



COURSE TECHNOLOGY  
CENGAGE Learning™

# Hands-On Microsoft Windows Server 2008

## *Chapter 7*

### *Configuring and Managing Data Storage*

# Objectives

- Understand storage options for Windows Server 2008
- Use the Disk Management tool to configure and manage storage
- Explain and configure RAID disk storage fault tolerance
- Understand storage enhancements in Windows Server 2008
- Back up disk storage

# Windows Server 2008 Storage Options

- **Basic disk**
  - One that uses traditional disk management techniques and contains primary partitions, extended partitions, and logical drives
- **Dynamic disk**
  - One that does not use traditional partitioning
- Dynamic disk architecture provides more flexibility than basic disks
  - So there is virtually no restriction on the number of volumes that can be on one disk

# Basic Disks

- **Partitioning**
  - A process that blocks a group of tracks and sectors to be used by a particular file system, such as NTFS
- **Formatting**
  - A process that creates a table containing file and folder information for a specific file system in a partition
- **Volume**
  - A logical designation of disk storage that is created out of one or more physical disks
  - Is partitioned and formatted with one file system

# Basic Disks (continued)

- Basic disks recognize primary and extended partitions
- Basic disks also can be configured for any of three RAID levels:
  - Disk striping (RAID level 0)
  - Disk mirroring (RAID level 1)
  - Disk striping with parity (RAID level 5)
- **RAID** stands for redundant array of inexpensive (or independent) disks
  - A set of standards for lengthening disk life and preventing data loss

# Basic Disks (continued)

- MBR and GPT support
  - When a drive is partitioned, a **Master Boot Record (MBR)** and a **partition table** are created
    - At the beginning track and sectors on the disk
  - The MBR is located in the first sector and track of the hard disk
    - Has startup information about partitions and how to access the disk
  - The partition table contains information about each partition created

# Basic Disks (continued)

- MBR and GPT support (continued)
  - **Globally Unique Identifier (GUID) Partition Table or GPT**
    - A newer way to partition disks, without imposing the same type of limits on the number of partitions as with MBR
  - GPT is one element of the Extensible Firmware Interface (EFI) approach
    - Offered by the Unified EFI Forum
  - GPT disks store partition information in each partition using main and backup tables

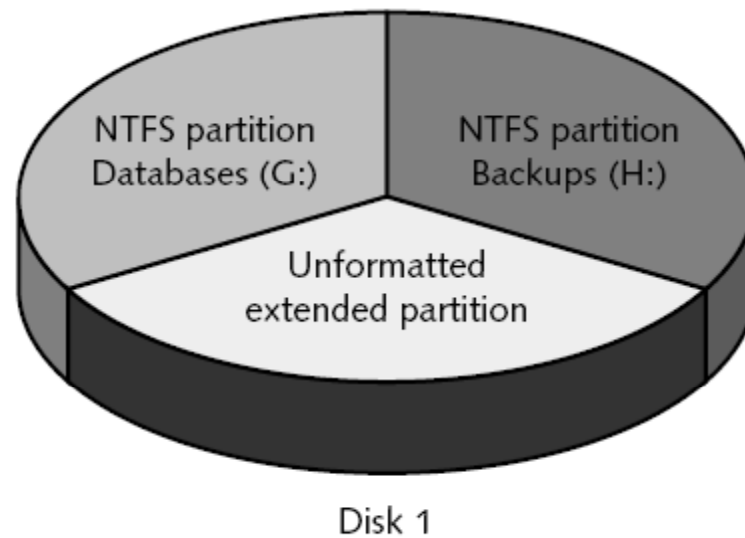
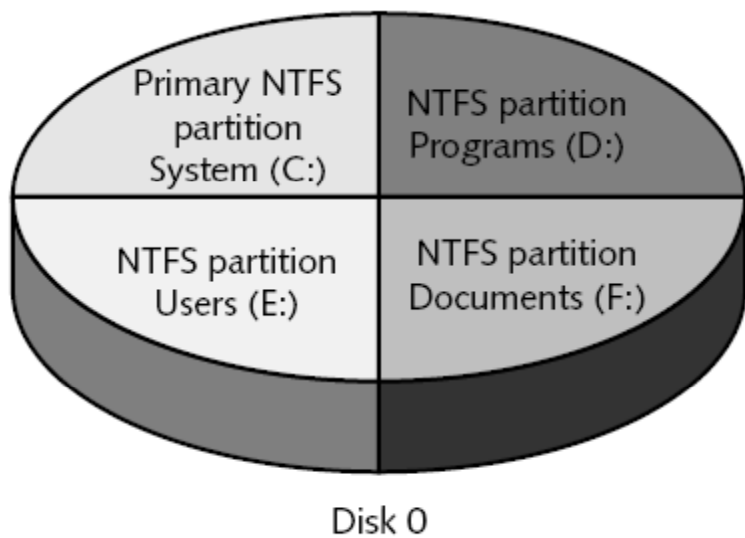
# Basic Disks (continued)

