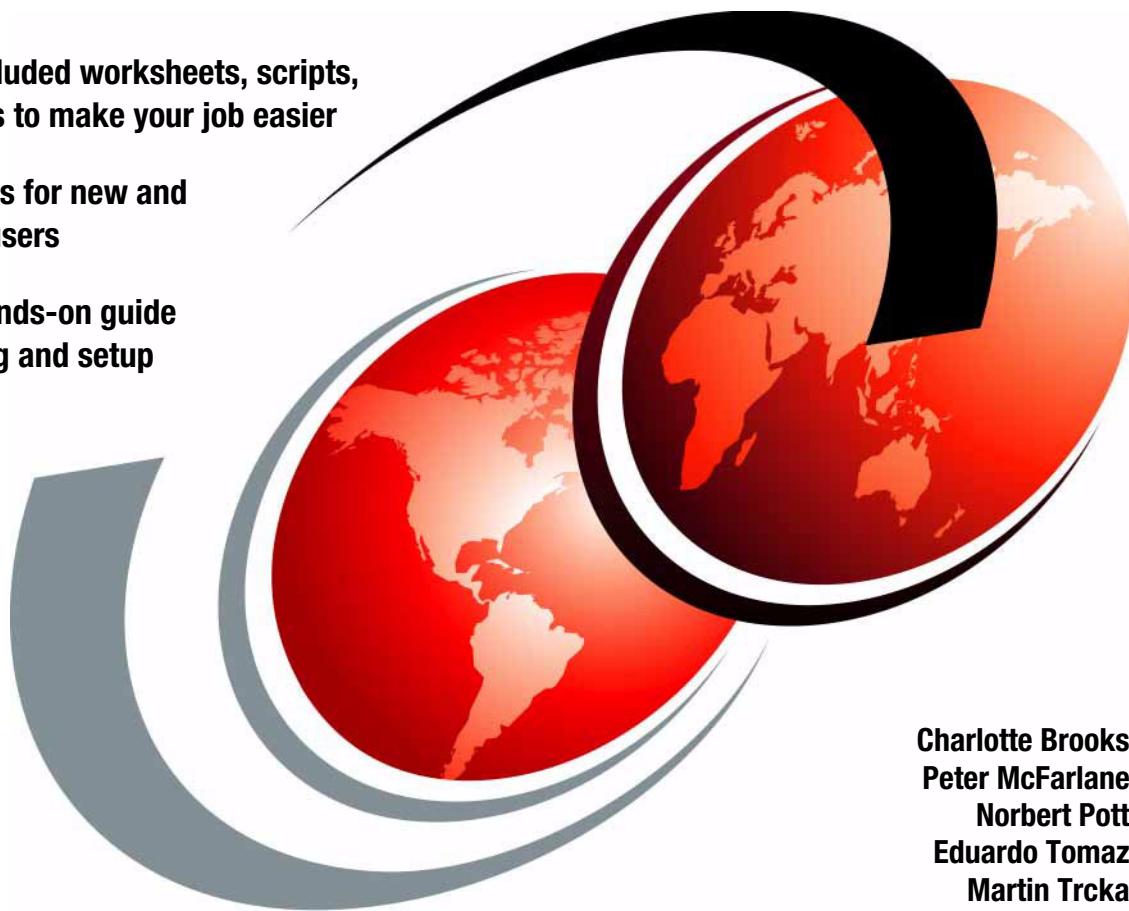


IBM Tivoli Storage Manager Implementation Guide

Use the included worksheets, scripts,
and macros to make your job easier

See features for new and
advanced users

Use this hands-on guide
for planning and setup



Charlotte Brooks
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Redbooks



International Technical Support Organization

IBM Tivoli Storage Manager Implementation Guide

June 2006

Note: Before using this information and the product it supports, read the information in "Notices" on page xxiii.

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Preface

This IBM® Redbook describes how to integrate, install, configure, and operate the very latest IBM Tivoli® Storage Manager in heterogeneous environments.

You will learn how to implement and operate IBM Tivoli Storage Manager. You should already have a conceptual understanding of IBM Tivoli Storage Manager. We show you how to set up and implement the software, covering basic and advanced topics for Windows-based, AIX®-based, and Linux-based operating system platforms.

We demonstrate how to handle all of the important tasks necessary to protect your business: planning, client and server installation, operations, performance considerations, SAN environments, NDMP, and much more.

This practical guide is intended for these audiences: system administrators, new to IBM Tivoli Storage Manager, who are asked to commence a basic IBM Tivoli Storage Manager implementation for the very first time; as well as administrators who want to learn more about the basic and advanced components and their implementation. This book is also a very valuable resource if you are planning to become a certified IBM Tivoli Storage Manager consultant.

A companion redbook, *IBM Tivoli Storage Management Concepts*, SG24-4877, is available. It covers concepts, architecture, and systems management features of IBM Tivoli Storage Manager and shows complementary products available. That book is a useful general introduction for people who have had no previous exposure to IBM Tivoli Storage Manager.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization, San Jose Center.

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Jason Basler and Ashish Agarwal developed and provided Chapter 17, “Server-free data movement” on page 565.

Jennifer Davis developed and provided the sections 20.2, “Using SysBack for Bare Machine Recovery” on page 639, and “Integrating SysBack™ for System Backup and Recovery with Tivoli Storage Manager”.

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Part 1

Introduction

The objective of this book is to provide material describing how to implement and operate IBM Tivoli Storage Manager. We assume a basic knowledge of IBM Tivoli Storage Manager, which you can gain by reading the companion IBM Redbook, *IBM Tivoli Storage Management Concepts*, SG24-4877.

A successful implementation of IBM Tivoli Storage Manager benefits enormously from planning prior to attempting to set up the environment. The planning for what equipment is needed (such as hardware platform, size of processor, network connectively, and tape library) should all have been done before trying to make IBM Tivoli Storage Manager work in an environment that may not be suitable.



Implementation checklists

In this chapter we offer an overview of the IBM Tivoli Storage Manager environment described in our book, as well as implementation checklists for planning, installing, and operating that environment.

Our environment provides an integrated solution that incorporates client and server options, basic performance recommendations, and operational processes. In our experience, this environment has been shown to satisfy the most common client requirements while also forming a sound basis for extension.

The checklists provide step-by-step processes to plan and implement an IBM Tivoli Storage Manager environment. Although geared towards our book environment, the checklists can be used for any implementation. There are separate checklists for planning the environment, server implementation, client implementation, and daily operations.

We have provided planning sheets, option files, and administrative macros to help plan and implement your IBM Tivoli Storage Manager environment. Appendix A, “Planning and sizing worksheets” on page 723, and Appendix B, “Book support material: macros and scripts” on page 729, provide copies of those materials.

1.1 The big picture

Any Tivoli Storage Manager solution consists of a number of pieces that are crafted to satisfy a particular set of requirements. These solution pieces include definitions for data storage management, policy management, user management, and operational management.

The difficulty is in determining how to craft each of these pieces to complete the solution jigsaw puzzle. This is complicated by the vast number of options and variations that are possible with Tivoli Storage Manager.

This book is not designed to be a follow-along implementation guide that will actually install, configure, and implement Tivoli Storage Manager in your environment. Rather, the book is designed to provide you with step-by-step instructions and examples that you can follow when you design and implement your solution in your specific environment with your business policies and needs.

We have developed a functional Tivoli Storage Manager environment that has been shown to satisfy a number of key client requirements. Those key requirements are:

- ▶ Multiple backup copies of files to be kept
- ▶ Second copy of backup data to be kept off-site
- ▶ Restore time to be minimized
- ▶ High level of automation

Our environment also incorporates basic performance tuning recommendations and operational procedures for onsite-offsite tape movement. It forms a sound platform for future development.

Figure 1-1 on page 5 shows the data storage management perspective of our Tivoli Storage Manager environment. The figure shows the flow of data to and from the onsite storage pools and off-site copy pools. Some key features of this environment are:

- ▶ Separate storage pools for client directory information and client data
- ▶ Client data written to a disk storage pool, then migrated to tape storage pool
- ▶ Duplicate copies of onsite data created for off-site storage
- ▶ Mirrored Tivoli Storage Manager database and recovery log

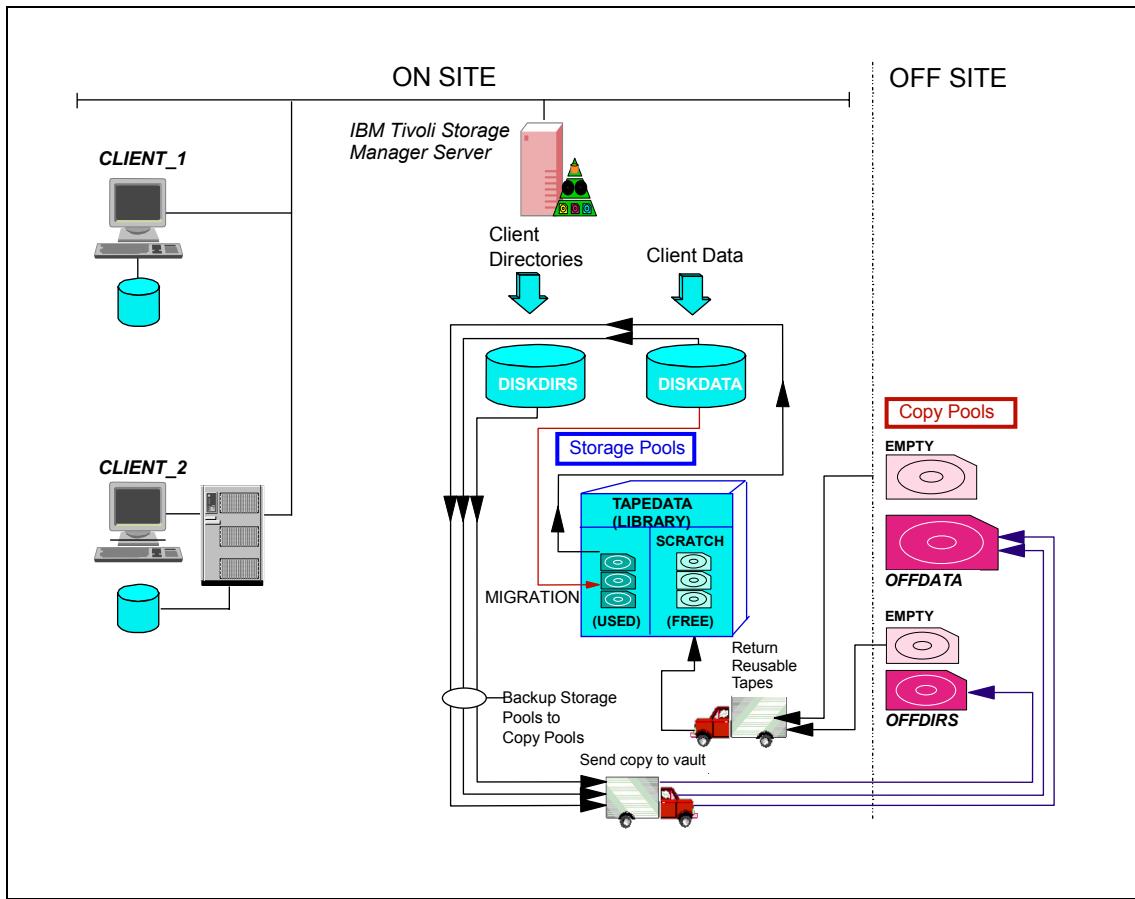


Figure 1-1 Our IBM Tivoli Storage Manager environment

The two primary disk storage pools hold client directory information (DISKDIRS) and client data (DISKDATA). The remaining storage pool (TAPEDATA) is on tape and holds only client data. A copy of the client data is stored in one off-site storage pool (OFFDATA), and a copy of the client directory data is stored in another storage pool (OFFDIRS).

1.1.1 Our support material

We provide worksheets, option files, and administrative macros to help plan and implement your Tivoli Storage Manager environment.

The worksheets are used during the planning phase of a Tivoli Storage Manager implementation, which we use and discuss in Chapter 2, “Implementation planning” on page 15.

The option files provided are examples for customizing your Tivoli Storage Manager server and clients. If you want to use them in your implementation, you need to modify the example files to fit into your environment, and replace the existing options files with these.

The administrative macros are used to reduce some steps in your Tivoli Storage Manager implementation. Again, you need to modify some of the macros to meet specific requirements in your Tivoli Storage Manager environment.

The support material we use here is available in softcopy on the Internet from the Redbooks Web server. Point your Web browser to:

<ftp://www.redbooks.ibm.com/redbooks/SG245416>

Alternatively, you can get to the same Web page at:

<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg245416.html?Open>

Select **Additional Materials** and click the suggested link.

We provide two files. Each file contains all the support material in compressed format. The UNIX platform file is named sg245416.tar, and the Windows platform file is named sg245416.zip.

Table 1-1 lists the contents of the support material from those files.

Table 1-1 Our support material

File name	Contents
dsmopt.aix	Client user options file for AIX
dsmopt.nw	Client options file for NetWare
dsmopt.win	Client options file for Windows
dsmserv.aix	Server options file for AIX
dsmserv.mvs	Server options file for MVS™
dsmserv.win	Server options file for Windows NT/2000
dsmsys.aix	Client system options file for AIX
mac.admins	Administrative macro to define administrators
mac.optionsets	Administrative macro to define client option sets
mac.schedules	Administrative macro to define administrative and client schedules
mac.scripts	Administrative macro to define server scripts

File name	Contents
mac.stgcreate	Administrative macro to create storage pools
mac.stgdelete	Administrative macro to delete default storage pools
mac.policy	Administrative macro to define policy domains, policy sets, management classes, and copy groups
planning.123	Planning spreadsheets (Lotus® 123 format)
plan_sampledata.123	Planning spreadsheets (Lotus 123 format) with some sample data
planning.xls	Planning spreadsheets (Microsoft Excel format)
plan_sampledata.xls	Planning spreadsheets (Microsoft Excel format) with some sample data
readme.1st	Contents of support materials

We recommend that you download the support material files into a separate directory on a system from which you can run an administrative command client. In our experience, the implementation works best when you choose a UNIX or Windows platform for that system.

1.2 Planning checklist

Proper planning for your Tivoli Storage Manager environment is critical to the success of the implementation. This cannot be stressed enough. Plan first, verify the plan, then execute the plan.

The tasks contained in the Tivoli Storage Manager planning checklist are shown in Table 1-2. You should complete all of these tasks before implementing the Tivoli Storage Manager environment.

Table 1-2 Planning checklist

Tasks	Refer to
Download our support materials.	Table 1-1 on page 6
Complete client requirements worksheet.	2.2, “Client environment data” on page 16
Complete data retention worksheet.	2.3, “Data retention requirements” on page 26

Tasks	Refer to
Choose server platform.	2.4, “Server architecture considerations” on page 30
Size Tivoli Storage Manager server.	2.5, “System size” on page 33
Determine network load.	Table 2-8 on page 37
Complete Tivoli Storage Manager database worksheet.	Table 2-9 on page 43
Complete Tivoli Storage Manager recovery log worksheet.	Table 2-10 on page 44
Complete Tivoli Storage Manager storage pool worksheet.	Table 2-11 on page 48
Complete Tivoli Storage Manager disk worksheet.	Table 2-13 on page 49
Determine tape library.	2.9.2, “Tape libraries” on page 52
Determine number of tape drives.	Table 2-15 on page 51
Determine number of tape volumes.	2.10.1, “On-site volumes” on page 53 and 2.10.2, “Off-site volumes” on page 56
Complete administrator worksheet.	Table 2-16 on page 59

1.2.1 Server implementation checklist

The server checklist identifies those tasks you must complete to set up this Tivoli Storage Manager server environment. The tasks contained in the checklist are shown in Table 1-3. These tasks are performed by either the system administrator or the Tivoli Storage Manager administrator.

The checklist consists of a series of tasks that must be performed sequentially. Each task in the table has a reference to another section in this book. The referred section contains the specific details about how to complete that task. For some tasks, we additionally refer to the macro file we provide, as described in 1.1.1, “Our support material” on page 5.

Table 1-3 Server implementation checklist

Tasks	Refer to:	Macro
Download latest server code fixes.	3.2, “Latest software updates” on page 68	

Tasks	Refer to:	Macro
Install base server code and latest fixes.	3.3, “AIX server installation” on page 70, 3.4, “Linux server installations” on page 72 or 3.5, “Windows 2000/2003 server installation” on page 78 for your specific platform	
Update server options file.	3.7.1, “Server options file” on page 91	
Create database volumes.	5.1, “Database” on page 188	
Create recovery log volumes.	5.2, “Recovery log” on page 192	
Mirror database.	5.6.1, “Database mirroring” on page 205	
Mirror recovery log.	5.6.2, “Recovery log mirroring” on page 206	
Remove default database volumes.	5.7.1, “Removing the default database volume” on page 207	
Remove default recovery log volumes.	5.7.2, “Removing the default recovery log volume” on page 209	
Set up server licensing.	9.2, “Registering licensed features” on page 305	
Define tape libraries.	6.2.1, “Defining a library” on page 222	
Define a library path.	6.2.4, “Defining a path to a drive in a library” on page 226	
Define tape drives.	6.2.3, “Defining a drive in a library” on page 225	
Define a tape path.	6.2.4, “Defining a path to a drive in a library” on page 226	

Tasks	Refer to:	Macro
Define device classes.	6.2.5, “Defining a device class for a library” on page 228	
Change server run-time settings.	3.7, “Customization” on page 91	
Define storage pools.	6.3, “Storage pools” on page 231	stgcreate
Define storage pool volumes.	6.4, “Storage pool volumes” on page 239	
Remove default storage pools.	6.3.5, “Deleting the default storage pools” on page 238	stgdelete
Define policy domains.	7.1.1, “Defining policy domains” on page 272	policy
Define policy sets.	7.1.2, “Defining policy sets” on page 272	policy
Define management classes.	7.1.3, “Defining management classes” on page 272	policy
Define backup copy groups.	7.1.4, “Defining backup copy groups” on page 274	policy
Define archive copy groups.	7.1.5, “Defining the archive copy group” on page 276	policy
Activate the new policy.	7.3.2, “Activating the recommended policy sets” on page 279	
Remove default policy management definitions.	7.3.3, “Deleting the STANDARD policy domain” on page 279	
Define administrator IDs.	8.1, “Management” on page 284	admins
Define administrative schedules.	12.2, “Administrative schedules” on page 374	schedules
Define client schedules.	12.3, “Client schedules” on page 386	schedules

Tasks	Refer to:	Macro
Create client option sets.	8.3, "Client option sets" on page 298	optionsets

1.2.2 Client implementation checklist

The client implementation checklist consists of two parts that identify those tasks you must complete to set up this Tivoli Storage Manager client environment. The tasks contained in the checklists are shown in Table 1-4 and Table 1-5.

Each checklist consists of a series of tasks that must be performed sequentially. Each task in the table has a reference to another section in this book. The section referred to contains the specific details on how to complete that task.

The first checklist consists of tasks performed at the Tivoli Storage Manager server. These tasks are performed by the Tivoli Storage Manager administrator.

Table 1-4 Client implementation checklist: server tasks

Tasks	Refer to
Register the client node.	"Registering a client node" on page 292
Associate client nodes with schedules.	12.3.3, "Associating a client with a schedule" on page 391
Associate client nodes with client option set.	8.3.5, "Associating a client node with a client option set" on page 301
Grant authority for Web client access.	"Web client" on page 183
Define event logging.	13.3, "Event monitoring" on page 404

The second checklist consists of tasks performed at the Tivoli Storage Manager client. These tasks are performed by the administrator of that client system.

Table 1-5 Client implementation checklist: client tasks

Tasks	Refer to
Download the latest client code.	4.1.1, "Backup-archive client" on page 98

Tasks	Refer to
Install the client code.	4.2, “Code installation” on page 101
Update the environment.	“Environment variables” on page 113
Update client options files.	“Options file” on page 114
Start backup-archive client.	“Starting a session” on page 172
Implement scheduler.	4.7, “Client scheduler” on page 173
Implement Web client.	“Web client” on page 183

1.2.3 Operations checklist

The operations checklist consists of those tasks you should complete on a daily basis. The tasks contained in the checklist are shown in Table 1-6. Each task in the table has a reference to another section in this book. Each section referred to contains the specific details on how to complete that task. This checklist does not include the tasks we recommend scheduling on a daily basis. See Chapter 13, “Routine tasks” on page 395, for more information about scheduled operations.

Table 1-6 Daily operations checklist

Tasks	Refer to
Check completion of client and administrative events.	13.6.2, “Client-server activity” on page 421
Bring free off-site volumes back to onsite.	13.7.5, “Off-site tape management to on-site” on page 439
Send copy tapes to off-site location.	13.7.3, “On-site and off-site tape management” on page 430
Send Tivoli Storage Manager database copy to off-site.	13.7.8, “Database backup management” on page 442
Check database and log utilization.	13.6, “Daily sanity checks” on page 414

Tasks	Refer to
Monitor number of scratch tapes available.	“Number of scratch tapes” on page 419
Check client restartable restores.	“Query restartable restore sessions” on page 424

1.3 Summary

In conclusion, we have discussed and given you access to many checklists, and now it is time to move into the actual planning details, architectural considerations, environments, and our recommendations.



2

Implementation planning

A successful implementation of IBM Tivoli Storage Manager benefits enormously from planning prior to attempting to set up the environment. We have just discussed the checklists you can use, and now we head into the planning stage.

2.1 Planning

Understanding your customers, your environment, your business, your needs, and your requirements are key to success, in storage management as well as business in general. Tivoli Storage Manager can help with your storage management needs and requirements. You will need three things to achieve success:

- ▶ Realistic goals and objectives
- ▶ Understanding
- ▶ Planning

In this chapter, as well as in the IBM Redbook *IBM Tivoli Storage Management Concepts*, SG24-4877, we present a number of planning worksheets that lead you through gathering the client requirements and the data retention requirements in an orderly way. We assume that you are somewhat familiar with IBM Tivoli Storage Management concepts and terms.

We provide planning sheets, option files, server scripts, and administrative macros to help plan and implement your Tivoli Storage Manager environment. Blank worksheets are provided in Appendix A, “Planning and sizing worksheets” on page 723. Appendix B, “Book support material: macros and scripts” on page 729, contains information about how to download those support materials and what those materials provide.

2.2 Client environment data

Tivoli Storage Manager exists to provide services to clients, so it makes sense to begin by gathering data about the client environment. A Tivoli Storage Manager client is the machine from which Tivoli Storage Manager backs up or archives data. It could be various types of workstation, mobile computer, file server, database, or application server. Even though you may know the machine as a server, to Tivoli Storage Manager it is considered a *client*. The Tivoli Storage Manager server refers to the machine where the Tivoli Storage Manager server code runs. The Tivoli Storage Manager server stores and manages all the data backed up from clients.

Note: For UNIX and Windows clients, Tivoli Storage Manager offers an extra level of protection called Logical Volume Backup. We use the terms Image Backup and Logical Volume Backup interchangeably throughout the book to refer to this feature.

At this point, it is very important that you consider your backup and restore requirements so that you can match the Tivoli Storage Manager features to your needs. Since statistics show that the majority of user restore requests are for single files or other small amounts of data, the Tivoli Storage Manager file-level backup is the foundation of any recovery strategy. However, there are additional methods to cover your data restore requirements more completely.

Tivoli Storage Manager provides the following backup methods:

- ▶ File-level backup: Good for small and ad-hoc file or directory restores, but may not be the optimal solution for large-volume restores.
- ▶ Logical volume backup: Good for large full restores, but only available on UNIX and Windows, and not for single file restores.
- ▶ Backup sets: Good for remote and portable restores.

Figure 2-1 shows some possible generic scenarios. Of course, you can combine those in different ways to fit your own requirements.

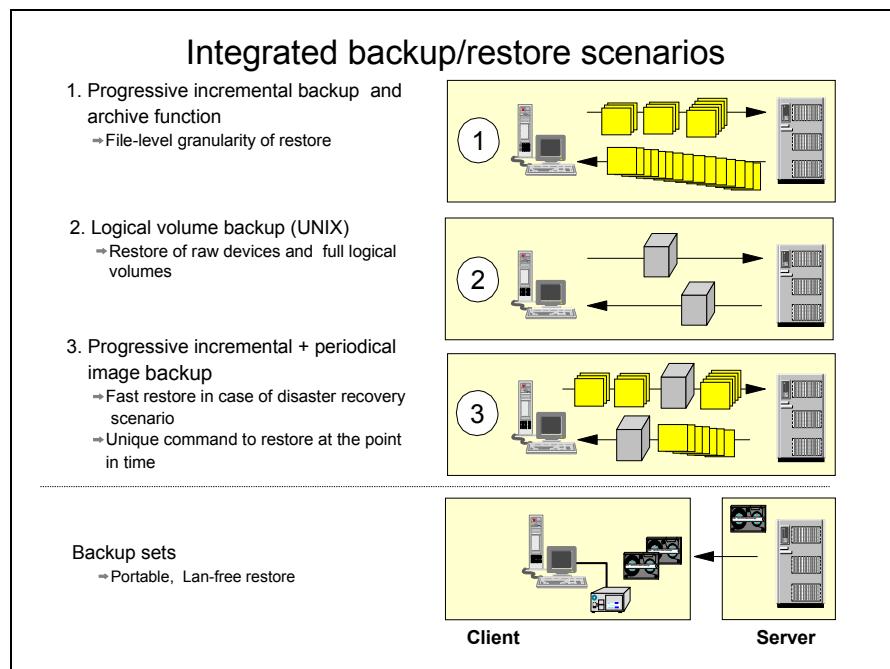


Figure 2-1 Tivoli Storage Manager backup/restore scenarios

Due to the nature and complexity of customer environments and requirements, our planning description will give the building blocks for your own environment definition. The tables and calculations take into account the backup, archive,

image, and backup set requirements that should be suitable for a real-life situation. In any case, you must evaluate whether all such requirements are really important in your case and decide whether to implement them.

Complete Table 2-1 using a column for data from each client being considered for this Tivoli Storage Manager implementation. Analyzing client data helps you make decisions about the Tivoli Storage Manager server environment. The information collected in the table is used for node definitions and for calculating database, recovery log, and storage pool sizes.

This table is presented in a portrait orientation in the book due to space considerations. If you have a large number of nodes or use a spreadsheet version, you may find the table more workable by transposing it to a landscape orientation.

Table 2-1 IBM Tivoli Storage Manager Client requirements worksheet

	Client Type1 Workstation	Client Type 2 Database server
Number of similar clients	20	4
ClientName	WORKSTN1..20	DBSERV1..4
Contact information	John at x1645 Remote users	Nick at x3761 UNIX and AIX
Operating system	Windows XP	UNIX servers
Total storage available (GB)	80	150
Total storage used (GB)	60	100
Total data changed per backup (GB)	6 = 10%	100 = 100%
Number of files or total GB to be backed up	3,000 * 20 = 60,000	2,000 * 4 = 8,000
Number of backup versions to be kept	2	7
Data compression	.5	.66
Backup window times	17:00–23:00	22:00–04:00
Number of hours to complete backups	14	6
Total recovery time frame per server	48 hours	8 hours
Tivoli Storage Manager restore time	24 hours	4 hours
Average GB copied per archive	10 * 20 = 200	4* 20 = 80
Number of files archived	4,000 * 20 = 80,000	3,000 * 4 = 12,000

	Client Type1 Workstation	Client Type 2 Database server
Number of archives kept	12	12
Archive frequency	Monthly	Monthly
Archive window times	Monthly	Month end
Archive number of hours	24 hours	24 hours
Number of image backups	1	12
Image backup frequency	N/A	Monthly
Number of backup sets	6	6
Backup set frequency	Monthly	Bi-monthly
Policy domain	Workstation	UNIX
Client option set	Windows	AIX

2.2.1 Client name

Enter the name Tivoli Storage Manager will use for each client. Each name must be unique. We recommend using the host name for the Tivoli Storage Manager client name, so various groups such as Help Desk personnel or end users can easily correlate the client node to the Tivoli Storage Manager name without having to look in a translation table.

By allowing the Tivoli Storage Manager client name to default to the machine name on Windows clients, you can roll out a standard Tivoli Storage Manager options file to numerous clients automatically without having to modify the options file for each client.

2.2.2 Contact information

Enter information identifying the contact person or group responsible for this client. This should be the person who knows the data structure and applications that run on these servers.

2.2.3 Operating system

Identify the operating system and level the client is using. Any clients using operating systems not supported by Tivoli Storage Manager will have to be handled separately.

2.2.4 Total storage available

Calculate the total amount of usable disk storage in GB available on the client. This number is the amount of disk storage seen by the client file system and does not contain the actual amount installed and used by a RAID or mirroring implementation.

2.2.5 Total storage used

Calculate the total amount of disk storage in GB currently in use or expected to be used on the client. If this number is unknown, use the Total storage available from above.

2.2.6 GB changed per backup

Calculate the amount of storage, data, or files changed between backup cycles. This value indicates how long the client will be busy backing up, and how robust a network is required to complete all the backups each backup cycle. It is used to estimate disk and tape storage requirements on the Tivoli Storage Manager server. Table 2-2 presents typical percentages of data changed for various sizes and types of data.

Table 2-2 Rules of thumb for selecting percentage of data changed

Configuration	Percentage of data changed (%)
Large, busy file server	10
Smaller, less busy file server	5
Workstation	1
Database using utilities or Tivoli Storage Manager for Databases	10–20
Database not using utilities or Tivoli Storage Manager for Databases	100

If your data change percentage is known, then enter that number in the worksheet. Otherwise, use Table 2-2 to estimate a rate, keeping in mind that your numbers may vary. A high estimate is better than one that is too low.

2.2.7 Number of files backed up

Calculate the total number of files to be backed up for each client. This number is used to estimate disk and tape storage requirements on the Tivoli Storage Manager server.

If the number of files is unknown, two values are possible. Enter either an estimate of the number of files in this field, or enter 10% of the Total Storage Used field, in GB.

2.2.8 Number of backup versions to be kept

Determine the number of changed copies that you want to keep of a file that exists on the client when the backup task runs. How many different versions of that file do you want to be able to restore? For example, if backup runs every night and a file changes every day, and you want to be able to restore any version up to one week ago, then you would choose 7 as the number of backups to keep. Remember that the more versions you choose to keep, the more database and storage pool space you will need to configure.

2.2.9 Data compression

Estimate a data compression rate. To do that, you must first decide whether to use data compression on the client.

Tivoli Storage Manager allows a client to compress data before sending it to the Tivoli Storage Manager server. To decide whether to use Tivoli Storage Manager compression, take into account the speed of your network, the speed of the client CPU, and whether the Tivoli Storage Manager server storage devices are capable of compression. Table 2-3 provides some criteria for selecting data compression.

Table 2-3 Rules of thumb for selecting data compression

Configuration	Compression
Dial-up connection	Yes
Network is approaching capacity	Yes
High-speed data network	No
Slower CPUs in clients	No
Faster CPUs in clients	Yes
No hardware compression on tape devices	Yes

Configuration	Compression
Small capacity or slow response storage devices	Yes

Compression takes time, so you need to decide whether the compression is helping or hurting the total elapsed time of your operation. In general, very high speed networks do not benefit as much from compression because network bandwidth is usually not saturated. Conversely, older client CPU models may run slowly because the CPU cannot compress data fast enough to keep the network connection busy.

Many sites have various combinations of these configurations, such as slow networks, slow CPUs, and small/slow devices. In this case, make a judgement call about using Tivoli Storage Manager compression. Performing tests may show you the most efficient mode for your environment.

Data compresses to varying degrees depending on the content of the files. Data composed of text, or many repeated characters like blanks, compresses well. Data that is already compressed, and data consisting of random characters like executables, does not compress well, and may actually grow.

If you decide to use compression, enter your data reduction rate. Use Table 2-4 to estimate the data reduction if your actual ratio is unknown, but the best advice is to make some tests on your actual data.

If you decide not to use compression, or are unsure whether to use compression, enter one (no compression) in the Data Compression field.

If you do not use client compression and your tape device has a hardware compression capability, then the data will still end up compressed when it reaches a tape volume. If you do use client compression, then you should disable any hardware compression capability on your tape devices, since data in general cannot be *doubly compressed*.

Table 2-4 Typical data compression ratios

	Compression ratio	Data reduction
Database data	3:1–4:1	0.66–0.75
Print and file server data	2:1	0.5
Executables, compressed data, encrypted data	1:1	1

2.2.10 Backup window times

Enter the times of the day between which Tivoli Storage Manager must start and complete its backup cycle. This window depends on when end-user client usage drops off, by availability requirements and by network capacity usage time frames.

2.2.11 Backup number of hours

Calculate the number of hours in the backup window.

2.2.12 Required recovery time frame

Identify the time frame in hours, which you have agreed to with the client, to recover a client completely. This is the time from when the data is lost to the time the data is usable again. It includes the time to fix or replace the machine and the time to restore the data.

Recovery time frames are vitally important, as this is the whole reason you are backing up.

This field documents your service level agreement with the client.

2.2.13 Tivoli Storage Manager restore time frame

Calculate the time frame, in hours, allotted to Tivoli Storage Manager to restore (possibly all) the data to the client. This number is used to size factors affecting the restore process such as network throughput and the number of tape drives required.

To calculate the Tivoli Storage Manager Restore Time Frame, subtract from the *required restore time frame*, the maximum time required to prepare the client machine for a restore. In reality, this number will vary, depending upon the complexity of the restore. In the worst case (a disaster), the time to prepare the machine may include contacting support, fixing or replacing the machine, installing an operating system, installing the Tivoli Storage Manager client code, and connecting to the network. In the best case (to simply recover deleted data), the time to prepare the machine may be the same as the required restore time frame.

A full Tivoli Storage Manager restore typically takes significantly more time than a full Tivoli Storage Manager backup. This is because of extra processing overhead that is required when restoring. Bear this in mind when planning the restore window—testing typical restores is essential to getting accurate data on restore transfer rates in your particular environment.

2.2.14 GB copied per archive

Calculate or estimate the amount of data to be archived during each archive session. Archives target specific data files. Typically, you do not archive whole systems.

2.2.15 Number of files archived

Calculate or estimate the number of files archived in each archive session. You can calculate this number by using an operating system utility to verify the size of a directory tree or an entire file space.

2.2.16 Number of archives kept

Identify how many archives will be kept. For example, if an archive is performed monthly, you may want to keep 12 copies of that archive. Note that this number is basically influenced by the retention period for that archive, since archives, unlike backups, do not have versions that expire.

2.2.17 Archive frequency

Determine how often you want to perform an archive function. Archives are typically run less frequently than incremental backups. Time frames such as monthly or yearly are common.

2.2.18 Archive window times

Enter the times between which Tivoli Storage Manager must start and complete its archive cycle for this client. This window is influenced by when end-user client usage drops off, by availability requirements, by network capacity usage time frames, or by when the data becomes available for archive.

Archive time frames may be less time sensitive than incremental backups if they are going against copies of data or against data already processed. Often it is not possible to automatically schedule this archive function using Tivoli Storage Manager schedules, due to the dependency on other events external to Tivoli Storage Manager.

This number may be a specific time frame, such as between 23:00 and 04:00, or a more general time frame, such as after month-end processing finishes.

2.2.19 Archive number of hours

Identify the number of hours available to complete the archive function.

2.2.20 Number of image backups

Identify the number of eligible system images that you want to back up. For a workstation that does not change very frequently, a good number could be six to twelve per machine.

2.2.21 Image backup frequency

Identify how often you want to perform image backups. A good standard will be on a monthly basis for less critical and static machines, with more frequent backups for more critical and dynamic machines.

2.2.22 Number of backup sets

Determine the number of backup sets that you want to create. This number must be balanced against your full recovery time and the change rate for data. Consider a more frequent backup set for large file systems.

2.2.23 Backup set frequency

Determine how often you will need to generate a backup set. Although a backup set is made of client data, it is a server-initiated process that requires some scratch tapes in the automated library or some guidelines for the operations team to run.

2.2.24 Policy domain

Leave this field blank. During the planning phase, this is unknown. We used this field in 1.2.1, “Server implementation checklist” on page 8, to contain the policy domain chosen for this client. For example, if you are implementing our configuration, the policy domains would be SERVER or WORKSTN.

For more information about policy domains see Chapter 7, “Data storage policies” on page 269.

2.2.25 Client option set

Leave this field blank. During the planning phase, this is unknown. We used this field in 1.2.2, “Client implementation checklist” on page 11, to contain the client option set chosen for this client. For example, if you are implementing our configuration, the client options set names would be AIX, WINDOWS, or NETWARE.

For more information about client option sets see 8.3, “Client option sets” on page 298.

2.3 Data retention requirements

In this section we identify the requirements for managing the data received from the clients. Categorize your data into a small number of groups with similar requirements. This table provides information to create copy groups under Management Classes in Tivoli Storage Manager, calculate storage pool sizes, and calculate the number of tapes required to hold the data.

Complete a column in Table 2-5 for each different group. We show two example groups.

Table 2-5 Storage policy requirement worksheet

	Example 1	Example 2
Group name	Workstn	Server
Number of backup versions	2	7
Backup file retention period	90 days	NOLIMIT
Number of deleted versions	1	2
Last deleted file version retention period	60 days	180 days
Archive retention period	180 days	360 days
Off-site copies	Yes	Yes
Onsite collocation	No	Yes
Off-site collocation	No	No
Image backup retention	30 days	30 days
Backup set retention	180 days	60 days

2.3.1 Group name

Choose a descriptive name for each categorized group of data. In our example, the Workstn group is used for files from a workstation, while the Server group is used for all data from a large file server.

2.3.2 Number of backup versions

Determine the number of changed copies that you want to keep of a file that exists on the client when the backup task runs. How many different versions of that file do you want to be able to restore? For example, if backup runs every night and a file changes every day, and you want to be able to restore any version up to one week ago, then you would choose 7 as the number of backups to keep.

You will use the Number of Backup Versions field as a basis to group your data storage requirements into management classes.

2.3.3 Backup file retention period

Determine the number of days you want to keep a backup version of a file (other than the current version). There are two options: keep the backup version for a set number of days; or specify NOLIMIT, which implies that you want Tivoli Storage Manager to retain all backup versions, other than the most recent version, indefinitely (the most recent active version is already stored indefinitely by default).

2.3.4 Number of deleted versions

Determine how many versions of a file to keep after the file has been deleted from the original file system. This parameter comes into force during the first backup cycle after the file has been deleted. For example, assume you are keeping seven versions of a file as specified above, and you have set this parameter to one. When the next backup cycle runs after the file has been deleted off the client, Tivoli Storage Manager will flag the six oldest backup versions of the file for deletion and just keep the most current backup version.

2.3.5 Last deleted file version retention period

Determine the number of days you want to keep the last backup version of a file after it has been deleted from the client. There are two options: keep the last backup version for a set number of days; or NOLIMIT, which implies that you want to keep the backup version indefinitely.

For example, if you are keeping one version of a deleted file, and you set this parameter to 60, then 60 days after this file is noticed by Tivoli Storage Manager as being deleted from the client file system, the one remaining backup version will be deleted from Tivoli Storage Manager.

2.3.6 Archive retention period

Determine how long you want to keep a file that is archived. Many sites set up a limited number of data groups with standard archive retention periods, such as seven days, 31 days, 180 days, 365 days, or 7 years. Nonstandard requests for archive retention periods are slotted into the next larger retention period group. This reduces management complexity at the expense of keeping some data longer than actually required. If every nonstandard request is honored, the number of groups quickly becomes unmanageable. On the other hand, you can use the backup set feature to retain all nonstandard backup requirements, or even just use backup sets instead of archive.

2.3.7 Off-site copies

Determine whether you want to send a copy of the data off-site. Copying data to a removable device like tape allows the data to be taken off-site. An off-site copy along with other procedures provides recoverability in the event that the Tivoli Storage Manager server becomes unusable, or that data on the Tivoli Storage Manager server becomes corrupted.

Enter Yes to use off-site copies or No to not use off-site copies.

2.3.8 Onsite collocation

Determine whether you want to use onsite collocation.

Tivoli Storage Manager uses collocation to dedicate as few tapes as required to hold all of one client's files. Collocation reduces elapsed time for multiple file restores and full client restores at the expense of using more tapes, potentially increasing backup times and increasing Tivoli Storage Manager management time for migration and for storage pool copies.

Collocating by client allows as many clients to be restored simultaneously as you have tape drives. If you have stringent restore requirements and sufficient tape drives, then collocation makes good sense.

Table 2-6 highlights some factors affecting whether to use collocation.

Table 2-6 Factors affecting collocation

	Onsite collocation	Off-site collocation
Short restore window	Yes	Yes
Less than 10 Clients, each 10 GB storage	No	No

	Onsite collocation	Off-site collocation
More than 50 clients, each 10 GB storage	No	No
More than 50 clients, each 100 GB or more	Yes	Yes/No
Limited disk or tape resources	No	No
Workstations	No	No
Database, print, and file servers	Yes	Yes

Tivoli Storage Manager implementations that are small (small number of clients managing a small amount of data) do not see much benefit from collocation, due to the small number of tapes required for any restore. Large Tivoli Storage Manager implementations often collocate both onsite and off-site files due to the amount of data required for the restore of a client.

Tape drive capacity is a consideration for collocation. To use the minimum number of tapes, each tape must be used to its maximum capacity. Smaller capacity tapes will tend to fill completely even with small clients. In this case, collocation may be useful. With large capacity tape devices and collocation, a small client may not be able to fill a tape. With a large number of clients, significant numbers of tape volumes may be required.

2.3.9 Off-site collocation

Determine whether you want to use off-site collocation. Off-site collocation is usually rarely used, as it greatly increases the number of tapes that need to be sent off-site.

2.3.10 Image backup retention

Determine how long you want to keep an image backup. Consider your restore time frame and balance the criticality of a full file space restore, compared with a single or a small number of files. Image backups can be very useful for quick restore of large file systems. However, this process will take longer, depending on how many changes there have been to the file system since the last image backup. A rule of thumb is to keep at least one weekly image for small servers and a monthly image for bigger servers (or more frequently if change rates in the file system are high).

2.3.11 Backup set retention

A backup set execution creates a copy of the client node's previously backed up active files and stores them on sequential media. This has an impact on the number of tapes that you may need, especially if you want to retain those backup sets for long periods of time or even if you want to have one copy onsite and one for off-site purposes.

Determine how long you want to keep the backup sets. Use a small retention if your data changes frequently and you do not need to keep it for long periods. You can use a longer retention for special cases or for legal requirements.

2.4 Server architecture considerations

Having gathered information about the total client environment, you can now make decisions about the architecture of the Tivoli Storage Manager server environment. This section deals with issues related to the Tivoli Storage Manager server.

2.4.1 Server platform

A Tivoli Storage Manager server runs on several platforms. How do you choose one platform over another? With only minor differences, a Tivoli Storage Manager server provides the same functionality on every platform. The major differences between Tivoli Storage Manager server platforms relate to capacity, cost, installation, operation, supported devices, and installed user base. Each of these factors is explained below. Table 2-7 summarizes these considerations in choosing a Tivoli Storage Manager server platform. Note these are indicative only and designed for comparative purposes.

In many cases, the choice of server platform will be dictated by enterprise policy or preference, and will be primarily related to the platforms already in use, and with skilled administrators available.

Table 2-7 Tivoli Storage Manager server platform considerations

	Windows system	UNIX	iSeries™	zSeries®
Installed user base	+++	AIX +++ Linux- ++; HP-UX, Sun™ Solaris™ +	+	+

	Windows system	UNIX	iSeries™	zSeries®
Cost	+	UNIX ++/+++ Linux +	++/+++	+++
Capacity	+	++/+++	++/+++	+++
Platform installation	Simple	Simple	Medium	Complex
Operation	Simple	Medium	Medium	Complex
Supported devices	Many	Many	Limited	Limited

2.4.2 Installed user base

The number of Tivoli Storage Manager servers installed for a particular platform is a consideration. At the time of writing, there are more Tivoli Storage Manager servers installed in Windows and AIX platforms, compared with the other choices.

2.4.3 Cost

Cost is a very dynamic area to discuss in a static manual, so we only generalize here. Check for special promotions and other discounts before committing to acquiring a particular platform configuration.

Cost is further subdivided into platform costs and Tivoli Storage Manager software license costs. Platform costs include the cost to acquire all the hardware and software to run the platform exclusive of the Tivoli Storage Manager software license. It ranges from low for a Windows system to high for zSeries. The high cost of installing a new zSeries system usually precludes it from being selected to run a Tivoli Storage Manager server exclusively. However, if this platform is already in use, it can be an economical choice, particularly if there is considerable in-house expertise on this platform available.

Tivoli Storage Manager license costs vary somewhat, with Windows costs being the lowest, followed by Linux, AIX, HP-UX, Sun Solaris, and iSeries costs. All of these are one-time charges to purchase the product. zSeries licenses are available for a one-time charge or as a monthly license fee. You may want to calculate the break-even point.

Tivoli Storage Manager server costs include a license for only one client by default. To manage more clients, more client licenses must be purchased. The actual client code is free to download. Under the current pricing model, Tivoli Storage Manager is sold as a per-processor fee for either a server or client

license. Check with your sales representative for more information about pricing and license regulations.

2.4.4 Capacity

The Tivoli Storage Manager server can essentially manage a basically unlimited number of clients and an unlimited amount of data (within restrictions of the maximum Tivoli Storage Manager server database size). With that said, the Tivoli selected Storage Manager server platform does limit the maximum configuration size. Various hardware platforms have different capacities in regard to the CPU power they can deliver to Tivoli Storage Manager, the number of devices that can be attached, and the maximum throughput.

Choose your platform with growth in mind. Moving from a small platform to a larger platform of the same server type, such as from a small pSeries system to a larger pSeries system, is relatively simple. Starting at the top end of a server type and moving to another server type, such as from Windows to AIX, involves export and import operations. Although the procedure is straightforward, it can be time-consuming and labor-intensive.

2.4.5 Platform installation

Installation consists of the platform installation and the Tivoli Storage Manager server code installation. Platform installation consists of hardware installation and configuration, and of operating system installation and configuration. Installation of each platform requires specialized knowledge that is not covered here.

The Tivoli Storage Manager server code installation varies by platform in the specifics, but generally follows a similar procedure. Installation on Windows can be easier due to the Windows wizards that have been provided. Installation of the Tivoli Storage Manager server on other platforms is not difficult for an administrator familiar with the platform.

2.4.6 Operation

Operation of a platform varies from reasonably simple on Windows, to complex on zSeries, with the UNIX and iSeries platforms somewhere in the middle. The availability of tools to assist in managing the operation of the various platforms is nearly opposite, in that the zSeries environment has a rich, powerful assortment of tools, while Windows is lacking in this regard.

Operation of Tivoli Storage Manager itself varies only in the way some operating system-specific Tivoli Storage Manager commands are issued on each platform.

It is important to look at the skills available among your staff for a particular operating system platform. If there are more people familiar with a particular platform, then it will be easier to maintain Tivoli Storage Manager in this environment.

2.4.7 Supported devices

There are a wide variety of supported devices on the Windows and UNIX platforms, including disk drives, tape drives, optical drives, and automated tape libraries. zSeries and iSeries are more limited in their choice of devices, but these devices generally have tremendous capacity.

Be careful if choosing a “smaller” platform that you will have the ability to attach the required amount of devices as the environment grows. On larger platforms this concern is usually reduced.

2.5 System size

Choosing the correct platform CPU size and memory requirements is an inexact art. As you would expect, the risk of configuring insufficient resources increases with the size of the Tivoli Storage Manager implementation. Small Tivoli Storage Manager implementations are at less risk of choosing an incorrect platform size, and the incremental cost to scale up or down is small. Many sites start small and grow into larger systems. However, this is of little help if you are starting large.

The Tivoli Storage Manager server is CPU-intensive, I/O-intensive, and memory-intensive. CPU is a function of the number of files to manage and how your platform processes I/O. A large number of small files is more CPU-intensive than a small number of large files. As the number of files and the amount of data to be moved increases, each backup, migration, storage pool copy, and expiration process will use more CPU to maintain the database entries. Tivoli Storage Manager takes advantage of multiple processors.

In our experience, zSeries platforms seem to be more CPU-intensive than UNIX platforms. zSeries sites should be aware that Tivoli Storage Manager can use significant amounts of CPU. We have seen Tivoli Storage Manager among the top five users of CPU on such systems.

I/O is the major part of Tivoli Storage Manager processing. In fact, Tivoli Storage Manager does very little else. Backups and restores, database updates and retrievals, and storage pool management (reclamation, migration, copying) are all I/O intensive. The I/O subsystem needs to be robust enough to handle this load. As the number of files and the amount of data climb, the need for a larger,

faster I/O subsystem increases. Separate controllers or adapters for disk and tape devices become essential as the load increases.

Memory is used to cache database entries, among other things. As the number of files being managed increases (and thus the database size increases), the amount of memory that Tivoli Storage Manager requires increases. zSeries users note that Tivoli Storage Manager likes to keep a large part of its address space in real storage. Since memory is relatively cheap, and you will never regret having too much memory, we recommend starting with a minimum of 1 GB and increasing from there.

2.6 Multiple Tivoli Storage Manager servers

When first setting up a Tivoli Storage Manager environment, we recommend implementing a single server. Once experience has been gained, and the implementation has grown enough to be reaching the capacity of the current server model family, a second server may be considered. We recommend upgrading your current server hardware to its next larger model before considering a second server, because this will keep the management overhead smaller. Tivoli Storage Manager can handle very large amounts of data or clients in one implementation. Currently, we have seen implementations with Tivoli Storage Manager internal server databases of 80 GB and larger (admittedly on very powerful, large platforms).

2.6.1 Reasons to consider multiple servers

Multiple Tivoli Storage Manager servers can be configured to provide some redundancy and disaster recoverability in the event of a Tivoli Storage Manager server outage. For example, a company with two well-connected sites, A and B, may decide to install a Tivoli Storage Manager system at each site. The system at site A would back up the client data from site B and vice versa. The loss of site A would mean that the Tivoli Storage Manager system at site B (which holds the backup data for site A) could immediately start restoring the client systems onto replacement equipment. The server at site A (which was lost) could be recovered to the server at site B.

The virtual volumes and Enterprise Administration capabilities of Tivoli Storage Manager make managing multiple servers easier by centralizing some administration functions and allowing changes to be replicated on some or all systems.

For very large or critical clients such as a large, enterprise-wide business intelligence complex, a dedicated Tivoli Storage Manager server (either on the same system or a different one) might be the best solution.

In installations where network connectivity is slow or expensive, placing a Tivoli Storage Manager server close to the clients usually makes sense. For example, for a business that has multiple file servers in each of a number of cities interconnected by a slow network, it may be appropriate to install a Tivoli Storage Manager server in each city.

2.6.2 Disadvantages of multiple servers

Multiple servers increase costs. Two small server CPUs may be more expensive than one larger CPU of the same power. Where one automated tape library may be enough, multiple servers may require multiple automated libraries. Every Tivoli Storage Manager server requires a Tivoli Storage Manager server license.

Management of a multiple-server environment is more complex, costly, and time consuming than a single environment. Installation and maintenance procedures have to be repeated on each server. Confusion about where data is stored, in the event of a restore, may result. Some of these disadvantages can be reduced by using the Enterprise Administration feature.

2.7 Network

The network connection plays an integral part in providing service to the client. If the other components of the solution have been correctly sized, it will often turn out that the network is the performance bottleneck. The network typically consists of a combination of network interface cards, hubs, routers, gateways, wire, and software. Tivoli Storage Manager server software, Tivoli Storage Manager client software, the server platform, and the client platform all have at least minimal monitoring or management capabilities. Often small networks may have no more than this (that is, no additional network management hardware or software), with limited or no network administration expertise. This makes the network a weak link in the overall management of the implementation.

Network design, implementation, and operation are beyond the scope of this book. However, we cover some basic recommendations.

2.7.1 Network considerations

The network speed to back up clients should be enough to transport common data and backup data. Generally, the backup should be done during nonworking hours. We call this period the backup window. While it is possible to split client backups to minimize network bandwidth, it makes the backup administration more difficult.

Workload calculations

An important consideration for designing the overall Tivoli Storage Manager solution is the total amount of data that the Tivoli Storage Manager server will need to support for backup or restore over a particular time frame.

A normal approach to estimate the network bandwidth needed is to consider all client information backed up in the same backup window using the following procedure:

1. Calculate the amount of data a Tivoli Storage Manager server will have to accommodate during its nightly backup window and ensure that the hardware can reasonably accommodate the data.
2. Calculate the amount of data that will be restored from a disaster recovery Tivoli Storage Manager server and ensure that the hardware will meet DR recovery SLAs.

We can calculate the workload for a Tivoli Storage Manager server in a theoretical environment. As an example, the environment has the following systems that we must back up:

- ▶ Twenty workstations

Each workstation has 60 GB of file data.

- Incremental forever backup with a change of approximately 10%
- Six-hour backup window

- ▶ Four database servers

Each server has 100 GB of database data.

- Full backups with a change of 100%
- Six-hour backup window

So doing the calculation for backup workload, each night we will need to back up:

$$(60 \times 20 \times .10) + (100 \times 4 \times 1) = 520 \text{ GB}$$

And dividing that by the time allowed for the backup:

$$\frac{520\text{GB}}{6\text{Hr}} \approx 86.6 \frac{\text{GB}}{\text{Hr}}$$

So the network interfaces, drives, Tivoli Storage Manager server, and all other infrastructures must handle this amount of data in order to meet SLAs for this environment. Note that this type of calculation does not only apply to backups—it can and should be done for disaster recovery restores and single system restores.

LAN/WAN transports

The performance of your network backup solution will be no better than the performance of your network. You must consider expected and real performance of your network when you are designing a Tivoli Storage Manager solution.

As an example, calculate theoretical network throughput using Fast Ethernet and a 40% efficiency:

- ▶ Assume 40–80% of total theoretical throughput for a TCP/IP adapter or protocol.
- ▶ Be careful of the CPU usage and real throughput of faster TCP/IP protocols (such as would). They often do not perform even close to the 80% rule.
- ▶ Measure LAN throughput outside of Tivoli Storage Manager with simple protocols such as FTP. This will provide a true picture of how a network is performing.

$$\frac{100Mb}{s} \times \frac{1B}{8b} \times \frac{1GB}{1024MB} \times \frac{60s}{1min} \times \frac{60min}{1Hr} \times .4 \approx 18 \frac{GB}{Hr}$$

Using this type of calculation, you can calculate the anticipated throughput for any network transport. Table 2-8 shows the most common throughputs.

Table 2-8 Common throughputs

Technology	MBps	Assume speed
Fast Ethernet	100 MBps	18 GB/hr at 40% efficiency
Gigabit Ethernet	1000 MBps	180 GB/hr at 40% efficiency
T1	1.54 MBps	0.5 GB/hr at 80% efficiency
T3	45 MBps	16 GB/hr at 80% efficiency

Using this table, your own calculations, and any real testing you may have done, you can validate the amount of data you need to move to back up and restore workload against your SLAs and your network transports. Obviously, if the network will not meet your SLAs, either the SLAs must be relaxed or the network must be improved.

LAN-free data movement (SAN backup and restore)

Tivoli Storage Manager for Storage Area Networks allows for Tivoli Storage Manager backups and restores to be sent over the SAN instead of the LAN, as shown in Figure 2-2 on page 38.

When planning for LAN-free data movement, remember that the file metadata must still be sent over the LAN. This metadata can add overhead to a LAN-free backup. Even though the data is streaming over the SAN to the tape or disk, the metadata still goes to the Tivoli Storage Manager server using whatever LAN protocol and speed are being used. As you might imagine, as the amount of metadata grows, the LAN-free backup speed will approach the speed of LAN-based backup.

Experience has shown that systems with large files (greater than 10 MB, on average) and large amounts of data (greater than 50 GB) are good candidates for LAN-free backup, while systems with numerous small files (average size in KB) often perform better using traditional LAN-based backups. Examples of the former include databases, mail systems, and ERP systems; examples of the latter are traditional file and print type servers.

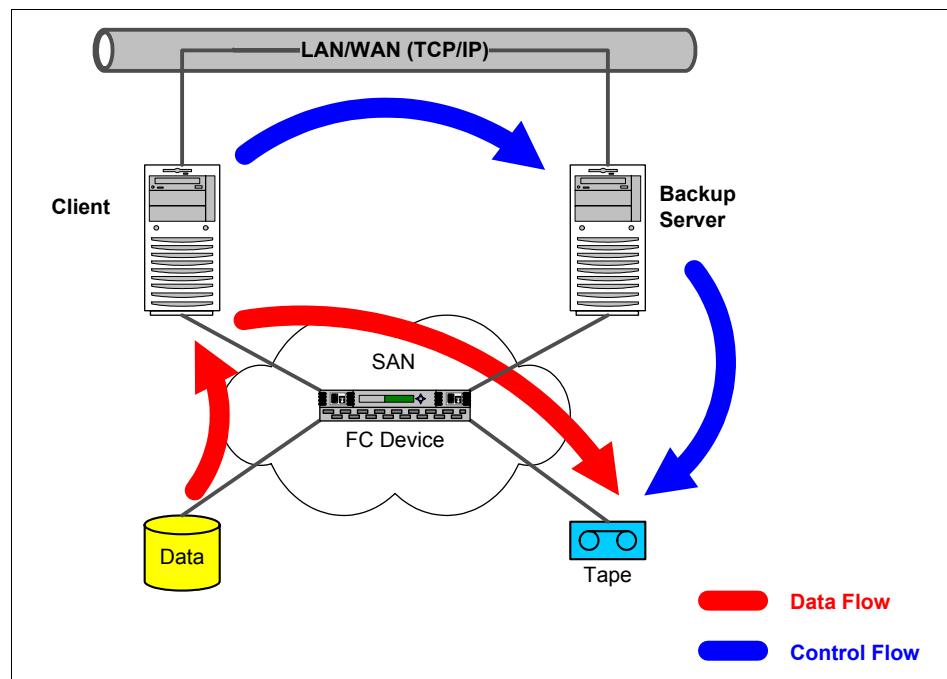


Figure 2-2 LAN-free data movement

2.7.2 Communication protocol

Most network protocols such as TCP/IP and NETBIOS are supported by Tivoli Storage Manager. TCP/IP is the most common communication method and the easiest to set up. Certain functions, such as server prompted mode and the Web clients, require TCP/IP.

2.7.3 Network name resolution

The Tivoli Storage Manager server machine requires a name that clients use to reference the Tivoli Storage Manager server. If TCP/IP is used, create a Domain Name Server (DNS) entry for Tivoli Storage Manager itself, as well as a DNS entry for the machine's host names. For example, create DNS name TSMSRV1 and use it in the client option files. If Tivoli Storage Manager needs to be moved to another machine, only the DNS entry needs to be changed, instead of editing the Tivoli Storage Manager options file for each client. However, using DNS may impact backup availability if for some reason the DNS service is down (the DNS name will not get resolved unless availability has been built into the DNS setup).

2.8 Disk considerations and sizing

Tivoli Storage Manager requires disk to operate, to hold the database, logs, and usually the primary storage pools. In this section we talk about how to choose a disk subsystem, and how to size the required amount of disk storage capacity.

2.8.1 The disk subsystem

In general, choose the fastest disk subsystem that you can afford. Slow disks may not be a hindrance for a small implementation, but as the site grows, disk access becomes a large percentage of the overall elapsed time to complete a task. Choose a scalable disk subsystem because the vast majority of Tivoli Storage Manager implementations grow substantially. Multiple I/O paths and hot-swappable components should also be considered, both for performance and availability.

2.8.2 Tivoli Storage Manager database

The Tivoli Storage Manager database is critical to the operation of the entire Tivoli Storage Manager environment. Systems with poorly designed Tivoli Storage Manager databases tend to run very poorly and rarely meet expectations. When planning a Tivoli Storage Manager environment, you should plan enough instances of Tivoli Storage Manager to keep the size of each Tivoli Storage Manager database reasonable.

The database size depends on how many files are managed with Tivoli Storage Manager, and whether the files are in a primary storage pool or a copy storage pool.

The database holds two types of data:

- ▶ Entries for backups: This sizing calculates how much of the database holds backup entries.
- ▶ Entries for archives: This sizing calculates how much of the database holds archive entries.

The database also holds items such as entries for policy settings, client definitions, image backups, server scripts, and the volume history, but typically, these are insignificant in sizing the database.

Use backup or archive sizing, or both, depending on what functions your server will perform. If both backup and archive are used, then add the calculated database sizes together to arrive at the total database size.

If you are planning to use backup sets, remember that these are not tracked in the Tivoli Storage Manager database, so they do not impact our calculation. They do affect the tape library size if the media used is retained online. Image backups are entered in the database, although only one entry for each backup is required. The database space requirements for image backup entries will therefore be small compared to the backups and archives, and we will not include this in our calculation.

Our calculations assume that each backed up or archived file version uses 600 bytes of space in the server database. If off-site copies are used as well, this takes an extra 200 bytes of space. Where we did not know the number of files to be kept, but only the total storage, we estimated 5% of the total server storage requirement for onsite copies and 1% for off-site.

Do not let the Tivoli Storage Manager database get too large. A good general rule is 120 GB or so, but there is no “magic” number. When expiration, database restores, and other Tivoli Storage Manager admin processes take too long and client restores become too slow, it is too big.

We recommend using Tivoli Storage Manager internal software mirroring—it is the fastest and most reliable. Spread Tivoli Storage Manager volumes over as many physical disks as possible and use smaller database volume sizes (for example, 4–8 GB), as this will improve Tivoli Storage Manager and database performance.

2.8.3 Database performance

Database performance is a critical factor in design and operation of a Tivoli Storage Manager solution. In this area, there are certain typical performance recommendations for any database, and some that are peculiar to the Tivoli Storage Manager database.

As with any database, the faster the disk used for the database the better. Spreading the database over as many physical disks as possible allows for better performance because multiple disk heads can be seeking, reading, and writing simultaneously.

Counter to conventional thinking, however, several design ideas are peculiar to Tivoli Storage Manager. First, our lab measurements and client experiences have shown Tivoli Storage Manager internal software database mirroring to be a very efficient means of providing database redundancy—often more so than hardware redundancy.

And finally, due to locking and threading information in the Tivoli Storage Manager server code, smaller logical database volumes tend to perform better than the larger ones. This is primarily due to Tivoli Storage Manager server code locking and threading considerations.

2.8.4 Database size

To estimate the Tivoli Storage Manager database size for backup data, use the data collected in Table 2-1 on page 18 and Table 2-5 on page 26.

The calculation is based upon the actual number of file versions backed up. If this is not known, you can estimate 5% of the amount of data backed up for the primary storage pool and 1% for copy pools.

1. Sum the Number of Files Backed Up field for all clients.
2. Multiply this number by the number of versions kept, giving a total number of files backed up.
3. Multiply this number by 600 bytes, to give bytes used in the database for all known files backed up.
4. If copy storage pools are used (and we strongly recommend this), multiply the total number of files backed up and calculated in step 2 above by 200 bytes, giving the bytes for known copy storage pool files.
5. Add the bytes for known copy storage pool files to the estimated bytes for copy storage pool files to give the total bytes for copy storage pool files.
6. Add the total bytes for backed up files to the total bytes for copy storage pool files to give the total bytes calculated for the database.
7. Calculate 135% of the total bytes calculated for the database to give the database size. This is for overhead and for growth.

For example, using the sample data in Table 2-1 on page 18 and Table 2-5 on page 26, calculate the sample database size as follows:

1. $60,000 \text{ (3,000 files per workstation * 20 clients)} + 8,000 \text{ (2,000 files per server)} = 68,000$
2. $60,000 * 2 + 8,000 * 7 = 176,000 \text{ files}$
3. $176,000 * 600 = 105.6 \text{ MB}$
4. $176,000 * 200 = 35.2 \text{ MB}$
5. $105.6 \text{ MB} + 35.2 \text{ MB} = 140.8 \text{ MB}$
6. $140.8 \text{ MB} * 1.35 = 190 \text{ MB database size for backup files}$

2.8.5 Archive sizing

To estimate the Tivoli Storage Manager database size for archive data, use the data collected in Table 2-1 on page 18 and Table 2-5 on page 26.

The calculation is based upon the number of files archived:

1. Sum the Number of Files Archived field for all clients.
2. Multiply the number of files archived by the number of archives kept times the yearly retention ratio (that is, desired monthly retention/12 months), giving a total number of files archived.
3. Multiply this number by 600 bytes to give total bytes for archived files.
4. If copy storage pools are used (and we strongly recommend this), then multiply the total number of files archived and calculated in step 2 above by 200 bytes, giving the total bytes for copy storage pool files.
5. Add the total bytes for archived files to the total bytes for copy storage pool files to give the total bytes calculated for the database.
6. Calculate 135% of the total bytes calculated for the database to give the database size for archives. This is for overhead and for growth.

For example, using the sample data in Table 2-1 on page 18 and Table 2-5 on page 26 calculate the sample database size for archive as follows:

1. $80,000 + 12,000 = 92,000 \text{ files}$
2. $92,000 * 12 * (12/12) = 1,104,000 \text{ files archived}$
3. $1,104,000 * 600 = 662.4 \text{ MB}$
4. $1,104,000 * 200 = 220.8 \text{ MB}$
5. $662.4 \text{ MB} + 220.8 \text{ MB} = 883.2 \text{ MB}$
6. $883.2 \text{ MB} * 1.35 = 1192.32 \text{ MB database size for archive data}$

2.8.6 Database volume identification

The total required database size including both backup and archive requirements will be $190 + 1192.32 = 1382.4$ MB.

We recommend using the Tivoli Storage Manager mirroring function for the database instead of a hardware or operating system mirroring, because Tivoli Storage Manager has additional functions to handle error conditions that may affect the mirrored copy.

If you are using Tivoli Storage Manager mirroring, you need to plan for the mirror copy by doubling the amount of disk for the database.

Various file systems have different maximum capacities, so the database may have to be split across numerous volumes to make up your database size. To ensure no single point of failure when mirroring the database, each volume in a mirrored set should be placed on a separate drive and even controller.

Note: By summing up backup and archive database sizes, you will have a full, consolidated database for the calculated time frame. You can start with a smaller configuration initially but leave enough spare disk space for growth. You should round up database volume sizes to multiples of 4 MB plus 1 MB for overhead.

Complete Table 2-9 with the database file names and the volume names for your primary database and copy database. This table includes the space for the backup and archive requirements.

Table 2-9 Database worksheet - backup and archive requirements

Database volume	File name (primary)	Size MB	File name (copy)	Size MB
Vol1	/tsm/database/primary/file01	693	/tsm/database/copy/file01	693
Vol2	/tsm/database/primary/file02	693	/tsm/database/copy/file02	693
	Total	1386	Total	1386

2.8.7 Tivoli Storage Manager recovery log

The size of the recovery log depends on the amount of data changed between Tivoli Storage Manager database backups. The larger the amount of data, the larger the recovery log needs to be. Either a full or an incremental Tivoli Storage Manager database backup (in roll-forward mode) resets the recovery log back to empty. If the recovery log fills up completely, Tivoli Storage Manager stops and

you have to manually increase the size of the recovery log. This may take some time but can usually be avoided with adequate precautions (for example, by monitoring and planning for growth).

To estimate the size of the recovery log, multiply the database size by the percentage of data that changes each backup cycle. Double this number to allow for two backup cycles to occur without a database backup. This gives a starting point for the recovery log.

For example, if the database size is 1386 MB, and 5% of the data changes every backup cycle, then the estimated size for the recovery log would be $1386 \text{ MB} \times 0.05 \times 2 = 138.6 \text{ MB}$ (141 MB for better allocation, if using a single volume).

As with the database, we recommend using the Tivoli Storage Manager mirroring function for the recovery log instead of hardware or operating system mirroring.

If you are using Tivoli Storage Manager mirroring, you need to plan for the mirror copy by doubling the amount of disk for the recovery log.

Various file systems have different maximum capacities, so the recovery log may have to be split across numerous volumes to make up your total recovery log size. To ensure no single point of failure when mirroring the recovery log, each volume in a mirrored set should be placed on a separate drive and even controller.

Complete Table 2-10 with the recovery log file names for your primary and copy recovery log.

Table 2-10 Recovery log worksheet

Log volume	File name (primary)	Size (MB)	File name (copy)	Size (MB)
Vol1	/tsm/log/primary/file01	141	/tsm/log/copy/file01	141
	Total	141	Total	141

2.8.8 Primary disk storage pool

The traditional Tivoli Storage Manager design uses disks as a cache for nightly backups. Data is migrated daily from disk to a less expensive medium such as tape.

A best practice is to have enough disk storage pool space to store one night's incremental file system backup, and send large file backups directly to tape (for example, database files) to optimize the overall I/O. Consider using the `cache=yes` parameter on disk storage pools—this means files remain on disk

until space is needed for further backups. This can significantly improve restore performance for recently backed up files.

As the cost of per megabyte of disk decreases, more and more disk is being used in Tivoli Storage Manager designs. Some use no tape at all, so that all backed up data is saved to disk. In this case, the file-type device class should be used, not a disk-type (even if a disk-type is the initial destination). Disk-type pools become fragmented if data is retained for extended periods of time, unlike file-type classes, which can be defragmented.

Tivoli Storage Manager supports a *tapeless* configuration through the use of disk storage pools or a device class of type file. When deciding whether to use only disk for backup-archive storage, consider the following caveats:

- ▶ Do a realistic analysis of the total amount of storage needed considering your data retention policies, total data, and growth expectations. Evaluate the cost of tape versus disk for storing all data.
- ▶ Invest in a disk technology that can permanently store the data. If the device can fail (and all devices can, whether RAID, mirrored, or anything else), consider using a copy storage pool for data redundancy.
- ▶ Carefully consider the cost and technical feasibility of getting the data off-site for disaster recovery purposes. Tape cartridges are portable. If using disk only, off-site copies have to be moved over a network transport.

In our scenario, when a client node backs up, archives, or migrates data via HSM, all data is stored in one primary storage pool. You could also use separate storage pools for a backup, archive, and HSM data for improved controls and manageability of production data.

To size the disk storage pool, calculate how much will be backed up during one cycle and add on a proportion of the amount of archive data transferred to the server. This amount (plus a contingency for growth) is the recommended size for the storage pool.

If you are also using Space Management (HSM) features, the rate of data migration to the server is hard to predict, so you need to get experience of your particular environment to make an accurate sizing.

Primary storage pools (usually disk devices) can be made larger or smaller than the recommended size, depending on the resources available. A larger pool size allows for more than one backup cycle of data to remain on disk, thus improving restore times. It also allows for spare capacity for an unexpectedly large amount of backup data to prevent server migration from running during backup. A smaller primary storage pool uses less disk, but runs the risk that the pool will fill up during back up. This is not functionally a problem, since the backup and

migration to the next storage pool can execute concurrently; however, performance will degrade.

We recommend using a primary disk storage pool of at least the recommended size to reduce interference from migration while backup is running.

2.8.9 Disk storage pool size

To estimate a primary storage pool size if running backup cycles only, do the following:

1. Using Table 2-1 on page 18, multiply the GB changed per backup by (1 - the Data compression rate) to give the total bytes transferred for each client.
2. Sum the total bytes transferred for all clients to give the total bytes transferred per backup cycle.
3. Add 15% to total bytes transferred per backup cycle to give the storage pool size. This allows for variability in the size and number of files per backup.

For example, using the sample figures in Table 2-1 on page 18, the GB changed per backup are $6 * 20$ (120 GB) and $4 * 100$ (400 GB), while the data compression figures are 0.5 and 0.66, respectively.

1. Multiplying 120 by $(1 - 0.5)$ gives 60, and multiplying 400 by $(1 - 0.66)$ gives 136.
2. Summing 60 and 136 gives 196 GB.
3. Adding 15% gives a storage pool size of 225.4 GB. We will round to 226 GB.

2.8.10 Archive disk sizing

In most environments, archive disk sizing is less critical than for backup. This is because backup operations tend to run much more frequently (usually nightly) and to a stricter time frame. Archives may run less frequently, and on weekends when the overall workload is lighter. Since in these circumstances the impact of running concurrent archive and storage pool migration might not be so critical, it is not normally necessary to use the full archive size in calculating storage pool requirements. Another factor to be considered for sites that are doing frequent archiving of large amounts of data, where the storage pool and processing impact are great, is the possibility of substituting backup set operations for archive. The advantage of this is that generating a backup set requires the Tivoli Storage Manager server only—the client is not involved in any way since the backup set is created using data that has already been sent to the server in normal backup operations.

To additionally increase the storage pool to hold archive data as well, follow these steps:

1. Using Table 2-1 on page 18 and the GB copied per archive field, group all machines that require simultaneous archive operations during one common time frame (for example, every month). Select the biggest group, giving peak archive size.
2. Take 10% of the peak archive size, giving the archive storage size.

For example, using the sample figures in Table 2-1 on page 18:

1. Assuming a monthly/month-end time frame as our baseline, we have the workstations (200 GB) and database servers (80 GB), which equals 280 GB.
2. Taking 10% from all archive storage required during the time frame, $280\text{ GB} * 0.10 = 28\text{ GB}$ for archive disk storage.

2.8.11 Image disk sizing

If you are planning to use image backups, you should consider sizing the disk storage pool to hold the file spaces you want to back up. This is because image backups are single objects and therefore the server will require that size for storing data (or at least part of it, assuming compression is enabled).

For example, assuming that the client file spaces eligible for image backup are /oralog (200 MB), /finsys (1.5 GB), /oradata (1 GB), and /findata (1 GB), then the disk image requirements should be at least 3.7 GB to hold those file spaces in disk without having to use tape immediately. This is especially true if you are running parallel backup operations (that is, executing multiple concurrent backup image commands). Alternatively, since the disk storage requirements are so high for this operation, you could consider sending these backups straight to tape, provided that you have enough tape drives and the backup window is long enough to coexist with normal backup and archive operations as well.

Note: You must sum up all disk storage requirements (backup, archive, image) to have your final disk storage size. You can, of course, start with smaller numbers and evaluate future growth.

We recommend that the disk storage pools be allocated on fault-tolerant hardware devices such as RAID 5 devices. If you are using hardware or operating system mirroring, you need to plan for the mirror copy by doubling the amount of disk for the primary storage pool.

Various file systems have different maximum capacities, so the primary storage pool may have to be split across numerous volumes to make up your total primary storage pool size. We recommend that the disk storage pools be placed

on their own disk devices and controller separate from the database and the recovery log, if possible.

Complete Table 2-11 with the primary storage pool file names and volume names for your primary storage pool. We are considering backup and archive requirements only, which was 226 + 28 GB = a total of 254 GB. If using 20 GB size for disk storage pool volumes, we would need at least 13 volumes.

Table 2-11 Primary storage pool worksheet

File name	Size (GB)
/tsm/stgpool/file01	20
/tsm/stgpool/file02	20
/tsm/stgpool/file03	20
/tsm/stgpool/file04	20
...	
/tsm/stgpool/file13	20
Total	254

2.8.12 Device configuration table and volume history file

The device configuration table and the volume history table also require disk space, but they are typically very small. The device configuration table contains entries for defined device classes and definitions for drives and libraries. Every volume that is used by Tivoli Storage Manager is tracked in the volume history database, including the volume identifier for the database backups. The volume history information is periodically copied out to a volume history file that you can specify with the VOLUMEHISTORY option in the dsmser.opt file.

We recommend defining at least two copies of both the device configuration table and the volume history file, in case one becomes unusable due to a hardware or software failure. We also highly recommend that you back up the device configuration file and the volume history file every time you back up your Tivoli Storage Manager database. These files will be invaluable in the event that you need to recover your Tivoli Storage Manager server.

Complete Table 2-12 on page 49 with the device configuration and volume history file names and sizes.

Table 2-12 Device configuration and volume history worksheets

Name	Size (MB)
/tsm/files/primary/devcfg1.out	0.5
/tsm/files/copy/devcfg2.out	0.5
/tsm/files/primary/volhist1.out	0.5
/tsm/files/copy/volhist2.out	0.5
Total	2

2.8.13 Total disk

Total disk refers only to the numbers discussed here. If you are using mirroring or some other version of RAID, you need to take that into consideration separately. The disk required to run the server platform operating system efficiently also has not been considered.

IBM Tivoli Storage Manager code requirements for disk vary depending on the server platform and release level. We use an estimate of 200 MB at the time of writing. Table 2-13 summarizes the disk requirements for the Tivoli Storage Manager server as we have planned it.

Table 2-13 Total IBM Tivoli Storage Manager disk required worksheet

	Size (GB)
IBM Tivoli Storage Manager code (dependent on platform)	.2
IBM Tivoli Storage Manager database	2.772
IBM Tivoli Storage Manager recovery log	.282
Primary storage pools	254
Device configuration table and volume history table	.002
Other (RAID, operating system)	0
Total	258

2.9 Tape drives and sizing

In this section we discuss the calculations for estimating the size of a tape library to support a Tivoli Storage Manager solution. Similar calculations can be used to determine the total disk storage needed to support an environment.

Most Tivoli Storage Manager designs incorporate tape and tape drives as the ultimate long-term storage locations for backups and archives. Therefore, it is important to understand the performance characteristics of tape drives and tapes when designing a Tivoli Storage Manager solution.

When using tape storage pools, a Tivoli Storage Manager server should have access to no less than two drives. For architecture calculation purposes, assume only 80% of maximum, uncompressed throughput for a tape drive. Be prepared to do restores while other administrative operations are happening on the system or when drives are broken.

Carefully consider card and bus throughput when attaching tape drives to systems. Most protocol/tape combinations can accommodate two or three tape drives per card. When using Fibre Channel/SAN attached tape drives and disks, do not mix disk and tape traffic on the same HBA.

When planning for tape drive throughput and tape capacity, it is best to be conservative. Although drives can perform close to and better than their compressed rating, typically their performance is far less than this in reality. We use 80% of native uncompressed throughput ratings and 150% of native capacity ratings for theoretical calculations of drive throughput and tape capacity.

Table 2-14 summarizes those calculations for some popular tape drives.

Table 2-14 Tape device comparisons

Tape drive	Native speed (MBps)	Native capacity (GB)	Assumed speed (GB/HR)	Assumed capacity (GB)
IBM LTO Gen 2	35	200	98	300
IBM LTO Gen 3	80	400	224	600
IBM 3590-E1A	14	40	39	60
IBM 3590-H1A	14	60	39	90
IBM 3592	40	300	112	450
STK T9840C	30	40	84	60
STK T9940C	30	200	84	300

Tape drive	Native speed (MBps)	Native capacity (GB)	Assumed speed (GB/HR)	Assumed capacity (GB)
Sony AIT-3	12	100	33	150

Whether you use Table 2-14 or your own calculations, it is critical when designing a Tivoli Storage Manager solution to measure the backup and potential restore workload against the speed of your tape solution. In our earlier example, for instance, we calculated that we needed to move 86.6 GB/HR to meet SLAs. So based on the theoretical numbers above, a solution that is capable of that data movement would take three LTO Gen 1 tape drives.

In addition to calculating backup workload, an architect must also consider administrative processes and potential restores when deciding how many tape drives a system needs. Each day, off-site copies of tapes must be made and reclamation must occur. A potential restore of a large system could also require multiple drives to meet SLAs.

A detailed discussion of specific I/O protocol speeds is beyond the scope of this book. However, you should understand the speeds of the drive you choose and recommendations for system connectivity. As a general rule, most hardware vendors recommend no more than two to three tape drives per interface card and, if using Fibre Channel, that tape traffic be separated from disk traffic.

The information in Table 2-15 will be used when sizing tape libraries and then when defining them to Tivoli Storage Manager.

Table 2-15 Tape drive configuration worksheet

	Option
Library model	IBM System Storage™ TS3310 Tape Library
Number of drives	2
Drive model	3580
Number of on-site tape volumes	19
Number of off-site tape volumes	29
Number of database volumes	6
Number of scratch tapes	9
Number of backup set tape volumes	5

	Option
Total tape volumes required	68
Assume 10% growth in first year	75

2.9.1 Tape devices

Tape drives come in all sizes, including, but not limited to, DLT, SDLT, LTO, 3590, and other device types. Each type of drive has a different data capacity, performance, cost, and reliability characteristics. Although data capacity and cost per megabyte stored are important, reliability is much more important. Having saved money buying tapes is small consolation when you are unable to restore your customer billing database due to a tape error.

In general, tape drives where the tape touches the read/write heads, such as 4 mm and 8 mm, tend to be less reliable (and slower) than tape drives where the tape does not touch the read/write heads, such as 3580 and 3590. If you do implement drives that touch the read/write heads, plan to replace the tapes at regular intervals.

2.9.2 Tape libraries

Tivoli Storage Manager was designed with automation in mind, specifically for automated tape libraries. The best and easiest way to run a Tivoli Storage Manager library is to keep all on-site data in the library so that tapes can be mounted automatically when needed for restores, backups, reclamation, and other Tivoli Storage Manager administration processes.

2.9.3 Number of tape drives

In attempting to reduce costs, some Tivoli Storage Manager customers might consider purchasing only one or at most two tape drives. Although the Tivoli Storage Manager could be configured with only one drive (or with a library containing one drive), we do not consider this to be a production-level solution and do not recommend it. A single drive solution cannot make additional data copies (for disaster recovery purposes) or perform space reclamation without considerable manual effort and additional disk resources. Any Tivoli Storage Manager server for production use should have a library with two or more tape drives. Here are some business reasons for selecting a multiple-drive solution:

- ▶ To avoid a single point of failure
- ▶ To avoid interruptions to automated backup processing (reclamation, backup stgpool, migration contention)

- ▶ To avoid limiting your scalability (few environments are static or shrink with regards to the amount of managed data)
- ▶ To avoid building additional complexity into the design and implementation, which will drive the cost of implementation higher
- ▶ Because the price point for libraries and tape drives have fallen significantly in the recent past

Two-drive systems allow for quicker reclamation and pool copies and reduced drive outages, but restores coming from tape may be delayed due to other competing tape activity. Systems with three or more tape drives can handle restores from tape occurring while tape reclamation or other tape processing is in progress.

As for the number of tape drives, a critical consideration is how quickly you need to restore one or more clients. More tape drives allow you to restore more clients in a given time. Collocation allows as many clients to be restored simultaneously as you have tape drives. If you have stringent restore requirements, collocation and multiple tape drives make sense. You could also consider features like backup sets and logical volume backups for highly time dependent servers to improve their restore window.

To calculate the rate of a restore operation, divide the amount of storage to be restored by the sustained data rate of the tape drive (not the instantaneous, or burst, rate) quoted by the manufacturer. If this number does not allow you to meet your service levels, collocation, more tape drives, faster tape drives, a new service level, or another backup strategy may be required.

We recommend a minimum of a library with a barcode reader and at least two tape drives for all production-level Tivoli Storage Manager solutions.

2.10 Tape volumes

Tape volumes are used to store on-site copies of data, off-site copies of data, and database backups. Additional tape volumes are required because all tape volumes are not filled to capacity. Some volumes are required to stock a scratch pool so that mounts for unused tape volumes can be satisfied. If you are considering backup sets and image backups, you may need to add more tapes to your scratch pool.

2.10.1 On-site volumes

You must consider how many tapes you will need to hold your backup, archive, and image data in a specified time frame. Each of those have different expiration

requirements, and therefore, the calculation may not be linear. In any case, keep in mind that it is best to assume a middle case/worst case scenario so that you do not run out of tapes.

Backup tapes

To calculate the number of on-site tape volumes required for backup operations, carry out the following calculations:

1. If this is a sequential storage pool (tape device), multiply the primary storage pool size by the number of backup versions from Table 2-5 on page 26 to give versions pool size.
2. Add the sum of all Total storage used fields for each client from Table 2-1 on page 18 to the versions pool size, giving tape pool size.
3. Divide the tape pool size by the device capacity to find the number of tape cartridges required.
4. Add 50% to cater to tapes that are in filling status to give the total cartridges required for on-site tapes.
5. If using collocation, normally there should be at least as many tape cartridges as there are clients. Consider tape native capacity as a rounding factor.

We do not use the compressed capacity of the tape here because we factored the client compression rate into the calculation of the storage pool size. If data is compressed at the client, it will not receive any benefit from hardware compression done by the tape drive.

Backup tape calculation

To calculate:

1. If the primary storage pool is 254 GB, and the number of versions kept is 7, then multiplying $1.04 * 7$ gives a 1778 GB versions pool size.
2. If the all the clients are using 1200 and 400 GB, then $1200 + 400 + 1778$ equals 3378 GB.
3. If the tape device has a capacity of 400 GB, then dividing 1938 by 400 gives 9 cartridges required to store all the data.
4. $5 * 1.5$ gives 14 total cartridges required for on-site tapes.
5. If we use collocation for the database servers, since there 4 database servers and 20 file servers, we have enough tape volumes.

Archive tapes

For archive tapes:

1. Using Table 2-1 on page 18, multiply the GB copied per archive by (1 - the data compression rate), giving transferred archive data.
2. For each client, multiply the transferred archive data by the number of archives kept in a year times the yearly retention ratio (that is, desired monthly retention/12 months), and sum up, giving total archive data.
3. Divide the total archive data by the native tape capacity, giving the total number of tapes required.

Archive tape calculation

To calculate:

1. The clients in our table have 200 GB and 80 GB of archive data. The compression ratios are 0.5 and 0.66. This equals $200 * (0.5)$ and $80 * (0.34)$, which equals 100 and 27.2 GB.
2. The number of archives kept are 12 and 12. The yearly retention ratios are $12/12$ and $12/12$. This equals $100 * 12 * 1 + 27.2 * 12 * 1 = 1526.4$ GB.
3. If the tape device has a capacity of 400 GB, then dividing 1526.4 GB by 400 gives 4 cartridges required to store all archive data.

Image backup tapes

Image requirements are calculated on total allocated file system space. For the sake of simplicity, we are not considering any compression rating (you can use the compression ratio for the client on the sum of file systems), and therefore the number is already overestimated without any need for extra tapes:

1. Consider all client file spaces eligible for image backup. Sum them all, giving transferred image size per client.
2. Using Table 2-1 on page 18, multiply the number of image backups by transferred image size per client times yearly retention ratio (that is, desired monthly retention/12 months), and sum them all giving total image size.
3. Divide the total image size by the native tape capacity, giving the total number of tapes required.

Image backup tape calculation

To calculate:

1. In our example, we assume that the sum of all of client 3 eligible file spaces for logical volume backup would be $10 \text{ GB} * 4 = 40 \text{ GB}$.
2. The retention ratio is $1/12$. Assuming the previous calculation, this gives $12 * 40 * 0.16 = 76.8 \text{ GB}$.

3. If the tape device has a capacity of 400 GB, then the image backup data needs only one tape to store it all (assuming no compression).

Therefore, the total on-site tape requirements for this example would be
 $14+4+1 = 19$ tapes.

2.10.2 Off-site volumes

You will probably have more tapes in your off-site pool than onsite, because of less frequent reclamation and partially filled tapes.

To estimate the number of tape cartridges required for off-site copies, use the number of onsite tape volumes calculated in the previous section. As a rough guide, add 50% to estimate the number of tapes required. In our example, this comes to 29 off-site tapes. Keep in mind that collocation may be set on for either, both, or none of the on-site and off-site tape pools, which will also affect tape volume requirements.

2.10.3 Database tape volumes

Each database backup requires at least one tape volume. We recommend backing up the database every day and keeping backups for at least five days.

To calculate the database tape volumes required:

1. Divide the database size calculated in, 2.8.4, “Database size” on page 41, by the tape device capacity and round up to the nearest whole number to give the number of tape volumes required for one database backup.
2. Multiply this number by six (five copies plus the copy just being made) to give the total number of tape volumes required for database backups.

For example, If the database size is 1386 MB, and the device capacity is 400 GB, each database backup will fit on one tape volume. Therefore, 1 tape * 6 versions = 6 tape volumes.

Scratch volumes

A scratch (or empty) volume is required every time Tivoli Storage Manager wants to write to an unused tape.

To estimate the number of scratch volumes required:

1. Total the number of tape volumes required for on-site tapes, off-site tapes, and database backup tapes.
2. Calculate 15% of this number to allocate for scratch tape volumes.

We have a total of 49 on-site, off-site, and scratch tapes. Fifteen percent of this is nine tapes.

Backup set volumes

It is worth calculating backup set tape space requirements separately from regular file-based processing due to the nature of backup sets. Note that although the backup set is a server-initiated procedure, our calculations are based on previous file-backup operations. Note that this step may not be necessary, since you may create backup sets onto disk and copy them onto media such as CD or use another tape format that is common to both the server and the client. For this calculation we are assuming the backup set consists of the entire client system's file; however, you may only use a subset of its file spaces.

To estimate the number of backup set volumes required:

1. Using Table 2-1 on page 18, multiply the total storage used by (1 - the data compression rate) to give the total gigabytes for each client. Round up to the next multiple of the native tape capacity, since backup sets, like server database backups, cannot stack onto tapes.
2. Multiply the number of backup sets by the total gigabytes for that client to give the client backup set size.
3. Multiply the client backup set size by the yearly retention ratio (that is, desired monthly retention/12 months) for that client. Sum all client backup set sizes to give the total backup set requirement.
4. Divide the total backup set requirement by the device capacity to find the number of tape cartridges required.

Backup set calculation

To calculate:

1. Multiplying 1200 by (1 - 0.5) gives 600, and multiplying 400 by (1 - 0.66) gives 136. Assuming a native tape capacity of 400 GB, this rounds up to 800 and 400 GB, respectively.
2. From previous calculations, client backup set sizes are $6 * 800$ (4800 GB) and $6 * 400$ (2400 GB).
3. Assuming retention periods of 4/12 and 2/12, this gives $4800 * 0.33 + 2400 * 0.16 = 2000$ GB as backup set space requirement.
4. If the tape device has a capacity of 400 GB, then dividing 2000 by 400 gives 5 cartridges required to store all backup set data during the specified time frame.

Adding up all these numbers as stored in Table 2-15 on page 51 gives a total of 68 tape volumes required, growing to 75 in the first year, assuming a 10% growth rate. You then need to consider this number against the library configurations available for your chosen technology. The IBM System Storage TS3310 with expansion unit has space for 128 cartridges, so this leaves some capacity for future growth. It should be noted that Tivoli Storage Manager setups rarely if ever shrink.

2.10.4 z/OS tape management

On all platforms except for iSeries and z/OS®, OS/390® (or MVS), Tivoli Storage Manager provides its own tape management functions. For z/OS, it uses the functions provided within the operating system or other tape library management systems.

Tivoli Storage Manager uses data set names to identify various types of Tivoli Storage Manager data sets. The data set name prefix is set by the device class parameter PREFIX. Each device class can have a different data set name prefix. The data set name suffix is fixed by Tivoli Storage Manager for various data types. The suffix .DBB indicates a database backup data set. The suffix .BFS indicates an on-site or off-site data copy.

Most tape library management systems on z/OS use the data set name to identify tapes to be taken off-site. Since Tivoli Storage Manager uses the data set name PREFIX.BFS for both on-site and off-site copies, the tape management system has no way to identify tapes that must be moved off-site.

To choose another data set name for off-site copies, create another device class for the off-site copies and choose a different prefix. Set the tape library management system to trigger on this different PREFIX.BFS data set name and off-site copies will be identified automatically.

Tivoli Storage Manager allows an external data manager (EDM) to control tapes. To inform the EDM when a tape goes into a scratch status, you can use the DFSMShsm™ ARCTVEXT parameter. Include the DELETIONEXIT ARCTVEXT parameter in the Tivoli Storage Manager server options file. For more information see *IBM Tivoli Storage Manager for MVS and OS/390 Administrator's Guide*, GC35-0377.

If your tape management system uses program names to identify External Data Managers, the Tivoli Storage Manager program name is ANRSERV.

2.11 Administrator IDs

Identify who will be the Tivoli Storage Manager administrators in your organization.

A Tivoli Storage Manager administrator controls Tivoli Storage Manager resources. There can be numerous administrators with varying levels of authority over the Tivoli Storage Manager server itself. Also, an administrator can use the Web backup-archive client to perform backup, restore, archive, and retrieve operations on the behalf of other users using a Web browser. Help desk personnel can use this to perform these client tasks for their end users without having to log on to the client machine.

If your Tivoli Storage Manager installation is large or widely dispersed, you should delegate some authority to administrators based on policy domains or storage pools. Therefore, a workstation administrator could look after setting data retention criteria for workstation data only (assuming the correct policy domains were set up). A UNIX administrator could be given Tivoli Storage Manager authority over UNIX data retention criteria only.

Since Tivoli Storage Manager logs all commands issued by administrators and it has no limit on the number of administrators, do not share administrator IDs. Sharing administrator IDs reduces the accountability of each ID, and therefore of all the people sharing the ID. Conversely, numerous administrator IDs may give too many people too much authority.

Table 2-16 suggests several administrator IDs you may want to implement.

Table 2-16 Administrator IDs worksheet

Functions	Administrator ID	Authority
Server console	SERVER_CONSOLE	System
System administrator	sysadmin	System
System support	support	System
System reporter	reporter	none
Client administrator	helpdesk	Node

We recommend that, once you have created your required IDs, that you delete the default installed administrator, admin, to prevent the possibility of this ID being misused. Many sites leave this ID with its default password, creating a big security hole for any malicious person with basic Tivoli Storage Manager knowledge.

2.11.1 License considerations

This section describes the tasks involved when licensing a Tivoli Storage Manager system, including registering, saving, and auditing.

The base IBM Tivoli Storage Manager feature includes the following support:

- ▶ An unlimited number of administrative clients
- ▶ Enterprise Administration, which includes command routing, enterprise configuration, and enterprise logging (server-to-server)
- ▶ Server-to-server virtual volume capabilities (does not include database and storage pool backup)
- ▶ Network Enabler (network connections for clients)
- ▶ AFS/DFS™ support (The S/390® platform includes the S/390 UNIX client as part of Managed System for SAN.)
- ▶ Smaller tape libraries

Tivoli Storage Manager Extended Edition also includes the disaster recovery manager, Space Management, NDMP backup, server-free backup LAN-free backup, and use of any size tape library.

2.11.2 Licensed features registration

You must register a new license if you want to add support for any of the following features that are not already in your existing license agreement. Tivoli Storage Manager uses a license file and the REGISTER LICENSE command to complete this task. Licenses are stored in enrollment certificate files, which contain licensing information for the server product. When registered, the licenses are stored in a nodelock file within the current directory.

To register a license, use the REGISTER LICENSE command, as well as the license file associated with the license. See Table 9-1 on page 304 and Table 9-2 on page 309 for a list of valid license files for the different versions of Tivoli Storage Manager.

Saving your licenses

Save the CD-ROM or directory containing your enrollment certificate files. You may need to register your licenses again for any of the following reasons:

- ▶ The server is corrupted.
- ▶ The server is moved to a different machine.

- The nodelock file is destroyed or corrupted. Tivoli Storage Manager stores license information in the nodelock file, which is located in the directory from which the server is started.

Monitoring licenses

When license terms change (for example, a new license is specified for the server), the server conducts an audit to determine whether the current server configuration conforms to the license terms. The server also periodically audits compliance with license terms. The results of an audit are used to check and enforce license terms. If 30 days have elapsed since the previous license audit, the administrator cannot cancel the audit.

If a Tivoli Storage Manager system exceeds the terms of its license agreement, one of the following occurs:

- The server issues a warning message indicating that it is not in compliance with the licensing terms.
- If you are running in Try Buy mode, operations fail because the server is not licensed for specific features.

You must contact your Tivoli Storage Manager account representative or authorized reseller to modify your agreement. An administrator can monitor license compliance by:

- Auditing licenses

Use the AUDIT LICENSES command to compare the current configuration with the current licenses.

Note: During a license audit, the server calculates, by node, the amount of backup, archive, and Space Management storage in use. This calculation can take a great deal of CPU time and can stall other server activity. Use the AUDITSTORAGE server option to specify that storage is not to be calculated as part of a license audit.

- Displaying license information

Use the QUERY LICENSE command to display details of your current licenses and determine licensing compliance.

- Scheduling automatic license audits

Use the SET LICENSEAUDITPERIOD command to specify the number of days between automatic audits.

2.12 Other considerations

There are numerous other topics to be considered when planning a Tivoli Storage Manager installation. Many of these topics are outside the scope of this book, but we mention them here for completeness.

- ▶ Staffing

Staffing requirements need to be addressed. The various functions such as operations, technical support, administration, and help desk may all be performed by one person in a small site. Larger sites may find a more specialized approach useful. To provide backup coverage, two people per function is always a good idea.

- ▶ Lead time

Some tasks such as installing a tape exit in z/OS may have considerable lead times before the change can be made. We have highlighted some of these, but check with your technical support group and your change management group for their guidelines.

- ▶ Monitoring

You may want to consider monitoring your Tivoli Storage Manager server system using a product such as Tivoli Enterprise™. We have highlighted some suggestions for this, but there are many more items that you may want to monitor. Monitoring also includes monitoring the health of the Tivoli Storage Manager software. Numerous queries are useful for displaying information about the Tivoli Storage Manager system and its operations. We have included some basic possibilities.

- ▶ Chargeback

Some Tivoli Storage Manager installations charge for their services. This is possible using the accounting records and site-specific programs. Some items you may want to consider charging for include bytes stored, CPU time per client, or tapes used.

- ▶ Code refreshes

New client code typically has been released every three months. With installations supporting large numbers of clients, keeping up with these refreshes of client code requires special consideration. Set up a procedure for tracking which clients are running which release of Tivoli Storage Manager code. Design your client installs to be as generic and as similar as possible. If an automated software install process is available, consult with the process owners regarding the best practices to use in setting up Tivoli Storage Manager clients.

- ▶ Export/Import

It is possible to export a client definition and all of its related data from one Tivoli Storage Manager server and import it into another Tivoli Storage Manager server. This facility is useful for moving clients from one server platform to another server on the same or different platform. With a large number of clients, or clients with a large amount of data, the export and import can take a significant amount of time, in the order of 24 to 48 hours. In these cases, planning and coordination need to be done as to when the exporting server ceases backups and the importing server starts backups.
- ▶ Server scripts

These are very useful for issuing Tivoli Storage Manager commands repeatedly, or with some rudimentary logic around them.
- ▶ SQL queries

These are powerful queries you can run against the Tivoli Storage Manager database to extract information.
- ▶ Problem determination

Diagnosing and resolving problems are tasks you will have to do on a regular basis. In general, once you have determined that you have a problem, install the latest level of Tivoli Storage Manager client and Tivoli Storage Manager server code and try to recreate the problem. If it still exists, you should engage formal software support procedures. Alternatively, you may search or post your problem to the Tivoli Storage Manager listserv list to see if someone else has experienced the problem or may be able to offer some suggestions.
- ▶ Disaster recovery

We recommend that planning and testing for disaster recovery be done on a regular basis. Disaster Recovery Manager (DRM) assists in gathering, maintaining, and recommending information and planning pertinent to disaster recovery.

2.13 Summary

Now that we have discussed planning and checklists in the initial chapters, as well as the need to read and understand the IBM Redbook *IBM Tivoli Storage Management Concepts*, SG24-4877, we can get started on the actual installation phase.



Part 2

Installation

In this part of the book we discuss the installation of the server and client code that will be used to implement IBM Tivoli Storage Manager. We provide implementation checklists and describe the various planning considerations you will need to take into account to get the best results.



Server installation

In this chapter we explain the steps relating to the basic installation of an IBM Tivoli Storage Manager server. We cover the topics of code installation and options file customization.

We assume that, before you enter into this installation, you have completed the planning worksheets, and have read and understood the *IBM Tivoli Storage Management Concepts*, SG24-4877. If not, please stop and take the time to do so now.

You will gain a better understanding and be more successful if you take the time to plan and design your total solution before you begin installation.

3.1 Software installation

We assume that you have read and understood the IBM Redbook, *IBM Tivoli Storage Management Concepts*, SG24-4877, as well as the previous chapters. You should also use the instructions in the associated *Quick Start* manual for your chosen Tivoli Storage Manager server platform to install the Tivoli Storage Manager code. The *Quick Start* manual is shipped with the install media. The latest version of this manual is also available from the Tivoli Storage Manager Web site in either HTML or PDF format. We recommend that you download the manual to ensure that you are working with the latest information. The URL for Tivoli Storage Manager publications is:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?toc=/com.ibm.itstorage.doc/toc.xml>

Note: We highly recommend that you read the readme.1st file to see the changes in the Tivoli Storage Manager version you are about to install, the hardware and software prerequisites, and any additional installation steps that might be needed.

3.2 Latest software updates

Tivoli Storage Manager server and client code fixes and enhancements are released on a regular basis. The fixes are available from IBM via the Internet or CD-ROM. Downloading from the Internet is preferable if your connection supports it. Many fixes can be quite large, as they are full or near-full code replacements. If you are unable to download from the Internet, you can order the fixes through your usual IBM service channel.

The Tivoli Storage Manager support home page has links to the latest Tivoli Storage Manager server fixes, Tivoli Data Protection for application fixes, Tivoli Storage Manager client code, and important download information. It also contains important FLASHES of late-breaking product news, which may affect your implementation. You may subscribe to updates via RSS, or regularly visit the Web site:

<http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html>

This link will take you to the FTP server:

<ftp://service.boulder.ibm.com/storage/tivoli-storage-management/maintenance/>

If you have downloaded many fixes you may find it more convenient to go directly to the FTP site and navigate through the directories to quickly find the latest fixes.

The individual fix directories in general include files listed below. The names and content of these files may vary slightly across platforms:

- ▶ **readme.ftp**
This file contains the download and install instructions.
- ▶ **readme.1st**
This file contains important information that is not yet available in manuals. This includes information such as description of code fixes, enhancements, limitations, and additions or corrections to the hardcopy publications.
- ▶ **Code images**
These files contain the actual code fixes. You should download and unpack these files exactly as instructed in the **readme.ftp** file.

If the fix is unavailable for download, or your environment is not suitable for downloading large files, you can use the fix number to order the code on CD-ROM from IBM support.

We recommend that you keep a copy of the latest server, agent, and client fix files on a suitable file server (which could be the Tivoli Storage Manager server itself) at your site. This allows easier distribution and code installation, especially for clients.

Attention: If you are using IBM tape devices such as 3580, 3592, and associated libraries, you do not need to install the Tivoli Storage Manager device driver, since these device drivers use the IBM tape driver. The IBM tape device drivers are available at the FTP site:

[ftp://ftp.software.ibm.com/storage/dev/drvr](http://ftp.software.ibm.com/storage/dev/drvr)

However, if you also install the Tivoli Storage Manager device driver, you will be able to use some useful utilities on the IBM tape devices.

At the time of the writing, a number of important server fixes are available to support library sharing and LAN-free environments. If you are using or planning to use these environments, we strongly recommend that you install server levels 5.2.7.1/5.3.2.3 or later.

3.3 AIX server installation

Here we show how to perform a fresh install of the Tivoli Storage Manager server code on AIX on a pSeries server with AIX V5.3 64-bit installed.

You must be logged in as root to install the Tivoli Storage Manager server code.

1. Insert the Tivoli Storage Manager server for AIX installation CD in the CD-ROM drive. From the operating system prompt, enter `smitty installp`. Choose **Install and Update from ALL Available Software**, as shown in Example 3-1.

Example 3-1 Tivoli Storage Manager installation: smitty installp

Install and Update Software

Move cursor to desired item and press Enter.

Install Software
Update Installed Software to Latest Level (Update All)
Install Software Bundle
Update Software by Fix (APAR)
Install and Update from ALL Available Software

2. Select the INPUT device where the installation packages are located. This is system dependent. Usually this will be the CD-ROM (for example, `/dev/cd0`) or a directory. We used the CD-ROM as our input device.
3. Select the filesets to install. Place the cursor in the Software to install option and enter F4 to display the list of available filesets. The Tivoli Storage Manager AIX server is supported on 32-bit and 64-bit platforms. For the supported filesets to select during installation or to upgrade from previous versions, see *Tivoli Storage Manager AIX Installation Guide*, GC32-1597.

Note: You cannot install both the 32-bit (`tivoli.tsm.server.rte`) and 64-bit (`tivoli.tsm.server.aix5.rte64`) server filesets on the same machine. Use the `AIX bootinfo -y` command to determine whether your system is 32 bit or 64 bit.

We selected the following 64-bit filesets:

- `tivoli.tsm.devices.aix5.rte` Device Support - AIX 5.x, 32-bit and 64-bit
- `tivoli.tsm.server.com` Server samples and diagnostic utilities
- `tivoli.tsm.server.aix5.rte64` Server runtime - AIX 5.x, 64-bit
- `tivoli.tsm.msg.en_US.server` Message Library and help
- `tivoli.tsm.msg.en_US.devices` SMIT menu catalogs
- `tivoli.tsm.license.aix5.rte64` License enablement module - 64-bit kernel

- tivoli.tsm.license.cert License certificates
 - tivoli.tsm.server.webcon Administration Center
4. Perform a preview install to make sure there is sufficient disk space and that all prerequisite filesets have been selected. With *PREVIEW only* and *Preview new LICENSE agreements* options set to Yes, press Enter.

Note: To install the server on AIX V5.2 or later, you must accept the license agreement. You can view the license agreement by selecting **Yes** on the *Preview new LICENSE agreement* option in smit.

5. If there is sufficient disk space and all prerequisite filesets have been selected, perform the actual install. With the *PREVIEW install* option set to No and *Accept new LICENSE agreement* set to Yes, press Enter. Example 3-2 shows the screen with all the selections we made for installation.

Example 3-2 Install and update from all available software

Install and Update from ALL Available Software

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

[Entry Fields]		
* INPUT device / directory for software	/dev/cd0	
* SOFTWARE to install	[tivoli.tsm.devices.ai> +	
PREVIEW only? (install operation will NOT occur)	no	+
COMMIT software updates?	yes	+
SAVE replaced files?	no	+
AUTOMATICALLY install requisite software?	yes	+
EXTEND file systems if space needed?	yes	+
OVERWRITE same or newer versions?	no	+
VERIFY install and check file sizes?	no	+
DETAILED output?	no	+
Process multiple volumes?	yes	+
ACCEPT new license agreements?	yes	+
Preview new LICENSE agreements?	no	+

6. Example 3-3 shows the final output after installation.

Example 3-3 Installation success

COMMAND STATUS

Command: OK stdout: yes stderr: no

Before command completion, additional instructions may appear below.

```
[TOP]
geninstall -I "a -cgNqwXY -J" -Z -d /usr/sys/inst.images -f File 2>&1

File:
I:tivoli.tsm.license.aix5.rte64 5.3.2.0
I:tivoli.tsm.license.cert      5.3.2.0
I:tivoli.tsm.msg.en_US.devices 5.3.2.0
I:tivoli.tsm.msg.en_US.server  5.3.2.0
I:tivoli.tsm.server.aix5.rte64 5.3.2.0
I:tivoli.tsm.server.com       5.3.2.0
I:tivoli.tsm.webcon          5.3.2.0
```

[MORE...235]

The report shows the list of filesets you have chosen to install and the status of the installation.

The Tivoli Storage Manager server process will automatically be started after a successful installation.

3.4 Linux server installations

This section shows the installation steps for Linux servers. We installed the server on a Red Hat Linux distribution.

For more information about Tivoli Storage Manager Server for Linux, please see the Information Center:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?toc=/com.ibm.itstorage.doc/toc.xml>

3.4.1 Installation packages

The installation packages are in rpm format, and include:

- ▶ TIVsm-license-5.3.2-0.i386.rpm
- ▶ TIVsm-server-5.3.2-0.i386.rpm
- ▶ TIVsm-tsmscsi-5.3.2-0.i386.rpm

3.4.2 Installation commands

Go to the directory where the TIVsm-server package was uncompressed and unpacked (or the mount point for CD-ROM). Execute the server installation script, `install_server`, as shown in Example 3-4.

Select the language for installation (2 for English in our example). The license agreement displays.

Example 3-4 Install_server: license acceptance

```
[root@palau:/tsm5320server]# ./install_server
Preparing License Agreement
Software Licensing Agreement
1. Czech
2. English
3. French
4. German
5. Italian
6. Polish
7. Portuguese
8. Spanish
9. Turkish
```

Please enter the number that corresponds to the language you prefer.

```
2
Software Licensing Agreement
Press Enter to display the license agreement on your screen. Please read the agreement carefully before installing the Program. After reading the agreement, you will be given the opportunity to accept it or decline it. If you choose to decline the agreement, installation will not be completed and you will not be able to use the Program.
```

International Program License Agreement

Part 1 - General Terms

BY DOWNLOADING, INSTALLING, COPYING, ACCESSING, OR USING THE PROGRAM YOU AGREE TO THE TERMS OF THIS AGREEMENT. IF YOU ARE ACCEPTING THESE TERMS ON BEHALF OF ANOTHER PERSON OR A COMPANY OR OTHER LEGAL ENTITY, YOU REPRESENT AND WARRANT THAT YOU HAVE FULL AUTHORITY TO BIND THAT PERSON, COMPANY, OR LEGAL ENTITY TO THESE TERMS. IF YOU DO NOT AGREE TO THESE TERMS,

- DO NOT DOWNLOAD, INSTALL, COPY, ACCESS, OR USE THE
PROGRAM; AND

- PROMPTLY RETURN THE PROGRAM AND PROOF OF ENTITLEMENT TO

Press Enter to continue viewing the license agreement, or,
Enter "1" to accept the agreement, "2" to decline it or
"99" to go back to the previous screen.

1

Accept the license by entering 1. Now select which package to install. We selected B BASIC INSTALL, as shown in Example 3-5. This installs the server and license packages.

Example 3-5 Install_server: basic installation

License Agreement Accepted
Ready to install RPM packages for i686.

Please select a package to install or "Q" to quit.
1 TIVsm-license-5.3.2-0
2 TIVsm-server-5.3.2-0
3 TIVsm-tsmscsi-5.3.2-0
4 TIVsm-cmdlinehelp.de_DE-5.3.0-0
5 TIVsm-cmdlinehelp.de_DE.utf8-5.3.0-0
6 TIVsm-cmdlinehelp.en_US.utf8-5.3.0-0
7 TIVsm-cmdlinehelp.es_ES-5.3.0-0
8 TIVsm-cmdlinehelp.es_ES.utf8-5.3.0-0
9 TIVsm-cmdlinehelp.fr_FR-5.3.0-0
10 TIVsm-cmdlinehelp.fr_FR.utf8-5.3.0-0
11 TIVsm-cmdlinehelp.it_IT-5.3.0-0
12 TIVsm-cmdlinehelp.it_IT.utf8-5.3.0-0
13 TIVsm-cmdlinehelp.ja_JP-5.3.0-0
14 TIVsm-cmdlinehelp.ja_JP.utf8-5.3.0-0
15 TIVsm-cmdlinehelp.ko_KR-5.3.0-0
16 TIVsm-cmdlinehelp.ko_KR.utf8-5.3.0-0
17 TIVsm-cmdlinehelp.pt_BR-5.3.0-0
18 TIVsm-cmdlinehelp.pt_BR.utf8-5.3.0-0
19 TIVsm-cmdlinehelp.zh_CN-5.3.0-0
20 TIVsm-cmdlinehelp.zh_CN.gb18030-5.3.0-0
21 TIVsm-cmdlinehelp.zh_CN.utf8-5.3.0-0
22 TIVsm-cmdlinehelp.zh_TW-5.3.0-0
23 TIVsm-cmdlinehelp.zh_TW.euctw-5.3.0-0
24 TIVsm-cmdlinehelp.zh_TW.utf8-5.3.0-0
B BASIC INSTALL
Q QUIT

b

```
The basic install includes the following packages:  
TIVsm-server-5.3.2-0  
TIVsm-license-5.3.2-0  
  
Should I continue with the basic install? (Y/N)  
y  
Installing TIVsm-server-5.3.2-0.  
Preparing...          ##### [100%]  
1:TIVsm-server      ##### [100%]  
  
Upgrading TSM server database...  
  
*****  
IMPORTANT: Read the contents of file /README  
for extensions and corrections to printed  
product documentation.  
*****  
Installing TIVsm-license-5.3.2-0.  
Preparing...          ##### [100%]  
1:TIVsm-license     ##### [100%]
```

After the installation is complete, you are again prompted for the package selection. This time, select **3** for the device driver package. Once the device driver installation is completed, select **Q** and press Enter.

Alternate installation: rpm package installer. You can also use the rpm package installer for your installation. The following is the command syntax used for this install, listed in the order of installation:

```
rpm -ivh TIVsm-license-5.3.2-0.i386.rpm  
rpm -ivh TIVsm-server-5.3.2-0.i386.rpm  
rpm -ivh TIVsm-tsmcsi-5.3.2-0.i386.rpm
```

3.4.3 Post-installation steps

After the installation, the server does not start automatically. We need to customize the server options file, /opt/tivoli/tsm/server/bin/dsmserv.opt. As shown in Example 3-6, the default dsmserv.opt file created at installation only defines a minimum of possible server options and is not sufficient to start the server.

Example 3-6 Default dsmserv.opt file after installation

```
[root@palau:/opt/tivoli/tsm/server/bin]# more dsmserv.opt
*** IBM TSM Server options file
*** Refer to dsmserv.opt.smp for other options
COMMMETHOD TCPIP
TCPPORT 1500
```

Example 3-7 shows our edited server options file.

Example 3-7 Edited dsmserv.opt

```
[root@palau:/opt/tivoli/tsm/server/bin]# more dsmserv.opt
*** IBM TSM Server options file
*** Refer to dsmserv.opt.smp for other options
COMMMETHOD TCPIP
TCPPORT 1500
TCPADMINPORT 1501
DEVCONFIG devcfg.out
EXPINTERVAL 0
```

After this, we started the server with the **dsmserv** command from the server executable directory, /opt/tivoli/tsm/server/bin, as shown in Example 3-8.

Example 3-8 Initial Linux Tivoli Storage Manager server startup

```
[root@palau:/opt/tivoli/tsm/server/bin]# ./dsmserv

Tivoli Storage Manager for Linux/i386
Version 5, Release 3, Level 2.0

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All rights reserved.
U.S. Government Users Restricted Rights - Use, duplication or disclosure
restricted by GSA ADP Schedule Contract with IBM Corporation.

ANR7800I DSMSERV generated at 03:39:28 on Sep 27 2005.
ANR7801I Subsystem process ID is 15131.
ANR0900I Processing options file dsmserv.opt.
```

```
ANR4726I The ICC support module has been loaded.  
ANR0990I Server restart-recovery in progress.  
ANR0200I Recovery log assigned capacity is 8 megabytes.  
ANR0201I Database assigned capacity is 36 megabytes.  
ANR0306I Recovery log volume mount in progress.  
ANR0353I Recovery log analysis pass in progress.  
ANR0354I Recovery log redo pass in progress.  
ANR0355I Recovery log undo pass in progress.  
ANR0352I Transaction recovery complete.  
ANR1635I The server machine GUID,  
9e.6f.a1.d2.ee.c7.d9.11.a5.b8.00.02.55.21.0e.79, has initialized.  
ANR2100I Activity log process has started.  
ANR4726I The NAS-NDMP support module has been loaded.  
ANR1794W TSM SAN discovery is disabled by options.  
ANR1305I Disk volume /opt/tivoli/tsm/server/bin/backup.dsm varied online.  
ANR1305I Disk volume /opt/tivoli/tsm/server/bin/archive.dsm varied online.  
ANR2803I License manager started.  
ANR8200I TCP/IP driver ready for connection with clients on port 1500.  
ANR2560I Schedule manager started.  
ANR0993I Server initialization complete.  
ANR0916I TIVOLI STORAGE MANAGER distributed by Tivoli is now ready for  
use.
```

Next we set up the server addresses to allow for server-to-server communication, as shown in Example 3-9, and a unique server name to allow for administration through the Administration Center.

Example 3-9 Setting the server high/low level address and server name

```
TSM:SERVER1> set serverlladdress 1500  
ANR2017I Administrator SERVER_CONSOLE issued command: SET SERVERLLADDRESS 1500  
ANR2133I Server lladdress set to 1500.  
TSM:SERVER1> set serverhladdress 9.43.86.83  
ANR2017I Administrator SERVER_CONSOLE issued command: SET SERVERHLADDRESS  
9.43.86.83  
ANR2132I Server hladdress set to 9.43.86.83  
TSM:SERVER1> set servername PALAU_SERVER1  
ANR2017I Administrator SERVER_CONSOLE issued command: SET SERVERNAME  
PALAU_SERVER1  
ANR2094I Server name set to PALAU_SERVER1.  
TSM:PALAU_SERVER1>
```

At this point the server is ready to be further customized, depending on what you require (more storage pools, tape drives, clients, server-to-server configuration). See the following chapters for more details.

3.4.4 Uninstallation of the server

If you need to uninstall the server, use rpm to uninstall the modules:

```
rpm -e TIVsm-license-5.3.2-0.i386.rpm  
rpm -e TIVsm-server-5.3.2-0.i386.rpm  
rpm -e TIVsm-tsmscsi-5.3.2-0.i386.rpm
```

Depending on the customization you did to your server, after the uninstall completes, there may be still files in the server directory /opt/tivoli/tsm/server/bin, for example, sample, database, log, and storage pool files that got created during server installation. If you are no longer using the Tivoli Storage Manager server, you can delete them manually and remove the server directory.

3.5 Windows 2000/2003 server installation

Next, we show how to install the Tivoli Storage Manager server on a Windows 2000 or 2003 platform. The server in the lab has the latest service pack installed.

3.5.1 Tivoli Storage Manager server package installation

To install:

1. We are installing the downloadable package available to registered users from the Passport Advantage® Web site. Alternatively, you might install from a CD. Before the installation begins, you are prompted for a location to store the temporary installation files. The default is C:\TSM/Images\TSMSRV5320_WIN. Once the package is extracted, click the **Install Products** option. An installation menu, as shown in Figure 3-1 on page 79, is displayed.



Install Products

Recommended Installation Sequence:

[TSM Server](#)

[TSM Server Licenses](#)

[TSM Language Packs](#)

[TSM Device Driver](#)

The recommended sequence minimizes the number of reboots and ensures that everything you need is installed when you configure the server.

Additional Installation:

[Return to Main Menu](#)

Figure 3-1 Windows Tivoli Storage Manager server installation menu

2. Choose the **TSM Server** installation package first. The InstallShield Wizard will guide you through the installation of the package. Click **Next** on the wizard welcome window.
3. The license agreement confirmation is displayed next. Read the license agreement carefully. To accept the license agreement select **I accept the terms in the license agreement** and click **Next**.
4. Enter customer information and choose access rights to the Tivoli Storage Manager server application. We entered the following:
 - User name: Senegal
 - Organization: ITSO
 - Install this application for anyone who uses this computer.Click **Next**.
5. The next window defines the setup type. You may choose **Custom** installation to select specific components only. However, we recommend that you choose **Complete** installation to make sure that all Tivoli Storage

Manager server components and prerequisites are installed. If you do not want to install the server to the default install path C:\Program Files\Tivoli\TSM, you can change the installation path on the custom setup page. Select **Complete** and click **Next**.

6. Now you can review your inputs to the installation wizard. If you are satisfied with your choices, click **Install** to begin the installation. The installation may take several minutes depending on the hardware used.
7. When the installation is complete, the InstallShield Wizard completion window will be displayed. Click **Finish** to return to the installation menu, as shown in Figure 3-1 on page 79.

3.5.2 Tivoli Storage Manager License package installation

To install:

1. After the server has been installed, choose **TSM Server Licenses** from the installation menu (Figure 3-1 on page 79).
2. The InstallShield Wizard for IBM Tivoli Storage Manager License initiates. Click **Next** on the wizard welcome window.
3. Enter customer information and choose access rights to the Tivoli Storage Manager server application. We entered the following:
 - User name: Senegal
 - Organization: ITSO
 - Install this application for anyone who uses this computer.

Click **Next**.

4. Define the setup type. You may choose **Custom** installation to select specific components only or change the installation path of the package. We recommend that you choose **Complete** installation to make sure that all Tivoli Storage Manager server license components and its prerequisites are installed. Select **Complete** and click **Next**.
5. Now you can review your inputs to the installation wizard. If satisfied with your choices, click **Install** to begin the installation.
6. When the server license installation is complete, the InstallShield Wizard completion window is shown. Click **Finish** to go back to the installation menu, as shown with Figure 3-1 on page 79. Choose **TSM Device Driver** next for installation.

3.5.3 Tivoli Storage Manager Device Driver package installation

To install:

1. Choose **TSM Device Driver** from the installation menu (Figure 3-1 on page 79).

Tip: You should disable the Windows Removable Storage Manager (RSMT™) component so that it will not conflict with Tivoli Storage Manager. To disable RSM, select **RSM** from the Windows services applet and change its startup type to *disabled*.

2. The InstallShield Wizard initiates. Click **Next** on the wizard welcome window.
3. Enter customer information and choose access rights to the Tivoli Storage Manager server application. We entered the following:

- User name: Senegal
- Organization: ITSO
- Install this application for anyone who uses this computer.

Click **Next**.

4. Define the setup type. You may choose **Custom** installation to select specific components only or change the installation path of the package. We recommend that you choose **Complete** installation to make sure that all Tivoli Storage Manager device driver components and prerequisites are installed. Select **Complete** and click **Next**.
5. Now you can review your inputs to the installation wizard. If satisfied with your choices, click **Install** to begin the installation.
6. When the device driver installation is complete, the InstallShield Wizard completion window will be displayed. Click **Finish** to go back to the installation menu, as shown in Figure 3-1 on page 79.

After the device driver installation, you will be prompted to reboot your system, as shown in Figure 3-2. You should reboot before continuing.

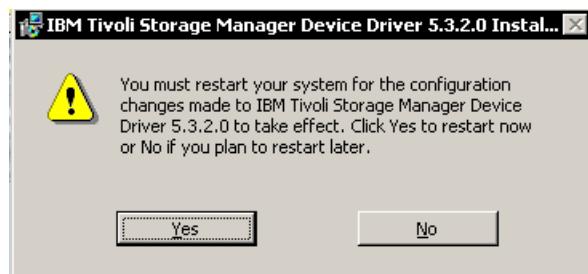


Figure 3-2 Windows reboot system after installation

If you want to install a different language pack or the backup-archive client code on the same machine, you may do so by choosing those options in the install menu.

3.5.4 Windows 2000/2003 configuration wizards

The Tivoli Storage Manager server utilities are available through the Tivoli Storage Manager program group. These provide access to various configuration wizards, an administrative interface, a server console, Web sites, and other useful utilities. In particular, the initial configuration wizards provide a structured way to implement a Tivoli Storage Manager environment. Each of the configuration wizards is also available independently within the Server Utilities.

The wizards provide a good front end to some steps in the Tivoli Storage Manager configuration. They are specially useful in the areas of licensing, services configuration, device configuration, volume formatting, and media preparation. The configuration wizards are easier to use than the equivalent administrative interfaces, particularly for a new user, as they hide the details of the command interface and provide good help. However, you still need some Tivoli Storage Manager knowledge to create a good working environment.

The wizards and server utilities do not cover all aspects of an implementation and are not suited to bulk entry of definitions (large server configuration). This task is better handled through the use of administrative macros or scripts. Our recommendation is to use the wizards with care.

Figure 3-3 shows the main screen for the server configuration wizard.

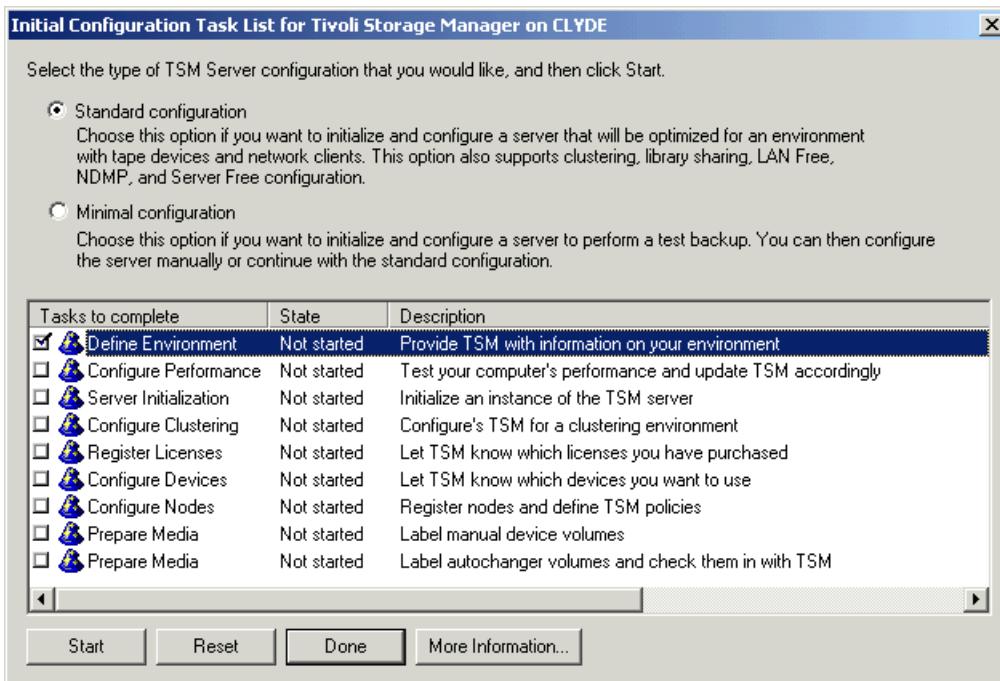


Figure 3-3 Server main configuration wizard

Information: The configuration wizards are not discussed in this book. Documentation is provided on the use of these wizards in the section "Performing the Initial Configuration" of *IBM Tivoli Storage Manager for Windows Quick Start*, GC32-0784.

3.6 Integrated Solution Console and Administration Center

Tivoli Storage Manager V5.3 and later servers are administered through a new administrative GUI interface, the Administration Center. This replaces the old administrative Web interface. The Administration Center is a Web-based interface used to centrally configure and manage Tivoli Storage Manager servers. The Administration Center is the only Web interface you can use to administer V 5.3 or later servers—the old administrative Web interface cannot be used for these.

You install the Administration Center as an IBM *Integrated Solutions Console* (ISC) component. The Integrated Solutions Console allows you to install components provided by multiple IBM applications, and access them from a single interface.

The Tivoli Storage Manager server itself can require a large amount of memory, network bandwidth, and processor resources. In many cases, the server performs best when other applications are not installed on the same system. If your system meets the combined requirements for the server and the Administration Center (for example, it has at least 2 GB of physical memory), you can use it to install both applications on a single machine. However, if you plan to use the Administration Center to manage an environment with a large number of servers or administrators, consider installing the Administration Center on a separate system.

You can install the ISC on any supported platform. In fact, we recommend installing ISC and the Administration Center on a separate system from your Tivoli Storage Manager server, regardless of what platform your Tivoli Storage Manager server is running on.

Figure 3-4 on page 85 shows an example of the Administration Center Health Monitor, monitoring five servers: ATLANTIC, DIOMEDE, LOCHNESS_SERVER1, PALAU, and WISLA.

Note: When you install or upgrade the server to Tivoli Storage Manager V5.3, you must give your servers unique names. If all of your servers have the default name SERVER1, you will only be able to add one of them to the Administration Center. You will then have to set the server names of the other servers.

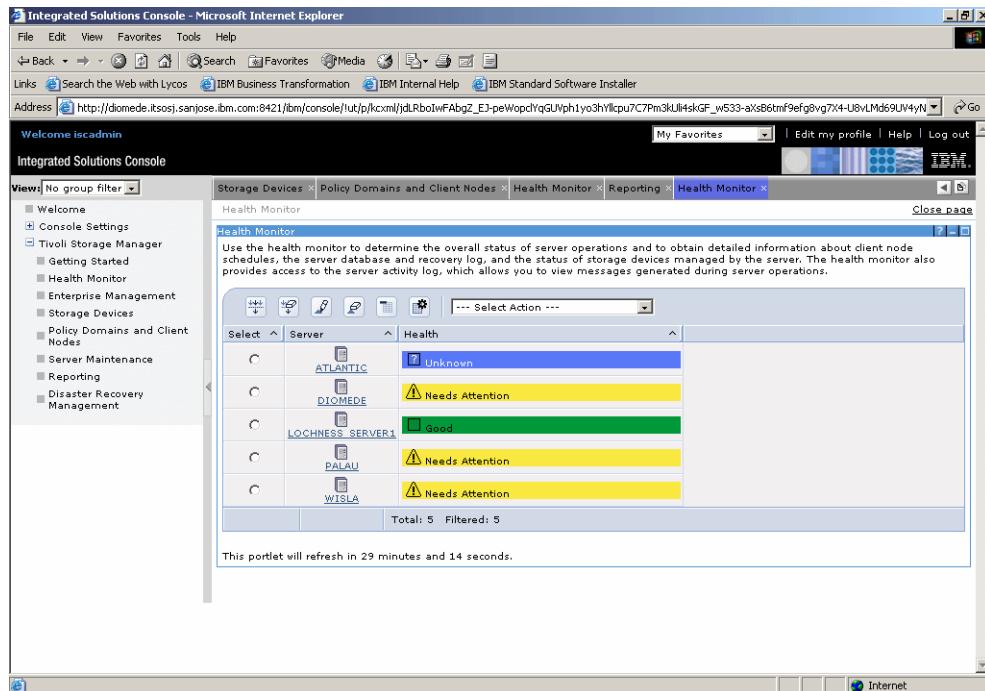


Figure 3-4 ISC and TSM Administration Center: sample figure

3.6.1 ISC and Administration Center installation

The ISC and the Administration Center are supported on AIX, Windows, Sun Solaris, and Linux. For detailed information about the system requirements and platform-specific installation instructions check the Tivoli Storage Manager server installation guide for your operating system. As a brief introduction we describe the installation steps on a Windows system here:

1. Go to the directory to which you have unpacked the ISC and Administration Center code. Start the installation with `setupISC.exe`. The InstallShield Wizard for IBM Integrated Solutions Console, as shown in Figure 3-5 on page 86, appears. Click **Next**.



Figure 3-5 InstallShield Wizard for IBM Integrated Solutions Console

2. The next screen shows detailed installation system requirements. This information is also available in the readme file in the installation directory. Make sure that your system meets the requirements and click **Next**.
3. Review the license information. If you accept, select **I accept the terms of the license agreement** and click **Next**.
4. You are prompted to provide a Integrated Solutions Console user ID, password, and password verification. We decided to keep the default ID, iscadmin. Once you have completed the input fields click **Next**.
5. Now you are prompted for the directory location to install the IBM Integrated Solutions Console. If you want to install to another directory, provide your input here—you can browse through your system for an alternate installation path. We kept the default of C:\Program Files\IBM\ISC601. Click **Next**.
6. Specify the ports to be used by the ISC. As a best practice, use secure ports to access the Administration Center. To do so, you must configure the ISC to use *Secured Sockets Layer (SSL)*. You can find detailed instructions in the Administrator's Guide Appendix for your system. We kept the defaults:
 - Web administration port (HTTP): 8421
 - Secure Web administration port (HTTPS): 8422

Click **Next**. You will be asked to review and confirm your settings as shown in Figure 3-6.

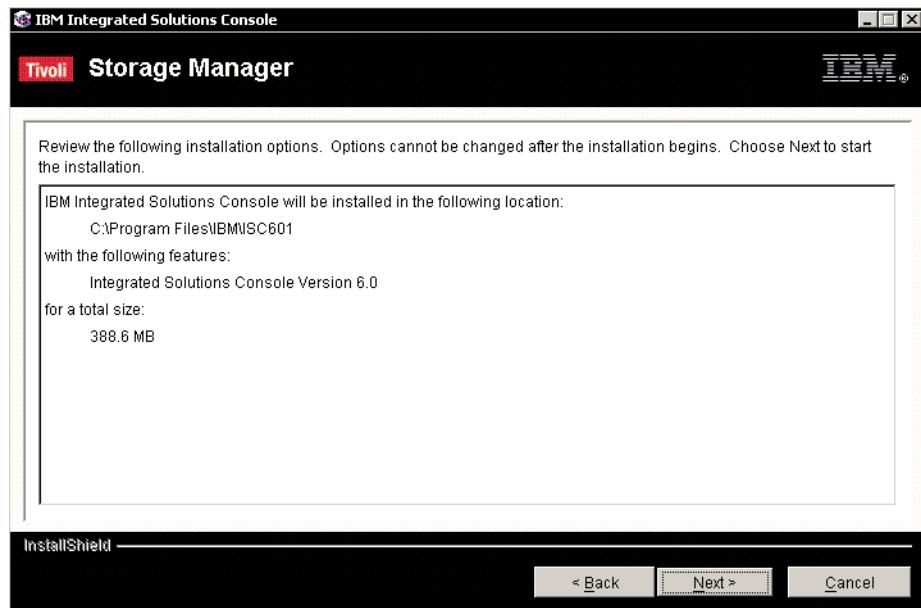


Figure 3-6 ISC installation: Review and confirm settings

7. To start the installation, click **Next**. The installation progress will be displayed as in Figure 3-7.

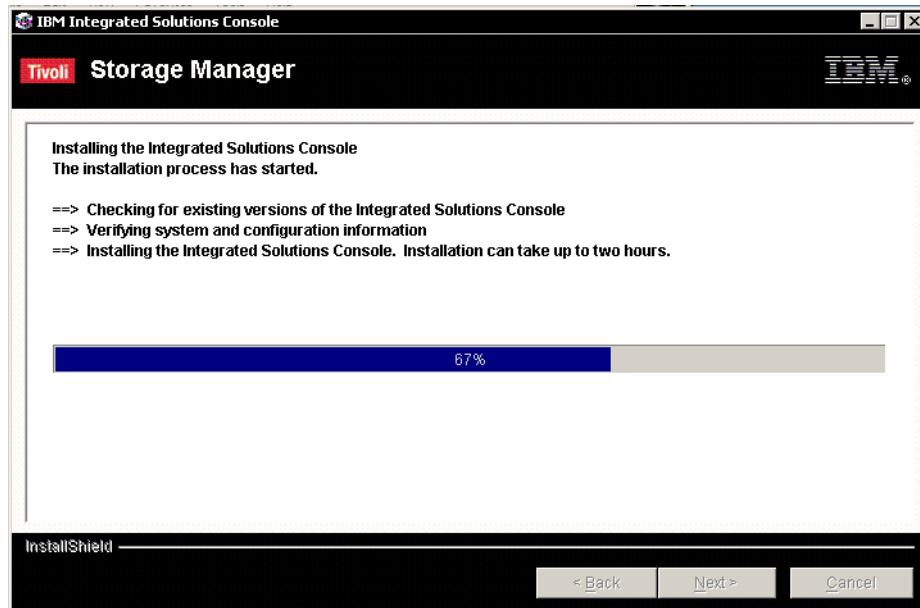


Figure 3-7 ISC installation progress

8. After the ISC installation is complete, a success screen is displayed. Click **Next**, then click **Finish**. You can now install the Administration Center, which is provided as a separate package.

9. Change to the directory to which you have extracted the Administration Center code and start setupAC.exe. The InstallShield Wizard for Tivoli Storage Administration Center is displayed, as shown in Figure 3-8. Click **Next**.

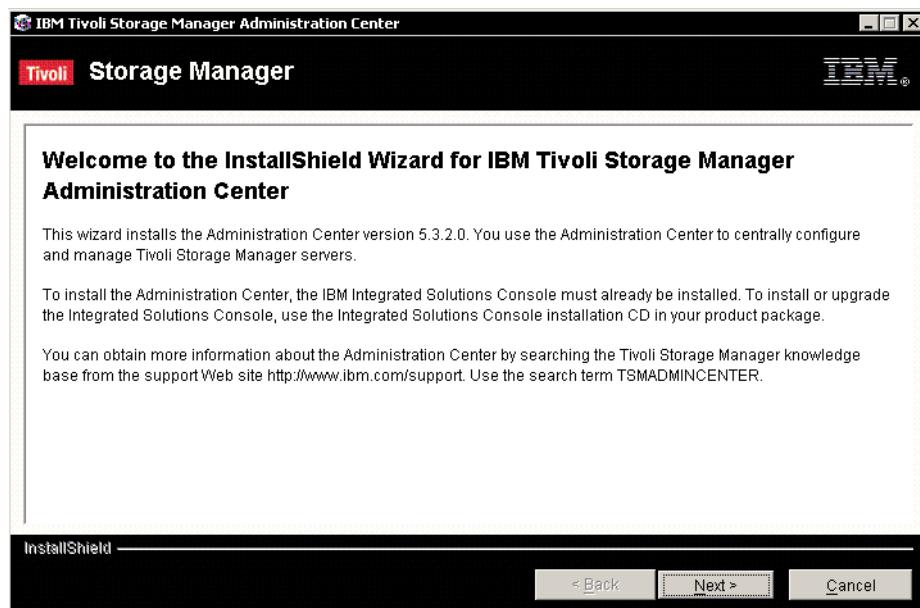


Figure 3-8 *InstallShield wizard for Administration Center*

10. Review the license information. If you accept, select **I accept the terms of the license agreement** and click **Next**.
11. To deploy the Administration Center component to the ISC, the Administration Center needs to know the values for the ISC installation path, the ISC port used, and the ISC administrator user ID. Review the information and if it is correct select **The information is correct on the review screen** and click **Next**.
12. For installation of the Administration Center you now need to enter the Integrated Solutions Console password. Use the one you defined in step 4 on page 86 and click **Next**.
13. The Administration Center can display information in languages other than English. You can enable language support in this step of the installation. If this support is enabled, the Administration Center attempts to display the same language as the Web browser used to access it. If the Web browser uses a different language from the Tivoli Storage Manager server, some information will be displayed in the language used by the server. To change the default language used by the Web browser, see the browser

documentation. If you do not require a language other than English make no selection and click **Next**. The installation configuration settings will be displayed for confirmation, as shown in Figure 3-9.

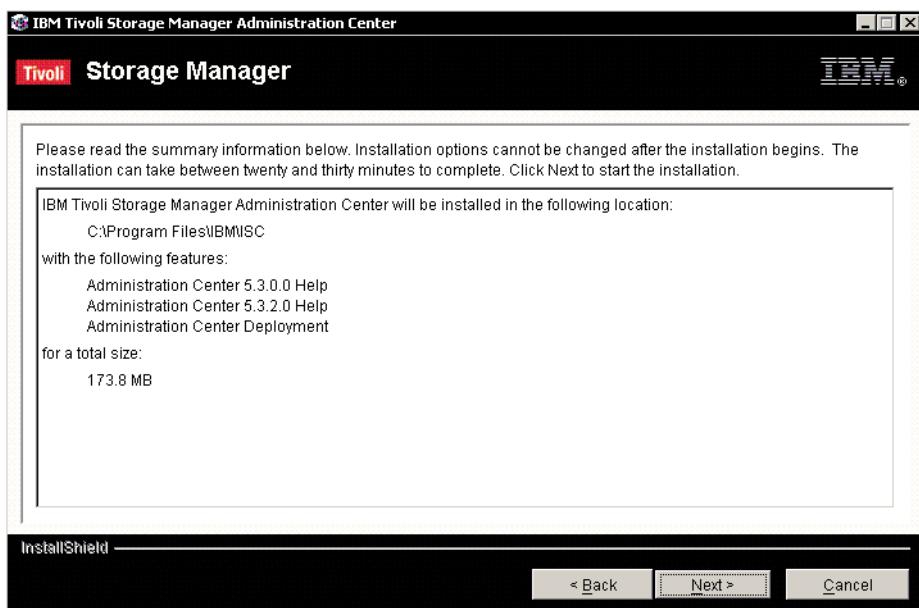


Figure 3-9 Administration Center installation: Confirm

14. Review the information and if it is correct click **Next**. The installation will start and the installation progress is displayed. Once the installation is completed a success screen like Figure 3-10 on page 91 is shown. Click **Next** to finish the installation. You now can access the console through your Web browser under <http://<machinename>:8421>. We give more information about the Administration Center in 10.1.2, “Administration Center interface” on page 313.

Note: The Administration Center assumes that the host system is using a static IP address instead of a dynamically assigned IP address. A static IP address is necessary because the Administration Center server must be listed on your domain name servers, which map the host name to the physical address of the system.

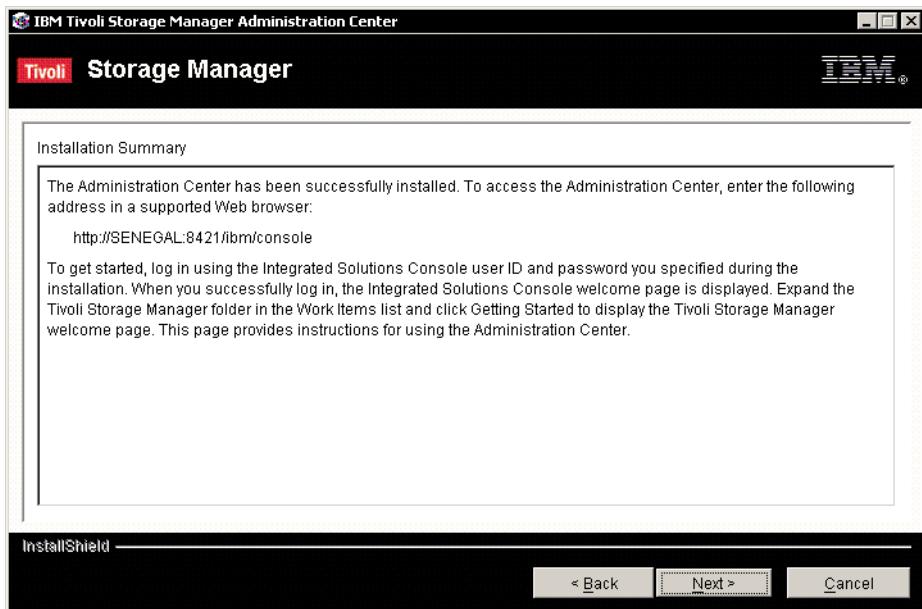


Figure 3-10 TSM Administration Center installation: success

3.7 Customization

The Tivoli Storage Manager server has a number of options and settings that control its operation. You specify the options in the server options, as well as some individual settings.

3.7.1 Server options file

Tivoli Storage Manager has a server options file with a set of default options to start the server. You can modify the server options file using a text editor. On some platforms, Tivoli Storage Manager provides a server options file editor to perform this function. The supplied default server options file contains information about what options and option values can be specified. You can display the current server options via the **query options** command.

We provide recommended options files for the various server platforms, because the layout of the supplied options file is not immediately intuitive. See “Server options files” on page 740, which contains our server option files. The file options are presented in a more logical sequence than those provided during the install. We assume that TCP/IP is the network protocol.

Table 3-1 shows the default location of the Tivoli Storage Manager server options file by server platform. We recommend saving a backup copy of the existing options file before updating it.

Table 3-1 Server options file location

Platform	File Location
AIX	/usr/tivoli/tsm/server/bin/dsmserv.opt
Linux	/opt/tivoli/tsm/server/bin/dsmserv.opt
HP/UX	/opt/tivoli/tsm/server/bin/dsmserv.opt
MVS	As specified by DDname OPTIONS
Solaris	/opt/tivoli/tsm/server/bin/dsmserv.opt
Windows 2000/2003	C:\Program Files\Tivoli\tsm\server\dsmserv.opt

Although the number of server options is very large, there are only a small number that need to be changed for each server. These options fall into the following categories:

- ▶ Communication
- ▶ Server storage
- ▶ Client server
- ▶ Site-dependent options
- ▶ Database and recovery log
- ▶ Data transfer
- ▶ Message
- ▶ Event logging
- ▶ Security and licensing
- ▶ Miscellaneous

Make sure to set the following options before continuing any configuration on your Tivoli Storage Manager server:

- ▶ COMMmethod
- ▶ TCPport
- ▶ VOLUMEHistory
- ▶ DEVCONFIG
- ▶ TCPADMINPORT

Note: At server initialization, the server reads the server options file. If you update a server option by editing the file, you must stop and restart the server to activate the updated server options.

For more information about the different server options, see *IBM Tivoli Storage Manager Quick Start Manual* and *Administrator's Reference Manual* for your platform.

3.7.2 Settings

Tivoli Storage Manager provides default server run-time settings. These settings are stored in the Tivoli Storage Manager database and persist across server restarts. You specify the server settings via the administrative interface. You can display the current server settings via the `query status` command.

The default values for the server settings are generally acceptable. There are a few settings for which we recommend values other than the defaults. The settings are changed via the `set` command and fall into the following categories:

- ▶ Security-related settings
- ▶ Our recommended settings

Security-related settings

Table 3-2 shows the various default security-related settings for the server. We recommend that you select values for these settings that reflect the security policy at your site.

Table 3-2 Security-related settings

Setting and value	Description
AUTHENTICATION ON	Whether administrators and client nodes must use a password to access the server
INVALIDPWLIMIT 0	Maximum number of failed logon attempts before a node or administrator is locked
MINPWLENGTH 0	Minimum length of a password
PASSEXP 90	Password expiration period

For example, consider the security policy at a company that specifies that all passwords must be changed every 90 days and must be a minimum of six characters in length. If three invalid passwords are entered in response to a

password prompt, that user must have the system access revoked. Example 3-10 shows how this policy is implemented through administrative commands.

Example 3-10 Setting security-related commands on the server

```
tsm: TSM>set authentication on
ANR2095I Authentication parameter set to ON.
tsm: TSM>set invalidpwlimit 3
ANR2175I Invalid password limit set to 3 attempts.
tsm: TSM>set minpwlength 6
ANR2138I Minimum password length set to 6.
tsm: TSM>set passexp 90
ANR2092I Password expiration period set to 90 days.
```

Recommended server settings

We recommend changing some of the default server settings.

The accounting server setting determines whether an accounting record is created every time a client node session ends. The default is not to create these records. We recommend that accounting be switched on to collect these records. For z/OS systems, this information is recorded in the Systems Management Facility (SMF). For other systems, this information is written to a file that contains text records that can be viewed directly or can be imported into a spreadsheet program.

All Tivoli Storage Manager server activity is recorded in an activity log. This log is located in the Tivoli Storage Manager database and contains text messages. The log is pruned automatically every night at midnight. The default retention period for the log is only one day. This does not provide an adequate amount of information for production systems. We recommend that you specify a value of between 7 and 14 days.

The administrative commands to collect accounting information and keep server activity log records for 10 days are shown in Example 3-11. We are using the command-line interface (CLI) to enter these commands. See 10.2.3, “Command-line interface” on page 320, for information about how to invoke this.

Example 3-11 Set accounting on

```
tsm: TSM>set accounting on
ANR2091I Accounting parameter set to ON.

tsm: TSM>set actlogretention 10
ANR2090I Activity log retention period set to 10 days.
```

3.8 Summary

Now you have your Tivoli Storage Manager server installed. It is time to move on to installing the clients and testing your initial backup configuration. The following chapter talks specifically about configuring clients.



Backup-archive client installation

Now that you have your server installed, in this chapter we cover the steps you must perform to install and configure the backup-archive client. We also show you how to configure the backup-archive client to work either as a foreground program or as a background process, so that you can automate the backup processes using the scheduler facility. See 2.2, “Client environment data” on page 16, for planning considerations.

4.1 Backup-archive client code

There are three types of Tivoli Storage Manager client. Here we describe some of their characteristics.

4.1.1 Backup-archive client

The first type is the native *backup-archive client*. This client code is installed on every Tivoli Storage Manager client node and provides the local interface to back up and restore operations on that node. The client code includes a command-line interface (CLI) and a graphical user interface (GUI), either Java-based or native, depending on the platform. On most platforms both CLI and GUI are provided, but there are some exceptions. See 4.6, “Client interfaces” on page 168, for details of platform support. With these interfaces you can, by default, back up and restore files from that client node.

4.1.2 Web client

The second type is the *Web client*, which provides a remote interface to back up and restore operations on a Tivoli Storage Manager client node. This client is particularly suitable for help desk operations. The help desk administrator can perform restores on behalf of the end users as required without having to be physically present at that client, and only needs an Internet browser installed on their systems. The client who is receiving the remote operations needs to install the backup-archive client code, including the Web client component. Figure 4-1 on page 99 shows the difference between a traditional restore using the native backup-archive client and using the Web client.

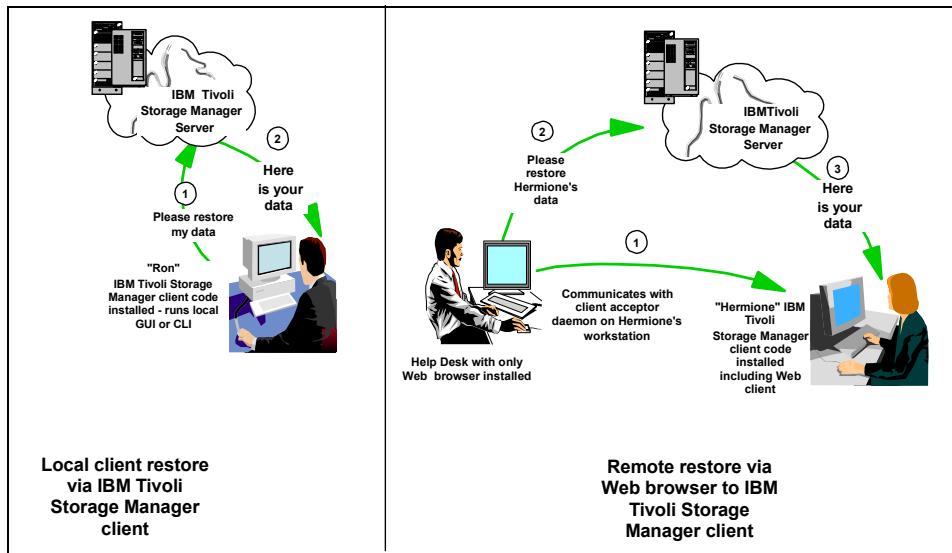


Figure 4-1 Difference between a local and Web-based restore

The Web backup-archive client main window is shown in Figure 4-2. Its functions are described in the following sections.

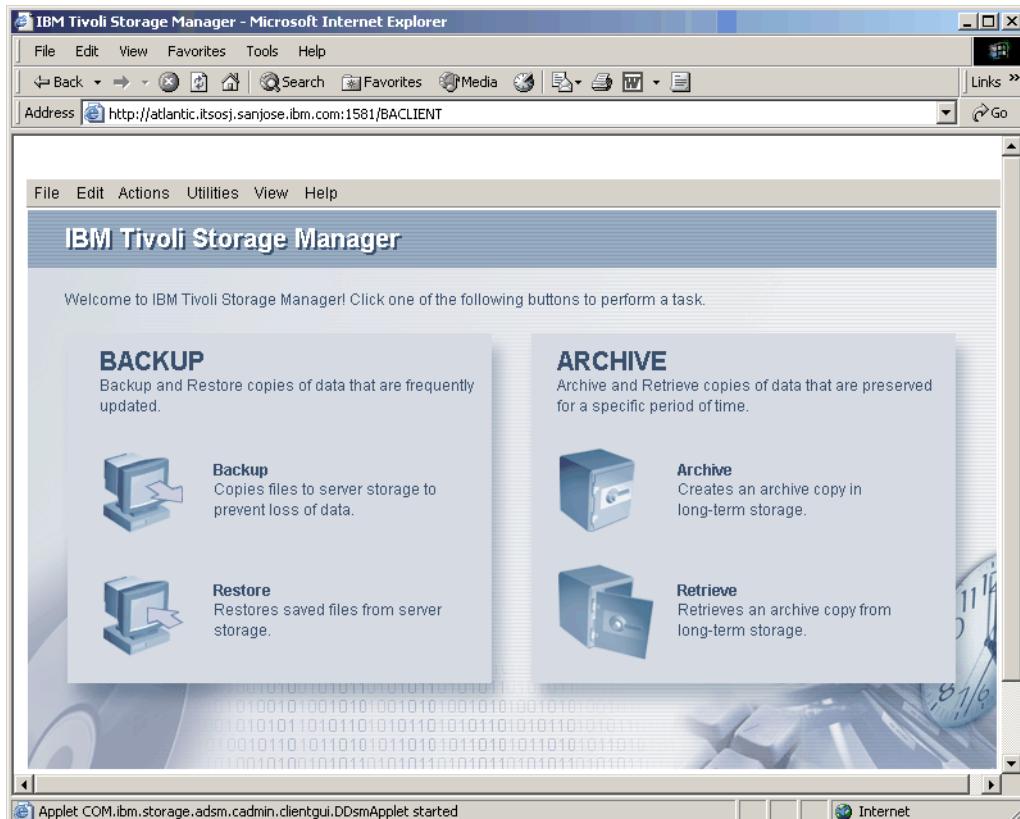


Figure 4-2 Web backup-archive client main window

The Web client has components that must be installed and configured on any client node that will be remotely accessed. For example, in Figure 4-1 on page 99, Hermione's system needs the Web client components of the backup-archive client set up so that the help desk staff can perform backup and restore operations for her using the browser.

The Web client is installed with the backup-archive client package. The Web client consists of two processes on the client workstation: the client acceptor and the remote client agent.

The client acceptor is an HTTP daemon that serves the Web client Java applet to the Web browser. The executable name is DSMCAD. On UNIX and Linux clients, it should be run as a daemon. For Windows 2000, XP, or 2003, it is installed and run as a service called *TSM Client Acceptor*.

The remote client agent performs the client functions initiated with the Web client interface. The name of the executable is DSMAGENT. The agent does not have to be running all the time. The acceptor daemon starts the agent when client functions are initiated through the Web client interface.

4.1.3 API client

The third type is the application program interface (API) client. This client allows other applications from IBM and other vendors to programmatically access the Tivoli Storage Manager services. For more information about the API client, see *IBM Tivoli Storage Manager Using the Application Program Interface*, GC32-0793.

4.2 Code installation

In this section we cover backup-archive client code installation on AIX, Linux, and Windows operating system platforms. The procedure for installation is generally the same across all platforms; however, there are some minor differences. For more information about installation and configuration of the backup-archive client, refer to the latest version of the *IBM Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide* for your specific platform.

4.2.1 Backup-archive client code

The backup-archive client is installed on each machine that you need to protect with backups. After installing the client code and customizing how it should interact with the Tivoli Storage Manager server, you have a working machine ready to send and receive data. Figure 4-3 shows our lab setup for installing and configuring the Tivoli Storage Manager client code.

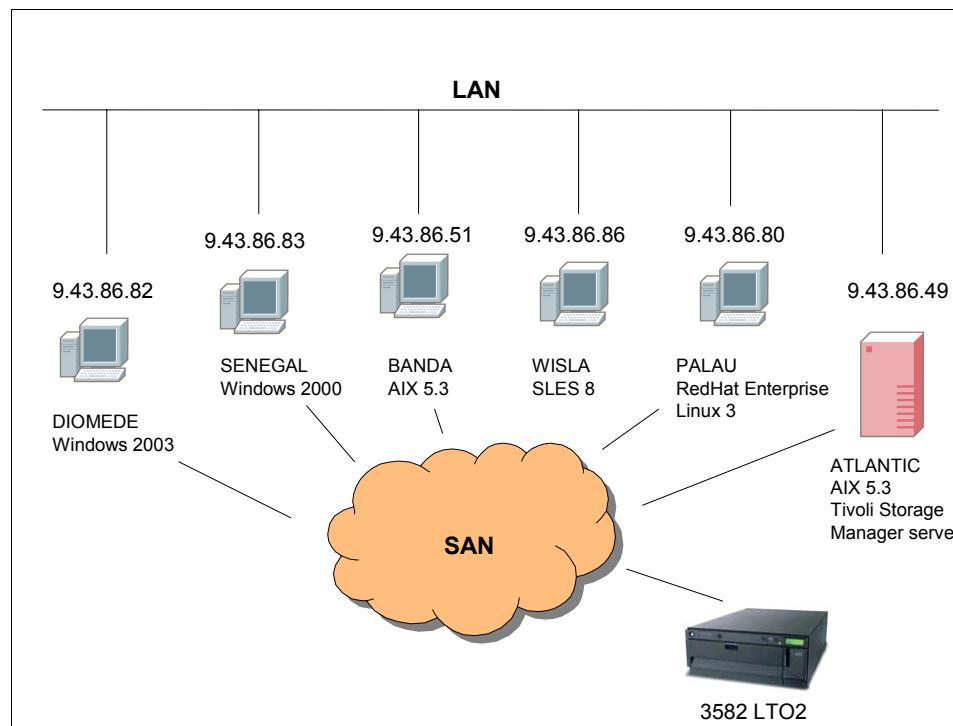


Figure 4-3 Tivoli Storage Manager lab setup

Tivoli Storage Manager client code fixes and enhancements are released regularly. We strongly recommend obtaining the latest code level before starting any installation. You should also check for any recent FLASHES of late-breaking product news that may affect your implementation. You may subscribe to updates via RSS, or regularly visit the Tivoli Storage Manager support Web site:

<http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html>

4.2.2 AIX backup-archive client

This section shows how to install the Tivoli Storage Manager backup-archive client code on a pSeries running AIX V5.3 with 64-bit kernel.

Note: With IBM Tivoli Storage Manager V5.3, there is no longer a separate 64-bit AIX client package. The same V5.3 client can be used on either 32-bit or 64-bit machines. Also note that the root user must install the client's filesets.

Here are the steps:

1. Insert either the Tivoli Storage Manager client for AIX installation CD in the CD-ROM drive or store a downloaded the installation package onto your file system. As root, enter smitty installp at the shell prompt.
2. Choose **Install and Update from ALL Available Software**, as shown in Example 4-1.

Example 4-1 Installation from ALL available software

Install and Update Software

Move cursor to desired item and press Enter.

Install Software
Update Installed Software to Latest Level (Update All)
Install Software Bundle
Update Software by Fix (APAR)
Install and Update from ALL Available Software

3. Select the device to be used for installation. Example 4-2 shows the available sources for the installation package. We selected the CD-ROM.

Example 4-2 Select source for installation

Install and Update from ALL Available Software

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

<p>* INPUT device / directory for software</p> <p>+-----+ INPUT device / directory for software Move cursor to desired item and press Enter. /dev/cd0 (IDE CD-ROM Drive I (650 MB)) /usr/sys/inst.images (Installation Directory) +-----+</p> <p>F1=Help F2=Refresh F3=Cancel</p>	<p>[Entry Fields]</p> <p>[] +</p>
---	------------------------------------

F1 F8=Image	F10=Exit	Enter=Do	-----+-----+
F5 /=Find	n=Find Next		
F9+-----+			

4. Select the filesets to install, as shown in Example 4-3. Place the cursor in the *SOFTWARE to install* option and press F4 to display the list of available filesets.

Example 4-3 Select software filesets

Install and Update from ALL Available Software

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

[Entry Fields]		
* INPUT device / directory for software	/dev/cd0	+-----+
* SOFTWARE to install	[]	+-----+
PREVIEW only? (install operation will NOT occur)	no	+-----+
COMMIT software updates?	yes	+-----+
SAVE replaced files?	no	+-----+
AUTOMATICALLY install requisite software?	yes	+-----+
EXTEND file systems if space needed?	yes	+-----+
OVERWRITE same or newer versions?	no	+-----+
VERIFY install and check file sizes?	no	+-----+
DETAILED output?	no	+-----+
Process multiple volumes?	yes	+-----+
ACCEPT new license agreements?	no	+-----+
Preview new LICENSE agreements?	no	+-----+

We installed the following filesets:

- tivoli.tsm.client.ba.jfs2
- tivoli.tsm.client.api.jfs2
- tivoli.tsm.books.en_US.client.htm

The tivoli.tsm.client.ba.jfs2 fileset contains the following packages:

- tivoli.tsm.client.ba.jfs2.base
- tivoli.tsm.client.ba.jfs2.common
- tivoli.tsm.client.ba.jfs2.image
- tivoli.tsm.client.ba.jfs2.nas
- tivoli.tsm.client.ba.jfs2.web

5. Perform a preview install to ensure that there is sufficient disk space and that all prerequisite filesets have been selected. Example 4-4 shows the *PREVIEW only* and *Preview new LICENSE agreements* options set to Yes.

Example 4-4 Smitty screen - preview only installation

Install and Update from ALL Available Software

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

[Entry Fields]	
* INPUT device / directory for software	/dev/cd0
* SOFTWARE to install	[+ 5.3.2.0 TSM BOOKS > +
PREVIEW only? (install operation will NOT occur)	yes +
COMMIT software updates?	yes +
SAVE replaced files?	no +
AUTOMATICALLY install requisite software?	yes +
EXTEND file systems if space needed?	yes +
OVERWRITE same or newer versions?	no +
VERIFY install and check file sizes?	no +
DETAILED output?	no +
Process multiple volumes?	yes +
ACCEPT new license agreements?	yes +
Preview new LICENSE agreements?	no +

Note: To install the backup-archive client on AIX V5.1 or later you must accept the license agreement. You can view the license agreement by selecting **Yes** on the Preview new LICENSE agreement option in smit.

6. If there is sufficient disk space and the preview did not indicate any missing requisite filesets, perform the actual install. Example 4-5 shows the Preview install option set to No and Accept new LICENSE agreements set to Yes.

