IBM Tivoli Storage Manager
Version 7.1.3

Introduction to Data Protection Solutions

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IBM

Note:
Before you use this information and the product it supports, read the information in "Notices" on page 55.

First edition (September 2015)

This edition applies to version 7, release 1, modification 3 of IBM Tivoli Storage Manager (product numbers 5608-E01, 5608-E02, 5608-E03), and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

About this publication

This publication provides an overview of IBM® Tivoli® Storage Manager concepts and data protection solutions that use best practices for Tivoli Storage Manager. A feature comparison chart helps you select the best solution for your organization's needs.

Who should read this guide

This guide is intended for anyone who is registered as an administrator for Tivoli Storage Manager. A single administrator can manage Tivoli Storage Manager, or several people can share administrative responsibilities.

You should be familiar with the operating system on which the server resides and the communication protocols required for the client/server environment. You also need to understand the storage management practices of your organization, such as how you are currently backing up workstation files and how you are using storage devices.

Publications

The Tivoli Storage Manager product family includes IBM Tivoli Storage FlashCopy® Manager, IBM Tivoli Storage Manager for Space Management, IBM Tivoli Storage Manager for Databases, and several other storage management products from IBM.

To view IBM product documentation, see http://www.ibm.com/support/knowledgecenter.

Part 1. Tivoli Storage Manager concepts

IBM Tivoli Storage Manager provides a comprehensive data protection environment.

Chapter 1. Tivoli Storage Manager overview

IBM Tivoli Storage Manager provides centralized, automated data protection that helps to reduce data loss and manage compliance with data retention and availability requirements.

Tivoli Storage Manager data protection components

The data protection solutions that Tivoli Storage Manager provides consist of Tivoli Storage Manager server, client systems and applications, and storage media. Tivoli Storage Manager provides management interfaces for monitoring and reporting the data protection status.

Clients

Clients are applications, virtual machines, and systems that must be protected. The clients send data to the Tivoli Storage Manager server, as shown in Figure 1.

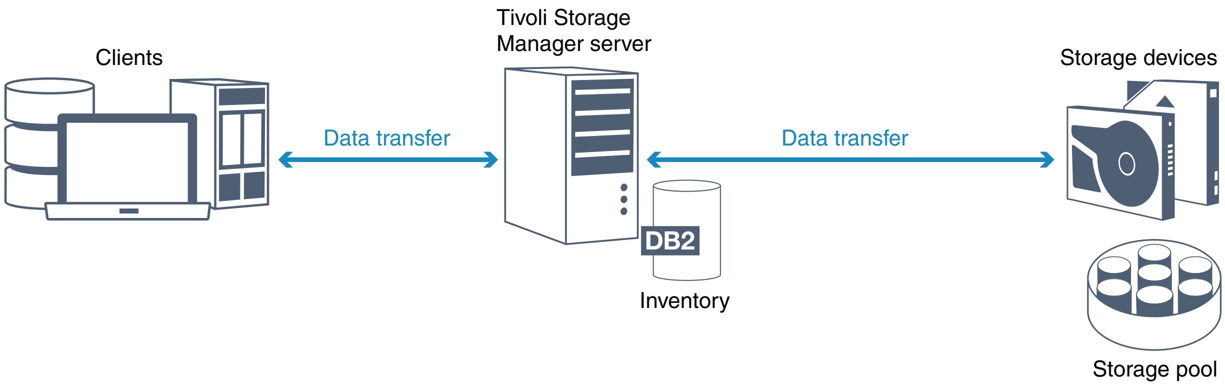


Figure 1. Components in the Tivoli Storage Manager data protection solution

Client software
In the context of Tivoli Storage Manager, a *client* fulfills the same role as an endpoint or agent in other industry data protection products. Client software must be installed on the client, and the client must be registered with the Tivoli Storage Manager server.

Client nodes
A client node is equivalent to a computer, virtual machine, or application, such as a Tivoli Storage Manager backup-archive client that is installed on a workstation for file system backups. Multiple nodes can be registered on a single computer.

Tivoli Storage Manager server

Client systems send data to the Tivoli Storage Manager server to be stored as backups or archives. The Tivoli Storage Manager server includes an *inventory* where information about client data is stored. The inventory includes the following components:

Database

Information about each file, logical volume, or database that the server backs up, archives, or migrates is stored in the server database. The server database also contains information about the policy and schedules for data protection services.

Recovery log

Records of database transactions are kept in this log. The database uses the recovery log to ensure data consistency in the database.

Storage media

The Tivoli Storage Manager server stores client data to storage media:

Storage devices

The Tivoli Storage Manager server can write data to hard disk drives, disk arrays and subsystems, stand-alone tape drives, tape libraries, and other types of random-access and sequential-access storage. Storage devices can be connected directly to the server or connected through a local area network (LAN) or a storage area network (SAN).

Storage pools

Storage devices that are connected to the Tivoli Storage Manager server are grouped into *storage pools*. Each storage pool represents a set of storage devices of the same media type, such as disk or tape drives. Tivoli Storage Manager stores all of the client data in storage pools. You can organize storage pools into a *hierarchy*, so that data storage can transfer from disk storage to lower-cost storage such as tape devices.

Tivoli Storage Manager services for data protection

Tivoli Storage Manager provides services to store and recover data from various types of clients. The data protection services are implemented through policies that are defined on the Tivoli Storage Manager server. You can use client scheduling to automate the data protection services.

Types of data protection services

Tivoli Storage Manager provides services to store and recover client data as shown in Figure 2 on page 5.

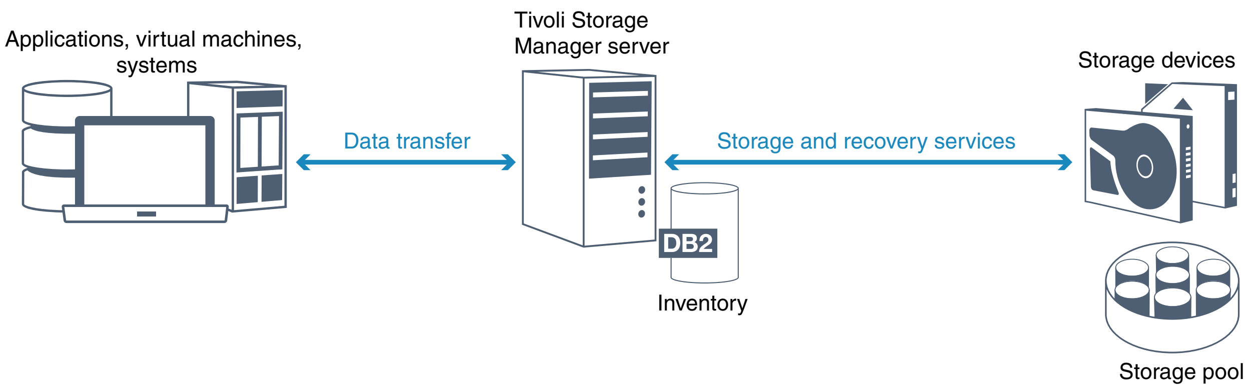

Applications, virtual machines, systems
Data transfer
Tivoli Storage Manager server
DB2
Inventory
Storage and recovery services
Storage devices
Storage pool

Figure 2. Tivoli Storage Manager data protection services

Tivoli Storage Manager provides the following types of data protection services:

Back up and restore services

You use a backup operation to create a copy of a *data object* that can be used for recovery if the original data object is lost. A data object can be a file, a directory, or a user-defined data object, such as a database. To minimize the use of system resources during the backup operation, Tivoli Storage Manager uses the *progressive incremental backup* method. For this backup method, a first full backup of all data objects is created and in subsequent backup operations only changed data is moved to storage. Compared to incremental and differential backup methods that require taking periodic full backups, the progressive incremental backup method provides the following benefits:

- Reduces data redundancy
- Uses less network bandwidth
- Requires less storage pool space

To further reduce storage capacity requirements and network bandwidth usage, Tivoli Storage Manager includes *data deduplication* for data backups. The data deduplication technique removes duplicate data extents from backups.

You use a restore operation to copy an object from a storage pool to the client. You can restore a single file, all files in a directory, or all of the data on a computer.

Archive and retrieve services

You use the archive service to preserve data that must be stored for a long time, such as for regulatory compliance. The archive service provides the following features:

- When you archive data, you specify how long the data must be stored.
- You can request that files and directories are copied to long-term storage on media. For example, you might choose to store this data on a tape device, which can reduce the cost of storage.
- You can specify that the original files are erased from the client after the files are archived.

The retrieve service provides the following features:

- When you retrieve data, the data is copied from a storage pool to a client node.

- The retrieve operation does not affect the archive copy in the storage pool.

Migrate and recall services

You use migrate and recall services to manage space on client systems. You can migrate data to server storage to maintain sufficient free storage space on a local file system. You can store migrated data on disk storage or in a *virtual tape library* (VTL) so that files can be recalled quickly. The files can be recalled to the client node on demand, either automatically or selectively. The goal of space management is to maximize available media capacity for new data and to minimize access time to data.

Types of client data that can be protected

You can protect data for the following types of clients with Tivoli Storage Manager:

Application clients

Tivoli Storage Manager can protect data for specific products or applications. These clients are called *application clients*. To protect the *structured data* for these clients, in other words the data in database fields, you must back up components that are specific to the application. Tivoli Storage Manager can protect the following applications:

- IBM Tivoli Storage Manager for Enterprise Resource Planning clients:
  - Data protection for SAP HANA
  - Data protection for SAP for DB2
  - Data protection for SAP for Oracle
- IBM Tivoli Storage Manager for Databases clients:
  - Data protection for Microsoft SQL server
  - Data protection for Oracle
- IBM Tivoli Storage Manager for Mail clients:
  - Data protection for IBM Domino
  - Data protection for Microsoft Exchange Server

Virtual machines

Virtual machines that are backed up by using application client software that is installed on the virtual machine. In the Tivoli Storage Manager environment, a virtual machine can be protected by the IBM Tivoli Storage Manager for Virtual Environments.

System clients

The following clients are called *system clients*:

- All clients that back up data in files and directories, in other words *unstructured data*, such as backup-archive clients and API clients that are installed on workstations.
- A Tivoli Storage Manager server that is included in a server-to-server virtual volume configuration.
- A virtual machine that is backed up by using backup-archive client software that is installed on the virtual machine.

Processes for managing data protection with Tivoli Storage Manager

Tivoli Storage Manager server inventory has a key role in the processes for data protection. You define policies that the server uses to manage data storage.

Data management process

Figure 3 shows the Tivoli Storage Manager data management process.

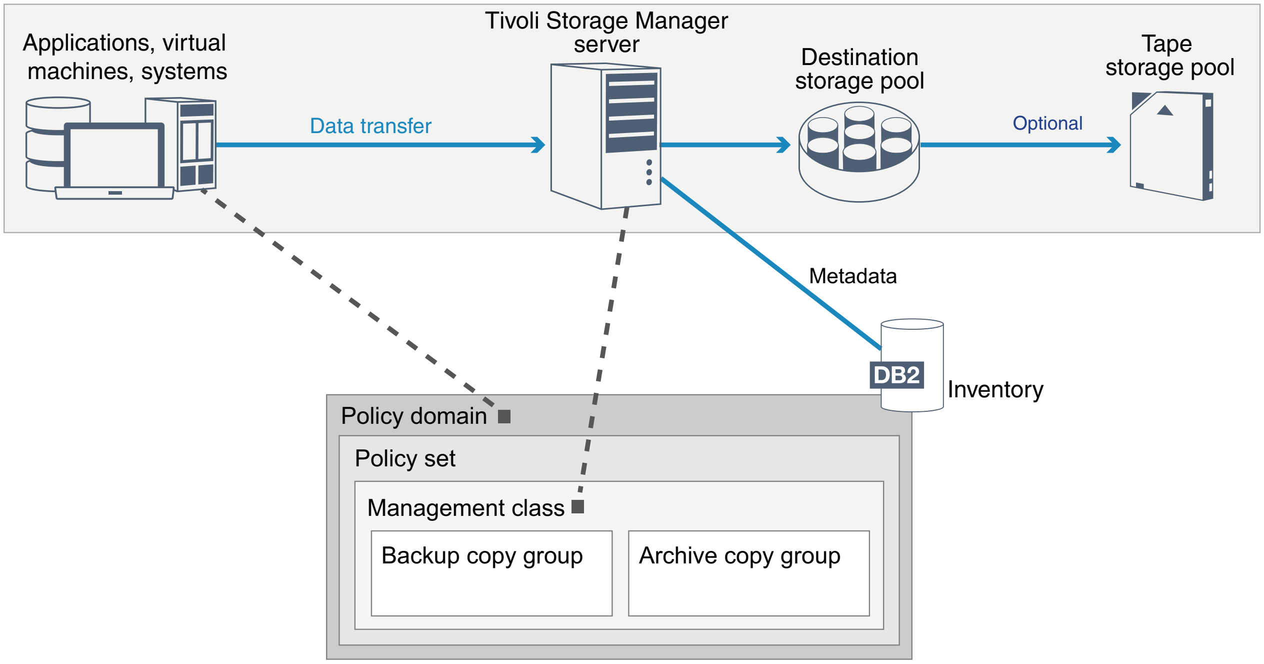


Figure 3. Tivoli Storage Manager data management process

Tivoli Storage Manager uses policies to control how the server stores and manages data objects on various types of storage devices and media. You associate a client with a policy domain that contains one active policy set. When a client backs up, archives, or migrates a file, the file is bound to a management class in the active policy set of the policy domain. The management class and the backup and archive copy groups specify where files are stored and how they are managed. If you set up server storage in a hierarchy, you can migrate files to different storage pools.