- Primary and extended partitions on MBR disks
  - A primary partition is one from which you can boot an operating system
  - At least one primary partition must be marked as active
    - Only one primary partition can be active at a given time
  - The active partition is the partition where your computer will look for the hardware-specific files to start the operating system



# Basic Disks (continued)

- Primary and extended partitions on MBR disks (continued)
  - An extended partition is created from space that is not yet partitioned
  - The purpose of an extended partition is to enable you to exceed the four-partition limit of a basic disk
  - Only one extended partition can exist on a single basic disk
- A computer with multiple partitions boots from the partition that is designated as the active partition
  - Must also be the system partition



**Figure 7-1** Partitions on two disk drives

# Basic Disks (continued)

- Activity 7-1: Viewing the Active Partition
  - Time Required: Approximately 10 minutes
  - Objective: Verify which partition is marked as active

# Basic Disks (continued)

- Activity 7-2: Customizing the MMC to Access Disk Management Tools
  - Time Required: Approximately 10 minutes
  - Objective: Create a customized console from which to perform disk management and disk defragmentation

# Basic Disks (continued)

- Volume and Stripe Sets
  - **Volume set**
    - Consists of two or more partitions that are combined to look like one volume with a single drive letter
  - **Stripe set**
    - Two or more disks that are combined like a volume set, but that are striped for RAID level 0 or RAID level 5

# Dynamic Disks

- A dynamic disk does not use traditional partitioning
  - Makes it possible to set up a large number of volumes on one disk
  - Provides the ability to extend volumes onto additional physical disks
- The number of disks that can be incorporated into one spanned volume is limited to 32
- Plan to convert basic disks to dynamic disks after you install Windows Server 2008

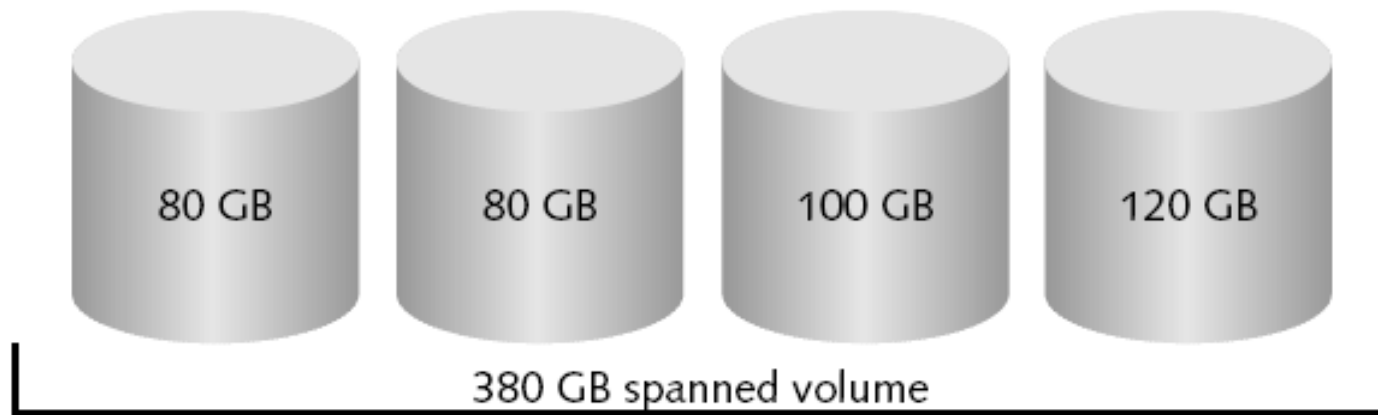
# Dynamic Disks (continued)

