/root0.vax/usr/sys
```
3. Create a directory in which to build the kernel. For example:

```
# mkdir CUSTOM
```
4. Create the customized configuration file and build the kernel according to the instructions in Section 4.7.1.1.
5. Change to each client's root area in turn. Remove the client's link to the default kernel, then link the client to the customized kernel. For example:

```
# cd /var/diskless/dlclient0/bergalt.root
# rm vmunix
# ln -s /usr/sys/CUSTOM/vmunix vmunix
```

6. Use the `addnode` command to change each client's secondary load file entry for proper booting. Refer to `addnode(8)` in the *ULTRIX Reference Pages*.

For example, a command like this changes the entry for the client `bergalt`:

```
# /etc/addnode bergalt -t /var/diskless/dlenv0/root0.vax/usr/sys
/CUSTOM/vmunix
```

Note

If you run the `dms` utility option `Modify Client Parameters` on a client after performing this procedure, the secondary load file entry is changed back to the default kernel for the client's processor type. If you run the `dms` utility `List Configuration Menu List by Environment` option on the client, there is no distinction shown between a client linked to a default kernel and a client linked to a shared kernel.

4.7.3 Setting Up Clients' Remote Home Directories

If you do not set up a default `fstab` file to be copied for clients to mount a log-in directory like `/usr/users`, you may have to set up each client's home directory to be exported from the server to the client processor. Part of the procedure is performed on the server and part on the client processor.

In the sample procedure that follows, the home directory is set up for a user named `rjones` who is in the development group, `devo`, on the client processor, `bergalt`. The server is called `tigris`.

The system manager on the server performs the following step:

1. Adds a line in the `/etc/exports` file that exports `rjones`'s directory, `home`, from `tigris` to the diskless client, `bergalt`.

The line looks like this:

```
/home/tigris/devo/rjones      bergalt
```

The user, `rjones`, performs the following steps on the diskless client processor:

1. Creates a home directory structure with the following order:

```
/home/machine/group/user.
```

The pathname for user `rjones` looks like this:

```
/home/tigris/devo/rjones
```

2. Adds a line like the following to the `/etc/fstab` file on `bergalt`, specifying the home directory:

```
/home/tigris/devo/rjones@tigris:/home/tigris/devo/rjones:rw:0:0:nfs::
```

3. Edits the `/etc/passwd` file on `bergalt`, to change the path of the home directory. See the Guide to System Environment Setup for information about editing the `/etc/passwd` file.

The edited `/etc/passwd` file entry for `rjones` looks like this:

```
rjones:v20BEwF1TWCPk:329:10:R Jones:/home/tigris/devo/rjones
```

Now, the home directory on `tigris` is accessed each time `rjones` logs on to `bergalt`.

4.8 Maintaining the Diskless Environment

This section contains information about maintaining the diskless server area.

4.8.1 Controlling Root File System Growth

Use the `df` command to show how much space clients are using. This helps you keep track of the file growth in each client's root directory. If clients use too much space, performance is adversely affected. See `df(1)`

4.8.2 Listing Installed Software Subsets

Use the `setld` command to find out which software subsets are installed into a particular `root?.vax` area.

For example, this command produces a list of the software subsets that have been installed into the common `root0.vax` area of `dlenv0`:

```
# setld /var/diskless/dlenv0/root0.vax -i
```

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

4.8.3 Removing Subsets

You can also use the `setld` command to remove software subsets from a common `root?.vax` area.

For example, if you had installed the Bisynchronous Communications subset, `ULTBSC030`, and wanted to remove it, you would use a command like this:

```
# setld /var/diskless/dlenv0/root0.vax -d ULTBSC030
```

The subset may not be fully removed from the `root` areas of any clients that have already been given copies of `root0.vax` if the subset placed files in the propagated `root` area of the `root0.vax` directory.

Troubleshooting 5

This chapter contains suggestions on which areas of the server to check if a client is having trouble booting the system and a description of the sequence of events that occur when a diskless client crashes.

5.1 Server Areas to Check for Client Booting Problems

This section contains suggestions for areas on the server processor which should be checked if a diskless client has trouble booting its system.

- Examine the recent entries in the file, `/usr/spool/mqueue/syslog`. This file should contain the sequence of MOP transmissions and specify any problems that occurred in the process. For example, MOP might have been unable to find the file, `netload.sys`. If this file does not exist in `/usr/lib/dnet`, then copy it from `/usr/mdec/netload` and make the file executable using commands like these:

```
# cp /usr/mdec/netload /usr/lib/dnet/netload.sys
# chmod 755 /usr/lib/dnet/netload.sys
```
- If a client crashes while booting with a message, `panic mountpc: cannot NFS mount file`, check to make sure that the `mountd` daemon is running on the server and that the client's directories are properly exported in the file, `/etc/exports`.
- If the client only boots to single-user mode, check to make sure that the client's `/usr` file system is exported and that the `dlclient?` area has an entry in the `/etc/exports` file.

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

```
/var/diskless/dlenv -n -o -r=0 nobody
/var/diskless/dlclient -n -r=0 nobody
/var/diskless/dlenv0/root0.vax/usr bergalt
/var/diskless/dlclient0/bergalt.root bergalt
/var/diskless/dlclient0/bergalt.swap bergalt
```

- Use the `getnode` command to identify the pathname of the kernel that the client was trying to boot. Refer to `getnode(8)` in the *ULTRIX Reference Pages*.

- Check the client's `/etc/ttyS` file for an entry to start a windowing environment for processors with graphics monitors. Make sure device special files have been made in the client's `/dev` directory using the `MAKEDEV` command. For example, client `bergalt`, a VAXstation II/GPX, would have the device special file `ttyv0` in `/var/diskless/dlclient1/bergalt.root` to start the windowing environment.

5.2 Client Crash Description

When a client set up by the `dms` utility for either a full or a partial crash dump of memory over the network crashes, the following events occur:

1. The client processor tries to dump the contents of its memory to the server using the maintenance operations protocol, MOP.
2. A message like this appears on the client:

```
Network Dumping ...
```

3. A core dump file is generated. This file is located in the directory, `/var/adm/crash/vmcore`, on the client. The MOP dumping procedure may take several minutes to complete, depending on how much traffic there is on the network.
4. Once the contents of the client's memory have been dumped, the client automatically reboots, using its default boot setting. See the hardware documentation for information about setting this parameter.
5. The default `/etc/rc.local` file on the client contains a line that calls the program, `/etc/savecore`, which transforms the `vmcore` image into a format that can be processed using the `adb` debugging program.
6. The `vmunix` image is copied from the `/` 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, two files, `vmunix.*` and `vmcore.*`, are added to the directory specified. 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.

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1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the data remains reliable and secure throughout its lifecycle.

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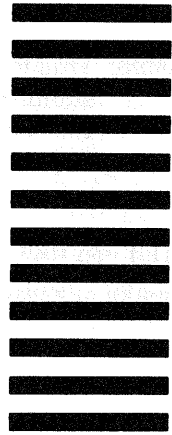


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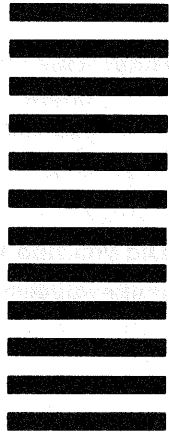


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