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COMPAQ TECHNOTE FOR NETWARE

TAPE BACKUP USING ARCSERVE v5.01 - WINDOWS EDITION FROM COMPAQ

First Edition (February, 1995)
Part Number 137672-001

Compaq Computer Corporation

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INTRODUCTION

Backup management is vital to a successful network implementation. Data loss can be catastrophic in most environments, resulting in the loss of days or weeks of productivity. A good backup management strategy can reduce lost productivity due to hardware or software failure. Performing regular tape backups is only a small part of backup management. Network administrators should develop a backup 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 data management plan.
- Establishing a data restoration procedure.

Tape backup software that can provide backup management services as well as perform tape backups can reduce the enormity of the management task. ARCserve v5.01 - Windows Edition from Compaq is centralized backup management software that uses the Microsoft Windows 3.1 interface to provide fully automated tape backup services for NetWare-based networks.

ABOUT THIS COMPAQ TECHNOTE

This Compaq TechNote for NetWare discusses ARCserve v5.01 - Windows Edition from Compaq in a Compaq server environment. It is for systems integrators and network administrators who are familiar with Compaq PC Servers and NetWare 3.1*x* and 4.*x*. The chapters in this Compaq TechNote contain the following information:

- ***Chapter 1*** - ARCserve - Windows Edition architecture and features, as well as a description of the Compaq TurboDAT Autoloader.
- ***Chapter 2*** - ARCserve - Windows Edition installation notes.
- ***Chapter 3*** - Storage management recommendations.
- ***Chapter 4*** - Performance considerations.
- ***Chapter 5*** - Example tape backup plan.

ARCSERVE V5.01 - WINDOWS EDITION FROM COMPAQ

ARCserve - Windows Edition is 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 (Windows interface) - Runs on the management workstation.
- ARCserve Server - NLM that runs on the file server.
- ARCserve Agents (MS-DOS, Microsoft Windows, OS/2) - Run on individual workstations.

  NOTE: Macintosh agents and UNIX agents are available separately.

Figure 1-1 illustrates the ARCserve software architecture. For a more detailed description of ARCserve - Windows Edition, see the *Cheyenne ARCserve for NetWare - Windows Edition Supervisor Guide*.

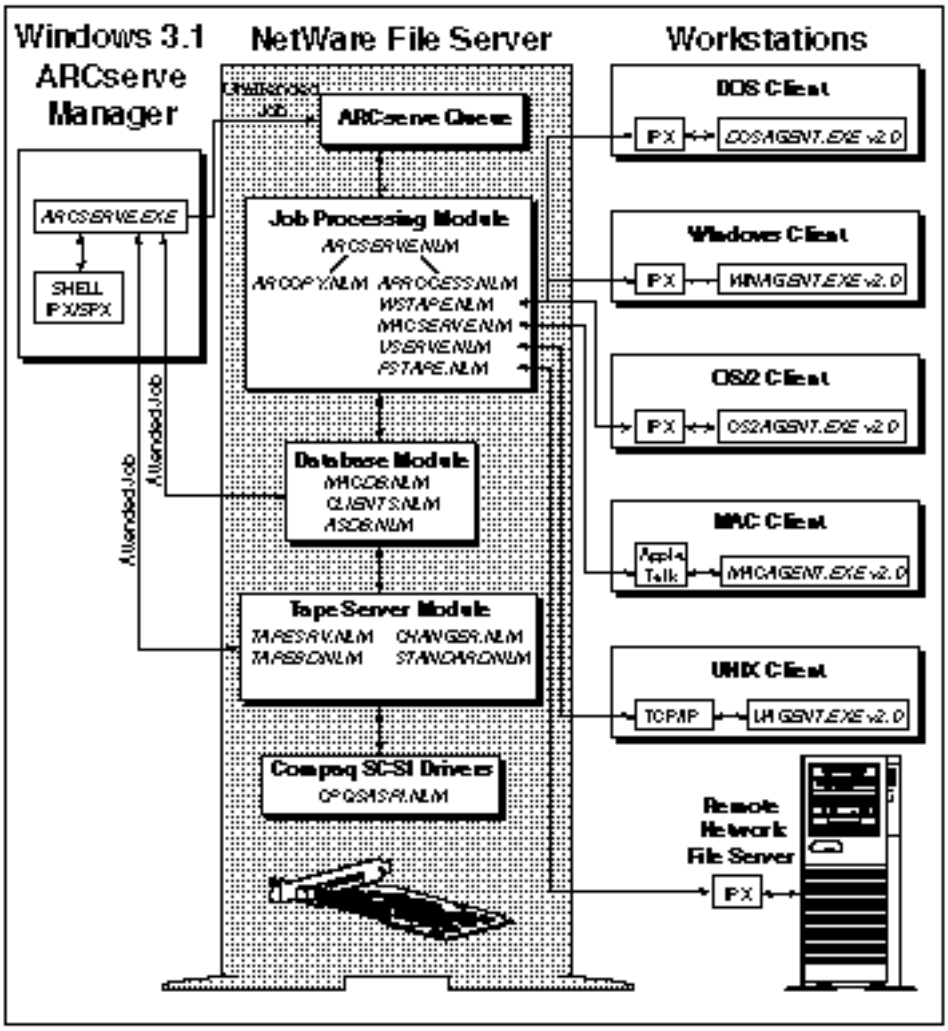

Figure 1-1. ARCserve v5.01 - Windows Edition from Compaq Architecture

Supported Tape Drives

ARCserve - Windows Edition supports the following Compaq tape drives for NetWare client-server tape backup:

- Compaq TurboDAT Autoloader (with the optional ARCserve Autoloader Agent from Compaq)
- Compaq 4-/16-Gigabyte TurboDAT Drive
- 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

Use Table 1-1 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 1-1
Recommended Compaq Tape Drive Subsystems

Compaq PC Server	Supported Tape Drives		
	5.0-GB DAT Drive	**4-/16-GB TurboDAT Drive**	**TurboDAT Autoloader**
ProLiant 1000 ProLiant 2000 ProLiant 4000	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board
ProSignia	Integrated Fast-SCSI-2 or Fast-SCSI-2 Controller Board	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	Fast-SCSI-2 Controller Board

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

ARCserve - Windows Edition includes a customized "picklist" of supported Compaq tape drive subsystems. During installation, ARCserve lists supported SCSI controllers and provides you with three options:

- Compaq ASPI SCSI Manager

  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

All Compaq controllers *except* the Compaq SCSI Option Adapter and the Compaq SCSI Compression Adapter use Compaq ASPI SCSI Manager support.

In addition, ARCserve - Windows Edition supports 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 - Windows Edition Features

ARCserve - Windows Edition offers a File Tracking System that uses a Novell Btrieve 6.0 database record manager, and Tape Cascading, which allows backup operations to continue on subsequent tape drives when the current tape reaches its capacity.

Using the Microsoft Windows "point and click" interface, ARCserve - Windows Edition includes a variety of other data management services, including:

- Parallel Streaming - Allows concurrent backup and restore operations to run to or from up to seven different tape drives on a single SCSI controller.
- Intelligent Restore - Allows you to selectively restore files.
- Auto Pilot Tape Management - Automates storage management with tape rotation, disk grooming, and disaster recovery. Uses the "grandfather, father, son" strategy.
- Compaq TurboDAT Autoloader Support - Allows high capacity storage management on the Compaq TurboDAT Autoloader using optional software modules.

ARCserve - Windows Edition includes NetWare Loadable Modules (NLMs) for servers and client agents for workstations. The user-version of ARCserve that you need is based on the user-version of NetWare installed on your network. For example, if you are using the 250-user version of NetWare, you need the 250-user version of ARCserve - Windows Edition.

ARCserve - Windows Edition provides Novell Btrieve 6.0 databases for the File Tracking System and Auto Pilot. Each server running ARCserve has its own set of databases containing information about jobs, tapes used, tape devices, and backed up files and directories.

With ARCserve - Windows Edition, you can schedule network backups to network servers configured with tape drives or to a dedicated tape backup server with multiple tape drives. This dedicated tape backup solution is easily managed, and offers performance advantages with ARCserve Parallel Streaming.

Parallel Streaming

Parallel Streaming allows concurrent backup to as many as seven tape devices controlled by a single SCSI controller. You can simultaneously back up several servers to several tape drives on one server. You can also restore files from a tape in another tape drive while you are backing up other servers.