- **Simple volume**

- A portion of a disk or an entire disk that is set up as a dynamic disk
- Can be extended onto multiple sections of the same disk

- **Spanned volume**

- Stored on 2 to 32 dynamic disks that are treated as one volume
- As you add new disks, the spanned volume can be extended to include each disk

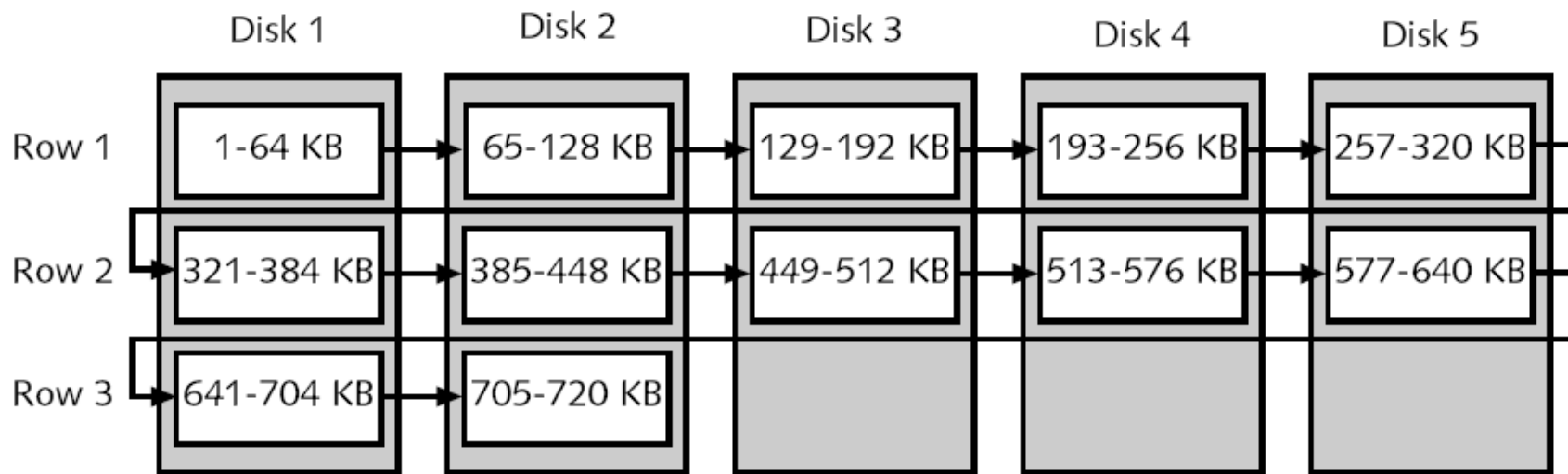


**Figure 7-4** Creating one spanned volume from four disks



# Dynamic Disks (continued)

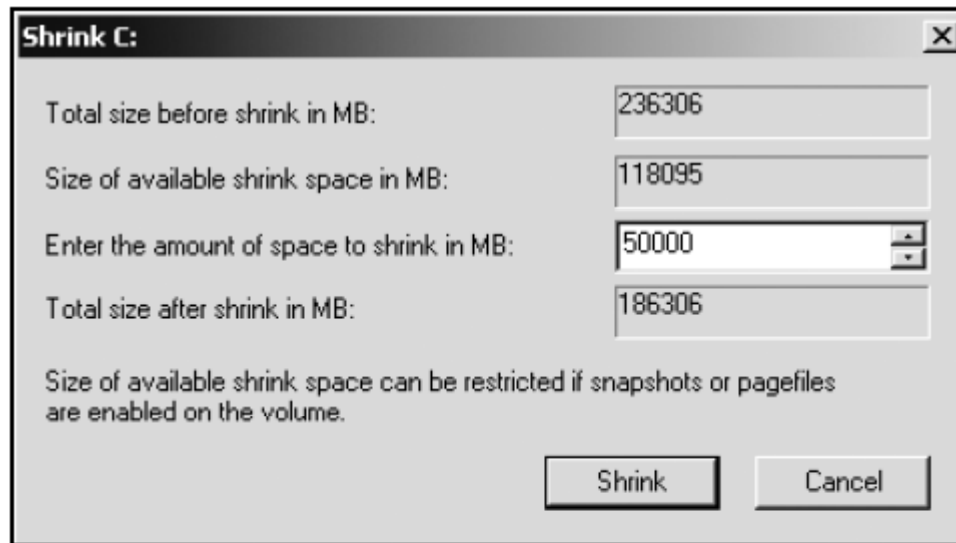
- **Striped volumes**
  - Often referred to as RAID-0
  - Extend the life of hard disk drives by spreading data equally over two or more drives
  - Another advantage: increases disk performance
  - In Windows Server 2008, striping requires at least two disks and can be performed over as many as 32
  - Data can be lost when one or more disks in the striped volume fail because the system has no automated way to rebuild data