Inventory components

The following inventory components are key to the operation of the Tivoli Storage Manager server:

Server database

The server database contains information about client data and server operations. The database stores information about client data, called *metadata*. Information about client data includes the file name, file size, file owner, management class, copy group, and location of the file in server storage. The database includes the following information that is necessary for the operation of the server:

- Definitions of client nodes and administrators
- Policies and schedules

- Server settings
- Records of server operations, such as activity logs and event records
- Intermediate results for administrative queries

Recovery log

The server records database transactions in the recovery log. The recovery log helps to ensure that a failure does not leave the database in an inconsistent state. The recovery log is also used to maintain consistency across server start operations. The recovery log consists of the following logs:

Active log

This log records current transactions on the server. This information is required to start the server and database after a disaster.

Log mirror (optional)

The active log mirror is a copy of the active log that can be used if the active log files cannot be read. All changes that are made to the active log are also written to a log mirror. You can set up one active log mirror.

Archive log

The archive log contains copies of closed log files that were in the active log. The archive log is included in database backups and is used for recovery of the server database. Archive log files that are included in a database backup are automatically pruned after a full database backup cycle is complete. The archive log must have enough space to store the log files for database backups.

Archive failover log (optional)

The archive failover log, also called a secondary archive log, is the directory that the server uses to store archive log files when the archive log directory is full.

Policy-based data management

A Tivoli Storage Manager *policy* for data protection management contains rules that determine how client data is stored and managed. The primary purpose of a policy is to control which storage pool client data is initially stored in, and to define retention criteria that controls how many copies of objects are stored and how long the copies are retained. Policy-based data management helps you to focus on the business requirements for protecting data rather than on managing storage devices and media. Administrators define policies and assign client nodes to a *policy domain*.

Depending on your business needs, you can have one policy or many. In a business organization, for example, different departments with different types of data can have customized storage management plans. Policies can be updated, and the updates can be applied to data that is already managed.

When you install Tivoli Storage Manager, a default policy that is named STANDARD is already defined. The STANDARD policy provides basic backup protection for user workstations. To provide different levels of service for different clients, you can add to the default policy or create a new policy.

You create policies by defining the following policy components:

Policy domain

The policy domain is the primary organizational method of grouping client nodes that share common rules for data management. Although a client node can be defined to more than one Tivoli Storage Manager server, the client node can be defined to only one policy domain on each server.

Policy set

A *policy set* is a number of policies that are grouped so that the policy for the client nodes in the domain can be activated or deactivated as required. An administrator uses a policy set to implement different management classes based on business and user needs. A policy domain can contain multiple policy sets, but only one policy set can be active in the domain. Each policy set contains a default management class and any number of additional management classes.

Management class

A *management class* is a policy object that you can bind to each category of data to specify how the Tivoli Storage Manager server manages the data. There can be one or more management classes. One management class is assigned to be the default management class that is used by clients unless they specifically override the default to use a specific management class.

The management class can contain a backup copy group, an archive copy group, and space management attributes. A copy group determines how the server manages backup versions or archived copies of the file. The space management attributes determine whether the file is eligible for migration by the space manager client to server storage, and under what conditions the file is migrated.

Copy group

A *copy group* is a set of attributes in a management class that controls the following factors:

- Where the server stores versions of backed up files or archive copies
- How long the server keeps versions of backed up files or archive copies
- How many versions of backup copies are retained
- What method to use to generate versions of backed up files or archive copies

Security management

Tivoli Storage Manager includes security features for administrator and user registration. After administrators are registered, they must be granted authority by being assigned one or more administrative privilege classes. An administrator with system privilege can perform any server function. Administrators with policy, storage, operator, or node privileges can perform subsets of server functions. The server can be accessed with the following methods, each controlled with a password:

- Administrator access to manage the server
- Client access to nodes to store and retrieve data

Also included are features that can help ensure security when clients connect to the server. Depending on business requirements, administrators choose one of the following client registration methods:

Open registration

When the client first connects to the server, the user is requested for a node name, password, and contact information. Open registration provides the user with following default settings:

- The client node is assigned to the STANDARD policy domain.
- The user can define whether files are compressed to decrease the amount of data that is sent over networks and the space that is occupied by the data in storage.
- The user can delete archived copies of files from server storage, but not backup versions of files.

Closed registration

Closed registration is the default method for client registration to the Tivoli Storage Manager server. For this type of registration, an administrator registers all clients. The administrator can make the following settings:

- Assign the node to any policy domain
- Determine if the user can use compression or not, or if the user has the ability to choose
- Control whether the user can delete backed up files or archived files

You can add more protection for your data and passwords by using Secure Sockets Layer (SSL). SSL is the standard technology that you use to create encrypted sessions for servers and clients, and provides a secure channel to communicate over open communication paths. With SSL, the identity of the server is verified by using digital certificates. If you authenticate passwords with a Lightweight Directory Access Protocol (LDAP) directory server, such as Active Directory, passwords between the Tivoli Storage Manager server and the LDAP server are protected by Transport Layer Security (TLS), a form of SSL.

User interfaces for the Tivoli Storage Manager environment

For monitoring and configuration tasks, Tivoli Storage Manager provides various interfaces, including the Operations Center, a command-line interface, and an SQL administrative interface.

Interfaces for data storage management

The Operations Center is the primary interface for administrators to monitor and administer Tivoli Storage Manager servers. A key benefit of the Operations Center is that you can monitor multiple Tivoli Storage Manager servers, as shown in Figure 4 on page 11. You can also monitor and administer Tivoli Storage Manager from a command-line administrative interface.

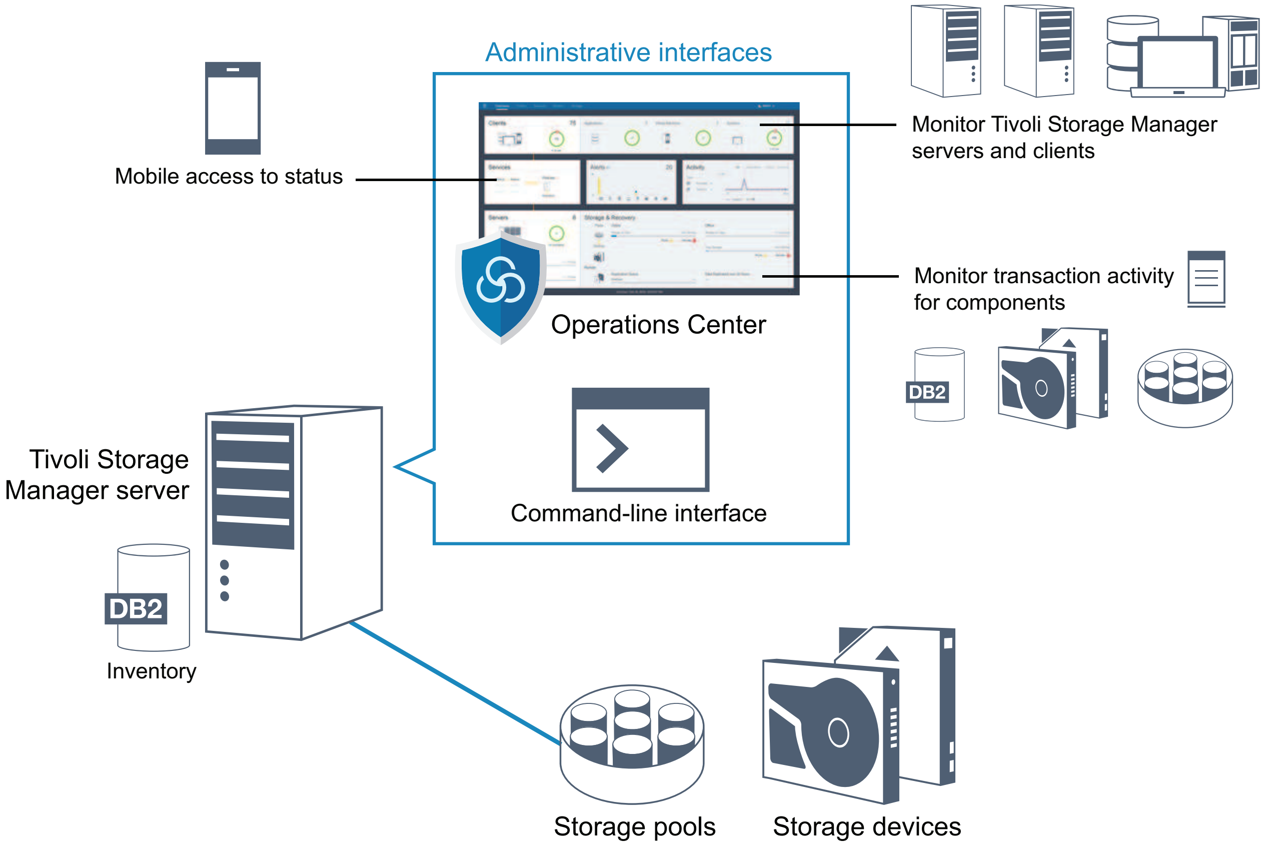

Administrative interfaces
Mobile access to status
Monitor Tivoli Storage Manager servers and clients
Monitor transaction activity for components
DB2
Operations Center
Command-line interface
Tivoli Storage Manager server
DB2
Inventory
Storage pools
Storage devices

Figure 4. Tivoli Storage Manager user interfaces

You can use the following interfaces to work with Tivoli Storage Manager:

Operations Center

The Operations Center provides web and mobile access to status information about the Tivoli Storage Manager environment. You can use the Operations Center to complete monitoring and certain administration tasks, for example:

- You can monitor multiple Tivoli Storage Manager servers and clients.
- You can monitor the transaction activity for specific components in the data path, such as the server database, the recovery log, storage devices and storage pools.

Command-line interface

You can use a command-line interface to run administration tasks for Tivoli Storage Manager servers. You can access the command-line interface through either the Tivoli Storage Manager administrative client or the Operations Center.

Access to information in the server database by using SQL statements

You can use SQL SELECT statements to query the Tivoli Storage Manager server database and display the results. Third-party SQL tools are available to aid administrators in database management.

Interfaces for client activity management

Tivoli Storage Manager provides the following types of interfaces for managing client activity:

- Tivoli Storage Manager application programming interface (API)
- Graphical user interfaces for Tivoli Storage Manager clients
- Web interface for the Tivoli Storage Manager backup-archive client
- Command-line interfaces for Tivoli Storage Manager clients

Chapter 2. Data storage concepts in Tivoli Storage Manager

The Tivoli Storage Manager provides functions to store data in a range of device and media storage.

To make storage devices available to a Tivoli Storage Manager server, you must attach the storage devices and map storage pools to device classes, libraries, and drives.

Types of storage devices

You can use various storage devices with Tivoli Storage Manager to meet specific data protection goals.

Storage devices and storage objects

The Tivoli Storage Manager server can connect to a combination of manual and automated storage devices. You can connect the following types of storage devices to Tivoli Storage Manager:

- Disk devices that are directly attached, SAN-attached, or network attached
- Physical tape devices that are either manually operated or automated
- Virtual tape devices
- Cloud object storage

Tivoli Storage Manager represents physical storage devices and media with storage objects that you define in the server database. Storage objects classify available storage resources and manage migration from one storage pool to another. Table 1 describes the storage objects in the Tivoli Storage Manager server storage environment.