Example 4-5 Smitty screen - preview of installation

Install and Update from ALL Available Software

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

[Entry Fields]	
* INPUT device / directory for software	/dev/cd0
* SOFTWARE to install	[+ 5.3.2.0 TSM BOOKS > +
PREVIEW only? (install operation will NOT occur)	no +
COMMIT software updates?	yes +
SAVE replaced files?	no +
AUTOMATICALLY install requisite software?	yes +

EXTEND file systems if space needed?	yes	+
OVERWRITE same or newer versions?	no	+
VERIFY install and check file sizes?	no	+
DETAILED output?	no	+
Process multiple volumes?	yes	+
ACCEPT new license agreements?	yes	+
Preview new LICENSE agreements?	no	+

7. Example 4-6 shows the final output after installation, including the list of filesets that were installed and the status of the installation.

Example 4-6 Smitty screen - installation complete

```
COMMAND STATUS
Command: OK          stdout: yes          stderr: no
Before command completion, additional instructions may appear below.
```

```
[MORE...161]
Installation Summary
-----
Name           Level      Part   Event    Result
-----
tivoli.tsm.client.api.jfs2 5.3.2.0    USR    APPLY   SUCCESS
tivoli.tsm.books.en_US.clie 5.3.2.0   USR    APPLY   SUCCESS
tivoli.tsm.client.ba.jfs2.c 5.3.2.0   USR    APPLY   SUCCESS
tivoli.tsm.client.ba.jfs2.w 5.3.2.0   USR    APPLY   SUCCESS
tivoli.tsm.client.ba.jfs2.n 5.3.2.0   USR    APPLY   SUCCESS
tivoli.tsm.client.ba.jfs2.i 5.3.2.0   USR    APPLY   SUCCESS
tivoli.tsm.client.ba.jfs2.b 5.3.2.0   USR    APPLY   SUCCESS
```

[BOTTOM]

Note: The Tivoli Storage Manager Client for JFS2 is not compatible with the Tivoli Storage Manager client for JFS or GPFS. Therefore, if you select to install a combination of filesets from JFS and JFS2 filesets, the installation would fail. The Tivoli Storage Manager Client for JFS2 client allows you to back up and restore files from a JFS or GPFS file system. However, migration and recall for Space Managed client (HSM) is possible only from a JFS2 file system.

4.2.3 Linux backup-archive client

We installed the client code on SuSE and Redhat Linux distributions. The installation packages are in rpm format.

Store the compressed installation package on the machine where you want to install the backup-archive client and do the following:

1. Decompress the zip file and unpack the tar file, as in Example 4-7. The command output was actually longer, as there were a number of localization files that we deleted for clarity.

Example 4-7 Unpacking Linux client installation packages

```
wisla:/tmp/tsm_client # gzip -dc TSMLinuxCliV5.3.2.tar.gz | tar -xvf -
linux86/LICENSE.TXT
linux86/README.HSMGUI
linux86/README_api_enu.htm
linux86/README_enu.htm
linux86/README_hsm_enu.htm
linux86/TIVsm-API64.i386.rpm
linux86/TIVsm-API.i386.rpm
linux86/TIVsm-BA.i386.rpm
linux86/TIVsm-HSM.i386.rpm
...
```

2. You need to install two rpm packages, TIVsm-API.i386.rpm and TIVsm-BA.i386.rpm, using the rpm utility, shown in Example 4-8. The API package must be installed before the BA package, as it contains libraries the BA package depends on.

Example 4-8 Installing Linux client packages

```
wisla:/tmp/tsm_client/linux86 # rpm -ivh TIVsm-API.i386.rpm
Preparing... ################################ [100%]
      package TIVsm-API-5.3.2-0 is already installed
wisla:/tmp/tsm_client # rpm -e TIVsm-API
wisla:/tmp/tsm_client # rpm -ivh TIVsm-API.i386.rpm
Preparing... ################################ [100%]
      1:TIVsm-API ################################ [100%]
Postinstall of the API
TSM Linux API installation complete.
Be sure to set up the configuration files!
```

```
wisla:/tmp/tsm_client/linux86 # rpm -ivh TIVsm-BA.i386.rpm
Preparing... ################################ [100%]
      1:TIVsm-BA ################################ [100%]
Postinstall of the Backup Archive client
TSM Linux client installation complete.
Be sure to set up the system configuration file
before starting the client!
```

3. After successful installation, you can display the installed filesets using the `rpm query` command, as shown in Example 4-9.

Example 4-9 Querying for installed client packages on Linux

```
wisla:/tmp/tsm_client/linux86 # rpm -qa | grep -i TIV
TIVsm-BA-5.3.2-0
TIVsm-API-5.3.2-0
wisla:/tmp/tsm_client/linux86 #
```

For more information about UNIX and Linux installation and prerequisites, see *IBM Tivoli Storage Manager for Unix and Linux Backup-Archive Clients Installation and User's Guide*, GC32-0789.

4.2.4 Windows backup-archive client

We installed the backup-archive client code on Diomedea, running Windows 2003 Server. The same installation package is used for other supported Windows platforms, such as Windows XP or Windows 2000.

There are two ways to install the backup-archive client on Windows: the standard Installshield wizard or with the command line. The latter is known as a silent, or unattended, client installation. By placing a customized version of the `msiexec` command (which invokes the Microsoft Software Installer) in a script or batch file, you can easily perform installations on multiple Windows machines.

Installshield method

The method is:

1. Insert the installation CD and when the autorun displays the main installation window, click **Install Products** to begin. Figure 4-4 shows the available backup-archive client installation packages.

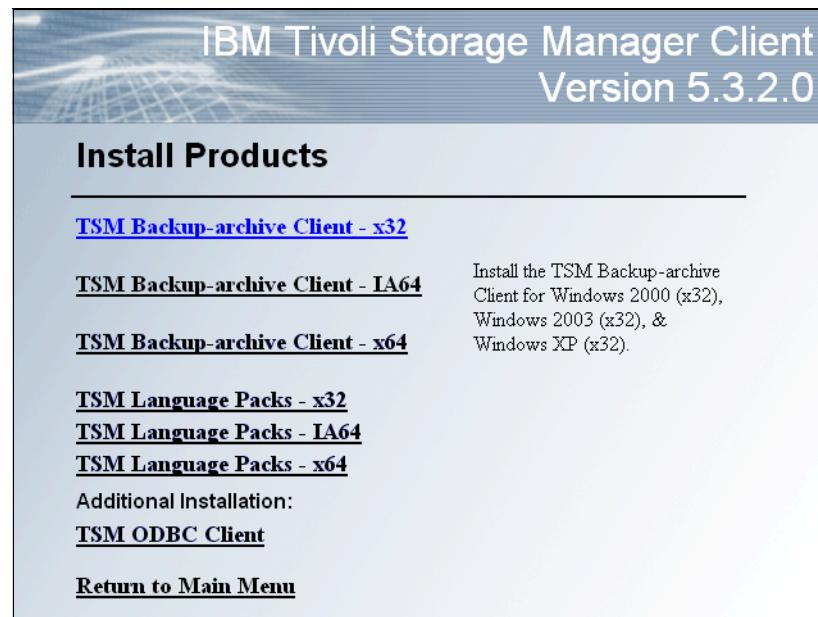


Figure 4-4 Backup-archive client installation packages

Click the appropriate product for your operating system platform. Our machine runs the 32-bit version of Windows 2003 on an x86-based processor, so we choose to install TSM Backup-archive Client - x32.

2. Select the language environment for the installation process (in our case English). The Installshield wizard then starts the installation process. Click **Next** and you are given an option to specify the destination folder where the client code is to be installed. In Figure 4-5 we chose to install the code in the default installation path, which is the recommended destination.



Figure 4-5 Client code destination

3. Choose the type of installation. In Figure 4-6 we chose a typical installation. You may choose Custom installation to select additional components and features, such as Open Files support, Image backup support, and more. However, when these features are not required, our recommendation is to choose Typical installation to make sure that all Tivoli Storage Manager basic client components and prerequisites are installed. Also, a Typical installation without the additional components mentioned above does not require a reboot after the client installation. You may install them later, when required.

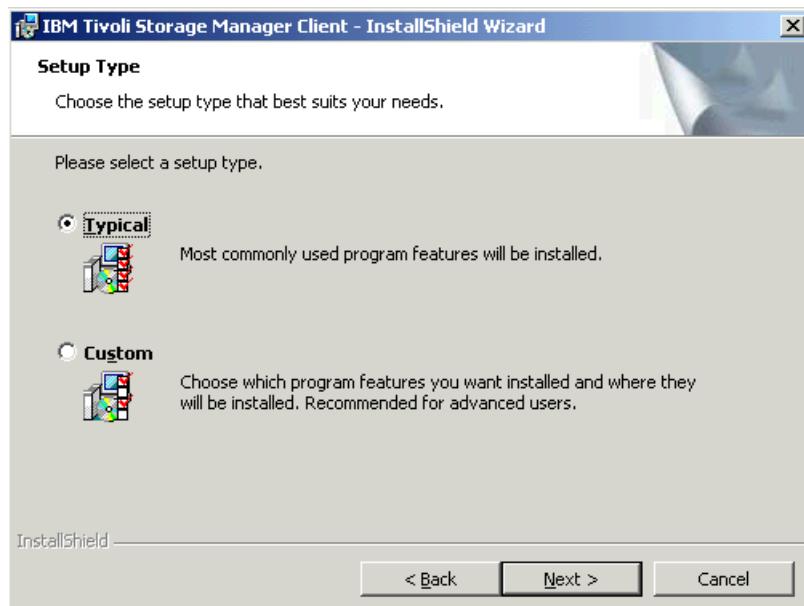


Figure 4-6 Client setup type

4. You are now ready to begin the Tivoli Storage Manager client installation. Here you have the option to go back and review your inputs to the installation wizard. If satisfied with your choices, click **Install** to begin the installation.

- When the installation is done, the window shown in Figure 4-7 will be displayed. Click **Finish** to end the installation.

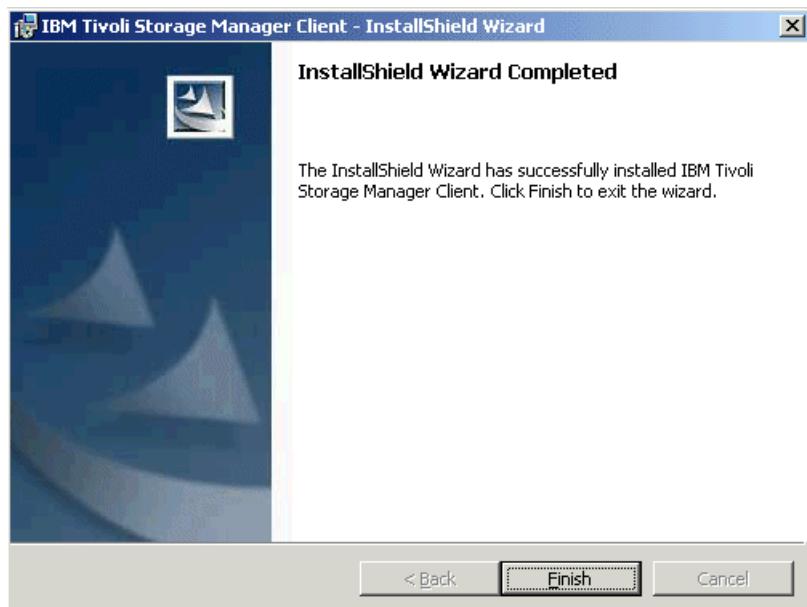


Figure 4-7 Completion of client installation

This concludes the interactive installation of the Windows backup-archive client.

Silent installation

Example 4-10 on page 113 shows a sample command to silently install the backup-archive command line client, GUI client, Web client, API, and HTML help files. You may need to customize this example to run correctly on your system. While the command is physically spread across multiple lines on this page, it is one single command. You can modify the example to also install a Tivoli Storage Manager Backup-Archive Client Language Pack.

Under certain conditions, a system reboot might be necessary for the installation to complete successfully. You may specify the options `RebootYesNo` and `REBOOT` to suppress this. These options cause the installation program to not reboot the system if circumstances would otherwise cause the reboot to occur. While this option is convenient, it should be used with caution because suppressing the reboot might cause the program to behave unpredictably. The most common reason that a reboot is required is if the installation is an upgrade to an existing Tivoli Storage Manager client, and the installation is performed while the client programs are running. Therefore, we recommend that you shut

down all Tivoli Storage Manager client programs and services before performing the installation.

Example 4-10 Backup-archive sample client silent installation

```
c:\>msiexec /i "C:\WindowsClient5.3.2\tsmcli\x32\client\Disk1\IBM Tivoli Storage  
Manager Client.msi" RebootYesNo="No" REBOOT="Suppress" ALLUSERS=1  
INSTALLDIR="c:\program files\tivoli\ tsm"  
ADDLOCAL="BackupArchiveGUI,BackupArchiveWeb,ApiRuntime,Readmes"  
TRANSFORMS=1033.mst /qn /l*v "c:\log.txt"  
c:\>
```

The installation process creates a Tivoli Storage Manager folder in the programs folder of the Windows Start menu. You may review the logfile for details about the installation procedure.

4.3 Customization

The following sections describe the various settings for the backup-archive client and the Web backup-archive client.

4.3.1 Backup-archive client customization

This section discusses how to customize the client installation:

- ▶ Setting environment variables
- ▶ Defining client options files
- ▶ Defining include-exclude lists

For a more detailed explanation, see the *Backup-Archive Client Installation and User's Guide* for each platform.

To customize the client, you can either manually edit the files described below or use the client configuration wizard available on most platforms, as described in 4.3.3, “Using the client configuration wizard” on page 120.

Environment variables

These are the variables to update and set in your client environment:

- ▶ PATH

This is the default search path that the operating system uses to locate executable files. Set this to include the fully qualified path of the Tivoli Storage Manager client directory, where executables such as dsmc or dsm reside.

- ▶ **DSM_CONFIG**
Specifies the location of the client options file dsm.opt. Set this environment variable to the fully qualified path and file name of the client options file.
- ▶ **DSM_DIR**
Specifies the location of all other client files. Set this environment variable to the directory where the client message file dsc*.txt, the executable file dsmc, and the resource files are located. On UNIX/Linux clients, this directory also contains the dsm.sys option file.
- ▶ **DSM_LOG**
Points to the directory where you want the dsrror.log, dsmwebcl.log, and dsmsched.log files to reside. The error log file, dsrror.log, contains information about any processing errors. The Web log file, dsmwebcl.log, is for errors that occur when the client is accessed through the Web interface. The schedule log, dsmsched.log, contains the output of scheduled commands.

Note: DSM_LOG environment variable changes have been made in the Tivoli Storage Manager V5.3 client and later to prevent a security or data integrity problem. Logs are no longer created in the installation directory. In addition, if the client cannot open a required log for writing, the client process will terminate. The Tivoli Storage Manager command-line client, the Web Client Acceptor, and the agent will *not* run without a writable dsrror.log.

- ▶ **LANG**
On AIX, HP-UX, Solaris, Linux, and Windows platforms, the backup-archive client automatically detects the language of the system locale and displays in that language. To change the locale on UNIX/Linux, use the LANG environment variable. For example, if LANG is set to Czech, the backup-archive is displayed in Czech, provided that the Czech client language pack is installed. If Tivoli Storage Manager cannot load the Czech message catalog, it will default to the English (United States) language pack. On Windows platforms, use the LANGUAGE client option to change the national language in which the client displays the messages.

Options file

Tivoli Storage Manager includes options that control processing for user sessions. For example, you can use options to tell Tivoli Storage Manager which communication method to use, what format to use for dates, whether to use client compression, and more.

We provide recommended option files for the various client platforms, as the layout of the supplied options file is not immediately intuitive.

The backup-archive client has at least one configuration file, which is divided into the following parts:

- ▶ Communication options
- ▶ Operational options
- ▶ Site-dependent options
- ▶ Include-exclude options

Some of the configuration steps on the client side may need complementary configuration on the Tivoli Storage Manager server side.

On all non-UNIX platforms, all options reside in the client options file, dsm.opt (Preferences file for Macintosh), which resides by default in the Tivoli Storage Manager client installation directory.

On UNIX (including Linux), the root user can set options in three different files:

- ▶ Client system options file (dsm.sys)
Contains options required to establish communication with a Tivoli Storage Manager server and options that authorize users on the client node to use Tivoli Storage Manager services. It can also contain options that affect backup and archive processing, and options that affect scheduled services.
- ▶ Client user options file (dsm.opt)
Contains options that determine which Tivoli Storage Manager server is used, and that specify the formats for date, time, and numbers. It can also contain options affecting backup, archive, restore, and retrieve processing. Users can also create their own personalized client user options file if they want to use different options. Options from a client user options file can be over-ridden by using appropriate Tivoli Storage Manager commands.
- ▶ Include-exclude options file
Specifies file and directory patterns to be included or excluded from backup services. It also contains statements to associate specific files with different management classes. This file can be called any legal file name and be located in any directory, provided that its full path name is referenced in the dsm.sys file.

Because there are many different options and settings possible in these files, we provide recommended client options files for various client platforms in “Client options files” on page 746. We assume that TCP/IP is the network protocol. Most options may also be centrally set using client option sets on the Tivoli Storage Manager server. See 8.3, “Client option sets” on page 298, for more information about this.

Communication options

Each Tivoli Storage Manager client needs basic communication settings to send or receive data. You can choose any protocol that is supported by Tivoli Storage Manager, provided that both client and server are properly configured for them. Depending on the type of Tivoli Storage Manager server, you may need help from the system administrator to put all the necessary communication definitions in place. The server may have multiple communication protocols configured. If that is the case, you may choose any of those to start communicating with the Tivoli Storage Manager server.

Here is a list of communication options you need to set:

► **COMMMETHOD**

Specifies the communication method used for client-server communication. The Tivoli Storage Manager server options file (dsmser.opt) must have specified the same communication method with a valid port address so that the server can accept client requests. Examples of various communications methods available are TCP/IP, HTTP (for Web client), shared memory, or named pipe. The vast majority of Tivoli Storage Manager configurations use TCP/IP for regular backup-archive operations.

► **TCP SERVER ADDRESS**

Specifies the TCP/IP address or host name of a Tivoli Storage Manager server. If using the host name, make sure that it is resolvable on the client machine; otherwise, you will not be able to connect to the Tivoli Storage Manager server. If you use name resolution, you will depend on the DNS to be up and running. If you believe that name resolution may not be always available during your backup windows, consider using the IP address instead. Although it gives you less flexibility, it will work despite any name resolution service problem.

► **TCPPORT**

Specifies a TCP/IP port address for a Tivoli Storage Manager server. The default value is 1500.

► **TCPCLIENTPORT**

Specifies a different TCP/IP port number for the server to contact than the one that was used to make the first server contact. This option is used with server-prompted scheduling, and only while the scheduler is running. The default value is 1501.

► **TCPWINDOWSIZE**

Specifies the size, in kilobytes, of the TCP/IP sliding window for the client node. This setting is highly operating-system specific. You must only use the allowed values for your TCP/IP implementation.

- ▶ **TCPBUFSIZE**
Specifies the size, in kilobytes, of the Tivoli Storage Manager internal TCP/IP communication buffer. This setting is highly operating-system specific. You must only use the allowed values for your TCP/IP implementation.
- ▶ **NODENAME**
Indicates the client node name to over-ride the default value of the host name.
- ▶ **HTTPPORT**
Specifies a TCP/IP port where the Tivoli Storage Manager Client Acceptor (Web client) will listen for potential connections from remote users. By default, if the Web client is configured, it listens on port 1581.
- ▶ **WEBPORTS**
Enables the use of the Web client outside a firewall by specifying the TCP/IP port numbers used by the Tivoli Storage Manager Client Acceptor service and Web Client Agent service for communications with the Web client.

When using firewalls: Use of firewalls requires additional configuration settings and considerations when using Tivoli Storage Manager. To allow clients to communicate with a server across a firewall, the ports specified in these options must be open in the firewall:

- ▶ **TCPPORT**
- ▶ **HTTPPORT**
- ▶ **WEBPORTS**

However, if the client scheduler is running in server-prompted mode, it is not necessary to open any ports on the firewall. You can set the option SESSIONINITIATION to serveronly in the client options file and then the client will not attempt to contact the server. The SESSIONINITIATION option only affects the behavior of the client scheduler when running in prompted mode.

Operational options

Here are some examples of client options for backup, restore, and scheduling services.

- ▶ **PASSWORDACCESS**
Specifies whether you want your Tivoli Storage Manager client node password to be automatically provided by the client whenever the client initiates a session to the server or you want to be prompted to enter it. We highly recommend setting PASSWORDACCESS to GENERATE, as this

provides a secure way for exchanging passwords and generating a new one whenever the old client node password expires.

► **REPLACE**

Specifies default behavior for when Tivoli Storage Manager restores files that already exist on the client node. This option applies to the **restore** and **retrieve** commands only.

► **SUBDIR**

Specifies whether you want Tivoli Storage Manager to include subdirectories of named directories during the client operations. This option applies, for example, to **selective**, **restore**, **archive**, and **retrieve**.

► **TAPEPROMPT**

Specifies whether to wait for a tape to mount if it is required for an interactive backup, archive, restore, or retrieve operation, or to prompt the user for a choice. The **TAPEPROMPT** setting has no impact on scheduled operations.

► **SCHEDMODE**

Specifies whether to use client-polling mode (the client node periodically asks the Tivoli Storage Manager server for scheduled work) or server-prompted mode (the server contacts the client node when it is time to start a scheduled operation). All communication methods can use client-polling mode, but only TCP/IP can use server-prompted mode. More information about scheduling operations is in 12.3, “Client schedules” on page 386.

► **CLUSTERNODE**

Specifies that the client participates in a clustered environment (for example, HACMP, MSCS, VERITAS Cluster Service, Novell Cluster Service).

► **COMPRESSION**

If set to yes, the client compresses objects before sending them to the Tivoli Storage Manager server.

► **DIRMC**

Specifies the management class for directories to bind to. If you do not specify this option to associate a management class with directories, the management class in the active policy set of your policy domain with the longest retention period will be used for directories. We recommend that you select a management class for individual directories that retains directories at least as long as it retains the files associated with them.

Site-dependent options

If your locale is not the United States, then we recommend that you adjust the date, number, and time format options and also the language option in your client

options file to support your requirements. Respective client options are DATEFORMAT, NUMBERFORMAT, and TIMEFORMAT.

Include-exclude options

The include-exclude options are written into the client user options file dsm.opt on non-UNIX platforms. On UNIX/Linux, include-exclude options are either written into the client system options file (dsm.sys) or in a separate file, called the include-exclude file. If you use a separate include-exclude file, rather than including the statements directly, use the option INCLEXCL in the client system options file dsm.sys to indicate the name and location of the include-exclude file:

```
INCLEXCL /tsm/server1/inclexcl.file
```

Having determined where to put the include-exclude options, here is how to specify them. The two statements INCLUDE and EXCLUDE are used.

The INCLUDE option specifies files to include for backup services. Also use this option to assign a management class either to specific files or to all files to which you have not already assigned a specific management class, and for which you do not want Tivoli Storage Manager to use the default management class.

The EXCLUDE option excludes files from backup or archive services. When you back up files, any files you exclude are not considered for backup. For example, we recommend excluding the Tivoli Storage Manager installation directory.

Further, a combination of exclude and include rules may be used to enforce compression or encryption on certain subsets of files.

Include-exclude options are checked from the bottom up to the top of the list until a match is found. If so, the processing stops and checks whether the option is INCLUDE or EXCLUDE. If the option is INCLUDE, the file is backed up using the assigned management class. If the option is EXCLUDE, the file is not backed up. Any file that does not match any of the rules is automatically included for backup and is bound to the default management class.

Tip: If your workstation is memory constrained, specify the option MEMORYEFFICIENTBACKUP Yes in your client options file. Specifying Yes reduces memory consumption but increases backup time.

You can also use the RESOURCEUTILIZATION option to increase the number of parallel sessions initiated to the Tivoli Storage Manager server. By default, a client uses two sessions: one session to query the server and one to send file data. For example, a RESOURCEUTILIZATION 10 setting permits up to eight sessions with the server, which may result in faster backup as multiple file spaces are backed up in parallel.

4.3.2 Web backup-archive client

These client options are important when using the Web client:

- ▶ **PASSWORDACCESS**

The PASSWORDACCESS option must be set to *generate* and the password itself must be generated by first running a backup-archive client session. The remote client agent establishes connection to Tivoli Storage Manager in the same manner as the backup-archive GUI and command-line clients. It requires the generated client password to authenticate a client session when the Web client is used.

- ▶ **HTTPPORT**

The acceptor daemon listens on a TCP/IP port for incoming connections from an administrator's Web browser. By default it listens on port 1581. This default port can be overridden with the HTTPPORT client option.

- ▶ **REVOKEREMOTEACCESS**

The REVOKEREMOTEACCESS option has two possible values: none, which is the default, and access. If the option is set to none, any administrator user ID with either client access or client owner authority can perform client operations. If the option is set to access, administrator user IDs with only client access authority cannot perform remote client operations. A message displayed in the Web browser indicates that the administrator user ID being used has insufficient authority. Administrators with client owner or later authorities can still perform client functions. Figure 4-1 on page 99 summarizes the Web client options.

- ▶ **WEBPORTS**

The WEBPORTS option is used in firewall environments and was explained in "Communication options" on page 116.

Table 4-1 Web client options

Option	Value
PASSWORDACCESS	GENERATE
HTTPPORT	1581
REVOKEREMOTEACCESS	NONE
WEBPORTS	CADPort and AgentPort, defaults are 0

4.3.3 Using the client configuration wizard

The next sections describe how to use the backup-archive client configuration wizard on UNIX/Linux and Windows platforms.

When the GUI client starts, it checks to see whether a client user options file exists. If the client user options file does not exist (which is typically the case when the client is first installed), the setup wizard automatically starts to guide you through the configuration process. You can re-launch the setup wizard at any time to modify your client configuration files.

The wizard creates the options files with the specified values, so it is an alternative to setting all the options we have presented in the previous sections.

Note: If you are using the setup wizard in the Java GUI on UNIX or Linux platforms, a new dsm.opt and dsm.sys is created, overwriting the existing dsm.opt and dsm.sys file. The Java GUI should only be used for initial setup if a previous dsm.opt or dsm.sys file does not exist; otherwise, existing dsm.opt or dsm.sys files will be overwritten.

This does not apply to the native Windows and Macintosh clients.

4.4 UNIX/Linux configuration wizard

The configuration wizard figures and procedures described below were performed on an AIX system; however, the techniques and options are similar on all other platforms where the Java GUI is available.

The configuration wizard is used to create, update, and delete the client options files.

In this section we show you how to create a new client options file using the client configuration wizard in the backup-archive client Java GUI.

Important: Before configuring the client, the Tivoli Storage Manager administrator must have defined the client to the Tivoli Storage Manager server using the **register node** command. The administrator will supply you with the defined node name and password to use in the configuration. See 8.2.3, “Working with client nodes” on page 292, for more information about defining clients at the server.

To create a new client options file:

1. Open the Java GUI with the command `dsmj`. Since this is the first time we run the client, and the options file is not configured yet, the client wizard starts immediately, as shown in Figure 4-8. We choose **Create a new options file** and click **Next**.

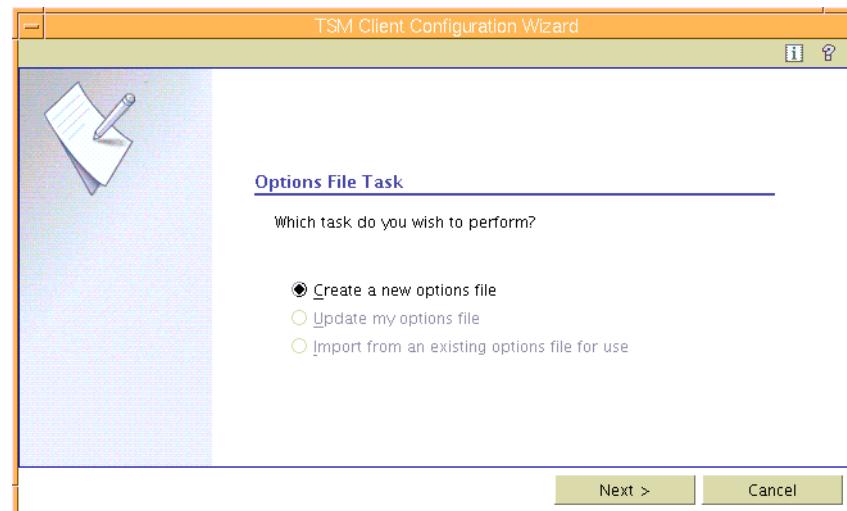


Figure 4-8 Java GUI client configuration wizard

2. In the next screen (Figure 4-9) enter the Tivoli Storage Manager server name. On UNIX clients, you may create multiple server definitions in your central option file (dsm.sys), each with different settings. Each set of definitions uses a different stanza in the dsm.opt file and is identified by a *stanza* name corresponding to the Tivoli Storage Manager server name. We enter the server name TSM_ATLANTIC. Do not use the IP address or host name here.

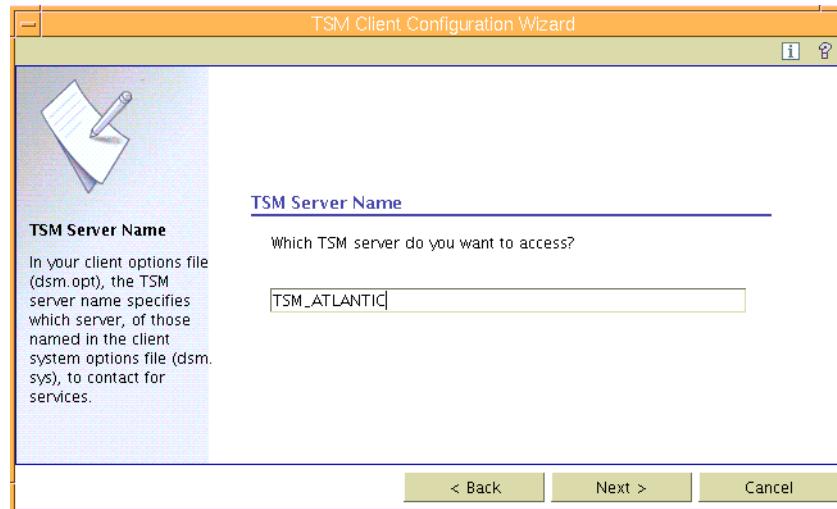


Figure 4-9 Server name definition

3. Next specify the communication method between the client and the server. In our lab we installed the client on the same machine as the server, and so could use either of two methods, TCP/IP and Shared Memory (available only

if the client resides on the same machine as server code). We chose TCP/IP, as in Figure 4-10, since this is the most common method across all client types.

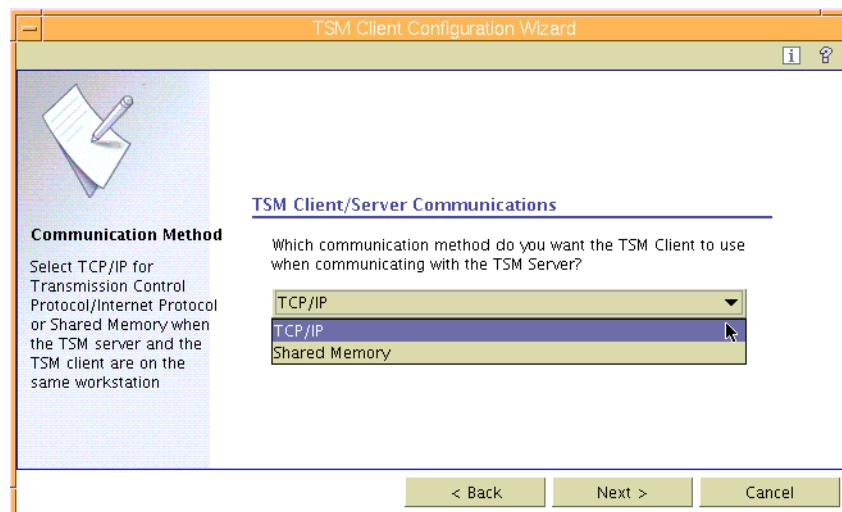


Figure 4-10 Client/Server communication method screen

- When using the TCP/IP communication method, we need to provide the address of the server and the TCP/IP port the server instance listens on, as in Figure 4-11. You may use either the TCP/IP address or the host name. In our case, the server is installed on the same machine as the client, ATLANTIC, and since we do not want to depend on name resolution services, we provide the dotted IP address. Our server listens on the default port number, 1500.

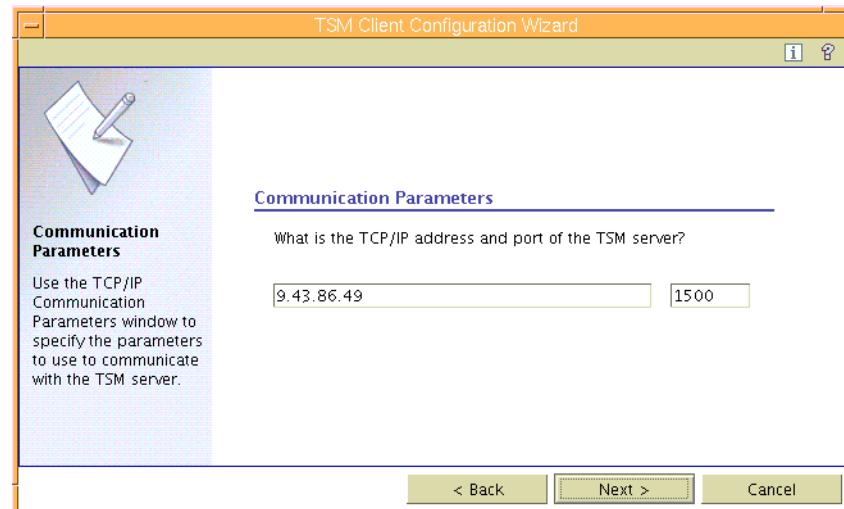


Figure 4-11 Setting up communication parameters

5. Enter the client node name that will be used to authenticate with the server defined in this stanza. You need to ask your Tivoli Storage Manager administrator what node name they used to register your client to the server. Often this is the same as the host name, but it may not be. In Figure 4-12 we used the host name ATLANTIC as the node name.

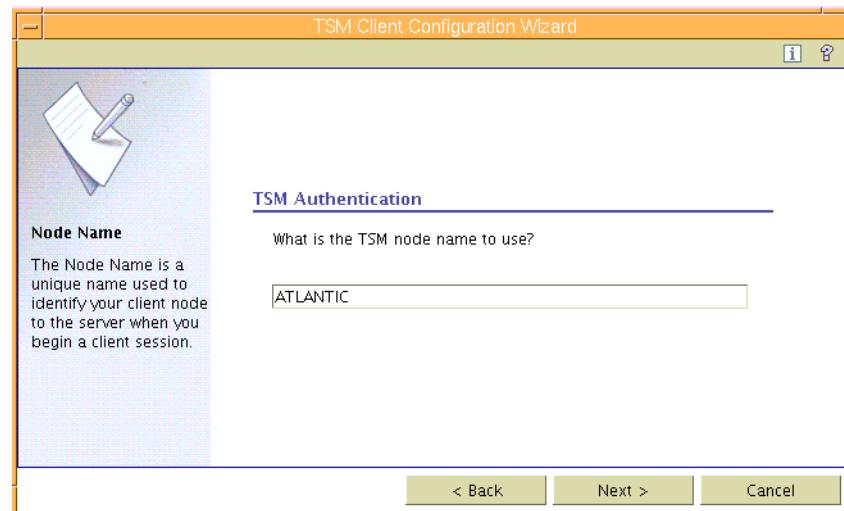


Figure 4-12 Client node name configuration screen

6. In the final screen, Figure 4-13, you are prompted to apply the settings configured in the previous screens. To review or change any options, click **Back**. When satisfied, complete the configuration wizard by clicking **Finish**.

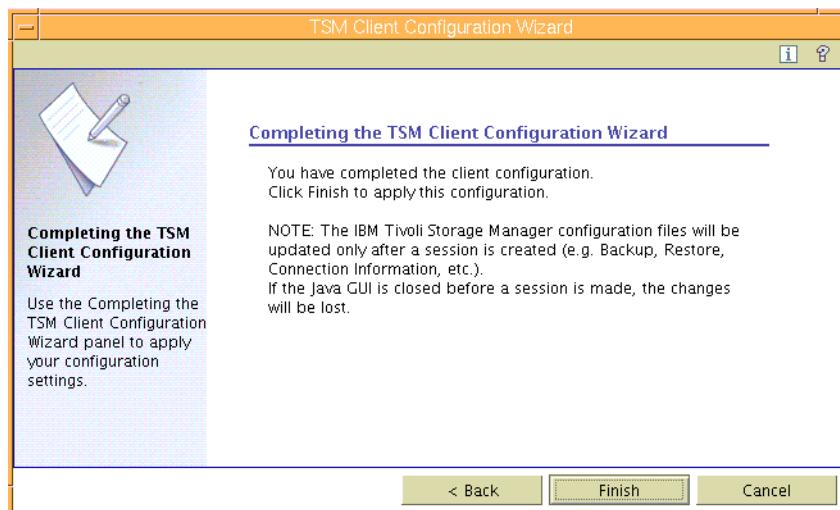


Figure 4-13 Completing client configuration

7. The backup-archive client then automatically starts with the login screen. Enter in your password, as shown in Figure 4-14. You need to ask your Tivoli Storage Manager administrator for the password, which was specified for your client node when it was registered at the Tivoli Storage Manager server. You can now run basic backup operations.

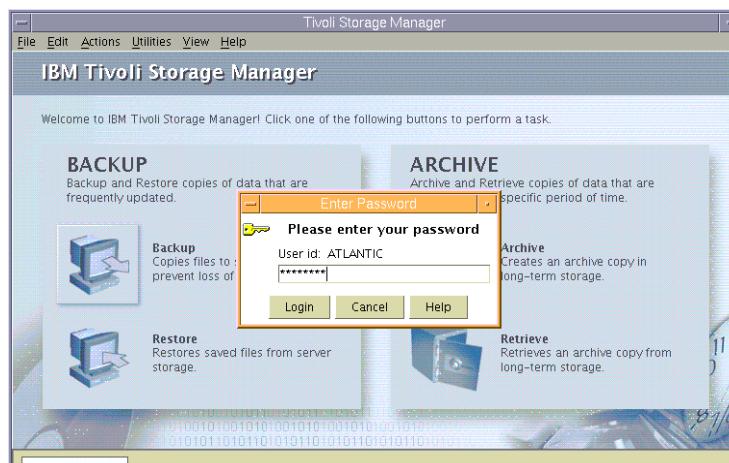


Figure 4-14 UNIX Tivoli Storage Manager client login

Note: Before a Tivoli Storage Manager client can log in to the Tivoli Storage Manager server, it must be first defined to the Tivoli Storage Manager server using the `register node` command.

Journalling on AIX setup

With the client V5.3.3 you can use the journalling service to run journal-based backups on AIX nodes. This service observes and keeps track of changes in files in local file systems. During incremental backups this information is used to select files for backup, which improves performance compared with the standard technique of scanning the file system for changes.

To enable journal-based backup, install and configure the Tivoli Storage Manager journal daemon. This daemon can be configured by editing the journal daemon configuration sample file, `tsmjbbd.ini.smp`, and saving it as `tsmjbbd.ini`. Both files should be in the default install directory.

The journal configuration file (`tsmjbbd.ini`) needs as a minimum a list of the file systems to monitor. These two lines are sufficient:

```
[JournalizedFilesystemSettings]  
JournalizedFileSystems=/home
```

We recommend also entering a `JournalDir` setting and a `JournalExcludeList` for the database files, as shown in Example 4-11. An `errorlog` setting will also explicitly name the errorlog file. Once the configuration file is created, the journal daemon can be started using the script file `/usr/tivoli/tsm/client/ba/bin/rc.tsmjbb`.

Example 4-11 Journal configuration settings `tsmjbbd.ini`

```
[JournalSettings]  
Errorlog=/tsm/journal/jberror.log  
Journaldir=/tsm/journal/  
  
[JournalExcludeList]  
; Note that this list contains the journal database files.  
*.jdb.jbbdb  
*.jdbInc.jbbdb
```

```
[JournalizedFileSystemSettings]  
JournalizedFileSystems=/home /xyz
```

The journal will write initialization information to the file specified by the `errorlog` option. When you are satisfied the journal is working correctly, you should run

the script file /usr/tivoli/tsm/client/ba/bin/jbbinittab. This puts the following entry in /etc/inittab so that the journal daemon starts when the machine boots:

```
tsmjbb:2:wait:/usr/tivoli/tsm/client/ba/bin/rc.tsmjbb > /dev/console 2>&1
```

4.5 Use of Windows configuration wizards

The Windows backup-archive client configuration wizard allows you to configure the client options file, Web client, client scheduler, journal engine, online image support, and open file support. The following sections show how to configure all of these using the wizards.

4.5.1 Backup-archive client configuration

Although Windows clients use a native GUI backup-archive client as opposed to the Java GUI on UNIX and Linux, the wizard configuration process for the Windows backup-archive client is almost identical.

Important: Before configuring the client, the Tivoli Storage Manager administrator must have defined the client to the Tivoli Storage Manager server using the **register node** command. The administrator will supply you with the defined node name and password to use in the configuration. See 8.2.3, “Working with client nodes” on page 292, for more information about defining clients to the server.

To do this:

1. Start the native GUI either from **Start → Programs → Tivoli Storage Manager → Backup-Archive GUI** or with the `dsm` command at the command line.

On startup, the client checks whether a client options file exists as specified in the `DSM_CONFIG` environment variable. If not, it immediately starts a setup wizard to configure the client options file (see Figure 4-15). Click **Next**.



Figure 4-15 Client Configuration Wizard startup window

2. In the next screen (Figure 4-16) you have the option to create, update, or import an options file. We select **Create a new options file**.

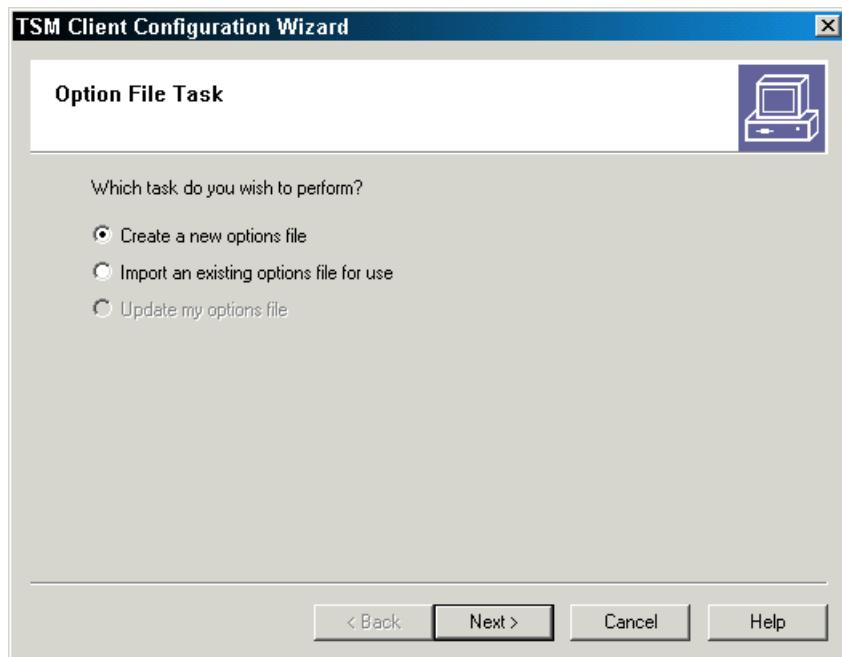


Figure 4-16 Windows create options file

3. Enter a node name to be used by the client. You need to contact your Tivoli Storage Manager administrator to obtain the node name they have used to register your client to the server. In Figure 4-17 we used the host name, DIOMEDE.

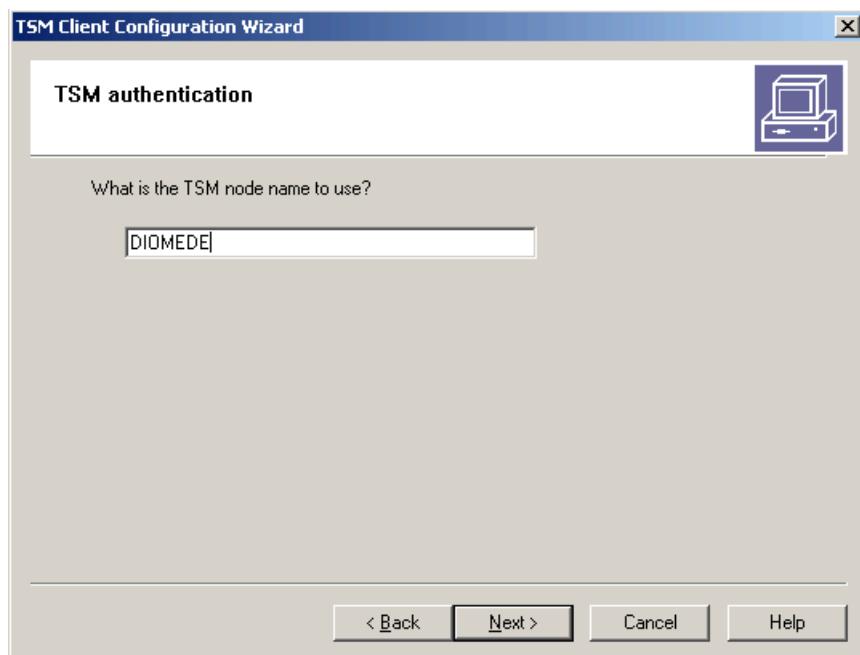


Figure 4-17 Windows client nodename

4. Select the communication method. We chose TCP/IP, as in Figure 4-18.

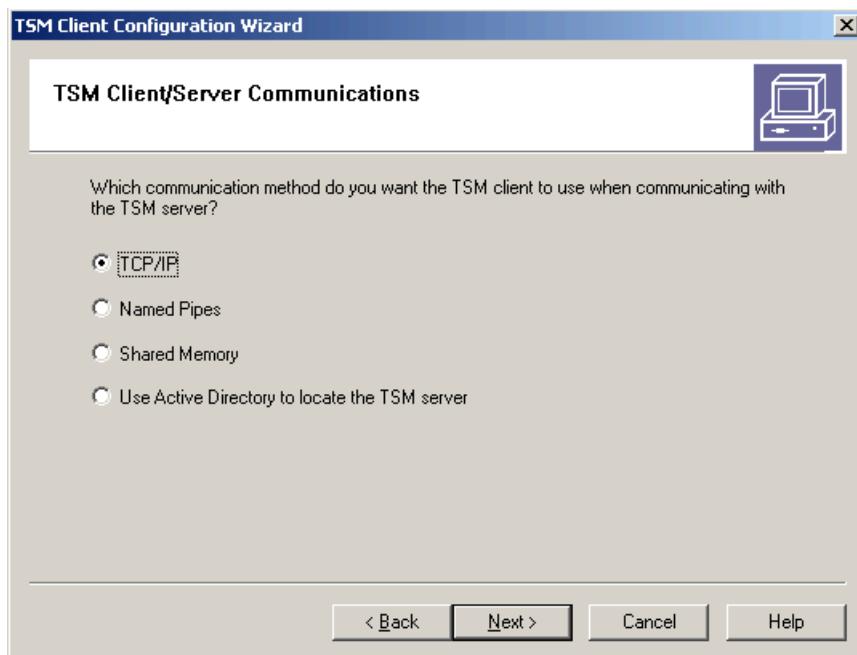


Figure 4-18 Client-server communication method

5. Enter the Tivoli Storage Manager server IP address or resolvable host name and the TCP/IP port number. Figure 4-19 shows our values using the default TCP/IP port of 1500.

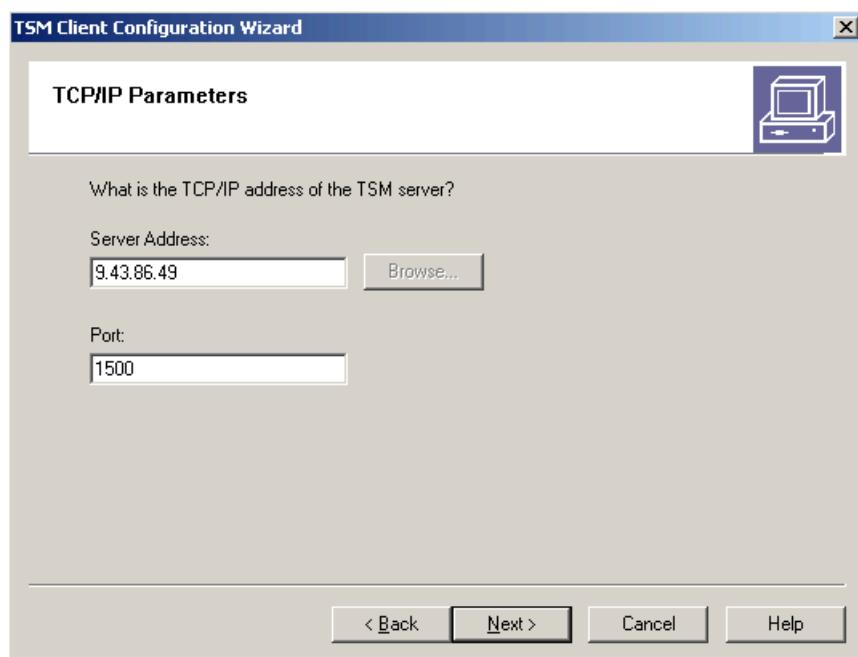


Figure 4-19 TCP/IP parameters

6. Figure 4-20 shows a recommended include/exclude file list. These files are in most cases not needed for system recovery, so the client configuration wizard gives you the option to directly exclude here, while allowing other files to be backed up or archived.

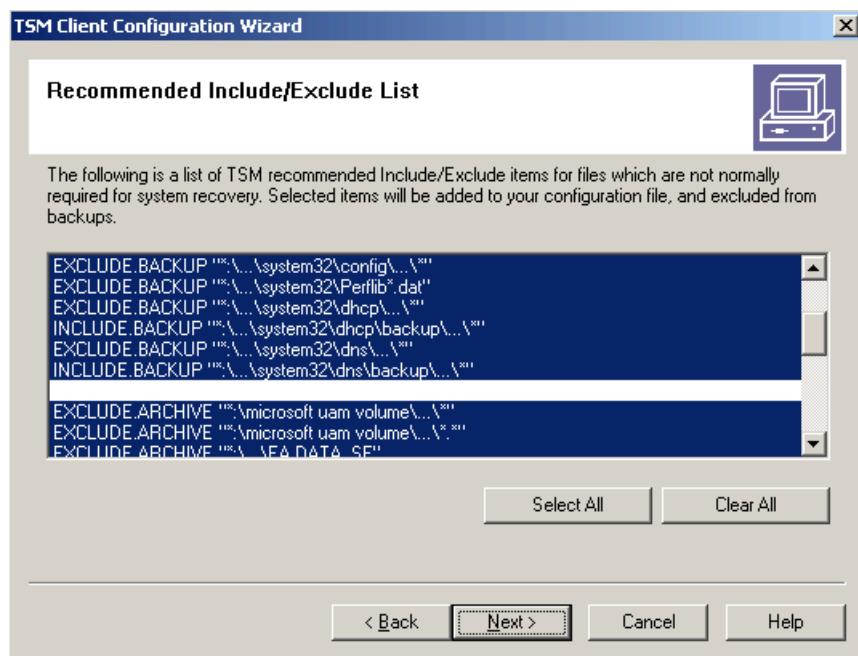


Figure 4-20 Recommended Include/Exclude List

7. Next you can specify file suffixes to be excluded, regardless of their physical location in the file system. Your choices here depend on your particular environment. You might exclude audio or video files, such as .avi or .mp3, for

example. On the other hand, excluding executables (.exe) or dynamic library files (.dll) might have a negative impact on the recovery procedures. In our example, Figure 4-21, we exclude video files with an .avi suffix.

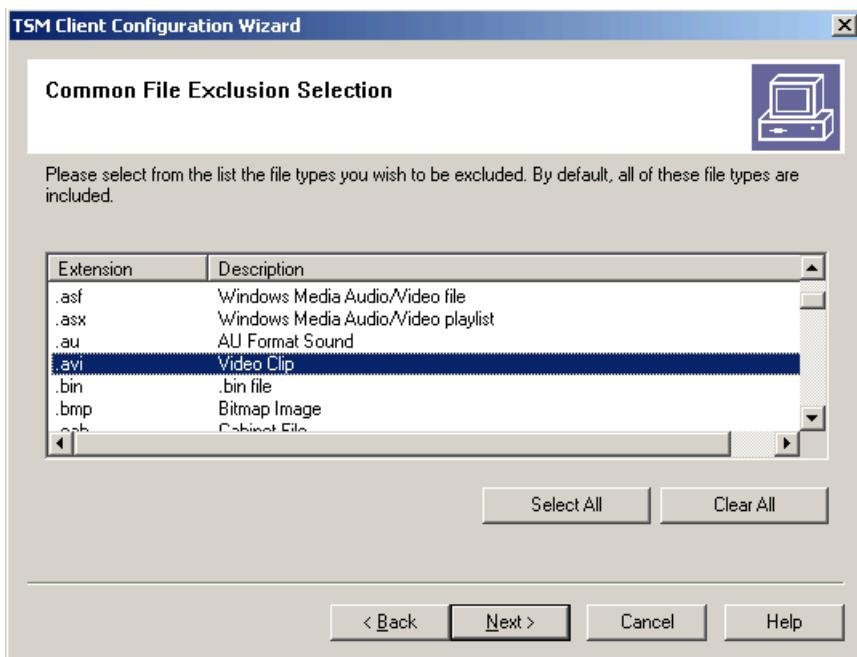


Figure 4-21 Common File Exclusion Selection

8. In the window shown in Figure 4-22 on page 137 you can specify which file systems and system objects, collectively referred to as *domains*, you want to include during incremental and image backup processing. Choose the respective operation from the menu. Either choose all local file systems and system objects by checking the Backup all local file systems option or explicitly select a subset of those. Usually, you want to incrementally back up

all file systems, so we recommend the Backup all local file systems option unless you really do want to exclude certain file systems from backup. Doing this ensures that if you add a new partition or disk, it will be automatically included in incremental backup operations.

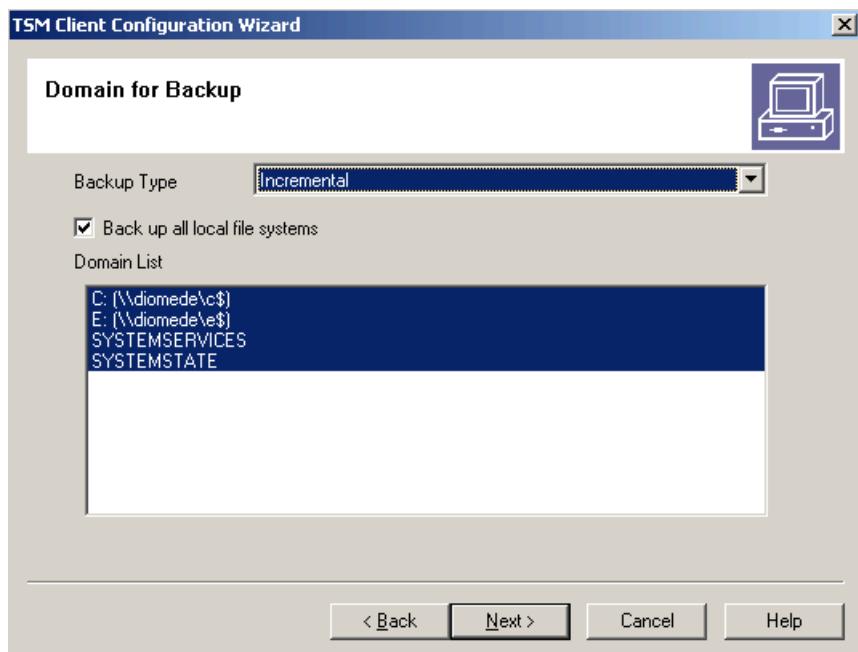


Figure 4-22 Specifying domains for incremental and image backups

9. Figure 4-23 shows the end of the wizard. To apply the settings you have selected, click **Finish**. You can also modify your selections by going back.

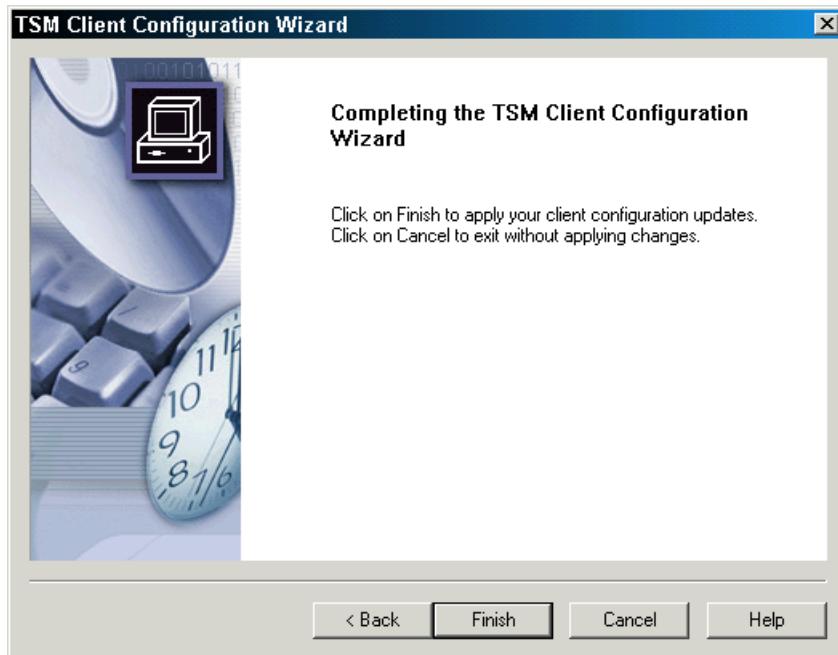


Figure 4-23 Completion of client configuration wizard

10. The client GUI automatically starts. You are prompted to enter the client node ID and password, as shown in Figure 4-24. You need to ask your Tivoli Storage Manager administrator for the password that was specified for your client node when it was registered at the Tivoli Storage Manager server. You can now run basic backup operations.



Figure 4-24 Windows Tivoli Storage Manager client login

4.5.2 Web client configuration

To run the configuration tasks and launch the configuration wizard from the backup-archive client main screen. Select **Utilities** → **Setup Wizard** from the client GUI, shown in Figure 4-59 on page 172.

1. We are setting up the Web client, so select **Help me configure the TSM Web Client**, as shown in Figure 4-25.

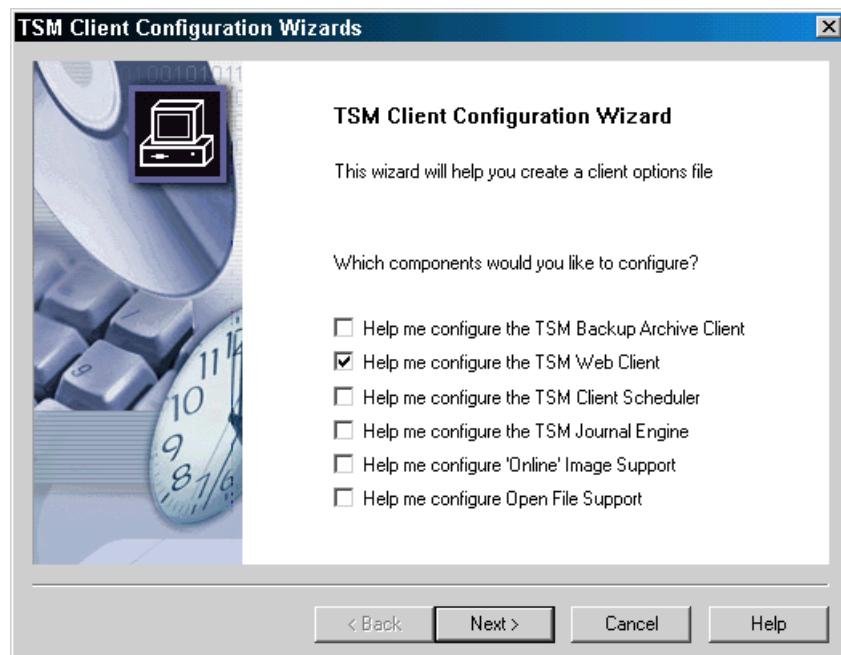


Figure 4-25 Configuring the Web client selection

2. We want to install a new Web client, so select this option as in Figure 4-26.

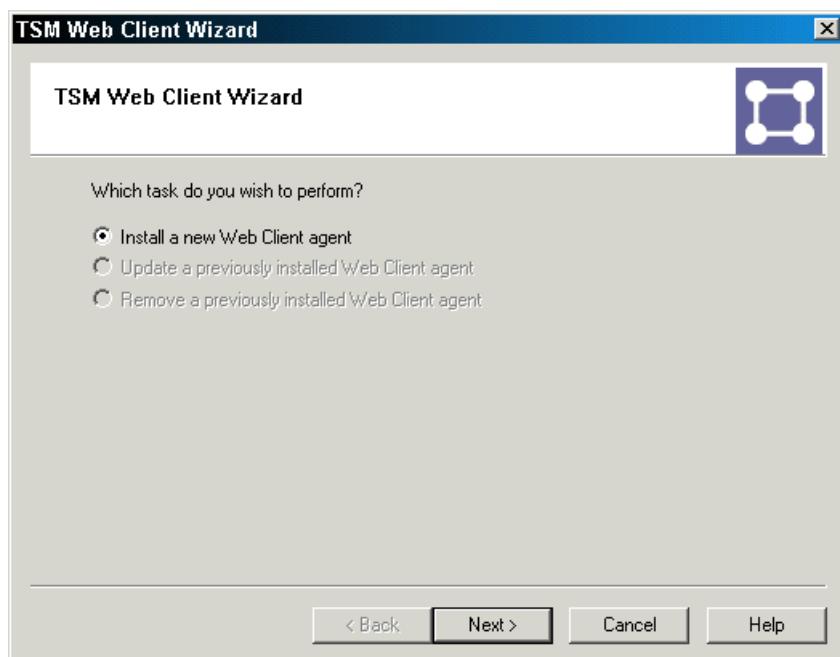


Figure 4-26 Installing a new Web client screen panel

3. As shown in Figure 4-27, we select the name of the Web Service “Client Acceptor process, which you will see running and also will be seen later in the Windows services list. We accept the default name.

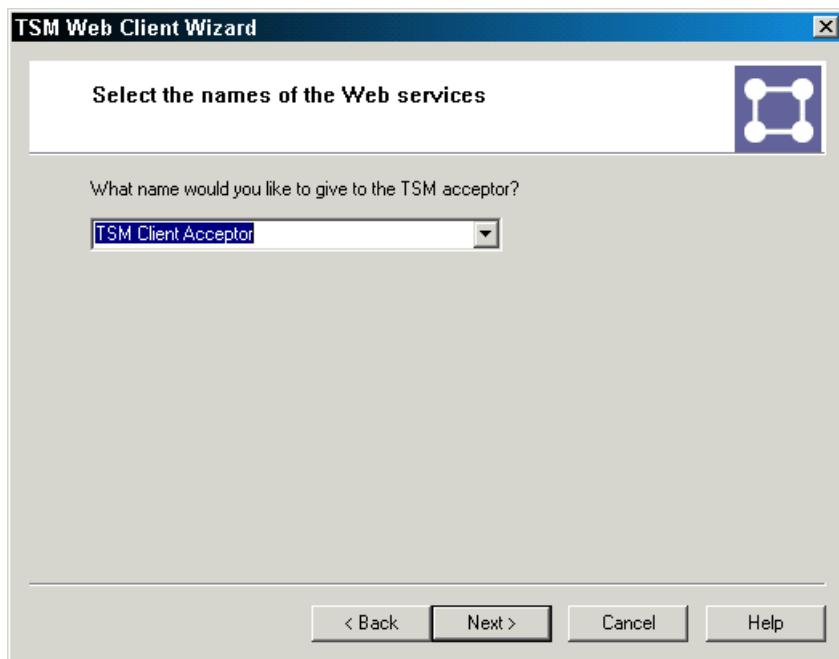


Figure 4-27 Selection of the Web services

4. Enter the path and file name of the options file, as in Figure 4-28. We have chosen the default location, which is the client installation directory, in subdirectory `baclient`.

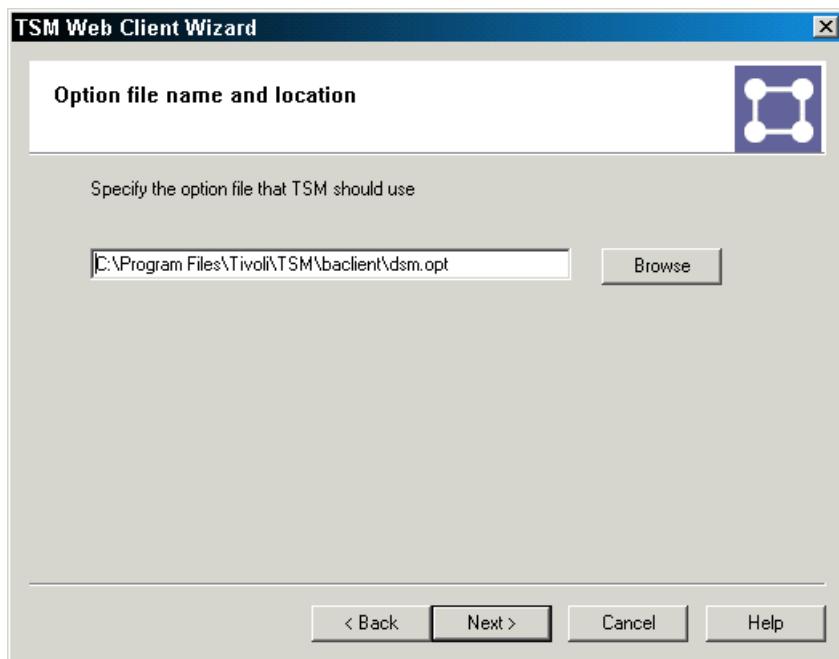


Figure 4-28 Choose the path and file name of the options file

5. In Figure 4-29, specify the port that the Web Client Acceptor will listen on. This will be the port you reference when connecting with your browser. We choose the default, 1581.

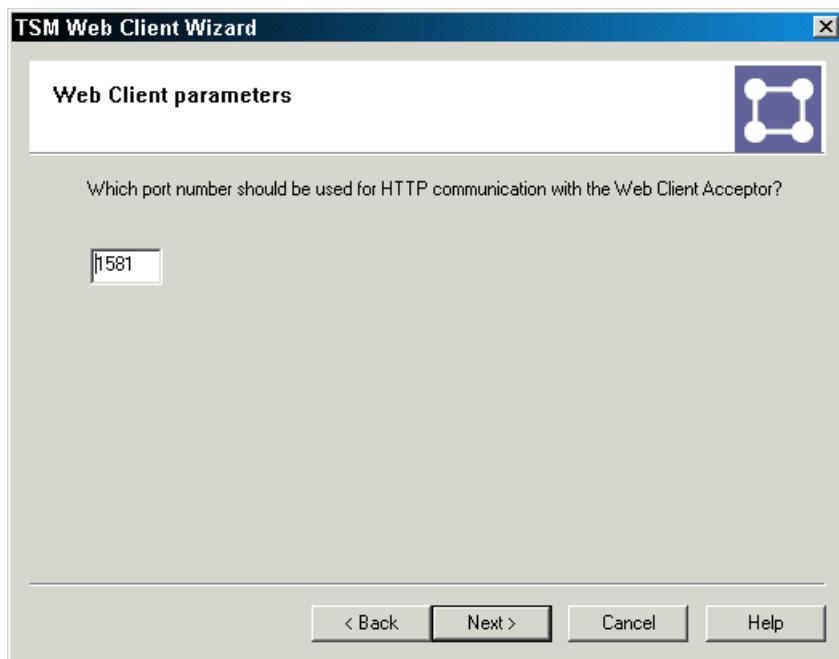


Figure 4-29 Enter a Web Client Acceptor port number

6. It should display your client node name. Enter in the client password, as shown in Figure 4-30. We recommend checking the **Contact the TSM server to validate password** box so that the client will authenticate with the Tivoli Storage Manager server to validate the password that you specified.



Figure 4-30 Enter the client's node name and password

7. In the Service login options panel, select the Windows account that will start and run the Web client service. Also you can select whether to start the service automatically or manually, as shown in Figure 4-31.

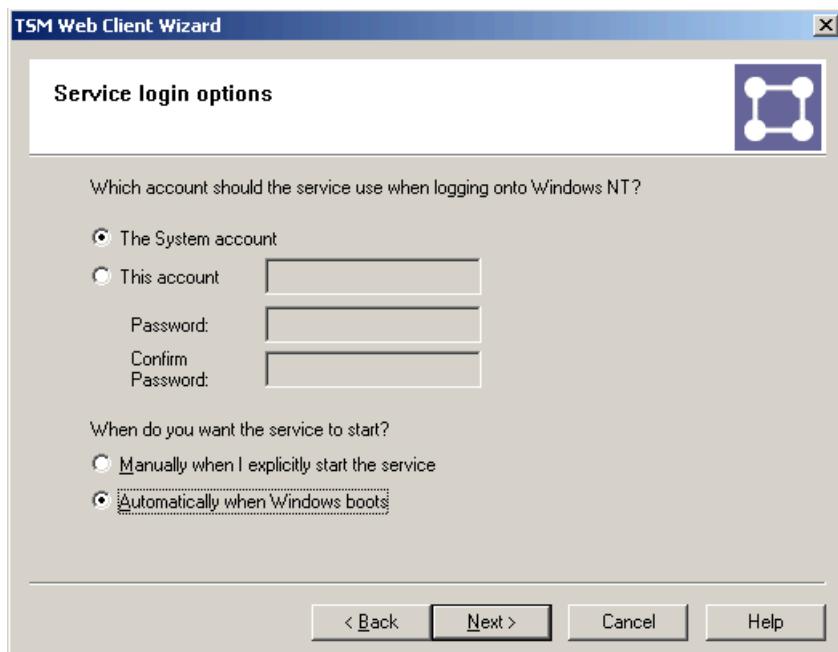


Figure 4-31 Selection panel for the account and startup options

8. Next, choose a name for the remote client agent, as in Figure 4-32. This will be the name of the service that displays in the Windows services applet. Note that this service only runs when requested by the Web client; therefore, you do not specify startup options here. We accepted the default name.

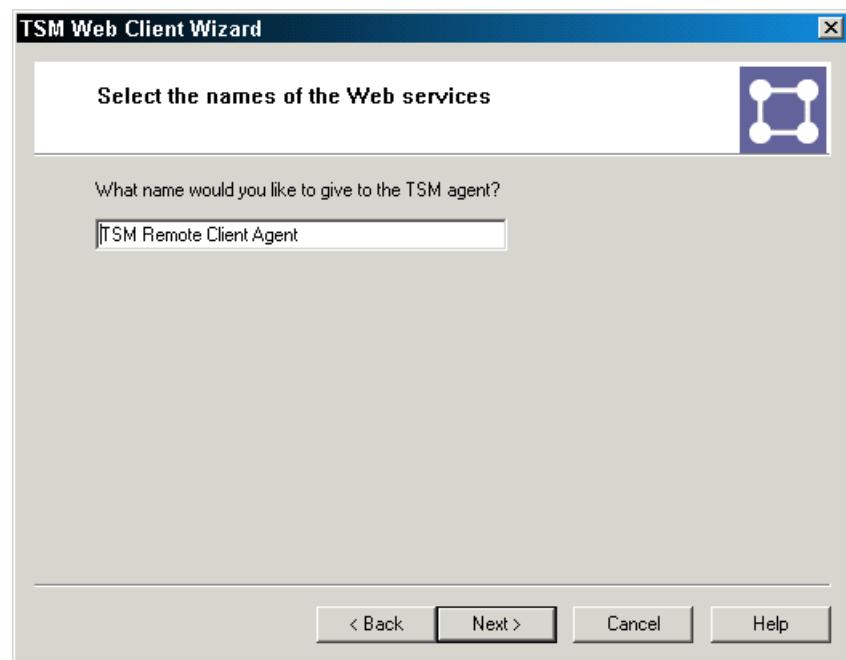


Figure 4-32 Select the name of the client agent

9. Determine whether you want to revoke access to this Web client for administrators with access privilege, which is shown in Figure 4-33. Note that this will not restrict the administrators who are granted client owner privilege. We leave it with default option, which is no restriction to other administrators.

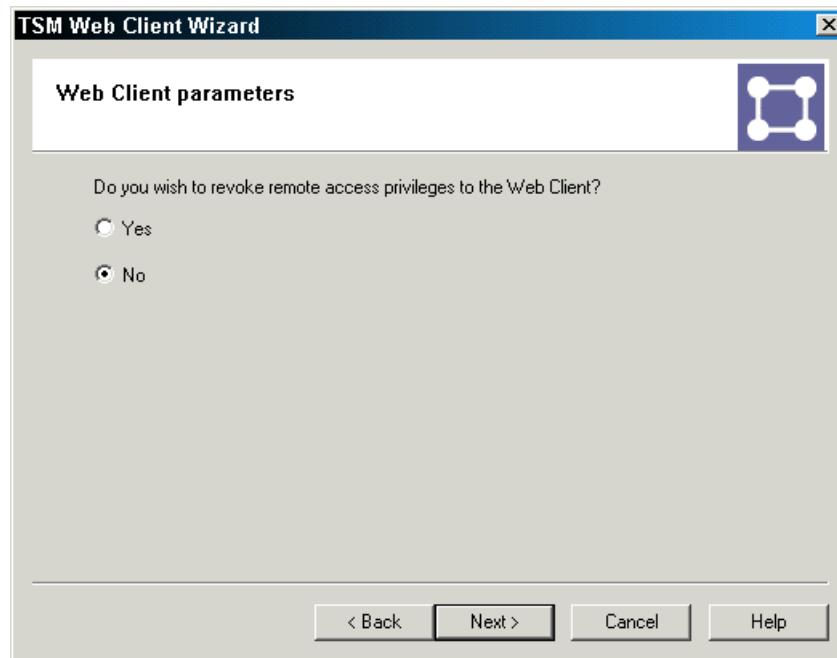


Figure 4-33 Choose whether to allow remote access to the Web client

10. In the window shown in Figure 4-34 choose whether to start the Web client services after this wizard completes.

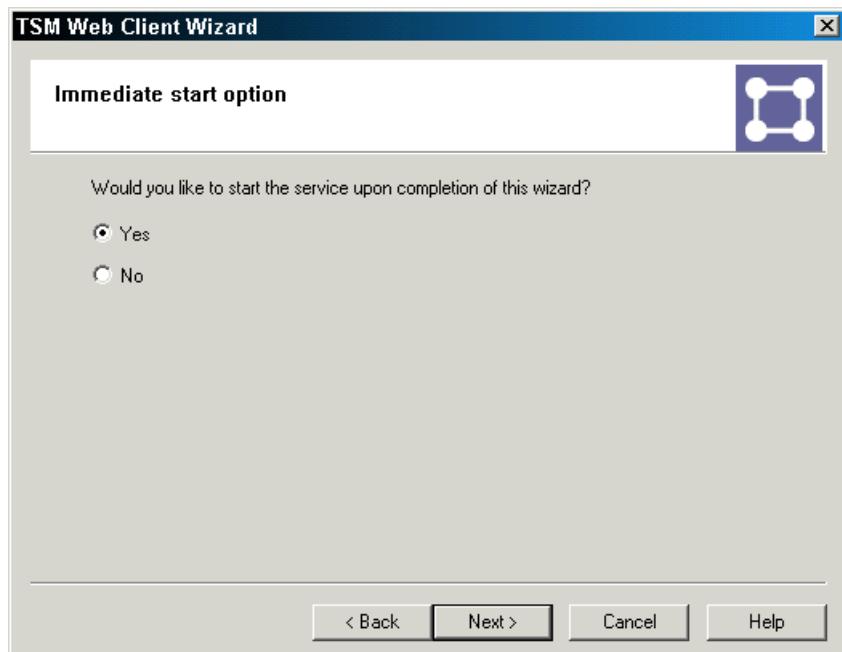


Figure 4-34 Choose whether to start the service after the wizard completes

11. Figure 4-35 is the completion screen for the wizard. Click **Finish** to commit the changes or **Back** to review your selections.

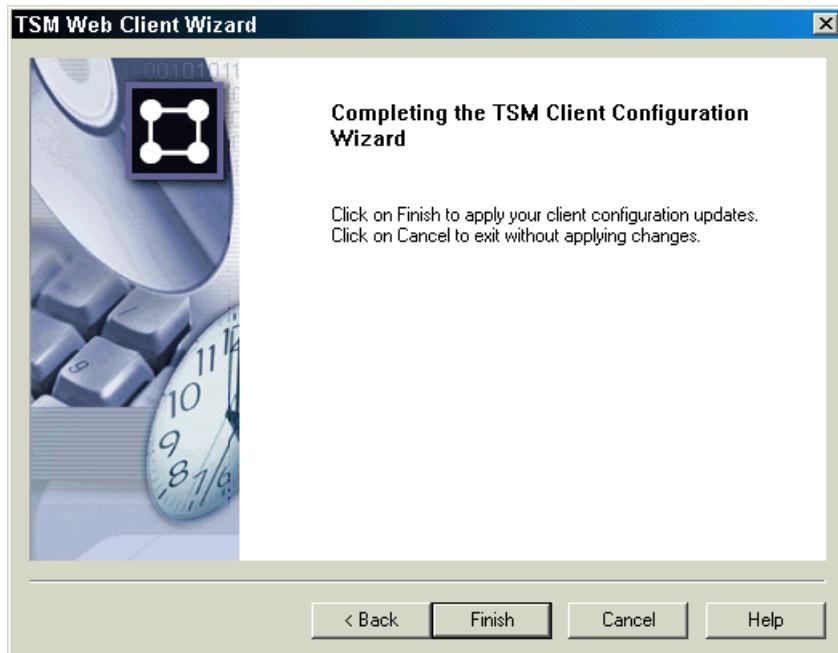


Figure 4-35 Completion panel for the Web client configuration

12. Figure 4-36 shows that we are all done.

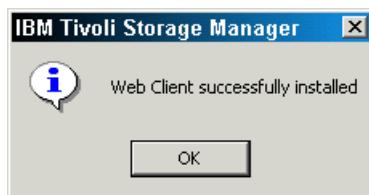


Figure 4-36 That is all for this wizard

4.5.3 Client scheduler configuration

This section shows how to use the Windows wizard to configure the client scheduler, which will communicate with the Tivoli Storage Manager server to perform scheduled events, such as incremental backups. Unlike with the Web client, there are situations where you might operate more than one scheduler service at a time. This technique is used when you want your data to be backed up by different node names. For example, if you are running a database server in

an MSCS cluster environment, you will have one scheduler service backing up operating system files on local disks using a local node name and another scheduler service, running under a cluster-wide node name, backing up database files on shared disks. If this is the case you would run this wizard multiple times to configure each scheduler service.

1. Launch the wizard as before (Figure 4-25 on page 139), but this time select **Help me configure the TSM Client Scheduler**.
2. As this is our first scheduler service, we only have the option to install a new scheduler service, as shown in Figure 4-37.

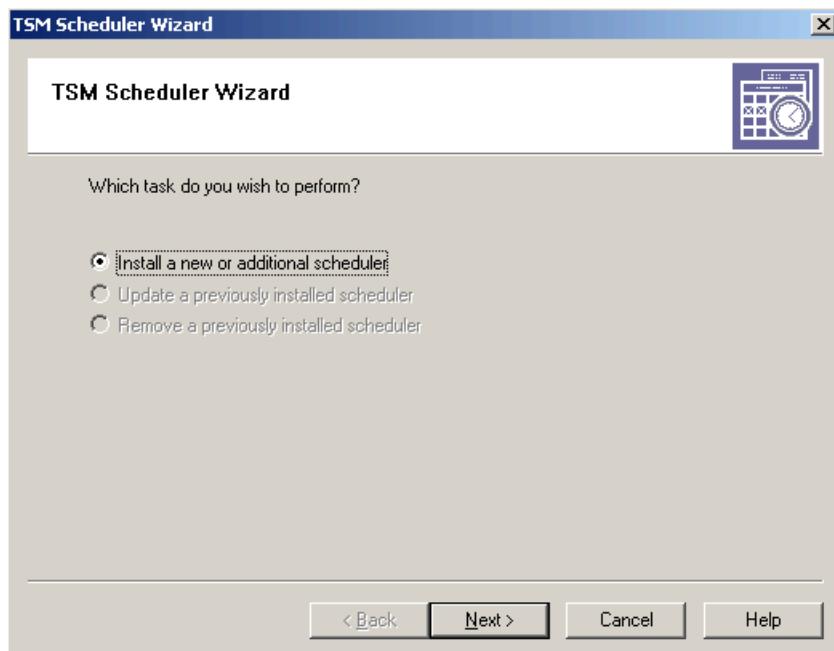


Figure 4-37 Installing a new client TSM Scheduler Wizard selection

3. Enter a name for the scheduler service, as in Figure 4-38. You can choose to install it on the local machine or on a remote machine. Optionally, you may specify for the Web Client Acceptor Daemon (CAD) to operate the scheduler service. This is useful if running in memory-constrained environments, as the CAD consumes less memory than the traditional client scheduler service.

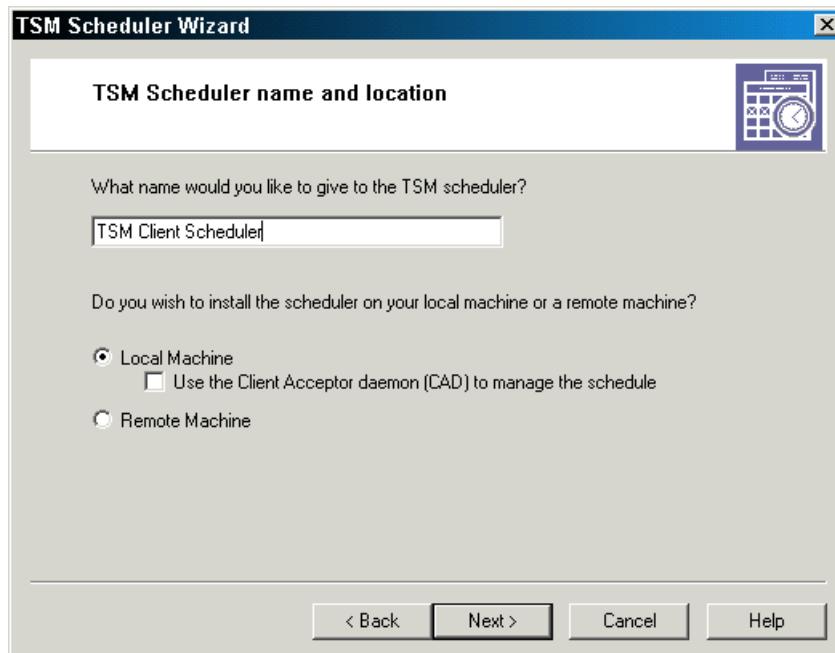


Figure 4-38 Choosing the name and location of the client scheduler

4. In Figure 4-39, enter the option file. For our first scheduler instance, this is the standard client options file. If running multiple scheduler clients, then each needs its own client options file.

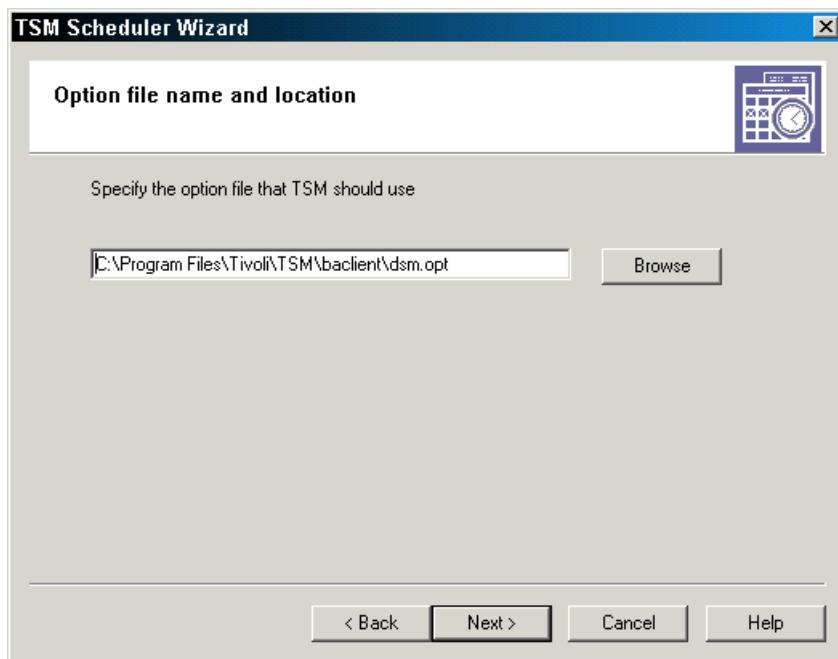


Figure 4-39 Select the option file to use

5. Enter the client node name and password (Figure 4-40). As before in step 6 on page 144, you can choose to immediately authenticate to the Tivoli Storage Manager server.

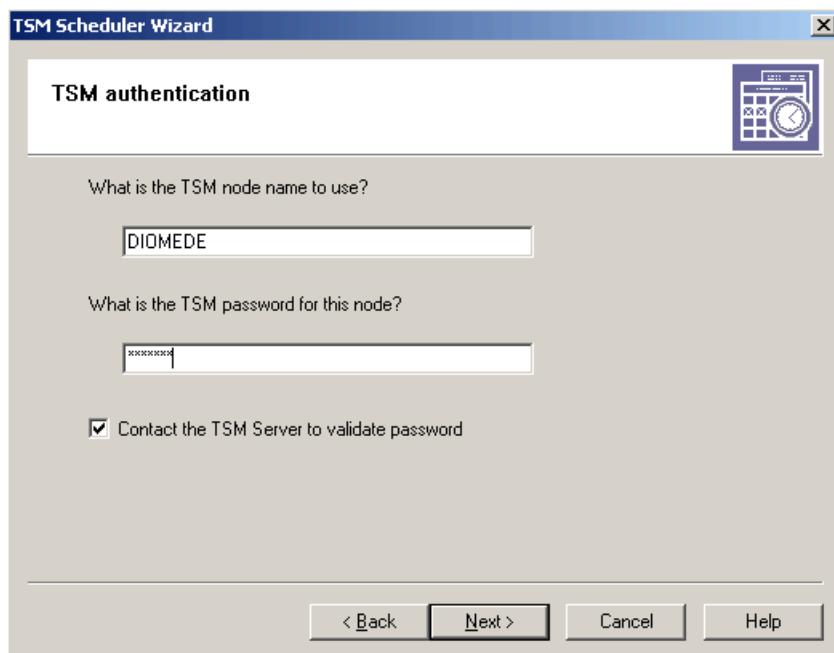


Figure 4-40 Supply the client node name and password

6. Choose which Windows account to run the service in, and the startup options, as in Figure 4-41.

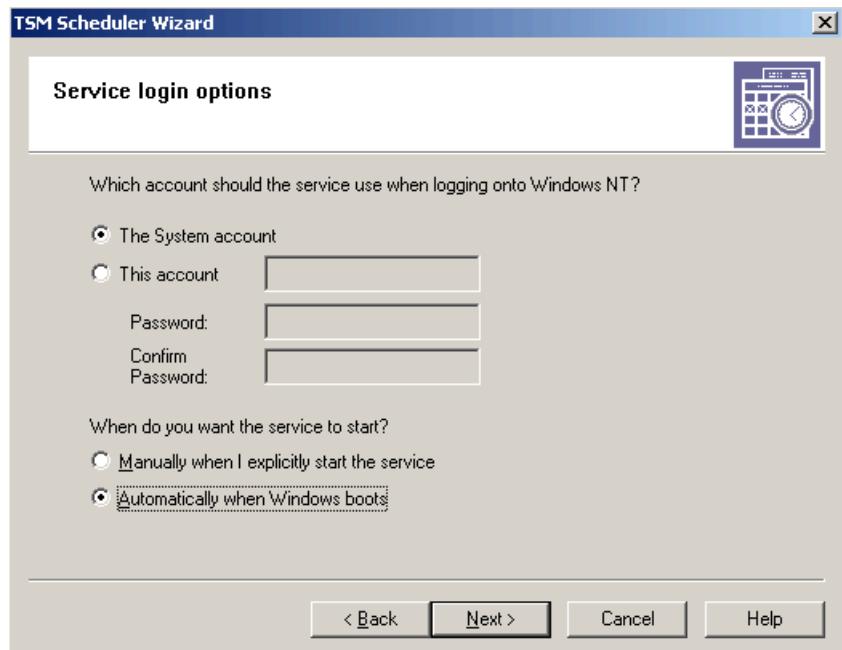


Figure 4-41 Choose the Windows account and starting options for the client

7. Enter a directory and name for the schedule and error log files. We accepted the default locations, as shown in Figure 4-42. We also selected to log events to the Windows Event Log.

The schedule log contains the results of scheduled operations, and can be either verbose or summary information, depending on the options set in the dsm.opt file. The error log will contain any errors created by the scheduler, communication sessions with the server, and general backup failures.

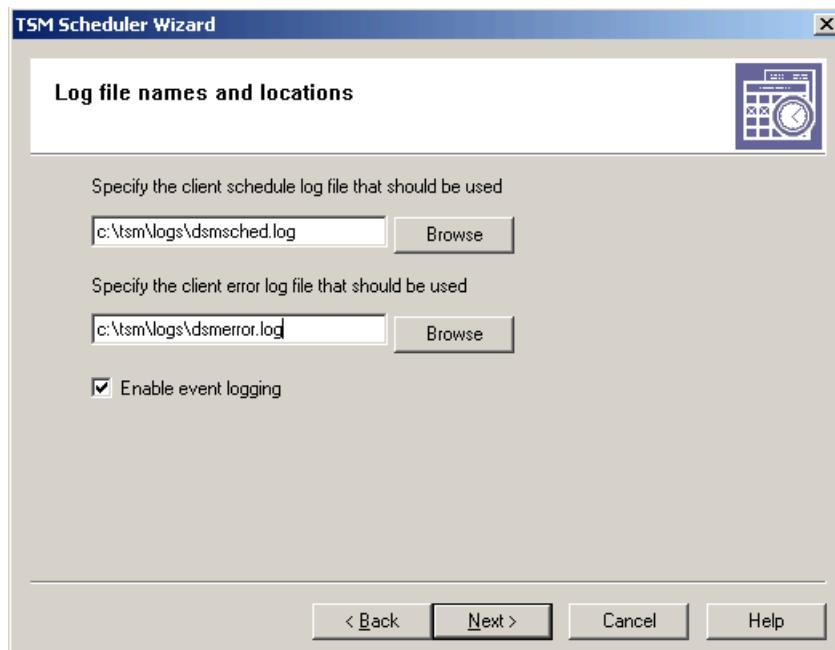


Figure 4-42 Defining schedule and error log names

8. In Figure 4-43, choose whether to start the scheduler service after this wizard completes.



Figure 4-43 Startup choice once the wizard has completed

9. Figure 4-44 is the completion screen for the wizard. Click **Finish** to commit the changes or **Back** to review your selections.

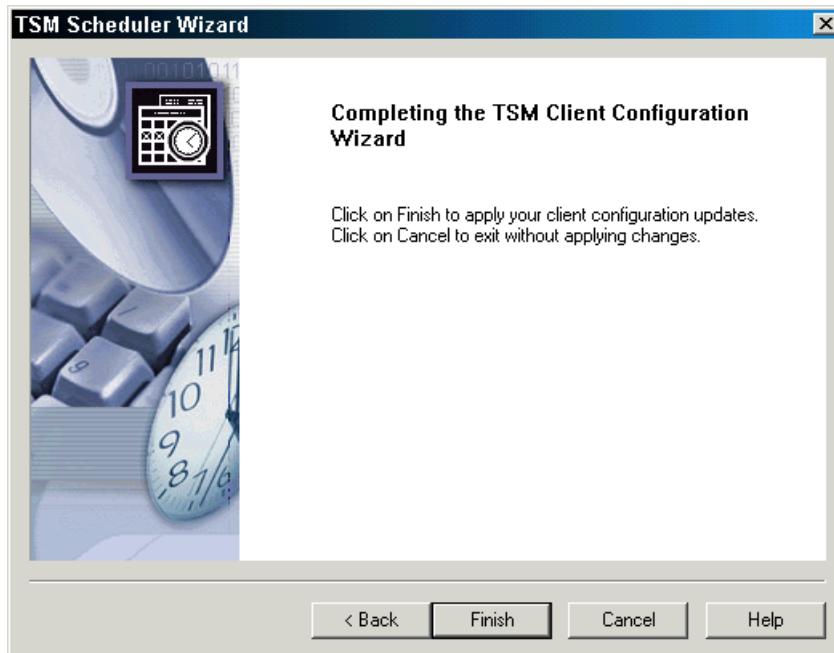


Figure 4-44 Configuration completion panel

10. Figure 4-45 shows the successful completion message.



Figure 4-45 Scheduler installed

4.5.4 Journal engine configuration

The journal engine component observes and keeps track of changes in files in local file systems. During incremental backups this information is used to select files for backup, which improves performance compared with the standard technique of scanning the file system for changes.

This section shows how to configure this feature with the wizard:

1. Start the wizard from the backup-archive client and select **Help me configure the TSM Journal Engine** from the screen shown in Figure 4-25 on page 139.
2. In Figure 4-46, choose **Install a new Journal Engine**. This panel also has options to update and remove the journal engine if it already exists.

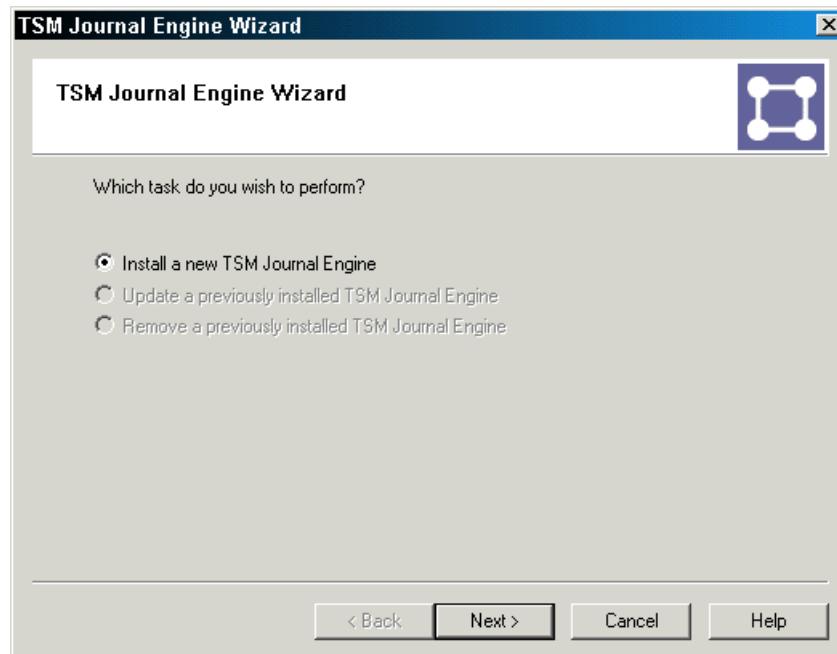


Figure 4-46 *Installing a new journal engine*

3. In the screen shown in Figure 4-47 select which file systems you want to journal. You can select individual file systems or check to **Journal all local file systems**.

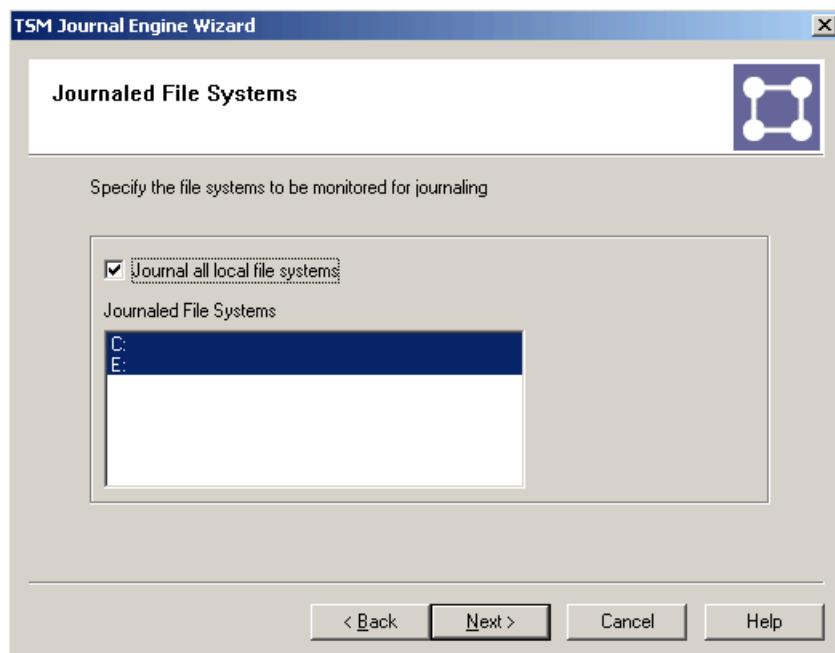


Figure 4-47 Choose the file systems that are to be journaled

4. In the screen shown in Figure 4-48 specify where to put the journal database. You can have one single journal database for all the journaled file systems, or have the journal files spread across the respective file systems. If running the journal engine in a clustered environments, you would want separately stored databases on the shared cluster disks, so that they are available in the event of a failover.

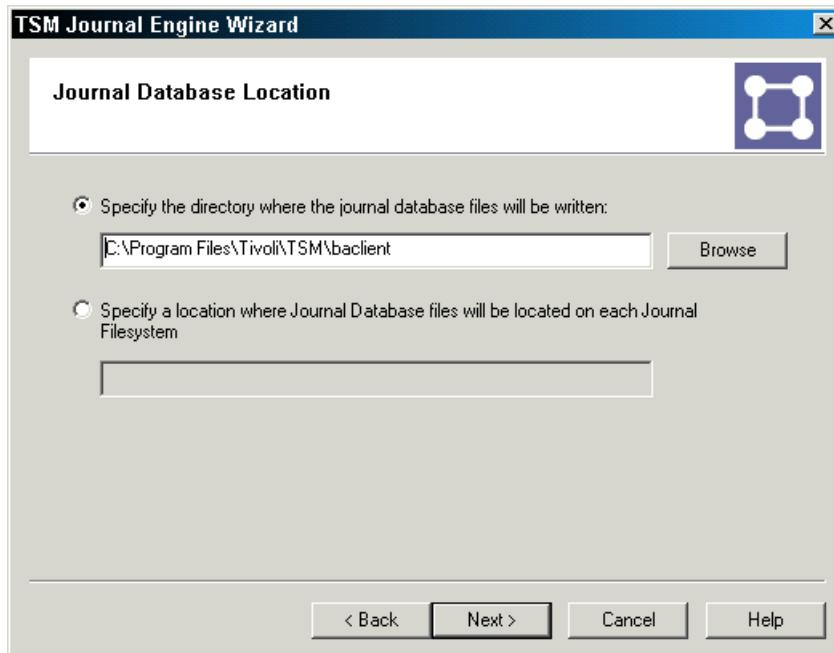


Figure 4-48 Specify the location for the journal database

5. In the next screen (Figure 4-49 on page 161) you specify which particular changes in the file systems are to be monitored by the journal engine. By default, creating new objects, changing the content of the existing ones, and changing access control attributes and other NTFS security changes are monitored. We use these defaults, since there is usually no need to monitor changes such as file size (which will be caught by last modification time) and last access time (which does not necessarily mean that an object is being changed).

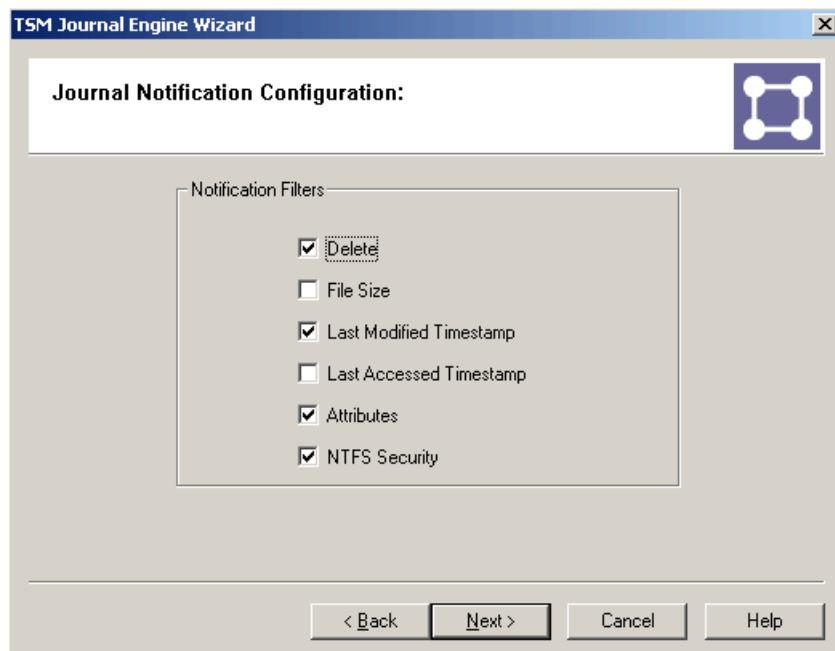


Figure 4-49 Journal engine notification filters

6. You can limit the maximum size of the journal database. We recommend not doing this, as shown in Figure 4-50.

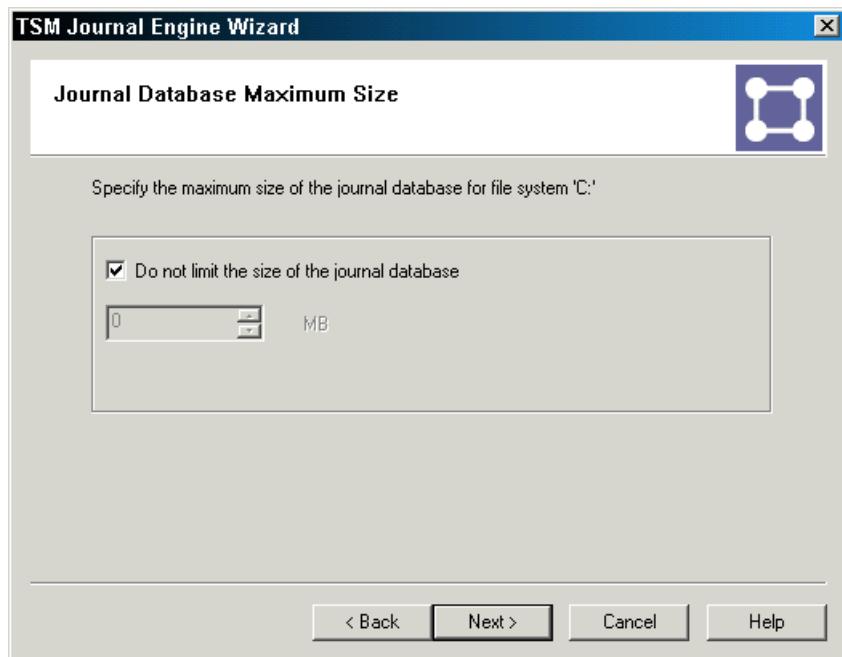


Figure 4-50 Journal database maximum size panel

7. Define the service login options. As with the other services, we recommend running as the system account, as shown in Figure 4-51.

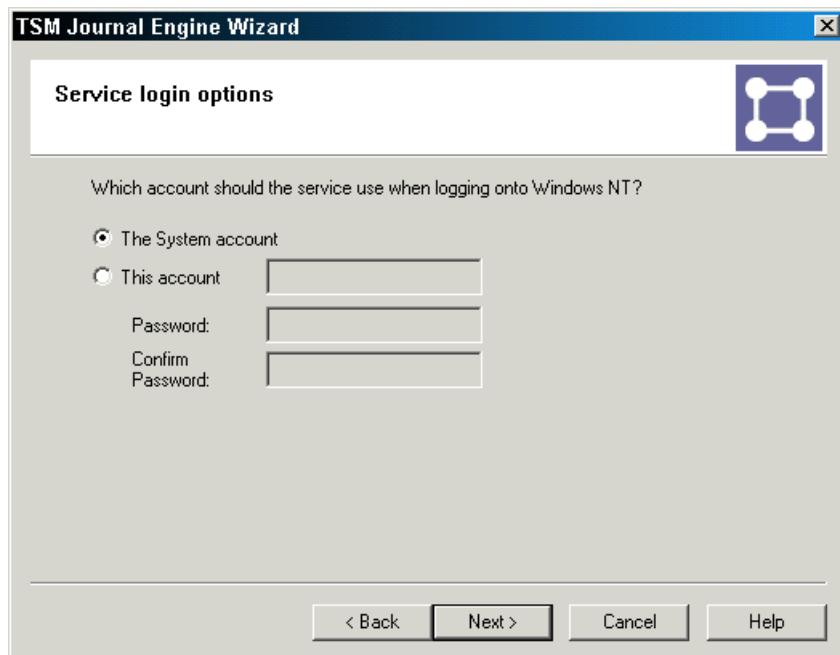


Figure 4-51 Login properties for the journal service

8. In the screen shown in Figure 4-52 we select to start the service immediately.

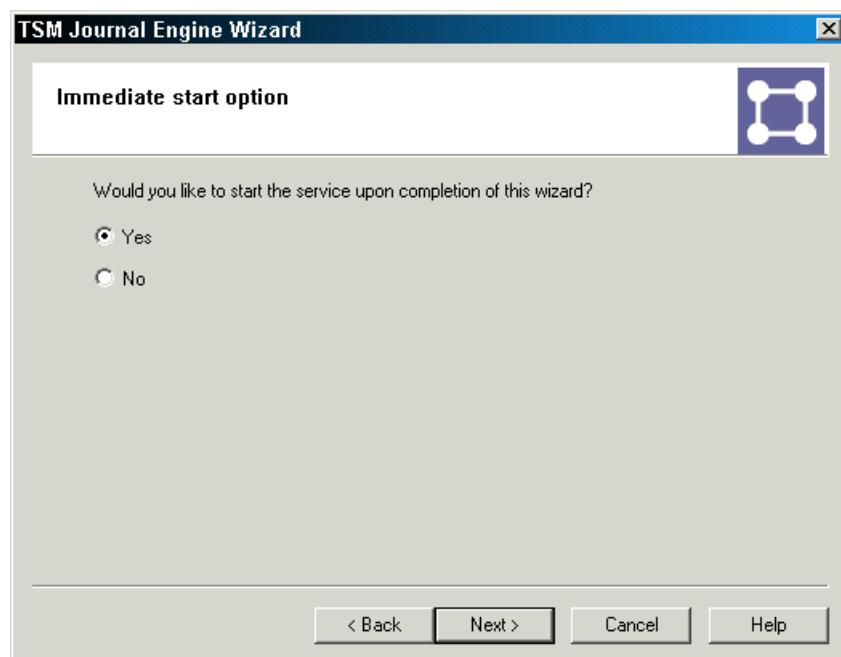


Figure 4-52 Start up service after the wizard completes

9. Figure 4-53 is the completion screen for the wizard. Click **Finish** to commit the changes or **Back** to review your selections.

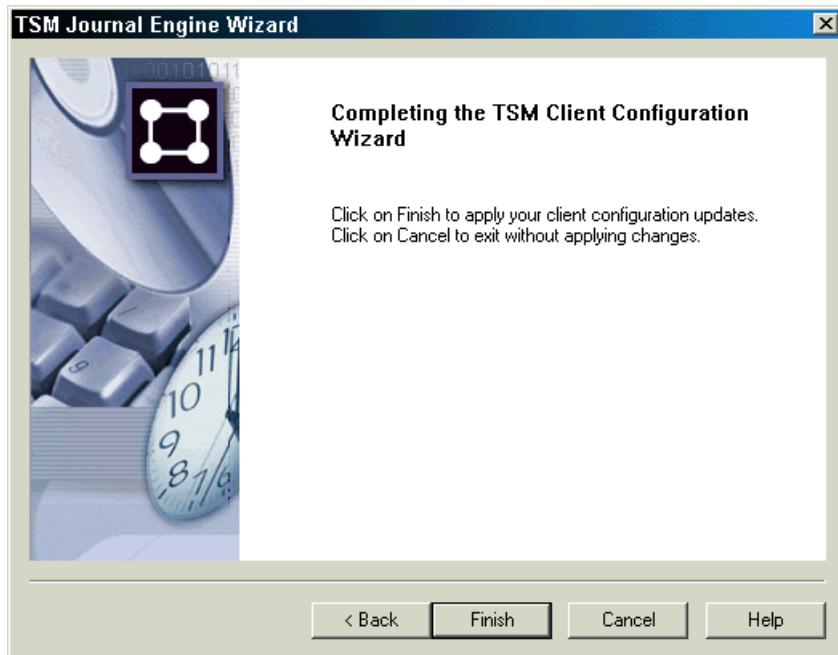


Figure 4-53 Journal service completion wizard

10. The journal engine is successfully installed, as shown in Figure 4-54.



Figure 4-54 Journal engine successfully installed panel

4.5.5 Online image support configuration

In this section we describe how to configure online image support:

1. Start the wizard from the backup-archive client and select **Help me configure 'Online' Image Support** from the screen shown in Figure 4-25 on page 139.

2. Select **Install the Logical Volume Snapshot Agent**, as in Figure 4-55.

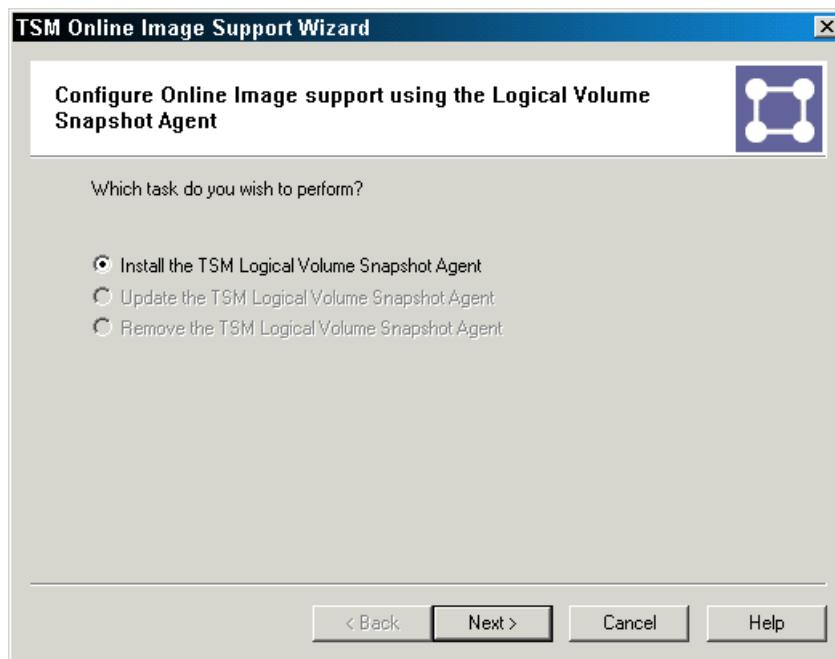


Figure 4-55 *Install panel for the online image support*

3. There are no options to select. The agent simply performs the installation. Click **Next** on the completion window. You are prompted to reboot the system (Figure 4-56 on page 167).



Figure 4-56 Successful configuration of online image support

4.5.6 Open File Support configuration

As with the previous configuration, Open File Support is very short and simple. Open File backup is now supported on all supported Windows platforms, such as Windows 2000, XP, and the recently added Windows 2003.

1. Start the wizard from the backup-archive client and select **Help me configure Open File Support** from the screen shown in Figure 4-25 on page 139.
2. As shown in Figure 4-57, select **Install the Logical Volume Snapshot Agent** for open file support.

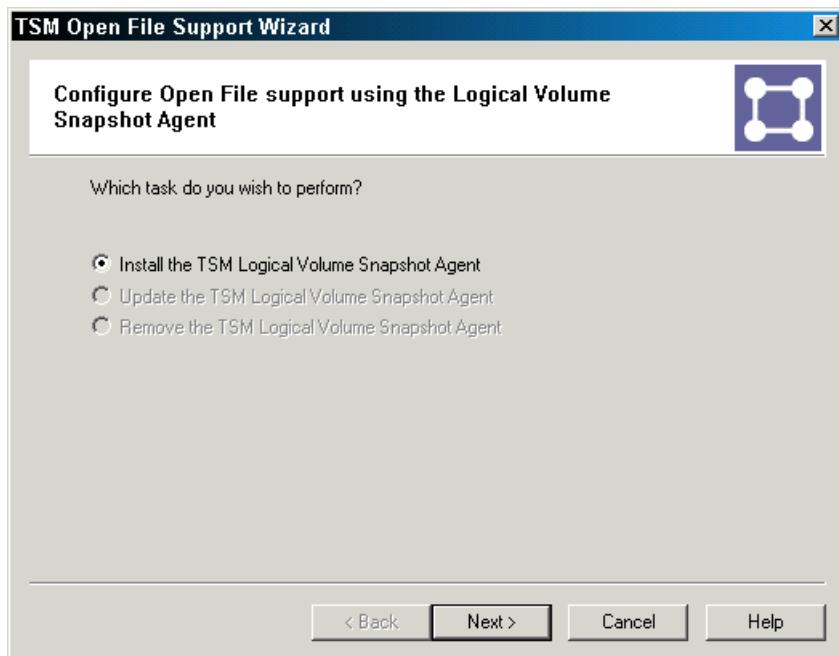


Figure 4-57 Installation of the Logical Volume Snapshot Agent panel

3. There are no options to select. The agent simply installs. Click **Next** on the completion window. Figure 4-58 shows that the agent has successfully installed.

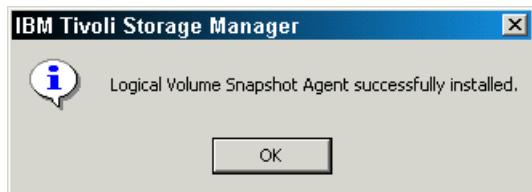


Figure 4-58 Successfully completed panel

4.6 Client interfaces

Tivoli Storage Manager client interfaces are used to perform client tasks on the Tivoli Storage Manager server. In this section we describe how to start, use, and stop the command line interface (CLI) and the GUI. Example 4-12 on page 169 lists all available backup-archive client interfaces by platform.

Example 4-12 Backup-archive client interfaces by platform

Platform	Command-line client	Native GUI	Java GUI	Web client	API client
Apple Macintosh	x	x			
Hewlett-Packard HP/UX PA-RISC	x		x	x	x
Hewlett-Packard HP/UX Itanium®	x		x	x	x
IBM AIX 5L	x		x	x	x
Linux for x86	x		x	x	x
Linux for pSeries	x		x	x	x
Linux for iSeries	x		x	x	x
Linux for zSeries	x			x	x
Microsoft Windows 2000 Professional	x	x		x	x
Microsoft Windows XP	x	x		x	x
Microsoft Windows 2000 Server, Advanced Server, Datacenter	x	x		x	x
Microsoft Windows 2003 Standard, Enterprise, Datacenter	x	x		x	x
Novell NetWare	x			x	x
Sun Solaris	x		x	x	x
OS/400®					x
z/OS	x			x	x

There are minor differences between the backup-archive client code on different platforms. For example, the Windows client has specific options to handle the Windows registry information, which are not found in any other platform. Despite those specific options, all commands are the same except for the file space specification for each platform (in UNIX/Linux this uses the format /usr/tivoli, and in Windows, D:\newdir). Although the examples in this section are based on

UNIX, we also give examples of Windows commands.

4.6.1 Command line

The command-line interface (CLI) is a character mode interface, and therefore is well suited for those users who are generally familiar with these types of interfaces, for example, UNIX or Windows shells. It is also useful if you cannot access the GUI for some reason, or for creating scripts to automate a backup process. The CLI can be used for backup, restore, archive, or retrieve operations and to start the Tivoli Storage Manager scheduler.

Starting a session

To start the command-line interface, enter `dsmc` at the operating system prompt, as shown in Example 4-13.

Example 4-13 Backup-archive client command-line interface

```
root@Atlantic /: dsmc
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/06  10:54:16
  (c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.
Node Name: ATLANTIC
Please enter your user id <ATLANTIC>:
Please enter password for user id "ATLANTIC":

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Data compression forced off by the server
  Server date/time: 02/20/06  10:54:16  Last access: 02/20/06  10:54:04
tsm>
```

You can see the prompt `tsm>`, where you can type backup-archive client commands. When issuing the first command, you may be prompted for your password before the command is executed. This occurs if you are not using automatic password handling. If you set up your client to use automatic password handling, by setting the `PASSWORDACCESS` option to `GENERATE`, the command you issue will be executed directly.

Once a command is executed, you always return back to the `tsm>` prompt. This interactive method is also called *loop* mode.

Another way to start a client session is the so-called *batch* mode. You simply type `dsmc` together with the actual command parameter that you want to execute. In this mode, the backup-archive client processes the command and returns to

the operating system prompt. This is the recommended way to use the `dsmc` command when creating scripts for automation. You can create each `dsmc` command in turn (as well as any other operating system command you want to include in the script) and save it in a batch file for processing later.

Help for the CLI

Example 4-14 shows the Help utility available from the `tsm>` command prompt. Type `help` and then select a number from the list.

Example 4-14 Backup-archive client help options

```
tsm> help
```

To search the IBM Tivoli Storage Manager technical support Web site to find technical solutions and answers to frequently asked questions, refer to <http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html>.

The following help topics are available.

Enter the number of the desired help topic or 'q' to quit,
'd' to scroll down, 'u' to scroll up.

- 0 - Summary of Changes
 - 1 - Using Commands
 - 2 - Select from the commands listed below:
 - 3 - ARCHIVE
 - 4 - BACKUP GROUP
 - 5 - BACKUP IMAGE
 - 6 - BACKUP NAS
 - 7 - BACKUP WAS
 - 8 - CANCEL PROCESS
 - 9 - CANCEL RESTORE
 - 10 - DELETE ACCESS
 - 11 - DELETE ARCHIVE
 - 12 - DELETE BACKUP
-

Stopping a session

If the Tivoli Storage Manager backup-archive client is running in loop mode and resting at the `tsm>` prompt, enter `quit` to end the session as shown in Example 4-15. This terminates the connection with the Tivoli Storage Manager server and returns to the calling program, which is normally the operating system prompt.

Example 4-15 Exiting a loop mode session

```
tsm> quit  
root@atlantic / >
```

Note: To terminate a running backup-archive session, if it is executing a command, either enter CTRL-C in the session window or ask the Tivoli Storage Manager administrator to issue the **cancel session** command. If you use CTRL-C to cancel a running restore operation, the Tivoli Storage Manager administrator also needs to cancel the restartable restore using the **cancel restore** command.

4.6.2 GUI

Most end users find the GUI more attractive and intuitive than the command line. You can use it for all Tivoli Storage Manager client operations except for scheduled operations.

Starting a session

To start the GUI, enter **dsm** at the operating system prompt. The GUI is almost the same on Windows and UNIX/Linux.

Figure 4-59 shows the main screen of the client GUI on Windows.

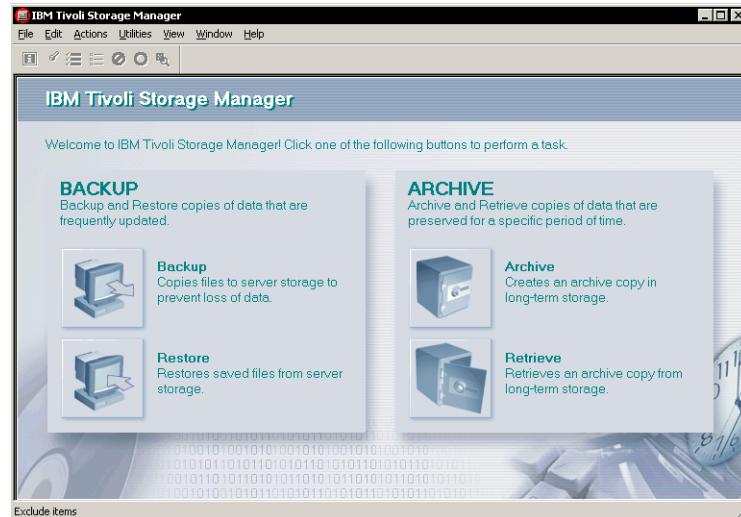


Figure 4-59 Windows GUI client interface

Figure 4-60 shows the main screen of the Java™-based client GUI on UNIX and Linux.

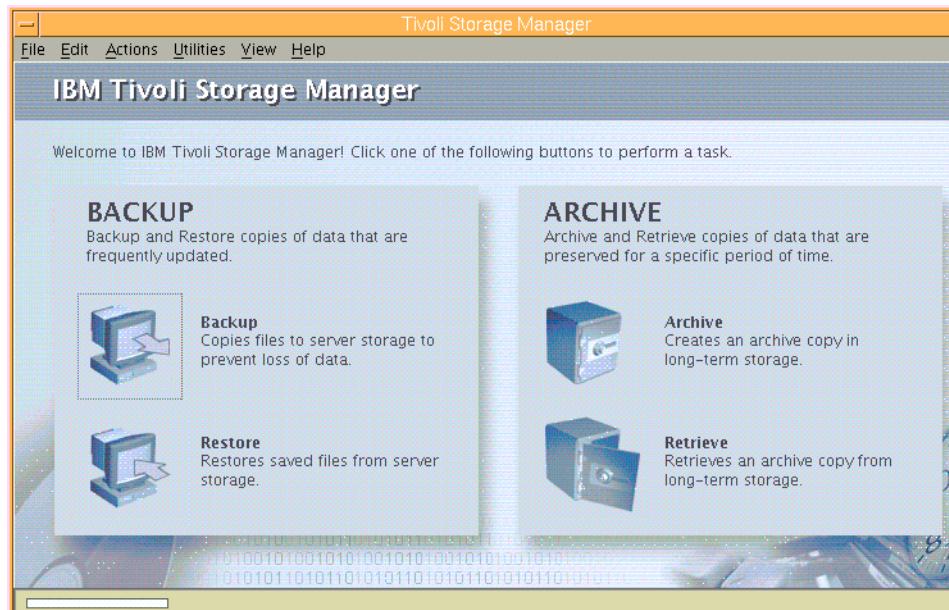


Figure 4-60 Java-based backup-archive client GUI interface

Depending on the features of your UNIX machine, for example, if it has the Common Desktop Environment (CDE) installed, you can add an option in the workplace screen so that it is easier to start Tivoli Storage Manager.

Stopping a session

To stop a GUI session, select **File** → **Exit** from the menu in the main window.

4.7 Client scheduler

A Tivoli Storage Manager administrator can create schedules for clients so that they perform defined tasks automatically on a regular basis. For example, you can define schedules to automatically run an incremental file backup at the end of each day, or to archive a particular directory tree every Friday.

This procedure, known as central scheduling, is a cooperative effort between the server and the client node. You associate clients with one or more schedules that are part of the policy domain maintained in the Tivoli Storage Manager database. You use the central scheduler on the server and start the client scheduler

process on the workstation. Once you start the client scheduler, further intervention is not necessary.

Note: The schedule start time is based on the server clock, not the client clock. This makes it easier for you to manage schedule start times for clients in different time zones.

With regard to scheduling, you may also want to:

- ▶ Display information about available schedules.
- ▶ Display information about work that the schedule has completed.
- ▶ Modify scheduling options in the client options file.

Note: Make sure that you have the Tivoli Storage Manager administrative command-line client installed and that the client-server communication is working correctly before you attempt to start the client scheduler service.

You cannot start the client scheduler from the Tivoli Storage Manager GUI.

4.7.1 Starting the client scheduler

You can start the Tivoli Storage Manager client scheduler either manually or with each system start. If you change the client options files while the client scheduler is running, it must be stopped and re-started to pick these up.

However, for Windows clients, if you chose to have the scheduler managed by the Client Acceptor Daemon (CAD), in step 3 on page 151, this is not required. CAD reads the client options file whenever an operation, such as scheduled incremental backup, is performed; therefore, it can pick up options file changes dynamically.

Manual start

Note: The client scheduler can only be started by a Tivoli Storage Manager-authorized user. This is a user who has administrative authority for the Tivoli Storage Manager client on a workstation. This user changes passwords, performs open registrations, and deletes file spaces.

You can manually start up the Tivoli Storage Manager scheduler if it was accidentally stopped, if you want to re-start it to pick up a changed client option, or if you want to force it to run immediately, for example, while testing a new function.

To start the client scheduler on your client node and connect to the server scheduler, enter the **dsmc schedule** command from the operating system prompt, as shown in Example 4-16. You will be prompted to type in the password unless you have set the PASSWORDACCESS GENERATE option in the client option file (dsm.opt). The scheduling requirement is one of the strongest reasons for recommending the PASSWORDACCESS GENERATE option. If you do not specify this you will always be prompted for a password unless you include it in a script file or use the PASSWORD client option in the option file. Either possibility is undesirable. There is probably no one around to enter the password, and entering it in a script or in the option file in plain text exposes a security risk.

Since a schedule has been defined for this client, the output shows the details and specifies when it will execute. The scheduler will remain “quiet” until contacted by the server to start the operation.

Example 4-16 Manually starting the client scheduler

```
root@brazil > dsmc sched
IBM Tivoli Storage Manager
Command Line backup-archive Client Interface-Version 5, Release 2, Level 0.0 h4
(c) Copyright by IBM Corporation and other(s) 1990, 2003. All Rights Reserved.

Querying server for next scheduled event.
Node Name: AIXCLIENT
Session established with server TSMSERVER: Windows
    Server Version 5, Release 2, Level 0.0
    Server date/time: 04/11/03  15:00:59  Last access: 04/11/03  15:00:40

Next operation scheduled:
-----
Schedule Name:      INCR_BKUP
Action:             Incremental
Objects:
Options:
Server Window Start: 09:00:00 on 04/12/03
-----
Waiting to be contacted by the server.
```

When you start the client scheduler, it runs continuously until you close the window, therefore ending the process, or log off your system.

UNIX/Linux

To run the schedule command in the background and to keep the client scheduler running even if you log off your UNIX system, enter the command shown in Example 4-17 on page 176 from the UNIX shell.

Example 4-17 Running the client scheduler in the background - UNIX

```
root@ / > nohup dsmc schedule 2> /dev/null &
```

Windows

We showed how to configure the client scheduler using the wizard in 4.5.3, “Client scheduler configuration” on page 149.

As shown in Figure 4-61, we can see a running scheduler service called TSM Client Scheduler in the Windows service list. It is set to start up automatically.

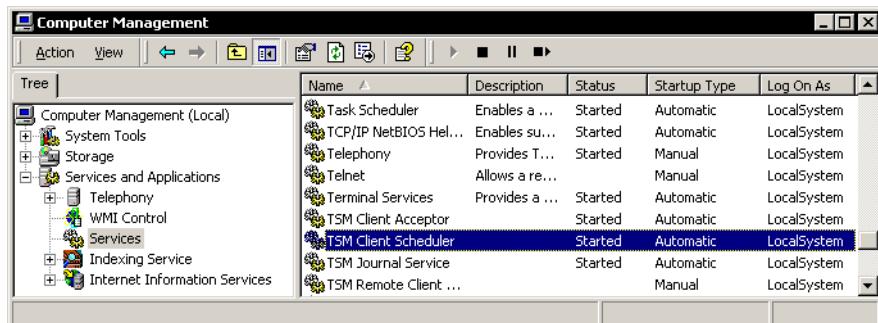


Figure 4-61 Client scheduler service is running on a machine

The Tivoli Storage Manager Windows client also provides a utility, dsmcutil, that may be used as a substitute for the client configuration wizard. It does exactly the same as the wizard, in just one command (although with a couple of necessary parameters) on the operating system command line.

This is particularly useful in enterprise environments where running the client configuration wizard for each single service on each machine would be a time-consuming process. Instead, dsmcutil can be run in a script to configure the scheduler and other services on multiple client machines at once.

Example 4-18 shows how to manually install the client scheduler named *TSM Central Scheduler* on node DIOMEDE on a Windows 2003 machine.

Example 4-18 installation and configuration of scheduler service using dsmcutil

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil install scheduler
/name:"TSM Central Scheduler" /node:DIOMEDE /password:diomedede
/autostart:yes
```

```
TSM Windows NT Client Service Configuration Utility
Command Line Interface - Version 5, Release 3, Level 2.0
(C) Copyright IBM Corporation, 1990, 2005, All Rights Reserved.
Last Updated Sep 17 2005
TSM Api Verison 5.3.2
```

```
Command: Install TSM Client Service
Machine: DIOMEDE(Local Machine)
Installing TSM Client Service:
```

```
Machine : DIOMEDE
Service Name : TSM Central Scheduler
Client Directory : C:\Program Files\Tivoli\TSM\baclient
Automatic Start : yes
Logon Account : LocalSystem
```

```
The service was successfully installed.
```

```
Creating Registry Keys ...
Updated registry value 'ImagePath' .
Updated registry value 'EventMessageFile' .
Updated registry value 'TypesSupported' .
Updated registry value 'TSM Central Scheduler' .
Updated registry value 'ADSMClientKey' .
Updated registry value 'OptionsFile' .
Updated registry value 'EventLogging' .
Updated registry value 'ClientnodeName' .
```

```
Generating registry password ...
Authenticating TSM password for node DIOMEDE ...
```

```
Connecting to TSM Server via client options file
'C:\Program Files\Tivoli\TSM\baclient\dsm.opt' ...
Password authentication successful.
The registry password for TSM node DIOMEDE has been updated.
Starting the 'TSM Central Scheduler' service ...
The service was successfully started.
C:\Program Files\Tivoli\TSM\baclient>
```

The `dsmcutil` utility can also be used to install the other services (Web client, journal engine, and so on) as well as query and update service settings. For more information about the use and syntax of `dsmcutil`, see *IBM Tivoli Storage Manager Backup-Archive Clients Installation and User's Guide*, GC32-0788.

Example 4-19 shows a `dsmcutil` query execution.

Example 4-19 dsmcutil query scheduler service status

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil
query /name:"TSM Central Scheduler"

TSM Windows NT Client Service Configuration Utility
Command Line Interface - Version 5, Release 3, Level 2.0
(C) Copyright IBM Corporation, 1990, 2005, All Rights Reserved.
Last Updated Sep 17 2005
TSM Api Verison 5.3.2

Command: Query TSM Client Service Parameters
Machine: DIOMEDE(Local Machine)

Connecting to service 'TSM Central Scheduler' ...
Service Configuration/Status:
Service Name      : TSM Central Scheduler
Image Path        : "C:\Program Files\Tivoli\TSM\baclient\dsmcsvc.exe"
Logon Account    : LocalSystem
Start Type       : Auto
Current Status   : Started

TSM Client Service Registry Settings:
Client Service Type = Client Scheduler Service
Options file        = C:\Program Files\Tivoli\TSM\baclient\dsm.opt
Event Logging       = YES
TSM Client Node    = DIOMEDE
Comm Protocol     = (value not currently set)
Server             = (value not currently set)
Server Port        = (value not currently set)
Schedule Log       = (value not currently set)
Error Log          = (value not currently set)
Cluster Enabled    = (value not currently set)
Cluster Name       = (value not currently set)
C:\Program Files\Tivoli\TSM\baclient>
```

Automatic start

We recommend the scheduler service to be automatically started when operating system boots. This is to ensure that the server can contact the client to

execute regular schedules, especially if you have an enterprise policy to have Tivoli Storage Manager machines backed up at some point in the day.

If you rely on manual startup, this can be easily forgotten if the owner of the client system has to reboot it for some reason, resulting in a missed backup schedule.

UNIX/Linux

If you want to start the client scheduler when the system reboots, set the PASSWORDACCESS option parameter to GENERATE in your client system options file, and include the following command in the /etc/inittab (for AIX) file:

```
tsm:2345:once:/usr/bin/dsmc schedule >/dev/console 2>&1 #Start Scheduler
```

The scheduler starts the next time the system is rebooted. On other UNIX variants enter a similar command in the startup files.

Windows

We showed how to set up the scheduler service for automatic start in 4.5.3, “Client scheduler configuration” on page 149. You can also do this using dsmcutil.

You can also change settings using the Services applet like any other operating system or application service. Figure 4-62 shows how to do this.

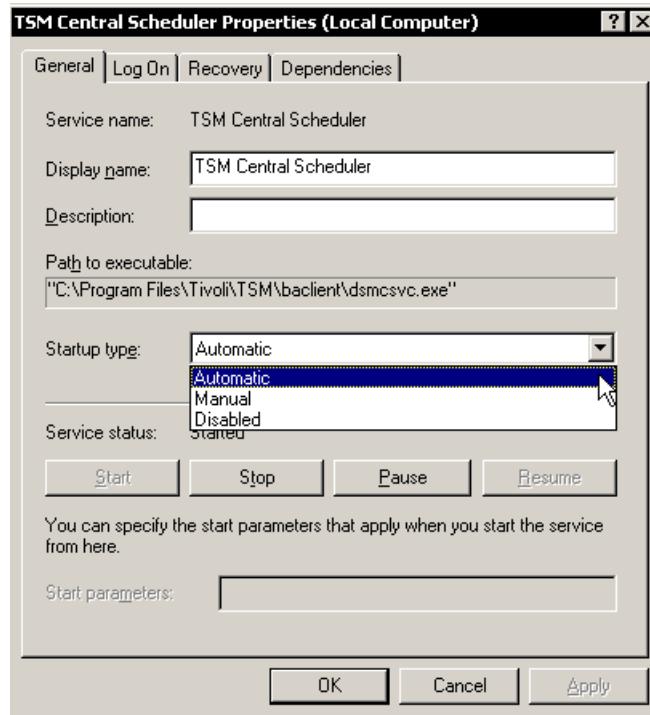


Figure 4-62 Changing startup behavior of the client scheduler service in Windows

4.7.2 Stopping the scheduler

To terminate a running client scheduler in foreground mode, you can cancel the operation by pressing **Ctrl+C** in the session window. If the scheduler is running silently, you can ask the Tivoli Storage Manager administrator to issue the **cancel session** command. The administrator may need to cancel all multi-threaded sessions for the client. If the scheduler is executing a restore process, the Tivoli Storage Manager administrator needs to cancel the restartable restore by issuing the **cancel restore** command.

On Windows platforms, you can also terminate the client scheduler by stopping its service in the Services applet or calling the `dsmcutil stop` command, as shown in Example 4-20.

Example 4-20 Stopping client scheduler service using dsmcutil stop command

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil stop
/name:"TSM Central Scheduler"

TSM Windows NT Client Service Configuration Utility
Command Line Interface - Version 5, Release 3, Level 2.0
(C) Copyright IBM Corporation, 1990, 2005, All Rights Reserved.
Last Updated Sep 17 2005
TSM Api Verison 5.3.2

Command: Stop TSM Client Service
Machine: DIOMEDE(Local Machine)

Stopping the 'TSM Central Scheduler' service ....
The service was successfully stopped.
C:\Program Files\Tivoli\TSM\baclient>
```

4.8 Web client usage

The Tivoli Storage Manager Web backup-archive client is a Java-based interface that enables authorized users to perform remote operations on a backup-archive client system.

4.8.1 Remote client GUI

The Web client is a Java applet that provides a remote client GUI for Tivoli Storage Manager backup-archive clients. Authorized users can access the Web client remotely using a Web browser. The graphic is the initial client hub window displayed in the Web browser when the Web client is accessed.

The Web client can be used from any workstation running a Web browser with Java support, such as Microsoft Internet Explorer or Mozilla Firefox.

4.8.2 Client functions

The Web client supports all of the backup-archive client functions. It can be used to perform all file-based functions such as backup, restore, archive, and retrieve operations. For both UNIX and Windows clients, the Web interface also supports

logical volume operations. The Windows Web client can also back up and restore system objects.

For file-based restore operations, both active and inactive files can be restored, and the point-in-time restore function is supported. You may search for specific files in the backup, restore, archive, or retrieve window, by filtering file names or filtering the directory tree. You can restore a backup set without a server connection.

The Web client is another client interface, and is used only to perform backup-archive client operations. If used from a Web browser on a remote workstation, with a user ID with client access privilege, no local access to back up or archive data is provided on that remote workstation. Data cannot be restored or retrieved locally; it can only be restored to or retrieved to the client workstation that owns the data. A Web browser can also be used locally on the client workstation to invoke the Web client as an alternative interface to the backup-archive client command-line interface or GUI.

Using the Web client via the browser means that you actually do not have to have any Tivoli Storage Manager code on the Web browser workstation, yet you can perform backup, restore, archive, or retrieve operations on behalf of the actual client.

4.8.3 Access authorization

Use of the Web client interface is authenticated whenever backup, restore, archive, or retrieve Web client functions are performed. Authentication of the Web client interface is separate, and independent, from authentication between the client node and the server.

An administrator user ID is required to use the Web client. This administrator user ID, and associated password, is used to authenticate that the user has sufficient authority to perform remote client functions. Two administrative authorities are provided to enable this authentication:

- ▶ Client owner
- ▶ Client access

These authorities can be used to enable usage of the Web client interface for backup-archive client owners and help desk personnel. A user ID with client access privilege can only restore data back to its original system. A user ID with client owner privilege can restore data to another system if required.

4.8.4 Starting the Web client

The Web client consists of two processes on the client workstation: the client acceptor and remote client agent.

Client acceptor

The Client Acceptor Daemon (CAD) is an HTTP daemon that serves the Web client Java applet to the Web browser. The name of the executable is dsmcad.

On UNIX/Linux clients, it should be run as a daemon. To have the Web client automatically available when the system is started, edit the /etc/inittab file on AIX (or use the equivalent startup file on other UNIX variants) and add the following entry:

```
dsmcad:2345:once:/usr/tivoli/tsm/client/ba/bin/dsmcad >/dev/console 2>&1 #Start  
the TSM WEB agent
```

On Windows platforms use the dsmcutil utility or the GUI wizard to install the client acceptor and remote agent services. Make sure that the startup options for both services are set to automatic.

Remote client agent

The remote client agent performs the client functions initiated with the Web client interface. The name of the executable is dsmagent. The agent does not run all the time. The acceptor daemon starts the agent when client functions are initiated through the Web client interface.

Web client

To access the Web backup-archive client, start your Web browser. In the Location or Address field, enter the URL:

```
http://<machinename>:1581
```

Where <machinename> is the host name or TCP/IP address of the Tivoli Storage Manager client machine that you want to connect to, and 1581 is the TCP/IP port number set by the HTTPPORT option.

Figure 4-63 shows the main Web client screen.

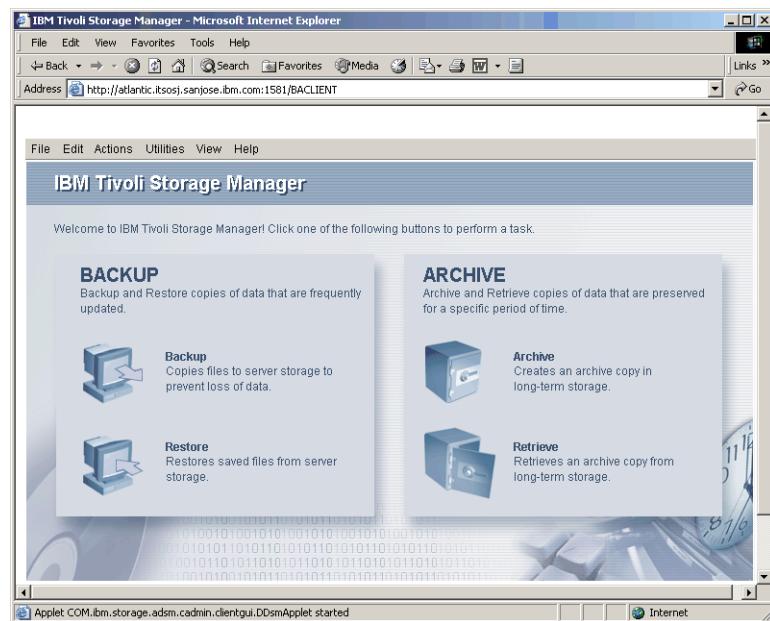


Figure 4-63 Platform-independent Web client

When you try to connect to a client by using the Web client interface, Tivoli Storage Manager validates the administrator ID given. You are then granted access to the Web client interface, the client is connected to the Tivoli Storage Manager, and the main window displays. Figure 4-64 shows a login dialog box for a Web client session.



Figure 4-64 Web client login dialog box

4.8.5 Stopping the remote agent services

In general, there is no need to stop the remote agent services manually.

On Windows platforms, if you wish to disable administrators from accessing the Web client, you can prevent the service from starting by disabling it. To do that, change the service setting to disabled or use a dsmcutil equivalent command. In Example 4-21 we change the startup behavior of the scheduler service and subsequently stop the service operation.

Example 4-21 Disabling Web client from starting upon system reboot using dsmcutil

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil update
/name:"TSM Remote Client Agent" /autostart:no
```

```
TSM Windows NT Client Service Configuration Utility
Command Line Interface - Version 5, Release 3, Level 2.0
(C) Copyright IBM Corporation, 1990, 2005, All Rights Reserved.
Last Updated Sep 17 2005
TSM Api Verison 5.3.2
```

```
Command: Update TSM Client Service Parameters
Machine: DIOMEDE(Local Machine)
```

```
Opening Registry Keys ...
Located service 'TSM Remote Client Agent' .
Updated registry value 'Start' .
```

```
C:\Program Files\Tivoli\TSM\baclient>dsmcutil stop
/name:"TSM Remote Client Agent"
```

```
TSM Windows NT Client Service Configuration Utility
Command Line Interface - Version 5, Release 3, Level 2.0
(C) Copyright IBM Corporation, 1990, 2005, All Rights Reserved.
Last Updated Sep 17 2005
TSM Api Verison 5.3.2
```

```
Command: Stop TSM Client Service
Machine: DIOMEDE(Local Machine)
```

```
Stopping the 'TSM Remote Client Agent' service ....
The service was successfully stopped.
C:\Program Files\Tivoli\TSM\baclient>
```

In a UNIX environment, you can stop the dsmcad process by using the **kill** command, as shown in Example 4-22.

Example 4-22 Stopping the remote agent service on Unix and Linux platforms

```
root@Atlantic /: ps -ef | grep dsmcad
    root 200792      1  0 11:49:12      -  0:00 dsmcad
    root 221318 184822  0 11:49:13 pts/5  0:00 grep dsmcad
root@Atlantic /: kill 200792
root@Atlantic /: ps -ef | grep dsmcad
    root 200794 184822  0 11:49:24 pts/5  0:00 grep dsmcad
root@Atlantic /:
```

4.9 Summary

You now have your server and clients installed and basic backup and restore functions tested and working. Next we proceed with further configuration and customization of the environment to suit your specific requirements.



Database and recovery log

By now you should have completed the installation of your IBM Tivoli Storage Manager server and clients, and done some basic functional testing. You are ready to move on to further customization. In this chapter we cover the steps to set up and change your database and recovery log settings to a recommended configuration.

The Tivoli Storage Manager database contains all the information needed for server operations, and information about client data that has been backed up, archived, and space-managed. The database and the recovery log are closely related. The recovery log caches database transactions, allowing you to replay the transactions in the event of the database requiring restoration.

The information in this chapter assumes that you have read the IBM Redbook *IBM Tivoli Storage Management Concepts*, SG24-4877, and have planned your database and recovery log sizes. See 2.8, “Disk considerations and sizing” on page 39, for planning considerations. If you have not planned the values that your installation requires to run Tivoli Storage Manager, please do so before continuing.

Use the information you gathered from the planning chapter when you issue your own commands. Because the database and recovery log configurations are highly dependent on site-specific values, we cannot predict all possible combinations. Instead, we provide a sequence of example commands that you can use to best configure the database and recovery log for your environment.

5.1 Database

The database is a critical Tivoli Storage Manager component. It must be configured for good availability performance.

5.1.1 Database design considerations

Before you start, there are a few important differences to consider, depending on which platform you will be using.

Platform-specific information: Some minor changes are required in UNIX/Linux and Windows because of the different file space naming conventions of those platforms. The examples in this section are from Windows and AIX systems. Use the correct directory separator for your platform when entering file and path names. For other platforms, see the *IBM Tivoli Storage Manager Administrator's Reference* for that server.

Tivoli Storage Manager has a single database made up of one or more *volumes*. A database volume is a physical file located on one of the server's file systems. In other words, the database is a logical entity made up of physical files.

Database volume numbers, sizes, and locations affect database performance. The following points should be considered:

- ▶ All database volumes must reside on random access media, that is, disk drives.
- ▶ If there is more than one database volume, more than one process can access the database simultaneously.
- ▶ If there is more than one database volume, the data is distributed across all available volumes and writes to the database volumes are performed in a *round-robin* fashion. Suppose the database has three volumes, vol01, vol02, and vol03. A sequence of four writes would go 1 to vol01, 2 to vol02, 3 to vol03, and 4 to vol01. Writing in a round-robin fashion distributes the load and makes the most of available resources.
- ▶ Create database volumes the same size if possible.
- ▶ Database segments are 4 MB in size, so a volume must be a multiple of 4 MB. One recommendation is to make your database volume sizes a multiple of the power of 2, that is, 128 MB, 256 MB, 512 MB, 1024 MB, 2048 MB, and so on.
- ▶ Tivoli Storage Manager requires 1 MB of space (known as the *restart area*) at the start of the volume. Take this overhead into account when calculating disk usage.

- ▶ If you have a number of physical disks (or logical LUNs) allocated for use with Tivoli Storage Manager, try to position the database volumes on different file systems, to leverage performance provided by the hardware.
- ▶ If using mirroring for database and recovery log volumes, and you do not have enough disks to locate all primary and mirror volumes separately:
 - Place primary database volumes on the same physical disks as the mirror recovery log volumes.
 - Place primary recovery log volumes on the same physical disks as the mirror database volumes.
- ▶ The current maximum size for the database is 530 GB.

As an example, say your planning shows that you need an 8 GB database. One way to configure an 8 GB database would be to create 8 x 1024 MB volumes. Add 1 MB each for the restart area and you have a database size of 8200 MB.

Note: If you forget to include the 1 MB for the restart area, or the format size is not a multiple of 4 MB, the `define dbvolume` command will ensure that the size is rounded to a multiple of 4 MB, and add 1 MB. See Example 5-1 on page 191.

Example 5-1 on page 191 shows a database consisting of four volumes (vol01.dsm through vol04.dsm). The volumes could exist on the same disk or be spread across any number of actual disk drives or LUNs. Although the volumes are separate files from an operating system point of view, Tivoli Storage Manager regards the database as a single logical entity.

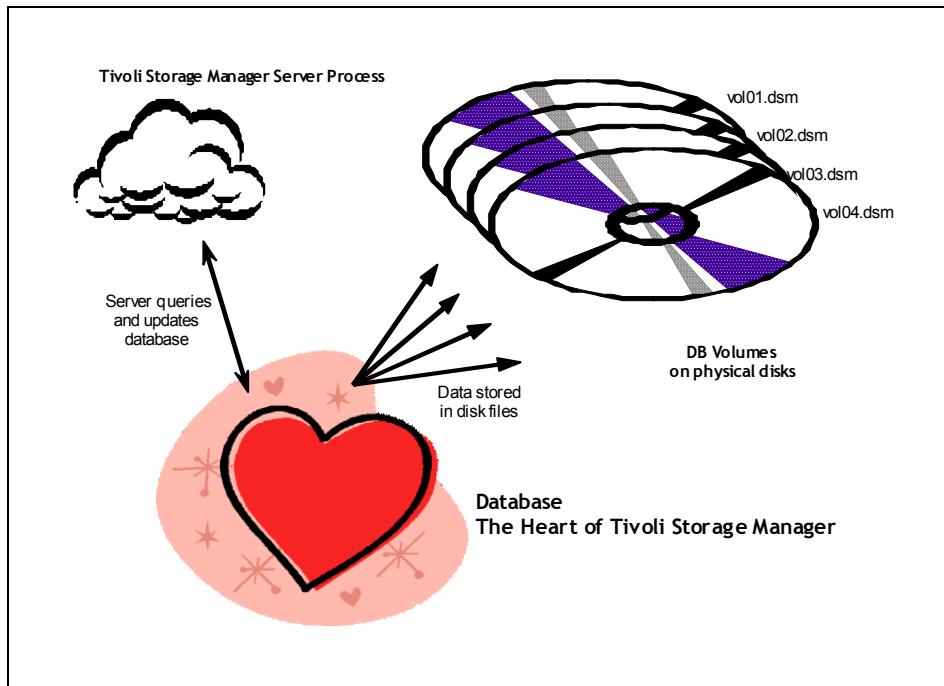


Figure 5-1 Tivoli Storage Manager database volumes

5.1.2 Defining database volumes

There are two ways to allocate a new database volume. The most common and easiest to use is the **define dbvolume** command (or equivalent Administration Center GUI function). The FORMATSIZE option allows you to specify the size for the volume.

The second method is to first use the external DSMFMT utility (from a shell or command window) to allocate the volume file. Then use the **define dbvolume** command to define the database volume to Tivoli Storage Manager (without specifying the FORMATSIZE option). For more information about the DSMFMT utility, see the Administrator's Reference for your server platform.

Whichever method you choose to define the volume, you must extend the database once the volume is defined. The **extend db** command allows the database to use the newly defined volume.

Example 5-1 shows how to define a new database volume on a Windows server. The volume is called C:\TSMDATA\DBP\DBV_01.DSM and is 1 GB in size.

Example 5-1 Defining a database volume

```
tsm: LOCHNESS_SERVER1>define dbvolume c:\tsmdata\dbp\dbv_01.dsm formatsize=1024  
wait=yes
```

ANR0984I Process 36 for DEFINE DBVOLUME started in the FOREGROUND at 14:46:43.

ANR2240I Database volume C:\TSMDATA\DBP\DBV_01.DSM defined.

ANR0986I Process 36 for DEFINE DBVOLUME running in the FOREGROUND processed 1 items for a total of 1,074,790,400 bytes with a completion state of SUCCESS at 14:46:43.

```
tsm: LOCHNESS_SERVER1>query db
```

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
2,024	1,000	1,024	996	4,096	256,000	1,202	0.5	0.5

```
tsm: LOCHNESS_SERVER1>query dbvol
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
C:\TSMDATA\SERV- ER1\DB1.DSM	Sync'd		Undef- ined		Undef- ined
C:\TSMDATA\DBP\DBV_01.DSM	- Sync'd		Undef- ined		Undef- ined

The output shows that the volume has been created. The **query db** command shows the available space. Note that the available space is *not* the amount of space currently in use by the database. It is the total amount of space available in database volumes. The *assigned* capacity is the amount of space currently in use by the database.

Note also that even though we specified a format size of 1024 MB, the actual size allocated was 1025 MB ($1025 * 1024 * 1024 = 1,074,790,400$). As mentioned above, the define process adds the extra 1 MB for the restart area.

UNIX users: Database volume file names are case-sensitive.

Example 5-2 shows the second phase—extending the database.

Example 5-2 Extending the database

tsm: LOCHNESS_SERVER1>**query db**

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
2,024	1,000	1,024	996	4,096	256,000	1,202	0.5	0.5

tsm: LOCHNESS_SERVER1>**extend db 1024**

ANR2248I Database assigned capacity has been extended.

tsm: LOCHNESS_SERVER1>**query db**

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
2,024	2,024	0	2,016	4,096	518,144	1,506	0.3	0.3

After the assigned capacity is extended, the output from **query db** changes accordingly. As we have extended the database to use all the defined database volumes, the maximum extension column shows 0 bytes.

5.2 Recovery log

The recovery log performs two functions, depending on its *mode* setting. Firstly, the recovery log stores database transactions that have not yet been committed to the database. Any operation that updates the Tivoli Storage Manager database is first written to the recovery log. Secondly, if the recovery log mode is *roll forward*, the transaction is cached in the recovery log after it has been committed. Caching of transactions allows you to replay the transactions at a later point in time to enhance database recovery, if needed. See 5.3, “Setting the log mode” on page 196, for more information.

As with its database, Tivoli Storage Manager considers the recovery log as one logical object, made up of a number of physical files, or *volumes*.

5.2.1 Recovery log design considerations

Recovery log volume numbers, sizes, and locations affect performance of the recovery log. The following points should be considered:

- ▶ All recovery log volumes must be on random access media (that is, disk drives).
- ▶ If there is more than one recovery log volume, more than one process can access the recovery log simultaneously.
- ▶ If there is more than one recovery log volume, the data is distributed across all available volumes and writes to the log volumes are performed in a round-robin fashion. Suppose the recovery log has three volumes, log01, log02, and log03. A sequence of four writes would go 1 to log01, 2 to log02, 3 to log03, and 4 to log01. Writing in a round-robin fashion distributes the load and makes the most of available resources.
- ▶ Create recovery log volumes the same size if possible.
- ▶ Recovery log segments are 4 MB in size, so a volume must be a multiple of 4 MB. One recommendation is to make recovery log volume sizes a multiple of the power of 2, that is, 128 MB, 256 MB, 512 MB, and so on.
- ▶ Tivoli Storage Manager requires 1 MB of space (known as the *restart area*) at the start of the volume.
- ▶ If you have a number of physical disks (or logical LUNs) allocated for use with Tivoli Storage Manager, try to position the recovery log volumes on different file systems, to leverage performance provided by the hardware.
- ▶ If using mirroring for database and recovery log volumes, and you do not have enough disks to locate all primary and mirror volumes separately:
 - Place primary database volumes on the same physical disks as the mirror recovery log volumes.
 - Place primary recovery log volumes on the same physical disks as the mirror database volumes.
- ▶ The total maximum size for the recovery log is 13 GB. That is, the sum of the sizes of all recovery log volumes must be 13 GB or less.

As an example, say your planning shows that you need 4 GB of recovery log space. One way to configure this would be to create 8 x 512 MB volumes. Add 1 MB each for the restart area and you have a recovery log size of 4104 MB.

Figure 5-2 shows a recovery log consisting of three volumes (log01.dsm through log03.dsm). The volumes could exist on the same disk, or be spread across any number of actual disk drives.

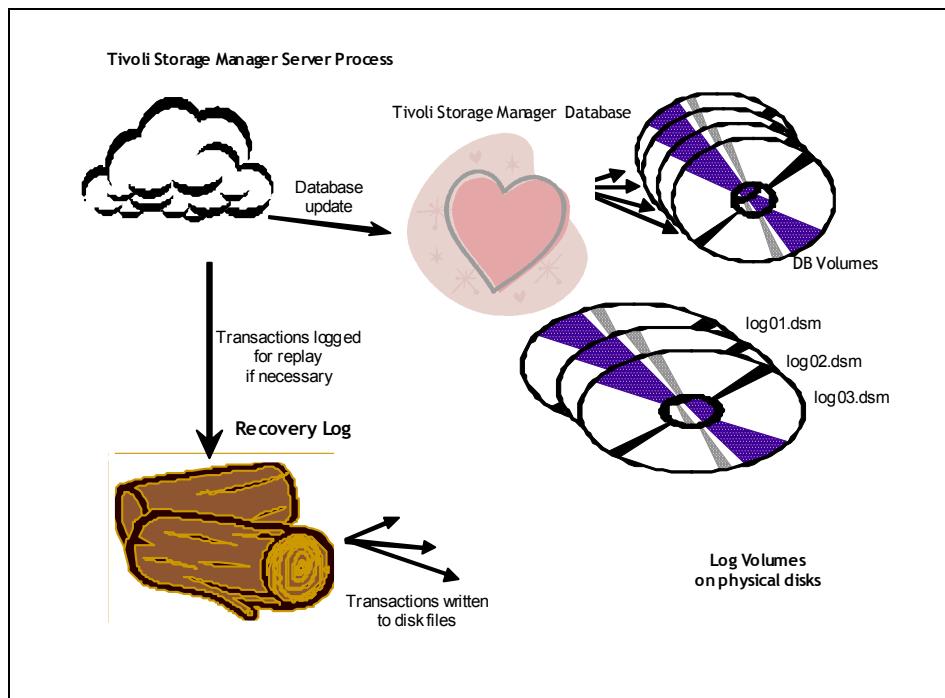


Figure 5-2 Recovery log volumes

5.2.2 Defining recovery log volumes

There are two ways to allocate a new recovery log volume. The most common and easiest method to use is the administrative **define logvolume** command (or equivalent Administration Center GUI function) specifying the FORMATSIZE option.

The second method is to use the DSMFMT utility command (from a shell or command window) to allocate the volume file. Then use the **define logvolume** command to define the recovery log volume to Tivoli Storage Manager (without specifying the FORMATSIZE option). For further information about the DSMFMT utility, see the Administrator's Reference for your server platform.

Example 5-3 shows how to allocate a new recovery log volume on a Windows server. The volume is called D:\TSMDATA\RLP\LOG_01.DSM and is 512 MB in size.

Example 5-3 Defining a recovery log volume

```
tsm: LOCHNESS_SERVER1>define logvol D:\tsmdata\rlp\log_01.dsm formatsize=512
wait=yes
ANR0984I Process 72 for DEFINE LOGVOLUME started in the FOREGROUND at 16:04:30.
ANR2260I Recovery log volume D:\TSMDATA\RLP\LOG_01.DSM defined.
ANR0986I Process 72 for DEFINE LOGVOLUME running in the FOREGROUND processed 1
items for a total of 537,919,488 bytes with a completion state of SUCCESS at
16:04:30.
```

```
tsm: LOCHNESS_SERVER1>query log
```

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
1,012	500	512	492	4,096	127,488	359	0.3	0.7

```
tsm: LOCHNESS_SERVER1>query logvol
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
C:\TSMDATA\SERV-ER1\LOG1.DSM	Sync'd		Undef-ined		Undef-ined
D:\TSMDATA\RLP\LOG_01.DSM	Sync'd		Undef-ined		Undef-ined

The output shows that the volume has been created. The **query log** command shows the available space. Note that the available space is *not* the amount of space currently in use by the recovery log. It is the total amount of space available in recovery log volumes. The *assigned* capacity is the amount of space currently in use by the recovery log.

Even though we specified a format size of 512 MB, the actual size allocated was 513 MB ($513 * 1024 * 1024 = 537,919,488$). As mentioned previously, the define process adds the extra 1 MB for the restart area.

UNIX users: Recovery volume file names are case-sensitive.

As with the database, you must extend the recovery log once you have defined a new volume. Example 5-4 shows how to extend the recovery log using the **extend log** command.

Example 5-4 Extending the recovery log

```
tsm: LOCHNESS_SERVER1>extend log 512 wait=yes
ANR0984I Process 74 for EXTEND LOG started in the FOREGROUND at 16:21:18.
ANR0307I Recovery log extend in progress; 4 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 8 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 12 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 16 megabytes of 512 formatted.
...
ANR0307I Recovery log extend in progress; 500 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 504 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 508 megabytes of 512 formatted.
ANR0307I Recovery log extend in progress; 512 megabytes of 512 formatted.

ANR2268I Recovery log assigned capacity has been extended.
ANR0988I Process 74 for EXTEND LOG running in the FOREGROUND processed
536,870,912 bytes with a completion state of SUCCESS at 16:21:29.
```

```
tsm: LOCHNESS_SERVER1>query log
```

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
1,012	1,012	0	1,008	4,096	258,560	153	0.1	0.2

Notice that an ANR0307I message is printed for every 4 megabytes of the log volume that is formatted. After the assigned capacity is extended, the output from **query log** changes accordingly. As we have extended the log to use all the defined volumes, the maximum extension column shows 0 bytes.

5.3 Setting the log mode

Use the **set logmode** command to set the mode for saving recovery log records. The log mode determines how Tivoli Storage Manager saves records in the recovery log and controls the kind of database recovery you can use. The two log modes are NORMAL and ROLLFORWARD.

- ▶ **NORMAL**

In normal mode, Tivoli Storage Manager saves only those transactions needed to restore the database to the point of the last database backup. Tivoli Storage Manager deletes any unnecessary transactions from the

recovery log. Changes made to the database since the last backup cannot be recovered if the database is lost. Database backups can only be used to perform point-in-time recovery (that is, to the time of the last database backup). In NORMAL log mode, you need less space for the recovery log, since Tivoli Storage Manager deletes transactions once they have been committed to the database.

► **ROLLFORWARD**

In rollforward mode, Tivoli Storage Manager caches all transaction changes made to the database since the last time it was backed up. Tivoli Storage Manager deletes cached transactions only after a successful database backup. The cached transactions can be used to restore the database to its most current state (roll-forward recovery) after loading the most current database backup series. A database backup series created in ROLLFORWARD mode can be used for either point-in-time recovery or roll-forward recovery. We recommend ROLLFORWARD mode for the superior recoverability it brings to the server database. Note that in ROLLFORWARD mode, more recovery log space is required.