**Figure 7-5** Disks in a striped volume

# Dynamic Disks (continued)

- Shrinking a volume
  - Windows Server 2008 comes with the ability to shrink a basic or dynamic disk volume
  - Shrinking a volume enables you to create a new partition when one is needed and you don't have extra disks
  - When you shrink a volume, Windows Server 2008 starts from the end of that volume
    - Works its way back through contiguous space to create unallocated disk space
  - You can specify the amount of space to recover



**Figure 7-6** Shrinking a volume

# Disk Management

- Disk Management tool
  - Provides a central location for viewing disk information and performing tasks such as creating and deleting partitions and volumes

# Creating a Partition and Simple Volume

- Partitions operate as separate storage units on a hard disk
- The most basic way to create a partition is to take unallocated disk space
  - Use the New Simple Volume Wizard to create a simple volume
- You can also delete a partition using the Disk Management tool
- Once a partition is formatted, it is called a volume and can be assigned a drive letter

# Creating a Partition and Simple Volume (continued)

- Activity 7-3: Creating a Simple Volume
  - Time Required: Approximately 10–30 minutes
  - Objective: Create a new partition from unpartitioned disk space

# Converting a Partitioned Basic Disk to a Dynamic Disk

- Activity 7-4: Converting a Basic Disk
  - Time Required: Approximately 10 minutes
  - Objective: Convert a simple basic disk to a dynamic disk



# Mounting a Drive

- Windows Server 2008 enables you to mount a drive as an alternative to giving it a drive letter
- **Mounted drive**
  - One that appears as a folder and is accessed through a path like any other folder
- You can mount a basic or dynamic disk drive, a CD/DVD drive, or a removable drive
- **Home directory or home folder**
  - A server folder that is associated with a user's account and that is a designated workspace for the user to store files

# Mounting a Drive (continued)

- Activity 7-5: Configuring a Mounted Drive
  - Time Required: Approximately 10–15 minutes
  - Objective: Learn how to set up a mounted drive

# Managing Disks

- Using Disk Defragmenter
  - When you save a file to a disk, Windows Server 2008 saves the file to the first area of available space
  - The file might not be saved to a contiguous area of free space
    - The disk gradually becomes **fragmented**
- The process of **defragmenting**
  - Locates fragmented folders and files and moves them to a location on the physical disk so they are in contiguous order

# Managing Disks (continued)

- Activity 7-6: Using the Disk Defragmenter
  - Time Required: Approximately 15 minutes
  - Objective: Practice using Disk Defragmenter

# Managing Disks (continued)

- Using Disk Check
  - The Disk Check tool allows you to scan your disk for bad sectors and file system errors
- This tool is meant for use when no users need to access the files on the disk you want to check
  - Because the disk is made unavailable during the scan for problems
- Options:
  - Automatically fix file system errors
  - Scan for and attempt recovery of bad sectors

# Managing Disks (continued)

- Activity 7-7: Using Disk Check
  - Time Required: Depends on the size of the disk and number of files (10 to over 40 minutes)
  - Objective: Learn how to use Disk Check

