

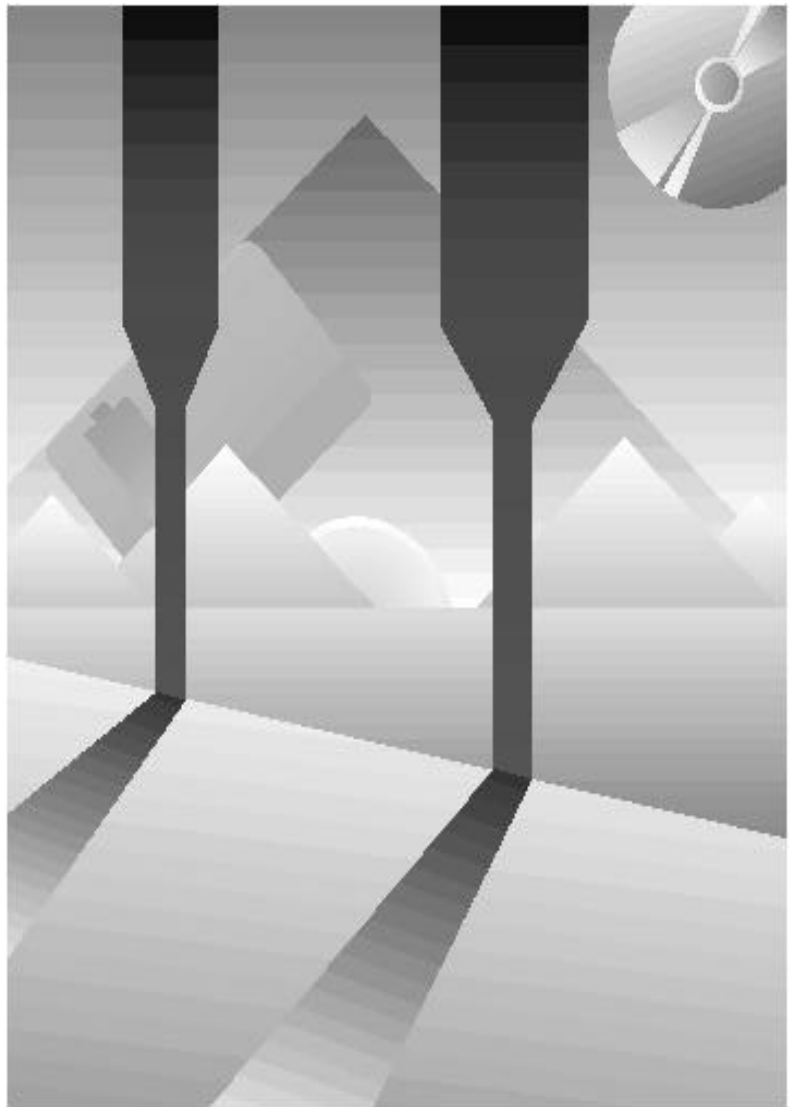
COMPAQ

NetWare Tape Backup Management Using ARCserve from Compaq

Compaq TechNote

Includes information on:

- Configuring supported Compaq tape drive subsystems
- Installing ARCserve from Compaq
- Establishing a tape backup management plan
- Optimizing tape backup performance



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COMPAQ TECHNOTE FOR NETWARE
NETWARE TAPE BACKUP MANAGEMENT USING
ARCSERVE FROM COMPAQ

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Chapter 1

INTRODUCTION

Storage management is key to a successful network implementation. Performing regular tape backups is only part of storage management. Data loss can be catastrophic in most environments, resulting in the loss of days or weeks of productivity. A good storage management strategy can reduce the amount of lost productivity due to hardware or software failure. Most network administrators establish a storage management strategy that includes the following:

- Completing an evaluation of the network and data to be backed up, and developing a risk assessment based on the nature of the data and the amount of risk incurred by data loss.
- Establishing a tape backup plan, including the frequency of backups, the amount of data to be backed up, and a backup schedule for each server.
- Organizing network directory structures and defining a disk management plan.
- Establishing a data restoration procedure.

Tape backup software is key to effective storage management. Tape backup software that can provide storage management services as well as perform tape backups (attended and unattended) can reduce the enormity of the management task. ARCserve from Compaq is storage management software that provides fully automated tape backup services for NetWare-based networks. It includes a variety of management services, including disk grooming, Auto Pilot tape rotation, and Quick Recover.

ABOUT THIS COMPAQ TECHNOTE

This COMPAQ TechNote for NetWare discusses configuration of COMPAQ tape drive subsystems and installation and use of ARCserve from Compaq in a NetWare environment. It is for system integrators and network administrators who are familiar with COMPAQ PC Servers and NetWare v3.1x. The chapters in this COMPAQ TechNote contain the following information:

- **Chapter 1** - ARCserve from Compaq software description, including tape software architecture and features.
- **Chapter 2** - Tape drive configuration for the COMPAQ 5.0-Gigabyte Digital Audio Tape (DAT) Drive and the COMPAQ 525-Megabyte Advanced Common Architecture (ACA) Tape Drive.
- **Chapter 3** - ARCserve tape software installation, including installation of ASPI support.
- **Chapter 4** - Storage management recommendations.
- **Chapter 5** - Performance considerations.
- **Chapter 6** - Example tape backup plan.
- **Appendix** - Configuration of other supported COMPAQ tape drives.



IMPORTANT: This COMPAQ TechNote focuses on specific installation guidelines for ARCserve 4.0 from Compaq and supported COMPAQ tape drive subsystems. Configuration of third-party tape drive subsystems or other versions of Cheyenne ARCserve is not within the scope of this COMPAQ TechNote.



ARCSERVE TAPE SOFTWARE ARCHITECTURE

ARCserve 4.0 from Compaq, by Cheyenne Software, Inc., is a centralized NetWare v3.1x-compatible client-server tape backup utility. It includes NetWare Loadable Modules (NLMs) for servers and client agents for workstations. The user-version of ARCserve that you need for your network is based on the user-version of NetWare installed on your network.

NOTE: ARCserve is also NetWare System Fault Tolerance III (SFT III) compatible.

ARCserve provides a centralized backup system, where the administrator performs network backups to a tape backup server. This tape backup server can be a network server configured with a tape drive or a dedicated tape backup server with multiple tape drives that back up the entire network. Most network servers have enough bandwidth to function as tape backup servers, allowing you to use the resources available on the network for backup. These servers perform daily network services, and during off-peak hours or when necessary, perform network backup services.

ARCserve supports the following COMPAQ tape drives for NetWare client-server tape backup:

- COMPAQ 5.0-Gigabyte DAT Drive
- COMPAQ 525-Megabyte ACA Tape Drive
- COMPAQ 1.3-/2.0-Gigabyte DAT Drive
- COMPAQ 320-/525-Megabyte Tape Drive

ARCserve is a backup solution based on the client-server model, where the client workstation requests or schedules backups and the server performs them. ARCserve uses a management workstation to control all backup and restore operations. You can use any available, secure workstation as the management workstation.

ARCserve consists of the following software modules:

- ARCserve Manager
- ARCserve Server
- Workstation Agents (MS-DOS, Microsoft Windows, OS/2)

NOTE: Macintosh agents and UNIX agents are available separately.

- ARCserve Tape Driver

Figure 1-1 illustrates the ARCserve software architecture.

ARCserve Server runs on the network server and performs the backup and archiving operations. It also allows you to perform tape-related functions such as format, erase, re-tension, and test.

Workstation agents, TSR programs that run on MS-DOS, OS/2, Windows, UNIX, and Macintosh workstations, allow users to back up, restore, and archive without requiring the individual workstation to be logged into the server.

The ARCserve Tape Driver controls the operation of the tape drive installed in the tape backup server. ARCserve is hardware independent and supports industry-standard tape drives with QIC-02 or SCSI interfaces.

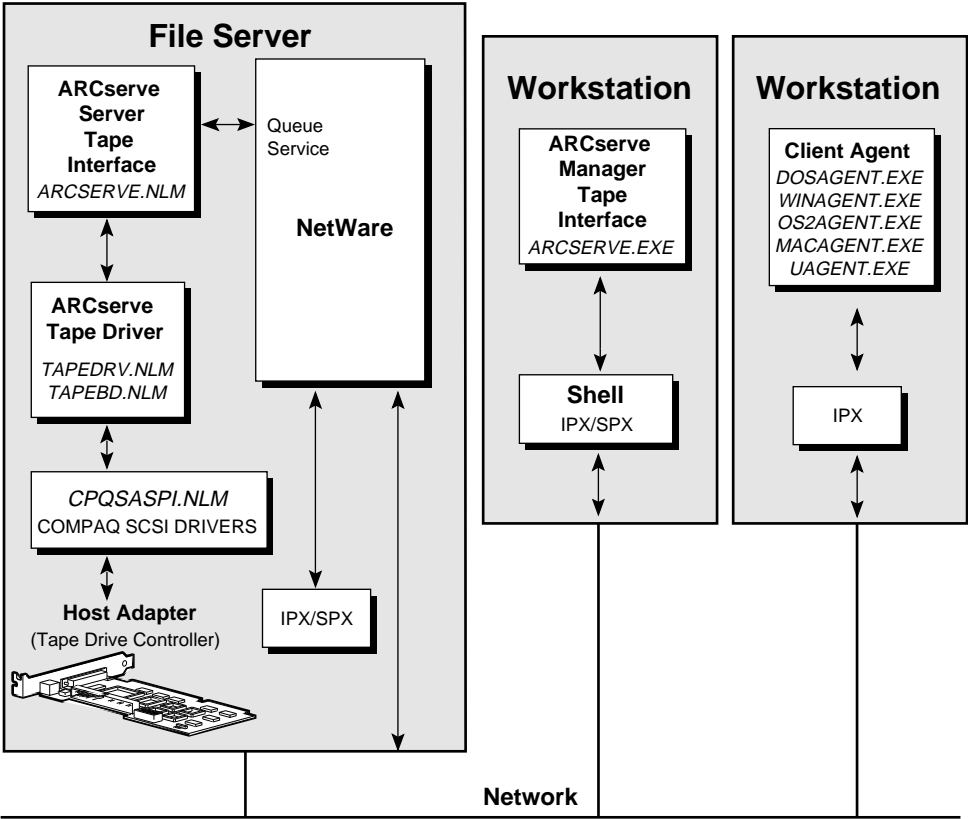


Figure 1-1. ARCserve Software Architecture

ARCSERVE 4.0 FROM COMPAQ DESCRIPTION

ARCserve 4.0 from Compaq provides all the functionality of Cheyenne ARCserve 4.0 with added features such as customized installation for COMPAQ tape drive subsystems and a Short Erase option that erases the beginning of the tape so that you can erase used tapes within seconds, rather than hours. Using ARCserve from Compaq, you can also enable data compression on the tape drive, and enable and disable data compression from within ARCserve. ARCserve software features and these additional ARCserve from Compaq features are described in the following paragraphs.

ARCserve Features

ARCserve allows you to perform scheduled backups and archives, as well as complete and selective restores, on all network servers and workstations. ARCserve storage management software includes the following:

- Auto Pilot data management system
- Backup methods
- Queue management

AUTO PILOT

The Auto Pilot data management system automatically provides for all the considerations that the system administrator must address during backups. Auto Pilot provides the following:

- Tape rotation and notification for permanent tapes
- Disk grooming
- Daily logs
- Disaster recovery
- Tapes-required-per-year calculation



Auto Pilot schedules tape rotation using the grandparent/parent/child scheme. This scheme is based on daily backups with full weekly backups, full monthly backups, and a full yearly backup. You can skip days, such as weekends. If you are performing full daily backups, then the last full daily backup (for example, the Friday backup) becomes the full weekly backup. If you are performing differential or incremental daily backups, then you can perform a full weekly backup. The last full weekly backup of the month becomes the monthly backup. At year-end, the last full monthly backup becomes the yearly backup. Auto Pilot identifies the tapes to reuse and the tapes to store off site.

Disk grooming on the server is an optional process in which Auto Pilot removes dormant files after a certain number of copies of these files exist on permanent tapes. You can specify the period of time and the number of copies to make of the files. You can also exclude specific files and directories from the grooming process.

Auto Pilot provides daily logs that help you manage backup data. Daily logs provide tape label information, such as

- Tape name and backup type.
- Server on which you performed the backup.
- Tapes you need for the next backup, new tapes you need, and tapes you should reuse.
- Next backup start time.
- Information on the data you backed up to tape and the backups you missed.

Auto Pilot assists you in recovery from system failure through the use of the ARCserve Quick Recover feature. Quick Recover identifies the tapes you need to restore the server or workstation to the desired state.

Depending on the backup method you choose and the frequency of your backups, Auto Pilot calculates the number of tapes, assuming one tape per backup, required for a full year, including recycled and permanent tapes. If you need more than one tape for per backup, use the following formula for the total number of tapes required.

Tapes per backup x tapes needed for one year = total tapes required

BACKUP METHODS

ARCserve provides several methods of backup. These backup methods differ in the amount of data included in the backup, and consequently in the amount of time required to complete the backup. You can perform backups using the Auto Pilot feature of ARCserve or from the ARCserve Main menu.