When you change the log mode to ROLLFORWARD, if the database backup trigger is set, a database backup will immediately run.

To configure the log for ROLLFORWARD mode, issue the **set logmode** command, as shown in Example 5-5. The command takes effect immediately. You do not need to restart the server.

Example 5-5 Set logmode to roll forward

```
tsm: LOCHNESS_SERVER1> set logmode rollforward
```

```
ANR2294I Log mode set to ROLLFORWARD.
```

To check that the command was successful, use the **query status** command and note the Log Mode field.

Example 5-6 Check status for log mode

```
tsm: LOCHNESS_SERVER1>query status
                               Server Name: LOCHNESS_SERVER1
                               Server host name or IP address: 9.43.86.84
...
                               Retry Period: 5 Minute(s)
                               Scheduling Modes: Any
                               Log Mode: RollForward
                               Database Backup Trigger: Not Defined
                               BufPoolSize: 261,120 K
...
```

Note: If you are changing the recovery log to rollforward mode, the recovery log size must be increased. To estimate the new value, reset the cumulative log consumption statistic using the administrative command **reset logconsumption**. Monitor the cumulative consumption over a number of days. Divide the cumulative consumption by the number of days since you reset the value, to get an average value. A safe size for the log pool is around 30–40% larger than this figure.

5.4 Defining the database backup trigger

The database backup trigger determines when to back up the Tivoli Storage Manager database, based on the recovery log utilization. When the recovery log is in rollforward mode, the potential for it to fill up is much greater than in normal mode. If the recovery log fills up, it is possible that the server can stall or even halt unexpectedly. By defining a database backup trigger, when the recovery log usage reaches the defined percentage, the server database is automatically backed up. The backup operation clears the cached transactions, clearing the recovery log.

Use the **define dbbackuptrigger** command to define settings for the database backup trigger, such as the percentage of the assigned capacity and device class to be used for automatic database backups. You can also define the number of incremental database backups that can be run before a full backup must run. These settings are used only when the recovery log mode is ROLLFORWARD.

The actual percentage to choose depends on the planning considerations discussed in Chapter 2, “Implementation planning” on page 15. We recommend using 75% as a starting point and use the default number of incrementals (six). Monitor your environment’s activity to make sure that you do not trigger database backups too frequently, as this creates unnecessary load on the server and increases tape mount activity. If database backups are triggering too frequently, consider increasing the recovery log size.

Example 5-7 shows how to set the limit of 75% and run up to six incremental database backups before a full database backup.

Example 5-7 Setting the database backup trigger

```
tsm: LOCHNESS_SERVER1>def dbbackuptrigger devclass=1to2-dc logfullpct=75
numincremental=6 incrdevclass=1to2-dc
ANR2282I Database backup trigger defined and enabled.
tsm: LOCHNESS_SERVER1>query process
```

Process Number	Process Description			Status		
76	Database Backup			Full backup: 0 pages of 1500 backed up.		
				Current output volume: LT0888		

tsm: LOCHNESS_SERVER1> query dbbackuptrigger						
Full Device Class	Incremental Device Class	Log Percentage	Fulls	Between Fulls	Minimum Backup Interval (minutes)	Minimum Log Freed Percentage
LT02-DC	LT02-DC	75	6	0	0	0

Notice that once we defined the database backup trigger, a database backup was immediately started. To verify that the **define dbbackuptrigger** command was successful, issue the **query dbbackuptrigger** command.

Tip: The combination of the dbbackuptrigger and rollforward mode may require some tuning attention. As with most automated processes, regular operational monitoring is required.

5.5 Setting the expansion trigger

Tivoli Storage Manager lets you fully automate the process of increasing the database and recovery log, whenever necessary. For example, suppose you have a 4 GB database and a 2 GB recovery log. You want to increase the size of the database by 25% when it is 85% utilized, but not to more than 8 GB. You also want to increase the recovery log by 30% when it is 75% utilized, but not to more than 4 GB.

Note: Setting a space trigger does not mean that the percentage used in the database and recovery log will always be less than the value specified with the FULLPCT parameter. Tivoli Storage Manager checks utilization when database and recovery log activity results in a *commit*. Deleting database volumes and reducing the database does not cause the trigger to activate. Therefore, the utilization percentage can exceed the set value before new volumes are online.

z/OS tip: Database expansion triggering is not fully supported in Tivoli Storage Manager for z/OS. On this platform, the **define spacetrigger** command does not cause new volumes to be created. It causes the database and recovery log to be extended if space is available. Event logging allows messages to display the amount of new space that is needed to satisfy the space trigger utilization parameter. You can use these messages to initiate automatic expansion or to complete an allocation job (refer to ANRFMT1 and ANRFMT, sample jobs that are located in the ASAMPLIB library).

5.5.1 Database space trigger

To define a new space trigger for the database, so that new volumes will be automatically created (Tivoli Storage Manager generates the volume names), issue the **define spacetrigger db** command as in Example 5-8. The **expansionprefix** parameter specifies the directory where the volumes will be created.

Example 5-8 Defining and querying the database spacetrigger

```
tsm: LOCHNESS_SERVER1>define spacetrigger db fullpct=85 spaceexpansion=25  
expansionprefix=c:\tsmdata\dbp\ maximumsize=8192  
ANR2274I Data Base Space trigger defined and enabled.
```

```
tsm: LOCHNESS_SERVER1>query spacetrigger db
```

DB Full Percentage	DB Space Expansion Percentage	DB Expansion prefix	DB Maximum Size (Megabytes)	Mirror Prefix 1	Mirror Prefix 2
85	25	c:\tsmdata\dbp	8,192		

Use **query spacetrigger db** to show the current settings.

The maximum size we want the database to grow to is 8 GB, as specified in the **MAXIMUMSIZE** parameter. The system limit for the database is 530000 MB (530 GB). If you do not want to set a particular maximum size, set **MAXIMUMSIZE** to zero or omit the parameter to disable checking for maximum size. In this case, the database will keep growing to the system limit. If you need to change the trigger definition later, use the **update spacetrigger** command.

Whenever the system detects that the database needs extra space, it triggers the expansion, and writes messages to the activity log, as shown in the **query actlog** command in Example 5-9.

Example 5-9 Activity log messages from database expansion

```
tsm: LOCHNESS_SERVER1>query actlog
...
02/16/06 13:44:27 ANR4414I Data Base Space expansion Is Needed, 4 Megabytes
needed.
02/16/06 13:44:27 ANR4412I Data Base and Recovery Log Space expansion
triggered.
02/16/06 13:44:28 ANR2240I Database volume C:\TSMDATA\DBP\0200888.DBF defined.
```

5.5.2 Recovery log space trigger

To define a new space trigger for the recovery log to automatically create new volumes (Tivoli Storage Manager generates the volume names), use the **define spacetrigger log** command as in Example 5-10. The expansionprefix parameter specifies the directory where the volumes will be created.

Example 5-10 Defining and querying the recovery log spacetrigger

```
tsm: LOCHNESS_SERVER1>define spacetrigger log fullpct=75 spaceexpansion=30
expansionprefix=d:\tsmdata\r1p\ maximumsize=4096
ANR2279I Recovery Log Space trigger defined and enabled.
```

```
tsm: LOCHNESS_SERVER1>query spacetrigger log
```

LOG Full Percentage	LOG Space Expansion Percentage	LOG Expansion prefix	LOG Maximum Size (Megabytes)	Mirror Prefix 1	Mirror Prefix 2
75	35	d:\tsmdata\r1p\	4,096		

You can specify a MAXIMUMSIZE from 9 MB through 13000 MB (13 GB) for the recovery log. Set MAXIMUMSIZE to zero or omit the parameter to disable checking for maximum size and allow the recovery log to grow to the system limit. If you need to change the trigger definition later, use the **update spacetrigger** command.

Whenever the system detects that the recovery log needs extra space, it triggers the expansion and writes messages in the activity log, as shown in the **query actlog** command in Example 5-11.

Example 5-11 Activity log messages from recovery log expansion

```
tsm: LOCHNESS_SERVER1>query actlog
...
02/16/06 18:06:48 ANR4413I Recovery Log Space expansion Is Needed, 4 Megabytes
needed.
02/16/06 18:06:48 ANR4412I Data Base and Recovery Log Space expansion
triggered.
02/16/06 18:06:50 ANR2260I Recovery log volume D:\TSMDATA\RLP\L8675309.LOG
defined.
```

Note: The maximum size of the recovery log is 13 GB. The server will not automatically extend the recovery log beyond 12 GB. An automatic expansion may exceed the specified database or recovery log maximum size, but not the 13 GB recovery log limit. However, after the maximum has been reached, no further automatic expansions will occur.

Important: Although Tivoli Storage Manager can expand either the database, recovery log, or both if needed, be careful if using software mirroring. You can only specify one directory location for the expansionprefix parameter in the **define spacetrigger** command. If you are using Tivoli Storage Manager mirroring for the database or log, you may find volumes on a single disk, making mirroring ineffective. You must reallocate the mirror copies to the correct place.

5.6 Mirroring

When you first install Tivoli Storage Manager and initialize your server, the database and recovery log volumes are not mirrored. However, we strongly recommend that you create mirrors for the database and recovery log volumes.

Mirroring of database and recovery log volumes provides an extra level of recoverability, should a system fail during a write operation. If a partial write to a non-mirrored volume occurs, transaction recovery operations cannot complete when the server is restarted. The database will need to be restored from its most recent backup. With mirrored volumes, the chance that at least one of the mirror writes was successful is much higher. If a partial write is detected, a mirror volume can be used to construct valid images of the missing pages. For this reason we recommend that you use the Tivoli Storage Manager provided

mirroring function at a minimum, rather than just operating system software or disk hardware mirroring.

Although you can mirror either the database or the recovery log, we recommend that you mirror both. Mirroring both database and log provides better availability and recoverability.

In Figure 5-3, the Tivoli Storage Manager database volumes are mirrored to two different disks, so if one fails, the server can still function. The recovery log volumes are also duplicated. Note that Tivoli Storage Manager still has one database object and one recovery log object, regardless of whether mirroring is implemented.

You can use two-way or three-way mirroring. With two-way, there are two copies of each database or recovery log volume; with three-way, there are three copies of each database or recovery log volume. Figure 5-3 shows two-way mirroring.

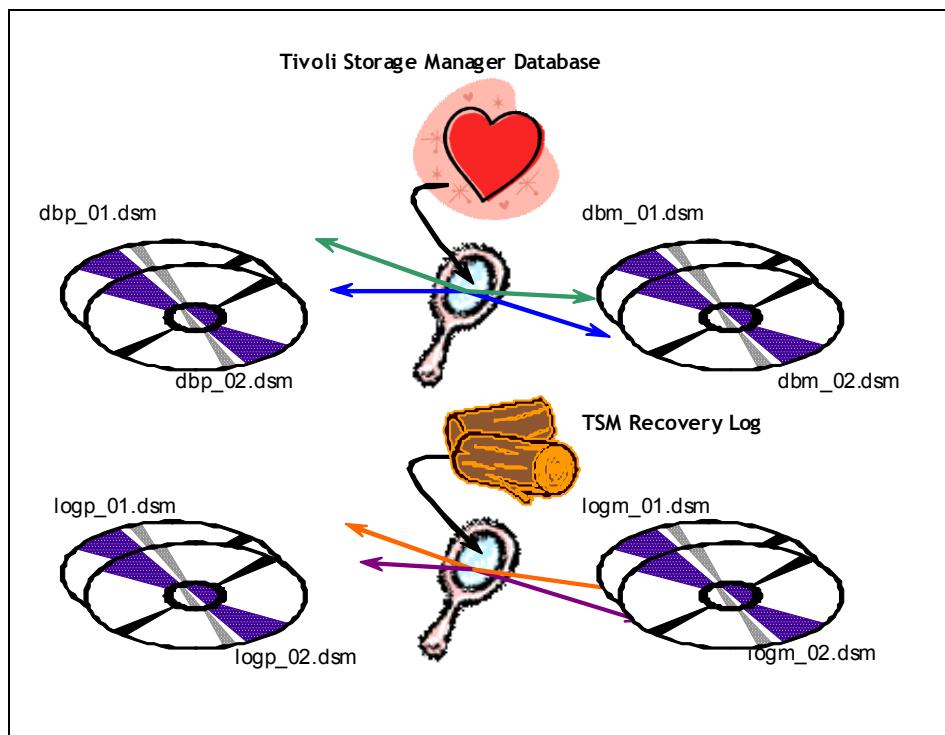


Figure 5-3 Database and recovery log mirroring

All database volume copies are equal, as are all recovery log volume copies. There is no concept of a master and secondary mirror copy. The server can continue operating in the event of a failure of any single volume.

Tivoli Storage Manager copy volumes must have at least the same capacity as the original volumes. If your database consists of eight volumes of 1 GB each, you will need eight more 1 GB allocated volumes to completely mirror the database. If you create volumes larger than necessary, Tivoli Storage Manager gives a warning message (ANR2253W for database and ANR2273W for the log), but still allows you to use the allocated volume. The extra capacity will be wasted). We recommend creating all copies of each volume at the same size. You should mirror all or none of the volumes—there is no point in only mirroring some of them.

Use separate disks for each of the volumes in a mirrored set, so that you do not lose data if one disk fails. Although you can technically place primary and mirror copies on the same disk, this is also a waste of space and will probably even decrease performance because of disk head contention.

When using two-way mirroring, we recommend using four disks for the database and recovery log volumes to keep each set of volumes on a separate disk. If you can, go one step further and ensure that the disks are on separate controllers. In a SAN environment, your disks will probably be virtualized, and running separate controllers for each LUN is not likely.

Table 5-1 shows an example of database and recovery log directories for UNIX/Linux and Windows, respectively. We assume that the four UNIX/Linux file systems are built on separate disks.

Table 5-1 Database and recovery log volume placement on four disks

Type of volume	UNIX file system mount points	Windows location
Database volumes	/tsm/database/primary	D:\TSMDATA\DBP
Mirrored database volumes	/tsm/database/mirror	E:\TSMDATA\DBM
Log volumes	/tsm/log/primary	F:\TSMDATA\RLP
Mirrored log volumes	/tsm/log/mirror	G:\TSMDATA\RLM

If four separate disks for your database and recovery log volumes are not possible, we recommend a minimum of two separate disks. In this way, you can place primary database and mirror log volumes on one disk, and primary log and

mirror database volumes on the other. Table 5-2 shows how the volume placement would work. We assume for the UNIX examples, that /tsm and /tsm1 are file systems created on separate disks.

Table 5-2 Database and recovery log volume placement on two disks

Type of volume	UNIX directories	Windows location
Database volumes	/tsm/primary/database	D:\TSMDATA\DBP
Mirrored database volumes	/tsm1/mirror/database	E:\TSMDATA\DBM
Log volumes	/tsm1/primary/log	E:\TSMDATA\RLP
Mirrored log volumes	/tsm/mirror/log	D:\TSMDATA\RLM

AIX tip: We recommend that you use Tivoli Storage Manager mirroring rather than AIX mirroring if you are using raw logical volumes. AIX tracks mirroring activity by writing control information to the first 512 bytes of the USER area in a raw volume. This is not a problem for database and recovery log volumes, but Tivoli Storage Manager control information is also written in this area. If AIX overwrites Tivoli Storage Manager control information when raw volumes are mirrored, Tivoli Storage Manager may not be able to vary the volume online.

5.6.1 Database mirroring

To mirror the database, use the **define dbcopy** administrative command or the DSMFMT utility for each volume that you want to mirror. Example 5-12 shows how to create a mirror volume of the volume created in Example 5-1 on page 191 using **define dbcopy**.

Example 5-12 Defining and querying database volume mirrors

```
tsm: LOCHNESS_SERVER1>define dbcopy c:\tsmdata\dbp\dbv_01.dsm
d:\tsmdata\dbm\dbm_01.dsm formatsize=1024 wait=yes
ANR0984I Process 79 for DEFINE DBCOPY started in the FOREGROUND at 16:16:41.
ANR2242I Database volume copy D:\TSMDATA\DBM\DBM_01.DSM defined;
synchronization process started (process ID 80).
ANR0986I Process 79 for DEFINE DBCOPY running in the FOREGROUND processed 1
items for a total of 1,074,790,400 bytes with a completion state of SUCCESS at
16:16:41.

tsm: LOCHNESS_SERVER1>query process
```

Process	Process Description	Status
---------	---------------------	--------

Number					
80	Database Copy Synchronization	Volume C:\TSMDATA\DBM\DBM_01.DSM - 888 megabytes of 1024			
tsm: LOCHNESS_SERVER1>query dbvol					
Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
C:\TSMDATA\SERV- ER1\DB1.DSM	Sync'd		Undef- ined		Undef- ined
C:\TSMDATA\DBP\-\ DBV_01.DSM	Sync'd	D:\TSMDATA\DBM\-\ DBM_01.DSM	Sync'd		Undef- ined

As soon as the copy volume is created, a background process synchronizes the data in the primary volume to the mirror. The output of **query dbvol** now shows the two mirror volumes and the status of each copy. The status should always be *Sync'd*.

We can see there is still the previous database volume present, C:\TSMDATA\SERVER1\DB1.DSM, which is not mirrored. We address this in 5.7.1, “Removing the default database volume” on page 207.

5.6.2 Recovery log mirroring

To mirror the recovery log, use the **define logcopy** administrative command or use the DSMFMT utility for each log volume you want to mirror. Example 5-13 shows how to create a mirror volume of the volume created in Example 5-3 on page 195 using **define logcopy**.

Example 5-13 Defining and querying recovery log volume mirrors

```
tsm: LOCHNESS_SERVER1>define logcopy d:\tsmdata\rlp\log_01.dsm
c:\tsmdata\rlm\lgm_01.dsm formatsize=512 wait=yes
ANR0984I Process 83 for DEFINE LOGCOPY started in the FOREGROUND at 16:36:27.
ANR2262I Recovery log volume copy C:\TSMDATA\RLM\LGM_01.DSM defined;
synchronization process started (process ID 84).
ANR0986I Process 83 for DEFINE LOGCOPY running in the FOREGROUND processed 1
items for a total of 537,919,488 bytes with a completion state of SUCCESS at
16:36:27.
```

tsm: LOCHNESS_SERVER1>query process

Process Number	Process Description	Status

```

84      Recovery Log Copy  Volume C:\TSMDATA\RLM\LGM_01.DSM - 256
          Synchronization    megabytes of 512

tsm: LOCHNESS_SERVER1>query logvol

  Volume Name      Copy      Volume Name      Copy      Volume Name      Copy
  (Copy 1)        Status     (Copy 2)        Status     (Copy 3)        Status
  -----
C:\TSMDATA\SERV- Sync'd                  Undef-      Undef-
ER1\LOG1.DSM           edined                edined
D:\TSMDATA\RLP\Sync'd   C:\TSMDATA\RLM- Sync'd      Undef-
LOG_01.DSM             LGM_01.DSM           edined
  -----

```

As with the database volume mirror, after the log copy volume is created, a background process synchronizes the data in the primary volume to the mirror. The output of **query logvol** now shows the two mirror volumes and the status of each copy. The status should always be *Sync'd*.

We can see there is still the previous database volume present, C:\TSMDATA\SERVER1\LOG1.DSM, which is not mirrored. We address this in 5.7.2, “Removing the default recovery log volume” on page 209.

5.7 Removing default volumes

During installation on UNIX/Linux platforms, default database and recovery log volumes are created, usually in the server installation directory (/usr/tivoli/tsm/server/bin on AIX, for example). On Windows, the install process does not create any database or log volumes. You initialize the server with a wizard that allows you to specify where your first database and log volumes are located.

We recommend removing the initial default database and recovery log volumes. Removing them gives you complete control over the new database and recovery log distribution. If your Tivoli Storage Manager server is running on a Windows platform, and you wish to remove the first database and log volumes that you created in favor of better placement, you can also follow the examples.

5.7.1 Removing the default database volume

To remove a database volume, you must first have enough free space existing in the database to reduce its size by the amount of the volume’s size. The Tivoli Storage Manager server will automatically move any active pages in the volume that you are removing to other volumes. The **query db** command in the Maximum Reduction (MB) column shows the amount by which the database can be

reduced. You must first define a new volume and extend the database if the number in that column is smaller than the size of the volume you wish to delete.

Use the **reduce db** command to reduce the database size. Once the database is reduced in size, the desired volume can be deleted. Example 5-14 shows the procedure.

Example 5-14 Reducing database size

tsm: ATLANTIC>**query db**

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
1,040	1,040	0	1,032	4,096	266,240	1,996	0.7	0.8

tsm: ATLANTIC>**reduce db 16**

ANR2250I Database assigned capacity has been reduced.

tsm: ATLANTIC>**query db**

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct Util
1,040	1,024	16	1,016	4,096	266,144	1,992	0.8	0.8

We see we have plenty of space for reduction, as the default database volume is only 16 MB in size. We have one other mirrored volume of 1 GB, so there is enough space to reduce the size of the database. The second **query db** shows that the maximum extension is now 16 MB, since the default volume has not yet been deleted.

Use the **query dbvolume** command to see the full name of the file. You can now delete the default database volume using the **delete dbvolume** command, as shown in Example 5-15.

Example 5-15 Deleting a database volume

tsm: ATLANTIC>**q dbvol**

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
/usr/tivoli/tsm- Sync'd			Undef-		Undef-
/server/bin/db-			ined		ined
.dsm					

```

/tsm/db/primary- Sync'd      /tsm/db/mirror/- Sync'd      Undefined
  /dbp_01.dsm                  dbm_01.dsm

tsm: ATLANTIC>delete dbvol /usr/tivoli/tsm/server/bin/db.dsm
ANR2244I Delete process initiated for database volume /usr/tivoli/tsm/
server/bin/db.dsm (process id 11).
ANS8003I Process number 11 started.

tsm: ATLANTIC>q dbvol

Volume Name      Copy      Volume Name      Copy      Volume Name      Copy
(Copy 1)          Status    (Copy 2)          Status    (Copy 3)          Status
-----
----- /tsm/db/primary- Sync'd      /tsm/db/mirror/- Sync'd      Undefined
          /dbp_01.dsm                  dbm_01.dsm
-----
```

Even though the volume no longer appears in the **query dbvol** output, the file itself is not deleted by the process. You should now physically remove the file from the file system.

5.7.2 Removing the default recovery log volume

The procedure for removing the default recovery log volume is very similar to that for removing the default database volume. You must first have enough free space existing in the recovery log to reduce its size by the amount of the volume's size. The Tivoli Storage Manager server will move any active pages in the volume that you are removing to other volumes. Use the **reduce log** command, as shown in Example 5-16.

Example 5-16 Reducing the recovery log size

```

tsm: ATLANTIC>q log
Available Assigned Maximum Maximum Page Total Used Pct Max.
Space Capacity Extension Reduction Size Usable Pages Util Pct Util
(MB)       (MB)        (MB)     (MB)   (bytes)   Pages
-----
----- 520       520        0       512    4,096    132,608  317   0.2   0.2
```

```

tsm: ATLANTIC>reduce log 8
ANR2270I Recovery log assigned capacity has been reduced.
```

```

tsm: ATLANTIC>q log
Available Assigned Maximum Maximum Page Total Used Pct Max.
Space Capacity Extension Reduction Size Usable Pages Util Pct Util
(MB)       (MB)        (MB)     (MB)   (bytes)   Pages
-----
----- 520       512        8       504    4,096    132,560  321   0.2   0.2
```

We see that there is enough space to reduce the log by 8 MB, the size of the default recovery log volume. To delete the volume, use the **delete logvol** command, as shown in Example 5-17.

Example 5-17 Deleting a recovery log volume

```
tsm: ATLANTIC>q logvol
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
/usr/tivoli/tsm- /server/bin/lo- g.dsm	Sync'd		Undef- ined		Undef- ined
/tsm/log/primar- y/logp_01.dsm	Sync'd	/tsm/log/mirror- /logm_01.dsm	Sync'd		Undef- ined

```
tsm: ATLANTIC>delete logvol /usr/tivoli/tsm/server/bin/log.dsm
```

```
ANR2264I Delete process initiated for recovery log volume /usr/tivoli/tsm/  
server/bin/log.dsm (process id 12).  
ANS8003I Process number 12 started.
```

```
tsm: ATLANTIC>q logvol
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
/tsm/log/primar- y/logp_01.dsm	Sync'd	/tsm/log/mirror- /logm_01.dsm	Sync'd		Undef- ined

Even though the volume no longer appears in the **query logvol** output, the file itself is not deleted by the process. You should now physically remove the file from the file system.

5.8 Database backup

The Tivoli Storage Manager database is the heart of Tivoli Storage Manager—it tracks the location of all your backed-up objects. Without it, your backups are just a bunch of ones and zeros. It is vitally important to run regular Tivoli Storage Manager database backups.

If the database becomes damaged or lost, you can restore it by running the Tivoli Storage Manager server in database restore mode: DSMSERV RESTORE DB. You will require the latest database backup media.

If you are following the steps in this chapter, the DBBACKUPTRIGGER will already start database backups as needed. However, we also recommend that you run a *full* database backup on a regular basis (at least daily). If you make a number of database configuration changes, such as we did earlier in this chapter, you should run a backup immediately afterwards. You should not rely solely on the DBBACKUPTRIGGER to produce your regular backups. The DBBACKUPTRIGGER is a safeguard to stop your recovery log from filling up. You will also see how to back up the database at least once every night as a scheduled operation in Chapter 12, “Scheduling” on page 371.

Use the **backup db** command to back up a Tivoli Storage Manager database to sequential access storage volumes. You can use **backup db** to run one of the following types of backup:

- ▶ Full backup (TYPE=FULL): Backs up the entire Tivoli Storage Manager database. Example 5-18 shows how to perform a full backup operation.
- ▶ Incremental backup (TYPE=INCREMENTAL): Backs up only those database pages that have been added or changed since the last time the database was backed up.
- ▶ DBSnapshot (TYPE=DBSNAPSHOT): Specifies that you want to run a full snapshot database backup. The entire contents of the database are copied and a new snapshot database backup is created without interrupting the existing full and incremental backup series for the database. Example 5-19 shows how to perform a snapshot backup operation.

Example 5-18 Creating a full database backup

```
tsm: ATLANTIC>backup db type=full devclass=1to2-dc wait=yes

ANR0984I Process 14 for DATABASE BACKUP started in the FOREGROUND at 11:33:54.
ANR2280I Full database backup started as process 14.
ANR4554I Backed up 960 of 2001 database pages.
ANR4554I Backed up 1920 of 2001 database pages.
ANR4550I Full database backup (process 14) complete, 2001 pages copied.
ANR0985I Process 14 for DATABASE BACKUP running in the FOREGROUND completed
with completion state SUCCESS at 11:34:30.
```

Example 5-19 Creating a database snapshot

```
tsm: ATLANTIC>backup db type=dbsnapshot devclass=1to2-dc wait=yes

ANR0984I Process 15 for DATABASE BACKUP started in the FOREGROUND at 11:39:31.
ANR2287I Snapshot database backup started as process 15.
ANR4554I Backed up 960 of 2002 database pages.
ANR4554I Backed up 1920 of 2002 database pages.
```

```
ANR4550I Full database backup (process 15) complete, 2002 pages copied.  
ANR0985I Process 15 for DATABASE BACKUP running in the FOREGROUND completed  
with completion state SUCCESS at 11:40:08.
```

The output from the two examples is very similar because the snapshot was run immediately after the full backup.

Tip: The devclass parameter may have a different value for your installation. You can run the `query devclass format=detailed` command to check the available device classes and `query library` to check the corresponding libraries available for use. You can run the `backup db` command at any time, without having to stop the server.

Tip: We recommend sending the most up-to-date Tivoli Storage Manager database backup off-site, to form a recovery position for your Tivoli Storage Manager environment.

Although our book material uses the full and incremental features to handle Tivoli Storage Manager database backups, you should consider also running a DBSNAPSHOT as well. Keep the full and incremental database backups onsite for faster recovery. The DBSNAPSHOT backup, being an out-of-band backup and not dependent on any incremental backups, should be taken off-site with any other off-site tapes.

5.9 Additional commands

This section details some extra commands that relate to the Tivoli Storage Manager database.

5.9.1 DELETE VOLHIST TYPE=DBBACKUP

If you are using the Disaster Recovery Manager (DRM), your database backups will be managed and expired automatically. You do not need to delete volume history. However, if you are not using DRM, you need to manually delete database backup volume history after a period of time.

A common problem reported by new Tivoli Storage Administrators is running out of tapes. It turns out that many tapes have been used by old server database backups, and they have never been expired. The problem can be compounded by the fact that each database backup requires its own tape—it is not possible to “stack” multiple backups onto a single tape.

You should think of this as a security feature. Database backups are extremely important—you do not want to be in the situation where the last seven days of database backups are contained on one tape that, at the crucial moment when a restore is required, turns out to be unreadable. That is why you have to use a new tape each time you back up the database, regardless of whether it is a full or incremental backup.

Use the **delete volhistory** command to remove the references to old database backups from the Tivoli Storage Manager database. Depending on the options chosen, **delete volhistory** can delete sequential volumes used for database backups, storage pools, or other purposes.

When records containing volume history information about volumes that are not in storage pools (volume types DBSNAPSHOT, BACKUPFULL, BACKUPINCR, and EXPORT) are deleted, the volumes return to scratch status if they were acquired by Tivoli Storage Manager as scratch volumes. For scratch volumes with device type FILE, the files are deleted.

When records containing volume history information about volumes in storage pools are deleted, the volumes themselves are not affected and remain in the Tivoli Storage Manager database. In 12.2.2, “Defining the volume history schedules” on page 380, we describe setting up a schedule to take care of volume history deletion automatically.

Tip: Do not run the **delete volhist** command to delete obsolete database backups if you are using DRM. DRM handles the expiry itself.

5.9.2 ESTIMATE DBREORGSTATS

Occasionally, if your database grows to be quite large, and has been in use for a long period of time, it may benefit from a reorganization. Although database dump and reload is beyond the scope of this book, a command introduced with Tivoli Storage Manager V5.3 might assist you in determining whether your database needs attention.

The **ESTimate DBREorgstats** command examines the database and determines whether the database would benefit from a re-organization. Example 5-20 shows how to run the command.

Example 5-20 Estimating database reorganization statistics

```
tsm: LOCHNESS_SERVER1>estimate dbreorgstats wait=yes
```

```
ANR0984I Process 87 for ESTIMATE DBREORG started in the FOREGROUND at 12:09:21.  
ANR1782W ESTIMATE DBREORG process 87 started - server performance may be  
degraded while this process is running.
```

ANR1784I A database reorganization would reduce the database utilization by an estimated 0 MB.

ANR0987I Process 87 for ESTIMATE DBREORG running in the FOREGROUND processed 940 items with a completion state of SUCCESS at 12:09:21.

ANR0381I Buffer pool statistics were successfully reset.

The output shows that reorganization would result in a zero megabyte reduction, so we do not need to perform a dump and reload at this stage. Note the message regarding performance degradation (ANR1782W). Ensure that you do not run the command during periods of peak usage. Note also that the buffer pool statistics were reset at the completion of the command.

5.10 Summary

You have now finished configuring your database and recovery log volumes to suit your environment. The next step is to do the same for storage pool volumes, and configure your storage devices.



Data storage

In the previous chapters we created planning material and performed installations, followed by database and recovery log customization. This chapter deals with storage configuration and customization. We assume that you have read and understood the IBM Redbook *IBM Tivoli Storage Management Concepts*, SG24-4877.

In the following sections we discuss how IBM Tivoli Storage Manager manages data storage pools and how you can define them, query them for status, and make changes based on operational requirements.

6.1 Example environment

The examples presented in this chapter are based on the environment shown in Figure 6-1. The example environment contains four primary storage pools and two copy pools. Client data backups go to the disk-based storage pool DISKDATA and are then migrated to the sequential storage pool, TAPEDATA. OFFDATA is set up as a copy pool for taking data off-site. Client directory structures, which are much smaller in size, are directed to the sequential file storage pool DISKDIRS. They are then backed up to the copy pool, OFFDIRS.

In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into Tivoli Storage Manager. The macro, mac.stgcreate, which we provide to create the storage pools in our book environment, is shown in “Create storage pools” on page 738.

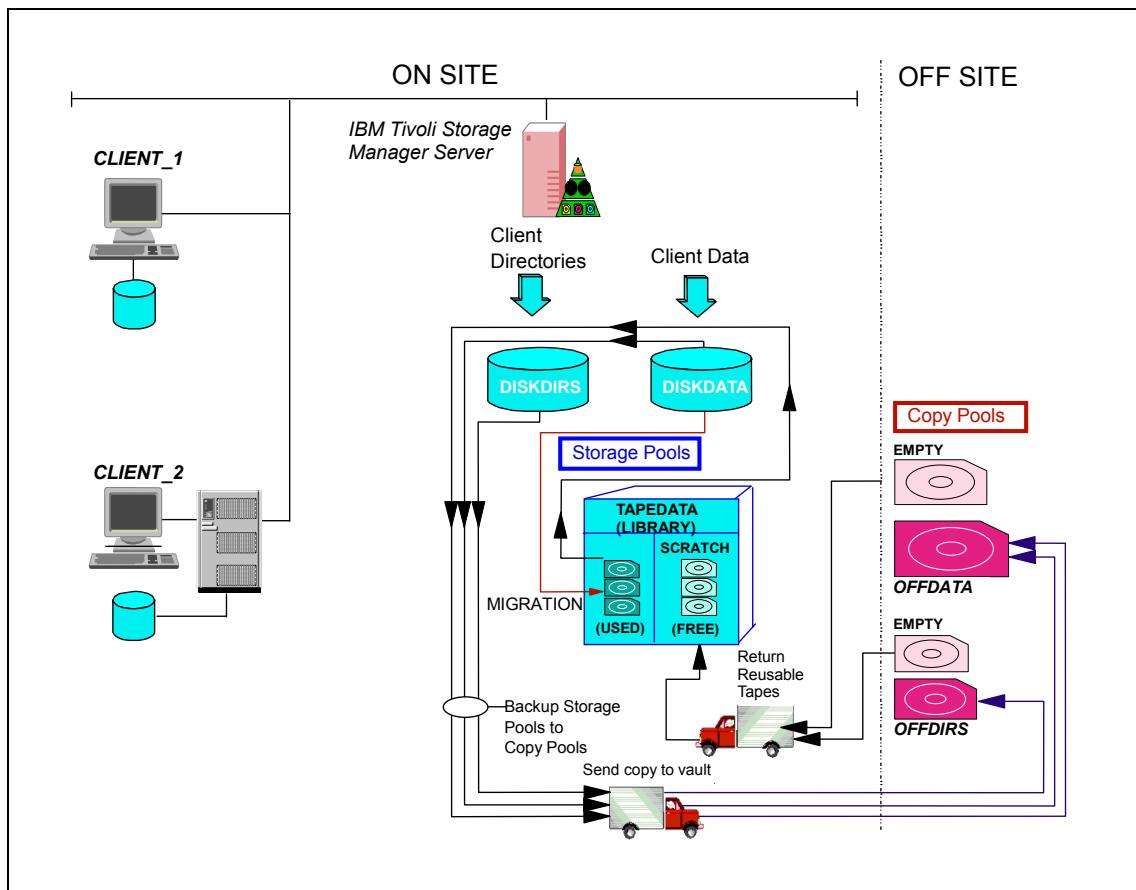


Figure 6-1 Storage pool hierarchy for our recommended setup

6.1.1 Primary storage pools

In our example solution we set up four primary storage pools: TAPEDATA, DISKDATA, DISKDIRS, and NONE. Storage pool TAPEDATA must be set up before storage pool DISKDATA, because DISKDATA refers to TAPEDATA as its next storage pool.

The examples in this chapter set up the following storage pools:

1. A primary storage pool named TAPEDATA, with device class LTO2-DC. The pool has collocation by node, and reclamation turned off (set to 100%).
2. A primary storage pool named DISKDATA, with a device class of DISK. It has an upper threshold of 70% that must be reached for migration to start, and a lower threshold of 30% that is reached or surpassed before migration stops. The pool to which data migrated goes is called TAPEDATA. The disk pool does not cache migrated data.
3. A primary storage pool named DISKDIRS, with a device class of FILE. It has migration turned off and no next storage pool, keeping the client directory structure permanently on disk. The pool has collocation by node, ensuring that clients' directories will be stored in separate volumes. Note that only directories from clients where the directories have extended attributes will be stored in the storage pool. Windows and NetWare clients have extended file attributes. On UNIX clients, the directory entries are stored directly in the Tivoli Storage Manager database. The reason for having a separate storage pool for directories is so that we can guarantee the directories will be stored on disk, and not require tape mounts when files are restored. If you do not use the DIRM C client option to specify where directories are stored, they will be sent to whichever storage pool is pointed to by the management class with the longest retention period, which might end up being a tape storage pool.
4. A dummy storage pool named NONE that is simply a definition. No data will be stored in this storage pool, and there are no volumes assigned to it. It is simply used as a migration destination to prevent warnings when activating a policy set. See 7.1.3, “Defining management classes” on page 272, for a further explanation.

6.1.2 Copy storage pools

The example solution has two copy storage pools:

- ▶ OFFDATA for making copies of TAPEDATA to take off-site. OFFDATA is not collocated, and has reclamation set to 100% to avoid the reclamation process from starting until our scheduled reclamation. Reuse delay is set to five days.

- ▶ OFFDIRS, for making copies of DISKDIRS to take off-site. OFFDIRS is not collocated and also has its reclamation threshold set to 100%. Reuse delay is set to five days.

6.2 Devices

Before defining a new device to the Tivoli Storage Manager server, the device must first be configured under the operating system. We need the device name that the operating system understands when configuring the device to Tivoli Storage Manager.

Tivoli Storage Manager divides physical devices into two broad categories: random access devices and sequential access devices.

- ▶ *Random access devices*: magnetic disk devices. Tivoli Storage Manager uses disk devices for two main purposes:
 - To store the database and recovery log.
 - To store data from client nodes. The client data is stored in disk storage pools.

There are two types of disk-based storage pool:

- Those with random access volumes using a DISK device class
- Those with sequential volumes using a FILE device class (See next bullet, Sequential access devices.)

Magnetic disk devices do not need defining to Tivoli Storage Manager; they can be referred to directly using a standard drive and path reference, for example, C:\TSMDATA\STG\DISK_1.DSM for Windows or /tsm/stg/disk_01.dsm for UNIX/Linux. The device type of DISK is predefined in Tivoli Storage Manager and cannot be altered.

- ▶ *Sequential access devices*: tape drives, optical devices, and Write Once Read Many (WORM) devices. Medium changers such as tape libraries are also included, as well as sequential volumes on disk (FILE device class).

Drives and libraries must first be defined under the operating system. You then define the library and drives to Tivoli Storage Manager before defining storage pools that use the devices.

The FILE device type of DISK is predefined in Tivoli Storage Manager and cannot be altered.

Device drivers

IBM supplies device drivers for each of its library and tape devices, for each operating system the device is supported on. If you will be using another

vendor's device, you may require operating system device drivers for the device from the vendor. The following points should be noted:

- ▶ On Windows 2000 and 2003, you may need to use the Tivoli Storage Manager Device Driver.
 - However, if you are using IBM tape devices, such as the TS3100, TS3200, or TS3500 with LTO drives, you should install the IBM-supplied tape device drivers for Windows. You do not need to install the Tivoli Storage Manager Device Driver.
 - If you have devices from another vendor that are supported by Tivoli Storage Manager, you should install the Tivoli Storage Manager Device Driver.

You should also disable the Windows Removable Storage (RSM) service, as it may interfere with Tivoli Storage Manager.

Check the Windows device manager to ensure that the library appears under *Medium Changers* and the tape drives appear under *Tape Drives*. All devices should be *working properly*.

- ▶ For AIX and UNIX, IBM libraries and drives such as the TS3100, TS3200, or TS3500 with LTO drives, require the IBM Atape.driver package to be installed. Some IBM libraries, such as the 3494, also require the IBM atldd package. If you have a non-IBM device supported by Tivoli Storage Manager, you must install the tivoli.tsm.devices package.
- ▶ For Linux platforms, IBM libraries and drives require the IBM ibmtape and ibmatl packages for the particular Linux you are using. Non-IBM devices supported by Tivoli Storage Manager require the appropriate device driver package installed from the Tivoli Storage Manager distribution for the particular Linux you are using.

To use a sequential device with Tivoli Storage Manager, a number of components must be configured. The components can be thought of in two classes, physical and logical, and must be configured in the following order:

- ▶ Physical
 - a. The library (SCSI (automated) or MANUAL)
 - b. The library *path* (that is, the link from the server to the library's operating system device)
 - c. Tape drives within the library
 - d. Drive paths (one for each drive)
- ▶ Logical
 - a. *Device class*: Here you create a class for the library and associate it with the device type and the library name. The device type is from a Tivoli

- Storage Manager-supported list, and common to all Tivoli Storage Manager server platforms (for example LTO, 4MM, DLT).
- b. *Storage pool*: This specifies the device class to use for storing data. Storage pools have various attributes based on the device type. Many storage pools can use the same device class.
- c. *Volumes*: These are objects belonging to a particular storage pool. For sequential access devices, volumes are usually tape cartridges or magneto-optical discs. Volumes can be assigned to a scratch pool where they are used as needed or assigned as private to a particular storage pool.

As mentioned above, when configuring sequential access devices for use, there is an order that must be followed. If you try to create a Tivoli Storage Manager object that has a parameter referring to another item, that item must already exist.

Table 6-1 on page 221 details the steps required in order to configure each device and storage pool you wish to set up. It also shows the reference sections in this chapter for completing the tasks.

Note: The examples in this section deal with an automated library (SCSI). Automated libraries are the most common libraries in use.

Table 6-1 Guide to setting up storage pools

Order of definition	Component class	Component	To define the type of device below, follow each component section			
			Auto library	Disk stg pool	Sequential disk stg pool	Copy stg pool
1	Physical	Library	6.2.1, “Defining a library” on page 222	N/A	N/A	N/A
2		Library Path	6.2.2, “Defining a path to a library” on page 223	N/A	N/A	N/A
3		Drive	6.2.3, “Defining a drive in a library” on page 225	N/A	N/A	N/A
4		Drive Path	6.2.4, “Defining a path to a drive in a library” on page 226	N/A	N/A	N/A

Order of definition	Component class	Component	To define the type of device below, follow each component section			
			Auto library	Disk stg pool	Sequential disk stg pool	Copy stg pool
5	Logical	Device Class	6.2.5, “Defining a device class for a library” on page 228	N/A	6.2.6, “Defining a sequential file device class” on page 230	
6		Storage Pool	6.3.1, “Defining a sequential access tape storage pool” on page 232	6.3.2, “Defining a random access disk storage pool” on page 233	6.3.3, “Defining a sequential access file storage pool” on page 234	6.3.4, “Defining a copy storage pool” on page 237
7		Volume	6.4.2, “Tape volumes” on page 241	6.4.1, “Defining random access disk volumes” on page 239	N/A	

6.2.1 Defining a library

There are two parts to configuring a library: defining the library and defining a path to it. To define the library, you simply need the name you will call it, the type (SCSI, MANUAL, 349X, and so on), whether you will share it with another Tivoli Storage Manager server, and whether you wish unlabeled tapes to be automatically labelled for use. Example 6-1 shows an example of the **define library** command.

Example 6-1 Defining an automated SCSI library

```
tsm: ATLANTIC>define library 3582lib libtype=scsi shared=yes autolabel=yes
ANR8400I Library 3582LIB defined.
```

```
tsm: ATLANTIC>q libr f=d
```

Library Name: 3582LIB

```
Library Type: SCSI
    ACS Id:
    Private Category:
    Scratch Category:
    WORM Scratch Category:
    External Manager:
        Shared: Yes
        LanFree:
    ObeyMountRetention:
    Primary Library Manager:
        WWN:
        Serial Number:
        AutoLabel: Yes
        Reset Drives: Yes
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 12:17:50
```

6.2.2 Defining a path to a library

A path to a device is a link between the Tivoli Storage Manager server and the operating system name for the device. Automated libraries have a medium changer (also known as a robot) that performs movement operations on tapes inside the library. The medium changer has an associated operating system device name. You will need to find the operating system device names for each device before you define it to Tivoli Storage Manager.

Windows 2000/2003: Open the Tivoli Storage Management Console. In the left-hand pane, expand Tivoli Storage Manager, your server name, TSM Device Driver, Reports, Device Information. The device is under the TSM Name column in the right-hand pane, for example, lb0.1.0.2.

AIX users: Run the following AIX command to find the device name, for example, `/dev/smco`:

```
root@Atlantic /: lsdev -Cc tape
rmt0 Available 1Z-08-01 IBM 3580 Ultrium Tape Drive (FCP)
rmt1 Available 1Z-08-01 IBM 3580 Ultrium Tape Drive (FCP)
smc0 Available 1Z-08-01 IBM 3582 Library Medium Changer (FCP)
```

Before defining the path, the library must already be defined, as in 6.2.1, “Defining a library” on page 222. Paths also have a source and a destination. The source is the name of the server or datamover from which you are defining the path. The destination is the name of the library or drive to which you are defining

the path. Example 6-2 shows an example of the **define path** command when used to define a path from a server to a library.

Example 6-2 Defining a path to an automated library

```
tsm: ATLANTIC>define path ATLANTIC 3582LIB srctype=server autodetect=yes  
desttype=library device=/dev/smco online=yes  
ANR1720I A path from ATLANTIC to 3582LIB has been defined.
```

```
tsm: ATLANTIC>q path f=d  
  
Source Name: ATLANTIC  
Source Type: SERVER  
Destination Name: 3582LIB  
Destination Type: LIBRARY  
Library:  
Node Name:  
Device: /dev/smco  
External Manager:  
LUN:  
Initiator: 0  
Directory:  
On-Line: Yes  
Last Update by (administrator): ADMIN  
Last Update Date/Time: 02/22/2006 12:32:27
```

```
tsm: ATLANTIC>q library f=d  
  
Library Name: 3582LIB  
Library Type: SCSI  
ACS Id:  
Private Category:  
Scratch Category:  
WORM Scratch Category:  
External Manager:  
Shared: Yes  
LanFree:  
ObeyMountRetention:  
Primary Library Manager:  
WWN: 500308C140067006  
Serial Number: 0000013108231000  
AutoLabel: Yes  
Reset Drives: Yes  
Last Update by (administrator): ADMIN  
Last Update Date/Time: 02/22/2006 12:32:41
```

With the path successfully created, the **query library** command now provides us with some more information. We can see the SAN World-Wide Name (WWN) and the library's serial number.

6.2.3 Defining a drive in a library

Libraries with multiple drives must have each drive defined to Tivoli Storage Manager. Each drive and each cartridge location in a library has what is known as an *element address*. The element address is used by the device driver when it sends a media movement command, for example, “move tape in element 4096 to tape drive at element 256”. Element information must be supplied when you define the drive, along with the serial number and, optionally, the WWN for SAN-attached drives. Use the **define drive** command to define each drive.

Element information

Element numbers can be discovered automatically when you specify the ELEMENT=AUTODetect option. However, the element number is not detected until you run the **define path** command. The element address is also printed in the manual that came with the library. Windows also has a wizard that can display the element number.

Serial number

The serial number of the drive can also be discovered automatically by specifying the SERIAL=AUTODetect option. Again, the element number is not detected until you run the **define path** command. Windows also has a wizard that can display the drive serial number.

WWN

The WWN can also be supplied if you wish. Typically, however, the WWN is detected when the **define path** command polls the drive to obtain other information.

Defining the drive

Example 6-3 shows the commands to define drives named DR00 and DR01 in the library named 3582LIB that we created earlier.

Example 6-3 Defining drives in an automated library

```
tsm: ATLANTIC>define drive 3582lib dr00 serial=autod online=yes element=autod  
cleanfreq=asneeded  
ANR8404I Drive DR00 defined in library 3582LIB.
```

```
tsm: ATLANTIC>define drive 3582lib dr01 serial=autod online=yes element=autod  
cleanfreq=asneeded
```

```
ANR8404I Drive DR01 defined in library 3582LIB.
```

```
tsm: ATLANTIC>q dr f=d
```

```
Library Name: 3582LIB
  Drive Name: DR00
  Device Type: UNKNOWN
  On-Line: Yes
  Read Formats:
  Write Formats:
    Element:
      Drive State: UNKNOWN
      Volume Name:
      Allocated to:
        WWN:
      Serial Number:
    Last Update by (administrator): ADMIN
    Last Update Date/Time: 02/22/2006 12:58:40
  Cleaning Frequency (Gigabytes/ASNEEDED/NONE): ASNEEDED
```

Notice that the element, serial number, WWN, and read and write format fields are not yet populated.

6.2.4 Defining a path to a drive in a library

As for the library, use the **define path** command. However, specify different options when defining a path to a drive. Example 6-4 shows the syntax of **define path** for drives.

Example 6-4 Defining drive paths

```
tsm: ATLANTIC>define path ATLANTIC DR00 srctype=server desttype=drive
1library=3582lib device=/dev/rmt0 online=yes
ANR1720I A path from ATLANTIC to 3582LIB DR00 has been defined.
```

```
tsm: ATLANTIC>define path ATLANTIC DR01 srctype=server desttype=drive
1library=3582lib device=/dev/rmt1 online=yes
ANR1720I A path from ATLANTIC to 3582LIB DR01 has been defined.
```

```
tsm: ATLANTIC>q drive f=d
```

```
Library Name: 3582LIB
  Drive Name: DR00
  Device Type: LTO
  On-Line: Yes
  Read Formats: ULTRIUM2C,ULTRIUM2,ULTRIUMC,ULTRIUM
  Write Formats: ULTRIUM2C,ULTRIUM2,ULTRIUMC,ULTRIUM
  Element: 257
```

```
Drive State: UNKNOWN
Volume Name:
Allocated to:
    WWN: 500308C140067006
    Serial Number: 1110177214
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 13:59:08
Cleaning Frequency (Gigabytes/ASNEEDED/NONE): ASNEEDED

Library Name: 3582LIB
Drive Name: DR01
Device Type: LTO
On-Line: Yes
Read Formats: ULTRIUM2C,ULTRIUM2,ULTRIUMC,ULTRIUM
Write Formats: ULTRIUM2C,ULTRIUM2,ULTRIUMC,ULTRIUM
Element: 256
Drive State: UNKNOWN
Volume Name:
Allocated to:
    WWN: 500308C140067003
    Serial Number: 1110176223
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 13:59:21
Cleaning Frequency (Gigabytes/ASNEEDED/NONE): ASNEEDED
```

When the paths are defined, the drive information is obtained. You can see in the example that the element number, serial number, WWN, and supported format fields are now populated. The Drive State field remains unknown at this stage, as we have not read from, nor written to, either of the drives.

The path information for the drives can also be displayed using **query path**, as shown in Example 6-5.

Example 6-5 Querying drive path information

```
tsm: ATLANTIC>q path * * srct=server destt=drive libr=35821ib f=d
```

```
Source Name: ATLANTIC
Source Type: SERVER
Destination Name: DR00
Destination Type: DRIVE
    Library: 3582LIB
    Node Name:
    Device: /dev/rmt0
External Manager:
    LUN:
    Initiator: 0
    Directory:
```

```
On-Line: Yes
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 13:59:08

Source Name: ATLANTIC
Source Type: SERVER
Destination Name: DR01
Destination Type: DRIVE
Library: 3582LIB
Node Name:
Device: /dev/rmt1
External Manager:
LUN:
Initiator: 0
Directory:
On-Line: Yes
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 13:59:21
```

6.2.5 Defining a device class for a library

A device class is the link between a storage pool and a particular device where you wish to store data.

In order to create a storage pool to use our library and tape drives, we must define a device class for the library (and its drives). A library can be defined in many device classes, and a device class can be used by many storage pools.

To define a device class, use the **define devclass** command. This command has many different options depending on the type of devices you are using. You should read the online help (**help define devclass**) before defining your device classes.

Some of the important options are:

- ▶ **FORMAT** defines the format in which the device reads and writes.
- ▶ **MOUNTRetention** specifies the amount of time a tape will remain mounted in a drive after it becomes idle. The default of 60 minutes is generally too long for most environments. If your environment requires frequent tape mounts, set a low value (5 or 10 minutes).
- ▶ **MOUNTWait** specifies the length of time the server will wait for a tape to become available in the library (that is, either mounted in a drive for a manual library, or checked in to an automated library).

Example 6-6 shows defining a device class for use with an IBM 3582 LTO2 library.

Example 6-6 Defining an LTO device class

```
tsm: ATLANTIC>define devclass LT02-DC library=3582LIB devtype=lto format=ultrium2c  
estcapacity=400G mountretention=10 mountwait=20 mountlimit=drives  
ANR2203I Device class LT02-DC defined.
```

```
tsm: ATLANTIC>q devc 1to2-dc f=d
```

```
Device Class Name: LT02-DC
Device Access Strategy: Sequential
Storage Pool Count: 0
    Device Type: LTO
        Format: ULTRIUM2C
    Est/Max Capacity (MB): 409,600.0
        Mount Limit: DRIVES
    Mount Wait (min): 20
    Mount Retention (min): 10
        Label Prefix: ADSM
        Library: 3582LIB
        Directory:
        Server Name:
        Retry Period:
        Retry Interval:
        Shared:
    High-level Address:
        Minimum Capacity:
            WORM: No
        Scaled Capacity:
Last Update by (administrator): ADMIN
Last Update Date/Time: 02/22/2006 14:48:51
```

The **query devclass** command shows the attributes of device classes.

You can, if you wish, define other device classes that use the same library. It is entirely up to how you want to configure your environment. For example, you could define another device class to be used exclusively for creating off-site tapes.

If you are using a separate library or a z/OS server platform, you need to define a separate device class.

Tip: Most tape library management systems on z/OS use the dataset name to identify tapes to be taken off-site. Tivoli Storage Manager uses the format <prefix>.BFS for both on-site and off-site dataset names in one device class. To choose another dataset name for off-site copies, create another device class for the off-site copies and choose a different prefix. Set the tape library management system to trigger on this off-site name, and off-site copies will be identified automatically.

The command shown in Example 6-7 defines a device class named LTO2-OFFSITE for library 3582LIB.

Example 6-7 Defining an extra device class for the same library

```
tsm: ATLANTIC>define devclass LT02-OFFSITE library=3582LIB devtype=lto
format=ultrium2c estcapacity=400G mountretention=10 mountwait=20 mountlimit=drives
ANR2203I Device class LT02-OFFSITE defined.
```

6.2.6 Defining a sequential file device class

Device classes that use a type of FILE allow a random access (disk) device to simulate a sequential device. The most common uses for sequential file storage pools are:

- ▶ If your library has a single drive and you want to perform reclamation on volumes in storage pools using this library. When you specify the reclamation pool for the storage pools, it must be a primary sequential storage pool. To use a disk for reclamation you must create a sequential file storage pool.
- ▶ Creating database backups for keeping on-site and online.

To configure a sequential storage pool, you must first define a device class of device type FILE. When defining the device class, you need to specify which directory to use and what the maximum size of each volume can be. Volumes in a sequential file storage pool are, of course, files. You can specify how big each of these files can become before the Tivoli Storage Manager server closes one and creates another.

As for other device classes, use the **define devclass** command, specifying the DEVType=FILE option. Example 6-8 defines a device class named SEQF-DC with a maximum capacity of 256 MB. We also create a sequential file device class for use with directory metadata (from the directory management class).

Example 6-8 Defining a sequential file device class

```
tsm: ATLANTIC>define devclass seqf-dc devtype=file mountlimit=25 maxcapacity=256M  
directory=/tsm/stg/seqf  
ANR2203I Device class SEQF-DC defined.
```

```
tsm: ATLANTIC>q devc seqf-dc f=d
```

```
Device Class Name: SEQF-DC  
Device Access Strategy: Sequential  
Storage Pool Count: 0  
Device Type: FILE  
Format: DRIVE  
Est/Max Capacity (MB): 256.0  
Mount Limit: 25  
Mount Wait (min):  
Mount Retention (min):  
Label Prefix:  
Library:  
Directory: /tsm/stg/seqf  
Server Name:  
Retry Period:  
Retry Interval:  
Shared:  
High-level Address:  
Minimum Capacity:  
WORM: No  
Scaled Capacity:  
Last Update by (administrator): ADMIN  
Last Update Date/Time: 02/22/2006 15:50:07
```

```
tsm: ATLANTIC>define devclass dirm-dc devtype=file mountlimit=50 maxcapacity=64M  
directory=/tsm/stg/dirm  
ANR2203I Device class DIRM-DC defined.
```

6.3 Storage pools

Storage pools are the logical entities in which Tivoli Storage Manager stores client data. Up to now, we have configured the devices that our storage pools will use for physically storing the data. Now we create the pools.

Tivoli Storage Manager has two types of storage pools:

- ▶ Primary storage pools
- ▶ Copy storage pools

A primary storage pool can use random access storage (DISK device class) or sequential access storage (tape, optical, or file device classes). A copy storage pool can use only sequential access storage.

You can define your storage pools in any order. However, it is easier to first create the pools that will be pointed to by others.

6.3.1 Defining a sequential access tape storage pool

Define a primary tape storage pool using the **define stgpool** command with your defined device class (LTO2-DC in our case). Important options are:

- ▶ MAXSCRatch: This is the number of scratch tapes that the storage pool can use before it reports that it is full. For automatic libraries, set MAXSCRatch to a large number (for example, 1,000,000) to avoid the server stopping when the storage pool is “full.” For manual libraries with a small capacity, set MAXSCRatch to a more realistic number.
- ▶ REClaim: This is the percentage of empty space on a tape volume that will cause the server to try to consolidate the remaining data to another volume. Set REClaim to 100 to disable reclamation. This requires scheduled reclamation for the storage pool.
- ▶ COLlocate: This specifies whether the server tries to keep data from a client, group of clients, or client file spaces on as few tapes as possible (known as collocation). Collocation reduces the number of tapes required to perform restore operations, but will increase the number of tapes required to store client data.
- ▶ RECLAIMSTGpool: If your library has only one drive, you will need another primary sequential storage pool to permit reclamation. Note that we do not recommend single drive configurations for production systems, as discussed in 2.9.3, “Number of tape drives” on page 52.

Example 6-9 defines a primary sequential tape pool.

Example 6-9 Defining a primary sequential tape pool

```
tsm: ATLANTIC>define stgpool tapedata LT02-DC description="Primary tape pool"
reclaim=100 maxscratch=1000000 collocate=node
ANR2200I Storage pool TAPEDATA defined (device class LT02-DC).
```

```
tsm: ATLANTIC>q stgp
Storage   Device   Estimated   Pct   Pct   High   Low   Next Storage
```

Pool Name	Class Name	Capacity	Util	Migr	Mig	Mig	Pool
Pct Pct							
TAPEDATA	LT02-DC	0.0 M	0.0	0.0	90	70	

6.3.2 Defining a random access disk storage pool

Define a primary disk storage pool using the **define stgpool** command with the predefined device class of DISK. Some of the options you should consider are:

- ▶ NEXTstgpool: defines the next storage pool in the hierarchy. NEXTstgpool is where migrated data is sent, or files exceeding MAXSize (see below).
- ▶ MAXSize: the maximum size a file can be to be stored in the storage pool. Any file over this size is written to the next storage pool. If NEXTstgpool is not defined, the store operation for the file fails.
- ▶ Hlghmig: the threshold at which migration starts. When the storage pool reaches this percentage of its capacity, a migration process will begin to move the data to the NEXTstgpool.
- ▶ LOwmig: when migration stops. When migration is running, if the utilization of the pool falls to or below this value, migration stops.
- ▶ CAChe: specifies whether a copy of a migrated file is cached in the pool after migration to the next pool. Caching files can improve restore performance, but may cause other processes to suffer. For example, if a disk pool is full of cached files, when a client backs up new data into that pool, the server must find suitable cached files to remove and provide free space for the new data.

Example 6-10 defines a storage pool named DISKDATA with a high migration threshold of 80% and a low migration threshold of 30%. We also create the dummy pool NONE. Both use the predefined device class of DISK.

Example 6-10 Defining a random access DISK storage pool

```
tsm: ATLANTIC>define stgpool DISKDATA disk description="Disk storage pool"
nextstgpool=tapedata maxsize=1G highmig=80 lowmig=30
ANR2200I Storage pool DISKDATA defined (device class DISK).
```

```
tsm: ATLANTIC>define stg none DISK
ANR2200I Storage pool NONE defined (device class DISK).
```

```
tsm: ATLANTIC>q stgp
```

Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Pct Migr	High Mig	Low Mig	Next Storage Pool
Pct Pct							

DISKDATA	DISK	0.0 M	0.0	0.0	80	30	TAPEDATA
NONE	DISK	0.0 M	0.0	0.0	90	70	
TAPEDATA	LTO2-DC	0.0 M	0.0	0.0	90	70	

Note that the estimated capacity and utilization figures are zero at this point, as we have not assigned any volumes or stored any data as yet.

6.3.3 Defining a sequential access file storage pool

Define a primary tape storage pool using the **define stgpool** command with your defined device class (LTO2-DC). Some of the options you should consider are:

- ▶ **MAXSCRatch**: number of scratch volumes that the storage pool can use before it reports that it is full. For sequential file storage pools, set MAXSCRatch to a large number (for example, 1,000,000) to avoid the server stopping when the storage pool is full. Sequential file storage pools create and delete volumes as required. However, when a volume is created, the number of scratch volumes used is incremented.
- ▶ **COLlocate**: specifies whether the server tries to keep data from a client, group of clients, or client file spaces on as few tapes as possible (known as *collocation*). Collocation reduces the number of volumes required to perform restore operations, but will increase the number of volumes required to store client data.

Example 6-11 shows the definition of two sequential access storage pools.

Example 6-11 Defining sequential file storage pools

```
tsm: ATLANTIC>define stgpool DISKFILE seqf-dc description="Sequential file storage
pool" collocate=node maxscratch=1000000
ANR2200I Storage pool DISKFILE defined (device class SEQF-DC).

tsm: ATLANTIC>define stgpool DISKDIRS dirm-dc description="Sequential file storage
pool for directory metadata" collocate=node maxscratch=1000000
ANR2200I Storage pool DISKDIRS defined (device class DIRM-DC).
```

tsm: ATLANTIC>q stgp

Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Pct Migr	High Mig Pct	Low Mig Pct	Next Storage Pool
DISKDATA	DISK	0.0 M	0.0	0.0	80	30	TAPEDATA
DISKDIRS	DIRM-DC	0.0 M	0.0	0.0	90	70	

DISKFILE	SEQF-DC	0.0 M	0.0	0.0	90	70
NONE	DISK	0.0 M	0.0	0.0	90	70
TAPEDATA	LT02-DC	0.0 M	0.0	0.0	90	70

Operation of a sequential access FILE storage pool

A sequential access storage pool with a FILE device class acts somewhat differently compared to a storage pool mapped to a physical tape or optical device. When disk is used, the server opens a file only when one is required. The storage pool shows an estimated capacity of zero megabytes until data has been sent to it. Following a client backup operation, we see the estimated capacity increase. The estimated capacity is calculated as the product of the maximum volume size (MAXCAP, 64 MB) and the maximum number of scratch volumes allowed (MAXSCR, 1,000,000). For DISKDIRS, the estimated capacity is 64,000 GB (64 TB).

The server creates and names volumes as they are needed. Volumes do not have to be defined in sequential file storage pools.

The first volume created in the DISKDIRS pool is named 0000001b.BFS.

Example 6-12 Sequential FILE storage pool volumes

tsm: ATLANTIC>q vol

Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Volume Status
/tsm/stg/dirm/0000001B-.BFS	DISKDIRS	DIRM-DC	64.0	100.0	Full
/tsm/stg/dirm/0000002A-.BFS	DISKDIRS	DIRM-DC	64.0	0.0	Filling

From AIX shell prompt:

```
root@Atlantic :/ cd /tsm/stg/dirm
root@Atlantic /tsm/stg/dirm: ls -l
total 132608
-rw----- 1 root      system      67108864 Feb 23 15:52 0000001b.bfs
-rw----- 1 root      system      786432 Feb 23 15:52 0000002a.bfs
```

Single drive reclamation using disk for reclaim storage pool

To perform reclamation with a single tape drive, specify the RECLAIMSTGpool parameter when creating the tape storage pool. RECLAIMSTGpool points to another primary sequential storage pool that can be used as the holding area for the data being consolidated. The *holding area* storage pool then refers to the original pool being reclaimed as its NEXTstgpool. Note that we do not

recommend using single drive configurations for production environments, as discussed in 2.9.3, "Number of tape drives" on page 52.

Example 6-13 updates the existing storage pool TAPEDATA to use DISKFILE as its reclamation storage pool. We then update DISKFILE to change its next storage pool to TAPEDATA.

Example 6-13 Updating storage pools

```
tsm: ATLANTIC>update stgpool tapedata reclaimstgpool=diskfile
ANR2202I Storage pool TAPEDATA updated.
```

```
tsm: ATLANTIC>q stg tapedata f=d

Storage Pool Name: TAPEDATA
Storage Pool Type: Primary
Device Class Name: LT02-DC
Estimated Capacity: 0.0 M
Space Trigger Util:
    Pct Util: 0.0
    Pct Migr: 0.0
    Pct Logical: 0.0
    High Mig Pct: 90
    Low Mig Pct: 70
    Migration Delay: 0
    Migration Continue: Yes
    Migration Processes: 1
    Reclamation Processes: 1
    Next Storage Pool:
        Reclaim Storage Pool: DISKFILE
    Maximum Size Threshold: No Limit
        Access: Read/Write
        Description: Primary tape pool
    Overflow Location:
    Cache Migrated Files?:
        Collocate?: Node
    Reclamation Threshold: 100
    Offsite Reclamation Limit:
    Maximum Scratch Volumes Allowed: 1,000,000
    Number of Scratch Volumes Used: 0
    Delay Period for Volume Reuse: 0 Day(s)
        Migration in Progress?: No
        Amount Migrated (MB): 0.00
    Elapsed Migration Time (seconds): 0
        Reclamation in Progress?: No
    Last Update by (administrator): ADMIN
        Last Update Date/Time: 02/23/2006 09:35:08
    Storage Pool Data Format: Native
    Copy Storage Pool(s):
```

```

Continue Copy on Error?:  

    CRC Data: No  

    Reclamation Type: Threshold

tsm: ATLANTIC>update stg diskfile nextstgpool=tapedata  

ANR2202I Storage pool DISKFILE updated.

tsm: ATLANTIC>q stg diskfile

Storage      Device      Estimated   Pct      Pct      High     Low     Next Storage
Pool Name    Class Name  Capacity    Util     Migr    Mig     Mig     Pool
                           Pct       Pct
-----  -----  -----  -----  -----  -----  -----  -----
DISKFILE     SEQF-DC      0.0 M    0.0     0.0     90      70     TAPEDATA
-----
```

6.3.4 Defining a copy storage pool

A copy storage pool is used to create copies (backups) of primary storage pools.

In our example solution, we have two copy storage pools: OFFDIRS and OFFDATA.

Reuse delay

The example copy pools have a reuse delay of five days. The reuse delay must expire before empty off-site tape volumes are moved back to the scratch pool. The delay allows for a period of time in which the off-site tapes, even though “empty,” may be required for a restore. For example, if your most current off-site backups were destroyed in transit, you may need to restore from a database backup made four days ago. The four-day-old database backup will still reference now-empty tapes, but consider them as having data. The reuse delay allows you to use these tapes even though they are currently considered empty. The reuse delay is especially helpful during a long company shutdown, such as at the end of the year, when the off-site data must remain intact in case a disaster occurs at your main site. You should set the reuse delay equal to the expiry period of your database backups. For example, if you are using DRM and your DRMDBBackupexpiredays is set to 6, or you run **delete volhistory type=dbbackup todays=today-6**, you should set REUsedelay on the copy storage pools to 6 as well.

The commands given in Example 6-14 set up the following storage pools:

- ▶ A copy storage pool named OFFDIRS, with device class LTO2-DC.
Reclamation is switched off and the reuse delay is set for five days.
- ▶ A copy storage pool named OFFDATA, with device class LTO2-DC.
Reclamation is switched off and the reuse delay is set for five days.

When defining copy storage pools, the same options as for defining sequential pools apply, except you must specify POOLTYPE=COPIY, and reclamation is by default set at 100 percent.

Example 6-14 Defining copy storage pools

```
tsm: ATLANTIC>define stgpool OFFDIRS 1to2-dc pooltype=copy description="Copy  
storage pool for directories" maxscratch=1000000 reusedelay=5  
ANR2200I Storage pool OFFDIRS defined (device class LT02-DC).
```

```
tsm: ATLANTIC>define stgpool OFFDATA 1to2-dc pooltype=copy description="Copy  
storage pool for data" maxscratch=1000000 reusedelay=5  
ANR2200I Storage pool OFFDATA defined (device class LT02-DC).
```

```
tsm: ATLANTIC>q stg pooltype=copy
```

Storage Pool Name	Device Class	Estimated Capacity	Pct Util	Pct Migr	High Mig Pct	Low Mig Pct	Next Pool	Storage
OFFDATA	LT02-DC	0.0 M	0.0					
OFFDIRS	LT02-DC	0.0 M	0.0					

6.3.5 Deleting the default storage pools

Now that you have created your storage pools as planned, you can delete the default storage pools to tidy up your installation. The **delete stgpool** command removes a storage pool, as shown in Example 6-15.

Example 6-15 Deleting the default storage pools

```
tsm: ATLANTIC>del stgpool archivepool  
ANR2200I Storage pool ARCHIVEPOOL deleted.
```

```
tsm: ATLANTIC>del stgpool backuppool  
ANR2200I Storage pool BACKUPPOOL deleted.
```

```
tsm: ATLANTIC>del stgpool spacemgpool  
ANR2200I Storage pool SPACEMGPOOL deleted.
```

In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into the Tivoli Storage Manager. The macro mac.stgdelete, which we provide to delete the default storage pools, is shown in “Delete default storage pools” on page 739. The macro deletes the four default storage pools automatically set up by the Windows installation, including an additional storage pool named DISKPOOL. Note that a Tivoli Storage Manager installation on a UNIX platform does *not* create DISKPOOL. You must remove the line deleting DISKPOOL before running the macro.

6.4 Storage pool volumes

Now that our storage pools are defined, we must perform one final task for each of them. Storage pools must contain volumes to be able to store data. For disk storage pools, volumes are simply files (usually large) located on the server’s file systems. For tape storage pools (both primary and copy), volumes are physical tape cartridges. In order to write to or read from the tapes, they must be *mountable*, that is, present in a library. Tape volumes are still regarded as part of a storage pool even though they might no longer be inside a tape library (that is, *not-mountable* or *off-site*).

This section provides examples of assigning volumes to storage pools. You can add or remove volumes to and from storage pools without interrupting server operations. For example, if you install a new disk drive for a disk pool, the Tivoli Storage Manager administrator can move the storage pool data from the old pool to the new pool without shutting down the server. Or, if you have to add space to a storage pool, you can easily define new volumes and expand the size of the storage pool without disrupting service.

6.4.1 Defining random access disk volumes

Disk volumes can be defined to a Tivoli Storage Manager storage pool in two ways. Described here is the more efficient one-step process using the **define volume** command with the FORMATSIZE option. The other method has two steps: prepare the disk volume using the dsmfmt utility and then define the volume to the storage pool using the **define volume** command.

By now you will have decided on your disk storage pool volume numbers and sizes. Remember that it is better to have a number of smaller volumes than a single large volume in your disk storage pools. Although they take up the same amount of space, having more smaller volumes is more efficient. With a single volume in the pool, only a single server thread can write to it at any given time. With more volumes, more server threads can write to them simultaneously. Multiple volumes can be spread over more physical disks, enhancing

performance. And with more volumes, you can easily remove some from one pool and assign to another if your requirements change during processing (temporarily or permanently).

Example 6-16 shows the commands to define and query volumes.

Example 6-16 Defining volumes to the DISKDATA storage pool

```
tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_01.dsm
formatsize=2048 wait=no
ANR2491I Volume Creation Process starting for /tsm/stg/diskdata/ddvol_01.dsm,
Process Id 16.
ANS8003I Process number 16 started.

tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_02.dsm
formatsize=2048 wait=no
ANR2491I Volume Creation Process starting for /tsm/stg/diskdata/ddvol_02.dsm,
Process Id 17.
ANS8003I Process number 17 started.

tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_03.dsm
formatsize=2048 wait=no
...
tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_04.dsm
formatsize=2048 wait=no
...
tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_05.dsm
formatsize=2048 wait=no
...
tsm: ATLANTIC>define volume diskdata /tsm/stg/diskdata/ddvol_06.dsm
formatsize=2048 wait=nos
ANR0984I Process 21 for DEFINE VOLUME started in the FOREGROUND at 11:33:53.
ANR2206I Volume /tsm/stg/diskdata/ddvol_06.dsm defined in storage pool DISKDATA
(device class DISK).
ANR0986I Process 21 for DEFINE VOLUME running in the FOREGROUND processed 1
items for a total of 2,147,483,648 bytes
with a completion state of SUCCESS at 11:37:19.

tsm: ATLANTIC>q vol stg=diskdata

      Volume Name          Storage     Device      Estimated    Pct   Volume
           Pool Name        Class Name Capacity     Util   Status
-----  -----  -----  -----  -----  -----
/tsm/stg/diskdata-  DISKDATA    DISK       2,048.0    0.0  On-Line
/ddvol_01.dsm
/tsm/stg/diskdata-  DISKDATA    DISK       2,048.0    0.0  On-Line
/ddvol_02.dsm
/tsm/stg/diskdata-  DISKDATA    DISK       2,048.0    0.0  On-Line
/ddvol_03.dsm
```

```

/tsm/stg/diskdata- DISKDATA DISK 2,048.0 0.0 On-Line
/ddvol_04.dsm
/tsm/stg/diskdata- DISKDATA DISK 2,048.0 0.0 On-Line
/ddvol_05.dsm
/tsm/stg/diskdata- DISKDATA DISK 2,048.0 0.0 On-Line
/ddvol_06.dsm

tsm: ATLANTIC>q stg diskdata

Storage Device Estimated Pct Pct High Low Next Storage
Pool Name Class Name Capacity Util Migr Mig Mig Pool
----- ----- ----- ----- ----- ----- ----- -----
DISKDATA DISK 12 G 0.0 0.0 80 30 TAPEDATA

```

The example starts five *define volume processes* in the background (some status messages have been removed to save space) and one in the foreground. Once all six are created, use **query volume** to display them. Notice that the storage pool statistics show an estimated capacity of 12 GB. You can also view the files at an operating system level, as shown in Example 6-17.

Example 6-17 Listing the volumes from the operating system

```

root@Atlantic : cd /tsm/stg/diskdata
root@Atlantic /tsm/stg/diskdata: ls -la
total 25166232
drwxr-xr-x 2 root system 256 Feb 23 11:33 .
drwxr-xr-x 6 root system 4096 Feb 23 11:32 ..
----- 1 root system 2147483648 Feb 23 11:36 ddvol_01.dsm
----- 1 root system 2147483648 Feb 23 11:36 ddvol_02.dsm
----- 1 root system 2147483648 Feb 23 11:37 ddvol_03.dsm
----- 1 root system 2147483648 Feb 23 11:37 ddvol_04.dsm
----- 1 root system 2147483648 Feb 23 11:37 ddvol_05.dsm
----- 1 root system 2147483648 Feb 23 11:37 ddvol_06.dsm
root@Atlantic /tsm/stg/diskdata:

```

6.4.2 Tape volumes

Tape volumes require a different procedure to make them ready for use. Firstly, a tape volume has to be prepared. Most modern tape libraries rely on a barcode label on the side of the tape cartridge to provide the robot with information about the cartridge. Most DLT and LTO media come without labels, but typically cannot be used (in a library) without them. You should order labels when you order your tape supplies. Labels can be made to your specifications. A label normally has three letters (that you can choose to be meaningful if you like), and three numbers that typically run in sequence for each label (for example, IBM000,

IBM001, IBM002, ... IBM999, and so on). Each tape cartridge must be supplied with a label before you attempt to use it in a library.

Tip: Although Tivoli Storage Manager allows you to use a volume label (also known as VOLSER or Volume ID) longer than six characters, we strongly recommend using a maximum of six alphanumeric characters. This is to maintain compatibility with other ANSI label systems.

Tapes with external labels on the cartridge can be loaded into the library, either by opening the door and physically placing them in magazine or cartridge slots or importing them into the library via the bulk loader or I/O port. Methods of importing cartridges into a library are specific to the library. Please consult your documentation for instructions.

Now that the new tapes are in the library, Tivoli Storage Manager must write a label to them before they can be used. The barcode label on the side of the cartridge is usually used as the source for the label being written.

There are two methods to label tapes: using the administrative command **label libvolume** or using the external **dsmlabel** command. If you use **label libvolume**, the labelling process can also check the tapes in to Tivoli Storage Manager's inventory. If you choose to use **dsmlabel**, you must then use **checkin libvolume** to check the tapes into inventory.

Once the tapes are checked in, they can be used, either in a scratch pool, or assigned as private volumes to a particular storage pool.

If a tape already has a label written to it (that is, it has been used before), the tape can simply be checked in to the library without having to be re-labelled.

In Example 6-18 we loaded 17 new cartridges into our IBM 3582 library. We used the **label libvolume** command to label and check the tapes into the library, and specified the option **LABELSource=Barcode** to tell the labelling process to use the barcode as the label.

Example 6-18 Labelling and checking tape into the library

```
tsm: ATLANTIC>label libvolume 3582lib search=yes labelsource=barcode  
checkin=scratch  
ANS8003I Process number 888 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
----------------	---------------------	--------

25	LABEL LIBVOLUME	ANR8801I Labelling volumes in library 3582LIB; 6 volume(s) labelled.
----	-----------------	---

The label libvolume process runs in the background, and you can check the status using the **query process** command. The labelling process can take a long time if you are labelling a whole library full of tapes. The activity log also shows the completion messages from the label libvolume process. You can then query the library's contents using **query libvolume**, as shown in Example 6-19.

Example 6-19 Querying the activity log and library volumes

```
tsm: ATLANTIC>q actlog begint=-00:05
Date/Time           Message
-----
02/23/2006 14:35:07 ANR8801I LABEL LIBVOLUME process 25 for library 3582LIB
                      completed; 17 volume(s) labelled, 17 volume(s)
                      checked-in. (SESSION: 82, PROCESS: 25)
02/23/2006 14:35:07 ANR0985I Process 25 for LABEL LIBVOLUME running in the
                      BACKGROUND completed with completion state SUCCESS at
                      14:35:07. (SESSION: 82, PROCESS: 25)
```

tsm: ATLANTIC>q libvol

Library	Name	Volume	Name	Status	Owner	Last Use	Home	Device
							Element	Type
3582LIB		020AKK		Scratch		4,096	LTO	
3582LIB		021AKK		Scratch		4,097	LTO	
3582LIB		022AKK		Scratch		4,117	LTO	
3582LIB		023AKK		Scratch		4,099	LTO	
3582LIB		026AKK		Scratch		4,102	LTO	
3582LIB		027AKK		Scratch		4,116	LTO	
3582LIB		028AKK		Scratch		4,104	LTO	
3582LIB		029AKK		Scratch		4,103	LTO	
3582LIB		030AKK		Scratch		4,106	LTO	
3582LIB		031AKK		Scratch		4,107	LTO	
3582LIB		032AKK		Scratch		4,100	LTO	
3582LIB		033AKK		Scratch		4,109	LTO	
3582LIB		034AKK		Scratch		4,098	LTO	
3582LIB		036AKK		Scratch		4,101	LTO	
3582LIB		037AKK		Scratch		4,113	LTO	
3582LIB		038AKK		Scratch		4,114	LTO	
3582LIB		039AKK		Scratch		4,115	LTO	

The Home Element column is the numerical address of the cartridge slot in the library. The library user's guide has a diagram to map the address to a physical

slot. Note that **query libvolume** displays the inventory in order of the volume label, not by element or slot. Note also that the Owner and Last Use fields are not populated, as the tapes have only just been checked in and not used yet.

Replies to messages

Depending on the method used to load the tapes into the library, you may need to answer a message generated by the server. If a message is generated, the **label libvolume** or **checkin libvolume** process will not proceed until you answer the message. The message is generated to give you time to load the cartridges. Example 6-20 shows a checkin process via the I/O port, the request it generates, and how to deal with it.

Example 6-20 Querying for and answering messages

```
tsm: ATLANTIC>checkin libvol 3582lib search=bulk checklabel=barcode status=scratch
ANS8003I Process number 29 started.

tsm: ATLANTIC>q pr

  Process  Process Description  Status
  Number

-----
  29  CHECKIN LIBVOLUME    ANR8425I Checking in volumes in search mode in
      library 3582LIB.

tsm: ATLANTIC>query request
ANR8352I Requests outstanding:
ANR8373I 001: Fill the bulk entry/exit port of library 3582LIB with all LTO
volumes to be processed within 60 minute(s); issue 'REPLY' along with the
request ID when ready.

tsm: ATLANTIC>reply 001
ANR8499I Command accepted.

tsm: ATLANTIC>q actlog begint=-00:05
Date/Time          Message
-----
02/23/2006 14:57:09 ANR8352I Requests outstanding: (SESSION: 82)
02/23/2006 14:57:09 ANR8373I 001: Fill the bulk entry/exit port of library
      3582LIB with all LTO volumes to be processed within 60
      minute(s); issue 'REPLY' along with the request ID when
      ready. (SESSION: 82)
02/23/2006 14:57:20 ANR2017I Administrator ADMIN issued command: REPLY 001
      (SESSION: 82)
02/23/2006 14:57:20 ANR8499I Command accepted. (SESSION: 82)
02/23/2006 14:58:02 ANR8430I Volume 033AKK has been checked into library
      3582LIB. (SESSION: 82, PROCESS: 29)
02/23/2006 14:58:02 ANR8431I CHECKIN LIBVOLUME process completed for library
```

```
3582LIB; 1 volume(s) found. (SESSION: 82, PROCESS: 29)
02/23/2006 14:58:02 ANR0985I Process 29 for CHECKIN LIBVOLUME running in the
BACKGROUND completed with completion state SUCCESS at
14:58:02. (SESSION: 82, PROCESS: 29)
```

The process actually starts before we answer the request, but there is no way to tell that it is waiting unless you query for requests (or have an administrative session open in console mode). The request and reply are logged in the activity log, and we see the completion messages from our checkin libvol process.

6.5 Additional commands

The following sections provide examples of commands directly related to data storage.

6.5.1 Auditing library contents

The **audit library** command verifies that the inventory of an automated library is consistent with the server's inventory for that library. You should audit your library if someone accidentally or deliberately moves tapes around in their slots, or inserts or removes volumes without using the correct Tivoli Storage Manager commands. It is also useful as a general check if you suspect that Tivoli Storage Manager's own inventory of the tapes does not match the real situation (for example, if you see messages in the activity log complaining that tapes are not where they are expected to be). If any inconsistencies are detected, the server updates its inventory to reflect the current state of the library. Missing volumes are deleted and moved volumes are updated with their new location. Volumes that are not part of the server's inventory are not added, they must be checked in.

The **audit library** command does not perform any operations until all volumes in any of the tape drives are dismounted (that is, the drives must be idle). You can force volume dismounts using the **dismount volume** command.

By default, **audit library** mounts each tape and reads the label. If the labels written on the tapes are the same as the barcodes, you can specify **CHECKLabel=Barcode**. The audit process will then read the barcode only, checking against the server's inventory. Be aware that the audit process can be time consuming, especially for large-capacity libraries, as it must mount and read the label on every volume.

Example 6-21 shows the audit process for our 3582LIB library.

Example 6-21 Auditing library contents

```
tsm: ATLANTIC>audit library 3582lib checklabel=barcode
ANS8003I Process number 34 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
34	AUDIT LIBRARY	ANR8459I Auditing volume inventory for library 3582LIB.

```
tsm: ATLANTIC>q act begint=-00:03
```

Date/Time	Message
02/23/2006 15:30:46	ANR2017I Administrator ADMIN issued command: AUDIT LIBRARY 3582lib checklabel=barcode (SESSION: 82)
02/23/2006 15:30:46	ANR0984I Process 34 for AUDIT LIBRARY started in the BACKGROUND at 15:30:46. (SESSION: 82, PROCESS: 34)
02/23/2006 15:30:46	ANR8457I AUDIT LIBRARY: Operation for library 3582LIB started as process 34. (SESSION: 82, PROCESS: 34)
02/23/2006 15:30:48	ANR2017I Administrator ADMIN issued command: QUERY PROCESS (SESSION: 82)
02/23/2006 15:30:51	ANR2017I Administrator ADMIN issued command: QUERY PROCESS (SESSION: 82)
02/23/2006 15:30:53	ANR8461I AUDIT LIBRARY process for library 3582LIB completed successfully. (SESSION: 82, PROCESS: 34)
02/23/2006 15:30:53	ANR0985I Process 34 for AUDIT LIBRARY running in the BACKGROUND completed with completion state SUCCESS at 15:30:53. (SESSION: 82, PROCESS: 34)

6.5.2 Auditing volume contents

The **audit volume** command checks for inconsistencies between the database references for objects stored on a volume, and what is actually found to be stored on the volume. The volume must be mounted in a tape drive in order to read its contents. The **audit volume** command is especially useful when integrity errors are detected on a volume, as you can determine what, if any, files on the volume are still readable and take appropriate action to restore it from a copy storage pool.

By contrast, the **query content** command (see 6.5.10, “Querying volume contents” on page 260) displays only the database’s view of what is stored and does not require the volume to be mounted.

Example 6-22 audits a volume named 031AKK and logs any discrepancies to the activity log.

Example 6-22 Audit volume process

```
tsm: ATLANTIC> audit volume 031AKK fix=no
ANR2310W This command will compare all inventory references to volume 031AKK
with the actual data stored on the volume and will report any discrepancies;
the data will be inaccessible to users until the operation completes.

Do you wish to proceed? (Yes/No) y
ANR2313I Audit Volume (Inspect Only) process started for volume 031AKK (process
ID 40).
ANS8003I Process number 40 started.
```

Specifying the FIX=No option (which is the default) reports any discrepancies to the activity log only. No changes are made. We recommend that you run with FIX=No first before running with FIX=Yes, just to see what will happen when the volume is “fixed.” Example 6-23 shows the process with FIX=Yes specified.

Example 6-23 Audit volume process, Fix=Yes

```
tsm: ATLANTIC> audit volume 031AKK fix=yes
ANR2310W This command will compare all inventory references to volume 031AKK
with the actual data stored on the volume and will report any discrepancies;
the data will be inaccessible to users until the operation completes.

Do you wish to proceed? (Yes/No) y
ANR2313I Audit Volume (Repair) process started for volume 031AKK (process ID
42).
ANS8003I Process number 42 started.
```

tsm: ATLANTIC> q pr

Process	Process Description	Status Number
42	Audit Volume (Repair)	Volume 031AKK (storage pool TAPEDATA), Files Processed: 888, Damaged Files Found: 65, Partial Files Skipped: 0. Current Physical File (bytes): 1,365,981,012 Current input volume: 031AKK.

tsm: ATLANTIC>q act

Date/Time	Message
-----------	---------

```
-----  
02/23/2006 16:22:25 ANR2017I Administrator ADMIN issued command: AUDIT VOLUME  
031AKK FIX=YES (SESSION: 110)  
02/23/2006 16:22:25 ANR0984I Process 35 for AUDIT VOLUME (REPAIR) started in  
the BACKGROUND at 16:38:13. (SESSION: 110, PROCESS: 42)  
02/23/2006 16:22:26 ANR1199I Removable volume 031AKK is required for audit  
process. (SESSION: 110)  
02/23/2006 16:22:26 ANR8324I LTO volume 031AKK is expected to be mounted (R/W).  
(SESSION: 110)  
02/23/2006 16:28:13 ANR2312I Audit Volume (Repair) process started for volume  
031AKK (process ID 42). (SESSION: 110, PROCESS: 42)  
02/23/2006 16:28:13 ANR8340I Removable volume 031AKK mounted.  
(SESSION: 110, PROCESS: 42)  
02/23/2006 16:28:13 ANR0512I Process 42 opened input volume 031AKK (SESSION:  
110, PROCESS: 42)  
02/23/2006 16:38:14 ANR4132I Audit volume process ended for volume 031AKK;  
3628380 files inspected, 911 damaged files deleted,  
371 damaged files marked as damaged,  
1282 objects updated. (SESSION: 110, PROCESS: 42)  
02/23/2006 16:38:14 ANR0987I Process 42 for AUDIT VOLUME (REPAIR) running in  
the BACKGROUND processed 3628380 items with a completion  
state of SUCCESS at 16:38:14. (SESSION: 110, PROCESS: 42)  
02/23/2006 16:38:14 ANR0514I Session 110 closed volume 031AKK. (SESSION: 110)
```

6.5.3 Back up a storage pool

The **backup stgpool** command backs up a primary storage pool to a copy pool. If the primary storage pool is a tape storage pool, two physical drives will be required. The input volume from the primary storage pool will be mounted in one drive, while the output volume from the copy storage pool will be mounted in the other. The two drives can be in the same or different libraries. To back up a random access storage pool to a copy storage pool requires only one drive. Typically, the storage pool backup process is automated. We describe how in 12.2.1, “Defining an off-site backup schedule” on page 377.

Backing up from a disk pool is generally quicker than backing up from a tape storage pool. However, current generation LTO3 drives on a SAN can outperform disks when streaming. We recommend that you perform your storage pool backups according to your tape hardware speed.

Nevertheless, we recommend that you size your disk pools sufficiently to hold all the data from a normal night’s backup operation. Sufficiently sized disk pools will prevent migration to tape during the backup period.

Typically, you would define one copy storage pool for a primary storage pool hierarchy. In our setup, both DISKDATA and TAPEDATA are backed up to the

copy storage pool OFFDATA. Because the **backup stgpool** operation is incremental, only new files in the primary pool are copied to the copy pool. If we first back up DISKDATA, then TAPEDATA, any files that might have migrated from DISKDATA to TAPEDATA after we backed up DISKDATA do not get copied a second time from TAPEDATA to OFFDATA.

Example 6-24 backs up a storage pool named TAPEDATA to a copy pool named OFFDATA.

Example 6-24 Backup storage pool

```
tsm: ATLANTIC> backup stgpool tapedata offdata
ANS8003I Process number 18 started.

tsm: ATLANTIC> query proc

Process Process Description Status
Number

-----
18 Backup Storage Pool Primary Pool TAPEDATA, Copy Pool OFFDATA, Files
Backed Up: 0, Bytes Backed Up: 0, Unreadable
Files: 0, Unreadable Bytes: 0. Current Physical
File (bytes): 1,074,198
Current input volume: ALF007.
Waiting for mount of scratch volume (11
seconds).
```

Check the activity log to see the successful completion, as shown in Example 6-25.

Example 6-25 Verifying that the storage pool backup completed

```
tsm: ATLANTIC> query actlog

02/23/06 17:54:40 ANR2017I Administrator ADMIN issued command: BACKUP
STGPOOL tapedata offdata
02/23/06 17:54:40 ANR0984I Process 18 for BACKUP STORAGE POOL started in the
BACKGROUND at 17:54:40.
02/23/06 17:54:40 ANR2110I BACKUP STGPOOL started as process 18.
02/23/06 17:54:40 ANR1210I Backup of primary storage pool TAPEDATA to copy
storage pool OFFDATA started as process 18.
02/23/06 17:54:40 ANR1228I Removable volume ALF007 is required for storage
pool backup.
02/23/06 17:54:40 ANR8324I LTO volume ALF007 is expected to be mounted
(R/W).
02/23/06 17:55:12 ANR8329I LTO volume ALF007 is mounted R/W in drive DR00
(/dev/rmt0), status: IDLE.
02/23/06 17:55:12 ANR8334I 1 volumes found.
02/23/06 17:55:15 ANR2017I Administrator ADMIN issued command: QUERY REQ
```

```
02/23/06 17:55:15 ANR8346I QUERY REQUEST: No requests are outstanding.  
02/23/06 17:56:02 ANR8337I LTO volume CLA001 mounted in drive DR01  
          (/dev/rmt1).  
02/23/06 17:56:02 ANR1340I Scratch volume CLA001 is now defined in storage  
          pool OFFDATA.  
02/23/06 17:56:12 ANR1212I Backup process 18 ended for storage pool  
          TAPEDATA.  
02/23/06 17:56:12 ANR0986I Process 18 for BACKUP STORAGE POOL running in the  
          BACKGROUND processed 1646 items for a total of 6,459,588  
          bytes with a completion state of SUCCESS at 17:56:12.  
02/23/06 17:56:12 ANR1214I Backup of primary storage pool TAPEDATA to copy  
          storage pool OFFDATA has ended. Files Backed Up: 1646,  
          Bytes Backed Up: 6459588, Unreadable Files: 0, Unreadable  
          Bytes: 0.
```

It may be beneficial, if you have enough fast tape drives, to consider setting the COPYSTGpools attribute of the primary disk storage pools. The COPYSTGpools attribute causes the server to write to the copy storage pool set by COPYSTGpools at the same time as it is storing data in the primary disk pool. While this has distinct advantages (you do not have to back up your primary storage pool later on, for example), the backup process can slow down from the client's point of view, as it waits for two writes to complete instead of one.

6.5.4 Check a tape in to a library

The **checkin libvolume** command can perform two functions. Firstly, it can move a tape volume from an I/O port on the library into an empty cartridge slot within the library. Secondly, it updates Tivoli Storage Manager's volume inventory for the library. If a tape has already been placed in a slot inside the library, **checkin libvolume** can simply search the library for the tape.

Before the next two examples, the tapes were checked out of the library and the tape magazines removed for library maintenance purposes. The magazines were placed back in the library in the same positions as before.

Example 6-26 shows the checkin process for scratch volumes.

Example 6-26 Checking in volumes in search mode

```
tsm: ATLANTIC>checkin libvol 35821ib search=yes checklabel=barcode status=scratch  
ANS8003I Process number 8 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
-----	-----	-----

8 CHECKIN LIBVOLUME ANR8425I Checking in volumes in search mode
in library 3582LIB.

tsm: ATLANTIC>**q act**

Date/Time	Message
02/27/2006 10:54:38	ANR8430I Volume 039AKK has been checked into library 3582LIB. (SESSION: 128, PROCESS: 8)
02/27/2006 10:54:38	ANR8430I Volume 027AKK has been checked into library 3582LIB. (SESSION: 128, PROCESS: 8)
02/27/2006 10:54:38	ANR8443E CHECKIN LIBVOLUME: Volume 022AKK in library 3582LIB cannot be assigned a status of SCRATCH. (SESSION: 128, PROCESS: 8)
02/27/2006 10:54:38	ANR8431I CHECKIN LIBVOLUME process completed for library 3582LIB; 14 volume(s) found. (SESSION: 128, PROCESS: 8)
02/27/2006 10:54:38	ANR0985I Process 8 for CHECKIN LIBVOLUME running in the BACKGROUND completed with completion state SUCCESS at 10:54:38. (SESSION: 128, PROCESS: 8)

tsm: ATLANTIC>**q libvol**

Library Name	Volume Name	Status	Owner	Last Use	Home Element	Device Type
3582LIB	021AKK	Scratch		4,097	LTO	
3582LIB	026AKK	Scratch		4,102	LTO	
3582LIB	027AKK	Scratch		4,116	LTO	
3582LIB	028AKK	Scratch		4,104	LTO	
3582LIB	029AKK	Scratch		4,103	LTO	
3582LIB	030AKK	Scratch		4,106	LTO	
3582LIB	031AKK	Scratch		4,107	LTO	
3582LIB	032AKK	Scratch		4,100	LTO	
3582LIB	033AKK	Scratch		4,109	LTO	
3582LIB	034AKK	Scratch		4,098	LTO	
3582LIB	036AKK	Scratch		4,101	LTO	
3582LIB	037AKK	Scratch		4,113	LTO	
3582LIB	038AKK	Scratch		4,114	LTO	
3582LIB	039AKK	Scratch		4,115	LTO	

Notice that the volume 022AKK cannot be assigned a status of scratch. 022AKK belongs to storage pool TAPEDATA (similarly with 023AKK (OFFDATA) and 020AKK (database backup)).

To check the extra volumes in, we must check them in as private. Example 6-27 shows the checkin process for the private volumes.

Example 6-27 Checking in tapes with private status

```
tsm: ATLANTIC>checkin libvol 3582lib status=private checklabel=barcode search=yes  
ANS8003I Process number 10 started.
```

```
tsm: ATLANTIC>q act
```

Date/Time	Message
02/27/2006 11:10:09	ANR8430I Volume 020AKK has been checked into library 3582LIB. (SESSION: 129, PROCESS: 10)
02/27/2006 11:10:09	ANR8430I Volume 023AKK has been checked into library 3582LIB. (SESSION: 129, PROCESS: 10)
02/27/2006 11:10:09	ANR8430I Volume 022AKK has been checked into library 3582LIB. (SESSION: 129, PROCESS: 10)
02/27/2006 11:10:09	ANR8431I CHECKIN LIBVOLUME process completed for library 3582LIB; 3 volume(s) found. (SESSION: 129, PROCESS: 10)
02/27/2006 11:10:09	ANR0985I Process 10 for CHECKIN LIBVOLUME running in the BACKGROUND completed with completion state SUCCESS at 11:10:09. (SESSION: 129, PROCESS: 10)

```
tsm: ATLANTIC>q libvol
```

Library Name	Volume Name	Status	Owner	Last Use	Home Element	Device Type
3582LIB	020AKK	Private	ATLANTIC	4,096	LTO	
3582LIB	021AKK	Scratch		4,097	LTO	
3582LIB	022AKK	Private	ATLANTIC	4,117	LTO	
3582LIB	023AKK	Private	ATLANTIC	4,099	LTO	
3582LIB	026AKK	Scratch		4,102	LTO	
3582LIB	027AKK	Scratch		4,116	LTO	
3582LIB	028AKK	Scratch		4,104	LTO	
3582LIB	029AKK	Scratch		4,103	LTO	
3582LIB	030AKK	Scratch		4,106	LTO	
3582LIB	031AKK	Scratch		4,107	LTO	
3582LIB	032AKK	Scratch		4,100	LTO	
3582LIB	033AKK	Scratch		4,109	LTO	
3582LIB	034AKK	Scratch		4,098	LTO	
3582LIB	036AKK	Scratch		4,101	LTO	
3582LIB	037AKK	Scratch		4,113	LTO	
3582LIB	038AKK	Scratch		4,114	LTO	
3582LIB	039AKK	Scratch		4,115	LTO	

Notice that the Last Use column is blank, as these tapes were used before being checked out and back in again. The Last Use column only applies to tapes that have been used after being checked in.

6.5.5 Check out library volumes

To check out library volumes, use the **checkout libvol** command. Depending on the library and the operation you perform, there can be up to three parts to the checkout operation:

- ▶ Issue the command to check out the library volume.
- ▶ Check for outstanding messages requiring replies.
- ▶ Reply to the messages.

If you are checking out a single volume, you can have it moved to the I/O port to make it easier to remove. If you are checking out a large number of tapes it may be easier to check the volumes out, but have the checkout process leave them in the library for manual removal later on.

Check out the volumes

Example 6-28 shows checking out a single volume to the I/O port of the library.

Example 6-28 Checking out a single volume from a library

```
tsm: ATLANTIC>checkout libvolume 35821ib 033akk remove=yes
ANS8003I Process number 28 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
28	CHECKOUT LIBVOLUME	ANR8436I Checking out volume 033AKK from library 3582LIB.

```
tsm: ATLANTIC>q act
```

Date/Time	Message
02/23/2006 14:52:50	ANR8829I Remove volume 033AKK from slot 16 of library 3582LIB at your convenience. (SESSION: 82, PROCESS: 28)
02/23/2006 14:52:50	ANR8438I CHECKOUT LIBVOLUME for volume 033AKK in library 3582LIB completed successfully. (SESSION: 82, PROCESS: 28)
02/23/2006 14:52:50	ANR0985I Process 28 for CHECKOUT LIBVOLUME running in the BACKGROUND completed with completion state SUCCESS at 14:52:50. (SESSION: 82, PROCESS: 28)

Example 6-29 shows checking out multiple volumes together by separating the volume labels with commas (no spaces). You can also specify a file name that contains a list of volumes to be checked out.

Example 6-29 Checking out multiple volumes from a library

```
tsm: ATLANTIC>checkout libvolume 3582LIB 027akk,028akk,029akk remove=yes
```

```
ANS8003I Process number 53 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
53	CHECKOUT LIBVOLUME	ANR8436I Checking out volume 027AKK from library 3582LIB.

Check for messages

When checking volumes out of a library such as an IBM 3582 with only a single slot I/O port, the checkout command will move one tape to the I/O port, issue a message, and wait for you to reply to it.

To check for outstanding messages, issue a **query request** command, as shown in Example 6-30.

Example 6-30 Checking for messages

```
tsm: ATLANTIC>query request
```

```
ANR8352I Requests outstanding:
```

```
ANR8322I 015: Remove LTO volume 027AKK from entry/exit port of library 3582LIB;  
issue 'REPLY' along with the request ID when ready.
```

Reply to the message

Issue the **reply** command with the message number (015 from Example 6-30).

Example 6-31 Replying to a message

```
tsm: ATLANTIC>reply 015
```

```
ANR8499I Command accepted.
```

The checkout command will continue to process each volume, issuing a message for each one.

6.5.6 Deleting storage-related objects

To remove storage-related objects, we use variations of the **delete** command. To delete objects in the storage hierarchy, you must first delete objects that depend on the object you wish to delete.

Suppose you want to delete a library. You must first remove any references to it. The following objects *must* first be removed before deleting the library:

- ▶ Paths to drives in the library
- ▶ Drives in the library
- ▶ The path to the library

If you wish to remove all objects associated with a library, you should also remove the storage pools and device classes using the library. You do not have to delete the device class or storage pools using the library to delete the library.

Tape volumes are bound to a device class; if you wish to delete the device class you must first delete all the tape volumes that are bound to it. Deleting all those tape volumes may not be desirable. However, if you wish to keep using the tapes, you will need to create a new library that uses the same device class as the one being deleted.

You can only delete a storage pool if there are no storage pool volumes assigned to it. If there are storage pool volumes assigned, you need to use **delete volume** to remove them first. With **delete volume**, you can specify whether to discard any data stored on the volumes. Be very careful with this command. You can also use **move data** to move data from one storage pool to another.

Example 6-32 shows the sequence of commands required to remove a library.

Example 6-32 Library deletion command sequence

```
tsm: ATLANTIC>del path atlantic dr00 srct=server destt=drive libr=3582lib
ANR1721I A path from ATLANTIC to 3582LIB DR00 has been deleted.
```

```
tsm: ATLANTIC>del path atlantic dr01 srct=server destt=drive libr=3582lib
ANR1721I A path from ATLANTIC to 3582LIB DR01 has been deleted.
```

```
tsm: ATLANTIC>del drive 3582lib dr00
ANR8412I Drive DR00 deleted from library 3582LIB.
```

```
tsm: ATLANTIC>del drive 3582lib dr01
ANR8412I Drive DR01 deleted from library 3582LIB.
```

```
tsm: ATLANTIC>del path atlantic 3582lib srct=server destt=library
ANR1721I A path from ATLANTIC to 3582LIB has been deleted.
```

```
tsm: ATLANTIC>del library 3582lib
ANR8410I Library 3582LIB deleted.
```

```
tsm: ATLANTIC>q libvol
ANR2034E QUERY LIBVOLUME: No match found using this criteria.
ANS8001I Return code 11.
```

```
tsm: ATLANTIC>q vol devc=1to2-dc
```

Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Volume Status
022AKK	TAPEDATA	LTO2-DC	409,600.0	11.3	Filling
023AKK	OFFDATA	LTO2-DC	409,600.0	11.3	Filling

Note that once the library is deleted, no library volumes are present, even though we did not specifically check the volume out of the library before deleting it. Note also that the volumes are still bound to the device class LTO2-DC.

6.5.7 Mounted volumes

In some cases, you may wish to view which volumes are mounted, and dismount them before the mount retention period expires for the storage pool. Use the **query mount** and **dismount volume** commands. As shown in Example 6-33, there are two idle volumes mounted. We issue two **dismount** commands to unload them from the drives.

Example 6-33 Dismounting volumes

```
tsm: ATLANTIC>q mount
ANR8329I LTO volume 023AKK is mounted R/W in drive DR00 (/dev/rmt0), status:
IDLE.
ANR8329I LTO volume 022AKK is mounted R/W in drive DR01 (/dev/rmt1), status:
IDLE.
ANR8334I          2 matches found.
```

```
tsm: ATLANTIC>dismount volume 023AKK
ANR8499I Command accepted.
```

```
tsm: ATLANTIC>dismount volume 022AKK
ANR8499I Command accepted.
```

```
tsm: ATLANTIC>q mount
ANR8331I LTO volume 023AKK is mounted R/W in drive DR00 (/dev/rmt0), status:
DISMOUNTING.
```

```
ANR8331I LTO volume 022AKK is mounted R/W in drive DR01 (/dev/rmt1), status:  
DISMOUNTING.  
ANR8334I          2 matches found.
```

6.5.8 Migration

Migration is the process of moving data from one primary storage pool to the next storage pool specified by the NEXTstgpool attribute. Migration is performed with the **migrate stgpool** command. Specify a temporary low-migration threshold (LOwMig) and a duration (DUration) in minutes for which you want the migration process to run. The low-migration threshold, specified as a percentage value, indicates that the migration process will stop when the storage pool utilization reaches or is below this number. If you specify a duration, however, then the process will stop after this time period, regardless of whether the low threshold is reached. If you want the process to always continue until the threshold is reached, do not specify this parameter. During the period that the **migrate stgpool** command is active, the high migration threshold is ignored.

Example 6-34 shows the migration of the DISKDATA pool to TAPEDATA and the messages you will see in the activity log. In this case, we set the migration threshold to 0, which means that migration continues until the storage pool utilization is 0% (that is, until the storage pool is empty).

Example 6-34 Manual migration of a storage pool

```
tsm: ATLANTIC>migrate stgpool diskdata low=0 dur=30  
ANR2110I MIGRATE STGPOOL started as process 38.  
ANR1000I Migration process 38 started for storage pool DISKDATA manually,  
highMig=80, lowMig=0, duration=30.  
ANS8003I Process number 38 started.  
  
tsm: ATLANTIC>q pr  
  
Process  Process Description      Status  
Number  
-----  
38       Migration              Disk Storage Pool DISKDATA, Moved Files: 0,  
                                         Moved Bytes: 0, Unreadable Files: 0,  
                                         Unreadable Bytes: 0. Current Physical File  
(bytes): 4,096 Waiting for mount of scratch  
volume (10 seconds).  
  
tsm: ATLANTIC>q act  
  
Date/Time           Message  
-----
```

02/24/2006 09:23:51	ANR2017I Administrator ADMIN issued command: MIGRATE STGPOOL diskdata low=0 dur=30 (SESSION: 165)
02/24/2006 09:23:51	ANR0984I Process 38 for MIGRATION started in the BACKGROUND at 09:23:51. (SESSION: 165, PROCESS: 38)
02/24/2006 09:23:51	ANR2110I MIGRATE STGPOOL started as process 38. (SESSION: 165, PROCESS: 38)
02/24/2006 09:23:51	ANR1000I Migration process 38 started for storage pool DISKDATA manually, highMig=80, lowMig=0, duration=30. (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:13	ANR8379I Mount point in device class LT02-DC is waiting for the volume mount to complete, status: WAITING FOR VOLUME. (SESSION: 165)
02/24/2006 09:24:13	ANR8334I 1 matches found. (SESSION: 165)
02/24/2006 09:24:26	ANR8337I LTO volume 022AKK mounted in drive DR01 (/dev/rmt1). (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:26	ANR1340I Scratch volume 022AKK is now defined in storage pool TAPEDATA. (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:30	ANR0513I Process 38 opened output volume 022AKK. (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:34	ANR1001I Migration process 38 ended for storage pool DISKDATA. (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:34	ANR0986I Process 38 for MIGRATION running in the BACKGROUND processed 2166 items for a total of 77,815,808 bytes with a completion state of SUCCESS at 09:24:34. (SESSION: 165, PROCESS: 38)
02/24/2006 09:24:34	ANR0514I Session 165 closed volume 022AKK. (SESSION: 165)

Note the messages regarding the selection of a scratch tape (022AKK) and defining it in the TAPEDATA pool.

6.5.9 Moving data

The **move data** command moves data from one volume to another within the same storage pool or to another storage pool. If you are moving data within the same tape storage pool you will require two drives free (one for the source volume, one for the target volume).

The move data command can be used for moving any remaining data from a tape giving errors or moving data from a non-collocated tape to a collocated storage pool.

Example 6-35 on page 259 shows the **move data** command required to move data from one tape to another in the same tape storage pool. Volume 021AKK has data from three different nodes. We have changed the COLlocation attribute from No to Node. The move process moves data from the single volume to three others, keeping the data from each node separate.

Example 6-35 Moving data from one volume to another

```
tsm: ATLANTIC>move data 021akk stg=tapedata
ANR2232W This command will move all of the data stored on volume 021AKK to
other volumes within the same storage pool;
the data will be inaccessible to users until the operation completes.
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y
ANS8003I Process number 1 started.
```

```
tsm: ATLANTIC>q pr
```

Process Number	Process Description	Status
1	Move Data	Volume 021AKK (storage pool TAPEDATA), Target Pool TAPEDATA, Moved Files: 59769, Moved Bytes: 8,817,810,249, Unreadable Files: 0, Unreadable Bytes: 0. Current Physical File (bytes): 23,018,105 Current input volume: 021AKK. Current output volume: 029AKK.

```
tsm: ATLANTIC>q act
```

Date/Time	Message
02/28/2006 09:35:07	ANR2017I Administrator ADMIN issued command: MOVE DATA 021akk stg=tapedata (SESSION: 1)
02/28/2006 09:35:08	ANR1140I Move data process started for volume 021AKK (process ID 1). (SESSION: 1, PROCESS: 1)
02/28/2006 09:38:53	ANR1176I Moving data for collocation set 2 of 3 on volume 021AKK. (SESSION: 1, PROCESS: 1)
02/28/2006 09:38:53	ANR0515I Process 1 closed volume 028AKK. (SESSION: 1, PROCESS: 1)
02/28/2006 09:47:36	ANR1340I Scratch volume 030AKK is now defined in storage pool TAPEDATA. (SESSION: 1, PROCESS: 1)
02/28/2006 09:49:05	ANR1342I Scratch volume 021AKK is now pending - volume will be deleted from storage pool TAPEDATA after the reuse delay period for this storage pool has elapsed. (SESSION: 1, PROCESS: 1)
02/28/2006 09:49:05	ANR1141I Move data process ended for volume 021AKK. (SESSION: 1, PROCESS: 1)
02/28/2006 09:49:05	ANR0986I Process 1 for MOVE DATA running in the BACKGROUND processed 99594 items for a total of 12,903,630,500 bytes with a completion state of SUCCESS at 09:49:05. (SESSION: 1, PROCESS: 1)

6.5.10 Querying volume contents

You can see what files are on a volume using the **query content** command. The **query content** command queries the database to display the contents of a volume. It does not mount and read the volume. A volume does not have to be in a library before running **query content**, since only the database is queried, not the volume itself. The output generated by **query content** can be very long, but can be reduced by specifying the COUnt option, which limits the number of files displayed to COUnt, or by specifying the NODE or FIllespace options.

Example 6-36 shows an example of the output from **query content**.

Example 6-36 Querying volume contents

tsm: ATLANTIC>**q con 022akk**

Node Name	Type	Filespace Name	FSID	Client's Name for File
PARIS	Bkup	\paris\c\$	1	\ AUTOEXEC.BAT
PARIS	Bkup	\paris\c\$	1	\ CONFIG.SYS
PARIS	Bkup	\paris\c\$	1	\DOCUMENTS AND SETTINGS\ADMINISTRATOR\ NTUSER.INI
PARIS	Bkup	\paris\c\$	1	\DOCUMENTS AND SETTINGS\ADMINISTRATOR\ APPLICATION DATA\ADODE\FRAMEMAKER\7-.0\ MAKER.INI
...				
PARIS	Bkup	\paris\c\$	1	\LOTUS\123\ICONS\ RANGE.SMI
PARIS	Bkup	\paris\c\$	1	\LOTUS\123\ICONS\ RECORD.SMI
PARIS	Bkup	\paris\c\$	1	\LOTUS\123\ICONS\ SCRIPTNG.SMI
PARIS	Bkup	\paris\c\$	1	\LOTUS\123\ICONS\ SHEET.SMI

You can also use the COPied parameter, which will display files that either have or have not been backed up to a copy storage pool, depending on whether the parameter is set YES or NO.

6.5.11 Querying occupancy

The **query occupancy** command displays information about where a client's file spaces are stored and how much space they occupy. The information provided by **query occupancy** is only updated when an **audit license** command is run. If you have not run a license audit for some time, the results from **query occupancy** may not reflect reality.

Example 6-37 on page 261 shows the output from the **query occupancy** command.

Example 6-37 Querying occupancy

```
tsm: ATLANTIC>q occ
```

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
PARIS	Bkup	\paris\c\$	1	DISKDIRS	2,716	1.81	1.81
PARIS	Bkup	\paris\c\$	1	OFFDATA	2,166	73.67	73.67
PARIS	Bkup	\paris\c\$	1	TAPEDATA	2,166	73.67	73.67
PIERRE	Bkup	\pierre\c\$	1	DISKDIRS	8,624	5.95	5.95
PIERRE	Bkup	\pierre\c\$	1	OFFDATA	53,229	2,133.66	2,133.66
PIERRE	Bkup	\pierre\c\$	1	TAPEDATA	53,229	2,123.66	2,123.66

The **query occupancy** command can also be used to determine whose file spaces are occupying a certain device class or storage pool, as shown in Example 6-38.

Example 6-38 Querying occupancy based on device class

```
tsm: ATLANTIC>q occ devc=1to2-dc
```

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
PARIS	Bkup	\paris\c\$	1	OFFDATA	2,166	73.67	73.67
PARIS	Bkup	\paris\c\$	1	TAPEDATA	2,166	73.67	73.67
PIERRE	Bkup	\pierre\c\$	1	OFFDATA	53,229	2,133.66	2,133.66
PIERRE	Bkup	\pierre\c\$	1	TAPEDATA	53,229	2,123.66	2,123.66

6.5.12 Rename a storage pool

The **rename stgpool** command renames a storage pool. Note that if you change the name of a storage pool, you must update any management class copy groups that point to the original name.

Example 6-39 renames our DISKDATA pool to OLDRDATA.

Example 6-39 Renaming a storage pool

```
tsm: ATLANTIC>rename stg diskdata olrdata
```

```
ANR2213I RENAME STGPOOL: Storage pool DISKDATA renamed to OLDRDATA.
```

```

tsm: ATLANTIC>q stg
Storage      Device      Estimated   Pct    Pct  High  Low  Next Storage
Pool Name    Class Name  Capacity    Util   Migr  Mig  Mig  Pool
Pct          Pct
-----
OLDRDATA     DISK        12 G       0.0   0.0   80   30  TAPEDATA

```

6.5.13 Reclamation

Data on tapes in sequential access storage pools will eventually expire, leaving portions of the tapes with empty areas (also known as fragmentation). Over time, fragmentation can cause many tapes to have very little valid data on them.

Reclamation is the process where the valid data on a number of tapes is consolidated onto a smaller number of tapes. The tapes that are emptied by the reclamation process are returned to scratch status for reuse. See “Data Storage” in *IBM Tivoli Storage Management Concepts*, SG24-4877.

Reclamation is usually scheduled during a period of low activity because it can be a very intensive operation, for both the server and the tape drives. However, you can run reclamation manually using the **reclaim stgpool** command.

The **reclaim stgpool** command takes a number of options. To set the reclamation threshold, set the THreshold parameter to a value between 50 and 99. The THreshold value represents the percentage of reclaimable space on a volume. To check the amount of reclaimable space on a volume, run a **query volume** command. Subtract the value in the Pct Utilized column from 100 to obtain the percentage of reclaimable space on the volume. The other parameter required for **reclaim stgpool** is the DUration parameter. DUration is the length of time reclamation will run for on the selected storage pool. If there is nothing to reclaim, or reclamation finishes before the duration is over, the process exits.

Example 6-40 shows an example of the **reclaim stgpool** command.

Example 6-40 Reclaim stgpool command

```
tsm: ATLANTIC>reclaim stgpool offdata threshold=85 duration=30
```

```
tsm: ATLANTIC>q act
```

Date/Time	Message
03/02/2006 11:00:28	ANR2017I Administrator ADMIN issued command: RECLAIM STGPOOL offdata threshold=85 duration=30 (SESSION: 5)
03/02/2006 11:00:28	ANR0984I Process 1 for SPACE RECLAMATION started in the BACKGROUND at 11:00:28. (SESSION: 5, PROCESS: 1)
03/02/2006 11:00:28	ANR2110I RECLAIM STGPOOL started as process 1. (SESSION:

5, PROCESS: 1)
03/02/2006 11:00:28 ANR4931I Reclamation process 1 started for copy storage pool OFFDATA manually, threshold=85, offsiteRclmLimit=No Limit, duration=30. (SESSION: 5, PROCESS: 1)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):ANR2110I RECLAIM STGPOOL started as (SESSION: 5)
03/02/2006 11:00:28 ANR1040I Space reclamation started for volume 032AKK, storage pool OFFDATA (process number 1). (SESSION: 5, PROCESS: 1)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):process 1. (SESSION: 5)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):ANR4931I Reclamation process 1 started (SESSION: 5)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):for copy storage pool OFFDATA manually, (SESSION: 5)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):threshold=85, offsiteRclmLimit=No Limit, (SESSION: 5)
03/02/2006 11:00:28 ANR2753I (RECLAIM_OFFDATA):duration=30. (SESSION: 5)
03/02/2006 11:00:28 ANR2756I Scheduled command RECLAIM_OFFDATA started successfully. (SESSION: 5, PROCESS: 1)
03/02/2006 11:00:28 ANR1044I Removable volume 030AKK is required for space reclamation. (SESSION: 5, PROCESS: 1)
03/02/2006 11:01:22 ANR8337I LTO volume 030AKK mounted in drive DRO0 (mt0.0.0.2). (SESSION: 5, PROCESS: 1)
03/02/2006 11:01:24 ANR8337I LTO volume 039AKK mounted in drive DR01 (mt1.0.0.2). (SESSION: 5, PROCESS: 1)
03/02/2006 11:01:24 ANR0512I Process 1 opened input volume 030AKK. (SESSION: 5, PROCESS: 1)
03/02/2006 11:01:24 ANR0513I Process 1 opened output volume 039AKK. (SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR1342I Scratch volume 032AKK is now pending - volume will be deleted from storage pool OFFDATA after the reuse delay period for this storage pool has elapsed. (SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR1041I Space reclamation ended for volume 030AKK.
03/02/2006 11:03:27 ANR4933I Space reclamation ended for offsite volume 032AKK. (SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR4934I Offsite reclamation ended for storage pool OFFDATA, Number Processes 1, Number Volumes Reclaimed 1, Elapsed Time 179 seconds.(SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR4932I Reclamation process 1 ended for storage pool OFFDATA. (SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR0986I Process 1 for SPACE RECLAMATION running in the BACKGROUND processed 29315 items for a total of 2,760,732,066 bytes with a completion state of SUCCESS at 11:03:27. (SESSION: 5, PROCESS: 1)
03/02/2006 11:03:27 ANR4936I Reclamation of storage pool OFFDATA has ended. Files reclaimed: 29315, Bytes reclaimed: 2760732066, Files reconstructed: 0, Unreadable files: 0. (SESSION: 5)

Notice that volume 032AKK, once empty, will not be deleted from the pool until after the reuse delay.

6.5.14 SQL commands

The Tivoli Storage Manager database can be queried using structured query language (SQL) commands. The implementation of SQL within Tivoli Storage Manager is based on the SQL-1992 and SQL-1999 standards but is not a complete implementation; some SQL commands such as UNION, INTERSECT, and EXCEPT are not supported.

Three system catalog tables are available for querying:

- ▶ SYSCAT.TABLES contains information about all tables that can be queried.
- ▶ SYSCAT.COLUMNS describes the columns in each table.
- ▶ SYSCAT.ENUMTYPES defines the valid values for each enumerated data type.

For select operations, you can use TABLES, COLUMNS, and ENUMTYPES to display the database structure:

- ▶ **select tablename, remarks from tables**
- ▶ **select tablename, colname, typename, remarks from columns**
- ▶ **select typename, values, remarks from enumtypes**

When selecting the column data from the columns table, it is better to use a where clause to limit the output to that of the table you are looking for, as shown in Example 6-41.

Example 6-41 Querying the columns of a system table

```
tsm: LOCHNESS_SERVER1>select tablename, colname, typename, remarks from columns
where tablename='LIBVOLUMES'
```

TABNAME	COLNAME	TYPENAME	REMARKS
LIBVOLUMES	LIBRARY_NAME	VARCHAR	Library Name
LIBVOLUMES	VOLUME_NAME	VARCHAR	Volume Name
LIBVOLUMES	STATUS	VARCHAR	Status
LIBVOLUMES	OWNER	VARCHAR	Owner
LIBVOLUMES	LAST_USE	VARCHAR	Last Use
LIBVOLUMES	HOME_ELEMENT	INTEGER	Home Element
LIBVOLUMES	CLEANINGS_LEFT	INTEGER	Cleanings Left
LIBVOLUMES	DEVTYPE	VARCHAR	Device Type
LIBVOLUMES	MEDIATYPE	INTEGER	Media Type
LIBVOLUMES	OLD_STATUS	VARCHAR	Orig Status

Note that the table name is a string literal (enclosed in single quotes). The name must be supplied as it is stored in syscat.tables (that is, in uppercase). If it was supplied in lowercase, no data would have been returned.

You can generate your own custom queries and create your own commands by placing the queries into server scripts.

Example 1

Example 6-42 shows a select statement using the data obtained in Example 6-41 on page 264. The query generates a list of tape volumes in the library, sorted by the slot (home_element) number.

Example 6-42 Selecting libvolume data

```
tsm: ATLANTIC>select volume_name as "Volume", \
cont> library_name as "Library", \
cont> home_element as "Slot", \
cont> devtype as "Device type" \
cont> from libvolumes \
cont> order by home_element
```

Volume	Library	Slot	Device type
020AKK	3582LIB	4096	LTO
021AKK	3582LIB	4097	LTO
034AKK	3582LIB	4098	LTO
023AKK	3582LIB	4099	LTO
032AKK	3582LIB	4100	LTO
036AKK	3582LIB	4101	LTO
026AKK	3582LIB	4102	LTO
029AKK	3582LIB	4103	LTO
028AKK	3582LIB	4104	LTO
033AKK	3582LIB	4105	LTO
030AKK	3582LIB	4106	LTO
031AKK	3582LIB	4107	LTO
037AKK	3582LIB	4113	LTO
038AKK	3582LIB	4114	LTO
039AKK	3582LIB	4115	LTO
027AKK	3582LIB	4116	LTO
022AKK	3582LIB	4117	LTO

Example 2

Example 6-43 counts the number of volumes within each storage pool. This can be useful where you have large libraries with many volumes.

Example 6-43 Querying the number of volumes in each storage pool

```
tsm: ATLANTIC>select count(*) as "Number", \
cont> stgpool_name as "Storage Pool" \
cont> from volumes group by stgpool_name
```

Number	Storage Pool
6	DISKDATA
22	DISKDIRS
5	OFFDATA
5	TAPEDATA

Example 3

Example 6-44 lists how many files have been backed up from each node. You could query the ARCHIVES table instead of BACKUPS to see the number of files archived from each node.

Example 6-44 Querying the number of files backed up by each node

```
tsm: ATLANTIC>select node_name as "Node", \
cont> count(*) as "Files" from backups group by node_name
ANR2963W This SQL query may produce a very large result table, or may require a
significant amount of time to compute.
```

Do you wish to proceed? (Yes (Y)/No (N)) y

Node	Files
ATLANTIC	85
PAMELA	12065
PARIS	4882
PIERRE	61853

Notice the warning that is displayed when a potentially complex or time-consuming or space-consuming query is issued. You can answer no if you prefer to run the query at another time.

Example 4

Example 6-45 shows the volumes where a node has data stored and the storage pool that the volumes belong to.

Example 6-45 Querying volume usage by node

```
tsm: ATLANTIC> select distinct node_name, \
cont> volume_name from volumeusage where node_name='PARIS'
```

NODE_NAME	VOLUME_NAME	STGPOOL_NAME
PARIS	/tsm/stg/dirm/0000001B.BFS	DISKDIRS
PARIS	/tsm/stg/dirm/0000002A.BFS	DISKDIRS
PARIS	023AKK	OFFDATA
PARIS	022AKK	TAPEDATA

For more information about SQL commands, use the **help select** command.

6.6 Summary

You have now completed the storage pool section, in which we have covered topics related to configuring storage devices such as drives and libraries, managing tape volumes, and various related commands.

In the next chapter we focus on defining your policies (rules) for managing your data that has been backed up to Tivoli Storage Manager.



Data storage policies

In this chapter we focus on the actual storage policy implementation. Before continuing, you should have already filled out the planning sheets, and we assume that you have read and understood the *IBM Tivoli Storage Management Concepts*, SG24-4877. We have now covered planning through installation and customizing your storage devices. Now we cover how to set up your storage policies.

A data storage environment consists of three types of resources: machines, rules, and data. The machines are computers containing data that must be backed up, and the rules specify how the backup copies are to be treated.

Depending on how you need to manage your backup data, your data storage policy can be very simple or very complex. The simplest policy would have one set of rules that apply to all of the data in your organization, while the most complex policy would be to have a unique set of rules for each individual file. Most installations fall somewhere between these two extremes.

IBM Tivoli Storage Manager has entities that group and organize the resources and define relationships between them. A client, also known as a *node* in IBM Tivoli Storage Manager terminology, is grouped together with other nodes into a *policy domain*. The domain links the nodes to a *policy set*, which consists of *management classes*. A management class contains rules called *copy groups* that it links to the data. When the data is linked to particular rules, it is said to be bound to the management class that contains the rules.

7.1 Recommended setup

Figure 7-1 on page 271 shows the key components of our sample policy configuration. We define two policy domains, SERVER and WORKSTN. Both domains have *similar* policy sets and management classes, but their copy group details show that the SERVER domain has more copies and longer retention periods than the WORKSTN domain. It is not necessary to define multiple domains, but this demonstrates that the policy is really defined in the copy groups, and that the rest of the constructs are used primarily for flexibility.

In our environment, we want our data to be treated in the following way:

- ▶ Nodes registered to the SERVER domain will retain a maximum of three object copies (VEREXIST), and inactive copies will be stored for a maximum of 100 days (RETEXTRA) after becoming inactive. If an object is deleted from a node file system, we will retain only the latest copy (VERDEL) for 100 days (RETONLY). Primarily, we want to store only consistent backup copies (SHRSTATIC). Files that are being changed during backup, such as log files, should be bound to the *special* management class whose rules allow storing such files, but first attempt to back them up consistently (SHRDYNAMIC). Their retention and versioning rules are the same as for the normal data. We will archive files for a year (RETVER). Further, we want to store a maximum of three logical volume backups, and keep the inactive image backups for a maximum of 120 days once they became inactive.
- ▶ Nodes registered to the WORKSTN domain will retain a maximum of two object copies (VEREXIST), while inactive copies will be stored for a maximum of 30 days (RETEXTRA) after becoming inactive. If an object is removed from a node file system, we will retain only the latest copy of the object (VERDEL) for 30 days (RETONLY). Primarily, we want to store only consistent backup copies (SHRSTATIC). Files that are being changed during backup, such as log files, should be bound to the *special* management class whose rules allow storing such files, but first attempt to back them up consistently (SHRDYNAMIC). Log files should be bound to a management class whose rules allow storing changing files eventually (SHRDYNAMIC). Their retention and versioning rules are the same as for the normal data. We will archive objects for 30 days (RETVER). Further, we want to store a maximum of two logical volume backups, and keep the inactive image backups for a maximum of 30 days once they became inactive (RETEXTRA).

Obviously, your environment will have specific data protection requirements that may differ from our setup. This is the purpose of the planning process. The provided values here may give you a reasonable starting point for later customizations.

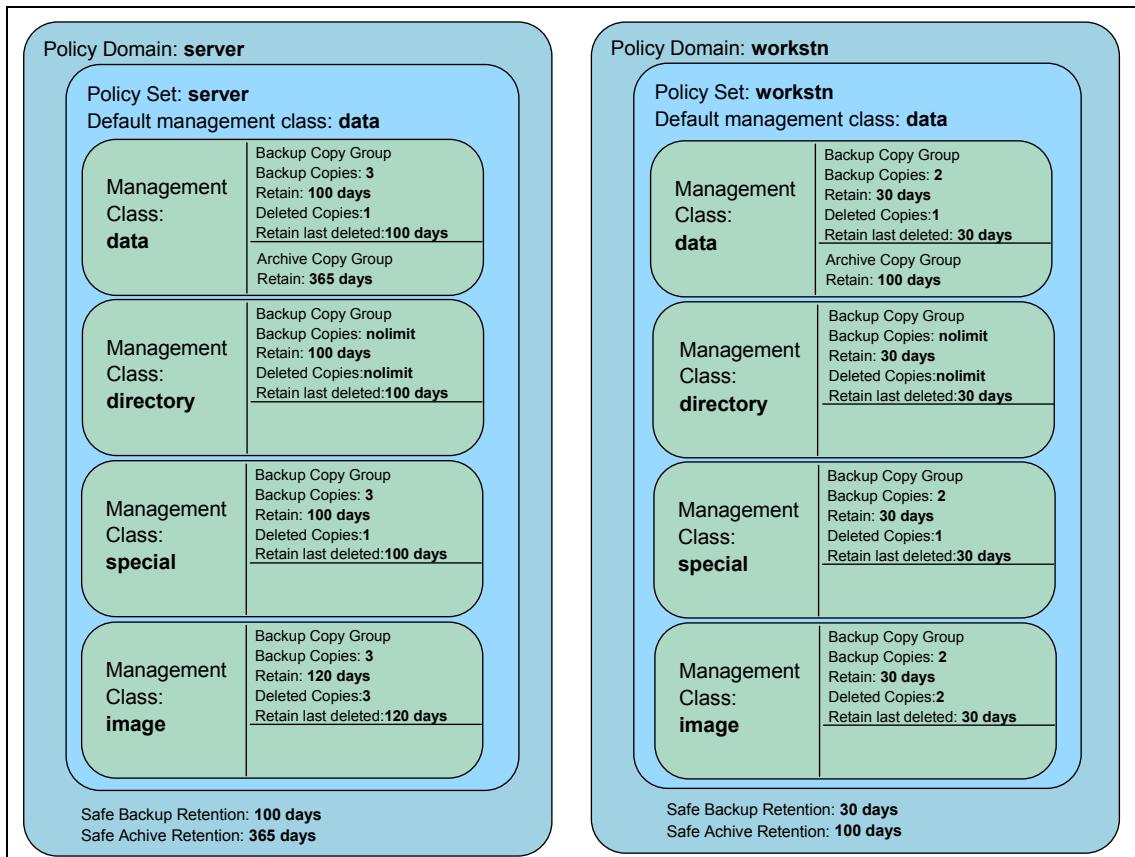


Figure 7-1 Sample policy definitions

In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into IBM Tivoli Storage Manager. The macro mac.policy, which we provide to define the recommended policy settings in our book environment, is shown in “Define policy structure” on page 733.

7.1.1 Defining policy domains

The sample configuration consists of two policy domains: for servers and for workstations, respectively. The typical nature of the data found on each type of machine makes this a logical division of resources and follows the administrative boundaries used by many customers. Example 7-1 defines these policy domains, using the **define policy** command.

Example 7-1 Recommended policy domains

```
tsm: ATLANTIC>define domain server description="Server Nodes" backretention=100  
archretention=365  
ANR1500I Policy domain SERVER defined.  
  
tsm: ATLANTIC>define domain workstn description="Workstation Nodes"  
backretention=30 archretention=100  
ANR1500I Policy domain WORKSTN defined.
```

7.1.2 Defining policy sets

We recommend defining one policy set for each of the policy domains, as shown in Example 7-2. We use the **define policyset** command.

Example 7-2 Defining a policy set per domain

```
tsm: ATLANTIC>def policyset server server description="Policy Set for Server  
Nodes"  
ANR1510I Policy set SERVER defined in policy domain SERVER.  
  
tsm: ATLANTIC>def policyset server workstn description="Policy Set for Workstation  
Nodes"  
ANR1510I Policy set WORKSTN defined in policy domain SERVER.
```

7.1.3 Defining management classes

We have defined four management classes for each domain in the sample configuration. These management classes are used to categorize the domain data:

- ▶ DATA: This is the default management class for each domain. It is used for most of the data in the environment.
- ▶ DIRECTORY: Directory objects are assigned to this class. Binding directories to a special management class allows us to properly set their expiration rules and control their final storage repository.
- ▶ SPECIAL: This management class is used to store files that are being modified during backup. An application log file could be bound to this

management class to make sure that a copy is taken. A typical example of this type of file is an application log file that receives messages or errors. While the application is running, it is likely that the file will be modified with additional messages or errors while the scheduled Tivoli Storage Manager backup or archive operations are run. Let us assume that it is determined that it is OK to back up or archive this file, even if it is being updated, since the file will still be valid for restore. Since we do not want to stop the application so that the file is released cleanly for backup, we assign it to a management class whose specifications (in the backup-archive copy group definitions) include parameters for treatment of data that is being modified while a backup-archive operation is being performed. One of these options allows the file to be backed up even if it is being modified.

- ▶ **IMAGE:** This management class is used to store logical volume backups, should you have such machines. This is useful if you want to handle the retention period differently for such operations. It is also useful if you further need to create a separate storage pool to store these backup (a tape storage pool, for example).

HSM or Space Management clients (using IBM Tivoli Storage Manager for Space Management) are not covered in this book, but there is a Space Management parameter in the management class definition that we must change to avoid problems. The MIGDESTINATION parameter specifies the name of the storage pool for the migration of space-managed files, and it defaults to a storage pool that we deleted during the recommended configuration steps. We point it to a dummy storage pool called NONE, which allows us to validate and activate the policy set without receiving any error messages.

Example 7-3 shows the management classes for the recommended configuration defined, using the **define mgmtclass** command. We assign the DATA management class as the default class for each policy set, with the **assign defmgmtclass** command.

Example 7-3 Defining management classes

```
tsm: ATLANTIC> define mgmtclass server server data migdestination=NONE
description="Default management class for Server domain"
ANR1520I Management class DATA defined in policy domain SERVER, set SERVER.
```

```
tsm: ATLANTIC> assign defmgmtclass server server data
ANR1538I Default management class set to DATA for policy domain SERVER, set SERVER.
```

```
tsm: ATLANTIC> define mgmtclass server server directory migdestination=NONE
description="Directory management class for Server domain"
ANR1520I Management class DIRECTORY defined in policy domain SERVER, set SERVER.
```

```

tsm: ATLANTIC> define mgmtclass server server special migdestination=NONE
description="Special management class for Server domain"
ANR1520I Management class SPECIAL defined in policy domain SERVER, set SERVER.

tsm: ATLANTIC> define mgmtclass server server image migdestination=NONE
description="Image management class for Server domain"
ANR1520I Management class IMAGE defined in policy domain SERVER, set SERVER.

tsm: ATLANTIC> define mgmtclass workstn workstn data migdestination=NONE
description="Default management class for Workstn domain"
ANR1520I Management class DATA defined in policy domain WORKSTN, set WORKSTN.

tsm: ATLANTIC> assign defmgmtclass workstn workstn data
ANR1538I Default management class set to DATA for policy domain WORKSTN, set
WORKSTN.

tsm: ATLANTIC> define mgmtclass workstn workstn directory migdestination=NONE
description="Directory management class for Workstn domain"
ANR1520I Management class DIRECTORY defined in policy domain WORKSTN, set
WORKSTN.

tsm: ATLANTIC> define mgmtclass workstn workstn special migdestination=NONE
description="Special management class for Workstn domain"
ANR1520I Management class SPECIAL defined in policy domain WORKSTN, set
WORKSTN.

tsm: ATLANTIC> define mgmtclass workstn workstn image migdestination=NONE
description="Image management class for Workstn domain"
ANR1520I Management class IMAGE defined in policy domain WORKSTN, set WORKSTN.

```

7.1.4 Defining backup copy groups

The reasons for creating two domains (WORKSTN and SERVER) are clearly illustrated in the backup copy group parameters. The two domains differ in the following ways:

- ▶ VEREXISTS: The WORKSTN domain only maintains two copies of existing data, as compared to three copies in the SERVER domain.
- ▶ RETEXTRA: The WORKSTN domain only keeps extra inactive copies for 30 days, as compared to 100 days in the SERVER domain.
- ▶ RETONLY: The WORKSTN domain keeps the last copy of deleted data for 30 days, as compared to 100 days in the SERVER domain.

Note: For expiration control of image backups, versions deleted (VERDEL) and retain only (RETONLY) settings do not apply. Image backups are controlled by the VEREXIST and RETEXTRA options only. Nevertheless, in our example we set the values of retver/retonly verexist/verdel the same for both *image* management classes to avoid confusion.

Directory expiration should be governed by a separate management class. The backup copy group retention options for both existing versions and deleted versions for this management class should be set so that the directory objects do not expire before the files beneath them in the directory tree. In our case, we allow an unlimited number of directory objects to be stored within the Tivoli Storage Manager repository for as long as a file object associated with a directory exists in the repository. In other words, we set directory object expiration at least as long as the longest retention for the files. It is all right to store an unlimited number of directory objects, since they occupy insignificant space within the Tivoli Storage Manager server repository as compared to file and other objects. This will ensure that your clients can perform point-in-time restores within the defined expiration period.

The SERIALIZATION parameter also illustrates the difference between the management classes. The backup copy group for the *special* management class is set up to use the serialization parameter of SHRDYNAMIC instead of SHRSTATIC. Log files and other files where the files are always open, but that we nevertheless want to back up, should be bound to this management class.

Tip: If some of your data require policy settings different than our recommended defaults (for example, if you need to keep seven copy versions of certain files), then you need to create an additional management class for this purpose, and assign the data to it using the INCLUDE option. See “Options file” on page 114 for further information.

In Example 7-4 we define the backup copy group for each of the management classes, using **define copygroup** command.

Example 7-4 Defining backup copy group

```
tsm: ATLANTIC> define copygroup server server data type=Backup
destination=DISKDATA frequency=1 verexists=3 verdeleted=1 retextra=100 retonly=100
mode=modified serialization=shrstatic
ANR1530I Backup copy group STANDARD defined in policy domain SERVER, set
SERVER, management class DATA.
```

```
tsm: ATLANTIC> define copygroup server server directory type=Backup
```

```
destination=DISKDIRS frequency=1 verexists=nolimit verdeleted=nolimit retextra=100
retonly=100 mode=modified serialization=shrstatic
ANR1530I Backup copy group STANDARD defined in policy domain SERVER, set
SERVER, management class DIRECTORY.
```

```
tsm: ATLANTIC> define copygroup server server special type=Backup
destination=DISKDATA frequency=1 verexists=3 verdeleted=1 retextra=100 retonly=100
mode=modified serialization=shrdynamic
ANR1530I Backup copy group STANDARD defined in policy domain SERVER, set
SERVER, management class SPECIAL.
```

```
tsm: ATLANTIC> define copygroup server server image type=backup
destination=diskdata frequency=1 verexists=3 verdeleted=3 retextra=120 retonly=120
mode=modified serialization=static
ANR1530I Backup copy group STANDARD defined in policy domain SERVER, set
SERVER, management class IMAGE.
```

```
tsm: ATLANTIC> define copygroup workstn workstn data type=Backup
destination=DISKDATA frequency=1 verexists=2 verdeleted=1 retextra=30 retonly=30
mode=modified serialization=shrstatic
ANR1530I Backup copy group STANDARD defined in policy domain WORKSTN, set
WORKSTN, management class DATA.
```

```
tsm: ATLANTIC> define copygroup workstn workstn directory type=Backup
destination=DISKDIRS frequency=1 verexists=nolimit verdeleted=nolimit
retextra=30 retonly=30 mode=modified serialization=shrstatic
ANR1530I Backup copy group STANDARD defined in policy domain WORKSTN, set
WORKSTN, management class DIRECTORY.
```

```
tsm: ATLANTIC> define copygroup workstn workstn special type=Backup
destination=DISKDATA frequency=1 verexists=2 verdeleted=1 retextra=30 retonly=30
mode=modified serialization=shrdynamic
ANR1530I Backup copy group STANDARD defined in policy domain WORKSTN, set
WORKSTN, management class SPECIAL.
```

```
tsm: ATLANTIC> define copygroup workstn workstn image type=backup
destination=diskdata frequency=1 verexists=2 verdeleted=2 retextra=30 retonly=30
mode=modified serialization=static
ANR1530I Backup copy group STANDARD defined in policy domain WORKSTN, set
WORKSTN, management class IMAGE.
```

7.1.5 Defining the archive copy group

For the sample configuration, we define archive copy groups only for the default management classes. The *data* management class in the SERVER domain keeps archived objects for a year, while in the WORKSTN policy domain,

archives are retained for 100 days (Example 7-5). Files that are changing during archiving are not stored. If it later turned out that we had additional archive requirements, for example, to keep certain files for seven years, we could easily define a suitable archive copy group in an existing or new management class.

Example 7-5 Defining archive copy group

```
tsm: ATLANTIC>define copygroup server server data type=archive  
destination=diskdata retver=365 serialization=shrstatic  
ANR1535I Archive copy group STANDARD defined in policy domain SERVER, set  
SERVER, management class DATA.
```

```
tsm: ATLANTIC>define copygroup workstn workstn data type=archive  
destination=diskdata retver=100 serialization=shrstatic  
ANR1535I Archive copy group STANDARD defined in policy domain WORKSTN, set  
WORKSTN, management class DATA.
```

7.2 Verifying policy definitions

To check the policy definitions, use the `query copygroup` command. The output displays the policy domain, policy set, management class, and copy group names, as well as the copy group parameters. Note that it is really the copy group definitions that define the policy for the domain; the rest of the constructs between the domain and copy group just provide flexibility in your configuration.

7.2.1 Backup copy groups

Example 7-6 shows how to check the settings for the recommended backup copy groups, using the `query copygroup` command to display the attributes.

Example 7-6 Querying backup copy groups

```
tsm: ATLANTIC> query copygroup server server type=backup
```

Policy Domain Name	Policy Set Name	Mgmt Class Name	Copy Group Name	Versions Data Exists	Versions Data Deleted	Retain Extra Versions	Retain Only Version
SERVER	SERVER	DATA	STANDARD	3	1	100	100
SERVER	SERVER	DIRECTORY	STANDARD	No Limit	No Limit	100	100
SERVER	SERVER	IMAGE	STANDARD	3	3	120	120
SERVER	SERVER	SPECIAL	STANDARD	3	1	100	100

```
tsm: ATLANTIC> query copygroup workstn workstn type=backup
```

Policy	Policy	Mgmt	Copy	Versions	Versions	Retain	Retain
--------	--------	------	------	----------	----------	--------	--------

Domain Name	Set Name	Class Name	Group Name	Data Exists	Data Deleted	Extra Versions	Only Version
WORKSTN	WORKSTN	DATA	STANDARD	2	1	30	30
WORKSTN	WORKSTN	DIRECTORY	STANDARD	No Limit	No Limit	30	30
WORKSTN	WORKSTN	IMAGE	STANDARD	2	2	30	30
WORKSTN	WORKSTN	SPECIAL	STANDARD	2	1	30	30

7.2.2 Archive copy groups

Example 7-7 shows how to check the settings for the archive copy groups. Use the **query copygroup** command to get a quick look at the attributes.

Example 7-7 Querying archive copy groups

```
tsm: ATLANTIC> query copygroup server server type=archive
```

Policy Domain Name	Policy Set Name	Mgmt Class Name	Copy Group Name	Retain Version
SERVER	SERVER	DATA	STANDARD	365

```
tsm: ATLANTIC> query copygroup workstn workstn type=archive
```

Policy Domain Name	Policy Set Name	Mgmt Class Name	Copy Group Name	Retain Version
WORKSTN	WORKSTN	DATA	STANDARD	100

7.3 Validating and activating a policy set

The last step in setting up your policy is to validate and activate your policy set. The commands are very straightforward and have few parameters.

7.3.1 Validating the recommended policy sets

The **validate policyset** command checks for completeness in the management class and copy group definitions. It validates these policies and makes them ready for activation.

Example 7-8 shows how to validate the recommended policy sets.

Example 7-8 Validating policy sets

```
tsm: ATLANTIC> validate policyset server server  
ANR1515I Policy set SERVER validated in domain SERVER (ready for activation).
```

```
tsm: ATLANTIC> validate policyset workstn workstn  
ANR1515I Policy set WORKSTN validated in domain WORKSTN (ready for activation).
```

7.3.2 Activating the recommended policy sets

The **activate policyset** command makes specified policy active, as the controlling policy within its policy domain.

Example 7-9 shows how to activate the recommended policy sets.

Example 7-9 Activating policy sets

```
tsm: ATLANTIC> activate policyset server server
```

```
Do you wish to proceed? (Yes/No) y  
ANR1514I Policy set SERVER activated in policy domain SERVER.
```

```
tsm: ATLANTIC> activate policyset workstn workstn
```

```
Do you wish to proceed? (Yes/No) y  
ANR1514I Policy set WORKSTN activated in policy domain WORKSTN.
```

```
tsm: ATLANTIC> query domain
```

Policy Domain Name	Activated Policy Set	Activated Default Mgmt Class	Number of Registered Nodes	Description
SERVER	SERVER	DATA	0	Server Nodes
WORKSTN	WORKSTN	DATA	0	Workstation Nodes

7.3.3 Deleting the STANDARD policy domain

The installation process created a policy domain called STANDARD. Once you have created your required policy, you should remove the STANDARD domain information to clean up your environment. The **delete domain** command removes an existing policy domain. This command is very powerful in that it also removes the underlying policy sets, management classes, and copy groups that belong to the domain. For this reason, the **delete domain** command should be used with

caution. Example 7-10 shows how to remove a policy domain named STANDARD.

Example 7-10 Removing the standard domain

```
tsm: ATLANTIC> delete domain standard
```

```
Do you wish to proceed? (Yes/No) yes  
ANR1501I Policy domain STANDARD deleted.
```

If a policy domain contains nodes and file spaces, this command fails. You must remove all registered nodes from a policy domain before deleting it. There are two ways to accomplish this task:

- ▶ Delete the nodes and their file spaces.
- ▶ Move the nodes including their file spaces to another domain.

Deleting a node

To delete a node, remove the node data with the **delete filesystem** command, delete any backup sets registered to the server with the **delete backupset** command, and remove the node definition with the **remove node** command.

Example 7-11 shows how to remove the file spaces and node definition for the node DIOMEDE.

Be careful—this will remove the database information for all backed up, archived, and migrated data from the Tivoli Storage Manager server for that client node, including from any copy storage pools.

Example 7-11 Removing file spaces and node definitions

```
tsm: ATLANTIC> delete filesystem DIOMEDE *
```

```
ANR2238W This command will result in the deletion of all inventory references  
to the data on filesystems that match the pattern * for node DIOMEDE, whereby  
rendering the data unrecoverable.
```

```
Do you wish to proceed? (Yes/No) y  
ANS8003I Process number 18 started.
```

```
tsm: ATLANTIC> delete backupset DIOMEDE *
```

```
ANR2365I Backupset TRCKA_BS.18773 for node DIOMEDE has been deleted.
```

```
tsm: ATLANTIC> remove node DIOMEDE
```

```
Do you wish to proceed? (Yes/No) y  
ANR2061I Node DIOMEDE removed from policy domain STANDARD.  
ANR2129I Administrative userid DIOMEDE defined ONLY for authority over node  
DIOMEDE has been removed.
```

Moving a node

The **update node** command can be used to assign a node to a new domain. The data is bound to the management classes in the new domain during the next backup operation. The process of assigning the data to the new domain's management classes is called rebinding.

If the new domain has the same management class names as the old one and providing that the copy group rules within management class definitions are the same, very little change takes place, as the data is governed only by the management class name and not the policy domain name. However, if the new domain has completely different management class names, then the data is rebound to the default management class for the domain. The first backup after the domain change may take longer than normal, due to the rebinding process, but it is a one time operation and returns to normal speed thereafter.

Note: Be careful when migrating a node to another policy domain. If a client had data backed up under the old domain, the data is rebound to the same management class in the new domain, if it exists. If the management class does not exist in the new domain, the data is rebound to the default management class of the new domain. If this management class does not have a backup copy group, the data is rebound to the retention grace period defined in the new domain. This can lead to undesired expiration of backup versions.

Example 7-12 shows how to move the node SENE GAL from its current domain to the WORKSTN domain.

Example 7-12 Moving a node to a different domain

```
tsm: ATLANTIC> update node SENE GAL domain=workstn  
ANR2063I Node SENE GAL updated.
```

```
tsm: ATLANTIC> query node SENE GAL
```

Node Name	Platform	Policy Domain	Days Since Last Access	Days Since Password Set	Locked?
SENE GAL	WinNT	WORKSTN	<1	<1	No

7.4 Enforcing your policy

Once the policy is defined, you want to enforce it using the `expire inventory` command. This command makes sure that any extra copies of data in your copy groups are removed from the database. It also takes care of data that is older than your specified retention period. The backup copy group parameters VEREXISTS, VERDELETED, RETEXTRA, and RETONLY are applied to backup data through the expiration process as well as the archive copy group parameter RETVER. Example 7-13 shows how to expire the database references from the Tivoli Storage Manager server.

Example 7-13 Expiring inventory

```
tsm: ATLANTIC> expire inventory
```

```
ANS8003I Process number 22 started.
```

This command can be computationally intensive; therefore, it should be run during quieter times on the Tivoli Storage Manager server.

The EXPINTERVAL parameter in the server options file specifies the number of hours between automatic expiration processing, and is initially configured for 24 hours. With automatic expiration processing enabled, the server runs inventory expiration at start-up and every 24 hours thereafter. We recommend setting the EXPINTERVAL to zero (disabling automatic expiration) and defining a daily administrative schedule to run this command at a convenient time. We show how to do this in 12.2.4, “Defining an expiration schedule” on page 382.

7.5 Summary

We expect that you now understand and have configured the policies for your data retention. Next we discuss user management, to provide you with an understanding of administration roles within Tivoli Storage Manager.



Managing Tivoli Storage Manager

This chapter explains the creation and maintenance of users of an IBM Tivoli Storage Manager system.

8.1 Management

Using the information you have gathered during the planning phase, as well as the understanding you have gained from reading *IBM Tivoli Storage Management Concepts*, SG24-4877, you should be able now define both users and clients on your Tivoli Storage Manager server.

There are two categories of users:

- ▶ Administrators
- ▶ Client nodes

8.1.1 Administrators

Administrators manage Tivoli Storage Manager server resources such as storage pools, devices, and data management policies.

You need at least one administrator—and can have more with varying levels of authority. Administrators with system privileges can perform any Tivoli Storage Manager function. Administrators with policy, storage, operator, or analyst privileges can perform subsets of Tivoli Storage Manager functions.

Administrators primarily use the Tivoli Storage Manager command-line interface (CLI) or the Administration Center to enter commands acting against the Tivoli Storage Manager server.

Administrators may also use the Web backup-archive client to perform backup, restore, archive, and retrieve operations on behalf of other users remotely. A typical scenario is where help desk personnel use the Web client to perform these client tasks for their end users without needing to be physically present at the end-user location or to log on to the client machine. They can simply perform the operation from their browser. Use of the Web backup-archive client requires special *client access authority* for the client, which will be restored.

All commands issued by administrators are logged to the server activity log. See 2.11, “Administrator IDs” on page 59, for planning considerations.

In a smaller implementation, there may be only one Tivoli Storage Administrator performing both administrator and help desk services. In larger enterprises, these functions are probably both functionally and geographically dispersed, so that multiple administrators with different authorities are required.

8.1.2 Considerations

Creating an administrator is a two-step process:

1. Define the administrator ID.
2. Grant the necessary privileges.

The **register admin** command explicitly creates an administrator ID with certain defined privileges. If an administrator with the same name as the client node already exists during registration of a new node, then this administrator ID is automatically updated to grant owner access to it. You can use the optional CONTACT parameter to distinguish administrators.

The **grant authority** command grants the necessary privileges to an administrator. The only required parameters are the administrator name and the privileges being granted. You can reduce an administrator's authority by revoking one or more privilege classes and granting other classes as needed.

The **query admin** command displays information about one or more administrators. Any administrator can issue this command.

8.1.3 Default environment

During the initial server installation, Tivoli Storage Manager defines two administrator IDs automatically, SERVER_CONSOLE and ADMIN.

SERVER_CONSOLE

SERVER_CONSOLE allows you to administer the server after Tivoli Storage Manager is installed. At installation, the SERVER_CONSOLE ID is automatically registered as an administrator and given system authority. You can use the SERVER_CONSOLE ID to issue administrative commands.

When the server is started in interactive mode (or foreground), typically with the **dsmsserv** command, a server console is started with a command prompt running with the assigned authority of the SERVER_CONSOLE ID. This is in contrast to running the server in background mode, either as a Windows service or under UNIX using the **nohup** command. In that case, no command prompt is presented.

In an emergency situation, administrative commands can be issued from the server console to correct situations, such as forgotten administrator passwords and locked IDs. This assumes your server console runs in a secure environment. If you cannot secure your server console from unauthorized access, you should revoke the privilege of the SERVER_CONSOLE ID, perhaps to analyst. If you do this, you must first define at least one other new administrator ID with system privilege. We do not recommend reducing the SERVER_CONSOLE privileges,

since it might be the only way to recover from certain emergencies if you have lost the password of all other administrative IDs.

You cannot:

- ▶ Register or update the SERVER_CONSOLE user ID.
- ▶ Lock or unlock the SERVER_CONSOLE user ID.
- ▶ Rename the SERVER_CONSOLE user ID.
- ▶ Remove the SERVER_CONSOLE user ID.
- ▶ Assign a password to the SERVER_CONSOLE user ID.
- ▶ Route commands from the SERVER_CONSOLE user ID.

We recommend having at least two systems administrators. Tivoli Storage Manager will not allow you to remove either the SERVER_CONSOLE ID or the last administrator ID with system privilege.

ADMIN

ADMIN is an administrator that has system privileges and an initial password of ADMIN. This administrator is used to set up your Tivoli Storage Manager environment. You should immediately change the password from the default. For enhanced security after your environment has been created, we recommend that you delete or lock this administrator, since many people know of this ID's existence and could use it to gain access to your system.

8.1.4 Recommended administrators

We recommend that you define the following administrators to support your Tivoli Storage Manager environment:

- ▶ System
- ▶ Support
- ▶ Reporting
- ▶ Client

We also recommend that you use the optional CONTACT parameter to distinguish administrators. Although we have recommended certain administrator names, you do not have to use them. You can use any name suitable for your purposes.

In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into Tivoli Storage Manager. The macro mac.admins, which we provide to define administrative IDs for our book environment, is shown in “Define administrators” on page 730.

System

Define an ID for the Tivoli Storage Manager administrator and another for your backup Tivoli Storage Manager administrator. These administrators should have system privileges. You should have at least two administrator IDs with system privileges so that if you lose the password of one, the other ID can reset it, as shown in “Changing an administrator password” on page 290.

In Example 8-1, we define an administrator named TSMADMIN1 and a backup named TSMADMIN2. The initial password for both administrators is TOMAZ. We grant these IDs system privilege.

Example 8-1 Commands to create an administrator

```
tsm: ATLANTIC> register admin tsmadmin1 tomaz contact="IBM Tivoli Storage Manager Administrator"
```

```
ANR2068I Administrator TSMADMIN1 registered.
```

```
tsm: ATLANTIC> grant authority tsmadmin1 classes=system
```

```
ANR2076I System privilege granted to administrator TSMADMIN1.
```

```
tsm: ATLANTIC> register admin tsmadmin2 tomaz contact="IBM Tivoli Storage Manager Administrator - (Alternate)"
```

```
ANR2068I Administrator TSMADMIN2 registered.
```

```
tsm: ATLANTIC> grant authority tsmadmin2 classes=system
```

```
ANR2076I System privilege granted to administrator TSMADMIN2.
```

Support

Define an ID for your Tivoli Storage Manager technical support person. This ID should have the system privilege.

In Example 8-2 we define a support administrator named SUPPORT. The initial password for this administrator is ALINE. We also grant system privileges to this ID.

Example 8-2 Creating a support ID

```
tsm: ATLANTIC> register admin support aline contact="IBM Tivoli Storage Manager Support"
```

```
ANR2068I Administrator SUPPORT registered.
```

```
tsm: ATLANTIC> grant authority support classes=system
```

```
ANR2076I System privilege granted to administrator SUPPORT.
```

Reporting

Define an ID for Tivoli Storage Manager reporting purposes. Although this administrator has no special privileges, it does have authority to issue QUERY commands. This is especially useful for producing regular reports through a method such as scripts. Disclosure of this administrator's password does not create a security exposure, because the administrator cannot change any Tivoli Storage Manager resources.

In Example 8-3 we define a support administrator named REPORT. The initial password for this administrator is MIKE.

Example 8-3 Creating a reporting ID

```
tsm: ATLANTIC> register admin report mike contact="IBM Tivoli Storage Manager
Reporting"
ANR2068I Administrator REPORT registered.
```

Client

Define an ID for the Web administrative client access. This administrator would have client access authority to all nodes in the Tivoli Storage Manager environment. In particular, this administrator can perform restore operations on behalf of users. This is usually sufficient for smaller organizations. In larger organizations, you might require multiple administrators with this authority.

In Example 8-4 we define a client administrator named HELPDESK. The initial password for this administrator is LEILLA.

Later in "Granting access to client nodes" on page 294 we give this administrator client access authority to the nodes that we define.

Example 8-4 Registering a client node

```
tsm: ATLANTIC> register admin helpdesk leilla contact="IBM Tivoli Storage Manager
Client Administrator"
ANR2068I Administrator HELPDESK registered.
```

8.1.5 Working with administrators

In this section we explain how to perform various processes related to administrators that you will find useful in your Tivoli Storage Manager environment.

Displaying administrators

Use the `query admin` command to display administrators. If no administrator name is specified, all administrators are displayed. If an administrator name is specified, only that administrator's information is displayed.

In Example 8-5 we display the list of all administrators.

Example 8-5 Displaying administrators

tsm: ATLANTIC> `query admin`

Administrator Name	Days Since Last Access	Days Since Password Set	Locked?	Privilege Classes
ADMIN	<1	4	No	System
HELPDESK	<1	<1	No	
REPORT	<1	<1	No	
SERVER_CONSOLE			No	System
SUPPORT	<1	<1	No	System
TSMADMIN1	<1	<1	No	System
TSMADMIN2	<1	<1	No	System

Then, in Example 8-6, we display full details of the administrator HELPDESK.

Example 8-6 Configuration for a helpdesk administrator

tsm: ATLANTIC> `query admin helpdesk format=detail`

```
Administrator Name: HELPDESK
Last Access Date/Time: 02/07/2006 04:33:42
Days Since Last Access: <1
Password Set Date/Time: 02/07/2006 04:33:42
Days Since Password Set: <1
Invalid Sign-on Count: 0
Locked?: No
Contact: IBM Tivoli Storage Manager Client Administrator
System Privilege:
Policy Privilege:
Storage Privilege:
Analyst Privilege:
Operator Privilege:
Client Access Privilege:
Client Owner Privilege:
Registration Date/Time: 02/07/2006 04:33:42
Registering Administrator: ADMIN
Managing profile:
Password Expiration Period:
```

Changing an administrator password

An administrative user can change his or her own password using the **update admin** command. A user with system privilege can change any administrator's password. There is no way to determine the current password for an administrator—if it is forgotten or lost, another administrator must reset it. Therefore you should always have two administrator IDs at a minimum.

Example 8-7 shows changing the password for the administrator named TSMADMIN2 to SHARKS.

Example 8-7 Changing an administrator password

```
tsm: ATLANTIC> update admin tsmadmin2 sharks
ANR2071I Administrator TSMADMIN2 updated.
```

When this command is logged to the server activity log, the password in the log is replaced by asterisks (*), as shown in Example 8-8.

Example 8-8 The update command logged to the server activity log

```
02/07/2006 05:06:45      ANR2071I Administrator ADMIN issued command: UPDATE
ADMIN tsmadmin2 ?****? (SESSION: 74)
02/07/2006 05:06:45      ANR2071I Administrator TSMADMIN2 updated. (SESSION:
74).
```

Deleting the ADMIN administrator

After you have defined your required system administrators, delete the installed system administration ID, ADMIN. Because you cannot delete an administrator if that administrator is currently accessing the server, you must log on to Tivoli Storage Manager as a different administrator to perform this task.

Example 8-9 shows the operation with the **remove admin** command.

Example 8-9 Deleting the admin administrator