Parallel Streaming allows you to back up and restore as many as seven connected network servers and clients simultaneously to seven separate tape drives. Using ARCserve - Windows Edition, you can select entire NetWare servers or networked clients (DOS, Windows, OS/2, UNIX, or Macintosh) to be backed up or restored simultaneously. You can also select files, subdirectories, and server volumes from networked servers and workstations. Performing multiple backup and restore operations simultaneously with ARCserve - Windows Edition provides exceptional throughput in a Compaq and NetWare environment.

Intelligent Restore

ARCserve - Windows Edition provides you with an enterprise-wide view of your network, allowing you to easily select sources and destinations for tape backup and restorations.

Three ways to select files for restoration include:

- From the Tree View - The Tree View shows a Windows-based graphical representation of the network with the files that have been backed up to tape. This is the most flexible method of selecting files to restore.
- From the Tape View - The Tape View displays the names of all the tapes used for backup, and the files on each one. Use the Tape View if you already know the tape from which you wish to restore data.
- From the Tape Session View - The Tape Session View displays the tapes that are currently attached to the backup server. Use the Tape Session method if the ARCserve tape database is not available.

Auto Pilot

ARCserve - Windows Edition allows you to perform backups using a customized rotation cycle of your own design, or by using Auto Pilot Tape Management. Auto Pilot uses the "grandfather-father-son" strategy, and lets you know the number of tapes you need, which tapes to use on a particular day, and which tapes you can overwrite. Auto Pilot provides for automatic tape formatting, tape naming, and disk grooming, which removes server files that have been inactive for a period of time.

The grandfather-father-son 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 the week (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.

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 per backup, use the following formula for the total number of tapes required.

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

ARCserve - Windows Edition 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. When used with the Compaq TurboDAT Autoloader, ARCserve - Windows Edition provides exceptional tape backup performance and automated tape management.

Compaq TurboDAT Autoloader Support

ARCserve - Windows Edition supports the Compaq TurboDAT Autoloader, a high-performance Digital Audio Tape (DAT) drive that uses Digital Data Standard 2 (DDS2) technology to perform at double the speed and double the capacity of other DAT drives. The TurboDAT Autoloader contains an integrated 4-/16-Gigabyte TurboDAT Drive and provides fully automated backup for large networks and high-capacity storage environments. In addition to the standard four-cartridge magazine, an optional twelve-cartridge magazine is available for the TurboDAT Autoloader.

The TurboDAT Autoloader is supported in the following servers:

- Compaq ProLiant Family of Servers
- Compaq ProSignia Family of Servers
- Compaq Systempro/XL

Using ARCserve - Windows Edition and the TurboDAT Autoloader together can provide unattended backups of up to 96 gigabytes. You do not have to switch tapes, so backups can be scheduled during off-peak times, such as late at night or on weekends.

ARCserve - Windows Edition requires the ARCserve Autoloader Agent from Compaq v2.0 to support the Compaq TurboDAT Autoloader.

NOTE: For ARCserve 4.0, use the ARCserve Autoloader Agent from Compaq v1.0. The ARCserve Autoloader Agent from Compaq package contains both versions of the Agent.

ARCserve - Windows Edition and the TurboDAT Autoloader provide fast, random-access restoration of any file in the tape magazine. The software keeps track of the location of the tapes in the magazine, as well as the name and location of each file on the tapes. In addition to this file tracking capability, ARCserve - Windows Edition uses the random access functionality of the hardware to restore a single file from any tape in the TurboDAT Autoloader in minutes. Full system restorations are also faster, since the tapes are mounted in the magazine, and you can initiate a restore from a remote location without having to manually insert tapes in the tape drive.

Most errors in backup and restore operations are the result of operator errors. Since the TurboDAT Autoloader backup solution reduces human interaction, the number of operator errors can be reduced.

You can use the ARCserve Auto Pilot feature to automatically schedule all backups to the TurboDAT Autoloader. Auto Pilot works with the TurboDAT Autoloader to accomplish complete backup schedules of networked servers without requiring operator intervention. You can also design a more individualized backup plan. Regardless of the method used to schedule backups, the twelve-cassette tape magazine can provide automated backups and restorations without human intervention for weeks at a time.

The TurboDAT Autoloader can be easily added to your current ARCserve 4.0 or ARCserve - Windows Edition environment. All of your current backup scripts can be used with the TurboDAT Autoloader, or you can design a more optimized backup strategy.

The combination of ARCserve - Windows Edition and the ARCserve Autoloader Agent from Compaq v2.0 allows you to control multiple TurboDAT Autoloaders and tape drives simultaneously.

NOTE: The ARCserve Autoloader Agent from Compaq v1.0 supports only one TurboDAT Autoloader.

The software also provides security for the tape backup process by locking the magazine in the drive when it is mounted. This disables the eject key on the front of the drive, which prevents unauthorized removal of the tape magazine.

You can configure ARCserve - Windows Edition to archive files that have not been accessed in a certain period of time. ARCserve - Windows Edition moves these files to the TurboDAT Autoloader. This frees up valuable server storage space, but keeps the files near-line in the TurboDAT Autoloader so they can be restored quickly if required.

Using ARCserve - Windows Edition together with the TurboDAT Autoloader can greatly simplify the tape backup process for your NetWare environment. Scheduling backups with ARCserve - Windows Edition while taking advantage of the multi-tape capability of the TurboDAT Autoloader automates your backup process and requires a minimum of user intervention.

Chapter 2
SOFTWARE INSTALLATION NOTES

ARCserve v5.01 - Windows Edition from Compaq supports tape backup and restore operations on both NetWare 3.*x* and 4.*x* servers, as well as DOS, Windows, OS/2, Macintosh, and UNIX clients. NetWare 4.*x* includes new operating system features, such as directory services, file compression, and file migration. These new features affect the server backup and restore process.

ARCserve - Windows Edition requires Novell Storage Management Services to back up and restore NetWare 3.*x* and 4.*x* servers. For DOS, Windows, OS/2, Macintosh, and UNIX client workstations, use the ARCserve client agents.

NOVELL STORAGE MANAGEMENT SERVICES (SMS)

Novell provides Storage Management Services (SMS), a collection of services and application programming interfaces (APIs) that enable backup applications to effectively back up and restore NetWare 3.*x* and 4.*x* servers. SMS ships with NetWare 4.01. The latest versions of the SMS NLMs are also available on NetWire on CompuServe. The latest SMS versions are necessary for ARCserve - Windows Edition.

Figure 2-1 illustrates SMS setup on the tape backup and remote servers.