Regardless of which feature of ARCserve you use to perform backups, perform full or complete backups on a weekly basis, combined with differential or incremental backups on a daily basis to protect data. In some environments, perform a full weekly backup, schedule certain volumes for daily full backups, and perform incremental or differential daily backups for the other volumes.

NOTE: Chapter 4 of this COMPAQ TechNote provides detailed information on backup planning and management.

If you schedule and perform backups from Auto Pilot, it provides the following backup options:

- **Full backup** - Complete backup of all files regardless of time stamp or archive bit. The advantage of a full backup is that a full restore requires only a single set of backup tapes. However, sometimes it is difficult to back up a large amount of data with a limited backup capacity or in a limited amount of time.
- **Differential backup based on the archive bit** - Backup of all files that have the archive bit set to 1. Full backups reset the archive bit of each volume or hard drive to 0. To restore data, use the last full backup and the latest differential backup.
- **Differential backup based on modified date** - Backup of all files that have been modified since the last full backup. As the amount of time between differential backups and the last full backup increases, the differential backup grows to the almost the same size as the full backup. To restore data, use the last full backup and the latest differential backup.



- **Incremental backup based on archive bit** - Backup of files that have the archive bit set to 1. To perform incremental backups based on the archive bit, select *Yes* at the Reset Archive Bit option when building backup script files. ARCserve backs up files if the archive bit has been set to 1 since the last backup (full, differential, or incremental). Since the archive bit resets to 0 after each backup, ARCserve backs up only changed files, requiring less time to back up the files. To restore data, use the full backup first and each incremental backup since the last full backup in chronological order.

If you do not use Auto Pilot and perform backups from the ARCserve Main menu, the menu provides four methods of backup:

- **Complete backup** - Backup of all files regardless of time stamp or archive bit. Full backups only require a single set of backup tapes to restore data to the server, but limited backup capacity or limited time may prohibit full daily backups.
- **Incremental backup based on file access date** - Backup of files that have not been accessed since the threshold date. The threshold date must be specified. These files need not be modified to be backed up to tape.
- **Incremental backup based on time stamp** - Backup of all files with a time stamp later than the threshold date. The threshold date must be specified.
- **Incremental backup based on archive bit** - Backup of files that have the archive bit set to 1. To perform incremental backups based on the archive bit, you must select *Yes* at the Reset Archive Bit option when building the backup script files. The archive bit resets to 0 after each backup.

QUEUE MANAGEMENT

ARCserve makes use of NetWare security features. System administrators with supervisor-level access can:

- Set up and administer backup queues.
- Assign operators and users for each queue.



- Activate and deactivate the ARCserve server.
- Set up and use the Auto Pilot feature to perform network backup queues.

Each backup server can have up to 8 queues, and each queue can have up to 250 backup jobs scheduled. You can assign a priority level (1 to 8, with 1 being the highest priority) to each queue. The backup server scans queues with higher priorities more often than queues with lower priorities. The order of jobs within the queue is defined by the execution time/date and the submission time/date. ARCserve creates two priority-1 queues during installation, AUTO_PILOT and CHEY_A_Q.

Queue operators can manage their assigned queues by submitting and deleting jobs, modifying jobs and putting jobs on hold, and changing the execution order of jobs. Queue users can manage their own jobs by submitting and deleting their own jobs, modifying their jobs or putting them on hold, and rescheduling their own jobs.

Added Features for ARCserve 4.0 from Compaq

ARCserve 4.0 from Compaq includes the following *additional* features for easy installation:

- Customized *TAPEDRV.NLM* that scans the server at startup for tape drives on the SCSI bus and assigns a host bus number to the SCSI bus with the tape drive. ARCserve requires that tape drives reside on a SCSI bus with the host bus number defined.



IMPORTANT: If your server includes multiple tape drives, these tape drives must reside on the same SCSI bus.

-
- Customized "picklist" of supported COMPAQ tape drive subsystems. During installation, the ARCserve from Compaq Installation screen lists supported SCSI controllers and provides you with three options.
 - COMPAQ ASPI SCSI Manager for:
 - COMPAQ 32-Bit Fast-SCSI-2 Controller
 - COMPAQ Integrated 32-Bit Fast-SCSI-2 Controller
 - COMPAQ Integrated SCSI-2 Options Port
 - COMPAQ SCSI Option Adapter
 - COMPAQ SCSI Compression Adapter
 - Short Erase feature that allows you to erase the beginning of the tape, so the tape appears "blank" to the software. Short erases take only a few seconds, but long erases may take hours.
 - Disable data compression on the COMPAQ 5.0-Gigabyte DAT Drive from within ARCserve. You can enable data compression on the tape drive, and disable and enable data compression from ARCserve. This provides for data interchange between compression and non-compression DAT drives.



IMPORTANT: ARCserve from Compaq does not allow compressed and non-compressed data on a single tape. For more information, refer to "Configuring ARCserve Options" in Chapter 3.

- Support for the following third-party tape drives:
 - Exabyte 8200 2.2-Gigabyte (8 millimeter) Tape Drive
 - Exabyte 8500 5.0-Gigabyte (8 millimeter) Tape Drive
 - Cipher Sierra Half-Inch Tape Drive
 - Archive Anaconda 1.35-Gigabyte QIC Tape Drive

ARCserve from Compaq provides easy installation and effective tape backup management for your network servers. However, using the software is only part of a complete storage management strategy. The following chapters discuss tape drive configuration, ARCserve installation and configuration, storage management, and performance optimization.



Chapter 2

CONFIGURING THE HARDWARE

ARCserve from Compaq supports the following COMPAQ tape drive subsystems:

- 5.0-Gigabyte DAT Drive
- 525-Megabyte ACA Tape Drive
- 1.3-/2.0-Gigabyte DAT Drive
- 320-/525-Megabyte Tape Drive

This chapter discusses configuration of the 5.0-Gigabyte DAT Drive and the 525-Megabyte ACA Tape Drive. Configuration requirements and procedures depend on which COMPAQ PC Server you configure and which tape drive subsystem you use.

NOTE: To configure the 1.3-/2.0-Gigabyte DAT Drive subsystem or the 320-/525-Megabyte Tape Drive subsystem, refer to the Appendix.



IMPORTANT: The 525-Megabyte ACA Tape Drive and the 5.0-Gigabyte DAT Drive can also be configured with the SCSI Option Adapter and the SCSI Compression Adapter; however, these configurations have not been extensively tested.

Use Table 2-1 to determine the appropriate hardware for your server tape drive subsystem. For supported third-party tape drives, refer to the documentation that ships with the tape drive.

Table 2-1
Recommended COMPAQ Tape Drive Subsystems

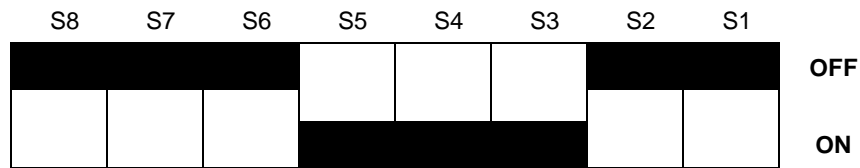
COMPAQ PC Server	Supported Tape Drives	
	525-MB ACA Tape Drive	5.0-GB DAT Drive
ProSignia	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board
SYSTEMPRO/XL	Integrated SCSI-2 Options Port or Fast-SCSI-2 Controller Board	Integrated SCSI-2 Options Port or Fast-SCSI-2 Controller Board
SYSTEMPRO/LT	Fast-SCSI-2 Controller Board	Fast-SCSI-2 Controller Board
Enhanced SYSTEMPRO	Fast-SCSI-2 Controller Board	Fast-SCSI-2 Controller Board
SYSTEMPRO	Fast-SCSI-2 Controller Board	Fast-SCSI-2 Controller Board

NOTE: The COMPAQ 6260 SCSI-2 Controller is not supported in a NetWare environment.

CONFIGURING THE 5.0-GIGABYTE DAT DRIVE

The 5.0-Gigabyte DAT Drive supports industry-standard Digital Data Storage (DDS) tape formats and DDS tape formats with data compression (DDS-DC). It reads and writes DDS uncompressed and DDS-DC compressed data. Data compression is supported on the tape drive.

Switch settings on the tape drive allow you to enable and disable the data compression, enable or disable self-test, and set the SCSI ID. The default switch settings are shown below:



The default switch settings represent the following:

- As shown in the diagram above, the default settings for switches S1, S2, and S3 are SCSI ID=4. All tape drives are shipped with SCSI ID=4. If you are installing the tape drive in a server that has other SCSI devices installed, ensure that the tape drive has a unique SCSI ID.

If you are configuring a server with multiple tape drives, ensure that the tape drives reside on the same SCSI bus. At server startup, ARCserve from Compaq scans the SCSI buses in the server for tape drives.

- The default setting for switch S4 is ON. Although earlier tape drive adapters are SCSI-1 compatible, you can leave the S4 switch enabled (S4 switch ON) and still connect the 5.0-Gigabyte DAT Drive to an earlier tape drive adapter.
- The default setting for switch S5 is ON.
- The default setting for switch S6 is OFF. In this position, data compression is enabled. Leave data compression enabled, so that if you must disable data compression, you can do so from ARCserve.
- The default setting for switch S7 is OFF.
- The default setting for switch S8 is OFF.

To configure the tape drive for installation, perform the following steps:

1. Ensure that tape drive switches S4 through S8 are set accordingly as shown in Figure 2-1.



2. Set a unique SCSI ID for the tape drive, using drive switches S1, S2, and S3. The default SCSI ID setting is 4.

For easy hardware management in the COMPAQ ProSignia, set the SCSI ID to match the drive bay number in which the tape drive will be installed. For example, to install the tape drive in drive bay 5 of the COMPAQ ProSignia, set the SCSI ID to 5.

NOTE: When installing the tape drive in the COMPAQ ProSignia, the standard SCSI option cable that ships with the COMPAQ ProSignia is designed for installation of the tape drive in drive bay 4. Installing the tape drive in drive bay 5 or 6 requires the use of the seven-device SCSI option cable (PN 149117-001).

3. When configuring SCSI devices, the last SCSI device on the bus must be configured to terminate the bus. If the tape drive is the only SCSI device in the server, depending on your hardware configuration, you can terminate the bus in one of two ways:
 - Terminate the bus on the controller for configurations that include either the Fast-SCSI-2 Controller Board or the Integrated Fast-SCSI-2 Controller.
 - Leave the terminating resistors on the tape drive for configurations that do not include the Fast-SCSI-2 Controller Board or the Integrated Fast-SCSI-2 Controller. This applies particularly when using the Integrated SCSI-2 Options Port on the COMPAQ SYSTEMPRO/XL.

If the tape drive shares the SCSI bus with other SCSI devices, terminate the bus on the *last* SCSI device, or if you are using the Fast-SCSI-2 Controller board or the Integrated Fast-SCSI-2 Controller, terminate the bus on the controller.

4. Install the tape drive in the server and attach the tape drive cables to the controller.

NOTE: When installing the tape drive in the COMPAQ SYSTEMPRO/XL, a 12-inch SCSI option cable that supports up to two SCSI devices connects to the Integrated SCSI-2 Options Port.