```
root@Atlantic :/ dsmadmc
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id: tsmadmin1
Enter your password:

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/07/06  09:28:42  Last access: 02/07/06  09:23:40
```

```
tsm: ATLANTIC> remove admin admin  
Do you wish to proceed? (Yes (Y)/No (N)) y  
ANR2069I Administrator ADMIN removed.
```

Attention: You can remove administrators from the server so that they no longer have access to administrator functions, but you cannot remove the last administrator with system privileges and you cannot remove the administrator SERVER_CONSOLE.

8.2 Client nodes

When the Tivoli Storage Manager server is installed, the Tivoli Storage Manager backup-archive client and the administrative client are installed on the same machine as the server by default. Most installations of Tivoli Storage Manager also include backup-archive clients and application clients on other machines, often running on different operating systems.

Typically, a node corresponds directly to a machine, as in the case of a backup-archive client that is installed on a user's computer for file system backups. However, multiple nodes can exist on a single machine. For example, a system running Microsoft SQL Server contain both a Tivoli Storage Manager for Databases (Data Protection for SQL Server) application client for database and transaction log backups, and a regular backup-archive client for file system backups.

Each Tivoli Storage Manager backup-archive client must be registered with the Tivoli Storage Manager server before any backup and recovery operations can be performed for that backup-archive client. Although Tivoli Storage Manager provides two modes, open and closed, for registering client nodes to the server, we recommend for security reasons that you do not change the closed mode default.

8.2.1 Considerations

To register a client node, use the **register node** command. At a minimum, you need to supply a node name and a client access password. We recommend using the TCP/IP host name for the Tivoli Storage Manager node name. If you define your own Tivoli Storage Manager policy domains, then you must also use the DOMAIN parameter. Further, we recommend that you also specify the USERID parameter.

The DOMAIN parameter specifies the name of the policy domain to which the node is assigned. If you do not specify a policy domain name, the node is assigned to the default policy domain (STANDARD). Within our recommended environment, there are two domains, SERVER and WORKSTN, and no STANDARD domain. Consequently, if you use our environment, you must specify the DOMAIN parameter when registering a client node.

The USERID parameter specifies an administrative ID that will be defined as an administrator with node owner (client access) authority to the client. Node authority allows an administrator to use the Web backup-archive client. When the USERID parameter is omitted, an administrator with the same name as the node is defined. This is the default. We recommend that you specify USERID=NONE and grant node authority to the HELPDESK administrator and other administrators explicitly through the **grant authority** command.

8.2.2 Default environment

Except for z/OS, one client node is registered to the Tivoli Storage Manager server during the initial server installation. This is for the Tivoli Storage Manager server itself. The name of this client is CLIENT, with initial password CLIENT. The node is assigned to the STANDARD domain. To comply with our recommendation of using the host name for each client node, you should use the **rename node** command to change the name of the node from CLIENT to the host name, and the **update node** command to assign it to a new policy domain.

8.2.3 Working with client nodes

In this section we explain how to perform various processes related to client nodes that you will find useful in your Tivoli Storage Manager environment.

Registering a client node

Use the **register node** command to define a client to the server. In our environment, we supply the required parameters (node name, node password, domain name) and an additional two parameters (contact, userid).

Table 8-1 shows a layout you can use for documenting the information needed to register the clients, completed with a set of sample client information.

Table 8-1 Client requirements worksheet: example

Node name	Contact	Domain
PROPAGANDA	Tomaz - First Floor	SERVER
LOSGATOS	Aline - Second Floor	WORKSTN

Node name	Contact	Domain
MILES	Leilla - Help Desk	SERVER

Example 8-10 shows the commands to create these nodes. We give all nodes the same password, SHARKS.

Example 8-10 Registering a client node

```
tsm: ATLANTIC> register node propaganda sharks domain=server userid=none
contact="TAL (Tomaz Aline Leilla)"
ANR2060I Node PROPAGANDA registered in policy domain SERVER.

tsm: ATLANTIC> register node losgatos sharks domain=workstn userid=none
contact="Tomaz_Aline_Leilla@work"
ANR2060I Node LOSGATOS registered in policy domain WORKSTN.

tsm: ATLANTIC> register node miles sharks domain=server userid=none
contact="Tomaz@home"
ANR2060I Node MILES registered in policy domain SERVER.
```

Displaying client nodes

Use the **query node** command, as shown in Example 8-11, to display client nodes. If you do not specify a node name, all nodes are displayed. If you do specify a node name, only that node's information is displayed.

Example 8-11 Displaying client node summary

```
tsm: ATLANTIC> query node
```

Node Name	Platform	Policy Domain Name	Days Since Last Access	Days Since Password Set	Locked?
LOSGATOS	WinNT	WORKSTN	<1	<1	No
MILES	AIX	SERVER	<1	<1	No
PROPAGANDA	AIX	SERVER	<1	<1	No

Example 8-12 shows the full details of the node named LOSGATOS.

Example 8-12 Displaying full client node details

```
tsm: ATLANTIC> query node losgatos format=detailed
```

```

Node Name: LOSGATOS
Platform: WinNT
Client OS Level: 5.00
Client Version: Version 5, Release 3, Level 2.0
```

```

Policy Domain Name: WORKSTN
Last Access Date/Time: 02/07/2006 17:52:24
Days Since Last Access: <1
Password Set Date/Time: 02/07/2006 17:43:44
Days Since Password Set: <1
    Invalid Sign-on Count: 0
        Locked?: No
            Contact: Tomaz_Aline_Leilla@work
                Compression: Client
Archive Delete Allowed?: Yes
Backup Delete Allowed?: No
Registration Date/Time: 02/07/2006 17:43:44
Registering Administrator: TSMADMIN1
Last Communication Method Used:
    Bytes Received Last Session: 0
    Bytes Sent Last Session: 0
    Duration of Last Session: 0.00
    Pct. Idle Wait Last Session: 0.00
    Pct. Comm. Wait Last Session: 0.00
    Pct. Media Wait Last Session: 0.00
        Optionset: AIX_LIST
        URL:
        Node Type: Client
Password Expiration Period:
    Keep Mount Point?: No
Maximum Mount Points Allowed: 1
    Auto Filespace Rename : No
    Validate Protocol: No
        TCP/IP Name: IBM-ATLANTIC
        TCP/IP Address:
        Globally Unique ID: 34.90.42.30.95.07.11.da.bb.e3.00.40.96.32.2d.a7
Transaction Group Max: 0
    Data Write Path: ANY
    Data Read Path: ANY
Session Initiation: ClientOrServer
High-level Address:
Low-level Address:
Collocation Group Name:
    Proxynode Target:
    Proxynode Agent:

```

Granting access to client nodes

An administrator can perform all client operations on behalf of the user through the Web backup-archive client. The administrator needs node authority to perform those operations. An administrative user with system privilege can grant that authority.

Example 8-13 shows how to grant node authority for all nodes to a client administrator named HELPDESK.

Example 8-13 Granting access to client nodes

```
tsm: ATLANTIC> grant authority helpdesk classes=node node=*

ANR2126I GRANT AUTHORITY: Administrator HELPDESK was granted ACCESS authority
for client LOSGATOS.
ANR2126I GRANT AUTHORITY: Administrator HELPDESK was granted ACCESS authority
for client MILES.
ANR2126I GRANT AUTHORITY: Administrator HELPDESK was granted ACCESS authority
for client PROPAGANDA.
```

Now if we display the administrator details, with the **query admin** command, we can see it has client access privileges, as in Example 8-14.

Example 8-14 Administrator has client access privilege

```
tsm: ATLANTIC> query admin helpdesk format=detail

Administrator Name: HELPDESK
Last Access Date/Time: 02/07/2006 18:33:42
Days Since Last Access: <1
Password Set Date/Time: 02/07/2006 18:33:42
Days Since Password Set: <1
Invalid Sign-on Count: 0
Locked?: No
Contact: IBM Tivoli Storage Manager Client Administrator
System Privilege:
Policy Privilege:
Storage Privilege:
Analyst Privilege:
Operator Privilege:
Client Access Privilege: LOSGATOS MILES PROPAGANDA
Client Owner Privilege:
Registration Date/Time: 02/07/2006 04:33:42
Registering Administrator: ADMIN
Managing profile:
Password Expiration Period:
```

If you create additional nodes and you want administrators to have authority to those nodes, the **grant authority** command must be reissued.

Changing passwords for client nodes

An administrative user with either system privilege, unrestricted policy privilege, or restricted policy privilege for the policy domain to which the client node is assigned can change the password of a client node.

In Example 8-15, we change the password for the client node named MILES to LAND, using the **update node** command.

Example 8-15 Changing passwords for client nodes

```
tsm: ATLANTIC> update node miles land
ANR2063I Node MILES updated.
```

Tip: You can only change a node password if that node is not currently accessing the server.

Deleting file spaces for a client node

An administrative user with either system privilege, unrestricted policy privilege, or restricted policy privilege for the policy domain to which the client node is assigned, can delete node file spaces. File spaces contain a client's backup and archive data. There are one or more file spaces for each client.

The **delete filesystem** command creates a server process that deletes one or more file spaces as a series of batch database transactions. If the **delete filesystem** process is canceled or if a system failure occurs, a partial deletion can occur. In this case, a subsequent **delete filesystem** command for the same node will delete the remaining data. You must delete all backup and archive file spaces that belong to a client node before you can delete that client node.

Important: Use the **delete filesystem** command with caution. It deletes the client's backed up and archived data from the Tivoli Storage Manager server, including any data in copy storage pools.

Example 8-16 displays the file spaces for the client LOSGATOS.

Example 8-16 Querying file spaces for a client node

```
tsm: ATLANTIC> query filesystem losgatos
```

Node Name	Filespace Name	FSID	Platform	Filespace Type	Is Filespace Unicode?	Capacity (MB)	Pct Util
LOSGATOS	/	1	AIX	JFS2	No	32.0	44.9
LOSGATOS	/opt	2	AIX	JFS2	No	128.0	76.1

In Example 8-17 we delete the file space /opt for the client LOSGATOS. Note that we are not deleting any files on the client itself—we are deleting all records of any files backed up or archived in that file system on the Tivoli Storage Manager server.

Example 8-17 Deleting file spaces for a client node

```
tsm: ATLANTIC> delete filesystem losgatos /opt
ANR2238W This command will result in the deletion of all inventory references
to the data on filesystems that match the pattern /opt (fsId=2) for node
LOSGATOS, whereby rendering the data unrecoverable.
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y
ANS8003I Process number 14 started.
```

File space deletions can run in either the background or the foreground. Example 8-17 was run in the background. To monitor the process, use the **query process** command. You can view messages from the process in the server activity log.

To run file space deletion in the foreground, add the WAIT=YES parameter to the command. Foreground processes write messages directly to your CLI session. If the file space contains a large number of files, we recommend running the deletion in the background.

Example 8-18 shows the results of deleting file spaces in the foreground.

Example 8-18 Administrative command to delete file spaces

```
tsm: ATLANTIC> delete filesystem losgatos * wait=yes
ANR2238W This command will result in the deletion of all inventory references to the
data on filesystems that match the pattern * (fsId=1) for node LOSGATOS, whereby
rendering the data unrecoverable.
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y
ANR0984I Process 15 for DELETE FILESPACE started in the FOREGROUND at 14:12:46.
ANR0800I DELETE FILESPACE * (fsId=1) for node LOSGATOS started as process 15.
ANR0802I DELETE FILESPACE * (fsId=1) (backup/archive data) for node LOSGATOS started.
ANR0806I DELETE FILESPACE * (fsId=1) complete for node LOSGATOS: 12 objects deleted.
ANR0987I Process 15 for DELETE FILESPACE running in the FOREGROUND processed 12 items
with a completion state of SUCCESS at 14:12:46.
```

```
tsm: ATLANTIC>q filesystem losgatos
ANR2034E QUERY FILESPACE: No match found using this criteria.
ANS8001I Return code 11.
```

Deleting a client node

An administrative user with either system privilege, unrestricted policy privilege, or restricted policy privilege for the policy domain to which the client node is

assigned, can delete a client node. Before removing a client node, you must delete all its backup and archive files. Use the `remove node` command, as shown in Example 8-19.

Example 8-19 Deleting a client node

```
tsm: ATLANTIC> remove node losgatos
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y  
ANR2061I Node LOSGATOS removed from policy domain STANDARD.  
ANR2129I Administrative userid LOSGATOS defined ONLY for authority over node  
LOSGATOS has been removed.
```

8.3 Client option sets

A Tivoli Storage Manager client session has a set of options that are used during backup, archive, restore, or retrieve processes. Options can be specified in two ways:

- ▶ In the client options file, which is created during the setup of a client (see “Options file” on page 114). A client options file is a set of Tivoli Storage Manager client options stored in one or two (UNIX/Linux clients only) files on the client.
- ▶ Using the client option set. (This is optional.) A client option set is a set of Tivoli Storage Manager client options stored in the Tivoli Storage Manager database. An option set can be associated with one or more Tivoli Storage Manager clients, but a client can be associated with only one option set.

8.3.1 Considerations

We recommend using client option sets to make administration easier, particularly in environments with a large number of clients, and as the number of available options grows. Using client option sets centralizes the management of those options and clients. It is easier to update a client option set once than to perform the same update to the local client options file on each node.

Which value takes priority

The options defined in a client option set are a subset of the available client options. Options such as communications are still stored on the client machine.

When the same option is specified in both the local options file and the option set, the client options file value takes priority by default. However, you can specify that individual options in an option set cannot be overridden in the client's local options file, using the `FORCE=YES` parameter when defining the option.

Include-exclude rules

If you put include-exclude statements in the client options set, these will always override the include-exclude statements in the client options file. You can imagine that the client options set include-exclude statements are added at the bottom of the client options file, so that they are evaluated first. The sequence number attached to each include-exclude statement in the client option set determines the order in which it is added to the existing include-exclude statements at the end of the client options file. Include-exclude statements in a client option set will always be seen and processed during backup first, before any statements in the client options file. Therefore, one set of default values can be defined for each type of client in a client option set, yet the client machines can still be customized, within acceptable limits.

For example, suppose you have the following statements in a client option set:

```
include c:\test\* seq=1  
exclude c:\working\* seq=2
```

And, suppose you have the following statements in a client options file:

```
exclude c:\test\*  
include c:\working\*
```

The complete set of include-exclude specifications would be:

```
exclude c:\test\* (second to last statement from the client options file)  
include c:\working\* (last statement from the client options file)  
include c:\test\* (sequence number 1 from the client option set)  
exclude c:\working\* (sequence number 2 from the client option set)
```

Reminder: Include-exclude statements are processed from bottom to top.

Processing using this set of include-exclude statements would result in the files under C:\working not being backed up, and those files under C:\test being backed up.

8.3.2 Default environment

There are no client option sets created by default in a Tivoli Storage Manager environment.

8.3.3 Recommended client option sets

In our environment, we use multiple client option sets. All option sets are built from the base option set, which we called “redbook”. This option set contains options other than the include-exclude specifications. All other option sets are

based on the client platform. Each is built from the base option set with the addition of specific include-exclude recommendations for that platform.

8.3.4 Working with client option sets

In this section we explain how to perform various processes related to client option sets that you will find useful in your Tivoli Storage Manager environment.

Creating a client option set

To define a client option set:

1. Create the option set.
2. Populate it with client options.

You create a new client option set with the **define cloptset** command or you can clone an existing option set with the **copy cloptset** command. You can add an option to an option set with the **define clientopt** command. You can remove an option from an option set with the **delete clientopt** command. You need system privilege or unrestricted policy privilege to issue these commands.

In Example 8-20 we define a client option set named WINDOWS and populate it with options.

Example 8-20 Creating a client option set

```
tsm: ATLANTIC> define cloptset windows
ANR2046I DEFINE CLOPTSET: Optionset WINDOWS defined.

tsm: ATLANTIC> define clientopt windows compression yes
ANR2050I DEFINE CLIENTOPT: Option COMPRESSION defined in optionset WINDOWS.

tsm: ATLANTIC> define clientopt windows maxcmdretries 4
ANR2050I DEFINE CLIENTOPT: Option MAXCMDRETRIES defined in optionset
WINNT_LIST.

tsm: ATLANTIC> define clientopt windows verbose ""
ANR2050I DEFINE CLIENTOPT: Option VERBOSE defined in optionset WINDOWS.
```

Example 8-21 shows how to clone the client option set named WINDOWS to another named WINDOWS_CLONE, replacing the VERBOSE option with the QUIET option.

Example 8-21 Copying client option sets

```
tsm: ATLANTIC> copy cloptset windows windows_clone
ANR2055I COPY CLOPTSET: Optionset WINDOWS copied to optionset WINDOWS_CLONE.

tsm: ATLANTIC> delete clientopt windows_clone verbose
ANR2053I DELETE CLIENTOPT: Option VERBOSE, sequence number 0,has been deleted
from optionset WINDOWS_CLONE.

tsm: ATLANTIC> define clientopt windows_clone quiet ''
ANR2050I DEFINE CLIENTOPT: Option QUIET defined in optionset WINDOWS_CLONE.
```

8.3.5 Associating a client node with a client option set

The client node definition should be updated to use a client option set. You need either system privilege, unrestricted policy privilege, or restricted policy privilege for the policy domain to which the client node belongs to use the required **update node** command.

Use the SQL **select** command to view the names of all the client option sets, as shown in Example 8-22.

Example 8-22 Select command for client option sets

```
tsm: ATLANTIC> select * from cloptssets

OPTIONSET_NAME          DESCRIPTION           LAST_UPDATE_BY      PROFILE
-----                  -----
AIX                     Include/Exclude      TSMADMIN1
                        list for AIX
                        Systems

WINDOWS                Include/Exclude      TSMADMIN1
                        list for Windows
                        System
```

Example 8-23 shows how to associate the client node named MILES with the client option set AIX.

Example 8-23 Associating a client with a client option set

```
tsm: ATLANTIC> update node miles cloptset=aix
ANR2063I Node MILES updated.
```

Deleting a client option set

You need either system privilege or unrestricted policy privilege to delete a client option set with the **delete cloptset** command.

In Example 8-24 we delete the option set WINDOWS.

Example 8-24 Deleting client option sets

```
tsm: ATLANTIC> delete cloptset windows_list
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y  
ANR2048I DELETE CLOPTSET: Optionset WINDOWS deleted.
```

The association between a node and a client option set is removed automatically when that client option set is deleted. The node is not associated with another client option set until and unless you reissue the **update node** command.

8.4 Summary

You have now established administrative roles within your Tivoli Storage Manager server, which will allow the control, monitoring, and management of the data flow from the clients through the final storage media. Next we discuss licensing options for your environment.



Licensing

In this chapter we describe the tasks of licensing an IBM Tivoli Storage Manager system and monitoring its compliance. We discuss the process of registering, activating, and monitoring your licenses (but not the marketing or packaging of your licenses). This process is the same for each feature, no matter which package or product offering is purchased. The features will still need to have their respective licenses registered.

The method of packaging IBM Tivoli Storage Manager for purchase changes from time to time, which also changes entitlements of the product. Licenses by client versus purchases by processors are marketing issues and not license or product issues.

9.1 Licensed features

The base Tivoli Storage Manager server license supports an unlimited number of administrative clients, one backup-archive client using named pipes or shared memory protocol, and a selection of removable media devices. Table 9-1 lists all currently available licensed features you can add on to your base IBM Tivoli Storage Manager server license at V5.3 (for V5.2 options, see 9.6, “Tivoli Storage Manager V5.2 license features” on page 309).

With V5.3, you do not register licenses for any of the Tivoli Storage Manager agents (for example, Tivoli Storage Manager for Databases, Tivoli Storage Manager for Mail). Agent license validation is done on the client side, independent from the server.

Table 9-1 Tivoli Storage Manager 5.3 licensed features

Licensed feature	License files
The base IBM Tivoli Storage Manager license: basic backup-archive with the base client and server.	tsmbasic.lic
IBM Tivoli Storage Manager Extended Edition: additional advanced functions including: <ul style="list-style-type: none">▶ Disaster recovery manager▶ Large libraries (greater than 3 drives or 40 slots)▶ Tape Library Sharing over LAN▶ NDMP backup and restore for NAS appliances including IBM N series▶ Server-free data movement	tsmee.lic
IBM System Storage Archive Manager has additional functionality in: <ul style="list-style-type: none">▶ Data retention protection▶ Event-based Retention Management▶ Expiration/Deletion suspension (Deletion hold)	dataret.lic

The enrollment certificate files for all Tivoli Storage Manager licenses that can be registered with the server are on the Tivoli Storage Manager installation CD-ROM. You register those licenses that you need (and are entitled to) using the **register license** command, specifying the name of the enrollment certificate file. When registered, the licenses are stored in a file named *nodelock* in the current directory.

Tip: Tivoli Storage Manager V 5.3 and newer servers that have data retention protection enabled and have access to a Network Appliance or IBM N series filer with the SnapLock licensed feature (Data ONTAP 7.1 or later) can store data in storage pools with RECLAMATIONTYPE set to SNAPLOCK. Data created on volumes in these storage pools will be managed by a retention date.

9.2 Registering licensed features

If you received a Tivoli Storage Manager evaluation (try-and-buy), the license registration is done automatically during the installation of the server and you do not need to do anything further.

If you bought a base Tivoli Storage Manager server license, you can buy licenses for licensed features, and register those licenses by specifying the license files using the **register license** command.

You can register any or all of the features shown in Table 9-1 on page 304. For example, if you want to register the Tivoli Storage Manager Extended Edition license, issue the commands shown in Example 9-1.

Example 9-1 Registering licenses

```
tsm: ATLANTIC>reg license file=tsmbasic.lic
ANR2852I Current license information:
ANR2853I New license information:
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.

tsm: ATLANTIC>reg license file=tsmee.lic
ANR2852I Current license information:
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2853I New license information:
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.
```

Note: The `register license` command has changed with the Tivoli Storage Manager V5.3. You now have far fewer options. You can register licenses for server components. This includes Tivoli Storage Manager (base), Tivoli Storage Manager Extended Edition, and IBM System Storage Archive Manager. You cannot register licenses for components that are licensed on the basis of processors (for example, Tivoli Storage Manager for Mail, Tivoli Storage Manager for Databases, Tivoli Storage Manager for ERP, Tivoli Storage Manager for Copy Services, Tivoli Storage Manager for Advanced Copy Services, Tivoli Storage Manager for Space Management).

Your license agreement determines what you are licensed to use. Even if you are not using the REGISTER LICENSE command to register all components, you are expected to comply with the license agreement and use only what you have purchased. Use of the REGISTER LICENSE command implies that you agree to and accept the license terms specified in your license agreement.

9.3 Saving your licenses

When license registration is complete, the licenses are stored in a file named `nodelock` in the server start directory.

Keep the installation CD-ROM that contains the license certificate files in a safe place to be used if you need to reregister your licenses. This might occur if:

- ▶ The server is corrupted.
- ▶ The server has moved to a different machine.
- ▶ The `NODELOCK` file is destroyed or corrupted.

9.4 License compliance

If license terms change (for example, if a new license is defined for the server), the server conducts an audit to determine whether the current server configuration conforms to the license terms.

The server also periodically audits compliance with the license terms. The results of this audit are used to check and enforce license terms. If 30 days have elapsed since the previous license audit, the administrator cannot cancel the audit.

If the server uses a licensed feature but the license is not registered, the function fails. When you issue a command associated with an unlicensed feature, Tivoli Storage Manager does not issue a warning message, and the command fails.

If a Tivoli Storage Manager system exceeds the terms of its license agreement, one of the following occurs:

- ▶ The server issues a warning message indicating that it is not in compliance with the licensing terms.
- ▶ Operations fail because the server is not licensed for specific features.

In either case, you must contact your IBM account representative or authorized IBM Software reseller to modify your agreement.

9.5 Monitoring licenses

There are two commands to monitor the license registration on your Tivoli Storage Manager system:

- ▶ **query license**
- ▶ **audit license**

9.5.1 Displaying license information

Use the **query license** command to display details of your current licenses and determine licensing compliance, as shown for a Tivoli Storage Manager V5.3 server in Example 9-2.

Example 9-2 Displaying license information

tsm: ATLANTIC>**q license**

```
Last License Audit: 02/16/06 14:53:43
Number of TDP for Oracle in use: 0
Number of TDP for Oracle in try buy mode: 0
    Number of TDP for MS SQL Server in use: 0
    Number of TDP for MS SQL Server in try buy mode: 0
    Number of TDP for MS Exchange in use: 0
    Number of TDP for MS Exchange in try buy mode: 0
    Number of TDP for Lotus Notes in use: 0
    Number of TDP for Lotus Notes in try buy mode: 0
    Number of TDP for Lotus Domino in use: 0
    Number of TDP for Lotus Domino in try buy mode: 0
    Number of TDP for Informix in use: 0
    Number of TDP for Informix in try buy mode: 0
    Number of TDP for SAP R/3 in use: 0
    Number of TDP for SAP R/3 in try buy mode: 0
    Number of TDP for ESS in use: 0
    Number of TDP for ESS in try buy mode: 0
    Number of TDP for ESS R/3 in use: 0
    Number of TDP for ESS R/3 in try buy mode: 0
```

```
Number of TDP for EMC Symmetrix in use: 0
Number of TDP for EMC Symmetrix in try buy mode: 0
    Number of TDP for EMC Symmetrix R/3 in use: 0
Number of TDP for EMC Symmetrix R/3 in try buy mode: 0
    Number of TDP for WAS in use: 0
        Number of TDP for WAS in try buy mode: 0
    Is IBM System Storage Archive Manager in use ?: No
    Is IBM System Storage Archive Manager licensed ?: No
    Is Tivoli Storage Manager Basic Edition in use: Yes
    Is Tivoli Storage Manager Basic Edition licensed: Yes
    Is Tivoli Storage Manager Extended Edition in use: No
    Is Tivoli Storage Manager Extended Edition licensed: Yes
    Server License Compliance: Valid
```

9.5.2 Auditing licenses

An administrator can monitor license compliance by issuing the administrative command **audit licenses**, as shown in Example 9-3. This command is used to compare the current configuration with the current licenses.

Example 9-3 Auditing licenses

```
tsm: ATLANTIC>audit license
ANR2817I AUDIT LICENSES: License audit started as process 143.
ANS8003I Process number 3 started.
```

9.5.3 Scheduling automatic license audits

Use the **set licenseauditperiod** command to specify the number of days between automatic audits performed by the Tivoli Storage Manager server. In Example 9-4, we set the audit period to 30 days.

Example 9-4 Defining a audit tomfooleries

```
tsm: ATLANTIC> set licenseauditperiod 30
```

9.6 Tivoli Storage Manager V5.2 license features

For reference purposes, Table 9-2 on page 309 shows the license features for Tivoli Storage Manager V5.2.

Table 9-2 Tivoli Storage Manager 5.2 licensed features

Licensed feature	License files
Additional backup-archive clients: The base IBM Tivoli Storage Manager license supports one backup-archive client; Licensing additional clients with any number of clients (replace x with valid number of clients)	xclient.lic
IBM Tivoli Storage Manager for Space Management; Hierarchical storage management (HSM) clients, also known as space-managed clients	spacemgr.lic
IBM Tivoli Storage Manager Disaster Recovery Manager	drm.lic
IBM Tivoli Storage Manager for Databases; Tivoli Data Protection for Oracle	oracle.lic
IBM Tivoli Storage Manager for Databases; Tivoli Data Protection for MS SQL Server	mssql.lic
IBM Tivoli Storage Manager for Mail; Tivoli Data Protection for MS Exchange	msexch.lic
IBM Tivoli Storage Manager for Mail; Tivoli Data Protection for Lotus Notes®	lnotes.lic
IBM Tivoli Storage Manager for Mail; Tivoli Data Protection for Lotus Domino®	domino.lic
IBM Tivoli Storage Manager for Databases; Tivoli Data Protection for Informix®	informix.lic
IBM Tivoli Storage Manager for Applications; Tivoli Data Protection for ERP	r3.lic
IBM Tivoli Storage Manager for Hardware; Tivoli Data Protection for EMC Symmetrix	emcsymm.lic
IBM Tivoli Storage Manager for Hardware; Tivoli Data Protection for EMC Symmetrix for R/3	emcsymr3.lic
IBM Tivoli Storage Manager for Hardware; Tivoli Data Protection for ESS	ess.lic
IBM Tivoli Storage Manager for Hardware; Tivoli Data Protection for ESS for R/3	essr3.lic

Licensed feature	License files
Managed libraries	library.lic
Library sharing	libshare.lic
IBM Tivoli Storage Manager for Applications; Tivoli Data Protection for WebSphere® Application Server	was.lic
IBM Tivoli Storage Manager for NDMP	ndmp.lic
Managed System for SAN use	mgsyssan.lic
Managed System for LAN use	mgsyslan.lic



Administrative client

In the previous chapters we discussed the various stages from planning through implementation of the server and clients, then moved on to the storage setup, licensing, and administrative roles. Here we describe administrative interfaces available in IBM Tivoli Storage Manager.

With V5.3 of Tivoli Storage Manager, a new Web-based administrative interface for the Tivoli Storage Manager environment is available. This is the Administration Center, which is hosted in the Integrated Solutions Console (ISC) framework. Administration Center has replaced the previous server-bound Web administrative interface, which is no longer supported in V5.3 and later, since it uses a completely different administrative API.

We briefly cover the installation and setup of the ISC with the Administration Center component, as well as the command-line administrative client. Further, we demonstrate capabilities of both tools regarding managing and monitoring Tivoli Storage Manager environments.

IBM Tivoli Storage Manager has always provided a command-line interface, called the *administrative client*, that allows you to manage and monitor one or more IBM Tivoli Storage Manager servers and resources. Various graphical interfaces (GUIs) on different versions have also been available.

For details on ISC and Administration Center setup, refer to *IBM Tivoli Storage Manager Version 5.3 Technical Guide*, SG24-6638.

10.1 Administration Center

The Administration Center Web-interface provides an easy way to manage multiple server instances from a single browser window. It is available since Tivoli Storage Manager V5.3, and is hosted in the Integrated Solution Console (ISC) framework. ISC is a general framework, supporting multiple modules that serve different purposes. The Administration Center module enables you to manage and monitor your Tivoli Storage Manager environment specifically.

10.1.1 Installation

Both products, Administration Center and Integrated Solutions Console, are distributed separately. ISC is available via regular system order, while the Administration Center is available via the normal IBM service FTP site. To install:

1. Install the ISC.
2. Install the Administration Center into ISC.

Since ISC is built on top of WebSphere Application Server and PortalBase, it requires significant system resources. We recommend installing it on a different machine than the one running the Tivoli Storage Manager server.

Essentially, there are three ways to install ISC: You may run the Java-based installation wizard; console installation wizard; or perform silent, unattended installation. The complete installation procedure (for ISC and the Administration Center) is covered in detail, including graphics, in *IBM Tivoli Storage Manager Version 5.3 Technical Guide*, SG24-6638. We provided a summary of the installation procedure in 3.6, “Integrated Solution Console and Administration Center” on page 83.

After installing the ISC, you can install the Administration Center. Again, you can use the installation wizard, console installation wizard, or silent installation method. Note that the ISC must be running when installing the Administration Center.

After a successful installation, the following URL will be launched automatically, displaying the ISC logon screen:

`http://<machine name>:<Web Administration Port>/ibm/console`

If you set up ISC with the default values, the port number is either 8421 for HTTP connection or 8422 for secure Web administration port.

For complete details on software and hardware requirements on all supported platforms, time needed to set up ISC and the Administration Center, and known

limitations, refer to the *IBM Tivoli Storage Manager Administration Center Readme*.

10.1.2 Administration Center interface

To access the Administration Center, type

`http://<machine_name>:<port>/ibm.console` in your browser, as shown in Figure 10-1. We installed the ISC and Administration center on the system DIOMEDE.

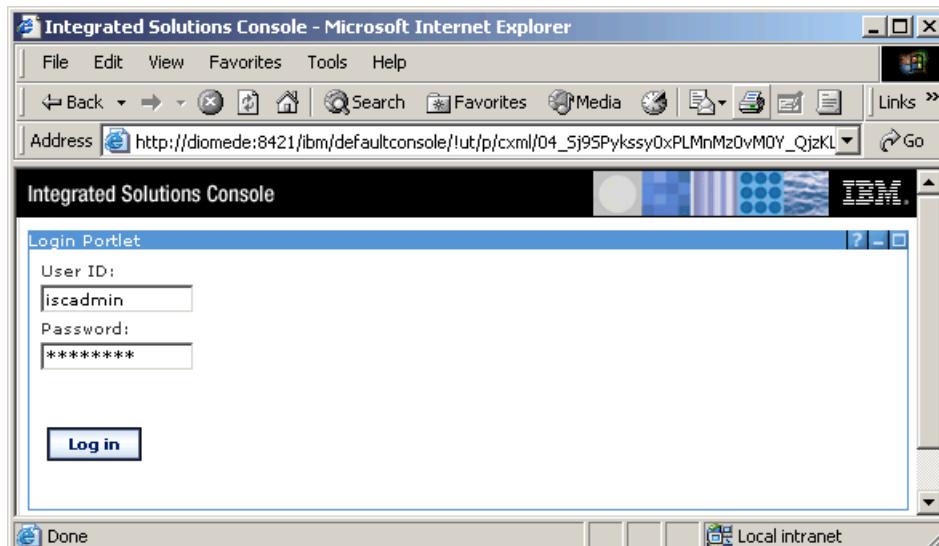


Figure 10-1 ISC login screen

Enter the ISC administrator ID and password and click **Log In** to start the Administration Center (see Figure 10-2 on page 314).

Tip: ISC administrator IDs are discussed in the section *ISC User and Group Management* in Chapter 12 of *IBM Tivoli Storage Management Concepts*, SG24-4877.

Now you are ready to manage your Tivoli Storage Manager Server. The Administration Center allows you to define server connections, which means to set up a connection between the Administration Center and a Tivoli Storage Manager server instance. Remember, the Administration Center is not of itself a server instance, it is a standalone product, and therefore you have to define the connection.

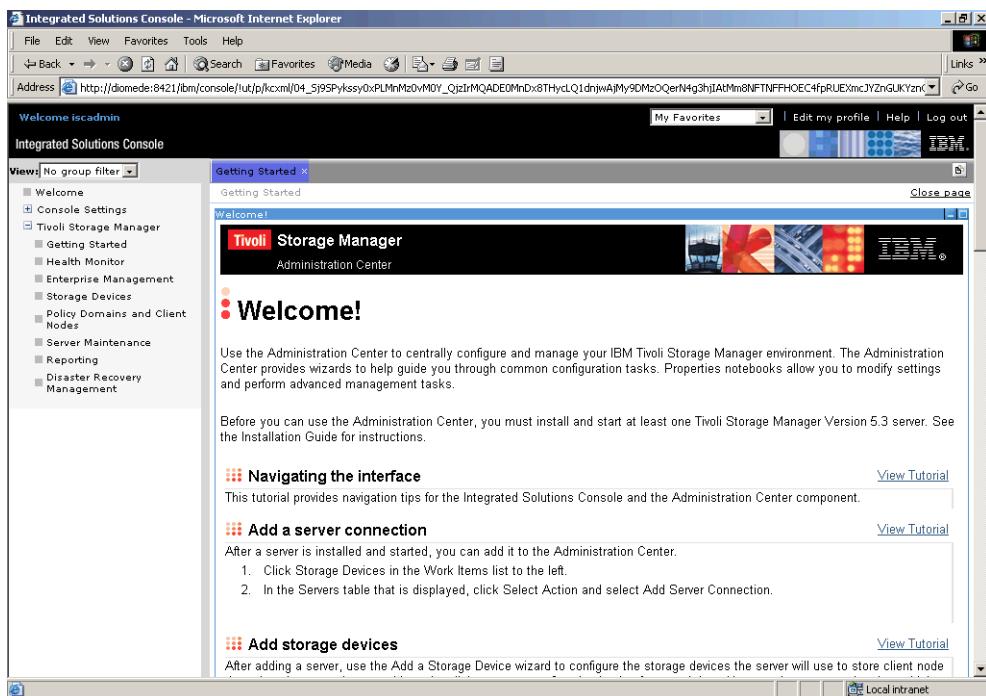


Figure 10-2 Administration Interface welcome window

The Administration Center is a task-oriented interface that guides you through the administration of Tivoli Storage Manager servers. Without a deep knowledge of Tivoli Storage Manager internals and exact command syntax, you may easily define and configure all the components of a Tivoli Storage Manager server, including:

- ▶ *Storage devices*: This includes storage pools, volumes, libraries and drives, and so on.
- ▶ *Policy domains client nodes*: This includes policy sets, management classes, and copy groups, as well as registering nodes to the domains, defining their central client option sets, and scheduling tasks to be executed on clients.
- ▶ *Server Maintenance*: This helps you to define and schedule basic server maintenance procedures, such as backing up primary storage pools and database, identifying copy storage pool and database backup volumes to be moved to the off-site location, as well as migration and reclamation processes.
- ▶ *Health Monitor*: This assists you with determining the overall status of server operations; helps you to obtain detailed information about client node schedules, the server database and recovery log, and the status of storage

devices managed by the server. The Health Monitor also provides access to the server activity log, so you can view messages generated during server operations.

- ▶ *Disaster Recovery Management:* If your servers are licensed for Tivoli Storage Manager Extended Edition, you can use this function to automatically generate a disaster recovery plan and track media.

Figure 10-3 shows the defined connections to our servers and their status as seen by the Health Monitor. As you can see, you can manage all your enterprise environments from just one place, with just a TCP/IP connection to your servers from the Administration Center.

The screenshot shows the Integrated Solutions Console interface in Microsoft Internet Explorer. The left sidebar has a 'View' dropdown set to 'No group filter' and a tree menu with nodes like Welcome, Console Settings, Tivoli Storage Manager, Disaster Recovery Management, etc. The main area is titled 'Health Monitor' and contains a sub-header 'Health Monitor'. Below it is a detailed description of the health monitor's purpose. A table lists five servers: ATLANTIC, DIOMEDE, LOCHNESS SERVER1, PALAU, and WISLA. The status for ATLANTIC is 'Needs Attention' (yellow bar), while the others are 'Good' (green bars). At the bottom of the table, it says 'Total: 5 Filtered: 5'. A note at the bottom states 'This portlet will refresh in 29 minutes and 51 seconds.'

Select	Server	Health
○	ATLANTIC	⚠ Needs Attention
○	DIOMEDE	Good
○	LOCHNESS SERVER1	Good
○	PALAU	Good
○	WISLA	Good

Figure 10-3 Server environment overview and health status

Additionally, the Administration Center allows you to issue commands to your server using a Java-based command-line administrative interface from your browser window (see Figure 10-4 on page 316). To start the CLI, select **Use Command Line** from any Select Action menu where the list of servers is

displayed. You can use this tool without having to install the CLI code, which is described in the following section.

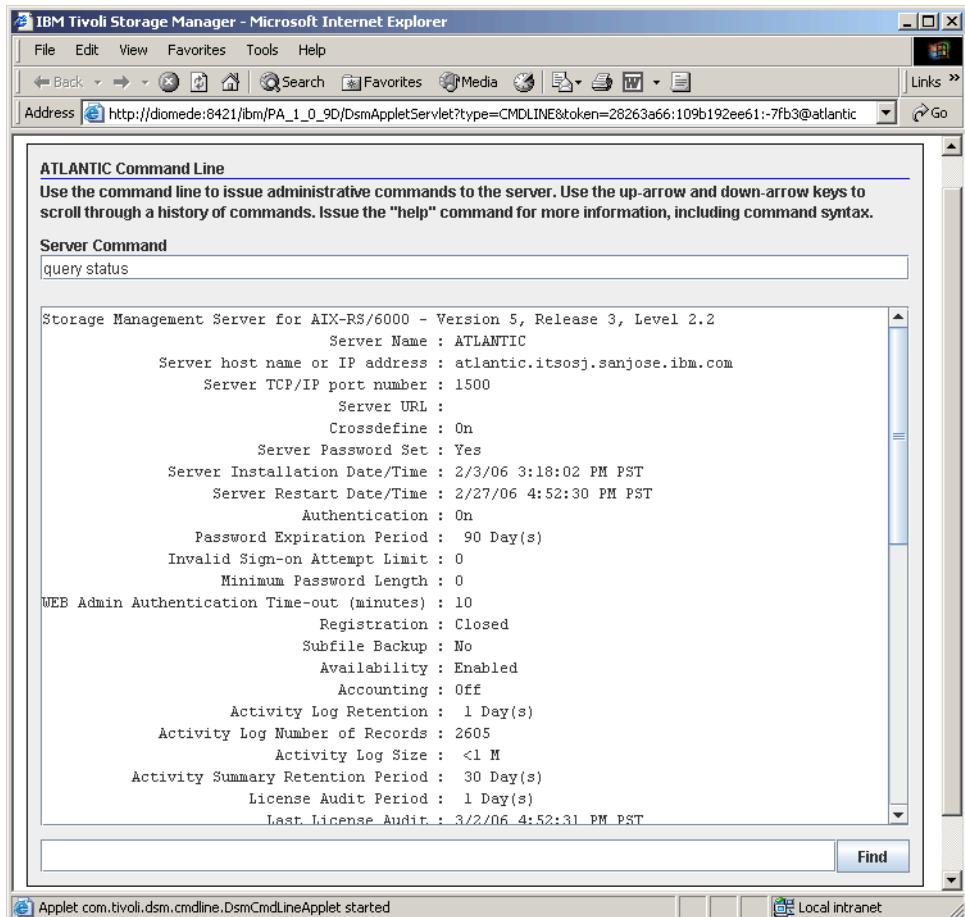


Figure 10-4 Java-based command line administrative interface

We recommend that you use the Administration Center administrative interface, since it allows you to perform all Tivoli Storage Manager administrator functions from a single place using task-oriented wizards without the need to study all server commands and possible consequences.

10.2 Administrative client

Now we consider the Tivoli Storage Manager administrative client, which provides a command-line interface (CLI) to a Tivoli Storage Manager server. We

explain how to install a Tivoli Storage Manager administrative client and tell you what options to configure. Some examples of the interfaces for various types of access are also included.

The command-line administrative client is a tool that looks and operates the same on all supported platforms. There is no dependency between the platform running the administrative client and that of the server. For example, you can administer a UNIX, Linux, or z/OS server from an administrative client installed on Windows and vice versa.

10.2.1 Code installation

The command-line administrative client (CLI) is provided as a part of the backup-archive client package. Therefore, you need to install the base backup-archive client on the machines you intend to manage Tivoli Storage Manager servers from, using the CLI. Typically, the CLI is installed on the Tivoli Storage Manager server itself and any workstations used by the administrators.

On UNIX and Linux, the CLI is installed automatically with the backup-archive client package. There is no option to install just the CLI.

Not so on Windows. The CLI is also part of the backup-archive client package, but it is not installed automatically by a *Typical* installation using the InstallShield wizard. To install the CLI on Windows, choose the *Custom* installation and make sure to choose the administrative client feature to be installed, as shown in Figure 10-5 on page 318.

Note that even if you specify to install the administrative client only, the Microsoft Software Installer installs corequisite packages, such as backup-archive client GUI, Web files, and API client.

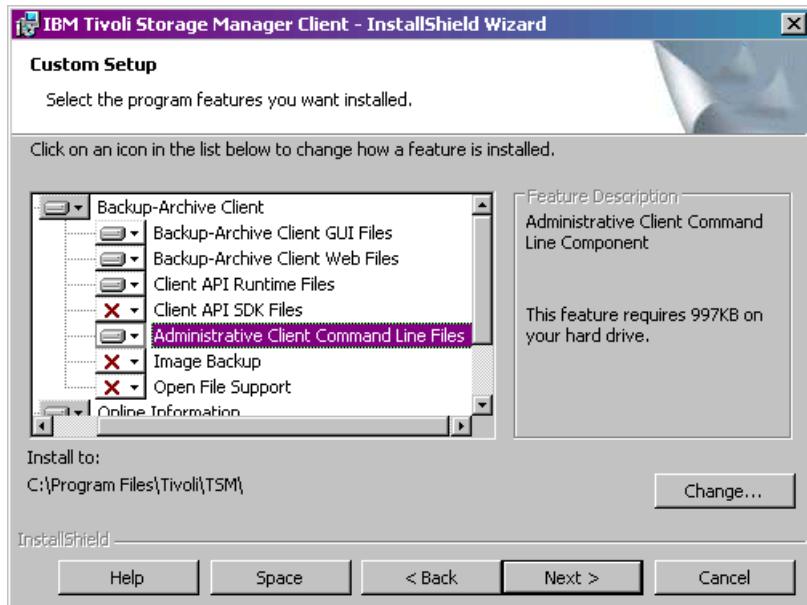


Figure 10-5 Using InstallShield Wizard to install the administrative client interface

A faster method is to make a silent installation using msieexec, where you may specify the administrative client to be installed, as in Example 10-1.

Example 10-1 Silent installation of administrative client interface using msieexec

```
c:\>msieexec /i "C:\WindowsClient5.3.2\tsmcli\x32\client\Disk1\IBM Tivoli  
Storage Manager Client.msi" RebootYesNo="No" REBOOT="Suppress" ALLUSERS=1  
INSTALLDIR="c:\program files\tivoli\ tsm" ADDLOCAL="AdministrativeCmd"  
TRANSFORMS=1033.mst /qn /l*v "c:\tmp\admincli_inst.log"
```

10.2.2 Administrative command-line client customization

Regardless of the client platform, to use the CLI you must:

- ▶ Configure the client options file.
- ▶ Have a Tivoli Storage Manager server administrator ID with the appropriate authority granted. See 8.1.4, “Recommended administrators” on page 286, for information about creating an administrator ID.

Client options for the administrative client are set in the client options files. Assuming a TCP/IP communications method, the only required option is the TCPSERVERADDRESS. We recommend using a DNS name instead of the dotted IP address for the TCPSERVERADDRESS. A dotted IP address is

inflexible, because it creates management issues if the Tivoli Storage Manager server is moved or the addressing scheme is changed. Other useful parameters include the date, time, number, and language format options. Note that UNIX and Linux clients require the additional SERVERNAME stanza in their options files.

When the TCPSERVERADDRESS option is set, the client will attempt to connect at the default TCP/IP port, 1500. If your server is listening for client connections on another port, specify that port using TCPPORT client option.

With Tivoli Storage Manager V5.1 and later you can separate client and administrative sessions using the new client and server option TCPADMINPORT (see Example 10-2). This can be useful in communications across a firewall, since you may create different sets of rules for backup-archive clients and administrative clients.

You can use the TCPADMINPORT option provided that the Tivoli Storage Manager server instance also has the TCPADMINPORT option set in the server options file (Example 10-2). Administrative client sessions are allowed on either port, unless the server option ADMINONCLIENTPORT is set NO, but by default will use the port specified by TCPADMINPORT (see Example 10-3 on page 320).

Table 10-1 summarizes some of the most common administrative client options.

Table 10-1 Administrative client options

	Option	Notes
TCPSERVERADDRESS	atlantic	The DNS name or IP address
TCPPORT	1500	Default
TCPADMINPORT	1505	Port number
DATEFORMAT	3	YYYY-MM-DD
TIMEFORMAT	1	hh:mm:ss
NUMBERFORMAT	1	1,000.00

Example 10-2 Necessary client options for establishing an administrative session

TCPSERVERADDRESS	ATLANTIC
TCPPORT	1500
TCPADMINPORT	1505

Example 10-3 shows starting a CLI session and displaying the port.

Example 10-3 Establishing an administrative session on TCPADMINPORT

```
C:\Documents and Settings\Administrator>dsmadmc
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id: admin

Enter your password: *****

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/21/2006 14:19:43  Last access: 02/21/2006 14:12:30

tsm: ATLANTIC>q option tcpadminport

  Server Option          Option Setting
  -----                  -----
TcpAdminPort           1505

tsm: ATLANTIC>q session

  Sess Comm.  Sess      Wait   Bytes   Bytes Sess  Platform Client Name
  Number Method State    Time    Sent    Recvd Type
  -----  -----  -----  -----  -----  -----  -----
        4  Tcp/Ip Run     0 S     309     223 Admin WinNT  ADMIN

tsm: ATLANTIC>
```

In Example 10-4, we confirm that the session is running on the required port.

Example 10-4 Administrative session is opened on port 1505

```
root@Atlantic /: netstat | grep 1505
tcp4       0      0  atlantic.1505                diomede.2148      ESTABLISHED
```

10.2.3 Command-line interface

The CLI is a character mode interface, and therefore is well suited for users who like to type commands or who are used to similar interfaces including UNIX shells or Windows command prompts. It is also useful if you cannot access the Web administrative interface for any reason (for example, no browser available on a particular system).

To start the CLI, enter `dsmadmc` at the operating system prompt. You will be prompted for an administrative ID and password. Without authentication, you cannot log on to the Tivoli Storage Manager server. Example 10-5 shows the start of an administrative client session on AIX.

Obviously, the client can only connect to the Tivoli Storage Manager server if the server instance is actually running.

Example 10-5 Dsmadmc command-line client

```
root@Atlantic /: dsmadmc
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id: admin

Enter your password:

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/21/2006 14:40:06  Last access: 02/21/2006 14:24:23
```

```
tsm: ATLANTIC>
```

You then type administrative Tivoli Storage Manager commands at the prompt `tsm: SERVERNAME>`. Once an administrative command is executed, you always return back to the `tsm: SERVERNAME>` prompt. This interactive method is also called *loop mode*. If you use the interactive mode, you do not have to re-enter your password with each command.

Another way to start a CLI session is the so-called *batch mode*. You simply type `dsmadmc` together with the administrative ID, the password, and the actual command that you want to execute. In this mode, the administrative client processes the command and returns to the operating system prompt.

To get help from the CLI prompt, type `help xxx`, where `xxx` is blank, a command, or a Tivoli Storage Manager message number.

As well as providing an interface for executing commands, the CLI offers two other modes that are used for monitoring purposes only. You cannot enter administrative commands while in either of these two modes. These modes are:

- ▶ *Console mode*: When `dsmadmc` is run with the `-consolemode` argument (see Example 10-6 on page 322) after authentication, all activity log messages are displayed as they are generated. In this mode, you can watch the status of your server instance without having to search the activity log interactively.

- ▶ *Mount mode:* This is similar to console mode, but displays only messages related to mount and dismount operations on volumes, including requests to the administrator to checkout or checkin a volume. Example 10-7 shows how to start mount mode with **dsmadmc -mountmode**.

Example 10-6 Administrative client run in console mode

```
C:\>dsmadmc -consolemode
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id: admin

Enter your password: *****

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/21/2006 14:52:16  Last access: 02/21/2006 14:40:06

ANR2017I Administrator ADMIN issued command: QUERY LIBVOL
ANR2017I Administrator ADMIN issued command: QUERY DEVCLASS
ANR2017I Administrator ADMIN issued command: BACKUP DB type=full scratch=yes
devclass=lto2-dc wait=yes
ANR0984I Process 1 for DATABASE BACKUP started in the FOREGROUND at 14:52:59.
ANR2280I Full database backup started as process 1.
ANR8337I LTO volume 028AKK mounted in drive LT01 (/dev/rmt0).
ANR0513I Process 1 opened output volume 028AKK.
ANR1360I Output volume 028AKK opened (sequence number 1).
ANR4554I Backed up 960 of 1953 database pages.
ANR4554I Backed up 1920 of 1953 database pages.
ANR1361I Output volume 028AKK closed.
ANR0515I Process 1 closed volume 028AKK.
ANR4550I Full database backup (process 1) complete, 1953 pages copied.
ANR0985I Process 1 for DATABASE BACKUP running in the FOREGROUND completed with
completion state SUCCESS at 14:53:35.
ANR8336I Verifying label of LTO volume 028AKK in drive LT01 (/dev/rmt0).
ANR8468I LTO volume 028AKK dismounted from drive LT01 (/dev/rmt0) in library
LIB1.
```

Example 10-7 Administrative client run in mount mode

```
C:\>dsmadmc -mountmode
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id: admin
```

```
Enter your password: *****  
  
Session established with server ATLANTIC: AIX-RS/6000  
Server Version 5, Release 3, Level 2.2  
Server date/time: 02/21/2006 14:58:44 Last access: 02/21/2006 14:52:16  
  
ANR8337I LT0 volume 029AKK mounted in drive LT02 (/dev/rmt1).  
ANR8336I Verifying label of LT0 volume 029AKK in drive LT02 (/dev/rmt1).  
ANR8468I LT0 volume 029AKK dismounted from drive LT02 (/dev/rmt1) in library  
LIB1.  
ANR8336I Verifying label of LT0 volume 029AKK in drive LT01 (/dev/rmt0).  
ANR8829I Remove volume 029AKK from slot 16 of library LIB1 at your  
convenience.
```

If you are familiar with operating system shell environments, you will find the CLI to be a powerful tool for administering Tivoli Storage Manager server instances. You may build automated scripts that ease administration tasks or provide comprehensive monitoring outputs. For detailed information about `dsmadmc` command arguments, syntax, and features, see the *IBM Tivoli Storage Manager Administrator's Reference* for your server platform.

10.3 Summary

You should now understand what tasks are possible using the administrative client interfaces. We will now proceed to the next chapter, which discusses client operations in detail.



Part 3

Operational details

In this part of the book we discuss client and server operational tasks, such as backup, restore, archive, retrieval functions, client and server interfaces, client scheduling, administration tasks, and scheduling, as well as many routine operations that should be performed daily or weekly. We also include more advanced operational tasks, such as server-to-server exporting, setting up Tivoli Storage Manager to send Tivoli Enterprise Console® alerts, and a rather lengthy section on performance.



Client operations

Continuing on from the setup and configuration part of this book, we have now begun the operational portion in which our initial discussions center on how to perform backup-archive client operations such as backing up, restoring, archiving, and retrieving data. Sample commands are given for both UNIX and Windows platforms.

For more information about client operations, see the *IBM Tivoli Storage Manager Backup-Archive Client Installation and User's Guide* for the appropriate platform.

11.1 Running backup operations

To start backing up a file, directory, or the whole machine, use the **incremental** command, which is the default option from the GUI. This command backs up all new or changed files in your default client domain, or in the file systems specified that are not excluded from backup operations.

An alternative backup command is the **selective** command (option Always backup from the GUI). During a selective backup, Tivoli Storage Manager sends copies of files to the server, regardless of whether they have changed since the last backup. This might result in having more than one copy of the same file version on the server. If that occurs, you might not have as many different file copy versions on the server as you intended. Your version limit might consist of identical files. To avoid that, you should normally use the **incremental** command to back up only changed and new files. However, you could consider doing a periodic **selective** backup operation to regroup all the files of one machine onto one tape. This might be helpful if you are not collocating data, or as an alternative to the backup set functionality. We recommend that the Tivoli Storage Manager administrator defines appropriate collocation settings for the target storage pools, so you do not need to run selective backups. Remember that the backup set functionality usually performs this task more efficiently, as it is done entirely within the server and without requiring resending of any client data to the server.

You can also back up one or more volumes or RAW volumes as a single object by using the **backup image** command. Image backups are much faster than full file system backups. They also occupy less space on the Tivoli Storage Manager server database since only one object entry is required to represent the whole image. You can perform a static image backup, which unmounts and remounts the volume as read-only to prevent applications from accessing it during the backup process. If you do not want to remount the volume as read-only, you can perform a dynamic image backup.

A set of files that are on different file spaces can also be backed up to one virtual file space on the Tivoli Storage Manager server. The **backup group** command allows you to create a consistent point-in-time backup of a group of files that is managed as a single logical entity.

Journal-based backup is supported on Windows and AIX (at V5.3.3.0 and later) clients. If the journal engine service is installed and running, then by default, incremental backups will automatically perform journal-based backup on the selected file systems that are monitored by the journal engine service.

Table 11-1 gives examples of backup operations using a UNIX backup-archive client.

Table 11-1 Backup command examples: UNIX

If you want to perform this operation...	... then this is the client command:
Incremental backup of the client domain	dsmc incremental
Incremental backup of a file system (/home)	dsmc incremental /home/
Incremental backup of all files in a directory (/home/fred) and all its subdirectories	dsmc incremental /home/fred/ -subdir=yes
Selective backup of a file system (/home) and all its subdirectories	dsmc selective /home/ -subdir=yes
Selective backup of all files in a directory (/home/fred) and all its subdirectories	dsmc selective /home/fred/ -subdir=yes
Point-in-time, full logical volume backup for a file system (/tsm)	dsmc backup image /tsm
Logical volume backup for a RAW device (/dev/test)	dsmc backup image /dev/test
Full backup of all files in /home/list1 to the virtual filespace=/virtualtsm containing group leader grp	dsmc backup group -filelist=/home/list1 -groupname=grp -virtualfsname=/virtualtsm

Table 11-2 gives examples of backup operations using a Windows backup-archive client.

Table 11-2 Backup command examples: Windows

If you want to perform this operation...	...then this is the client command:
Incremental backup of the client domain	dsmc incremental
Incremental backup of all files in a directory (c:\wilma) and all its subdirectories	dsmc incremental c:\wilma* -subdir=yes
Selective backup of a directory (c:\wilma)	dsmc selective c:\wilma*
Selective backup of all files in a directory (c:\wilma) and all its subdirectories	dsmc selective c:\wilma* -subdir=yes

If you want to perform this operation...	...then this is the client command:
Point-in-time full logical volume backup for a drive	<code>dsmc backup image d:\</code>
Full backup of all files in c:\data\list1.txt home to the virtual filesystem=virtualtsm containing group leader grp	<code>dsmc backup group -filelist=c:\data\list1.txt -groupname=grp -virtualfsname=\virtualtsm</code>

Tip on include-exclude processing: Especially on Windows platforms, be careful of the difference between the patterns of double wildcard (*.*) and single wildcard (*). In an INCLUDE/EXCLUDE statement, these patterns are processed differently. The specification INCLUDE C:\WORK* will match all files in the WORK directory. The specification INCLUDE C:\WORK*.* will match files in the WORK directory only if they include the period or dot. For the backup commands, however, the patterns are considered the same. For example, the two commands DSMC INCREMENTAL C:\WORK* and DSMC INCREMENTAL C:\WORK*.* both match all files.

Therefore, if you put INCLUDE C:\WORK*.* in your INCLUDE/EXCLUDE list and then issue the command DSMC INCREMENTAL C:\WORK* you will not see any files without the dot being backed up. This is because they do not match the INCLUDE rule (assuming an EXCLUDE statement excludes everything else).

We recommend that you configure all include/exclude options with a single wildcard (for example, INCLUDE C:\WORK*, EXCLUDE D:\TEMP*) to avoid potential hard-to-diagnose problems, unless you have a specific requirement for files with dots in their names.

The next example illustrates the relationship between wildcards in the INCLUDE/EXCLUDE statements and backup commands.

11.1.1 Exclude rules preventing some files from being backed up

Suppose there are two files in a directory c:\tsm, myfile.doc and myfile. We configure an exclude rule to avoid some of the files, as shown in Example 11-1.

Example 11-1 Include/exclude settings in dsm.opt

```
..  
exclude c:\.../*  
include c:\TS\*.*  
...
```

The DSMC INCR command will never back up the file c:\tsm\myfile because it is not caught by the INCLUDE statement and therefore is excluded under the EXCLUDE rule. It does not matter if you use double wildcard (*.*) or single wildcard (*) on the INCR command. Example 11-2 shows that the file myfile is excluded, but myfile.doc is included. Look at the objects inspected and the objects backed up statistics.

Example 11-2 Windows incremental backup using double wildcard (.*) search string*

```
C:\Program Files\Tivoli\TSM\baclient>dsmc i c:\TS\*.*  
IBM Tivoli Storage Manager  
Command Line Backup/Archive Client Interface  
Client Version 5, Release 3, Level 2.0  
Client date/time: 02/20/2006 14:13:12  
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.  
  
Node Name: TSM_CLIENT_DEMO  
Session established with server LOCHNESS_SERVER1: Windows  
Server Version 5, Release 3, Level 2.2  
Server date/time: 02/20/2006 14:13:47 Last access: 02/20/2006 14:12:56  
  
Incremental backup of volume 'c:\tsm\*.*'  
Directory--> 0 \\klchv3x\c$\TS [Sent]  
Directory--> 0 \\klchv3x\c$\TS\charlotte [Sent]  
Directory--> 0 \\klchv3x\c$\TS\eduardo [Sent]  
Directory--> 0 \\klchv3x\c$\TS\martin [Sent]  
Directory--> 0 \\klchv3x\c$\TS\norbert [Sent]  
Directory--> 0 \\klchv3x\c$\TS\peter [Sent]  
Normal File--> 104,908 \\klchv3x\c$\TS\myfile.doc [Sent]  
Successful incremental backup of '\\klchv3x\c$\TS\*'  
  
Total number of objects inspected: 8  
Total number of objects backed up: 7  
Total number of objects updated: 0
```

```

Total number of objects rebound:          0
Total number of objects deleted:         0
Total number of objects expired:        0
Total number of objects failed:         0
Total number of subfile objects:        0
Total number of bytes transferred:     103.78 KB
Data transfer time:                   0.01 sec
Network data transfer rate:          10,378.22 KB/sec
Aggregate data transfer rate:        5.88 KB/sec
Objects compressed by:                0%
Subfile objects reduced by:          0%
Elapsed processing time:             00:00:17

```

Example 11-3 shows that even if the string on the backup command is changed from double wildcard (*.*) to single wildcard (*), the file myfile is still excluded from the backup. Please note that we have deleted the file space that was created by the previous test, from the server.

Example 11-3 Windows incremental backup using single wildcard () search string*

```

C:\Program Files\Tivoli\TSM\baclient>dsmc i c:\TS\*
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/2006 14:15:15
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Node Name: TSM_CLIENT_DEMO
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/2006 14:15:50 Last access: 02/20/2006 14:13:53

Incremental backup of volume 'c:\tsm\*'
Directory-->          0 \\klchv3x\c$\TS [Sent]
Directory-->          0 \\klchv3x\c$\TS\charlotte [Sent]
Directory-->          0 \\klchv3x\c$\TS\eduardo [Sent]
Directory-->          0 \\klchv3x\c$\TS\martin [Sent]
Directory-->          0 \\klchv3x\c$\TS\norbert [Sent]
Directory-->          0 \\klchv3x\c$\TS\peter [Sent]
Normal File-->       104,908 \\klchv3x\c$\TSmyfile.doc [Sent]
Successful incremental backup of '\\klchv3x\c$\TS\*'

Total number of objects inspected:      8
Total number of objects backed up:     7
Total number of objects updated:       0
Total number of objects rebound:        0

```

```
Total number of objects deleted:          0
Total number of objects expired:          0
Total number of objects failed:           0
Total number of subfile objects:          0
Total number of bytes transferred:       103.78 KB
Data transfer time:                     0.00 sec
Network data transfer rate:            0.00 KB/sec
Aggregate data transfer rate:          6.89 KB/sec
Objects compressed by:                 0%
Subfile objects reduced by:            0%
Elapsed processing time:                00:00:15
```

The same happens for the corresponding **dsmc selective** commands.

11.1.2 UNIX command-line examples and output

Here are some UNIX backup examples. They were taken on an AIX client, but all UNIX and Linux clients work similarly.

Incremental backup

Example 11-4 shows an incremental backup operation.

Example 11-4 UNIX incremental backup

```
root@Atlantic /tsm: dsmc incr /TS/ -su=yes
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/06  15:17:55
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Node Name: ATLANTIC
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/06  15:17:12  Last access: 02/20/06  15:10:02

Incremental backup of volume '/TS/'
Directory-->          256 /TS/charlotte [Sent]
Directory-->          256 /TS/eduardo [Sent]
Directory-->          256 /TS/lost+found [Sent]
Directory-->          256 /TS/martin [Sent]
Directory-->        4,096 /TS/norbert [Sent]
Directory-->          256 /TS/peter [Sent]
Directory-->        4,096 /TS/sys [Sent]
Normal File-->      1,048,576 /TS/charlotte/data1 [Sent]
Normal File-->      1,048,576 /TS/charlotte/data2 [Sent]
```

```
Normal File--> 1,048,576 /TS/charlotte/data3 [Sent]
Normal File--> 1,048,576 /TS/eduardo/data1 [Sent]
Normal File--> 1,048,576 /TS/eduardo/data2 [Sent]
Normal File--> 1,048,576 /TS/eduardo/data3 [Sent]
Normal File--> 1,048,576 /TS/martin/data1 [Sent]
Normal File--> 1,048,576 /TS/martin/data2 [Sent]
Normal File--> 1,048,576 /TS/martin/data3 [Sent]
Normal File--> 1,048,576 /TS/norbert/data1 [Sent]
Normal File--> 1,048,576 /TS/norbert/data2 [Sent]
Normal File--> 1,048,576 /TS/norbert/data3 [Sent]
Normal File--> 1,048,576 /TS/peter/data1 [Sent]
Normal File--> 1,048,576 /TS/peter/data2 [Sent]
Normal File--> 1,048,576 /TS/peter/data3 [Sent]
Normal File--> 105 /TS/sys/devconfig.txt [Sent]
Normal File--> 233 /TS/sys/dsmser.dsk [Sent]
Normal File--> 67,985 /TS/sys/dsmser.opt [Sent]
Normal File--> 9 /TS/sys/hbaapi.lvl [Sent]
Normal File--> 1,027 /TS/sys/rc.tsmserver [Sent]
Normal File--> 641 /TS/sys/volhist.txt [Sent]
Successful incremental backup of '/TS/*'
```

```
Total number of objects inspected: 28
Total number of objects backed up: 28
Total number of objects updated: 0
Total number of objects rebound: 0
Total number of objects deleted: 0
Total number of objects expired: 0
Total number of objects failed: 0
Total number of bytes transferred: 15.06 MB
Data transfer time: 1.28 sec
Network data transfer rate: 11,967.25 KB/sec
Aggregate data transfer rate: 7,686.76 KB/sec
Objects compressed by: 0%
Elapsed processing time: 00:00:02
```

Logical volume backup

Example 11-5 shows an example of a full logical volume backup operation.

Example 11-5 UNIX logical volume backup

```
root@Atlantic /tsm: dsmc backup image /home -se=lochness
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
Client Version 5, Release 3, Level 2.0
Client date/time: 02/20/06 15:20:47
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.
```

```
Node Name: ATLANTIC
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/06  15:20:05  Last access: 02/20/06  15:18:50
```

Backup Image Function Invoked.

```
Using static image backup.
Volume -->      33,554,432 /home [Sent]
Image Backup processing of '/home' finished without failure.
```

```
Total number of objects inspected:      1
Total number of objects backed up:      1
Total number of objects updated:        0
Total number of objects rebound:        0
Total number of objects deleted:        0
Total number of objects expired:        0
Total number of objects failed:         0
Total number of bytes transferred:     32.00 MB
Data transfer time:                  5.00 sec
Network data transfer rate:          6,553.60 KB/sec
Aggregate data transfer rate:        9,860.06 KB/sec
Objects compressed by:              0%
Elapsed processing time:            00:00:03
```

Note on AIX JFS and raw volumes: The backup image command knows the difference between a raw logical volume (with no file system) and a logical volume with a journaled file system (JFS) defined to it. You cannot use the backup image function to try to back up a defined JFS file system using its raw device specification. In the previous example, if you try to run a **dsmc backup image /dev/tsm**, the command will fail because this is a JFS file system. On the other hand, you will be able to perform a **dsmc backup image /dev/test1lv**, provided it is a raw logical volume with no JFS file system definitions in place.

Example 11-6 shows a successful raw image backup (/dev/test) and a failure (/dev/tsm) when trying to use the backup image function on a defined JFS file system.

Example 11-6 UNIX raw logical volume backup

```
root@Atlantic /tsm: lsfs test1v00
lsfs: 0506-915 No record matching /tsm/test1v00 was found in /etc/filesystems.

root@Atlantic /tsm: dsmc backup image /dev/test1v00
IBM Tivoli Storage Manager
```

```
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/06  15:39:25
  (c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.
```

```
Node Name: ATLANTIC
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/06  15:38:42  Last access: 02/20/06  15:30:56
```

Backup Image Function Invoked.

```
Using static image backup.
Volume -->      33,554,432 /dev/testlv00 [Sent]
Image Backup processing of '/dev/testlv00' finished without failure.
```

```
Total number of objects inspected:          1
Total number of objects backed up:          1
Total number of objects updated:            0
Total number of objects rebound:            0
Total number of objects deleted:            0
Total number of objects expired:           0
Total number of objects failed:             0
Total number of bytes transferred:         32.00 MB
Data transfer time:                      5.00 sec
Network data transfer rate:              6,553.60 KB/sec
Aggregate data transfer rate:            10,794.67 KB/sec
Objects compressed by:                  0%
Elapsed processing time:                00:00:03
```

```
root@Atlantic /tsm: lsfs /dev/hd1
Name          Nodename   Mount Pt      VFS  Size    Options   Auto
Accounting
/dev/hd1       --        /home        jfs2  65536   --
no
```

```
root@Atlantic /tsm: dsmc backup image /dev/hd1 -se=lochness
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/06  15:43:23
  (c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.
```

```
Node Name: ATLANTIC
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/06  15:42:40  Last access: 02/20/06  15:38:42
```

Backup Image Function Invoked.

ANS1063E The specified path is not a valid file system or logical volume name.

Group backup

Example 11-7, Example 11-8, and Example 11-9 on page 339 show examples of commands related to and including the **backup group** command.

Example 11-7 shows the output of the **query filesystem** command. At this point, we have not executed the **backup group** command yet.

Example 11-7 Query file space

```
tsm: LOCHNESS_SERVER1>q files
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/2006 15:43:38  Last access: 02/20/2006 15:30:55
```

Node Name	Filespace Name	FSID Name	Platform	Filespace Type	Is pace	Capacity (MB)	Pct Util
					pace Unicode?		
ATLANTIC	/TS	1	AIX	JFS2	No	32.0	48.3
ATLANTIC	/home	2	AIX	JFS2	No	32.0	1.1
ATLANTIC	/dev/test1- v00	3	AIX	RAW	No	32.0	100.0
TSM_CLIENT_DEMO	\\\k1chv3x\~- c\$	3	WinNT	NTFS	Yes	38,154.3	21.1

In Example 11-8, first we have created a list of files to back up in a file called **filelist**. We then execute the **backup group** command.

Example 11-8 Backup group command and output

```
root@Atlantic /TS: more filelist
/home/guest/data1
/TS/charlotte/data1
/TS/charlotte/data
/TS/eduardo/data1
/TS/martin/data2
/TS/norbert/data1
/TS/peter/data3
/usr/tivoli/tsm/client/ba/bin/dsm.opt
filelist: END
```

```

root@Atlantic > dsmc backup group -filelist=/TS/filelist
             -groupname=residentgrp -virtualfsname=/tsmresidentfs -mode=full

IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/20/2006 17:40:02
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Node Name: ATLANTIC
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/2006 17:39:19  Last access: 02/20/2006 17:16:08

Backup GROUP function invoked mode= FULL.

Directory-->          256 /home/guest [Sent]
Normal File-->        1,048,576 /home/guest/data1 [Sent]
Directory-->          256 /TS/charlotte [Sent]
Normal File-->        1,048,576 /TS/charlotte/data1 [Sent]
Normal File-->        1,048,576 /TS/charlotte/data2 [Sent]
Directory-->          256 /TS/eduardo [Sent]
Normal File-->        1,048,576 /TS/eduardo/data1 [Sent]
Directory-->          256 /TS/martin [Sent]
Normal File-->        1,048,576 /TS/martin/data2 [Sent]
Directory-->          4,096 /TS/norbert [Sent]
Normal File-->        1,048,576 /TS/norbert/data1 [Sent]
Directory-->          256 /TS/peter [Sent]
Normal File-->        1,048,576 /TS/peter/data3 [Sent]
Directory-->          256 /usr/tivoli [Sent]
Directory-->          256 /usr/tivoli/tsm [Sent]
Directory-->          256 /usr/tivoli/tsm/client [Sent]
Directory-->          256 /usr/tivoli/tsm/client/ba [Sent]
Directory-->          4,096 /usr/tivoli/tsm/client/ba/bin [Sent]
Normal File-->        655 /usr/tivoli/tsm/client/ba/bin/dsm.opt [Sent]

Normal File-->        171 /TS/filelist [Sent]
Backup processing of 'residentgrp' finished without failure.

Total number of objects inspected:      20
Total number of objects backed up:     20
Total number of objects updated:       0
Total number of objects rebound:       0
Total number of objects deleted:       0
Total number of objects expired:       0
Total number of objects failed:        0
Total number of bytes transferred:    7.00 MB
Data transfer time:                  0.59 sec

```

Network data transfer rate:	11,954.42 KB/sec
Aggregate data transfer rate:	3,551.03 KB/sec
Objects compressed by:	0%
Elapsed processing time:	00:00:02

Example 11-9 is on the Tivoli Storage Manager server. It shows that a new file space is created, /tsmresidentsfs, after completion of the **backup group** command. Notice that the file space type is TSMVFS.

Example 11-9 Query file space output after group backup

tsm: LOCHNESS_SERVER1>**q files**

Node Name	Filespace Name	FSID	Platform Type	Filespace Type	Is Unicode?	Capacity (MB)	Pct Util
<hr/>							
ATLANTIC	/TS	1	AIX	JFS2	No	32.0	48.3
ATLANTIC	/home	2	AIX	JFS2	No	32.0	1.1
ATLANTIC	/dev/test1-v00	3	AIX	RAW	No	32.0	100.0
ATLANTIC	/tsmreside-ntfs	4	AIX	TSMVFS	No	0.0	0.0
TSM_CLIENT_DEMO	\\\k1chv3x\c\$	3	WinNT	NTFS	Yes	38,154.3	21.1
WINHSM_CLIENT_DEMO	- winhsm_filespace	2	Windows	API:TSM HSM Client for Windows	Yes	183.3	100.0

Important: The **backup group** command can only be executed from the Tivoli Storage Manager backup-archive command line.

On the Tivoli Storage Manager client, we can see details of the group with the **query group** command, as shown in Example 11-10. We can see the members of the group with the **showmembers** option.

Example 11-10 Client queries the group

```
tsm> q group /tsmresidents/*
      Size     Backup Date      Mgmt Class A/I Type Group
      ----  -----
    7,351,355 B 02/20/2006 16:13:43  DEFAULT   A  FULL /tsmresidents/residentgrp

tsm> q group /tsmresidents/residentgrp -showmembers
      Size     Backup Date      Mgmt Class A/I Type Group
      ----  -----
```

7,351,355	B	02/20/2006 16:13:43	DEFAULT	A	FULL	/tsmresidents/residentgrp
Size		Backup Date	Mgmt Class	A/I	File	
-----		-----	-----	-----	-----	-----
256	B	02/20/2006 16:13:43	DEFAULT	A	/tsmresidents/home	
256	B	02/20/2006 16:13:43	DEFAULT	A	/tsmresidents/TS	
4,096	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/usr	
256	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/home/gue	
st						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/home/gue	
st/data1						
256	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/charl	
otte						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/charl	
otte/data1						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/charl	
otte/data2						
256	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/eduar	
do						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/eduar	
do/data1						
256	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/marti	
n						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/marti	
n/data2						
4,096	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/norbe	
rt						
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/norbe	
rt/data1						
256	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/peter	
1,048,576	B	02/20/2006 16:13:44	DEFAULT	A	/tsmresidents/TS/peter	
/data3						
256	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li						
256	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li/tsm						
256	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li/tsm/client						
256	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li/tsm/client/ba						
4,096	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li/tsm/client/ba/bin						
656	B	02/20/2006 16:13:45	DEFAULT	A	/tsmresidents/usr/tivo	
li/tsm/client/ba/bin/dsm.opt						

Create backup set

Backup sets are created using a Tivoli Storage Manager server command, rather than via the backup-archive client. The generated backup set can be stored in a file or on sequential storage. In Example 11-11 we create a backup set of the client file space /TS onto disk storage, using a FILE device class.

Example 11-11 Create a backup set

```
tsm: ATLANTIC>generate backupset atlantic BS1 /TS devc=seqf-dc wait=yes
ANR0984I Process 137 for GENERATE BACKUPSET started in the FOREGROUND at
16:47:18.
ANR3500I Backup set for node ATLANTIC as BS1.136180 being generated.
ANR3501I Backup set for ATLANTIC as BS1.136180 completed successfully -
processed 33 files.
ANR3505I Backup set for ATLANTIC as BS1.136180 used volume
/tsm/stg/seqf/43247638.ost.
ANR0987I Process 137 for GENERATE BACKUPSET running in the FOREGROUND processed
33 items with a completion state of SUCCESS at 16:47:19.

tsm: ATLANTIC>q backupset

      Node Name: ATLANTIC
      Backup Set Name: BS1.136180
          Date/Time: 03/24/2006 16:47:19
      Retention Period: 365
      Device Class Name: SEQF-DC
          Description: No Description
```

The server automatically creates a file to store the backup set, /tsm/stg/seqf/43247638.ost. The client can see the backup set created using the **query backup set** command, as in Example 11-12.

Example 11-12 Client query backup set

```
tsm> q backupset

      Backup Set Name           Generation Date   Retention Description
      -----                   03/24/2006 16:47:19  365      No Description
1 BS1.136180
tsm>
```

The point of backup sets is that they can be made to portable media, like tapes or written to CDs. The media can then be loaded directly at the client for direct restore. In our case, we are using the backup-archive client on the Tivoli Storage Manager server itself, and we wrote the backup set to a disk file. Therefore this file is automatically available for restore, which we will see in the 11.2.1, “UNIX command-line examples and output” on page 348.

11.1.3 Windows GUI backup examples

Figure 11-1 shows the Windows backup GUI. On other platforms, use the Java or Web client—the look and feel is almost identical.

From this window you can select specific files or folders that you want to back up and you can select from an incremental, selective, or image backup.

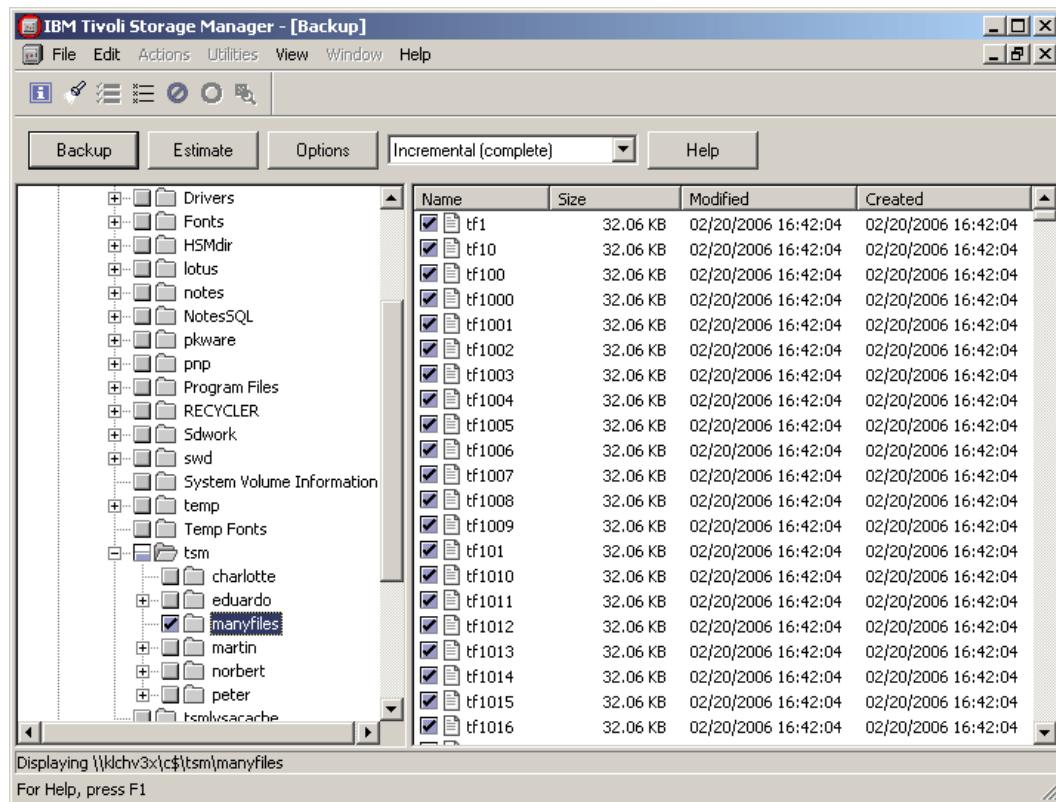


Figure 11-1 Windows backup GUI

The estimate function (see the Estimate button next to the Backup button) calculates the total amount of data selected for backup and estimates the amount of time it will take to back it up. Figure 11-2 on page 343 shows the estimated output for the files selected in the previous figure. This function is historical, that is, the calculated length of time for the backup is based on the throughput of the previous client operation. Therefore, the first time you use the Tivoli Storage Manager client and run the estimate function, the *estimated transfer time* is grayed out, since there is no previous data to refer to.

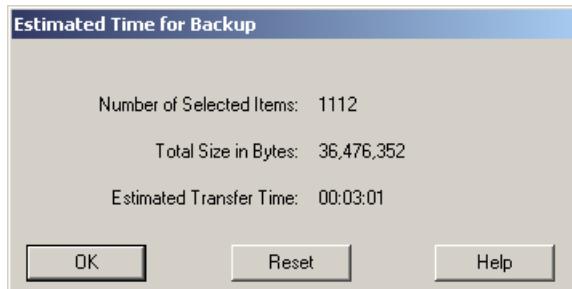


Figure 11-2 Estimate function

After the backup operation is complete, a status report similar to Figure 11-3 displays. This report contains data such as the total amount of files backed up and the transfer rate during the backup operation. The View button is available only if there errors were encountered during the operation.

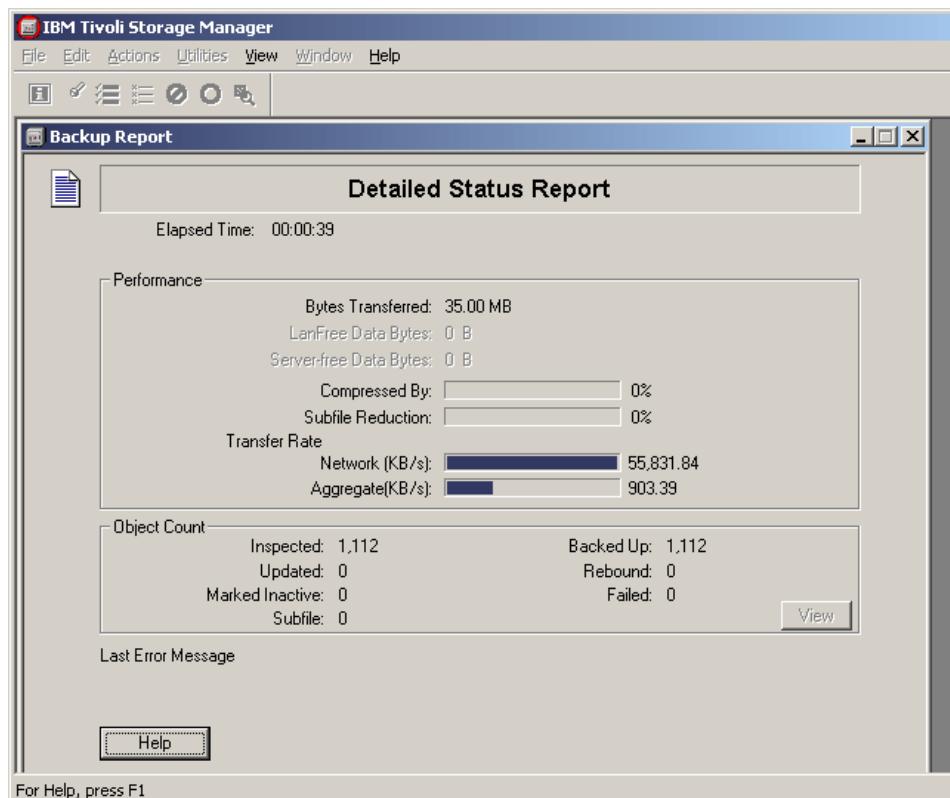


Figure 11-3 Backup report

11.1.4 Additional backup options for Windows

In this section we discuss backup options available for Windows clients only:

- ▶ Adaptive subfile backups should be used if backups are sent on a device with very limited bandwidth, such as a modem. Only changed portions of the files are sent over the network. This reduces traffic in the network and speeds up backup as well. Set the subfilebackup, subfilecacheopath, and subfilecachesize in the client options file, dsm.opt.
- ▶ You can perform Open File backups on Windows 2000/2003/XP clients if the Logical Volume Snapshot Agent (LVSA) is installed and configured. Tivoli Storage Manager takes a point-in-time copy of a file that is locked (opened) by another application. LVSA can be installed using the client configuration wizard.
- ▶ You can back up the Windows 2000/XP system objects together or individually. We recommend that you back it up together to maintain consistency. For Windows 2003 clients, you can back up system state and system services. Tivoli Storage Manager uses the Microsoft Volume Shadowcopy Services (VSS) to do this. Figure 11-4 on page 345 shows how to back up the system object from the Tivoli Storage Manager GUI. We recommend that you perform a full backup of all the components of the system object at the same time so that it is in a consistent state.

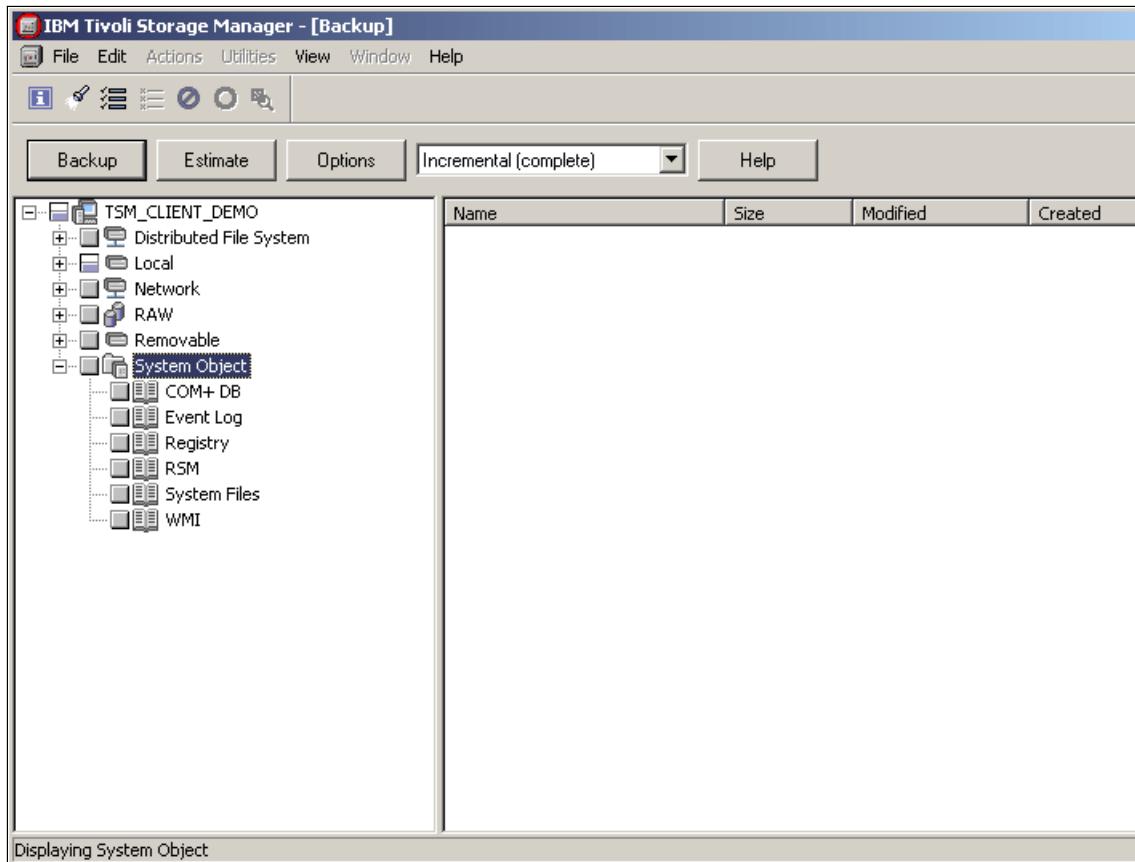


Figure 11-4 Windows 2000 system object backup

11.2 Running restore operations

To restore a file, a directory, or even the whole machine, you need to know two things: *what* you want to restore (file name, directory), and, optionally, from *when* (point-in-time), if you want to restore a file version other than the most recent one.

Important: You do not need to know where the data actually is. When you request a file, Tivoli Storage Manager finds its location in the server database and seeks the right disk portion or mounts the right tape volume.

To restore files, specify the directories or selected files either at the command line or by clicking down through the directory structure displayed in the GUI. Both

the GUI and the command-line interface have search functions in case you do not know the exact file names or directories needed for restore. You can also select the files from a list using the PICK option with the command-line restore command, as shown in Example 11-13.

Example 11-13 UNIX restore with pick option

```
tsm> restore /TS/* -subdir=yes -pick
```

TSM Scrollable PICK Window - Restore

#	Backup Date/Time	File Size A/I	File
1.	02/20/06 15:17:12	256 B A	/TS/charlotte
2.	02/20/06 15:17:12	256 B A	/TS/eduardo
3.	02/20/06 15:17:12	256 B A	/TS/lost+found
4.	02/20/06 15:17:12	256 B A	/TS/martin
5.	02/20/06 15:17:12	4.00 KB A	/TS/norbert
6.	02/20/06 15:17:12	256 B A	/TS/peter
7.	02/20/06 15:17:12	4.00 KB A	/TS/sys
8.	02/20/06 15:17:12	1.00 MB A	/TS/charlotte/data1
9.	02/20/06 15:17:12	1.00 MB A	/TS/charlotte/data2
10.	02/20/06 15:17:12	1.00 MB A	/TS/charlotte/data3
11.	02/20/06 15:17:12	1.00 MB A	/TS/eduardo/data1
12.	02/20/06 15:17:12	1.00 MB A	/TS/eduardo/data2
13.	02/20/06 15:17:12	1.00 MB A	/TS/eduardo/data3
14.	02/20/06 15:17:12	1.00 MB A	/TS/martin/data1
15.	02/20/06 15:17:12	1.00 MB A	/TS/martin/data2

0-----10-----20-----30-----40-----50-----60-----7

<U>=Up <D>=Down <T>=Top =Bottom <R#>=Right <L#>=Left
<G#>=Goto Line # <#>=Toggle Entry <+>=Select All <->=Deselect All
<#:#+>=Select A Range <#:#->=Deselect A Range <0>=Ok <C>=Cancel
pick>

The options at the bottom of the screen allow you to select all or some of the file entries for restore.

You can restore files to their original directory or to a different location. Depending on what you are restoring, you may need to use the PRESERVEPATH option, which specifies how much of the source path you want to preserve and append to the destination path specified with the restore operation.

A file copy can be in one of three states: active, inactive, or expired. An active file copy is the most current copy of the file, an inactive file copy is a previous copy of the file (or any copy of a file that no longer exists on the client), and an expired file copy is a copy to be removed from the Tivoli Storage Manager server. Only active versions are presented for restore unless you use the INACTIVE or

LATEST options. The INACTIVE option instructs Tivoli Storage Manager to display and restore an inactive backup if an active one is not available, and the LATEST option restores the most recent backup version of a file, even if that backup is inactive. You cannot restore an expired file version.

Table 11-3 gives some examples of restore operations using a UNIX backup-archive client.

Table 11-3 Restore command examples: UNIX

If you want to perform this operation... then this is the client command
Restore a single file (/home/barney).	<code>dsmc restore /home/barney</code>
Restore a directory and all files from that level (/home).	<code>dsmc restore "/home/"</code>
Restore all files in a directory (/home) with all its subdirectories.	<code>dsmc restore "/home/" -subdir=yes</code>
Restore a full directory (/home to /temp) with all subdirectories and write full path on destination.	<code>dsmc restore /home/barney /temp -preservepath=complete -subdir=yes</code>
Restore a logical volume image to an existing mounted file system (/tsm).	<code>dsmc restore image /tsm</code>
Restore a RAW device to an existing allocated area (/dev/testlv).	<code>dsmc restore image /dev/testlv</code>
Restore a backup set (barney_monthlyBS.1234) from the server.	<code>dsmc restore backupset barney_monthlyBS.1234</code>
Restore a backup set using local tape unit (/dev/rmt0).	<code>dsmc restore backupset /dev/rmt0 -location=tape</code>
Restore a subset of files from a tape backup set.	<code>dsmc restore backupset /dev/mt0 /home/*.log -location=tape</code>
Restore all members in the /virtualtsm/grp group backup to their original location.	<code>dsmc restore group {virtualtsm}/grp</code>

Note: Only a UNIX root user can perform the backup and restore image operations.

Table 11-4 gives some examples of restore operations using a Windows backup-archive client.

Table 11-4 Restore command examples: Windows

If you want to perform this operation... then this is the client command
Restore a single file (C:\tsm\betty.doc).	dsmc restore c:\tsm\betty.doc
Restore a directory and all files from that level (C:\tsm).	dsmc restore c:\tsm\
Restore the image d:.	dsmc restore image d:
Restore all files from a directory (C:\tsm,) with all its subdirectories.	dsmc restore c:\tsm\ -subdir=yes
Restore a full subdirectory (C:\tsm to D:\temp) with all subdirectories, and write full path on destination.	dsmc restore c:\tsm\ d:\temp -preservepath=complete -subdir=yes

Tip: Use the option verifyimage with the restore image command to detect bad sectors in the destination volume.

11.2.1 UNIX command-line examples and output

Here are some command-line examples.

File restore

Example 11-14 shows a UNIX restore operation and its command output. To simulate a real-life scenario, we deleted the original data from the client before doing the restore, so we are not prompted for collision options.

Example 11-14 UNIX restore output

```
tsm> restore /TS/* -subdir=yes
Restore function invoked.

ANS1247I Waiting for files from the server...
Restoring          256 /TS/charlotte [Done]
Restoring          256 /TS/eduardo [Done]
Restoring          256 /TS/lost+found [Done]
Restoring          256 /TS/martin [Done]
Restoring        4,096 /TS/norbert [Done]
Restoring          256 /TS/peter [Done]
Restoring        4,096 /TS/sys [Done]
Restoring    1,048,576 /TS/charlotte/data1 [Done]
Restoring    1,048,576 /TS/charlotte/data2 [Done]
```

```
Restoring      1,048,576 /TS/charlotte/data3 [Done]
Restoring      1,048,576 /TS/eduardo/data1 [Done]
Restoring      1,048,576 /TS/eduardo/data2 [Done]
Restoring      1,048,576 /TS/eduardo/data3 [Done]
Restoring      1,048,576 /TS/martin/data1 [Done]
Restoring      1,048,576 /TS/martin/data2 [Done]
Restoring      1,048,576 /TS/martin/data3 [Done]
Restoring      1,048,576 /TS/norbert/data1 [Done]
Restoring      1,048,576 /TS/norbert/data2 [Done]
Restoring      1,048,576 /TS/norbert/data3 [Done]
Restoring      1,048,576 /TS/peter/data1 [Done]
Restoring      1,048,576 /TS/peter/data2 [Done]
Restoring      1,048,576 /TS/peter/data3 [Done]
Restoring          105 /TS/sys/devconfig.txt [Done]
Restoring         233 /TS/sys/dsmServ.dsk [Done]
Restoring        67,985 /TS/sys/dsmServ.opt [Done]
Restoring            9 /TS/sys/hbaapi.lvl [Done]
Restoring       1,027 /TS/sys/rc.tsmserver [Done]
Restoring          641 /TS/sys/volhist.txt [Done]
```

Restore processing finished.

```
Total number of objects restored:      28
Total number of objects failed:         0
Total number of bytes transferred:    15.06 MB
Data transfer time:                  9.28 sec
Network data transfer rate:        1,661.26 KB/sec
Aggregate data transfer rate:      1,154.78 KB/sec
Elapsed processing time:           00:01:11
tsm>
```

Backup set restore

Example 11-15 shows a partial restore from a local backup set that is on disk. In this case, some of the files already exist so we had the option to replace the existing copy, skip restoring that object, or terminate the restore option. Note that a partial restore from a backup set is available only using the command-line interface. If you use the GUI, then you can only restore the complete backup set.

Example 11-15 UNIX partial backup set restore

```
tsm> restore backupset /tsm/stg/seql/43247638.ost /TS/peter/*
-subdir=yes -location=file
Restore function invoked.
```

ANS1247I Waiting for files from the server...

--- User Action is Required ---

```

File '/TS/peter/data1' exists

Select an appropriate action
 1. Replace this object
 2. Replace all objects that already exist
 3. Skip this object
 4. Skip all objects that already exist
 A. Abort this operation
Action [1,2,3,4,A] : 2
Restoring      1,048,576 /TS/peter/data1 [Done]
Restoring      1,048,576 /TS/peter/data2 [Done]
Restoring      1,048,576 /TS/peter/data3 [Done]

Restore processing finished.

Total number of objects restored:      3
Total number of objects failed:        0
Total number of bytes transferred:    3.00 MB
Data transfer time:                  1.77 sec
Network data transfer rate:          1,730.94 KB/sec
Aggregate data transfer rate:        757.23 KB/sec
Elapsed processing time:             00:00:08

```

An example of restoring from a backup set that is available on the Tivoli Storage Manager server is shown in Example 11-16. We first query the server to obtain the name of the backup sets that have already been generated.

Example 11-16 UNIX full backup set restore

```

tsm> q backupset
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/20/06  17:16:08  Last access: 02/20/06  17:11:52

      Backup Set Name           Generation Date   Retention Description
----- 1 060220ATLANTIC.10271      02/20/06  17:15:35  365      No Description

tsm> restore backupset 060220ATLANTIC.10271
Restore function invoked.

ANS1247I Waiting for files from the server...
Restoring      256 /TS/charlotte [Done]
Restoring      256 /TS/eduardo [Done]
Restoring      256 /TS/lost+found [Done]
Restoring      256 /TS/martin [Done]
Restoring      4,096 /TS/norbert [Done]
Restoring      256 /TS/peter [Done]

```

```
Restoring      4,096 /TS/sys [Done]

Restoring      1,048,576 /TS/charlotte/data1 [Done]
Restoring      1,048,576 /TS/charlotte/data2 [Done]
Restoring      1,048,576 /TS/charlotte/data3 [Done]
Restoring      1,048,576 /TS/eduardo/data1 [Done]
Restoring      1,048,576 /TS/eduardo/data2 [Done]
Restoring      1,048,576 /TS/eduardo/data3 [Done]
Restoring      1,048,576 /TS/martin/data1 [Done]
Restoring      1,048,576 /TS/martin/data2 [Done]
Restoring      1,048,576 /TS/martin/data3 [Done]
Restoring      1,048,576 /TS/norbert/data1 [Done]
Restoring      1,048,576 /TS/norbert/data2 [Done]
Restoring      1,048,576 /TS/norbert/data3 [Done]
Restoring      1,048,576 /TS/peter/data1 [Done]
Restoring      1,048,576 /TS/peter/data2 [Done]
Restoring      1,048,576 /TS/peter/data3 [Done]
Restoring          105 /TS/sys/devconfig.txt [Done]
Restoring          233 /TS/sys/dsmserv.dsk [Done]
Restoring          67,985 /TS/sys/dsmserv.opt [Done]
Restoring            9 /TS/sys/hbaapi.lvl [Done]
Restoring          1,027 /TS/sys/rc.tsmserver [Done]
Restoring          641 /TS/sys/volhist.txt [Done]
```

Restore processing finished.

```
Total number of objects restored:      28
Total number of objects failed:        0
Total number of bytes transferred:    15.09 MB
Data transfer time:                  1.15 sec
Network data transfer rate:         13,401.74 KB/sec
Aggregate data transfer rate:       3,643.36 KB/sec
Elapsed processing time:             00:00:20
tsm>
```

If the backup set is made to tape, you can also restore from it if you have the same kind of tape drive on the client. In that case, you take the tape from the tape device attached to the Tivoli Storage Manager server, and specify that device name (for example, /dev/rmt0) and -location=tape on the **restore backupset** command.

Group restore

Example 11-17 on page 352, Example 11-18 on page 352, and Example 11-19 on page 353 show how to restore from a group backup. Example 11-17 on page 352 shows you how to list the groups backed up in a specific virtual Tivoli Storage Manager file space. We have two group backups in the /tsmresidentfs virtual Tivoli Storage Manager file space.

Example 11-17 Query group output

```
tsm> query group /tsmresidentfs/*
          Size      Backup Date      Mgmt Class A/I Type Group
          ----      -----      -----
    7,351,354  B  02/20/2006 17:39:19  DEFAULT     A  FULL /tsmresidentfs/residentgrp
root@Atlantic /tsm:
```

Example 11-18 shows the output of the command **dsmc restore group /tsmresidentfs/* -pick -showmembers**. You can choose a specific file to restore that belongs in a specific group by including the option showmembers.

Example 11-18 Restore group command

```
tsm> restore group /tsmresidentfs/* -pick -showmembers
IBM Tivoli Storage Manager Scrollable PICK Window - Restore Group

          #      Backup Date/Time      File Size A/I  Type Group
          ---      -----
 1. | 02/21/2006 11:08:38      7.01 MB  A  FULL /tsmresidentfs/Tivoli S
 2. | 02/20/2006 17:39:19      7.01 MB  A  FULL /tsmresidentfs/resident

          0-----10-----20-----30-----40-----50-----60-----7
<U>=Up  <D>=Down  <T>=Top  <B>=Bottom  <R#>=Right  <L#>=Left
<G#>=Goto Line #  <#>=Toggle Entry  <+>=Select All  <->=Deselect All
<#:#+>=Select A Range  <#: #->=Deselect A Range  <0>=Ok  <C>=Cancel
pick>
```

Example 11-19 shows the contents of the group *residentgrp* and the output of the restore. From the pick window, you may choose the specific file that you want to restore. In the example, we chose to restore the file *data1* in the directory */home/guest*.

Example 11-19 Restore group command and output

TSM Scrollable PICK Window - Restore

#	Backup Date/Time	File Size A/I	File
1.	02/20/2006 17:39:19	1.00 MB I	/TS/charlotte/data1
2.	02/20/2006 17:39:19	1.00 MB I	/TS/charlotte/data2
3.	02/20/2006 17:39:19	1.00 MB I	/TS/eduardo/data1
x 4.	02/20/2006 17:39:19	1.00 MB I	/home/guest/data1
5.	02/20/2006 17:39:19	1.00 MB I	/TS/martin/data2
6.	02/20/2006 17:39:19	1.00 MB I	/TS/norbert/data1
7.	02/20/2006 17:39:19	1.00 MB I	/TS/peter/data3
8.	02/20/2006 17:39:20	655 B I	/usr/tivoli/tsm/client/ba/bi

0-----10-----20-----30-----40-----50-----60-----7
<U>=Up <D>=Down <T>=Top =Bottom <R#>=Right <L#>=Left
<G#>=Goto Line # <#>=Toggle Entry <+>=Select All <->=Deselect All
<#:#+>=Select A Range <#: #->=Deselect A Range <0>=Ok <C>=Cancel
pick> o
Restoring 1,048,576 /home/guest/data1 [Done]

Restore processing finished.

Total number of objects restored: 1
Total number of objects failed: 0
Total number of bytes transferred: 1.00 MB
Data transfer time: 0.34 sec
Network data transfer rate: 2,944.80 KB/sec
Aggregate data transfer rate: 3.77 KB/sec
Elapsed processing time: 00:04:38
tsm>

11.2.2 Windows GUI restore examples

Figure 11-5 shows the restore GUI on Windows. On other platforms, use the Java or Web client—the look and feel is almost identical.

You may select specific files, directories, or complete drives to restore. To restore inactive files, select **Display inactive/active files** from the view menu.

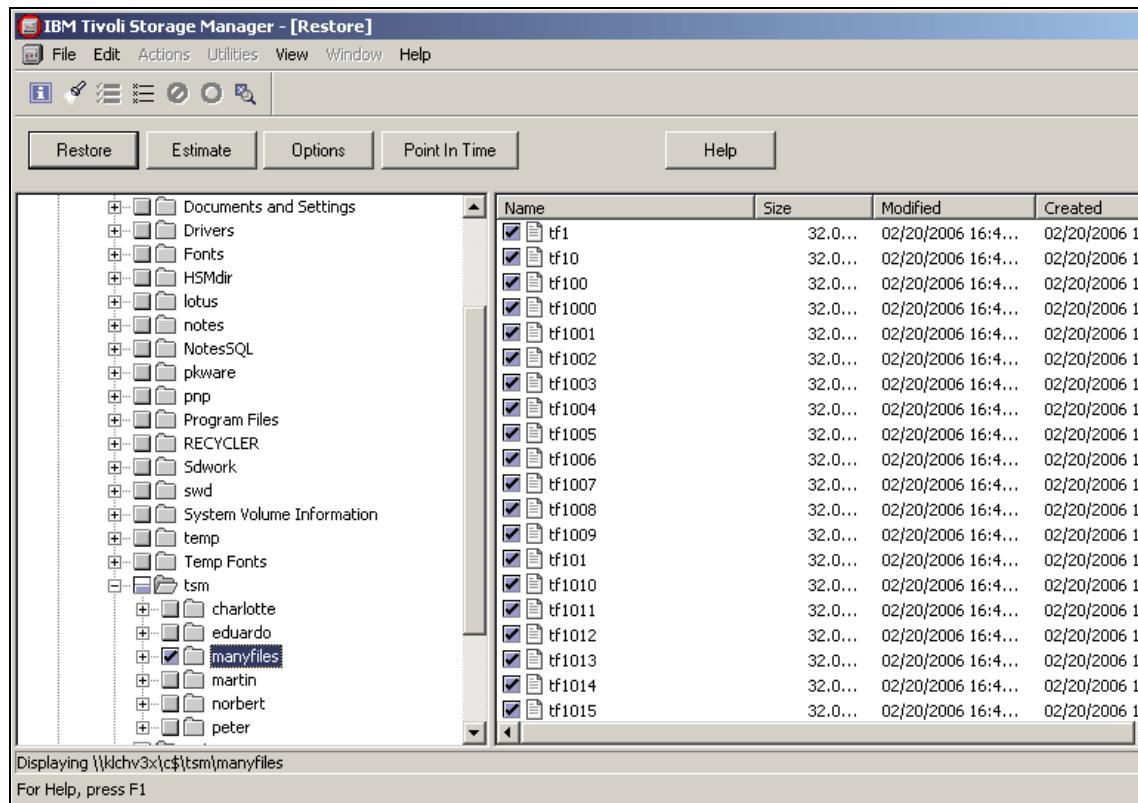


Figure 11-5 Windows restore GUI

The estimate function, as described in 11.1.3, “Windows GUI backup examples” on page 342, is also available when doing a restore operation. You can also choose to do a point-in-time restore if you do not want to restore the latest backup or if you want to restore files backed up on a specific date. Figure 11-6 on page 355 shows the point-in-time function.

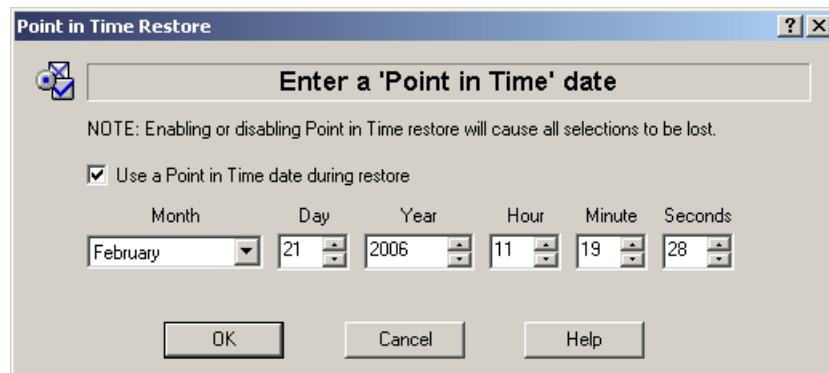


Figure 11-6 Point-in-time restore function

You can specify other restore options, such as to prompt when a file with the same name is present in the destination path, or to restore files or folders only from the source path. Figure 11-7 shows the restore options window.

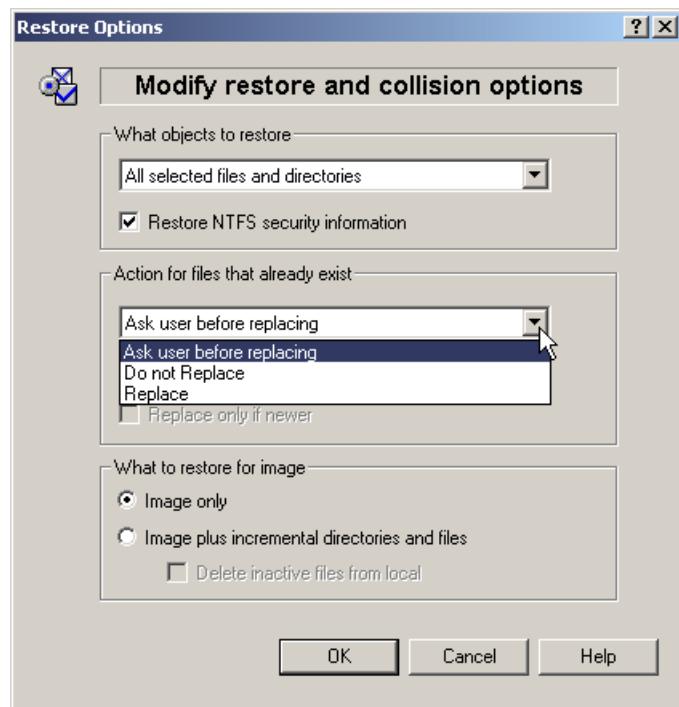


Figure 11-7 Restore options

After choosing the files, directories, or drives you want to restore, you will be prompted for the destination of the restore operation, as shown in Figure 11-8. You can select to restore the files you selected in the original path or to a different directory or drive.

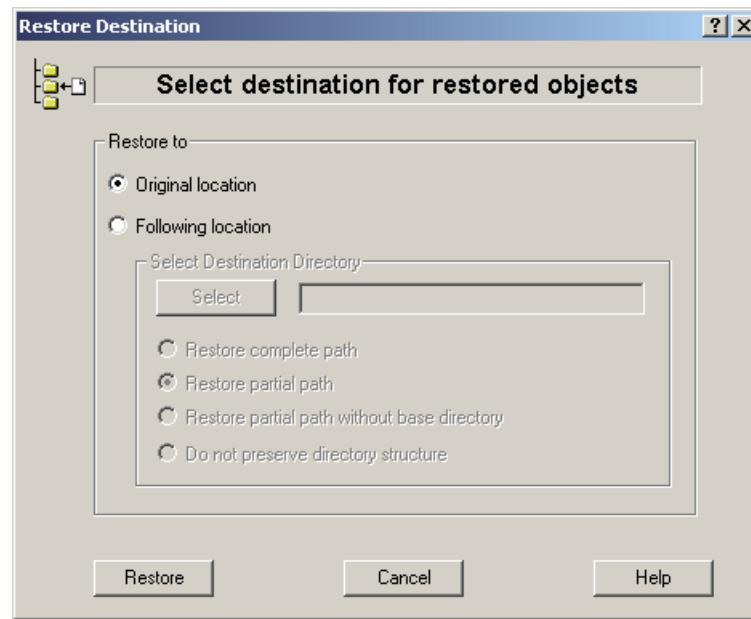


Figure 11-8 Restore destination options

A detailed report is available after the restore operation, as in Figure 11-9 on page 358. If there were errors during the restore, click the **View** button to see the details.

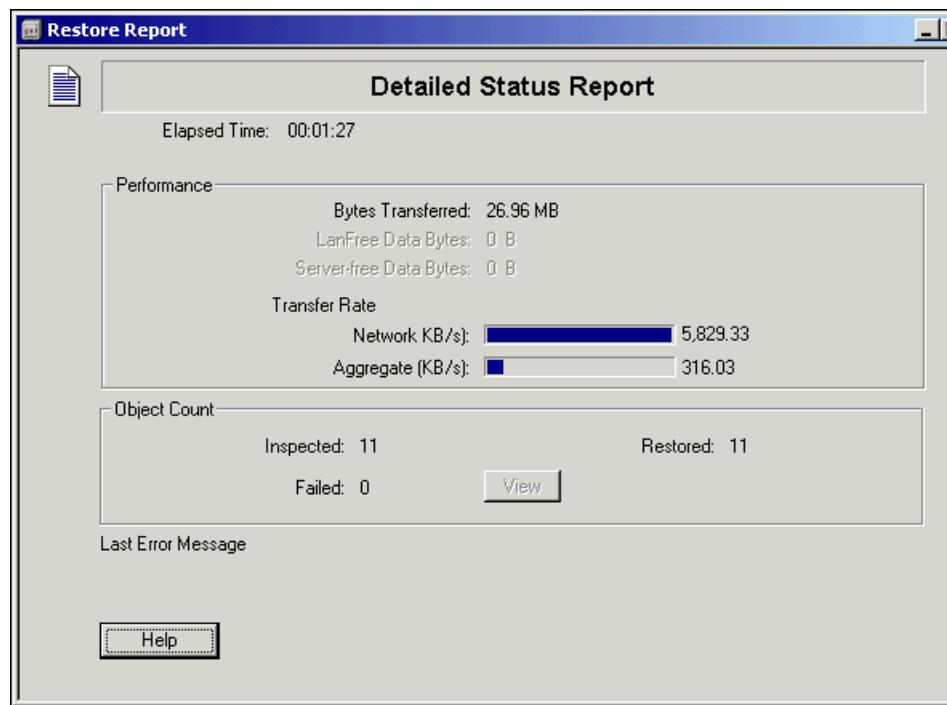


Figure 11-9 Restore report

For Windows users, you can restore the system object using the GUI, as shown in Figure 11-10 on page 359. We recommend that you restore the components of the system object together to make sure that the system state is consistent after the restore operation. See 20.1, “Windows Bare Machine Recovery” on page 630, for more information about restoring a Windows system object backup for Bare Machine Recovery.

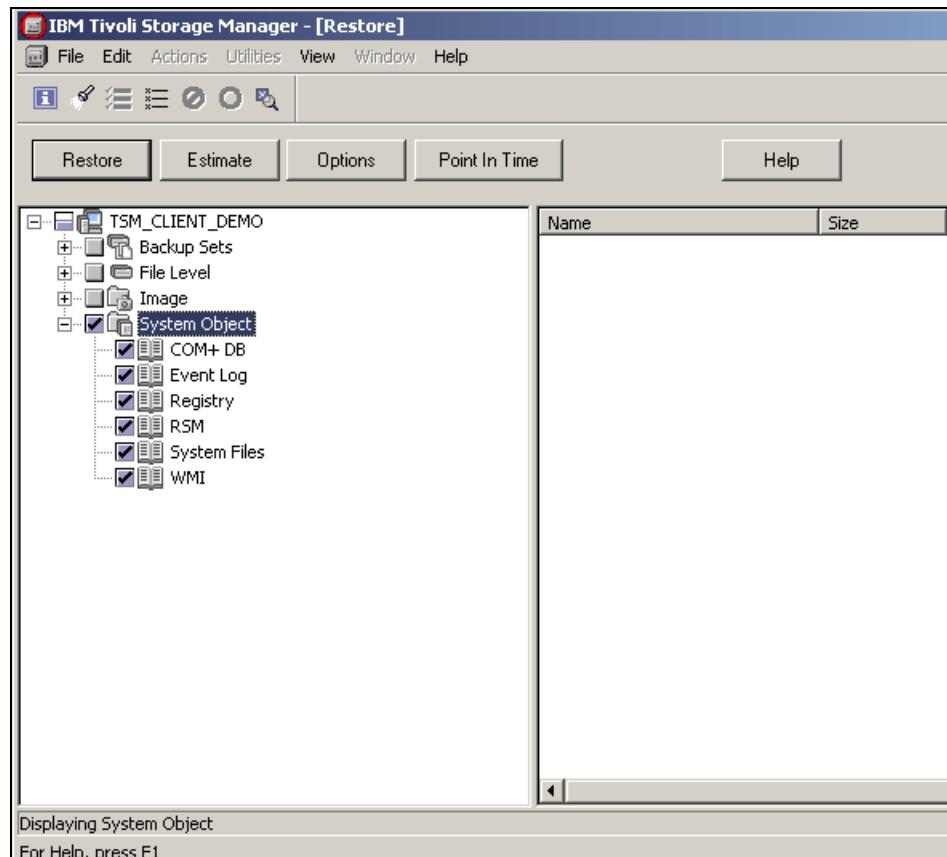


Figure 11-10 System object restore

11.3 Running archive operations

The `archive` command archives a single file, selected files, or all files in a directory and its subdirectories on a Tivoli Storage Manager server. Use this command to save files that you want to keep in their present condition for a long period of time, and to control them by expiration date only. There is no version control for archives. You can also use archives to release storage space on your

workstation and delete files as you archive them using the DELETEFILES option. Typically, you use archives to save information with either a legal requirement (for example, account information, annual reports, billing information, or annual customer reports); or an internal audit requirement (for example, application logs, user activity information, or employee files).

When you use the **archive** command with the ARCHMC option, you can select any available management class in the active policy set that has an archive copygroup. If you omit this option then the default management class is used. This enables you to select the retention period (according to the retention period in days specified in the archive copygroup) for all the data you are archiving. The output of each archive operation is called an archive package and is by default given a description of the time and date when the archive was made.

To override the default description, specify your own text with the DESCRIPTION option. You can later use the assigned archive package description to add additional files to an existing package. The package description can also be used to query for existing packages or to retrieve files from the package, without needing to know exactly what files were contained in it. The description is case-sensitive.

Table 11-5 gives examples of archive operations using a UNIX backup-archive client.

Table 11-5 Archive command examples: UNIX

If you want to perform this operation... then this is the client command
Archive all files from a directory (/home).	dsmc archive /home/ -subdir=yes
Archive files from different directories (/home and /temp).	dsmc archive /home/ /temp/-subdir=yes
Archive files from a directory (/home) to a management class called Y1 (which is one year retention).	dsmc archive /home/ -archmc=y1
Create a new archive package called "PEBBLES-FILES" from a directory (/home).	dsmc archive /home/ -subdir=yes -description="PEBBLES-FILES"
Add files from a directory (/temp) to an archive package called "PEBBLES-FILES".	dsmc archive /temp/ -subdir=yes -description="PEBBLES-FILES"

Table 11-6 gives examples of archive operations using a Windows backup-archive client.

Table 11-6 Archive command examples: Windows

If you want to perform this operation... then this is the client command
Archive all files from a directory (c:\tsm).	dsmc archive c:\tsm\ -subdir=yes
Archive files from different directories (c:\tsm and c:\temp).	dsmc archive c:\tsm\ c:\temp\ -subdir=yes
Archive files from a directory (c:\tsm) to a management class called Y1 (which is one-year retention).	dsmc archive c:\tsm\ -archmc=y1
Create a new package called "PEBBLES-FILES" from a directory (c:\tsm).	dsmc archive c:\tsm\ -subdir=yes -description="PEBBLES-FILES"
Add files from a directory (c:\temp) to an archive package called "PEBBLES-FILES".	dsmc archive c:\temp\ -subdir=yes -description="PEBBLES-FILES"

11.3.1 UNIX command-line examples and output

Example 11-20 shows an archive operation and its command output.

Example 11-20 UNIX archive command output

```
tsm> archive /TS/* -subdir=yes -desc="Monthly Archive" -archmc=archmc
Archive function invoked.
```

```
Directory-->          4,096 /TS/ [Sent]
Directory-->          256 /TS/charlotte [Sent]
Directory-->          256 /TS/eduardo [Sent]
Directory-->          256 /TS/lost+found [Sent]
Directory-->          256 /TS/martin [Sent]
Directory-->          4,096 /TS/norbert [Sent]
Directory-->          256 /TS/peter [Sent]
Directory-->          4,096 /TS/sys [Sent]
Normal File-->        171 /TS/filelist [Sent]
Normal File-->        0 /TS/restore [Sent]
Normal File-->        2,229 /TS/dsmerror.log [Sent]
Normal File-->        1,048,576 /TS/charlotte/data1 [Sent]
Normal File-->        1,048,576 /TS/charlotte/data2 [Sent]
Normal File-->        1,048,576 /TS/charlotte/data3 [Sent]
Normal File-->        1,048,576 /TS/eduardo/data1 [Sent]
Normal File-->        1,048,576 /TS/eduardo/data2 [Sent]
Normal File-->        1,048,576 /TS/eduardo/data3 [Sent]
```

```
Normal File--> 1,048,576 /TS/martin/data1 [Sent]
Normal File--> 1,048,576 /TS/martin/data2 [Sent]
Normal File--> 1,048,576 /TS/martin/data3 [Sent]
Normal File--> 1,048,576 /TS/norbert/data2 [Sent]
Normal File--> 1,048,576 /TS/norbert/data3 [Sent]
Normal File--> 1,048,576 /TS/norbert/data1 [Sent]
Normal File--> 1,048,576 /TS/peter/data1 [Sent]
Normal File--> 1,048,576 /TS/peter/data2 [Sent]
Normal File--> 1,048,576 /TS/peter/data3 [Sent]
Normal File--> 67,985 /TS/sys/dsmserv.opt [Sent]
Normal File--> 233 /TS/sys/dsmserv.dsk [Sent]
Normal File--> 9 /TS/sys/hbaapi.lvl [Sent]
Normal File--> 1,027 /TS/sys/rc.tsmserver [Sent]
Normal File--> 105 /TS/sys/devconfig.txt [Sent]
Normal File--> 641 /TS/sys/volhist.txt [Sent]
Archive processing of '/TS/*' finished without failure.
```

```
Total number of objects inspected: 32
Total number of objects archived: 32
Total number of objects updated: 0
Total number of objects rebound: 0
Total number of objects deleted: 0
Total number of objects expired: 0
Total number of objects failed: 0
Total number of bytes transferred: 15.07 MB
Data transfer time: 1.29 sec
Network data transfer rate: 11,933.99 KB/sec
Aggregate data transfer rate: 7,672.37 KB/sec
Objects compressed by: 0%
Elapsed processing time: 00:00:02
tsm>
```

11.3.2 Windows GUI archive examples

Figure 11-11 on page 363 shows the archive GUI on Windows. On other platforms, use the Java or Web client—the look and feel is almost identical.

You may enter your own description for the files you want to archive. If you do not enter one, by default, the description will be the date the archive was made.

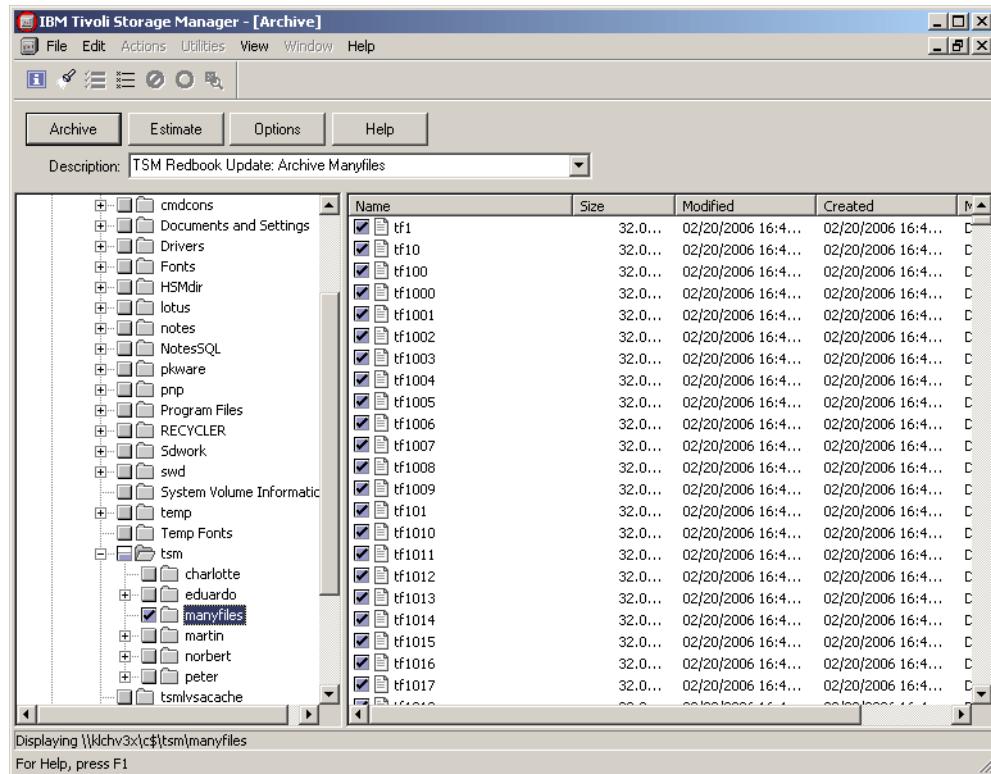


Figure 11-11 Windows archive GUI

The estimate function is also available for the archive operation. See 11.1.3, “Windows GUI backup examples” on page 342, for more information about the estimate function. You can modify archive options shown in Figure 11-12 on page 364, such as choosing a specific management class for the archive operation. If you do not specify a management class, the archive operation will use the archive copy group in the default management class. You can also specify to delete the files from the client system after they are successfully archived.



Figure 11-12 Archive options

A detailed report similar to Figure 11-13 is available for viewing. It will show the archive statistics and the errors encountered, if any.

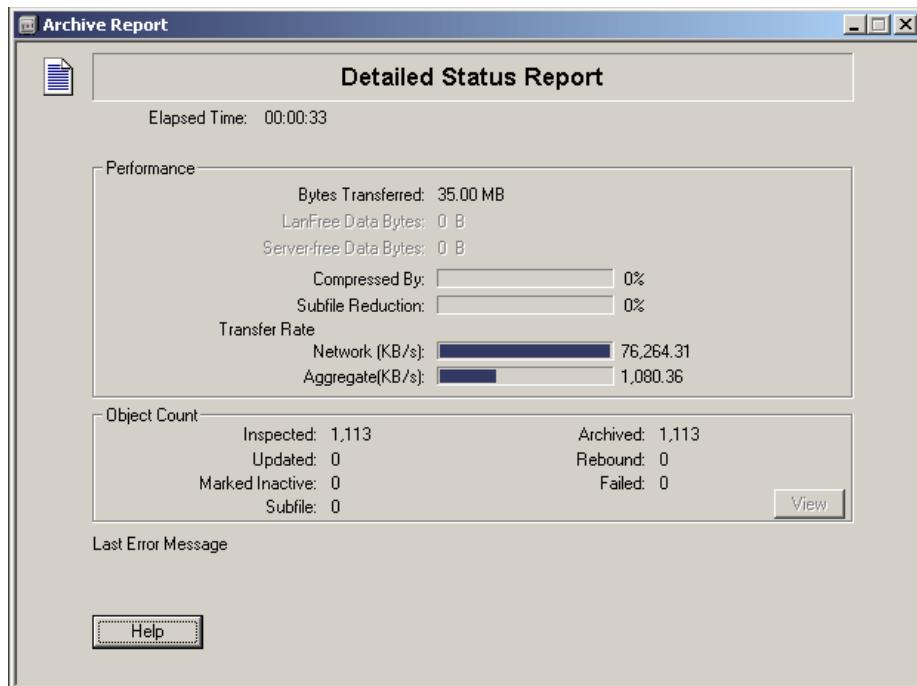


Figure 11-13 Archive report

11.4 Running retrieve operations

The **retrieve** command obtains copies of archived files from the Tivoli Storage Manager server. You can specify either selected files or whole directories to retrieve archived files. The DESCRIPTION field allows you to search for the descriptions assigned to the files when they were archived.

Table 11-7 gives examples of retrieve operations using a UNIX backup-archive client.

Table 11-7 Retrieve command examples: UNIX

If you want to perform this operation... then this is the client command
Retrieve a single file (/home/myfile1).	dsmc retrieve /home/myfile1
Retrieve files from a directory (/home).	dsmc retrieve /home

If you want to perform this operation... then this is the client command
Retrieve files from a directory (/home) with a description "MYDATA_NOV2002" and save them into another location (/temp).	dsmc retrieve /home/ /temp/-subdir=yes -description="MYDATA_NOV2002"

Table 11-8 gives examples of retrieve operations using a Windows backup-archive client.

Table 11-8 Retrieve command examples: Windows

If you want to perform this operation... then this is the client command
Retrieve a single file (c:\tsm\myfile1).	dsmc retrieve c:\tsm\myfile1
Retrieve files from a directory (c:\tsm).	dsmc retrieve c:\tsm\ -subdir=yes
Retrieve files from a directory (c:\tsm) with a description "MYDATA_NOV2002" and save them into another location (c:\temp).	dsmc retrieve c:\tsm\ c:\temp\ -subdir=yes -description="MYDATA_NOV2002"

Note: The description field is case-sensitive.

The same restore rules apply for the retrieve operations when using the PRESERVEPATH option.

11.4.1 UNIX command-line examples and output

Example 11-21 shows command output for a retrieve operation on the objects stored for Eduardo. The retrieved data does not exist on the client workstation before the retrieve operation, so we are not prompted for collision options.

Example 11-21 UNIX retrieve command output

```
tsm> retrieve /TS/eduardo/* -desc="Monthly Archive"
Retrieve function invoked.
```

```
Retrieving          256 /TS/eduardo [Done]
Retrieving      1,048,576 /TS/eduardo/data1 [Done]
Retrieving      1,048,576 /TS/eduardo/data2 [Done]
Retrieving      1,048,576 /TS/eduardo/data3 [Done]
```

Retrieve processing finished.

```
Total number of objects retrieved:      4
Total number of objects failed:        0
Total number of bytes transferred:    3.00 MB
```

```
Data transfer time:          1.66 sec
Network data transfer rate: 1,846.62 KB/sec
Aggregate data transfer rate: 1,015.30 KB/sec
Elapsed processing time:    00:00:03
tsm>
```

11.4.2 Windows GUI retrieve examples

Figure 11-14 on page 367 shows the Tivoli Storage Manager retrieve GUI (Windows). On other platforms, use the Java or Web client. You can choose to retrieve specific files within an archive package or you can retrieve the whole archive package.

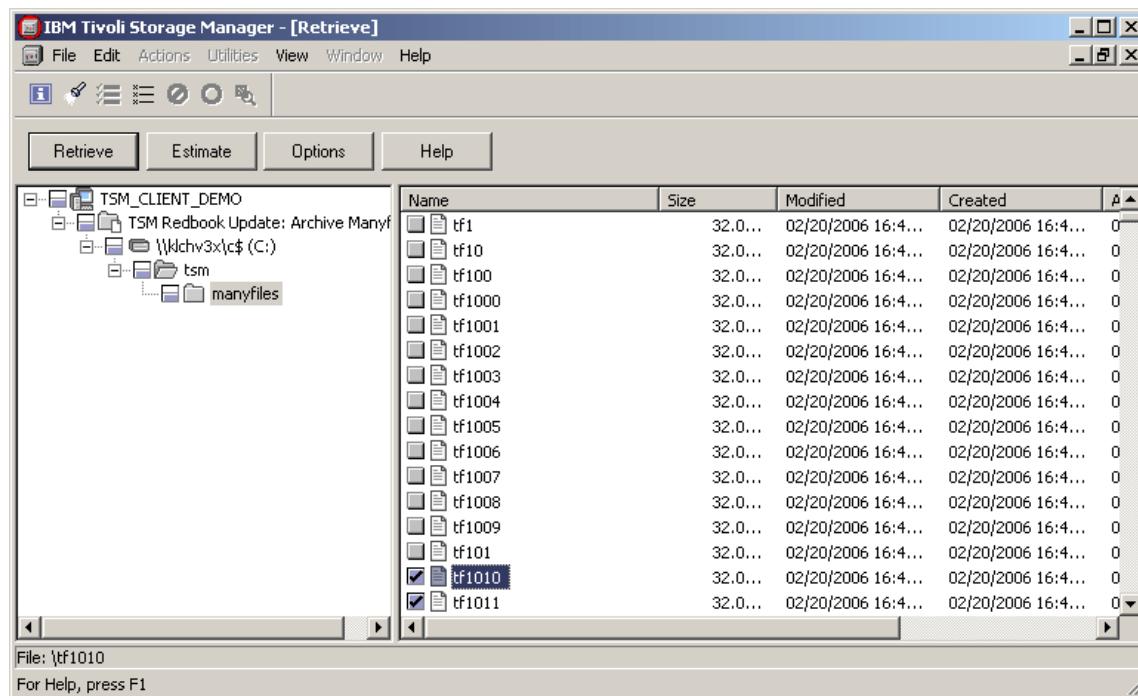


Figure 11-14 Windows retrieve GUI

The estimate function is also available for retrieve operations. The function is discussed in 11.1.3, “Windows GUI backup examples” on page 342.

You can specify retrieve options similar to restore options, as shown in Figure 11-15. You can choose to overwrite files without prompting you or to retrieve files or directories only from the package you selected.

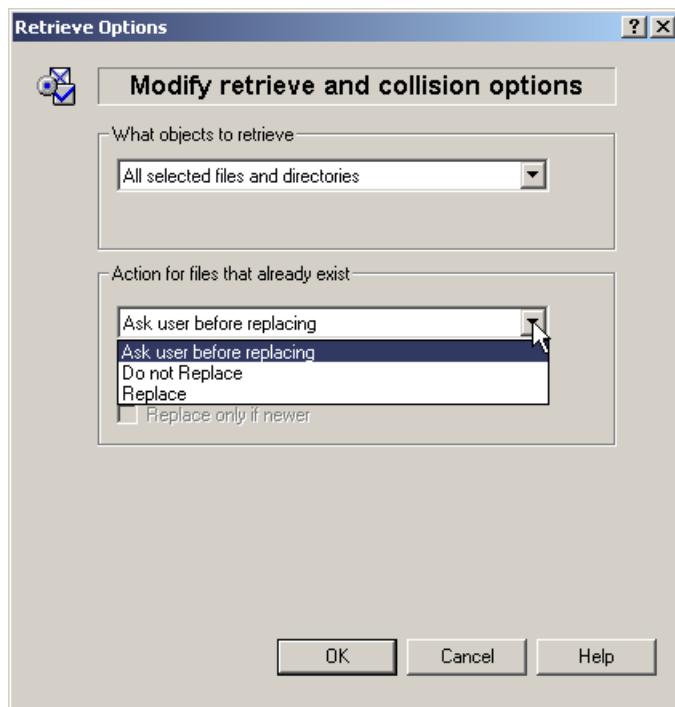


Figure 11-15 Retrieve options

Once you have chosen the files or package you want to archive, you will be prompted for the destination of the retrieve operation, as shown in Figure 11-16. You may choose to retrieve the files back to their original location or to a different path.

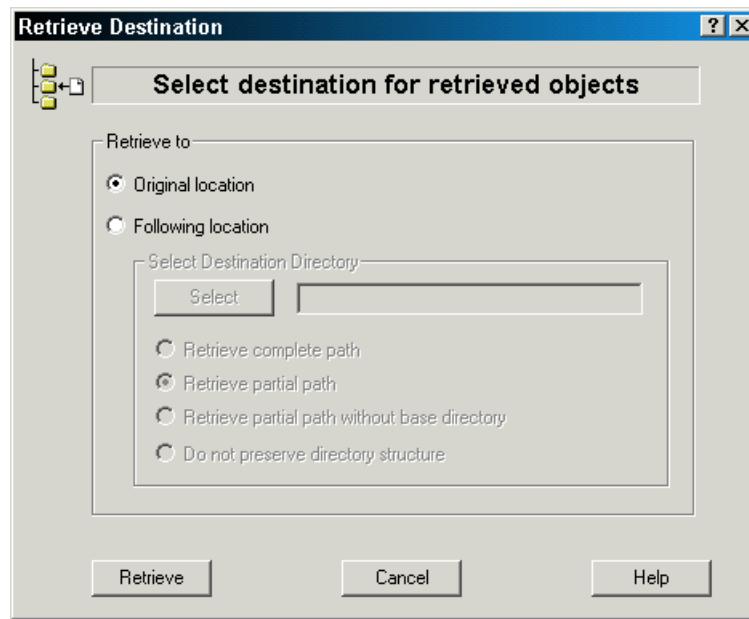


Figure 11-16 Retrieve destination

A detailed status report similar to Figure 11-17 is available for review. This contains the retrieve statistics and the errors encountered, if any.

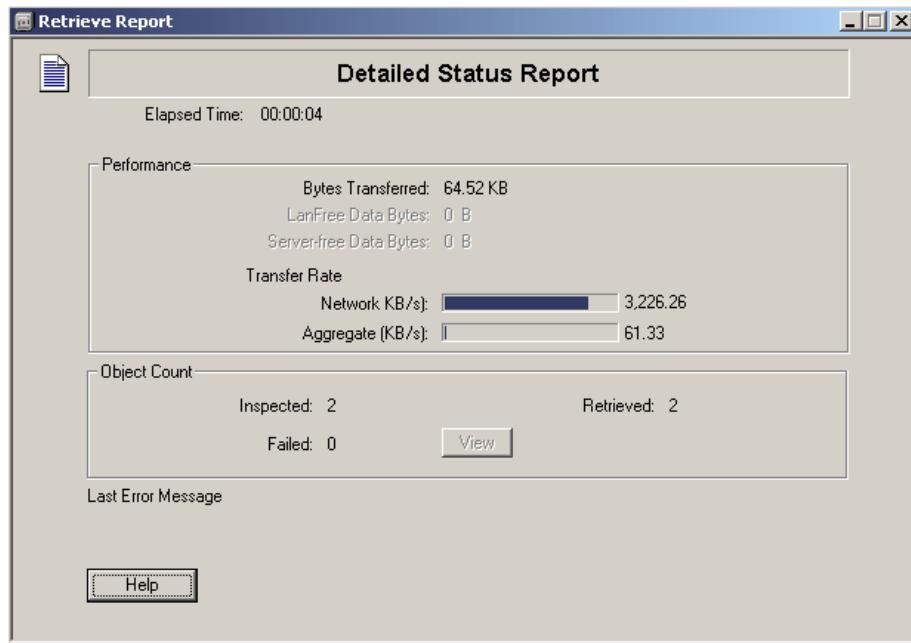


Figure 11-17 Retrieve report

11.5 Summary

You are now familiar with the client operations, such as backup, restore, archive, and retrieve. The client command line and graphical interfaces were also discussed in this chapter. The next chapter covers the administrative and client scheduling.



Scheduling

Scheduling is at the core of efficient IBM Tivoli Storage Manager operations. Having a comprehensive and integrated set of schedules allows the server to run with very little intervention during normal operational periods. IBM Tivoli Storage Manager scheduling is divided into two categories: administrative scheduling and client scheduling. The two categories differ in three key areas:

- ▶ Execution location: An administrative schedule performs an action on the IBM Tivoli Storage Manager server while the client schedule can only execute on the IBM Tivoli Storage Manager client.
- ▶ Domain privilege: Only an administrator with system privilege can manage an administrative schedule, while an administrator with policy privileges in the client's domain can manage the client schedule. The feature's granularity can be very useful when distributing management control across a large enterprise.
- ▶ An administrative schedule can only initiate an internal IBM Tivoli Storage Manager command, while a client schedule can initiate an internal client action such as an incremental backup, or run an external command such as a shell script or executable.

For both types of schedules, there are four key pieces of information:

- ▶ A command or action to be executed
- ▶ When the command or action executes
- ▶ The period, or window, in which the command or action should start
- ▶ How often the command or action should be repeated

The command or action that you run may be an incremental backup (client schedule) or a storage pool migration (administrative schedule) that should run every day at a particular time. You also have to estimate how long the command runs so that you can synchronize your schedules and balance the load on the server.

In addition, there is a special client schedule called *Clientaction*, which is for a client action that you only want to run once. If the client scheduler mode is *server-prompted*, the schedule runs immediately. If the client scheduler mode is *client polling*, the schedule runs the next time the client polls the server. For example, if you wish to initiate a backup on a new client, and you want it to run immediately, you set the scheduler mode of the client to server-prompted and define a clientaction to perform an incremental backup on the node.

Introduced with IBM Tivoli Storage Manager Version 5.3 are different *styles* of schedules. Both client and administrative schedules can now be either *Classic* or *Enhanced*. The styles refer to the way in which schedules are started and repeated. *Classic* refers to the original style of setting the start time and repetition of the schedule using a limited number of options. *Enhanced* refers to the new style, which provides more specific options for setting the repetition. You can now configure a schedule to happen, for example, on the last day of each month.

In this chapter we provide scheduling rules of thumb and recommendations that will give you a good base configuration.

12.1 The wheel of life

Figure 12-1 on page 374 shows the recommended series of operations that should occur in a Tivoli Storage Manager environment and the sequence in which those operations should occur. The actual start time and duration of the various operations depend on your scheduling requirements. The sequence of events, however, should not deviate too much from that shown here.

The circle represents a 24-hour clock, indicating the hours of the day. The daily schedule has a period where clients perform their backups. Once the clients are finished, the server performs housekeeping. The server makes copies of the disk storage pools for off-siting. The server backs up its database, deletes volume history, saves the device configuration, and creates a list of tapes for vault processing. The server then migrates the data from disk storage pools to on-site tape pools, and reclaims blank space from tape pools. Finally, the expiration process runs before a new round of client backups begins for that night. We describe these actual operations in more detail in the following sections.

The Tivoli Storage Manager server clock determines all schedule start times, regardless of the time zones of the clients.

Many factors influence the actual start time and duration of the various operations, including the client backup window, storage pool sizes, amount of data, and so on. Nevertheless, you need to carefully consider the timing and sequencing; if not, jobs can overlap and not complete properly, or jobs can tie up server resources unnecessarily.

In the following sections we explain how such things can be accomplished.

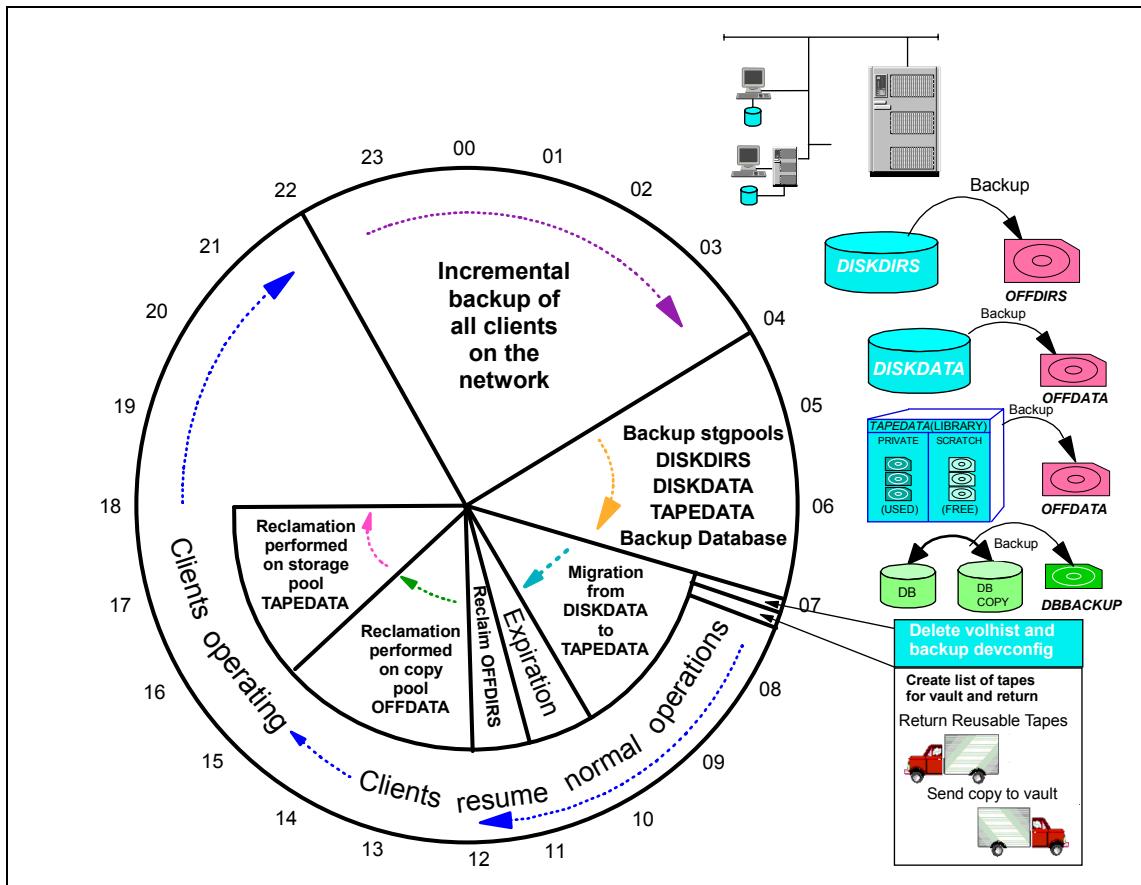


Figure 12-1 Scheduling of operations

12.2 Administrative schedules

An administrative schedule is a directive to trigger an action on the Tivoli Storage Manager server. It consists of an internal server command and parameters describing when the action should happen. As each administrative schedule can only run one server command, the command itself may be a *run* command, that runs an internally defined server script containing other internal server commands.

Example 12-1 shows the syntax to define an administrative schedule named DB_BACKUP for a full database backup starting at 7 a.m. every morning.

Example 12-1 Defining an administrative schedule

```
tsm: ATLANTIC>define schedule db_backup type=administrative cmd="backup db
devc=1to2-dc type=full" starttime=07:00 active=yes description="Daily Database
Backup"
ANR2577I Schedule DB_BACKUP defined.
```

```
tsm: ATLANTIC>query sched type=admin
```

* Schedule Name	Start Date/Time	Duration	Period	Day
DB_BACKUP	02/17/06 07:00:00	1 H	1 D	Any

The option “active=yes” must be entered if you want the schedule to run. The default is no. The **update schedule** command can be used at a later point in time to enable or disable the schedule. The **query schedule** command provides information about schedules. If you do not include “type=admin” it will, by default, print information about client schedules.

We have assembled a series of administrative schedules to help you set up a Tivoli Storage Manager environment that will minimize user intervention while providing a high level of data availability.

The first step in setting up administrative schedules is knowing which commands to run. Table 12-1 shows our recommendations for commands that should be scheduled and where to find more information about them. The table also includes our estimates on various other factors based on a typical implementation.

Client schedules are not, of course, administrative, but they are included to emphasize that all scheduling in your environment should be based on your client schedules. The table has a recommended set of schedules with all of the specifics required to execute in your environment if you follow the recommendations made in this book.

Table 12-1 Recommended schedules

#	Function	Task	Duration (hrs)	Task dependency	Refer to
1	Back up client data to Tivoli Storage Manager server.	Schedule client backups.	6.0	Site requirements	12.3, “Client schedules” on page 386

#	Function	Task	Duration (hrs)	Task dependency	Refer to
2	Copy backup data to off-site storage pool media.	Backup storage pool DISKDIRS.	0.5	Task 1 complete	12.2.1, “Defining an off-site backup schedule” on page 377
3		Backup storage pool DISKDATA.	1.0	Task 1 complete	
4		Backup storage pool TAPEDATA.	1.0	Task 1 complete	
5		Backup database.	0.5	Tasks 2, 3, and 4 complete	
6	Volume history management.	Delete volume history data for database backup volumes.	0.25	Task 5 complete	12.2.2, “Defining the volume history schedules” on page 380
7	Prepare disk storage pools for next backup window.	Migrate data from DISKDATA to TAPEDATA.	3.0	Task 5 complete	12.2.3, “Defining a migration schedule” on page 382
8	Database space management.	Expire inventory.	1.0	None	12.2.4, “Defining an expiration schedule” on page 382

#	Function	Task	Duration (hrs)	Task dependency	Refer to
9	Defragment tape volumes in sequential storage pools.	Reclaim volumes from OFFDIRS.	1.0	None	12.2.5, “Defining a reclamation schedule” on page 383
10		Reclaim volumes from OFFDATA.	3.0	None	
11		Reclaim volumes from TAPEDATA.	3.0	None	
12	Enable statistics.	Audit licenses.	0.25	None	12.2.6, “Defining a licensing audit schedule” on page 385

We recommend that no other schedules or administrative tasks are performed during client backups, so that backups have the maximum system resources available to them to minimize the backup time. Running administrative tasks or schedules during the client backup window will only take processing cycles away from the backup tasks.

12.2.1 Defining an off-site backup schedule

When the client backups are complete, the new data in the primary storage pools should be copied to a copy storage pool. The copy storage pool tapes, along with the database backup tapes, should be taken to a secure off-site location or vault. The copy storage pool and database backup tapes are referred to collectively as the off-site backups, and will be used to restore your environment in the event of a catastrophic failure or disaster.

Flow of events

The order of execution of these tasks should be as follows:

1. Check that there are no running sessions with the clients. When you back up the primary storage pools and database, you want to make sure that you are capturing an up-to-date copy. If a client is still backing up its data, wait until it is done before starting the off-site backups.

2. Back up the primary storage pools to their copy storage pool. See 6.5.3, “Back up a storage pool” on page 248, for more information.
 - a. Back up the DISKDIRS storage pool to the OFFDIRS storage pool.
 - b. Back up the DISKDATA storage pool to the OFFDATA storage pool.
 - c. Back up the TAPEDATA storage pool to the OFFDATA storage pool.
3. Back up the database. See 5.8, “Database backup” on page 210, for more information.

Since all of these commands are going to take a variable amount of time to execute, and they should be run in sequence, it makes sense to use a server script to run them. This will guarantee that each command will complete its tasks before another command is started.

Defining the server script

Example 12-2 displays the commands you would use to manually accomplish the off-site backup tasks. We can put the commands into a server script to run them one after the other.

Example 12-2 Commands for storage pool backup

```
select * from sessions where upper(session_type)='NODE'
backup stgpool diskdirs offdirs wait=yes
backup stgpool diskdata offdata wait=yes
backup stgpool tapedata offdata wait=yes
backup db devclass=coffsite type=full scratch=yes
```

When working interactively, you would use the **query session** command to check whether any clients are still backing up. If you see any clients still backing up, you can just wait for a while and try again. However, a script cannot tell from the output of the query session if there are any clients backing up. Instead, we use the SQL select statement (as shown in the first line of Example 12-2) and check its return code. If clients are still backing up, the return code is true. We can then make the script reschedule itself for a later time. If the return code is false (that is, no clients are backing up), we can proceed with the storage pool backups.

Example 12-3 shows the finished script for our recommended configuration. In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into Tivoli Storage Manager. The macro mac.scripts, which we provide to define a script to back up storage pools and the database to an off-site location, is shown in “Define server scripts” on page 737.

Example 12-3 Contents of “REDBOOK_OFFSITE” script

```
/*-----*/
/* Script Name: REDBOOK_OFFSITE          */
/* Description: Back up all primary storage */
```

```

/*
 * pools, followed by the      */
/* database. If there are    */
/* active node sessions,     */
/* reschedule to run again in */
/* 20 minutes                 */
/*
 * The script will back up   */
/* three storage pools named */
/* diskdirs, diskdata and    */
/* tapedata to copypools named */
/* offdata and offdirs.       */
/* Example: run redbook_offsite */
/* -----*/
select * from sessions where -
upper(session_type)='NODE'
if (rc_ok) goto reschedule
backup stgpool diskdirs offdirs wait=yes
backup stgpool diskdata offdata wait=yes
backup stgpool tapedata offdata wait=yes
backup db devclass=coffsite type=full scratch=yes
exit
reschedule:
delete schedule redbook_offsite_retry type=admin
define schedule redbook_offsite_retry type=admin -
cmd="run redbook_offsite" -
active=yes starttime=NOW+0:20 peru=onetime

```

You can call the script anything you like, but it should represent the function performed by the script, and not be already in use. You can check this with the **query script** command. Example 12-4 shows that the intended name of our script “REDBOOK_OFFSITE” is not in use as yet.

Example 12-4 Query script output

tsm: LOCHNESS_SERVER1>**query script**

Name	Description	Managing profile
-----	-----	-----
Q-COLUMNS	Query columns from a TSM database table	
Q-TABLES	Show available TSM database tables	

Once the script is defined to the server, you need to define a schedule that will run the script for you every day at 4 a.m. The macro, mac.schedules, which we provide to define recommended schedules in our book environment, is shown in “Define schedules” on page 735 and includes the schedule definition command in Example 12-5 on page 380.

Example 12-5 Defining the REDBOOK_OFFSITE schedule

```
tsm: LOCHNESS_SERVER1>define schedule redbook_offsite type=admin cmd="run  
redbook_offsite" desc="Backup all data for off site storage" starttime=04:00
```

```
active=yes
```

```
ANR2577I Schedule REDBOOK_OFFSITE defined.
```

```
tsm: LOCHNESS_SERVER1>q sched redbook* type=admin
```

* Schedule Name	Start Date/Time	Duration	Period	Day
REDBOOK_OFFSITE	02/20/2006 04:00:00	1 H	1 D	Any

12.2.2 Defining the volume history schedules

If you have licensed the Disaster Recovery Manager (DRM), we recommend that you run a schedule to back up the volume history on a daily basis. DRM will handle expiry of database backups.

If you are not using DRM, we recommend that you run one schedule to delete the old database backup volume history, and also one schedule to back up the volume history, on a daily basis.

Every volume that is used by Tivoli Storage Manager, including the volumes used for server database backups, is tracked in the server database. You can access this information while the server is up with the **query volhistory** command. The volume history information is very important because it tells you which volume holds your most recent database backup. If the server database is lost or corrupted, you need to know which is the latest backup in order to restore your database. However, if you cannot start the server, the database is not available, and you cannot retrieve the information. Therefore, a separate copy of the volume history information should be periodically saved to a text file. You can specify the file name with the VOLUMEHISTORY option in the server options file (dsmerv.opt). You can specify multiple VOLUMEHISTORY entries in the options file to specify more than one file. We recommend maintaining at least two copies of the volume history file, in case one becomes unusable.

When you back up the database, the previous database backups become obsolete. However, it is wise to save the older backup for a short time before returning them to scratch volume status for reuse. DRM will take care of

database backup expiry, but if you have not licensed it, you must delete the volume history yourself. Use the **delete volhistory** command to do this. We recommend deleting any database backups that are older than seven days. The **delete volhistory** command will never delete the current database backup, so we use “today-6” when specifying the “TODATE” option.

The two recommended schedules are **DELETE_VOLHIST** and **BACKUP_VOLHIST**.

DELETE_VOLHIST

We define a schedule to delete volume history, called **DELETE_VOLHIST**, specifying a type of **TYPE=DBBACKUP**, as shown in Example 12-6.

Example 12-6 Defining the DELETE_VOLHIST schedule

```
tsm: LOCHNESS_SERVER1>define schedule delete_vohist type=admin cmd="delete
volhistory type=dbbackup todate=today-6" description="Delete volume history
information for database backups" starttime=07:00 active=yes
ANR2577I Schedule DELETE_VOLHIST defined.
```

```
tsm: LOCHNESS_SERVER1>q sched delete* t=a
```

* Schedule Name	Start Date/Time	Duration	Period	Day
- -----	-----	-----	-----	---
DELETE_VOLHIST	02/20/2006 07:00:00	1 H	1 D	Any

BACKUP_VOLHIST

Some operations, like the **delete volhistory** command, do update the volume history in the server database, but do not update the external volume history files. To ensure that the external volume history data is current, you should schedule a daily volume history backup using the **backup volhistory** command. Example 12-7 shows how to create the schedule.

Example 12-7 Defining the BACKUP_VOLHIST schedule

```
tsm: LOCHNESS_SERVER1>define schedule backup_vohist type=admin cmd="backup
volhistory" description="Backup volume history file" starttime=07:05 active=yes
ANR2577I Schedule BACKUP_VOLHIST defined.
```

```
tsm: LOCHNESS_SERVER1>q sched backup* t=a
```

* Schedule Name	Start Date/Time	Duration	Period	Day
- -----	-----	-----	-----	---
BACKUP_VOLHIST	02/20/2006 07:05:00	1 H	1 D	Any

12.2.3 Defining a migration schedule

Migration of your primary storage pools during client backup can and will slow down the client backup sessions and can impact the scheduling of other server processes. We recommend scheduling primary storage pool migration outside the client backup window. Also, make sure that the disk-based storage pools are large enough to hold the daily backup data from the clients, to avoid a server-triggered migration during client backups.

With Tivoli Storage Manager V5.3, migration is now a single-step process with the introduction of the **migrate stgpool** command. Previously, to migrate data from a storage pool, you had to change the storage pool high and low migration thresholds to start the migration, wait a suitable amount of time, and then reset the thresholds to their normal operational values. In terms of scheduling, you had to create two schedules, one to set the thresholds to a low value, and another some time later to reset them.

With the **migrate stgpool** command, you specify a temporary low migration threshold, and a duration for which the temporary threshold is valid. At the end of the period, the threshold is reset to its previous value. During the period that the **migrate stgpool** command is active, the high migration threshold is ignored.

A single schedule is required to perform migration. Example 12-8 shows the command required.

Example 12-8 Defining the MIGRATION schedule

```
tsm: LOCHNESS_SERVER1>define schedule MIGRATION type=admin cmd="migrate stgpool
diskdata lo=0 duration=180" desc="Perform migration on DISKDATA storage pool"
starttime=07:00 active=yes
ANR2577I Schedule MIGRATION defined.

tsm: LOCHNESS_SERVER1>q sched migration t=a

*   Schedule Name      Start Date/Time          Duration    Period     Day
-   -----              -----                  -----      -----    -----
MIGRATION           02/21/2006 07:00:00        1 H        1 D      Any
```

12.2.4 Defining an expiration schedule

Managing the amount of space used by your database is important. When client backup and archive data expires, the references and metadata must be removed from the database. The client backup process handles half of the task by marking expired data references while backing up client data. The second half of the task is handled by the **expire inventory** command, which physically removes the marked entries from the database.

The default Tivoli Storage Manager configuration file specifies a 24-hour cycle for expiration, with expiration processing beginning 24 hours from when you first start the server. Unfortunately, this situation is rarely ever satisfactory. Expiration of inventory can be computationally intensive and it is best scheduled during a quiet server time to minimize its impact on server operations. It is also helpful to run inventory expiration before you run reclamation, so that the reclamation process can consolidate newly expired space.

Therefore, we recommend scheduling the expire inventory command daily, as shown in Example 12-9. The schedule assumes you have disabled the default expiration execution as recommended in 7.4, “Enforcing your policy” on page 282.

Example 12-9 Defining an inventory expiration schedule

```
tsm: LOCHNESS_SERVER1>define schedule EXPIRE_INVENTORY type=admin  
description="Inventory expiration" cmd="expire inventory" starttime=10:00  
active=yes  
ANR2577I Schedule EXPIRE_INVENTORY defined.
```

```
tsm: LOCHNESS_SERVER1>q sched expire* t=a
```

*	Schedule Name	Start Date/Time	Duration	Period	Day
-	EXPIRE_INVENTORY	02/21/2006 10:00:00	1 H	1 D	Any

12.2.5 Defining a reclamation schedule

Data on tapes in sequential access storage pools will eventually expire, leaving portions of the tapes with empty areas (also known as fragmentation). Over time, fragmentation can cause many tapes to have very little valid data on them.

Reclamation is the process where the valid data on a number of tapes is consolidated onto a smaller number of tapes. The tapes that are emptied by the reclamation process are returned to scratch status for reuse. See “Data Storage” in *IBM Tivoli Storage Management Concepts*, SG24-4877.

We recommend controlling when the reclamation process runs using a schedule that sets and resets the reclamation threshold for each storage pool. Outside of the scheduled reclamation periods, the REClaim parameter for the storage pool should remain at 100, disabling reclamation from running. Controlling reclamation is desirable because it demands heavy use of the tape drives and might interfere with normal backup or restore operations if allowed to be run by the server.

Tivoli Storage Manager V5.3 introduces the **reclaim stgpool** command, which makes reclamation a one-step process. Previously, you had to update the

storage pool, selecting a threshold to trigger reclamation. Then you would wait for a period of time, and run another **update stgpool** command to reset the reclamation threshold to its previous value. You can still use the two-step update storage pool method, but the **reclaim stgpool** command is preferred.

The **reclaim stgpool** command takes a number of options. To set the reclamation threshold, set the THreshold parameter to a value between 50 and 99. The THreshold value represents the percentage of reclaimable space required on a volume, in order for it to be eligible to be reclaimed. To check the amount of reclaimable space on a volume, run a **query volume** command. Subtract the value in the Pct Utilized column from 100 to obtain the percentage of reclaimable space on the volume. The other parameter required for **reclaim stgpool** is the DUration parameter. DUration is the length of time reclamation will run for on the selected storage pool.

Each sequential storage pool should have one schedule to perform reclamation. We have three sequential storage pools in our recommended configuration. Example 12-10 shows three schedules to perform the reclamations. We specified a threshold of 85 so that only volumes with 15% or less utilization of valid data will be reclaimed in this operation.

Example 12-10 Defining reclamation schedules

```
tsm: LOCHNESS_SERVER1>define schedule RECLAIM_OFFDIRS type=admin
description="Perform reclamation on the OFFDIRS storage pool" cmd="reclaim stgpool
offdirs threshold=85 duration=60" starttime=11:00 active=yes
ANR2577I Schedule RECLAIM_OFFDIRS defined.

tsm: LOCHNESS_SERVER1>define schedule RECLAIM_OFFDATA type=admin
description="Perform reclamation on the OFFDATA storage pool" cmd="reclaim stgpool
offdata threshold=85 duration=180" starttime=12:00 active=yes
ANR2577I Schedule RECLAIM_OFFDATA defined.

tsm: LOCHNESS_SERVER1>define schedule RECLAIM_TAPEDATA type=admin
description="Perform reclamation on the TAPEDATA storage pool" cmd="reclaim
stgpool tapedata threshold=85 duration=180" starttime=15:00 active=yes
ANR2577I Schedule RECLAIM_TAPEDATA defined.

tsm: LOCHNESS_SERVER1>q sched reclaim* t=a
```

* Schedule Name	Start Date/Time	Duration	Period	Day
RECLAIM_OFFDATA	02/21/2006 12:00:00	1 H	1 D	Any
RECLAIM_OFFDIRS	02/21/2006 11:00:00	1 H	1 D	Any
RECLAIM_TAPEDATA	02/21/2006 15:00:00	1 H	1 D	Any

12.2.6 Defining a licensing audit schedule

Occasionally, you may wish to check storage statistics for your clients, that is, how much data the clients are storing on the server, and what type of data that is. The **query auditoccupancy** command provides information about client data usage, as shown in Example 12-11.

Example 12-11 Audit occupancy data

```
tsm: LOCHNESS_SERVER1>q auditocc
License information as of last audit on 02/21/2006 at 11:04:40.
```

Node Name	Backup Storage Used (MB)	Archive Storage Used (MB)	Space-Managed Storage (MB)	Total Used (MB)
LOCHNESS	37	0	0	37
PAMELA	0	184	0	184
PIERRE	888	101	0	989
PARIS	267	12	0	289
ATLANTIC	118	0	0	118
BANDA	353	0	0	353

The data displayed by **query auditoccupancy** is updated whenever the **audit licenses** command is run on the Tivoli Storage Manager server. We recommend auditing the licenses daily to maintain up-to-date client statistics. The schedule definition is shown in Example 12-12.

Example 12-12 License audit schedule definition

```
tsm: LOCHNESS_SERVER1>define schedule AUDIT_LICENSE type=admin description="Audit
licenses" cmd="audit licenses" starttime=00:00 active=yes
ANR2577I Schedule AUDIT_LICENSE defined.
```

```
tsm: LOCHNESS_SERVER1>q sched audit* t=a
```

* Schedule Name	Start Date/Time	Duration	Period	Day
AUDIT_LICENSE	02/21/2006 00:00:00	1 H	1 D	Any

12.2.7 Querying administrative events

You can query the scheduled events using the **query event** and **query schedule** commands. Example 12-13 shows the outputs from these commands.

Example 12-13 Querying administrative events

```
tsm: LOCHNESS_SERVER1>q schedule * type=admin
```

* Schedule Name	Start Date/Time	Duration	Period	Day
AUDIT_LICENSE	02/21/2006 00:00:00	1 H	1 D	Any
BACKUP_VOLHIST	02/20/2006 07:05:00	1 H	1 D	Any
DELETE_VOLHIST	02/20/2006 07:00:00	1 H	1 D	Any
EXPIRE_INVENTORY	02/21/2006 10:00:00	1 H	1 D	Any
MIGRATION	02/21/2006 07:00:00	1 H	1 D	Any
RECLAIM_OFFDATA	02/21/2006 11:00:00	1 H	1 D	Any
RECLAIM_OFFDIRS	02/21/2006 10:00:00	1 H	1 D	Any
RECLAIM_TAPEDATA	02/21/2006 14:00:00	1 H	1 D	Any
REDBOOK_OFFSITE	02/20/2006 04:00:00	1 H	1 D	Any

```
tsm: LOCHNESS_SERVER1>q event * type=admin
```

Scheduled Start	Actual Start	Schedule Name	Status
02/21/2006 04:00:00	02/21/2006 04:00:24	REDBOOK_OFFSITE	Completed
02/21/2006 07:00:00	02/21/2006 07:00:24	DELETE_VOLHIST	Completed
02/21/2006 07:05:00	02/21/2006 07:05:24	BACKUP_VOLHIST	Completed
02/21/2006 10:00:00	02/21/2006 10:31:54	RECLAIM_OFFDIRS	Completed
02/21/2006 11:00:00	02/21/2006 11:00:24	RECLAIM_OFFDATA	Completed
02/21/2006 14:00:00		RECLAIM_TAPEDATA	Future
02/22/2006 00:00:00		AUDIT_LICENSE	Future
02/22/2006 04:00:00		REDBOOK_OFFSITE	Future
...			

The **query schedule** command shows the schedules in alphabetical order, while the **query event** command shows the chronological order. Note that for both commands you must specify **type=admin** (or **t=a**) to report on administrative objects.

12.3 Client schedules

A client schedule is a directive to trigger an action on one or more Tivoli Storage Manager clients. It differs from an administrative schedule in that it specifies that an action be performed on the Tivoli Storage Manager client. The client scheduling system consists of a server portion and a client portion. The server

part is integrated into the Tivoli Storage Manager process and is responsible for managing the schedules and notifying clients. The client scheduler is a separate process on the Tivoli Storage Manager client and provides communication between the server and client. See “Scheduling” in *IBM Tivoli Storage Management Concepts*, SG24-4877, for further information about the client portion of the client scheduling system.

A Tivoli Storage Manager client with an active scheduler process can be scheduled to perform any of the following actions:

- ▶ Back up (either incremental or selective)
- ▶ Archive
- ▶ Restore
- ▶ Retrieve
- ▶ External command or script
- ▶ Macro
- ▶ Image backup or restore (UNIX)

The most common use of client schedules is to for an automatic incremental backup process for a group of machines.

At this point in the configuration of Tivoli Storage Manager, you should have installed the Tivoli Storage Manager client software on your clients and defined them to a policy domain. You should also have activated the scheduler service on the client so that it is ready to accept schedules. The remaining activities are performed on the server. To complete a client schedule you need to perform the following operations on the server:

1. Define a client schedule.
2. Associate a client with the schedule.
3. Verify the client schedule.

12.3.1 Defining a client backup schedule

In 1.1.1, “Our support material” on page 5, we show how to load a predefined macro into Tivoli Storage Manager. The macro mac.schedules, which we provide to define schedules for our book environment, are shown in “Define schedules” on page 735.

The **define schedule** command defines a schedule to the Tivoli Storage Manager server. You then use the **define association** command to associate each client with the schedule.

To define a client schedule, specify the following information:

- ▶ Policy domain name: The schedule will be created within this policy domain and can only be associated with nodes within that domain. Only

administrators who have policy rights for the domain or system rights can control these schedules.

- ▶ Schedule name: The schedule name can be any unique name you choose, up to 30 characters long. It should represent the function it performs.
- ▶ Start time: The time of day that you want the schedule to trigger your action.
- ▶ Startup duration: The period in which the scheduler will initiate the schedule after the start time.

Client schedules are very dependent on site requirements, but we have some recommendations that are applicable for a wide range of environments.

Our recommended policy configuration includes two policy domains, one for servers and one for workstations. We must therefore define a client backup schedule for each domain. The parameters for each schedule are very similar except for the domain name. The schedules start at 10 p.m. with a startup window of three hours. The commands and output are shown in Example 12-14.

Example 12-14 Defining client schedules

```
tsm: LOCHNESS_SERVER1>define schedule server server_nightly action=incremental  
starttime=22:00 duration=3 durunits=hours period=1 perunits=days  
description="Nightly backup schedule for SERVER domain"
```

```
ANR2500I Schedule SERVER_NIGHTLY defined in policy domain SERVER.
```

```
tsm: LOCHNESS_SERVER1>define schedule workstn workstn_nightly action=incremental  
starttime=22:00 duration=3 durunits=hours period=1 perunits=days  
description="Nightly backup schedule for Workstation domain"
```

```
ANR2500I Schedule WORKSTN_NIGHTLY defined in policy domain WORKSTN.
```

```
tsm: LOCHNESS_SERVER1>q sched
```

Domain	*	Schedule Name	Action	Start Date/Time	Duration	Period	Day
SERVER	-	SERVER_NIGHTLY	Inc Bk	02/21/2006 22:00:00	3 H	1 D	Any
WORKSTN		WORKSTN_NIGHTLY	Inc Bk	02/21/2006 22:00:00	3 H	1 D	Any

Note that we do not specify a type or style of schedule. If we omit the type, *client* is assumed. If we omit the SCHEDStyle, *classic* is assumed.

12.3.2 Defining an enhanced client schedule

An enhanced client schedule performs the same actions as a classic client schedule, but allows you to be more specific with repetition intervals.

Before Tivoli Storage Manager V5.3, there were limited options for setting the repetition parameters. You could not, for example, schedule a backup to run on the first Wednesday of each month—with enhanced schedules, you can.

We wish to schedule an image backup of the C drive of our Windows workstations on the last Friday of every month, at 1 a.m. When defining the schedule, we use the SCHEDStyle=enhanced option, and use the MONth, DAYOFMonth, WEEKofmonth, and DAYofweek options. Example 12-15 shows the command.

Example 12-15 Defining an enhanced client schedule

```
tsm: LOCHNESS_SERVER1>define sched workstn monthly_image starttime=01:00
action=imagebackup object="C:" schedstyle=enhanced month=any weekofmonth=last
dayofweek=friday description="Monthly image backup for workstations"
ANR2500I Schedule MONTHLY_IMAGE defined in policy domain WORKSTN.
```

```
tsm: LOCHNESS_SERVER1>define association workstn monthly_image pamel
ANR2510I Node PAMELA associated with schedule MONTHLY_IMAGE in policy domain
WORKSTN.
```

```
tsm: LOCHNESS_SERVER1>query event workstn monthly_image enddate=12/31/2006
```

Scheduled Start	Actual Start	Schedule Name	Node Name	Status
02/24/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
03/31/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
04/28/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
05/26/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
06/30/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
07/28/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
08/25/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
09/29/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
10/27/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
11/24/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future
12/29/2006 01:00:00		MONTHLY_IMAGE	PAMELA	Future

The **query event** output shows the projected dates that the schedule will run for the rest of 2006, all of which are the last Fridays of each month.

Figure 12-2 and Figure 12-3 show the corresponding panels from the Administration Center, selecting the day of week and week of the month.

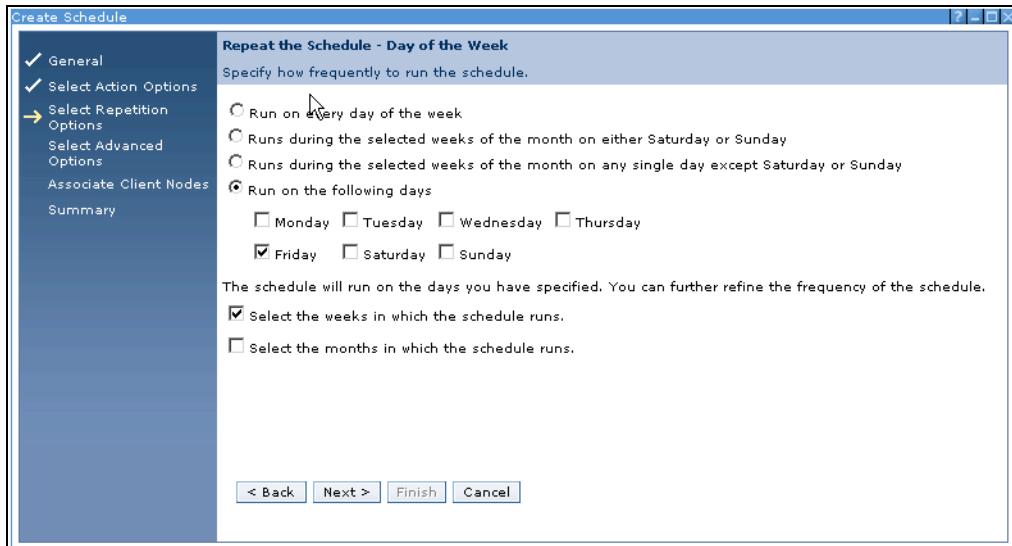


Figure 12-2 Enhanced schedule repetition, day of week, ISC panel

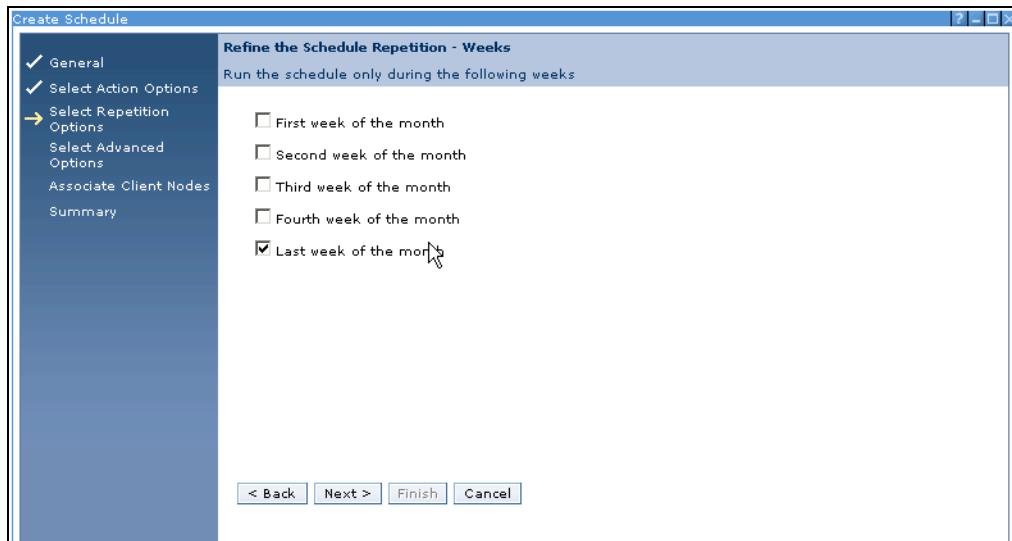


Figure 12-3 Enhanced schedule, week of month, ISC panel

12.3.3 Associating a client with a schedule

Once the schedule is defined, we need to specify which client nodes will run it. The **define association** command forms the link between the schedule and the node. Nodes are associated to schedules within their own domain. A node must be registered on the server before defining an association for it, but it does not necessarily have to be in contact with the server. Example 12-16 shows the actual commands and the output.

Example 12-16 Associating clients with schedules

```
tsm: LOCHNESS_SERVER1>define association server server_nightly lochness
ANR2510I Node LOCHNESS associated with schedule SERVER_NIGHTLY in policy
domain SERVER.

tsm: LOCHNESS_SERVER1>define association server server_nightly atlantic
ANR2510I Node ATLANTIC associated with schedule SERVER_NIGHTLY in policy
domain SERVER.

tsm: LOCHNESS_SERVER1>define association workstn workstn_nightly pamelapierre
ANR2510I Node PAMELA associated with schedule WORKSTN_NIGHTLY in policy domain
WORKSTN.
ANR2510I Node PIERRE associated with schedule WORKSTN_NIGHTLY in policy domain
WORKSTN.

tsm: LOCHNESS_SERVER1>query assoc

Policy Domain Name: SERVER
    Schedule Name: SERVER_NIGHTLY
    Associated Nodes: LOCHNESS ATLANTIC

Policy Domain Name: WORKSTN
    Schedule Name: WORKSTN_NIGHTLY
    Associated Nodes: PAMELA PIERRE
```

Notice that you can specify more than one node by separating the node names with a comma only (no spaces between commas and node names).

12.3.4 Verifying the client schedules

Check when the schedules are due to run using the **query event** command. If the nodes and schedules are set up and associated correctly, you will see an entry for each node/schedule pair, as shown in Example 12-17.

Example 12-17 Querying client events

Scheduled Start	Actual Start	Schedule Name	Node Name	Status
02/12/00 22:00:00		SERVER_NIGHTLY	LOCHNESS	Future
02/12/00 22:00:00		SERVER_NIGHTLY	ATLANTIC	Future
02/12/00 22:00:00		WORKSTN_NIGHTLY	PAMELA	Future
02/12/00 22:00:00		WORKSTN_NIGHTLY	PIERRE	Future

The scheduled events are listed as expected. One final task you can perform to ensure that the client knows about the schedule is to start the backup-archive client and issue a **query schedule** command. In Example 12-18, we query the schedules on the client PIERRE.

Example 12-18 Querying a client schedule from the client

```
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 02/21/2006 14:43:21
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Node Name: PIERRE
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/21/2006 14:39:15  Last access: 02/20/2006 16:50:14

tsm> q sched
  Schedule Name: WORKSTN_NIGHTLY
    Description: Nightly backup schedule for Workstation domain
  Schedule Style: Classic
    Action: Incremental
    Options:
    Objects:
    Priority: 5
  Next Execution: 7 Hours and 21 Minutes
    Duration: 1 Hour
    Period: 1 Day
    Day of Week: Any
    Month:
  Day of Month:
```

Week of Month:
 Expire: Never

tsm> quit



Routine tasks

IBM Tivoli Storage Manager, like any other software system, has to be maintained and operated in order to check that the tasks that are implemented are still working. To accomplish this, you may need to consider how many people will be dedicated to Tivoli Storage Manager.

Depending on the size of your installation, this can range from a single person to a complete team. In this chapter we consider staffing requirements and discuss the various routine operations for which they will be responsible.

13.1 Operations staff

The operations team is responsible for monitoring, correcting errors, and working together with technical support to isolate any non-specific error condition.

Basically, you need the following logical roles among your current or future Tivoli Storage Manager operations team. Depending on the actual number of people in the team, some or all of these roles may be combined into the same actual person:

- ▶ **Operator:** Handles Tivoli Storage Manager daily tasks and special server procedures.
- ▶ **Technical support:** Installs new client code, upgrades server code, activates trace functions, deals with hardware configurations, answers end-user questions, and handles error conditions.
- ▶ **Storage Administrator:** Performs sanity checks in the environment, evaluates capacity planning issues, and manages storage pools.
- ▶ **System Administrator:** Manages Tivoli Storage Manager policies, defines new nodes and management classes, and reports error conditions to technical support.

Tivoli Storage Manager provides a centralized point for backup, restore, archive, and retrieve operations, as well as backup sets and logical volume operations. All of these functions require monitoring and special operational procedures. As a rule of thumb, consider having at least two people responsible for Tivoli Storage Manager, so that each one can handle the workload in case of a problem (this way you can also avoid the risk of concentrating all your Tivoli Storage Manager information in only one person).

All the personnel directly involved in Tivoli Storage Manager administration—the Tivoli Storage Manager operations team—need to divide their Tivoli Storage Manager workload into some basic activities:

- ▶ **Server procedures:** Start and stop the Tivoli Storage Manager server.
- ▶ **Daily operations:** Check database free space, check activity log, check volumes in and out, send tapes off-site, request to bring tapes on-site, check Tivoli Storage Manager devices, back up Tivoli Storage Manager database (or monitor its execution), and label new tapes.
- ▶ **Error or critical conditions:** Bring an off-site volume for the restore; create another database or recovery log; and deal with storage pool shortages, mirror write failures, communication errors, device problems, media errors, off-site tape not found, full or partial disaster recovery, and any other non-specific problems.

13.2 Server procedures

In this section we show how to start and stop a Tivoli Storage Manager server. Tivoli Storage Manager is essentially a software program that runs as any other application in your system. This means that you can start the server and let it run continuously and uninterrupted for days, weeks, or even longer if desired.

13.2.1 Starting the Tivoli Storage Manager server

The Tivoli Storage Manager server can run in either the foreground or the background. When running in the foreground, you can have an active open console, with all system messages displayed (similar to Example 10-6 on page 322). From this server console, you can issue all administrative commands (depending on the authority that is available for the SERVER_CONSOLE administrator ID; see 8.1.2, “Considerations” on page 285). When running in the background, you can close the active window without stopping the server process. This is the recommended way if you are planning to have the Tivoli Storage Manager server automatically started or stopped.

In this section we explain how to start a Tivoli Storage Manager server. (We assume that it is not running yet.) Otherwise, you must stop it first and issue the commands we explain. You can have the Tivoli Storage Manager server automatically started, in which case you need to configure it as a background process. If you wish to have it started manually, then the Tivoli Storage Manager server needs to be configured as a foreground process. For further details on how to start the Tivoli Storage Manager server, refer to the *Tivoli Storage Manager Quick Start* manual, which comes with the product software.

Active console mode

To start a Tivoli Storage Manager server in the foreground, run `dsmServ` in the Tivoli Storage Manager system directory. All output messages will be redirected to standard output. If you run the server in the foreground, closing the window automatically halts the server.

Example 13-1 shows how to manually start the Tivoli Storage Manager server on AIX in active console mode. This server console session is established using a predefined administrator ID SERVER_CONSOLE. All Tivoli Storage Manager system messages are displayed on the console. The Tivoli Storage Manager server is ready to receive and send data to the client machines.

Example 13-1 Startup of server to demonstrate the console

```
root@Atlantic /usr/tivoli/tsm/server/bin: dsmServ
ANR7800I DSMSERV generated at 19:57:13 on Nov 28 2005.
```

Tivoli Storage Manager for AIX-RS/6000
Version 5, Release 3, Level 2.2

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restricted by GSA ADP Schedule Contract with IBM Corporation.