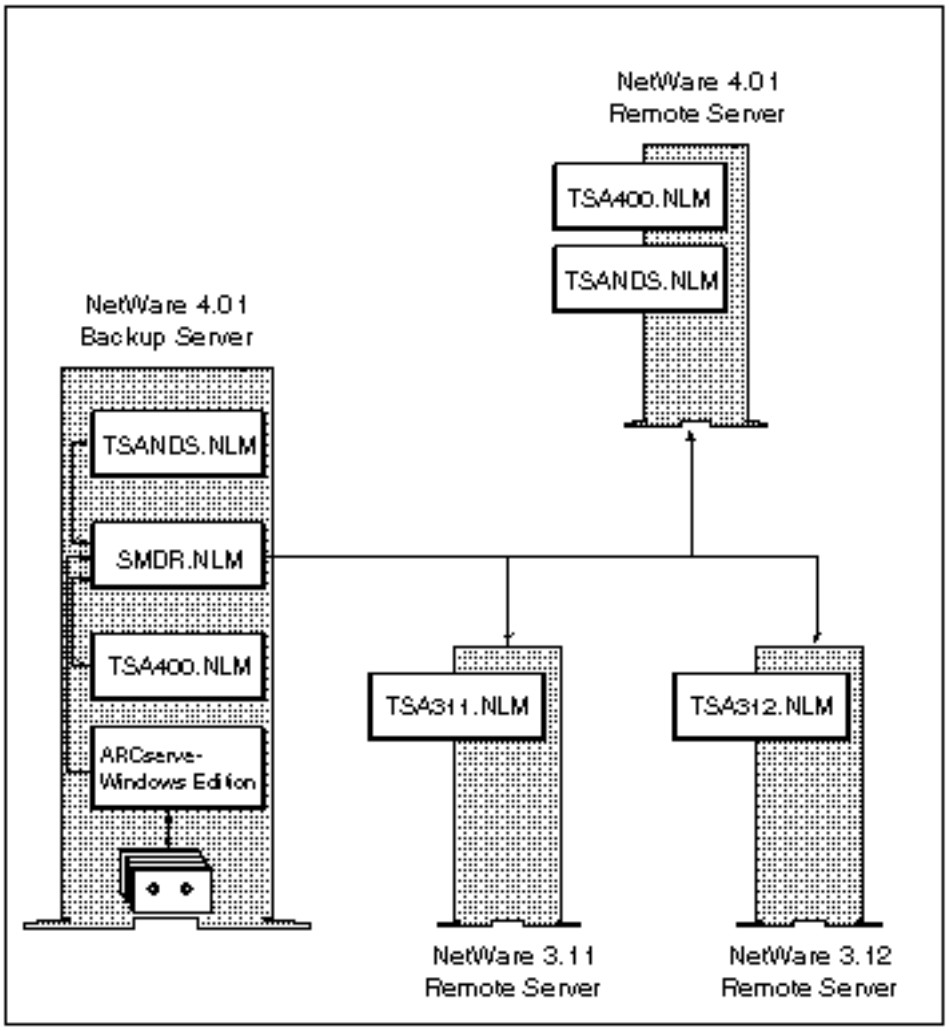

Figure 2-1. Novell Storage Management Services (SMS) and ARCserve - Windows Edition

ARCserve - Windows Edition uses the Storage Management Data Requester (*SMDR.NLM* for NetWare 4.*x* and *SMDR31X.NLM* for NetWare 3.*x*) to request and send data to and from the Target Services Agents (TSAs), which reside on any NetWare server to be backed up and restored. *SMDR.NLM* and *SMDR31X.NLM* are automatically loaded by ARCserve - Windows Edition.

TSAs are required on all servers to be backed up. They collect the data from the server and send it to ARCserve - Windows Edition, or receive data from ARCserve and restore it to the server.

TSA400.NLM allows ARCserve - Windows Edition to back up and restore the NetWare 4.*x* file system. Compressed files are read directly from disk and backed up to tape without being decompressed by NetWare. If the files are restored, they are written back to the disk in the compressed format.

Files that have been moved to an optical storage device by NetWare 4.*x* file migration are backed up directly to tape without being read back to the hard disk. When migrated files are restored, they are immediately migrated to optical storage.

TSANDS.NLM allows ARCserve - Windows Edition to back up and restore directory services under NetWare 4.*x*. To back up directory services in NetWare 4.*x*, you must back up a volume or server. The entire NetWare directory services tree is backed up automatically during the volume or server backup. (This tree will be backed up once per job, even if you select multiple servers or volumes.) You cannot back up only directory services. Directory services are saved to tape as separate sessions, however, so you can *restore* only directory services, without restoring the volume or server.

! **IMPORTANT:** All NetWare 4.*x* servers that will be backed up using ARCserve - Windows Edition must have bindery emulation enabled. Bindery emulation is enabled during NetWare 4.*x* installation. Future versions of ARCserve v5.01 - Windows Edition from Compaq will not require bindery emulation.

TSA311.NLM allows ARCserve - Windows Edition to back up and restore the NetWare 3.11 file system. *TSA312.NLM* allows ARCserve - Windows Edition to back up and restore the NetWare 3.12 file system.

ARCSERVE INSTALLATION OVERVIEW

To install ARCserve - Windows Edition in your Compaq and NetWare server environment, follow the general guidelines discussed in this section. Refer to the *Cheyenne ARCserve for NetWare - Windows Edition Installation Guide* for more detailed instructions.

Hardware Installation and Configuration

Install the Compaq tape drives or the TurboDAT Autoloader in your server. See the installation instructions that came with your Compaq hardware.

If you install more than one tape drive in the server, each one must be connected to the same SCSI controller.

! **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 - Windows Edition prompts you for this information during installation.

Compaq provides NetWare device drivers to optimize ARCserve - Windows Edition tape backup. These NetWare device drivers are distributed on the NetWare Programs from Compaq (NPFC) diskette and through The Compaq Connection, a Compaq forum on CompuServe.

CPQSASPI.NLM from Compaq (on the NPFC diskette) provides ASPI support by assigning ASPI host numbers to all configured SCSI buses. ARCserve - Windows Edition uses ASPI host numbers to identify which devices reside on which SCSI bus.

Copy the following device drivers from the NPFC diskette or The Compaq Connection to SYS:SYSTEM on all servers requiring tape backup:

- *CPQSXPT.NLM* - Transport layer
- *CPQS710.DSK* - Controller driver
- *CPQSASPI.NLM* - Compaq SCSI ASPI Manager driver
- *CPQS94.DSK* - Controller driver for SCSI devices connected to the Compaq Systempro/XL SCSI-2 Options port

Software Installation and Configuration

The following steps assume that Microsoft Windows is already installed on the management workstation. These steps also assume that NetWare is installed, and that the client can log into the server.

The following steps outline specific areas of ARCserve - Windows Edition installation, and are not to be considered complete instructions for installing the software. For more detailed ARCserve - Windows Edition installation instructions, see the *Cheyenne ARCserve for NetWare - Windows Edition Installation Guide*.

! **IMPORTANT:** ARCserve - Windows Edition does not support directory services login under NetWare 4.*x*. All NetWare 4.*x* servers that will be backed up using ARCserve - Windows Edition must have bindery emulation enabled. Bindery emulation is enabled during NetWare 4.*x* installation.

---

1. In the NetWare 3.1*x* environment, log into the server as SUPERVISOR, or as a user with SUPERVISOR privileges.

   If you are logging into a NetWare 4.*x* server and are using the NetWare 4.*x* client shells (NetWare 4.*x* client VLMs), you must log in as ADMIN or as a user with ADMIN privileges, using the /B option. For example:

   ```
   LOGIN [SERVERNAME] / ADMIN /B
   ```

2. Start Microsoft Windows 3.1 (or greater) on the client workstation.

3. Insert ARCserve disk #1 in the A: drive.
4. At Windows Program Manager, select *File* → *Run*. At the Command Line: prompt, enter A:\SETUP.
5. Follow the setup instructions. Select the appropriate controller for your environment. If you are installing ARCserve - Windows Edition on a server that supports the ASPI interface, select *Compaq SCSI ASPI Manager*. See Table 2-1 for more information.

   If you are installing ARCserve - Windows Edition on a server configured with the SCSI Option Adapter or the SCSI Compression Adapter, select the appropriate option.
6. Provide other installation diskettes when prompted. When ARCserve - Windows Edition installation is complete, perform the following steps.
7. To enable ARCserve - Windows Edition to back up DOS and MAC files through SMS, follow these steps:

   a. On the tape backup server, access the ARCserve Scheduler Console screen.

   b. At the Available Options screen, select *Configuration*.

   c. Enable "*Use SMS logic for DOS and MAC files also."* The default is *No*. Select *Yes*.

   d. Press the **F2** key to save the configuration.
8. For controllers using ASPI support, edit the *AUTOEXEC.NCF* file *on the ARCserve tape backup server* to automatically load the Compaq SCSI ASPI Manager, Compaq device drivers, and ARCserve - Windows Edition. See Table 2-1 for information on support for Compaq SCSI controllers. Include the following commands in the *AUTOEXEC.NCF* file:

   ```
   LOAD CPQS710.DSK (or CPQS94.DSK)
   LOAD CPQSASPI.NLM
   ASTART.NCF
   ```

Table 2-1
Support for Compaq SCSI Controllers

COMPAQ SCSI Controller	Use ASPI Support?	Compaq Device Driver
Fast-SCSI-2 Controller Board	Yes	*CPQS710.DSK*
Integrated Fast-SCSI-2 Controller	Yes	*CPQS710.DSK*
SCSI-2 Options Port	Yes	*CPQS94.DSK*
SCSI Compression Adapter	No	No Compaq driver required
SCSI Option Adapter	No	No Compaq driver required

9. Edit the *AUTOEXEC.NCF* on the tape backup server *and any remote servers you intend to back up* to automatically load the Novell SMS files. For NetWare 3.11 servers, use the following command:

   LOAD TSA311.NLM

   For NetWare 3.12 servers, use the following command:

   LOAD TSA312.NLM

   For NetWare 4.*x* servers, use the following commands:

   LOAD TSANDS.NLM

   LOAD TSA400.NLM

10. ARCserve - Windows Edition automatically installs Novell SMS files to SYS:SYSTEM on the tape backup server where ARCserve - Windows Edition is installed. You must manually copy the following SMS files from SYS:SYSTEM on the tape backup server to SYS:SYSTEM on any network server you wish to back up:
    - *TSA311.NLM* dated 9-20-93 or later (for NetWare 3.11 servers)
    - *TSA312.NLM* dated 9-20-93 or later (for NetWare 3.12 servers)
    - *SMDR31X.NLM* dated 6-15-93 or later (for NetWare 3.11 and 3.12 servers)
    - *TSA400.NLM* dated 9-20-93 or later (for NetWare 4.*x* servers)
    - *TSANDS.NLM* dated 8-19-93 or later (for NetWare 4.*x* servers)
    - *SMDR.NLM* dated 6-15-93 or later (for NetWare 4.*x* servers)

To reduce the risk of data and productivity loss in networking environments, you must establish a storage management strategy. Chapter 3 discusses storage management and developing an effective tape backup plan.