Table 1. Storage objects and representations

Storage object	What the object represents
Volume	A discrete unit of storage on disk, tape, or other storage media. Each volume is associated with a single storage pool.
Storage pool	A collection of available volumes of the same media type. Tivoli Storage Manager uses the following types of storage pool: • Directory-container storage pools • Sequential access storage pools associated with a device class • Random access storage pools associated with a device class • Cloud-container storage pools
Container	The unit of storage that is used by directory-container storage pools.
Device class	The type of storage device that can use the volumes that are defined in a sequential-access or random-access storage pool. Each device class of removable media type is associated with a single library.

Table 1. Storage objects and representations (continued)

Storage object	**What the object represents**
Library	A storage device. For example, a library can represent a stand-alone drive, a set of stand-alone drives, a multiple-drive automated device, or a set of drives that is controlled by an external media manager.
Drive	An object of a tape library device that provides the capability to read and write data to tape library media. Each drive is associated with a single library.
Path	The specification of the data source and the device destination. Before a storage device can be used, a path must be defined between the device and the source server that is moving data.
Data mover	A SAN-attached device that is used to transfer client data. A data mover is used only in a data transfer where the Tivoli Storage Manager server is not present, such as in a Network Data Management Protocol (NDMP) environment. Data movers transfer data between storage devices without using significant server, client, or network resources.
Server	A Tivoli Storage Manager server that is managed by another Tivoli Storage Manager server.

The administrator defines the storage objects in the logical layer of the server, as illustrated in Figure 5 on page 15.

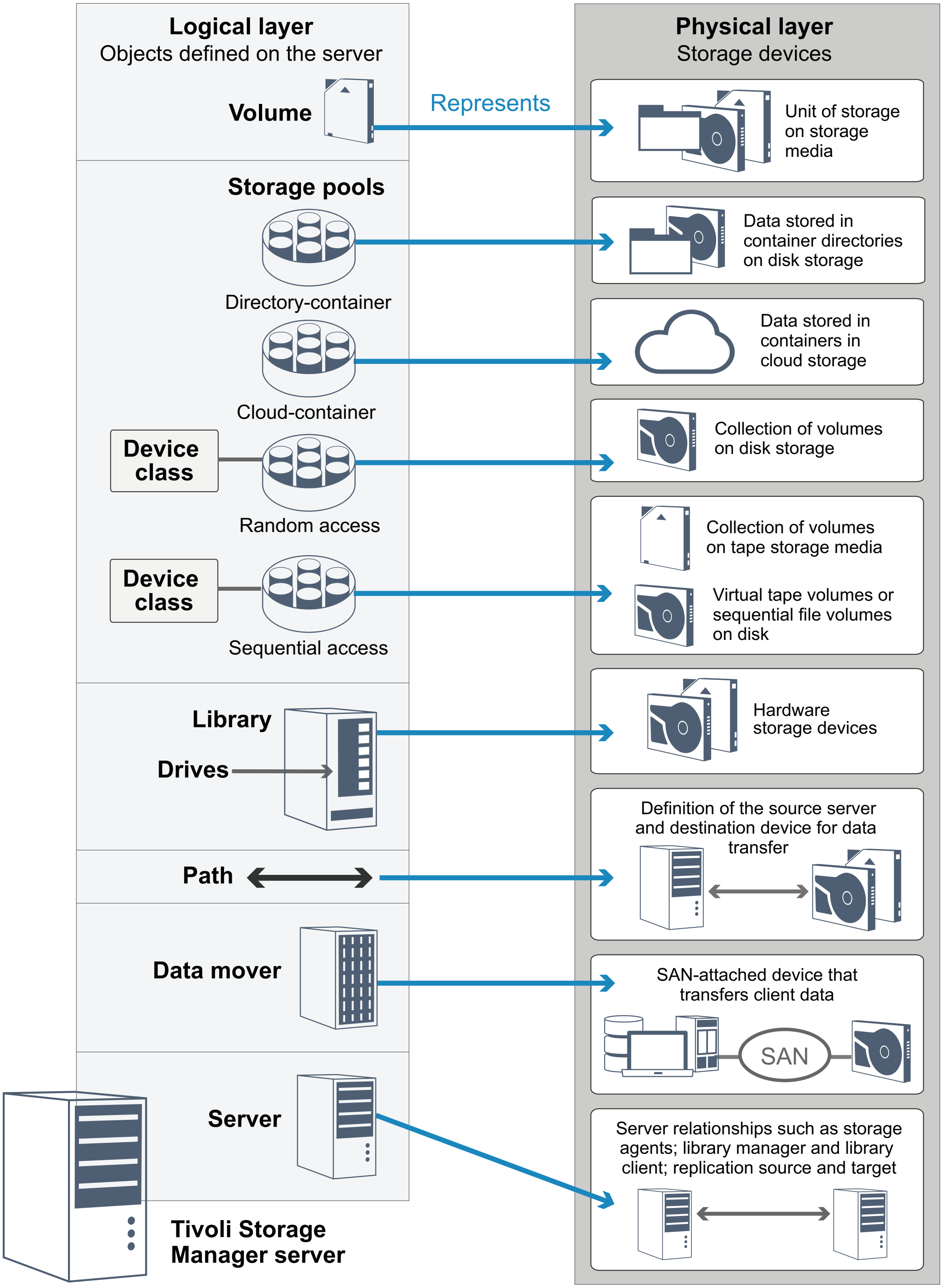

Logical layer
Objects defined on the server
Volume
Represents
Physical layer
Storage devices
Unit of storage on storage media
Storage pools
Directory-container
Data stored in container directories on disk storage
Cloud-container
Data stored in containers in cloud storage
Device class
Random access
Collection of volumes on disk storage
Device class
Sequential access
Collection of volumes on tape storage media
Virtual tape volumes or sequential file volumes on disk
Library
Drives
Hardware storage devices
Path
Definition of the source server and destination device for data transfer
Data mover
SAN-attached device that transfers client data
SAN
Server
Server relationships such as storage agents; library manager and library client; replication source and target
Tivoli Storage Manager server

Figure 5. Storage objects for use with Tivoli Storage Manager

Disk devices

You can store client data on disk devices with the following types of volume:

- Directories in directory-container storage pools
- Random-access volumes of device type DISK
- Sequential-access volumes of device type FILE

Tivoli Storage Manager offers the following features when you use directory-container storage pools for data storage:

- You can apply data deduplication and disk caching techniques to maximize data storage usage.
- You can retrieve data from disk much faster than you can retrieve data from tape storage.

Physical tape devices

In a physical tape library the storage capacity is defined in terms of the total number of volumes in the library. Physical tape devices can be used for the following activities:

- Storing client data that is backed up, archived, or migrated from client nodes
- Storing database backups
- Exporting data to another server or offsite storage

Moving data to tape provides the following benefits:

- You can keep data for clients on a disk device at the same time that the data is moved to tape.
- You can improve tape drive performance by streaming the data migration from disk to tape.
- You can spread out the times when the drives are in use to improve the efficiency of the tape drives.
- You can move data on tape to off-site vaults.
- You can limit power consumption because tape devices do not consume power after data is written to tape.
- You can apply encryption that is provided by the tape drive hardware to protect the data on tape.

Compared to equivalent disk and virtual tape storage, the unit cost to store data tends to be much lower for physical tape devices.

Virtual tape libraries

A *virtual tape library* (VTL) does not use physical tape media. When you use VTL storage, you emulate the access mechanisms of tape hardware. In a VTL, you can define volumes and drives to provide greater flexibility for the storage environment. The storage capacity of a VTL is defined in terms of total available disk space. You can increase or decrease the number and size of volumes on disk.

Defining a VTL to the Tivoli Storage Manager server can improve performance because the server handles mount point processing for VTLs differently than for real tape libraries. Although the logical limitations of tape devices are still present, the physical limitations for tape hardware are not applicable to a VTL thus affording better scalability. You can use the Tivoli Storage Manager VTL when the following conditions are met:

- Only one type and generation of drive and media is emulated in the VTL.
- Every server and storage agent with access to the VTL has paths that are defined for all drives in the library.

Data storage in storage pools

Logical storage pools are the principal components in the Tivoli Storage Manager model of data storage. You can optimize the usage of storage devices by manipulating the properties of storage pools and volumes.

Types of storage pools

The group of storage pools that you set up for the Tivoli Storage Manager server is called *server storage*. You can define the following types of storage pools in server storage:

- Primary storage pools
- Copy-storage pools
- Active-data storage pools

Primary storage pools

When a user tries to restore, retrieve, recall, or export file data, the requested file is obtained from a primary storage pool. Depending on the type of primary storage pool, the storage pools can be located on site or off site. You can arrange primary storage pools in a storage hierarchy so that data can be transferred from disk storage to lower-cost storage such as tape devices. Figure 6 on page 18 illustrates the concept of primary storage pools in Tivoli Storage Manager.

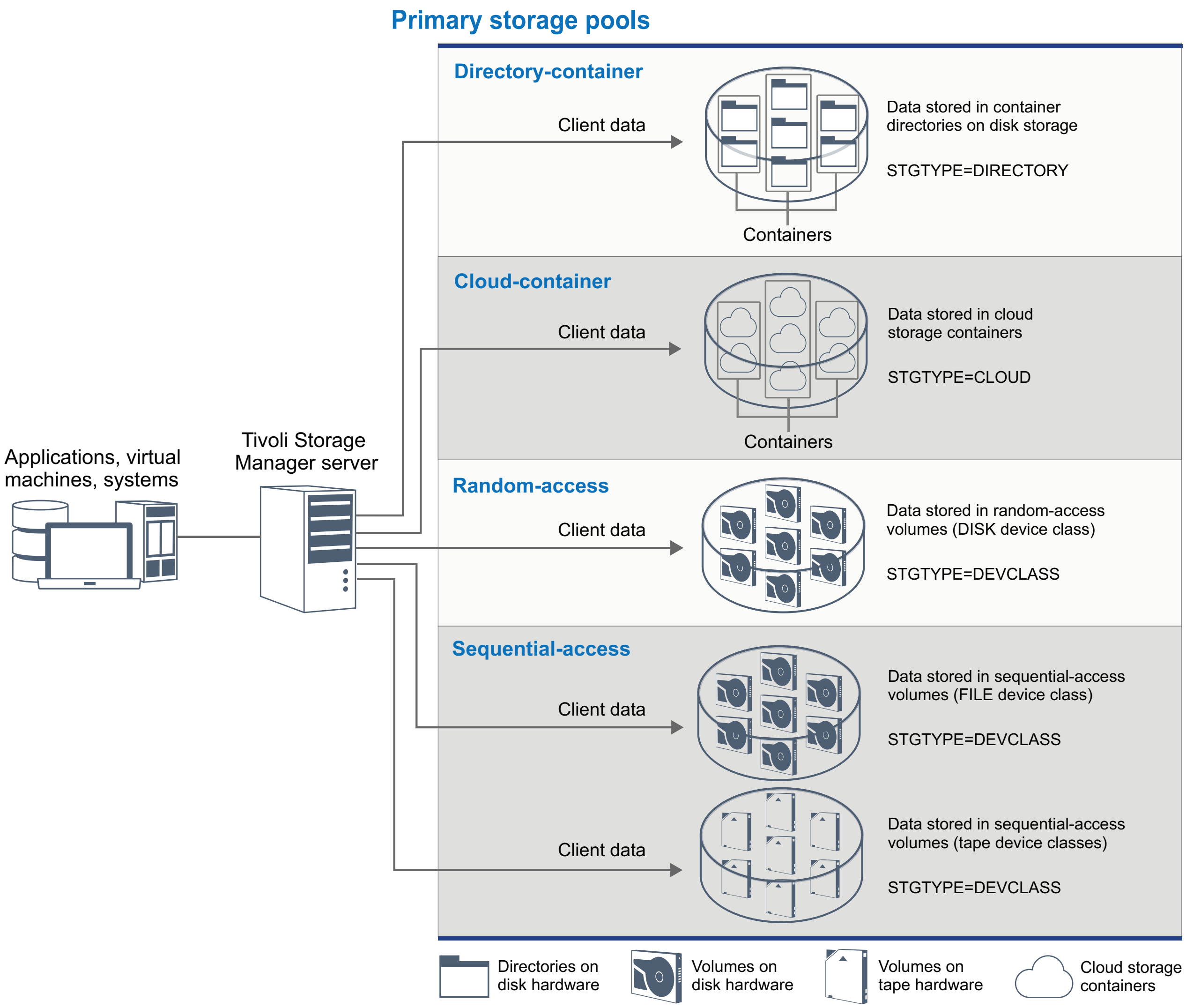

Primary storage pools
Directory-container
Client data
Data stored in container directories on disk storage
STGTYPE=DIRECTORY
Containers
Cloud-container
Client data
Data stored in cloud storage containers
STGTYPE=CLOUD
Containers
Applications, virtual machines, systems
Tivoli Storage Manager server
Random-access
Client data
Data stored in random-access volumes (DISK device class)
STGTYPE=DEVCLASS
Sequential-access
Client data
Data stored in sequential-access volumes (FILE device class)
STGTYPE=DEVCLASS
Client data
Data stored in sequential-access volumes (tape device classes)
STGTYPE=DEVCLASS
Directories on disk hardware
Volumes on disk hardware
Volumes on tape hardware
Cloud storage containers

Figure 6. Primary storage pools in Tivoli Storage Manager

You can define the following types of primary storage pool:

Directory-container storage pools

Directory-container storage pools contain containers that are stored in storage pool directories. In directory-container storage pools, data is deduplicated at the same time that the data is stored. By using directory-container storage pools, you remove the need for volume reclamation, which improves server performance and reduces the cost of storage hardware. You can protect and repair data in directory-container storage pools at the level of the storage pool.