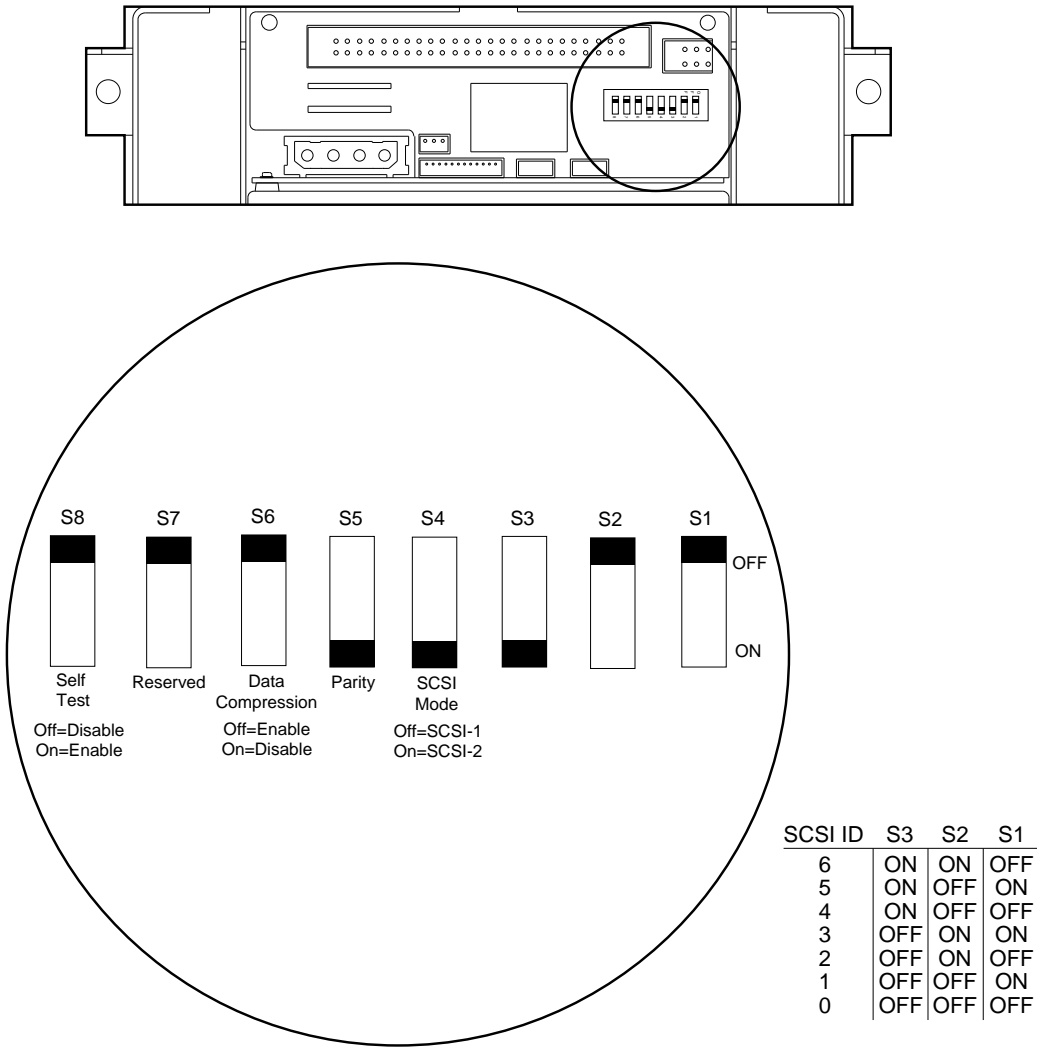


Figure 2-1. 5.0-Gigabyte DAT Drive Switch Settings and SCSI IDs

CONFIGURING THE 525-MEGABYTE ACA TAPE DRIVE

You can configure the 525-Megabyte ACA Tape Drive with most COMPAQ SCSI controllers. If you are installing the 525-Megabyte ACA Tape Drive in the COMPAQ ProSignia, use the Integrated Fast-SCSI-2 Controller. If you are installing the 525-Megabyte ACA Tape Drive in the COMPAQ SYSTEMPRO/XL, use the Integrated SCSI-2 Options Port.

1. Set a unique SCSI ID for the tape drive. The default SCSI ID setting is 4. For easy hardware management in the COMPAQ ProSignia, set the SCSI ID to match the drive bay number in which the tape drive will be installed. For example, if you are installing the tape drive in drive bay 5, set the SCSI ID to 5.

NOTE: When installing the tape drive in the COMPAQ ProSignia, the standard SCSI option cable that ships with the COMPAQ ProSignia is designed for installation of the tape drive in drive bay 4. Installing the tape drive in drive bay 5 or 6 requires the use of the seven-device SCSI option cable (PN 149117-001).

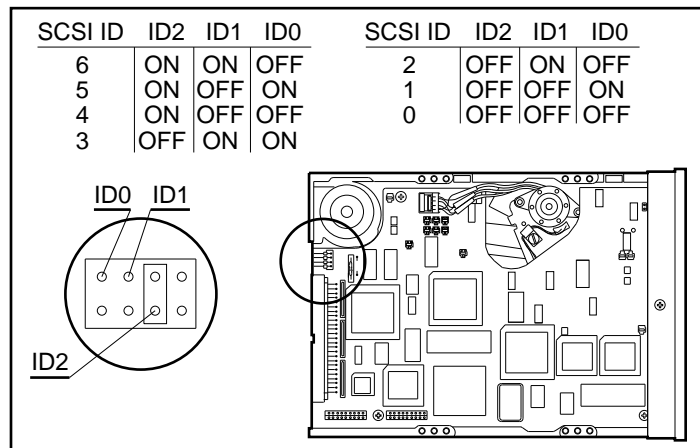


Figure 2-2. Jumper Settings for 525-Megabyte ACA Tape Drive



2. When configuring SCSI devices, one SCSI device on the bus must be configured to terminate the bus. If the tape drive is the only SCSI device in the server, depending on your hardware configuration, you can terminate the bus in one of two ways:
 - Terminate the bus on the controller for configurations that include either the Fast-SCSI-2 Controller or the Integrated Fast-SCSI-2 Controller.
 - Leave the terminating resistors on the tape drive for configurations that do not include the Fast-SCSI-2 Controller board or the Integrated Fast-SCSI-2 Controller. This applies particularly when using the Integrated SCSI-2 Options Port on the COMPAQ SYSTEMPRO/XL.

If the tape drive shares the SCSI bus with other SCSI devices, terminate the bus on the *last* SCSI device, or if you are using the Fast-SCSI-2 Controller board or the Integrated Fast-SCSI-2 Controller, terminate the bus on the controller.

3. Install the tape drive in the server and attach the tape drive cables to the controller.

NOTE: When installing the tape drive in the COMPAQ SYSTEMPRO/XL, a 12-inch SCSI option cable that supports up to two SCSI devices connects to the Integrated SCSI-2 Options Port.

USING THE COMPAQ EISA CONFIGURATION UTILITY

Configure the tape drives with the EISA Configuration Utility. The COMPAQ Options Configuration diskette contains the required EISA configuration files. To configure the COMPAQ 5.0-Gigabyte DAT Drive or the COMPAQ 525-Megabyte ACA Tape Drive, perform the following steps:

1. Boot the server with the COMPAQ System Configuration diskette version 2.10 (or a later version) in the diskette drive.
2. At the Primary Operating System menu, select *NetWare* and press the **ENTER** key.



3. When prompted for Auto configuration, select *Yes*.
4. Select *Step 5: Save and Exit*.

When you configure SCSI hard drives and tape drives in your server, ARCserve uses the Advanced SCSI Programming Interface (ASPI) host number to identify which devices reside on which SCSI bus. The *CPQSASPI.NLM* device driver from Compaq (on the NetWare Programs from Compaq diskette that ships with NetWare from Compaq) provides ASPI support by assigning host numbers to all configured SCSI buses. For configurations that use the COMPAQ ASPI interface, the tape drive subsystem is configured automatically.

NOTE: For details on ASPI support, refer to "ASPI Support for ARCserve" in Chapter 3 of this COMPAQ TechNote.

For configurations that do not use *CPQSASPI.NLM*, you must note and record the hardware switch settings. ARCserve prompts you for this information during software installation.

To record the switch settings, perform the following:

1. From the Steps in Configuring Your Computer screen, select *Step 3: View or Edit Details*.
2. In the View and Edit Details screen, highlight *Enabled* under the slot information where your tape drive adapter resides, and press the **F6** key. For example, if your tape drive is configured with the COMPAQ SCSI Option Adapter in slot 4 of your server, the information is under *Slot 4*.
3. Verify the displayed Interrupt (IRQ), DMA Channel, and Port Address settings.



IMPORTANT: Note these hardware settings. For configurations that do not support ASPI, ARCserve prompts you for this information during the software installation process.

4. Press the **F10** key to return to the View or Edit Details screen.



5. Press the **F10** key to return to the Steps in Configuring Your Computer screen.
6. Select *Step 5: Save and Exit*.

The tape drive subsystem configuration is complete. To continue with the software installation, refer to Chapter 3 of this COMPAQ TechNote.



Chapter 3

INSTALLING THE SOFTWARE

Configuration requirements and procedures depend on which COMPAQ PC Server you configure as the server and which tape drive subsystem you use.

ASPI SUPPORT FOR ARCSERVE

ARCserve uses ASPI host numbers to identify which devices reside on which SCSI bus. *CPQSASPI.NLM* from Compaq (on the NetWare Programs from Compaq diskette) provides ASPI support by assigning ASPI host numbers to all configured SCSI buses. During server startup, the *TAPEDRV.NLM* (in ARCserve from Compaq only) scans the SCSI bus for ASPI supported devices.



IMPORTANT: If your server includes multiple tape drives, these tape drives must reside on the same SCSI bus.

NOTE: When you configure low-throughput devices, such as tape drives, on the same SCSI bus as high-throughput devices, such as Fast-SCSI-2 hard drives, low-throughput devices do *not* affect the performance of high-throughput devices. Each SCSI device negotiates its throughput on the bus.

Table 3-1 lists the SCSI controllers supported by ARCserve and defines which tape drive controllers support the ASPI interface. When configuring your tape drive subsystem, use Table 3-1 to identify whether your configuration requires the *CPQSASPI.NLM*.



Table 3-1
ASPI Support for COMPAQ SCSI Controllers

COMPAQ SCSI Controller	Use ASPI Support?
Fast-SCSI-2 Controller Board	Yes
Integrated Fast-SCSI-2 Controller	Yes
SCSI-2 Options Port	Yes
SCSI Compression Adapter	No
SCSI Option Adapter	No

INSTALLING ARCSERVE FROM COMPAQ



IMPORTANT: When configuring a server with a SCSI Compression Adapter or a SCSI Option Adapter, record the hardware switch settings and SCSI ID from the EISA Configuration Utility. ARCserve prompts you for this information during installation.

When configuring the tape drive subsystem with Fast-SCSI-2 hard drives, ensure that the following drivers are loaded and added to the *STARTUP.NCF* file before beginning ARCserve installation.

CPQSXPT
CPQS710
CPQSDISK

NOTE: For the COMPAQ SYSTEMPRO/XL with the SCSI-2 Options Port for the tape drive, *CPQS94.DSK* appears in place of *CPQS710.DSK*. If your server includes a drive array rather than Fast-SCSI-2 hard drives, *CPQDA386.DSK* appears in place of *CPQSDISK.DSK*. If your server includes IDE drives, *ISADISK.DSK* appears in place of *CPQSDISK.DSK*.



1. From a local workstation, log into the server as SUPERVISOR.
2. Create a subdirectory for ARCserve on the workstation hard drive. If using a diskless workstation, create the subdirectory on a server volume.
3. Copy all files from the ARCserve Manager/Server diskette to the ARCserve subdirectory.
4. From the ARCserve subdirectory, type the following command line:

```
INSTALL [servername] [dirname]
```

Where:

servername is the network server where the ARCserve NLMs will be installed, and dirname is the ARCserve directory on the server.

For example:

```
INSTALL Compaq SYS:Archlog
```



IMPORTANT: If you are installing ARCserve on a server configuration that uses the ASPI interface, copy the *CPQSASPI.NLM* from the NetWare Programs from Compaq diskette into the SYSTEM subdirectory of the server SYS volume.

-
5. Insert the ARCserve Tape Support Disk in the workstation diskette drive.
 6. From the diskette drive prompt, enter the following:

```
INSTALL
```
 7. If the workstation can access more than one server, a "pick list" of NetWare servers displays. Select the appropriate server and press the **ENTER** key.
 8. The ARCserve from Compaq Installation screen appears. If you are installing ARCserve on a server that supports the ASPI interface, select *COMPAQ ASPI SCSI Manager*. If you are installing ARCserve on a server configured with the SCSI Option Adapter or the SCSI Compression Adapter, select the appropriate option.

- The Tape Driver Configuration screen appears with the I/O Buffers field displaying the default buffer settings as follows. Each buffer uses 64 Kbytes of system memory. The default is 6 buffers. You can configure the number of I/O buffers from 2 buffers to 32 buffers.

```
I/O Buffers: 6
```

Change the I/O Buffers value by highlighting the field, typing the number of desired buffers, and pressing the **ENTER** key.

NOTE: For more information on ARCserve I/O buffers, refer to Chapter 5 of this COMPAQ TechNote.

- Press the **F2** key to continue installation. The server displays the following message:

```
Install and Configure the Tape Driver [ ]
```

Press the **Y** key for YES.

- At the server console, load *INSTALL.NLM* by entering the following at the NetWare prompt:

```
LOAD INSTALL
```

- Verify that the following drivers are loaded and that these command lines are included in the *AUTOEXEC.NCF* file of your server in the order shown below:

```
LOAD CPQSASPI
LOAD TAPEDRV
LOAD ARCSERVE
```

NOTE: If you are installing ARCserve on a server with a tape drive subsystem that does not use ASPI support, the *CPQSASPI.NLM* should not appear.

ARCserve installation is complete. You can configure ARCserve on other servers, begin scheduling backups, develop backup script files, and so on.



CONFIGURING ARCSERVE OPTIONS

ARCserve provides options for automating the backup process, establishing queues, authorizing users and operators, and activating or deactivating ARCserve. This allows you to manage your servers and your backups more efficiently. From the ARCserve Available Topics menu, you can configure ARCserve with the following options:

- ARCserve Host Server
- Administration
- Quick Start
- Auto Pilot Tape Management
- Schedule Unattended Jobs
- Attended Operations
- File Tracking System and QFA Restore

The following paragraphs discuss configuration of some of the key options.

You must select an ARCserve host, a server with the ARCserve NLM loaded, to perform most backup and restore operations. Once you select the ARCserve host server, all other options you select are performed on the host server.

The Administration option allows you to activate or deactivate ARCserve Server. If you are running an unattended backup, ARCserve prompts you for verification of job cancellation.