```
ANR0900I Processing options file /tsm/sys/dsmserv.opt.  
ANR4726I The ICC support module has been loaded.  
ANR0990I Server restart-recovery in progress.  
ANR0200I Recovery log assigned capacity is 8 megabytes.  
ANR0201I Database assigned capacity is 16 megabytes.  
ANR0306I Recovery log volume mount in progress.  
ANR0353I Recovery log analysis pass in progress.  
ANR0354I Recovery log redo pass in progress.  
ANR0355I Recovery log undo pass in progress.  
ANR0352I Transaction recovery complete.  
ANR1635I The server machine GUID,  
00.00.00.00.95.0b.11.da.bb.57.08.63.09.2b.56.31, has initialized.  
ANR2100I Activity log process has started.  
ANR4726I The NAS-NDMP support module has been loaded.  
ANR2803I License manager started.  
ANR8200I TCP/IP driver ready for connection with clients on port 1500.  
ANR0993I Server initialization complete.  
ANR2560I Schedule manager started.  
ANR0916I TIVOLI STORAGE MANAGER distributed by Tivoli is now ready for use.  
ANR2828I Server is licensed to support IBM System Storage Archive Manager.  
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.  
ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.  
tsm: ATLANTIC>
```

When you start the server, check the startup messages—either as they appear on the screen or by querying the server activity log. You will soon become familiar with them so that you know what messages are *normal*, and what messages are cause for concern. For example, if one of the mirrored database or log volumes cannot be brought online, usually because of a disk problem, it will trigger a startup error message. If you note this when the server starts, you can start investigating and fixing the problem straight away.

On Windows systems, you can also start the server in active console mode from the Tivoli Storage Manager server utilities program. Figure 13-1 shows the main Tivoli Storage Manager server utilities screen and the Launch option to start Tivoli Storage Manager in console mode.

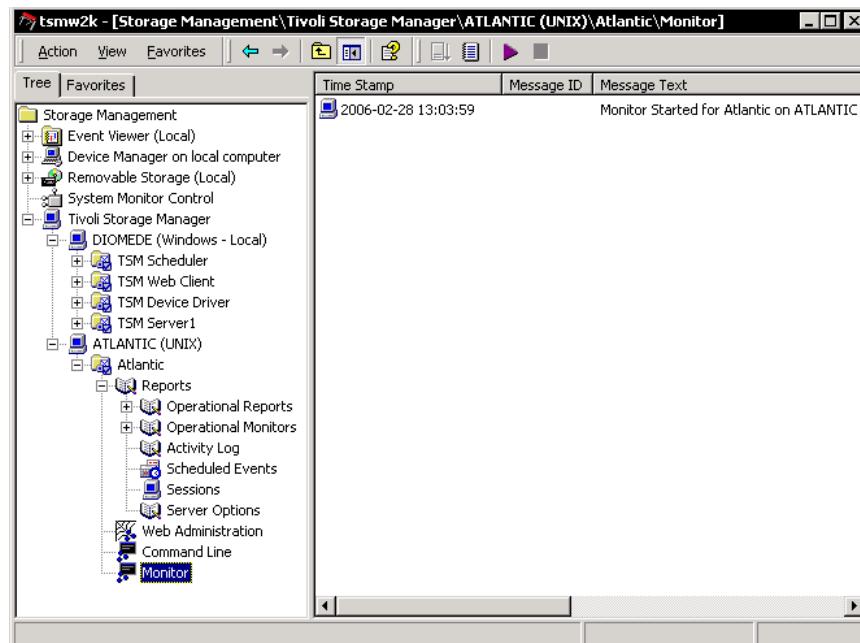


Figure 13-1 Tivoli Storage Manager management monitor option

Background mode

You can start the Tivoli Storage Manager server in the background, either manually or with each system start.

Manual start

On UNIX/Linux, to manually start the Tivoli Storage Manager server in the background, run the script `rc.adsmser`, from the Tivoli Storage Manager installation directory, as shown in Example 13-2.

Example 13-2 Starting Tivoli Storage Manager in AIX

```
root@Atlantic /usr/tivoli/tsm/server/bin: nohup rc.adsmser >/dev/console 2>&1&
```

On Windows, the Tivoli Storage Manager server is installed as a manual service. To start it, go to **Settings** → **Control Panel** → **Administrative Tools** → **Services**, select the Tivoli Storage Manager server service, and start it.

Automatic start

On AIX, after the Tivoli Storage Manager server installation, the system is configured to start the Tivoli Storage Manager server automatically during the system startup. The following entry is added to the system initialization file /etc/inittab:

```
autosrvr:2:once:/usr/tivoli/tsm/server/bin/rc.adsmsserv >/dev/console 2>&1  
#Start the IBM Tivoli Storage Manager server
```

Solaris, HP-UX, and Linux also use the /etc/inittab for automatic startup of processes; however, you may prefer to put the commands into another of the possible startup files. We recommend that you refer to your operating system documentation and talk with the system administrator to decide on the best configuration.

On Windows, the Tivoli Storage Manager server is installed as a manual service. To change its status to automatic, go to **Settings** → **Control Panel** → **Administrative Tools** → **Services**, select the Tivoli Storage Manager server service, and change its startup setting to automatic.

The Tivoli Storage Manager server will be started automatically the next time the system is rebooted. You can then check that the server is running by trying to connect to the server from an administrative client or a backup-archive client, or by checking whether the Tivoli Storage Manager server process (UNIX/Linux) or service (Windows 2000/2003) is running.

Administrative console session

If you start the Tivoli Storage Manager server in the background, we highly recommend running an additional administrative client session in console mode on the administrative workstation. This session displays all Tivoli Storage Manager messages so that you can easily monitor the Tivoli Storage Manager system. However, it is not an active session, that is, you cannot issue administrative commands here. Example 13-3 starts an administrative session in console mode.

Example 13-3 Starting an admin session in console mode

```
root@Atlantic /usr/tivoli/tsm/server/bin: dsmadmc -console -id=report  
-password=mike  
IBM Tivoli Storage Manager  
Command Line Administrative Interface - Version 5, Release 3, Level 2.0  
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.  
  
Session established with server TSM: AIX-RS/6000  
Server Version 5, Release 3, Level 2.2  
Server date/time: 02/14/06 14:01:13 Last access: 02/14/06 14:00:42
```

Note: We recommend that you create a specific analyst administrator for this purpose so that it can only query the server.

13.2.2 Stopping the Tivoli Storage Manager server

There are two ways of stopping a Tivoli Storage Manager server:

- ▶ Immediate stop: This brings the server down immediately. All system processes and client activity are interrupted.
- ▶ Drain system activity and stop: This is the recommended way, because you can understand what processes were in progress and what you may need to restart later on. Performing basic pre-checks and then stopping gives you (and the operations team) an idea of the workload that may need to be restarted. It is also a more orderly and therefore a cleaner shutdown than the immediate stop.

Stopping the Tivoli Storage Manager server immediately

You can halt the server without warning if an unplanned operating system problem requires the server to be stopped. On Windows, terminate the server by stopping the service. To change the status of the server service, go to **Settings → Control Panel → Administrative Tools → Services**, select the Tivoli Storage Manager server service, and stop it.

When you halt the server, all processes are abruptly stopped and client sessions are canceled, even if they are not completed. Any in-progress transactions are rolled back when the server is restarted. When the server is halted, neither administrator activity nor client operations are possible. We recommend that you halt the server only after current administrative and client node sessions have completed or canceled.

On all platforms, including Windows, use the **halt** command to shut down the Tivoli Storage Manager server, as shown in Example 13-4.

Example 13-4 Halt command

```
tsm: ATLANTIC> halt
ANR2017I Administrator SERVER_CONSOLE issued command: HALT
ANR7835I Server thread 1 terminated in response to server shutdown.
ANR7835I Server thread 14 terminated in response to server shutdown.
....
ANR7835I Server thread 41 terminated in response to server shutdown.
ANR7835I Server thread 43 terminated in response to server shutdown.
ANR7835I Server thread 44 terminated in response to server shutdown.
ANR0991I Server shutdown complete.
```

Note: The QUIESCE option with the **halt** command is recommended only if you plan to do a database dump by using the **dsmserv dumpdb** command immediately after halting. Because Tivoli Storage Manager supports online database backup (**backup db** command), the **dsmserv dumpdb** command should rarely, if ever, be needed.

Draining system activity before stopping the server

To shut down the server without severely impacting administrative and client node activity with the server, we recommend taking some steps before actually issuing the **halt** command to the server:

1. Disable the server: Prevents new client node sessions from starting. Disabling new client sessions prevents users from establishing client node sessions with the server. This command does not affect current client sessions in progress or system processes like migration and reclamation. To disable client node access to the server, use the **disable sessions** command, as shown in Example 13-5.

Example 13-5 Disable sessions

```
tsm: ATLANTIC> disable sessions
```

When you disable client sessions from the server, administrators can still access it, and current client node activity completes unless the user logs off or you cancel the client node session.

You can issue the **query status** command to determine if the server is enabled or disabled.

2. Query for session information: Identify any existing administrative and client node sessions.

When an administrator or client accesses Tivoli Storage Manager, either an administrative or client node session is established with the server. Each session is assigned a unique session number. You can see that because of the multi-threading features of the Tivoli Storage Manager client, node ATLANTIC has many active sessions with the server. To request information about client sessions, enter the **query session** command, as in Example 13-6.

Example 13-6 Query session

```
tsm: ATLANTIC> query session
```

Sess	Comm.	Sess	Wait	Bytes	Bytes	Sess
Platform	Client	Name				
Number	Method	State	Time	Sent	Recv	Type
-----	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----

AIX	3	Tcp/Ip	Run	0 S	261.6 K	2.3 K	Admin
			TSMADMIN				
AIX	20	Tcp/Ip	IdleW	1 S	1.1 M	768	Node
			ATLANTIC				
AIX	21	Tcp/Ip	RecvW	0 S	591	191.2 M	Node
			ATLANTIC				
AIX	22	Tcp/Ip	IdleW	10 S	1,023	1.3 K	Node
			ATLANTIC				
AIX	23	Tcp/Ip	RecvW	0 S	549	492.3 M	Node
			ATLANTIC				

3. Notify users: Notify any existing administrative and client node sessions that you plan to shut down the server. Tivoli Storage Manager does not provide a network notification facility; you must use external means to notify users.
4. Cancel any existing administrative or client node sessions: To cancel a session, you must identify it by its session number. You can identify the session number by issuing the **query session** command. For example, in the screen above, one session number is 20 (client ATLANTIC). You can cancel that session by entering the **cancel session** command, as shown in Example 13-7.

Example 13-7 Cancel session command

```
tsm: ATLANTIC> cancel session 20
```

A client may still have other active sessions running. If you want to cancel just those client sessions, you will have to cancel them one by one.

On the other hand, if you want to cancel all backup-archive client sessions, enter the **cancel session a11** command, as shown in Example 13-8.

Example 13-8 Cancel session all

```
tsm: ATLANTIC> cancel session a11
ANR0490I Canceling session 21 for node ATLANTIC (AIX)
ANR0490I Canceling session 22 for node ATLANTIC (AIX)
ANR0483W Session 21 for node ATLANTIC (AIX) terminated - forced by
administrator.
ANR0483W Session 22 for node ATLANTIC (AIX) terminated - forced by
administrator.
```

If an operation, such as a backup or an archive process, is interrupted when you cancel the session, Tivoli Storage Manager rolls back the results of the current transaction. That is, any changes that are not yet committed to the database are undone. If necessary, the cancellation process may be delayed. For example, while a client restore session is in a restartable state, the file space is locked and no files can be moved from sequential volumes. This prevents the data from being migrated, moved, reclaimed, or backed up by

another operation. These sessions will automatically expire when the specified restore interval has passed. For further details, see the **query restore** and **cancel restore** commands.

5. Find out if any other processes are running, such as server migration or inventory expiration, by using the **query process** command. If a database backup process is running, allow it to complete before halting the server. If other types of processes are running, cancel them by using the **cancel process** command.
6. Halt the server and all server operations by using the **halt** command, as explained in “Stopping the Tivoli Storage Manager server immediately” on page 401.

13.3 Event monitoring

Tivoli Storage Manager provides a complete set of messages that can be enabled, disabled, stored, or even forwarded to other Tivoli Storage Manager servers, user programs, systems management consoles like Tivoli Enterprise Console (TEC) from Tivoli, or to (SNMP) management applications. These components are known as *event receivers*. You can enable the event receivers that are available and appropriate to your environment. Since event logging has a full set of functions and features that are beyond of the scope of this book, we only cover basic settings.

Tivoli Storage Manager divides the range and the source of the messages by prefixes. For example, prefix ANR is for server messages, and most of prefix ANS messages are from backup-archive client sessions. Details of all these messages are explained in *IBM Tivoli Storage Manager Messages*, GC35-0382.

You can enable or disable messages for any particular receiver, except for one—you cannot disable server events from being sent to the server activity log.

At server startup, events are logged automatically to both the Tivoli Storage Manager server console and the Tivoli Storage Manager activity log. Messages can appear on the server console, the administrative client, an operator terminal, the Administration Center, the backup-archive client, or the space-management client.

The Tivoli Storage Manager activity log helps the administrator track server activity and monitor the system. The activity log contains messages generated by the server and is stored in the database. All messages sent to the server console are stored in the activity log. Examples of the types of messages stored in the activity log include:

- ▶ When client sessions start or end
- ▶ When migration starts or ends
- ▶ When backed up files are expired from data storage
- ▶ Any output generated from background processes

13.3.1 Event receivers

To check whether event logging is enabled for a receiver, use the **query status** command and check the Active Receivers field, as shown in Example 13-9.

Example 13-9 Checking the active receivers field

```
tsm: ATLANTIC> query status
Storage Management Server for AIX-RS/6000 - Version 5, Release 3, Level 2.2

          Server Name: ATLANTIC
          Server host name or IP address:
          Server TCP/IP port number: 1500
          Crossdefine: Off
          Server Password Set: No
          Server Installation Date/Time: 02/03/06 15:18:02
          Server Restart Date/Time: 02/14/06 14:07:22
          Authentication: On
          Password Expiration Period: 90 Day(s)
          Invalid Sign-on Attempt Limit: 0
          Minimum Password Length: 0
          Registration: Closed
          Subfile Backup: No
          Availability: Enabled
          Accounting: Off
          Activity Log Retention: 1 Day(s)
          Activity Log Number of Records: 457
          Activity Log Size: <1 M
          Activity Summary Retention Period: 30 Day(s)
          License Audit Period: 30 Day(s)
          Last License Audit: 02/14/06 13:44:25
          Server License Compliance: Valid
          Central Scheduler: Active
          Maximum Sessions: 100
          Maximum Scheduled Sessions: 50
          Event Record Retention Period: 10 Day(s)
          Client Action Duration: 5 Day(s)
```

```
Schedule Randomization Percentage: 25
    Query Schedule Period: Client
    Maximum Command Retries: Client
        Retry Period: Client
    Scheduling Modes: Any
        Log Mode: Normal
Database Backup Trigger: Not Defined
    BufPoolSize: 524,288 K
Active Receivers: CONSOLE ACTLOG
Configuration manager?: Off
    Refresh interval: 60
Last refresh date/time:
    Context Messaging: Off
    Server-free Status: Not Supported
    Server-free Batch Size:
Table of Contents (TOC) Load Retention: 120 Minute(s)
    Machine Globally Unique ID:
00.00.00.00.95.0b.11.da.bb.57.08.63.09.2b.56.31
    Archive Retention Protection: Off
    Encryption Strength: AES
```

We recommend running the **begin eventlogging** command to make sure that all defined receivers are active. Use this command to begin logging events to one or more receivers. Event logging automatically begins when the server is started for the console and activity log, and for any receivers that are started automatically based on entries in the server options file. A receiver for which event logging has begun is an active receiver. Example 13-10 shows you how to activate all defined receivers.

Example 13-10 Activating defined receivers

```
tsm: ATLANTIC> begin eventlogging
ANR1825I Event logging active for the CONSOLE receiver.
ANR1825I Event logging active for the ACTLOG receiver.
```

We recommend enabling nodename logging so that you can also monitor client activity centrally in the server. Note that enabling client events to the activity log will increase the Tivoli Storage Manager database utilization. You can set a retention period for the log records by using the **set actlogretention** command.

To enable a specific receiver (such as CONSOLE, ACTLOG, EVENTSERVER, FILE, FILETEXT, SNMP, TIVOLI, USEREXIT) use the **enable events** command, as shown in Example 13-11.

Example 13-11 Enable events command

```
tsm: ATLANTIC>enable events actlog all nodename=*
ANR1844I ENABLE EVENTS command processed
```

Tip for Windows: Windows also has the EVENTLOG receiver, which sends events to the application eventlog so that you can use the Windows Event Viewer to monitor a Tivoli Storage Manager system. We recommend sending the error and sever category events to the Windows Event Log.

13.4 Health monitoring

After the Integration Solutions Console (ISC) and Administration Center are installed, Tivoli Storage Manager servers should be added to the portal. Only Tivoli Storage Manager V5.3 and later releases can be added.

Health Monitoring uses the Tivoli Storage Manager Server Administrator account ADMIN_CENTER. This account is locked by default and needs to be unlocked and enabled (as described in 13.4.1, “Enabling the ADMIN_CENTER account” on page 408) you can use Health Monitoring. You need to do this for all your Tivoli Storage Manager servers.

Attention: Ensure that the ADMIN_CENTER password is known to all of your Tivoli Storage Manager Administrators so that it does not become locked.

13.4.1 Enabling the ADMIN_CENTER account

To enable the ADMIN_CENTER account:

1. Open a view of your Tivoli Storage Manager server so that you can see the menu option Server Properties, as shown in Figure 13-2.
2. In the Server Properties portlet, select **Administrators**, and check the box next to the ADMIN_CENTER account.

The screenshot shows the Integrated Solutions Console interface. On the left, there's a navigation tree with various management categories like Welcome, Console Settings, Tivoli Storage Manager, and Reporting. The main area is titled 'Enterprise Management' and shows a table of servers. One row for 'ATLANTIC' is selected. Below this, a detailed 'ATLANTIC Server Properties' window is open. Under the 'Administrators' tab, a table lists accounts with columns for Name, Authority Level, and Days Since Last Access. The 'ADMIN_CENTER' account is highlighted with a checked checkbox in the first column.

Select	Name	Authority Level	Days Since Last Access
<input type="checkbox"/>	ADMIN	System	<1
<input checked="" type="checkbox"/>	ADMIN_CENTER	System	<1
<input type="checkbox"/>	ATLANTIC	Client Owner	8
<input type="checkbox"/>	DIOMEDE	Client Owner	4
<input type="checkbox"/>	PROPAGANDA	Client Owner	14
<input type="checkbox"/>	SERVER_CONSOLE	System	

Figure 13-2 Server Properties view showing Administrators

3. Select **Modify Administrator** from the menu.

4. Update the password if necessary and ensure that the Lock check box is *not* checked, as shown in Figure 13-3.

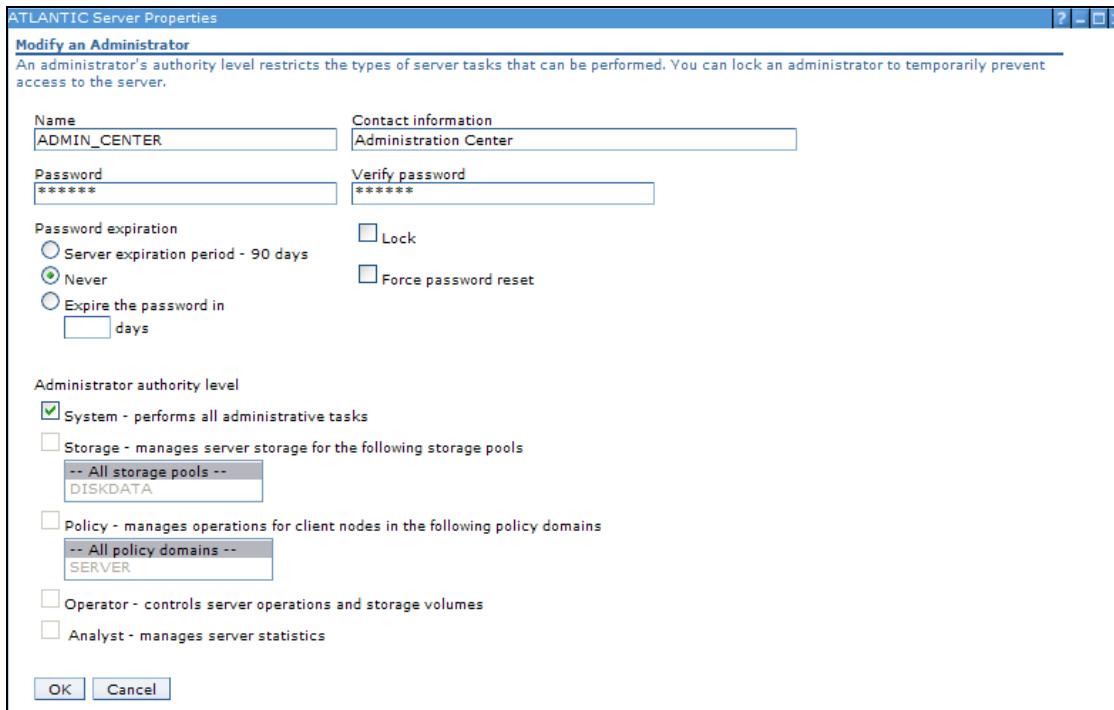


Figure 13-3 ADMIN_CENTER account update pwd and Lock box unchecked

13.4.2 Using Health Monitoring

Using the Health Monitor, you get an overall view of how the servers and their storage devices are running. The Health Monitor analyzes the information it obtains from each server to present an overall health status.

Normal (green)

The server is running and the Health Monitor identified no problems.

Unknown (blue)

The server could not be contacted. Possible causes include:

- The server is not currently running.
- Network problems prevent communications with the server.

- ▶ The administrator name that the Health Monitor uses, ADMIN_CENTER, is locked or does not exist on the server.
- ▶ There were internal errors in the Health Monitor.

Click the server name to get more information about possible causes.

Warning or Needs Attention (yellow)

The Health Monitor detected conditions that might develop into significant problems. You need to take preventive actions for the server's database, storage devices, or both. Click the server name for details.

Critical or Error (red)

The Health Monitor detected significant problems in the server's database, storage devices, or both. The problems prevent the server from operating normally. For example, the database or recovery log is out of space or a library is not functioning.

To configure the Health Monitor to check the health of Tivoli Storage Manager servers:

1. Open the Administration Center in the ISC.
2. Click **Health Monitoring** in the navigation tree.
3. Select **Configure Health Monitoring** from the menu in the Health Monitor portlet, as shown in Figure 13-4.

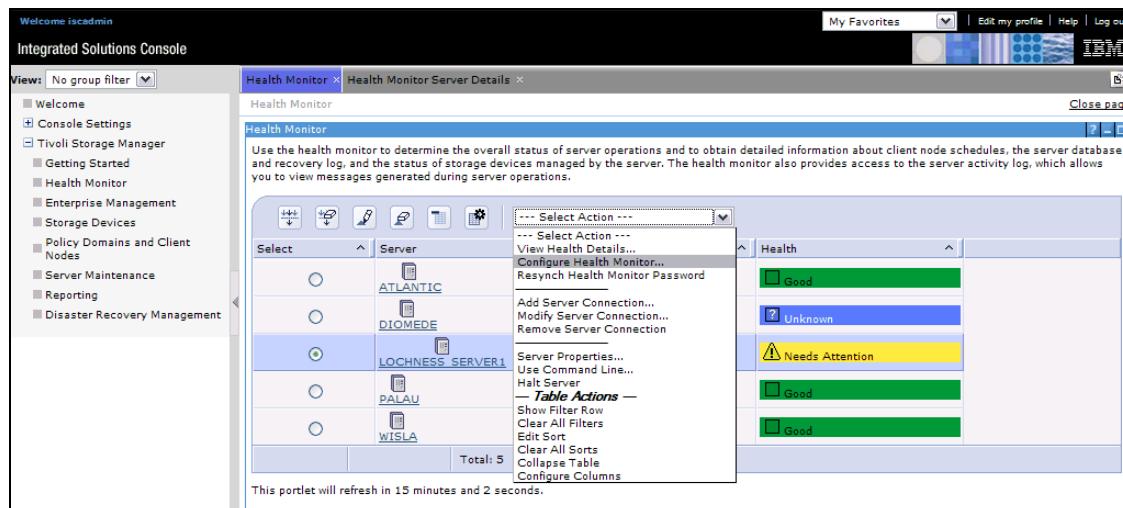


Figure 13-4 Health monitor menu selection

4. Enter the password and refresh interval to enable the Health Monitor, as shown in Figure 13-5. Click **OK** to complete.

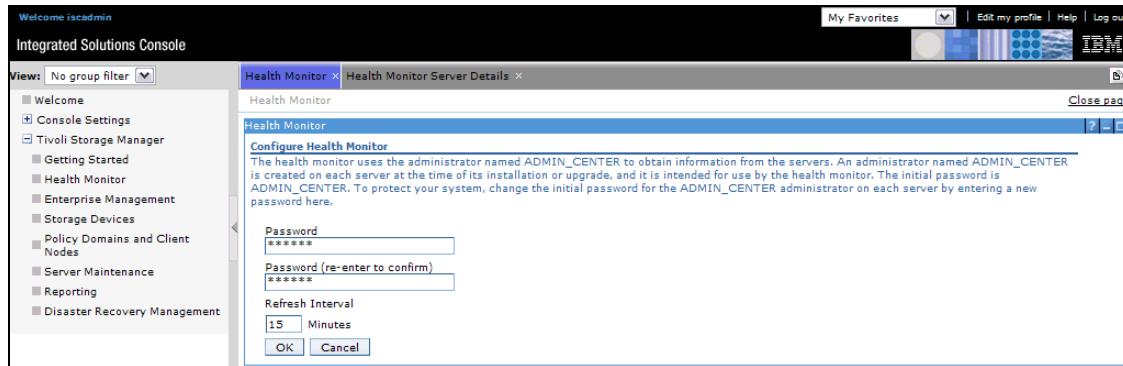


Figure 13-5 Defining the Health Monitor password and refresh interval

5. To display the status of a Tivoli Storage Manager Server, click **Health Monitor** in the navigation tree. Select the **Health Monitor** menu to display more details, as shown in Figure 13-6.

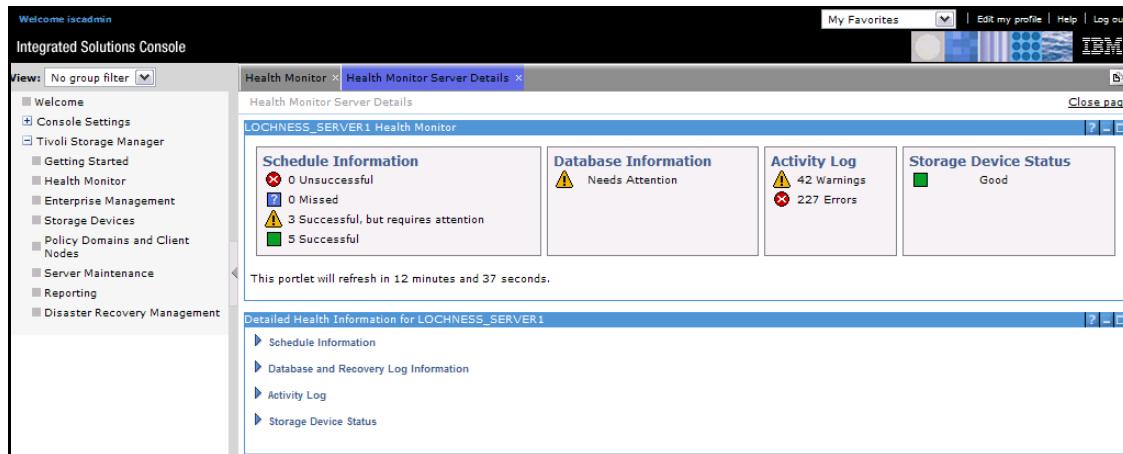


Figure 13-6 Health monitor details

The expanded view of the Health Monitor provides further access to Schedule Information events, Server database and Recovery log management functions, the Activity log viewer, and Storage Device status.

13.5 Operational Reporting

The Tivoli Storage Manager Operational Reporting feature automates some of the monitoring tasks you typically perform manually. By generating reports and monitors, Operational Reporting notifies you if a server requires attention.

Operational reports can be scheduled to run daily and are generated even if there are no problems. Operational monitors are special types of reports, and can be scheduled to run hourly. The monitors will send you a notification only if there are issues.

Operational Reporting does not maintain a separate database of information and is not a trending tool. Operational Reporting is included as part of the Tivoli Storage Manager for Windows server and is also available as a stand-alone package for a Windows server.

For information about installing the stand-alone package, see “Installing the IBM Tivoli Storage Manager Operational Reporting Stand-alone Package” in the *IBM Tivoli Storage Manager for Windows Administrator’s Guide*.

13.5.1 Functions

Operational Reporting is administered through the Microsoft Management Console on a Windows machine. Operational Reporting runs as a service and supports multiple Tivoli Storage Manager servers running on a single machine.

An operational report consists of the following parts:

- ▶ Standard report
- ▶ Customized summary
- ▶ Optional extensions that you can create

You can select which sections to include in the report. The Operational Reporting installation package contains two default custom summary templates as:

- ▶ One for a report
- ▶ One for a monitor

Default e-mail messages will notify you if the server is running smoothly, or if there are issues such as failed or missed schedules. You can also link to a Web summary page to check operational reports about your server. An operational monitor will notify you either through e-mail or by sending an instant message to your Windows desktop.

Figure 13-7 shows the quick glance view of your Tivoli Storage Manager environment health using the daily report.

Daily Report TSM 24 hour Report for ATLANTIC generated at 2006-02-28 19:02:37 on tsmadmin1 covering 2006-02-27 19:02:37 to 2006-02-28 19:02:36	
Server name: ATLANTIC, platform: AIX-RS/6000, version: 5.3.2.2, date/time: 02/28/2006 14:01:07	
Custom Summary	
Item	Results
Administrative Schedules Successful:	6
Administrative Schedules Errors:	0
Administrative Schedules Failed:	0
Administrative Schedules Missed:	0
Client Schedules Completed with No Errors:	0
Client Schedules Completed with Skipped Files:	0
Client Schedules Completed with Warnings:	0
Client Schedules Completed with Errors:	0
Client Schedules Failed:	0
Client Schedules Missed:	0
Scheduled Nodes with empty contact information:	0
Total GB Backed Up:	105.04
Total GB Restored:	
Total GB Archived:	
Total GB Retrieved:	
Last Database Backup:	2006-02-28 11:00
% Database Utilization:	1.9
Database Cache Hit Ratio:	100.0
% Maximum Recovery Log Utilization:	2.3
Disk Pool Total MB:	382208.0
% Disk Pool Utilization:	0.0
Disk volumes offline:	0
Number of drives:	3
Number of tape mounts:	26
Total number of minutes tapes were mounted:	675
Total number of volumes:	16
Number of scratch volumes:	228
Number of unavailable volumes:	0
Number of read-only volumes:	1
Volume Reclamation warning:	0
Total number of administrators:	6
Total number of nodes:	7
AIX:	2
HPUX:	0
Linuxx86:	1
Macintosh:	0
NetWare:	0
OS/2:	0
Solaris:	0
Windows NT/2000/2003:	2
Data Protection (Mail, Database, etc.):	2
Unused:	0
Other:	0
Total number of file spaces:	14
License Compliance:	VALID

TSM Operational Reporting - Version 5, Release 3, Level 2.0

Figure 13-7 IBM Tivoli Operational Reporting result

Operational Reporting can write data to a file that can be read by a TEC log file adapter. The log file adapter reads the information and forwards it to the Tivoli Enterprise Console. For more information about Operational Reporting, see *IBM Tivoli Storage Manager Version 5.3 Technical Guide*, SG24-6638.

13.6 Daily sanity checks

This section shows you how to perform basic, yet important, system validations on your Tivoli Storage Manager environment. These checks are run manually, but obviously many could (and should) be automated.

We show the commands using the CLI. The same information is also available from the Administration Center; however, use of the CLI allows you to script these commands. We recommend that you start by issuing these commands daily. Then once you feel confident that the environment is performing smoothly, you might switch to a weekly schedule for some of the commands, to balance the amount of information to process with the need to keep informed.

You should run monitoring commands as part of the daily operations check, as a sync-point for all your administrators, especially if there are multiple teams working different shifts and locations.

Tivoli Storage Manager has a rich set of commands that allow you to monitor and create your own reports. The **query** command set is the base for most information from the server. Type `help query` or `help query <command>` for more details about all of the options.

Display database information

This section shows important Tivoli Storage Manager queries for the database and recovery log. The queries are listed in alphabetical order.

To display information about your current database occupancy and how much space is still available for extension, use the **query db** command, as shown in Example 13-12.

Example 13-12 Query db command and format, detailed report

```
tsm: ATLANTIC>query db

Available Assigned Maximum Maximum Page Total Used Pct Max.
Space Capacity Extension Reduction Size Usable Pages Util Pct
(MB) (MB) (MB) (MB) (bytes) Pages
-----
1,024 1,024 0 984 4,096 262,144 9,409 3.6 3.6

tsm: ATLANTIC> query db format=detailed

Available Space (MB): 1,024
Assigned Capacity (MB): 1,024
Maximum Extension (MB): 0
Maximum Reduction (MB): 992
Page Size (bytes): 4,096
```

```
Total Usable Pages: 262,144
    Used Pages: 8,361
        Pct Util: 3.2
        Max. Pct Util: 3.2
    Physical Volumes: 2
    Buffer Pool Pages: 131,072
Total Buffer Requests: 1,964
    Cache Hit Pct.: 84.83
    Cache Wait Pct.: 0.00
    Backup in Progress?: No
    Type of Backup In Progress:
        Incrementals Since Last Full: 0
        Changed Since Last Backup (MB): 29.43
            Percentage Changed: 90.10
    Last Complete Backup Date/Time: 02/24/2006 07:00:23
    Estimate of Recoverable Space (MB): 0
Last Estimate of Recoverable Space (MB): 02/17/2006 11:48:26
```

Display database volumes information

Use the **query dbvolume** command to display information about one or more database volumes, including available, allocated, and free space on the volume. This command displays information about the specified database volume and any database volume copies, as shown in Example 13-13.

Example 13-13 Viewing database volumes

```
tsm: ATLANTIC>query dbvol
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
/tsm/db/primary- /dbp_01.dsm	Sync'd	/tsm/db/mirror/- dbm_01.dsm	Sync'd		Undef- ined

Display information about the recovery log

Use the **query log** command to display allocation information about the recovery log, including utilization, expansion, and reduction abilities, as in Example 13-14.

Example 13-14 Query log command

```
tsm: ATLANTIC> query log
```

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Util
512	512	0	504	4,096	130,560	308	0.2	0.4

```
tsm: ATLANTIC> query log format=detail

    Available Space (MB): 512
    Assigned Capacity (MB): 512
    Maximum Extension (MB): 0
    Maximum Reduction (MB): 508
        Page Size (bytes): 4,096
    Total Usable Pages: 130,560
        Used Pages: 233
        Pct Util: 0.2
        Max. Pct Util: 0.2
    Physical Volumes: 2
        Log Pool Pages: 2,560
    Log Pool Pct. Util: 1.22
    Log Pool Pct. Wait: 0.00
Cumulative Consumption (MB): 215.78
Consumption Reset Date/Time: 02/03/2006 15:18:02
```

Information about log volumes

Use the **query logvolume** command to display information about one or more recovery log volumes, including available, allocated, and free space on the volume. This command displays information about the specified recovery log volume and any recovery log volume copies; the output is shown in Example 13-15.

Example 13-15 Viewing the log volumes

```
tsm: ATLANTIC>query logvolume
```

Volume Name (Copy 1)	Copy Status	Volume Name (Copy 2)	Copy Status	Volume Name (Copy 3)	Copy Status
/tsm/log/primarylog_01.dsm	Sync'd	/tsm/log/mirror-logm_01.dsm	Sync'd		Undefined

Display sequential volume history information

Use the **query volhistory** command to display sequential volume history information that has been collected by the server, as shown in Example 13-16.

Example 13-16 Using the volume history for information about sequential volumes

```
tsm: ATLANTIC>query volhistory
```

```
Date/Time: 02/24/2006 09:24:26
Volume Type: STGNEW
Backup Series:
```

```

Backup Operation:
  Volume Seq:
  Device Class: LT02-DC
  Volume Name: 022AKK
Volume Location:
  Command:

  Date/Time: 02/24/2006 09:28:21
  Volume Type: STGNEW
  Backup Series:
Backup Operation:
  Volume Seq:
  Device Class: LT02-DC
  Volume Name: 023AKK
Volume Location:
  Command:

  Date/Time: 02/24/2006 16:55:36
  Volume Type: STGNEW
  Backup Series:
Backup Operation:
  Volume Seq:
  Device Class: LT02C
  Volume Name: 020AKK
Volume Location:
  Command:

```

13.6.1 Data storage

In this section we describe important Tivoli Storage Manager queries for data storage. The queries are listed in alphabetical order.

Client node storage utilization

Use the **query auditoccupancy** command (Example 13-17) to display information about the client node server storage utilization. The displayed information is current as of the last license audit processed by the Tivoli Storage Manager server. You can use this information to determine whether you need to balance client node storage utilization needs, as well as to bill clients for storage usage.

Example 13-17 Auditoccupancy command

```
tsm: ATLANTIC>query auditoccupancy
License information as of last audit on 02/26/06 at 16:43:26.
```

Node Name	Backup Storage Used (MB)	Archive Storage Used (MB)	Space-Managed Storage Used (MB)	Total Storage Used (MB)
-----------	--------------------------	---------------------------	---------------------------------	-------------------------

CLIENT	0	0	0	0
ATLANTIC	1,236	0	0	1,236
MILES	0	0	0	0
LOSGATOS	0	0	0	0
PROPAGANDA	0	0	0	0
TRCKA	0	0	0	0
PARIS	4,670	0	0	4,670
DIOMEDE	159	0	0	159

Display drive information

Use the **query drive** command to display information about a drive located in a server-attached library. Use this command to validate whether all drives are online, as shown in Example 13-18.

Example 13-18 Query drive command to discover drive details

```
tsm: ATLANTIC>query drive
```

Library Name	Drive Name	Device Type	On-Line
3582_SHARED	DR00	LTO	Yes
3582_SHARED	DR01	LTO	Yes

Query a library volume

Use the **query libvolume** command to display information about one or more volumes that have been previously checked into an automated library for use by the Tivoli Storage Manager server. This command includes both scratch and private tapes, as shown in Example 13-19.

Example 13-19 Query libvolume command

```
tsm: ATLANTIC>query libvolume
```

Library Name	Volume Name	Status	Owner	Last Use	Home Element	Device Type
3582_SHARED	020AKK	Private	ATLANTIC	Data	4,096	LTO
3582_SHARED	021AKK	Scratch			4,097	LTO
3582_SHARED	026AKK	Scratch			4,102	LTO
3582_SHARED	027AKK	Scratch			4,116	LTO
3582_SHARED	028AKK	Scratch			4,104	LTO
3582_SHARED	029AKK	Scratch			4,103	LTO

3582_SHARED	030AKK	Scratch	4,106	LTO
3582_SHARED	031AKK	Scratch	4,107	LTO
3582_SHARED	038AKK	Scratch	4,114	LTO
3582_SHARED	039AKK	Scratch	4,115	LTO

Number of scratch tapes

You can use an SQL query to display the number of scratch tapes available in the library, as shown in Example 13-20. You want to be sure not to run out of scratch tapes, or backup and migration operations may fail.

Example 13-20 SQL statement to query for scratch tapes

```
tsm: ATLANTIC> select count(*) as NUM_SCRATCH_TAPES from LIBVOLUMES where STATUS
='Scratch'
```

NUM_SCRATCH_TAPES

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Sequential access storage pool media

Use the `query media` command to display information about the sequential access primary and copy storage pool volumes, as shown in Example 13-21.

Example 13-21 Query media command

```
tsm: ATLANTIC> query media * stg=offdata
```

Volume Name	State	Location	Automated LibName
-----	-----	-----	-----
039AKK	Mountable in library		3582_SHARED
040AKK	Mountable in library		3582_SHARED

Display file space information by storage pool

Use the `query occupancy` command to display information about where a client's file spaces are stored and how much space they occupy. This command can be used to display information about file spaces that are stored in primary or copy storage pools, as shown in Example 13-22.

Example 13-22 Query occupancy command

```
tsm: ATLANTIC> query occupancy
```

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied	Logical Space Occupied
-----------	------	----------------	------	-------------------	-----------------	-------------------------	------------------------

				(MB)	(MB)
ATLANTIC	Bkup /	10	DISKDATA	1,002	12.09
ATLANTIC	Bkup /usr	11	DISKDATA	20,324	1,223.98
ATLANTIC	Bkup /TSM4SBR	12	DISKDATA	4	1,051.15
DIOMEDE	Bkup \\diomede-\c\$	1	DISKDATA	4,263	158.78
PARIS	Bkup \\k1chv4f-\c\$	1	DISKDATA	31,167	4,520.61
PARIS	Bkup \\k1chv4f-\c\$	1	DISKDIRS	2,734	1.83
PARIS	Bkup \\k1chv4f-\c\$	1	OFFDATA	2,166	73.67
PARIS	Bkup \\k1chv4f-	1	TAPEDATA	2,166	73.67

Query one or more pending mount requests

Use the **query request** command to display information about one or more pending mount requests, as shown in Example 13-23. Mount requests are issued for any library or manual drive that does not have a separate library manager configured.

Example 13-23 Query request command

```
tsm: ATLANTIC> query request
ANR8352I Requests outstanding:
ANR8323I 003: Insert ANY volume 041AKK R/W into entry/exit port of library
3582_SHARED within 60 minute(s); issue 'REPLY' along with the request ID when
ready.
```

Query one or more storage pools

Use the **query stgpool** command to display information about one or more storage pools, as shown in Example 13-24.

Example 13-24 Command to query the server's storage pools

```
tsm: ATLANTIC>query stgpool
```

Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Pct Migr	High Mig Pct	Low Mig Pct	Next Storage Pool
DISKDATA	DISK	12 G	56.7	56.7	80	30	TAPEDATA
DISKFILE	SEQF-DC	0.0 M	0.0	0.0	90	70	TAPEDATA
NONE	DISK	0.0 M	0.0	0.0	90	70	
OFFDATA	LT02-DC	409,600,000 G	0.0				

OFFDIRS	LT02-DC	0.0 M	0.0			
TAPEDATA	LT02-DC	409,600,0-	0.0	0.0	90	70
		00 G				
TAPEDATA_LF	LT02C	0.0 M	0.0	0.0	90	70

Query one or more storage pool volumes

Use the **query volume** command to display information about one or more storage pool volumes, as shown in Example 13-25. This command displays information about volumes defined to Tivoli Storage Manager. Scratch volumes are not displayed by this command, since they have only been checked into a library as a scratch volume, but not yet defined or used by Tivoli Storage Manager.

Example 13-25 Query volume command

tsm: ATLANTIC>query volume						
Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity	Pct Util	Volume Status	
/tsm/stg/dirm/0000001B.- BFS	DISKDIRS	DIRM-DC	1.8	100.0	Full	
/tsm/stg/dirm/0000002A.- BFS	DISKDIRS	DIRM-DC	64.0	0.0	Filling	
/tsm/stg/diskdata/ddvol- _01.dsm	DISKDATA	DISK	2,048.0	41.1	On-Line	
/tsm/stg/diskdata/ddvol- _02.dsm	DISKDATA	DISK	2,048.0	49.2	On-Line	
/tsm/stg/diskdata/ddvol- _03.dsm	DISKDATA	DISK	2,048.0	71.2	On-Line	
/tsm/stg/diskdata/ddvol- _04.dsm	DISKDATA	DISK	2,048.0	66.6	On-Line	
/tsm/stg/diskdata/ddvol- _05.dsm	DISKDATA	DISK	2,048.0	68.4	On-Line	
/tsm/stg/diskdata/ddvol- _06.dsm	DISKDATA	DISK	2,048.0	43.7	On-Line	
020AKK	TAPEDATA_LF	LT02C	381,468.0	0.7	Filling	
022AKK	TAPEDATA	LT02-DC	409,600.0	0.0	Filling	
023AKK	OFFDATA	LT02-DC	409,600.0	0.0	Filling	

13.6.2 Client-server activity

In this section we describe important Tivoli Storage Manager queries for client-server activities. The queries are listed in alphabetical order.

Search activity log for messages

One of the basic commands to access the activity log is the **query actlog** command. Use the **query actlog** command to search the server activity log for messages, as shown in Example 13-26. You can select messages by date/time range, message number, or string expression. If the command is issued without parameters, all messages that were generated in the last hour are displayed.

Example 13-26 Query actlog command output

```
tsm: ATLANTIC>query actlog
02/27/2006 09:20:14      ANR8323I 001: Insert ANY volume 041AKK R/W into
                           entry/exit port of library 3582_SHARED within 60
                           minute(s); issue 'REPLY' along with the request ID
                           when ready. (SESSION: 5, PROCESS: 1)
02/27/2006 09:20:15      ANR2017I Administrator ADMIN issued command: QUERY
                           PROCESS (SESSION: 5)
02/27/2006 09:20:20      ANR2017I Administrator ADMIN issued command: QUERY REQ
                           (SESSION: 5)
02/27/2006 09:20:20      ANR8352I Requests outstanding: (SESSION: 5)
02/27/2006 09:20:20      ANR8323I 001: Insert ANY volume 041AKK R/W into
                           entry/exit port of library 3582_SHARED within 60
                           minute(s); issue 'REPLY' along with the request ID
                           when ready. (SESSION: 5)
02/27/2006 09:20:21      ANR2017I Administrator ADMIN issued command: QUERY REQ
                           (SESSION: 5)
02/27/2006 09:20:21      ANR8352I Requests outstanding: (SESSION: 5)
02/27/2006 09:20:21      ANR8323I 001: Insert ANY volume 041AKK R/W into
                           entry/exit port of library 3582_SHARED within 60
                           minute(s); issue 'REPLY' along with the request ID
                           when ready. (SESSION: 5, PROCESS: 1)
02/27/2006 09:20:27      ANR2017I Administrator ADMIN issued command: HELP q
                           (SESSION: 5)
02/27/2006 09:20:28      ANR2017I Administrator ADMIN issued command: QUERY
                           ACTLOG search=sta_diomede msgno=8337 (SESSION: 3).
```

To search for warning messages, use the query shown in Example 13-27.

Example 13-27 Using the search parameter with query actlog

```
tsm: ATLANTIC>query actlog search="ANR???W"
```

Date/Time	Message
-----	-----
02/27/2006 08:33:01	ANR0568W Session 51 for admin ADMIN (AIX) terminated - connection with client severed. (SESSION: 51)
02/27/2006 08:33:13	ANR8216W Error sending data on socket 22. Reason 32. (SESSION: 276)

02/27/2006 08:43:27 ANR2121W ATTENTION: More than 28 MB of the database has changed and the last database backup was more than 24 hours ago. Use the BACKUP DB command to provide for database recovery.

02/27/2006 09:09:55 ANR8925W Drive DRO0 in library 3582_SHARED has not been confirmed for use by server STA_DIOMEDE for over 900 seconds. Drive will be reclaimed for use by others.

Query scheduled and completed events

Use the **query event** command to display scheduled and completed events. This command takes two forms, depending on whether the query applies to scheduled client operations or scheduled administrative commands.

Each scheduled client operation and administrative command is called an event. The server tracks each scheduled event and records the results of each function in the database. An event record is created whenever processing of a scheduled command is started or missed.

The **query event** command may display information about an event for which there is no event record. For example, if you request information about a scheduled event in the future, the **query event** command displays the status of *Future* for the event even though no event record has been created for this event. In addition, the **query event** command displays the status for past events whose event records have already been removed from the database. In this case, the server returns the status of *Uncertain*, because the actual event status cannot be determined without the event records. Without parameters, the command displays scheduled client events, as shown in Example 13-28.

Example 13-28 Query event command

```
tsm: ATLANTIC> q event * *
```

Scheduled Start	Actual Start	Schedule Name	Node Name	Status
02/27/06 00:00:00	02/27/06 00:30:11	INCR_DAILY PROPAGANDA		Completed
02/27/06 01:00:00	02/27/06 02:00:10	INCR_DAILY LOSGATOS		Completed
2/27/06 03:00:00		INCR_DAILY DIOMEDE		Future
02/27/06 03:30:00		INCR_DAILY ATLANTIC		Future

To query scheduled administrative events use the type=administrative parameter, as shown in Example 13-29.

Example 13-29 Query event type syntax

```
tsm: ATLANTIC> query event * type=administrative
```

Scheduled Start	Actual Start	Schedule Name	Status
02/27/06 06:00:00	02/27/06 06:00:20	MIGRATION_START	Completed
02/27/06 11:00:00		MIGRATION_STOP	Future
02/27/06 12:00:00		EXPIRATION	Future
02/27/06 13:00:00		RECLAIM_START	Future
02/27/06 13:00:00		RECL_DRM_START	Future
02/27/06 18:00:00		RECLAIM_STOP	Future
02/27/06 18:00:00		RECL_DRM_STOP	Future
02/27/06 19:00:00		DBBACKUP	Future

Query one or more server processes

Use the **query process** command to display information about one or more active background processes, as shown in Example 13-30.

Example 13-30 Query process command

```
tsm: ATLANTIC> q process
```

Process Number	Process Description	Status
3	Database Backup	Full backup: 0 pages of 8383 backed up. Waiting for mount of scratch volume (3 seconds).

Query restartable restore sessions

Use the **query restore** command to display information about the restartable restore sessions recorded in the server database. Certain restore operations invoke a special protocol with Tivoli Storage Manager. These special restores are called restartable restore sessions. It is desirable to know which restores are using this protocol for two reasons:

1. Restartable restore sessions that fail for some reason (network outage, client failure, or server outage) can be restarted from the last committed transaction where the restore operation left off. This can save valuable time because these restore operations do not have to return to the beginning of the operation. The **query restore** command displays the restartable restore sessions.

- Restartable restore sessions lock the file space and do not allow files to be moved off of sequential volumes. The **query restore** command displays the restartable restore sessions and their associated file space, as shown in Example 13-31. The **cancel restore** command can be used to cancel a restartable restore session.

Example 13-31 Query restore for any restartable restore processes

tsm: ATLANTIC> query restore				
Sess Number	Restore State	Elapsed Minutes	Node Name	Filespace Name
-1	Restartable	1	ATLANTIC	/usr

Query one or more client sessions

Use the **query session** command to display information about one or more administrative and client node sessions, as shown in Example 13-32. For backup and restore, there are usually at least two sessions, and sometimes more—one is a control session.

Example 13-32 Query session

tsm: ATLANTIC> query session								
Sess Name	Comm. Number	Sess Method	Wait State	Bytes Time	Bytes Sent	Sess Recv	Platform	Client
112	Tcp/Ip	IdleW	4 S	1.1 K	803	Node	AIX	
ATLANTIC								
113	Tcp/Ip	RecvW	0 S	1.3 K	719.4 M	Node	AIX	
ATLANTIC								
Sess Name	Comm. Number	Sess Method	Wait State	Bytes Time	Bytes Sent	Sess Recv	Platform	Client
145	Tcp/Ip	IdleW	0 S	1.1 K	803	Node	AIX	ATLANTIC
236	Tcp/Ip	RecvW	0 S	1.3 K	719.4 M	Node	AIX	ATLANTIC
145	Tcp/Ip	Run	0 S	111.6 K	106	Admin	WinNT	ADMIN
236	Tcp/Ip	Run	0 S	10.8 K	706	Admin	AIX	ADMIN

13.7 Storage media management

This section shows you how to use Tivoli Storage Manager removable media (tapes or optical media), how to label them, and how to manage the many possible stages a tape can have. When the Tivoli Storage Manager accesses a removable media volume, it checks the volume name in the label header to ensure that the correct volume is accessed. Although we use the term *tape* for simplicity, this section applies equally to optical media.

Tape is a vital component of the storage hierarchy. When you start using Tivoli Storage Manager, you have to create storage pools to hold all your data. After a storage pool is defined, you also need to define volumes to the storage pool so that you have space to store the data. Tivoli Storage Manager allows you to use and reuse removable media to store data.

13.7.1 Tape use overview

All tape volumes must be labeled before they can be used. A volume can be either explicitly defined or not. If you want a volume to be used only when it is requested by name, then you *define* it to Tivoli Storage Manager. A defined volume is a private volume and is assigned to a specific storage pool. A volume that is not defined is a scratch volume. A storage pool can request available scratch volumes up to the number specified for that storage pool.

How does a tape get used in Tivoli Storage Manager?

- ▶ Tapes are labelled and checked into the library. In a manual library, checking in simply means storing them (for example, on shelves). Checking in to an automated library means adding media to the library volume inventory. You have to decide whether to check in as private or scratch volumes. Using scratch volumes is more convenient in most cases.
- ▶ Tapes get used in a number of Tivoli Storage Manager operations (client backup, archive, and HSM operations, server database backups, storage pool backups, migrations, and reclamations). Tapes are selected automatically for each of these operations according to server policies and availability.
- ▶ Some tapes are kept onsite and others are sent off-site for disaster recovery purposes.
- ▶ The data on a tape volume changes over time as a result of:
 - Expiration of files.
 - Movement and deletion of file spaces by an administrator.
 - Automatic reclamation of media. The amount of data on the volume and the reclamation threshold set for the storage pool affects when the volume

is reclaimed. When the volume is reclaimed, any valid, unexpired data is moved to other volumes or possibly to another storage pool (for storage pools with single-drive libraries).

When a volume becomes empty because all valid data either expires or is moved to another volume, the volume is available for reuse. The empty volume becomes a scratch volume again if it was initially a scratch volume.

If an off-site volume becomes empty, you are informed that you can bring it back onsite for reuse.

- ▶ You determine when the media has reached its end of life, that is, when you do not want to use it any more either because it is too old to reliably store data or because you are upgrading to newer tape technology.

Figure 13-8 shows this process.

We give more information about physical location of tapes in 13.7.3, “On-site and off-site tape management” on page 430.

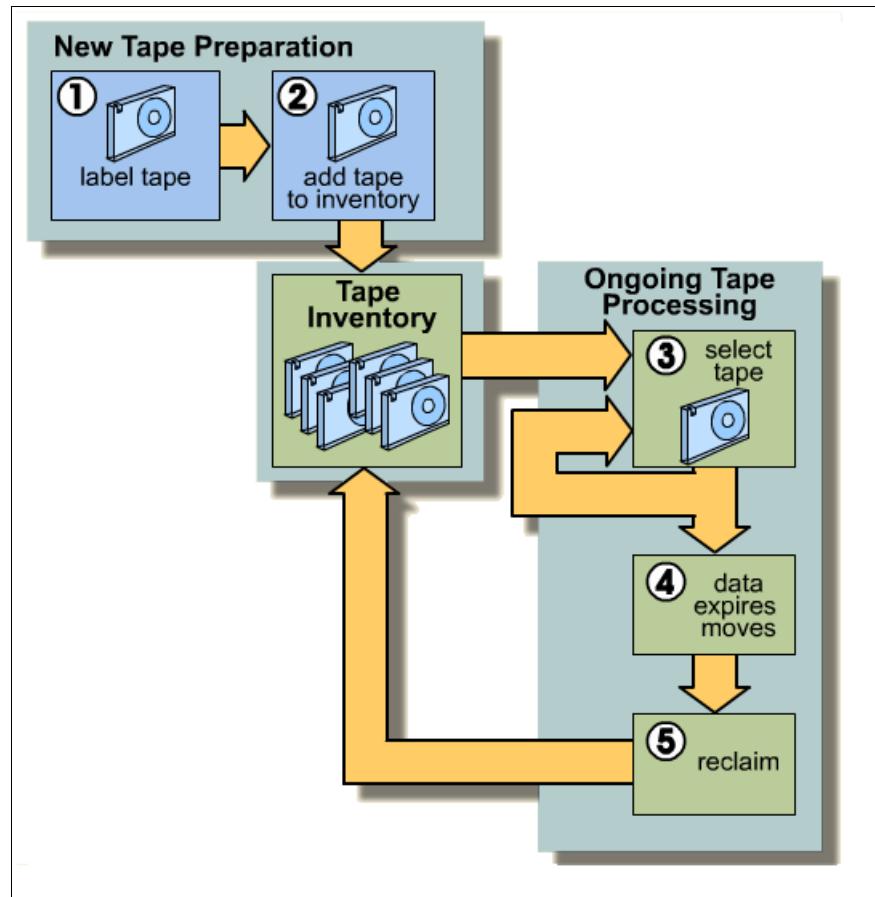


Figure 13-8 How Tivoli Storage Manager tapes are processed

13.7.2 Label and check in tapes

The **label libvolume** command requires parameters to specify:

- ▶ The name of the library where the storage volume is located
- ▶ The name of the storage volume
- ▶ Whether to overwrite a label on the volume
- ▶ Whether to search an automated library for volumes for labeling
- ▶ How to assign the labels:
 - To prompt for volume names in SCSI libraries
 - To read and use the barcode label in SCSI, 349X, and ACSLS libraries

- ▶ Whether to check in the volume to the scratch pool or as a private volume
- ▶ The type of device (applies to 349X libraries only)

Depending on the library that you have (349x, SCSI, or MANUAL), the command syntax may be slightly different. For further details, type:

```
help label libvolume
```

The **label libvolume** command requires at least one drive that is not in use by any other Tivoli Storage Manager process. If there are mounted but idle volumes, use the **dismount volume** command to dismount the idle volume and make the drive available. By default, the **label libvolume** command does not overwrite an existing label. Use the **OVERWRITE=YES** parameter to change this.

Attention: Overwriting an existing volume label destroys all of the data that resides on the volume. Before relabeling a volume that still contains valid data, you can either move the data (**move data** command) or delete the contents of the volume (**delete volume** command with *discarddata=yes*). The labels on VolSafe volumes can be overwritten only once.

To label new tapes (scratch tapes) in a SCSI library with no barcode reader, follow Example 13-33. You will be prompted to enter a label for each tape in turn.

Example 13-33 Labeling tapes without barcodes

```
tsm: ATLANTIC> label libv MYLIB search=yes labelsource=prompt checkin=scratch
ANS8003I Process number 11 started.
```

```
tsm: ATLANTIC> query request
ANR8809I 011: Please provide the label name for the volume in slot element 34
of library MYLIB by issuing REPLY n LABEL=xxx within 60 minutes, where n is
the request ID and xxx is the desired label name.
```

```
tsm: ATLANTIC> reply 11 label=043akk
ANR8499I Command accepted.
```

```
tsm: ATLANTIC> query actlog search=043akk
```

Date/Time	Message
<hr/>	
02/14/06 13:56:29	ANR2017I Administrator TSMADMIN1 issued command: REPLY 11 label=043AKK
02/14/06 13:56:45	ANR8810I Volume 043AKK has been labeled in library MYLIB.
02/14/06 13:56:58	ANR8427I CHECKIN LIBVOLUME for volume 043AKK in library MYLIB completed successfully.
02/14/06 13:57:09	ANR2017I Administrator TSMADMIN1 issued command: QUERY ACTLOG search=043AKK

Checking in tapes in a library with the barcode reader is shown in Example 6-18 on page 242.

If you have a manual library (for example, a single stand-alone 8-mm drive) with no barcode reader, specify the label you want to use, as shown in Example 13-34.

Example 13-34 Manual library tape management

```
tsm: ATLANTIC> label libvolume 8mmlib 043CC1 overwrite=yes
ANS8003I Process number 12 started.

tsm: ATLANTIC> query process
Process Process Description Status
Number
-----
12 LABEL LIBVOLUME      ANR8804I Labelling volume 043CC in library
8MMLIB.

tsm: ATLANTIC> query actlog search=043CC

Date/Time          Message
-----
02/19/06 13:07:25 ANR2017I Administrator TSMADMIN1 issued command: LABEL
                   libvolume 8MMLIB 043CC overwrite=yes
02/19/06 13:07:25 ANR8326I 012: Mount 8MM volume 043CC R/W in drive RMT1
                   (/dev/mt1) of library 8MMLIB within 60 minutes.
02/19/06 13:09:41 ANR8372I 012: Remove 8MM volume 043CC from drive RMT1
                   (/dev/rmt1) of library 8MMLIB.
02/19/06 13:09:41 ANR8800I LABEL LIBVOLUME for volume 043CC in library
                   8MMLIB completed successfully.
02/19/06 13:09:57 ANR2017I Administrator TSMADMIN1 issued command: QUERY
                   ACTLOG search=043CC
```

Tip: Although Tivoli Storage Manager allows you to use a volume identification longer than six characters, we strongly recommend that you use up to six alphanumeric characters for the label (also known as VOLSER or Volume ID). This should be compatible with other ANSI styled label systems.

13.7.3 On-site and off-site tape management

Detailed information about this topic is provided in Chapter 19, “Disaster Recovery Manager” on page 589. We simply summarize the process here. The distinction between on-site data and off-site data copies is a key component to successfully handling many tape management procedures and one of the key concepts for Tivoli Storage Manager.

For our discussion we assume that all data that is available in the company is on-site data. All data that is remotely stored in another location is off-site data.

Figure 13-9 shows on-site and off-site tape volumes.

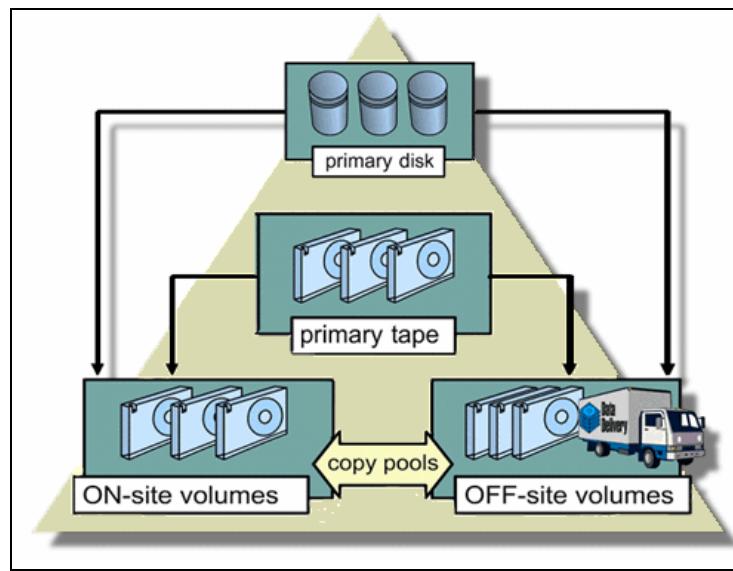


Figure 13-9 On-site and off-site distinction

Tapes used for on-site data are copied to different tapes to be sent to an off-site location. Tivoli Storage Manager keeps track of all volumes and their locations, on-site and off-site.

Figure 13-10 shows a typical tape management with enhanced control of the actual state of the tapes.

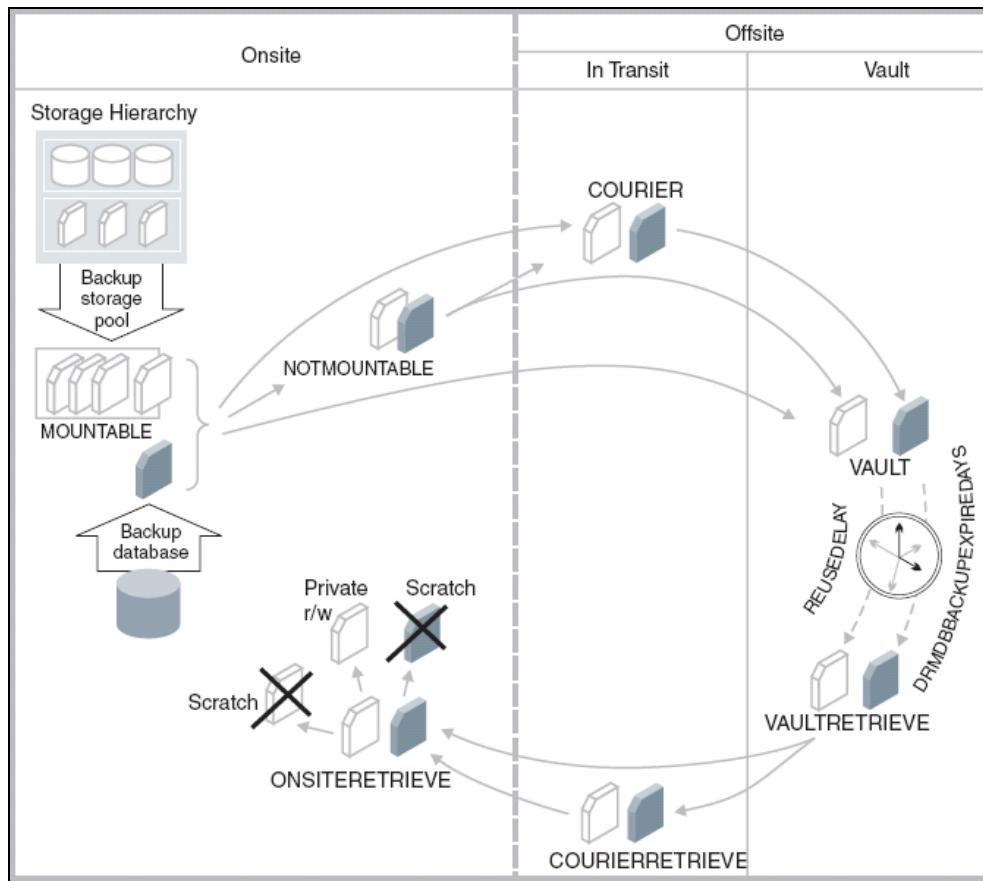


Figure 13-10 IBM Tivoli Storage Manager and tape life cycle

Providing that all of your primary storage pools are being backed up, then under normal conditions, the off-site tapes contain exactly the same versions of valid data that you have on-site. This means that on-site and off-site volumes mirror the same data, correct to the time of the last storage pool backup operation. This does not mean that you have the same amount of tapes, but simply shows that what you have “inside” is the same that you have “outside” (regardless of the number of tapes).

Figure 13-11 shows how data is generically processed on tape from the moment the data is backed up until it is sent to the off-site location.

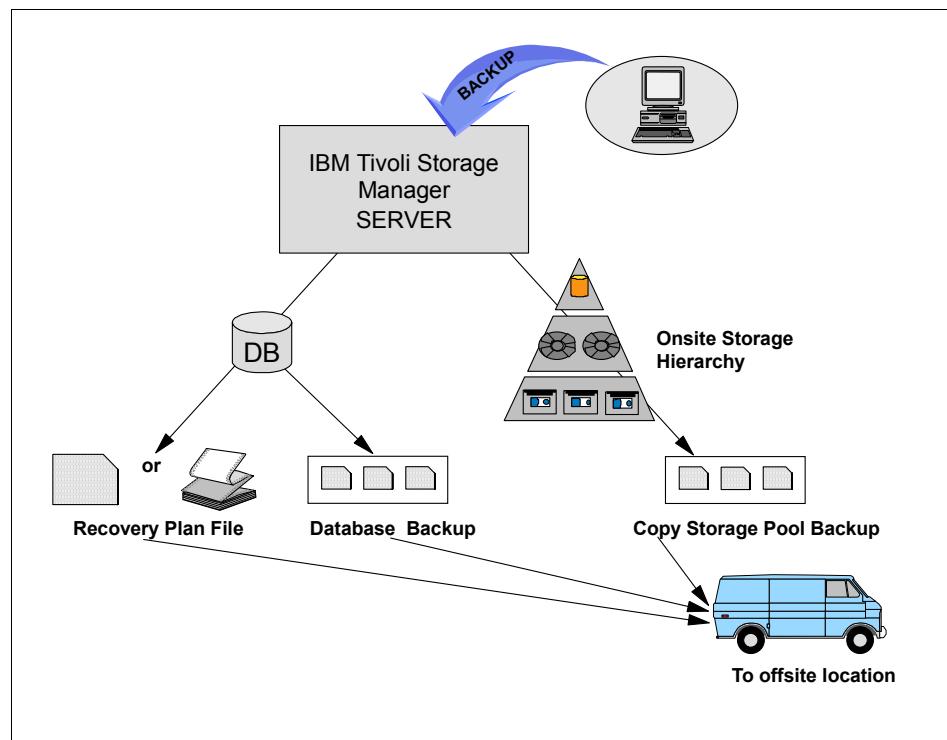


Figure 13-11 Tivoli Storage Manager tape processing

13.7.4 Moving data from on-site to off-site

The commands explained in this section show how to move data from onsite to off-site. Note that Tivoli Disaster Recovery Manager (see Chapter 19, “Disaster Recovery Manager” on page 589) automatically performs most of the tape movement operations described here, reducing the need for generating, testing, and maintaining separate scripts.

For standalone tape drives (known as manual libraries in Tivoli Storage Manager),, Tivoli Storage Manager sends messages to request that volumes be mounted when they are needed. When Tivoli Storage Manager needs to write to a tape, it first tries to write to a previously used tape in the storage pool with enough room for new data (within the restrictions of collocation, if enabled). If that is not possible, Tivoli Storage Manager asks to mount a SCRATCH (unused) tape for use. In manual libraries, there is no inventory, that is, the command **query**

1ibvolume does not apply. Therefore there is no concept of checking volumes in and out.

For devices in automated libraries (such as a tape autochanger), Tivoli Storage Manager interacts with the library to mount volumes, but sends messages when the library needs attention from an operator. Tivoli Storage Manager also tracks the inventory of media in each automated library.

The steps that you need to perform to send data off-site are:

1. Back up your vital data to the copy storage pools.
2. List all volumes that must be sent off-site.
3. Check out volumes from the library.
4. Update the volume location to off-site.

Back up your vital data

Use the **backup stgpool** command to create copies of files that reside in a primary storage pool and store them in a copy storage pool, as shown in Example 13-35. File versions are only copied if they do not already exist in the copy storage pool. If a file is already present in the specified copy storage pool, then it is not recopied. However, if a copy of a physical file already exists in the copy storage pool, but the copy is marked damaged, a new copy will be created, provided that the primary physical file is not also marked damaged. The following commands back up on-site data from the DISKDATA and DISKDIRS storage pools to the OFFDATA and DISKDIRS storage pools, respectively. This task can also be automated using a server script, as shown in Example 12-5 on page 380.

Example 13-35 Creating off-site backups

```
tsm: ATLANTIC> backup stgpool diskdata offdata
ANR2017I Administrator TSMADMIN1 issued command: BACKUP STGPOOL diskdata
offdata
ANR0984I Process 23 for BACKUP STORAGE POOL started in the BACKGROUND at
15:12:44.
ANR2110I BACKUP STGPOOL started as process 23.
ANR1210I Backup of primary storage pool DISKDATA to copy storage pool OFFDATA
started as process 23.
ANR8337I 3582SHARED volume 044AKK mounted in drive RMT1 (/dev/rmt1).
ANR1340I Scratch volume 044AKK is now defined in storage pool OFFDATA.
ANR1212I Backup process 23 ended for storage pool DISKDATA.
ANR0986I Process 23 for BACKUP STORAGE POOL running in the BACKGROUND processed
146 items for a total of 12,578,213 bytes with a completion state of SUCCESS at
15:16:32.
ANR1214I Backup of primary storage pool DISKDATA to copy storage pool OFFDATA
has ended. Files Backed Up: 146, Bytes Backed Up: 12578213, Unreadable Files:
0, Unreadable Bytes: 0.
```

```
tsm: ATLANTIC> query volume * stg=offdata
```

Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity (MB)	Pct Util	Volume Status
044AKK	OFFDATA	COFFSITE	5,000.0	0.2	Filling

```

tsm: ATLANTIC> backup stgpool diskdirs offdirs
ANR2017I Administrator TSMADMIN1 issued command: BACKUP STGPOOL diskdirs
offdirs
ANR0984I Process 28 for BACKUP STORAGE POOL started in the BACKGROUND at
15:17:44.
ANR2110I BACKUP STGPOOL started as process 28.
ANR1210I Backup of primary storage pool DISKDIRS to copy storage pool OFFDIRS
started as process 28.
ANR8337I 3582SHARED volume 034AKK mounted in drive RMT1 (/dev/rmt0).
ANR1340I Scratch volume 034AKK is now defined in storage pool OFFDIRS.
ANR1212I Backup process 23 ended for storage pool DISKDIRS.
ANR0986I Process 28 for BACKUP STORAGE POOL running in the BACKGROUND processed
146 items for a total of 106,496 bytes with a completion state of SUCCESS at
15:18:21.
ANR1214I Backup of primary storage pool DISKDIRS to copy storage pool OFFDIRS
has ended. Files Backed Up: 146, Bytes Backed Up: 106496, Unreadable Files:
0, Unreadable Bytes: 0.

tsm: ATLANTIC> query volume * stg=offdirs

| Volume Name | Storage Pool Name | Device Class Name | Estimated Capacity (MB) | Pct Util | Volume Status |
|-------------|-------------------|-------------------|-------------------------|----------|---------------|
| 034AKK      | OFFDIRS           | COFFSITE          | 5,000.0                 | 0.1      | Filling       |


```

List volumes to send off-site

Use the **query volume** command to list all off-site tapes that need to go to the off-site location. In our example, we assume that an off-site tape is any tape that belongs to the copy storage called OFFDATA and OFFDIRS that is still available in the library, and therefore, must be moved to a separate safe location (a vault). By using the ACCESS and STATUS parameters, we can distinguish between volumes newly added to the off-site pool, which therefore need to be taken off-site, and volumes already safely off-site. These are shown in Example 13-36.

Example 13-36 More query volume command syntax examples

```

tsm: ATLANTIC> query volume * access=readwrite,readonly status=full,filling
stgpool=offdata

| Volume Name | Storage Pool Name | Device Class Name | Estimated Capacity (MB) | Pct Util | Volume Status |
|-------------|-------------------|-------------------|-------------------------|----------|---------------|
|-------------|-------------------|-------------------|-------------------------|----------|---------------|


```

044AKK	OFFDATA	COFFSITE	5,000.0	0.2	Filling
tsm: ATLANTIC> query volume * access=readwrite,readonly status=full,filling stgpool=offdirs					
Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity (MB)	Pct Util	Volume Status
034AKK	OFFDATA	COFFSITE	5,000.0	0.1	Filling

The **query volume** command lists the volumes just used, 044AKK and 034AKK. The off-site movement operation must take into account two types of volumes: FULL and FILLING. You must issue the command for both statuses, so that you move all needed volumes.

We recommend that you keep a record of these volumes for tracking purposes.

Checking out volumes from the library

This command is only used if you have an automated tape library. Use the **checkout libvolume** commands to remove Tivoli Storage Manager control of a storage volume located in a library. You must use the same volume listing that you got from the previous **query volume** section. In our case, the volumes are 044AKK and 034AKK, as shown in Example 13-37.

Example 13-37 checkout library volume command

```
tsm: ATLANTIC> checkout libv 3582SHARED 044AKK

ANR2017I Administrator TSMADMIN1 issued command: CHECKOUT libv 3582SHARED
044AKK
ANR0984I Process 27 for CHECKOUT LIBVOLUME started in the BACKGROUND at
16:00:11.
ANR8434I CHECKOUT LIBVOLUME: Operation for volume 044AKK in library 3582SHARED
started as process 27.
ANR8336I Verifying label of 3582SHARED volume 044AKK in drive RMT2 (/dev/rmt1).
ANR8307I 008: Remove 3582SHARED volume 044AKK from slot with element number 21
of library 3582SHARED; issue 'REPLY' along with the request ID when ready.
```

```
tsm: ATLANTIC> reply 8
ANR8499I Command accepted.
ANR8438I CHECKOUT LIBVOLUME for volume 044AKK in library 3582SHARED completed
successfully.
ANR0985I Process 27 for CHECKOUT LIBVOLUME running in the BACKGROUND completed
with completion state SUCCESS at 16:02:46.
```

```
tsm: ATLANTIC> checkout libv 3582SHARED 034AKK
```

```
ANR2017I Administrator TSMADMIN1 issued command: CHECKOUT libv 3582SHARED  
034AKK  
ANR0984I Process 16 for CHECKOUT LIBVOLUME started in the BACKGROUND at  
16:03:11.  
ANR8434I CHECKOUT LIBVOLUME: Operation for volume 034AKK in library 3582SHARED  
started as process 16.  
ANR8336I Verifying label of 3582SHARED volume 034AKK in drive RMT2 (/dev/rmt1).  
ANR8307I 009: Remove 3582SHARED volume 034AKK from slot with element number 25  
of library 3582SHARED; issue 'REPLY' along with the request ID when ready.  
  
tsm: ATLANTIC> reply 9  
ANR8499I Command accepted.  
ANR8438I CHECKOUT LIBVOLUME for volume 034AKK in library 3582SHARED completed  
successfully.  
ANR0985I Process 27 for CHECKOUT LIBVOLUME running in the BACKGROUND completed  
with completion state SUCCESS at 16:03:49.
```

Tip: A REPLY command is not required if you specify a wait time of zero using the optional WAITTIME parameter with the **checkin libvolume** command. The default wait time is 60 minutes.

Update volume location to off-site

Before you update the volume information to the off-site location, you have to make sure that the desired volumes have been physically sent and delivered to the off-site location. To avoid a situation in which the volumes are requested for mounts while in transition to the off-site location, you can set the volumes to unavailable while in transition by using the **update volume** command with STATUS set to UNAVAILABLE.

You can change the off-site location name to one suitable for your site. Once in the off-site location, Tivoli Storage Manager never asks for volumes with a status of off-site to be mounted.

The next example assumes that you have the volumes 044AKK and 034AKK from the previous **backup stgpool** commands and the volumes have been delivered to the off-site location. Now you want to update their location to "ITSO vault", as shown in Example 13-38.

Example 13-38 Update volume access location syntax example

```
tsm: ATLANTIC> update volume * access=offsite location="ITSO vault"  
whereaccess=readwrite,readonly wherestg=offdata wherestatus=full,filling
```

ANR2207I Volume 044AKK updated.

```
tsm: ATLANTIC> query volume 044AKK format=detailed  
Volume Name: 044AKK
```

```
Storage Pool Name: OFFDATA
Device Class Name: COFFSITE
Estimated Capacity (MB): 5,000.0
Pct Util: 0.2
Volume Status: Filling
Access: Offsite
Pct. Reclaimable Space: 99.8
Scratch Volume?: Yes
In Error State?: No
Number of Writable Sides: 1
Number of Times Mounted: 1
Write Pass Number: 1
Approx. Date Last Written: 02/22/06 15:16:32
Approx. Date Last Read: 02/22/06 15:16:32
Date Became Pending:
Number of Write Errors: 0
Number of Read Errors: 0
Volume Location: ITSO vault
Last Update by (administrator): TSMADMIN1
Last Update Date/Time: 02/22/06 15:17:21
```

```
tsm: ATLANTIC> update volume * access=offsite location="ITSO vault"
whereaccess=readwrite,readonly wherestg=offdirsa wherestatus=full,filling
```

```
ANR2207I Volume 034AKK updated.
```

```
tsm: ATLANTIC> query volume 034AKK format=detailed
Volume Name: 034AKK
Storage Pool Name: OFFDIRS
Device Class Name: COFFSITE
Estimated Capacity (MB): 5,000.0
Pct Util: 0.1
Volume Status: Filling
Access: Offsite
Pct. Reclaimable Space: 99.9
Scratch Volume?: Yes
In Error State?: No
Number of Writable Sides: 1
Number of Times Mounted: 1
Write Pass Number: 1
Approx. Date Last Written: 02/22/06 15:18:21
Approx. Date Last Read: 02/22/06 15:18:21
Date Became Pending:
Number of Write Errors: 0
```

Number of Read Errors: 0
Volume Location: ITS0 vault
Last Update by (administrator): TSMADMIN1
Last Update Date/Time: 02/22/06 15:19:21

13.7.5 Off-site tape management to on-site

In this section we show how to move off-site volumes to the on-site location. These off-site volumes either have no active data on them (status of EMPTY) or are being returned to recreate damaged data in a primary storage pool.

Off-site tapes can be seen as your second good copy of critical data. As you perform backup and archive operations, all data is saved in storage pools, which are the basic unit for on-site operations. When you perform a **backup stgpool** command, Tivoli Storage Manager verifies which data has not previously been sent to off-site yet and then performs the copy operation of any new data. This means the operation is incremental and hence minimizes the amount of time required to execute it.

As backup and archive data age and expire, the off-site tapes contain less and less active data. Off-site tape reclamation consolidates these tape volumes, replacing the partially filled tapes with full and empty tapes. The newly emptied tapes remain in a *pending* state until after the reuse delay period has expired. At this time the status of the tape changes to EMPTY. Empty tapes can be brought back on-site and returned to the scratch pool.

These are the steps that you need to perform to receive tapes from off-site:

1. Identify the volumes to be brought on-site.
2. Update the volume location.
3. Move the tape volumes from off-site to on-site.
4. Check storage volumes in to a library.

Identify volumes to bring on-site

You must first check which volumes are available to return on-site. The following **query volume** command shows two volumes (040AKK and 041AKK) that are now available to be brought back, as shown in Example 13-39.

Example 13-39 More examples of the query volume command

```
tsm: ATLANTIC> query volume * access=offsite status=empty
```

Volume Name	Storage Pool Name	Device Class Name	Estimated Capacity (MB)	Pct Util	Volume Status
-------------	-------------------	-------------------	-------------------------	----------	---------------

040AKK	OFFDATA	COFFSITE	0.0	0.0	Empty
041AKK	OFFDIRS	COFFSITE	0.0	0.0	Empty

We recommend that you keep a record of these volumes for tracking purposes and use it as a shipping list for your off-site location.

The tape volumes should now be moved from the off-site location to your on-site location.

Updating volume locations to on-site

When the previously identified tape volumes have been returned on-site, you must update the location and access mode so that the volume can be reused. In the next example, both volumes are deleted from the storage pool location and are now considered scratch volumes, as shown in Example 13-40.

Example 13-40 More update volume syntax examples

```
tsm: ATLANTIC> update volume * access=readwrite location="" wherestg=offdata  
wherestatus=empty whereaccess=offsite
```

ANR2208I Volume 040AKK deleted from storage pool OFFDATA.

```
tsm: ATLANTIC> update volume * access=readwrite location="" wherestg=offdirs  
wherestatus=empty whereaccess=offsite
```

ANR2208I Volume 041AKK deleted from storage pool OFFDIRS.

13.7.6 Checking volumes into a library

To inform the server that a new volume is available in an automated library, check in the volume with the **checkin libvolume** command or **label libvolume** command with the *checkin* option specified. When a volume is checked in, the server adds the volume to its library volume inventory. You can use the **label libvolume** command to check in and label volumes in one operation.

When you check in a volume, you must supply the name of the library and the status of the volume (private or scratch). Do not mix volumes with barcode labels and volumes without barcode labels in a library device because barcode scanning can take a long time for unlabeled volumes. Use the **checklabel=yes** (not **NO** or **BARCODE**) option on the **checkin libvolume** command when checking VolSafe volumes into a library. This is true for both ACSLS and SCSI libraries.

The volumes are checked in as scratch, because they are empty. This is demonstrated in Example 13-41. We do not specify to label them because these tapes have returned from previous use, and therefore we can use their existing labels.

Example 13-41 Checkin libvolume for searching and defining scratch tapes

```
tsm: ATLANTIC> checkin libvolume 3582SHARED search=yes status=scratch
ANR2017I Administrator TSMADMIN1 issued command: CHECKIN libvolume 3582SHARED
search=yes status=scratch
ANR0984I Process 10 for CHECKIN LIBVOLUME started in the BACKGROUND at
17:00:36.
ANR8422I CHECKIN LIBVOLUME: Operation for library 3582SHARED started as process
10.
ANR8430I Volume 040AKK has been checked into library 3582SHARED.
ANR8430I Volume 041AKK has been checked into library 3582SHARED.
ANR8431I CHECKIN LIBVOLUME process completed for library 3582SHARED; 2
volume(s) found.
ANR0985I Process 10 for CHECKIN LIBVOLUME running in the BACKGROUND completed
with completion state SUCCESS at 17:05:29.
```

Allowing swapping of volumes when the library is full

If no empty slots are available in the library when you are checking in volumes, the check-in fails unless you allow swapping. If swapping is allowed and the library is full, Tivoli Storage Manager selects a volume to eject before checking in the volume you requested. Tivoli Storage Manager ejects the volume that it selects for the swap operation from the library and replaces the ejected volume with the volume that is being checked in. Use the SWAP=YES option with the **checkin libvolume** command to allow swapping, for example:

```
checkin libvolume 3582SHARED 045AKK swap=yes
```

Tivoli Storage Manager selects the volume to eject by checking first for any available scratch volume, then for the least frequently mounted volume.

Tip: For further details about the **checkin** command and swap option, type:

```
help checkin libvolume
```

13.7.7 Reclaiming off-site tapes

Off-site storage pool volumes expire their data in the same way as on-site volumes. The expiration process run by the Tivoli Storage Manager updates the expired file version for both on-site and off-site volumes. You do not need to mount the off-site volume for this. It is done entirely as a server database update operation.

Off-site tapes also become emptier over time and need to be reclaimed. We need the reclamation process so that the size of our off-site storage pool does not grow indefinitely. We already know that reclaiming on-site volumes requires mounting the volume to be reclaimed, and copying its valid data onto a new tape, thereby freeing the empty tape for reuse. It would be very inconvenient if reclaiming off-site volumes also required them to be mounted. Fortunately, this is not the case.

When an off-site volume is eligible for reclamation, Tivoli Storage Manager will determine the ON-SITE volumes, which contain the same valid data remaining on the off-site tape. It mounts the on-site tape and copies those files onto a new or existing volume belonging to the copy storage pool. This volume is then eligible to be transported off-site and the old off-site volume now switches to PENDING and then the EMPTY state. We can then bring it back on-site for reuse.

Tivoli Storage Manager will only ask to bring the old (unused off-site) tape after you send the new tape to off-site.

13.7.8 Database backup management

Managing Tivoli Storage Manager database backups is a critical task in the total environment. Database backups should be done every day, and the copies should be moved off-site to provide disaster recovery.

The steps involved in the movement of backups from on-site to off-site, and their return, are similar to those for storage pool data. Tivoli Disaster Recovery Manager simplifies the management of on-site/off-site tape movement for both storage pool and database data. We highly recommend using Tivoli Disaster Recovery Manager.

Moving database backups off-site

The steps that you need to perform to send database backups off-site are:

1. Back up your database.
2. Identify the volumes to be taken off-site.
3. Remove volumes from the library.
4. Move the volumes off-site.

Back up your database

You can perform a backup of the database at any time by using the `backup db` command. For examples see 5.8, “Database backup” on page 210.

This task can also be automated using a server script, as shown in Example 12-1 on page 375.

Database backup volumes are tracked in a different manner than those of storage pools. Use the **query volhistory** command to identify tape volumes containing database backups. Alternately, you can use the activity log messages to identify those tapes. Assuming that the database backup has been done, the command to display the volumes is shown in Example 13-42.

Example 13-42 Querying the volume history file for db backups

```
tsm: ATLANTIC> query volhist type=dbbackup begindate=today
```

```
        Date/Time: 02/22/06 17:30:24
        Volume Type: BACKUPFULL
        Backup Series: 17
        Backup Operation: 0
        Volume Seq: 1
        Device Class: LT02
        Volume Name: 046AKK
        Volume Location:
        Command:
```

The volumes you require are those identified in the database backup with the latest time stamp.

Remove backups from library

This step only applies if your backup tapes are in a library. You can use the **checkout libvolume** command to remove database backup tapes from the library. This is the same process as that for storage pool data (see Example 13-43).

Example 13-43 Removing the db backups from the library

```
tsm: ATLANTIC> checkout libv 3582SHARED 046AKK
ANR2017I Administrator TSMADMIN1 issued command: CHECKOUT libv 3582SHARED
046AKK
ANR0984I Process 17 for CHECKOUT LIBVOLUME started in the BACKGROUND at
18:06:33.
ANR8434I CHECKOUT LIBVOLUME: Operation for volume 046AKK in library 3582SHARED
started as process 13.
ANR8336I Verifying label of 3582SHARED volume 046AKK in drive RMT2 (/dev/rmt2).
ANR8322I 011: Remove 3582SHARED volume 046AKK from entry/exit port of library
3582SHARED; issue 'REPLY' along with the request ID when ready.
```

```
tsm: ATLANTIC> reply 11
```

```
ANR2017I Administrator TSMADMIN1 issued command: REPLY 11
ANR8499I Command accepted.
```

ANR8438I CHECKOUT LIBVOLUME for volume 046AKK in library 3582SHARED completed successfully.

ANR0985I Process 17 for CHECKOUT LIBVOLUME running in the BACKGROUND completed with completion state SUCCESS at 18:07:40.

Move volumes off-site

You should move the backup volumes to your off-site location. We recommend that you track the tapes in a movement log.

Reusing backup tapes

You should keep a minimum of three days of database backup tapes. If you want to allow for holiday weekends, then a larger number, such as four or five, may be more appropriate. Our book environment uses five tapes.

The steps that you need to perform to reuse database backup tapes are:

1. Identify the volumes to be brought on-site.
2. Move the tape volumes from off-site to on-site.
3. Update the volume to scratch.
4. Check storage volumes in to a library.

Identify the volumes to be brought on-site

Database backups remain active until their entry is deleted from the volume history. However, once it has been deleted, Tivoli Storage Manager has no knowledge of the volume at all.

As there is no way to display just the oldest database backup volumes, we use the **query volhistory** command to identify all tape volumes containing database backups older than a specific number of days. The volumes you require are those with the oldest time stamp. The command shown in Example 13-44 uses nine days.

Example 13-44 Query for dbbackup volumes in the past nine days

tsm: ATLANTIC> **query volhistory type=dbbackup enddate=today-9**

```
Date/Time: 02/13/06 16:03:24
Volume Type: BACKUPFULL
Backup Series: 17
Backup Operation: 0
    Volume Seq: 1
    Device Class: LT02
    Volume Name: 023AKK
Volume Location:
Command:
```

Move the tape volumes from off-site to on-site

You should move the backup volumes from your off-site location to your site. We recommend that you track the tapes in a movement log.

Update the volume to scratch

Use the **delete volhistory** command to return the database backup volumes to scratch. Because there is no way to just delete the oldest database backup volumes, you must delete backups that are older than a specified number of days. Example 13-45 uses five days.

Example 13-45 Deleting volume history five days and older

```
tsm: ATLANTIC> delete volhistory type=dbbackup todate=today-5
```

```
Do you wish to proceed? (Yes/No) y
ANR2467I DELETE VOLHISTORY: 1 sequential volume history entries were
successfully deleted.
```

Check storage volumes in to a library

This step only applies if your backup tapes are in a library.

Use the **checkin libvolume** command (Example 13-46) to put the database backup tapes into the library. This is the same process as that for the storage pool data, which is shown in Example 13-41 on page 441.

Example 13-46 Checkin library volume syntax example

```
tsm: ATLANTIC> checkin libvolume 3582SHARED search=yes status=scratch
ANR2017I Administrator TSMADMIN1 issued command: CHECKIN LIBVOLUME 3582SHARED
search=yes status=scratch
ANR0984I Process 14 for CHECKIN LIBVOLUME started in the BACKGROUND at
19:21:12.
ANR8422I CHECKIN LIBVOLUME: Operation for library 3582SHARED started as process
14.
ANR8430I Volume 047AKK has been checked into library 3582SHARED.
ANR8431I CHECKIN LIBVOLUME process completed for library 3582SHARED; 1
volume(s) found.
ANR0985I Process 14 for CHECKIN LIBVOLUME running in the BACKGROUND completed
with completion state SUCCESS at 19:22:39.
```

13.8 Error conditions

Tivoli Storage Manager can write error information to both the Tivoli Storage Manager activity log and the operating system log. Some errors may not be related to Tivoli Storage Manager. Thus, it may detect a system failure that may

be related to hardware problems, or even a software component reporting error conditions.

13.8.1 Tivoli Storage Manager errors

Error analysis is a key point to your Tivoli Storage Manager environment. If for any reason the Tivoli Storage Manager cannot write data to a tape, it may retry the operation (using hardware built-in recovery features) or it may fail due to a non-recoverable error. The Tivoli Storage Manager will notify all error conditions to the console, the Tivoli Storage Manager activity log, or the operating system log. For example, you can check that the Tivoli Storage Manager has an error condition logged by using the **query actlog** command with the SEARCH parameter, as shown in Example 13-47.

Example 13-47 Actlog syntax used for identifying an error

```
tsm: ATLANTIC> query actlog begindate=02/01/2006 search=*error*
ANR2017I Administrator TSMADMIN1 issued command: QUERY ACTLOG
begindate=02/01/2006 search=*error*

Date/Time           Message
-----
...
02/23/06  00:50:03      ANR8302E I/O error on drive RMT1 (/dev/rmt1)
(OP=LOCATE,
CC=0, KEY=03, ASC=31, ASCQ=00,
SENSE=70.00.03.00.00.00.58.00.00.00.00.31.00.FE.0A.36-
.30.40.51.00.09.01.31.08.0E.B8.50.00.00.2B.00.00.31.89.0-
3.18.33.36.00.06.33.3D.00.06.00.00.00.DD.39.00.33.42.04.-
00.00.03.FF.00.00.DD.73.06.00, Description=An
undetermined error has occurred). Refer to Appendix
B in
the 'Messages' manual for recommended action.

02/23/06  00:50:03      ANR8302E I/O error on drive RMT1 (/dev/rmt1)
(OP=LOCATE,
CC=0, KEY=03, ASC=31, ASCQ=00,
SENSE=70.00.03.00.00.00.00.58.00.00.00.00.31.00.FF.0A.3A-
.5E.40.51.00.01.01.31.08.0E.10.40.00.00.2B.00.00.33.3D.0-
0.00.00.00.00.00.00.00.00.00.00.00.00.DD.39.00.33.42.04.-
00.00.03.FF.00.00.DD.73.06.00, Description=An
```

undetermined error has occurred). Refer to Appendix B in
the 'Messages' manual for recommended action.

....

```
02/24/06 03:21:45 ANR1414W Volume 032AKK access mode is "read-only" due to  
previous write error.
```

Example 13-47 on page 446 shows two library errors and one volume error. The volume error may be because of a true hardware problem or a media error. In this case, you may try to use another tape to isolate the problem or even use another tape unit. You might realize that it was just a matter of cleaning the unit.

13.8.2 Machine errors

Although Tivoli Storage Manager can handle many error conditions, it cannot resolve all possible errors. Therefore, when an unexpected error condition is met, Tivoli Storage Manager notifies the operating system event logging so that you may further isolate the problem. Note that not all error messages are true problems. Sometimes they are simply information messages (for example, if a 3590 tape needs cleaning, then the 3494 library manager may mount the tape and create an information record indicating that a CLEAN operation was performed).

AIX error report using errpt

You can locate Tivoli Storage Manager errors in the AIX error log by using the operating system command **errpt**. You also can use the system management interface tool (SMIT) fast path to run the **errpt** command. To use the SMIT fast path, enter **smit errpt**.

Notice that the information shown in Example 13-48 may not all be from Tivoli Storage Manager. In this example, the LFTDD error is not related to Tivoli Storage Manager. The lmcpd and rmt1 errors might be a Tivoli Storage Manager problem or a hardware problem. You or the technical staff must investigate the conditions when the problem occurs and take the required actions.

Example 13-48 Output example for the AIX errpt command

```
root@ / > errpt | pg
```

IDENTIFIER	TIMESTAMP	T C	RESOURCE_NAME	DESCRIPTION
0F78A011	0215052600	T H	rmt1	RECOVERY LOGIC INITIATED BY DEVICE
C6ACA566	0214122700	U S	lmcpd	MESSAGE REDIRECTED FROM SYSLOG
C6ACA566	0214121300	U S	lmcpd	MESSAGE REDIRECTED FROM SYSLOG
C6ACA566	0214083800	U S	lmcpd	MESSAGE REDIRECTED FROM SYSLOG
D1A1AE6F	0212153100	I H	rmt1	TAPE SIM/MIM RECORD
E507DCF9	0212152400	I H	rmt1	TAPE DRIVE NEEDS CLEANING

D1A1AE6F	0212152400	I H rmt1	TAPE SIM/MIM RECORD
E85C5C4C	0212083000	P S LFTDD	SOFTWARE PROGRAM ERROR
E85C5C4C	0212083000	P S LFTDD	SOFTWARE PROGRAM ERROR
0BA49C99	0212082600	T H scsi0	SCSI BUS ERROR
2BFA76F6	0212075000	T S SYSPROC	SYSTEM SHUTDOWN BY USER
9DBCFDEE	0212083000	T O errdemon	ERROR LOGGING TURNED ON
192AC071	0212074800	T O errdemon	ERROR LOGGING TURNED OFF
8BDD5B42	0212062600	T H pdisk17	DISK OPERATION ERROR

You can use the **errpt -a** command to look at the error details, as shown in Example 13-49.

Example 13-49 AIX errpt command sample

```
root@ / > errpt -a
LABEL: SYSLOG
IDENTIFIER:C6ACA566
Date/Time:      Thu Feb 23 00:50:03
Sequence Number: 45343
Machine Id:    000D0659A00
Node Id:       sm010
Class:          S
Type:           UNKN
Resource Name: 1mcpd
Description
MESSAGE REDIRECTED FROM SYSLOG
User Causes
OPERATOR REDIRECTED SYSLOG MESSAGES TO ERROR LOG
    Recommended Actions
        REVIEW DETAILED DATA
Detail Data
SYSLOG MESSAGE
ERROR on 3494a, volume 012AKK, ERA 83 Library Drive Exception
```

Example 13-50 shows another AIX **errpt** sample.

Example 13-50 Another AIX errpt sample

```
root@ / > errpt -a

LABEL: SYSLOG
IDENTIFIER:C6ACA566

Date/Time:      Fri Feb 24 03:21:45
Sequence Number: 45343
Machine Id:    00D0659A00
Node Id:       sm010
Class:          S
```

Type: UNKN
Resource Name: 1mcpd

Description
MESSAGE REDIRECTED FROM SYSLOG

User Causes
OPERATOR REDIRECTED SYSLOG MESSAGES TO ERROR LOG

Recommended Actions
REVIEW DETAILED DATA

Detail Data
SYSLOG MESSAGE
ERROR on 3494a, volume 024AKK, ERA 83 Library Drive Exception

Windows System event viewer

Tivoli Storage Manager logs error, information, and warning conditions to the Windows system application log. You can browse it by using the event viewer utility that comes with the Windows system.

Figure 13-12 shows an example of our Windows environment logging errors about the Tivoli Storage Manager application. Note that not all of these may be true error conditions. You must evaluate whether it is actually a problem or simply a misconfiguration.

The screenshot shows the Windows Event Viewer interface titled "Computer Management". The main window displays a table of event logs. The columns are: Type, Date, Time, Source, Category, Event, and User. The "Type" column uses icons to represent event levels: red X for Error, yellow exclamation mark for Warning, and blue asterisk for Information. The "Source" column lists various applications like AdsmServer, WinMgmt, Symantec AntiVirus, COM+, and Automatic Updates. The "Category" column contains numerical values like (2034), None, and 4104. The "Event" column has values like 21, 6, and 16. The "User" column shows "N/A" for most entries. The table is scrollable, with visible scroll bars on the right and bottom.

Type	Date	Time	Source	Category	Event	User
Error	2/16/2006	2:27:49 AM	AdsmServer	(2034)	21	N/A
Error	2/16/2006	2:57:53 AM	AdsmServer	(2034)	21	N/A
Error	2/16/2006	2:27:49 AM	AdsmServer	(2034)	21	N/A
Error	2/16/2006	2:57:53 AM	AdsmServer	(2034)	21	N/A
Error	2/16/2006	2:57:53 AM	AdsmServer	(2034)	21	N/A
Error	2/16/2006	2:57:53 AM	AdsmServer	(2034)	21	N/A
Warning	5/10/2004	8:31:58 AM	WinMgmt	None	61	N/A
Warning	2/13/2006	12:50:40 PM	Symantec AntiVirus	None	6	N/A
Warning	1/26/2006	8:10:24 AM	WinMgmt	None	61	N/A
Warning	2/7/2006	1:19:59 PM	COM+	CRM	4104	N/A
Warning	2/6/2006	12:05:11 PM	Symantec AntiVirus	None	6	N/A
Warning	1/30/2006	12:06:30 PM	Symantec AntiVirus	None	6	N/A
Warning	1/28/2006	4:31:46 PM	Automatic Updates	(1)	16	N/A
Warning	5/11/2004	12:32:04 PM	LoadBaff	None	2000	N/A

Figure 13-12 IBM Tivoli Storage Manager error entries in Windows Event Viewer

In this example we selected for further analysis one of the red events (indicated by the small stop sign), which is an error condition. Figure 13-13 shows that a QUERY DRIVE command was executed in one of our Tivoli Storage Manager server test environments, but no drives were found since none were defined.

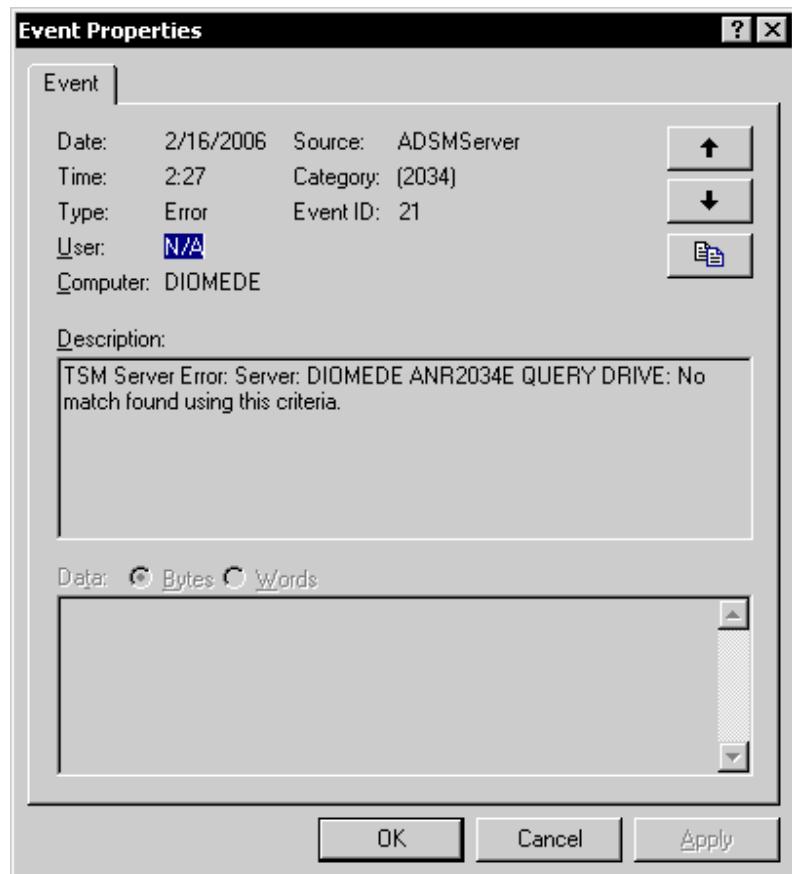


Figure 13-13 Detailed event information of an IBM Tivoli Storage Manager error

13.9 Summary

In this chapter we covered many of the ongoing tasks that should be performed to ensure that your Tivoli Storage Manager environment enjoys a long and healthy life. Although automation is important for many tasks, the administrator must always be notified of actions taken or warnings issued. You need to ensure that communication between the administrators and the Tivoli Storage Manager environment has been automated using alerts or e-mail notifications, which do

require customization. In our next chapter we move on to more advanced operational topics.



Advanced operations

In this chapter we cover exporting data from the server and server groups, reorganizing the database, and integrating the IBM Tivoli Storage Manager environment with the IBM Tivoli Enterprise Console (TEC).

The ability to export data and definitions from server to server is an efficient way to move (migrate) a client node from one server to another. Server groups are an efficient way of querying multiple servers with a single command. Reorganizing your database can provide a performance increase if the database has become fragmented. Integration with TEC provides an extra dimension to enterprise management.

14.1 Exporting server to server

In this section we cover the facility to export and import data directly between servers using TCP/IP.

Before Tivoli Storage Manager V5.2, you could export to media, physically move the media onto another server, then import. Often, this tended to be problematic and slow. With the new export function, you can export and import between servers directly.

Here we review the export process, and later in the chapter we describe an example scenario.

Tivoli Storage Manager server export and import processing supports the following functions:

- ▶ Direct server export to server import via TCP/IP between two servers of the same or differing platforms. Using the network eliminates the need for compatible sequential device types between servers for data movement.
- ▶ Merging of imported data into existing client file spaces on the server.
- ▶ Ability to export client file data based on a date and time specification, allowing maintenance of duplicate copies of client data on two or more servers.

You can still use the previous version of the **export** and **import** commands, specifying a sequential access deviceclass. For details, see the “EXPORT NODE -- To Sequential Media” section of the chapter “Administrative Commands” in the *Administrator’s Reference* for your server operating system platform.

14.2 Exporting data directly to another server

You can export all server control information or a subset of server control information when specifying one or more of the following **export** commands:

- ▶ **export admin**
- ▶ **export node**
- ▶ **export policy**
- ▶ **export server**

When you export data to a target server, you must specify the server name that will import the data.

14.2.1 Preparing to export to another server for immediate import

When you export data to another server over the network, the export triggers an immediate import on the target server. You can export data to a Tivoli Storage Manager server of the same or different operating system as the originating server. A server-to-server export operation performs the following operations:

1. Opens a session with the target server
2. Authenticates with the administrator's user ID and password
3. Starts the equivalent of an import server process on the target server

Prerequisites for exporting

The prerequisites are:

- ▶ Tivoli Storage Manager must be installed and configured on the target server. This includes defining volumes for the database and recovery log, and defining initial server storage, as described in Chapter 5, “Database and recovery log” on page 187, and Chapter 6, “Data storage” on page 215.
- ▶ Enterprise configuration can optionally be defined for the target server so you can distribute consistent policies, administrators, schedules, and scripts to the target server. For more information about enterprise configuration, see the chapter “Working with a Network of IBM Tivoli Storage Manager Servers” in the *Administrator’s Guide* for your server operating system platform.
- ▶ The target server must be defined on the originating server, and vice versa, using the **define server** command.
- ▶ The administrator who will perform the export must be defined with the same administrator name and password on the target server, with system authority on the target server.

14.2.2 Exporting administrator information to another server

When you issue the **export admin** command, the server exports administrator definitions. Each administrator definition includes:

- ▶ Administrator name, password, and contact information
- ▶ Any administrative privilege classes the administrator has been granted
- ▶ Whether the administrator ID is locked from server access

You can specify a list of administrator names or you can export all administrator names. Example 14-1 on page 456 shows an export of all administrator definitions to the target server LOCHNESS. Note that the PREVIEWImport=Yes

option allows you to preview the export without actually exporting the data, to see how much space will actually be required on the target server. To actually perform the operation, re-run the command without the PREVIEW option.

Example 14-1 Exporting administrators

```
tsm: ATLANTIC>export admin * toserver=lochness preview=yes
ANR0609I EXPORT ADMIN started as process 8.
ANS8003I Process number 8 started.

tsm: ATLANTIC>q act

Date/Time          Message
-----
03/01/2006 14:41:47 ANR2017I Administrator ADMIN issued command: EXPORT ADMIN
                      * toserver=lochness previewimport=yes (SESSION: 252)
03/01/2006 14:41:47 ANR0984I Process 8 for EXPORT ADMIN started in the
                      BACKGROUND at 14:41:47. (SESSION: 252, PROCESS: 8)
03/01/2006 14:41:47 ANR0609I EXPORT ADMIN started as process 8. (SESSION: 252,
                      PROCESS: 8)
03/01/2006 14:41:47 ANR0402I Session 253 started for administrator ADMIN
                      (Server) (Memory IPC). (SESSION: 252)
03/01/2006 14:41:47 ANR0408I Session 254 started for server ADMIN (Windows)
                      (Tcp/Ip) for server registration. (SESSION: 252)
03/01/2006 14:41:47 ANR0610I EXPORT ADMIN started by ADMIN as process 8.
                      (SESSION: 252)
03/01/2006 14:41:47 ANR0638I EXPORT ADMIN: Processing administrator ADMIN.
                      (SESSION: 252)
03/01/2006 14:41:47 ANR0638I EXPORT ADMIN: Processing administrator
                      ADMIN_CENTER. (SESSION: 252)
03/01/2006 14:41:47 ANR0638I EXPORT ADMIN: Processing administrator ATLANTIC.
                      (SESSION: 252)
03/01/2006 14:41:47 ANR0638I EXPORT ADMIN: Processing administrator PARIS.
                      (SESSION: 252)
...
...
03/01/2006 14:41:47 ANR0617I EXPORT ADMIN: Processing completed with status
                      SUCCESS. (SESSION: 252)
03/01/2006 14:41:47 ANR0625I EXPORT ADMIN: Copied 11 administrators. (SESSION:
                      252)
03/01/2006 14:41:47 ANR0629I EXPORT ADMIN: Copied 872 bytes of data. (SESSION:
                      252)
03/01/2006 14:41:47 ANR0611I EXPORT ADMIN started by ADMIN as process 8 has
                      ended. (SESSION: 252)
03/01/2006 14:41:47 ANR0986I Process 8 for EXPORT ADMIN running in the
                      BACKGROUND processed 11 items for a total of 872 bytes
                      with a completion state of SUCCESS at 14:41:47. (SESSION:
                      252)
```

14.2.3 Exporting client node information to another server

When you issue the **export node** command, the server exports client node definitions. Each client node definition includes:

- ▶ User ID, password, and contact information
- ▶ Name of the policy domain to which the client is assigned
- ▶ File compression status
- ▶ Whether the user has the authority to delete backed up or archived files from server storage
- ▶ Whether the client node ID is locked from server access

You can also specify whether to export file data. File data includes file space definitions and authorization rules, as well as the file objects themselves. You can export file data in any of the following groupings of files:

- ▶ Active and inactive versions of backed up files, archive copies of files, and space-managed files
- ▶ Active versions of backed up files, archive copies of files, and space-managed files
- ▶ Active and inactive versions of backed up files
- ▶ Active versions of backed up files
- ▶ Archive copies of files
- ▶ Space-managed files

Tip: When you specify a list of node names or node patterns, the server will not report the node names or patterns that do not match any entries in the database. Check the summary statistics in the activity log to verify that the server exported all intended nodes.

Example 14-2 shows the export node process in preview mode.

Example 14-2 Exporting a node

```
tsm: ATLANTIC>export node paris filedatall toserver=lochness
ANR0609I EXPORT NODE started as process 9.
ANS8003I Process number 9 started.

tsm: ATLANTIC>q pr

  Process  Process Description    Status
  Number

-----
  9   EXPORT NODE                ANR0648I Have copied the following: 1 Nodes  1
                                         Filespaces 3895 Backup Files 547429051 Bytes
```

(0 errors have been detected).

tsm: ATLANTIC>**q act**

Date/Time	Message
03/01/2006 14:53:50	ANR2017I Administrator ADMIN issued command: EXPORT NODE paris filedata=all toserver=lochness preview=y (SESSION: 255)
03/01/2006 14:53:50	ANR0984I Process 9 for EXPORT NODE started in the BACKGROUND at 14:53:50. (SESSION: 255, PROCESS: 9)
03/01/2006 14:53:50	ANR0609I EXPORT NODE started as process 9. (SESSION: 255, PROCESS: 9)
03/01/2006 14:53:50	ANR0610I EXPORT NODE started by ADMIN as process 9. (SESSION: 255)
03/01/2006 14:53:50	ANR0635I EXPORT NODE: Processing node PARIS in domain WORKSTN. (SESSION: 255)
03/01/2006 14:53:50	ANR0637I EXPORT NODE: Processing file space \\PARIS\c\$ for node PARIS fsId 1 . (SESSION: 255)
03/01/2006 15:00:44	ANR0626I EXPORT NODE: Copied 1 node definitions. (SESSION: 255)
03/01/2006 15:00:44	ANR0627I EXPORT NODE: Copied 1 file spaces 0 archive files, 33901 backup files, and 0 space managed files. (SESSION: 255)
03/01/2006 15:00:44	ANR0630I EXPORT NODE: Copied 4641786 kilobytes of data. (SESSION: 255)
03/01/2006 15:00:44	ANR0611I EXPORT NODE started by ADMIN as process 9 has ended. (SESSION: 255)
03/01/2006 15:00:44	ANR0986I Process 9 for EXPORT NODE running in the BACKGROUND processed 33903 items for a total of 4,753,189,781 bytes with a completion state of SUCCESS at 15:00:44. (SESSION: 255)

14.2.4 Exporting policy information to another server

When you issue the **export policy** command, the server exports the following information belonging to each specified policy domain:

- ▶ Policy domain definitions
- ▶ Policy set definitions, including the active policy set
- ▶ Management class definitions, including the default management class
- ▶ Backup copy group and archive copy group definitions
- ▶ Schedule definitions
- ▶ Associations between client nodes and schedules

Example 14-3 shows the export policy process in preview mode, and a selection of messages logged to the activity log.

Example 14-3 Exporting policy domains

```
tsm: ATLANTIC>export policy * toserver=lochness_server1 previewimport=yes
```

```
ANR0609I EXPORT POLICY started as process 14.
```

```
ANS8003I Process number 14 started.
```

```
tsm: ATLANTIC>q act
```

Date/Time	Message
03/01/2006 15:08:29	ANR2017I Administrator ADMIN issued command: EXPORT POLICY * toserver=lochness previewimport=yes (SESSION: 255)
03/01/2006 15:08:29	ANR0984I Process 14 for EXPORT POLICY started in the BACKGROUND at 15:08:29. (SESSION: 255, PROCESS: 14)
03/01/2006 15:08:29	ANR0609I EXPORT POLICY started as process 14. (SESSION: 255, PROCESS: 14)
03/01/2006 15:08:29	ANR0402I Session 259 started for administrator ADMIN (Server) (Memory IPC). (SESSION: 255)
03/01/2006 15:08:29	ANR0408I Session 260 started for server ADMIN (Windows) (Tcp/Ip) for server registration. (SESSION: 255)
03/01/2006 15:08:29	ANR0610I EXPORT POLICY started by ADMIN as process 14. (SESSION: 255)
03/01/2006 15:08:29	ANR0639I EXPORT POLICY: Processing domain SERVER. (SESSION: 255)
03/01/2006 15:08:29	ANR0640I EXPORT POLICY: Processing policy set ACTIVE in policy domain SERVER. (SESSION: 255)
03/01/2006 15:08:29	ANR0640I EXPORT POLICY: Processing policy set SERVER in policy domain SERVER. (SESSION: 255)
03/01/2006 15:08:29	ANR0641I EXPORT POLICY: Processing management class IMAGE in domain SERVER, set SERVER. (SESSION: 255)
03/01/2006 15:08:29	ANR0642I EXPORT POLICY: Processing backup copy group in domain SERVER, set ACTIVE, management class SPECIAL. (SESSION: 255)
03/01/2006 15:08:29	ANR0605I EXPORT POLICY: No schedule associations were found in policy domain * for exporting. (SESSION: 255)
03/01/2006 15:08:29	ANR0617I EXPORT POLICY: Processing completed with status SUCCESS. (SESSION: 255)
03/01/2006 15:08:29	ANR0620I EXPORT POLICY: Copied 4 domain(s). (SESSION: 255)
03/01/2006 15:08:29	ANR0621I EXPORT POLICY: Copied 7 policy sets. (SESSION: 255)
03/01/2006 15:08:29	ANR0622I EXPORT POLICY: Copied 22 management classes. (SESSION: 255)
03/01/2006 15:08:29	ANR0623I EXPORT POLICY: Copied 27 copy groups. (SESSION: 255)
03/01/2006 15:08:29	ANR0629I EXPORT POLICY: Copied 4822 bytes of data. (SESSION: 255)

```
03/01/2006 15:08:29 ANR0611I EXPORT POLICY started by ADMIN as process 14 has
ended. (SESSION: 255)
03/01/2006 15:08:29 ANR0986I Process 14 for EXPORT POLICY running in the
BACKGROUND processed 60 items for a total of 4,822 bytes
with a completion state of SUCCESS at 15:08:29. (SESSION:
255)
```

14.3 Exporting and importing server to server

This section demonstrates how to export a client's data and metadata to another Tivoli storage Manager server, using server-to-server communication.

14.3.1 Moving a complete node's data and meta data

In our lab we have configured the following environment:

- ▶ Tivoli Storage Manager AIX server (Atlantic)
- ▶ Tivoli Storage Manager Windows 2003 server (Lochness)
- ▶ Tivoli Storage Manager Windows XP client (Paris)

Figure 14-1 shows our setup.

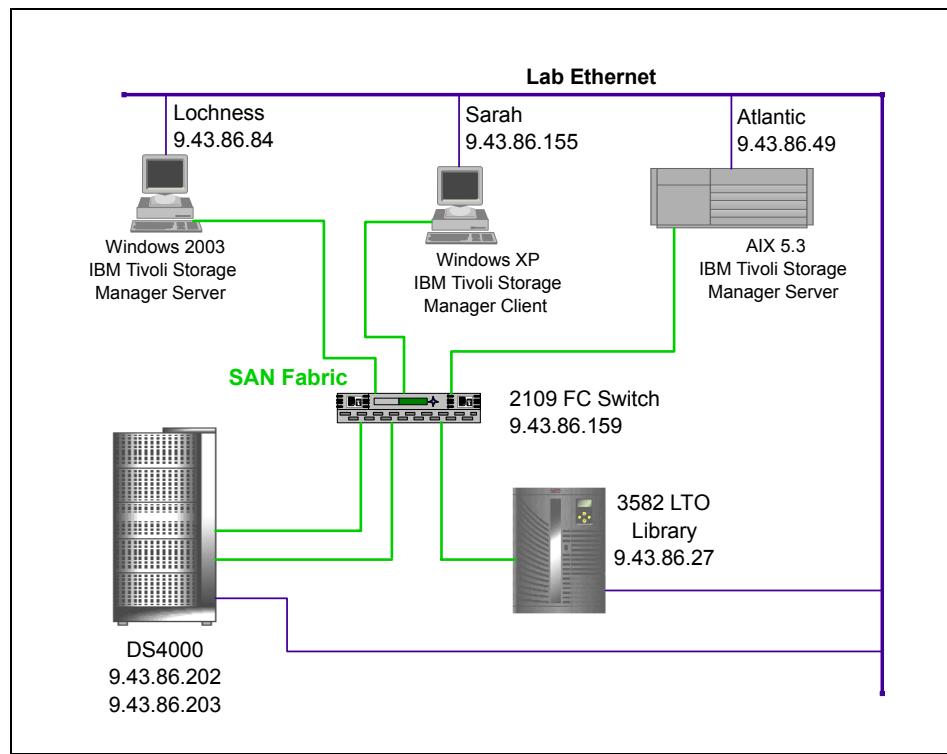


Figure 14-1 Server-to-server lab setup

The Windows XP Tivoli Storage Manager backup-archive client Sarah is currently configured to send its data to the Windows server Lochness. As shown in Example 14-4, we issue a **define server** command on the two servers, which will then allow us to authenticate and pass each other data.

On Atlantic, we issue the command shown in Example 14-4.

Example 14-4 Defining server Lochness on Atlantic

```
tsm: ATLANTIC>define server lochness serverpassword=itso h1address=9.43.86.84  
11address=1500  
ANR1660I Server LOCHNESS defined successfully.
```

Example 14-5 shows the reciprocal command on Lochness.

Example 14-5 Defining server Atlantic on Lochness

```
tsm: LOCHNESS_SERVER1>define server atlantic serverpassword=itso
h1address=9.43.86.49 11address=1500
ANR1660I Server ATLANTIC defined successfully.
```

After defining the two servers, we can issue the **export node** command on Atlantic. Lochness is the target server. Example 14-6 shows the example.

Example 14-6 Exporting the node, Sarah

```
tsm: LOCHNESS_SERVER1>export node sarah filedata=all toserver=atlantic
ANR0609I EXPORT NODE started as process 5.
ANS8003I Process number 5 started.
```

After starting the export process, you can monitor the progress on both servers using **query process**.

Example 14-7 Querying processes on each node

```
tsm: LOCHNESS_SERVER1>q pr

Process  Process Description  Status
Number

-----
5      EXPORT NODE          ANR0648I Have copied the following: 1 Nodes  2
                                                Filespaces  9559 Backup Files  979764778 Bytes
                                                (0 errors have been detected).
                                                Current input volume(s): 029AKK,(89
                                                Seconds)C:\TSMDATA\STG\DISKDIRS\00000020.BFS,
                                                (119 Seconds)
```

tsm: ATLANTIC>q pr

```
Process  Process Description  Status
Number

-----
23     IMPORT (from Server  ANR0648I Have copied the following: 1 Nodes  2
          LOCHNESS_SERVER1)    Filespaces  15109 Backup Files  1507021717
                                                Bytes (0 errors have been detected).
                                                Current output volume(s):
                                                /stg/dirm/00000052.BFS,(168 Seconds)
```

Once the process is complete, the results can be found in the actlog output, as shown in Example 14-8 and Example 14-9 on page 464.

Example 14-8 Lochness' activity log for the export process

Date/Time	Message
<hr/>	
03/01/2006 16:13:08	ANR2017I Administrator ADMIN issued command: EXPORT NODE sarah filedata=all toserver=atlantic (SESSION: 32)
03/01/2006 16:13:08	ANR0984I Process 5 for EXPORT NODE started in the BACKGROUND at 16:13:08. (SESSION: 32, PROCESS: 5)
03/01/2006 16:13:08	ANR0609I EXPORT NODE started as process 5. (SESSION: 32, PROCESS: 5)
03/01/2006 16:13:08	ANR0402I Session 41 started for administrator ADMIN (Server) (Memory IPC). (SESSION: 32)
03/01/2006 16:13:08	ANR0408I Session 42 started for server ADMIN (AIX-RS/6000) (Tcp/Ip) for server registration. (SESSION: 32)
03/01/2006 16:13:08	ANR0610I EXPORT NODE started by ADMIN as process 5. (SESSION: 32)
03/01/2006 16:13:08	ANR0635I EXPORT NODE: Processing node SARAH in domain WORKSTN. (SESSION: 32)
03/01/2006 16:13:08	ANR0637I EXPORT NODE: Processing file space \\klchv4f\c\$ for node SARAH fsId 1 . (SESSION: 32)
03/01/2006 16:13:08	ANR0637I EXPORT NODE: Processing file space SYSTEM OBJECT for node SARAH fsId 2 . (SESSION: 32)
...	
03/01/2006 16:13:50	ANR8337I LTO volume 029AKK mounted in drive DRO0 (mt0.0.0.2). (SESSION: 32)
03/01/2006 16:13:50	ANR0510I Session 32 opened input volume 029AKK. (SESSION: 32)
03/01/2006 16:21:33	ANR0405I Session 42 ended for administrator ADMIN (AIX-RS/6000). (SESSION: 32)
03/01/2006 16:21:33	ANR0514I Session 32 closed volume 029AKK. (SESSION: 32)
03/01/2006 16:21:33	ANR0617I EXPORT NODE: Processing completed with status SUCCESS. (SESSION: 32)
03/01/2006 16:21:33	ANR0626I EXPORT NODE: Copied 1 node definitions. (SESSION: 32)
03/01/2006 16:21:33	ANR0627I EXPORT NODE: Copied 2 file spaces 0 archive files, 37859 backup files, and 0 space managed files. (SESSION: 32)
03/01/2006 16:21:33	ANR0630I EXPORT NODE: Copied 4966809 kilobytes of data. (SESSION: 32)
03/01/2006 16:21:33	ANR0611I EXPORT NODE started by ADMIN as process 5 has ended. (SESSION: 32)

03/01/2006 16:21:33 ANR0986I Process 5 for EXPORT NODE running in the BACKGROUND processed 37862 items for a total of 5,086,013,044 bytes with a completion state of SUCCESS at 16:21:33. (SESSION: 32)

Example 14-9 Atlantic's activity log of the import process

tsm: ATLANTIC>q act

Date/Time	Message
03/01/2006 16:14:05	ANR0407I Session 269 started for administrator ADMIN (Windows) (Tcp/Ip lochness.itsosj.sanjose.ibm.com(2998)). (SESSION: 269)
03/01/2006 16:14:05	ANR0984I Process 23 for IMPORT (from Server LOCHNESS_SERVER1) started in the BACKGROUND at 16:14:05. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:05	ANR4711I IMPORT SERVER (DATES=ABSOLUTE REPLACEDEFS=NO MERGE=NO PREVIEW=NO) by administrator ADMIN from server LOCHNESS_SERVER1 (Process 5) starting as process 23. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:05	ANR0610I IMPORT (from Server LOCHNESS_SERVER1) started by ADMIN as process 23. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:10	ANR0615I IMPORT (from Server LOCHNESS_SERVER1): Reading EXPORT NODE data from server LOCHNESS_SERVER1 exported 03/01/06 16:13:08. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:10	ANR0635I IMPORT (from Server LOCHNESS_SERVER1): Processing node SARAH in domain WORKSTN. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:10	ANR2034E QUERY NODE: No match found using this criteria. (SESSION: 269)
03/01/2006 16:14:10	ANR2060I Node SARAH registered in policy domain WORKSTN. (SESSION: 269)
03/01/2006 16:14:10	ANR2099I Administrative userid SARAH defined for OWNER access to node SARAH. (SESSION: 269)
03/01/2006 16:14:10	ANR0636I IMPORT (from Server LOCHNESS_SERVER1): Processing file space \\sarah\c\$ for node SARAH as file space \\sarah\c\$. (SESSION: 269, PROCESS: 23)
03/01/2006 16:14:10	ANR0636I IMPORT (from Server LOCHNESS_SERVER1): Processing file space SYSTEM OBJECT for node SARAH as file space SYSTEM OBJECT. (SESSION: 269, PROCESS: 23)
...	
03/01/2006 16:22:31	ANR0626I IMPORT (from Server LOCHNESS_SERVER1): Copied 1 node definitions. (SESSION: 269, PROCESS: 23)
03/01/2006 16:22:31	ANR0627I IMPORT (from Server LOCHNESS_SERVER1): Copied 2 file spaces 0 archive files, 37859 backup files, and 0 space managed files. (SESSION: 269, PROCESS: 23)
03/01/2006 16:22:31	ANR0628I IMPORT (from Server LOCHNESS_SERVER1): Used 0 volume(s). (SESSION: 269, PROCESS: 23)
03/01/2006 16:22:31	ANR0630I IMPORT (from Server LOCHNESS_SERVER1): Copied

03/01/2006 16:22:31 4966809 kilobytes of data. (SESSION: 269, PROCESS: 23)
 ANR0611I IMPORT (from Server LOCHNESS_SERVER1) started by
 ADMIN as process 23 has ended. (SESSION: 269, PROCESS:
 23)
 03/01/2006 16:22:31 ANR0986I Process 23 for IMPORT (from Server
 LOCHNESS_SERVER1) running in the BACKGROUND processed
 37862 items for a total of 5,086,013,044 bytes with a
 completion state of SUCCESS at 16:22:31. (SESSION: 269,
 PROCESS: 23)
 03/01/2006 16:22:31 ANR0405I Session 269 ended for administrator ADMIN
 (Windows). (SESSION: 269)

Note that the number of bytes exported and imported match (5,086,013,044), as they should.

To compare the two nodes, query the occupancy for Sarah on each server, as shown in Example 14-10 and Example 14-11.

Example 14-10 Querying occupancy on Lochness

tsm: LOCHNESS_SERVER1>q occ sarah

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
SARAH	Bkup	\\\sarrah\\c\$	1	DISKDIRS	2,714	1.84	1.84
SARAH	Bkup	\\\sarrah\\c\$	1	OFFDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	\\\sarrah\\c\$	1	OFFDIRS	2,714	1.84	1.84
SARAH	Bkup	\\\sarrah\\c\$	1	TAPEDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	SYSTEM OBJECT	2	OFFDATA	1,810	243.42	243.42
SARAH	Bkup	SYSTEM OBJECT	2	TAPEDATA	1,810	243.42	243.42

Example 14-11 Querying occupancy on Atlantic

tsm: ATLANTIC>q occ sarah

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
SARAH	Bkup	\\\sarrah\\c\$	1	DISKDATA	33,329	4,580.45	4,580.45

SARAH	Bkup	\sarah\c\$	1	DISKDIRS	2,714	0.75	0.75
SARAH	Bkup	SYSTEM OBJECT	2	DISKDATA	1,810	242.84	242.84

Note that although Lochness appears to have more data for Sarah, we can see that the extra data are in copy storage pools. The actual number of files and directories, and the amount of data stored, is identical (including policy details).

After changing the destination server to Atlantic in Sarah's dsm.opt file, the first backup will only send its incremental (changed) files since the last backup completed with Lochness.

The last step in the process is to delete the exported node from the originating server (that is, delete Sarah from Lochness). Use **delete filespace** to remove Sarah's data, then **remove node** once all the file spaces have been removed.

14.3.2 Moving a node's metadata

There may be situations where you may require moving just a node's metadata. The metadata is all the details about the client node, but not the actual managed data for that client. The command for this operation is shown in Example 14-12. Note the parameter **filedata=none**.

Example 14-12 Exporting metadata only

```
tsm: ATLANTIC> export node paris domains=workstn filedata=none
toserver=lochness
ANR0609I EXPORT NODE started as process 888.
ANS8003I Process number 888 started.
```

After the export process, and changing the destination server in dsm.opt on Paris, the node Paris will connect to Lochness exactly as it would after a full data export. However, as there is no data on Lochness belonging to Paris, a complete backup (initial incremental) will be performed.

14.4 Moving a node back to an originating server

Suppose that we exported the client Sarah from the server Lochness to Atlantic. However, suppose also that we did not remove it, nor its managed backup data, from Lochness. We then switched Sarah to do backups to Atlantic. Some time passes, and we want to export Sarah back to the server Lochness, with all of the data. Using the merge feature of the **export node** command, we can ensure that the data originally on Lochness belonging to Sarah are brought up to date with

subsequent backups performed on Atlantic. Below are some details on merging of files.

14.4.1 Merging file spaces

You can merge imported client backup, archive, and space-managed files into existing file spaces, and automatically skip duplicate files that may exist in the target file space on the server. Optionally, you can have new file spaces created. Choosing to merge file spaces allows you to restart a cancelled import operation because files that were previously imported can be skipped in the subsequent import operation. The merge option is available when you issue an **export server** or **export node** command. When you merge file spaces, the server performs versioning of the imported objects based on the policy bound to the files. An import operation may leave the target file space with more versions than policy permits. Files are versioned to maintain the policy intent for the files, especially when incremental export (using the FROMDate and FROMTime parameters) is used to maintain duplicate client file copies on two or more servers.

Here is how the server merges imported files, based on the type of object, when you specify MERGEfilespace=Yes.

Archive objects

If an archive object for the imported node having the same TCP/IP address, TCP/IP port, name, insert date, and description is found to already exist on the target server, the imported object is skipped. Otherwise, the archive object is imported.

Backup objects

If a backup object for the imported node has the same TCP/IP address, TCP/IP port, insert date, and description as the imported backup object, the imported object is skipped. When backup objects are merged into existing file spaces, versioning will be done according to policy just as it occurs when backup objects are sent from the client during a backup operation. To do this:

- ▶ If the imported backup object has a later (more recent) insert date than an active version of an object on the target server with the same node, file space, TCP/IP address, and TCP/IP port, then the imported backup object becomes the new active copy, and the active copy on the target server is made inactive. Tivoli Storage Manager expires this inactive version based on the number of versions that are allowed in the policy.
- ▶ If the imported backup object has an earlier (less recent) insert date than an active copy of an object on the target server with the same node, file space,

TCP/IP address, and TCP/IP port, then the imported backup object is inserted as an inactive version.

- ▶ If there are no active versions of an object with the same node, file space, TCP/IP address, and TCP/IP port on the target server, and the imported object has the same node, file space, TCP/IP address, and TCP/IP port as the versions, then:
 - An imported active object with a later insert date than the most recent inactive copy will become the active version of the file.
 - An imported active object with an earlier insert date than the most recent inactive copy will be imported as an inactive version of the file.
- ▶ Any imported inactive objects will be imported as other inactive versions of the object.

Using the `mergefilespace` option

Following our successful export of Sarah's data to Atlantic, we run a `dsmc incr` command on Sarah. Example 14-13 shows the updated occupancy figures on both servers after an incremental backup from Sarah to Atlantic.

Example 14-13 Updated occupancy after an incremental backup

```
tsm: LOCHNESS_SERVER1>q occ sarah
```

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
SARAH	Bkup	\sarah\c\$	1	DISKDIRS	2,714	1.84	1.84
SARAH	Bkup	\sarah\c\$	1	OFFDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	\sarah\c\$	1	TAPEDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	SYSTEM OBJECT	2	OFFDATA	1,810	243.42	243.42
SARAH	Bkup	SYSTEM OBJECT	2	TAPEDATA	1,810	243.42	243.42

```
tsm: ATLANTIC>q occ sarah
```

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)

SARAH	Bkup \\sarah\c\$	1	DISKDATA	33,443	4,601.39	4,601.39
SARAH	Bkup \\sarah\c\$	1	DISKDIRS	2,738	0.77	0.77
SARAH	Bkup SYSTEM OBJECT	2	DISKDATA	3,620	486.40	486.40

We can see that on Atlantic, there are now 114 more files from C: and 1810 more files from the SYSTEM OBJECT.

We now run the export node operation, as shown in Example 14-14, to send the node Sarah back to Lochness, using the mergefilespace=yes option.

Example 14-14 Export with MERGEfilespaces

```
tsm: ATLANTIC>export node sarah filedatal=all toserver=lochness
mergefilespace=yes
```

After the process has completed, the activity log on Lochness shows that only a small number of files were transferred. The export process only transferred what was necessary to bring Lochness up to date (Example 14-15).

Example 14-15 Activity log entries for export with MERGEfilespaces

```
tsm: LOCHNESS_SERVER1>q act
```

Date/Time	Message
-----	-----
03/02/2006 11:10:32	ANR0627I IMPORT (from Server ATLANTIC): Copied 2 file spaces 0 archive files, 1954 backup files, and 0 space managed files. (SESSION: 6, PROCESS: 2)
03/02/2006 11:10:32	ANR0656W IMPORT (from Server ATLANTIC): Skipped 0 archive files, 37859 backup files, and 0 space managed files. (SESSION: 6, PROCESS: 2)
03/02/2006 11:10:32	ANR0628I IMPORT (from Server ATLANTIC): Used 0 volume(s). (SESSION: 6, PROCESS: 2)
03/02/2006 11:10:32	ANR0629I IMPORT (from Server ATLANTIC): Copied 277982016 bytes of data. (SESSION: 6, PROCESS: 2)
03/02/2006 11:10:32	ANR0611I IMPORT (from Server ATLANTIC) started by ADMIN as process 2 has ended. (SESSION: 6, PROCESS: 2)
03/02/2006 11:10:32	ANR0986I Process 2 for IMPORT (from Server ATLANTIC) running in the BACKGROUND processed 1956 items for a total of 277,982,016 bytes with a completion state of SUCCESS at 11:10:32. (SESSION: 6, PROCESS: 2)

The additional files that were backed up while connected to Atlantic are now visible on Lochness' query occupancy output, as shown in Example 14-16.

Example 14-16 Occupancy after file spaces are merged

tsm: ATLANTIC>q occ sarah

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
SARAH	Bkup	\sarah\c\$	1	DISKDATA	33,443	4,601.39	4,601.39
SARAH	Bkup	SYSTEM OBJECT	2	DISKDATA	3,620	486.40	486.40

tsm: LOCHNESS_SERVER1>q occ sarah

Node Name	Type	Filespace Name	FSID	Storage Pool Name	Number of Files	Physical Space Occupied (MB)	Logical Space Occupied (MB)
SARAH	Bkup	\sarah\c\$	1	DISKDATA	114	20.92	20.92
SARAH	Bkup	\sarah\c\$	1	DISKDIRS	2,738	1.85	1.85
SARAH	Bkup	\sarah\c\$	1	OFFDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	\sarah\c\$	1	TAPEDATA	33,329	4,591.80	4,591.80
SARAH	Bkup	SYSTEM OBJECT	2	DISKDATA	1,810	242.91	242.91
SARAH	Bkup	SYSTEM OBJECT	2	OFFDATA	1,810	243.42	243.42
SARAH	Bkup	SYSTEM OBJECT	2	TAPEDATA	1,810	243.42	243.42

The occupancy on Lochness is now the same as Atlantic. Note that the occupancy is the same even though the files are stored in different storage pools.

Using the fromdate and fromtime options

You can limit the file data exported to objects that were stored on the server on or after a specific date and time. You can use the FROMDate and FROMTime parameters to export data based on the date and time the file was originally stored in the server.

The FROMDate and FROMTime parameters only apply to client user file data. These parameters have no effect on other exported information (for example, policies). If clients continue to back up to the originating server while their data is

being moved to a new server, you can move the backup data that was stored on the originating server after the export operation was initiated. The FROMDate and FROMTime options are available when you issue an `export server` or `export node` command.

14.4.2 Suggestions for leveraging the export feature

Here are some reasons why you may want to export data:

- ▶ Splitting an overloaded server into two or three servers
 - Server-to-server export is faster than server-to-media and media-to-server import.
 - Server-to-server export transfers data from different server platforms.
 - ▶ Moving some clients temporarily to do server maintenance
- One disadvantage is the amount of data moved, either during the initial export or if the client does a full incremental during the first backup after being moved.
- ▶ Migrating from an earlier version of Tivoli Storage Manager with older tape technology to a new version with new tape technology (possibly with new server platform)
 - a. Set up new the server platform, the Tivoli Storage Manager, and new tape technology.
 - b. Set up disk-based storage pool with NEXTstgpool pointing to new tape technology.
 - c. Export administrators and policies from the old server.
 - d. Export nodes from the old server when network load permits.

14.5 Server groups and remote command routing

Two often-overlooked features of server-to-server communications are the server group and remote command routing. Remote command routing allows you to run a command on another server. Server groups allow you to route commands to multiple servers by specifying the group name.

To configure a server group, use these commands:

- ▶ `define servergroup` defines the name of a group for use with remote command routing.
- ▶ `define grpmember` adds servers to a group.

In Example 14-17 we create a new group and add two members. Use **query servergroup** to display information about server groups.

Example 14-17 Defining a server group and members

```
tsm: LOCHNESS_SERVER1>define servergroup redserv desc="Redbook SG24-5416 Server Group"
```

```
ANR1673I Server group REDSERV defined successfully.
```

```
tsm: LOCHNESS_SERVER1>define grpmember redserv atlantic, lochness
```

```
ANR1674I Member ATLANTIC defined successfully in server group REDSERV.
```

```
ANR1674I Member LOCHNESS defined successfully in server group REDSERV.
```

```
tsm: LOCHNESS_SERVER1>q servergroup
```

Server Group	Members	Description	Managing profile
REDSERV	ATLANTIC	Redbook SG24-5416	
	LOCHNESS	Server Group	

To use a server group for command routing, simply specify the group name followed by a colon (:), followed by the command you wish to run on each server in the group. Similarly, to route a command to a single server, specify the server name followed by a colon, followed by the command you wish to run.