Restriction: You cannot use any of the following functions with directory-container storage pools:

- Migration
- Reclamation
- Aggregation
- Collocation
- Simultaneous-write

- Storage pool backup
- Virtual volumes

If your storage objectives require any of these functions, then you can also implement storage pools that are associated with device classes.

Cloud-container storage pools

The cloud-container storage pools that are provided by Tivoli Storage Manager can store data to an object-store based cloud storage provider. By storing data storage in cloud-container storage pools, you can exploit the cost per unit advantages that clouds offer along with the scale-up and scale-out capabilities that cloud storage provides.Tivoli Storage Manager manages the credentials, security, read and write I/Os, and the data lifecycle for data that is stored to the cloud. When cloud-container storage pools are implemented in the server, you can write directly to the cloud by configuring a cloud-container storage pool with the cloud credentials. The Tivoli Storage Manager server writes deduplicated and encrypted data directly to the cloud. You can back up and restore data or archive and retrieve data directly from the cloud-container storage pool.

You can define the following types of Tivoli Storage Manager cloud-container storage pools:

On premises

You can use the on premises setting to store data in a private cloud, for additional security and maximum control over your data. The disadvantages of a private cloud are higher costs due to hardware requirements and on-site maintenance.

Off premises

You can use the off premises setting to store data in a public cloud and achieve lower costs than for a private cloud, for example by eliminating maintenance. However, these benefits must be balanced against possible performance issues due to connection speeds and reduced control over your data.

Storage pools that are associated with device classes

You can define a primary storage pool to use the following types of storage devices:

DISK device class

In a DISK device type of storage pool, data is stored in random access disk blocks. You can use caching in DISK storage pools to increase client restore performance with some limitations on server processing. Space allocation and tracking by blocks uses more database storage space and requires more processing power than allocation and tracking by volume.

FILE device class

In a FILE device type of storage pool, files are stored in sequential volumes for better sequential performance than for storage in disk blocks. To the server, these files have the characteristics of a tape volume so that this type of storage pool is better suited for migration to tape. FILE volumes are useful for *electronic vaulting*, where data is transferred electronically to a remote site rather than by physical shipment of tape. In general, this type of storage pool is preferred over DISK storage pools.

The Tivoli Storage Manager server uses the following default random-access primary storage pools:

ARCHIVEPOOL
In the STANDARD policy, this storage pool is the destination for files that are archived from client nodes.

BACKUPPOOL
In the STANDARD policy, this storage pool is the destination for files that are backed up from client nodes.

SPACEMGPOOL
This storage pool is for space-managed files that are migrated from Tivoli Storage Manager for Space Management client nodes.

Copy storage pools

Copy storage pools contain active and inactive versions of data that is backed up from primary storage pools. A directory-container storage pool cannot be used as a copy storage pool. In addition, data from a directory-container storage pool cannot be copied into a copy storage pool. Figure 7 illustrates the concept of copy storage pools in Tivoli Storage Manager.

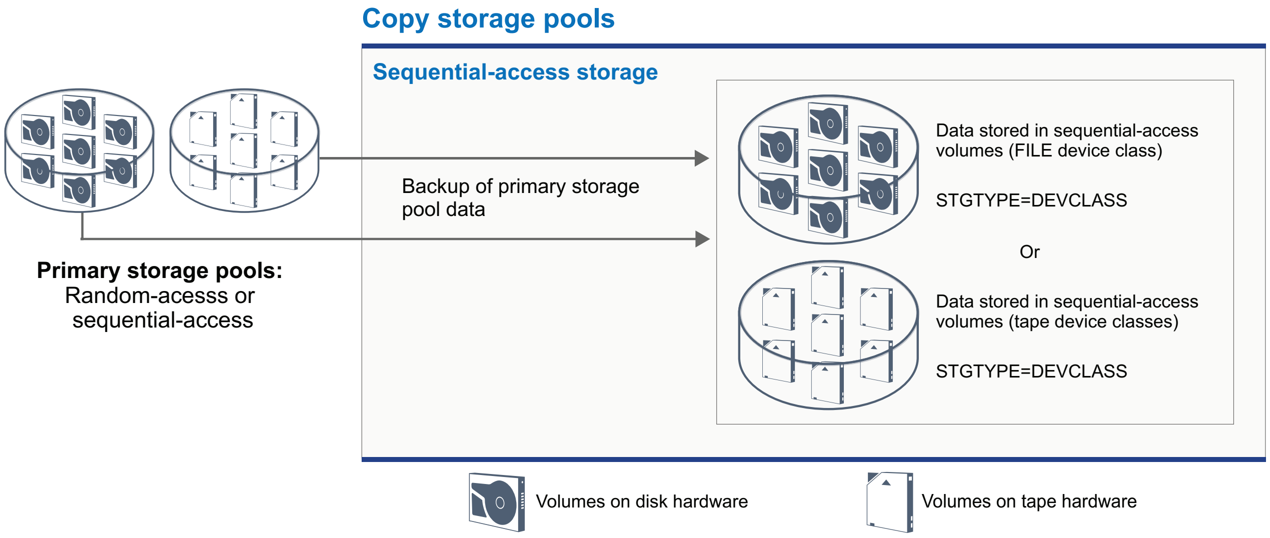

Copy storage pools
Sequential-access storage
Backup of primary storage pool data
Data stored in sequential-access volumes (FILE device class)
STGTYPE=DEVCLASS
Or
Data stored in sequential-access volumes (tape device classes)
STGTYPE=DEVCLASS
Primary storage pools: Random-acesss or sequential-access
Volumes on disk hardware
Volumes on tape hardware

Figure 7. Copy storage pools in Tivoli Storage Manager

Copy storage pools provide a means of recovering from disasters or media failures. For example, when a client attempts to retrieve a damaged file from the primary storage pool, the client can restore the data from the copy storage pool.

You can move the volumes of copy storage pools offsite and still have the server track the volumes. Moving these volumes offsite provides a means of recovering from an onsite disaster. A copy storage pool can use sequential-access storage only, such as a tape device class or FILE device class.

Active-data storage pools

An active-data pool contains only active versions of client backup data. In this case, the server does not have to position past inactive files that do not have to be restored. A directory-container storage pool cannot be used as an active-data storage pool. You use active-data pools to improve the efficiency of data storage and restore operations, for example this type of storage pool can help you to achieve the following objectives:

- Increase the speed of client data restore operations
- Reduce the number of onsite or offsite storage volumes
- Reduce the amount of data that is transferred when you copy or restore files that are vaulted electronically in a remote location

Data that is migrated by hierarchical storage management (HSM) clients and archive data are not permitted in active-data pools. As updated versions of backup data are stored in active-data pools, older versions are removed as the remaining data is consolidated from many sequential-access volumes onto fewer, new sequential-access volumes. Figure 8 illustrates the concept of active-data storage pools in Tivoli Storage Manager.

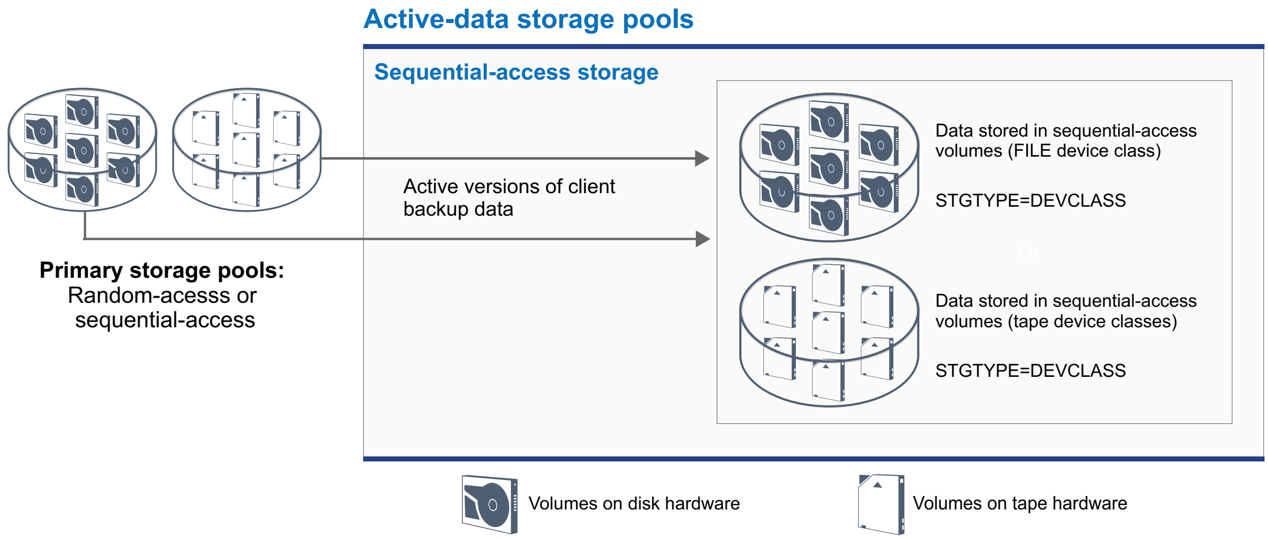

Active-data storage pools
Sequential-access storage
Active versions of client backup data
Data stored in sequential-access volumes (FILE device class)
STGTYPE=DEVCLASS
Or
Data stored in sequential-access volumes (tape device classes)
STGTYPE=DEVCLASS
Primary storage pools: Random-acesss or sequential-access
Volumes on disk hardware
Volumes on tape hardware

Figure 8. Active-data storage pools in Tivoli Storage Manager

Active-data pools can use any type of sequential-access storage. However, the benefits of an active-data pool depend on the device type that is associated with the pool. For example, active-data pools that are associated with a FILE device class are ideal for fast client restore operations because of the following reasons:

- FILE volumes do not have to be physically mounted
- Client sessions that are restoring from FILE volumes in an active-data pool can access the volumes concurrently, which improves restore performance

Data transport to storage across networks

The Tivoli Storage Manager environment provides ways to securely move data to storage across various types of networks and configurations.

Network configurations for storage devices

Tivoli Storage Manager provides methods for configuring clients and servers on a local area network (LAN), on a storage area network (SAN), LAN-free data movement, and as network-attached storage.

Data backup operations over a LAN

Figure 9 shows the data path for Tivoli Storage Manager backup operations over a LAN.

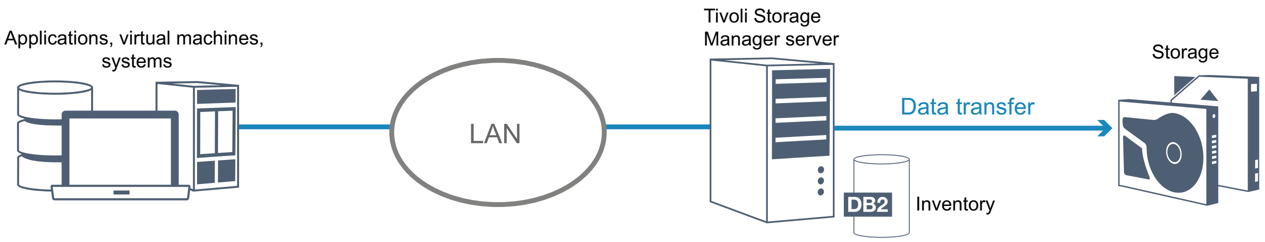

Applications, virtual machines, systems
LAN
Tivoli Storage Manager server
Data transfer
Storage
DB2
Inventory

Figure 9. Tivoli Storage Manager backup operations over a LAN

In a LAN configuration, one or more tape libraries are associated with a single Tivoli Storage Manager server. In this type of configuration, client data, electronic mail, terminal connection, application program, and device control information must all be handled by the same network. Device control information and client backup and restore data flow across the LAN.