The Administration option also includes queue management. ARCserve creates two queues during installation: `AUTO_PILOT` and `CHEY_A_Q`. The `AUTO_PILOT` is reserved for Auto Pilot functions, and only users with SUPERVISOR-level access have access to this queue. You can add queues or modify existing queues.

The Administration option also includes the Activity Log and the Tape Usage Log. The Activity Log provides information on both attended and unattended backups, including the queue name, user's name, time/date, and errors that occurred during operation. The Tape Usage Log tracks information about individual tapes used. Both of these logs provide reports.

The Auto Pilot Tape Management feature provides fully automated backups, including tape rotation, backup schemes, disk grooming, and disaster recovery. Before configuring Auto Pilot, deactivate ARCserve Server. From the Auto Pilot menu, select *Auto Pilot Sets* to configure Auto Pilot for a tape set. The Auto Pilot Sets option includes the Auto Pilot Set Configuration Form.

Auto Pilot Daily and Full Logs provide information on the last backup performed and the next backup. The Target Profile Report provides information on the type of backup performed and whether the backup session was completed. In the event of a server failure, the Target Profile Report lists the tapes required to restore the server.

The Recover Auto Pilot Database option can be used when the Auto Pilot subdirectory on a host server is corrupted. The first and last session on each tape set include a copy of the Auto Pilot Database. Should the Auto Pilot subdirectory on the host server become corrupted, you can use this option to restore the Auto Pilot database. Once you restore the database, you can resume ARCserve operations.

The Auto Pilot Quick Recover option assists you in restoring the server. Auto Pilot lists the tapes that are required to restore the server to the desired state. When you use Quick Recover, you specify the date to which you want to restore the server, and Auto Pilot provides a list of the tapes required to complete the restore process.

The Schedule Unattended Jobs option allows you to schedule and manage unattended backups. These backups do not require user intervention during operation. Auto Pilot provides scheduling forms. When you complete these forms, Auto Pilot saves the forms as script files for reuse.



ARCserve does not allow compressed and non-compressed data on a single tape. When reusing tapes, you can back up non-compressed data to a previously written tape with compressed data by performing the following:

1. From the ARCserve from Compaq SCSI Tape Driver screen, select the *Erase Tape* option.
2. Select *Compression Disable*.
3. When ARCserve prompts you to verify compression disable, select *Yes* to disable compression on the tape drive.
4. Begin your backup.



Chapter 4

STORAGE MANAGEMENT

The typical network server in a resource-sharing environment has the resources available to handle all backup tasks and continue to provide network services. ARCserve offloads the backup and restore tasks from a dedicated workstation to the server. The server then performs the processor and disk-intensive operations. This arrangement enhances security and centralizes administrative tasks, because the backup occurs at the tape backup server, not at a workstation.

To manage data storage, you must evaluate the nature of the data and develop a plan for management of all network server and workstation backups. Storage management consists of the following activities:

- Performing a risk assessment
- Defining a disk management plan
- Determining the frequency of backups
- Establishing a tape backup plan

These activities are discussed in detail in the following sections.

RISK ASSESSMENT

Perform a risk assessment of the data on your network, and examine the following factors:

- Time required to rebuild the data if it is lost.
- Cost of manual reentry of all lost data from the previous backup.
- Value, criticality, and volatility of the data.
- Maximum amount of time that the department or company can survive without the data or the network system.

DISK MANAGEMENT

A good disk management plan includes the organization of server data based on the amount of data, its criticality, how often it changes, and the amount of security that it requires.

Files associated with applications that run on your servers require backup only when these files change. Static data does not require frequent backup. Data that changes constantly should be backed up frequently.

As a general rule, separate application files from data files on your network server hard drive subsystem. Store application files in the server SYS volume, so that you do not need to back up the SYS volume unless files in this volume change. Store data files in a separate volume (for example, VOL1). When performing backups, ARCserve allows you to select volumes as well as subdirectories within each volume for backup, so that you can manage backups closely, if needed.

A well-organized directory structure can also minimize the impact of human errors. Files that are shared by many users have the potential for corruption or deletion. Store files shared by users in an easily located subdirectory in the volume and perform daily backups for these subdirectories, so that file restoration is efficient.

A well-maintained server hard disk can save backup time. Plan to perform routine housekeeping tasks on the server regularly, including the following:

- Delete files with extension *.BAK* once a week. Leaving *.BAK* files on the hard disk almost doubles the amount of disk space required for each file. Unless these files are mission-critical or are crucial to productivity, remove them at least once a week, or before backup.
- Avoid duplication of files on the server hard drives. Some data files are duplicated to preserve data integrity; however, most duplicated files are the result of user error. Verify that the duplicate files are not needed, and delete old versions of these files.

- Restrict the size of the user home directory space. Users with large amounts of home directory space do not perform housekeeping tasks until they run out of space. In the meantime, backups are performed on useless data and duplicate files, wasting valuable hard disk and tape space.

A hard disk management plan should include distribution of backup workload and data housekeeping. Balance the backup workload among servers. Do this in the planning stages of the network and as routine maintenance. A well-balanced backup scheme, where all backup systems support an equal amount of hard disk space, provides for faster and more reliable backups.

NOTE: Chapter 6 of this COMPAQ TechNote includes an example of workload balancing.

FREQUENCY OF BACKUP

The most successful backup plan provides for some sort of daily backup. If you choose less frequent backups, then the frequency of backups should be proportional to the amount of work performed on the hard drive and the criticality of the data. This is a matter of experience and judgment. Use the following criteria to decide how often to back up the hard drive subsystem:

- Value and volatility of data
- Risk of losing data
- Reliability of backup hardware and software

TAPE BACKUP PLAN

Establish a tape backup and tape storage plan to ensure timely, routine backups (incremental or differential and full backups). Keep tapes readily available and clearly labeled to ensure that when you must retrieve backed-up files, you can obtain the tapes and retrieve the files efficiently.

When performing tape backups, use the Auto Pilot feature of ARCserve to supervise all backups. Auto Pilot allows you to develop script files for scheduled unattended backups, establishes a tape rotation scheme, keeps records of all backup and restore activities, and provides for efficient data recovery in the event of data loss.

Use the following formula to establish tape backup performance expectations for a single unattended backup server using a 5.0-Gigabyte DAT Drive with data compression enabled.

$$\frac{\text{Disk Space of Local Server}}{20} + \frac{\text{Disk Space of Remote Server}}{7} + \frac{\text{Disk Space of Workstation}}{6}$$

In the formula, 20 represents the average amount of data per minute (20 megabytes for unattended backup, and 8 megabytes for attended backup) that can be backed up locally to tape. The value of 7 represents the average amount of data per minute (7 megabytes) that can be backed up to tape over the network. The value of 6 represents the average amount of data per minute (6 megabytes) that can be backed up from a network workstation.

NOTE: For more information on tape backup throughput performance, refer to Chapter 5 of this COMPAQ TechNote.

For example, the amount of time needed to back up a local server with 3 gigabytes of disk space, a remote server with 1 gigabyte of disk space, and a strategic workstation with 320 megabytes of disk space is calculated in the following manner:

$$\frac{3,000}{20} + \frac{1,000}{7} + \frac{320}{6} = 346.17 \text{ minutes}$$

In this example, the server requires approximately 5.75 hours to perform an unattended backup. Attended backup would require approximately 9.5 hours.



If the tape backup storage capability is limited, use the following guidelines:

- If local server backup storage capacity is limited, increase the backup capacity by adding another backup device. The COMPAQ SYSTEMPRO Line of PC Servers can support up to two internal tape drives. The COMPAQ ProSignia can support up to three tape drives internally.
- Use multiple backup servers to balance the backup load and increase capacity. This provides hardware redundancy in case of tape backup system failure.

Whenever possible, perform local backups, rather than remote backups, if you are using multiple backup servers. Local backups can achieve backup throughput performance of 20 megabytes per minute or more; remote backups can achieve backup throughput performance of only 6 to 7 megabytes per minute. Using multiple backup servers increases the amount of data that can be backed up in a given amount of time by distributing the workload.

Using multiple servers can also reduce the risk of total network failure if one server fails. You can still back up and restore workstations and servers from an alternate backup server.

- Plan multilevel backups. Some volumes require a full daily backup, while some need only differential or incremental backup.
- Enforce storage management plans.

Backup Manager

The most logical candidates for tape backup responsibility are users with SUPERVISOR-level access, such as system administrators and system operators. Select both a primary backup manager and a secondary backup manager to provide support services in the event of a server failure.

Ensure that the backup managers are provided adequate training in managing the network and backup as well as performing backup procedures. Also ensure that the backup manager remains familiar with the data restoration process.

Scheduled Backups

Schedule backups for periods when network traffic is low and server activity is minimal. ARCserve allows you to build script files and schedule them during off-peak hours.

The server CPU Utilization rises approximately 12 to 20 percent during backups. An increase of 12 to 20 percent CPU Utilization during work hours can impact server performance. Performing local unattended backups adds workload to the hard drive subsystem, potentially affecting server performance. Performing remote, attended, or workstation backups adds traffic to the network, potentially affecting network performance.

NOTE: Refer to Chapter 5 for more information on performance considerations.

Scheduling backups for off-peak hours allows you to back up most of the files on the server hard disk, while the network activity is low, since most of the files are closed and available for backup. ARCserve skips open files and does not back them up, unless you configure ARCserve to automatically retry skipped files.

Tape Rotation Scheme

A full daily backup of all files in the system may seem like a guarantee of data integrity, but it can also be time-consuming and is often impractical for high-volume hard disk activity. One alternative to daily full backups is a weekly full backup with differential or incremental daily backups.

As described earlier, Auto Pilot uses the grandparent/parent/child tape rotation scheme. This backup scheme uses four tape sets, and assumes one tape is used per day. The tape sets are labeled Monday, Tuesday, Wednesday, and Thursday. These tapes include daily incremental backups of only the files that have changed. This scheme also uses a fifth tape set, labeled Friday, as a full weekly system backup.



As an additional precaution, rotate another set of four tapes labeled Friday, as full weekly backups, keeping four full copies of the system with the oldest copy being 4 weeks old.

In addition to daily incremental backups and tape rotation for the weekly full backup, many companies make a monthly "total system" backup. Store this tape set off site to protect against data loss due to fire or other disasters. This backup strategy requires a total of 20 tape sets: 4 Monday through Thursday incremental backup tape sets, 4 Friday full backup tape sets, and 12 monthly full backup tape sets.

The Auto Pilot feature of ARCserve helps you adhere to your rotation scheme by prompting you for the appropriate tapes. This reduces the risk of unintentionally overwriting a tape with critical data, such as weekly or monthly full backup data.

Tape Cartridge Management

Properly label each cartridge and tape with its name for easy retrieval and for enforcement of the rotation scheme. Keep a comprehensive record of each cartridge and tape, including what data is on the cartridge, the targeted server, when you performed the backup, any problems encountered in the backup process, and the rotation schedule. When storing tape cartridges on site, place cartridges in a secured location, such as a locked room.

As a part of tape cartridge management, ARCserve does not allow compressed and non-compressed data on a single tape. When reusing tapes, you can back up non-compressed data to a previously written tape with compressed data by performing the following:

1. From the ARCserve from Compaq SCSI Tape Driver screen, select the *Erase Tape* option.
2. Select *Compression Disable*.
3. When ARCserve prompts you to verify compression disable, select *Yes* to disable compression on the tape drive.
4. Begin your backup.

Disaster Recovery

A reliable tape backup plan allows you to roll back and retrieve unintentionally damaged or deleted files. To provide this kind of service to network users, incorporate an off-site rotation and retrieval process and store a copy of the most recent weekly or monthly full backup on site.



IMPORTANT: Periodically restore tape data to a server hard drive to check backup hardware components. This also allows you to become familiar with the restoration procedure. When you must restore data, time is usually critical.

Auto Pilot provides two methods for recovery of data. The Quick Recover feature allows you to restore files quickly to a server or workstation. When you implement Quick Recover, Auto Pilot prompts you for the required tapes. You can even target a specific date to which you want to restore a server.

The other method for data recovery is used in the event of a corruption of the ARCserve subdirectory. This feature is called Recover Auto Pilot Database. Each backup performed by Auto Pilot includes a copy of the Auto Pilot database. Should you require the use of this feature, select *Recover Auto Pilot Database* from the Auto Pilot menu.

NOTE: You can use these features only for restoring data with Auto Pilot backup tapes.

Tape Backup Hardware Redundancy

Data is usually restored as soon as possible after an accident happens. For example, if an airline network server that handles the flight reservations fails and all data is lost, the server must be repaired and the data restored immediately. With a regular backup routine, the data is secured on the tape. However, if the backup system has also failed, can the company afford to perform without the crucial data until a new tape backup system arrives?



A well-designed backup system should cover all aspects, including backup hardware redundancy. Providing hardware redundancy is expensive, but the time and data that are lost can potentially cost far more. A single network server may require two backup systems to provide better data security against data disaster. For multiple servers, each network server should include at least one backup subsystem, so that another one can be used if one subsystem fails.

Security

Include backup security measures whenever possible. Data can be compromised during the backup process. Use both physical and logical security measures to protect data integrity, such as the QuickLock feature in COMPAQ PC Servers and the SECURE CONSOLE command in NetWare.