Chapter 3
STORAGE MANAGEMENT

ARCserve v5.01 - Windows Edition from Compaq offloads the backup and restoration 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 managing all network server and workstation backups. Storage management consists of the following activities:

- Performing a risk assessment
- Defining a data 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, or cost of manual reentry of lost data.
- 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.

DATA MANAGEMENT

A good data 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 - Windows Edition 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 error. 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 drive 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 data management plan should include distribution of backup workload and data housekeeping. 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. ARCserve - Windows Edition Parallel Streaming also allows you to use a single tape backup server to provide backup services for many servers on the LAN. Larger network configurations may require several tape backup servers.

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, you can use the Auto Pilot feature of ARCserve - Windows Edition to supervise all backups, or schedule backups for a more specialized backup plan. Auto Pilot creates a very specific backup plan for you; scheduling backups allows you to develop script files for a more individualized plan.

Auto Pilot uses the grandfather-father-son tape rotation scheme. Using either Auto Pilot or scheduling backups allows you to establish a tape rotation scheme, keep 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-stream backup server using the 4-/16-Gigabyte TurboDAT Drive with data compression enabled.

$$\frac{\text{Data (in MB) on Local Server}}{29} + \frac{\text{Data (in MB) on Remote Server}}{14} = \text{Backup time in minutes}$$

In the formula, 29 represents the average amount of data per minute that can be backed up locally to tape. The value of 14 represents the average amount of data per minute that can be backed up to tape over the network.

NOTE: For more information on tape backup throughput performance, refer to Chapter 4 of this Compaq TechNote.

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

$$\frac{3{,}000}{29} + \frac{1{,}000}{14} = 175 \text{ minutes}$$

In this example, the server requires 2 hours and 55 minutes to perform a backup.

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 more tape backup devices or the Compaq TurboDAT Autoloader.
- You can use the Parallel Streaming capability of ARCserve - Windows Edition to back up as many as seven different servers to seven different tape drives concurrently. See Chapter 4 for information on tape backup performance.
- 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 - Windows Edition allows you to build script files and schedule them during off-peak hours.

Server CPU Utilization rises significantly using ARCserve - Windows Edition. Performing local backups adds workload to the hard drive subsystem, affecting server performance. Performing remote backups adds traffic to the network, potentially affecting network performance.

NOTE: Refer to Chapter 4 for more information on performance considerations.

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

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 in Chapter 1, Auto Pilot uses the grandfather-father-son tape rotation scheme. This backup scheme uses four daily tape sets, and assumes one tape set 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 uses a fifth tape set, labeled Friday, as a full weekly system backup.

As an additional precaution, rotate the four tape sets labeled Friday as full weekly backups, keeping four full copies of the system, with the oldest copy being four 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 - Windows Edition 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.

Auto Pilot supports the Compaq TurboDAT Autoloader. You can also schedule backups following your own individual backup scheme.

Tape Cartridge Management

Properly label each cartridge and tape with its name for easy retrieval and for enforcement of the rotation scheme. ARCserve - Windows Edition keeps a comprehensive record of each tape, including what data is on the tape, 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 them in a secured location, such as a locked room.

The ARCserve - Windows Edition Auto Pilot feature 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 provide methods for efficient data recovery in the event of data loss.

As a part of tape cartridge management, ARCserve - Windows Edition 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 erasing the tape first, or by overwriting the tape with tape drive compression disabled. You can disable tape drive hardware compression using ARCserve - Windows Edition.

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 - Windows Edition 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 Quick Recover and Recover Auto Pilot Database for restoring data only with Auto Pilot backup tapes.

You can also restore files by selecting them from the ARCserve - Windows Edition Tree view, Tape view, or Tape Session view. See Chapter 1 for more information on the Intelligent Restore feature.

Tape Backup Hardware Redundancy

Data is usually restored as soon as possible after data loss. 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 security can be compromised during the backup process, since tapes are small and easily moved. Assess the potential risk of stolen data, and minimize or eliminate its possibility. Use physical security measures to protect data security, such as keeping tapes in a secure area not accessible to unauthorized personnel. ARCserve - Windows Edition can provide an additional logical level of security by adding a password to the backup session. The password is then required when files are restored from this session.

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.

Chapter 4
PERFORMANCE NOTES

A typical enterprise-wide NetWare local area network (LAN) consists of many servers distributed throughout an organization. In a typical LAN, there are two ways to back up server data. The highest performance (and most expensive) solution requires a tape drive and ARCserve - Windows Edition software in each server. Servers are not always centrally located, however, and this solution may require you to monitor and replace tapes on many remote servers.

The second method of backing up network server data requires several tape drives on a single server. Other servers back up their data to this centrally located server. This solution is less costly and more easily managed, but can offer slower performance with single-stream backups. ARCserve v5.01 - Windows Edition from Compaq addresses the performance issues in this solution by offering concurrent backup with parallel streaming.

ARCserve - Windows Edition Parallel Streaming allows you to back up and restore up to seven servers concurrently, each to a separate tape drive. This offers dramatic performance improvement over single-stream backups, which are limited to network backup rates between 10 and 15 megabytes per minute.

This chapter discusses factors that can affect ARCserve -Windows Edition tape backup performance. When establishing your tape backup plan, perform several backups to determine the exact performance for your environment. Monitor the system processor, disk channel, NIC channel, and memory utilization to understand the effect that tape backup will have on the network environment.

This chapter discusses the following topics:

- Compaq integration testing configuration
- Performance results and considerations for local backup, including system processor and disk channel utilization, and ARCserve I/O buffers
- Performance results and considerations for remote backup, including network topology, bridges and routers, and network packet size, traffic, and bandwidth
- Other performance considerations such as file size, data compression, and file fragmentation

INTEGRATION TESTING CONFIGURATION

This chapter includes performance test results for single- and multiple-stream backups using ARCserve - Windows Edition and a single tape backup server with multiple tape drives. Compaq integration engineers performed backups using 267 megabytes of binary, text, spreadsheet, and database files ranging from under 1 Kbyte to more than 10 megabytes. This data mix represents data that would be backed up from a typical network server in a resource-sharing environment.

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

- Compaq ProLiant 1000 Model 5/60 as the backup server
  - 32 megabytes of standard system memory
  - Five 330-Megabyte Fast-SCSI-2 Hard Drives connected to the Integrated 32-Bit Fast-SCSI-2 Controller
  - Five 4-/16-Gigabyte TurboDAT Drives and two 5.0-Gigabyte Digital Audio Tape (DAT) Drives connected to the 32-Bit Fast-SCSI-2 Controller Board
  - Two Compaq 32-Bit NetFlex Controllers

- Compaq ProSignia Model 5/60 as a file server
  - 16 megabytes of standard system memory
  - Integrated 32-Bit Fast-SCSI-2 Controller
  - 1.05-Gigabyte Fast-SCSI-2 Hard Drives
  - 32-Bit NetFlex Controller
- Compaq ProSignia Model 486DX2/66 as a file server
  - 28 megabytes of standard system memory
  - Integrated 32-Bit Fast-SCSI-2 Controller
  - Two 550-Megabyte Fast-SCSI-2 Hard Drives
  - 32-Bit NetFlex Controller
- Compaq ProSignia Model 486DX2/66 as a file server
  - 14 megabytes of standard system memory
  - 32-Bit Fast-SCSI-2 Controller Board
  - Two 550-Megabyte Fast-SCSI-2 Hard Drives
  - 32-Bit NetFlex Controller
- Compaq ProSignia Model 486/33 as a file server
  - 36 megabytes of standard system memory
  - 32-Bit Fast-SCSI-2 Controller Board
  - Two 550-Megabyte Fast-SCSI-2 Hard Drives
  - 32-Bit NetFlex Controller
- Compaq Systempro Model 486/33 as a file server
  - 32 megabytes of standard system memory
  - Compaq Intelligent Drive Array (IDA) Controller
  - Two 210-Megabyte Hard Drives
  - 32-Bit NetFlex Controller