# Managing Disks (continued)

- Using *chkdsk*
  - You can also check your disk for errors by running the *chkdsk* utility from the Command Prompt window
  - In NTFS, *chkdsk* checks files, folders, indexes, security descriptors, user files, sectors, and disk allocation units

# Managing Disks (continued)

Table 7-1 *chkdsk* switch and parameter options

Switch/Parameter	Purpose
[ <i>volume</i> ] (such as C:)	Specifies that <i>chkdsk</i> only check the designated volume
[ <i>filename</i> ] (such as *.dll)	Enables a check of the specified file or files only
<i>/c</i>	Uses an abbreviated check of the folder structure
<i>/f</i>	Instructs <i>chkdsk</i> to fix errors that it finds
<i>/i</i>	Uses an abbreviated check of indexes
<i>/L:size</i>	Enables you to specify the size of the log file created by the disk check
<i>/r</i>	Searches for bad sectors, fixes problems, and recovers information (when not possible; use the Recover command on separate files)
<i>/x</i>	Dismounts or locks a volume before starting



# Managing Disks (continued)

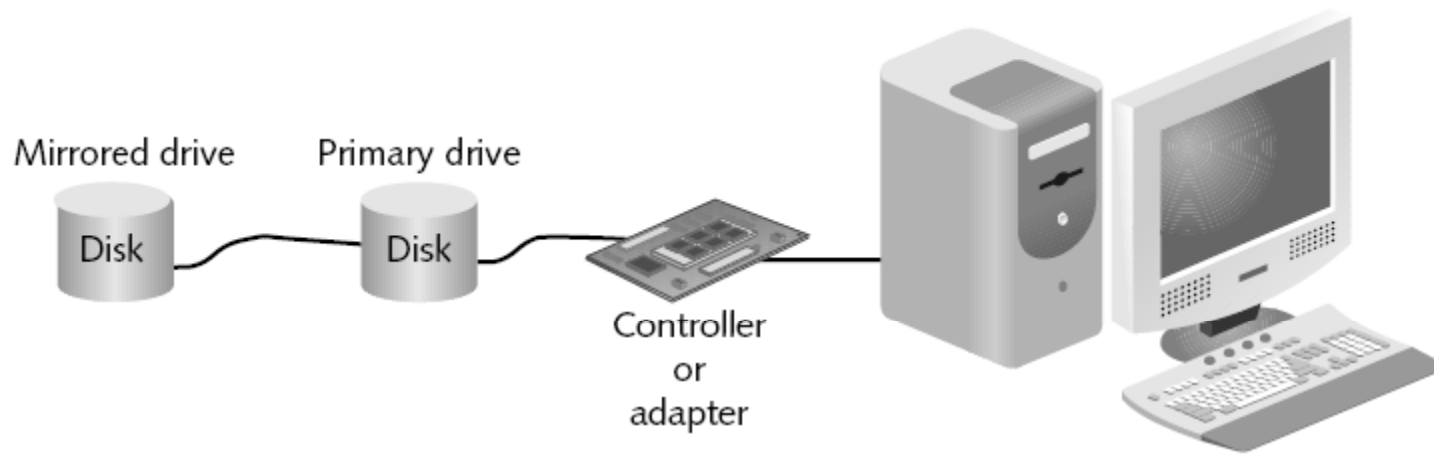
- Activity 7-8: Using *chkdsk* from the Command Line
  - Time Required: Depends on the size of the disk and number of files (10 to over 40 minutes)
  - Objective: Learn how to use *chkdsk* from the command line