Example 14-18 shows routing commands to a single server, and a server group.

Example 14-18 Remote command routing

```
tsm: LOCHNESS_SERVER1>atlantic: q session
```

```
ANR1699I Resolved ATLANTIC to 1 server(s) - issuing command Q SESSION against server(s).
```

```
ANR1687I Output for command 'Q SESSION ' issued against server ATLANTIC follows:
```

Sess Number	Comm. Method	Sess State	Wait Time	Bytes Sent	Bytes Recvd	Sess Type	Platform	Client Name
415	Tcp/Ip	Run	0 S	157	195	Admin	Windows	ADMIN

```
ANR1688I Output for command 'Q SESSION ' issued against server ATLANTIC completed.
```

```
ANR1694I Server ATLANTIC processed command 'Q SESSION ' and completed successfully.
```

```
ANR1697I Command 'Q SESSION ' processed by 1 server(s): 1 successful, 0 with warnings, and 0 with errors.
```

```
tsm: LOCHNESS_SERVER1>redserv: q db
```

```
ANR1699I Resolved REDSERV to 2 server(s) - issuing command Q DB against
```

server(s).

ANR1687I Output for command 'Q DB ' issued against server ATLANTIC follows:

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct
1,024	1,024	0	984	4,096	262,144	8,515	3.2	3.6

ANR1688I Output for command 'Q DB ' issued against server ATLANTIC completed.

ANR1687I Output for command 'Q DB ' issued against server LOCHNESS_SERVER1 follows:

Available Space (MB)	Assigned Capacity (MB)	Maximum Extension (MB)	Maximum Reduction (MB)	Page Size (bytes)	Total Usable Pages	Used Pages	Pct Util	Max. Pct
2,024	2,024	0	1,516	4,096	518,144	130,250	25.1	25.1

ANR1688I Output for command 'Q DB ' issued against server LOCHNESS_SERVER1 completed.

ANR1694I Server ATLANTIC processed command 'Q DB ' and completed successfully.

ANR1694I Server LOCHNESS_SERVER1 processed command 'Q DB ' and completed successfully.

ANR1697I Command 'Q DB ' processed by 2 server(s): 2 successful, 0 with warnings, and 0 with errors.

Server groups make it easy to query multiple servers with a single command.

14.6 Reorganizing the database

Over time, database volumes can become fragmented. You can restore the efficiency of the database and improve database performance by unloading and reloading it. The database reload process compresses and reorganizes the database. The procedure includes estimating the reorganization statistics, unloading the database, formatting database and recovery log volumes to prepare for loading, and then loading the database. The server cannot be running during a database unload or load, as the load operations read device information from the device configuration file, not from the server's database.

Note: We recommend using a device class of FILE for the dsmser unloaddb and dsmser loaddb operations. If you use any other type of device class for the operations, you must use a drive that is assigned to a manual library (library type of MANUAL). If the drive that you want to use is not assigned to a manual library, you must edit the device configuration file to temporarily change the definition so that it appears to be in a manual library.

Deciding whether you really need to reorganize the database

Reorganizing the Tivoli Storage Manager database is not a task to be taken lightly. The load operation can take a long time (24+ hours) if your database is large. To facilitate the process, Tivoli Storage Manager V5.3 introduced the **estimate dbreorgstats** command. This command examines the database and logs, and records an estimate of recoverable space in the activity log. You can use this information to decide whether to go ahead. Example 14-19 shows the command output.

The **estimate dbreorgstats** command itself may run for some time, consuming I/O. It should not be run when the server is particularly active. In the case below, it took close to two minutes to run on a database of about 500 MB.

Example 14-19 Estimate dbreorgstats

```
tsm: LOCHNESS_SERVER1>estimate dbreorgstats
ANS8003I Process number 3 started.

tsm: LOCHNESS_SERVER1>q pr

Process   Process Description      Status
Number

-----
3        ESTIMATE DBREORG      Processing table 62 of 140 total tables.
                                         Evaluated 86578 pages.

tsm: LOCHNESS_SERVER1>q act search=reorg

Date/Time          Message
-----
03/02/2006 11:50:14 ANR2017I Administrator ADMIN issued command: ESTIMATE
                      DBREORGSTATS (SESSION: 12)
03/02/2006 11:50:14 ANR0984I Process 3 for ESTIMATE DBREORG started in the
                      BACKGROUND at 11:50:14. (SESSION: 12, PROCESS: 3)
03/02/2006 11:50:14 ANR1782W ESTIMATE DBREORG process 3 started - server
                      performance may be degraded while this process is
                      running. (SESSION: 12, PROCESS: 3)
03/02/2006 11:51:51 ANR1784I A database reorganization would reduce the
                      database utilization by an estimated 89 MB. (SESSION: 12,
```

```
PROCESS: 3)
03/02/2006 11:51:51 ANR0987I Process 3 for ESTIMATE DBREORG running in the
BACKGROUND processed 120287 items with a completion state
of SUCCESS at 11:51:51. (SESSION: 12, PROCESS: 3)
03/02/2006 11:53:37 ANR2017I Administrator ADMIN issued command: QUERY ACTLOG
search=reorg (SESSION: 12)
```

As you can see from the example, we would recover only 89 MB, not enough to justify the operation.

However, if you have recently deleted a number of nodes with large numbers of files, you may find that you can recover significant amounts of space.

Procedure for reorganizing the database

To reorganize the database, follow these steps:

1. *Important:* First back up the database. If an outage occurs while loading your database, you can use the backup to recover the database.
2. Ensure that a current device configuration file exists. You must also specify the name of the device configuration file with the DEVCONFig option in the server options file.

Important: If you specified more than one file with the DEVCONFig option, remove all but one file name for the dump and load process. After the process is complete, you can add the other file names back.

The device configuration file includes a copy of the device class, library, and drive definitions for the server. The utility commands used for the dump and load procedure need the device definitions. See the *IBM Tivoli Storage Manager Administrator's Reference* for details on the DEVCONFig option.

3. Ensure that the device configuration file contains the required definitions for the device that you want to use for the operations.
 - To use a disk device, you must use a device class of type FILE for the operations, and the device class definition must exist in the device configuration file.
 - To use other sequential device types, check the definition of the library and the drive in the device configuration file. The library and the drive must be defined as a *manual* library and drive. If not, make a copy of your

device configuration file and store the original file in a safe place. Edit the copy of the file to have temporary manual definitions for the library and the drive you will use. Follow these guidelines:

- For the library definition, change the library type to MANUAL and remove any parameters not allowed for a MANUAL type of library. For example, you have the library defined in your device configuration file like this:

```
DEINE LIBRARY 3582LIB LIBTYPE=SCSI SHARED=YES
```

You need to change the definition to this:

```
DEFINE LIBRARY 3582LIB LIBTYPE=MANUAL
```

- For the drive definition, remove any parameters that do not apply to a drive in a manual library. For example, you have the drive defined like this:

```
DEFINE DRIVE 3582LIB DR00 ELEMENT=256
```

You need to change the definition to this:

```
DEFINE DRIVE 3582LIB DR00
```

See the *IBM Tivoli Storage Manager Administrator's Reference* for details about the **define library** and **define drive** commands.

4. Before unloading the database, estimate how many tapes you will need:
 - If the server is *not* running, use the size of your existing physical database volumes as an estimate of how many tapes to use.
 - If the server is running, you can use the following steps to estimate the number of tapes required:
 - i. Request information about the database:
`query db`
 - ii. From the output of the command, multiply the used pages by the page size to determine space occupied by the database.
 - iii. Use the result to estimate the number of tapes of a specific device class that you will need to unload the database. The space required will likely be less than your estimate.
5. Halt the server if it is still running.
6. With the server *not* running, use the DSMSERV UNLOADDB utility to unload the database. For example, issue this command:
`dsmserv unloaddb devclass=lto2-dc scratch=yes`

Note: The dsmserv executable is located in the server/bin directory on UNIX/Linux, and c:\program files\tivoli\tsm\server on Windows.

Because the library is defined to be a manual library, you will need to manually mount the tapes.

Important: Keep track of the order in which the tape volumes are written when the database is unloaded. You must specify the volume names in the same order when you reload the database using the DSMSERV LOADDB utility. For this task you can either:

- ▶ Review the output generated by the DSMSERV UNLOADDB utility and record the order of the volumes.
- ▶ Manually view the volume history file to identify the tape volumes containing the unloaded database. The volumes have a volume type of DUMPDB. (Do *not* restart the server and issue **query volhistory** at this step.)

7. Format the database and recovery log using the DSMSERV LOADFORMAT utility. This utility prepares the existing server database for the DSMSERV LOADDB utility. For example, issue this command:

```
dsmserv loadformat 1 c:\tsmdata\rlp\logv_01.dsm 1 c:\tsmdata\dbp\dbv_01.dsm
```

The command above prepares one recovery log volume (c:\tsmdata\rlp\logv_01.dsm) and one database volume (c:\tsmdata\dbp\dbv_01.dsm).

8. Reload the database using the volumes that contain the data from the unload operation. For example:

```
dsmserv loaddb devclass=1to2-dc volumenames=DBD001,DBD002
```

For the volume names, ensure that you do the following operations:

- Enter the volume names in the same order in which they were used for the dsmserv unloaddb utility.
 - Separate the volume names with a comma and no intervening spaces.
9. If you edited your device configuration file in step 3, replace the edited version of the device configuration file with the original version.
 10. Start the server.

14.7 Tivoli Storage Manager and TEC integration

Tivoli Storage Manager includes the Tivoli receiver, a Tivoli Enterprise Console (TEC) adapter for sending Tivoli Storage Manager events to the TEC. You can specify the events to be logged based on their source. The valid event names are listed in Table 14-1.

Table 14-1 TEC event names

Event name	Source
TSM_SERVER_EVENT	Tivoli Storage Manager server
TSM_CLIENT_EVENT	Tivoli Storage Manager clients
TSM_APPL_EVENT	Tivoli Storage Manager API
TSM_TDP_DOMINO_EVENT	Data Protection for Lotus Domino
TSM_TDP_EXCHANGE_EVENT	Data Protection for MS Exchange Server
TSM_TDP_INFORMIX_EVENT	Data Protection for Informix
TSM_TDP_ORACLE_EVENT	Data Protection for Oracle
TSM_TDP_SQL_EVENT	Data Protection for MS SQL
TSM_TDP_SAP_R3_EVENT	Data Protection for mySAP
TSM_TDP_ESS_DB2_EVENT	Data Protection for IBM ESS for DB2®
TSM_TDP_ESS_Oracle_EVENT	Data Protection for IBM ESS for Oracle

This section shows how to enable and configure Tivoli as an event receiver on the Tivoli Storage Manager server. See the *IBM Tivoli Storage Manager Administrator's Guide* for more information about TEC configuration.

The application clients (Data Protection for ...) must have enhanced TEC support enabled in order to route the events to TEC. Because of the high number of messages, you should not enable all messages from a node for logging to TEC.

To set up TEC as a receiver for event logging:

1. Define the Tivoli Storage Manager event classes to the TEC with the `ibmstm.baroc` file, which is distributed with the server. Before the events are displayed on a TEC, you must import `ibmstm.baroc` into an existing rule base or create a new rule base and activate it. You must then define an event source and event group. The section “Logging Events to the Tivoli Enterprise Console” in the *IBM Tivoli Storage Manager Administrator's Guide* shows how to perform these tasks.

Note: See the TEC documentation for instructions on removing an existing baroc file, if needed, and installing a new baroc file.

2. Enable events for logging to the Tivoli receiver (TEC). The following enables logging for severe and error messages coming from all Tivoli Storage Manager nodes and servers to TEC. Refer to the *IBM Tivoli Storage Manager Administrator's Guide* for more information about enabling and disabling events for logging.

```
enable events TIVOLI error,severe
```

3. In the server options file (dsmserv.opt), specify the location of the host on which the TEC server is running. For example, to specify a TEC server at the IP address 9.114.22.345:1555, enter the following commands:

```
techost 9.114.22.345  
tecport 1555
```

4. Begin TEC event logging. You do this in one of two ways:

- To begin event logging automatically at server startup, specify the following server option:

```
tecbegineventlogging yes
```

Or:

- Enter the following command:

```
begin eventlogging tivoli
```

14.8 Summary

We have covered details about implementing a server-to-server export and server groups, reorganizing your database, and integrating the Tivoli Storage Manager alerts with the Tivoli Enterprise Console (TEC) environment. In the following chapter we increase the degree of complexity by discussing performance tuning. Before moving into the tuning section, a good understanding of the Tivoli Storage Manager environment and a good understanding of the many directly related infrastructure components is very important.



Performance considerations

In this chapter we emphasize the importance of a complete tuning methodology. We hope you will gain an understanding of all the related components and understand the importance of making changes one at a time, then retesting against a base-line performance number.

Misinterpreting the results of performance-related testing is also common. Ensure that you follow a logical and documented process. *Careful* and *concise* are two important words when describing a tuning exercise.

We discuss parameters that can be tuned to get the maximum performance during backup, archive, restore, and retrieve operations. Remember that an IBM Tivoli Storage Manager implementation is typically quite complex, covering a range of variables that could affect performance.

You will find much more detailed information about performance tuning and the available parameters in *IBM Tivoli Storage Manager Performance Tuning Guide*, SC32-9101.

15.1 How to measure performance

In measuring Tivoli Storage Manager performance, you need to fine-tune parameters and run specific testing scenarios. Fine-tuning Tivoli Storage Manager is not just for backup, since the restore window is as important, or more so, than the backup window. Some parameters might improve backup at the expense of restore and vice versa. Or they might improve both operations but require more system resources. You need to determine the best balance in your environment, depending on the frequency and criticality of each backup and restore operation.

In most cases where the backup parameters are different from the restore parameters, the backup and restore windows can be maximized.

Getting the maximum performance of the system requires performing and recording a series of tests so that the throughput can be tabulated. These tests should encompass both for backup and restore.

Tivoli Storage Manager performance can be influenced by various tuning parameters. Tuning these functions for good performance requires diligence and expertise on the part of the installer. The number of parameters that may be set within Tivoli Storage Manager are quite small; it is the tuning of the client, server, and network options that can become very complex.

Performance tuning for a single platform function is quite complex, but due to years of experience, it is generally well understood. However, Tivoli Storage Manager functions in the client-server realm typically support many operating systems, work across networks, and accept different communication protocols. Consequently, there are many more factors that affect performance. All of these factors can affect Tivoli Storage Manager performance significantly:

- ▶ Average client file size
- ▶ Percentage of files changed since last incremental backup
- ▶ Percentage of bytes changed since last incremental backup
- ▶ Client hardware (CPUs, RAM, disk drives, network adapters)
- ▶ Client operating system client activity (non-Tivoli Storage Manager workload)
- ▶ Communication protocol type
- ▶ Communication controller hardware
- ▶ Network utilization
- ▶ Network speed
- ▶ Network reliability
- ▶ Server hardware (CPUs, RAM, disk drives, network adapters)
- ▶ Server storage pool devices (disk, tape, optical)
- ▶ Server activity (non-Tivoli Storage Manager workload)
- ▶ Final output repository type (disk, tape, optical)

Clearly, with so many combinations and possibilities, it is not feasible to discuss all possible combinations of these parameters within the scope of this book. This book should be taken as advice to follow when faced with performance questions, so that you do not limit yourself to considering only the Tivoli Storage Manager tunable parameters covered here.

Performance tuning and bottleneck discovery are complex tasks requiring deep knowledge of Tivoli Storage Manager, the underlying operating system, and the attached hardware components. Unless you really know what you are doing, you should consider hiring someone more experienced for these tasks.

Remember that a high-performance environment without any bottlenecks does not exist. But as long as you know your bottlenecks, and have reduced them and the constraints they cause, you are on the right path.

15.1.1 Network benchmarking

Network benchmarking in Tivoli Storage Manager is the process of measuring a given network's capacity at a specific time during the day or evening.

Sometimes during a Tivoli Storage Manager deployment our customers have commented that the product does not perform as expected, that backup times are very slow, and they ask what is wrong with the backup product. It should be understood that all backup products are essentially an integration of bottlenecks. As a result, you need to be able to isolate and address these weak links as issues are identified.

A very large percentage of these poorly performing configurations are not related to Tivoli Storage Manager at all. But, how do you prove this when the network has some busy moments during the day, but reaches complete saturation during evening hours? Obviously, measurements taken at 11:00 a.m. are not useful to determine what is going on at 11:00 p.m.

The answer to this very vague problem is to benchmark the network bandwidth precisely before (or after, or both) the backup starts. Customers normally ask “Who will do this, and how are they going to time this precise effort to occur at 11:30 p.m.? Our evening operations staff is small and rather busy during these hours; they do not have time to be running benchmarks.”

Here is how it works: The first task is to generate a data file that is “sizable”—based on the network over which you are running. For example, if you are running over a switched 100 megabit (averaging 10 MBps), you would create a file sized between 256–512 MB. For a 1 Gigabit (1 Gbps) network, use a file of 1 GB or larger. Sun Solaris nodes have a handy command, `mkfile`, which is perfectly suited for creating exact sized files; otherwise you can use a

compression application to combine and or compress a bunch of smaller files into one big file of the required size. *Do not* try to push multiple smaller files that equal the total size that you are trying to move—this will skew your benchmarks.

The next task is to automate an FTP logon and push/pull this file from the Tivoli Storage Manager client to the Tivoli Storage Manager server. This is cleverly done by creating an FTP script that will:

1. Connect to the FTP daemon on the Tivoli Storage Manager server.
2. Push a file over to the Tivoli Storage Manager server.
3. Pull the file from the Tivoli Storage Manager server to the local system.
4. Delete the file on the Tivoli Storage Manager server after the pull.
5. Log off.

Example 15-1 and Example 15-1 show two typical FTP scripts. The first one is for Microsoft platforms and the second is for UNIX platforms. With minor modifications, you can get this code to work on your own platforms.

Example 15-1 *FTP sample script for Windows*

```
@echo off
echo open 9.48.202.28      > $ftp$.cmd

echo user username password >> $ftp$.cmd
echo bin                  >> $ftp$.cmd
rem echo hash            >> $ftp$.cmd
echo cd <targetdirectory> >> $ftp$.cmd
echo dir                 >> $ftp$.cmd
echo put <samplefile> >> $ftp$.cmd
echo get <samplefile> >> $ftp$.cmd
echo del <samplefile> >> $ftp$.cmd
rem echo dir            >> $ftp$.cmd
echo bye                >> $ftp$.cmd

FTP.EXE -n -s:$ftp$.cmd
del $ftp$.cmd
```

Example 15-2 *Sample FTP script for UNIX*

```
ftp -n TSM-Server <- EOF!
user username password
cd <targetdirectory>
put <samplefile>
get <samplefile>
del <samplefile>
bye
EOF!
```

So how do you launch the FTP script right before the backup occurs? By including your FTP script in a Tivoli Storage Manager client options file (or dsm.sys on UNIX/Linux) as pre-schedule (or post-schedule, or both) commands:

```
PRESCHEDULECMD c:\temp\ftpbench.bat  
POSTSCHEDULECMD c:\temp\ftpbench.bat
```

The script will then run automatically. How do you find the output? All the output from the script will be logged into the node's dsmsched.log file. When you come in the next morning, locate the file and search for the FTP statistics.

Example 15-3 shows that the move of a 13 MB file achieved a transfer rate of 162.26 KB per second over a VPN link from Dover, New Jersey, to Austin, Texas.

Example 15-3 Sample ftp script execution

```
226 Transfer complete.  
ftp: 723 bytes received in 0.01Seconds 72.30Kbytes/sec.  
ftp> get db-13mb.txt  
200 PORT command successful.  
150 Opening data connection for db-13mb.txt (13631488 bytes).  
226 Transfer complete.  
ftp: 13631488 bytes received in 84.01Seconds 162.26Kbytes/sec.  
ftp> bye  
221 Goodbye.
```

This should give us a good idea of what the traffic is at the exact time of the night that you are trying to complete your backups. Once that is achieved, you can then extrapolate the data to a spreadsheet and then calculate the time it will take to complete your backups for the amount of data you have.

Please note that the FTP transfer statistics, as collected above, might mask an underlying performance problem reading from local or writing to remote disk. If you want to verify that the disk I/O is not the bottleneck, you can collect the transfer statistics without actually reading from/writing to disk, as shown in Example 15-4, for UNIX systems.

Example 15-4 UNIX: FTP command without disk bottleneck

```
ftp <servername>  
bin  
put "|dd if=/dev/zero bs=64k count=10000" /dev/null  
quit
```

Chapter 15-5, “z/OS: FTP command without disk bottleneck” on page 486 shows an example of connecting to a z/OS system and switching to the *dev.null directory to avoid write I/O on the target system. The local file is being read from in this example.

Example 15-5 z/OS: FTP command without disk bottleneck

```
C:\>ftp <system>
Connected to <system>.
220-FTPD1 IBM FTP CS V1R2 at <SYSTEM>, 15:44:09 on 2006-02-27.
220 Connection will close if idle for more than 5 minutes.
User (<system>:(none)): triple8
331 Send password please.
Password:
230 TRIPLE8 is logged on. Working directory is "TRIPLE8.".
ftp> cd *dev.null
250-Working Directory for PUT is NULL Device;
250 for GET is "TRIPLE8." name prefix.
ftp> bin
200 Representation type is Image
ftp> put TESTFILE.exe zz.exe
200 Port request OK.
125 Storing data in the Null directory (*dev.null).
250 Transfer completed successfully.
ftp: 225904 bytes sent in 0.03Seconds 7530.13Kbytes/sec.
ftp> quit
221 Quit command received. Goodbye.
```

You can also use the FTP transfer statistics and compare those against the backup/restore numbers from a selective file backup and restore. When dealing with just a single large file, we will not see any database processing overhead but will collect comparable numbers for network throughput. To avoid any file caching side effects, create a file that is larger than the client memory, then FTP transfer the file from the server to the client and back. The preferred target directory is the directory where your server's disk storage pools are located.

Doing the put/get will provide output similar to Example 15-6.

Example 15-6 FTP statistics for the put transfer of a 500 MB file

```
C:\>ftp banda.itsosj.sanjose.ibm.com
Connected to banda.itsosj.sanjose.ibm.com.
User (banda.itsosj.sanjose.ibm.com:(none)): maximilian
331-Password:
230-Last login: Fri Mar  3 11:02:27 PST 2006 on ftp from ::ffff:9.43.86.888
230-User maximilian logged in.
ftp> put 500MBFile
200 PORT command successful.
```

```
150 Opening data connection for 500MBFile.  
226 Transfer complete.  
ftp: 536801936 bytes sent in 52.09Seconds 10304.49Kbytes/sec.  
ftp> get 500MBFile  
200 PORT command successful.  
150 Opening data connection for 500MBFile (524288000 bytes).  
226 Transfer complete.  
ftp: 536801936 bytes received in 57.13Seconds 9396.97Kbytes/sec.
```

Now back up the same file from your client machine to the Tivoli Storage Manager server, as shown in Example 15-7.

Example 15-7 Backup of a 500 MB test file

```
tsm> sel 500MBFile  
Selective Backup function invoked.  
Normal File-->      524,288,000 /home/root/500MBFile [Sent]  
Selective Backup processing of '/home/root/500MBFile' finished without failure.
```

```
Total number of objects inspected:      1  
Total number of objects backed up:      1  
Total number of objects updated:        0  
Total number of objects rebound:        0  
Total number of objects deleted:        0  
Total number of objects expired:        0  
Total number of objects failed:         0  
Total number of bytes transferred:     500.02 MB  
Data transfer time:                  43.59 sec  
Network data transfer rate:          11,745.37 KB/sec  
Aggregate data transfer rate:        11,115.00 KB/sec  
Objects compressed by:                0%  
Elapsed processing time:              00:00:46
```

So the time taken to complete the backup for this single object (46 seconds) is close to the time it took to transfer the file using FTP (57.13 seconds). That is good. Now check the restore numbers, as shown in Example 15-8.

Example 15-8 Restore of a 500 MB test file

```
Restore function invoked.
```

```
Restoring      524,288,000 /home/root/500MBFile [Done]  
Restore processing finished.
```

```
Total number of objects restored:      1  
Total number of objects failed:        0  
Total number of bytes transferred:    500.02 MB
```

Data transfer time:	416.28 sec
Network data transfer rate:	1,229.97 KB/sec
Aggregate data transfer rate:	1,216.43 KB/sec
Elapsed processing time:	00:07:03

So now, why did it take so long to restore the object? From the FTP statistics we know that the network is capable of transferring the file at about the same time in both directions. We answer the question in the next sections.

15.1.2 Tivoli Storage Manager client performance tracing

The Tivoli Storage Manager client can optionally collect instrumentation statistics for commands executed.

Attention: Using these tracing facilities is done at your own risk.

From a performance standpoint, do not activate the trace settings if you are in a stable environment and are not experiencing problems. Trace routines require processing time and could slow down application response times. If a problem occurs, you can always activate the trace routines to gather trace information for diagnostic purposes. Call your IBM Service Representative for assistance with diagnosing Tivoli Storage Manager problems.

The Tivoli Storage Manager client includes client instrumentation procedures that provide performance instrumentation statistics broken down by threads. Activating this feature will generate a file that contains the summary statistics.

Tivoli Storage Manager V5.3 and later clients (all except Novell clients) use file name `dsminstr.report.pnnnnn`, where `nnnnn` is the process ID of the `dsmc` process. On Novell systems the file name will be just `dsminstr.report`. The file will be in the directory set in the `DSM_LOG` environment variable.

On earlier Tivoli Storage Manager clients, the file name is `dsminstr.report`, stored in the client installation directory. Once created, subsequent traces will append to this file.

The report only shows threads with instrumented activities, and logs only the CLI client and scheduler, not the GUI. Example 15-9 shows how to enable tracing.

Example 15-9 Client performance tracing

<code>-testflag=instrument:detail</code>	(command line)
<code>testflag=instrument:detail</code>	(options file)

The output file name cannot be specified, but after the task is complete, you can rename it to a meaningful name, for example, YYMMDD_client_stats.txt. Example 15-10 shows the output for the backup of the 500 MB file. We have shown only the thread information that is important to this investigation.

Example 15-10 Client instrumentation statistics: backup

TSM Client final instrumentation statistics: Thu Feb 23 09:52:13 2006

Instrumentation class: Client detail
Completion status: Success

Detailed Instrumentation statistics for

Thread: 1029 Elapsed time 44.384 sec
Section Actual (sec) Average(msec) Frequency used

Process Dirs	0.000	0.0	0
Solve Tree	0.000	0.0	0
Compute	0.008	0.0	2001
BeginTxn Verb	0.000	0.0	1
Transaction	0.025	25.3	1
File I/O	0.628	0.3	2002
Compression	0.000	0.0	0
Encryption	0.000	0.0	0
CRC	0.000	0.0	0
Delta	0.000	0.0	0
Data Verb	43.587	21.8	2001
Confirm Verb	0.005	5.1	1
EndTxn Verb	0.048	48.2	1
Sleep	0.010	10.0	1
Thread Wait	0.040	39.6	1
Other	0.034	0.0	0

We did not expect anything spectacular from this trace, as the backup was running fine, so now let us compare it to the restore numbers. The statistics, again an extract only, are shown in Example 15-11.

Example 15-11 Client instrumentation statistics: restore

TSM Client final instrumentation statistics: Thu Feb 23 10:44:29 2006

Instrumentation class: Client detail
Completion status: Success

Detailed Instrumentation statistics for

Thread: 772 Elapsed time 422.012 sec
Section Actual (sec) Average(msec) Frequency used

Process Dirs	0.001	1.0	1
Solve Tree	0.000	0.0	0
Compute	0.000	0.0	0
BeginTxn Verb	0.000	0.0	2
Transaction	0.043	21.5	2
File I/O	2.729	1.4	2002
Compression	0.000	0.0	0
Encryption	0.000	0.0	0
CRC	0.000	0.0	0
Delta	0.000	0.0	0
Data Verb	416.477	207.6	2006
Confirm Verb	0.000	0.0	0
EndTxn Verb	0.000	0.0	0
Sleep	0.000	0.0	0
Thread Wait	0.371	185.3	2
Other	2.392	0.0	0

The statistics show, from the *File I/O* section, that it takes slightly longer to write the file compared to the read. But this section only takes a small amount of time during the restore. The majority of the time is spent in the *Data Verb* section. This now could be server-related processing or indicate a communication problem between the server and the client. Before we look at the server-generated statistics in 15.1.3, "Tivoli Storage Manager server

“performance tracing” on page 492, we explain the sections of the client instrumentation traces:

Client Setup	Initial processing including signon, authorization, and queries for policy set and file system information.
Process Dirs	Processing directory and file information before backing up or restoring any files. For incremental backup, it includes querying the server for backup status information. For classic restore, it includes retrieving the file list. For no-query-restore, this is not used.
Solve Tree	For selective backup, determining whether there are any new directories in the path that need to be backed up. This involves querying the server for backup status information about directories. This can be large if there are a large number of directories.
Compute	Computing throughput and transfer sizes.
Transaction	A general category to capture all time not accounted for in the other sections. Includes file open/close time, which can be large, especially during restore of many small files. Also includes message display time, which can be large if running without the quiet option or with detailed traces enabled. Average time for this section is not meaningful.
BeginTxn Verb	Frequency used indicates the number of transactions that were used during the session.
File I/O	Requesting data to be read or written on the client file system.
Compression	Compressing or uncompressing data.
Encryption	Encrypting or decrypting data.
CRC	Computing or comparing CRC values.
Delta	Adaptive subfile backup processing, including determining the changed file bytes or blocks.
Data Verb	Sending or receiving data to/from the communication layer. High data verb time prompts an investigation of server performance and the communication layer (which includes elements of both the client and server).
Confirm Verb	During backup, sending a confirm verb and waiting for a response to confirm that the data is being received by the server.
EndTxn Verb	During backup, waiting for the server to commit the transaction. This includes updating the database pages in

	memory and writing the recovery log data. For backup direct to tape, this includes flushing the tape buffers.
Sleep	Sleeping time.
Thread Wait	Time spent waiting on another thread.
Other	Time spent on any other task not mentioned above. If you see a high number here, you should look at the statistics reported by other threads, since this does not necessarily indicate a problem with this particular thread.

Please note that the trace facilities can be changed at any time by development without notification.

15.1.3 Tivoli Storage Manager server performance tracing

The Tivoli Storage Manager server can collect instrumentation statistics for a period of time.

Attention: Using these tracing facilities is done at your own risk.

From a performance standpoint, do not activate the trace settings if you are in a stable environment and are not experiencing problems. Trace routines require processing time and could slow down the response times of your workstation applications. If a problem occurs, you can always activate the trace routines to gather trace information for diagnostic purposes. Call your Tivoli Service Representative for assistance in diagnosing Tivoli Storage Manager problems.

Tivoli Storage Manager server performance instrumentation shows threads with disk, tape, or network I/O operations during the observation period. To activate performance instrumentation, use the **instrumentation begin** command, as in Example 15-12.

Example 15-12 Start server performance instrumentation

`tsm> INStrumentation Begin [Maxthread=number]`

By default, a maximum number of 1024 threads can be instrumented. To end performance instrumentation, enter the **instrumentation end** command, as in Example 15-13.

Example 15-13 Stop server performance instrumentation

`tsm> INStrumentation End > <valid_path_and_filename>`

By default, the output is sent to the console or administrative display, using a pipe to redirect it to a file. We collected the server instrumentation traces for the backup and the restore attempt. Since we know we are backing up a file of 500 MB it is easy to identify the related threads from the server trace by looking at the Total KB section. Example 15-14 shows the threads for the backup.

Example 15-14 Server instrumentation statistics: backup

Thread 46 SessionThread (Win Thread ID 2860)	09:47:57.875-->09:48:42.281						
Session ID 79 BANDA (AIX)							
Operation Count Totime Avgtime Mintime Maxtime InstTput Total KB							
<hr/>							
Network Recv	24752	44.249	0.002	0.000	0.031	11571.4	512024
Network Send	11	0.000	0.000	0.000	0.000		0
Acquire Latch	65	0.000	0.000	0.000	0.000		
Acquire XLatch	134	0.000	0.000	0.000	0.000		
Thread Wait	2012	0.110	0.000	0.000	0.047		
Unknown		0.047					
<hr/>							
Total		44.406				11530.5	512024
<hr/>							
Thread 48 AgentThread (Win Thread ID 1612)	09:47:57.921-->09:48:42.265						
C:\TSMDATA\STG\FILECLASS\00000012.							
Operation Count Totime Avgtime Mintime Maxtime InstTput Total KB							
<hr/>							
Disk Write	2001	7.030	0.004	0.000	0.016	72867.1	512256
Disk Commit	2	0.047	0.024	0.015	0.032		
Acquire XLatch	3	0.000	0.000	0.000	0.000		
Thread Wait	2010	37.221	0.019	0.000	0.032		
Unknown		0.046					
<hr/>							
Total		44.344				11551.9	512256

By matching the threads reading and writing data for a single session, the bottleneck can be seen. In Example 15-14 on page 493 it is the network. A faster network would increase backup times. This proves one simple statement: The process can only be as fast as the slowest component involved. But we are interested in why the restore was so slow. So now have a look at those server instrumentation statistics, as shown in Example 15-15.

Example 15-15 Server instrumentation statistics: restore

Thread 48 AgentThread (Win Thread ID 3192)	10:40:15.890-->10:47:16.890						
C:\TSMDATA\STG\FILECLASS\00000012.							
Operation Count Totime Avgtime Mintime Maxtime InstTput Total KB							
<hr/>							
Disk Read	2001	9.365	0.005	0.000	0.032	54699.0	512256
Disk Commit	1	0.015	0.015	0.015	0.015		

Acquire XLatch	3	0.000	0.000	0.000	0.000		
Thread Wait	2007	411.620	0.205	0.000	2.172		
Unknown		0.000					
Total		421.000				1216.8	512256
 Thread 46 SessionThread (Win Thread ID 2604) 10:40:13.437-->10:47:16.906							
Session ID 86 BANDA (AIX)							
Operation	Count	Tottime	Avgtime	Mintime	Maxtime	InstTput	Total KB
Network Recv	51	4.344	0.085	0.000	2.390	0.2	1
Network Send	4017	419.032	0.104	0.000	0.219	1221.9	512025
Acquire Latch	43	0.000	0.000	0.000	0.000		
Acquire XLatch	105	0.000	0.000	0.000	0.000		
Thread Wait	2006	0.061	0.000	0.000	0.031		
Unknown		0.032					
Total		423.469				1209.1	512026

Here we see that the server can read from the storage pool volume with an instrumented throughput of 54 MBps, but the data is sent back to the client with only about 1.2 MBps. From the Network Recv section of the backup trace, we know that the client is sending the data with 24752 verbs, but the server is sending the data back with only 4017 verbs (Network Send of the restore trace).

This makes us review the client and server communications options, and here we find the cause of the problem: since we were running with a minimal client systems option file, we did not specify the DISKBUFSIZE or the related ENABLELANFREE option. With ENABLELANFREE set to NO, the DISKBUFSIZE on our AIX system defaulted to 256 KB for the DISKBUFSIZE. This does not work well with the Windows Tivoli Storage Manager server communication when it transmits data back to the AIX client. So we specified a value of DISKBUFSIZE to 32 and the improved result for the restore is shown with Example 15-16. The restore time is now down to 46 seconds—success.

Example 15-16 Restore after configuration change

```
# dsmc res /home/root/500MBFile
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 3.0 0220FB
  Client date/time: 02/23/06 13:46:40
(c) Copyright by IBM Corporation and other(s) 1990, 2006. All Rights Reserved.

Node Name: BANDA
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/23/06 13:42:24 Last access: 02/23/06 13:27:49
```

Restore function invoked.

```
Restoring      524,288,000 /home/root/500MBFile [Done]
```

Restore processing finished.

Total number of objects restored:	1
Total number of objects failed:	0
Total number of bytes transferred:	500.06 MB
Data transfer time:	41.12 sec
Network data transfer rate:	12,452.21 KB/sec
Aggregate data transfer rate:	11,026.84 KB/sec
Elapsed processing time:	00:00:46

This example should provide you with a basic idea of the steps needed to approach and investigate Tivoli Storage Manager performance-related questions within your environment.

Often the first clue to a performance problem is unexpected results. These symptoms should be documented for later analysis and possible correlation with log data provided by the client and the server. Performance tuning is an iterative process and usually the first performance trace leads to further tracing on either the client, the network, or the server. Document your changes to the configuration and keep track of the results after the changes are applied.

As described in 15.1, “How to measure performance” on page 482, the number of influencing factors is huge, and each requires detailed consideration to increase overall performance.

Note: If archive performance is an issue, make sure to consult Appendix A, “Using TSM’s Archive Function,” in the *Tivoli Storage Manager Performance Tuning Guide*, SG32-9101.

15.2 Architecture-based performance tuning

In this section we describe design considerations for a Tivoli Storage Manager implementation. We first offer conceptual guidelines to follow, as well as provide a list of parameters for precise tuning.

15.2.1 Database and recovery log

When implementing a Tivoli Storage Manager server, consider using multiple disk volumes for the database and recovery log files. This enables the server process to spread its I/O (input/output) over several volumes in parallel, which increases read and write performance. Subsequently, a greater quantity of smaller disks can provide better performance than would fewer and larger disks of the same rotation speed.

To support the above configuration, you may be able to *stripe* the database and log volumes across multiple disks, which would balance the I/O load so that it is not only spread over multiple database volumes, but also over multiple disks.

Note: When spreading your database and log volumes over multiple disks, ensure that the DB volumes do not share the same physical disks as the LOG volumes. With this said, when including mirroring for these volumes, again you should ensure that separate physical disks are chosen for the mirrors as well. The remaining unused disk space on these volumes can be used to spread out your disk pools, again ensuring balance I/O.

Another option is to put multiple database volumes on a striped volume set of disks to increase performance.

When located on separate disk volumes, mirroring can increase not only server stability, but also server performance. The Tivoli Storage Manager server can access multiple database copies at the same time and prioritizes the volume copy with the shortest response time. Thus if your hardware does not support mirroring, the Tivoli Storage Manager server does this very well, provided that you balance the I/O with the appropriate volume placement.

Tivoli Storage Manager access to the database for reading/writing is highly random in nature. Keep in mind that large read-ahead buffers defined for the volumes might hurt performance rather than help you.

15.2.2 Storage pools

The advice given in the previous section is also valid for disk storage pools, that is, you can increase performance by using multiple small volumes for disk storage pools instead of using one big volume.

Figure 15-1 on page 497 shows the side effects of placing multiple storage pool volumes on a single disk. The increased seek activity can degrade performance.

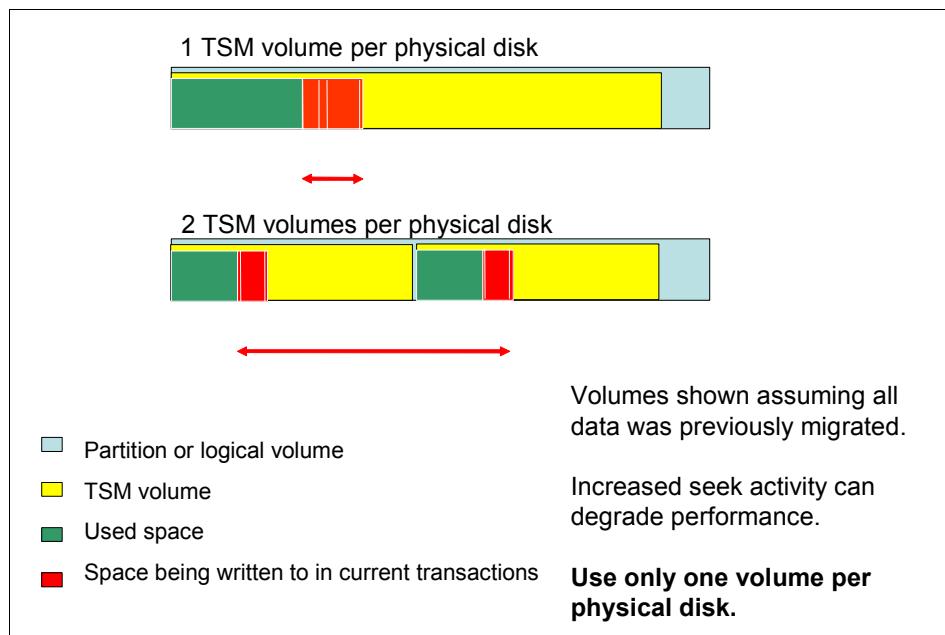


Figure 15-1 Tivoli Storage Manager volume definitions

It is also preferable to send backups of large amounts of data, such as entire client databases, directly to tape instead of buffering in a disk storage pool. This allows the client to take advantage of the high streaming performance of most advanced tape drives when writing large files and avoids extra data movement from the migration process, which will likely be immediately triggered.

Backups of file servers and workstations should be directed to a disk storage pool to avoid tape mount delays. Also, a disk storage pool supports more multiple sessions than the available tape devices.

15.2.3 Versioning

Keeping a lot of different backup versions of files makes the Tivoli Storage Manager server database larger. A larger server database will not be accessed as fast as a smaller one and requires more time for backup and inventory expiry operations. The planning process is important in order to make sure you keep only as many versions as really needed.

Incremental backup is nearly always preferred over selective backup, because selective backup generates a new version every time, regardless of whether the specific file has changed or not.

15.2.4 Client configuration

Using the powerful include and exclude options, you can specify the amount of files to be backed up to a very detailed level. Careful use of these options can reduce the daily amount of backup data significantly and thus improve both client and server performance.

15.2.5 LAN-free backup/restore

Using LAN-free backups can unburden LAN traffic significantly, as well as reduce the overhead on the Tivoli Storage Manager server, since the data is directly transferred to tape. This feature is important, especially for clients whose backups are routed to tape directly (databases, for example).

15.3 Tivoli Storage Manager server

In this section we discuss the most common tuning parameters for all Tivoli Storage Manager servers.

15.3.1 Server database and recovery log

This section covers server options to influence the performance and behavior of the server database and the recovery log.

BUFPOLSIZE

Cache storage is provided by the database buffer pool size, which allows frequently used database pages to remain cached in memory. This means faster access times and better performance, because the pages can be read and updated from memory instead of requiring I/O operations to external storage. The larger the database buffer pool, the more space there is to keep pages in memory. However, since the buffer pool is implemented in real memory, its size must be balanced against total memory requirements for the whole system and any other workloads.

To measure the effectiveness of the database buffer pool, monitor the cache hit percentage. This number indicates how often a database page request could be satisfied from the cache as opposed to requiring disk access. An optimal setting for the database buffer pool is one in which the cache hit percentage is greater

than or equal to 98%. To check the cache hit percentage, use the `query db f=d` command, as shown in Example 15-17. This shows that our cache hit percentage is 99.89%, which is fine.

Example 15-17 query db f=d

```
tsm: LOCHNESS_SERVER1>q db format=detail

    Available Space (MB): 2,024
    Assigned Capacity (MB): 2,024
    Maximum Extension (MB): 0
    Maximum Reduction (MB): 1,616
        Page Size (bytes): 4,096
        Total Usable Pages: 518,144
        Used Pages: 104,680
            Pct Util: 20.2
            Max. Pct Util: 20.2
            Physical Volumes: 3
            Buffer Pool Pages: 65,280
            Total Buffer Requests: 37,804
            Cache Hit Pct.: 99.89
            Cache Wait Pct.: 0.00
            Backup in Progress?: No
            Type of Backup In Progress:
            Incrementals Since Last Full: 2
            Changed Since Last Backup (MB): 113.02
            Percentage Changed: 27.64
            Last Complete Backup Date/Time: 02/21/2006 17:12:20
            Estimate of Recoverable Space (MB): 0
            Last Estimate of Recoverable Space (MB): 02/17/2006 12:09:21
```

Increasing the `BUFOOLSIZE` parameter can improve the performance of many Tivoli Storage Manager server functions, such as multi-client backup, storage pool migration and backup, expiration processing, and move data. If the cache hit percentage is lower than 98%, increase the `BUFOOLSIZE` value in the server options file. For most servers, we recommend starting with a value of 32768, which equals 8192 database pages. If you have enough memory, increase in 1 MB increments. A cache hit percentage greater than 98% indicates that the proper `BUFOOLSIZE` has been reached. However, continuing to raise `BUFOOLSIZE` beyond that level may still be helpful. While increasing `BUFOOLSIZE`, take care not to cause paging in the virtual memory system. Monitor system memory usage to check for any increased paging after changing the `BUFOOLSIZE`.

Tip: Tivoli Storage Manager can use the parameter SELFTUNEbufpoolsize YES in the server options file to activate self-tuning. When you activate this option, the server will check the cache hit ratio each time inventory expiration is run. If the value is less than 98%, then it will increase the BUFPOOLSIZEx by a predictable factor related to the actual cache hit ratio achieved. An upper limit for BUFPOOLSIZEx with self-tuning is imposed of 10% of the real memory for AIX, HP UX, Solaris, Linux, and Windows, and 50% of the region size in z/OS. If you still need a larger BUFPOOLSIZEx and it is acceptable in your environment, you will have to set the value manually.

MIRRORWRITE

This specifies how mirrored volumes are accessed when the server writes pages to the recovery log or database during normal processing. A value of *sequential* specifies that the server writes to the mirrored volume one after another. Server performance decreases because a successful I/O must occur before the next write can occur. A value of *parallel* specifies that the server writes to all mirrored volumes in parallel. This mode allows all mirrors to obtain the new page at approximately the same time.

Note: If a system outage occurs at exactly the instant that each mirror is partially complete in writing its page, a partial write to each mirror could result. See the DBPAGESHADOW option below to prevent this.

When using mirrored database volumes in sequential mode, using a disk system with write caching ability can improve database performance. When writing in sequential mode, one database volume write must complete before the mirror is written to. A disk system with write cache allows the mirror to be written to almost instantaneously, nearly doubling the amount of write activity possible. Many disk systems can do this; however it may need to be specifically enabled. Check your disk vendor's documentation for details.

DBPAGESHADOW

This specifies whether database page shadowing is enabled. If database page shadowing is enabled, Tivoli Storage Manager mirrors every write to a database page. This mirror is represented by a shadow file that contains these written mirrors. DBPAGESHADOW YES eliminates the requirement to set MIRRORWRITE SEQUENTIAL to prevent exposure to partial page writes. We recommend keeping the default of YES.

Database reorganization

Over time, database volumes can become fragmented. You can restore the efficiency of the database and improve database performance by reorganizing

the database using database unload and reload processing. By reloading the database, you compress and reorganize it. This process is described in detail in Chapter 14, “Advanced operations” on page 453.

15.3.2 Transactions

This section covers server options that influence the performance and behavior of data movement within the server.

TXNGROUPMAX

The option TXNGROUPMAX specifies the number of files that are transferred as a group between a client and the server between transaction commit points. A group of client files is known as an *aggregate* or *physical file*. Client backup, archive, restore, and retrieve performance may improve by using a larger value for this option.

TXNGROUPMAX is used in conjunction with the client TXNBYTELIMIT option. See “TXNBYTELIMIT” on page 506 for a more detailed description of the transaction process and the side effects on the recovery log.

MOVEBATCHSIZE and MOVESIZETHRESH

The MOVEBATCHSIZE and MOVESIZETHRESH options help tune the performance of the server processes that involve the movement of data between storage media. These processes include storage pool backup and restore, migration, reclamation, and move data.

These options specify the number of files and the quantity of data that are to be moved and grouped together in a batch, within the same server transaction.

MOVEBATCHSIZE and MOVESIZETHRESH apply to file aggregates, or physical files, as described under TXNGROUPMAX in the previous section.

The number of client files moved for each server database transaction during a server storage pool backup or restore, migration, reclamation, or move data operation will be determined by the number and size of the files in the batch. If the number of files in the batch equals the MOVEBATCHSIZE before the cumulative size of the files becomes greater than the MOVESIZETHRESH, then the MOVEBATCHSIZE is used to determine the number of files moved or copied in the transaction. If the cumulative size of files being gathered for a move or copy operation exceeds the MOVEBATCHSIZE value before the number of files becomes equivalent to the MOVEBATCHSIZE, then the MOVESIZETHRESH value is used to determine the number of files moved or copied in the transaction.

If the MOVEBATCHSIZE or MOVESIZETHRESH parameters are increased from the default values, the server will require more recovery log space—up to two or more times larger than a recovery log when the defaults are used. Also, the server requires more time to initialize at startup. The impact of a larger recovery log size will be felt while running the server with the logmode set to NORMAL (the default value). If you choose to increase these values for performance reasons, be sure to monitor recovery log usage during the first few storage pool backup/restore, migration, reclamation, or move data executions to ensure sufficient recovery log space is available.

Tip: Tivoli Storage Manager can be configured to auto-configure and monitor these parameters, so that it can increase its ranges for better throughput.

When the SELFTUNETXNSIZE parameter is set to YES in the server options file, the MOVEBATCHSIZE and MOVESIZETHRESH server options will both be set to their maximum possible values to optimize server throughput. Also, the server will monitor and change the value of TXNGROUPMAX to optimize client-server throughput.

Recovery log

If you use the TXNGROUPMAX and TXNBYTELIMIT parameters, remember that larger transactions require more recovery log space. The Tivoli Storage Manager server can require more time when re-starting, to process the log entries. Again, see “TXNBYTELIMIT” on page 506 for more information about the transaction process and the side effects on the recovery log.

15.3.3 Communication

This section covers server options that influence the performance and behavior of communication protocols between client and server.

MAXSESSION

The MAXSESSION parameter specifies the maximum number of simultaneous client sessions that can connect to the Tivoli Storage Manager server. The default value is 25 client sessions, and the minimum value is two. The maximum value is limited only by available virtual memory or communication resources. This parameter specifies the maximum number of simultaneous client sessions that can connect to the Tivoli Storage Manager server. By limiting the number of clients, server performance can be improved, but the availability of Tivoli Storage Manager services to the clients is reduced.

Since Tivoli Storage Manager clients use multi-threading, you should consider the total number of concurrent nodes, times the number of concurrent sessions

that the server must handle. If you need 10 concurrent nodes to perform backup operations and each of them has a multi-threading capability (resource utilization) of 4, then you must set maxsession to at least 40 (10 x 4).

MAXSCHEDSESSIONS

The MAXSCHEDSESSIONS parameter specifies the number of sessions that the server can use for processing scheduled operations. It is specified as a percentage of the total number of server sessions available (the MAXSESSION parameter). You should set this to less than 100, otherwise it could lead to a situation where all the available sessions are being used for running client scheduled backups and a critical restore cannot run because there are no spare session slots.

Use the **query status** command to display the current MAXSCHEDSESSIONS value, and change it to another value with the **set maxschedsessions** command.

TCPWINDOWSIZE

This option specifies the size of the TCP sliding window in kilobytes. The TCPWINDOWSIZE option overrides the operating system's TCP send and receive spaces. In AIX, for instance, these parameters are named `tcp_sendspace` and `tcp_recvspace`. The TCPWINDOWSIZE option specifies the size of the TCP sliding window for all clients and all but MVS servers. A larger window size can improve communication performance, but uses more memory. It enables multiple frames to be sent before an acknowledgment is obtained from the receiver. If long transmission delays are being observed, increasing the TCPWINDOWSIZE may improve throughput.

The size of the TCP/IP buffer is used when sending or receiving data. The window size used in a session is the smaller of the server and client window sizes. Larger window sizes use additional memory but may improve performance.

The general recommendation is to set TCPWINDOWSIZE to 64 (except Windows, which is 63). Clients now default to 63. In an SP2 environment with a high-speed switch set the TCPWINDOWSIZE to a value between 128–640, and when using Gigabit Ethernet with Jumbo Frames – 9000 MTU set the TCPWINDOWSIZE to 128.

Tip: On AIX, the network option `rfc1323` must be set on to have TCPWindow sizes larger than 64K-1.

TCPBUFSIZE

The TCPBUFSIZE option specifies the size of the internal TCP communication buffer that is used to transfer data between the client node and the server. A large buffer can improve communication performance, but requires more memory.

The default setting of TCPBUFSIZE to 32 on client and server is the recommended value.

TCPNODELAY

The TCPNODELAY option, when set to Yes, allows data packets less than the MTU size to be sent out immediately. We recommend staying with the default setting of YES.

15.3.4 General parameters

These parameters can affect system performance and can be manually tuned according to client requirements.

Note: The following parameters must be set in the server options file and require a restart of the Tivoli Storage Manager server to take effect.

EXPINTERVAL

The Tivoli Storage Manager server runs automatic inventory expiration to remove unneeded client backup and archive file copies from the server. The EXPINTERVAL option specifies the interval in hours between automatic expiries.

Backup and archive copy groups specify the criteria that make copies of files eligible for deletion from data storage. However, even when a file becomes eligible for deletion, the file is only marked for deletion in the server database. It is not physically deleted from the database and storage pools until expiration processing occurs. If expiration processing does not occur periodically, storage pool space is not reclaimed from expired client files, and the Tivoli Storage Manager server requires increased disk storage space.

Expiration processing is very CPU intensive. If possible, it should be run when other Tivoli Storage Manager processes are not occurring. To enable this, either schedule expiration once per day, or use the `setopt expinterval 0` command and manually start the process with the `expire inventory` command at the server.

Tip: If SELFTUNEbufpoolsize is set to YES, **expire inventory** processing will also trigger the buffer pool performance monitoring algorithm to check whether a performance improvement could be gained (based on previous server execution and available real memory).

THROUGHPUT thresholds

Use the THROUGHPUTTIMETHRESHOLD and THROUGHPUTDATATHRESHOLD to control how Tivoli Storage Manager handles slow performing client sessions. Slow performing sessions may pin your recovery log and result in slower overall server performance. These options allow you to specify thresholds that must be met by client sessions in order to be considered productive and avoid cancellation.

The THROUGHPUTDATATHRESHOLD is specified in kilobytes per second, and specifies the throughput that a client session must reach to prevent being cancelled after the time threshold is reached.

The THROUGHPUTTIMETHRESHOLD is specified in minutes, and is added to the media wait time, to determine the total client session time. It specifies the time threshold for a session after which it may be cancelled for low throughput.

If the server detects that the client data transfer rate is below the specified threshold, the session is considered to be eligible for termination after the time threshold is reached.

COLLOCATION

The speed at which you can restore the files, among other parameters, also depends on how many tape drives are available on the server, and whether you are using collocation to keep file spaces assigned to as few volumes as possible.

With tape capacities becoming larger and larger, collocation by groups of nodes is now supported. Groups of nodes can be defined, and the server can then collocate data based on these groups. Collocation by group can yield the following benefits:

- ▶ Reduce unused tape capacity by allowing more collocated data on individual tapes.
- ▶ Minimize mounts of target volumes.
- ▶ Minimize database scanning and reduce tape passes for sequential-to-sequential transfer.

For newly defined storage pools, the default storage pool collocation setting is now *group*.

You can have the server collocate client data when the data is initially stored in server storage. If you have a storage hierarchy, you can also have the data collocated when the server migrates the data from the initial storage pool to the next storage pool in the storage hierarchy.

15.4 Client node

In this section we focus on tuning parameters on the Tivoli Storage Manager client to obtain maximum performance when using Tivoli Storage Manager. These parameters can be changed or added to the client options file.

15.4.1 Transactions

This section covers the Tivoli Storage Manager client options that influence the performance and behavior of data movement on and onto the server.

TXNBYTELIMIT

This specifies the batch size, in kilobytes, for Tivoli Storage Manager server transactions. TXNBYTELIMIT is used together with TXNGROUPMAX. This option reduces the number of server transactions by increasing the amount of data within any one transaction. Therefore, the amount of overhead during backup, restore, archive, and retrieve caused by database commits is reduced.

Note: This option can also be defined and adjusted by the server as required during self-tuning operations.

A *transaction* is the unit of work exchanged between the client and the server. Because the client program can transfer more than one file or directory between the client and server before it commits the data to server storage, a transaction can contain more than one object. This is called a *transaction group*. This option allows you to control the amount of data sent between the client and server before the server commits the data and changes to the server database, thus changing the speed with which the client performs work.

The amount of data sent within a single transaction applies when files are batched together during backup or when receiving files from the server during a restore procedure. The administrator can limit the number of files or directories contained within a group transaction using the TXNGROUPMAX option; the actual size of a transaction can be less than your limit. Once this number is reached, the client commits the transaction to the server even if the transaction byte limit is not reached.

If you increase this parameter, consider that:

- ▶ More data per transaction will increase server recovery log requirements. Check log and log pool space to ensure that there is enough space, and remember that a larger log may increase server startup time.
- ▶ More data per transaction may result in more data being retransmitted if a retry occurs. During a retry, all objects belonging to the current transaction need to be retransmitted, which can decrease performance.

Tip: Check your client log files for retransmission attempts during backups. They can occur, for example, when a file grows because client compression is enabled and the *compressalways* option is set to *no*.

- ▶ The benefits of changing this parameter are subject to configuration and workload characteristics. In particular, this parameter benefits tape storage pool backup more than disk storage pool backup, especially if the workload consists of many small files.

When setting the size of transactions, consider setting a smaller size if you are experiencing many resends due to files changing during backup when using static, shared static, or shared dynamic. This applies to both static and shared, because when a client detects that a file has changed during backup and decides not to send that file, it still has to re-send the other files in the transaction.

RESOURCEUTILIZATION

The RESOURCEUTILIZATION client option regulates the level of resources (that is, number of concurrent sessions) the Tivoli Storage Manager client and server can use during processing.

Tivoli Storage Manager clients are automatically multi-session capable and this function is transparent to the end user. However, the RESOURCEUTILIZATION parameter allows the user to customize the function.

This option increases or decreases the ability of the Tivoli Storage Manager client to create multiple sessions. The value of RESOURCEUTILIZATION does not represent the amount of sessions created by the client - it specifies the level of resources the Tivoli Storage Manager server and client can use during backup or archive processing. During backup or archive, the higher the value, the more sessions the client can start if it deems necessary.

The parameter can range from 1 to 10. When the option is not set, which is the default, only two sessions are created to the server. One session is opened for querying the server and the other for transferring file data.

If you set the RESOURCEUTILIZATION option to enable multiple client/server sessions and are backing up direct to tape, you must also update the server option MAXNUMP for client node maximum mount points allowed.

The following factors can affect the throughput of multiple sessions:

- ▶ The server's ability to handle multiple client sessions. Is there sufficient memory, multiple storage volumes, and CPU cycles to increase backup throughput?
- ▶ The client's ability to drive multiple sessions (sufficient CPU, memory, and so on).
- ▶ The configuration of the client storage subsystem. File systems that are striped across multiple disks, using either software striping or RAID-5, can better handle an increase in random read requests than a single drive file system. A file system on a single drive may not see performance improvement if it attempts to handle many random concurrent read requests.
- ▶ Sufficient bandwidth in the network to support the increased traffic.

These are some potentially undesirable aspects of running multiple sessions:

- ▶ The client could produce multiple accounting records.
- ▶ The server may not start enough concurrent sessions. To avoid this, the server MAXSESSIONS parameter must be reviewed and possibly changed.
- ▶ A query node command may not summarize client activity.

15.4.2 Communication

This section covers client options to influence the performance and behavior of communication protocols between client and server.

DISKBUFSIZE

The DISKBUFSIZE option specifies the maximum disk I/O buffer size (in kilobytes) that the client may use when reading files. Optimal backup, archive, or HSM migration client performance may be achieved if the value for this option is equal to or smaller than the amount of file read ahead provided by the client file system. A larger buffer will require more memory and may not improve performance. This option replaces the formerly available LARGECOMMBUFFERS option. We recommend keeping the default value unless otherwise advised by IBM support.

TCPBUFSIZE

The TCPBUFSIZE option specifies the size of the internal TCP communication buffer that is used to transfer data between the client node and the server. A

large buffer can improve communication performance, but requires more memory.

TCPWINDOWSIZE

The TCPWINDOWSIZE option specifies the size of the TCP/IP sliding window in kilobytes. This option overrides the operating system's TCP send and receive spaces. It specifies the size of the TCP sliding window for all clients, and all but MVS servers. A larger window size can improve communication performance, but uses more memory. It enables multiple frames to be sent before an acknowledgment is obtained from the receiver. If long transmission delays are being observed, increasing the TCPWINDOWSIZE may improve throughput.

TCPNODELAY

The TCPNODELAY option, when set to Yes, allows data packets less than the MTU size to be sent out immediately. We recommend setting the value to yes.

15.4.3 General parameters

These parameters can affect system performance and can be manually tuned according to client requirements.

COMPRESSION

The COMPRESSION option compresses files before they are sent to the Tivoli Storage Manager server. Compressing files reduces the amount of data storage required to store backup versions and archive copies of your files. It can, however, affect Tivoli Storage Manager throughput because of the CPU cycles required to compress the file.

Client data compression will save storage space, network capacity, and server cycles. However, compression may decrease throughput. If compression is on, backups can be significantly slower, depending on client processor speed, than if it were disabled. Compression may be beneficial for a fast processor on a slow network, but probably not for a slow processor on a fast network.

By default, files continue compressing even if the operation is causing the file size to increase. This can be the case if you are backing up already compressed files, such as ZIP archives. To prevent continued compression if the file size grows, and to send the file again without compression, use the COMPRESSALWAYS option set to no. When set to no, the current transaction will get rolled back and the objects for the transactions need to get retransmitted. You might want to edit your include/exclude list to exclude precompressed options from compression using the exclude.compression option.

The client COMPRESSION option is only in effect if your Tivoli Storage Manager administrator specifies that your client node may choose its own compression. When a node is registered using the `register node` command, there is a COMPRESSION parameter that allows the server to enforce compression, enforce non-compression, or allow the client to choose for itself. The default value is that the client can choose by setting the COMPRESSION value in the client options file. If the administrator wants to force a client to use compression, regardless of the contents of the client options file, then use the command `update node` with the parameter compression=yes.

General rules for using Tivoli Storage Manager compression:

- ▶ If you are backing up directly to tape, and the tape drive supports its own compaction, use the tape drive compaction, not Tivoli Storage Manager compression. If you have already compressed the data at the client level, then the tape drive compaction will not be able to reduce the data further.
- ▶ Do not use Tivoli Storage Manager compression if a client currently has built-in file compression support, like the Tivoli Storage Manager client for NetWare. Tivoli Storage Manager compression on these clients will not yield additional reduction in the amount of data backed up to the server.
- ▶ If you are using compressed file systems (for example, NTFS compression on a Windows system), the Tivoli Storage Manager client reads the uncompressed data stream regardless of the compression state of that file in the file system. This means that the file is uncompressed during the read and, if it is compressable data, gets compressed again by the client during the backup. This decompression/compression overhead may decrease backup performance. When the same file is restored, the client will decompress the file data received from the server and write the uncompressed data to the file system, where it will get re-compressed by the file system driver. Because of this extra processing required, we do not recommend using Tivoli Storage Manager compression on NTFS compressed file systems.

COMPRESSALWAYS

The COMPRESSALWAYS option controls what occurs when a file grows during compression. You can continue compressing, or send the object again as is if it grows during compression. This option is used with the COMPRESSION option.

DIRMC

This option had a big impact on restore performance in earlier versions of Tivoli Storage Manager, where directories were restored first, followed by the files. It was therefore an advantage to have directory information cached so that it was permanently on disk, and best practices design was to create small storage pools specifically for directories. The DIRMC directive in the client options file was used to bind directories to a management class pointing to this storage pool.

Restore processing has changed since then: during the process directories will be created with default attributes and the correct attributes and ACL information is applied once the data is read from the media. Therefore the original reason to cache directories on disk no longer applies.

Nevertheless, the DIRM option is still useful. If you do not specify this option to associate a management class with directories, the client, during backup, uses the management class in the active policy set of your policy domain with the longest retention period, which could point to a storage pool on tape. This might result in unwanted mount requests during a backup. Therefore, in the design described in this book, we have used a separate storage pool and management class for directories and recommend using the DIRM option.

QUIET

The QUIET option keeps messages from being written to the screen during backups. By default, Tivoli Storage Manager displays information about each file it backs up. To prevent this, use the QUIET option. Messages and summary information are still written to the log files.

There are two main benefits of using the QUIET option:

- ▶ For tape backup, the first transaction group of data is always resent. To avoid this, use the QUIET option to reduce retransmissions at the client.
- ▶ If you are using the client scheduler to schedule backups, using the QUIET option dramatically reduces disk I/O overhead to the schedule log and improves Tivoli Storage Manager throughput.

15.5 System design for performance

In this section we discuss some areas of hardware based design considerations when setting up a Tivoli Storage Manager server system.

15.5.1 PCI busses

Most pSeries machines have multiple PCI busses. As an example, when backing up to tape over a LAN it is not desirable to have the network adaptor and the tape (SCSI, fibre) adaptor on the same bus. Spreading the PCI adapters across different busses based on predicted usage will provide the most efficient layout.

15.5.2 Tape busses (SCSI, Fibre)

Placing too many tape devices on a bus can cause contention issues. For HVD SCSI tape devices, no more than two devices should be placed on a single bus.

For Fibre Channel tape devices, consider the throughput of the tape device and the HBA. For example, if you are using third generation LTO drives with rated performance of 80 MBps, and your backup data streams are able to push the drives to close to this limit, you might choose to put one or two drives per 2 Gbps HBA. Do not forget to consider the effect of compression.

It is often difficult to achieve the rated speed of high speed adaptors such as Gigabit Ethernet and Fibre Channel, no matter what the application. Do not plan on achieving full rated speed with these cards.

15.5.3 Disk topology

It is desirable to have a single Tivoli Storage Manager volume per disk, be it database, log, or storage pool. This provides the least contention, allowing each volume to act independently. This is often difficult as disk sizes get larger and RAID is insisted upon. It takes discipline to dedicate a 72 GB disk to a small 6 GB log volume, for example. Use of virtualization technologies such as the IBM TotalStorage® SAN Volume Controller can assist here, since virtual disks can be made of any size.

In the case of RAID, there is little choice but to have multiple Tivoli Storage Manager volumes per logical disk. This is an built-in downside to RAID. Instead of each disk acting independently, they must all work in unison, limiting performance.

When using JBOD, placing two storage pool volumes on a single disk will not result in a degradation, and may provide an improvement in performance. This is due to the fact that Tivoli Storage Manager writes synchronously to storage pool volumes, and providing the disk with other work to do increases aggregate performance.

15.5.4 System memory

The largest use of memory in a Tivoli Storage Manager server is the database buffer pool. A large buffer pool can improve database performance because fewer disk I/O is necessary. You should provide enough real memory for an optimal buffer pool. The buffer pool is adjusted using the BUFPOLLSIZE option, described in 15.3.1, “Server database and recovery log” on page 498. Set this option to between 1/8 and 1/2 of real memory.

15.5.5 Network

If possible, use dedicated networks for backup (LAN or SAN) so that other network traffic is not sharing the same wire as backup data.

Gigabit technology supports jumbo frames (9000 bytes), which should be used whenever Gigabit Ethernet hardware is implemented. Unfortunately not every Gigabit hardware component implements jumbo frames. Using this feature is only practical when all elements (server, switch, and client) are capable of it.

15.5.6 Tape devices

Calculation of your daily throughput for backup and archive data as well as the amount of data being sent directly to tape should lead to a minimum number of tapes that should be in place to sustain your data flow. Remember to size the number of tape devices to serve the data flow during the *peak* backup window, not on an daily average basis.

If you have to schedule certain server operations like migration, reclamation, or storage pool backup during the backup window, make sure that there are enough tape drives available to support these additional operations. Even if these server operations are typically scheduled outside the normal backup window, you should allow a number of tape drives serving unscheduled restore or retrieve operations.

15.6 Special performance tips

This section describes tuning tips for special areas that may depend on a certain operating system.

15.6.1 LAN-free tuning

When using LAN-free backup and restore, TCPNODELAY must be set to YES (the default) on the Storage Agent and server.

15.6.2 LTO/DLT tape tuning

Due to the high latency of the `write filemarks` command, LTO and DLT tape devices benefit from making Tivoli Storage Manager transactions as large as possible. Setting server TXNGROUPMAX to greater than 512 files and client TXNBYTELIMIT to the maximum of 2097152 bytes can reduce the number of transactions, enhancing performance. It is important to understand that these settings can effect the server's recovery log utilization, and will increase the amount of time between transaction commits. At Tivoli Storage Manager V5.2 and later, the maximum setting for the TXNGROUPMAX value has been increased from 256 to 65000. The double-up and test rule should be followed for these parameters.

15.6.3 File system volumes versus raw logical volumes

As a rule of thumb, the general recommendation is to put Tivoli Storage Manager server volumes on *raw logical volumes* (RLV) in a UNIX environment. In addition to the read/write performance, RLV volumes do not fragment and the creation is very fast. Support for RLVs is available on all UNIX Tivoli Storage Manager platforms, with the exception of Linux. RLVs are not supported for sequential access storage pools (device class of type file).

Tests on AIX have shown little difference in performance between using Tivoli Storage Manager storage pool volumes on JFS2 file systems using direct I/O and raw logical volumes. The same is true for tests on Solaris systems using VxFS file systems with the QuickIO option being enabled.

Note: On AIX, be aware that only storage pool volumes attempt to utilize the AIXDIRECTIO option, not database or log volumes.

If you decide to place your server volumes on a file system, be aware of fragmentation in the file system, especially if you create a lot of volumes at the same time. Also, creating such volumes can take some time, as the whole file is written during initialization.

15.6.4 AIX virtual memory system tuning

AIX is very aggressive in caching file system data. In many cases this is highly desirable. In the case of Tivoli Storage Manager, file system caching provides no benefit since the data is not likely to be in cache when it is needed (for migration or restore). This is due to the large volume of data Tivoli Storage Manager processes, which is typically much greater than available memory.

AIX will often page out application memory (including Tivoli Storage Manager) in favor of file system cache data. This is undesirable since it often causes the Tivoli Storage Manager database buffer pool to be paged out to disk, negating much of the benefit of the buffer pool. This can cause misleading database cache hit statistics since Tivoli Storage Manager believes it has that data in memory, when in fact it has much of that data on disk in paging space. The symptoms for this behavior are high-paging rates, as seen by the `vmstat` command. This can be avoided by tuning AIX such that it will not favor file system cache over application memory. This is accomplished by using the `vmtune` command provided in the `bos.adt.samples` AIX fileset.

By default, AIX will use up to 80% of memory as a file system cache. For machines dedicated to Tivoli Storage Manager this should be lowered. A good starting point is 50%. This parameter is called maxperm. This may be done by

running the **vmtune** command shown in Example 15-18 (pre AIX V5.2) and the **vmo** command in Example 15-19 (AIX V5.2 and later).

Example 15-18 Tuning pre-5.2 AIX file system cache usage

```
/usr/samples/kernel/vmtune -P50
```

Example 15-19 Tuning AIX 5.2 and newer file system cache usage

```
vmo -o maxperm%=50
```

For a detailed explanation of the **vmo** tunables, please see VMM page replacement tuning under:

<http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.doc/aixbman/prftungd/memperf5.htm>

If, after a period of time, paging still occurs, this may be lowered further. This behavior can also be avoided by using raw logical volumes for the disk storage pools. AIX will not attempt to cache data residing on a raw logical volume and will then be less likely to need to page out application memory. Raw logical volumes are also more efficient (in terms of CPU utilization) since AIX does not spend time attempting to cache this data. If a Tivoli Storage Manager server has high CPU utilization, better performance might be obtained by using raw logical volumes.

Often system paging is interpreted as a lack of memory. With Tivoli Storage Manager, this does not happen often, and paging can (and should) usually be eliminated with the tuning above. AIX clients can also benefit from altering the maxperm parameter. During backup, files are read into cache that are not likely to be read again.

As before, this can cause application memory to be paged out, causing the main application of that machine to suffer during backup. Lowering maxperm can help with this. Beware of the effects of tuning maxperm on the client application. The performance of the main application may depend on file system cache in some instances (like a file server). In this case it may be desirable to just alter maxperm before and after a Tivoli Storage Manager backup, or not at all.

Another tunable parameter is maxpgahead, which controls the AIX read-ahead algorithms. Read-ahead is desirable on the client during backup, and on the Tivoli Storage Manager server during storage pool migration from disk.

We recommend setting maxpgahead to the maximum of 256. When tuning maxpgahead you must also adjust the maxfree parameter to allow room for this data. The maxfree parameter should equal minfree+maxpgahead (or later), as shown in Example 15-20.

Example 15-20 Tuning pre AIX 5.2 read-ahead algorithms

```
/usr/samples/kernel/vmtune -R256 -f120 -F376
```

The vmtune settings do not survive system reboot. Place them in a script run by /etc/inittab on startup.

On AIX 5.2 and later, the **vmtune** command is replaced by **vmo** and **ioo** commands. See Example 15-21.

Example 15-21 Tuning AIX 5.2 and later read-ahead algorithms

```
vmo -o maxfree=376  
vmo -o minfree=120  
ioo -o maxpgahead=256  
ioo -o j2_maxPageReadAhead=256
```

For more information about the commands, see the AIX documentation or man pages for **vmtune**, **vmo**, and **ioo**.

15.6.5 Use NTFS partitions for the server

In a Microsoft Windows environment, place the Tivoli Storage Manager server recovery log, database, and disk storage pool volumes on partitions formatted using NTFS. NTFS has the following advantages:

- ▶ It offers support for larger disk partitions than FAT.
- ▶ It has better data recovery.
- ▶ It has better file security.
- ▶ Formatting Tivoli Storage Manager storage pool volumes on NTFS partitions is much faster than on FAT partitions.

Warning: NTFS file compression must not be used on disk volumes that are used by the Tivoli Storage Manager server, because of the potential for performance degradation.

15.6.6 Journal-based incremental backup

Using journal-based incremental backup (JBB) can provide substantially faster incremental backups of file systems with a large number of files with small daily change rates. Configuration of the journal options is done in the tsmjbbd.ini file in the client install directory. See the file for supported settings and configurable parameters. To show you the difference between a classic incremental and JBB type of backup, we created a file system with more than 240,000 objects and collected an instrumentation trace for an incremental backup when only a single file has been changed. The statistics for the backup without JBB are shown in Example 15-22.

Example 15-22 Incremental backup, no journal

TSM Client final instrumentation statistics: Thu Feb 23 16:43:53 2006

Instrumentation class: Client detail
Completion status: Success

Detailed Instrumentation statistics for

Thread: 1029 Elapsed time 406.568 sec
Section Actual (sec) Average(msec) Frequency used

Process Dirs	0.000	0.0	0
Solve Tree	0.000	0.0	0
Compute	0.000	0.0	3
BeginTxn Verb	0.000	0.0	1
Transaction	0.004	3.9	1
File I/O	0.002	0.5	4
Compression	0.000	0.0	0
Encryption	0.000	0.0	0
CRC	0.000	0.0	0
Delta	0.000	0.0	0
Data Verb	0.005	1.7	3
Confirm Verb	0.000	0.0	0
EndTxn Verb	0.010	10.1	1
Sleep	0.010	10.0	1
Thread Wait	406.429	406429.1	1
Other	0.108	0.0	0

Detailed Instrumentation statistics for

Thread: 515 **Elapsed time 406.433 sec**

Section	Actual (sec)	Average(msec)	Frequency used
Process Dirs	308.412	8.7	35332
Solve Tree	0.000	0.0	0
Compute	0.000	0.0	0
BeginTxn Verb	0.000	0.0	0
Transaction	0.000	0.0	0
File I/O	0.000	0.0	0
Compression	0.000	0.0	0
Encryption	0.000	0.0	0
CRC	0.000	0.0	0
Delta	0.000	0.0	0
Data Verb	0.000	0.0	0
Confirm Verb	0.000	0.0	0
EndTxn Verb	0.000	0.0	0
Sleep	0.000	0.0	0
Thread Wait	0.040	39.7	1
Other	97.981	0.0	0

..

Session established with server LOCHNESS_SERVER1: Windows
 Server Version 5, Release 3, Level 2.2
 Server date/time: 02/23/06 16:39:37 Last access: 02/23/06 16:32:12

Total number of objects inspected: 242,421
 Total number of objects backed up: 2
 Total number of objects updated: 0
 Total number of journal objects: 0
 Total number of objects rebound: 0
 Total number of objects deleted: 0
 Total number of objects expired: 0
 Total number of objects failed: 0
 Total number of bytes transferred: 87.33 KB
 LanFree data bytes: 0 B
 Server-Free data bytes: 0 B
 Data transfer time: 0.00 sec
 Network data transfer rate: 16,750.46 KB/sec
 Aggregate data transfer rate: 0.21 KB/sec
 Total number of bytes pre-compress: 89,411
 Total number of bytes post-compress: 89,411
 Objects compressed by: 0%
Elapsed processing time: 00:06:46
 Average file size: 43.65 KB

So out of the total time of 406 seconds, it takes 308 seconds to process the 35332 directories and realize that only two objects have changed. In addition, the server is queried for the objects available, resulting in a search and transfer of 82 MB worth of inventory information, as shown with producer session 134 in Example 15-23. Not only do we have to collect the information from the server, we need to transfer it through the network to make it available for the client session to check for changed objects.

Example 15-23 TSM server query session information

```
tsm: LOCHNESS_SERVER1>q se
```

Sess	Comm.	Sess	Wait	Bytes	Bytes	Sess	Platform	Client Name
Number	Method	State	Time	Sent	Recv'd	Type		
121	Tcp/Ip	Run	0 S	8.4 K	456	Admin	WinNT	ADMIN
134	Tcp/Ip	IdleW	1 S	82.0 M	1.8 K	Node	AIX	BANDA

Now we run the same operation, but with JBB enabled. The statistics are shown in Example 15-24.

Example 15-24 Journal-based backup statistics

```
Session established with server LOCHNESS_SERVER1: Windows  
Server Version 5, Release 3, Level 2.2  
Server date/time: 02/23/06 17:12:31 Last access: 02/23/06 17:11:38
```

```
Incremental backup of volume '/home'  
Querying Journal for '/home'  
Processing 1 Journal entries for '/home'  
Successful incremental backup of '/home'
```

```
Total number of objects inspected: 1  
Total number of objects backed up: 1  
Total number of objects updated: 0  
Total number of objects rebound: 0  
Total number of objects deleted: 0  
Total number of objects expired: 0  
Total number of objects failed: 0  
Total number of bytes transferred: 88.03 KB  
Data transfer time: 0.00 sec  
Network data transfer rate: 17,737.50 KB/sec  
Aggregate data transfer rate: 43.80 KB/sec  
Objects compressed by: 0%  
Elapsed processing time: 00:00:02
```

Please keep in mind that this is only a single small test in our lab, but it should be sufficient to explain the major advantages of journaling to you.

We recommend that you leave the journal database size set to unlimited. Limiting the journal database size could potentially cause the journal to become invalid, and then Tivoli Storage Manager would resort to a full incremental backup. Of course, the journal size will depend on how many distinct files and directories are updated or deleted between backups, and hence on how much activity the file system sees. Very active file systems will need more space for the journal database than inactive file systems. We also recommend placing the journal database on a disk with at least 1 GB of free space. If free disk space is limited, consider performing backups more frequently than once per day, as this will also limit the journal database size.

15.7 Summary

When all is said and done with regard to performance, one thing should be clear: This job is never complete. As your client workload changes, your network configuration will evolve, the amount of managed data will increase, databases and their specialized client requirements will change, and hardware will get faster. All of these factors combine to move bottlenecks around your environment in an endless game of cat and mouse.

Figure 15-2 on page 521, while by far not complete, should give you a good starting point when reviewing your Tivoli Storage Manager tunables.

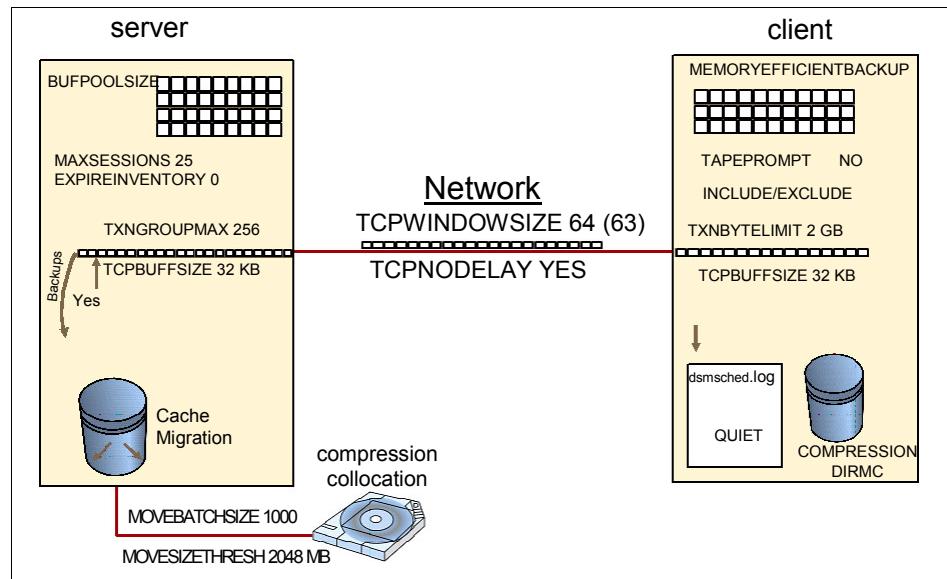


Figure 15-2 Tivoli Storage Manager tunables overview

If you document all your changes, making one change then re-testing, you will build yourself a smooth path to a continually top-performing solution. However, if you are less structured in your approach, and do not keep good documentation, then frustrating times might be waiting just around the corner. If your experiences become overwhelming, you might require the assistance of a very experienced subject matter expert. All of the authors have spent time working through some of the challenges created by careless haphazard approaches, and we hope that you will follow the careful structured path.



Part 4

Advanced topics

In this part of the book we discuss more advanced topics, such as LAN-free backups and using Network Data Management Protocol (NDMP) and the Network Appliance file server to achieve file level restore. Also included is the Disaster Recovery Manager, bare metal machine recovery, Tivoli Data Protection complimentary products, and, finally, how to upgrade your IBM Tivoli Storage Manager server and clients.



Leveraging SAN environments

We now enter into the advanced topics for this guide.

In this chapter we describe how to exploit your SAN environment to perform LAN-free client operations. We cover, in detail, requirements and procedures to set up LAN-free backup to tape using advanced IBM Tivoli Storage Manager features, such as library sharing, server to server communication, SAN device discovery, and more.

We show you how to install and configure the Storage Agent component, which is a prerequisite for LAN-free operations, and how to deploy the Storage Agent into your IBM Tivoli Storage Manager architecture.

Finally, we show you how to determine whether client operations such as backups and restores were made via LAN-free and which important considerations you should make before deploying the LAN-free feature to your data protection procedures.

More information about LAN-free environments, especially about various library sharing scenarios and LAN-Free backups to disk, is in *Get More Out of Your SAN with IBM Tivoli Storage Manager*, SG24-6687.

16.1 LAN-free prerequisites

Before deploying LAN-free data movement in your environment, you should carefully plan the system configuration, since this provides a smooth transition through system setup into production. As part of your planning, you need to identify the following:

- ▶ Which devices will be used for LAN-free data movement
- ▶ Which clients will use LAN-free data movement
- ▶ Which server will manage your client data
- ▶ Which library will be shared among the server and clients
- ▶ Compatibility of server and Storage Agent code, as well as compatibility of server and Storage Agent and the shared library drives

Note: Only Storage Agents Versions 5.2.3, 5.2.4 (and later) and 5.3 (and later) are supported by Tivoli Storage Manager V5.3.

Basically, the LAN-free environment consists of a Tivoli Storage Manager server and client machines with both the backup-archive and Tivoli Storage Manager for SAN clients installed. Tivoli Storage Manager for SAN is referred to as the Storage Agent. The Storage Agent, sometimes described as a small Tivoli Storage Manager server, is responsible for performing LAN-free operation upon client requests. Last but not least, both server and Storage Agent need access to a shared tape library (or disk system) connected to the SAN.

Using a SAN as a data transmission media for Tivoli Storage Manager client backup or restore operations requires that several conditions and requirements be met:

- ▶ The SAN configuration must be supported by Tivoli Storage Manager, from a hardware and software perspective.
- ▶ TCP/IP is required for communication between the Tivoli Storage Manager server, the client, and the Storage Agent.
- ▶ You need sufficient licenses for LAN-free operations, that is, licenses of Tivoli Storage Manager for SAN.
- ▶ A Tivoli Storage Manager backup-archive client or a Tivoli Storage Manager Data Protection application client must be installed on a client system.

As shown in Figure 16-1 on page 527, our LAN-free lab environment consists of a client DIOMEDE running Microsoft Windows 2003 and a Tivoli Storage Manager server V5.3.2, ATLANTIC, running on AIX 5.3. Both systems are connected via LAN and SAN. We also need a shared tape library connected to

the SAN. This is an IBM TotalStorage 3582 Tape Library (IBM 3582) with 2 LTO2 drives and Control Path Failover (CPF) feature enabled.

Note: CPF is an optional feature of the IBM 3582 that provides automatic control path failover to a preconfigured redundant control path if an HBA or control path drive fails, without aborting the current operation in progress. CPF is supported under AIX, Linux, Solaris, HP-UX, and Windows.

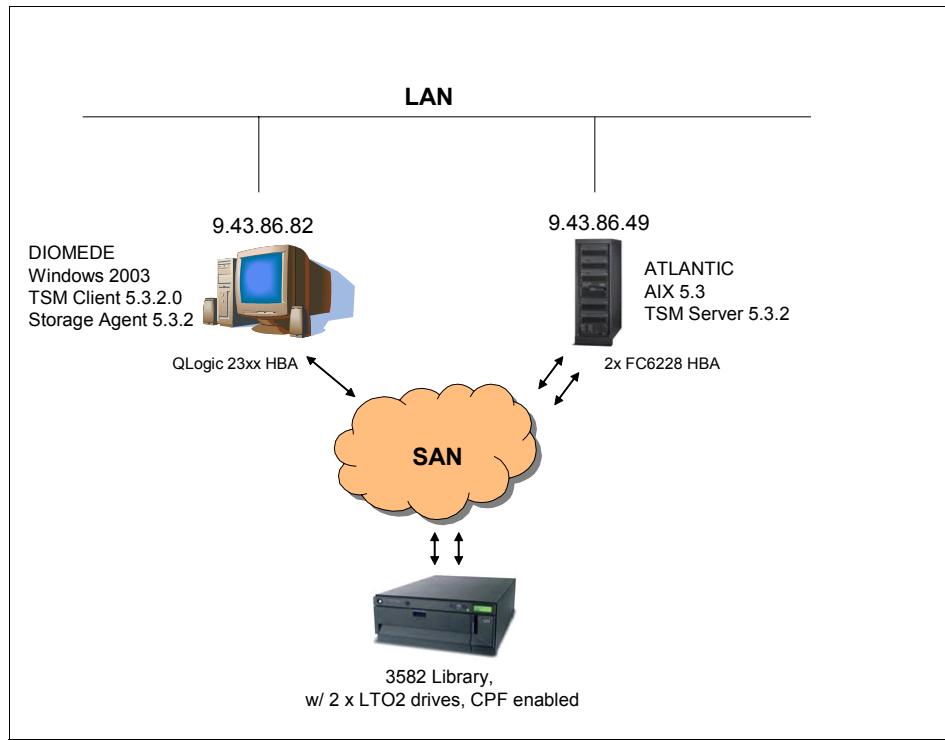


Figure 16-1 SAN lab environment

Note: The Tivoli Storage Manager server and Storage Agents may run on different platforms, for example, servers on AIX and Storage Agents run on Solaris and Windows client machines.

Apart from properly setting up the SAN itself, including configuring the switches, and cabling and zoning the devices participating in the SAN environment, you should install the supported Fibre Channel Host Bus Adapters (HBA) in the client machines, including the HBAs device drivers and firmwares.

In the following sections we discuss LAN-free client data transfer using Tivoli Storage Manager and the Storage Agent. In particular, we cover these topics:

- ▶ Setting up and configuring Tivoli Storage Manager server for LAN-free
- ▶ Configuring devices on the client machine for LAN-free
- ▶ Setting up and configuring the Storage Agent on a client machine
- ▶ Customizing the client for LAN-free
- ▶ Operations and considerations when using LAN-free data transfer

For more information about operating Tivoli Storage Manager in SAN environments, see *Get More Out of Your SAN with IBM Tivoli Storage Manager*, SG24-6687.

16.2 Server setup for LAN-free

Before setting up the server for LAN-free operations, the Tivoli Storage Manager server itself must be installed and running. The machine hosting the server instance needs to be connected to the SAN.

The instructions in this section assume that you can detect and use your SAN-attached library devices, and that all SAN devices and components have current microcode and firmware levels installed.

Once the hardware, firmware, and operating systems are prepared, the Tivoli Storage Manager configuration is virtually identical, regardless of the platform used. Here we describe configuring the Tivoli Storage Manager server on an AIX 5L platform.

In a Tivoli Storage Manager SAN environment, where the library is shared between several hosts, the Tivoli Storage Manager server is referred to as the *library manager*. The library manager owns and controls the library device and processes all requests from the library clients, such as mounting and dismounting volumes.

In our case, the library clients are Storage Agents. Library clients request shared library resources, such as a drive or media, from the library manager, but use them independently of the library manager.

In this library-sharing environment, the most important relationship is the one between the server and the Storage Agent—or library manager and library client. Establishing communication between library manager and library clients is called server-to-server communication in Tivoli Storage Manager terminology.

We prepare our server instance for server-to-server communication, setting up the server name, which must be unique across the whole Tivoli Storage Manager

environment. Further, each server name has an associated password that will be used during the server-to-server authentication process. Note that the server name is independent of DNS name or TCPSERVERADDRESS, as specified on the clients. It is just an identifying string for a server in a Tivoli Storage Manager server-to-server communication.

Also note that in some server-to-server configurations you may allow cross defining among servers, which facilitates defining server-to-server communication. Cross defining does not apply to Storage Agent definitions, so we do not cover it here.

Finally, make sure that the Tivoli Storage Manager server's high-level address (IP address) and low-level address (port) are set. We leave the port number for server-to-server communication on the default value 1500 (see Example 16-1).

Example 16-1 Prepare the server instance for server-to-server communication

```
tsm: ATLANTIC>set servername atlantic
ANR2094I Server name set to ATLANTIC.
```

```
tsm: ATLANTIC>set serverpassword xxxx
ANR2131I Server password set.
```

```
tsm: ATLANTIC>set serverhaddress atlantic.itsosj.sanjose.ibm.com
ANR2132I Server haddress set to atlantic.itsosj.sanjose.ibm.com.
```

```
tsm: ATLANTIC>set serverladdress 1500
ANR2133I Server laddress set to 1500.
```

You may review your settings with the **query status** command, as shown in Example 16-2.

Example 16-2 Server status output

```
tsm: ATLANTIC>query status
Storage Management Server for AIX-RS/6000 - Version 5, Release 3, Level 2.2
```

```
Server Name: ATLANTIC
Server host name or IP address: atlantic.itsosj.sanjose.ibm.com
Server TCP/IP port number: 1500
Crossdefine: On
Server Password Set: Yes
```

16.2.1 Defining library, drives, and associated paths on the server

As we said, the library must be shared between server and Storage Agents for LAN-free operations. Therefore, in contrast to a typical library definition, you must enable the library for SAN sharing using the shared=yes parameter; otherwise, the library clients will not be able to communicate with the drives.

Additionally, Tivoli Storage Manager V5.3 and later supports an option when defining the library, resetdrives. This is mainly used in cluster failover configurations, since its purpose is to reset SCSI reservations on defined drives during the server instance startup. However, it can also be helpful in non-clustered solutions, so we set the resetdrives value to yes, as in Example 16-3.

Example 16-3 Library and drive definition

```
tsm: ATLANTIC>define library 3582_shared libtype=scsi shared=yes resetdrives=yes  
autoLabel=yes serial=autodetect  
ANR8400I Library 3582_SHARED defined.  
  
tsm: ATLANTIC>define path atlantic 3582_SHARED srctype=server \  
cont> desttype=library autodetect=yes device=/dev/smco  
ANR1720I A path from ATLANTIC to 3582_SHARED has been defined.  
  
tsm: ATLANTIC>define drive 3582_shared dr00 serial=autodetect \  
cont> element=autodetect cleanfrequency=None  
ANR8404I Drive DR00 defined in library 3582_SHARED.  
  
tsm: ATLANTIC>define drive 3582_shared dr01 serial=autodetect \  
cont> element=autodetect cleanfrequency=None  
ANR8404I Drive DR01 defined in library 3582_SHARED.  
  
tsm: ATLANTIC>define path atlantic dr00 srctype=server desttype=drive \  
cont> library=3582_shared device=/dev/rmt0 online=yes  
ANR1720I A path from ATLANTIC to 3582_SHARED DR00 has been defined.  
  
tsm: ATLANTIC>define path atlantic dr01 srctype=server desttype=drive  
library=3582_shared \  
cont> device=/dev/rmt1 online=yes  
ANR1720I A path from ATLANTIC to 3582_SHARED DR01 has been defined.
```

Tip: LTO drives have an internal self-cleaning mechanism, which cleans a drive any time a tape is to be loaded. Therefore, you do not need to set the cleaning frequency in the drive definition.

16.2.2 Defining the device class

In Example 16-4 we define a device class for the IBM 3582 with the appropriate tape format. Note that we set the tape retention time to 5 minutes only, to ensure that tape volumes are dismounted as soon as they are no longer required for the operation in progress. Thus, when a library manager or client requires a mount point in the future, it does not need to wait for the idle tape to be dismounted first.

Example 16-4 Define the device class for the shared library

```
tsm: ATLANTIC>define devclass LT02C devtype=LTO 1library=3582_SHARED \
cont> format=ULTRIUM2C mountretention=5 mountlimit=DRIVES
ANR2203I Device class LT02C defined
```

Note: In a mixed server and Storage Agent version environment, you should choose a recording format supported by both server and Storage Agent. For example, if your drives support more than one recording format (that is, LTO3 drives support writes using both LTO2 and LTO3 format), and your server is running Version 5.3.2 (which supports LTO3), but Storage Agents are on 5.2.3 (which supports only LTO2), you must either choose LTO2 format or upgrade your Storage Agent to a version that supports LTO3.

For the complete syntax of the **define devclass** command for other storage devices supported by IBM Tivoli Storage Manager, refer to the *IBM Tivoli Storage Manager Administrator's Reference*.

16.2.3 Creating primary sequential storage pool for LAN-free

Now define a storage pool using the device class we just created, which will be used by the LAN-free clients as their data destination. In Example 16-5 we define a primary sequential storage pool called TAPEDATA_LF.

Example 16-5 Define a primary sequential storage pool for LAN-free

```
tsm: ATLANTIC>define stgp tapedata_lf 1to2c description="Lan-free storage pool"\
cont> collocate=no maxscratch=99
ANR2200I Storage pool TAPEDATA_LF defined (device class LT02C).
```

16.2.4 Defining policy

The last step is to define a management class with an associated copy group in the policy domain that uses the LAN-free storage pool. We then validate and activate the policy set to make the management class available for clients registered to the domain (see Example 16-6 on page 532). For more explanation on policy implementation, see Chapter 7, “Data storage policies” on page 269.

Example 16-6 Prepare policy components for the LAN-free clients

```
tsm: ATLANTIC>define mgmtclass server server lanfree migdestination=NONE
ANR1520I Management class LANFREE defined in policy domain SERVER, set SERVER.
```

```
tsm: ATLANTIC>define copygroup server server lanfree type=backup verexist=3
verdel=1 retextra=100 retonly=100 destination=TAPEDATA_LF
ANR1530I Backup copy group STANDARD defined in policy domain SERVER, set SERVER, management class LANFREE.
```

```
tsm: ATLANTIC>validate policy server server
ANR1515I Policy set SERVER validated in domain SERVER (ready for activation).
```

```
tsm: ATLANTIC>activate policy server server
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y
ANR1514I Policy set SERVER activated in policy domain SERVER.
```

```
tsm: ATLANTIC>query copygroup server active lanfree f=d
```

```
Policy Domain Name: SERVER
Policy Set Name: ACTIVE
Mgmt Class Name: LANFREE
Copy Group Name: STANDARD
Copy Group Type: Backup
Versions Data Exists: 3
Versions Data Deleted: 1
Retain Extra Versions: 100
Retain Only Version: 100
    Copy Mode: Modified
    Copy Serialization: Shared Static
    Copy Frequency: 0
Copy Destination: TAPEDATA_LF
Table of Contents (TOC) Destination:
    Last Update by (administrator): ADMIN
    Last Update Date/Time: 02/23/2006 14:45:26
    Managing profile:
    Changes Pending: No
```

Now we can register our client DIOMEDE to the policy domain SERVER. Note that although the *dataread* and *datawrite* parameters are set to their default values (*any* for both), we set it explicitly in the example to show you how you can control the transfer path used by the client. You may set the transmission to either LAN, or LANFREE, or both (*any*). Specifying *any* means that the LAN-free path will be tried at first and, if unavailable, data will be moved via the LAN.

Additionally, you may want to allow your client to allocate more than one tape drive for concurrent tape I/O operation, by specifying the MAXNUMMP parameter during node registration. Our library has only two drives, so the maximum in our case is maxnummp=2.

Example 16-7 Register node with data path and maxnummp specification

```
tsm: ATLANTIC>register node diomede diomede datawritepath=any datareadpath=any
maxnummp=2
ANR2060I Node DIOMEDE registered in policy domain STANDARD.
ANR2099I Administrative userid DIOMEDE defined for OWNER access to node
DIOMEDE.
```

16.2.5 LAN-free validation

Now validate the available management classes and their associated destination storage pools for LAN-free capability. Example 16-8 shows there is one storage pool capable of LAN-free transfer. See the LAN-free capable column.

Example 16-8 Validate management classes and storage pools for LAN-free

```
tsm: ATLANTIC>validate lanfree diomede sta_diomede
ANR0387I Evaluating node DIOMEDE using storage agent STA_DIOMEDE for LAN-free
data movement.
```

Node Name	Storage Agent	Operation	Mgmt Class	Destination Name	LAN-free capable?	Explanation
DIOM- EDE	STA_DIO- MEDE	BACKUP	DATA	DISKDATA	No	Destination storage pool is DISK.
DIOM- EDE	STA_DIO- MEDE	BACKUP	DIRECTORY	DISKDIRS	No	No available online paths.
DIOM- EDE	STA_DIO- MEDE	BACKUP	IMAGE	DISKDATA	No	Destination storage pool is DISK.
DIOM- EDE	STA_DIO- MEDE	BACKUP	LANFREE	TAPEDATA_LF	Yes	
DIOM- EDE	STA_DIO- MEDE	BACKUP	SPECIAL	DISKDATA	No	Destination storage pool is DISK.
DIOM- EDE	STA_DIO- MEDE	ARCHIVE	DATA	DISKDATA	No	Destination storage pool is DISK.
ANR1706I Ping for server 'STA_DIOMEDE' was able to establish a connection.						

ANR0388I Node DIOMEDE using storage agent STA_DIOMEDE has 1 storage pools capable of LAN-free data movement and 5 storage pools not capable of LAN-free data movement.

16.3 Storage Agent setup

Here we describe how to install and configure the Storage Agent on a Windows 2003 machine, including installing the IBM 3582 device drivers for the shared library.

The Storage Agent is an interface between a client and a server. It does not itself initiate the backup or restore operation, since this is a backup-archive client responsibility. Therefore, you should already have the backup-archive client installed on your machine, as described in 4.2, “Code installation” on page 101. Later we show the client customization steps to enable LAN-free transfer during client operations.

We recommend performing normal LAN-based backup and restore tests on the client node before installing and configuring the Storage Agent. By doing so, you can verify the basic connectivity and operation of the Tivoli Storage Manager client and server.

If you already have a library defined on your server, make sure that the parameter *shared* is set to yes.

To configure the Storage Agent:

1. Identify the shared library and drives in the client operating system.
2. Install device drivers for the library and tape drives.
3. Install the Storage Agent software.
4. Configure the Storage Agent and set it as a service.
5. Obtain device information.
6. Define the Storage Agent and device paths.
7. Customize the client options file to enable LAN-free.

Note: Remember, you cannot install the Storage Agent on a machine that is an Tivoli Storage Manager server.

16.3.1 Device drivers for shared devices

First we must properly set up our shared library and tape devices in the client operating system. In other words, you need to provide the operating system with device drivers it would use to operate the devices on its own.

Since we have an LTO library, we have to use IBM tape device drivers. For non-IBM devices, you might choose either third-party device drivers or use the Tivoli Storage Manager device drivers included in the Storage Agent package. The supported devices and required device drivers are on the Tivoli Storage Manager Web site:

http://www.ibm.com/software/sysmgmt/products/support/IBM_TSM_Supported_Devices_for_AIXHPSUNWIN.html

Figure 16-2 shows that we have two unidentified medium changers (libraries) and two tape drives. We have two libraries because our library has the Control Path Failover feature enabled. Thus each drive may take control of the robotics.

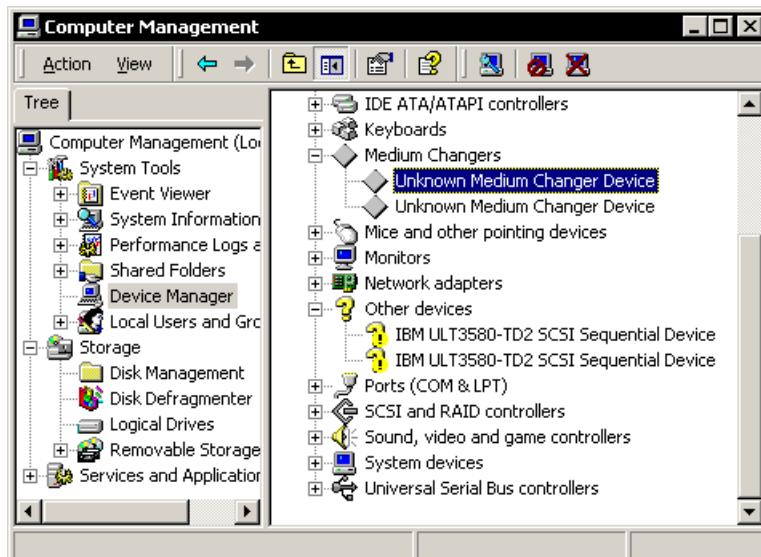


Figure 16-2 Windows device manager

Now we may supply the correct device drivers. Note that since V6.0.8.2 of the IBM Tape device drivers, the installation method has changed. With support for CPF in the Windows device driver, you must either follow the instructions in the readme file or run the install.exe binary, which performs all the necessary steps to install device drivers. We ran the install.exe to install the device driver for both the library and medium changer.

Note: We strongly recommend that you disable the Windows Removable Storage Manager (RSM) component so that it will not conflict with the device drivers. Disable the RSM component by selecting RSM from the Windows services available and updating its startup type to disabled.

After the installation, our devices are now correctly identified as IBM 3582 LTO Library and IBM ULT3580-TD2 SCSI Sequential Device (see Figure 16-3).

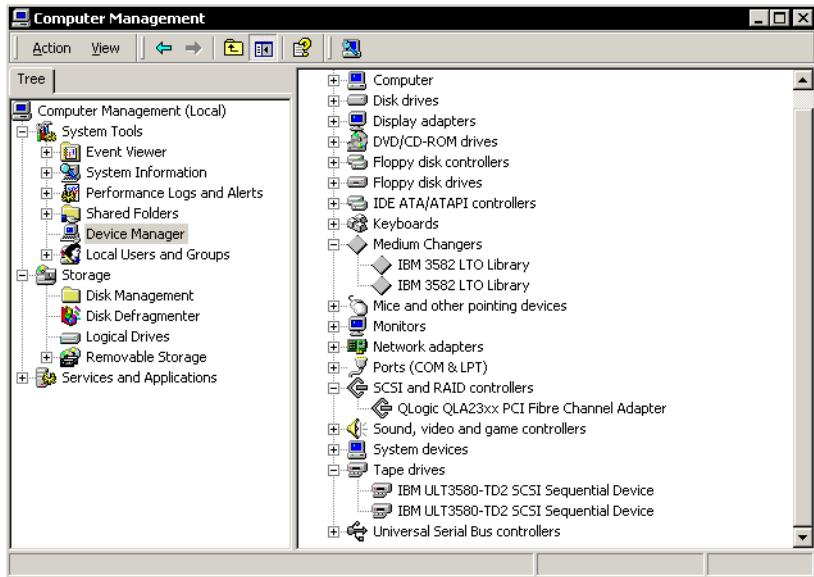


Figure 16-3 Correctly identified devices in Windows Device Manager

Important: If your environment includes an IBM LTO Ultrium tape drive and your Storage Agent will be installed on Windows 2000, you must verify and possibly change the HBA setting. For most HBAs, this value is located in the MAXIMUMSGLIST registry setting (see Figure 16-4). Tivoli Storage Manager requires that the MAXIMUMSGLIST value on the Storage Agent be equal to or greater than HEX 41 (decimal 65) or a data integrity error may occur. To verify or change the current registry setting, perform the following operations:

1. Edit the registry using regedit.
2. Click **HKEY_LOCAL_MACHINE** → **System** → **Current Control Set** → **Services** → **(Vendor HBA name)** → **Parameters** → **Device**.
3. Change the setting's hex value to 41. Close the registry editor and continue with the Storage Agent installation and configuration procedure. Repeat the process for all Windows 2000 Storage Agents in the environment.

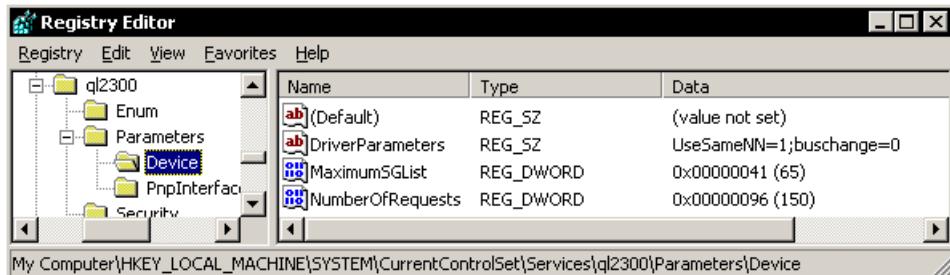


Figure 16-4 Registry settings for MaximumSGList in Windows 2000

Later you may run the dsmmaxsg utility included with the Storage Agent package to increase the maximum transfer length for HBAs and, consequently, the block size used for writing or reading data from certain types of tape drives, such as LTO, 3592, and more. For details see *IBM Tivoli Storage Manager for SAN Storage Agent User's Guide*, GC32-0785.

16.3.2 Storage Agent software installation

Here we describe how to install the Windows Storage agent. For UNIX, see *IBM Tivoli Storage Manager for Storage Area Network UNIX Storage Agent User's Guide*, GC32-0771.

1. Figure 16-5 on page 538 shows the Storage Agent installation menu that launches when you run install.exe or mount the CD. Depending on your library type, you may need to install both packages (TSM Storage Agent code and TSM Device Driver). The Device Driver's package is needed for non-IBM tape libraries. For demonstration purposes, we install both items. Note that a reboot is required after installation, so we recommend that you follow the sequence of the items in the menu.



Figure 16-5 Storage Agent and Device Driver installation screen

2. Click **TSM Storage Agent** and a wizard will launch. Click **Next**.
3. Enter customer information and choose access rights to the Storage Agent application, as shown in Figure 16-6.



Figure 16-6 Windows Storage Agent customer information

4. Choose the type of installation. In Figure 16-7 we chose Complete installation. You may choose Custom installation to select Storage Agent code installation, or console plugin installation, or both, which is the default. Our recommendation is to choose **Complete** installation to make sure that all components and their prerequisites are installed.

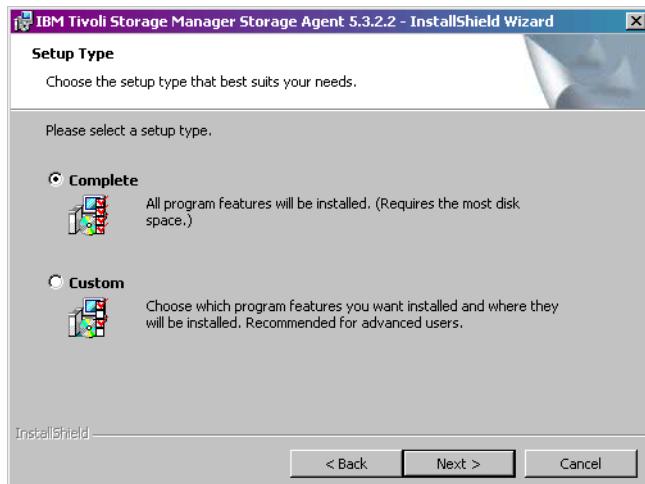


Figure 16-7 Windows Storage Agent setup type

5. On the next screen, you have the option to go back and review your inputs to the installation wizard, or continue. If you are satisfied with your choices, begin the installation by clicking **Install**.
6. When installation is finished, a completion window is displayed. Click **Finish** to return to the installation menu.

Now you may continue with TSM Device Driver installation. Since the installation process is straightforward and practically the same as Storage Agent installation, we do not cover it here. When the device driver is successfully installed, you are prompted to reboot your machine to apply changes.

Note: On Windows 2000 machines, enable the device driver using `tsmscsi /enable` command, which is located in the Storage Agent installation directory.

Note: On Windows Server 2003 systems, devices are automatically controlled by the default Windows Device Driver, even if you install the IBM Tivoli Storage Manager driver (TSMSCSI). In this case, you must manually update the controlling driver for each device you want to be controlled by TSMSCSI. For details on the configuration procedure see *IBM Tivoli Storage Manager for SAN for Windows Storage Agent User's Guide*, GC32-0785.

16.3.3 Configuring the Storage Agent

In order for the Storage Agent to communicate with the server instance, server-to-server communication is required. In 16.2, “Server setup for LAN-free” on page 528, we prepared our Tivoli Storage Manager server for this communication by setting up the server name, password, address, and port of the server instance.

Register Storage Agent on Tivoli Storage Manager server

Now we need to define the Storage Agent on the server. This is similar to the server-to-server configuration. You define a unique Storage Agent name, a password, a communication path (IP address or DNS name) to the Storage Agent, and the IP port the agent listens on (see Example 16-9).

Example 16-9 Defining Storage Agent on the server for server-to-server communication

```
tsm: ATLANTIC>define server sta_diomede serverpassword=sta_diomede532 \
cont> h1address=diomede.itsosj.sanjose.ibm.com l1address=1502 \
cont> description="Storage Agent on Diomede"
ANR1660I Server STA_DIOMEDE defined successfully.
```

Customize Storage Agent configuration file

The next step is to edit the Storage Agent configuration file. This is analogous to the server options file, and is called dsmsta.opt, located in the installation path. There are numerous options you may set; however, for the basic setup you need only the devconfig and tcport options (see Example 16-10). Since the devconfig option is by default set to devconfig.txt, we only need to change the default TCPPORT for the Storage Agent to the value defined in Example 16-9 (that is, 1502), and then we can proceed with the Storage Agent service setup.

Example 16-10 Option file dsmsta.opt

DEVCONFIG	devconfig.txt
TCPPORT	1502

Unlike other supported platforms, the Storage Agent package on Windows provides two ways to initialize the Storage Agent—command line or using a GUI wizard. We describe both ways; however, the wizard is the preferred method, since typing commands is more error prone and (this is important) the wizard automatically configures the Storage Agent as a service in Windows.

Storage Agent initialization using GUI wizard

To initialize:

1. If you selected a Complete Storage Agent installation, an MMC console plugin is provided for the Storage Agent initialization. To start it, select **Start → Programs → Tivoli Storage Manager → Management Console**. If the Storage Agent is not configured yet, the initialization wizard starts immediately, as in Figure 16-8. Or you can start it manually by double-clicking **Storage Agent Initialization** on the right hand side of the window.



Figure 16-8 Storage Agent initialization wizard

2. On the page shown in Figure 16-9, enter the Storage Agent configuration values, which we have specified in the Storage Agent definition in the Tivoli Storage Manager server (Example 16-9 on page 540). Specifically, provide the Storage Agent name and password and TCP/IP address.

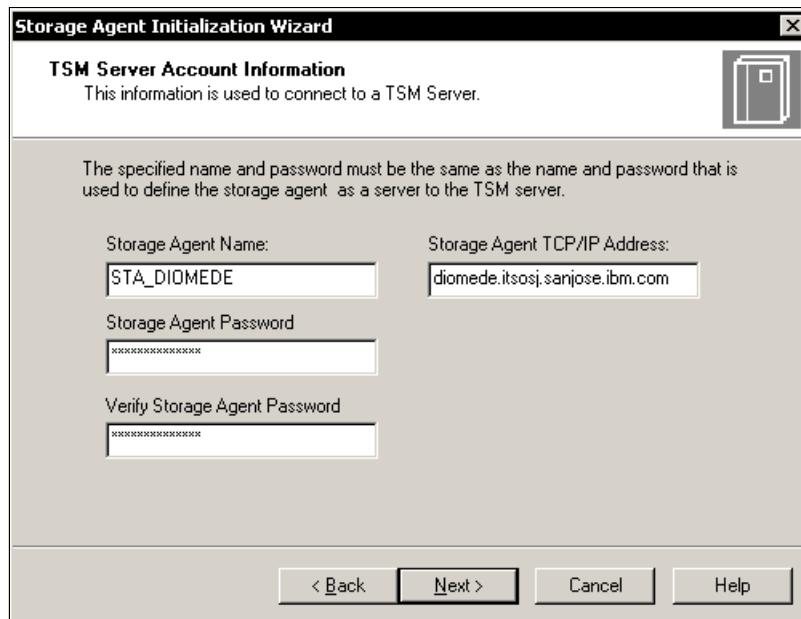


Figure 16-9 Storage Agent configuration

3. On the page shown in Figure 16-10, enter the Tivoli Storage Manager server details (the server name, password, server IP address, and port number) to match the definitions given in Example 16-1 on page 529.

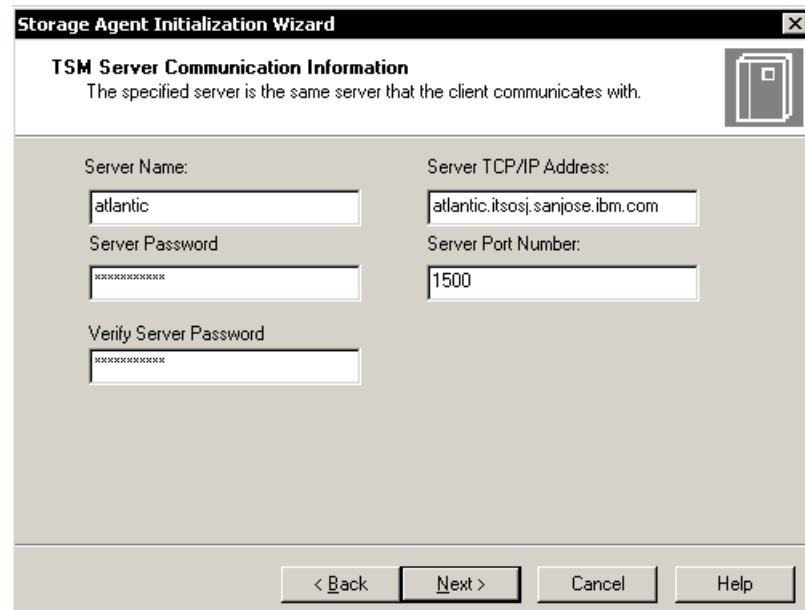


Figure 16-10 Tivoli Storage Manager server details

4. On the page shown in Figure 16-11, set the Storage Agent service behavior. We recommend automatically starting the service on reboot, and if you require the service to run under a specific account, give the account details.

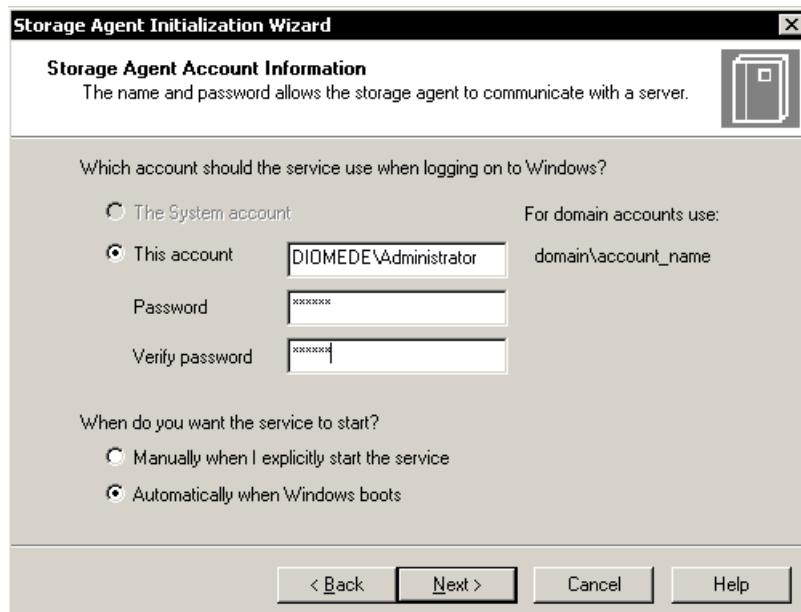


Figure 16-11 Storage Agent service configuration

- On the final screen, click **Back** to review the entries, or complete the initialization by clicking **Finish**. Provided your account password was correct, the initialization wizard subsequently configures a service in Windows and starts it, as shown in Figure 16-12.

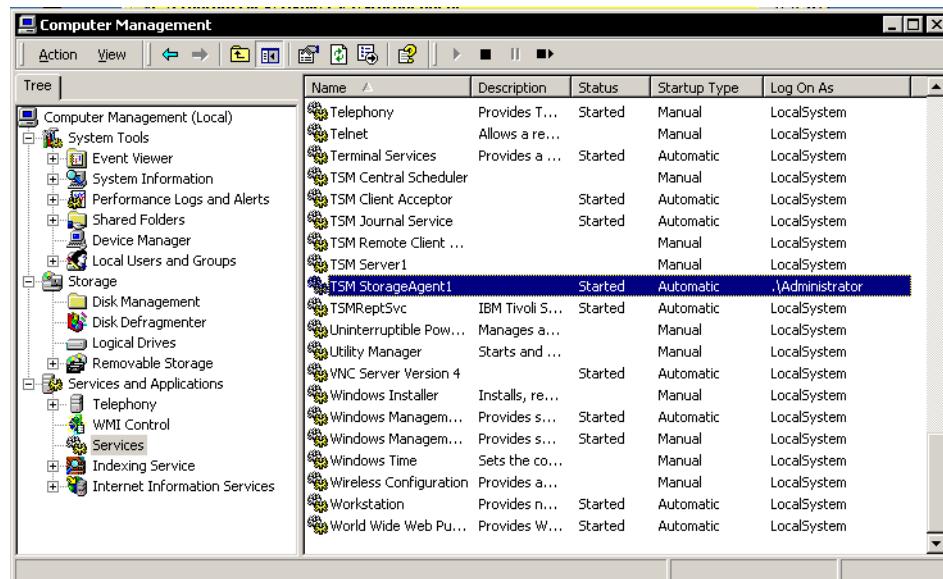


Figure 16-12 Running Storage Agent service in Windows Services

- If the service started successfully, two sessions are opened to the Tivoli Storage Manager server. One session is for the Storage Agent itself, and the other is for event logging to the Tivoli Storage Manager server, as shown in Example 16-11.

Example 16-11 Storage Agent sessions on the server

tsm: ATLANTIC>**query session**

Sess	Comm.	Sess	Wait	Bytes	Bytes	Sess	Platform	Client Name
Number	Method	State	Time	Sent	Recv'd	Type		
<hr/>								
178	Tcp/Ip	Run	0 S	1.1 K	192	Admin	AIX	ADMIN
179	Tcp/Ip	IdleW	5 S	1.5 K	796	Server	Windows	STA_DIOMEDE
180	Tcp/Ip	IdleW	5 S	253	705	Server	Windows	STA_DIOMEDE

tsm: ATLANTIC>

Although it may seem that communication is correctly established, you should verify this using the **ping server** command. This checks not only that the defined

Storage Agent is reachable on the specified address, but also that the Storage Agent is listening on the specified port as well. Example 16-12 shows that connection to our Storage Agent was successfully tested.

Example 16-12 Verifying the connection from the server to the Storage Agent

```
tsm: ATLANTIC>ping server sta_diomede  
ANR1706I Ping for server 'STA_DIOMEDE' was able to establish a connection.
```

Storage Agent initialization using the command line

You can alternatively initialize the Storage Agent using the **dsmsta** **setstorageserver** command, as shown in Example 16-13. Again, specify the Storage Agent name, password, IP address, and port number followed by the Tivoli Storage Manager server connection details.

Example 16-13 Storage agent initialization using command line

```
C:\Program Files\Tivoli\TSM\storageagent>dsmsta -k "StorageAgent1"  
setstorageserver myname=sta_diomed mypassword=sta_diomed532  
myh1address=DIOMEDE.ITSOSJ.SANJOSE.IBM.COM servername=ATLANTIC  
serverpassword=atlantic532 h1address=ATLANTIC.ITSOSJ.SANJOSE.IBM.COM  
11address=1500  
ANR0900I Processing options file C:\Program Files\Tivoli\TSM\storageagent\dsms-  
ta.opt.  
ANR7800I DSMSERV generated at 10:12:40 on Dec 9 2005.
```

Tivoli Storage Manager for Windows
Version 5, Release 3, Level 2.2

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ANR4726I The ICC support module has been loaded.
ANR1432I Updating device configuration information to defined files.
ANR1433I Device configuration information successfully written to devconfig.tx-
t.
ANR2119I The SERVERNAME option has been changed in the options file.
ANR0467I The SETSTORAGESERVER command completed successfully.

The initialization procedure creates the lines shown in Example 16-14 in the device configuration file for the Storage Agent, pointed to by the devconfig option in the dsmsta.opt file. In our case, devconfig points to the devconfig.txt file.

Example 16-14 Device configuration file for the Storage Agent

```
C:\Program Files\Tivoli\TSM\storageagent>more devconfig.txt
SET STANAME STA_DIOMEDE
SET STAPASSWORD 21e38f499c8a4e26b1dba1c8c2cb8d882f
SET STAHLADDRESS DIOMEDE.ITSOSJ.SANJOSE.IBM.COM
DEFINE SERVER ATLANTIC HLADDRESS=ATLANTIC.ITSOSJ.SANJOSE.IBM.COM LLADDRESS=1500
SERVERPA=21b4c69b596f6ebd88c68f1819b9101a9f
```

You may then start the Storage Agent using the **dsmsta** command in the foreground to verify that the Storage Agent successfully starts and connects to the server, as shown in Example 16-15.

Example 16-15 Storage Agent startup on the foreground

```
C:\Program Files\Tivoli\TSM\storageagent>dsmsta
ANR0900I Processing options file C:\Program Files\Tivoli\TSM\storageagent\dsmsta.opt.
ANR7800I DSMSERV generated at 10:12:40 on Dec 9 2005.

Tivoli Storage Manager for Windows
Version 5, Release 3, Level 2.2

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ANR4726I The ICC support module has been loaded.
ANR8260I Named Pipes driver ready for connection with clients.
ANR8273I Shared memory driver ready for connection with clients on port 1.
ANR8200I TCP/IP driver ready for connection with clients on port 1500.
ANR0408I Session 1 started for server ATLANTIC (AIX-RS/6000) (Tcp/Ip) for
storage agent.
ANR0993I Server initialization complete.
ANR0916I TIVOLI STORAGE MANAGER distributed by Tivoli is now ready for use.
ANR0408I Session 2 started for server ATLANTIC (AIX-RS/6000) (Tcp/Ip) for event
logging.
TSM:STA_DIOMEDE>
```

Setting up Storage Agent service using the command line

Example 16-16 shows how to define a Storage Agent service using the command line. It is based on the assumption that you defined your Storage Agent using the syntax in Example 16-13 on page 546, since the same service name is needed here. Note that you must also provide your Windows administrator account and password.

Example 16-16 Storage Agent service installation using the command line

```
C:\Program Files\Tivoli\TSM\storageagent>install "TSM StorageAgent1"  
"C:\Program Files\Tivoli\TSM\storageagent\dstasvc.exe" Administrator Password  
Service installed
```

16.3.4 Device configuration on the Storage Agent

Now we proceed to the device configuration part of the overall LAN-free configuration. The Storage Agent, in order to be able to use drives in the shared library, must have defined paths to these drives on the server.

We recommend that you define paths to all available drives, even if you only want the Storage Agent to use some of them. In this case, limit the number of available mount points in the device class using the MOUNTLIMIT parameter, rather than defining a subset of the paths. Thus, you increase the chance that the Storage Agent can get a mount point if needed.

To configure the devices, you need to identify which drives are seen by the Storage Agent system. The **tsmdlst** utility in the Storage Agent installation directory provides this function.

Using **tsmdlst**, you can easily display information for devices attached to your Storage Agent. Apart from the device name, it displays SCSI ID, LUN, bus, port, and device identifier information, which typically includes microcode level information. In SAN environments, **tsmdlst** lists any HBAs along with any corresponding device driver information. For SAN devices, the serial number (SSN) and World Wide Name (WWN) are also displayed if they can be detected.

Example 16-17 shows the output of the **tsmdlst** command on our DIOMEDE Storage Agent. We trimmed the description field of the command output to fit the example in the page without wrapping.

Example 16-17 Device listing as seen by the Windows machine using tsmdlst utility

```
C:\Program Files\Tivoli\TSM\storageagent>tsmdlst /detail
```

```
Tivoli Storage Manager -- Device List Utility
```

5697-TSM (C) Copyright IBM Corporation 2000, 2005. All rights reserved.
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restricted by GSA ADP Schedule Contract with IBM Corporation.

Computer Name: DIOMEDE
TSM Device Driver: ADSMScsi - Not Running

One HBA was detected.

Manufacturer	Model	Driver	Version	Firmware
QLogic Corporation	2312	ql2312.sys	8.1.5.60 (W2K IP)	3.01.10
<hr/>				
Device Type:	TapePeripheral			
TSM Device Name:	mt0.0.0.2			
TSM Device Type:	LTO			
ID:	0			
LUN:	0			
Bus:	0			
Port:	2			
Serial Number:	-			
World Wide Name:	0000000000000000			
Device Identifier:	IBM ULT3580-TD2	53Y2		
Supported Generic Tape:	Yes			
Variable Blocks:	Yes			
Filemarks:	Yes			
Relative Blocks:	Yes			
Reverse Position:	Yes			
<hr/>				
Device Type:	MediumChangerPeripheral			
TSM Device Name:	lb0.1.0.2			
TSM Device Type:	LIBRARY			
ID:	0			
LUN:	1			
Bus:	0			
Port:	2			
Serial Number:	-			
World Wide Name:	-			
Device Identifier:	IBM ULT3582-TL	307B		
<hr/>				
Device Type:	TapePeripheral			
TSM Device Name:	mt1.0.0.2			
TSM Device Type:	LTO			
ID:	1			
LUN:	0			
Bus:	0			
Port:	2			

```
Serial Number:      -
World Wide Name:   -
Device Identifier: IBM      ULT3580-TD2      53Y2
Supported Generic Tape: Yes
Variable Blocks:    Yes
Filemarks:          Yes
Relative Blocks:   Yes
Reverse Position:  Yes

Device Type:        MediumChangerPeripheral
TSM Device Name:   lb1.1.0.2
TSM Device Type:   LIBRARY
ID:                1
LUN:               1
Bus:               0
Port:              2
Serial Number:     -
World Wide Name:   -
Device Identifier: IBM      ULT3582-TL      307B
```

Completed in: 0 days, 0 hours, 0 minutes, 1 seconds.

As you can see, the provided information is quite comprehensive. Two libraries and two tape drives were detected, along with the HBA. The output did not, however, display the serial number or WWN identifier. This is because we are using the IBM tape device drivers, rather than the Tivoli Storage Manager native device drivers. To get this information, we add the /xinquiry parameter (see Example 16-18).

Example 16-18 Device listing for devices using IBM Tape device drivers

```
C:\Program Files\Tivoli\TSM\storageagent>tsmdlst /xinquiry
```

Tivoli Storage Manager -- Device List Utility

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Computer Name: DIOMEDE
TSM Device Driver: ADSMScsi - Not Running

One HBA was detected.

Manufacturer	Model	Driver	Version	Firmware

QLogic Corporation 2312 q12312.sys 8.1.5.60 (W2K IP) 3.01.10

Looking for devices...

TSM Name	ID	LUN	Bus	Port	SSN	WWN	TSM
mt0.0.0.2	0	0	0	2	1110177214	500308C140067006	LTO
mt1.0.0.2	1	0	0	2	1110176223	500308C140067003	LTO

Completed in: 0 days, 0 hours, 0 minutes, 1 seconds.

Defining paths between Storage Agent and shared drives

Now we must match the tape drives with those ones defined on the Tivoli Storage Manager server. We are using different operating systems—AIX for the server and Windows 2003 for the Storage Agent. Therefore the operating system device names for tape drives differ and we must match them according to their serial number and WWN IDs, which are always unique. Example 16-19 shows the serial number and WWNs of the tape drives on the AIX Tivoli Storage Manager server.

Example 16-19 Device identification on AIX 5L

```
root@Atlantic :/lsattr -El rmt0 | grep ww_name
ww_name      0x500308c140467006 World Wide Port Name

root@Atlantic :/lscfg -vl rmt0 | grep Serial
Serial Number.....1110177214

root@Atlantic :/lsattr -El rmt1 | grep ww_name
ww_name      0x500308c140467003 World Wide Port Name

root@Atlantic :/lscfg -vl rmt1 | grep Serial
Serial Number.....1110176223
```

By matching up the WWN and serial numbers from Example 16-18 on page 550 and Example 16-19, we see that the rmt0 device on AIX is mt0.0.0.2 on the Windows machine and rmt1 matches mt1.0.0.2. These devices match the dr00 and dr01 drive and path definitions already made on the server, shown in Example 16-3 on page 530. We may now define appropriate paths between the Storage Agent and the shared tape drives.

In Example 16-20, we define the required paths.

Example 16-20 Storage agent path definition to the shared tape drives

```
tsm: ATLANTIC>define path sta_diomede dr00 srctype=server desttype=drive \
cont> library=3582_shared device=mt0.0.0.2
ANR1720I A path from STA_DIOMEDE to 3582_SHARED DR00 has been defined.
```

```
tsm: ATLANTIC>define path sta_diomede dr01 srctype=server desttype=drive \
cont> library=3582_shared device=mt1.0.0.2
ANR1720I A path from STA_DIOMEDE to 3582_SHARED DR01 has been defined.
```

We review our settings using the **query path** command, which reveals all defined paths, as shown in Example 16-21.

Example 16-21 Defined path summary using query path command

```
tsm: ATLANTIC>query path
```

Source Name	Source Type	Destination Name	Destination Type	On-Line
ATLANTIC	SERVER	3582_SHARED	LIBRARY	Yes
ATLANTIC	SERVER	DR00	DRIVE	Yes
ATLANTIC	SERVER	DR01	DRIVE	Yes
STA_DIOMEDE	SERVER	DR00	DRIVE	Yes
STA_DIOMEDE	SERVER	DR01	DRIVE	Yes

16.4 SAN device discovery support

With Tivoli Storage Manager V5.3 and later, the server and Storage Agent option sandiscovery, if specified, means that the server will perform SAN discovery during both server initialization and if the device path has changed.

Essentially, if the SAN device identification has been changed due to SAN environmental changes, such as device, cabling changes, or bus resets, the server or Storage Agent will discover these changes during server or Storage Agent startup or when accessing the paths during operations with the drives and will perform the necessary changes to the path definition, based on the drive serial number. Thus, the path will not go offline. Instead, it stays online and available for the operation.

On Windows platforms this option is set by default. On other platforms enable SAN discovery using the SANDISCOVERY on option in the server options file

dsmerv.opt (or in dsmsta.opt for Storage Agents). You can also dynamically set the option using the administrative CLI, as in Example 16-22.

Example 16-22 Dynamically setting SANDISCOVERY option

```
tsm: ATLANTIC>setopt sandiscovery on
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y  
ANR2119I The SANDISCOVERY option has been changed in the options file.
```

```
tsm: ATLANTIC>query option sandiscovery
```

Server Option	Option Setting
SANDiscovery	On

Note: The ability to accurately define SAN devices on the server and Storage Agent in AIX relies on functionality built into the operating system. In particular, fileset devices.common.IBM.fc.hba-api provides a 32-bit and 64-bit API for use by Tivoli Storage Manager.

If the server or Storage Agent cannot load the library or the library is missing, it will issue message ANR8226E. If the library is not at the minimum required level, it will issue message ANR8227E. With any of these messages, the QUERY SAN command will show no information and SAN discovery will not be performed.

With the SAN discovery feature enabled, you may review the SAN attached devices using the **query san** command, as seen in the Example 16-23.

Example 16-23 Query SAN command output on the server

```
tsm: ATLANTIC>query san
```

Device	Vendor	Product	Serial Number	Device Type
DRIVE	IBM	ULT3580-TD2	1110177214	/dev/rmt0
LIBRARY	IBM	ULT3582-TL	0000013108231000	/dev/smcl0
DRIVE	IBM	ULT3580-TD2	1110176223	/dev/rmt1
LIBRARY	IBM	ULT3582-TL	0000013108231000	/dev/smcl1

16.4.1 Recovering from offline paths

Starting with Storage Agent V5.3.2, the tsmdlst utility can also help keep Tivoli Storage Manager path statements up-to-date for IBM tape devices. This can be especially useful when working with versions of the server that do not include the

Accurate SAN Mapping feature. For example, if a pre-Version 5.3 Tivoli Storage Manager server is installed on AIX and path statements need to be set up for a Windows-based Storage Agent, tsmdlst can be used to display the required information and also generate a macro that can be used to synchronize paths when devices change in the SAN and to update the offline paths.

Below we show how to update paths from the Storage Agent machine if a path goes offline. Provided that the cause has been ascertained and resolved (for example, fixing a damaged fiber), you may update the path in two steps, as follows:

1. Generate the path file, which includes tape drive identification.
2. Apply the path file to make the offline paths online again.

We changed one of our Storage Agent paths to the offline state (see Example 16-24).

Example 16-24 Offline path

tsm: ATLANTIC>**query path**

Source Name	Source Type	Destination Name	Destination Type	On-Line
ATLANTIC	SERVER	3582_SHARED	LIBRARY	Yes
ATLANTIC	SERVER	DR00	DRIVE	Yes
ATLANTIC	SERVER	DR01	DRIVE	Yes
STA_DIOMEDE	SERVER	DR00	DRIVE	No
STA_DIOMEDE	SERVER	DR01	DRIVE	Yes

Example 16-25 shows a path file generation on the Storage Agent. Essentially, the file contains the tape drive names and their unique identification numbers, such as serial and WWN numbers. The output is then saved to the C:\Program Files\Tivoli\TSM\Console\tsmdlst_pathfile.txt file.

Example 16-25 Path file generation using tsmdlst

C:\Program Files\Tivoli\TSM\storageagent>**tsmdlst /xinquiry /genpathfile**

Tivoli Storage Manager -- Device List Utility

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U.S. Government Users Restricted Rights - Use, duplication or disclosure
restricted by GSA ADP Schedule Contract with IBM Corporation.

Computer Name: DIOMEDE
TSM Device Driver: ADSMScsi - Not Running

One HBA was detected.

Manufacturer	Model	Driver	Version	Firmware
QLogic Corporation	2312	ql2312.sys	8.1.5.60 (W2K IP)	3.01.10

Looking for devices...

TSM Name	ID	LUN	Bus	Port	SSN	WWN
mt0.0.0.2	0	0	0	2	1110177214	500308C140067006 LTO
mt1.0.0.2	1	0	0	2	1110176223	500308C140067003 LTO

Pathfile was written out as C:\PROGRA~1\Tivoli\TSM\Console\tsmdlst_pathfile.txt

Completed in: 0 days, 0 hours, 0 minutes, 1 seconds.

Afterwards, we use the path file to update all offline paths remotely on the server from the Storage Agent machine (see Example 16-26).

Example 16-26 Offline path update using tsmdlst utility on the Storage Agent machine

```
C:\Program Files\Tivoli\TSM\storageagent>tsmdlst -genmacropathoffline  
-execmacropathoffline -id=admin -pass=admin -tcps=atlantic -tcpp=1500  
-server=atlantic -stagent=sta_diomedes
```

Tivoli Storage Manager -- Device List Utility

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Computer Name: DIOMEDE
TSM Device Driver: ADSMScsi - Not Running

One HBA was detected.

Manufacturer	Model	Driver	Version	Firmware
QLogic Corporation	2312	ql2312.sys	8.1.5.60 (W2K IP)	3.01.10

TSM Name	ID	LUN	Bus	Port	SSN	WWN
mt0.0.0.2	0	0	0	2	-	0000000000000000
1b0.1.0.2	0	1	0	2	-	-

```
mt1.0.0.2    1    0    0    2    -          -
1b1.1.0.2    1    1    0    2    -          -

Obtained information for 2 paths from TSM server.

Obtained information for 2 drives from TSM server.

Obtained information for 2 devices from
C:\PROGRA^1\Tivoli\TSM\Console\tsmdlst_pathfile.txt

Executed macro: C:\PROGRA^1\Tivoli\TSM\Console\tsmdlst_path_offline.mac,
results:
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/24/2006 16:27:27  Last access: 02/24/2006 16:24:46

ANS8000I Server command: 'update path STA_DIOMEDE DR00 srctype=SERVER
desttype=DRIVE li
brary=3582_SHARED device=mt1.0.0.2 online=Yes'
ANR1722I A path from STA_DIOMEDE to 3582_SHARED DR00 has been updated.

ANS8002I Highest return code was 0.

Completed in: 0 days, 0 hours, 0 minutes, 2 seconds.
```

16.5 Client LAN-free customization

We assume that you have already configured the client options file (dsm.opt for Windows clients and dsm.sys for UNIX clients) to connect to the Tivoli Storage Manager server and that your client can back up or restore your data via LAN.

In order to utilize the LAN-free path for client operations, you need to further customize the client options file in order to specify the communication method, the Storage Agent address, and the port on which the Storage Agent listens for requests.

Depending on the platform and Storage Agent configuration, you may use different communication methods between the client and the Storage Agent, as follows:

- ▶ TCP/IP
- ▶ Shared memory
- ▶ Named pipes

Our Storage Agent is configured for TCP/IP communication only. If you want to use other methods, you must enable them in the Storage Agent configuration file, dsmsta.opt.

We added the following options to our client options file, dsm.opt, on the Storage Agent, DIOMEDE. See Example 16-27.

Example 16-27 Client customization for LAN-free

ENABLELANFREE	YES
LANFREECOMMETHOD	TCPIP
LANFREETCPERVERADDRESS	diomede.itsosj.sanjose.ibm.com
LANFREETCPPORT	1502

These options specify that the client will use the Storage Agent to access SAN-attached devices when the path is available during backup, restore, archive, and retrieve processing.

With TCP/IP as a configured communication method, a client can use a Storage Agent that is running on a different machine as well. Data traffic will be via LAN from the client to the Storage Agent and via SAN from the Storage Agent to the final storage device.

Note: For Data Protection clients, such as Data Protection for SQL, you must ensure that the API client is installed on the same machine as the Data Protection module. Then add the options specified in Example 16-27 to the API client options file, referenced to by the DSM_CONFIG system variable, to enable the LAN-free path.

For detailed prerequisites for using LAN-free with API clients, see the *IBM Tivoli Storage Manager for SAN Storage Agent User's Guide* for your platform.

As well as the necessary communication parameters, you may need to bind client data to a LAN-free capable management class. Use an *include* statement in the client options file, as follows:

```
INCLUDE      c:\console\...\*          LANFREE
```

With this statement, our client binds all objects in the C:\console subdirectory to our management class LANFREE, which is the only management class having a storage pool capable of LAN-free in our environment. See Example 16-8 on page 533. Unless other *include* statement exists, all other objects residing on our DIOMEDE machine will be bound to the default management class, which is not LAN-free capable.

For more information about binding objects see Chapter 7, “Data storage policies” on page 269.

16.6 Performing LAN-free operations

If all necessary components participating in the LAN-free path, such as the Storage Agent, server-to-server configuration, storage pools, paths, client options, and more, are correctly configured and set, the client operations are automatically performed using the LAN-free path.

In Figure 16-13 we make an incremental backup of the c:\console directory, and since we have the console directory bound to a LAN-free capable management class, it is done via SAN instead of LAN, as shown in Figure 16-14 on page 559.

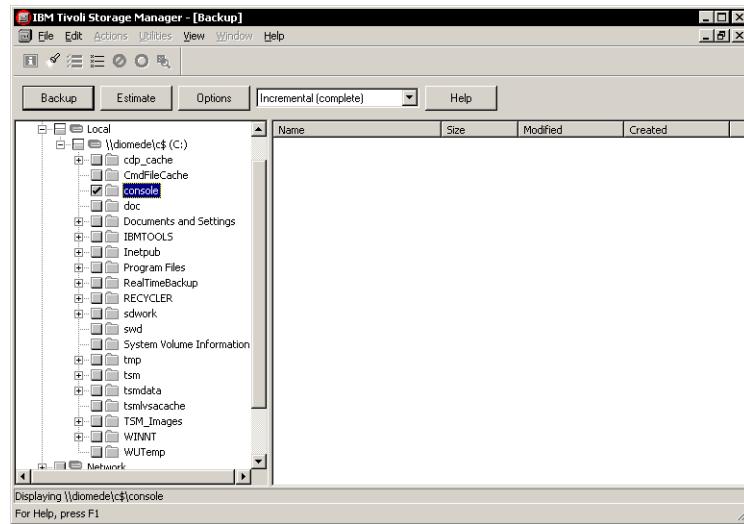


Figure 16-13 Backup of c:\console directory

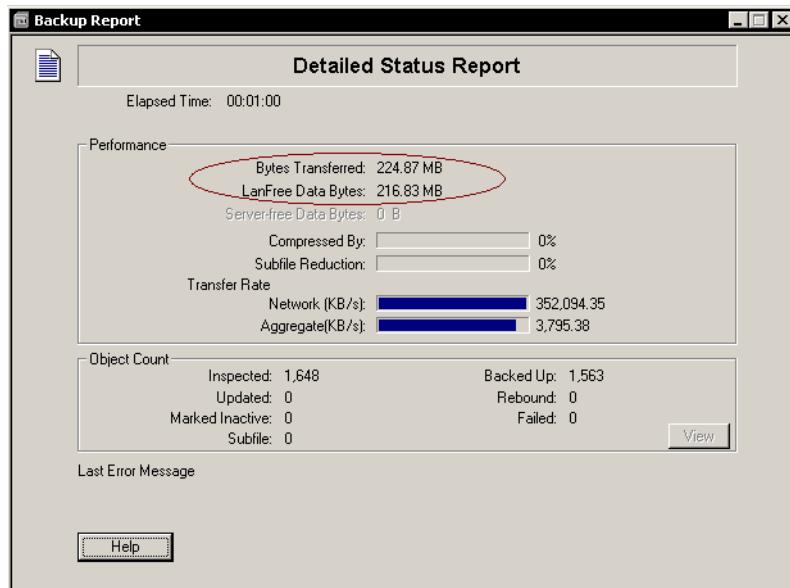


Figure 16-14 Backup status window

As you can see in Figure 16-14, the positive LanFree Data Bytes value confirms that the backup was done via SAN. The difference between the Bytes Transferred and LanFree data Bytes value is because the LAN path is used for storing metadata in the server database, and thus the total value for transferred data will always be slightly greater than the LanFree Bytes value.

In Example 16-28 we show statistics as produced by the command-line backup-archive client for another incremental backup operation. Again, you can easily distinguish how much data was transferred via SAN from the *LanFree data bytes* statistic value.

Example 16-28 Command-line client summary statistics

Total number of objects inspected:	762
Total number of objects backed up:	538
Total number of objects updated:	0
Total number of objects rebound:	0
Total number of objects deleted:	0
Total number of objects expired:	0
Total number of objects failed:	0
Total number of subfile objects:	0
Total number of bytes transferred:	932.57 MB
LanFree data bytes:	929.32 MB
Data transfer time:	14.36 sec
Network data transfer rate:	66,478.35 KB/sec

```
Aggregate data transfer rate:      6,978.46 KB/sec
Objects compressed by:            0%
Subfile objects reduced by:       0%
Elapsed processing time:         00:02:16
ANS1074W The operation was stopped by the user.
```

16.6.1 Determining whether the data movement is LAN-free

Monitor the administrative CLI **query session** output against the node that is running the LAN-free backup. Review the bytes sent and bytes received.

In our test, Example 16-29, when LAN-free data movement was occurring, a **query session** on the Storage Agent shows about 683 MBs received so far from the DIOMEDE node, displayed in the Bytes Recvd column.

Example 16-29 LAN-free session statistics on Storage Agent

```
tsm: ATLANTIC>sta_diomede: query session
ANR1699I Resolved STA_DIOMEDE to 1 server(s) - issuing command QUERY SESSION
against server(s).
ANR1687I Output for command 'QUERY SESSION ' issued against server STA_DIOMEDE
follows:
```

Sess	Comm.	Sess	Wait	Bytes	Bytes	Sess	Platform	Client Name
Number	Method	State	Time	Sent	Recv'd	Type		
1	Tcp/Ip	IdleW	11 S	679	1.9 K	Server	AIX-RS/6000	ATLANTIC
3	Tcp/Ip	IdleW	0 S	3.5 K	253	Server	AIX-RS/6000	ATLANTIC
4	Tcp/Ip	IdleW	0 S	2.9 K	3.2 K	Server	AIX-RS/6000	ATLANTIC
7	Tcp/Ip	Run	0 S	382	682.7 M	Node	WinNT	DIOMEDE
8	Tcp/Ip	Run	0 S	10.2 K	11.0 K	Server	AIX-RS/6000	ATLANTIC
12	Tcp/Ip	Run	0 S	160	234	Admin	AIX-RS/6000	ADMIN

ANR1688I Output for command 'QUERY SESSION ' issued against server STA_DIOMEDE completed.

The output on the Tivoli Storage Manager server shows a very small number of bytes of metadata received for the same node. This confirms that data movement is LAN-free. See Example 16-30.

Example 16-30 Client session statistics on server

```
tsm: ATLANTIC>query session

| Sess   | Comm.  | Sess  | Wait | Bytes | Bytes  | Sess   | Platform | Client Name |
|--------|--------|-------|------|-------|--------|--------|----------|-------------|
| Number | Method | State | Time | Sent  | Recv'd | Type   |          |             |
| 326    | Tcp/Ip | IdleW | 12 S | 1.9 K | 679    | Server | Windows  | STA_DIOMEDE |
| 328    | Tcp/Ip | IdleW | 1 S  | 253   | 3.6 K  | Server | Windows  | STA_DIOMEDE |


```

329	Tcp/Ip	IdleW	1 S	3.3 K	3.0 K	Server	Windows	STA_DIOMEDE
331	Tcp/Ip	SendW	0 S	2.9 K	139	Admin	AIX	ADMIN
332	Tcp/Ip	IdleW	50 S	1.6 K	497	Node	WinNT	DIOMEDE
333	Tcp/Ip	IdleW	3 S	389	6.8 K	Node	WinNT	DIOMEDE
334	Tcp/Ip	RecvW	2 S	11.0 K	10.2 K	Node	WinNT	DIOMEDE

Further, you can monitor the Tivoli Storage Manager server console for new sessions. If you see a message that a session proxied by a Storage Agent for a node was established, this confirms a LAN-free operation (see Example 16-31).

Example 16-31 IBM Tivoli Storage Manager console output

```
root@Atlantic /usr/include: dsmadmc -id=admin -pa=admin -consolemode
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Session established with server ATLANTIC: AIX-RS/6000
  Server Version 5, Release 3, Level 2.2
  Server date/time: 02/27/2006 08:44:34  Last access: 02/27/2006 08:41:49

ANR0406I Session 332 started for node DIOMEDE (WinNT) (Tcp/Ip
diomedes.itsosj.sanjose.ibm.com(3384)).
ANR0406I Session 333 started for node DIOMEDE (WinNT) (Tcp/Ip
diomedes.itsosj.sanjose.ibm.com(3386)).
ANR0408I Session 334 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
storage agent.
ANR0415I Session 334 proxied by STA_DIOMEDE started for node DIOMEDE.
ANR0408I Session 335 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
library sharing.
ANR0408I Session 336 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
library sharing.
ANR0409I Session 335 ended for server STA_DIOMEDE (Windows).
ANR8337I LTO volume 020AKK mounted in drive DRO0 (/dev/rmt1).
ANR0409I Session 336 ended for server STA_DIOMEDE (Windows).
ANR0511I Session 334 opened output volume 020AKK.
ANR0408I Session 340 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
library sharing.
ANR0409I Session 340 ended for server STA_DIOMEDE (Windows).
ANR0408I Session 341 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
library sharing.
ANR0514I Session 334 closed volume 020AKK.
ANR0408I Session 342 started for server STA_DIOMEDE (Windows) (Tcp/Ip) for
library sharing.
ANR0409I Session 341 ended for server STA_DIOMEDE (Windows).
ANR0409I Session 342 ended for server STA_DIOMEDE (Windows).
```

```
ANR0403I Session 333 ended for node DIOMEDE (WinNT).  
ANR0403I Session 334 ended for node DIOMEDE (WinNT).  
ANR0403I Session 332 ended for node DIOMEDE (WinNT).
```

Alternatively, you may use the following command to figure out whether the data movement was LAN-free:

```
query actlog search=storage_agent_name msgno=8337
```

Last but not least, from the Tivoli Storage Manager client, the detailed status report after each client operation also shows you the amount of LAN-free data transferred. If the client operation failed to use the LAN-free path then the LAN-free Data Bytes information is grayed out in the GUI status window or the value for the respective statistic item is zero in backup-archive CLI.

16.6.2 LAN-free data transfer considerations

Tivoli Storage Manager LAN-free data transfer provides an effective means to off-load backup-archive data traffic from your LAN to the SAN. LAN-free data transfer improves performance especially when backing up large files, typically larger than 50 MB.

Therefore, we recommend that you use LAN-free transfer to back up large databases and file system images because there is a significant performance improvement. This also allows you to fully utilize your LAN for other application and communication processing.

On the other hand, there are instances where LAN data transfer may be faster than LAN-free data transfer, particularly when backing up many small-size files. Traditional incremental backups where only a small amount of the data has changed usually perform better over the LAN than LAN-free, since this type of operation usually does not allow a tape drive to operate at streaming speeds.

To ensure better performance, you must consider the following items:

- ▶ The hardware speeds of the LAN-based hardware versus the SAN-based hardware
- ▶ The topology configured, and whether bandwidth is shared or dedicated
- ▶ The average size of the files being transferred

16.7 Summary

This chapter has demonstrated the configuration of the LAN-free feature in a Tivoli Storage Manager environment. We have provided implementation details

and explained how this technology might be deployed. In the next chapter we show how to configure Tivoli Storage Manager to use a server-free communication path.



Server-free data movement

In this chapter we describe an IBM Tivoli Storage Manager server-free backup environment. Data is copied directly from a disk that is SAN-attached to the Tivoli Storage Manager client to a SAN-attached tape drive using an additional Data Mover component in the tape library.

17.1 Server-free: What it is and why to use it

Server-free data movement provides a way to back up and restore large volumes of data between client-owned disks and storage devices in a method that reduces overhead on the Tivoli Storage Manager server and Tivoli Storage Manager Client, and that minimizes data transfer on the LAN.

Tivoli Storage Manager allows clients to directly back up and restore file system images between disk storage and tape devices accessible over a Storage Area Network (SAN). An outbound datamover such as IBM SAN Data Gateway handles the server-free data movement on behalf of the Tivoli Storage Manager server. The datamover must be able to execute the SCSI-3 extended copy command.

Server-free datamovers must have addressability to all the devices involved, which include disk and tape drives. Unlike traditional LAN and LAN-free backups and restore, data passes through neither the client nor the server. Instead, the datamover handles the data. In this way, backup and restore operations do not require resources from client or server processors or from LAN.

Figure 17-1 shows how data is actually transferred on a Storage Area Network during server-free backup/restore.

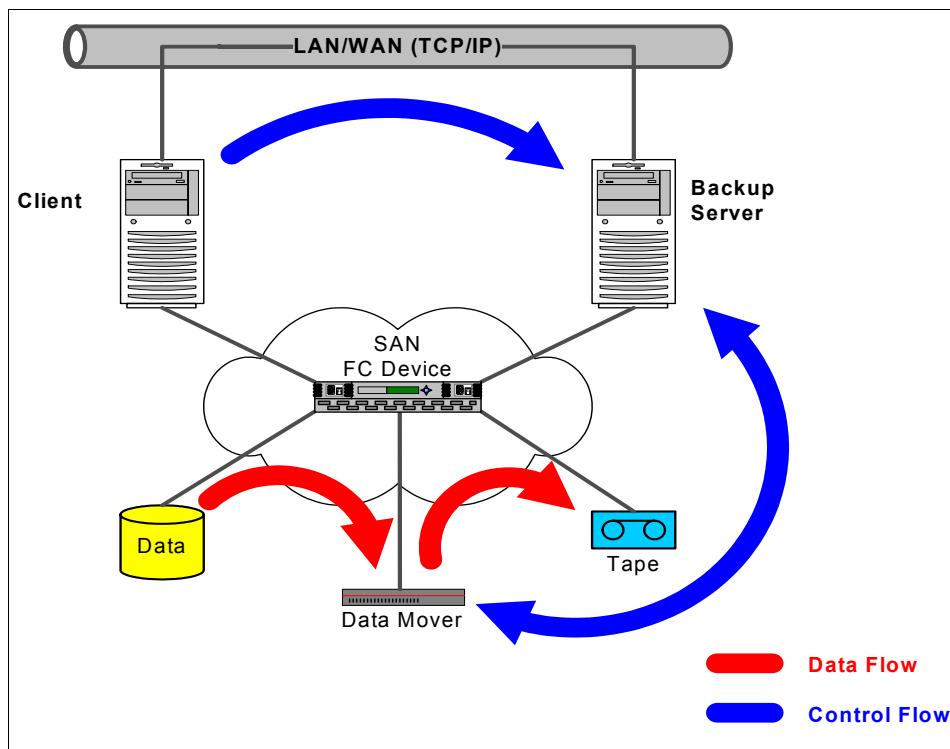


Figure 17-1 Server-free data movement

Operations for server-free backup/restore are done in the following order:

1. The Tivoli Storage Manager client initiates the backup or restore request.
2. The Tivoli Storage Manager Server issues a mount request to the library.
3. The datamover initiates a copy operation.
4. The data is copied between the disk and the tape library.

Server-free operations transfer only volume images, not standard, file-level data. If the client cannot perform a server-free backup or restore, the operation first fails over to LAN-free operation. If a LAN-free operation cannot be performed, the client attempts a LAN-based backup or restore. Server-free operation can restore LAN-free or LAN-based volume image backups. (The image data should be stored in storage pools with a data format of NONBLOCK.) Currently, server-free image backup is supported for Windows 2000 clients only. Image backup of both raw volumes and volumes that contain NTFS file systems are supported. Tivoli Storage Manager supports both online and offline image backup using server-free data movement.

The Tivoli Storage Manager client allows server-free backup and restore of volume images between different volume layouts, with the exception of software-based RAID-5 volumes and software-striped volumes. When restoring a software-based mirror volume (RAID-1), Tivoli Storage Manager restores to the primary copy only and uses the operating system to resynchronize the stale mirrors. The client supports volume layouts such as striped and mirrored only on Windows 2000 dynamic disks.

Server-free data movement has the following advantages:

- ▶ It reduces Tivoli Storage Manager client and server CPU utilization. With data movement operations being performed by an outboard copy engine, the client or server CPU will not be utilized for data movement and will thus be available for other applications.
- ▶ It eliminates data movement on the LAN. Implementation of the SCSI-3 extended copy command will cause the data to be transferred directly between devices over the SAN or SCSI bus.
- ▶ It improves performance for data movement operations. Direct transfer between devices through a high speed Fibre Channel should perform better than our current mode that utilizes a slower network connection with multiple buffer copy operations in the client and server processors.
- ▶ It improves scalability. The Tivoli Storage Manager server will be able to handle more concurrent client connections and server operations because it will not be copying data. The Tivoli Storage Manager client processor will likewise be able to handle more application load because cycles will not be needed to read and send data buffers to the server

17.2 Server-free setup requirements

The SAN should be already configured in order to perform server-free data movement. The hardware specifications provided below only depict one successful implementation of server-free data movements. There can be other possible hardware that can be used to set up server-free data movement.

Our test environment used the following configuration. Note that some of the hardware/software/device drivers are not at the latest level. However, the setup and operation procedure for the server-to-server function has not changed substantially. To see a list of the latest hardware/software/HBA/device driver levels, see:

- ▶ Hardware
 - Tivoli Storage Manager Server:
 - IBM xSeries® server

- Windows 2000 Advanced Server Service Pack 3
- 2 x QLogic 2200 HBA (Device Driver: 8.0.8)
- Tivoli Storage Manager client:
 - IBM xSeries server
 - Windows 2000 Advanced Server Service Pack 3
 - 2 x QLogic 2200 HBA (Device Driver: 8.0.8)
- Disk Subsystem:
 - IBM FAStT500 Raid controller with /2 EXP 500 disk enclosures
- Fabric:
 - 2*IBM 2109 S08 + 1 * IBM 2109 S16 cascaded
 - IBM SAN Fibre Channel Switch 2109 Model S08 (Kernel: 5.4, Fabric OS: v2.6.0c)
- Library:
 - IBM Ultrium 3583 with six LTO drives and integrated SAN Data Gateway (pathlight 5000) (Windows 2000 Device Driver: 5.0.4.5)
 - Datamover Firmware: 4.200.5
 - LTO Drive Firmware: 25D4
 - Library Firmware: 2.80
- ▶ Software
 - Server and Client operating system
 - Windows 2000 Advanced Server Service Pack 3
 - SoftwareDisk subsystem manager
 - IBM FAStT Storage Manager V7.1 or later
 - SAN gateway management
 - IBM StorWatch Specialist V2.7 or later

Note: The Tivoli Storage Manager Server will need two HBAs, one for connecting to the SAN disk and other for the 3583 LTO tape library. We tried configuring a single HBA for disks and tape, but this does not work very well with Windows 2000.

Tip: A second HBA on the Tivoli Storage Manager client is only necessary if you want to do both server-free and LAN-free operations on the client machine.

17.3 Configuration steps: Overview

Here is an overview of the steps you should follow to successfully configure server-free data movement:

1. Set up the Storage Area Network.
2. Set up FAStT 500.
3. Set up IBM 3583. Make sure the tape library has the correct firmware level.
4. Install HBAs on the client and server machines. Install the correct device driver and API for the HBAs. Refer to the requirements section for the level of drivers and API.
5. Connect the client and server machines to the Fibre Switches.
6. Create zones as described in the setup section.
7. Install device drivers for IBM 3583 on the server machine.
8. Install the FAStT storage Manager on one of the machines to manage FAStT 500 Box.
9. Enable the SAN Data Gateway (datamover).
10. Set up the Tivoli Storage Manager Server.
11. Set up the Tivoli Storage Manager Client.

17.4 Setting up server-free data movement

Configuration for server-free data movement requires the steps described below. We assume that you have knowledge about how to set up zoning and update firmware for various SAN devices.

17.4.1 SAN configuration

The SAN should be configured correctly. We do not show you how to set up the SAN, but we provide you with a view of the SAN after the setup.

Figure 17-2 shows the SAN setup you will need in order to perform a server-free data movement. Before moving to the next step, using StorWatch specialist, make sure that you can see the tape drives. Using FAStT storage manager, make sure that you can see the disks. Also, check for the latest available firmware for the IBM 3583. Update the drive, RMU, and library firmware.