Data backup operations over a SAN

Figure 10 shows the data path for Tivoli Storage Manager backup operations over a SAN.

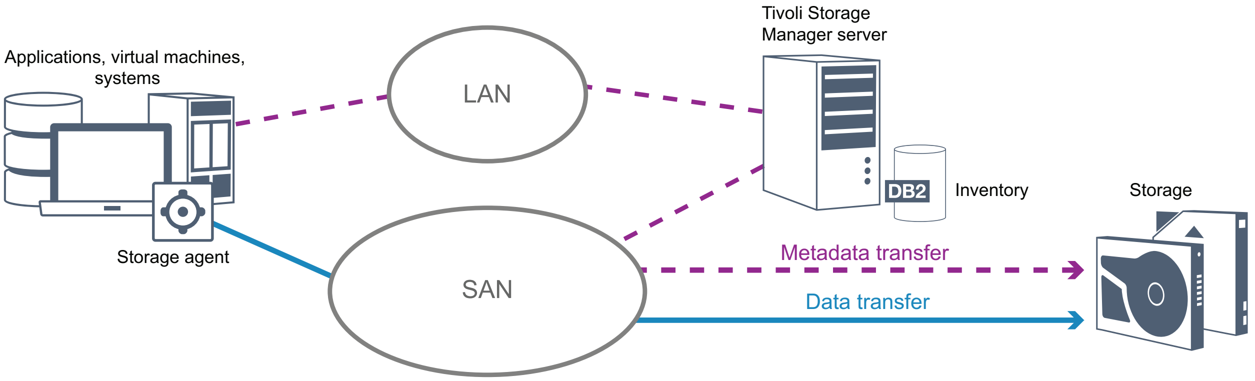

Applications, virtual machines, systems
Storage agent
LAN
SAN
Tivoli Storage Manager server
DB2
Inventory
Storage
Metadata transfer
Data transfer

Figure 10. Tivoli Storage Manager backup operations over a SAN

A SAN is a dedicated storage network that can improve system performance. On a SAN, you can consolidate storage and relieve the distance, scalability, and bandwidth limitations of LANs and wide area networks (WANs). By using Tivoli Storage Manager in a SAN, you can take advantage of the following functions:

- Share storage devices among multiple Tivoli Storage Manager servers. Devices that use the GENERICTAPE device type are not included.
- Move client data directly to storage devices by configuring a storage agent on the client system.
- Share tape drives and libraries that are supported by the Tivoli Storage Manager server.
- Consolidate multiple clients under a single client node name in a General Parallel File System (GPFS cluster.

LAN-free data movement

LAN-free data movement requires the installation of a storage agent on the client system. Through the storage agent, the client can directly back up and restore data to a tape library or shared file system such as GPFS. The Tivoli Storage Manager server maintains the server database and recovery log, and acts as the library manager to control device operations. The storage agent on the client handles the data transfer to the device on the SAN. This implementation frees bandwidth on the LAN that would otherwise be used for client data movement.

Network-attached storage

Network-attached storage (NAS) file servers are dedicated storage servers whose operating systems are optimized for file-serving functions. NAS file servers typically interact with Tivoli Storage Manager through industry-standard network protocols, such as network data management protocol (NDMP) or as primary storage for FILE device storage pools and directory-container storage pools. Tivoli Storage Manager provides the following basic types of configurations that use NDMP for backing up and managing NAS file servers:

- Tivoli Storage Manager backs up a NAS file server to a library device that is directly attached to the NAS file server. The NAS file server, which can be remote from the Tivoli Storage Manager server, transfers backup data directly to a drive in a SCSI-attached tape library. Data is stored in NDMP-formatted storage pools, which can be backed up to storage media that can be moved offsite for protection in case of an onsite disaster.
- Tivoli Storage Manager backs up a NAS file server to a Tivoli Storage Manager storage-pool hierarchy. In this type of configuration, you can store NAS data directly to disk, either random access or sequential access, and then migrate the data to tape. Data can also be backed up to storage media that can be moved offsite. The advantage of this type of configuration is that you have all of the data management features associated with a storage pool hierarchy.
- The Tivoli Storage Manager client reads the data from the NAS system and sends the data to the server to be stored.

Storage management

You manage the devices and media that are used to store client data through the Tivoli Storage Manager server. The server integrates storage management with the policies that you define for managing client data in the following areas:

Device support for server storage

With Tivoli Storage Manager, you can use directly-attached devices and network-attached devices for server storage. Tivoli Storage Manager represents physical storage devices and media with administrator-defined storage objects.

Data migration through the storage hierarchy

For primary storage pools other than directory-container storage pools, you can organize the storage pools into one or more hierarchical structures. This storage hierarchy provides flexibility in a number of ways. For example, you can set a policy to back up data to disks for faster backup operations. The Tivoli Storage Manager server can then automatically migrate data from disk to tape.

Removal of expired data

The policy that you define controls when client data automatically expires from the Tivoli Storage Manager server. To remove data that is eligible for expiration, a server expiration process marks data as expired and deletes metadata for the expired data from the database. The space that is occupied by the expired data is then available for new data. You can control the frequency of the expiration process by using a server option.

Media reuse by reclamation

As server policies automatically expire data, the media where the data is stored accumulates unused space. For storage media other than directory-container storage pools or random disk storage pools, the Tivoli Storage Manager server implements *reclamation*, a process that frees media for reuse without traditional tape rotation. Reclamation automatically defragments media by consolidating unexpired data onto other media when the free space on media reaches a defined level. The reclaimed media can then be used again by the server. Reclamation allows media to be automatically circulated through the storage management process and minimize the number of media that are required.

Consolidating backed up client data

By grouping the client data that is backed up, you can minimize the number of media mounts required for client recovery. The Tivoli Storage Manager server provides the following methods for grouping client files on storage media other than directory-container storage pools:

Collocating client data

The Tivoli Storage Manager server can *collocate* client data, in other words client data is stored on a small number of volumes instead of spreading the data across many volumes. Collocation by client minimizes the number of volumes that are required to back up and restore client data. However, collocation by client might increase the number of volume mounts because each client might have a dedicated volume instead of the data from several clients being stored in the same volume.

You can set the server to collocate client data when the data is initially placed in server storage. In a storage hierarchy, you can collocate the data when the server migrates the data from the initial storage pool to the next storage pool in the storage hierarchy. You can collocate by client, by file space per client, or by a group of clients. Your selection depends on the size of the file spaces that are stored and restore requirements.

Associating active-data pools with various devices

Active-data pools are useful for fast client restores, reducing the number of onsite or offsite storage volumes, or reducing bandwidth when you copy or restore files that are vaulted electronically in a remote location. Active-data pools that use removable media, such as tape, offer similar benefits. Although tape devices must be mounted, the server does not have to position past inactive files. However, the primary benefit of using removable media in active-data pools is that the number of volumes that are used for onsite and offsite storage is reduced. If you store data to a remote location, you can minimize the amount of data that must be transferred by copying and restoring only active data.

Creating a backup set

A backup set contains all of the active backed-up files that exist for that client in server storage. The backup set is portable and is retained for the time that you specify. A backup set is in addition to the backups that are already stored and requires additional media.

Moving data for a client node

You can consolidate data for a client node by moving the data within server storage. You can move a backup set to different media, where the backup set is retained until the time that you specify. Consolidating data can help to improve efficiency during client restore or retrieve operations.

Chapter 3. Data protection strategies with Tivoli Storage Manager

Tivoli Storage Manager provides ways that you can implement various data protection strategies.

You can configure Tivoli Storage Manager to send data to storage devices that are on the local site or on a remote site. To maximize data protection, you can configure replication to a remote server.

Strategies to minimize the use of storage space for backups

To minimize the amount of storage space that is required, Tivoli Storage Manager backs up data by using the data deduplication and progressive incremental backup techniques.

Data deduplication

When the Tivoli Storage Manager server receives data from a client, the server identifies duplicate data extents and stores unique instances of the data extents in a directory-container storage pool, as shown in Figure 11. The data deduplication technique improves storage utilization and eliminates the need for a dedicated data deduplication appliance.

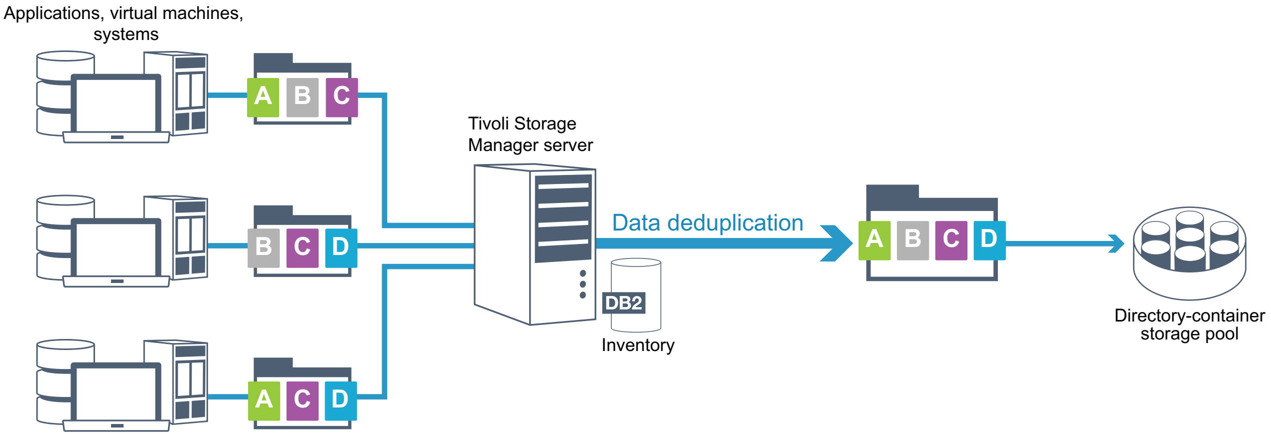

Applications, virtual machines, systems
A
B
C
B
C
D
A
C
D
Tivoli Storage Manager server
Data deduplication
DB2
Inventory
A
B
C
D
Directory-container storage pool

Figure 11. Data deduplication process

If the same byte pattern occurs many times, data deduplication greatly reduces the amount of data that must be stored or transferred. In addition to whole files, Tivoli Storage Manager can also deduplicate parts of files that are common with parts of other files.

Tivoli Storage Manager provides the following types of data deduplication:

Server-side data deduplication

The server identifies duplicate data extents and moves the data to a directory-container storage pool. The server-side process uses *inline data* *deduplication*, where data is deduplicated at the same time that the data is written to a directory-container storage pool. Deduplicated data can also be stored in other types of storage pools. Inline data deduplication on the server provides the following benefits:

- Eliminates the need for reclamation
- Reduces the space that is occupied by the stored data

Client-side data deduplication

Processing is distributed between the server and the client during a backup process. The client and the server identify and remove duplicate data to save storage space on the server. In client-side data deduplication, only compressed, deduplicated data is sent to the server. The server stores the data in the compressed format that is provided by the client. Client-side data deduplication provides the following benefits:

- Reduces the amount of data that is sent over the local area network (LAN)
- Eliminates extra processing power and time that is required to remove duplicate data on the server
- Improves database performance because the client-side data deduplication is also inline

You can combine both client-side and server-side data deduplication in the same production environment. The ability to deduplicate data on either the client or the server provides flexibility in terms of resource utilization, policy management, and data protection.

Progressive incremental backup

In the progressive incremental backup process, the Tivoli Storage Manager server monitors client activity and backs up any files that change since the initial full backup. Entire files are backed up, so that the server does not need to reference base versions of the files. This backup technique eliminates the need for multiple full backups of client data thus saving network resources and storage space.

Strategies for disaster protection with Tivoli Storage Manager

Tivoli Storage Manager provides strategies to protect data if a disaster occurs. These strategies include storage pool protection and node replication on a remote site, sending backups on tape to a remote site, device replication, and configuring storage area network (SAN) solutions.

Replication to a remote site

Figure 12 on page 29 shows the Tivoli Storage Manager replication process to a remote site.