SUMMARY

To reduce the risk of data and productivity loss in networking environments, you must establish a storage management strategy. This includes the following tasks:

- Evaluating the amount, nature, and criticality of the data to determine the types of backup required (full, differential, or incremental).
- Analyzing the average and peak workloads of the network, especially the servers.
- Determining the frequency of backups, schedule, and tape rotation for backups.
- Assigning backup managers, providing them with SUPERVISOR-level access, and training them in the backup and restore process.
- Organizing server hard drive subsystems to allow efficient backups.
- Implementing disaster recovery plans and security.

An effective tape backup plan provides for all of these considerations.



The two key elements to your backup plan are the amount and criticality of the data. The nature of the data affects the type of backup you can perform, the backup schedule, the tape rotation and management scheme, how you organize your hard drive subsystem, and the types of security measures that should be taken. For example, a large amount of data may exceed the available time to perform full daily backups, and you may have to perform differential backups or back up selected directories.

The Auto Pilot feature of ARCserve from Compaq can help you execute your backup plan by providing fully automated backup services as well as storage management services for NetWare networks. Auto Pilot can help you define your backup schedule and tape rotation schemes, organize and groom your server hard drive subsystems, manage tapes, develop script files that can be executed on schedule and unattended, and provide methods for efficient data recovery in the event of data loss.



Chapter 5

PERFORMANCE CONSIDERATIONS

To manage performance effectively, evaluate backup performance regularly to optimize the backup procedure. Several factors contribute, in varying degrees, to the performance of the tape backup system:

- Server performance
- Tape drive and hard drive subsystem performance
- Network traffic
- File size
- Data streaming
- Data compression
- ARCserve I/O buffers
- Attended versus unattended backup
- File fragmentation

Some of these factors, such as the file fragmentation, affect performance only minimally. Data streaming and data compression, on the other hand, can greatly impact performance. When establishing your tape backup plan, perform several backups and analyze your server workload using CPU Utilization in *MONITOR.NLM*. Note the increase in CPU Utilization before, during, and after backups. The CPU Utilization during backups usually rises by 12 to 20 percent over CPU Utilization before and after backups. Knowing the amount of workload increase during backups helps you determine baseline performance.

How the listed factors affect performance depends on whether you perform remote backups or local backups. Consider these factors during your analysis, based on the information provided in the following sections.

This chapter includes performance test results based on integration testing. Integration engineers performed backups using 368 megabytes of files that varied in size and type. File sizes ranged from under 1 Kbyte to more than 10 megabytes. File types included binary, text, spreadsheet, and database. This data mix was used to represent data that would be backed up from a typical network server in a resource-sharing environment.

NOTE: Unless otherwise noted, full backups were performed for all integration performance testing.

The following configurations were used to perform all integration testing for this chapter:

- COMPAQ ProSignia Model 486/33-1050
 - 16 megabytes of standard system memory
 - Integrated Fast-SCSI-2 Controller
 - COMPAQ 32-Bit NetFlex Controller
 - 5.0-Gigabyte DAT Drive connected to the Integrated Fast-SCSI-2 Controller

NOTE: In this configuration, the tape drive and the Fast-SCSI-2 hard drive reside on the same SCSI bus.

- COMPAQ ProSignia Model 486/33-1020
 - 16 megabytes of standard system memory
 - IDA-2 Controller
 - COMPAQ 32-Bit NetFlex Controller
 - 5.0-Gigabyte DAT Drive connected to the Integrated Fast-SCSI-2 Controller



SERVER PERFORMANCE

The busier the server is with routine functions, such as printing and file services, the longer it takes to complete a backup. For this reason, perform backups during off-peak network hours, such as between 6 p.m. and 6 a.m., to reduce the amount of network traffic and the load on the server. During backup, the CPU Utilization, as displayed in *MONITOR.NLM*, rises 12 to 20 percent for the duration of the backup. A high-performance tape backup server can speed up the process.

Although a high-performance server can have some positive impact on backup throughput performance, the server configuration is rarely the limiting factor. However, some server subsystems can affect performance. For example, a tape drive subsystem that includes a data compression feature can improve backup performance as well as increase tape capacity. If performance is a main factor in your evaluation of a tape backup solution, consider a tape drive subsystem with data compression, such as the 5.0-Gigabyte DAT Drive.

Regardless of the server performance capabilities, backups affect server performance. How the server is affected depends on the type of backup you perform (local or remote). When a server performs a *local* backup, it backs up its own files. Local backups affect the hard drive subsystem performance. When a server performs a *remote* backup, it backs up the files of another server over the network. Remote backups affect the LAN subsystem (NIC and physical network).



Since local backup does not use the network, only the server resources are affected during the backup. Figure 5-1 illustrates the hard disk activity during *local* server backup. During integration testing, performing a local unattended backup of 368 megabytes of data with data compression enabled required approximately 16 minutes (about 23 megabytes per minute).

Since local backups add workload to the hard drive subsystem, before beginning local backups, ensure that the server can accommodate the additional workload. When possible, perform backups during off-peak hours.

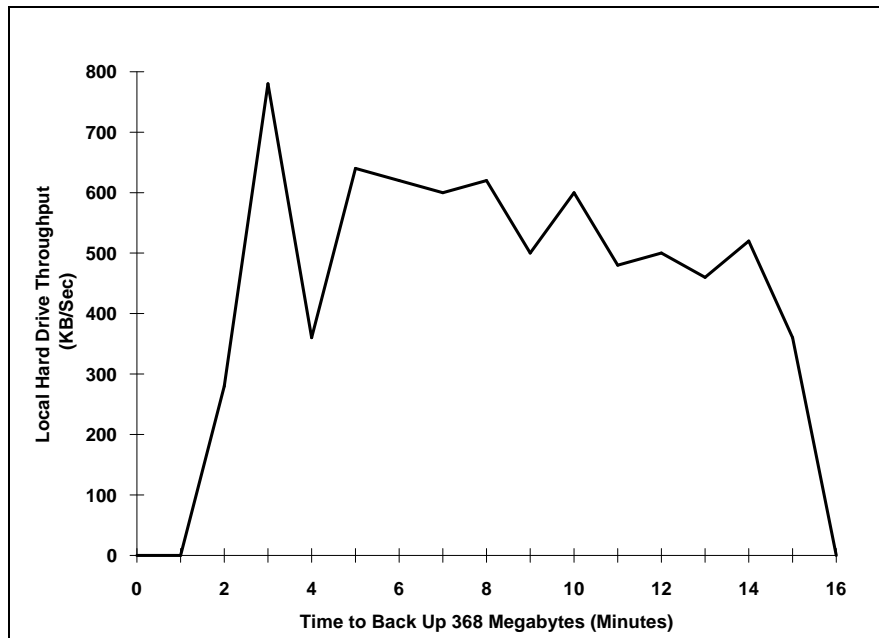


Figure 5-1. Hard Disk Activity Caused by Local Backup

Remote backups affect the server LAN subsystem, due to the amount of network traffic generated during backup. Figure 5-2 shows LAN subsystem activity caused by *remote* backup. During integration testing, backing up 368 megabytes remotely required about 49 minutes (7.5 megabytes per minute). For this reason, plan remote backups during light network traffic, and ensure that the server is available for the entire backup period. In Figure 5-2, the server required 49 minutes to back up 368 megabytes of data remotely. Remote backup of 3 gigabytes requires about 7 hours.

In most network resource-sharing environments, enabling data compression does not yield a performance improvement, because the LAN bottleneck masks any improvement that data compression provides. However, using data compression allows you to back up more data per tape.

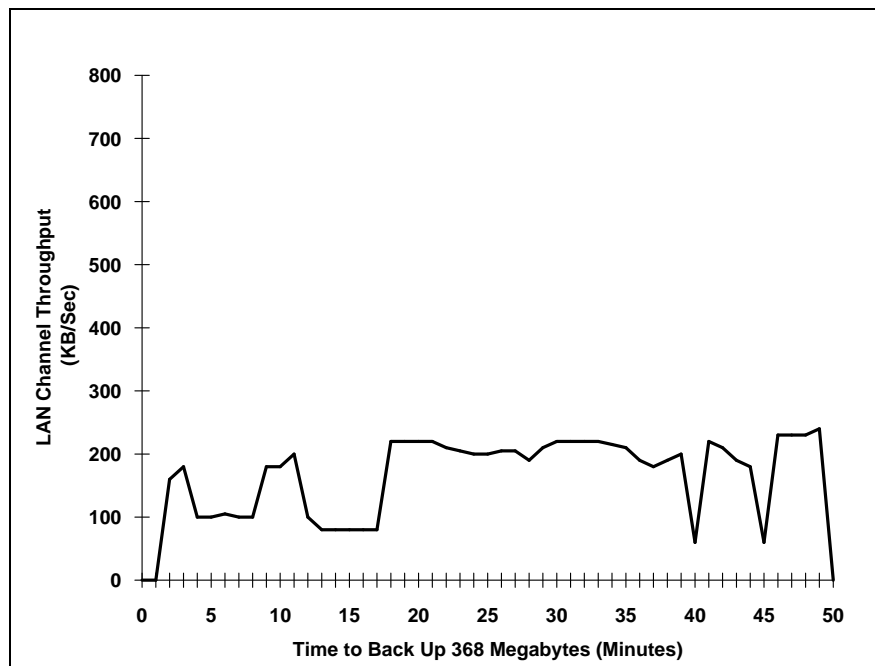


Figure 5-2. LAN Traffic Activity Caused by Remote Backup



Figure 5-3 illustrates the CPU Utilization during local and remote backups. During integration testing, backing up 368 megabytes of data locally required approximately 16 minutes (23 megabytes per minute). Backing up the same amount of data remotely required 49 minutes (7.5 megabytes per minute).

CPU Utilization peaked between 17 and 18 percent during local backup, but decreased to 5 percent once the backup was completed. Although CPU Utilization did not rise above 13 percent during the remote backup, the backup required 49 minutes. During the 49-minute backup, the CPU Utilization remained above 10 percent. When you must perform remote backups, ensure that the backup server can manage an additional 10 to 20 percent CPU Utilization without affecting the overall server performance.

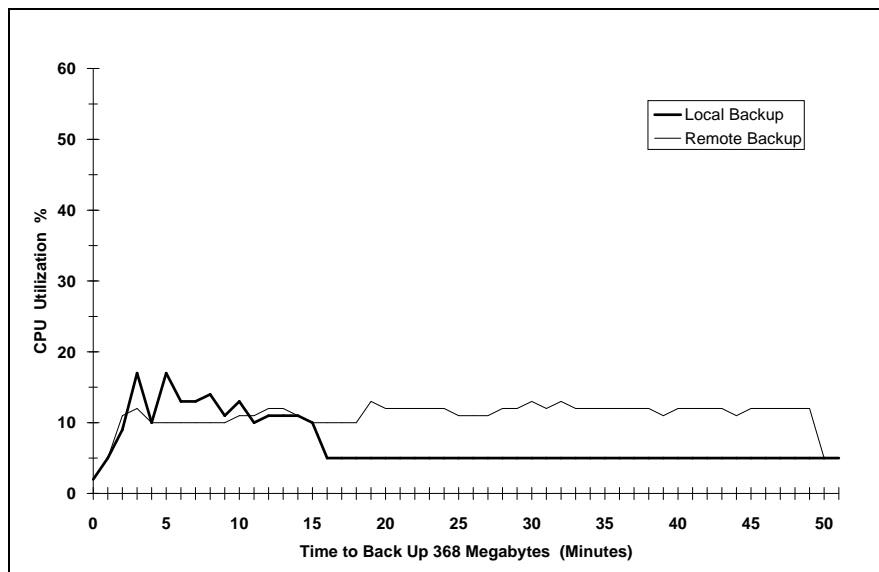


Figure 5-3. CPU Utilization During Backup

NOTE: Local backup was completed in 16 minutes. Remote backup was completed in 49 minutes.



TAPE DRIVE AND HARD DRIVE SUBSYSTEM PERFORMANCE

When performing local backups, the 20-megabyte per minute average backup throughput of the COMPAQ 5.0-Gigabyte DAT Drive is characteristic of 5.0-gigabyte DAT drives with data compression enabled. At 20 megabytes per minute, 5 gigabytes of hard disk space requires approximately 4 hours for a full local backup. Optimum data transfer rates, using data compression on the tape drive, reach approximately 30 megabytes per minute. With data compression disabled, the average backup throughput rate for local backup is approximately 10 to 11 megabytes per minute.

NETWORK TRAFFIC

When backing up multiple servers or workstations to the backup server, the amount of network traffic can affect backup performance. Perform backups after normal business hours, when network traffic is light, to improve performance and to avoid adding more traffic to the network. Backing up the server during times of low network activity, such as at night and on weekends, allows optimum performance. It also allows you to perform backups when most data and application files are closed. ARCserve skips open files and does not back them up, but you can configure ARCserve to retry skipped files.

Using ARCserve, you can achieve optimum backup throughput rates when you perform local backups, where the server backs up its own data, rather than remote backups, where one server backs up the data of another server. During remote backup, data is transferred over the network from one server to another server, and the overhead generated by this transfer of data yields backup throughput rates that are only 30 percent of local backup rates.