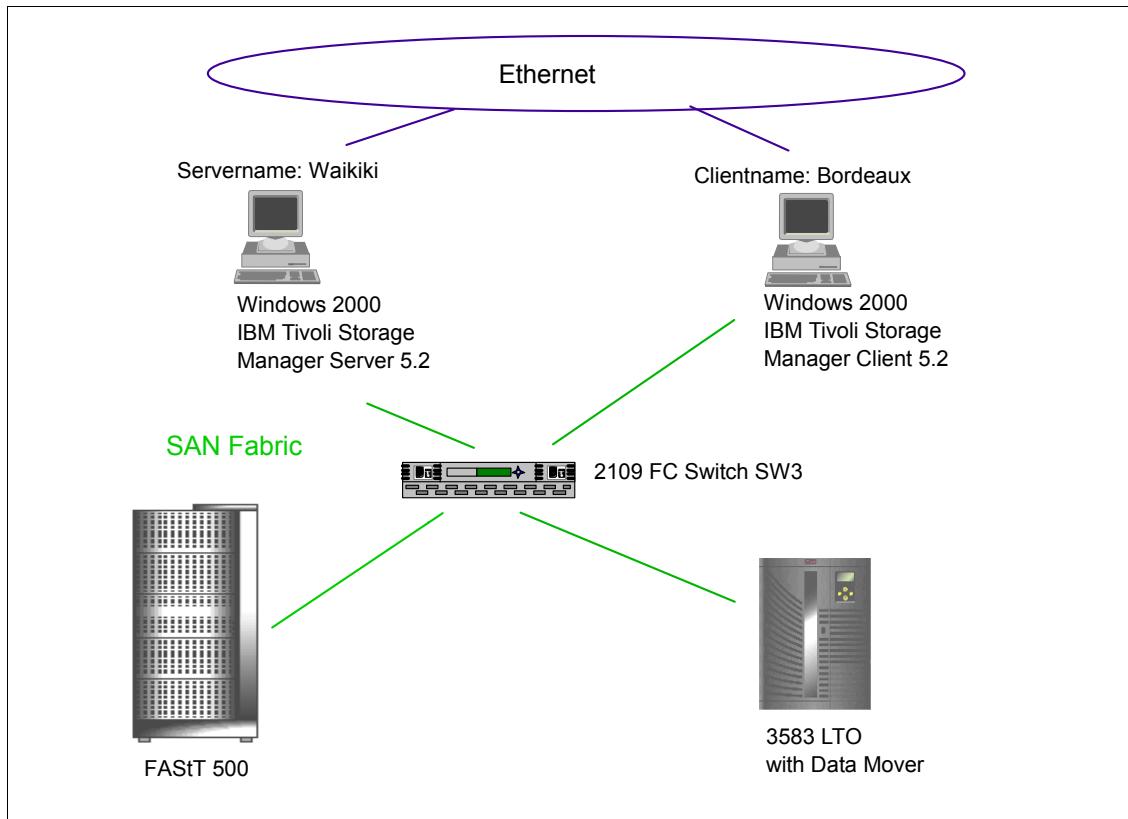


Figure 17-2 SAN network

17.4.2 SAN zoning

Zoning allows you to partition your SAN into logical groupings of devices that can access each other. Using zoning, you can arrange fabric-connected devices into logical groups, or zones, over the physical configuration of the fabric. Zones can vary in size depending on the number of fabric-connected devices. Figure 17-3 on page 572 shows the zoning for our server-free backup.

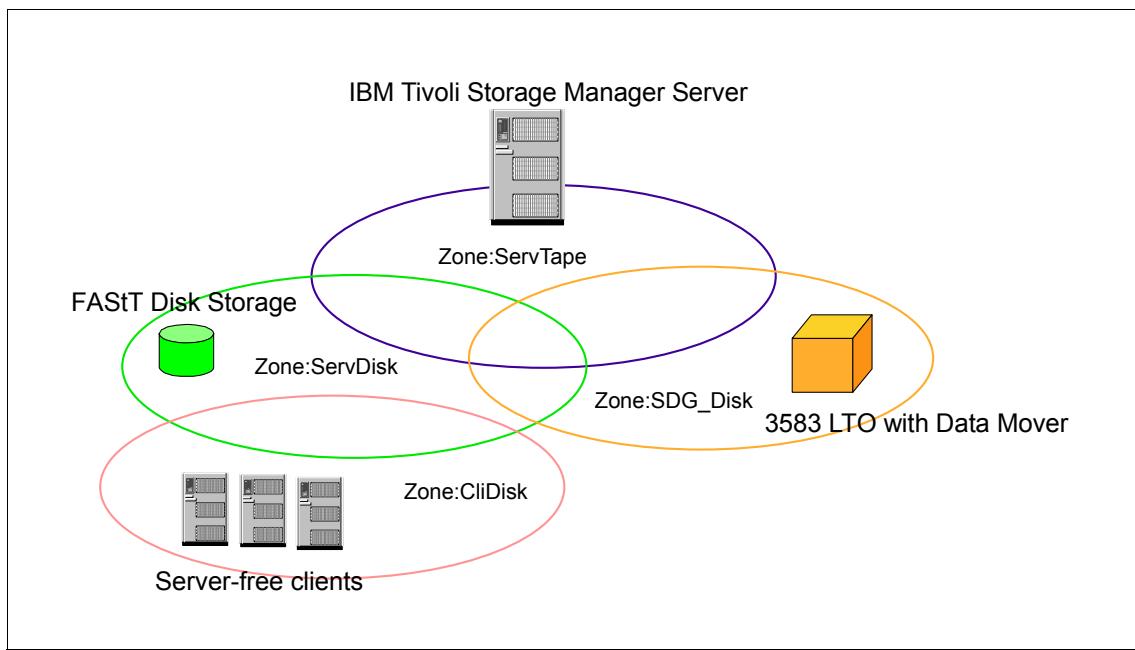


Figure 17-3 Server-free SAN zoning

Table 17-1 provides a description of the zone members.

Table 17-1 Server-free zoning

Zone	Members
ServTape	3583, Tivoli Storage Manager Server HBA1
ServDisk	FASST 500, Tivoli Storage Manager Server HBA2
CliDisk	Tivoli Storage Manager Client HBA1, FASST 500
SDG_Disk	3583 (datamover), FASST 500

The following list describes the zones:

- ▶ ServTape: This zone enables the server to access the tape media.
- ▶ ServDisk: This zone enables the server to see the disks in order to perform server-free data movement. The server should be able to see the disks in order to perform a **define disk** command on the server.
- ▶ CliDisk: The client accesses the disk directly on the Storage Area Network.
- ▶ SDG_Disk: This zone allows SAN Data Gateway to access the disk directly and copy the data directly from disks to tape and vice-versa.

Note: We have used soft zoning in this scenario.

For more information about zoning, refer to the *IBM SAN Fibre switch 2109 Model S08 Guide* for managing and implementing zones in a Storage Area Network.

Figure 17-4 shows our SAN configuration overview using the IBM StorWatch software. Your administration interface will be different, depending on the type of SAN gateway used.

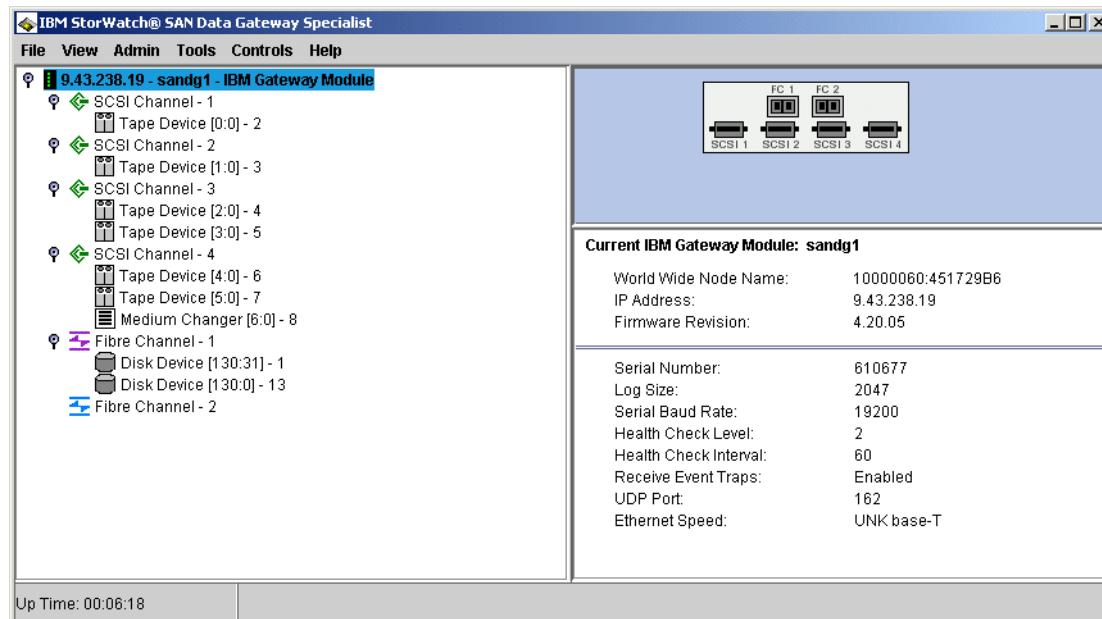


Figure 17-4 StorWatch SAN configuration overview

17.4.3 Setting up the SAN Data Gateway (datamover)

In order to perform the extended copy command from the datamover built into the IBM 3583, we need to enable the datamover, as described in the following steps (if you have already done this, just proceed to the second to last step):

1. On Windows, connect a null modem cable from the serial port on the top of the gateway to a free serial port on the Windows workstation.
2. Open HyperTerminal and create a profile for the Gateway using:
 - Bits/seconds: 19200
 - Data Bits: 8
 - Parity: None
 - Stop Bits: 1
 - Flow Control: XON/XOFF
3. Reset the box by typing `initializeBox`.
4. Enable the Command and control interface:
`enableCC`
5. Next rebuild the SCSI Mapping DB to get all the drive LUNs to show up in order by issuing `mapRebuildDatabase`.
6. Next compress the DB to remove inactive devices:
`mapCompressDatabase`
7. Set the FC Connection to Point-to-Point protocol `fcConnTypeGet` (this displays the current setting).
 - 0 - loop
 - 1 - point-to-point
 - 2 - loop preferred
 - 3 - point-to-point preferred
8. Issue the command `fcConnTypeSet 1,1`. This will set port 1 to point-to-point (2,1 will set port 2).
9. Next set the port mode to public target and initiator: `fcPortModeSet 1,19` (port 1 mode 19).
10. Set the host type for the machine that will control the library (very important if you are switching this library from a different host type). Using `hostTypeShow` will tell you the current settings. Use `setHostX,OSName`, where *X* = the port (0 will set all ports, 1 will set port 1, and 2 will set port 2) and *OSName* is one of the following:
 - AIX
 - AS400
 - HP-UX
 - NETWARE

- gateway
- generic
- SOLARIS
- Unisys
- nt (default)

11. Then enable the IP port:

```
ethEnable
```

12. Set the IP address:

```
ethAddrSet "192.168.0.212", "255.255.255.0"
```

13. Set the gateway:

```
gateAddrSet "192.168.0.1"
```

14. Now issue the following command to enable the datamover agents:

```
sncFeatureEnable "License Key String"
```

The license key string is a unique key provided with the device. However, if the license key was factory-installed, you can use *enable* instead of the actual license key string. For example:

- First: **SncFeatureEnable "BVRZC-G79DN"**
- **Value = 0 = 0x0**
- Second: **SncFeatureEnable "enable"**
- **Value = 0 = 0x0**
- The datamover license is valid.

15. Reboot the gateway:

```
reboot
```

17.4.4 Configuring Tivoli Storage Manager server

To configure the Tivoli Storage Manager server for server-free data movement, follow these steps:

1. Install the Ultrium device drivers (current level). Make sure that the server system can recognize the tape drives and medium changer.
2. Set the processing options on the server:

```
set registration open
```

3. Set the server communication options:

```
set servername waikiki
set serverpass tsm52level0
```

4. Register the administrators and grant them authority:

```
register admin waikikiadmin waikikiadmin  
grant auth waikikiadmin cl=system
```

5. Define the disk storage volumes:

```
define vol archivepool I:\tsmserv\data\arch01.dsm
```

Continue until all volumes are defined.

6. Define the 3583 LTO tape library:

```
define library TAPE_LIB libtype=scsci shared=yes
```

7. Define the path from the server to the library:

```
define path waikiki 3583_svt SRCT=server destt=library device=\.\Changer0  
online=yes
```

The device name can be obtained using the **query san** command on the server. Example 17-1 shows how to find the device name, in italics.

Example 17-1 SAN query

TSM:WAIKIKI>q san ANR2017I Administrator SERVER_CONSOLE issued command:				
Device	Vendor	Product	Serial	Device
GATEWAY	IBM	Gateway	610677	Module
DRIVE	IBM	ULT3580-TD1	6811154801	Tape0
DRIVE	IBM	ULT3580-TD1	6811155213	Tape1
DRIVE	IBM	ULT3580-TD1	6811154684	Tape2
DRIVE	IBM	ULT3580-TD1	6811155177	Tape3
DRIVE	IBM	ULT3580-TD1	6811155203	Tape4
DRIVE	IBM	ULT3580-TD1	6811154087	Tape5
LIBRARY	IBM	ULT3583-TL	IBM7815216	<i>Changer0</i>
DISK	IBM	3552	1T03510567	
DISK	IBM	Universal	1T03510567	Xport

8. Define all the drives for the tape library:

```
define drive 3583_svt drivea element=256 wwn=20010060451729B6  
serial=6811154801
```

or

```
define drive 3583_svt drivea element=autodetect wwn= autodetect serial=  
autodetect
```

We only show how to define one drive. You can define others using the same procedure; the element number will increment by 1 for every new drive. You can also use the Tivoli Storage Manager server autodetect feature to detect the WWN, element number, and serial numbers.

Example 17-2 shows how to get the WWN and serial number for drives in the library.

Example 17-2 Retrieve WWN and serial numbers

```
TSM:WAIKIKI>
q san type=drive f=d
ANR2017I Administrator SERVER_CONSOLE issued command: QUERY SAN type=drive f=d
Device Type: DRIVE
    Vendor: IBM
    Product: ULT3580-TD1
Serial Number: 6811154801
    Device: Tape0
Data Mover: No
    Node WWN: 10000060451729B6
    Port WWN: 20010060451729B6
    LUN: 2
    SCSI Port: 4
    SCSI Bus: 0
    SCSI Target: 0
```

9. Define paths from the server to the drives:

```
define path waikiki drivea SRCT=server destt=drive libr=3583_svt
device=\.\Tape0 online=yes
```

Device information can be found from the **q san** command (see Example 17-2 on page 577).

10. Define the device class and storage pool going to the LTO tape library:

```
define devclass 3583_svt devtype=LTO library=3583_svt
define stgpool tapepool 3583_svt maxscratch=100 dataformat=nonblock
```

Note: The dataformat must be nonblock for server-free data movement.

11. Define the datamover integrated into the tape library (3583 LTO):

```
DEFINE DATAMOVER sandg1 wwn=20010060451729B6 dataformat=nonblock
serial=610667 type=scsi
```

The world wide name and serial number for the datamover can be found with the **q san** command. There is another parameter called *IBM Tivoli Storage Manager copythreads* when defining the datamover. The parameter, *copythreads*, specifies the number of concurrent copy operations that the datamover can support. If other programs or servers will be using the extended copy capabilities of the datamover device, you may want to specify fewer than the maximum number of concurrent copy commands supported by the device for this parameter.

Note: The QLogic API for the HBA on the Tivoli Storage Manager server should be at level V1.27.06.

Example 17-3 SAN query for the datamover

```
TSM:WAIKIKI>q san f=d
ANR2017I Administrator SERVER_CONSOLE issued command: QUERY SAN f=d

Device Type: GATEWAY
  Vendor: IBM
  Product: Gateway Module
Serial Number: 610677
  Device:
    Data Mover: Yes
      Node WWN: 10000060451729B6
      Port WWN: 20010060451729B6
        LUN: 0IBM Tivoli Storage Manager
      SCSI Port: 4
      SCSI Bus: 0
      SCSI Target: 0
```

12.Define SAN disks for the client bordeaux:

```
reg node bordeaux bordeaux archdel=yes backdel=yes do=basvt1_sf
define disk bordeaux Harddisk2 wwn=200800A0B80C00D3 serial=1T03510567

Issue dsmc query diskinfo to get the disk name (that is, Harddisk2). See
Example 17-4 for details.
```

Important: The disk name is case-sensitive.

Example 17-4 WWN for the disk

```
TSM:WAIKIKI>q san type=disk f=d
ANR2017I Administrator SERVER_CONSOLE issued command: QUERY SAN type=disk f=d

Device Type: DISK
  Vendor: IBM
  Product: 3552
Serial Number: 1T03510567
  Device:
    Data Mover: No
      Node WWN: 201A00A0B80C00D2
      Port WWN: 201A00A0B80C00D3
        LUN: 0
      SCSI Port: 5
      SCSI Bus: 0
      SCSI Target: 0
```

13. Define paths from the datamover to the tape drives:

```
define path sandg1 drivea srct=datamover destt=drive libr=3583_svt
```

Define paths for all of the drives in the same way.

13. Define paths from the datamover to the disks:

```
define path sandg1 Harddisk4 srct=datamover destt=disk node=bordeaux
```

17.4.5 Configuring the Tivoli Storage Manager Client

Follow these steps to configure the Tivoli Storage Manager client for server-free data movement:

1. Install the Logical Volume Snapshot Agent (LVSA) so that you can perform online image backup. We showed how to do this in 4.5.6, “Open File Support configuration” on page 167.
2. Make sure that you can see the SAN disk from the client device manager.
3. Make sure that the node name is the same as defined for the disks on the Tivoli Storage Manager server.
4. Make sure that the server-free client node is assigned to the correct policy domain. The policy domain must back up directly to the tape.
5. Edit dsm.opt to add line enableserverfree=yes. You can also specify other parameters for server-free data movement like snapshotcachelocation and snapshotcachesize.
6. The last step is to specify a backup command like this:

```
dsmc backup image <drive name for the san attached disk> <options>
```

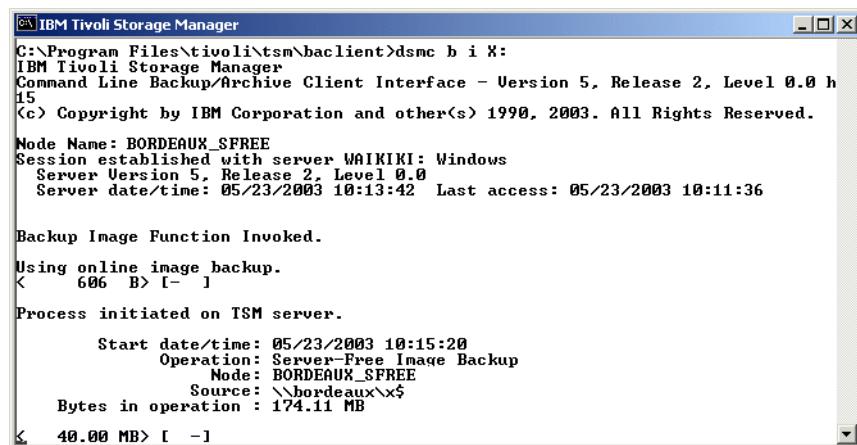
Options can be found in the Tivoli Storage Manager client help. Examples are:

- dsmc backup image D:
- dsmc restore image D: E: -noprompt

17.5 Running server-free backup and restore

The screen captures in this section show how the server-free backup works once it is set up.

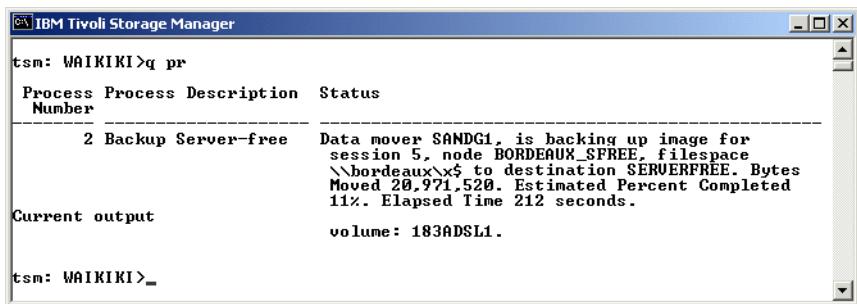
Figure 17-5 shows a server-free client backup in process.



```
C:\Program Files\tivoli\tsm\baclient>dsmc b i X:  
IBM Tivoli Storage Manager  
Command Line Backup/Archive Client Interface - Version 5, Release 2, Level 0.0 h  
15  
(c) Copyright by IBM Corporation and other(s) 1990, 2003. All Rights Reserved.  
Node Name: BORDEAUX_SFREE  
Session established with server WAIKIKI: Windows  
Server Version 5, Release 2, Level 0.0  
Server date/time: 05/23/2003 10:13:42 Last access: 05/23/2003 10:11:36  
  
Backup Image Function Invoked.  
Using online image backup.  
< 606 B> [-]  
Process initiated on TSM server.  
Start date/time: 05/23/2003 10:15:20  
Operation: Server-Free Image Backup  
Node: BORDEAUX_SFREE  
Source: \\bordeaux\x\$  
Bytes in operation : 174.11 MB  
< 40.00 MB> [ - ]
```

Figure 17-5 Server-free client backup in process

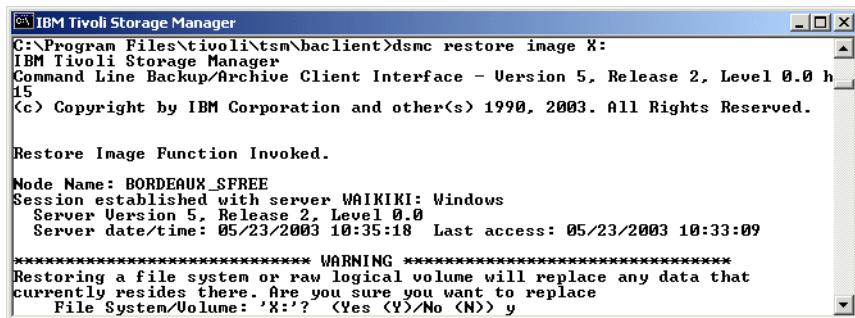
Next we check the Tivoli Storage Manager server status, as shown in Figure 17-6.



```
tsm: WAIKIKI>q pr  
Process Process Description Status  
Number  
2 Backup Server-free Data mover SANDG1, is backing up image for  
session 5, node BORDEAUX_SFREE, filespace  
\\bordeaux\x\$ to destination SERVERFREE. Bytes  
Moved 20,971,520. Estimated Percent Completed  
11%. Elapsed Time 212 seconds.  
Current output  
volume: 183ADSL1.  
  
tsm: WAIKIKI>_
```

Figure 17-6 Server-free backup server status query

After finishing the backup successfully, we can restore from the client, as shown in Figure 17-7.



The screenshot shows a command-line interface window titled "IBM Tivoli Storage Manager". The command entered is "dsmc restore image X:". The output shows the session details: Node Name: BORDEAUX_SFREE, Session established with server WAIKIKI: Windows, Server Version 5, Release 2, Level 0.0, Server date/time: 05/23/2003 10:35:18, Last access: 05/23/2003 10:33:09. A warning message follows: "Restoring a file system or raw logical volume will replace any data that currently resides there. Are you sure you want to replace File System/Volume: 'X:'? <Yes <Y>/No <N>> y".

Figure 17-7 Tivoli Storage Manager server-free client restore in process

17.6 Summary

We have shown how to configure and run a server-free client backup. In the next chapter we discuss Tivoli Storage Manager with Network Attached Storage devices, using NDMP.



Network Data Management Protocol (NDMP)

This chapter gives an overview of backing Network Attached Storage (NAS) file server by using Network Data Management Protocol (NDMP). Tivoli Storage Manager Extended Edition includes support for the use of NDMP to back up and recover NAS file servers. The latest detailed implementation information about this topic is available in the IBM Redbook *Using the System Storage N Series with IBM Tivoli Storage Manager*, SG24-7243.

18.1 NDMP terminology

The key goals of NDMP include interoperability, contemporary functionality, and extensibility. This section is useful for understanding the general NDMP terms.

- ▶ **NDMP**
Network Data Management Protocol. An open protocol for enterprise-wide network-based backup.
- ▶ **NDMP client**
The application that controls the NDMP server.
- ▶ **NDMP host**
The host that executes the NDMP server application. Data is backed up from the NDMP host to either a local tape drive or to a backup device on a remote NDMP host.
- ▶ **NDMP server**
The virtual state machine on the NDMP host that is controlled using the NDMP protocol. There is one of these for each connection to the NDMP host. This term is used independently of implementation.

18.1.1 Tivoli Storage Manager and NDMP

Tivoli Storage Manager Extended Edition uses Network Data Management Protocol (NDMP) to perform high-performance, scalable backups and restores. The backups and restores minimize network traffic and transfer data outboard of the Tivoli Storage Manager client and server. Tivoli Storage Manager enables data backup and restore on Network Attached Storage (NAS) devices that support Network Data Management Protocol (NDMP) Version 3.0.

NDMP defines a mechanism and protocol for controlling backup, recovery, and other transfers of data between primary and secondary storage. The NDMP architecture separates the Data Servers (NAS) and Tape Servers (Tivoli Storage Manager), participating in archival or recovery operations. NDMP also provides low-level control of tape devices and SCSI media changers.

18.1.2 NDMP backup for NAS

A full or differential backups can be performed at a directory or file system level, including snapshots that are stored as either file systems or subdirectories. Restores can be performed of an entire file system or selected files and directories within the file system. Multiple backup and restore operations can be performed in parallel.

Currently, NDMP for full or differential backups can be performed at a directory or file system level, including snapshots that are stored as either file systems or subdirectories to a Tivoli Storage Manager server running on AIX, Sun Solaris, HP-UX, Linux, or Windows. This uses NDMP to back up a full file system image and to restore an entire file system image. After a full backup image has been created, subsequent backups can be differential images. A differential image consists of all of the files that have changed since the previous full image backup.

The restore of a differential image automatically restores the differential image after the appropriate full image has been restored. Backup and restore operations can be scheduled using the administrative command scheduler. During backup and restore operations, data flows directly between the tape drive and the Network Attached Storage (NAS) appliance.

Figure 18-1 shows the topology for Tivoli Storage Manager NDMP operations.

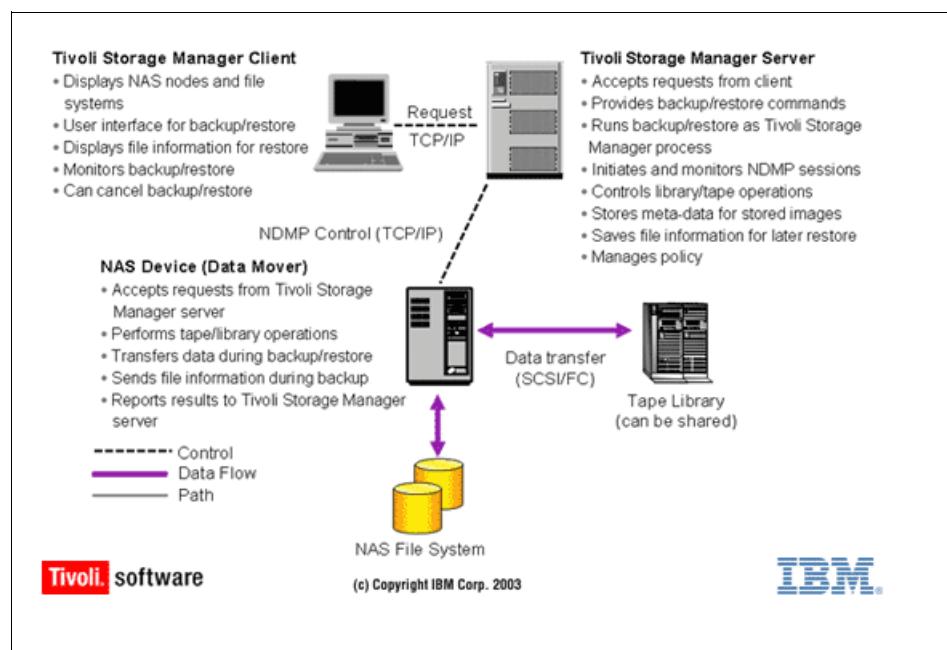


Figure 18-1 NDMP operations and Tivoli Storage Manager interactions

18.1.3 NDMP support

NDMP operations can be performed using SCSI or ACSLS tape libraries. Additionally, 349X tape libraries may be used with some NAS devices. NDMP for NAS backup works with either a SCSI-attached tape device local to the NAS appliance or with a SAN-attached SCSI or ACSLS device that can be shared

with the Tivoli Storage Manager server. Drives must be supported by both the NAS appliance and the NAS operating system. Drives can be dedicated to NDMP operations from a single NAS file server or can be shared.

Table 18-1 shows Tivoli Storage Manager devices on Network Attached Storage (NAS) that support NDMP.

Table 18-1 Supported Devices for NAS

Device	Capacity	AIX	HP-UX	SUN	Windows
Any EMC Celerra File Server running Dart 5.1.9.3 or later. If running Dart OS Version 5.4, must be at level 5.4.15 or later.	N/A	5.2.0	5.2.0	5.2.0	5.2.0
Any Network Appliance File Server running Data ONTAP Version 6.1.1 or later.	N/A	Base	5.1.1	Base	Base
Any Ready for IBM Tivoli Software certified NAS file server. See Additional Device Support below for more information	N/A	5.2.2	5.2.2	5.2.2	5.2.2
IBM System Storage N series File Server.	N/A	5.2.7 5.3.2.2	5.2.7 5.3.2.2	5.2.7 5.3.2.2	5.2.7 5.3.2.2
Network Appliance NearStore appliances via NDMP, requires Data ONTAP 6.1.1 or later. This device can also be used as an Tivoli Storage Manager storage pool device via the sequential device class.	N/A	Base	5.1.1	Base	Base

Refer to the Tivoli Storage Manager device support Web page and your NAS vendor's documentation for complete latest NDMP device support:

http://www.ibm.com/software/sysmgmt/products/support/IBM_TSM_Supported_Devices_for_AIXHPSUNWIN.html

18.1.4 Multiple NAS appliances

Multiple NAS appliances can share tape resources if they have Fibre Channel (FC) access to the drive and if backups are performed via the same Tivoli Storage Manager server. Depending on the configuration, drives can be shared with LAN-free backup/restore operations. NDMP operations for backup of NAS file servers have been enhanced to support the following functions:

- ▶ Directory-level backup of NAS data, which enables the division of a file system backup operation among several NDMP backup operations as well as several tape drives. This enhancement will reduce backup and restore times.
- ▶ NDMP directory-level backup enables Tivoli Storage Manager to back up user-created snapshots that are stored as subdirectories, specifically Network Appliance snapshots.
- ▶ The NDMP-controlled backups/restores can be performed in full file system image and differential file system image.
- ▶ Backup to local tape devices without LAN network data movement.
- ▶ NDMP isolates backup software from hardware/software changes on NAS appliances.

If you have a large NAS file system, initiating a backup at a directory level reduces backup and restore times and provides more flexibility in configuring your NAS backups. By defining virtual file spaces, a file system backup can be partitioned among several NDMP backup operations and multiple tape drives. You can also use different backup schedules to back up subtrees of a file system.

The virtual file space name cannot be identical to any file system on the NAS node. If a file system is created on the NAS device with the same name as a virtual file system, a name conflict will occur on the Tivoli Storage Manager server when the new file space is backed up.

Note: Virtual file space mappings are supported only for NAS nodes. For more information about virtual file space mapping commands, see the *Tivoli Storage Manager Administrator's Reference*.



Disaster Recovery Manager

In this chapter we present an example of how to set up and test Disaster Recovery Manager (DRM) functions. The example presented here was adapted from the IBM Redbook *Disaster Recovery Strategies with Tivoli Storage Management*, SG24-6844, and has been updated to reflect current levels.

Due to the complexity of disaster recovery, our implementation guide is not intended to supply you with all of the knowledge required to effectively design, implement, and manage your DRM solution. To achieve a better perspective and understanding, we encourage you to read the aforementioned IBM Redbook.

19.1 Example of a DRM implementation

This section contains a practical example of using Disaster Recovery Manager. In our lab we have a Windows 2003 Tivoli Storage Manager server, LOCHNESS, connected to a SAN-attached IBM 3582 Tape Library. The Tivoli Storage Manager server is called LOCHNESS_Server1. The storage pool setup is the same as our example solution in Chapter 6, “Data storage” on page 215.

In our scenario, we set up DRM on LOCHNESS, backed up all the necessary data, and restored the Tivoli Storage Manager server onto another Windows 2003 system called CASEY. The result was that the Tivoli Storage Manager server named LOCHNESS_Server1 was recovered to the machine called CASEY, as shown in Figure 19-1. Our situation most closely matches a disaster recovery with a cold standby machine.

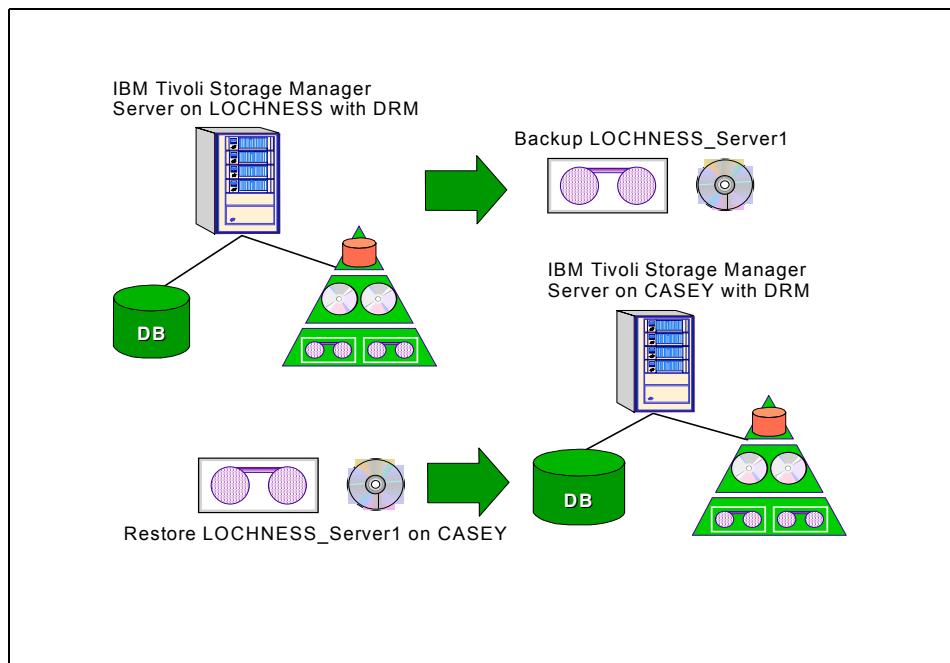


Figure 19-1 DRM lab setup

Here is a summary of the steps to perform:

- ▶ Tivoli Storage Manager server settings
 - DRM setup:
 - Register DRM (Extended Edition) license.
 - Define copy storage pools (if not already done).

- Configure DRM settings.
- Create instructions files.
- Daily operations:
 - Back up the primary storage pools to the copy storage pools (usually scheduled).
 - Back up the Tivoli Storage Manager database (usually scheduled).
 - Move DR media states.
 - Remove the volumes from the library.
 - Run PREPARE.
 - Transport DR media off-site.
 - Return empty media from off-site.
- ▶ Restore operations on the backup server:
 - Install the operating system and Tivoli Storage Manager server software.
 - Restore the server using DRM scripts.

19.2 DRM setup

Before using DRM, we need to perform basic configuration tasks.

19.2.1 Register DRM license

To use DRM, it must first be licensed in Tivoli Storage Manager. DRM is now included with the Tivoli Storage Manager Extended Edition. To license DRM, use **register license** with the file tsmee.lic. Example 19-1 shows the procedure.

Example 19-1 Registering Tivoli Storage Manager Extended Edition

```
tsm: LOCHNESS_SERVER1>q lic
                                         Last License Audit: 02/27/2006 00:00:09
...
    Is IBM System Storage Archive Manager in use ?: No
    Is IBM System Storage Archive Manager licensed ?: No
    Is Tivoli Storage Manager Basic Edition in use: Yes
    Is Tivoli Storage Manager Basic Edition licensed: Yes
    Is Tivoli Storage Manager Extended Edition in use: No
    Is Tivoli Storage Manager Extended Edition licensed: No
                                         Server License Compliance: Valid
```

```
tsm: LOCHNESS_SERVER1>register license file=tsmee.lic
```

ANR2852I Current license information:
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2853I New license information:
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.

tsm: LOCHNESS_SERVER1>**q lic**

Last License Audit: 02/27/2006 00:00:09

...
Is IBM System Storage Archive Manager in use ?: No
Is IBM System Storage Archive Manager licensed ?: No
Is Tivoli Storage Manager Basic Edition in use: Yes
Is Tivoli Storage Manager Basic Edition licensed: Yes
Is Tivoli Storage Manager Extended Edition in use: No
Is Tivoli Storage Manager Extended Edition licensed: Yes
Server License Compliance: Valid

Note that the Extended Edition is now licensed but not, as yet, in use. Note also that there is no specific entry for DRM.

19.2.2 Create a copy storage pool

To transport tapes to an off-site location using the DRM, you must make backups of your primary storage pools. In 6.3, “Storage pools” on page 231, we created the copy storage pools shown in Table 19-1.

Table 19-1 Storage pools

Primary storage pool	Copy storage pool
DISKDATA	OFFDATA
TAPEDATA	OFFDATA
DISKDIRS	OFFDIRS

Example 19-2 shows using the **define stgpool** command to create the copy storage pool OFFDATA using the device class defined for the LTO tape library. Note the value of REUsedelay=6. This is important for ensuring recovery integrity. See step 8 on page 596 for more information about how this relates to the database backup series expiration value.

Example 19-2 Creation of copy storage pool

```
tsm: LOCHNESS_SERVER1>define stgpool offdata lto2-dc pooltype=copy reclaim=100
maxscratch=10000 reusedelay=6 collocate=no
ANR2200I Storage pool OFFDATA defined (device class LT02-DC).
```

Query stgpool displays the details of the new pool, as shown in Example 19-3.

Example 19-3 Query stgpool command output

```
tsm: LOCHNESS_SERVER1>q stg offdata f=d

Storage Pool Name: OFFDATA
Storage Pool Type: Copy
Device Class Name: LT02-DC
Estimated Capacity: 0.0 M
Space Trigger Util:
    Pct Util: 0.0
    Pct Migr:
    Pct Logical: 0.0
    High Mig Pct:
    Low Mig Pct:
    Migration Delay:
    Migration Continue:
    Migration Processes:
Reclamation Processes: 1
    Next Storage Pool:
    Reclaim Storage Pool:
Maximum Size Threshold:
    Access: Read/Write
    Description:
    Overflow Location:
    Cache Migrated Files?:
        Collocate?: No
    Reclamation Threshold: 100
    Offsite Reclamation Limit: No Limit
Maximum Scratch Volumes Allowed: 10,000
Number of Scratch Volumes Used: 0
Delay Period for Volume Reuse: 6Day(s)
Migration in Progress?:
    Amount Migrated (MB):
Elapsed Migration Time (seconds):
Reclamation in Progress?: No
```

```
Last Update by (administrator): ADMIN
      Last Update Date/Time: 02/27/2006 15:25:52
      Storage Pool Data Format: Native
      Copy Storage Pool(s):
      Continue Copy on Error?:
      CRC Data: No
      Reclamation Type: Threshold
```

19.2.3 DRM settings

Now we configure the DRM settings. Most of the DRM basic settings are set using SET commands.

1. First, we need to specify a directory where the DR plans will be stored, and a prefix that will name each file. To set the prefix we use the **set drmplanprefix** command. You should specify the plan prefix with an absolute directory path followed by your chosen file name prefix. Using the form shown in Example 19-4, our DR plans generated by DRM will be stored in the directory C:\TSMDATA\DRM\PLANS\ and each file will be prefixed by the string LOCHNESS-DR_. If you do not set the directory and prefix, plans are created in the server's default path (the directory where the instance of the Tivoli Storage Manager server is running from) with a file name consisting only of the date and time the plan was created. Enclose the prefix in quotes if it contains metacharacters or spaces.

Example 19-4 Setting the DRM plan prefix

```
tsm: LOCHNESS_SERVER1>set drmplanprefix "c:\tsmdata\drm\plans\lochness-dr"
ANR6700I SET DRMPLANPREFIX command completed successfully.
```

2. Next we set the prefix for where site-specific recovery instructions will be stored. The DRM **prepare** command will look for the instructions files in this directory if it is set. We set the instructions directory using **set drminstrprefix**. You should specify the instructions prefix with an absolute path. Using the syntax shown in Example 19-5 on page 595, the recovery instruction files should be located in the directory C:\TSMDATA\DRM\INSTRUCTIONS\. The prefix does not need to be specified. If you do not set the directory, instructions are searched for in the server's default path (the directory from where the instance of the Tivoli Storage Manager server is running).

The recovery instruction files are user-created and should contain any site-specific instructions related to the DR process. You can create the files using any plain text editor. Be sure to include any information that is relevant to your installation. Instruction files will be automatically included in the DR plan. The standard names for the instruction plans are:

- RECOVERY.INSTRUCTIONS.GENERAL: Contains general information such as the name of the system administrator, backup administrators and operators names, contact details, security guards, passwords, and so on.
- RECOVERY.INSTRUCTIONS.OFFSITE: Contains information about the off-site vault location and courier service, including name, phone number, e-mail, fax, after-hours pager, and so on. Also contains the procedure for retrieving tapes from the vault including pass phrases and your client number/details.
- RECOVERY.INSTRUCTIONS.INSTALL: Contains installation instructions for the Tivoli Storage Manager server, and site-specific details such as passwords, hardware/software requirements, fix levels, media locations, and so on.
- RECOVERY.INSTRUCTIONS.DATABASE: Contains instructions to recreate the Tivoli Storage Manager server database and recovery log volumes. It is a good idea to keep up-to-date directory listings of the volumes (for example, `1s` on UNIX platforms, `dir` on Windows) in this file.
- RECOVERY.INSTRUCTIONS.STGPOOL: Contains instructions to recreate the Tivoli Storage Manager server primary storage pool volumes. It is a good idea to keep up-to-date directory listings of the volumes (for example, `1s` on UNIX/Linux, `dir` on Windows) in this file.

Example 19-5 Setting the DRM instructions files prefix

```
tsm: LOCHNESS_SERVER1>set drminstrprefix "c:\tsmdata\drm\instructions\"  
ANR6700I SET DRMINSTRPREFIX command completed successfully.
```

3. Next, we specify a character that will be appended to the end of the replacement volume names in the recovery plan file. The character is set using `set drmplanvpostfix`. Use of this special character allows you to easily search the recovery plan so that you can change the names at recovery time. In Example 19-6, we use the default character of `@`.

Example 19-6 Setting the DRM replacement volumes postfix

```
tsm: LOCHNESS_SERVER1>set drmplanvpostfix @  
ANR6700I SET DRMPLANVPOSTFIX command completed successfully.
```

4. Now we use `set drmchecklabel` to specify whether Tivoli Storage Manager will mount and read the labels of tape media when they are checked out using

the **move drmedia** command. The default value is YES. We will set it to NO in Example 19-7.

*Example 19-7 Setting DRM**CHECKLABEL***

```
tsm: LOCHNESS_SERVER1>set drmchecklabel no  
ANR6700I SET DRMCHECKLABEL command completed successfully.
```

5. Now we need to indicate which primary storage pools will be managed by DRM, using **set drmprimestgpool**. The primary storage pools we set here will be recoverable by DRM after a disaster. In Example 19-8, we specify our storage pools DISKDATA, DISKDIRS, and TAPEDATA to be managed by DRM.

Example 19-8 Setting primary storage pools managed by DRM

```
tsm: LOCHNESS_SERVER1>set drmprimestgpool diskdata,diskdirs,tapedata  
ANR6700I SET DRMPRIMSTGPOOL command completed successfully.
```

6. Similarly, we use **set drmcopystgpool** to indicate one or more copy storage pools to be managed by DRM. The copy pools configured here will be used to recover the primary storage pools after a disaster. The **move drmedia** and **query drmedia** commands will only process volumes in the copy storage pools listed here by default (unless explicitly over-ridden with the COPYSTGPOOL parameter). In Example 19-9 we specify that our copy storage pools OFFDATA and OFFDIRS are to be managed by DRM.

Example 19-9 Setting copy storage pools managed by DRM

```
tsm: LOCHNESS_SERVER1>set drmcopystgpool offdata,offdirs  
ANR6700I SET DRMCOPYSTGPOOL command completed successfully.
```

7. Next, use **set drmcouriername** to define the name of your courier company. If not set, the courier name will default to "COURIER". Any meaningful string can be inserted here, enclosing the string in quotes if spaces or special characters are included in the name (Example 19-10).

Example 19-10 Setting the DRM courier name

```
tsm: LOCHNESS_SERVER1>set drmcouriername "Rocket Couriers"  
ANR6700I SET DRMCOURIERNAME command completed successfully.
```

8. Now we specify the number of days before a database backup series expires using **Set drmdbbackupexpiredays**. This parameter applies to both database snapshots and full-plus-incremental database backup series. The age of the last volume in the series must exceed the expiration value defined here to be eligible for expiration. The most recent backup series of either type is never deleted. Therefore, a value of 6 will keep database backups for one week.

In Example 19-11 we specify an expiration value of 6 days. To ensure that the database can be restored to an earlier level and database references to files in the storage pool are still valid, the number of days specified by this setting and the number of days specified by the REUsedelay parameter in the copy storage pool definitions should be the same.

Example 19-11 Setting database backup expiry period

```
tsm: LOCHNESS_SERVER1>set drmdbbackupexpiredays 6  
ANR6700I SET DRMDBBACKUPEXPIREDAYS command completed successfully.
```

9. The **set drmfileprocess** command (shown in Example 19-12) indicates whether the **move drmedia** and **query drmedia** commands should process database backup volumes and copy storage pool volumes that have been defined with the FILE device class. The default value is NO.

Example 19-12 Setting processing for FILE device class volumes

```
tsm: LOCHNESS_SERVER1>set drmfileprocess no  
ANR6700I SET DRMFILEPROCESS command completed successfully.
```

10. Next, specify the location where media will be stored while it is waiting to be sent to the off-site location, using **set drmnottablename**. The location name is used by the **move drmedia** command to set the location of volumes that are in transition to the NOTMOUNTABLE state. The default value is NOTMOUNTABLE.

Example 19-13 Setting the NOTMOUNTABLE location

```
tsm: LOCHNESS_SERVER1>set drmnottablename "East dock"  
ANR6700I SET DRMNOTMOUNTABLENAME command completed successfully.
```

11. If you are using Tivoli Storage Manager server-to-server communication and intend to store recovery plans on another server, use **set drmrpfexpiredays** to set the expiry period. When plans are stored on another Tivoli Storage Manager server, they are automatically expired after drmrpfexpiredays days. The most recent files are never deleted. Example 19-14 shows changing this value from the default of 60 days to 6 days.

Example 19-14 Setting remote plan file expiry period

```
tsm: LOCHNESS_SERVER1>set drmrpfexpiredays 6  
ANR6700I SET DRMRFEXPIREDAYS command completed successfully.
```

12. Identify the vault name with **set drmvaultname**, as shown in Example 19-15 on page 598. You can specify any string or leave the default value of VAULT.

Example 19-15 Setting the vault name

```
tsm: LOCHNESS_SERVER1>set drmvaultname "Rocket Vault"
ANR6700I SET DRMVAULTNAME command completed successfully.
```

19.2.4 Verifying the settings

You can display and check settings of the DRM parameters with the **query drmstatus** command, as shown in Example 19-16.

Example 19-16 Querying DRM status

```
tsm: LOCHNESS_SERVER1>q drmst
```

```
Recovery Plan Prefix: C:\TSMDATA\DRM\PLANS\LOCHNESS-DR
Plan Instructions Prefix: C:\TSMDATA\DRM\INSTRUCTIONS\
Replacement Volume Postfix: @
Primary Storage Pools: DISKDATA DISKDIRS TAPEDATA
Copy Storage Pools: OFFDATA OFFDIRS
Not Mountable Location Name: East dock
Courier Name: Rocket Couriers
Vault Site Name: Rocket Vault
DB Backup Series Expiration Days: 6 Day(s)
Recovery Plan File Expiration Days: 6 Day(s)
Check Label?: No
Process FILE Device Type?: No
Command File Name:
```

19.3 Daily operations

After setup, DRM will now manage your tape movements and generate a recovery plan for you. As we discussed in Chapter 12, “Scheduling” on page 371, a number of operations are scheduled to happen after the client backups are complete. For disaster recovery, we are concerned with the first of those schedules, backing up the primary storage pool and database. The list below details the procedures required for DRM operations on a daily basis:

1. Back up the primary storage pools to copy storage pools.
2. Back up the Tivoli Storage Manager database.
3. Perform DR tape movement commands.
4. Generate a recovery plan.
5. Physically transport media and plan off-site.

We now discuss each step in detail.

Throughout this section we refer to the possible states in which a piece of DR media could be. DR media are volumes used for storage pool and database backup. The states and their life cycle are shown in Figure 19-2. DR media states are changed using `move drmedia`.

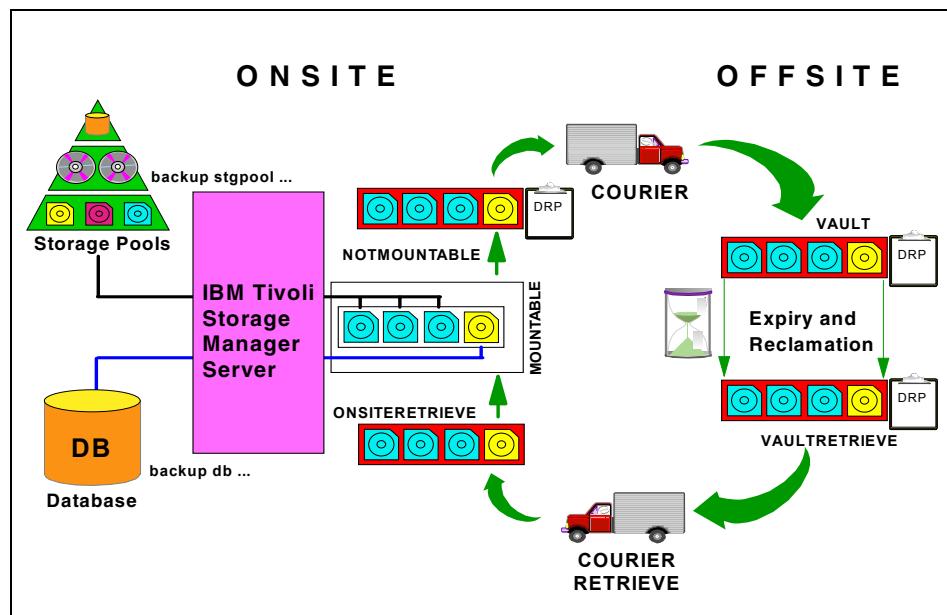


Figure 19-2 DRM media states and life cycle

Table 19-2 lists the valid DR media states and their meanings.

Table 19-2 DR media states

DR media state	Description
MOuntable	Volume is in a tape library onsite and is accessible by the server.
NOTMOuntable	Volume is not in a tape library but remains onsite. It is not accessible by the server.
COURier	Volume is in transit to the off-site vault location.
VAULT	Volume is off-site at the vault.
VAULTRetrieve	Volume is off-site at the vault and contains no valid data. It is ready for transport back onsite.
COURIERRetrieve	Volume is in transit from the vault to onsite.

DR media state	Description
ONSITERetrieve	Volume has been returned onsite and can be loaded into a library for reuse.

Note that a volume does not have to move through all states. You can skip states, as long as it is clearly understood which states your media are in at any given time. For example, you do not have to transit a MOUNTable tape through NOTMOUNTable and COURier before it can be in the VAULT state. You can transit a MOUNTable tape directly to VAULT if you wish. Likewise, a VAULTRetrieve tape can transit directly to ONSITERetrieve if desired.

19.3.1 Back up primary storage pools to copy storage pool

The first step in the tape offsite process is to back up the primary storage pools. As discussed above, the storage pool backups are usually (and should be) run by a schedule overnight. We show examples of manually backing up the primary storage pools below.

In our example solution, the clients back up to the primary storage pool, DISKDATA, which migrates to the pool TAPEDATA. We must back up both of the storage pools to our copy storage pool, OFFDATA. We use the **backup stgpool** command, as shown in Example 19-17. We also back up the primary storage pool DISKDIRS to our copy storage pool OFFDIRS. The example shows a number of queries that you can use to view the status of the jobs as they run.

Note that when we run the first backup stgpool operation on the pool DISKDATA, there is no data to back up. This indicates that the pool has already been completely migrated to TAPEDATA, leaving it empty.

Example 19-17 Primary storage pool backup

```
tsm: LOCHNESS_SERVER1>backup stg diskdata offdata maxprocess=1 wait=no
ANR2111W BACKUP STGPOOL: There is no data to process for DISKDATA.
ANS8001I Return code 11.
```

```
tsm: LOCHNESS_SERVER1>backup stg tapedata offdata maxprocess=1 wait=no
ANS8003I Process number 2 started.
```

```
tsm: LOCHNESS_SERVER1>q pr
```

Process Number	Process Description	Status
2	Backup Storage Pool	Primary Pool TAPEDATA, Copy Pool OFFDATA, Files Backed Up: 6825, Bytes Backed Up: 954,088,410, Unreadable Files: 0, Unreadable Bytes: 0.

```
Current Physical File (bytes): 24,179,840
Current input volume: 028AKK. Current output
volume: 032AKK.
```

```
tsm: LOCHNESS_SERVER1>q mount
ANR8330I LTO volume 028AKK is mounted R/W in drive DR01 (mt1.0.0.2), status:
IN USE.
ANR8330I LTO volume 032AKK is mounted R/W in drive DR00 (mt0.0.0.2), status:
IN USE.
ANR8334I      2 matches found.
```

```
tsm: LOCHNESS_SERVER1>backup stg diskdirs offdirs maxprocess=1 wait=no
ANS8003I Process number 6 started.
```

```
tsm: LOCHNESS_SERVER1>q pr
```

Process Number	Process Description	Status
6	Backup Storage Pool	Primary Pool DISKDIRS, Copy Pool OFFDIRS, Files Backed Up: 2395, Bytes Backed Up: 1,694,189, Unreadable Files: 0, Unreadable Bytes: 0. Current Physical File (bytes): 660 Current input volume: C:\TSMDATA\STG\DISKDIRS\0000001C.BFS. Current output volume: 036AKK.

```
tsm: LOCHNESS_SERVER1>q actlog
```

Date/Time	Message
02/28/2006 11:19:23	ANR2017I Administrator ADMIN issued command: BACKUP STGPOOL tapedata offdata maxprocess=1 wait=no (SESSION: 3)
02/28/2006 11:19:23	ANR0984I Process 2 for BACKUP STORAGE POOL started in the BACKGROUND at 11:19:23. (SESSION: 3, PROCESS: 2)
02/28/2006 11:19:23	ANR2110I BACKUP STGPOOL started as process 2. (SESSION: 3, PROCESS: 2)
02/28/2006 11:19:23	ANR1210I Backup of primary storage pool TAPEDATA to copy storage pool OFFDATA started as process 2. (SESSION: 3, PROCESS: 2)
02/28/2006 11:19:23	ANR1228I Removable volume 028AKK is required for storage pool backup. (SESSION: 3, PROCESS: 2)
02/28/2006 11:19:25	ANR2017I Administrator ADMIN issued command: QUERY PROCESS (SESSION: 3)
02/28/2006 11:19:32	ANR2017I Administrator ADMIN issued command: QUERY MOUNT (SESSION: 3)
02/28/2006 11:20:26	ANR1340I Scratch volume 032AKK is now defined in storage pool OFFDATA. (SESSION: 3, PROCESS: 2)

02/28/2006 11:20:26 ANR8337I LTO volume 028AKK mounted in drive DR01
(mt1.0.0.2). (SESSION: 3, PROCESS: 2)

02/28/2006 11:20:29 ANR0513I Process 2 opened output volume 032AKK. (SESSION:
3, PROCESS: 2)

02/28/2006 11:20:29 ANR0512I Process 2 opened input volume 028AKK. (SESSION:
3, PROCESS: 2)

02/28/2006 11:31:48 ANR0986I Process 2 for BACKUP STORAGE POOL running in the
BACKGROUND processed 99594 items for a total of
12,903,630,500 bytes with a completion state of SUCCESS
at 11:31:48. (SESSION: 3, PROCESS: 2)

02/28/2006 11:31:48 ANR0514I Session 3 closed volume 030AKK. (SESSION: 3)

02/28/2006 11:31:48 ANR0514I Session 3 closed volume 032AKK. (SESSION: 3)

02/28/2006 11:31:48 ANR1214I Backup of primary storage pool TAPEDATA to copy
storage pool OFFDATA has ended. Files Backed Up: 99594,
Bytes Backed Up: 12903630500, Unreadable Files: 0,
Unreadable Bytes: 0. (SESSION: 3)

...

02/28/2006 13:30:20 ANR2017I Administrator ADMIN issued command: BACKUP
STGPOOL diskdirs offdirs maxprocess=1 wait=no (SESSION:
13)

02/28/2006 13:30:21 ANR0984I Process 6 for BACKUP STORAGE POOL started in the
BACKGROUND at 13:30:21. (SESSION: 13, PROCESS: 6)

02/28/2006 13:30:21 ANR2110I BACKUP STGPOOL started as process 6. (SESSION:
13, PROCESS: 6)

02/28/2006 13:30:21 ANR1210I Backup of primary storage pool DISKDIRS to copy
storage pool OFFDIRS started as process 6. (SESSION: 13,
PROCESS: 6)

02/28/2006 13:30:21 ANR1228I Removable volume
C:\TSMDATA\STG\DISKDIRS\0000001A.BFS is required
for storage pool backup. (SESSION: 13, PROCESS: 6)

...

02/28/2006 13:31:24 ANR0986I Process 6 for BACKUP STORAGE POOL running in the
BACKGROUND processed 5427 items for a total of 3,863,586
bytes with a completion state of SUCCESS at 13:31:24.
(SESSION: 13, PROCESS: 6)

02/28/2006 13:31:24 ANR0514I Session 13 closed volume
C:\TSMDATA\STG\DISKDIRS\00000020.BFS. (SESSION: 13)

02/28/2006 13:31:24 ANR0514I Session 13 closed volume 036AKK. (SESSION: 13)

02/28/2006 13:31:24 ANR1214I Backup of primary storage pool DISKDIRS to copy
storage pool OFFDIRS has ended. Files Backed Up: 5427,
Bytes Backed Up: 3863586, Unreadable Files: 0, Unreadable
Bytes: 0. (SESSION: 13)

19.3.2 Backup of Tivoli Storage Manager database

After successfully backing up all primary storage pools, we can back up the Tivoli Storage Manager database. Using **backup db**, as shown in Example 19-18, we see the output from running the command in the foreground (wait=yes) and the activity log entries. The database backup is written to volume 037AKK.

Example 19-18 Backup of Tivoli Storage Manager database

```
tsm: LOCHNESS_SERVER1>backup db devc=lto2-dc type=full wait=yes
ANR0984I Process 7 for DATABASE BACKUP started in the FOREGROUND at 13:36:20.
ANR2280I Full database backup started as process 7.
ANR4554I Backed up 64896 of 129915 database pages.
ANR4554I Backed up 129792 of 129915 database pages.
ANR4550I Full database backup (process 7) complete, 129915 pages copied.
ANR0985I Process 7 for DATABASE BACKUP running in the FOREGROUND completed with
completion state SUCCESS at 13:37:10.
```

```
tsm: LOCHNESS_SERVER1>q actlog
```

Date/Time	Message
02/28/2006 13:36:18	ANR2017I Administrator ADMIN issued command: BACKUP DB devc=lto2-dc type=full wait=yes (SESSION: 13)
02/28/2006 13:36:20	ANR0984I Process 7 for DATABASE BACKUP started in the FOREGROUND at 13:36:20. (SESSION: 13, PROCESS: 7)
02/28/2006 13:36:20	ANR2280I Full database backup started as process 7. (SESSION: 13, PROCESS: 7)
02/28/2006 13:36:53	ANR8337I LTO volume 037AKK mounted in drive DR01 (mt1.0.0.2). (SESSION: 13, PROCESS: 7)
02/28/2006 13:36:53	ANR0513I Process 7 opened output volume 037AKK. (SESSION: 13, PROCESS: 7)
02/28/2006 13:36:57	ANR1360I Output volume 037AKK opened (sequence number 1). (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:02	ANR4554I Backed up 64896 of 129915 database pages. (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:07	ANR4554I Backed up 129792 of 129915 database pages. (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:10	ANR1361I Output volume 037AKK closed. (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:10	ANR0515I Process 7 closed volume 037AKK. (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:10	ANR4550I Full database backup (process 7) complete, 129915 pages copied. (SESSION: 13, PROCESS: 7)
02/28/2006 13:37:10	ANR0985I Process 7 for DATABASE BACKUP running in the FOREGROUND completed with completion state SUCCESS at 13:37:10. (SESSION: 13, PROCESS: 7)

19.3.3 Querying DR media

When you are ready to move the DR media off-site, you can check the status of the tapes using **query drmedia**. **Query drmedia** lists all DR volumes, including those that should be moved off-site.

Example 19-19 shows the output of the **query libvolume** and **query drmedia** commands. Specifying the state as MOUNTABLE ensures that only DR media in the library will be displayed.

Example 19-19 Querying DR media

```
tsm: LOCHNESS_SERVER1>q libvol
```

Library Name	Volume Name	Status	Owner	Last Use	Home Element	Device Type
3582LIB	029AKK	Private		Data	4,103	LTO
3582LIB	030AKK	Private		Data	4,106	LTO
3582LIB	031AKK	Private		Data	4,107	LTO
3582LIB	032AKK	Private		Data	4,100	LTO
3582LIB	033AKK	Private		DbBackup	4,105	LTO
3582LIB	034AKK	Private		DbBackup	4,098	LTO
3582LIB	036AKK	Private		Data	4,101	LTO
3582LIB	037AKK	Private		DbBackup	4,113	LTO

```
tsm: LOCHNESS_SERVER1>q drmedia wherestate=mountable
```

Volume Name	State	Last Update Date/Time	Automated LibName
032AKK	Mountable	02/28/2006 11:31:48	3582LIB
036AKK	Mountable	02/28/2006 13:31:24	3582LIB
037AKK	Mountable	02/28/2006 13:36:20	3582LIB
034AKK	Mountable	02/28/2006 12:35:34	3582LIB
033AKK	Mountable	02/28/2006 12:31:36	3582LIB

Example 19-19 shows how to tell which volumes are database backups. The query libvol output lists the database backups as 033AKK, 034AKK, and 037AKK. Therefore, the other DR media are copy pool tapes (032AKK and 036AKK).

Before moving media off-site, we should check if any of the volumes are still mounted using **query mount**. If any are mounted, we dismount them with the **dismount volume** command, as shown in Example 19-20.

Example 19-20 Dismounting a mounted volume

```
tsm: LOCHNESS_SERVER1>query mount
ANR8329I LTO volume 037AKK is mounted R/W in drive DR01 (mt1.0.0.2), status:
IDLE.

tsm: LOCHNESS_SERVER1>dismount volume 037AKK
ANR8499I Command accepted.

tsm: LOCHNESS_SERVER1>q actlog

02/28/2006 14:15:24 ANR8336I Verifying label of LTO volume 037AKK in drive
DR01 (mt1.0.0.2).
02/28/2006 14:16:43 ANR8468I LTO volume 037AKK dismounted from drive DR01
(mt1.0.0.2) in library 3582LIB.
```

19.3.4 Send disaster recovery media off-site

Now we can initiate a move of the DR media we have just identified to the off-site location, using **move drmedia**. By default, **move drmedia** moves full/incremental database backup volumes and copy storage pool volumes (as specified by the **set drmcopystgpool** command in step 6 on page 596). The command output in Example 19-21 shows how the REMove=Yes option automatically ejects media from the library.

Example 19-21 Moving DR media to the vault

```
tsm: LOCHNESS_SERVER1>move drmedia * wherestate=mountable tostate=vault
remove=yes
ANR0609I MOVE DRMEDIA started as process 8.
ANS8003I Process number 8 started.

tsm: LOCHNESS_SERVER1>q actlog

Date/Time          Message
-----
02/28/2006 14:29:12 ANR2017I Administrator ADMIN issued command: MOVE DRMEDIA
                      * wherestate=mountable tostate=vault remove=yes
                      (SESSION: 13)
02/28/2006 14:29:12 ANR0984I Process 8 for MOVE DRMEDIA started in the
                      BACKGROUND at 14:29:12. (SESSION: 13, PROCESS: 8)
02/28/2006 14:29:12 ANR0609I MOVE DRMEDIA started as process 8. (SESSION: 13,
                      PROCESS: 8)
02/28/2006 14:29:12 ANR0610I MOVE DRMEDIA started by ADMIN as process 8.
```

```

(SESSION: 13, PROCESS: 8)
02/28/2006 14:29:12 ANR6696I MOVE DRMEDIA: CHECKOUT LIBVOLUME for volume
032AKK in library 3582LIB starting. (SESSION: 13,
PROCESS: 8)
02/28/2006 14:29:34 ANR8322I 001: Remove LTO volume 032AKK from entry/exit
port of library 3582LIB; issue 'REPLY' along with the
request ID when ready. (SESSION: 13, PROCESS: 8)
02/28/2006 14:32:09 ANR2017I Administrator ADMIN issued command: REPLY 001
(SESSION: 27)
02/28/2006 14:32:09 ANR8499I Command accepted. (SESSION: 27)
02/28/2006 14:32:09 ANR0405I Session 27 ended for administrator ADMIN (WinNT).
(SESSION: 27)
02/28/2006 14:32:09 ANR6697I MOVE DRMEDIA: CHECKOUT LIBVOLUME for volume
032AKK in library 3582LIB completed successfully.
(SESSION: 13, PROCESS: 8)
02/28/2006 14:32:09 ANR6683I MOVE DRMEDIA: Volume 032AKK was moved from
MOUNTABLE state to VAULT. (SESSION: 13, PROCESS: 8)
02/28/2006 14:32:09 ANR6696I MOVE DRMEDIA: CHECKOUT LIBVOLUME for volume
036AKK in library 3582LIB starting. (SESSION: 13,
PROCESS: 8)
02/28/2006 14:32:31 ANR8322I 002: Remove LTO volume 036AKK from entry/exit
port of library 3582LIB; issue 'REPLY' along with the
request ID when ready. (SESSION: 13, PROCESS: 8)
...
02/28/2006 14:35:00 ANR6683I MOVE DRMEDIA: Volume 033AKK was moved from
MOUNTABLE state to VAULT. (SESSION: 13, PROCESS: 8)
02/28/2006 14:35:00 ANR6682I MOVE DRMEDIA command ended: 5 volumes processed.
(SESSION: 13, PROCESS: 8)
02/28/2006 14:35:00 ANR0611I MOVE DRMEDIA started by ADMIN as process 8 has
ended. (SESSION: 13, PROCESS: 8)
02/28/2006 14:35:00 ANR0987I Process 8 for MOVE DRMEDIA running in the
BACKGROUND processed 5 items with a completion state of
SUCCESS at 14:35:00. (SESSION: 13, PROCESS: 8)

```

Example 19-21 on page 605 shows that the **move drmedia** command with the REMove=Yes option spawns a **checkout libvolume** for each volume, requiring an individual reply for each volume. If you have a small library with only a single slot entry/exit port, like our IBM 3582, you may wish to use REMove=No and manually export the tapes from the library's front panel.

Notice also that each volume was moved from the MOUNTABLE state directly to the VAULT state, bypassing the interim states.

We can check the media status once again with **query drmedia**, as shown in Example 19-22. (Note that only three of our five volumes are displayed.)

Example 19-22 Querying DR media with format=detailed

```
tsm: LOCHNESS_SERVER1>q drmedia f=d

        Volume Name: 032AKK
                      State: Vault
        Last Update Date/Time: 02/28/2006 14:32:09
                      Location: Rocket Vault
                      Volume Type: CopyStgPool
Copy Storage Pool Name: OFFDATA
Automated LibName:

        Volume Name: 036AKK
                      State: Vault
        Last Update Date/Time: 02/28/2006 14:32:40
                      Location: Rocket Vault
                      Volume Type: CopyStgPool
Copy Storage Pool Name: OFFDIRS
Automated LibName:

        Volume Name: 037AKK
                      State: Vault
        Last Update Date/Time: 02/28/2006 14:33:23
                      Location: Rocket Vault
                      Volume Type: DBBackup
Copy Storage Pool Name:
Automated LibName:
...

```

Figure 19-3 shows the process we used to back up the storage pools and database, and send the media off-site.

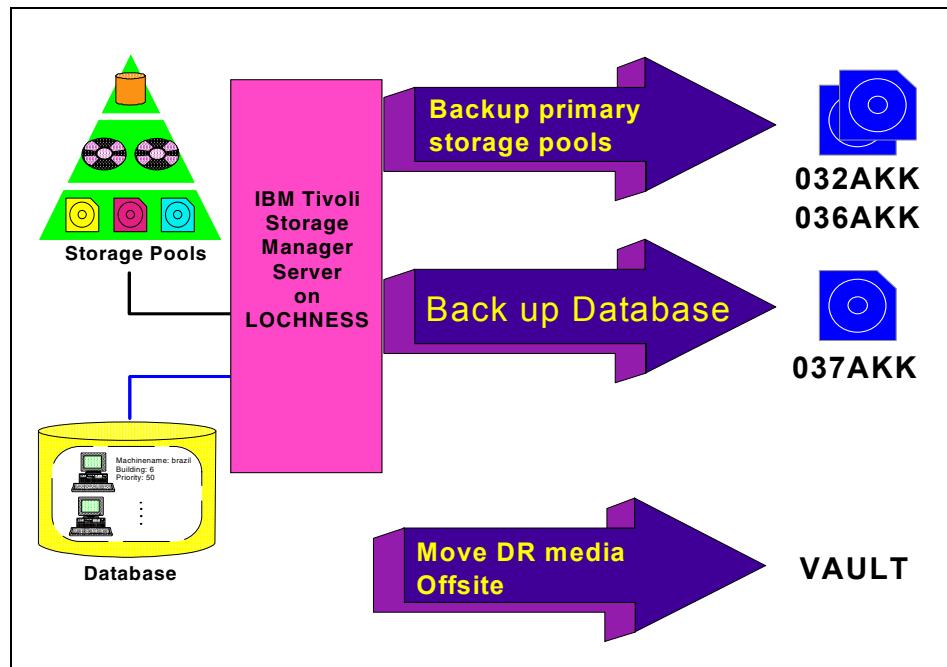


Figure 19-3 Primary pool backup and server database backup

19.3.5 Generate the recovery plan

Now we are ready to generate the disaster recovery plan, as shown in Figure 19-4.

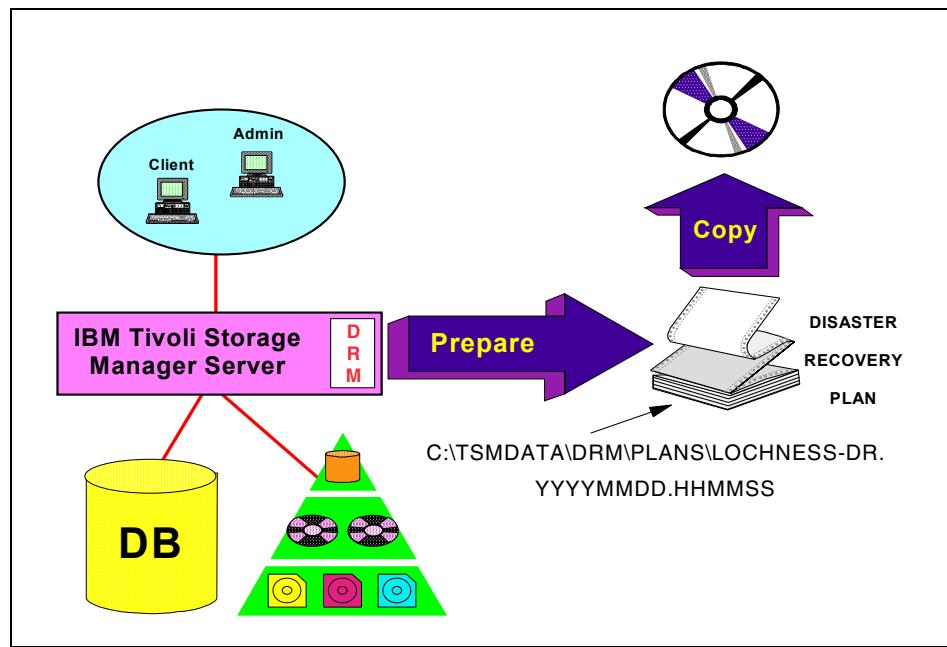


Figure 19-4 Disaster recovery plan generation

We generate the recovery plan using the **prepare** command, as shown in Example 19-23.

Example 19-23 Prepare a recovery plan

```
tsm: LOCHNESS_SERVER1>prepare  
ANS8003I Process number 9 started.  
  
tsm: LOCHNESS_SERVER1>q actlog
```

Date/Time	Message
02/28/2006 15:00:53	ANR2017I Administrator ADMIN issued command: PREPARE (SESSION: 13)
02/28/2006 15:00:53	ANR0984I Process 10 for PREPARE started in the BACKGROUND at 15:00:53. (SESSION: 13, PROCESS: 10)
02/28/2006 15:00:53	ANR9678W C:\Program Files\Tivoli\tsm\Server\dsmserv used for server executable. A server is currently running as a service. (SESSION: 13, PROCESS: 10)

```
02/28/2006 15:00:53 ANR6900I PREPARE: The recovery plan file  
C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.20060228.150053 was  
created. (SESSION: 13, PROCESS: 10)  
02/28/2006 15:00:53 ANR0985I Process 10 for PREPARE running in the BACKGROUND  
completed with completion state SUCCESS at 15:00:53.  
(SESSION: 13, PROCESS: 10)
```

The plan is now stored in a file in the local directory with a prefix, as defined in **set drmplanprefix**, as shown in step 1 on page 594. The file created is named C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.20060228.150053. As you can see from the time stamps on the activity log entries, the digits appended to the file name match the date and time the plan was created.

For safety we recommend that you create multiple copies of the recovery plan and store them in different locations. If you have more than one Tivoli Storage Manager server and are using server-to-server communication, you can create a remote copy of the plan. By specifying a DEVclass on the **prepare** command line, the local server will send the plan to the remote server specified in DEVclass. The DEVclass can only be of type SERVER.

Another way to create a remote copy is to override the default directory location by specifying an alternative (typically on a network drive) location with the PLANPrefix option on the **prepare** command line. The plans created can also be FTPed to another site and printed for emergency retrieval. Use whatever redundancy is necessary to maintain confidence that a copy of the plan will be accessible in the event of a disaster. A copy of the recovery plan should also be stored on removable media and transported to the vault location with the daily DR media.

19.3.6 Returning expired volumes

Part of your daily operations will also include moving tapes back on-site. Those that have expired can be returned to a library for use as scratch tapes. Volumes can be expired if they are EMPTY copy storage pool volumes or EXPIRED volumes from a database backup series. DRM automatically changes the state of such volumes to VAULTRetrieve. You can generate a list of DR media to be returned using the command:

```
QUERY DRMedia * WHERESTATE=vaultretrieve
```

Send this list to the vault administrators so that they can gather the tapes for return to the primary location. When you are notified that the volumes have been given to the courier, you can change the state in DRM using:

```
MOVE DRMedia * WHERESTATE=vaultretrieve
```

The media state is changed from VAULTRetrieve to COURIERRetrieve. When the courier has delivered the volumes to the primary location, change their state to ONSITERetrieve with the command:

```
MOVE DRMedia * WHERESTATE=courierretrieve
```

After changing the state to ONSITERetrieve the media no longer show when you use **query drmedia**.

Returned media can then be inserted into the library for reuse, with the **checkin 1ibvol** command. Note that you can also specify options to the **move drmedia** command for DR media in the COURIERRetrieve state to automatically generate a macro of **checkin 1ibvol** commands. Refer to the Tivoli Storage Manager Administrator's Reference for more details.

19.4 Server restore setup

If a disaster happens, you can easily use the DRM-generated plans and off-site media to restore the Tivoli Storage Manager server. Here is a summary of the process:

1. Obtain the latest disaster recovery plan.
2. Locate a suitable replacement machine.
3. Install the operating system and Tivoli Storage Manager on to the replacement machine.
4. Break the file into its various parts. You may need to update some parts before running the various macros and scripts.
5. Obtain the backup volumes from the vault.
6. Review the RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE and RECOVERY.SCRIPT.NORMAL.MODE files (created when splitting the DR plan into its parts), because they are important for restoring the server to a point where clients can be recovered.

An overview of the Tivoli Storage Manager server restore process is shown in Figure 19-5 on page 612. A number of these steps can be performed in parallel, for example, you can call your courier to obtain the off-site volumes while you are installing the replacement hardware.

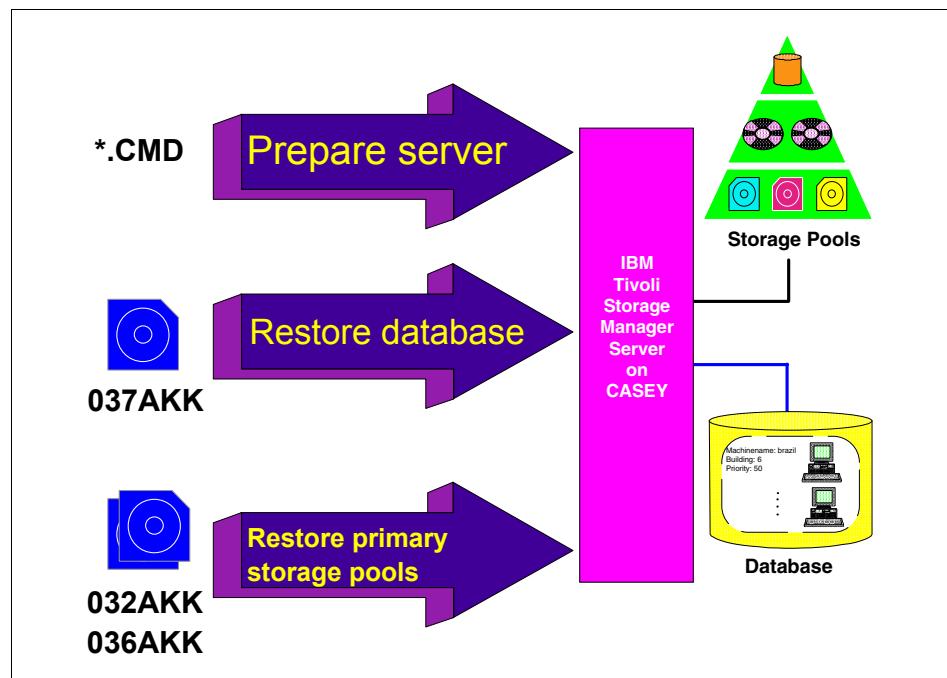


Figure 19-5 Server restoration process

19.4.1 Obtain the latest DR plan

The latest plan should be retrieved from the courier or from any other location, according to your company's policy, where it has been stored. Double-check that it is the latest version of the plan by referring to the line near the top of the file. For example, you might see this information:

Created by DRM PREPARE on 02/28/2006 15:32:16

The DR plan is created as a single file that is organized in *stanzas*.

The plan should be copied back to the *same directory* as it was stored on the original Tivoli Storage Manager server when it was created. See 19.5.2, “Review the Tivoli Storage Manager macros” on page 616, and 19.4.3, “Install the operating system and the server” on page 613.

19.4.2 Find a replacement server and storage

The RECOVERY.INSTRUCTIONS.INSTALL stanza specifies local information on hardware required. The RECOVERY.DEVICES.REQUIRED stanza specifies the device type needed to read the backups. The SERVER.REQUIREMENTS stanza specifies the disk space required.

19.4.3 Install the operating system and the server

Install the operating system and Tivoli Storage Manager server software on the replacement server. If your tape library uses a vendor-supplied driver (as opposed to the built-in TSMSCSI driver), you have to install it before starting Tivoli Storage Manager server recovery. Ensure that your operating system can communicate with the replacement library and drives.

Media names for recovery and their locations are specified in the RECOVERY.INSTRUCTIONS.INSTALL stanza and the MACHINE.RECOVERY.MEDIA.REQUIRED stanza. Ensure that the environment is the same as when the DR plan was created. The environment includes:

- ▶ The directory structure and location of the Tivoli Storage Manager server executables, enrollment certificates, administrative command-line client, and disk formatting utility.
- ▶ The directory structure for the Tivoli Storage Manager server instance-specific files and the database, log, and storage pool volumes.
- ▶ The directory structure where the server deposits DR plans. The plan will be split into its component parts in the next step.

19.5 Break out the disaster recovery plan

The DR plan is created as a single file that is organized in *stanzas*. Some of the stanzas contain macros or scripts for execution on the server to automate recovery. To obtain the macros and scripts, the plan needs to be broken out into its components.

You can either use a text editor to manually divide the recovery plan into its components, or use sample scripts shipped with Tivoli Storage Manager. For Windows, a VB Script, planexpl.vbs, is shipped. For UNIX and Linux, a sample awk script, planexpl.awk.smp, is shipped. You should keep a copy of the appropriate script off-site along with the recovery plan. We also recommend that you familiarize yourself with executing the scripts, as the plan will be large, and performing a manual breakout will be time-consuming.

If you elect to manually break the plan into its components, each stanza starts with the keyword *begin* and ends with the keyword *end*. You should create a file name with the same name as the stanza. The file should contain all lines between and including the *begin* and *end* keywords. Example 19-24 shows the contents of the SERVER.REQUIREMENTS stanza. Your file should have that name, and all of the contents shown in the example.

Example 19-24 DR plan stanza

begin SERVER.REQUIREMENTS

Database Requirements Summary:

 Available Space (MB): 2,024
 Assigned Capacity (MB): 2,024
 Pct. Utilization: 25.1
 Maximum Pct. Utilization: 25.1
 Physical Volumes: 3

Recovery Log Requirements Summary:

 Available Space (MB): 1,712
 Assigned Capacity (MB): 1,712
 Pct. Utilization: 0.0
 Maximum Pct. Utilization: 55.9
 Physical Volumes: 7

Server Installation Directory: C:\Program Files\Tivoli\tsm\

end SERVER.REQUIREMENTS

To use the sample script to break out a disaster recovery plan on Windows, use the syntax shown in Example 19-25.

Example 19-25 Break out a DR plan on Windows

C:\tsmdata\drm\plans> **cscript planexpl.vbs recoveryplanfilename**

For AIX, the syntax is shown in Example 19-26.

Example 19-26 Break out a DR plan on AIX

root@Atlantic /tsm/drm/plans: **awk -f planexpl.awk recoveryplanfilename**

For Sun Solaris, the syntax is shown in Example 19-27.

Example 19-27 Break out a DR plan on Solaris

```
root@Sol /tsm/drm/plans > nawk -f planexp1.awk recoveryplanfilename
```

Example 19-28 shows the command output from breaking out the DR plan on the replacement server. You can see that a number of files are created.

Example 19-28 Breaking out a DR plan on Windows

```
C:\tsmdata\drm\plans>cscript planexp1.vbs lochness-dr.20060228.153216
Microsoft (R) Windows Script Host Version 5.6
Copyright (C) Microsoft Corporation 1996-2001. All rights reserved.

Planfile: lochness-dr.20060228.153216
set planprefix to C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.SERVER.REQUIREMENTS
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.RECOVERY.VOLUMES.REQUIRED
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.RECOVERY.DEVICES.REQUIRED
Creating file
C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE.CMD
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.RECOVERY.SCRIPT.NORMAL.MODE.CMD
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.LOG.VOLUMES
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.DB.VOLUMES
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.LOGANDB.VOLUMES.INSTALL.CMD
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.LICENSE.REGISTRATION.MAC
Creating file
C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.COPYSTGPOOL.VOLUMES.AVAILABLE.MAC
Creating file
C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.COPYSTGPOOL.VOLUMES.DESTROYED.MAC
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.PRIMARY.VOLUMES.DESTROYED.MAC
Creating file
C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.PRIMARY.VOLUMES.REPLACEMENT.CREATE.CMD
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.PRIMARY.VOLUMES.REPLACEMENT.MAC
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.STGPOOLS.RESTORE.MAC
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.VOLUME.HISTORY.FILE
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.DEVICE.CONFIGURATION.FILE
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.DSMSERV.OPT.FILE
Creating file C:\TSMDATA\DRM\PLANS\LOCHNESS-DR.LICENSE.INFORMATION
```

If executed, the RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE batch program will delete the following log and db volumes if they exist and then reallocate them. During a normal disaster recovery scenario this is not a problem since you are going to restore data to them from the db backup.

```
C:\TSMDATA\RLP\L7373650.LOG
C:\TSMDATA\RLP\L8960750.LOG
```

```
C:\TSMDATA\RLP\LOG_01.DSM  
C:\TSMDATA\SERVER1\LOG1.DSM  
C:\TSMDATA\DBP\DBV_01.DSM  
C:\TSMDATA\SERVER1\DB1.DSM
```

19.5.1 Obtain the recovery volumes

A list of the off-site volumes required for recovery is in the stanza RECOVERY.VOLUMES.REQUIRED (and now also in the file LOCHNESS-DR.RECOVERY.VOLUMES.REQUIRED). The stanza is shown in Example 19-29. Use this list to alert the vault administrator that you need these tapes retrieved as soon as possible.

Example 19-29 Recovery volumes required

```
begin RECOVERY.VOLUMES.REQUIRED  
  
    Volumes required for data base restore  
  
        Location = Rocket Vault  
        Device Class = LT02-DC  
        Volume Name = 037AKK  
  
        Volumes required for storage pool restore  
  
        Location = Rocket Vault  
        Copy Storage Pool = OFFDATA  
        Device Class = LT02-DC  
        Volume Name = 032AKK  
  
        Copy Storage Pool = OFFDIRS  
        Device Class = LT02-DC  
        Volume Name = 036AKK  
  
    end RECOVERY.VOLUMES.REQUIRED
```

We can see that volume 037AKK is required for database restore, while 032AKK and 036AKK are required for storage pool restoration. You can confirm the currency of the volumes by looking at the volume history section of the recovery plan (VOLUME.HISTORY.FILE stanza).

19.5.2 Review the Tivoli Storage Manager macros

You should review the macros contained in the recovery plan. It is possible that the volumes you have available may not be exactly the ones that the DR plan macros are expecting. For any number of reasons, volumes may still be in

transit, or not yet picked up, and may have been destroyed in the disaster. Whatever the case, you need to examine and update the entries in the COPYSTGPOOL.VOLUMES.DESTROYED and COPYSTGPOOL.VOLUMES.AVAILABLE files, to reflect the current situation.

If all primary volumes were destroyed, no changes are required to the PRIMARY.VOLUMES.DESTROYED script and Tivoli Storage Manager macro files.

In PRIMARY.VOLUMES.REPLACEMENT.CREATE.CMD, we need to specify replacement volumes for the primary disk storage volumes. In Example 19-30 the primary storage pool volumes were originally located in C:\TSMDATA\STG\DISKDATA. The replacement volumes will be created in the same directory, with the @ character appended (as specified with **set drmplanvpostfix**). If you wish to change the location of the volumes, ensure that you create dsmfmt entries for all storage pool volumes.

Example 19-30 Contents of PRIMARY.VOLUMES.REPLACEMENT.CREATE.CMD

```
@echo off

rem Purpose: Create replacement volumes for primary storage pools that
rem   use device class DISK.
rem Recovery administrator: Edit this section for your replacement
rem   volume names. New name must be unique, i.e. different from any
rem   original or other new name.

rem Set the TSM management console directory.
pushd "C:\Program Files\Tivoli\tsm\Console"

echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM DISK 2,048.0M in DISKDATA
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM@" 2048

echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM DISK 2,048.0M in DISKDATA
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM@" 2048

echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM DISK 2,048.0M in DISKDATA
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM@" 2048

echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM DISK 2,048.0M in DISKDATA
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM@" 2048

echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM DISK 2,048.0M in DISKDATA
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM@" 2048
```

```
echo Replace C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM DISK 2,048.0M in DISKDATA  
dsmfmt -data "C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM@" 2048  
  
rem Restore the previous working directory.  
popd
```

In the file PRIMARY.VOLUMES.REPLACEMENT.MAC, we need to define replacement volumes for destroyed primary storage pool volumes, as shown in Example 19-31. Again, edit the file to suit your replacement machine.

Example 19-31 Contents of PRIMARY.VOLUMES.REPLACEMENT.MAC

```
/* Purpose: Define replacement primary storage pool volumes for either: */  
/*   1. Original volume in a storage pool whose device class was DISK. */  
/*   2. Original volume in a storage pool with MAXSCRATCH=0. */  
/*   3. Original volume in a storage pool and volume scratch=no. */  
/* Recovery administrator: Edit this section for your replacement */  
/* volume names. New name must be unique, i.e. different from any */  
/* original or other new name. */  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM@" acc=READW  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM@" acc=READW  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM@" acc=READW  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM@" acc=READW  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM@" acc=READW  
  
/* Replace C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM DISK 2,048.0M in DISKDATA */  
def vol DISKDATA "C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM@" acc=READW
```

19.5.3 Review the device configuration

Review the device configuration file to ensure that the hardware configuration at the recovery site is the same or equivalent to the original site. Any differences (for example, device special file names) must be updated in the device configuration file. Table 19-3 on page 619 shows the device configuration for the original and replacement machines. We can see that, as is commonly the case

with Windows, different SCSI addresses were assigned to the devices on the replacement server, compared to the original server.

Table 19-3 Review of the Tivoli Storage Manager device configuration

Tivoli Storage Manager server on LOCHNESS	Tivoli Storage Manager server on CASEY
IBM 3582 LTO tape library	IBM TS3310 LTO tape library
Medium changer address lb0.1.0.2	Medium changer address lb0.2.0.3
Tape drive mt0.0.0.2	Tape drive mt0.0.0.3
Tape drive mt1.0.0.2	Tape drive mt2.0.0.3

Although the IBM TS3310 is an automated library, we have to manually place the database backup volumes into the library, since there is no Tivoli Storage Manager server to check them in. We must then update the configuration information to identify the elements within the library where the volumes are located. The server is then able to locate the required database backup volumes during the recovery.

In Example 19-32 we added a line to the device configuration file, DEVICE.CONFIGURATION.FILE, with the location of tape volume 037AKK, and the actual element address 0016. Element address 16 corresponds to I/O station slot 1 in the 3310 library. For information about the element addresses for your particular devices, consult your tape library vendor documentation and the Tivoli Web site on device support:

<http://www.ibm.com/software/sysmgmt/products/support/>

We also updated the inventory to reflect the locations of the other two DR volumes, 032AKK and 036AKK (slots 17 and 18, respectively). We changed the DEFINE statements for the library and paths to reflect the actual new device special files for the library and tape drives, and changed the serial number to auto detection.

Example 19-32 Contents of DEVICE.CONFIGURATION.FILE

```
/* Device Configuration */
...
SET SERVERNAME LOCHNESS_SERVER1
SET SERVERPASSWORD 211f78779242c164e8bf552d1d4be3365a
DEFINE LIBRARY 3310LIB LIBTYPE=SCSI SHARED=NO AUTOLABEL=YES RESETDRIVE=NO
DEFINE DRIVE 3310LIB DR00 ELEMENT=257 ONLINE=Yes SERIAL=AUTODETECT
DEFINE DRIVE 3310LIB DR01 ELEMENT=256 ONLINE=Yes SERIAL=AUTODETECT
/* LIBRARYINVENTORY SCSI 3310LIB 020AKK 4096 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 021AKK 4097 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 022AKK 4117 101*/
```

```

/* LIBRARYINVENTORY SCSI 3310LIB 023AKK 4099 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 026AKK 4102 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 027AKK 4116 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 028AKK 4104 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 029AKK 4103 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 030AKK 4106 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 031AKK 4107 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 038AKK 4114 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 039AKK 4115 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 037AKK 0016 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 036AKK 0017 101*/
/* LIBRARYINVENTORY SCSI 3310LIB 032AKK 0018 101*/

DEFINE PATH LOCHNESS_SERVER1 3310LIB SRCTYPE=SERVER DESTTYPE=LIBRARY
DEVICE=1b0.2.0.3 ONLINE=YES
DEFINE PATH LOCHNESS_SERVER1 DR00 SRCTYPE=SERVER DESTTYPE=DRIVE LIBRARY=3310LIB
DEVICE=mt0.0.0.3 ONLINE=YES
DEFINE PATH LOCHNESS_SERVER1 DR01 SRCTYPE=SERVER DESTTYPE=DRIVE LIBRARY=3310LIB
DEVICE=mt2.0.0.3 ONLINE=YES

```

19.5.4 Start the restore Tivoli Storage Manager server scripts

To restore the Tivoli Storage Manager server to a point where clients can be recovered from copy storage pools, you need to invoke the script file, RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE. Enter the script file name at the command prompt and follow with administrator name and password as parameters. The script formats volumes for the database and recovery log, then restores the database using the volume in the tape library. The output is shown in Example 19-33.

Example 19-33 Invoke RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE

```
C:TSMDATA\DRM\plans>LOCHNESS-DR.RECOVERY.SCRIPT.DISASTER.RECOVERY.MODE.CMD
```

```
admin admin
```

```
    1 file(s) copied.  
    1 file(s) copied.  
    1 file(s) copied.
```

```
ANR0900I Processing options file c:\program files\tivoli\tsm\server1\  
dsmser.opt.
```

```
ANR7800I DSMSERV generated at 09:43:13 on Dec 9 2005.
```

```
Tivoli Storage Manager for Windows  
Version 5, Release 3, Level 2.2
```

```
Licensed Materials - Property of IBM
```

```
(C) Copyright IBM Corporation 1990, 2004.  
All rights reserved.
```

U.S. Government Users Restricted Rights - Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corporation.
Allocated space for C:\TSMDATA\SERVER1\DB1.DSM: 1049624576 bytes.
Allocated space for C:\TSMDATA\DBP\DBV_01.DSM: 1074790400 bytes.
Allocated space for C:\TSMDATA\DBP\DBV_01.DSM: 1074790400 bytes.
ANR0300I Recovery log format started; assigned capacity 1712 megabytes.
ANR0301I Recovery log format in progress; 4 megabytes of 1712.
ANR0301I Recovery log format in progress; 8 megabytes of 1712.
...
...
ANR0301I Recovery log format in progress; 1708 megabytes of 1712.
ANR0301I Recovery log format in progress; 1712 megabytes of 1712.
ANR0302I Recovery log formatting took 43294 milliseconds.
ANR0303I Format rate: 10121.75 pages/second.
ANR0304I Page service time: 0.09 ms.
ANR0305I Recovery log format complete.
ANR0306I Recovery log volume mount in progress.
ANR0353I Recovery log analysis pass in progress.
ANR0354I Recovery log redo pass in progress.
ANR0355I Recovery log undo pass in progress.
ANR0352I Transaction recovery complete.
ANR0992I Server installation complete.

ANR0900I Processing options file c:\program files\tivoli\tsm\server1\dsmserv.opt.
ANR7800I DSMSERV generated at 09:43:13 on Dec 9 2005.

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ANR8200I TCP/IP driver ready for connection with clients on port 1500.
ANR0200I Recovery log assigned capacity is 1712 megabytes.
ANR0201I Database assigned capacity is 2024 megabytes.
ANR4600I Processing volume history file C:\PROGRAM FILES\TIVOLI\TSM\SERVER1\VOLHIST.OUT.
ANR4620I Database backup series 2 operation 0 device class LT02-DC.
ANR4622I Volume 1: 037AKK.
ANR4634I Starting point-in-time database restore to date 02/28/2006 13:36:20.
ANR8337I LTO volume 037AKK mounted in drive DR01 (mt2.0.0.3).
ANR1363I Input volume 037AKK opened (sequence number 1).
ANR4646I Database capacity required for restore is 1024 megabytes.
ANR4649I Reducing database assigned capacity to 1024 megabytes.

```
ANR4638I Restore of backup series 2 operation 0 in progress.  
ANR4639I Restored 36888 of 129761 database pages.  
ANR4639I Restored 88876 of 129761 database pages.  
ANR4640I Restored 129761 pages from backup series 2 operation 0.  
ANR0306I Recovery log volume mount in progress.  
ANR4641I Sequential media log redo pass in progress.  
ANR4642I Sequential media log undo pass in progress.  
ANR1364I Input volume 037AKK closed.  
ANR4644I A full backup will be required for the next database backup operation.  
ANR4635I Point-in-time database restore complete, restore date 02/28/2006  
13:36:20.  
ANR8468I LTO volume 037AKK dismounted from drive DR01 (mt02.0.0.3) in library  
3310LIB.
```

Wait for the server to start. Ensure that the Administrative command line client option file is set up to communicate with this server, then press enter to continue recovery script execution.
Press any key to continue...

After pressing a key to continue, a second command window is opened and starts the Tivoli Storage Manager server, as shown in Example 19-34.

Example 19-34 Starting server after database recovery

```
ANR0900I Processing options file c:\program files\tivoli\tsm\server1\  
dsmser.opt.  
ANR7800I DSMSERV generated at 09:43:13 on Dec 9 2005.
```

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```
ANR4726I The ICC support module has been loaded.  
ANR0990I Server restart-recovery in progress.  
ANR0200I Recovery log assigned capacity is 1712 megabytes.  
ANR0201I Database assigned capacity is 1024 megabytes.  
ANR0306I Recovery log volume mount in progress.  
ANR0287W Contents of the page shadow file dbpgshdw.bdt are not valid.  
ANR0285I Database page shadowing started using file dbpgshdw.bdt.  
ANR0353I Recovery log analysis pass in progress.  
ANR0354I Recovery log redo pass in progress.  
ANR0355I Recovery log undo pass in progress.  
ANR0352I Transaction recovery complete.
```

ANR1635I The server machine GUID, 5d.6f.87.21.95.0b.11.da.82.63.00.0d.60.49.6a-.62, has initialized.

ANR2100I Activity log process has started.

ANR4726I The NAS-NDMP support module has been loaded.

ANR4726I The Centera support module has been loaded.

ANR4726I The ServerFree support module has been loaded.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM - unable to access disk device.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM - unable to access disk device.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_06.DSM - unable to access disk device.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_04.DSM - unable to access disk device.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_03.DSM - unable to access disk device.

ANR9969E Unable to open volume C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM. The most likely reason is that another TSM server is running and has the volume allocated.

ANR1311E Vary-on failed for disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_05.DSM - unable to access disk device.

ANR2803I License manager started.

ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.

ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.A

NR8260I Named Pipes driver ready for connection with clients.

ANR1305I Disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM varied online.

ANR2560I Schedule manager started.

ANR8200I TCP/IP driver ready for connection with clients on port 1500.

ANR8280I HTTP driver ready for connection with clients on port 1580.

ANR4747W The web administrative interface is no longer supported. Begin using the Integrated Solutions Console instead.

ANR8840E Unable to open device 1b0.1.0.2 with error -1.

ANR8440E Initialization failed for SCSI library 3582LIB; will retry in 2

minute(s).

```
ANR0993I Server initialization complete.  
TSM:LOCHNESS_SERVER1>  
ANR0407I Session 2 started for administrator ADMIN (WinNT)  
(Tcp/Ip PARIS(264-9)).
```

The scripts have finished successfully, the Tivoli Storage Manager database was restored, and the Tivoli Storage Manager server starts. In our case, the library and drive paths were altered in DEVICE.CONFIGURATION.FILE, which causes the ANR8840E errors. To correct the problem, we simply update the library and drive paths directly at the server prompt in the command window, as shown in Example 19-35.

Example 19-35 Updating library and drive paths

```
TSM:LOCHNESS_SERVER1>update path lochness_server1 3310lib srct=server  
destt=libr devi=lb0.2.0.3 online=yes  
ANR2017I Administrator SERVER_CONSOLE issued command: UPDATE PATH  
LOCHNESS_SERVER1 3310LIB SRCTYPE=SERVER DESTTYPE=LIBRARY DEVICE=lb0.2.0.3  
ONLINE=YES  
ANR1722I A path from LOCHNESS_SERVER1 to LB0.1.0.2 has been updated.  
  
TSM:LOCHNESS_SERVER1>update path lochness_server1 dr00 srct=server destt=drive  
1ibr=3310lib devi=mt0.0.0.3 online=yes  
ANR2017I Administrator SERVER_CONSOLE issued command: UPDATE PATH  
LOCHNESS_SERVER1 DRO0 SRCTYPE=SERVER DESTTYPE=DRIVE LIBRARY=3310LIB  
DEVICE=mt0.0.0.3 ONLINE=YES  
ANR1722I A path from LOCHNESS_SERVER1 to 3310LIB DR00 has been updated.  
  
TSM:LOCHNESS_SERVER1>update path lochness_server1 dr01 srct=server destt=drive  
1ibr=3310lib devi=mt2.0.0.3 online=yes  
ANR2017I Administrator SERVER_CONSOLE issued command: UPDATE PATH  
LOCHNESS_SERVER1 DR01 SRCTYPE=SERVER DESTTYPE=DRIVE LIBRARY=3310LIB  
DEVICE=mt2.0.0.3 ONLINE=YES  
ANR1722I A path from LOCHNESS_SERVER1 to 3310LIB DR01 has been updated.  
TSM:LOCHNESS_SERVER1>
```

Once the device configuration is set correctly, you can mount copy storage pool volumes upon request, check in the volumes in advance, or manually place the volumes in the library. You should ensure inventory consistency by issuing **audit library**.

After the library audit is complete, the Tivoli Storage Manager server is ready to provide restore services for clients using the copy storage pool volumes directly. If you plan to stay for some time on the replacement Tivoli Storage Manager machine, you should recreate the primary storage pools and their volumes to

enable backups to continue. You can restore storage pools and volumes using the script RECOVERY.SCRIPT.NORMAL.MODE.CMD.

19.5.5 Restore primary storage pools

To restore primary storage pools from copy storage pools, execute the script file, RECOVERY.SCRIPT.NORMAL.MODE. If client machines are damaged, you may want to delay this action until after all clients are recovered.

Note: This action is optional because Tivoli Storage Manager can access the copy storage pool volumes directly to restore client data. Using the copy pool volumes, you can minimize client recovery time, because server primary storage pools do not have to be restored first.

Enter the script file name at the command prompt passing the administrator name and password as arguments. The script creates replacement primary storage pool volumes, defines them to Tivoli Storage Manager, and restores them from the copy storage pool volumes. Example 19-36 shows the invocation of the script and the output from the first phase, which formats the new volumes (an example for one volume only is shown).

Example 19-36 Invoking RECOVERY.SCRIPT.NORMAL.MODE

```
C:\TSMDATA\DRM\plans>LOCHNESS-DR.RECOVERY.SCRIPT.NORMAL.MODE.CMD admin admin  
Replace C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM DISK 2,048.0M in DISKDATA  
TIVOLI STORAGE MANAGER by Tivoli
```

```
Tivoli Storage Manager (C)  
Copyright IBM Corporation 1990, 2004.  
All rights reserved.  
U.S. Government Users Restricted Rights - Use, duplication  
or disclosure restricted by GSA ADP Schedule Contract with IBM Corporation.  
Licensed Materials - Property of IBM.  
IBM Product ID 5608-ISM, 5608-ISX  
Allocated space for C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM@: 2147483648 bytes.  
...
```

The second phase is to define the volumes to the Tivoli Storage Manager server, as shown in Example 19-37 (an example for one volume only is shown).

Example 19-37 Phase 2, defining volumes to the Tivoli Storage Manager server

```
IBM Tivoli Storage Manager  
Command Line Administrative Interface - Version 5, Release 3, Level 2.0  
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.
```

```
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 03/01/2006 11:44:32 Last access: 03/01/2006 11:35:06

ANS8000I Server command: 'def vol DISKDATA
C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM@ acc=READW'
ANR2206I Volume C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM@ defined in storage pool
DISKDATA (device class DISK).

ANS8002I Highest return code was 0.

Activity log entries:
03/01/2006 11:35:16 ANR2017I Administrator ADMIN issued command: DEFINE VOLUME
  DISKDATA C:\TSMDATA\STG\DISKDATA\DDVOL_02.DSM@ acc=READW
  (SESSION: 4)
03/01/2006 11:35:16 ANR2206I Volume C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM@
  defined in storage pool DISKDATA (device class DISK).
  (SESSION: 4)
03/01/2006 11:35:16 ANR1305I Disk volume C:\TSMDATA\STG\DISKDATA\DDVOL_01.DSM@
  varied online. (SESSION: 4)
```

The third phase is to restore each storage pool, as shown in Example 19-38. The example shows DISKDATA being restored.

Example 19-38 Phase 3, restoring primary storage pools

IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.0
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

```
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 03/01/2006 11:44:32 Last access: 03/01/2006 11:35:06
```

```
ANS8000I Server command: 'restore stgp DISKDATA'
```

Activity log entries:

```
03/01/2006 11:35:23 ANR2017I Administrator ADMIN issued command: RESTORE
  STGPOOL DISKDATA
03/01/2006 11:35:23 ANR0984I Process 9 for RESTORE STORAGE POOL started in the
  BACKGROUND at 11:35:23.
03/01/2006 11:35:23 ANR1230I Restore of primary storage pool DISKDATA
  started as process 9.
03/01/2006 11:35:23 ANR2110I RESTORE STGPOOL started as process 9.
03/01/2006 11:44:32 ANR0986I Process 9 for RESTORE STORAGE POOL running in the
  BACKGROUND processed 5427 items for a total of
  376,963,072 bytes with a completion state of SUCCESS at
  11:44:32.
```

03/01/2006 11:44:32 ANR1238I Restore of primary storage pool DISKDATA has ended. Files Restored: 5427, Bytes Restored: 376963072, Unreadable Files: 0, Unreadable Bytes: 0.

Alternatively, you can use the recovery script as a guide and manually run each step.

If you wish to view the output of the commands run during the server restoration process, the results are logged in the following files:

- ▶ LOGANDB.VOLUMES.INSTALL.LOG
- ▶ LICENSE.REGISTRATION.LOG
- ▶ COPYSTGPOOL.VOLUMES.AVAILABLE.LOG
- ▶ PRIMARY.VOLUMES.DESTROYED.LOG
- ▶ COPYSTGPOOL.VOLUMES.DESTROYED.LOG
- ▶ PRIMARY.VOLUMES.REPLACEMENT.CREATE.LOG
- ▶ PRIMARY.VOLUMES.REPLACEMENT.LOG
- ▶ STGPOOLS.RESTORE.LOG

19.5.6 Summary of example disaster recovery plan

Using Tivoli Storage Manager Disaster Recovery Manager, we were able to quickly restore our Tivoli Storage Manager server named LOCHNESS_Server1 on a replacement set of hardware. The off-site backup of the Tivoli Storage Manager database and the copy storage pool volumes provided the necessary data.

Once your replacement server is up and running, you should use DRM procedures to return the retrieved vault recovery volumes so they are available in the event of another disaster. You can now resume normal backup and disaster protection operations.

19.6 Summary

As we mentioned on the first page of this chapter, our example and the associated explanations are not sufficient to supply the reader with enough understanding of disaster recovery to properly design and implement a solution. There are some excellent books on disaster recovery available. However, the IBM Redbook *Disaster Recovery Strategies with Tivoli Storage Management*, SG24-6844, is certainly one of the “must read” choices.

Implementing the Disaster Recovery Manager without a full understanding of the product, and a business commitment to its ongoing care and feeding, may lead to misconfiguration or undesirable results at a point when it is most needed.

Our next topic, Bare Machine Recovery, is similar, and we will discuss AIX and Windows system recovery.



Bare Machine Recovery

In this chapter we describe Bare Machine Recovery (BMR) setup and processes for Windows and AIX systems. IBM Tivoli Storage Manager is designed to back up and recover application data.

Recovering the operating system environment is not this product's goal. That said, as vendor technology improves from an operating system disaster recovery perspective, there are new features within the IBM Tivoli Storage Manager to leverage these enhancements.

20.1 Windows Bare Machine Recovery

Tivoli Storage Manager provides integration with documented Windows APIs for the backup of system objects/system state. This allows for a complete Bare Machine Recovery in combination with the boot/system partition and other data partitions.

However, to restore your system, you need to have previously gathered and saved certain machine-specific characteristics, such as network and disk partition information. Therefore, we discuss the methods for collecting this information using operating system utilities and storing this information within DRM. We then provide detailed instructions for recovery of Windows 2000 client, step-by-step, in conjunction with Tivoli Storage Manager.

Again, you should read *Deploying the Tivoli Storage Manager Client in a Windows 2000 Environment*, SG24-6141, for a comprehensive review of Windows 2000 and Bare Machine Recovery. It discusses additional considerations for restoring an Active Directory, Domain Controllers, and DFS.

20.1.1 Collect client machine information for disaster recovery

Collecting and recording information about your client systems will greatly help your ability to restore a Windows machine after a disaster to a pre-disaster state. There are several add-on tools, utilities, and features built into Windows that can assist you with information collection, including `msinfo32`, `srvinf0` (found in the Windows Resource Kit), `diskmap`, the Disk Management interface, `ipconfig`, or writing your own Windows Management Instrumentation (WMI) application (see the Windows 2000 SDK for more information about WMI). The information that should be collected for the client system should include:

- ▶ Hard drive partition information, for example, number and type of partitions, disk size, drive letters, amount of data used per volume, boot partition, and system directory
- ▶ System host name
- ▶ TCP/IP networking information, for example, IP address, subnet mask, default gateway, DNS information
- ▶ Windows Service Pack levels

Scripts or batch files can be used to automate the collection of client information for users not skilled in these kinds of system-level commands. Client system information should then be stored off-site for potential use during a disaster recovery procedure. Client system information can be imported into DRM (via scripts discussed in 20.1.3, “Store system information for DRM access” on page 633) or DRM administrators can be given access to system information

collected into a text file and backed up by the Tivoli Storage Manager backup-archive client.

The msinfo32 command

The **msinfo32** command is a feature of Windows that enables you to collect detailed system hardware and configuration data that can be used for problem determination. This same information can be useful for disaster recovery purposes since it documents the original system's configuration. Just storing **msinfo32** information does not prepare you for disaster recovery; you still need a predetermined and rehearsed strategy. However, having this information can be one more weapon in your disaster recovery arsenal.

The **msinfo32** command has both a GUI and a command-line interface. In this section we focus on the command-line interface, since it can be scheduled for periodic execution using mechanisms like the Tivoli Storage Manager Backup-Archive Client scheduler, scripts, or batch files. Generally, **msinfo32** will provide most of the required information listed above and is installed by default with Windows. It can be run by entering this at the command-line:

```
C:\Program Files\Common Files\Microsoft Shared\MSInfo\msinfo32.exe
```

You can use **msinfo32** to display configuration information interactively via the GUI interface, or generate a text file report via GUI or command-line batch invocation. The text file is organized in *categories* and *subcategories* stanzas, which are delimited with [category] and [subcategory] headings. There are many categories and subcategories of information in the report including Hardware Resources, IRQs, Memory, Drivers, and Environment Variables.

To run **msinfo32** and collect it in a report, execute the commands shown in Example 20-1.

Example 20-1 How to run msinfo32

```
cd \Program Files\Common Files\Microsoft Shared\MSInfo
```

```
<prompt>msinfo32 /report msinfo32.txt /categories +all
```

A portion of the output for our BMR client machine is shown in Example 20-2. Notice the first [System Information] stanza.

Example 20-2 Example of msinfo32 report output

```
System Information report written at: 02/24/06 10:49:27
System Name: TRIPLEEIGHT
[System Summary]
```

```
ItemValue
```

```
OS NameMicrosoft Windows XP Professional
Version5.1.2600 Service Pack 2 Build 2600
OS ManufacturerMicrosoft Corporation
System NameTRIPLEEIGHT
System ManufacturerIBM
System Model12373TG5
System TypeX86-based PC
Processorx86 Family 6 Model 9 Stepping 5 GenuineIntel ~1694 Mhz
BIOS Version/DateIBM 1RETDNWW (3.19 ), 13.10.2005
SMBIOS Version2.33
Windows DirectoryC:\WINDOWS
System DirectoryC:\WINDOWS\system32
Boot Device\Device\HarddiskVolume1
LocaleGermany
Hardware Abstraction LayerVersion = "5.1.2600.2180 (xpsp_sp2_rtm.040803-2158)"
User NameTRIPLEEIGHT\npott
Time ZonePacific Standard Time
Total Physical Memory1.024,00 MB
Available Physical Memory217,85 MB
Total Virtual Memory2,00 GB
Available Virtual Memory1,95 GB
Page File Space2,40 GB
Page FileC:\pagefile.sys
```

[Hardware Resources]

You probably should save the whole report, but if there are sections you are sure would not be useful you may want to delete them. If you type `msinfo32 /?` you can see various invocation options. If the `/categories` option did not seem to have the granularity you desired, a script can be used to extract selected information.

Note: Running `msinfo32` and generating a report may take some time. In our case it took about a half minute to generate the report.

On our test client system, we created a batch file to automatically save system information to a text file and then back it up to the Tivoli Storage Manager server. We created an icon on our desktop with a link to this batch file, which can be used to back up system information once changes have been made to the system. The sample batch file is shown in Example 20-3.

Example 20-3 Batch file for saving machine information

```
@echo off
echo.
echo SAVING MACHINE INFORMATION FOR DISASTER RECOVERY
echo.
```

```
c:\Program Files\Tivoli\TSM\config>msinfo32 /report  
c:\Program Files\Tivoli\TSM\config>msinfo32.txt /categories +all  
cd c:\Program Files\Tivoli\TSM\bclient  
dsmc sel c:\Program Files\Tivoli\TSM\config\msinfo32.txt  
pause  
exit
```

20.1.2 Collect partition and logical volume information with diskmap

The diskmap utility is a command-line disk mapping tool that allows users to view the partition and logical volume structures of the disks. It displays a map of the disk and produces a report about the disk's configuration. It provides information about the disk characteristics and a description of each partition and logical volume on the disk.

An example of using diskmap and the output from our main system volume is given in Example 20-4.

Example 20-4 Example diskmap output

```
C:\Program Files\Resource Kit>diskmap /d0  
Cylinders HeadsPerCylinder SectorsPerHead BytesPerSector MediaType  
    7752           240          63        512      12  
TrackSize = 32256, CylinderSize = 7741440, DiskSize = 60011642880 (57231MB)  
  
Signature = 0x64656469  
StartingOffset PartitionLength StartingSector PartitionNumber  
*            32256       60011610624             63              1  
  
MBR:  
Starting          Ending          System  Relative Total  
Cylinder Head Sector Cylinder Head Sector ID   Sector Sectors  
*      0   1   1      1023   239   63  0x07     63 117210177  
      0   0   0      0     0   0  0x00     0   0  
      0   0   0      0     0   0  0x00     0   0  
      0   0   0      0     0   0  0x00     0   0
```

20.1.3 Store system information for DRM access

You can store the msinfo32 information with regular Tivoli Storage Manager client backups of your application and systems data. Using this method the msinfo32 report file is picked up by the normal Tivoli Storage Manager backup-archive client incremental backup processing.

You can save the msinfo32 report file in any directory that is not excluded by the Tivoli Storage Manager backup-archive client. We recommend using a standard location where members of the organization will know to look.

Once there is a backup copy of the msinfo32 report for this machine in the Tivoli Storage Manager server, you probably want to allow other users, such as the members of your disaster recovery team, to access it. This assumes that they have Tivoli Storage Manager backup-archive client node IDs registered for them. In Example 20-5, the Tivoli Storage Manager backup-archive client command line (the GUI can also be used) is used to permit a Tivoli Storage Manager Client Node ID called DRTEAM to access the msinfo32.txt file backed up from the directory c:\program files\common files\microsoft shared\msinfo.

Example 20-5 Setting client system information report access

```
dsmc set acc backup "c:\program files\Tivoli\TSM\config\msinfo32.txt" DRTEAM
```

Assuming you have authorized it, a Tivoli Storage Manager backup-archive client user on another node could restore your msinfo32 report to a temporary directory on their machine so that it can be referred to an alternative location while the destroyed machine is rebuilt.

20.1.4 Insert client machine information into DRM

Client machine information can be inserted in DRM for potential use later during disaster recovery. The Tivoli Storage Manager INSERT MACHINE command allows an administrator to store machine characteristics and recovery instructions in DRM. Using this method the data can easily be queried and updated by an administrator, without requiring access to storage pool volumes, and the information can potentially be a part of a Tivoli Disaster Recovery Manager PREPARE recovery plan file.

We outline below how machine information can be inserted into DRM. We assume that the client machine is already defined as a DRM client machine (using the DEFINE MACHINE command). You can use the administrative

command line or the Administration Center to insert the client's machine information into DRM. Figure 20-1 shows how to use the Administration Center to insert client machine information.

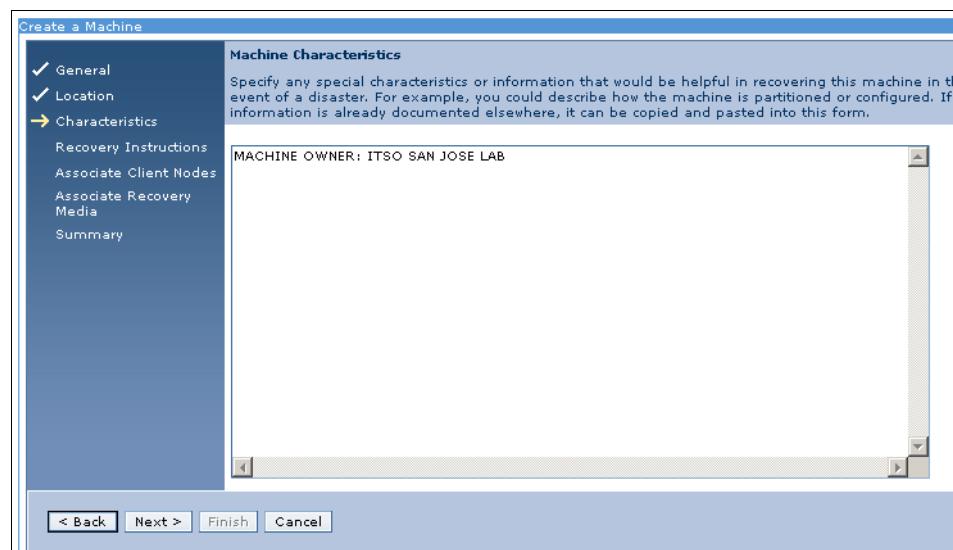


Figure 20-1 Insert machine characteristics using Admin Center

Alternatively, you can insert machine information using the command line, as shown in Example 20-6.

Example 20-6 Using the command line to insert machine information

```
insert machine tripleeight 1 char="MACHINE OWNER: ITSO SAN JOSE LAB"
```

20.1.5 Use machchar.vbs to insert machine reports into DRM

Since the INSERT MACHINE command allows for adding one line of information at a time, we can use a script or macro to easily add many lines of information at a time in DRM. Scripts are provided with Tivoli Storage Manager and can be found in the directory C:\Program Files\tivoli\tsm\server.

A script called machchar.vbs takes a text file and creates a Tivoli Storage Manager macro file of INSERT MACHINE commands. This macro can then be run by the Tivoli Storage Manager administrator to load a DRM MACHINE table with the information. Example 20-7 uses the machchar.vbs script and the

machine information report (msinfo32.txt) to create a macro (msinfo32.mac) that inserts multiple lines of client information automatically. A VBScript is run from the Windows command line, as shown in Example 20-7.

Example 20-7 Running machchar.vbs to start machine information collection

```
C:\Program Files\Tivoli\TSM\server>cscript machchar.vbs  
Microsoft (R) Windows Script Host Version 5.6  
Copyright (C) Microsoft Corporation 1996-2001. All rights reserved.
```

```
usage: cscript machchar.vbs machinename inputmachinenamefile  
outputmacrofilename
```

```
example: cscript machchar.vbs mch1 c:\client1\clientinfo.txt  
c:\client1\clientin  
fo.mac
```

```
C:\Program Files\Tivoli\TSM\server>cscript machchar.vbs tripleeight  
"c:\progra~1\tivoli\tsm\config\msinfo32.txt"  
"c:\progra~1\tivoli\tsm\config\msinfo32.mac"  
Microsoft (R) Windows Script Host Version 5.6  
Copyright (C) Microsoft Corporation 1996-2001. All rights reserved.
```

```
Creating TSM macro file: c:\progra~1\tivoli\tsm\config\msinfo32.mac
```

Now, from the administrative CLI, run this command (Example 20-8).

Example 20-8 Running the macro to insert machine date into DRM

```
macro "c:\Program Files\Common Files\Microsoft Shared\MSInfo\msinfo32bat.mac"
```

To view machine characteristics added to DRM, use the QUERY MACHINE command, as shown in Example 20-9.

Example 20-9 Querying DRM for client machine information

```
query machine tripleeight f=d
```

Machine information stored by DRM can also be included in the DRM plan file. This is the detailed disaster recovery file that is generated by the DRM PREPARE command. In order to include a machine's system information or

recovery instruction in the DRM plan file the defined system must be marked as adsmserver=yes on the UPDATE MACHINE command. Example 20-10 shows the command line to add our server to the DRM plan file.

Example 20-10 Incorporating machine information in the DRM plan file

```
update machine tripleeight adsmserver=yes
```

The recovery plan file is arranged in stanzas. After running the PREPARE commands, we would see the following stanzas in the recovery plan file related to our system, TRIPLEEIGHT, as shown in Example 20-11. Provided the plan file has been appropriately protected, this information will be available after a disaster so that it can be used to recover the client system.

Example 20-11 Machine information seen in DRM plan file

begin MACHINE.CHARACTERISTICS

Purpose: Hardware and software characteristics of machine TRIPLEEIGHT.

begin MACHINE.CHARACTERISTICS

Purpose: Hardware and software characteristics of machine TRIPLEEIGHT.

System Information report written at: 02/24/06 11:45:03

System Name: TRIPLEEIGHT

[System Summary]

ItemValue

OS NameMicrosoft Windows XP Professional

Version5.1.2600 Service Pack 2 Build 2600

OS ManufacturerMicrosoft Corporation

System Name TRIPLE EIGHT

System Manufacturer IBM

System Model 12373TG5

System Headers

System Type 86-based PC

ProcessorFamily 6 Model 9 Stepping 3 GenuineIntel 1094 MHz
BIOS Version/Date IBM_1RFTDNWW (3.19) 13.10.2005

BIOS Version/Dateline: IRETDNWW (3.19), 15.10.2005
SMBIOS Version: 2.33

SMB103 Version 2.33

Windows Directory C:\WINDOWS
System Registry C:\WINDOWS\

System Directory: \WINDOWS\system32
Boot Device\Device\Harddisk\Volume1

Boot Device\Device\HarddiskVolume1

LocaleGermany
NameAnd

Hardware Abstraction LayerVersion = "5.1.2600.2180 (xpsp_sp2_rtm.040803-2158)"
Hardware Abstraction LayerTRIPLE_FAULT

User Name|TRIPLEEIGHT\hpott
Title|Executive Director

Time Zone Pacific Standard Time

Total Physical Memory1.024,00 MB
Available Physical Memory181,29 MB
Total Virtual Memory2,00 GB
Available Virtual Memory1,91 GB
Page File Space2,40 GB
Page FileC:\pagefile.sys

[Hardware Resources]
end MACHINE.CHARACTERISTICS

20.1.6 Windows systems additional information

In the previous sections we described how to identify and back up important system configuration information on Windows platforms to prepare for the case of a disaster recovery. The complete procedure documentation, from backup preparation to the restore itself, is beyond the scope of this book. In addition, there are different ways to approach this: for example, you can plan to use the ASR recovery procedure; the Windows Preinstallation Environment recovery; or use complementary products, for example, Cristie Bare Machine Recovery.

The following are relevant resources with regards to disaster recovery and Bare Machine Recovery strategies within a Windows environment:

- The basic concepts are explained in *IBM Tivoli Storage Management Concepts*, SG24-4877:
<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg244877.html>
?Open
 - *Deploying the Tivoli Storage Manager Client in a Windows 2000 Environment*, SG24-6141:
<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246141.html>?Open
 - *Disaster Recovery Strategies with Tivoli Storage Management*, SG24-6844:
<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg246844.html>?Open
 - *Summary BMR Procedures for Windows NT and Windows 2000 with ITSM*, TIPS0102:
<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/tips0102.html>
?Open
 - *Using Microsoft Windows Automated System Recovery (ASR) to Recover Windows XP and Windows 2003 Systems with the IBM Tivoli Storage Manager Backup-Archive Client for Windows*:
<http://www.ibm.com/support/entdocview.wss?uid=swg27003812>

- ▶ *Tivoli Storage Manager Recovery Techniques Using Windows Preinstallation Environment (Windows PE):*
<http://www.ibm.com/support/entdocview.wss?uid=swg27003812>
- ▶ Modified Instructions for Complete Restores of Windows Systems: Bare Metal Restore (BMR), System State Restore, Windows System Object Restore:
<http://www.ibm.com/support/entdocview.wss?uid=swg21164812>

20.2 Using SysBack for Bare Machine Recovery

In this section we explain how to use IBM Tivoli Storage Manager for System Backup and Recovery (also known as SysBack) for AIX. SysBack is a comprehensive system backup, restore, and reinstallation tool for AIX. It is simple to use and highly effective in partitioned or non-partitioned environments, as well as in a cluster environment composed of multiple pSeries systems.

We discuss the following concepts:

- ▶ An introduction to SysBack
- ▶ Partition backup and reinstallation (system recovery)
- ▶ Cloning backup images between partitions or stand-alone systems
- ▶ SysBack Bare Machine Recovery with Tivoli Storage Manager environments
- ▶ Additional information regarding SysBack

SysBack has many features that give you the flexibility to administer partitioning-capable pSeries servers in a partitioned environment. This section covers several of the most beneficial features:

- ▶ Remote backup, restore, and installation capabilities

SysBack provides the ability to back up a system or partition to any other system or partition in the network running AIX. This feature enables you to have one or more partitions act as backup servers. With remote backup and restore capabilities, you no longer have to be concerned with having a backup device assigned to any given partition.

In addition to remote backup and restore capabilities, SysBack enables you to install your backup images over the network. This functionality is facilitated by the network boot feature. SysBack can provide its own network boot resources or a wrapper around an existing NIM configuration.

In contrast, mksysb can run remotely, but only to disk. Backups to a tape, CD, or DVD require a locally attached device. In order to perform a network install of a mksysb, you must also configure and use a NIM environment.

- ▶ Multiple supported media formats

SysBack can back up to, restore from, or install from all of the following media formats either locally or remotely across the network:

- Tape

SysBack's generic approach to tape control allows it to work with virtually any tape device, IBM or OEM, on the market.

- File on disk

SysBack allows you to back up your system to the file system or directory of your choice. When using a single system or partition to act as a backup server to other systems or partitions, you can configure the product to separate your backups by host name.

- Recordable CD or DVD devices

SysBack supports any recordable CD or DVD devices to which AIX can write a mksysb image.

Note: See /usr/lpp/bos.sysmgt/README.oem_cdwriters for the tested CD/DVD recordable devices.

- ▶ Backup and recovery of non-rootvg volume groups

SysBack will not only back up your rootvg volume group, but will also optionally back up your non-rootvg volume groups. This backup may be done as a part of your full system backup, all in a single backup process, or it may be backed up separately. You can choose to restore, or not restore, this non-rootvg data during an install from a SysBack backup.

In contrast to mksysb, any non-rootvg data that you would like to be backed up requires a separate backup and cannot be restored as a part of the mksysb install process.

- ▶ Raw logical volume support

SysBack backs up raw logical volumes by default. You can also optionally exclude them from backups.

In contrast, mksysb does not back up raw logical volumes.

- ▶ Optional coexistence with Network Install Manager (NIM)

If you are a current NIM user, SysBack can utilize your exiting NIM environment for the network boot capabilities.

- ▶ Special boot utilities

These are for partitions functioning as SP nodes or IBM @server Cluster 1600 systems. For customers whose partitions function as a part of an SP

complex or an IBM @server Cluster 1600, SysBack has specific boot and install utilities to interact with Parallel System Support Program (PSSP).

- ▶ Quick, easy setup and use

SysBack is SMIT menu driven and also enables complete command-line interaction. The most basic, initial configuration to perform a system backup takes a matter of moments. Other features can be configured as desired and are also quickly enabled.

20.2.1 An introduction to SysBack

For those who are not already SysBack users, this section briefly highlights the features of the product.

Backup options

SysBack provides five levels of backup granularity. In order of the most system comprehensive to the least, they are as follows:

- ▶ Full system (installation image)

This is the only backup type that can be used to completely reinstall a system or partition. It is similar in function to mksysb, but also includes raw logical volumes, and optionally, non-rootvg data. In addition, any subset of this backup can be individually recreated or restored. For example, an individual volume group, individual file systems or logical volumes, or specific files or directories can be recovered from this backup type.

This is also the only type of backup that can be sent to CD or DVD in addition to a tape or a file on disk.

- ▶ Volume group

This backup type backs up any active volume group on the system or partition. From this backup, you can recreate the LVM structure of a volume group and all of its file systems and logical volumes, as well as restore the data within them. Although this backup type allows you to back up the root volume group, we do not recommend that you do so, because you would not be able to reinstall a system or partition from a volume group backup of rootvg. Also, many of the LVM structures cannot be recreated on a running system or partition.

- ▶ File system

This backup type backs up specified file systems. From this backup type, you can recreate the LVM structure of the file system and restore its data.

- ▶ Logical volume

This backup type backs up specified raw logical volumes. From this backup type, you can recreate the LVM structure of the logical volume or restore its data, or both. Although it is possible to do so, we highly recommend that you do not use this backup option for logical volumes that have mount points.

- ▶ File and directory

This backup type backs up specified files and directories.

Incremental backups

All of the previously described backup types, except the full system (installation image) backup, can also be performed as standard UNIX type incremental backups (for example, levels 0–9).

Pull backups (also known as central managed backups)

The standard SysBack backup is considered a push backup, because the data is pushed from the client to the server. All backup types can also be pulled from the client by a server.

Note: The references to server and client refer specifically to the SysBack definitions only. A SysBack server may or may not be any other type of application server, file server, NFS server, and so on in your environment. In addition, the same machine or partition can be both a SysBack server and client.

Pulling the backups from clients enables you to use a single machine or partition to act as a central backup server. You can script, schedule, and thereby automate all backups for an entire environment from a single location.

There are 2-way and 3-way pull backups. A 2-way pull backup is when the same machine or partition initiates the client backup and stores the backup to media. Figure 20-2 illustrates the flow of a 2-way pull backup.

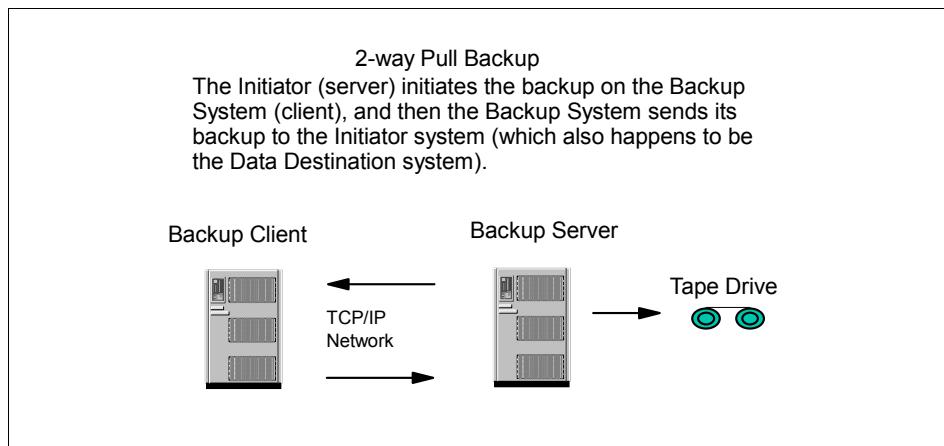


Figure 20-2 Two-way pull backup

A 3-way pull backup is when one machine or partition initiates the client backup, another machine or partition stores the backup data, and a third machine is the backup client. Figure 20-3 illustrates the flow of a 3-way pull backup.

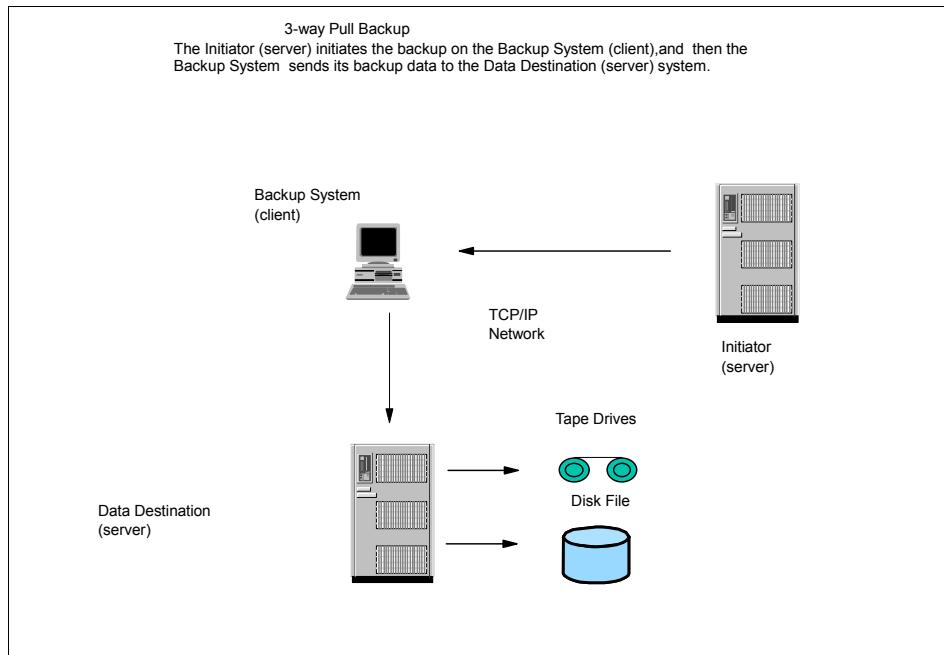


Figure 20-3 Three-way pull backup

Offline Mirror Backup function

SysBack provides a function to split AIX mirrors and back up the inactive copies. This enables database users to have minimal downtime, because it is only required to halt the database while the mirrors are being split. After the backup completes, SysBack automatically resynchronizes the stale partitions while the database is active.

Figure 20-4 depicts the relationship between mirrored copies after the Offline Mirror Backup feature splits them.

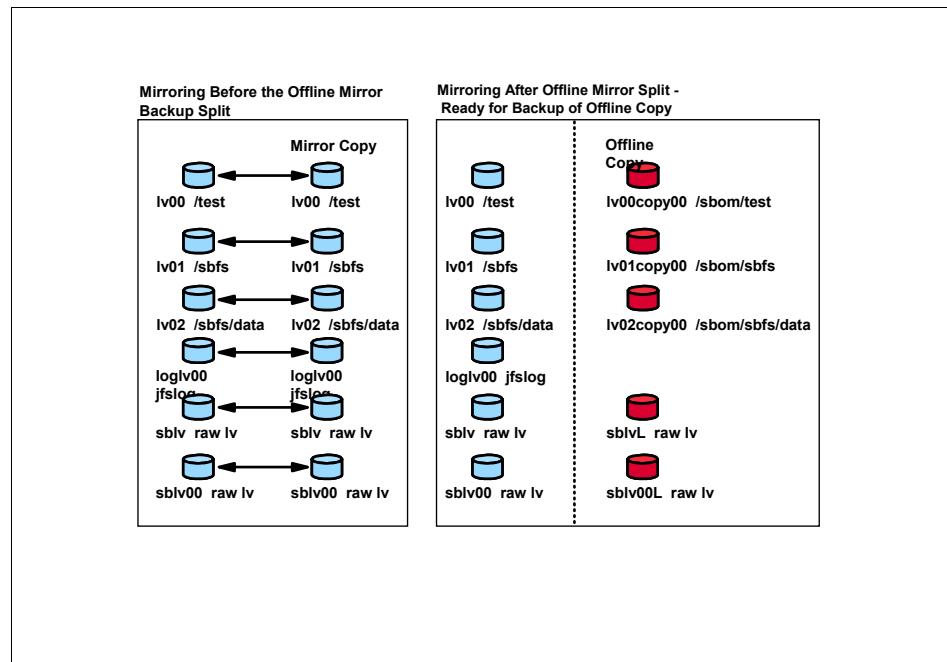


Figure 20-4 Mirrors split by the Offline Mirror Backup feature

Stacking backup images

SysBack provides the ability to stack multiple backups on a single tape. Figure 20-5 shows the image sequence on tape for a stack full system (installation image) backup.

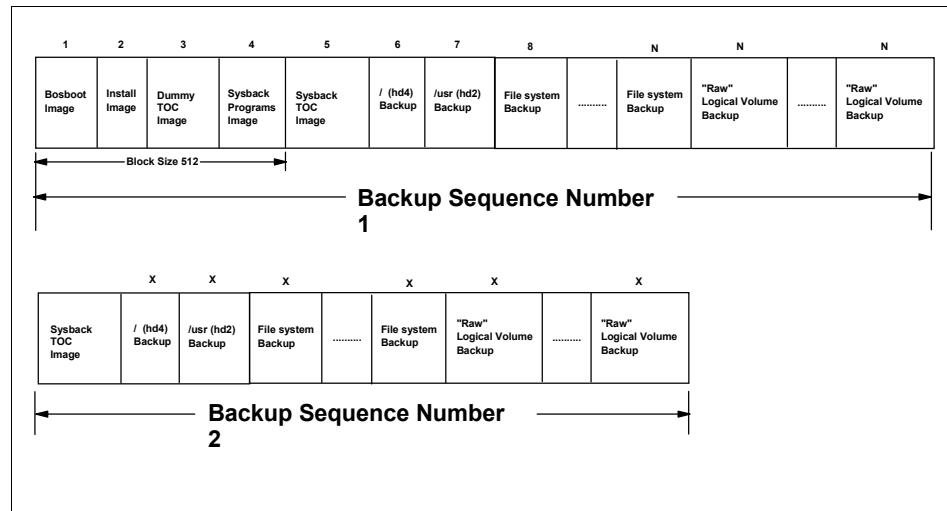


Figure 20-5 Stacked full system (installation image) backup tape layout

Recreating LVM structures and restoring data

SysBack provides the ability to do the following operations:

- ▶ Restore data only.
- ▶ Recreate LVM structures only.
- ▶ Recreate LVM structures and restore data all in the same process.

You can restore and recreate either an entire backup image, or any subset of data on a backup. For example, considering a volume group backup, you can:

- ▶ Restore the entire volume group and data.
- ▶ Recreate only the volume group LVM structures.
- ▶ Restore one or more individual file systems.
- ▶ Recreate only the LVM structure of one or more file systems.
- ▶ Restore one or more individual logical volumes.
- ▶ Recreate only the LVM structure of one or more logical volumes.
- ▶ Restore individual files or directories.

20.2.2 System installation options

SysBack provides the following installation options from a full system (installation image) backup:

- ▶ Full system installation

This process reinstalls the system by recreating the rootvg volume group and, optionally, any non-rootvg volume groups.

- ▶ Recovery installation

This process restores the system on the / (root) and /usr file systems after booting into maintenance mode. It is most useful in situations where you need to back out software installations or changes without impacting your other rootvg file systems.

Both of these installation types can be either prompted or unprompted:

- ▶ Prompted

This is the default SysBack installation method. The system or partition is booted from SysBack media to the SysBack Installation and Maintenance Main Menu. You can then change or customize any installation option before initiating the installation process.

- ▶ Unprompted

By pre-configuring certain tasks required for an installation, such as defining the console and terminal type, you can initiate an installation that requires no human intervention. In this situation, you will not be prompted to complete any customization through the SysBack Installation and Maintenance Main Menu.

Customizing an installation

During a prompted installation, all of the following tasks can be customized through the SysBack Installation and Maintenance Main Menu options:

- ▶ Change between the 32-bit and 64-bit kernels.
- ▶ Change between JFS and JFS2.
- ▶ Turn mirroring on or off and set the number of copies.
- ▶ Specify to recreate, ignore, or delete non-rootvg volume groups on the backup.
- ▶ Specify whether to restore files as non-sparse.
- ▶ Change any volume group attributes.
- ▶ Designate a disk as a hot spare.
- ▶ Change file system attributes or specify a file system to be ignored on restore.

- ▶ Change logical volume attributes or specify a logical volume to be ignored on restore.

These customization options can also be preconfigured and passed to an unprompted installation by creating a customized volume group information file.

20.2.3 Network boot

SysBack provides network boot capabilities to facilitate the installation of a machine or partition that does not have a locally attached bootable removable media device, such as a tape or CD/DVD device.

After a machine or partition has been successfully network booted, you can reinstall the system through a supported media device located on another machine or partition.

SysBack provides the ability to boot a machine or partition from another system of the same, or different, architecture. For example, a Common Hardware Reference Platform (CHRP) system can boot from an RSPC system. However, it should be noted that there are additional configuration tasks required for cross-architecture booting.

Note: AIX 5L Version 5.2 no longer supports the MCA or RSPC architectures.

There are two types of SysBack network boots:

- ▶ Classic network boot
- ▶ NIM resource network boot

The classic network boot method relies on the / (root) and the /usr file systems of the boot server for creating the network boot image. The boot server also fulfills other processing requirements for the client during the boot and installation process. Figure 20-6 illustrates the relationships between systems or partitions using the classic network boot method.

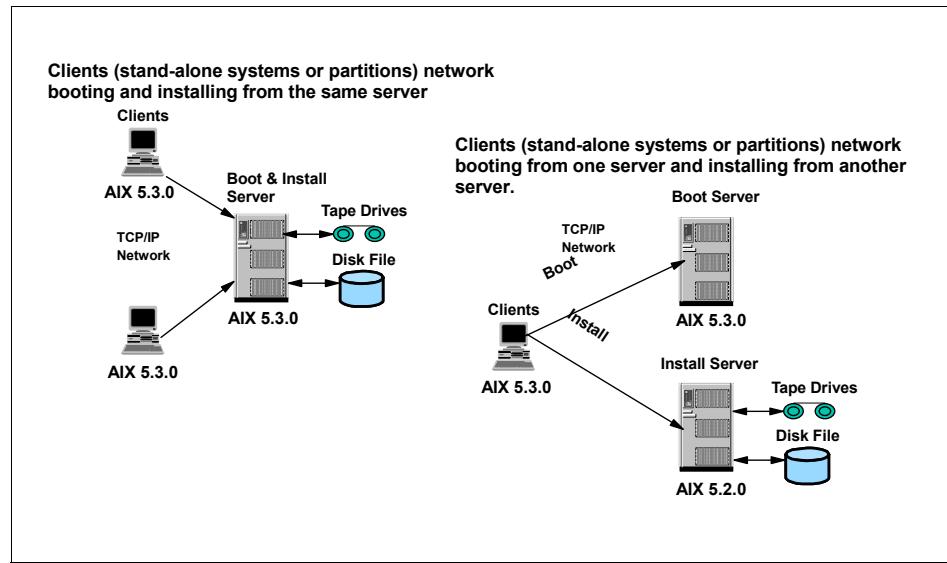


Figure 20-6 Classic network boot relationships

The NIM resource network boot method provides a mechanism for you to use existing NIM SPOT and lppsource resources in combination with SysBack boot and installation operations. The NIM resource network boot method relies on an existing NIM SPOT to create the network boot image and an existing NIM lppsource to provide the device support that the client may need to configure attached hardware.

Figure 20-7 illustrates the relationships between systems or partitions using the NIM resource network boot method.

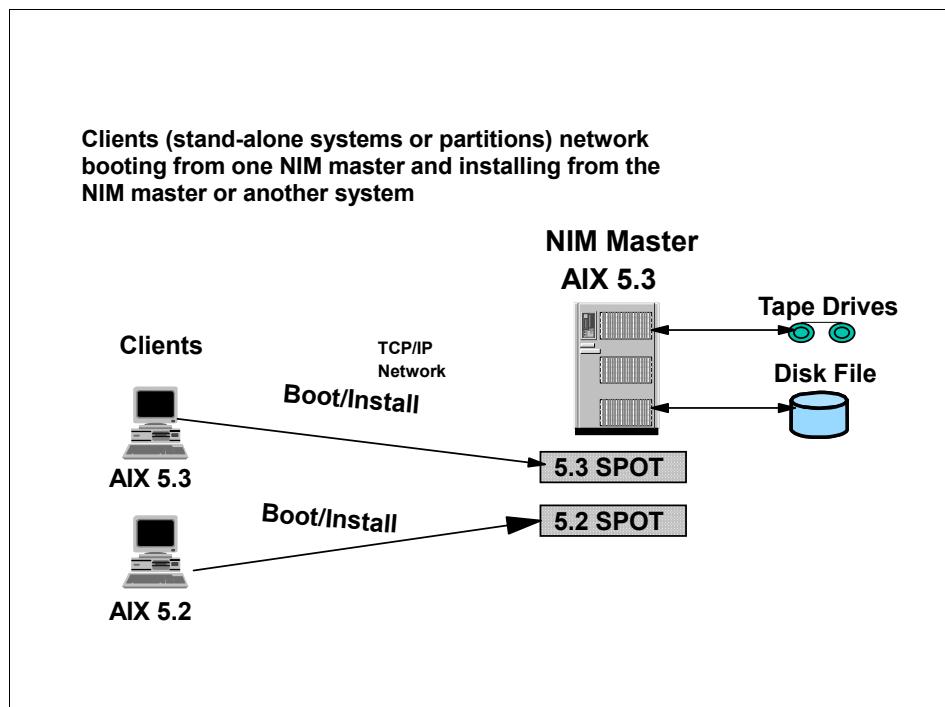


Figure 20-7 NIM resource network boot relationships

For customers whose partitions function as a part of an RS/6000® SP complex or an IBM @server Cluster 1600, SysBack has specific boot and install utilities to interact with PSSP. For these utilities, SysBack utilizes existing NIM resources that are a default part of the SP or cluster configuration in order to provide a server-initiated network boot and install through the control workstation. SysBack also executes the required PSSP functions to bring the partition back into the SP or cluster environment after system installation.

20.2.4 Multivolume backup and tape device support

SysBack interfaces with the tape drive units through generic SCSI commands used by all drives. SysBack does not directly interface to a tape library robot or auto-changer mechanism and, therefore, does not control its movement.

By design, SysBack simply ejects the tape when the end of volume is reached and waits for the next volume to be loaded. For a stand-alone tape drive, human intervention is required to load the next tape. However, if the unit is a tape

autoloader that has a mode of operation called *automatic* or *sequential*, then placing the autoloader in this mode allows SysBack and the hardware to take care of all the tape changes automatically without human intervention.

The hardware design of an autoloader's sequential mode will automatically load the next sequential volume when the tape is ejected from the drive. This behavior eliminates the need of an application, such as SysBack, to control the robot arm. This behavior is true across all tape autoloaders that have an automatic or sequential mode of operation.

However, if the unit is a tape library where the tape loading occurs through commands issued to the robot, then SysBack can still work with the library provided that you create a simple script to handle the robot functions.

Therefore, in essence, SysBack can work with any model library from any vendor. However, depending on the functionality of the library, you may or may not have to write a small script to control the robot functions for SysBack.

20.2.5 Partition backup, recovery, and cloning

SysBack can be used to back up and reinstall the same partition, or to clone that partition image to another system or partition. You can also clone an image of a stand-alone system to a partition.

The following examples demonstrate local and remote backups, partition recovery, and cloning. Other variations and options related to these procedures exist. Therefore, refer to the *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User's Guide*, along with product readme files, for more detailed information about any or all of these tasks. The manual is available at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.itsmsbr.doc/bmrug565191.htm>

The readme files are available in /usr/lpp/sysback after the product has been installed, as well as on the product media.

20.2.6 Partition backup and reinstallation (system recovery)

This section demonstrates the basic tasks required to do the following operations:

- ▶ Perform a system backup to a device assigned to the partition: Perform a basic boot and reinstall from that tape.

- ▶ Perform a system backup to a remote device assigned to another partition:
 - Perform a network boot.
 - Perform the reinstallation remotely across the network from tape.

All commands require execution by the root user.

Using a media device assigned to the partition

Local backups are backups that are performed to a device that is physically attached to the machine, and in this case, the partition. This type of backup is the easiest to implement. Figure 20-8 illustrates the relationship of a partition to a tape device for a local backup.

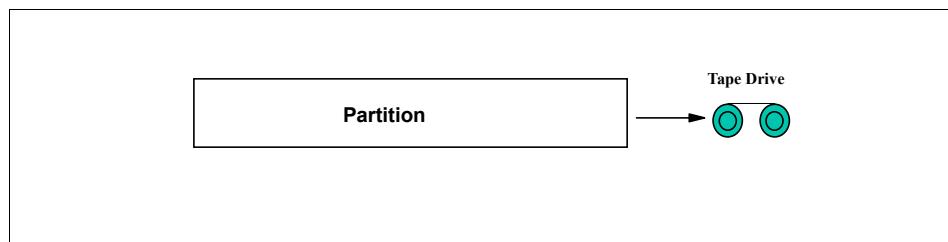


Figure 20-8 Local backup to tape

Sample backup to tape

To execute a full system (installation image) backup of a partition to be used only to reinstall this partition or another partition on this machine and to back up datavg in addition to rootvg, pointing the backup to the /dev/rmt0 device, issue the following command:

```
# /usr/sbin/sysback -f /dev/rmt0 datavg
```

Note: There are several other options available for the `/usr/sbin/sysback` command. Refer to Appendix A, “Commands,” in the *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User’s Guide* for more detailed information, available at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.tsmsbr.doc/bmrug565.htm>

Sample boot and install from tape

To sample boot and install from tape, do the following operations:

1. Place the backup tape in the drive and activate your partition to begin booting.

Note: If your boot device is not set to the tape drive, first boot into SMS and set the boot device.

2. The partition boots to the SysBack Installation and Maintenance Main Menu.
3. Using the menus, make any needed changes to the LVM information. When finished, select the **Install the System with Current Settings** option.
4. The install proceeds without any further intervention. Once completed, the system login prompt opens.

Using a media device assigned to a remote partition

Remote backups are backups sent across the network to a remote machine or partition. This backup type is easily accomplished after completing a quick, simple, one-time Remote Services configuration.

For the purposes of this example, let us assume the following scenario:

- ▶ SysBack is installed on both partitions.
- ▶ The host name of the partition to be backed up is pluto.
- ▶ The host name of the remote partition that has a tape drive assigned to it is mars.

Note: The following references to server and client refer specifically to the SysBack definitions only. A SysBack server may or may not be any other type of application server, NFS server, and so on in your environment.

Because it is not possible to boot a partition from a tape device assigned to another partition, a network boot of the partition is required. After the partition has been booted over the network, you can simply direct SysBack to restore from the remote tape device.

In order to perform a SysBack network boot, you must complete a one-time configuration procedure.

Figure 20-9 illustrates the relationship between partitions for a remote backup and network boot.

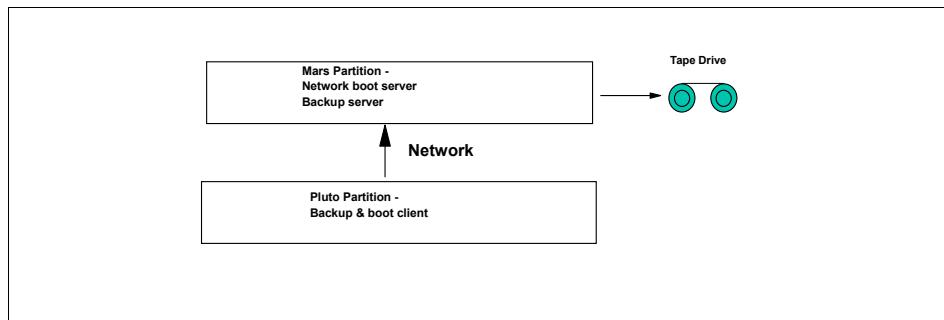


Figure 20-9 Remote backup to tape and network boot of partition

Onetime Remote Services configuration

Log in to the mars partition (server) and issue the following commands:

1. Issue the `/usr/sbin/cfgremsvs` command to configure Remote Services on this partition.
2. Issue the `/usr/sbin/cfgremaccess -h pluto -u a11 -f a11` command to define pluto's access to this partition and its tape drive resources.

Log in to the pluto partition (client) and execute the following commands:

1. Issue the `/usr/sbin/cfgremsvs` command to configure Remote Services on this partition.
2. Issue the `/usr/sbin/cfgremserver -a -h mars` command to define mars as the backup server.

Sample backup to tape

The following command creates a full system (installation image) backup of the client pluto partition, which includes both the datavg and rootvg volume groups. The backup will be created on the tape device (`/dev/rmt0`) on the server pluto.