- Compaq Systempro Model 486/33 as a file server
  - 16 megabytes of standard system memory
  - Compaq IDA Controller
  - Two 420-Megabyte Drive Array Pairs
  - 32-Bit NetFlex Controller
- Compaq Systempro Model 486/33 as a file server
  - 16 megabytes of standard system memory
  - Compaq IDA Controller
  - Two 210-Megabyte Hard Drives
  - 32-Bit NetFlex Controller

PERFORMANCE CONSIDERATIONS

The busier the server is with routine functions, such as printing and file services, the longer it takes to complete a backup. Schedule backups with ARCserve - Windows Edition during off-peak network hours, such as between 6 p.m. and 6 a.m., or on weekends, to reduce the load on the server and the amount of network traffic.

Regardless of the server's performance capabilities, the backup process affects 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).

Another performance consideration is whether the tape backup process is single- or multiple-stream. Single-stream backup backs up data from one device to one tape drive at a time. ARCserve 4.0 offers single-stream backup. Multiple-stream backup is addressed by ARCserve - Windows Edition Parallel Streaming, which allows concurrent backup and restoration processes on up to seven tape devices on one SCSI controller. Multiple streaming increases the throughput of the tape backup process, so you can back up and restore greater amounts of data in less time.

Local Backup Performance

Performance of local tape backups is affected by the following considerations:

- System processor utilization
- Disk channel utilization
- ARCserve - Windows Edition I/O buffers

SYSTEM PROCESSOR UTILIZATION

Since local backups add workload to the hard drive subsystem, ensure that the server can accommodate the additional workload. Compaq integration testing found ARCserve - Windows Edition to be system processor-intensive. For single-stream local backups, the system processor utilization averaged 54 percent, with peak utilization averaging 67 percent. Perform local backups during off-peak hours, when users are not affected by ARCserve - Windows Edition system processor utilization.

Compaq integration testing showed that for single-stream backup, local tape backup outperformed remote tape backup. Single-stream, local tape backups do not stress the server resources (disk channel, system processor, or memory). In the remote backup, network overhead reduces the throughput. See Figure 4-1.

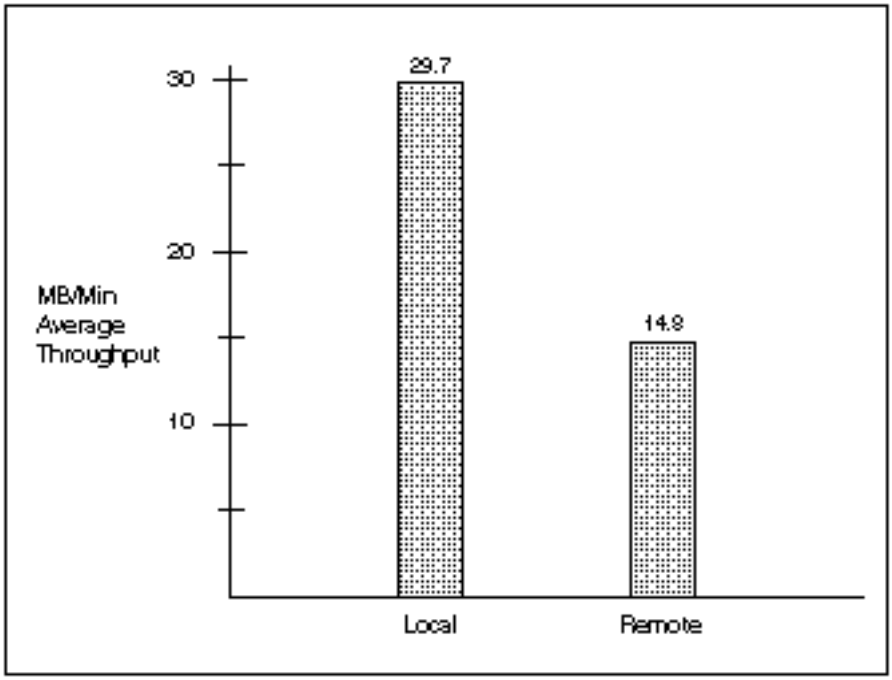

Figure 4-1. Comparison of Single-Stream Local and Remote Tape Backup Performance

Figure 4-2 illustrates how local tape backup performance can be improved by using the Parallel Streaming of ARCserve - Windows Edition. In Compaq integration testing, a backup of five streams (separate volumes on separate disks) reached an average throughput of 46 megabytes per minute. Each volume was on a separate SCSI disk on a single SCSI channel.

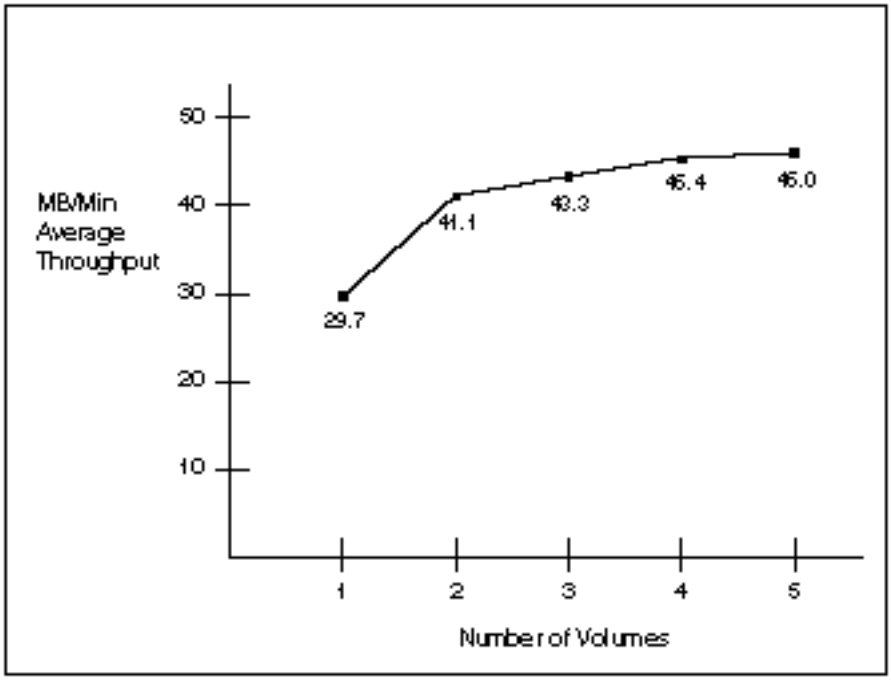

Figure 4-2. Multiple-Stream Local Tape Backup Performance

For multiple-stream local backups, integration testing showed that backup performance began to level out at three concurrent streams.

Remote concurrent tape backup performance actually began to outperform local tape backup between four and five streams. See "Remote Backup Performance" later in this chapter for more information.

For local backup, the system processor utilization averaged 79 percent, peaking at 89 percent when backing up four to five streams. After this point, integration testing showed diminishing returns. To achieve higher performance with more than three streams, you can move to a higher performance disk channel.

You may also see performance improvements from multiple-stream, local tape backup by splitting the volumes between two disk channels. Adding a second high performance Compaq SMART Array Controller or 32-Bit Fast-SCSI-2 Controller Board will double the capacity of the disk channel. While this may not necessarily double the disk throughput, backup performance is likely to improve.

DISK CHANNEL UTILIZATION

Disk channel bottlenecks are often difficult to diagnose because of the varying workloads characteristic of a typical NetWare 3.*x* file server. The disk channel limits can become stressed when you use ARCserve - Windows Edition to back up multiple volumes on the server. In NetWare 3.*x* environments, you can determine if the disk channel is becoming stressed by using *MONITOR.NLM* to see two key statistics: Current Disk Requests and Dirty Cache Buffers.