Figure 5-4 shows average backup throughput rates when local backups, remote backups from the server, and workstation backups to the server were performed. Performing local backups can dramatically improve backup throughput performance.

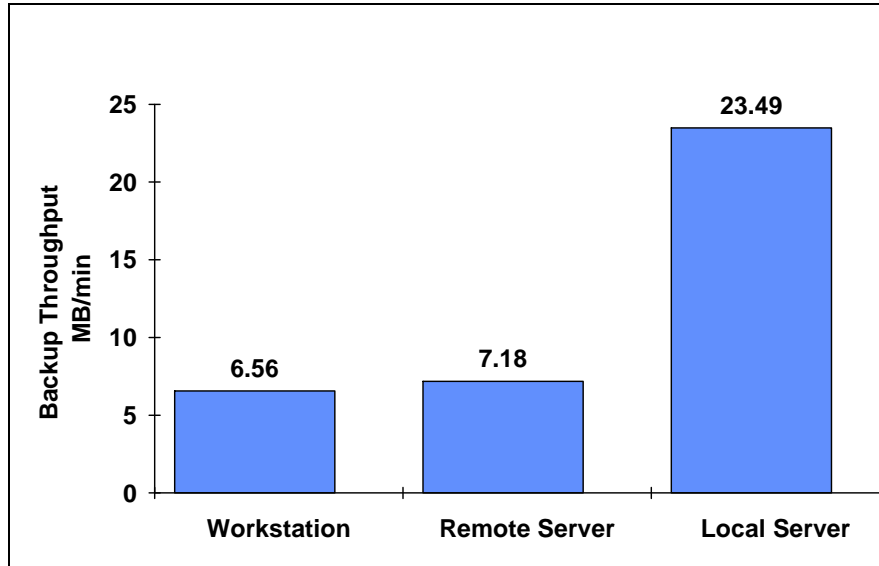


Figure 5-4. Performance Difference Between Local and Remote Backups

FILE SIZE

Often the advertised or quoted speed of the tape subsystem and tape backup software refers to a full local backup of files of the same size, usually large files, to avoid operating system overhead (for example, searching for the file location, locating the files, and so on). Backing up files of the same size allows the software to stream the data, making the backup more efficient; however, very few resource-sharing environments consist of files that are all the same size and type. Most resource-sharing environments consist of a mixture of files of various sizes and types, with few files larger than 64 Kbytes.



When evaluating tape drive subsystems for purchase, perform backups in your network environment or in an environment that closely resembles your network environment. Use the backup methods (incremental, differential, full, and selected directories, as well as local and remote) planned for your environment and the types of data that your network users generate.

DATA STREAMING

Data streaming is the process by which data is continuously fed to tape during the backup process. If data cannot always be transferred at the rate that the tape drive can accept and store it, the tape drive must stop and reposition. Repeated starting and stopping of the tape drive can degrade tape backup performance by up to 20 percent.

Most backups do not achieve constant data streaming. The ability of the system to achieve data streaming depends heavily on factors such as file size, whether you perform local or remote backups, data compression, and activity on the server.

Software that uses system memory to cache files provides the most consistent data streaming. ARCserve uses I/O buffers to determine the size of this cache. Each buffer uses 64 Kbytes of memory. The default is 6 buffers for SCSI devices and 4 buffers for QIC-02. Depending on your environment, increasing these values may enhance backup performance. However, if your total server memory is already at a minimum, increasing the number of I/O buffers takes away buffers from the NetWare Cache Buffers, which can adversely affect overall server performance.

DATA COMPRESSION

A key factor in backup throughput performance is data compression. Tape drive subsystems with a data compression feature, such as the COMPAQ 5.0-Gigabyte DAT Drive, perform backups more efficiently and store more data on the tape than tape drive subsystems without the data compression feature.

As discussed, the advertised or quoted speed of the tape subsystem and tape backup software refers to a full local backup under the most optimum conditions. This includes enabling data compression and using types of data, such as database and text files, that compress well. Backing up data that compresses well allows the software to stream the data, making the backup more efficient; however, very few resource-sharing environments consist of only one type of data. Most resource-sharing environments consist of a mixture of data types.

The type of data and its amount of redundancy determine the compression ratio. The more redundancy there is within the data to be archived (for example, text and database data), the higher the compression ratio.

NOTE: Enabling data compression does not yield a performance improvement during remote backup, because the LAN bottleneck masks any improvement that data compression provides. Using data compression allows you to back up more data per tape. If your tape drive subsystem supports data compression, always enable it.

Typical office environments generate a mixture of the following types of data:

- Binary data, such as operating system and application files.
- Text data, such as word processing document files.
- Database data, such as tables.
- Spreadsheet data, such as Lotus 1-2-3 and Microsoft Excel files.

Binary data is already in its most basic format and does not compress well when it is backed up to tape. Text, database, and spreadsheet data compress well, due to the amount of redundancy in the data. For optimum performance, store files that contain binary data, such as operating system and application program files, in a separate NetWare volume (for example, the SYS volume). You can then perform backups on the SYS volume only when the binary data changes, such as when you perform software upgrades. Storing binary data separately from other types of data not only provides better compression, but it also allows you to manage your hard disk effectively.

Figure 5-5 illustrates the difference in throughput performance when performing local backups with data compression enabled and disabled. As shown in Figure 5-5, the type of data you back up affects the data compression and the backup throughput.

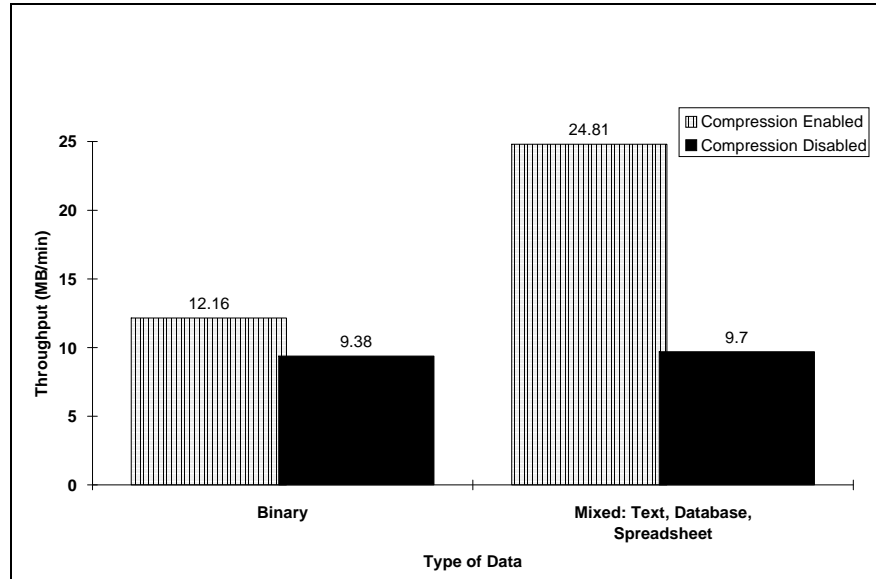


Figure 5-5. Throughput Performance With Data Compression Enabled and Disabled

ARCSERVE I/O BUFFERS

Software that uses system memory to cache files provides the most consistent data streaming. ARCserve I/O buffers determine the size of this cache. Each buffer uses 64 Kbytes of system memory. The default is 6 buffers for SCSI devices and 4 buffers for QIC-02 devices.

The amount of system memory used for I/O buffers may have little impact on backup throughput performance. For example, during integration testing, a local backup of 368 megabytes of mixed files was performed. In this case, the server could not always effectively stream the data, due to variance in file sizes. In environments with mixed file sizes, adding system memory for I/O buffers may not show a noticeable increase in performance. The throughput performance depends more on the ability of the server to stream the data than on the number of I/O buffers configured for ARCserve.

There are some instances, however, when the number of I/O buffers may improve performance. Integration testing indicated that adding I/O buffers may improve remote backup performance when the server backs up many large files of relatively the same size. For example, increasing the ARCserve I/O buffers on a server that backs up large database files may show a noticeable increase in performance.

Increasing the number of I/O buffers takes away buffers from the NetWare Cache Buffers. If your server system memory is limited, increasing the number of ARCserve I/O buffers can adversely affect overall server performance.

ATTENDED VERSUS UNATTENDED BACKUP

ARCserve allows you to perform both attended backups, which require administrator or user intervention for completion, and unattended backups, which allow you to spool the backup job to the server, freeing the server to perform network services.

During local unattended backups, the data is copied directly to the tape drive. During local attended backups, the data is sent to the workstation for processing and then to the backup server. This generates overhead on the server and the workstation, requires the workstation to be dedicated to the backup process during the backup, and increases the amount of network traffic during the backup. Figure 5-6 illustrates the difference in performance between local attended backup and local unattended backup.

In addition to the performance impact, attended backups (whether they are local or remote) tie up both the backup server and the workstation that submitted the request for attended backup. Once you send the request from the workstation, the workstation cannot perform other tasks during the backup. If you must perform attended backup, remember that at 8 megabytes per minute 1 gigabyte of data requires approximately 2 hours for backup.

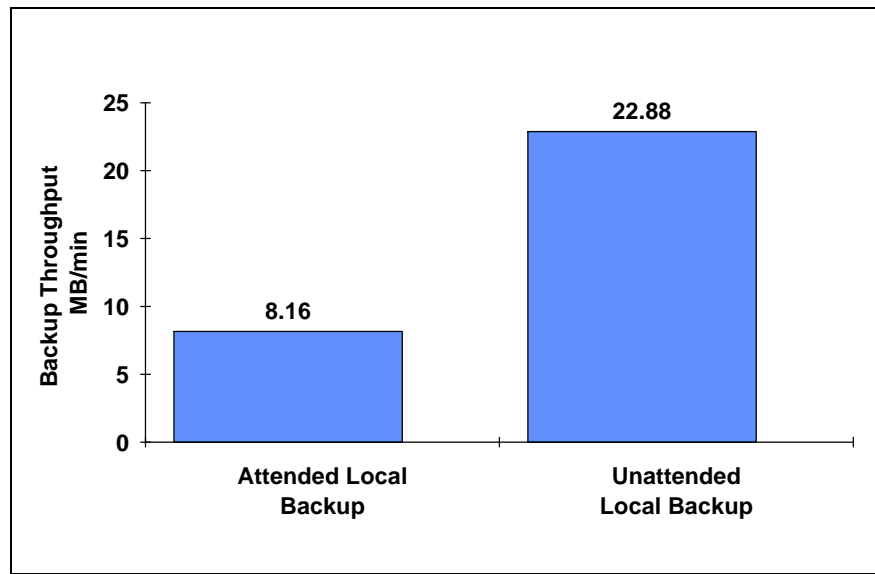


Figure 5-6. Attended Versus Unattended Local Backup Performance

When performing backups, disable the display option. The server requires less system processor time with this option disabled. As an added precaution, enable the Keyboard Password security feature or the QuickLock feature to ensure data integrity during attended backup at the manager workstation.

FILE FRAGMENTATION

File fragmentation does not materially impact the performance of the tape backup process. The NetWare elevator-seeking feature provides enhanced performance for file fragmentation by decreasing the number of times the hard drive read/write heads must travel across the disk to locate the pieces of the file. Elevator seeking allows the read/write heads to gather files in the direction in which they are moving as they move across the disk, instead of requiring the read/write heads to move back and forth across the disk to locate specific file fragments.

SUMMARY

Optimizing tape backup performance requires a well-organized tape backup plan and a well-managed hard drive subsystem. A good disk management plan provides orderly and efficient tape backups, reducing the amount of time required to back up large hard drive subsystems.

You can achieve the best possible performance by performing local backups. Local backups can improve performance over remote backups by almost 300 percent. Local backups also reduce the amount of traffic over the network, because each server backs up its own files. They also allow the server to stream the data, which can further enhance performance.

When you must perform remote backups, execute these backups during off-peak hours, and use servers that are not mission-critical and do not have a CPU Utilization greater than 60 percent. If your server includes many large files, increasing the number of ARCserve I/O buffers might improve performance. This, however, works only in environments with many large data files.

Always perform unattended backups to allow ARCserve to spool the backup job, rather than tie up the backup server and the workstation that submits the request.



Your particular environment provides unique considerations for enhancing performance. When establishing your tape backup plan, perform several backups using data from your network environment and analyze your server workload (for example, use CPU Utilization in *MONITOR.NLM*) to determine the baseline performance and to set expectations.



Chapter 6

TAPE BACKUP PLAN EXAMPLE

The following example demonstrates a possible backup solution for a large network that combines a variety of data types and applications.

NOTE: This example is not the only backup solution. Since each tape backup solution is site-specific, determine tape backup plans by performing an assessment of the network and the requirements of the network users. Use the following example as a guideline for determining the backup plan that meets your system needs.