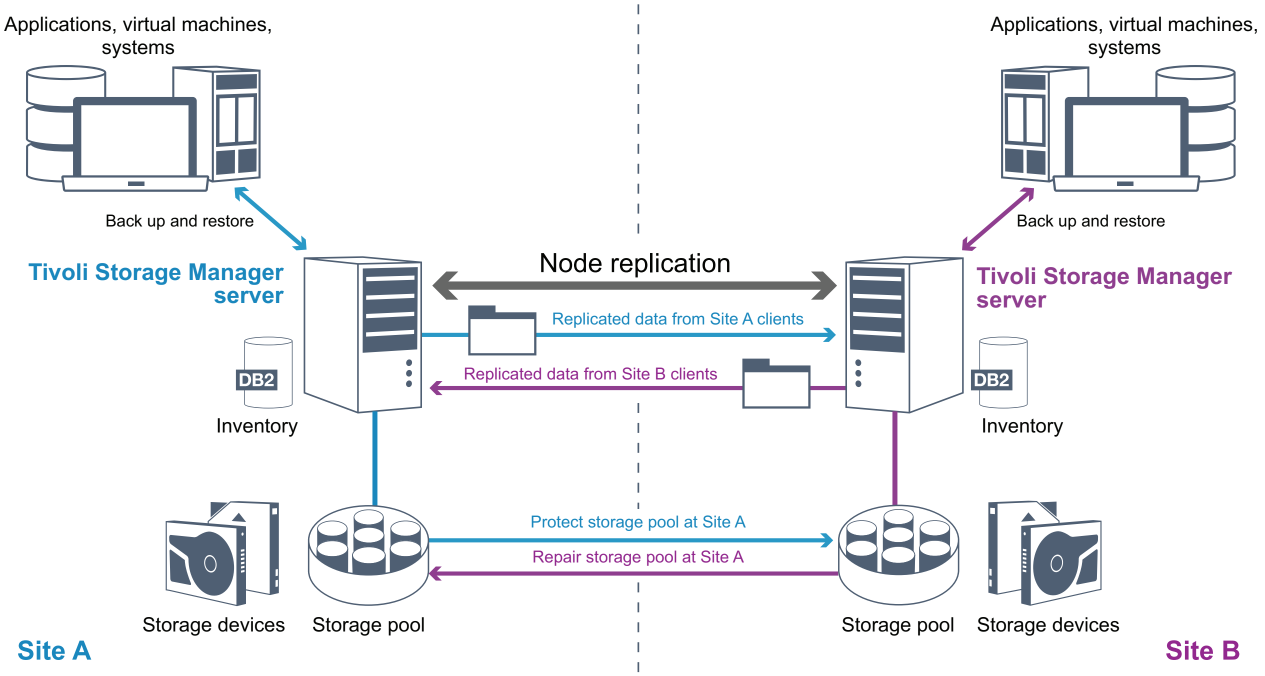

Applications, virtual machines, systems
Back up and restore
Tivoli Storage Manager server
DB2
Inventory
Storage devices
Storage pool
Site A
Node replication
Replicated data from Site A clients
Replicated data from Site B clients
Protect storage pool at Site A
Repair storage pool at Site A
Applications, virtual machines, systems
Back up and restore
Tivoli Storage Manager server
DB2
Inventory
Storage pool
Storage devices
Site B

Figure 12. Node replication process

Replication is the process of incrementally copying data from one Tivoli Storage Manager server to a remote Tivoli Storage Manager server. The server from which client data is replicated is called a *source replication server*. The server to which client data is replicated is called a *target replication server*. A replication server can function as a source server, a target server, or both. You use replication processing to maintain the same level of files on the source and the target servers. When client data is replicated, data that is not on the target server is copied. When replicated data exceeds the retention limit, the target server automatically removes the data. To maximize data protection, the local server and the remote server are synchronized, for example Site B replicates client data from Site A and Site A replicates client data from Site B. As part of replication processing, client data that was deleted from the source server is also deleted from the target server.

Tivoli Storage Manager provides the following replication functions:

- You can define policies for the target server policies for the following conditions:
  - Identical policies to the source server
  - Different policies to cater for different business requirements

  If a disaster occurs and the source server is unavailable, clients can recover data from the target server. If the source server cannot be recovered, you can convert clients to store data on the target server. When there is an outage, the source server can automatically fail over to a target server for data recovery.
- You can use replication processing to recover damaged files from FILE or DISK storage pools. You must replicate the client data to the target server before the file damage occurs. Subsequent replication processes detect damaged files on the source server and replace the files with undamaged files from the target server.

Role of replication in disaster protection

If a disaster occurs, you can recover replicated data from the remote site and maintain the same level of files on the source and target servers. You use replication to achieve the following objectives:

- Control network throughput by scheduling node replication at specific times
- Recover data from large-scale site loss
- Recover damaged files on the source server

To ensure a high level of server availability, you can use replication with a group of servers and clients, in other words *clustering*. In a clustered environment, a client is less likely to fail over to another server. If you replicate data from several source servers to one target server, there is a high dependency on the target server. A clustered environment reduces the dependency on the target server.

Storage pool protection

You use different techniques to protect against the permanent loss of data that is stored in directory-container storage pools and in FILE and DISK storage pools.

Directory-container storage pools

You use storage pool protection to protect specific directory-container storage pools if you do not need to replicate all the data that is contained in a client node. By protecting a directory-container storage pool, you do not use resources that replicate existing data and metadata, which improves server performance. As a best practice, you protect the directory-container storage pool before you replicate the client node. When node replication is started, the data extents that are already replicated through storage pool protection are skipped, which reduces the replication processing time. You can repair specific directory-container storage pools.

FILE and DISK storage pools

You use node replication to protect FILE and DISK storage pools. When you restore a storage pool, the Tivoli Storage Manager server determines which files are in that storage pool. Using file copies from a copy storage pool or an active-data pool, the server restores the files that were in the storage pool to the same or a different storage pool. As part of the restore operation, inactive file versions are deleted from the server database. Inactive file versions are deleted if the server determines that an inactive file needs to be replaced but cannot find the file in the active-data pool.

Database protection

You can use the replication technique to protect against the permanent loss of data that is stored in the server database. To restore the database, you must have the database backup volumes. The database backup volumes can be full, incremental, or snapshot. You can restore the database from replicated volumes in the following ways:

Point-in-time restore

Removes and re-creates the active log directory and archive log directory that is specified in `dsmserv.opt` file.

Restores the database image from backup volumes to the database directories recorded in a database backup or to new directories.

Restores archive logs from backup volumes to the overflow directory.

Applies logs from the overflow directory up to a specified point in time.

Most current restore

Does not remove and re-create the active log directory or archive log directory.

Restores a database image from the backup volumes to the database directories recorded in a database backup or to new directories.

Restores archive logs from backup volumes to the overflow directory.

Applies logs from overflow directory and archive logs from archive log directory.

Point-in-time restores are typically used for situations such as disaster recovery or to remove the effects of errors that can cause inconsistencies in the database. Database restores that use snapshot backups are a form of point-in-time restore. If you want to recover the database to the time when the database was lost, recover the database to the most current state.

Alternative methods for disaster protection

In addition to replication to a remote site, you can also use the following methods to protect data and implement disaster recovery with Tivoli Storage Manager:

Sending backup tapes to a remote site

Data is backed up to tape at scheduled times by the source server. The tapes are sent to a remote site. If a disaster occurs, the tapes are returned to the site of the source server and the data is restored on the source clients.

Multi-site appliance replication to a standby server

In the multi-site appliance configuration, the source appliance is replicated to a remote server in a SAN architecture. In this configuration, if the client hardware at the original site is damaged or destroyed, the source device can be replicated from the standby server at the remote site. This configuration provides disk-based backup and restore operations.

Strategies for disaster recovery with Tivoli Storage Manager

Tivoli Storage Manager provides several ways to protect and recover the server if the database or storage pools fail.

Automatic failover for disaster recovery

Automatic failover is an operation that switches to a standby system if a software, hardware, or network interruption occurs. In conjunction with node replication, automatic failover is used to recover data after a system failure. Figure 13 on page 32 shows the Tivoli Storage Manager automatic failover process.

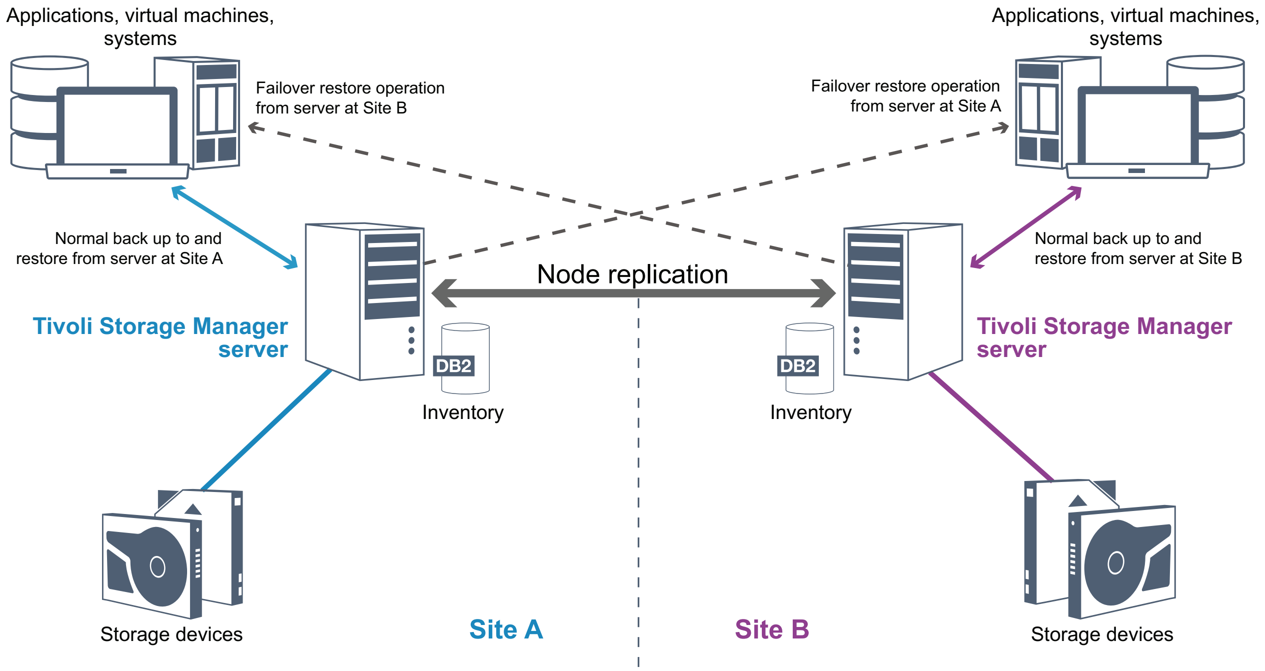

Applications, virtual machines, systems
Failover restore operation from server at Site B
Applications, virtual machines, systems
Failover restore operation from server at Site A
Normal back up to and restore from server at Site A
Node replication
Normal back up to and restore from server at Site B
Tivoli Storage Manager server
DB2
Inventory
DB2
Inventory
Tivoli Storage Manager server
Storage devices
Site A
Site B
Storage devices

Figure 13. Automatic failover process

Automatic failover for data recovery occurs if the source replication server is unavailable because of a disaster or a system outage. During normal operations, when the Tivoli Storage Manager client accesses a source replication server, the client receives connection information for the target replication server. The client node stores the failover connection information in the client options file.

During client restore operations, the Tivoli Storage Manager server automatically changes clients from the source replication server to the target replication server and back again. Only one server per node can be used for failover protection at any time. When a new client operation is started, the client attempts to connect to the source replication server. The client resumes operations on the source server if the source replication server is available.

To use automatic failover for replicated client nodes, the source replication server, the target replication server, and the client must be at the Tivoli Storage Manager V7.1 level or later. If any of the servers are at an earlier level, automatic failover is disabled and you must rely a manual failover process.

Recovery of Tivoli Storage Manager components

The server database, recovery log, and storage pools are critical to the operation of Tivoli Storage Manager and must be protected. If the database is unusable, the entire Tivoli Storage Manager server is unavailable and recovering data that is managed by the server might be difficult or impossible. Even without the database, fragments of data or complete files might be read from storage pool volumes that are not encrypted and security can be compromised. Therefore, you must always back up the database. Also, always encrypt sensitive data by using the Tivoli Storage Manager client or the storage device, unless the storage media is physically secured.

Tivoli Storage Manager provides several data protection methods, which include backing up storage pools and the database. For example, you can define schedules so that the following operations occur:

- After the initial full backup of your storage pools, incremental storage pool backups are run every night.
- Incremental database backups are run every night.
- Full database backups are run once a week.

For tape-based environments, you can use an optional feature, disaster recovery manager (DRM), to assist you in many of the tasks that are associated with protecting and recovering data. DRM is available with the Tivoli Storage Manager Extended Edition.