NOTE: For performance optimization information on NetWare 4.*x* environments, see the following Novell Application Notes:

- May 1993, *NetWare 4.x Performance Tuning and Optimization: Part 1*, Part Number 164-000032-005
- June 1993, *NetWare 4.x Performance Tuning and Optimization: Part 2*, Part Number 164-000032-006
- October 1993, *NetWare 4.x Performance Tuning and Optimization: Part 3*, Part Number 164-000032-010

In NetWare 3.*x* environments, Current Disk Requests show the number of disk requests in the queue waiting to be serviced. Dirty Cache Buffers are the number of file blocks in memory waiting to be written to disk.

The Current Disk Requests value can peak near or above 40 for brief periods of time; however, if the value is consistently near or above 40, performance may be degraded. Increasing the value of the SET MAXIMUM CONCURRENT DISK CACHE WRITES parameter can relieve this performance problem. You can also add a second hard drive controller to improve performance.

The SET MAXIMUM CONCURRENT DISK CACHE WRITES parameter controls how many write requests are placed in the elevator before the disk head begins a sweep across the disk platter. The default for this parameter is 50, within the range of 10 to 100.

To increase performance for tape backup, which performs more read operations than write operations, use a smaller value, such as 35. If the number of dirty cache buffers (in the *MONITOR.NLM* Information menu) is constantly greater than 70 percent of total cache buffers (also in the *MONITOR.NLM* Information menu), increase this value to improve write requests or decrease this value to improve read requests.

! **IMPORTANT:** As you change these parameters, optimizing the server for read operations can degrade server performance during write operations. Conversely, optimizing the server for write operations can degrade server performance during read operations.

The number of dirty cache buffers can also provide information about how many write requests reside in cache while awaiting a cache flush. You can view this value in the NetWare *MONITOR.NLM* Information menu. If this value is constantly *above 70 percent* of the total cache buffers, then the hard drive subsystem may be saturated.

When analyzing the number of dirty cache buffers, monitor the backup servers for several hours before making any changes. This ensures that the value displayed is not a peak activity value. If the number of dirty cache buffers is constantly high (above 70 percent of total cache buffers) during backup operations, there may be a performance problem, and you may need to add system memory to the server. Again, if you need more performance, you can add a second hard drive controller.

ARCSERVE I/O BUFFERS

ARCserve - Windows Edition I/O buffers can also affect tape backup performance. Each backup and restore operation that ARCserve - Windows Edition starts allocates server memory for buffer space. Using system memory to cache files provides the most consistent data streaming. ARCserve - Windows Edition I/O buffers determine the size of this cache. Each buffer uses 64 Kbytes of system memory. The default is 6 buffers.

Compaq integration testing showed that increasing the default buffer size to 24 provides increased performance for local backups. Figure 4-3 illustrates local backup performance with the buffers set at 6, 12, and 24.

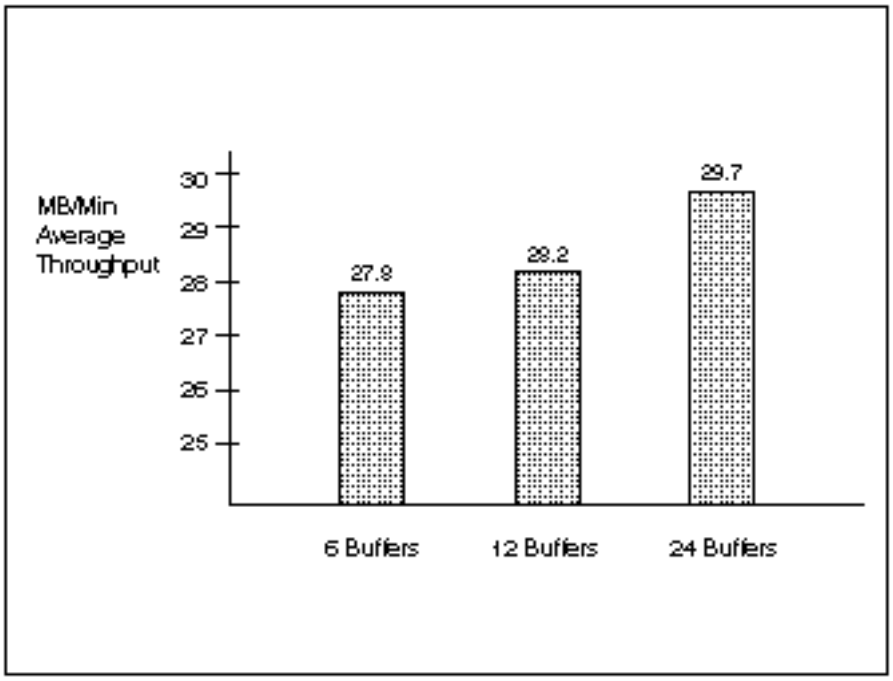

Figure 4-3. Comparison of Local Tape Backup Performance with 6, 12, and 24 ARCserve - Windows Edition I/O Buffers

To change the buffer size for backup and restore operations, edit the *ARCSRV.CFG* file located in the ARCSERVE\NLM subdirectory. The *ARCSRV.CFG* file contains a command line similar to the following for each tape drive installed:

```
NLMx = [NLM filename] [command line parameter list]
```

For example, to set the buffers to 24, append buffers=24 to each command line. An example of this command line might read:

```
NLM1 = standard group-GROUP_A scsiid-2 buffers=24
```

Since each buffer requires 64 Kbytes of server memory, you can determine the amount of system memory necessary on the backup server for concurrent backups by using the following formula:

Backup 1:	24 buffers	× 64 Kbytes =	1.5 megabytes
Backup 2:	16 buffers	× 64 Kbytes =	1.0 megabyte
Backup 3:	24 buffers	× 64 Kbytes =	1.5 megabytes
Total server memory for ARCserve buffers			4.0 megabytes

In addition to the memory required for backup servers, ARCserve - Windows Edition NLMs require approximately 1 megabyte of memory.

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

Remote Backup Performance

Remote backups (backing up the files of a server to a tape backup server over the network) affect the server LAN subsystem, due to the amount of network traffic generated during backup. Plan remote backups during periods of light network traffic, and ensure that the server is available for the entire backup period.

Integration testing indicated that the ARCserve - Windows Edition default I/O buffer size of 6 was optimum for remote backups. Figure 4-4 shows multiple-stream, remote tape backup performance on a single network segment. It illustrates the maximum average throughput for one to seven servers backing up to one server with multiple tape drives. The network utilization at seven streams was 78 percent. Between five and seven backup streams, the single Ethernet segment nearly reached its maximum throughput. (Performance numbers will vary, depending on your configuration.)

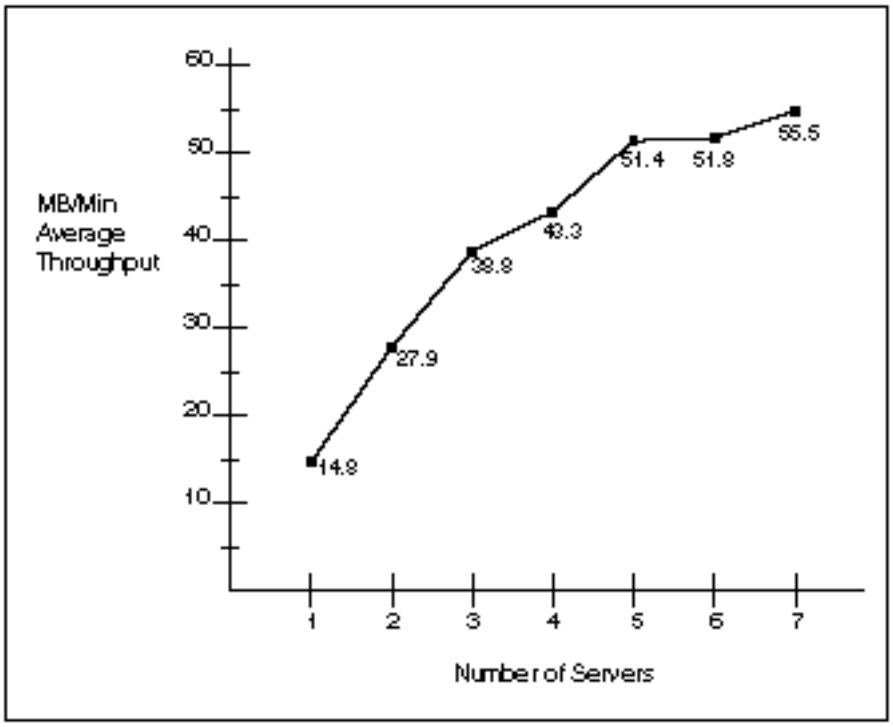

Figure 4-4. Multiple-Stream Remote Tape Backup Performance on a Single Network Segment

Performance begins to level off with five streams, reaching a maximum of 55.5 megabytes per minute average throughput.