NETWORK CONFIGURATION

- **Server ACCT** - COMPAQ SYSTEMPRO/XL Model 486/50-1050 with an additional 5.25 gigabytes of hard disk space (6.3 gigabytes total) and one COMPAQ 5.0-Gigabyte DAT Drive
- **Server LEGAL** - COMPAQ ProSignia Model 486DX2/66-1050 with an additional 3.15 gigabytes of hard disk space (4.2 gigabytes total) and one COMPAQ 5.0-Gigabyte DAT Drive
- **Server ENG1**- COMPAQ ProSignia Model 486-1050 with an additional 3.15 gigabytes of hard disk space (4.2 gigabytes total) and one COMPAQ 5.0-Gigabyte DAT Drive
- **Server ENG2**- Enhanced COMPAQ SYSTEMPRO Model 486-840 with one COMPAQ 1.3-/2.0-Gigabyte DAT Drive
- **Server ADMIN** - COMPAQ SYSTEMPRO/LT Model 386-840 with no tape drive subsystem

USER ENVIRONMENT

The network servers in this example environment are shared by several departments of the company, including the accounting department, the legal department, and the engineering group.

The Accounting department uses several applications over the network on a daily basis, including account consolidation and reporting applications and development tools. The accounting data collected from each accounting group is consolidated by one group and refined by spreadsheet and graphics programs. This is important, because the report goes to executive-level management and will be published for public use.

The Legal department uses the network servers for document image processing and storage. Images of all pertinent legal documents are stored on the servers and retrieved when needed. Document files that are not accessed for more than one year are archived and removed from the server. The data on these legal servers is crucial to the company's well-being. This data must be secured and kept error-free.

The Engineering department must share the resources of the legal department server, but it must also have its own server for task-specific applications. Engineers must access some legal documents and create their own document images as well. These engineers also use CAD applications for plotting and mapping, as well as engineering design and modeling applications.

The network also includes strategic users, such as corporate vice presidents and directors. Since these strategic users access many of the company's servers and use their workstations to store company confidential data, their workstations require both high security and consistent backups.

These departments use a variety of personal productivity applications such as word processing, spreadsheet, and graphics software.



ANALYSIS

The Accounting department data grows rapidly and changes constantly. It requires large amounts of hard disk space for accounting applications and data. The Accounting department uses ACCT as its server. The SYS volume is 2 gigabytes, containing all NetWare System and Public files, accounting application files, and personal productivity applications for the department (such as word processing, spreadsheet, and graphics). VOL1, 3.5 gigabytes, contains all data files for the accounting department. This information must be backed up often. Full weekly backups of VOL1 are planned with daily differential backups, because lost productivity can be detrimental to the department.

The Legal department uses large amounts of hard disk space, but the data does not change as rapidly as the accounting data. The Legal department uses the server for file storage and file sharing among the groups. Server LEGAL provides storage for legal documents and provides network services for users. The SYS volume of server LEGAL, 1 gigabyte, includes imaging and database application files. VOL1, 2.0 gigabytes, contains the image files for the legal group. VOL2, 500 megabytes, contains the data files for the legal group. Since the legal data does not change as rapidly as the accounting data and only certain case files are accessed during a given operating period, full weekly backups are performed on VOL1 and VOL2 of server LEGAL. Since only a small portion of the data changes during any given period, daily incremental backups of these volumes are scheduled.

The Engineering department is divided into two groups. One group uses a large database and accesses the legal image database, and one group performs engineering computations and runs modeling applications. These groups use two separate servers: ENG1 and ENG2. The SYS volume of server ENG1, 500 megabytes, contains all application files and System and Public files. VOL1, remaining, 3.5 gigabytes, contains the large database, data files, and image files. The SYS volume of server ENG2, 210 megabytes, contains all modeling application files and all computational application files as well as System and Public files. VOL1 of ENG2, remaining 630 megabytes, contains all CAD files, maps, and data files. Both ENG1 and ENG2 must be backed up fully every week, with differential backups occurring daily.

The server ADMIN provides miscellaneous network services, such as electronic mail and administrative file storage for users. ADMIN does not have a tape drive installed and must be backed up to another server tape drive. The SYS volume of server ADMIN, 420 megabytes, includes all electronic mail files and all user data for these files. The SYS volume requires backup only when users are added to the network. VOL1, remaining 420 megabytes, contains administrative data files, including memoranda, letters, spreadsheets, and so on.

To accommodate the confidential data generated by corporate strategic users, server ENG2 performs strategic workstation backups (approximately 260 megabytes of data from three workstations). Due to the nature of this data, backups are performed daily using low-priority incremental backup based on the archive bit and weekly using a full backup.

TAPE BACKUP PLAN

To reduce the risk of loss productivity due to a backup server failure, four of the five servers include tape drive subsystems. These servers back up portions of their own hard drives and portions of hard drives of other servers. The most efficient method for backing up multiple servers during the same time frame is to have each server back up its own volumes. This process of backing up 5 gigabytes of data (maximum amount of data a 5-gigabyte drive can archive) performs at approximately 20 megabytes of data per minute, so 5 gigabytes of data requires approximately 4 hours of backup time. Since backups are scheduled for the hours between 6 p.m. and 6 a.m., this allows ample time to perform full daily backups if required.

Performing remote backups requires approximately 7 megabytes per minute, so 5 gigabytes of data requires approximately 11.9 hours of backup time. This does not allow enough time to perform full daily backups during off-peak hours of 6 p.m. to 6 a.m. Differential or incremental backups require less time, but remote backup may be unacceptable for large networks. Some circumstances require that you perform remote backups (backups over the network), such as when the server hard disk capacity exceeds the capacity of the tape drive or when the server has no tape drive subsystem.

The backup process for this example scenario occurs as follows. Table 6-1 illustrates the distribution of the workload.

- Server ACCT contains 5.5 gigabytes of data. It is configured with a 5.0-Gigabyte DAT Drive and backs up its own VOL1 (4.0 gigabytes). With the space remaining on the tape, it backs up the server LEGAL SYS volume.

$$\frac{3,500}{20} + \frac{1,000}{7} = 317.86 \text{ minutes} \\ \text{or } 5.30 \text{ hours}$$

- Server LEGAL contains 3.5 gigabytes of data. It is configured with a 5.0-Gigabyte DAT Drive and backs up the SYS volume of server ACCT (2.0 gigabytes). With the space remaining on the tape, it backs up its own VOL1 (2.0 gigabytes).

$$\frac{2,000}{20} + \frac{2,000}{7} = 385.71 \text{ minutes} \\ \text{or } 6.43 \text{ hours}$$

- Server ENG1, with a 5.0-Gigabyte DAT Drive, backs up VOL2 of server LEGAL (500 megabytes). With the space remaining on the tape, it backs up all of its own files (4.0 gigabytes).

$$\frac{4,000}{20} + \frac{500}{7} = 271.43 \text{ minutes} \\ \text{or } 4.52 \text{ hours}$$

- Server ENG2, with a 1.3-/2.0-Gigabyte DAT Drive, backs up its own files (840 megabytes), VOL1 of server ADMIN (420 megabytes), and 260 megabytes of data from strategic workstations.

$$\frac{840}{20} + \frac{420}{7} + \frac{260}{6} = 145.33 \text{ minutes} \\ \text{or } 2.42 \text{ hours}$$

**Table 6-1
Example Tape Backup Scheme**

Backup Server	Data Requiring Backup					
	ACCT	LEGAL	ENG1	ENG2	ADMIN	Workstation
ACCT backs up ...	VOL1 3.5 GB	SYS 1.0 GB				
LEGAL backs up...	SYS 2.0 GB	VOL1 2.0 GB				
ENG1 backs up...		VOL2 500 MB	ALL 4.0 GB			
ENG2 backs up...				ALL 840 MB	VOL1 420 MB	260 MB
Total Server Data	5.5 GB	3.5 GB	4.0 GB	840 MB	420 MB	260 MB

To achieve the best performance and the most efficient backup, most of these example servers back up their own data, except where it is not feasible. For example, server ACCT requires more than 5.0 gigabytes of backup, so one volume is backed up remotely to another server. This configuration covers all production application and data files reliably and, at the same time, provides hardware redundancy, should data recovery be required.

TAPE BACKUP IMPLEMENTATION

Assign a network support person as the primary administrator in charge of backup and another support person as secondary administrator. Clearly define the responsibilities and procedures.



Using Auto Pilot, develop an automated procedure to implement backups, including ARCserve script files, and schedule them to execute during off-peak hours. Test this procedure off line to ensure data reliability and availability when restoration is needed.

Apply the procedure to the production network for a pilot test period of about one month, and modify the procedure based on the feedback of users.

Enforce the backup policy and review it regularly to accommodate evolving network environments and new backup technologies.

SERVER FAILURE AND DATA RECOVERY

In this scenario, server ADMIN fails during the work day and requires maintenance. This server includes electronic mail files for several groups and administrative files. Because the server ADMIN does not have a tape drive, you must recover the data over the network (remotely). Remote data recovery adds traffic to the network. If the data is not crucial and if data recovery can be performed during off-peak hours (for example, that evening), recover the data during off-peak hours.



IMPORTANT: When performing any data recovery, do not restore data using mission-critical servers. Since these servers are the core of corporate productivity, using these mission-critical servers compromises the security of the server and increases the risk of server failure due to work overload.

If the data must be recovered during peak hours, analyze each of the available servers, determine which server has the bandwidth to perform the recovery, and perform the recovery from the server. Using *MONITOR.NLM*, analyze the CPU Utilization statistic of each available server. Do not use servers with greater than 60 percent CPU Utilization, because these servers do not have the bandwidth to perform the recovery. Restoring the data remotely adds approximately 12 to 20 percent CPU Utilization to server workload.

In this scenario, the server ACCT cannot perform the recovery. It is currently running end-of-month reports. Although the *MONITOR.NLM* shows CPU Utilization at only 35 percent, server ACCT is considered mission-critical during end-of-month reporting. Server ENG2 is unavailable due to required software upgrades, and while server ENG2 is being upgraded, server ENG1 is performing all network services for the Engineering Department. CPU Utilization for server ENG2 is 68 percent. CPU Utilization for server LEGAL is 28 percent, so server LEGAL is the most practical choice for performing the data recovery.

The server LEGAL tape drive uses data compression, and the server ADMIN tape (server ADMIN is backed up to ENG2) consists of non-compressed data. Data compression must be disabled on the 5.0-Gigabyte DAT Drive to restore the server ADMIN data. When you insert the tape in the 5.0-Gigabyte DAT Drive, the drive recognizes the data as non-compressed and disables data compression automatically.

Server ADMIN received full weekly backups and incremental backups based on the archive bit. Since the archive bit resets to 0 after each backup (regardless of whether the backup is an incremental, differential, or full backup), begin restoring the data with the last full weekly backup, and then restore from each incremental backup in chronological order.



Appendix A

CONFIGURATION OF OTHER SUPPORTED COMPAQ TAPE DRIVES

A reliable tape backup system is key to ensuring data integrity and recovery from data loss. This chapter provides descriptions of the other supported tape drive subsystems. These tape drives are:

- COMPAQ 320-/525-Megabyte Tape Drive
- COMPAQ 1.3-/2.0-Gigabyte Digital Audio Tape (DAT) Drive

Both of these tape drives are shipped with tape drive adapter boards; however, you can also configure these tape drives with the Integrated Fast-SCSI-2 Controller in the COMPAQ ProSignia, optional 32-Bit Fast-SCSI-2 Controller Board, or the SCSI Options Port of the COMPAQ SYSTEMPRO/XL.

Table A-1 lists the available COMPAQ tape drive and SCSI adapters that support these tape drives.



IMPORTANT: The 525-Megabyte ACA Tape Drive and the 5.0-Gigabyte DAT Drive can also be configured with the SCSI Option Adapter and the SCSI Compression Adapter; however, these configurations have not been extensively tested.

NOTE: The COMPAQ 6260 SCSI-2 Controller is not supported in a NetWare environment.



Table A-1
Supported COMPAQ Tape Drive Subsystems

PC Server	Supported Tape Drives	
	320-/525-MB Tape Drive	1.3-/2.0-GB DAT Drive
ProSignia	Integrated Fast-SCSI-2, Fast-SCSI-2 Controller Board, or SCSI Option Adapter	Integrated Fast-SCSI-2, Fast-SCSI-2 Controller Board, or SCSI Compression Adapter
SYSTEMPRO/XL	Integrated SCSI-2 Options Port, Fast-SCSI-2 Controller Board, or SCSI Option Adapter	Integrated SCSI-2 Options Port, Fast-SCSI-2 Controller Board, or SCSI Compression Adapter
SYSTEMPRO/LT	Fast-SCSI-2 Controller Board or SCSI Option Adapter	Fast-SCSI-2 Controller Board or SCSI Compression Adapter
Enhanced SYSTEMPRO	Fast-SCSI-2 Controller Board or SCSI Option Adapter	Fast-SCSI-2 Controller Board or SCSI Compression Adapter
SYSTEMPRO	Fast-SCSI-2 Controller Board or SCSI Option Adapter	Fast-SCSI-2 Controller Board or SCSI Compression Adapter

COMPAQ 320-/525-MEGABYTE TAPE DRIVE SUBSYSTEM

The 320-/525-Megabyte Tape Drive subsystem includes a 320-/525-Megabyte QIC-525 format tape drive and the SCSI Option Adapter. The SCSI Option Adapter is a 16-bit adapter that provides data access for the 320-/525-Megabyte tape drive, backing up about 525 megabytes of data at a maximum transfer rate of 11 megabytes per minute.