# Introduction to Fault Tolerance

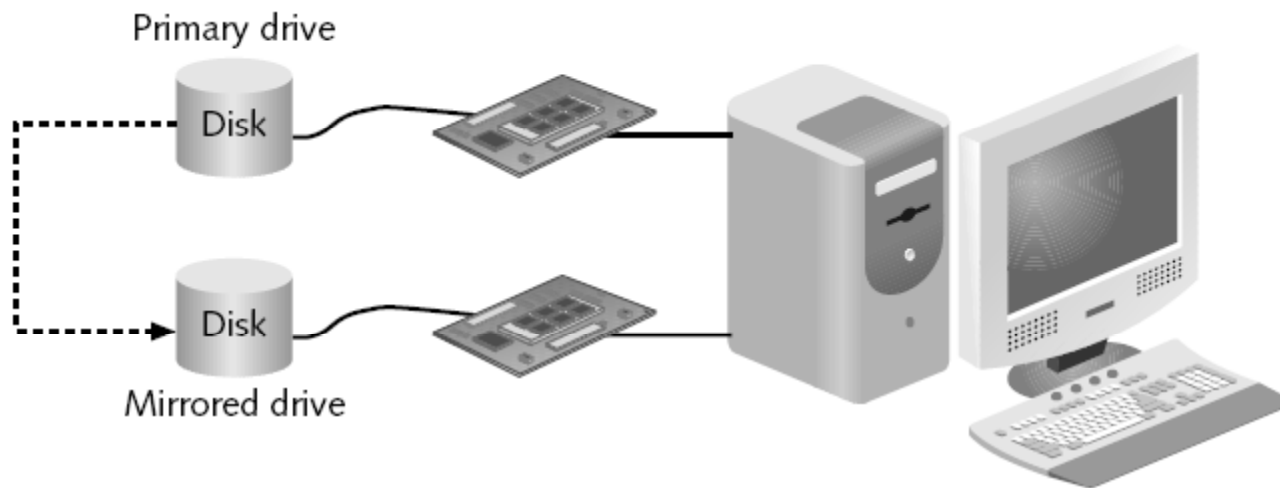
- **Fault tolerance**
  - The ability of a system to gracefully recover from hardware or software failure
- Windows Server 2008 provides a level of fault tolerance through software-level RAID
- With fault tolerance, data is written to more than one drive
  - In the event one drive fails, data can still be accessed from one of the remaining drives

# RAID Volumes

- RAID is a set of standards for lengthening disk life, preventing data loss, and enabling relatively uninterrupted access to data
- RAID level 0
  - Striping with no other redundancy features is RAID level 0
- RAID level 1
  - Disk duplexing is the same as disk mirroring, with the exception that it places the backup disk on a different controller or adapter than is used by the main disk



**Figure 7-13** Disk mirroring



**Figure 7-14** Disk duplexing

# RAID Volumes (continued)

- RAID level 2
  - Uses an array of disks whereby the data is striped across all disks in the array
- RAID level 3
  - Uses disk striping and stores error-correcting information, but the information is only written to one disk in the array
- RAID level 4
  - Stripes data and stores error-correcting information on all drives

# RAID Volumes (continued)

- RAID level 5
  - Combines the best features of RAID, including striping, error correction, and checksum verification
- Windows Server 2008 supports RAID levels 0, 1, and 5 for disk fault tolerance

# Using a Striped Volume (RAID-0)

- Reasons for using a RAID level 0 or a striped volume in Windows Server 2008 are to:
  - Reduce the wear on multiple disk drives by equally spreading the load
  - Increase disk performance compared with other methods for configuring dynamic disk volumes
- To create a striped volume, right-click the unallocated space for the volume and click New Striped Volume
- Only dynamic disks can be striped volumes