To achieve greater performance, the servers can be divided between two network segments. Compaq integration engineers "balanced" the servers between two network segments, placing three servers on segment A and three servers on segment B. Engineers added a server from each segment, one at a time, during testing. With six streams on a single segment, the average throughput is 51.8 megabytes per minute. With six streams on two segments, the average throughput is 63.7 megabytes per minute. (Performance numbers will vary, depending on your configuration.) See Figure 4-5.

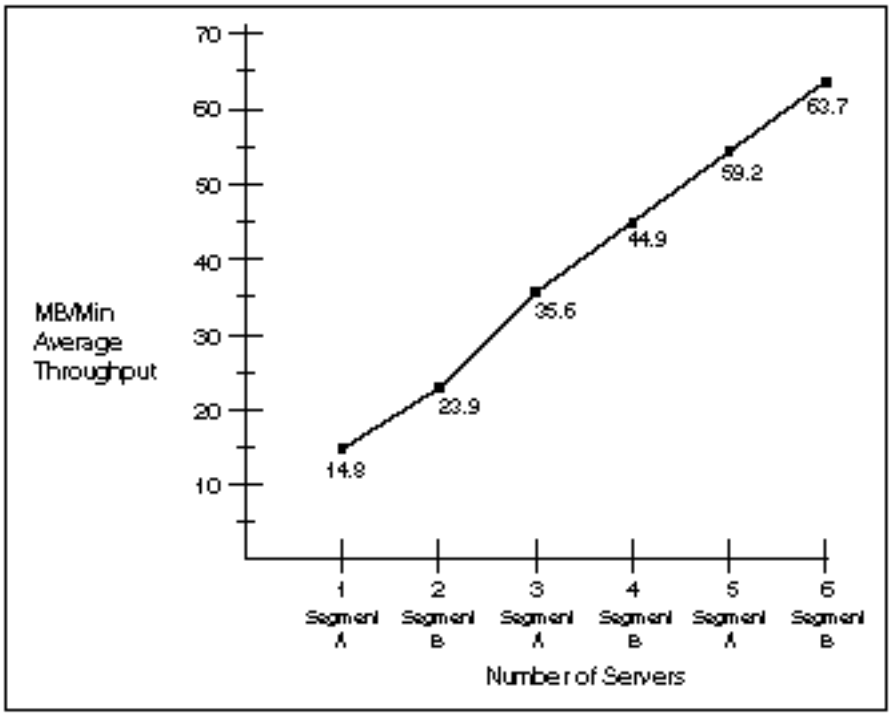

Figure 4-5. Multiple-Stream Remote Tape Backup Performance on Two Network Segments

Dividing the servers between two segments increased the rate at which data could be provided to the server through the network.

The average system processor utilization of the tape backup server during the backup is 59.5 percent, peaking at 70 percent. The network utilization with one stream is 23 percent, growing to 78 percent with seven streams. With system processor and network utilization at these levels, it is important to schedule tape backups during off- peak hours.

Compaq integration testing showed that multiple-stream local backup performance began to level off after three streams. At this point, remote backup began to show performance benefits. See Figure 4-6.

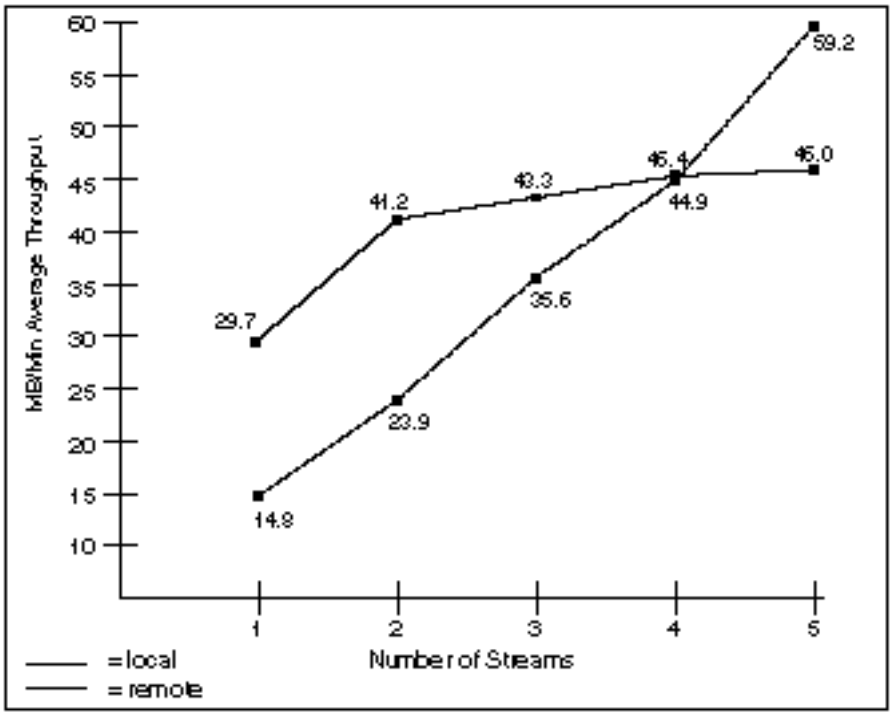

Figure 4-6. Comparison of Multiple-Stream Local and Remote Tape Backup Performance

With four or more backup streams, local backup performance begins to level off as the server's resources are taxed. The disk channel, system processor, and memory begin to reach a saturation point. With remote backup, however, the backup process has the resources of six servers working concurrently and using two Ethernet segments. The process does not tax these resources. After four streams, remote tape backup is faster than local tape backup.

Performance of remote tape backups is affected by the following considerations:

- Network topology
- Bridges and routers
- Novell Packet Burst network protocol
- Network traffic and bandwidth

NETWORK TOPOLOGY

Backup speed across the network is directly affected by the network topology, Ethernet or Token Ring. Ethernet has a maximum transfer rate of 60 megabytes per minute. Typical transfer rates are between 40 and 50 megabytes per minute. During a tape backup across the network, as more traffic is generated, packet collisions can begin to cause performance degradation.

Token ring topologies offer transfer rates of 24 and 96 megabytes per minute. Tape backup performance does not degrade as the network traffic increases.

BRIDGES AND ROUTERS

Network bridges or routers between the file server and the backup server will degrade tape backup performance. An optimum network configuration for tape backup performance across the network connects all servers through a high-speed backbone. Avoid placing bridges and/or routers between the tape backup server and file servers.

NOVELL PACKET BURST NETWORK PROTOCOL

In a NetWare 3.11 environment, the IPX protocol requires an acknowledgment for every packet sent across the wire. IPX packets are also limited to 512 bytes when sent across a standard IPX router. These limitations can affect network performance.

NetWare 3.11 network performance can be improved by Novell *PBURST.NLM*. Loading *PBURST.NLM* on the server allows multiple network packets to be sent before an acknowledgment is required. In addition to this burst capability, *PBURST.NLM* enables large-packet IPX, which allows packet sizes of greater than 512 bytes between IPX routers. In a NetWare 3.11 environment, load *PBURST.NLM* on both file and backup servers.

NOTE: *PBURST.NLM* is available from NetWire on CompuServe.

NetWare 3.12 and 4.01 automatically support packet burst and large internet packets, and do not require *PBURST.NLM*.

NETWORK TRAFFIC AND BANDWIDTH

In an Ethernet environment, as more traffic is generated, packet collisions will begin to cause performance problems. When network traffic exceeds the capacity of a single segment, you can redistribute the servers and workstations between two or more network segments.

Experiment with multiple-stream network backups in your environment to determine the optimal amount of servers to back up per segment. Use a network analyzer to determine if the network segment is saturated.

Other Performance Considerations

Other factors affecting both local and remote tape backup performance include:

- File Size
- Data Compression
- File Fragmentation

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 include a mixture of files of various sizes and types.

When evaluating tape drive subsystems for purchase, perform backups in your network environment or in an environment that closely resembles it. 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 COMPRESSION

A key factor in backup throughput performance is data compression. Tape drive subsystems with a data compression feature, such as the Compaq 4-/16-Gigabyte TurboDAT Drive, perform backups more efficiently and store more data on the tape than tape drive subsystems without the data compression feature.