```
# /usr/sbin/sysback -h mars -f /dev/rmt0 datavg
```

This backup can later be restored to the same or a different partition in the machine.

Note: There are several other configurable options available for the `/usr/sbin/sysback` command. Refer to Appendix A, “Commands,” in the *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User’s Guide* for more detailed information, available at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.itsmsbr.doc/bmrug565.htm>

Onetime network boot configuration

To do a onetime network boot configuration, log in to the mars partition (server) and execute the `/usr/sbin/mksbnetboot -h pluto -d your_network_type -T chrp -k mp -S server_ip -g client_gateway -s client_subnet` command in order to define pluto as a network boot client and to build the required boot image.

Note: The values allowed for the variable `your_network_type` are Ethernet or token ring. If your client and server are on the same subnet (the client does not require a gateway to get to the server), specify the server address again for the `client_gateway` variable.

Sample network boot

In order to network boot the pluto partition (client) from the mars partition (server), do the following operations:

1. Boot the pluto partition to the SMS menu.
2. Select **Multiboot**.
3. Select **Select Install Device**.
4. Select the desired network interface to use for the network boot process.
5. Type X two times to return to the main SMS menu.
6. Select **Remote Initial Program Load**.
7. Select **IP parameters**.
8. Input the same server IP address, client IP address, client gateway, and client subnet mask values that were used in the SysBack network boot configuration.

Note: If your client and server are on the same subnet (the client does not require a gateway to get to the server), specify the server address again for the `client_gateway` variable.

9. Type X to return to the Remote Initial Program Load menu.

10. Select **Adapter Parameters**.
11. Set any attributes appropriate to your network interface and network environment.
12. Type X to return to the Remote Initial Program Load menu.
13. Select **Test Ping**.
14. Input the appropriate IP information to ping the mars partition.
15. Type X two times to return to the main SMS menu.
16. Type X to exit SMS and start the network boot process.

The partition boots to the SysBack Installation and Maintenance Main Menu.

Sample install from remote tape

After your partition has booted to the **SysBack Installation and Maintenance Main Menu**, and if you want to install over the same network interface from which you booted, execute only steps 5 to 10 below. However, if you want to install from a different network interface, you must change to it and configure the desired network interface, as follows.

To install from a remote tape, do the following steps:

1. Select **Change Installation Device**.
2. Select the desired network interface.
3. Enter the client IP address, server IP address, client gateway, and subnet mask in order to use this interface.

Note: If your client and server are on the same subnet (the client does not require a gateway to get to the server), specify the server address again for the client_gateway variable.

4. Press Esc to return to the main menu.
5. Select **Change Volume Group & Logical Volume Information**.
6. Select the appropriate tape device on the remote system from the Select Source for Volume Group Data menu.
7. Tape processing occurs to position the tape to the correct location.
8. Press Esc to return to the main menu.
9. Select **Install the System with Current Settings** to begin the installation.
10. The install proceeds without any further intervention. Once completed, the system login prompt opens.

20.2.7 Cloning backup images between partitions

Cloning refers to creating a backup image of one machine or partition and installing a different machine or partition with that same image.

This section demonstrates the basic tasks required to do the following operations:

- ▶ Identify resources that may need to be supported for the cloning process.
- ▶ Perform a system backup to a device assigned to the partition:
 - Perform a basic boot and install using a DVD backup made from another partition.
- ▶ Perform a system backup to a remote device assigned to another partition:
 - Perform a network boot.
 - Perform a basic installation remotely across the network using a DVD backup made from another partition.

Note: There are other variations to prepare for needed support or to enable support at the time of install. However, these examples can be complicated and relate to very specific scenarios. The processes described here are the most direct and the least complicated.

Resource identification

When cloning, it is important to remember that an image from the source machine or partition must have all of the needed device driver filesets and kernel filesets installed to support the hardware of the new machine or partition.

In a partitioned environment, the need to identify the required device driver and kernel filesets is greatly reduced.

Device driver filesets

The essential device drivers needed to support each partition are the same across all of the partitions, because each partition exists on the same physical machine. Examples of essential device drivers might be filesets to support SCSI disk drives or the I/O bus.

However, each partition can have additional I/O slots assigned to it beyond the minimal requirements for defining a partition. These I/O slots may have adapter cards used to attach external devices. Various types of Ethernet adapters, or even differential SCSI adapters used to attach tape libraries, are examples of how these I/O slot allocations can be used. Each I/O component has an associated device driver.

In order to clone an image of one partition to another, we recommend that you identify any resource existing on the destination partition that does not exist on the source partition. Once identified, you should install the required device drivers to support those resources identified on to the source partition.

In a partitioned environment, there will be few, if any, resources to identify. Furthermore, because these resources would be optionally assigned I/O slots, these resources are not likely to keep the cloning operation from completing. In this scenario, missing device drivers could simply be installed on the destination partition as needed to configure an adapter card after the cloning operation has completed.

Note: We recommend that you reboot the operating system after installing device drivers to ensure that they are properly initialized into the running kernel. Doing this ensures that the needed support is included in the boot image that is created when you perform the backup.

Kernel support filesets

In a partitioned environment, there are only two choices of kernel support filesets available at the time of this publication:

- ▶ bos.mp: This fileset is required when running the 32-bit kernel.
- ▶ bos.mp64: This fileset is required when running the 64-bit kernel.

On partitioning-capable pSeries server models, the default action when installing AIX 5L V5.x is to install both kernel filesets.

Provided that you would like to run the same kernel after the cloning procedure as was running on the partition that created the backup, there are no additional tasks required. However, should you want to run a different kernel and would like to use SysBack to switch the kernel for you during the cloning procedure, you must install both filesets on the source partition before creating the backup.

Using a media device assigned to the same partition

Local backups are backups that are performed to a device that is physically attached to the machine and, in this case, the partition. This type of backup is the easiest to implement. Figure 20-10 on page 659 illustrates the relationship between partitions and their respective backup devices for a cloning operation.

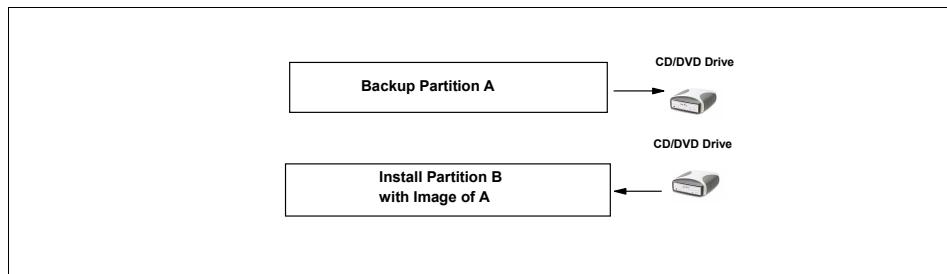


Figure 20-10 Local backup to CD/DVD and using that image for a new partition

Sample backup to DVD

Make sure that you have evaluated any additional hardware resources that will exist on the destination partition and install the needed device drivers to support them before performing the backup.

To execute a full system (installation image) backup of this partition to be used only to reinstall this partition or another partition on this machine, pointing the backup to the /dev/cd1 device, which uses 2.6 GB media, issue the following command:

```
# /usr/sbin/mksbcd -T "D" -t I -f /dev/cd1 -Z 2662
```

Starting with SysBack Version 5.6.5.0, you can create backups using the UDF structure on DVD media when using AIX 5.2 and later (as opposed to ISO9660). Issue the following command to use the UDF format:

```
# /usr/sbin/mksbcd -T "D" -t U -f /dev/cd1 -Z 2662
```

Note: A backup to CD/DVD has additional configuration requirements. There are also many additional flags, options, and potential considerations of the `/usr/sbin/mksbcd` command. See the `/usr/lpp/sysback/README.udf.dvdcd.txt` file for details about using this feature.

Sample boot and install from DVD

To boot and install from a DVD, do the following operations:

1. Place the DVD backup in the drive and activate your partition to begin booting.

Note: If your boot device is not set to the DVD drive, first boot into SMS and set the boot device.

2. The partition boots to the SysBack Installation and Maintenance Main Menu.
3. Using the menus, make any needed changes to the LVM information. When finished, select the **Install the System with Current Settings** option.

Note: This new partition may not have as many disk drives assigned to it as the source partition. The disk drives also may be of a different size. You may want to enable mirroring in this partition when it did not exist on the source partition. These changes, and many more, can be used to customize this installation. For more information about how to change LVM information, refer to Chapter 11, “Changing the Volume Group, Logical Volume, and Filesystem Attributes,” in the *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User’s Guide*, available at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.itsmsbr.doc/bmrug565.htm>

4. The install proceeds without any further intervention. Once completed, the system log in prompt appears.

Using a media device assigned to a remote partition

Remote backups are backups sent across the network to a remote machine or partition. This backup type is easily accomplished after completing a quick, simple, one-time Remote Services configuration.

For the purposes of this example, let us assume the following scenario:

- ▶ SysBack is installed on both partitions.
- ▶ The host name of the partition to be backed up is pluto:
 - This image is used to install a new partition.
 - The new partition network boots from this partition. Therefore, this partition is a boot server to the new partition.
 - This partition is also a backup client to mars.

Note: It is possible for a system or partition to be both a SysBack server and a client.

- ▶ The host name of the remote partition that has a DVD drive assigned to it is mars.
 - This is the partition from which the new partition is installed. Therefore, this partition is the install server to the new partition.
 - This partition is a backup server to pluto.

Because it is not possible to boot a partition from a DVD device assigned to another partition, a network boot of the new partition is required. After the partition has been booted over the network, you may simply direct SysBack to restore from the remote DVD device. In order to perform a SysBack network boot, you must complete a one-time configuration procedure.

Figure 20-11 illustrates the relationships between the partitions for this example.

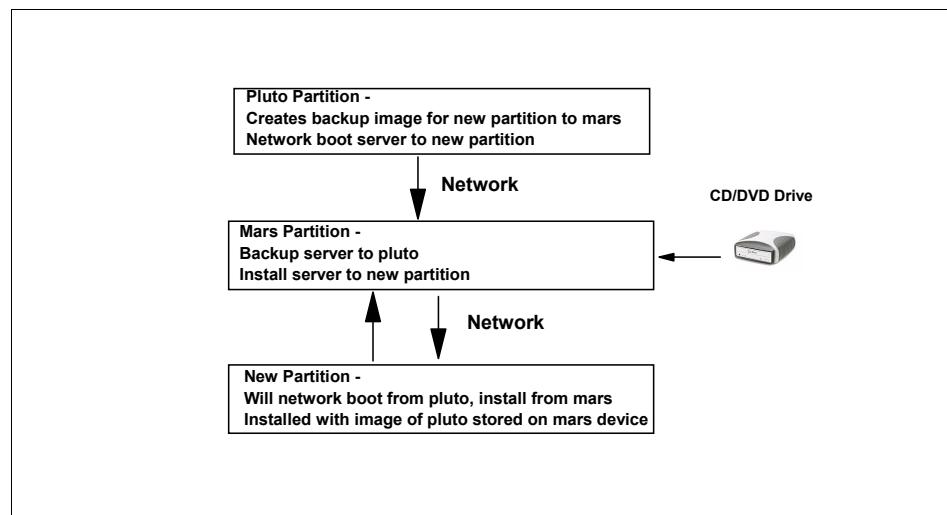


Figure 20-11 Remote backup, remote install, and network boot

One-time Remote Services configuration

To configure backup services between pluto (backup client) and mars (backup server), do the following operations:

1. Log in to the mars partition (backup server) and execute the following commands:
 - a. Issue the `/usr/sbin/cfgremsvs` command to configure Remote Services on this partition.
 - b. Issue the `/usr/sbin/cfgremaccess -h pluto -u a11 -f a11` command to define pluto's access to this partition and its tape drive resources.

2. Log in to the pluto partition (backup client) and execute the following commands:
 - a. Issue the `/usr/sbin/cfgremsvs` command to configure Remote Services on this partition.
 - b. Issue the `/usr/sbin/cfgremserver -a -h mars` command to define mars as the backup server.

To configure Remote Services between mars (installation server) and the new partition (client to be installed), do the following operations. Log in to the mars partition (install server) and execute the following commands:

1. Issue the `/usr/sbin/cfgremsvs` command to configure Remote Services on this partition.

Note: If you are working through this example in order and have already issued the above command, it need only be issued one time.

2. Issue the `/usr/sbin/cfgremaccess -h new_partition_hostname -u a11 -f a11` command to define the new partition's access to this partition and its DVD resources.

Note: This command assumes that the IP and host name of the new partition have been defined in your network environment.

Sample backup to DVD

Make sure that you have evaluated any additional hardware resources that will exist on the destination partition and install the needed device drivers to support them before performing the backup.

To execute a full system (installation image) backup of this partition to be used only to reinstall this partition or another partition on this machine, pointing the backup to the `/dev/cd1` device, which uses 2.6 GB media, issue the following command:

```
# /usr/sbin/mksbcd -T "D" -t I -h mars -f /dev/cd1 -Z 2662
```

Starting with Sysback V5.6.5.0, you can create backups with the UDF on DVD media when using AIX V5.2 and later. Issue the following command to use UDF format:

```
# /usr/sbin/mksbcd -T "D" -t U -h mars -f /dev/cd1 -Z 2662
```

Note: A backup to CD/DVD has additional configuration requirements. There are also many additional flags, options, and potential considerations of the `/usr/sbin/mksbcd` command. For details about using this feature, refer to the `/usr/lpp/sysback/README.udf.dvdcd.txt` file.

One-time network boot configuration

To do a one-time network boot configuration, log in to pluto (boot server to the new partition) and execute the command `/usr/sbin/mksbnetboot -h new_partition_hostname -d your_network_type -T chrp -k mp -S server_ip -g client_gateway -s client_subnet` in order to define pluto as a network boot client and to build the required boot image.

Note: The values allowed for the variable `your_network_type` are Ethernet or token ring. If your client and server are on the same subnet (the client does not require a gateway to get to the server), input the server address again for the `client_gateway` variable. This command also assumes that the IP and host name of the new partition have been defined in your network environment.

Sample network boot

To network boot the new partition (network boot client) from the pluto partition (network boot server), do the following operations:

1. Boot the new partition to the SMS menu.
2. Select **Multiboot**.
3. Select **Select Install Device**.
4. Select the desired network interface to use for the network boot process.
5. Type X two times to return to the main SMS menu.
6. Select **Remote Initial Program Load**.
7. Select **IP parameters**.
8. Input the same server IP address, client IP address, client gateway, and client subnet mask values that were used in the SysBack network boot configuration.

Note: If your client and server are on the same subnet (the client does not require a gateway to get to the server), specify the server address again for the `client_gateway` variable.

9. Type X to return to the Remote Initial Program Load menu.
10. Select **Adapter Parameters**.

11. Set any attributes appropriate to your network interface and network environment.
12. Type X to return to the Remote Initial Program Load menu.
13. Select **Test Ping**.
14. Input the appropriate IP information to ping the pluto partition.
15. Type X two times to return to the main SMS menu.
16. Type X to exit SMS and start the network boot process.

The partition boots to the SysBack Installation and Maintenance Main Menu.

Sample install from remote tape

After your partition has booted to the SysBack Installation and Maintenance Main Menu you must change the installation device to point to mars (install server) using the following steps:

1. Select **Change Installation Device**.
2. Select the desired network interface.
3. Enter the client and server IP addresses, client gateway, and subnet mask for mars.

Note: If your client and server are on the same subnet (the client does not require a gateway to get to the server), specify the server address again for the client_gateway variable.

4. Press Esc to return to the main menu.
5. Select **Change Volume Group & Logical Volume Information**.
6. Select the appropriate DVD device on the remote system from the Select Source for Volume Group Data menu.

Note: This new partition may not have as many disk drives assigned to it as the source partition. The disk drives may also be of a different size. You may want to enable mirroring in this partition when it did not exist on the source partition. These changes, and many more, can be used to customize this installation. For more information about how to change LVM information, refer to Chapter 11, “Changing the Volume Group, Logical Volume, and File system Attributes,” in the *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User’s Guide*, available at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.itsmsbr.doc/bmrug565.htm>

7. Press Esc to return to the main menu.

Note: If you want to keep the same host name and network information as was defined on pluto in this new partition (for example, this new partition replaces pluto), you do not need to execute steps 8–12 below. Simply go to step 13.

8. Select **Utilities**.
9. Select **Post Install Configuration Options**.
10. Select **Remove Network Settings After Install**.
11. Type **y** at the prompt **Do you wish to remove the network settings?**
12. Press Esc three times to return to the SysBack Installation and Maintenance Main Menu.
13. Select the **Install the System with Current Settings** option to begin the installation.
14. The installation proceeds without any further intervention. Once completed, the system login prompt opens.

You have now cloned (installed) the system backup image of pluto to the new partition.

20.2.8 Cloning from a stand-alone system to a partition

Using the same procedures as described in 20.2.7, “Cloning backup images between partitions” on page 657, you can also clone a backup image from a stand-alone system to a partition. This is useful in situations where your partition is replacing another machine.

To clone a backup image from a stand-alone system to a partition, do the following operations:

1. Identify the device driver filesets required by your partition and install them to your stand-alone system.
2. Identify the kernel fileset required by your partition and install it to your stand-alone system.
3. Ensure that you are running at least the minimum required level of AIX on the stand-alone system as is required by the partition.
4. Execute any Remote Services configuration required if performing a remote backup or install.

5. Execute any network boot configuration required if performing a network boot of the partition.
6. Execute the backup of the stand-alone system.
7. Install the backup image of the stand-alone system to the partition.

Figure 20-12 on page 666 shows that the same network backup and network boot capabilities exist between a stand-alone system and a partition as exists solely between partitions.

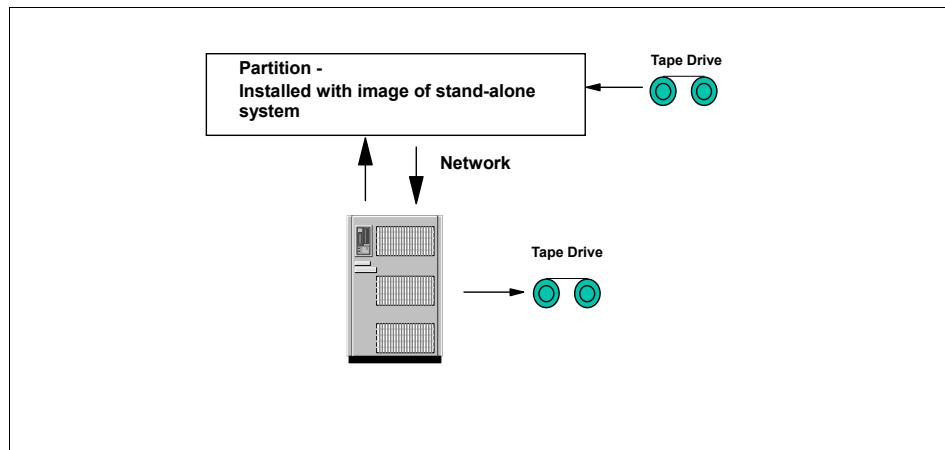


Figure 20-12 Stand-alone system interaction with a partition

20.2.9 License information

To license your Tivoli Storage Manager for System Backup and Recovery (SysBack) software, install the following filesets included on your product media in addition to the installation of the base `tivoli.tsm.client.sysback.rte` fileset:

- ▶ `tivoli.tsm.client.sysback.license.rte`
- ▶ `tivoli.tsm.client.sysback.license.cert`

Special licensing measures apply for customers using SysBack Versions 5.1–5.4. There are no license filesets for this version of SysBack. For detailed information related to licensing your product, refer to your product readme file located at `/usr/lpp/sysback/README.txt` or other documentation that accompanied your order.

20.2.10 Documentation

SysBack product documentation is available in the following ways:

- ▶ Product manual
- ▶ readme file

The manual

The *IBM Tivoli Storage Manager for System Backup and Recovery Installation and User's Guide* is available in hardcopy and softcopy forms. Hardcopy versions of the order must be individually ordered. Softcopy versions are located at:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp?topic=/com.ibm.itsmsbr.doc/bmrug565191.htm>

The readme file

SysBack documents the latest features and fixes since the last publication of the user's guide in its readme files. After the product is installed, the readme file is located in the /usr/lpp/sysback directory.

20.3 Integrating SysBack with Tivoli Storage Manager

SysBack V5.6 and later allows for the storage of backup objects into a Tivoli Storage Manager server. Backups to a Tivoli Storage Manager server may be manipulated like any other SysBack backup. They may be listed, verified, restored, and used for system reinstallation.

Combining the SysBack backup, restore, and network boot/install functions with a Tivoli Storage Manager server provides Bare Machine Recovery capability for Tivoli Storage Manager configurations. SysBack will back up and recover a system's volume group, logical volume, and file system information. Optionally, SysBack will back up any non-rootvg data specified.

20.3.1 Prerequisites, limitations, and exclusions

To install Tivoli Storage Manager for System Backup and Recovery (also known as SysBack) you must have the prerequisite software installed on your system.

Hardware requirements

SysBack supports the following hardware:

- ▶ IBM eServer pSeries and RS/6000 systems, including RS/6000 SP environments, and systems capable of the logical partitioning of AIX
- ▶ eServer pSeries Cluster 1600 systems using the PSSP option

Software requirements

The following software is required to use SysBack:

- ▶ AIX 5L V5.1, V5.2, or V5.3. Starting with Version 5.6.7.0, full functionality is provided for AIX V5.3—you can back up and restore all AIX V5.3 data to tape, TSM server, CD/DVD, or files on disk. This includes extended ACLS and NFS4 extended attributes. See the readme file for more information.
- ▶ If you will be using the Tivoli Storage Manager Integration feature, you will also need:
 - A previously configured Tivoli Storage Manager server that must be at V5.2.0 or later
 - The 32-bit Tivoli Storage Manager API client, which must be installed and at V5.2.0 or later
 - The Tivoli Storage Manager node name used for SysBack backups, which must be registered on the Tivoli Storage Manager server and configured to use the passwordaccess generate option

Note: This feature is not available in SysBack versions earlier than 5.6.

- ▶ The bos.sysmgt.sysbr fileset.

Note: You should update your bos.sysmgt.sysbr fileset to 5.1.0.10.

Otherwise, when booting from tape, CD, or DVD and attempting to make the root file systems (/ , /usr, /var, / tmp) JFS2 type, you will receive the error that files from /sbin/helpers/jfs2 are missing. For example:

/sbin/helpers/jfs2/mkfs or /sbin/helpers/jfs2/logform

This is because these files were not included in /usr/lpp/bosinst/tape/tapefile1 until 5.1.0.10 of bos.sysmgt.sysbr and are required for this scenario.

- ▶ If you will be using the Remote Services functions of SysBack, install the following items:
 - bos.rte.net
 - bos.net.tcp.client
- ▶ If you will be using the Classic Network Boot functions for the Network Installs, install bos.net.nfs.client.
- ▶ If you will be using the NIM Resource Network Boot functions for network installs, the NIM environment and resources must first be installed and configured in the desired locations for SysBack to use these resources. For information about installing and configuring NIM, see the *Network Installation Management Guide and Reference*.
- ▶ If you will be using SysBack on SP or Cluster 1600 systems, you must be using PSSP Level 3.4 or 3.5.

Note: At this time, SysBack does not include support for eServer pSeries Cluster 1600 systems using the CSM option available in AIX 5.2.

- ▶ When AIX is installed, the following are installed automatically with the system and may not be removed in order for SysBack to function properly:
 - bos.rte.bosinst
 - bos.rte.archive
 - bos.rte.libnetsvc (when using Network Install functions)

Limitations and exclusions applying to interaction

The limitations and exclusions are:

- ▶ You must exclude Tivoli Storage Manager HSM managed file systems from all SysBack backup processes (via an exclude list). You must use the Tivoli Storage Manager backup-archive client to back up these file systems instead. At restore time, SysBack may be used to rebuild the underlying file system structure for the HSM managed file system, but the actual file data and HSM stub file data should be restored via the Tivoli Storage Manager backup-archive client.
- ▶ There can be notable functional differences and limitations in MBCS environments. Please refer to Appendix B, “Functional Requirements & Limitations for DBCS and BiDi Environments,” in the *Installation and User’s Guide* for a detailed listing of impacted functionality. LAN-free backups are not supported.
- ▶ COMMMETHOD_TCPIP is the only supported Tivoli Storage Manager communication method.
- ▶ GPFS file systems are not supported.

Note: The Tivoli Storage Manager Backup-Archive Client can back up GPFS file systems.

- ▶ VERITAS file systems are not supported.
- ▶ AFS® and DFS file system structures cannot be recreated from backups. If the root user has the appropriate AFS or DFS permissions, then SysBack can back up the data.

Note: The Tivoli Storage Manager Backup-Archive Client can back up AFS and DFS file systems.

- ▶ Compression should not be set from within the SysBack backup commands when the backup destination is a Tivoli Storage Manager server. Compression of data is controlled through Tivoli Storage Manager configuration options.
- ▶ Files, directories, file systems, or logical volumes that you would like excluded from backup processing must be defined in the SysBack exclude list. Tivoli Storage Manager exclude processing does not apply to this backup process.
- ▶ If you are using SysBack's incremental backup function, and the destination is a Tivoli Storage Manager server, you must ensure that an adequate number of versions exist specified to avoid inadvertently expiring off members of a full incremental backup set.

Currently, there is no tracking that ties an individual incremental backup to the rest of the incremental backups in a series.

For example, if you specify to keep three backup versions in your Tivoli Storage Manager copy group, but do a level 0 backup, and then level 4 backups every Friday, by the end of the month your level 0 will have been versioned off by Tivoli Storage Manager.

20.3.2 Basic setup and configuration tasks

In order to perform backup, list, verify, query, or restore operations with a Tivoli Storage Manager server, you must perform the following configuration tasks:

- ▶ Register a Tivoli Storage Manager node.

Before you can perform any communications with a Tivoli Storage Manager server, you must first register a Tivoli Storage Manager node and define a password. The password will be initialized when the Tivoli Storage Manager virtual device is created. If your password is already initialized, such as when you are using the same node name as your Tivoli Storage Manager

Backup-Archive Client, it will be necessary for you to provide that password when creating the virtual device definition.

- ▶ Install the API client.

You must install the V5.2.0 (or later) Tivoli Storage Manager 32-bit API client for use with SysBack operations.

- ▶ Configure the Tivoli Storage Manager options file.

Operations between SysBack and Tivoli Storage Manager require at least this minimum information in the dsm.sys file:

```
SErvername lasher_main
NODename lasher
COMMMethod TCPIP
TCPPort 1500
TCPServeraddress tsmserver.your.domain.com
PASSWORDAccess generate
```

- ▶ Set Tivoli Storage Manager environment variables.

The Tivoli Storage Manager API client provides the following environment variables:

- DSMI_CONFIG: The fully qualified name for the client options file is usually named dsm.opt. Setting this variable is not supported with SysBack—it will always set this variable to /usr/lpp/sysback/tsm/dsm.opt.tsmXX, where X represents the Tivoli Storage Manager virtual device number.
- DSMI_DIR: The path that contains the dsm.sys, dsmtca, and the en_US subdirectory. Setting this variable is not supported with SysBack. SysBack will always look to the default API installation directory of /usr/tivoli/tsm/client/api/bin to locate these items in order to allow the Bare Machine Recovery functions.
- DSMI_LOG: The path that points to the API error log. You may configure this variable to designate the location and file name of the API error log. If this variable is not set, the API error log for SysBack operations will be located in /usr/lpp/sysback/sbtssmerror.log.

Note: This does not log the output of the SysBack command processing. This only logs the information for the API communications between the SysBack command processing and the Tivoli Storage Manager server.

- ▶ Create a Tivoli Storage Manager virtual device.

The steps for doing this are discussed in 20.3.3, “Creating a Tivoli Storage Manager virtual device” on page 672.

- ▶ Additional configuration for Bare Machine Recovery.

In order to perform a Bare Machine Recovery from a SysBack backup stored in a Tivoli Storage Manager server, you must execute the following configuration tasks:

- Configure operations for the backup, list, verify, query, and restore tasks as explained previously.
- Configure a SysBack Network Boot Client.
- Configure the Tivoli Storage Manager Network Install Client defaults.

20.3.3 Creating a Tivoli Storage Manager virtual device

To access the Tivoli Storage Manager Virtual Device configuration menus:

1. Log in as the root user.
2. Type `smitty sysback` and press Enter.
3. Navigate **TSM** → **TSM Virtual Device Configuration** → **Add a TSM Virtual Device** and press Enter.

4. Highlight the desired TSM server name stanza when prompted at the Select a TSM Server dialogue, as shown in Example 20-12, and press Enter.

Example 20-12 Server selection menu

TSM Virtual Device Configuration

Move cursor to desired item and press Enter.

Add a TSM Virtual Device
Change an Existing TSM Virtual Device
List TSM Virtual Devices
Remove a TSM Virtual Device

Select a TSM Server		
Move cursor to desired item and press Enter.		
Atlantic	lochness	
Esc+1=Help	Esc+2=Refresh	Esc+3=Cancel
Esc+8=Image	Esc+0=Exit	Enter=Do
/=Find	n=Find Next	
Es		
Es+		

Note: The list of IBM Tivoli Storage Manager server name stanzas is generated from the contents of the file /usr/tivoli/tsm/client/api/bin/dsm.sys.

Once you have selected a server name, you have to enter the password you used during the **register node** command, as shown in Example 20-13.

Example 20-13 Add TSM virtual device menu

Add a TSM Virtual Device

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

		[Entry Fields]
TSM Server Name		Atlantic
Client Node Password		[password]

Esc+1=Help	Esc+2=Refresh	Esc+3=Cancel	Esc+4=List
Esc+5=Reset	Esc+6=Command	Esc+7>Edit	Esc+8=Image
Esc+9=Shell	Esc+0=Exit	Enter=Do	

5. Enter the password that corresponds to the node name defined in this server stanza in the Password field.

You should be aware of the following information related to the password field:

- If this is the first connection to the Tivoli Storage Manager server for this node name, the password will be encrypted and stored in /etc/security/adsm or as specified with the PASSWORDDIR option in the dsm.sys file.
- If connections to the Tivoli Storage Manager server have previously been established by this or any other Tivoli Storage Manager client using this node name, you must enter the password that was previously stored in /etc/security/adsm or where specified with the PASSWORDDIR option in the dsm.sys file. If you do not know this password, you have two options:
 - Specify the password to the administrative ID created for this node name that has OWNER access.
 - Log in to the Tivoli Storage Manager server and issue the command **update node nodename newpassword** before attempting to create the TSM Virtual Device.

Note: For more information regarding the **update node** command, refer to *IBM Tivoli Storage Manager for AIX: Administrator's Reference*, GC32-0769.

Example 20-14 shows that a virtual device called *tsm0* has been created.

Example 20-14 Virtual device tsm0 created

COMMAND STATUS

Command: OK stdout: yes stderr: no

Before command completion, additional instructions may appear below.

Device tsm0 for TSM server lochness has been added.

Esc+1=Help Esc+2=Refresh Esc+3=Cancel Esc+6=Command
Esc+8=Image Esc+9=Shell Esc+0=Exit /=Find
n=Find Next

20.3.4 Configuring network boot options for BMR

In order to perform a Tivoli Storage Manager Bare Machine Recovery, the install client must initiate a network boot in order to access the SysBack System Installation & Maintenance Main Menus.

Network boot configuration procedures are performed like any other SysBack network boot configuration. All of the same requirements apply, with the following additional requirements:

- ▶ When performing a SysBack Classic Network Boot, the Tivoli Storage Manager 32-bit API client and the *tivoli.tivguid* (prerequisite of the API client) filesets must be installed on to the network boot server.
- ▶ When performing a SysBack NIM Resource Network Boot, the Tivoli Storage Manager 32-bit API client and *tivoli.tivguid* (prerequisite of the API client) filesets must be installed in to the NIM SPOT.

Note: There is no SysBack utility available for installing the Tivoli Storage Manager filesets into the NIM SPOT. You must install them yourself using standard NIM commands.

Optionally, you may choose to pre-configure the TSM Network Install Client defaults to avoid the manual entry of these values in the SysBack Installation & Maintenance Main Menus.

Note: You must configure the SysBack Network Boot Client for this system before setting this install defaults.

To access the TSM Network Install Client Defaults menu:

1. Log in as the root user.
2. Type smitty sysback and press Enter.
3. Select **TSM Configuration** → **Network Boot/Install Configuration** → **Classic Network Boot** → **Set TSM Network Install Client Defaults** and press Enter.
4. Highlight the desired network boot client when prompted in the Select a Client Name dialog, as shown in Example 20-15, and press Enter.

Example 20-15 Network boot client selection

Classic Network Boot

Move cursor to desired item and press Enter.

Add or Change a Network Boot Client
Rebuild Network Boot Image
Set Network Install Client Defaults
Set TSM Network Install Client Defaults
Remove a Network Boot/Install Client

Select a Client Name		
Move cursor to desired item and press Enter.		
atlantic.itsosj.sanjose.ibm.com		
Esc+/=Find	Esc+2=Refresh	Esc+3=Cancel
Esc+8=Image	Esc+0=Exit	Enter=Do
n=Find Next		

Note: The SysBack network boot client definition is based on the host name of the client system. This may or may not be the same as the Tivoli Storage Manager client node name.

Example 20-16 shows the options set for the node we configured in the lab.

Example 20-16 Set TSM network install client defaults

Set TSM Network Install Client Defaults

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

[TOP]	[Entry Fields]
* Hostname	atlantic.itsosj.sanjo>
Perform no-prompt installation?	no +
Debug Logging?	no +
THE FOLLOWING ARE REQUIRED FOR NOPROMPT INSTALL:	
Console Device Name	[/dev/tty]
Console Terminal Type (if ascii)	[term] +
Non-rootvg Volume Group Option	Restore rootvg only +
TSM Client Node Name	[atlantic]
TSM Admin ID	[admin]
Client Node or Admin Password	[password]
TSM Backup ID	[]
TSM Server Port	[1500]
TSM network device name	[/dev/tsm0] +
Gateway	[9.43.86.88]
[MORE...17]	
Esc+1=Help	Esc+2=Refresh
Esc+5=Reset	Esc+6=Command
Esc+9=Shell	Esc+0=Exit
	Esc+3=Cancel Esc+7>Edit Esc+8=Image
	Enter=Do

5. Press Enter to set the defaults.

20.3.5 Recovery and system reinstallation from a server

Performing a system installation or Bare Machine Recovery using a backup stored in a Tivoli Storage Manager server is done just like any other SysBack system installation, with the following exceptions:

- You must network boot the system to the Installation and Maintenance main menu. Tape, CD, or DVD device boots are not supported.
- The installation device will be a Tivoli Storage Manager virtual device rather than a tape, CD, DVD, or another network install server.

Once you have successfully executed a network boot, Example 20-17 shows the menu that will be displayed.

Example 20-17 SysBack Installation And Maintenance menu

```
+-----+
| IBM Tivoli Storage Manager for System Backup and Recovery |
+-----+
+-----+
| Installation & Maintenance |
| M A I N M E N U |
+-----+
Change Installation Device
Change Volume Group & Logical Volume Information
Install the System with Current Settings
Utilities Menu
Reboot the System
+-----+
| Installation Device: Tape Drive TSMDEV [tsm0] |
+-----+
| Use ARROW or Tab keys to move and ENTER to Select. |
+-----+
```

To verify or change the network information required to connect to a Tivoli Storage Manager server for retrieval of the SysBack backup image, select **Change Installation Device** to display the menu, as shown Example 20-18.

Example 20-18 Change installation device menu

```
+-----+
| Change Installation Device |
+-----+
Device Description Location
/dev/rmt0 5.0 GB 8mm Tape Drive 04-C0-00-5,0
/dev/ent0 10/100 Mbps Ethernet PCI Adapter II 04-B0
/dev/ent1 IBM 10/100/1000 Base-T Ethernet PCI Adapter 04-04
==> tsm0 TSM Virtual Device (ent1) 04-04
+-----+
| Select one network device or one or more tape devices. |
| The "=>" symbol indicates current choice(s). |
+-----+
| Use ARROW or Tab keys to move, ENTER to select or deselect, ESC when done. |
+-----+
```

Select the **tsmdev** device to verify or change the network interface associated with this restore process. The menu in Example 20-19 will be displayed.

Example 20-19 Change network interface menu

```
+-----+
|           Change Network Interface           |
+-----+
|           Device Description Location         |
| /dev/ent0 10/100 Mbps Ethernet PCI Adapter II 04-B0 |
| ==>/dev/ent1 IBM 10/100/1000 Base-T Ethernet PCI Adapter 04-04 |
+-----+
|           Select one network device or one or more tape devices.      |
|           The "=>" symbol indicates current choice(s).               |
+-----+
|           Use ARROW or Tab keys to move, ENTER to select or deselect, ESC when done. |
+-----+
```

Select the desired network interface and press Enter to verify or change the network settings associated with this restore process. The screen shown in Example 20-20 will be displayed.

Example 20-20 Change IBM Tivoli Storage Manager network settings menu

```
+-----+
|           Change TSM Network Settings          |
+-----+
| Client IP Address   9.43.86.49              |
| Client Node Name    atlantic                |
| TSM Admin ID        admin                   |
| Server IP Address   9.43.86.84              |
| Gateway IP Address  9.43.86.88              |
| Subnet Mask         255.255.254.0            |
| Port Number         1500                   |
| Password:           password                |
| Network Adapter:   ent1 [inactive]           |
+-----+
|           Enter the TSM server port number that corresponds to the desired TSM server |
|           connection for this installation.                                         |
+-----+
|           Use ARROWS or Tab to move or INS/DEL to edit. Press ESC to return.          |
+-----+
```

Verify or edit the values in each field as required for this restore process.

Once you have configured the installation device settings as desired, you will need to query the Tivoli Storage Manager server and select the backup object to restore. The easiest way to achieve this is to access the Change Volume Group & Logical Volume Information menu. Selecting this menu after setting your tsmdev installation device settings will cause SysBack to query the correct Tivoli Storage Manager server to obtain a list of backup objects available for restore. This is shown in Example 20-21.

Example 20-21 Query the server and select the backup to restore

```
+-----+
|   IBM Tivoli Storage Manage for System Backup and Recovery   |
+-----+
|          Backup ID    Active     Management Class    Backup Date      |
|=> 0.1345       Yes        SystemBackupClass  01/19/06 11:56:00|
|          0.1214       No         SystemBackupClass  01/18/06 13:10:05|
|          0.1010       No         OldBackupClass    01/15/06 09:54:25|
+-----+
|           Select the backup ID to use from the above list      |
|           The "=>" symbol indicates current choice(s).          |
+-----+
|           Use ARROW or Tab keys to move, ENTER to select or deselect, ESC when done. |
+-----+
```

Once you have selected the backup object to restore, you are ready to customize any other installation attributes as desired. If you do not need to make any changes, simply begin the install.



Data Protection configuration on the server

IBM Tivoli Storage Manager provides support for online backup of applications through the use of complementary products such as IBM Tivoli Storage Manager for Applications, IBM Tivoli Storage Manager for Databases, IBM Tivoli Storage Manager for Enterprise Resource Planning, IBM Tivoli Storage Manager for Copy Services, IBM Tivoli Storage Manager for Advanced Copy Services, and IBM Tivoli Storage Manager for Mail.

In this chapter we describe the configuration steps on the Tivoli Storage Manager server. For more information about the installation and configuration of these complementary products on the client side, refer to the *Installation and User's Guide* for each product. The IBM Redbook *IBM Tivoli Storage Management Concepts*, SG24-4877, also provides an overview of each of the data protection modules.

21.1 Basic assumptions

We assume that a Tivoli Storage Manager server is already installed and configured for backup and restore. If this is a brand new installation, you will need to perform Tivoli Storage Manager server configuration first.

Note: It is expected that the commands described in this chapter are familiar to the Tivoli Storage Manager administrator; otherwise, refer to Part 1, “Introduction” on page 1, or the *Administrator’s Guide*.

Generally, when using data protection modules, there are two major tasks that have to be performed on the Tivoli Storage Manager server:

- ▶ Define policy requirements.
- ▶ Register the node.

21.2 Policy creation requirements

Tivoli Storage Manager policies are used to specify how files are backed up, archived, migrated from client node storage, and managed in server storage.

Because the policy requirements for data protection backups are different from the desired settings for regular Tivoli Storage Manager backup clients, a different management class must be defined with Tivoli Storage Manager for managing data protection backups.

You have two options to do this:

- ▶ Define a management class in an existing policy domain.
- ▶ Define a new policy domain.

21.2.1 Defining a management class in an existing policy domain

This management class will be used for backup by the data protection module.

Example 21-1 creates a TDP_CLASS management class within an existing policy domain and policy set, both called STANDARD. It also creates the backup and archive copygroups containing the actual backup version and retention requirements.

Example 21-1 Define TDP management class and copygroups

```
tsm: ATLANTIC> define mgmtclass STANDARD STANDARD TDP_CLASS
ANR1520I Management class TDP_CLASS defined in policy domain STANDARD, set
STANDARD.
```

```
tsm: ATLANTIC> define copygroup STANDARD STANDARD TDP_CLASS type=backup
verexists=7 verdeleted=2 retextra=30 retonly=60 dest=TAPEPOOL
ANR1530I Backup copy group STANDARD defined in policy domain STANDARD, set
STANDARD, management class TDP_CLASS.
```

```
tsm: ATLANTIC> define copygroup STANDARD STANDARD TDP_CLASS type=archive
retver=365 destination=tapepool
ANR1535I Archive copy group STANDARD defined in policy domain STANDARD, set
STANDARD, management class TDP_CLASS.
```

The following parameters in the backup copygroup should be left as the defaults because they are not used by the TDP module: FREQUENCY, MODE, and SERIALIZATION. Make sure to activate the policy set that contains the new management class you just defined. Example 21-2 activates the policy set STANDARD in domain STANDARD.

Example 21-2 Activate a policy set

```
tsm: ATLANTIC> activate policyset STANDARD STANDARD
```

```
Do you wish to proceed? (Yes (Y)/No (N)) y
ANR1514I Policy set STANDARD activated in policy domain STANDARD.
```

If you choose to use a non-default management class, you will need to add an include statement in the client options file (dsm.opt for Windows, dsm.sys for UNIX) that is used by the data protection node, as shown in Example 21-3. This include statement binds the backup objects to the management class you have defined.

Example 21-3 Include statement in the client options file

```
include * TDP_CLASS
```

21.2.2 Defining a new policy domain

Rather than define a separate management class in an existing policy domain, you can also define a new policy domain where the default management class has the required settings. This method allows the default management class to be utilized for the data protection backups. There is no concern over an include statement not being recognized during the backup process. We recommend setting up the management class for the data protection clients in this way.

Example 21-4 shows how to define a new policy domain.

Example 21-4 Create data protection policy requirements

```
tsm: ATLANTIC> define domain TDP_DOMAIN
ANR1500I Policy domain TDP_DOMAIN defined.

tsm: ATLANTIC> define policyset TDP_DOMAIN STANDARD
ANR1510I Policy set STANDARD defined in policy domain TDP_DOMAIN.

tsm: ATLANTIC> define mgmtclass TDP_DOMAIN STANDARD STANDARD
ANR1520I Management class STANDARD defined in policy domain TDP_DOMAIN, set
STANDARD.

tsm: ATLANTIC> define copygroup TDP_DOMAIN STANDARD STANDARD type=backup
verexists=30 verdeleted=1 retextra=30 retonly=90 dest=tapepool
ANR1530I Backup copy group STANDARD defined in policy domain TDP_DOMAIN, set
STANDARD, management class STANDARD.

tsm: ATLANTIC> define copygroup TDP_DOMAIN STANDARD STANDARD type=archive
retver=365 destination=tapepool
ANR1535I Archive copy group STANDARD defined in policy domain TDP_DOMAIN, set
STANDARD, management class STANDARD.

tsm: ATLANTIC> assign defmgmtclass TDP_DOMAIN STANDARD STANDARD
ANR1538I Default management class set to STANDARD for policy domain TDP_DOMAIN,
set STANDARD.

tsm: ATLANTIC> activate policyset TDP_DOMAIN STANDARD

Do you wish to proceed? (Yes (Y)/No (N)) y
ANR1514I Policy set STANDARD activated in policy domain TDP_DOMAIN.
```

21.2.3 Backing up and archiving copygroup considerations

Backup and archive copygroup usage varies among the data protection modules. Here we discuss backup and archive copygroup requirements for each application.

Some data protection modules do not send any archive objects to the Tivoli Storage Manager server, so you do not need to worry about this. You may wish to have an archive copy group to prevent warning messages on the Tivoli Storage Manager server.

The archive feature of the Tivoli Storage Manager backup-archive client can be used to perform operating system and file level backups of the application files. With archives, you can group files together to expire at the same time. If you

choose to do this, pay attention to the archive copygroup that you are using. The archive copygroup will determine how long the objects will exist before expiring.

There are also specific backup retention and version requirements for specific data protection modules.

Table 21-1 summarizes the backup and archive copygroup requirements for each data protection module.

Table 21-1 Data protection backup and archive copygroup requirements

Data protection module	Backup copy group requirements	Archive copy group requirements
Data Protection for WebSphere Application Server	You can set verdeleted, verexist, retonly, and retextra parameters according to your retention requirements.	Not required.
Data Protection for Informix (or inbuilt Informix backup support)	You can set verdeleted, verexist, retonly, and retextra parameters according to your retention requirements.	Not required.
Data Protection for Microsoft SQL	For SQL <i>database objects</i> , you can set verdeleted, verexist, retonly, and retextra parameters according to your retention requirements. For <i>log</i> and <i>set</i> objects, which are always uniquely named, set the retonly parameter to control expiration. When selecting the retonly value for log backups, ensure that it is at least as long as the value for the backup objects the logs are associated with. <i>Data objects</i> and their associated <i>meta objects</i> should have the same version limits and retention values. You may want to consider storing meta objects in a disk-storage pool so that media mount is not necessary when doing data protection for SQL queries. Alternatively, you can use the same management class if you rarely need the meta objects.	Not required.
Data Protection for Oracle	Since backup objects inserted into the Tivoli Storage Manager backup storage pool have unique file names, they never expire on the Tivoli Storage Manager server. The following options must be set to handle this case: verdeleted=0 retonly=0	Not required.

Data protection module	Backup copy group requirements	Archive copy group requirements
Data Protection for Lotus Domino	<p>You can set verdeleted, verexist, retonly, and retextra parameters according to your retention requirements. Regular use of the <code>inactivatelog</code> command inactivates the archived transaction log files when all databases that would require that file for a complete recovery are inactive. Therefore, be sure to set the retention period for inactive transaction log files to be equal to or greater than that of the database backup objects.</p>	Not required.
Data Protection for MS Exchange	<p>For exchange server database backup objects, you can set verdeleted, verexist, retonly, and retextra parameters according to your retention requirements.</p> <p>However, note that incremental backups always have unique names. Therefore, they will only expire due to retonly limits. When setting the retonly parameter for incremental backups, the value must be as long as the value set for the full backup objects to which the incremental backups are associated. You can use the same management class for incremental and full backup objects to be sure an adequate value is used.</p>	Not required.
Data Protection for ESS (Oracle/DB2) Data Protection for DS and SVC (Oracle/DB2)	<p>Set the following values so that deleted backups are immediately removed from server storage:</p> <pre>verdeleted=0 retonly=0</pre>	Not required.

Data protection module	Backup copy group requirements	Archive copy group requirements
Data Protection for mySAP (DB2 or Oracle)	Not required.	You must define a management class for SAP system data, data files, offline redo logs, and copies of offline redo logs. Data Protection for mySAP uses its own <i>version control</i> mechanism for managing mySAP database backups. To do this, Data Protection for mySAP backs up all data only to management classes for which an archive copy group has been defined. In addition, to prevent backed up files in Tivoli Storage Manager being deleted because of their expiration date, the parameter <code>retver</code> should be set to unlimited (9999).

21.3 Register node

Before a Tivoli Storage Manager client can use the storage services of a Tivoli Storage Manager server, it must first authenticate to the Tivoli Storage Manager server using a nodename and password. A node is created by the Tivoli Storage Manager Administrator using the `register node` command. In 8.2.3, “Working with client nodes” on page 292, we show how to create client nodes.

When the node is registered, it has five key parameters: nodename, password, domain, maxnummp, and backdelete. The Tivoli Storage Manager backup-archive client defaults the nodename to the host name of the machine.

We strongly recommend registering a dedicated node for each Data Protection backup client, that is separate from the node that is used with the backup-archive client. If you have a separate policy domain for data protection backups, this is required, since a node can only belong to one domain. The password you specify will be used for authenticating the client API to the Tivoli Storage Manager server the first time a Data Protection session is invoked.

Note for Tivoli Storage Manager for Databases, Data Protection for Oracle: The administrator must run the `tdpoconf` utility program to set the password before using Data Protection for Oracle.

Note for Informix: The password specified in the `register node` command will be used with the `tdpipswd` program.

Note for Tivoli Storage Manager for ERP, Data Protection for mySAP: Tivoli Data Protection for mySAP has several password handling options. See the *Installation and User's Guide* for more information about the options and their implications.

The node that is used to back up Oracle or MS SQL database objects to Tivoli Storage Manager must be able to manually delete the backup objects. To do so, specify `BACKDELETE=YES` when registering the node. You can also update a node that has this value set to `NO` and set it to `YES` with the `update node` command.

The `MAXNUMMP` option restricts the number of tape mounts that a client can initiate. In order for the Tivoli Storage Manager client to use multiple sessions when sending backups to tape, the parameter `MAXNUMMP` must be equal to or greater than the number of sessions involved in the backup.

The `MAXNUMMP` option must not be set to a value greater than the actual number of physical drives defined to the Tivoli Storage Manager server. If the Data Protection module cannot acquire enough tape mounts, either because this value is set lower than the number of sessions or because sufficient tape drives are not available, the backups may fail, or have to wait for one session to finish.

21.4 Server configuration considerations

The following are some recommendations for additional configuration on the Tivoli Storage Manager server to improve data protection backups and restores. Refer to the Data Protection module *Installation and User's Guide* for more information.

Informix

To back up large Informix databases, edit the `dsmser.opt` and increase `commtimeout` to about 300 and `idletimeout` to 30.

Tivoli Storage Manager for Databases, Data Protection for MS SQL

The collocate parameter for the storage pool assigned to the Data Protection for the MS SQL client node should be set to *filespace* to ensure that individual data stripes stay on separate removable volumes. The default value is no. Not doing so may require more operations to make the data for each stripe of a restore simultaneously accessible.

The txngroupmax option in the dsmserv.opt file must be at least one more than the maximum number of stripes to be used for backup or restore operations regardless of media. The default value is 40.

Tivoli Storage Manager for Mail, Data Protection for Lotus Domino

To optimize the recover process, use collocation for the file space containing the transaction log files if they are stored on sequential media on the Tivoli Storage Manager server. The transaction log files are stored in a separate file space from the database files on the Tivoli Storage Manager server.

Tivoli Storage Manager for Mail, Data Protection for MS Exchange

The txngroupmax parameter must have a value of 12 or greater.

A single restore can require a full backup, a differential backup, or multiple incremental backups. We recommend using collocation if these backups are stored on removable media. Use a collocation by file space if you plan to restore multiple storage groups in parallel. This is recommended because all data for any one storage group is required within one Storage Manager Server file space.

Tivoli Storage Manager for Advanced Copy Services

Increase the value of the commtimeout option in the dsmserv.opt file to 600 seconds to prevent a time-out from occurring during large database backups.



Tivoli Storage Manager upgrade considerations

In this chapter we cover some upgrade procedures for IBM Tivoli Storage Manager environment. We describe both general considerations and specifics of upgrade procedures on AIX and Windows platforms. Linux, Solaris, and HP-UX are similar to the AIX procedures.

22.1 General upgrade considerations

When you move from one version of Tivoli Storage Manager to another, you are not just upgrading the server instance. The whole Tivoli Storage Manager environment consists of numerous components, such as tape devices, clients, and storage agents, that might be affected by the server upgrade. Therefore, we explain various consequences of the server migration to the rest of the environment and considerations you should take before upgrading the server.

Since the upgrade may involve hardware migration as well, we provide general techniques on how to migrate from one tape technology to another and what steps are needed to migrate data between libraries.

We show here a specific instance of upgrading to Tivoli Storage Manager V5.3.2; however, in general, similar principles apply. Always carefully read any readme files or flashes related to the version that you are upgrading to, as well as the Installation Guide manual, for any specific considerations.

22.1.1 Server

Generally, you can upgrade to the Tivoli Storage Manager Server V5.3.x from any previous version. The amount of time needed to upgrade from V5.2 to 5.3.x is negligible, and the change in database size is also negligible. Versions older than V5.2 will take longer to upgrade and may cause an increase in database size. Essentially, the older the version relative to the new version, the longer the upgrade process will take. Therefore, in general we recommend trying to stay as current as possible with product releases.

When upgrading multiple servers participating in library sharing to V5.3.x, the server acting as library manager must be upgraded first to maintain compatibility among the servers acting as library clients or storage agents. When upgrading multiple servers participating in server-to-server communication to V5.3.x, all servers must be upgraded at the same time.

Database

Before upgrading, perform a full backup of your database and save your Tivoli Storage Manager executables. If you need to revert to a previous release, you will have to restore from that database backup.

For AIX, Solaris, Linux, Windows, and HP-UX servers, the Tivoli Storage Manager database is automatically upgraded during the installation of the Tivoli Storage Manager V5.3.x server. After this database upgrade, you can no longer run a previous version of the server with the database, so to revert to a previous version, you would have to restore the corresponding database.

Bear in mind that if you upgrade to Tivoli Storage Manager 5.3.x from any previous release and you have Windows clients that back up their system objects, you should take specific actions to clean up the orphaned system object entries in the database. For details see the IBM Support Web site at:

<http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html>

FILE volumes and paths to FILE devices

When the V5.3 server starts, existing FILE volumes in a FILLING state are marked as full. In V5.2.x and earlier servers, the server accepted a PATH definition for a local FILE library and FILE drives, although it was not used in any way. Such definitions are not accepted by a V5.3 server and are rejected. This could be problematic if these definitions are contained in a devconfig file, and must be removed manually.

Password length

When the server database is upgraded to V5.3.0 or later, the encryption level of stored passwords is converted from DES 56-bit to AES 128-bit. During the conversion, decrypted passwords are checked against the server minimum password length setting. If a password is shorter than the minimum length, an invalid password error message is issued and the database upgrade fails.

Passwords shorter than the minimum length can exist if the server's minimum password length setting has been changed. Changing the setting does not affect existing passwords. The new password length is only enforced when passwords are first registered or updated. Any previously created or expired passwords that do not meet the current length requirement are considered invalid during the database upgrade.

If there is any possibility that shorter passwords are stored in the server database, use the following upgrade procedure:

1. Temporarily set the minimum password length to zero (0). To change the minimum password length, you can use either the Administration Center or the SET MINPWLENGTH command.
2. Back up the current server database.
3. Install the new version of Tivoli Storage Manager.
4. Reset the minimum password length to the desired value.

Transition version of administrative Web interface

The Administrative Web interface has been replaced with a completely new Web-based interface called Administration Center. Together with the Integrated Solution Console (ISC) that provides a framework for Administration Center, you

can administer all Tivoli Storage Manager V5.3 and later servers from a single point. The Administration Center is independent of the Tivoli Storage Manager instance—it may run on the same system as a server or on a separate system entirely. Since the Administration Center does not support previous versions of the Tivoli Storage Manager (prior to V5.2), you are still required to administer those using the old administrative Web interface. The old administrative Web interface will not be enhanced or have defect support.

Discontinued server platform support

The following Tivoli Storage Manager server operating systems supported in V5.2 were not migrated to V5.3 and are not supported in V5.3:

- ▶ OS/390 V2R10 and z/OS V1R1, V1R2, and V1R3
- ▶ z/VM® (You may want to migrate your IBM Tivoli Storage Manager z/VM servers to Linux.)
- ▶ HP-UX 11.0
- ▶ Red Hat Enterprise Linux Server 2.1
- ▶ SLES 7
- ▶ OS/400 PASE

22.1.2 Clients and Data Protection modules

As part of a migration plan from Tivoli Storage Manager V5.2 to V5.3.x, the clients and servers may be upgraded at different times. However, to help prevent disruption to your backup and archive activities during the migration, note the following:

- ▶ V5.2 clients can perform backup, restore, archive, and retrieve functions to a Tivoli Storage Manager V5.3 server.
- ▶ V5.3 clients can perform backup, restore, archive, and retrieve functions to a Tivoli Storage Manager V5.2 server, including V3.1-level functions to a Tivoli Storage Manager V3.1 server on VM.
- ▶ V5.2 HSM clients can perform migrate and recall functions to a Tivoli Storage Manager V5.3 server.
- ▶ V5.3 HSM clients can perform migrate and recall functions to a Tivoli Storage Manager V5.2 server.
- ▶ Data that was backed up from a V5.3 client to a Tivoli Storage Manager server can be restored using a V5.2 client, except for files backed up using 128-bit encryption.
- ▶ Data that was backed up from a V5.1 or V5.2 client to a Tivoli Storage Manager server can be restored using a Tivoli Storage Manager V5.3 client.

- ▶ V5.2 and V5.3 command-line administrative clients can administer Tivoli Storage Manager V5.2 and V5.3 servers, and the V3.1 VM server.
- ▶ The Motif native GUI on UNIX clients was not migrated to V5.3. The Java GUI client should be used instead.

Error log behavior change

Beginning with V5.3, client applications will not run without a writable log. If you start dsmadmc or dsmc as non-root, and if the option ERRORLOGNAME in dsm.sys points to a file that is not writable by non-root users, error message ANS1398E is displayed and the session does not start.

The following new rules apply (using dsrror.log as an example, but all logs are treated equally). The different error logs for the backup-archive client are explained in “Environment variables” on page 113 under DSM_LOG:

1. If the log does not exist, it will be created as follows (with default permissions):
 - With the name and in the directory specified in the ERRORLOGNAME option.
 - If the ERRORLOGNAME option is absent, the log will be created with the name dsrror.log in the directory specified in the DSM_LOG environment variable, if present.
 - Otherwise, the log will be created with the name dsrror.log in the current working directory.
 - Because default permissions are used, a log created by the root user might not be writable by any other user. If this is the case, the root user must set the proper permissions or ACLs to allow free use of the Tivoli Storage Manager application by all users who need to use it.
2. If the log is successfully created, an error-free session will leave a zero-length (empty) log file.
3. The client does not attempt to create logs in the root directory. ANS1398E is displayed when the method in rule 1 directs the log file to be created in the root directory.
4. If a log file exists and can be located using the method in rule 1, it will be used (and it can be in the root directory if you choose). Furthermore, whatever permissions you give that log file will be preserved by Tivoli Storage Manager.

We recommend that you create your log file before running the client, to make sure all eligible users have write access to that log. Use the ERRORLOGNAME option or the DSM_LOG environment variable to designate your predefined log file.

Further, certain background Tivoli Storage Manager applications might fail to start due to errors writing to dsrror.log. When these errors occur, a number of errors are recorded in the Windows event log (the System log on other platforms). An example is an error indicating that dsrror.log could not be written to, as shown in Example 22-1.

Example 22-1 Scheduler service fails to start due to errors writing to dsrror.log

```
C:\Program Files\Tivoli\Tsm\bclient>net start "TSM Sched"  
The TSM Sched service is starting.  
The TSM Sched service could not be started.  
A service specific error occurred: 12.
```

Additional setup steps are required for non-root users to run Tivoli Storage Manager applications or Tivoli Storage Manager for Data Protection applications. You will receive the ANS1398E error if you attempt to run Tivoli Storage Manager applications using an error log that has already been generated by root that is left with default permissions. For data protection clients, you might only receive a Tivoli Storage Manager API error.

Here is one method for setting up dsrror.log for use by non-root users:

1. Set ERRORLOGNAME in dsm.sys. For example, enter errorlogname /var/msgs/tsm/dsrror.log.
2. Generate a starter dsrror.log by issuing the **dsmc query session** command.
3. Modify the permissions on dsrror.log to allow writing by all users, for example, by entering the **chmod 666 /var/msgs/tsm/dsrror.log** command.

Discontinued client platform support

The following clients or client operating system levels were not migrated to V5.3. The V5.2 clients that support these operating systems can be used with the V5.3 Tivoli Storage Manager servers.

- ▶ Macintosh 10.1, 10.2
- ▶ Linux IA64
- ▶ HP-UX 11.0
- ▶ Linux Red Hat Advanced Server 2.1
- ▶ SLES 7
- ▶ NetWare 6.0
- ▶ Solaris 7
- ▶ OS/400 V5R1 (API client)
- ▶ OS/390 V2R10 and z/OS V1R1, V1R2, and V1R3
- ▶ SGI

- ▶ Tru64 UNIX
- ▶ Windows NT
- ▶ AIX AFS/DFS

The V5.2 clients can be downloaded from the Tivoli Storage Manager support Web page at:

<http://www.ibm.com/support/search.wss?tc=SSGSG7&rs=663&rank=8&dc=D400&dttm>

Data Protection for Informix

The Data Protection for Informix component of Tivoli Storage Manager for Databases, which is supported in V5.2, was not migrated to V5.3 and is not supported in V5.3. The latest release of IBM Informix Dynamic Server (IDS) is automatically enabled to back up to Tivoli Storage Manager and does not require Tivoli Storage Manager for Databases. If you are using previous versions of IDS and want the Data Protection for Informix component, you can only obtain it by separately purchasing Tivoli Storage Manager for Databases V5.2.

22.1.3 Storage Agent

Only Storage Agents V5.2.3, 5.2.4 (and later), and 5.3.x are supported by Tivoli Storage Manager V5.3.x. Before moving to V5.3, you must ensure that your Storage Agents are upgraded to one of these levels.

Note that Storage Agents at the Version 5.2.x level cannot access shared FILE volumes (using SANergy®) on 5.3.x servers using LAN-free protocols. Requests by 5.2.x Storage Agents are automatically re-directed to the server and handled using LAN protocols.

Discontinued Storage Agent platforms

The following Tivoli Storage Manager Storage Agent operating systems, supported in V5.2, were not migrated to V5.3 and are not supported in V5.3:

- ▶ HP-UX 11.0
- ▶ Red Hat Enterprise Linux Server 2.1
- ▶ SLES 7

22.2 Server upgrade best practices

When planning to upgrade your server, we recommend that you have a standby machine where the upgrade procedure and additional steps may be thoroughly tested and reviewed before rolling the upgrade procedure on to the production server.

22.2.1 Server quiesce

Before upgrading the server, the server instance should be as idle as possible. Consider the following:

1. Perform the scheduled upgrade during a period of little or no activity if possible.
2. Change the migration thresholds on the disk pools so as to move all the data to the tape pools before starting the upgrade.
3. Make a copy of your server options file, dsmserv.opt.
4. Disable the central scheduler (add DISABLESCHEDS YES to dsmserv.opt)
5. Cancel all remaining processes and sessions (issue the **disable sessions** command).
6. Add to the dsmserv.opt file EXPINTERVAL 0, which keeps expiration from running at startup.
7. Add to the dsmserv.opt file the NOMIGRRECL option, which keeps both migration and reclamation from running on the server at startup. Note that this is an undocumented command.
8. After you complete the upgrade, you can merge the original server options file to the current version, since some default options may have changed.

22.2.2 Backing up important components

Now, when the server is idle, you may proceed with the preparation steps, as follows:

1. Back up your primary disk and sequential storage pools.
2. Back up your server database.
3. Back up device configuration file (devconfig).
4. Back up volume history (volhist).
5. Make a copy of the dsmserv.dsk files and keep it in a safe place, since it contains database and recovery log volumes' file names and locations.
6. Make a copy of the dsmserv.opt files and keep in safe place, as it contains all of your server instance options. Note that if you already made the recommended changes to the server options file as described in the previous section, you should already have saved a copy of the file.
7. Halt your server instance.

22.2.3 Upgrading the server

Once the server instance is halted, you may perform the upgrade. This procedure differs among platforms, since each supported operating system has its native way to install software packages.

Nevertheless, one common approach applies to all platforms. When upgrading the server we distinguish between applying maintenance (base) and patch (fix) packages.

The base level code must applied first, then the patch level may be installed. Hence, if you intend to upgrade your server from Version 5.2.7.0 to 5.3.2.2, you must first upgrade to the base level (that is, to 5.3.2.0), and subsequently apply the 5.3.2.2 patch.

Then, after applying the base level, we recommend that you start your server instance in the foreground to see whether a database upgrade is required. If so, upgrade the database using the **dsserv upgrade** command and then go on with applying the appropriate patch to your server.

22.2.4 Testing new updates

After successfully upgrading your server instance, you should test the upgraded server instance as follows:

1. Start your server instance in the foreground and watch for any suspicious behavior or messages during startup in the console window.
2. Disable client sessions immediately after server startup.
3. Verify license status.
4. If device drivers were upgraded/installed as well, redefine paths.
5. Test your library and tape drives. Once drives/paths are defined and online, test with the **move data** command to verify that volumes can be mounted (in the correct drive) and can be read and written. Move data on a volume with a small amount of data.
6. Review any changed default server options, as well as new options, and test them in your environment.

If your upgrade is successful and you are not experiencing any difficulties, you should back up your database along with other important files before re-enabling production mode.

22.2.5 Enabling production mode

If your upgraded server instance seems to be in order, you may take the server out of idle state by following these steps:

1. Remove the nomigrrecl and disablescheds options and change expinterval to the desired value, in the dsmserv.opt file.
2. Raise the migration thresholds of your storage pools to the desired value.
3. Restart your server instance.
4. Run client tests. Try backing up and restoring an object or file space.

Following these outlined recommendations should make your upgrade procedure uncomplicated and safer, since you have your database along with other supporting files backed up. Should an upgrade procedure fail, you are able to bring your server instance back to the original level using these backed components.

We will now show some sample server upgrade procedures.

22.3 Performing server upgrades

In this section we discuss specific steps for upgrading the Tivoli Storage Manager V5.2 server running on Windows 2003 and AIX 5.3 to the latest version available at the time of writing this book, which is 5.3.2.2. For more information, refer to the *IBM Tivoli Storage Manager Installation Guide* manual for your server platform.

Bear in mind that whenever you are about to upgrade your Tivoli Storage Manager server, prior to migration you need to back up the following items:

- ▶ The IBM Tivoli Storage Manager database (**backup db**)
- ▶ The volume history file (**backup volhist**)
- ▶ The device configuration file (**backup devconfig**)
- ▶ The dsmserv.opt file
- ▶ The dsmserv.dsk file

You should also consider that the later versions contain more features and might therefore require additional database space. We recommend that you increase your database size by 5% prior to migration and reduce it after the migration when the database space has stabilized.

Make sure that the current storage devices you are using are supported by the new Tivoli Storage Manager version. Refer to the device support section of the Tivoli Storage Manager Web site at:

<http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html>

22.3.1 Migration on Windows

The objective of the test is to migrate Tivoli Storage Manager server V5.2.7.0 to V5.3.2.2. Before upgrading our server, we checked V5.3 server-specific requirements and support on the Web site:

http://www.ibm.com/support/docview.wss?rs=663&context=SSGSG7&uid=swg21064234&loc=en_US&cs=utf-8&lang=en

We used a Windows 2003 server with an IBM 3582 LTO library. Figure 22-1 shows the setup in our test environment.

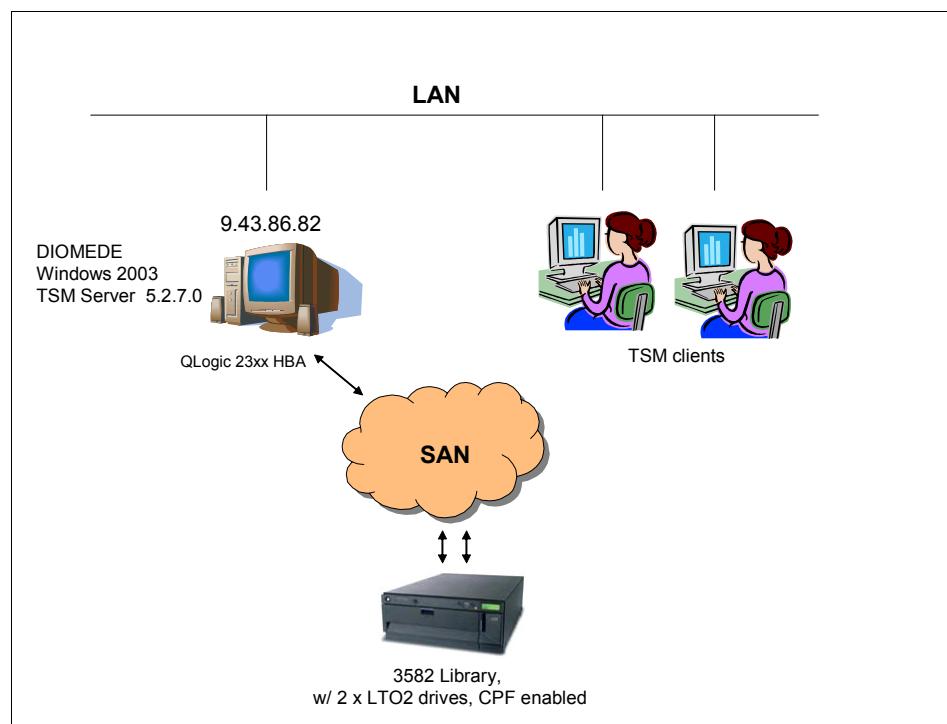


Figure 22-1 Windows lab environment

Generally, you can install a new Tivoli Storage Manager server version over a previous version of the server. This is called a *migrate install*. This means that

you do not need to uninstall the previous server before applying new one, since this is done automatically by the migration procedure.

When you upgrade multiple servers participating in library sharing to V5.3, the servers acting as library manager must be upgraded first to maintain compatibility among the servers acting as library clients or Storage Agents. When you upgrade multiple servers participating in server-to-server communication to V5.3, all servers must be upgraded at the same time.

Migration procedure

As a general rule, follow the recommendations in 22.1, “General upgrade considerations” on page 692, that is, quiesce the server instance and then back up the database and supporting files.

Apart from that, you should consider cleaning up the database by running the **expire inventory** command. Also, If your server is currently at a release earlier than V5.2, there might be additional steps you should take in preparation for upgrading to V5.3, such as expiration of system object file spaces. If you do not back up Windows clients or do not back up *system objects* on the Windows client, you are not affected by this problem. For details about these steps see the following IBM Web site:

http://www.ibm.com/support/docview.wss?rs=663&context=SSGSG7&q1=1078582&uid=swg21078582&loc=en_US&cs=utf-8&lang=en

Note: When migrating to Tivoli Storage Manager V5.3, the time necessary to install the packages can be considerable, depending on the number of Windows clients registered. The more Windows clients registered, the longer it will take to install the package.

Once you have finished the preparation phase, you may start the migration running the Tivoli Storage Manager setup wizard. Keep in mind that the base level (that is, 5.3.2) must be installed first, and then you may apply the patch (5.3.2.2).

Also note that installation will be stopped and the error message shown in Figure 22-2 will display if a running server or Storage Agent process is detected. All active servers must be halted before installation can proceed.



Figure 22-2 Migration failure due to running server process

Generally, you should upgrade your server environment in the following sequence:

1. Server
2. Server licenses
3. Language packs, if needed
4. Device Driver, if needed (requires reboot)

Your database is automatically upgraded during migration (see Figure 22-3).

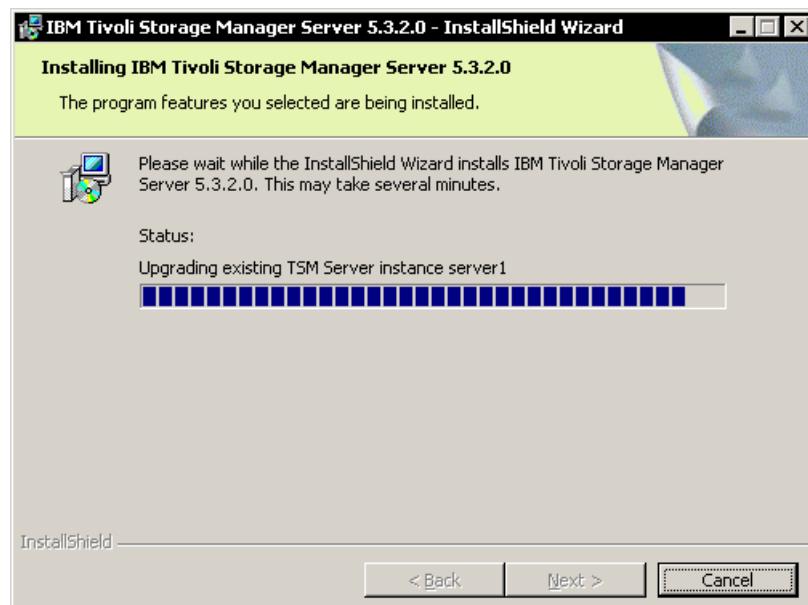


Figure 22-3 Automatic server instance upgrade during migration

Licensing has changed in V5.3. Although the server still reports the number of various clients in use, you no longer have to explicitly register licenses per client type. Instead, you have three licenses files available:

- ▶ tsmbasic.lic for the Basic Edition of the server
- ▶ tsmee.lic for the Extended edition of the server
- ▶ dataret.lic for the IBM System Storage Archive Manager

The installation wizard will automatically perform conversion to the required license status, since it removes the license files first and subsequently installs a new license package. You can see the server license status in the bottom of server console output, as shown in Example 22-2.

Note that if you upgraded the Tivoli Storage Manager Device Driver as well, the installation wizard requires a reboot of the machine (see Figure 22-4).

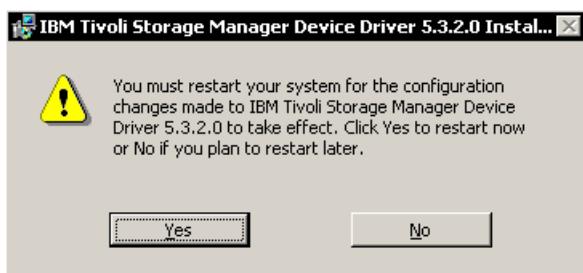


Figure 22-4 Device driver upgrade requires reboot of the machine

After you have all packages installed and the machine is rebooted, start the server instance in the foreground, as shown in Example 22-2. If everything seems to be in order and you are not getting any errors, halt the server by entering the **halt** command on the console prompt and continue applying the 5.3.2.2 patch.

Example 22-2 Server startup on the foreground

```
C:\Program Files\Tivoli\TSM\server>dsmserv
ANR0900I Processing options file c:\program files\tivoli\tsm\server1\dsmserv.opt.
ANR7800I DSMSERV generated at 11:34:40 on Sep 27 2005.
```

Tivoli Storage Manager for Windows
Version 5, Release 3, Level 2.0

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restricted by GSA ADP Schedule Contract with IBM Corporation.

ANR4726I The ICC support module has been loaded.
ANR0990I Server restart-recovery in progress.
ANR0200I Recovery log assigned capacity is 200 megabytes.
ANR0201I Database assigned capacity is 4096 megabytes.
ANR0306I Recovery log volume mount in progress.
ANR0285I Database page shadowing started using file dbpgshdw.bdt.
ANR0353I Recovery log analysis pass in progress.
ANR0354I Recovery log redo pass in progress.
ANR0355I Recovery log undo pass in progress.
ANR0352I Transaction recovery complete.
ANR1635I The server machine GUID, 57.47.aa.41.98.e8.11.da.81.34.00.0d.60.49.4c-.39, has initialized.
ANR2100I Activity log process has started.
ANR4726I The NAS-NDMP support module has been loaded.
ANR4726I The Centera support module has been loaded.
ANR4726I The ServerFree support module has been loaded.
ANR2803I License manager started.
ANR1305I Disk volume C:\TSMDATA\SERVER1\DISK2.DSM varied online.
ANR8260I Named Pipes driver ready for connection with clients.
ANR8280I HTTP driver ready for connection with clients on port 1580.
ANR4747W The web administrative interface is no longer supported. Begin using the Integrated Solutions Console instead.
ANR2560I Schedule manager started.
ANR0993I Server initialization complete.
ANR0916I TIVOLI STORAGE MANAGER distributed by Tivoli is now ready for use.
ANR8200I TCP/IP driver ready for connection with clients on port 1500.
ANR2828I Server is licensed to support IBM System Storage Archive Manager.
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.
TSM:DIOMEDE>

Applying the patch level (in our case 5.3.2.2) is straightforward and practically the same process as the installation of the base level. The only difference is that patches lack license and language packs, so you need to upgrade only your server and device driver code.

During upgrade, the installation wizard performs necessary updates to the server code, as shown in Figure 22-5.

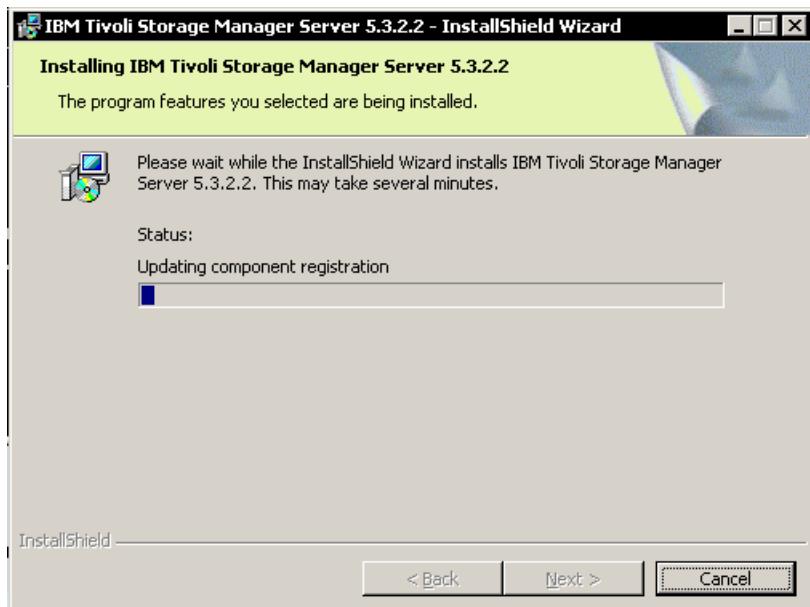


Figure 22-5 Updating the server instance: applying the patch level

Following a successful server upgrade you may patch the Tivoli Storage Manager Device Drivers, if used. However, this requires another reboot of the machine.

Again, after the server upgrade, you should follow the recommendations described in 22.2.4, “Testing new updates” on page 699. That essentially means starting the server, either in the foreground or the background; observing the server console output for any unusual messages and errors; and redefining your paths if devices have changed during device drivers update. Last but not least, you should test that your drives can read and write data by moving data from one volume to another.

If your verification tests do not reveal any problems, you may enable your server for production by following the steps given in 22.2.5, “Enabling production mode” on page 700.

Finally, you should back up your storage pools and database and create a new disaster recovery plan file. Refer to the *IBM Tivoli Storage Manager for Windows Administrator’s Guide*, GC32-0782, for more information.

22.3.2 Migration on AIX 5L

Our environment, as illustrated in Figure 22-6 on page 708, consists of an AIX 5.3 system called BANDA connected together with an IBM 3582 library to the SAN. The objective of the test is to describe the migration of Tivoli Storage Manager from V5.2.2.0 to V5.3.2.2.

The minimum supported version of AIX 5L by Tivoli Storage Manager V5.3 is AIX 5.1. You can install Tivoli Storage Manager V5.3 over a previous version without uninstalling it first.

The installation procedure uninstalls the old filesets on its own, then applies new filesets. However, If you are running the 32-bit version of Tivoli Storage Manager V5.2 in a 64-bit AIX kernel environment, you must uninstall your current version and then install the appropriate Tivoli Storage Manager V5.3 packages for the 64-bit kernel environment.

The same approach applies to the reverse case. If you are running the 64-bit version of Tivoli Storage Manager V5.2 in a 32-bit AIX kernel environment, you must uninstall your current version and then install the appropriate Tivoli Storage Manager V5.3 packages for the 32-bit kernel environment.

For an overview of which packages to install in different environments, see Table 22-1 on page 709.

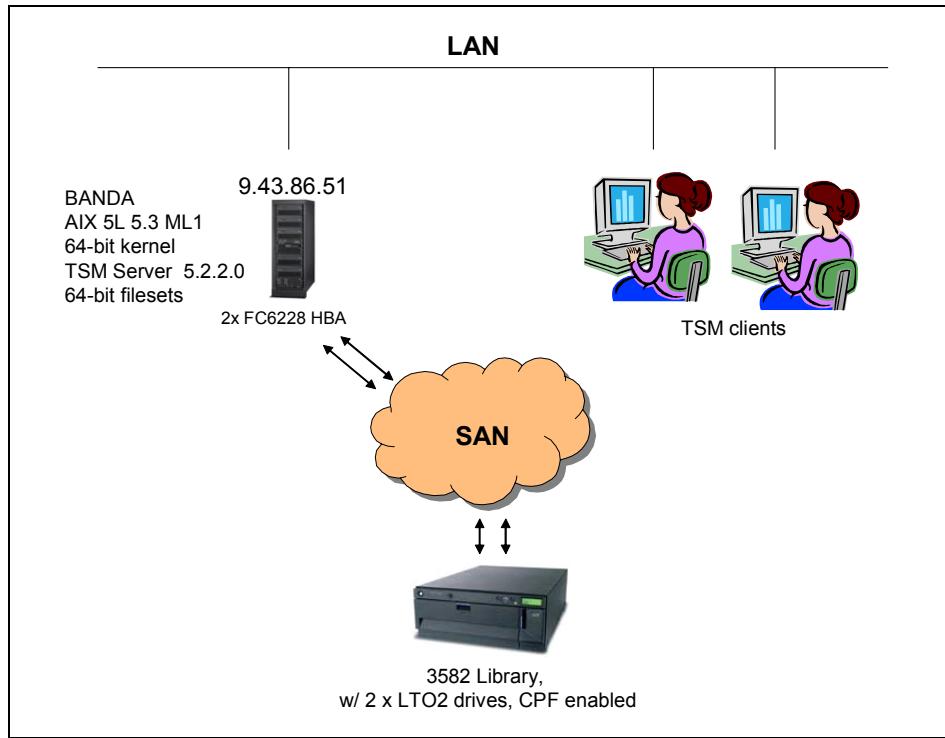


Figure 22-6 AIX lab environment

In any case, we recommend that you thoroughly check software and hardware requirements for Tivoli Storage Manager V5.3 on the IBM Web site:

http://www.ibm.com/support/docview.wss?rs=663&context=SSGSG7&uid=swg21052220&loc=en_US&cs=utf-8&lang=en

Note: If installing Tivoli Storage Manager V5.3 on AIX V5.1, you must first upgrade the C++ Runtime for AIX to V6 (xlc.rte.6.0.0.0 and later). This fileset is installed by default on AIX 5.2 and later.

Table 22-1 Software to install for different AIX environments

Environment	Software packages to install
32-bit AIX kernel	tivoli.tsm.devices.accls - STK Silo support (optional) tivoli.tsm.devices.aix5.rte - device support tivoli.tsm.server.com - server samples and diagnostic utilities tivoli.tsm.server.rte - server runtime tivoli.tsm.msg.en_US.server - message library and help tivoli.tsm.msg.en_US.devices - SMIT menu catalogs tivoli.tsm.license.rte - license enablement module tivoli.tsm.license.cert - license certificates tivoli.tsm.server.webcon - redirecting webmod to AdminCenter
64-bit AIX kernel	tivoli.tsm.devices.accls - STK Silo support (optional) tivoli.tsm.devices.aix5.rte - device support tivoli.tsm.server.com - server samples and diagnostic utilities tivoli.tsm.server.aix5.rte64 - server runtime tivoli.tsm.msg.en_US.server - message library and help tivoli.tsm.msg.en_US.devices - SMIT menu catalogs tivoli.tsm.license.aix5.rte64 - license enablement module tivoli.tsm.license.cert - license certificates tivoli.tsm.server.webcon - redirecting webmod to AdminCenter
If running server in a language other than US English	tivoli.tsm.msg.<your-language>.server - Message Library and Help tivoli.tsm.msg.<your-language>.devices - SMIT menu catalogs

The database is automatically upgraded during a migrate installation. However, if you are running additional Tivoli Storage Manager server instances on the same system, you must manually upgrade the database for each instance using the **dsmser upgradeadb** command.

If you are using the Tivoli Storage Manager server in an HACMP cluster and want to migrate to V5.3 from any previous version, you will need to convert to the new startserver script. Device resets are no longer performed by the startserver script. They are now done by the server during initialization of the library. If the resetdrives parameter is set to yes for a library, then the reset will be performed on the library manager for the library and all drives defined to it. If a library is defined as *shared*, the resetdrives parameter automatically defaults to yes for the library. Otherwise, you can run the **update library** command with resetdrives=yes. More information about HACMP with Tivoli Storage Manager is in the chapter “High availability clustering” in *IBM Tivoli Storage Management Concepts*, SG24-4877.

Migration procedure

We show the procedure to upgrade a Tivoli Storage Manager V5.2.2.0 server to V5.3.2.2 on AIX Version 5.3. As described earlier, migration is a two-step process. First we must install the base level (5.3.2) and then the fix level (5.3.2.2).

Example 22-3 shows the currently installed Tivoli Storage Manager filesets on Banda before the upgrade. Since we have the 64-bit AIX kernel, we are using 64-bit server filesets. If we had been using the 32-bit filesets in our 64-bit AIX kernel, we would have to uninstall those and install new appropriate filesets, as described in Table 22-1 on page 709.

Example 22-3 IBM Tivoli Storage Manager Version 5.2.2.0 filesets on BANDA

root@banda> ls1pp -L grep -i tivoli				
<i>tivoli.tsm.devices.aix5.rte</i>				
	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.license.aix5.rte64</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.license.cert</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.loc.server.elas</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.msg.en_US.devices</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.msg.en_US.webhelp</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>Web</i>				
<i>tivoli.tsm.server.aix5.rte64</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.server.com</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager
<i>tivoli.tsm.server.webadmin</i>	5.2.2.0	C	F	IBM Tivoli Storage Manager

Before you begin with the actual server migration, follow the steps outlined in 22.2, “Server upgrade best practices” on page 697, particularly those related to quiescing your server instance and backing up all necessary components of your server.

Apart from those, you should know that the Tivoli Storage Manager device definitions might not be preserved after migration. Therefore, after the installation you may have to redefine Tivoli Storage Manager devices. We recommend that you record your current device definitions to a text file before you begin the installation, as shown below:

```
1sdev -Cs fcp > definitions.fcp  
1sdev -Cs scsi > definitions.scsi
```

Note: You do not have to record definitions for IBM 3494, 3570, 3575, 3590, LTO, and 3592-type devices. These devices use the IBM-supplied drivers, not the Tivoli Storage Manager device drivers and will not be affected by the upgrade.

Also note that a migrate installation will not normally create a new database, recovery log, and storage pool volumes. However, if `dsmserv.dsk` is not in the `/usr/tivoli/tsm/server/bin` directory, the installation creates the following volumes in the `/usr/tivoli/tsm/server/bin` directory:

- ▶ Database volume (`db.dsm`)
- ▶ Recovery log volume (`log.dsm`)
- ▶ Storage pool volumes (`backup.dsm`, `archive.dsm`, and `spcmgmt.dsm`)

To use your existing database, recovery log, and storage pool volumes, ensure that a copy of the `dsmserv.dsk` file is in `/usr/tivoli/tsm/server/bin` and the file system is mounted before you do a migrate installation. You must not move the database, recovery log, and storage pool volumes.

Once you have finished all recommended steps, you must stop all of your running Tivoli Storage Manager server instances, either using the administrative CLI `halt` or the operating system `kill` command. We ensured that our server instance is not running, as shown in the Example 22-4.

Example 22-4 Server instance is not running

```
# ps -ef | grep dsmserv
root 426034 434374 0 09:06:43 pts/7 0:00 grep dsmserv
```

Provided that you have your installation media ready, you may begin with the migration procedure. Start SMIT and select **Software Install and Maintenance → Install and Update Software → Install and Update from ALL Available Software**.

Specify the INPUT device/directory, select **SOFTWARE to Install**, and select the appropriate filesets to install for your configuration (see Table 22-1 on page 709,

Set “COMMIT software updates?” to Yes, “SAVE replaced files?” to No, and “Accept new LICENSE agreements?” to Yes.

Note: You cannot reject a fileset once installed. You will have to uninstall it if needed.

Following a successful fileset installation using SMIT, you get SMIT output as shown in Example 22-5.

Example 22-5 SMIT installation summary report

Installation Summary				
Name	Level	Part	Event	Result
tivoli.tsm.server.com	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.server.com	5.3.2.0	ROOT	APPLY	SUCCESS
tivoli.tsm.server.aix5.rte6	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.server.aix5.rte6	5.3.2.0	ROOT	APPLY	SUCCESS
tivoli.tsm.loc.server.el1	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.license.cert	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.license.aix5.rte	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.devices.acs1s	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.devices.acs1s	5.3.2.0	ROOT	APPLY	SUCCESS
tivoli.tsm.server.webcon	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.devices.aix5.rte	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.devices.aix5.rte	5.3.2.0	ROOT	APPLY	SUCCESS
tivoli.tsm.msg.en_US.device	5.3.2.0	USR	APPLY	SUCCESS
tivoli.tsm.msg.en_US.server	5.3.2.0	USR	APPLY	SUCCESS

After your new filesets are applied, verify that any previous version filesets are removed, as shown in Example 22-6, and that you have only 5.3 filesets installed.

Example 22-6 Listing of installed base level server filesets

```
root@banda> lsLpp -L | grep -i tivoli
tivoli.tsm.devices.acs1s 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.devices.aix5.rte
    5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.license.aix5.rte64
    5.3.2.0 C F IBM Tivoli Storage Manager 64
tivoli.tsm.license.cert 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.loc.server.el1 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.msg.en_US.devices
    5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.msg.en_US.server
    5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.server.aix5.rte64
    5.3.2.0 C F IBM Tivoli Storage Manager 64
tivoli.tsm.server.com 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.server.webcon 5.3.2.0 C F IBM Tivoli Storage Manager Web
```

Now you may start the server instance on the foreground to check whether database upgrade was performed or if you are required to do it manually using the **dsmsserv upgradedb** command. In most cases, database upgrade should be automatically performed as part of the migration.

After verifying the server, you need to halt the server again and proceed with applying the fix level to your base level server.

In contrast to base-level installation, you do not need to run SMIT installation using the “Install and update from ALL available software” option. Instead, just type `smitty update_all` on the shell prompt and follow the SMIT screens to apply your patch filesets.

When your installation is finished, you may review the installed filesets level using the `1slpp -L` command, as shown in Example 22-7.

Example 22-7 Listing of server filesets after applying the patch level

```
root@banda> 1slpp -L | grep -i tivoli
tivoli.tsm.devices.acs1s 5.3.2.2 C F IBM Tivoli Storage Manager
tivoli.tsm.devices.aix5.rte
                           5.3.2.2 C F IBM Tivoli Storage Manager
tivoli.tsm.license.aix5.rte64
                           5.3.2.0 C F IBM Tivoli Storage Manager 64
tivoli.tsm.license.cert 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.loc.server.elas 5.3.2.0 C F IBM Tivoli Storage Manager
tivoli.tsm.msg.en_US.devices
                           5.3.2.2 C F IBM Tivoli Storage Manager
tivoli.tsm.msg.en_US.server
                           5.3.2.2 C F IBM Tivoli Storage Manager
tivoli.tsm.server.aix5.rte64
                           5.3.2.2 C F IBM Tivoli Storage Manager 64
tivoli.tsm.server.com 5.3.2.2 C F IBM Tivoli Storage Manager
tivoli.tsm.server.webcon 5.3.2.2 C F IBM Tivoli Storage Manager Web
```

Note that license filesets are not upgraded to the V5.3.2.2 since they were not part of the fix packages and they do not need explicit update.

Now you should follow the steps described in 22.2.4, “Testing new updates” on page 699. If the migration was successful, enable your server for production as described in 22.2.5, “Enabling production mode” on page 700.

In Example 22-8 we show startup of our upgraded server instance. As you can see, the server is properly licensed and the migration was successful.

Example 22-8 Upgraded server startup on the foreground

```
root@banda> ./dsmserv
ANR7800I DSMSERV generated at 19:57:13 on Nov 28 2005.

Tivoli Storage Manager for AIX-RS/6000
Version 5, Release 3, Level 2.2

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ANR0900I Processing options file dsmserv.opt.
ANR4726I The ICC support module has been loaded.
ANR0990I Server restart-recovery in progress.
ANR0200I Recovery log assigned capacity is 1024 megabytes.
ANR0201I Database assigned capacity is 4096 megabytes.
ANR0306I Recovery log volume mount in progress.
ANR0353I Recovery log analysis pass in progress.
ANR0354I Recovery log redo pass in progress.
ANR0355I Recovery log undo pass in progress.
ANR0352I Transaction recovery complete.
ANR1635I The server machine GUID,
00.00.00.00.9d.8f.11.da.a1.b5.08.63.09.2b.56.33, has initialized.
ANR2100I Activity log process has started.
ANR4726I The NAS-NDMP support module has been loaded.
ANR1794W TSM SAN discovery is disabled by options.
ANR8200I TCP/IP driver ready for connection with clients on port 1500.
ANR2803I License manager started.
ANR8285I Shared Memory driver ready for connection with clients on port 1510
ANR2560I Schedule manager started.
ANR8190I HTTP driver ready for connection with clients on port 1580.
ANR4747W The web administrative interface is no longer supported. Begin using
the Integrated Solutions Console instead.
ANR1305I Disk volume /usr/tivoli/tsm/server/bin/disk01.dsm varied online.
ANR1305I Disk volume /usr/tivoli/tsm/server/bin/disk02.dsm varied online.
ANR1305I Disk volume /usr/tivoli/tsm/server/bin/disk03.dsm varied online.
ANR0993I Server initialization complete.
ANR0916I TIVOLI STORAGE MANAGER distributed by Tivoli is now ready for use.
ANR2828I Server is licensed to support IBM System Storage Archive Manager.
ANR2828I Server is licensed to support Tivoli Storage Manager Basic Edition.
ANR2828I Server is licensed to support Tivoli Storage Manager Extended Edition.
```

22.4 Performing client upgrades

In this section we discuss the steps for upgrading clients to V5.3.2 on AIX and Windows platforms. For more information, refer to the *IBM Tivoli Storage Manager Backup-Archive Client Installation and User's Manual* for your platform.

In contrast to the server upgrade process, you can directly install the desired version of the client. There is no need to install the base level first and then the patch level.

You may want to keep a separate copy of your client options files (dsm.opt for Windows, dsm.opt and dsm.sys for UNIX/Linux) before migration. In any case, these files will not be overwritten during the upgrade, as long as they exist in the installation directory.

For client hardware and software requirements and supported file systems see the Tivoli Storage Manager client support Web site at:

<http://www.ibm.com/support/search.wss?rs=663&tc=SSGSG7&atrn=Keywords&atrv=ClientRequirements>

22.4.1 Windows

Tivoli Storage Manager supports a wide variety of Windows server and workstation operating systems. For detailed requirements see the Web site:

http://www.ibm.com/support/docview.wss?rs=663&context=SSGSG7&uid=swg21197133&loc=en_US&cs=utf-8&lang=en

Essentially, you may directly install the desired client level over any previous client version. The InstallShield Wizard removes the previous client code and installs the new version.

Before you start with the migration, stop any client-related processes, such as client scheduler or Web client.

The upgrade will not replace existing client files, such as dsm.opt, dsrror.log, dsmsched.log, and dsmwebcl.log. Depending on the features chosen to be installed, the InstallShield Wizard may ask to reboot the machine after the installation is finished. This is the case when you specify to install or upgrade Image Backup and Open File Support client components.

After the upgrade is done, you may start the backup-archive client GUI or CLI interface to check whether the installation was successful and subsequently restart client services, such as the Web client and scheduler.

22.4.2 AIX 5L client upgrade

Below we describe the procedure to upgrade the client from V5.2.2.9 to 5.3.2.0.

Tivoli Storage Manager V5.3 backup-archive client code requires at least AIX V5.1 installed. Detailed requirements for installing the client on AIX 5L can be found at:

http://www.ibm.com/support/docview.wss?rs=663&context=SSGSG7&uid=swg21052226&loc=en_US&cs=utf-8&lang=en

Essentially, before you attempt to migrate your client version, ensure there are no client processes running on the system, such as client scheduler or the Web client and that no user is performing any operation using backup-archive client, as shown in Example 22-9.

Example 22-9 Check client processes

```
root@banda> ps -ef | grep dsmc
root 430112 434374 0 14:49:28 pts/7 0:00 grep dsmc
```

Client packaging has changed since V5.2. There are now two separate backup-archive client packages, called Client for JFS and Client for JFS2, depending on the AIX file system type you are using.

The Tivoli Storage Manager Client for JFS2 is not compatible with the Tivoli Storage Manager Client for JFS or GPFS. You first need to remove the Tivoli Storage Manager Client for JFS or GPFS before you install the Tivoli Storage Manager Client for JFS2.

Our Banda machine has 32-bit 5.2.2 client filesets installed, as shown in Example 22-10.

Example 22-10 Client V5.2.2 filesets

```
root@banda> ls1pp -L | grep -i tivoli | grep -iE "client|books"
tivoli.tsm.books.en_US.client.htm
tivoli.tsm.books.en_US.client.pdf
tivoli.tsm.client.api.32bit
tivoli.tsm.client.ba.32bit.base
tivoli.tsm.client.ba.32bit.common
tivoli.tsm.client.ba.32bit.image
tivoli.tsm.client.ba.32bit.nas
tivoli.tsm.client.ba.32bit.web
```

If you try to install the JFS2 client over the old JFS client, your installation will fail, as illustrated in Example 22-11.

Example 22-11 Client installation failure when installing JFS2 over JFS client

```
Performing Pre-Installation tasks for the TSM API Client.  
#*****  
tivoli.tsm.client.api.jfs2 and tivoli.tsm.client.api.32bit  
can not be installed together. You must choose which one to  
install. Aborting installation of fileset:  
    tivoli.tsm.client.api.jfs2.  
#*****  
instal: Failed while executing the tivoli.tsm.client.api.jfs2.pre_i script.
```

Therefore, we must uninstall them first following the SMIT menus, **Software Installation and Maintenance** → **Software Maintenance and Utilities** → **Remove Installed Software**.

When you supply fileset names, software uninstallation occurs. Note that client uninstall will not remove client configuration files.

Once the filesets are removed, you may proceed with the installation of the new client version filesets using the following SMIT menus: **Software Installation and Maintenance** → **Install and Update Software** → **Install and Update from ALL Available Software**.

Supply the device or directory name from which the filesets are to be installed, and choose which filesets to install.

We installed the following filesets:

```
tivoli.tsm.client.ba.jfs2  
tivoli.tsm.client.api.jfs2  
tivoli.tsm.books.en_US.client.htm
```

The tivoli.tsm.client.ba.jfs2 fileset contains the following packages:

```
tivoli.tsm.client.ba.jfs2.base  
tivoli.tsm.client.ba.jfs2.common  
tivoli.tsm.client.ba.jfs2.image  
tivoli.tsm.client.ba.jfs2.nas  
tivoli.tsm.client.ba.jfs2.web
```

When the installation is done, restart the client processes such as the client scheduler or Web client. In Example 22-12, we started the client CLI to verify that the installation was correct and successful.

Example 22-12 Upgraded version of the AIX client

```
root@banda> dsmc
IBM Tivoli Storage Manager
Command Line Backup/Archive Client Interface
  Client Version 5, Release 3, Level 2.0
  Client date/time: 03/01/06  14:42:33
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Node Name: BANDA
Session established with server LOCHNESS_SERVER1: Windows
  Server Version 5, Release 3, Level 2.2
  Server date/time: 03/01/06  14:38:17  Last access: 03/01/06  14:06:34

tsm>
```

22.5 Storage Agent upgrade

Generally, Storage Agent upgrade is a similar process to the server upgrade. However, since Storage Agent does not have its own database or license files, the migration is easier and faster. Further, you do not need to apply the base level first and then the fix level; you can directly upgrade to the desired Storage Agent version.

Before you start the migration, stop all running Storage Agent services.

22.5.1 AIX Storage Agent migration

Migration installation will occur if you try to install Storage Agent over your previous version. You do not have to uninstall your previous version. When the upgrade is finished, your prior version will disappear.

After the migration, Tivoli Storage Manager device definitions might not be preserved. Therefore, you may need to redefine the Tivoli Storage Manager devices after the installation. Before you begin the installation, record your current device definitions using following commands:

```
1sdev -Cs fcp > definitions.fcp
1sdev -Cs scsi > definitions.scsi
```

Note: You do not have to record definitions for IBM 3494, 3570, 3575, LTO, and 3592-type devices. These devices use IBM-supplied drivers, not the Tivoli Storage Manager device drivers and will not be affected by the upgrade.

22.5.2 Windows 2003 Storage Agent migration

The upgrade procedure is the same as an AIX Storage Agent migration. You may directly install the desired version over a previous one.

Ensure that all of your Storage Agent services are stopped before you attempt to begin the migration. Also note that if you use Tivoli Storage Manager Device drivers for your SAN tape devices, the installation wizard will ask you to restart the machine at the end of the migration procedure.

When rebooted, your Storage Agent service should be up and running.

22.6 Library migration

If you are introducing new tape technology into your environment, you will want to effectively migrate your data from the old library to the new one, with minimal disruption. Or you may want to migrate data from one storage pool, whose data is stored on old generation tapes to the new storage pool defined on the new generation.

Since storage pool hierarchy is fundamental to Tivoli Storage Manager, incorporating new storage technologies is an easy task.

Essentially, the solution is built on two concepts:

- ▶ Each storage pool must have a device class.
- ▶ Each storage pool's data may migrate to another storage pool.

Therefore, if you want to migrate data between libraries, do not think on the library level. Rather, consider that your library consists of one or more storage pools using one or more device classes.

Hence, data can be migrated from one library to another by setting up chains of storage pools, where on one side are storage pools in the library that are to be migrated and on the other side are storage pools data are migrated to.

Consider the following scenario: You have two libraries, LIB_A with LTO1 tape drives and a new library, LIB_B with LTO3 drives. In library LIB_A, you have two storage pools called archive_tape and backup_tape. In library LIB_B you have other storage pools called archiveLTO3 and backupLTO3.

You want your clients to back up to the new library from now on and you want to migrate all your existing data from all volumes in the old library LIB_A (that is, from LTO1 volumes) to the new library LIB_B (that is, to LTO3). You may accomplish this task as follows:

1. Define your library LIB_B along with the drives and respective paths.
2. Define the new device class for your new library LIB_B.
3. Define new storage pools in library LIB_B called archiveLTO3 and backupLTO3.
4. Change the destination value in your copygroups' options to the new storage pools (that is, archiveLTO3 and backupLTO3).
5. Activate the changed policy.
6. Change your old storage pools' nextstgpool option to point to the respective storage pools in the new library (to archiveLTO3 and backupLTO3).
7. Once defined, you may trigger the migration by lowering the migration threshold (highmig and lowmig) on your old storage pools, archive_tape and backup_tape. Since the migration from one library to another is a time-consuming process, you may control the migration by changing these values as desired.
8. Once all data is migrated, you may delete the old storage pool definition.

Analogous to tape library migration, you may set the migration on a single storage pool whose data resides on an old generation of tapes to another, new one.



Part 5

Appendices

In this part of the book we provide the following supplementary information:

- ▶ Appendix A, “Planning and sizing worksheets” on page 723
- ▶ Appendix B, “Book support material: macros and scripts” on page 729



A

Planning and sizing worksheets

In this appendix are the worksheets that we introduced and recommended in Chapter 1, “Implementation checklists” on page 3.

The book support material is available in soft copy on the Internet from the IBM Redbooks Web server. Point your Web browser to:

<ftp://www.redbooks.ibm.com/redbooks/SG245416>

Alternatively, you can get to the same Web page at:

<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg245416.html?Open>

Select **Additional Materials** and click the suggested link.

Worksheets grouped in tables

Table A-1 Client requirements worksheet

Category	Client 1	Client 2	Client 3	Client 4
Client name				
Contact information				
Operating system				
Total storage available (GB)				
Total storage used (GB)				
GB changed per backup				
Number of files backed up				
Data compression				
Backup window times				
Backup number of hours				
Required recovery time				
IBM Tivoli Storage Manager recovery time				
GB copied per archive				
Number of files archived				
Number of archives kept				
Archive frequency				
Archive window times				
Archive number of hours				
Number of image backups				
Image backup frequency				
Number of backup sets				
Backup set frequency				
Policy domain				
Client option set				

Table A-2 Storage policy requirements worksheet

Category	Example 1	Example 2	Example 3
Group name			
Number of backup versions			
Backup file retention period			
Number of deleted versions			
Last deleted file version retention period			
Archive retention period			
Off-site copies			
Onsite collocation			
Off-site collocation			
Image backup retention			
Backupset retention			

Table A-3 Database worksheet

Database volume	Filename (primary)	Size (MB)	Filename (copy)	Size (MB)

Table A-4 Recovery log worksheet

Log volume	Filename (primary)	Size (MB)	Filename (copy)	Size (MB)
	Total		Total	

Table A-5 Device configuration and volume history worksheet

Category	Size (MB)
Total	

Table A-6 Total IBM Tivoli Storage Manager disk required worksheet

Category	Size (MB)
IBM Tivoli Storage Manager software (dependent on platform)	
IBM Tivoli Storage Manager database	
IBM Tivoli Storage Manager recovery log	
IBM Tivoli Storage Manager primary storage pools	
Device configuration table and volume history table	
Other (RAID, operating system)	
Total	

Table A-7 Tape drive configuration worksheet

Category	Option
Library model	
Number of drives	
Drive model	
Number of on-site tape volumes	

Category	Option
Number of off-site tape volumes	
Number of database volumes	
Number of scratch tapes	
Number of backupset tape volumes	
Total tape volumes required	

Table A-8 Administrator IDs worksheet

Functions	IBM Tivoli Storage Manager ID	Authority



B

Book support material: macros and scripts

This appendix contains listings of support material for this book. See section 1.1.1, “Our support material” on page 5, for considerations regarding this material.

The book support material is available in soft copy on the Internet from the IBM Redbooks Web server. Point your Web browser to:

<ftp://www.redbooks.ibm.com/redbooks/SG245416>

Alternatively, you can get to the same Web page at:

<http://www.redbooks.ibm.com>

Select **Additional Materials** and click the suggested link (or follow the instructions given, since the Web pages change frequently), and then select **SG245416**.

Macros

We have provided macros to help you implement your Tivoli Storage Manager environment. The names and values within those macros reflect the recommendations for our book environment. You may change them to suit your environment as required.

Define administrators

Example B-1 shows a Tivoli Storage Manager macro that contains the administrative commands to define our administrators.

Example: B-1 mac.admins sample

```
/*=====
/* Redbook Macro - Define Administrators (mac.admins)      */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* SG24-5416                                              */
/*
/* These scripts are supplied to help you implement a      */
/* Tivoli Storage Manager                                     */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your   */
/* environment as required.                                    */
/*
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/*
/*=====
/*
/*-----*/
/* System Administrators */
/*-----*/
register admin sysadmin sysadmin contact='System Administrator'
grant authority sysadmin classes=system
/*-----*/
/* System Support Administrators */
/*-----*/
register admin support support contact='System Support'
grant authority support classes=system
/*-----*/
/* System Reporting Administrators */
/*-----*/
register admin reporter reporter contact='System Reporting'
/*-----*/
/* Client Administrators */
/*-----*/
register admin helpdesk helpdesk contact='Client Administrator'
```

```
/* grant authority helpdesk classes=node node=* */
/* You first have to register client nodes for this command to succeed! */
/*-----*/
/* Query all administrators */
/*-----*/
query admin
```

Define client option sets

Example B-2 shows a Tivoli Storage Manager macro that contains the administrative commands to define our client option sets.

Example: B-2 mac.optionsets

```
=====
/* Redbook Support Materials File - (mac.optionsets) */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* (SG24-5416) */
/*
/* These scripts are supplied to help you implement a */
/* Tivoli Storage Manager */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your */
/* environment as required. */
/*
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/*
=====
/*--Special Note-----*/
/* Remove the comments from the following delete cloptset */
/* commands if you want to rerun this macro. */
/*
/*-----*/
/* delete cloptset redbook */
/* delete cloptset aix */
/* delete cloptset netware */
/* delete cloptset windows */
/* Base Option Set */
define cloptset redbook description="Redbook Base Set"
define clientopt redbook changingretries 4
define clientopt redbook compressalways yes
define clientopt redbook compression off
define clientopt redbook dirmc directory
define clientopt redbook domain all-local
define clientopt redbook maxcmdretries 2
define clientopt redbook memoryefficientbackup no
define clientopt redbook quiet
```

```

define clientopt redbook retryperiod 20
define clientopt redbook runasservice yes
define clientopt redbook schedmode prompted
define clientopt redbook scrolllines 20
define clientopt redbook scrollprompt no
define clientopt redbook subdir no
define clientopt redbook tapeprompt no
define clientopt redbook txnbytelimit 25600
/*-----*/
/* AIX Options Set */
/*-----*/
copy cloptset redbook aix
update cloptset aix description="AIX Clients"
define clientopt aix inclexcl "exclude /unix/" seq=1
define clientopt aix inclexcl "exclude.dir /unix/" seq=2
define clientopt aix inclexcl "exclude /.../core" seq=3
define clientopt aix inclexcl "exclude /tmp/.../*" seq=4
define clientopt aix inclexcl "include /.../dsmwebcl.log special" seq=5
define clientopt aix inclexcl "include /.../dsmsched.log special" seq=6
define clientopt aix inclexcl "include /.../dsrror.log special" seq=7
define clientopt aix inclexcl "include.image /.../* image" seq=8
/*-----*/
/* Netware Options Set */
/*-----*/
copy cloptset redbook netware
update cloptset netware description="Netware Clients"
define clientopt netware inclexcl "exclude sys:vol$log.err" seq=1
define clientopt netware inclexcl "exclude sys:ts$log.err" seq=2
define clientopt netware inclexcl "exclude sys:system/sys$log.err" seq=3
define clientopt netware inclexcl "exclude sys:system/events.log" seq=4
define clientopt netware inclexcl "exclude sys:system/secaudit.log" seq=5
define clientopt netware inclexcl "exclude sys:system/system.log" seq=6
define clientopt netware inclexcl "exclude sys:system/cmaster.dba" seq=7
define clientopt netware inclexcl "exclude sys:system/btrieve.trn" seq=8
define clientopt netware inclexcl "exclude sys:system/tsa/tsa$temp.*" seq=9
define clientopt netware inclexcl "include *:/.../dsmwebcl.log special" seq=10
define clientopt netware inclexcl "include *:/.../dsmsched.log special" seq=11
define clientopt netware inclexcl "include *:/.../dsrror.log special" seq=12
/*-----*/
/* Windows Options Set */
/*-----*/
copy cloptset redbook windows
update cloptset windows description="Windows Clients"
define clientopt windows inclexcl "exclude *:\...\pagefile.sys" seq=1
define clientopt windows inclexcl "exclude *:\...\netlogon.chg" seq=2
define clientopt windows inclexcl "exclude *:\...\system32\config\...\" seq=3
define clientopt windows inclexcl "exclude *:\...\ntuser.dat" seq=4
define clientopt windows inclexcl "exclude *:\...\ntuser.dat.log" seq=5
define clientopt windows inclexcl "exclude *:\...\temp\...\" seq=6

```

```
define clientopt windows inclexcl "exclude *:\...\cache\*" seq=7
define clientopt windows inclexcl "exclude *:\...\recycler\*" seq=8
define clientopt windows inclexcl "exclude *:\...\Temporary Internet Files\*"
seq=9
define clientopt windows inclexcl "exclude *:\microsoft uam volume\...\*"
seq=10
define clientopt windows inclexcl "exclude *:\ibmio.com" seq=11
define clientopt windows inclexcl "exclude *:\ibmdos.com" seq=12
define clientopt windows inclexcl "exclude *:\msdos.sys" seq=13
define clientopt windows inclexcl "exclude *:\io.sys" seq=14
define clientopt windows inclexcl "include *:../../dsmwebcl.log special" seq=15
define clientopt windows inclexcl "include *:../../dsmsched.log special" seq=16
define clientopt windows inclexcl "include *:../../dsrror.log special" seq=17
/*-----*/
/* Query all client option sets */
/*-----*/
select * from cloptsets
```

Define policy structure

Example B-3 shows a Tivoli Storage Manager macro that contains the administrative commands to delete the default storage pools.

Example: B-3 mac.policy

```
/*=====
/* Redbook Support Materials File - (mac.policy) */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* (SG24-5416) */
/*
/* These scripts are supplied to help you implement a */
/* Tivoli Storage Manager */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your */
/* environment as required. */
/*
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/*
/*=====*/
/*-----*/
/* Policy Domains */
/*-----*/
define domain server description="Server nodes" backretention=100 \
archretention=365
define domain workstn description="Workstation nodes" backretention=100 \
archretention=365
```

```

/*-----*/
/* Policy Sets */
/*-----*/
define policyset server server description="Server nodes"
define policyset workstn workstn description="Workstation nodes"
/*-----*/
/* Management Classes */
/*-----*/
define mgmtclass server server data migdestination=NONE \
description="Default management class for server domain"
assign defmgmtclass server server data
define mgmtclass server server directory migdestination=NONE \
description="Directory management class for server domain"
define mgmtclass server server special migdestination=NONE \
description="Special management class for server domain"
define mgmtclass server server image migdestination=NONE \
description="Image management class for server domain"
define mgmtclass workstn workstn data migdestination=NONE \
description="Default management class for workstn domain"
assign defmgmtclass workstn workstn data
define mgmtclass workstn workstn directory migdestination=NONE \
description="Directory management class for workstn domain"
define mgmtclass workstn workstn special migdestination=NONE \
description="Special management class for workstn domain"
define mgmtclass workstn workstn image migdestination=NONE \
description="Image management class for workstn domain"
/*-----*/
/* Copy Groups */
/*-----*/
define copygroup server server data type=Backup destination=DISKDATA \
frequency=1 verexists=3 verdeleted=1 retextra=100 retonly=100 \
mode=modified serialization=shrstatic
define copygroup server server directory type=Backup destination=DISKDIRS \
frequency=1 verexists=nolimit verdeleted=1 retextra=100 retonly=100 \
mode=modified serialization=shrstatic
define copygroup server server special type=Backup destination=DISKDATA \
frequency=1 verexists=3 verdeleted=1 retextra=100 retonly=100 \
mode=modified serialization=shrdynamic
define copygroup server server image type=backup destination=diskdata \
frequency=1 verexists=3 verdeleted=1 retextra=120 retonly=120 \
mode=modified serialization=static
define copygroup workstn workstn data type=Backup destination=DISKDATA \
frequency=1 verexists=1 verdeleted=1 retextra=30 retonly=30 \
mode=modified serialization=shrstatic
define copygroup workstn workstn directory type=Backup destination=DISKDIRS \
frequency=1 verexists=nolimit verdeleted=nolimit retextra=30 retonly=30 \
mode=modified serialization=shrstatic
define copygroup workstn workstn special type=Backup destination=DISKDATA \
frequency=1 verexists=2 verdeleted=1 retextra=30 retonly=30 \

```

```
mode=modified serialization=shrdynamic
define copygroup workstn workstn image type=backup destination=diskdata \
frequency=1 verexists=2 veredeleted=2 retextra=30 retonly=30 \
mode=modified serialization=static
define copygroup server server data type=Archive destination=DISKDATA \
retver=365 serialization=shrstatic
define copygroup workstn workstn data type=Archive destination=DISKDATA \
retver=100 serialization=shrstatic
/*-----*/
/* Validate policy sets */
/*-----*/
validate policyset server server
validate policyset workstn workstn
/*-----*/
/* Activate policy sets */
/*-----*/
activate policyset server server
activate policyset workstn workstn
```

Define schedules

Example B-4 shows a Tivoli Storage Manager macro that contains the administrative commands to define our schedules.

Example: B-4 mac.schedules

```
/*=====
/* Redbook Support Materials File - (mac.schedules)      */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* (SG24-5416)                                         */
/*
/* These scripts are supplied to help you implement a      */
/* Tivoli Storage Manager                                     */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your   */
/* environment as required.                                     */
/*
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/*
/*=====
/*
/* Offsite Backup Schedule */
/*
define schedule redbook_offsite type=admin cmd="run redbook_offsite" \
description="Backup all data for offsite storage" starttime=04:00 active=yes
/*-----*/
```

```

/* Volume History File Management */
/*
define schedule delete_vohist type=admin \
cmd="delete volhistory type=dbbackup todate=today-6" \
description="Delete volume history information for database backups" \
starttime=07:00 active=yes
define schedule backup_vohist type=admin cmd="backup volhistory" \
description="Backup volume history file" starttime=07:05 active=yes
*/
/* Disk Migration */
/*
define schedule MIGRATION type=admin cmd="migrate stgpool diskdata lo=0
duration=180" desc="Perform migration on DISKDATA storage pool" starttime=07:00
active=yes
*/
/* Inventory Expiration */
/*
define schedule EXPIRE_INVENTORY type=admin description="Inventory expiration"
cmd="expire inventory" starttime=10:00 active=yes
*/
/* Tape Space Reclamation */
/*
define schedule RECLAIM_OFFDIRS type=admin description="Perform reclamation on
the OFFDIRS storage pool" cmd="reclaim stgpool offdirs threshold=85
duration=60" starttime=11:00 active=yes
define schedule RECLAIM_OFFDATA type=admin description="Perform reclamation on
the OFFDATA storage pool" cmd="reclaim stgpool offdata threshold=85
duration=180" starttime=12:00 active=yes
define schedule RECLAIM_TAPEDATA type=admin description="Perform reclamation on
the TAPEDATA storage pool" cmd="reclaim stgpool tapedata threshold=85
duration=180" starttime=15:00 active=yes
*/
/* Audit Licences */
/*
define schedule AUDIT_LICENSE type=admin description="Audit licenses" \
cmd="audit licenses" starttime=00:00 active=yes
*/
/* Client Schedules */
/*
define schedule server server_nightly starttime=22:00 action=incremental
duration=3 durunits=hours \
description="Nightly backup schedule for SERVER domain"
define schedule workstn workstn_nightly action=incremental starttime=22:00
duration=3 durunits=hours\
description="Nightly backup schedule for WORKSTN domain"
define sched workstn monthly_image starttime=01:00 action=imagebackup
object="C:" schedstyle=enhanced month=any weekofmonth=last dayofweek=friday
description="Monthly image backup for workstations"
*/

```

```
/* Query all schedules      */
/*-----*/
query schedule
query schedule type=admin
```

Define server scripts

Example B-5 shows a Tivoli Storage Manager macro that contains the administrative commands to define our server scripts.

Example: B-5 mac.scripts

```
/*=====
/* Redbook Support Materials File - (mac.scripts)          */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* (SG24-5416)                                              */
/*
/* These scripts are supplied to help you implement a       */
/* Tivoli Storage Manager                                     */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your   */
/* environment as required.                                     */
/*
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/*
/*=====
/*-----*/
/* Define Offsite Storage Process                         */
/*-----*/
delete script redbook_offsite
define script redbook_offsite description="Backup all data for offsite storage"
update script redbook_offsite
"/*-----*/
update script redbook_offsite /* Script Name: redbook_offsite
*/
update script redbook_offsite /* Description: Backup data for offsite storage
*/
update script redbook_offsite
"/*-----*/
update script redbook_offsite /* If there are active node sessions, then
*/
update script redbook_offsite /* reschedule this script to run again in
*/
update script redbook_offsite /* 20 minutes. If there are no active node
*/"
```

```

update script redbook_offsite /* sessions, then backup all the onsite storage
*/
update script redbook_offsite /* pools and the ADSM database.
*/
update script redbook_offsite
/*-----*/
update script redbook_offsite "select * from sessions where -"
update script redbook_offsite "      upper(session_type)='NODE'"
update script redbook_offsite "if (rc_ok) goto reschedule"
update script redbook_offsite "backup stgpool diskdirs offdirs wait=yes"
update script redbook_offsite "backup stgpool diskdata offdata wait=yes"
update script redbook_offsite "backup stgpool tapedata offdata wait=yes"
update script redbook_offsite "backup db devclass=coffsite type=full
scratch=yes"
update script redbook_offsite "exit"
update script redbook_offsite "reschedule:"
update script redbook_offsite "delete schedule redbook_offsite_retry
type=admin"
update script redbook_offsite "define schedule redbook_offsite_retry type=admin
-"
update script redbook_offsite "      cmd='run redbook_offsite' active=yes -"
update script redbook_offsite "      starttime=NOW+0:20 perunits=onetime"
/*-----*/
/* Query all redbook scripts */
/*-----*/
query script redbook*

```

Create storage pools

Example B-6 shows a Tivoli Storage Manager macro that contains the administrative commands to create storage pools.

Example: B-6 mac.stgcreate

```

/*=====
/* Redbook Support Materials File - (mac.stgcreate)
/* Getting Started with Tivoli Storage Manager - Implementation
/* (SG24-5416)
/*
/* These scripts are supplied to help you implement a
/* Tivoli Storage Manager
/* environment. Names for device classes used should be entered
/* between the <> symbols and these <> symbols removed.
/* The MAXSCratch is set purposefully at a high value to avoid
/* any misleading out of space messages. You may set it to a more
/* meaningful value to better reflect the %util value of your
/* pool when q stgpool is run.
*/

```

```
/*
 * This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/* */
/*=====
define stgpool tapedata <<library device class name>> highmig=100 \
maxscratch=10000 collocate=no reclaim=100 reusedelay=1
define stgpool diskdata disk nextstgpool=tapedata highmig=70 lowmig=30 \
cache=no
define stgpool diskdirs <<sequential file class name>> highmig=100
define stgpool offdirs <<offsite library device class name>> pooltype=copy \
reclaim=100 maxscratch=10000 reusedelay=5
define stgpool offdata <<offsite library device class name>> pooltype=copy \
reclaim=100 maxscratch=10000 reusedelay=5
define stgpool none disk
```

Delete default storage pools

Example B-7 shows a Tivoli Storage Manager macro that contains the administrative commands to delete the default storage pools.

Example: B-7 mac.stgdelete

```
=====
/* Redbook Support Materials File - (mac.stgdelete) */
/* Getting Started with Tivoli Storage Manager - Implementation */
/* (SG24-5416) */
/*
/* These scripts are supplied to help you implement a */
/* Tivoli Storage Manager */
/* environment. The names and values reflect the recommendations */
/* for our Redbook environment. You may change them to suit your */
/* environment as required.
*/
/* This file is designed to be run as an Administrative Command */
/* Line macro. You should use the -itemcommit parameter when you */
/* start the admin session, otherwise the macro could fail!! */
/* */
/*=====*/
delete stgpool backuppool
delete stgpool archivepool
delete stgpool spacemgpool
delete stgpool diskpool
```

Server options files

We have created server option files for the AIX, MVS, and Windows NT server environments. Our environment assumes that TCP/IP is the network protocol, Web access is enabled for administrators, and basic performance tuning values are specified.

All possible server options for each platform have been specified in the respective files. Server options have been grouped into the same categories as they appear in the administrator reference manuals for ease of reference. Those categories are:

- ▶ Communications
- ▶ Automated Cartridge System Library
- ▶ Client-server communication processing
- ▶ Site dependent
- ▶ Database and recovery log
- ▶ Group and transfer data
- ▶ Messages
- ▶ Event logging
- ▶ Miscellaneous

Within each category, the options are ordered alphabetically. Options that are not active are preceded by an asterisk (*). All other options are active. Inactive options are those that are either not applicable for our TCP/IP communication protocol, or require further setup, such as those for Tivoli event monitoring.

AIX

Example B-8 shows our server options file for AIX. This file can also be used as the basis for a server options file for the HP/UX, Linux, and Solaris platforms.

Tivoli Storage Manager HP/UX and Solaris servers only support TCP/IP as a network protocol.

Example: B-8 AIX server options

```
*=====
* Tivoli Server Options File - AIX Version - (dsmserv.aix)      *
* Getting Started with Tivoli Storage Manager - Implementation   *
* SG24-5416                                                       *
*=====
*-----*
*Communications *
*-----*
COMMMETHOD           SHAREDMEM
COMMMETHOD           TCPIP
```

```

SHMPort           1
TCPNodelay      YES
TCPPort          1500
TCPADMINPort    1502
TCPWindowsize   2048
DNSLOOKUP       Yes
MOVEBatchsize   1000
MOVESIZETHRESH  2048
TXNGroupmax    1024
*-----*
*Automated Cartridge System Library Software *
*-----*
*ACSACESSID
*ACSLOCKDRIVE
*ACSQICKINIT
*ACSTIMEOUTX
*-----*
* Client-Server *
*-----*
COMMTIMEOUT     300
IDLETIMEOUT    30
RESOURCETIMEOUT 10
*-----*
* Site Dependent *
*-----*
DATEFORMAT       2
LANGUAGE          AMENG
NUMBERFORMAT     1
TIMEFORMAT        1
MAXSESSIONS      60
*-----*
* Database & Recovery Log *
*-----*
BUFPOLLSIZE      262144
LOGPOLLSIZE      10240
SELFTUNE_BUFPOLLSIZE YES
MIRRORREAD DB NORMAL
MIRRORREAD LOG NORMAL
MIRRORWRITE DB SEQUENTIAL
MIRRORWRITE LOG SEQUENTIAL
DBPAGEShadow      Yes
DBPAGESHADOWFile "/tsm/files/shadow/dbpgshdw.bdt"
*-----*
* Group *
*-----*
MOVEBATCHSIZE    500
MOVESIZETHRESH   256
TXNGROUPMAX     256

```

```

*-----*
* Message Options *
*-----*
DISPLAYLINFO YES
EXPQUIET YES
MESSAGEFORMAT 1
MSGINTERVAL 1
STATUSMSGCNT 10
*-----*
* Event Logging *
*-----*
EVENTSERVER YES
FILEEXIT NO
USEREXIT NO
*TECBEGINEVENTLOGGING
*TECHOSTNAME
*TECPORT
*-----*
* Miscellaneous *
*-----*
DEVCONFIG /tsm/files/primary/devconfig
DEVCONFIG /tsm/files/copy/devconfig
ENABLE3590LIBRARY NO
EXPINTERVAL 0
QUERYAuth None
RESTOREINTERVAL 1440
VOLUMEHISTORY /tsm/files/primary/volumehistory
VOLUMEHISTORY /tsm/files/copy/volumehistory

```

z/OS

Example B-9 shows our server options file for z/OS.

Example: B-9 MVS server options

```

*=====
* Tivoli Server Options File - zIS Version - (dsmserv.mvs)      *
* Getting Started with Tivoli Storage Manager - Implementation   *
* SG24-5416                                                       *
*=====
*-----*
* Communications *
*-----*
COMMMethod TCPIP

TCPNodelay YES
TCPPort 1500
TCPADMINPort 1502

```

TCPWindowsize	2048
DNSLOOKUP	Yes
MOVEBatchsize	1000
MOVESizethresh	2048
TXNGroupmax	1024
TCPNAME	TCPIP

* Client-Server *	

COMMTIMEOUT	300
IDLETIMEOUT	30
RESOURCETIMEOUT	10

* Site Dependent *	

DATEFORMAT	2
LANGUAGE	AMENG
NUMBERFORMAT	1
TIMEFORMAT	1

* Database & Recovery Log *	

BUFPoolsize	262144
LOGPoolsize	10240
SELFTUNE_BUFPOLSIZE	YES
MIRRORRead DB Normal	
MIRRORRead LOG Normal	
MIRRORWrite DB Sequential	
MIRRORWrite LOG Sequential	
DBPAGEShadow	Yes
DBPAGESHADOWFile	"dbpgshdw.bdt"

* Group *	

MOVEBatchsize	500
MOVESizethresh	256
TXNGroupmax	256

* Message Options *	

EXPQuiet	YES
MESsageformat	1
MSGInterval	1
STAtusmsgcnt	10
MSGHighlight	0
MSGSSuppress	0
ROUTECode	11

* Event Logging *	

```

*-----*
EVENTSERVer           YES
FILEEXIT              NO
FILETEXTEXIT          NO
USEREXIT              NO
*TECBegineventlogging
*TECHostname
*TECPort
*-----*
* Miscellaneous *
*-----*
DELetionexit          ARCTVEXT
DEVCONFIG             'TSM.SERVER.DEVCONFIG'
DEVCONFIG             'TSM.SERVER.DEVCONFIG.ALT'
EXPINterval           0
RESTORE INTERVAL      1440
VOLumeHistory         'TSM.SERVER.VOLHIST'
VOLumeHistory         'TSM.SERVER.VOLHIST.ALT'

```

Windows

Example B-10 shows the Windows server options.

Example: B-10 Windows server options

```

*=====
* Tivoli Storage Manager V5 Redbook Server Options File - Windows Version *
* Getting Started with Tivoli Storage Manager - Implementation (SG24-5416)  *
*=====
*-----*
*Communications *
*-----*
COMMMethod            NAMEDPIPE
COMMMethod            TCPIP

NAMEDpipename         \\.\PIPE\TSMPPIPE
NPBUffersize          8
TCPNodelay            YES
TCPPort                1500
TCPADMINPort          1502
TCPWindowsize         63
DNSLOOKUP              Yes
MOVEBatchsize          1000
MOVESizethresh        2048
TXNGroupmax           1024
*-----*
* Client-Server *
*-----*

```

COMMTIMEOUT	300
IDLETIMEOUT	30
RESOURCETIMEOUT10	

* Site Dependent *	

DATEFORMAT	2
LANGUAGE	AMENG
NUMBERFORMAT	1
TIMEFORMAT	1
MAXSESSIONS	60

* Database & Recovery Log *	

BUFPOLLOWSIZE	262144
SELFTUNE_BUFPOLLOWSIZE	Yes
LOGPOLLOWSIZE	10240
MIRRORREAD	DB Normal
MIRRORREAD	LOG Normal
MIRRORWRITE	DB Sequential
MIRRORWRITE	LOG Sequential
DBPAGESSHADOW	Yes
DBPAGESHADOWFILE	"dbpgshdw.bdt"

* Message Options *	

DISPLAYLFINFO	Yes
EXPQUIET	Yes
MESSAGEFORMAT	1
MSGINTERVAL	1
STATUSMSGCNT	10

* Event Logging *	

EVENTSERVER	Yes
FILEEXIT	No
FILETEXTEXIT	No
USEREXIT	No

* Miscellaneous *	

DISABLESCHEDS	No
EXPINTERVAL	0
RESTOREINTERVAL	1440
QUERYAUTH	None

* External backup files *	

DEVConfig	c:\tsm\files\primary\devconfig.out
DEVConfig	d:\tsm\files\copy\devconfig.out
VOLUMEHistory	c:\tsm\files\primary\volhist.out
VOLUMEHistory	d:\tsm\files\copy\volhist.out

Client options files

We have created client option files for the NetWare and Windows environments. Our environment assumes that TCP/IP is the network protocol, Web access is enabled for administrators, and basic performance tuning values are specified. You must replace fields surrounded by angle brackets (<> and >>) with the specific values for your site.

AIX

In this section we show AIX files.

Client system options file

Example B-11 shows our client system options file for AIX. This file can also be used as the basis for a client system options file for the HP/UX and Solaris platforms.

Example: B-11 AIX system options file

```
*-----*
* Stanza name - must match at least one SErvername stanzas in dsm.opt
SErvername          <<DSM.OPT Stanza name here (not hostname!!!)>>

* Communications.
NODename           <<Client node name here>>
COMMMethod          TCPPIP
TCPBuffsize         32
TCPNodelay          Yes
TCPPort              1500
TCPServeraddress    <<TSM Server Hostname here>>
TCPWindowsize        64
DISKBuffsize        1023
*-----*
* Operations *
*-----*
COMPRESSION          No
ERRORLOGName         "dsmerror.log"
ERRORLOGRetention    31
SCHELOGName          "dsmched.log"
SCHELOGRetention     14
```

```
PASSWORDAccess      Generate
SCHEDMODE          Prompted
MANAGEDServices    Schedule WebClient
*-----*
* Include/Exclude *
*-----*
*None - specified via the Client Option Set (AIX) instead
```

Client user options file

Example B-12 shows our client user options file for AIX. This file can also be used as the basis for a client user options file for the HP/UX and Solaris platforms.

Example: B-12 AIX client user options file

```
=====
* Redbook Client System Options File (dsm.sys) - AIX Version      *
* Getting Started with Tivoli Storage Manager - Implementation   *
* SG24-5416                                                       *
=====
*-----*
* Communications *
=====
* Redbook Client User Options File (dsm.opt) - AIX Version       *
* Getting Started with Tivoli Storage Manager - Implementation   *
* SG24-5416                                                       *
=====
*-----*
* Communications *
=====
*-----*
SERVERNAME      <<TSM-Server DSM.SYS Stanza name here (not hostname!!!) >>>
* Site dependent.
COMPRESSAlways  No
DATEformat      1
NUMBERformat    1
TIMEformat     1
Subdir          Yes
```

NetWare

Example B-13 shows our client options file for NetWare.

Example: B-13 Netware client options file

```
=====
* Redbook Client Options File - Netware Version (dsm.opt)        *
* Getting Started with Tivoli Storage Manager - Implementation   *
```

```

* SG24-5416 *
*=====
*-----*
* Identification *
*-----*
NODENAME <<Netware-Server-Name>>
*-----*
* Communications *
*-----*
COMMMETHOD          TCPIP
TCPBUFSIZE         63
TCPNODELAY         Yes
TCPPORT            1500
TCPSERVERADDRESS <<TSM-Server Hostname here>>
TCPWINDOWSIZE      63
DISKBuffsize       1023
*-----*
* Operations *
*-----*
CLUSTERnode        No
COMPRESSION         No
COMPRESSAlways     No
ERRORLOGName       "dsmerror.log"
ERRORLOGRetention  31
SCHEDLOGName       "dsmsched.log"
SCHEDLOGRetention  14
PASSWORDAccess     Generate
SCHEDMODE          Prompted
MANAGEDServices    Schedule WebClient
NWPWFile           On
NWUser              <<Servername\user:password must be FQ>>
*-----*
* Site Dependent *
*-----*
DATEFORMAT          1
LANGUAGE            AMENG
NUMBERFORMAT        1
TIMEFORMAT          1

SUbdir             Yes
*-----*
* Include/Exclude *
*-----*
*None - specified via the Client Option Set (NETWARE) instead

```

Windows

Example B-14 shows our client options file for Windows.

Example: B-14 Windows client options file

```
=====
* Redbook Client Options File - Windows Version (dsm.opt)      *
* Getting Started with Tivoli Storage Manager - Implementation   *
* SG24-5416                                                       *
=====
*-----*
* Communications *
*-----*
NODename          <<Client node name here>>
COMMMETHOD        TCPPIP
TCPBUFSIZE        63
TCPNODELAY        Yes
TCPPORT           1500
TCP SERVER ADDRESS <<TSM-Server hostname here>>
TCPWINDOWSIZE     63
DISKBuffsize      1023
*-----*
* Operations *
*-----*
COMPRESSION       No
COMPRESSA1ways    No
ERRORLOGName      "dsrror.log"
ERRORLOGRetention 31
SCHEDLOGName      "dsmched.log"
SCHEDLOGRetention 14
PASSWORDAccess    Generate
SCHEDEMODe        Prompted
MANAGEDServices   Schedule Webclient
*-----*
* Site Dependent *
*-----*
DATEFORMAT         1
LANGUAGE           AMENG
NUMBERFORMAT       1
TIMEFORMAT         1

SUBdir             Yes
*-----*
* Include/Exclude *
*-----*
*None - specified via the Client Option Set (WINDOWS) instead
```

Glossary

A

Agent A software entity that runs on endpoints and provides management capability for other hardware or software. An example is an SNMP agent. An agent has the ability to spawn other processes.

AL See arbitrated loop.

Allocated storage The space that is allocated to volumes, but not assigned.

Allocation The entire process of obtaining a volume and unit of external storage, and setting aside space on that storage for a data set.

Arbitrated loop A Fibre Channel interconnection technology that allows up to 126 participating node ports and one participating fabric port to communicate. See also Fibre Channel Arbitrated Loop and loop topology.

Array An arrangement of related disk drive modules that have been assigned to a group.

B

Bandwidth A measure of the data transfer rate of a transmission channel.

Bridge Facilitates communication with LANs, SANs, and networks with dissimilar protocols.

C

Client A function that requests services from a server and makes them available to the user. A term used in an environment to identify a machine that uses the resources of the network.

Client authentication The verification of a client in secure communications where the identity of a server or browser (client) with whom you wish to communicate is discovered. A sender's authenticity is demonstrated by the digital certificate issued to the sender.

Client-server relationship Any process that provides resources to other processes on a network is a server. Any process that employs these resources is a client. A machine can run client and server processes at the same time.

Console A user interface to a server.

D

DATABASE 2 (DB2) A relational database management system. DB2 Universal Database™ is the relational database management system that is Web-enabled with Java support.

Device driver A program that enables a computer to communicate with a specific device, for example, a disk drive.

Disk group A set of disk drives that have been configured into one or more logical unit numbers. This term is used with RAID devices.

E

Enterprise network A geographically dispersed network under the backing of one organization.

Enterprise Storage Server® Provides an intelligent disk storage subsystem for systems across the enterprise.

Event In the Tivoli environment, any significant change in the state of a system resource, network resource, or network application. An event can be generated for a problem, for the resolution of a problem, or for the successful completion of a task. Examples of events are the normal starting and stopping of a process, the abnormal termination of a process, and the malfunctioning of a server.

F

Fabric The Fibre Channel employs a fabric to connect devices. A fabric can be as simple as a single cable connecting two devices. The term is often used to describe a more complex network utilizing hubs, switches, and gateways.

FC See Fibre Channel.

FCS See Fibre Channel standard.

Fiber optic The medium and the technology associated with the transmission of information along a glass or plastic wire or fiber.

Fibre Channel A technology for transmitting data between computer devices at a data rate of up to 1 Gb. It is especially suited for connecting computer servers to shared storage devices and for interconnecting storage controllers and drives.

Fibre Channel Arbitrated Loop A reference to the FC-AL standard, a shared gigabit media for up to 127 nodes, one of which can be attached to a switch fabric. See also arbitrated loop and loop topology. Refer to American National Standards Institute (ANSI) X3T11/93-275.

Fibre Channel standard An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. Refer to ANSI X3.230-199x.

File system An individual file system on a host. This is the smallest unit that can monitor and extend. Policy values defined at this level override those that might be defined at higher levels.

G

Gateway In the SAN environment, a gateway connects two or more different remote SANs with each other. A gateway can also be a server on which a gateway component runs.

H

Hardware zoning Hardware zoning is based on physical ports. The members of a zone are physical ports on the fabric switch. It can be implemented in the following configurations: one to one, one to many, and many to many.

HBA See host bus adapter.

Host Any system that has at least one Internet address associated with it. A host with multiple network interfaces can have multiple Internet addresses associated with it. This is also referred to as a server.

Host bus adapter (HBA) A Fibre Channel HBA connection that allows a workstation to attach to the SAN network.

Hub A Fibre Channel device that connects up to 126 nodes into a logical loop. All connected nodes share the bandwidth of this one logical loop. Hubs automatically recognize an active node and insert the node into the loop. A node that fails or is powered off is automatically removed from the loop.

IP Internet protocol.

J

Java A programming language that enables application developers to create object-oriented programs that are very secure, portable across different machine and operating system platforms, and dynamic enough to allow expandability.

Java runtime environment (JRE™) The underlying, invisible system on your computer that runs applets the browser passes to it.

Java Virtual Machine (JVM™) The execution environment within which Java programs run. The Java virtual machine is described by the Java Machine Specification, which is published by Sun Microsystems. Because the Tivoli Kernel Services is based on Java, nearly all ORB and component functions execute in a Java virtual machine.

JBOD Just a Bunch Of Disks.

JRE See Java runtime environment.

JVM See Java Virtual Machine.

L

Logical unit number (LUN) The LUNs are provided by the storage devices attached to the SAN. This number provides you with a volume identifier that is unique among all storage servers. The LUN is synonymous with a physical disk drive or a SCSI device. For disk subsystems such as the IBM Enterprise Storage Server, a LUN is a logical disk drive. This is a unit of storage on the SAN that is available for assignment or unassignment to a host server.

Loop topology In a loop topology, the available bandwidth is shared with all the nodes connected to the loop. If a node fails or is not powered on, the loop is out of operation. This can be corrected using a hub. A hub opens the loop when a new node is connected and closes it when a node disconnects. See also Fibre Channel Arbitrated Loop and arbitrated loop.

LUN See logical unit number.

LUN assignment criteria The combination of a set of LUN types, a minimum size, and a maximum size used for selecting a LUN for automatic assignment.

LUN masking This allows or blocks access to the storage devices on the SAN. Intelligent disk subsystems like the IBM Enterprise Storage Server provide this kind of masking.

M

Managed object A managed resource.

Managed resource A physical element to be managed.

Management Information Base (MIB) A logical database residing in the managed system and defines a set of MIB objects. A MIB is considered a logical database because actual data is not stored in it, but rather provides a view of the data that can be accessed on a managed system.

MIB See Management Information Base.

MIB object A MIB object is a unit of managed information that specifically describes an aspect of a system. Examples are CPU utilization, software name, hardware type, and so on. A collection of related MIB objects is defined as a MIB.

N

Network topology A physical arrangement of nodes and interconnecting communications links in networks based on application requirements and geographical distribution of users.

N_Port node port A Fibre Channel-defined hardware entity at the end of a link that provides the mechanisms necessary to transport information units to or from another node.

NL_Port node loop port A node port that supports arbitrated loop devices.

O

Open system A system whose characteristics comply with standards made available throughout the industry, and therefore can be connected to other systems that comply with the same standards.

P

Point-to-point topology This consists of a single connection between two nodes. All the bandwidth is dedicated for these two nodes.

Port An endpoint for communication between applications, generally referring to a logical connection. A port provides queues for sending and receiving data. Each port has a port number for identification. When the port number is combined with an Internet address, it is called a socket address.

Port zoning In Fibre Channel environments, port zoning is the grouping together of multiple ports to form a virtual private storage network. Ports that are members of a group or zone can communicate with each other but are isolated from ports in other zones. See also LUN masking and subsystem masking.

Protocol The set of rules governing the operation of functional units of a communication system if communication is to take place. Protocols can determine low-level details of machine-to-machine interfaces, such as the order in which bits from a byte are sent. They can also determine high-level exchanges between application programs, such as file transfer.

R

RAID Redundant array of inexpensive or independent disks. A method of configuring multiple disk drives in a storage subsystem for high availability and high performance.

S

SAN See Storage Area Network.

SAN agent A software program that communicates with the manager and controls the subagents. This component is largely platform independent. See also subagent.

SCSI Small Computer System Interface. An ANSI standard for a logical interface to computer peripherals and for a computer peripheral interface. The interface utilizes a SCSI logical protocol over an I/O interface that configures attached targets and initiators in a multi-drop bus topology.

Server A program running on a mainframe, workstation, or file server that provides shared services. This is also referred to as a host.

Shared storage Storage within a storage facility that is configured such that multiple homogeneous or divergent hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must have a common model for the information on a storage device. You must design the programs to handle the effects of concurrent access.

Simple Network Management Protocol (SNMP) A protocol designed to give a user the capability to remotely manage a computer network by polling and setting terminal values and monitoring network events.

SNMP See Simple Network Management Protocol.

SNMP agent An implementation of a network management application that is resident on a managed system. Each node that is to be monitored or managed by an SNMP manager in a TCP/IP network must have an SNMP agent resident. The agent receives requests to either retrieve or modify management information by referencing MIB objects. MIB objects are referenced by the agent whenever a valid request from an SNMP manager is received.

SNMP manager A managing system that executes a managing application or suite of applications. These applications depend on MIB objects for information that resides on the managed system.

SNMP trap A message that is originated by an agent application to alert a managing application of the occurrence of an event.

Software zoning This is implemented within the Simple Name Server (SNS) running inside the fabric switch. When using software zoning, the members of the zone can be defined with node WWN, port WWN, or physical port number. Usually the zoning software also allows you to create symbolic names for the zone members and for the zones themselves.

SQL Structured Query Language.

Storage administrator A person in the data processing center who is responsible for defining, implementing, and maintaining storage management policies.

Storage area network (SAN) A managed, high-speed network that enables any-to-any interconnection of heterogeneous servers and storage systems.

Subagent A software component of SAN products that provides the actual remote query and control function, such as gathering host information and communicating with other components. This component is platform dependent. See also SAN agent.

Subsystem masking The support provided by intelligent disk storage subsystems like the Enterprise Storage Server. See also LUN masking and port zoning.

Switch A component with multiple entry and exit points or ports that provide dynamic connection between any two of these points.

Switch topology A switch allows multiple concurrent connections between nodes. There can be two types of switches, circuit switches and frame switches. Circuit switches establish a dedicated connection between two nodes. Frame switches route frames between nodes and establish the connection only when needed. A switch can handle all protocols.

T

TCP See Transmission Control Protocol.

TCP/IP Transmission Control Protocol/Internet Protocol.

Topology An interconnection scheme that allows multiple Fibre Channel ports to communicate. For example, point-to-point, arbitrated loop, and switched fabric are all Fibre Channel topologies.

Transmission Control Protocol (TCP) A reliable, full duplex, connection-oriented, end-to-end transport protocol running on IP.

W

WAN Wide Area Network.

Z

Zoning In Fibre Channel environments, zoning allows for finer segmentation of the switched fabric. Zoning can be used to instigate a barrier between different environments. Ports that are members of a zone can communicate with each other but are isolated from ports in other zones. Zoning can be implemented in two ways: hardware zoning and software zoning.

Other glossaries

For more information about IBM terminology, see the IBM Storage Glossary of Terms at:

<http://www.storage.ibm.com/glossary.htm>

For more information about Tivoli terminology, see the Tivoli Glossary at:

<http://publib.boulder.ibm.com/tividd/glossary/termstmst04.htm>

Abbreviations and acronyms

ABI	Application Binary Interface	AVI	Audio Video Interleaved
ACE	Access Control Entries	BDC	Backup Domain Controller
ACL	Access Control List	BIND	Berkeley Internet Name Domain
AD	Microsoft Active Directory	BNU	Basic Network Utilities
ADSM	ADSTAR Distributed Storage Manager	BOS	Base Operating System
AFS	Andrew File System	BRI	Basic Rate Interface
AIX	Advanced Interactive eXecutive	BSD	Berkeley Software Distribution
ANSI	American National Standards Institute	BSOD	Blue Screen of Death
APA	All Points Addressable	BUMP	Bring-Up Microprocessor
API	Application Programming Interface	CA	Certification Authorities
APPC	Advanced Program-to-Program Communication	CAL	Client Access License
APPN	Advanced Peer-to-Peer Networking®	C-SPOC	Cluster single point of control
ARC	Advanced RISC Computer	CDE	Common Desktop Environment
ARPA	Advanced Research Projects Agency	CDMF	Commercial Data Masking Facility
ASCII	American National Standard Code for Information Interchange	CDS	Cell Directory Service
ATE	Asynchronous Terminal Emulation	CERT	Computer Emergency Response Team
ATM	Asynchronous Transfer Mode	CGI	Common Gateway Interface
		CHAP	Challenge Handshake Authentication
		CIDR	Classless InterDomain Routing

CIFS	Common Internet File System	DHCP	Dynamic Host Configuration Protocol
CMA	Concert Multi-threaded Architecture	DLC	Data Link Control
CO	Central Office	DLL	Dynamic Load Library
COPS	Computer Oracle and Password System	DSA	Differentiated Service
CPI-C	Common Programming Interface for Communications	DSE	Directory Service Agent
CPU	Central Processing Unit	DNS	Directory Specific Entry Domain Name System
CSNW	Client Service for NetWare	EFS	Distributed Time Service
CSR	Client/server Runtime	EGID	Encrypting File Systems
DAC	Discretionary Access Controls	EISA	Effective Group Identifier
DARPA	Defense Advanced Research Projects Agency	EMS	Extended Industry Standard Architecture
DASD	Direct Access Storage Device	EPROM	Event Management Services
DBM	Database Management		Erasable Programmable Read-Only Memory
DCE	Distributed Computing Environment	ERD	Emergency Repair Disk
DCOM	Distributed Component Object Model	ERP	Enterprise Resources Planning
DDE	Dynamic Data Exchange	ERRM	Event Response Resource Manager
DDNS	Dynamic Domain Name System	ESCON®	Enterprise System Connection
DEN	Directory Enabled Network	ESP	Encapsulating Security Payload
DES	Data Encryption Standard	ESS	Enterprise Storage Server
DFS	Distributed File System	EUID FAT	Effective User Identifier File Allocation Table

FC	Fibre Channel	HSM	Hierarchical Storage Management
FDDI	Fiber Distributed Data Interface	HTTP	Hypertext Transfer Protocol
FDPR	Feedback Directed Program Restructure	IBM	International Business Machines Corporation
FEC	Fast EtherChannel technology	ICCM	Inter-Client Conventions Manual
FIFO	First In/First Out	IDE	Integrated Drive Electronics
FIRST	Forum of Incident Response and Security		
FQDN	Fully Qualified Domain Name	IDL	Interface Definition Language
FSF	File Storage Facility	IDS	Intelligent Disk Subsystem
FTP	File Transfer Protocol	IEEE	Institute of Electrical and Electronic Engineers
FtDisk	Fault-Tolerant Disk		
GC	Global Catalog		
GDA	Global Directory Agent	IETF	Internet Engineering Task Force
GDI	Graphical Device Interface	IGMP	Internet Group Management Protocol
GDS	Global Directory Service	IIS	Internet Information Server
GID	Group Identifier	IKE	Internet Key Exchange
GL	Graphics Library	IMAP	Internet Message Access Protocol
GSNW	Gateway Service for NetWare		
GUI	Graphical User Interface	I/O	Input/Output
HA	High Availability	IP	Internet Protocol
HACMP	High Availability Cluster Multiprocessing	IPC	Interprocess Communication
HAL	Hardware Abstraction Layer	IPL	Initial Program Load
HBA	Host Bus Adapter	IPsec	Internet Protocol Security
HCL	Hardware Compatibility List	IPX™	Internetwork Packet eXchange™
		ISA	Industry Standard Architecture

iSCSI	SCSI over IP	LOS	Layered Operating System
ISDN	Integrated Services Digital Network	LP	Logical Partition
ISNO	Interface-specific Network Options	LPC	Local Procedure Call
ISO	International Standards Organization	LPD	Line Printer Daemon
ISS	Interactive Session Support	LPP	Licensed Program Product
ISV	Independent Software Vendor	LRU	Least Recently Used
ITSEC	Initial Technology Security Evaluation	LSA	Local Security Authority
ITSO	International Technical Support Organization	LTG	Local Transfer Group
ITU	International Telecommunications Union	LUID	Login User Identifier
IXC	Inter Exchange Carrier	LUN	Logical Unit Number
JBOD	Just a Bunch of Disks	LVCB	Logical Volume Control Block
JFS	Journaled File System	LVDD	Logical Volume Device Driver
JIT	Just-In-Time	LVM	Logical Volume Manager
L2F	Layer 2 Forwarding		Master Boot Record
L2TP	Layer 2 Tunneling Protocol	MCA	Micro Channel® Architecture
LAN	Local Area Network	MDC	Meta Data Controller
LCN	Logical Cluster Number	MFT	Master File Table
LDAP	Lightweight Directory Access Protocol	MIPS	Million Instructions Per Second
LFS	Log File Service (Windows NT)	MMC	Microsoft Management Console
LFS	Logical File System (AIX)	MOCL	Managed Object Class Library
LFT	Low Function Terminal	MPTN	Multi-protocol Transport Network
JNDI	Java Naming and Directory Interface™	MS-DOS	Microsoft Disk Operating System
		MSCS	Microsoft Cluster Server

MSS	Maximum Segment Size	NSAPI	Netscape Commerce Server's Application
MSS	Modular Storage Server	NTFS	NT File System
MWC	Mirror Write Consistency	NTLDR	NT Loader
NAS	Network Attached Storage	NTLM	NT LAN Manager
NBC	Network Buffer Cache	NTP	Network Time Protocol
NBF	NetBEUI Frame	NTVDM	NT Virtual DOS Machine
NBPI	Number of Bytes per I-node	NVRAM	Non-Volatile Random Access Memory
NCP	NetWare Core Protocol	NetBEUI	NetBIOS Extended User Interface
NCS	Network Computing System	NetDDE	Network Dynamic Data Exchange
NCSC	National Computer Security Center	OCS	On-Chip Sequencer
NDIS	Network Device Interface Specification	ODBC	Open Database Connectivity
NDMP	Network Data Management Protocol	ODM	Object Data Manager
NDS	NetWare Directory Service	OLTP	OnLine Transaction Processing
NETID	Network Identifier	OMG	Object Management Group
NFS	Network File System	ONC™	Open Network Computing
NIM	Network Installation Management	OS	Operating System
NIS	Network Information System	OSF	Open Software Foundation
NIST	National Institute of Standards and Technology	OU	Organizational Unit
NLS	National Language Support	PAL™	Platform Abstract Layer
NNS	Novell Network Services	PAM	Pluggable Authentication Module
		PAP	Password Authentication Protocol
		PBX	Private Branch Exchange

PCI	Peripheral Component Interconnect	PSN	Program Sector Number
PCMCIA	Personal Computer Memory Card International Association	PSSP	Parallel System Support Program
PDC	Primary Domain Controller	PV	Physical Volume
PDF	Portable Document Format	PVID	Physical Volume Identifier
PDT	Performance Diagnostic Tool	QoS	Quality of Service
PEX	PHIGS Extension to X	RACF®	Resource Access Control Facility
PFS	Physical File System	RAS	Remote Access Service
PHB	Per Hop Behavior	RDBMS	Relational Database Management System
PHIGS	Programmer's Hierarchical Interactive Graphics System	RFC	Request for Comments
PID	Process Identification Number	RGID	Real Group Identifier
PIN	Personal Identification Number	RISC	Reduced Instruction Set Computer
PMTU	Path Maximum Transfer Unit	RMC	Resource Monitoring and Control
POP	Path Maximum Transfer Unit	RMSS	Reduced-Memory System Simulator
POSIX	Post Office Protocol	ROLTP	Relative OnLine Transaction Processing
	Portable Operating System Interface for Computer Environment	ROS	Read-Only Storage
POST	Power-On Self Test	RPC	Remote Procedure Call
PP	Physical Partition	RRIP	Rock Ridge Internet Protocol
PPP	Point-to-Point Protocol	RSCT	Reliable Scalable Cluster Technology
PPTP	Point-to-Point Tunneling Protocol	RSM	Removable Storage Management
PReP	PowerPC® Reference Platform®	RSVP	Resource Reservation Protocol
PSM	Persistent Storage Manager		

SACK	Selective Acknowledgments	SRM	Security Reference Monitor
SAK	Secure Attention Key	SSA	Serial Storage Architecture
SAM	Security Account Manager	SSL	Secure Sockets Layer
SAN	Storage Area Network	SUSP	System Use Sharing Protocol
SASL	Simple Authentication and Security Layer	SVC	Serviceability
SCSI	Small Computer System Interface	TAPI	Telephone Application Program Interface
SDK	Software Developer's Kit	TCB	Trusted Computing Base
SFG	Shared Folders Gateway	TCP/IP	Transmission Control Protocol/Internet Protocol
SFU	Services for UNIX		
SID	Security Identifier	TCSEC	Trusted Computer System Evaluation Criteria
SLIP	Serial Line Internet Protocol	TDI	Transport Data Interface
SMB	Server Message Block	TDP	Tivoli Data Protection
SMIT	System Management Interface Tool	TLS	Transport Layer Security
SMP	Symmetric Multiprocessor	TOS	Type of Service
SMS	Systems Management Server	TSM	Tivoli Storage Manager
SNA	Systems Network Architecture	TTL	Time to Live
SNAPI	SNA Interactive Transaction Program	UCS	Universal Code Set
SNMP	Simple Network Management Protocol	UDB	Universal Database
SP	System Parallel	UDF	Universal Disk Format
SPX	Sequenced Packet eXchange	UDP	User Datagram Protocol
SQL	Structured Query Language	UFS	UNIX File System
		UID	User Identifier
		UMS	Ultimedia Services
		UNC	Universal Naming Convention

UPS	Uninterruptable Power Supply	WFW	Windows for Workgroups
URL	Universal Resource Locator	WINS	Windows Internet Name Service
USB	Universal Serial Bus	WLM	Workload Manager
UTC	Universal Time Coordinated	WOW	Windows-16 on Win32
UUCP	UNIX to UNIX Communication Protocol	WYSIWYG	What You See Is What You Get
UUID	Universally Unique Identifier	WinMSD	Windows Microsoft Diagnostics
VAX	Virtual Address eXtension	XCMF	X/Open Common Management Framework
VCN	Virtual Cluster Name	XDM	X Display Manager
VFS	Virtual File System	XDMCP	X Display Manager Control Protocol
VG	Volume Group	XDR	eXternal Data Representation
VGDA	Volume Group Descriptor Area		
VGSA	Volume Group Status Area	XNS	XEROX Network Systems
VGID	Volume Group Identifier	XPG4	X/Open Portability Guide
VIPA	Virtual IP Address		
VMM	Virtual Memory Manager		
VP	Virtual Processor		
VPD	Vital Product Data		
VPN	Virtual Private Network		
VRMF	Version, Release, Modification, Fix		
VSM™	Virtual System Management		
W3C	World Wide Web Consortium		
WAN	Wide Area Network		

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

For information about ordering these publications, see “How to get IBM Redbooks” on page 770. Note that some of the documents referenced here may be available in softcopy only.

- ▶ *Deploying the Tivoli Storage Manager Client in a Windows 2000 Environment*, SG24-6141
- ▶ *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416
- ▶ *Tivoli Storage Manager Version 4.2 Technical Guide*, SG24-6277
- ▶ *Tivoli Storage Manager Version 5.1 Technical Guide*, SG24-6554
- ▶ *IBM Tivoli Storage Manager Version 5.3 Technical Guide*, SG24-6638
- ▶ *Introduction to SAN Distance Solutions*, SG24-6408
- ▶ *Backing Up Oracle Using Tivoli Storage Management*, SG24-6249
- ▶ *Backing Up DB2 Using IBM Tivoli Storage Manager*, SG24-6247
- ▶ *Backing Up Lotus Domino R5 Using Tivoli Storage Management*, SG24-5247
- ▶ *Using Tivoli Data Protection for Microsoft Exchange Server*, SG24-6147
- ▶ *R/3 Data Management Techniques Using Tivoli Storage Manager*, SG24-5743
- ▶ *Using Tivoli Data Protection for Microsoft SQL Server*, SG24-6148
- ▶ *Using Tivoli Storage Manager to Back Up Lotus Notes*, SG24-4534
- ▶ *Disaster Recovery Strategies with Tivoli Storage Management*, SG24-6844
- ▶ *Get More Out of Your SAN with IBM Tivoli Storage Manager*, SG24-6687
- ▶ *Backing up WebSphere Application Server with Tivoli Storage Management*, REDP-0149
- ▶ *A Practical Guide to Tivoli SANergy*, SG24-6146
- ▶ *Implementing IBM Tape in UNIX Systems*, SG24-6502
- ▶ *Implementing IBM Tape in Linux and Windows*, SG24-6268

- ▶ *The IBM TotalStorage Solutions Handbook*, SG24-5250
- ▶ *IBM TotalStorage NAS Backup and Recovery Solutions*, SG24-6831
- ▶ *IBM TotalStorage Tape Selection and Differentiation Guide*, SG24-6946
- ▶ *Managing device addressing of SAN attached tape for use with Tivoli Storage Manager*, REDP-0150
- ▶ *Managing Storage Management Tivoli Enterprise integration with Tivoli Storage Manager*, SG24-6117
- ▶ *IBM Tivoli Storage Manager in a Clustered Environment*, SG24-6679
- ▶ *Tivoli Storage Management Reporting*, SG24-6109
- ▶ *Using the System Storage N Series with IBM Tivoli Storage Manager*, SG24-7243

Other publications

These publications are also relevant as further information sources:

- ▶ *IBM Tivoli Storage Manager for AIX Quick Start V5.3*, GC32-0770
- ▶ *IBM Tivoli Storage Manager for AIX Administrator's Guide V5.3*, GC32-0768
- ▶ *IBM Tivoli Storage Manager for AIX Administrator's Reference V5.3*, GC32-0769
- ▶ *IBM Tivoli Storage Manager for HP-UX Quick Start V5.3*, GC32-0774
- ▶ *IBM Tivoli Storage Manager for HP-UX Administrator's Guide V5.3*, GC32-0772
- ▶ *IBM Tivoli Storage Manager for HP-UX Administrator's Reference V5.3*, GC32-0773
- ▶ *IBM Tivoli Storage Manager for Linux Quick Start V5.3*, GC32-4692
- ▶ *IBM Tivoli Storage Manager for Linux Administrator's Guide V5.3*, GC32-4690
- ▶ *IBM Tivoli Storage Manager for Linux Administrator's Reference V5.3*, GC32-4691
- ▶ *IBM Tivoli Storage Manager for Sun Solaris Quick Start V5.3*, GC32-0780
- ▶ *IBM Tivoli Storage Manager for Sun Solaris Administrator's Guide V5.3*, GC32-0778
- ▶ *IBM Tivoli Storage Manager for Sun Solaris Administrator's Reference V5.3*, GC32-0779
- ▶ *IBM Tivoli Storage Manager for Windows Quick Start V5.3*, GC32-0784

- ▶ *IBM Tivoli Storage Manager for Windows Administrator's Guide V5.3*,
GC32-0782
- ▶ *IBM Tivoli Storage Manager for Windows Administrator's Reference V5.3*,
GC32-0783
- ▶ *IBM Tivoli Storage Manager for AIX Storage Agent User's Guide*, GC32-0771
- ▶ *IBM Tivoli Storage Manager for HP-UX Storage Agent User's Guide*,
GC32-0772
- ▶ *IBM Tivoli Storage Manager for Linux Storage Agent User's Guide*,
GC32-4693
- ▶ *IBM Tivoli Storage Manager for Sun Solaris Storage Agent User's Guide*,
GC32-0781
- ▶ *IBM Tivoli Storage Manager for Windows Storage Agent User's Guide*,
GC32-0785
- ▶ *IBM Tivoli Storage Manager for UNIX Backup-Archive Clients Installation and User's Guide V5.3*, GC32-0789
- ▶ *IBM Tivoli Storage Manager for Windows Backup-Archive Clients Installation and User's Guide V5.3*, GC32-0788
- ▶ *IBM Tivoli Storage Manager for Space Management for UNIX: User's Guide*,
GC32-0794
- ▶ *IBM Tivoli Storage Manager Using the Application Program Interface V5.3*,
GC32-0793
- ▶ *IBM Tivoli Storage Manager for System Backup and Recovery - 5.6 - Installation and User's Guide*, GC32-9076
- ▶ *Tivoli SANergy - 2.2.4 - Administrator's Guide*, GC32-0740
- ▶ *IBM Tivoli Storage Manager for Application Servers: Data Protection for WebSphere Application Server Installation and User's Guide*, SC32-9075
- ▶ *IBM Tivoli Storage Manager for Databases: Data Protection for Microsoft SQL Server Installation and User's Guide*, SC32-9059
- ▶ *IBM Tivoli Storage Manager for Databases: Data Protection for Oracle for UNIX Installation and User's Guide*, SC32-9064
- ▶ *IBM Tivoli Storage Manager for Databases: Data Protection for Oracle for Windows Installation and User's Guide*, SC32-9065
- ▶ *IBM Tivoli Storage Manager for Databases: Data Protection for Informix Installation and User's Guide*, SH26-4095
- ▶ *IBM Tivoli Storage Manager for Enterprise Resource Planning: Data Protection for R/3 Installation and User's Guide for DB2 UDB*, SC33-6341

- ▶ *IBM Tivoli Storage Manager for Enterprise Resource Planning: Data Protection for R/3 Installation and User's Guide for Oracle*, SC33-6340
- ▶ *IBM Tivoli Storage Manager for Hardware: Data Protection for EMC Symmetrix for R/3 Installation and User's Guide*, SC33-6386
- ▶ *IBM Tivoli Storage Manager for Hardware: Data Protection for Enterprise Storage Server Databases (DB2 UDB) Installation and User's Guide*, SC32-9060
- ▶ *IBM Tivoli Storage Manager for Hardware: Data Protection for Enterprise Storage Server Databases (Oracle) Installation and User's Guide*, SC32-9061
- ▶ *IBM Tivoli Storage Manager for Hardware: Data Protection for IBM ESS for R/3 Installation and User's Guide for DB2 UDB*, SC33-8204
- ▶ *IBM Tivoli Storage Manager for Hardware: Data Protection for IBM ESS for R/3 Installation and User's Guide for Oracle*, SC33-8205
- ▶ *IBM Tivoli Storage Manager for Mail: Data Protection for Lotus Domino for UNIX and OS/400 Installation and User's Guide*, SC32-9056
- ▶ *IBM Tivoli Storage Manager for Mail: Data Protection for Lotus Domino for Windows Installation*, SC32-9057
- ▶ *IBM Tivoli Storage Manager for Mail: Data Protection for Lotus Domino, S/390 Edition Licensed Program Specifications*, GC26-7305
- ▶ *IBM Tivoli Storage Manager for Mail: Data Protection for Microsoft Exchange Server Installation and User's Guide*, SC32-9058

Online resources

These Web sites and URLs are also relevant as further information sources:

- ▶ IBM Software: Storage Management
<http://www.ibm.com/software/tivoli/solutions/storage/products.html>
- ▶ IBM Tivoli Software support site
<http://www.ibm.com/software/sysmgmt/products/support/>
- ▶ IBM Tivoli Storage Manager
<http://www.ibm.com/software/tivoli/products/storage-mgr/>
- ▶ IBM Tivoli Storage Manager Extended Edition
<http://www.ibm.com/software/tivoli/products/storage-mgr-extended>
- ▶ IBM Tivoli Storage Manager for Application Servers
<http://www.ibm.com/software/tivoli/products/storage-mgr-app-servers>

- ▶ IBM Tivoli Storage Manager for Databases
<http://www.ibm.com/software/tivoli/products/storage-mgr-db>
- ▶ IBM Tivoli Storage Manager for Enterprise Resource Planning
<http://www.ibm.com/software/tivoli/products/storage-mgr-erp>
- ▶ IBM Tivoli Storage Manager for Hardware
<http://www.ibm.com/software/tivoli/products/storage-mgr-hardware>
- ▶ IBM Tivoli Storage Manager for Mail
<http://www.ibm.com/software/tivoli/products/storage-mgr-mail>
- ▶ IBM Tivoli Continuous Data Protection for Files
<http://www.ibm.com/software/tivoli/products/continuous-data-protection>
- ▶ IBM Tivoli Storage Manager for Space Management
<http://www.ibm.com/software/tivoli/products/storage-mgr-space/>
- ▶ IBM Tivoli Storage Manager HSM for Windows
<http://www.ibm.com/software/tivoli/products/storage-mgr-hsm/>
- ▶ IBM Tivoli Storage Manager for Storage Area Networks
<http://www.ibm.com/software/tivoli/products/storage-mgr-san>
- ▶ IBM Tivoli Storage Manager for System Backup and Recovery
<http://www.ibm.com/software/tivoli/products/storage-mgr-sysback>
- ▶ IBM TotalStorage Productivity Center for Fabric
<http://www.ibm.com/software/tivoli/products/totalstorage-fabric/>
- ▶ IBM TotalStorage Productivity Center for Data
<http://www.ibm.com/software/tivoli/products/totalstorage-data/>
- ▶ Tivoli SANergy
<http://www.ibm.com/software/tivoli/products/sanergy>
- ▶ IBM Tivoli Software support site
<http://www.ibm.com/software/sysmgmt/products/support/>
- ▶ IBM.com FTP Software Server
<ftp://ftp.software.ibm.com/storage/tivoli-storage-management>
- ▶ Tivoli Software Information Center
<http://publib.boulder.ibm.com/tividd/td/tdprodlist.html>
- ▶ The Source for Java Technology
<http://java.sun.com/>

- ▶ IBM DB2 CommonStore Web site
<http://www.ibm.com/software/data/commonstore/>
- ▶ Performance Management Guide
<http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp>
- ▶ IBM Storage Media Product Selector
<http://www.storage.ibm.com/media/products.html>
- ▶ Tape and Optical Storage
<http://www.ibm.com/servers/storage/tape>
- ▶ IBM HP-UX Tape and Medium Changer Device Driver (ATDD) - readme file
<ftp://ftp.software.ibm.com/storage/devdrv/HPUX/README>
- ▶ IBM Developer Kit for AIX, Java Technology Edition
<http://www.ibm.com/developerworks/java/jdk/aix/index.html>
- ▶ QLogic Technical Support
http://www.qlogic.com/support/home_support.asp
- ▶ International Organization for Standardization
<http://www.iso.ch>
- ▶ American National Standards Organization
<http://www.ansi.org>
- ▶ RedHat Linux
<http://www.redhat.com/>
- ▶ SuSE Linux
http://www.suse.com/index_us.html
- ▶ The Linux Documentation Project
<http://www.tldp.org/>
- ▶ Linux RPM search engine
<http://www.rpmfind.net/>

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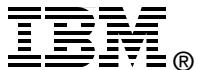
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