Set two switch banks in the 320-/525-Megabyte Tape Drive, one on the SCSI Option Adapter and one on the tape drive. Figure A-1 illustrates the switch settings for the SCSI Option Adapter.

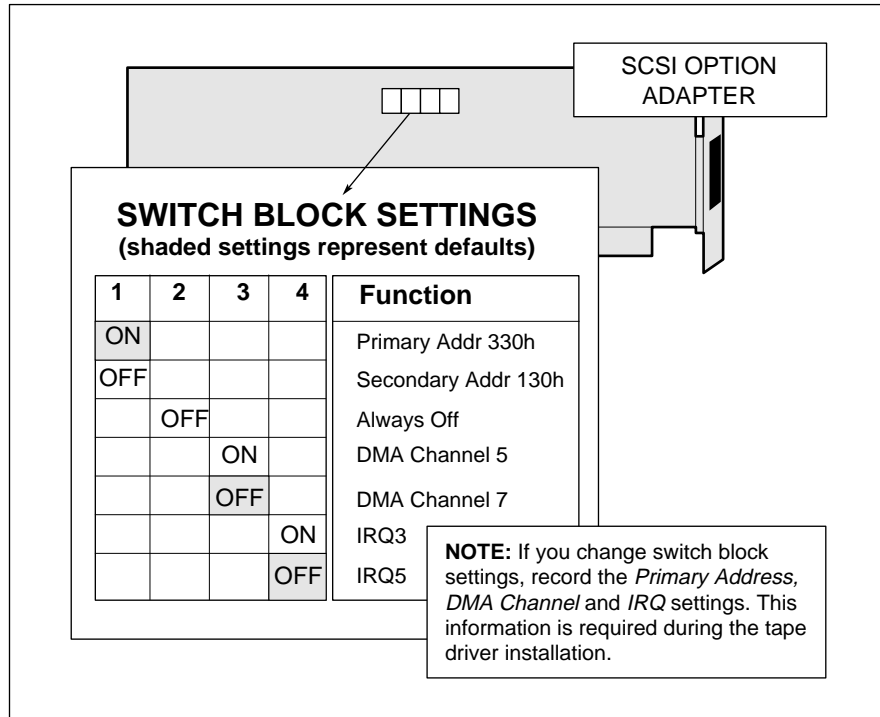


Figure A-1. Switch Settings for SCSI Option Adapter



Figure A-2 illustrates the settings for the SCSI ID on the tape drive. The default SCSI ID for the COMPAQ 320-/525-Megabyte Tape Drive is 4.

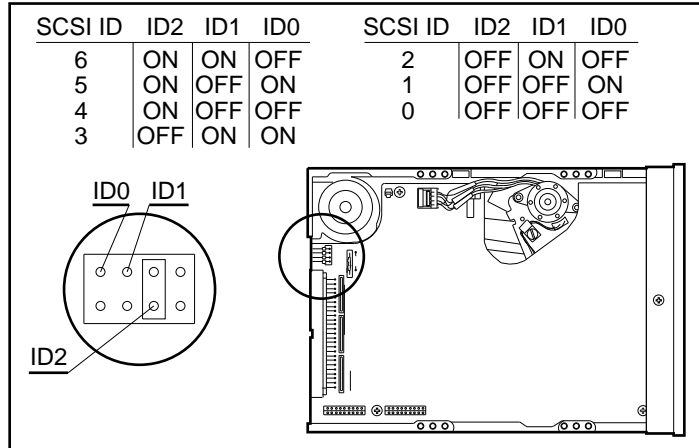


Figure A-2. Jumper Settings for 320-/525-Megabyte Tape Drive



IMPORTANT: If you change the default switch settings, note the *Interrupts (IRQ) settings, DMA Channel, and Port Address* when you run the EISA Configuration Utility. This information is required during ARCserve installation.

COMPAQ 1.3-/2.0-GIGABYTE DAT DRIVE SUBSYSTEM

The COMPAQ 1.3-/2.0-Gigabyte DAT Drive subsystem includes a 1.3-/2.0-Gigabyte DAT Drive and the SCSI Compression Adapter. The maximum data transfer rate for the 1.3-/2.0-Gigabyte DAT Drive is approximately 11 megabytes per minute when using ARCserve.



The SCSI Compression Adapter is a 16-bit SCSI controller that supports up to two tape drives. The COMPAQ 1.3-/2.0-Gigabyte DAT Drive includes the following features:

- Total backup capacity of up to 8 gigabytes when two DAT drives and data compression are used.
- Three layers of Error Correction Code plus read-after-write verify feature.
- Industry standard Digital Data Storage (DDS) format.
- 16-bit SCSI Compression Adapter.



IMPORTANT: ARCserve does not support data compression on the SCSI Compression Adapter, unless the SCSI Compression Adapter is configured with the COMPAQ 5.0-Gigabyte DAT Drive.

You must set the switch bank in the SCSI Compression Adapter to configure the controller. Figure A-3 illustrates the switch settings for the SCSI Compression Adapter. Figure A-4 illustrates the switch settings the SCSI ID on the 1.3-/2.0-Gigabyte DAT Drive. The default is SCSI ID=2.



IMPORTANT: If you change the default switch settings, note the *Interrupts (IRQ) settings*, *DMA Channel*, and *Port Address* when you run the EISA Configuration Utility. This information is required during ARCserve installation.

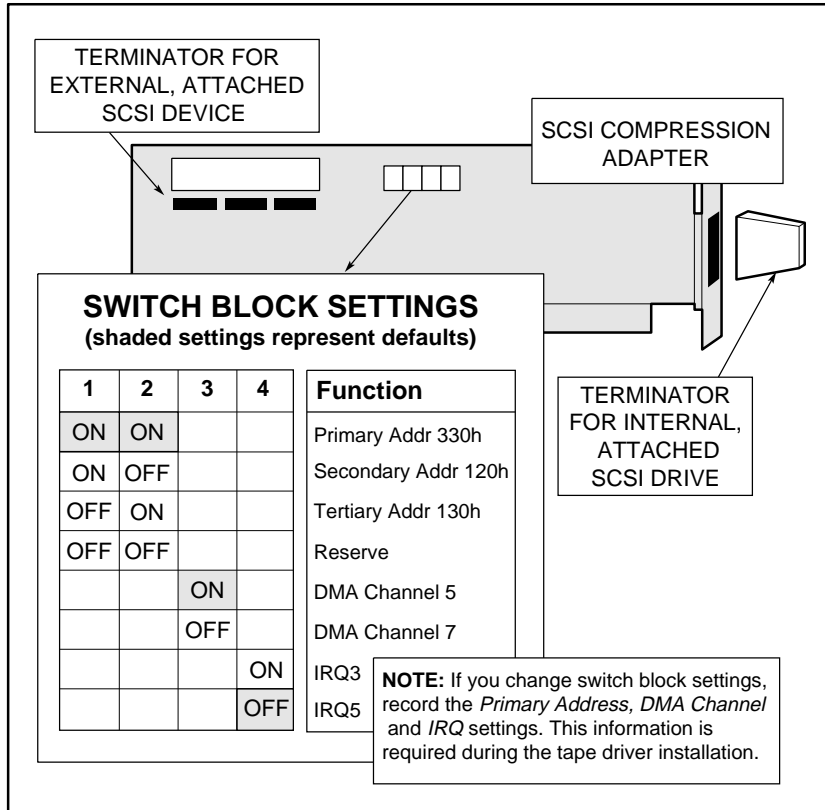


Figure A-3. Switch Settings for the SCSI Compression Adapter

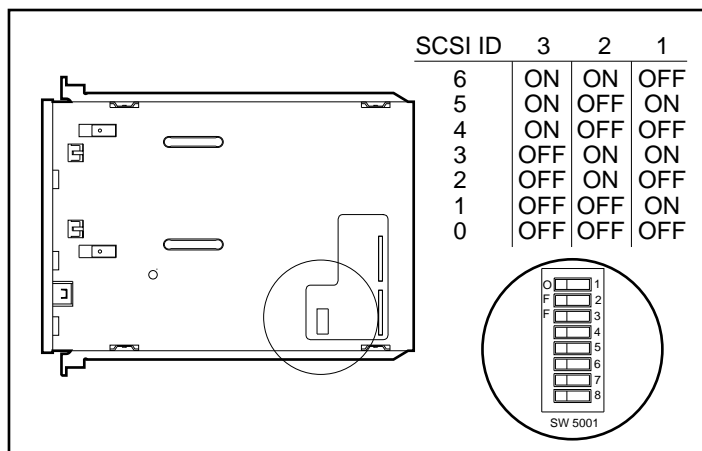


Figure A-4. Switch Settings for 1.3-/2.0-Gigabyte DAT Drive

USING THE COMPAQ EISA CONFIGURATION UTILITY

Configure the tape drive subsystems with the COMPAQ EISA Configuration Utility. The configuration files for all supported tape drive adapters are included with the EISA Configuration Utility.

To configure the COMPAQ 320-/525-Megabyte Tape Drive or the COMPAQ 1.3-/2.0-Gigabyte DAT Drive, perform the following steps:

1. If needed, set the appropriate switch settings on the tape drive adapter as shown in Figure A-3.
2. Set a unique SCSI ID for the tape drive as shown in Figure A-4.
3. Install the tape drive in the server.
4. Install the tape drive adapter in the server and attach the tape drive cables to the adapter.

5. Boot the server with the COMPAQ System Configuration diskette version 2.10 (or a later version) in the diskette drive. The server boots into the COMPAQ EISA Configuration Utility.

The EISA Configuration Utility verifies the EISA adapters in the system and adds them to the system configuration. The utility does not, however, automatically recognize and add ISA adapters to the system configuration. Because the SCSI Option Adapter and the SCSI Compression Adapter are ISA adapters, not EISA adapters, the EISA Configuration Utility does not automatically add these boards to the system configuration.

To add the SCSI Option Adapter or the SCSI Compression Adapter to the system configuration in the EISA Configuration Utility, continue with the following steps:

1. At the Primary Operating System menu, select *NetWare* and press the **ENTER** key.
2. From the Steps in Configuring Your Computer screen, select *Step 2: Add or Remove Boards*.
3. Press the **INSERT** key, and select *COMPAQ Board*.
4. Press the **ENTER** key to display the list of available configuration files.
5. Select the appropriate configuration file for your tape drive adapter. For the SCSI Option Adapter and the SCSI Compression Adapter, select *COMPAQ SCSI Adapter*. For other adapters, such as the Fast-SCSI-2 Controller Board, select the appropriate configuration file.
6. At the Add Confirmation screen, press the **ENTER** key to add the adapter to the configuration.
7. Select the appropriate slot for the adapter you are adding, and press the **ENTER** key. The display shows the adapter installed in the slot.
8. Press the **F10** key to return to the Steps in Configuring Your Computer screen.
9. Select *Step 3: View or Edit Details*.



10. In the View and Edit Details screen, highlight *Enabled* under the slot number section where the tape drive adapter resides, and press the **F6** key. For example, if the tape drive adapter resides in slot 3, the adapter status information (Enabled) should be in the Slot 3 section.
11. Note the displayed Interrupt (IRQ) settings, DMA Channel, and Port Address. Note these hardware settings. ARCserve prompts you for this information during installation.
12. Press the **F10** key to return to the View or Edit Details screen.
13. Press the **F10** key to return to the Steps in Configuring Your Computer screen.
14. Select *Step 5: Save and Exit*.
15. The EISA Configuration Utility checks for conflicts between the tape drive adapter and other expansion boards in the server. If there are conflicts, turn off the server, remove the conflicting adapters, and change switches to eliminate conflicts.

To configure the 320-/525-Megabyte Tape Drive or the 1.3-/2.0-Gigabyte DAT Drive with another supported COMPAQ SCSI controller (such as the Integrated 32-Bit Fast-SCSI-2 Controller in the COMPAQ ProSignia or the Integrated SCSI-2 Options Port in the COMPAQ SYSTEMPRO/XL), perform the following procedure after booting into EISA Configuration Utility:

1. At the Primary Operating System menu, select *NetWare* and press the **ENTER** key.
2. When prompted for Auto configuration, select *Yes*.
3. Select *Step 5: Save and Exit*.

Tape drive configuration is complete. To continue with the software installation, refer to Chapter 3 of this COMPAQ TechNote.



Appendix B

MULTIVENDOR INTEGRATION FROM COMPAQ

To help you successfully integrate and optimize your network or multivendor system, Compaq has developed a library of systems integration TechNotes for the NetWare, Microsoft Windows NT, and SCO UNIX operating system environments. TechNotes provide you with important information on topics such as network performance management, server management, and operating system interconnectivity.

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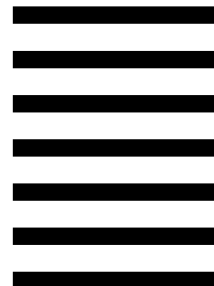
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