Preventive measures for recovery

Recovery is based on the following preventive measures:

- Mirroring, by which the server maintains a copy of the active log
- Backing up the database
- Backing up the storage pools
- Auditing storage pools for damaged files and recovery of damaged files when necessary
- Backing up the device configuration and volume history files
- Validating the data in storage pools by using cyclic redundancy checking
- Storing the `cert.kdb` file in a safe place to ensure that the Secure Sockets Layer (SSL) is secure

If you are using tape for storage, you can also create a disaster recovery plan to guide you through the recovery process by using DRM. You can use the disaster recovery plan for audit purposes to certify the recoverability of the Tivoli Storage Manager server. The disaster recovery methods of DRM are based on taking the following measures:

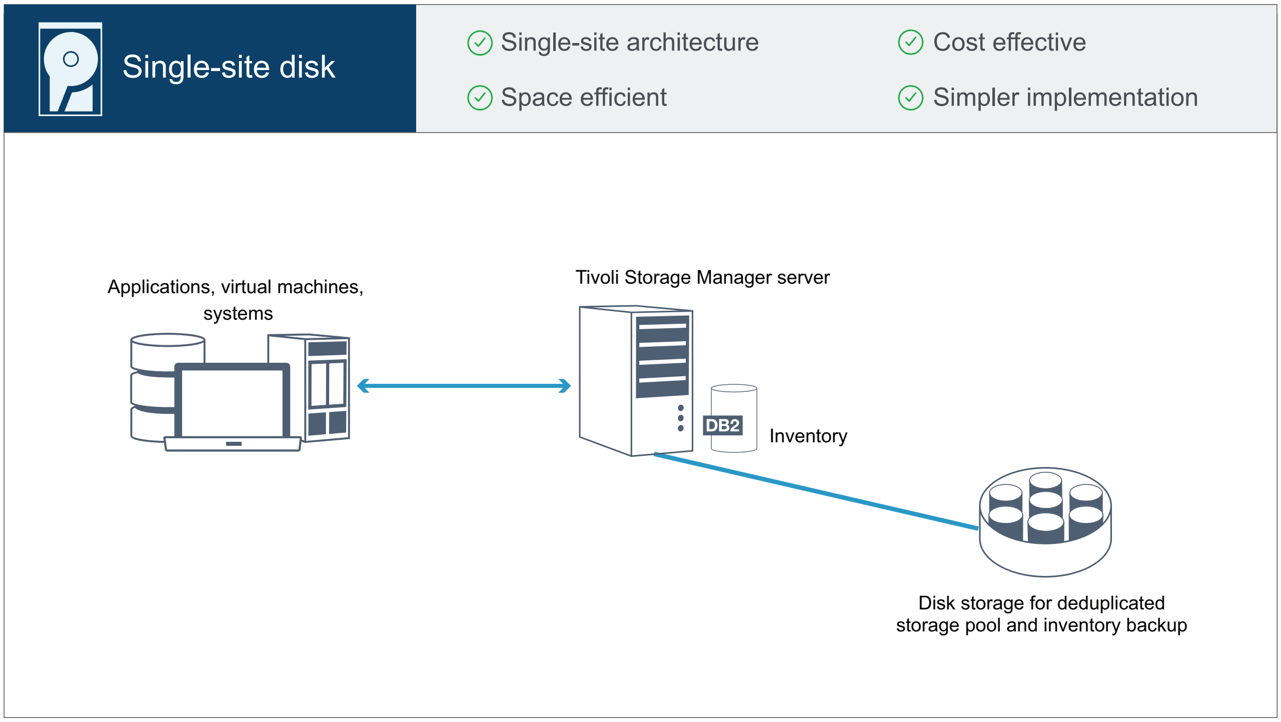
- Creating a disaster recovery plan file for the Tivoli Storage Manager server
- Backing up server data to tape
- Sending the server backup data to a remote site or to another Tivoli Storage Manager server
- Storing client system information
- Defining and tracking the storage media that is used for storing and recovering client data

Part 2. Tivoli Storage Manager solutions for data protection

To help you to deploy a data protection environment, review information about best practice Tivoli Storage Manager configurations, and select the best solution for your business needs.

Chapter 4. Disk-based data protection solution for a single location

The single-site disk-based solution uses Tivoli Storage Manager data deduplication and provides protection for data at a single location.


Single-site disk
✓ Single-site architecture
✓ Cost effective
✓ Space efficient
✓ Simpler implementation
Applications, virtual machines, systems
Tivoli Storage Manager server
DB2
Inventory
Disk storage for deduplicated storage pool and inventory backup

This solution provides the following benefits:

- Server system and storage hardware at a single site.
- Cost-effective use of storage capacity through the data deduplication feature.
- Space efficient solution with minimal hardware setup.
- Less complex implementation that requires installation and configuration for only one server and supporting storage hardware.

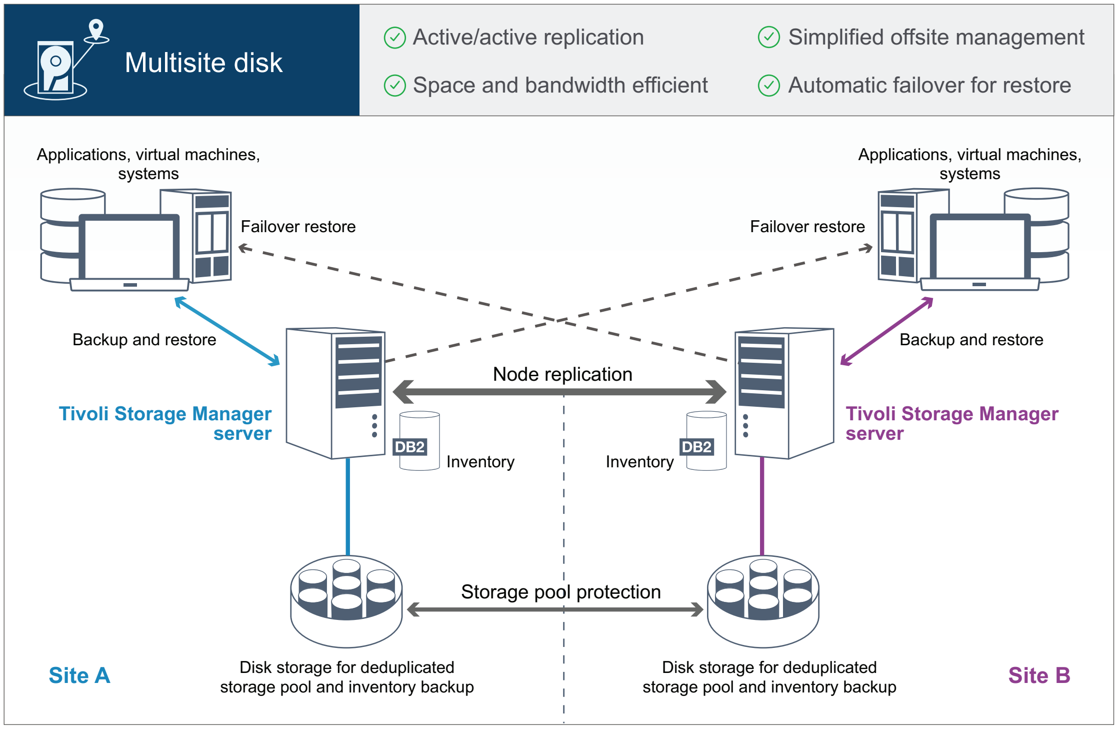
In this data protection configuration, the client sends data to the Tivoli Storage Manager server, where the data is deduplicated and stored on a disk-based container storage pool. The simplicity of the solution makes it suitable for entry-level environments for which a second copy of data is not required.

Related reference:

Chapter 8, “Comparing data protection solutions,” on page 45

Chapter 5. Disk-based data protection solution for multiple sites

The multisite disk-based solution uses Tivoli Storage Manager data deduplication and replication at two sites.


Multisite disk
✓ Active/active replication
✓ Simplified offsite management
✓ Space and bandwidth efficient
✓ Automatic failover for restore
Applications, virtual machines, systems
Failover restore
Applications, virtual machines, systems
Failover restore
Backup and restore
Backup and restore
Node replication
Tivoli Storage Manager server
Tivoli Storage Manager server
DB2
Inventory
Inventory
DB2
Storage pool protection
Site A
Disk storage for deduplicated storage pool and inventory backup
Disk storage for deduplicated storage pool and inventory backup
Site B

This solution provides the following benefits:

- Replication can be configured at both sites, in which each server protects data for the other.
- Offsite management for each location is simplified without the need to manage tape media.
- Bandwidth is efficiently used because only deduplicated data is replicated between the sites.
- Clients can automatically fail over to a target replication server, if the source replication server is unavailable.

In this data protection configuration, clients send data to the Tivoli Storage Manager source server, where the data is deduplicated and stored on a disk-based container storage pool. The data is replicated to the storage pool on the target server for each site.

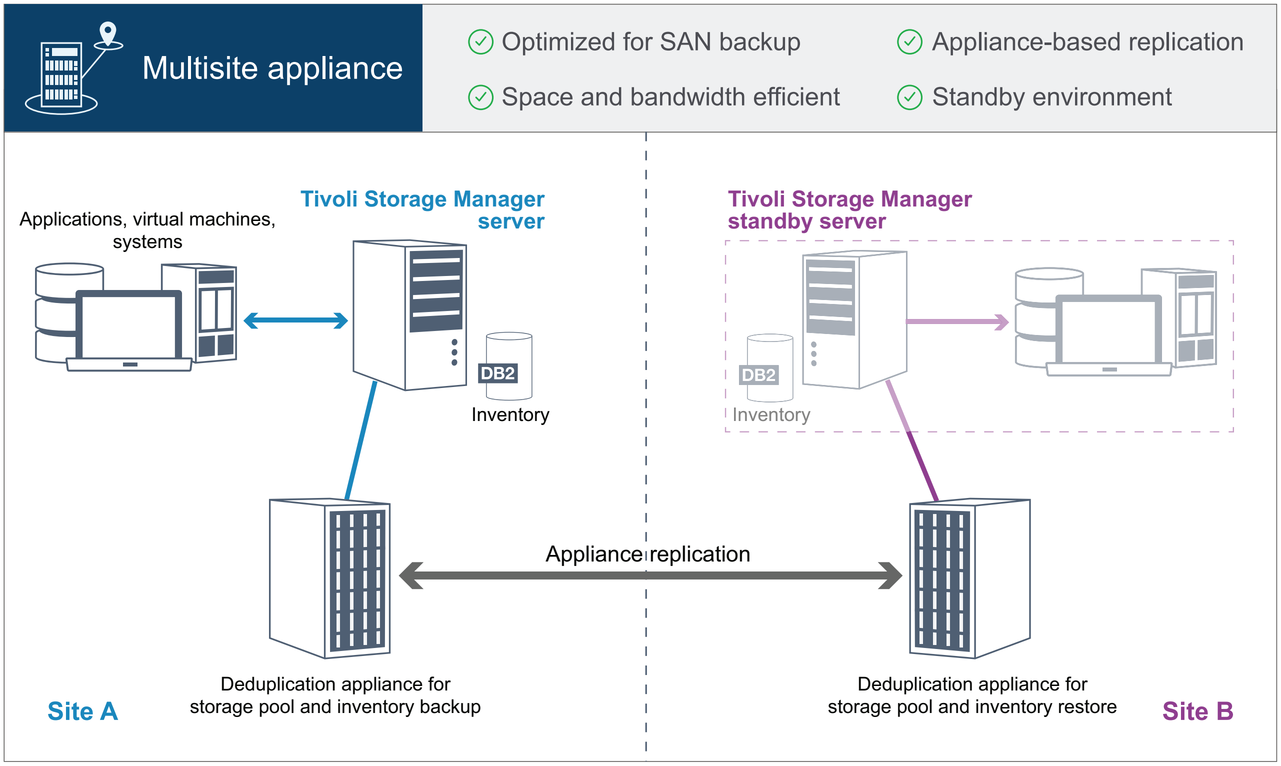
This solution is suitable for environments that require disaster protection. If mutual replication is configured, clients at both sites can use failover recovery for continued backups and data recovery from a highly available server.

Related reference:

Chapter 8, "Comparing data protection solutions," on page 45

Chapter 6. Appliance-based data protection solution for multiple sites

The multisite appliance-based solution uses appliance-based data deduplication and replication. A Tivoli Storage Manager server is configured at a second site for standby recovery if the primary server is unavailable.