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 data compression and using types of data, such as database and text files, that compress well.

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.

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.

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

Compaq integration testing showed that the Parallel Streaming feature of ARCserve - Windows Edition provides a substantial increase in tape backup performance. Schedule backups during off-peak hours, as ARCserve - Windows Edition can be system-processor intensive. Optimizing the system processor and hard drive subsystems, as well as the ARCserve - Windows Edition I/O buffers, can improve local tape backup performance. For remote tape backup environments, Compaq integration testing showed that splitting the file servers between two network segments improved multiple-stream performance. Other factors affecting remote tape backup performance are the network topology, bridges and routers, Novell Packet Burst network protocol, and network traffic and bandwidth.

Factors that affect both local and remote tape backup performance include the file size and data compression.

Chapter 5
TAPE BACKUP PLAN EXAMPLE

This chapter outlines 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

This example discusses a tape backup solution for an enterprise-wide NetWare network with the following server configurations:

- Accounting_1: Compaq ProSignia 486/33-1050
  - Two additional 2.10-Gigabyte Fast-SCSI-2 Hard Drives (for a total of 5.25 gigabytes of hard disk space)
  - 4 gigabytes of data
  - NetWare 4.01
- Accounting_2: Compaq ProSignia 486/33-1050
  - Two additional 2.10-Gigabyte Fast-SCSI-2 Hard Drives (for a total of 5.25 gigabytes of hard disk space)
  - 3 gigabytes of data
  - NetWare 4.01

- Legal_1: Compaq Systempro/LT 486DX2/50-2040
  - Three additional 1.05-Gigabyte Fast-SCSI-2 Hard Drives (for a total of 5.19 gigabytes of hard disk space)
  - 4 gigabytes of data
  - NetWare 3.12
- Legal_2: Compaq Systempro/LT 486DX2/50-1050
  - Two additional 1.05-Gigabyte Fast-SCSI-2 Hard Drives (for a total of 3.15 gigabytes of hard disk space)
  - 2 gigabytes of data
  - NetWare 3.12
- Engineering_1: Compaq ProLiant 1000 486DX2/66-2100A
  - Two additional 2.1-Gigabyte Pluggable SCSI-2 Drives (for a total of 6.3 gigabytes of hard disk space)
  - Compaq TurboDAT Autoloader
  - 5 gigabytes of data
  - NetWare 4.01
- Engineering_2: Compaq ProLiant 1000 486DX2/66-1050
  - Three additional 1050-Megabyte Pluggable SCSI-2 Drives (for a total of 4.2 gigabytes of hard disk space)
  - 3 gigabytes of data
  - NetWare 4.01
- Engineering_3: Compaq ProLiant 1000 486DX2/66-1050
  - Three additional 1050-Megabyte Pluggable SCSI-2 Drives (for a total of 4.2 gigabytes of hard disk space)
  - 2 gigabytes of data
  - NetWare 4.01

- Admin_1: ProSignia 486/33-1050 with a ProLiant Storage System
  - Three additional 2.10-Gigabyte Pluggable SCSI-2 Drives (for a total of 7.35 gigabytes of hard disk space)
  - 6 gigabytes of data
  - NetWare 3.12

USER ENVIRONMENT

The network servers in this example environment are shared by several departments of the company, including Accounting, Legal, and Engineering departments.

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 shares the document image processing application of the legal department server, but it must also have its own servers 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.

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 Accounting_1 and Accounting_2 as its servers. In this example, the Accounting department's 7 gigabytes of data includes all NetWare System and Public files, accounting application files, and personal productivity applications for the department (such as word processing, spreadsheet, and graphics).

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 servers for file storage and file sharing among the groups. Servers Legal_1 and Legal_2 provide storage for legal documents and provide network services for users. In this example, the Legal department's 6 gigabytes of data includes imaging and database application files, image files, and data files.

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 Engineering_1, Engineering_2, and Engineering_3. The Engineering department's 10 gigabytes of data includes System and Public files, all application files, the large database, data files, image files, modeling application files, computational application files, and CAD files, maps, and data files.

The server Admin_1 provides miscellaneous network services, such as electronic mail and administrative file storage for users. Admin_1's 6 gigabytes of data includes all electronic mail files and all user data for these files, and administrative data files, including memoranda, letters, spreadsheets, and so on.

TAPE BACKUP PLAN

This network is completely backed up over the weekend, with backups of all changed files performed on Monday through Thursday nights. Each server backs up over the network to the TurboDAT Autoloader on the Engineering_1 server. This is scheduled using ARCserve - Windows Edition.

Since the single-stream backups are scheduled for the weekend, performance is not as high a priority in this example as in other network configurations. For single-stream backups over the network on most LANs, you can expect a backup rate of between 10 and 14 megabytes per minute. Table 5-1 shows the duration of the backup on all example network servers at 12 megabytes per minute.

Table 5-1
Example Server Backup Times

Server Name	Amount of Data (Gigabytes)	Duration of Backup (Hours)
Accounting_1	4	5.55
Accounting_2	3	4.17
Legal_1	4	5.55
Legal_2	2	2.78
Engineering_1	5	6.94
Engineering_2	3	4.17
Engineering_3	2	2.78
Admin_1	6	8.33

To automate the backup, this plan calls for two twelve-cassette magazines for the TurboDAT Autoloader, each using 120-meter DDS2 tapes. With compression enabled on the tape drive, each tape will hold between 6 and 8 gigabytes of data.

Each magazine is kept in the Autoloader for two weeks. The first magazine is labeled, "Two Week Backups: Weeks 1 and 2." The second magazine is labeled, "Two Week Backups: Weeks 3 and 4."

Using ARCserve - Windows Edition, the tapes for these magazines are formatted with the labels listed in Table 5-2.

Table 5-2
Backup Tape Labels

Magazine 1	Magazine 2
Accounting_full_week1	Accounting_full_week3
Engineering_full_week1	Engineering_full_week3
Engineering_full_week1	Engineering_full_week3
Legal_full_week1	Legal_full_week3
Admin_full_week1	Admin_full_week3
Accounting_full_week2	Accounting_full_week4
Engineering_full_week2	Engineering_full_week4
Engineering_full_week2	Engineering_full_week4
Legal_full_week2	Legal_full_week4
Admin_full_week2	Admin_full_week4
(blank tape)	(blank tape)
Incrementals	Incrementals

On the Friday before the first Monday of the month, the first magazine ("Two Week Backups: Weeks 1 and 2") is inserted in the Autoloader. Using ARCserve - Windows Edition, backup for each server is scheduled beginning at 9 p.m. Friday.

Daily backups of all changed files are scheduled for Monday through Thursday nights at 11 p.m. The "Incrementals" tape is used for these changed files. On the first Monday of every month, this tape is overwritten.

On the third Friday of the month, the first magazine is removed, and the administrator uses a DAT cleaning cassette. The second magazine ("Two Week Backups: Weeks 3 and 4") is inserted in the Autoloader, following the same backup schedule as the first magazine.

The first five tapes (first full week) of the first magazine are taken off-site for archive storage. This keeps a permanent "snapshot" of the data on each server at the beginning of the month. Before this magazine is reinserted at the beginning of the next month, these tapes are replaced and formatted with the same name.

The "blank" tape is used for unscheduled backups, such as quarterly sales figures. Tapes are replaced after a year of use.

This plan eliminates most manual interaction with the backup tapes, requiring administrator intervention only twice: at the beginning and the middle of the month.

DATA RECOVERY

Server Admin_1 fails on a Thursday of the third week of the month. When the hard drive is replaced, and NetWare is brought back up, the administrator uses ARCserve - Windows Edition to schedule a full restore of the tape labeled "Admin_full_week_2." When this tape is restored, the administrator then restores Monday, Tuesday, and Wednesday backups from the "Incrementals" tape (in that order).

Since the first magazine is still in the Autoloader, there is no need to find the proper tapes or change the Autoloader cassette.

CONCLUSION

Establishing a storage management strategy with ARCserve - Windows Edition in your Compaq and NetWare environment can greatly simplify the tape backup process. ARCserve - Windows Edition offers significant performance benefits using Parallel Streaming. When used together with the Compaq TurboDAT Autoloader, ARCserve - Windows Edition can automate your backup process with a minimum of manual intervention.

Appendix

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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