Multisite appliance
✓ Optimized for SAN backup
✓ Appliance-based replication
✓ Space and bandwidth efficient
✓ Standby environment
Applications, virtual machines, systems
Tivoli Storage Manager server
DB2
Inventory
Tivoli Storage Manager standby server
DB2
Inventory
Appliance replication
Deduplication appliance for storage pool and inventory backup
Deduplication appliance for storage pool and inventory restore
Site A
Site B

This solution provides the following benefits:

- It is optimized for high-speed storage area network (SAN) backups and for use with Tivoli Storage Manager for SAN, when clients back up directly to SAN-attached virtual tape devices.
- Fast, appliance-based replication frees the Tivoli Storage Manager server from having to track replication metadata in the server database.
- The solution is space and bandwidth efficient.
- A standby environment provides for disaster recovery, but does not require the amount of resources that are needed for a fully active site.

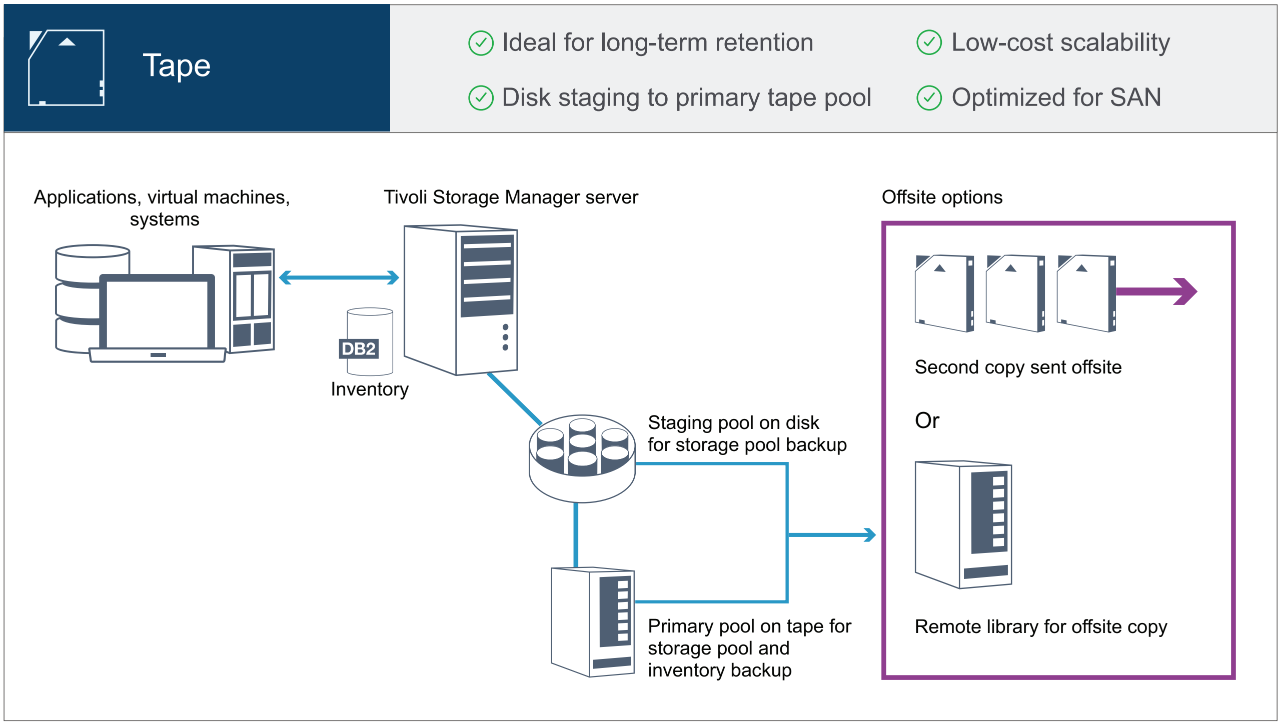
In this data protection configuration, the Tivoli Storage Manager server uses hardware appliances to deduplicate and replicate data. The appliance at Site A deduplicates data and then replicates it to the appliance at Site B for disaster protection. If a failure at Site A occurs, you make the standby server active by restoring the most recent database backup, and by activating the replicated copy of data.

Related reference:

Chapter 8, “Comparing data protection solutions,” on page 45

Chapter 7. Tape-based data protection solution at multiple sites

The tape-based solution uses disk-to-disk-to-tape backup and uses disk staging to optimize storage. Offsite options include sending data to another location, or copying data to a remote library.


Tape
✓ Ideal for long-term retention
✓ Low-cost scalability
✓ Disk staging to primary tape pool
✓ Optimized for SAN
Applications, virtual machines, systems
Tivoli Storage Manager server
DB2
Inventory
Offsite options
Second copy sent offsite
Or
Remote library for offsite copy
Staging pool on disk for storage pool backup
Primary pool on tape for storage pool and inventory backup

This solution provides the following benefits:

- Tape media is a flexible and affordable option for long-term data retention.
- The solution scales easily because of the reduced cost of tape media and Tivoli Storage Manager resources. Because there is no information to track for data deduplication processing, Tivoli Storage Manager database growth is slower, when compared with other solutions.
- Disk storage pool staging allows parallel backups for many clients.
- The solution is optimized for high-speed storage area network (SAN) backups and for use with Tivoli Storage Manager for SAN, when clients back up directly to Fibre Channel attached SANs
- Offsite copy options allow flexibility for a disaster recovery plan. If tapes are sent offsite, they can be stored in a vendor-managed vault, which reduces costs for the solution.

In this data protection configuration, the Tivoli Storage Manager server uses both disk and tape storage hardware. Storage pool staging is used, in which client data is initially stored in disk storage pools and then later migrated to tape storage pools.

With this solution, use Tivoli Storage Manager disaster recovery manager (DRM) to help you prepare a recovery plan for disasters.

Related reference:

Chapter 8, “Comparing data protection solutions,” on page 45

Chapter 8. Comparing data protection solutions

Compare the key features for each Tivoli Storage Manager solution to determine which configuration best meets your data protection requirements. Then, link to available documentation to implement the solution.

	Single-site disk	**Tape**	**Multisite appliance**	**Multisite disk**
Highlights				
Cost	$	$$	$$$$	$$$
Protection level	One data copy	Two or more data copies	Two or more data copies	Two or more data copies
Disaster recovery	None	Offsite copies	Standby server	Active server
Key benefits				
Leading-edge data reduction	✓	✓	✓	✓
Fast and efficient disk-based backup and restore operations	✓		✓	✓
Simplified offsite management				✓
Data deduplication feature included at no extra cost	✓			✓
Replication processing included at no extra charge				✓
Data deduplication at both the source and target server				✓
Low-cost scalability and optimized for long-term retention		✓		
Efficiency and cost				
Optimized for high-speed storage area network (SAN) backup operations		✓	✓	
Optimized for high-speed local area network (LAN)	✓		✓	✓
Global data deduplication across all data types and sources	✓		✓	✓
Bandwidth-efficient replication			✓	✓
Lower energy costs		✓		
Option for a second copy without additional disk hardware		✓		
Availability				
Offsite copy capability		✓	✓	✓
Appliance-based replication			✓	

	Single-site disk	**Tape**	**Multisite appliance**	**Multisite disk**
Client recovery from high-availability server				✓
Support of replication target in the Cloud				✓
Independent management of retention policies for replication data; ability to keep more or less data at recovery site				✓
Application-level replication; ability to choose which systems and applications are replicated				✓
Scalability				
Global data deduplication across Tivoli Storage Manager servers			✓	
SAN-optimized backup directly to tape for large data types		✓		
Single-instance petabyte scalability		✓		

What to do next

Review available documentation for the solutions in the Chapter 9, "Roadmap for implementing a data protection solution," on page 47.

Related reference:

Chapter 4, "Disk-based data protection solution for a single location," on page 37

Chapter 5, "Disk-based data protection solution for multiple sites," on page 39

Chapter 6, "Appliance-based data protection solution for multiple sites," on page 41

Chapter 7, "Tape-based data protection solution at multiple sites," on page 43

Chapter 9. Roadmap for implementing a data protection solution

Single-site disk solution

For steps that describe how to plan for, implement, monitor, and operate a single-site disk solution, see Single-site disk solution (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.solutions/c_ssdisk_solution.html).

Multisite disk solution

For steps that describe how to plan for, implement, monitor, and operate a multisite disk solution, see Multisite disk solution (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.solutions/c_msdisk_solution.html).

Multisite appliance solution

For a high-level overview of the tasks that are required to implement a multisite appliance solution, review the following steps:

1. Begin planning for the solution by reviewing V7.1.1 information at the following links:
   - Planning for server storage (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_devconcepts_planning_ulw.html)
   - Capacity planning (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_capplan.html)
2. Install the Tivoli Storage Manager server and optionally, the Operations Center. Review information at the following links:
   - Installing the server (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.common/t_installing_srv.html)
   - Installing the Operations Center (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.install/t_oc_inst_install.html)
3. Configure the server for VTL storage. Review V7.1.1 information at the following links:
   - AIX Linux Configuring and managing storage devices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_cfg_stg_dev_ul.html)
   - Windows Configuring and managing storage devices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_cfg_stg_dev_win.html)
   - Managing virtual tape libraries (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_vtl_managing.html)

   For guidance about performance best practices, see Configuration best practices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.perf.doc/t_optim_config.html).
4. Configure policies to protect your data. For details, see Customizing policies (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.admin/t_mplmntpol_getstrted.html).

5. Set up client schedules. For details, see Scheduling backup and archive operations (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.solutions/t_msdisk_cli_bkup_scheds.html).
6. Install and configure clients. To determine the type of client software that you need, see Adding clients (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.solutions/t_msdisk_cli_add.html) for details.
7. Configure monitoring for your system. For details, see Monitoring storage solutions (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.admin/t_mon_storage_env.html).

Tape solution

For a high-level overview of the tasks that are required to implement a tape solution, review the following steps:

1. Begin planning for the solution by reviewing V7.1.1 information at the following links:
   - Planning for server storage (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_devconcepts_planning_ulw.html)
   - Capacity planning (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_capplan.html)
2. Install the Tivoli Storage Manager server and optionally, the Operations Center. Review information at the following links:
   - Installing the server (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.common/t_installing_srv.html)
   - Installing the Operations Center (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.install/t_oc_inst_install.html)
3. Configure the server for tape storage. Review V7.1.1 information at the following links:
   - AIX Linux Configuring and managing storage devices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_cfg_stg_dev_ul.html)
   - Windows Configuring and managing storage devices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_cfg_stg_dev_win.html)

   For guidance about performance best practices, see Configuration best practices (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.perf.doc/t_optim_config.html).
4. Configure policies to protect your data. For details, see Customizing policies (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.admin/t_mplmntpol_getstrted.html).
5. Set up client schedules. For details, see Scheduling operations for client nodes (V7.1.1) (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.1/com.ibm.itsm.srv.doc/t_sched_nodes.html).
6. Install and configure clients. To determine the type of client software that you need, see Adding clients (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.solutions/t_msdisk_cli_add.html) for details.
7. Configure monitoring for your system. For details, see Monitoring storage solutions (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/srv.admin/t_mon_storage_env.html).

Related reference:

Chapter 8, “Comparing data protection solutions,” on page 45

Chapter 4, “Disk-based data protection solution for a single location,” on page 37

Chapter 5, “Disk-based data protection solution for multiple sites,” on page 39

Chapter 6, “Appliance-based data protection solution for multiple sites,” on page 41

Chapter 7, “Tape-based data protection solution at multiple sites,” on page 43

Part 3. Appendixes

Appendix. Accessibility features for the Tivoli Storage Manager product family

Accessibility features help users who have a disability, such as restricted mobility or limited vision to use information technology products successfully.

Accessibility features

The IBM Tivoli Storage Manager family of products includes the following accessibility features:

- Keyboard-only operation using standard operating-system conventions
- Interfaces that support assistive technology such as screen readers

The command-line interfaces of all products in the product family are accessible.

Tivoli Storage Manager Operations Center provides the following additional accessibility features when you use it with a Mozilla Firefox browser on a Microsoft Windows system:

- Screen magnifiers and content zooming
- High contrast mode

The Operations Center and the Tivoli Storage Manager server can be installed in console mode, which is accessible.

The Operations Center help system is enabled for accessibility. For more information, click the question mark icon on the help system menu bar.

Vendor software

The Tivoli Storage Manager product family includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for the accessibility information about its products.

IBM and accessibility

See the IBM Human Ability and Accessibility Center (http://www.ibm.com/able) for information about the commitment that IBM has to accessibility.

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Glossary

A glossary is available with terms and definitions for the IBM Tivoli Storage Manager family of products.

See Tivoli Storage Manager glossary (http://www.ibm.com/support/knowledgecenter/SSGSG7_7.1.3/tsm/glossary.html).

To view glossaries for other IBM products, see http://www.ibm.com/software/globalization/terminology/.

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