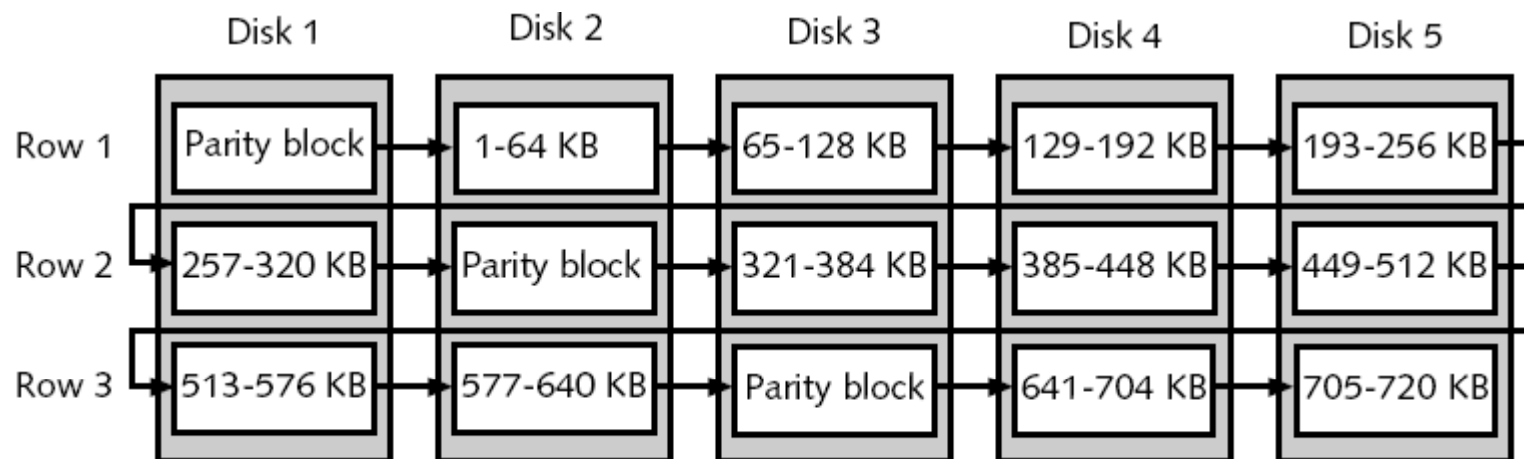
# Using a Mirrored Volume (RAID-1)

- Disk mirroring involves creating a shadow copy of data on a backup disk
- Only dynamic disks can be set up as a mirrored volume in Windows Server 2008
- One of the most guaranteed forms of disk fault tolerance
- Disk read performance is the same as reading data from any single disk drive
- A mirrored volume is created through the Disk Management tool



# Using a RAID-5 Volume

- Fault tolerance is better for a RAID-5 volume
- A RAID-5 volume requires a minimum of three disk drives
- Parity information is distributed on each disk
  - If one disk fails, the information on that disk can be reconstructed
  - The parity used by Microsoft is Boolean (true/false, one/zero) logic



**Figure 7-15** Disks in a RAID-5 volume

# Using a RAID-5 Volume (continued)

- The performance is not as fast as with a striped volume
  - Takes longer to write the data and calculate the parity block for each row
- Accessing data through disk reads is as fast as a striped volume
- A RAID-5 volume is particularly useful in a client/server system that uses a separate database for queries and creating reports
- Use the Disk Management tool to create a RAID-5 volume

# Software RAID vs. Hardware RAID

- Software RAID implements fault tolerance through the server's operating system
- Hardware RAID is implemented through the server hardware
  - Independent of the operating system
- Advantages over software RAID:
  - Faster read and write response
  - The ability to place boot and system files on different RAID levels
  - The ability to “hot-swap” a failed disk
  - More setup options to retrieve damaged data

# Disk Backup (continued)

- The advantages of performing a network backup
  - Backup jobs can be stored on a single backup media
  - One administrator can be responsible for backing up multiple servers
- The main disadvantages
  - The increase in network traffic
  - The Registry cannot be backed up from across the network

# Windows Server Backup

- Windows Server Backup tool offers the ability to back up all server files or files that have changed
- Enhancements in Windows Server 2008:
  - Is easier to recover from a backup
  - Has more backup options, including using the **Volume Shadow Copy Service (VSS)**
  - Is more reliable in recovering applications
  - Provides information about disk use
  - Offers the *wbadmin* command-line tool
  - Has full support to back up to optical media

# Windows Server Backup (continued)

- Considerations for using Windows Server Backup
  - Tool only backs up NTFS volumes
  - Tool does not back up to tape
  - If you have backup media made from Windows Server 2003 using Ntbackup.exe, you cannot restore from that media using the Windows Server Backup tool in Windows Server 2008

# Windows Server Backup (continued)

- Activity 7-9: Installing the Windows Server Backup Tool
  - Time Required: Approximately 10 minutes
  - Objective: Install the Windows Server Backup tool



# Backup Options

- **Full backup**
  - A backup of an entire system, including all system files, programs, and data files
  - Changes each file's archive attribute to show that it has been backed up
- **Incremental backup**
  - Only backs up files that are new or that have been updated
  - Backs up only files that have the archive attribute marked

# Backup Options (continued)

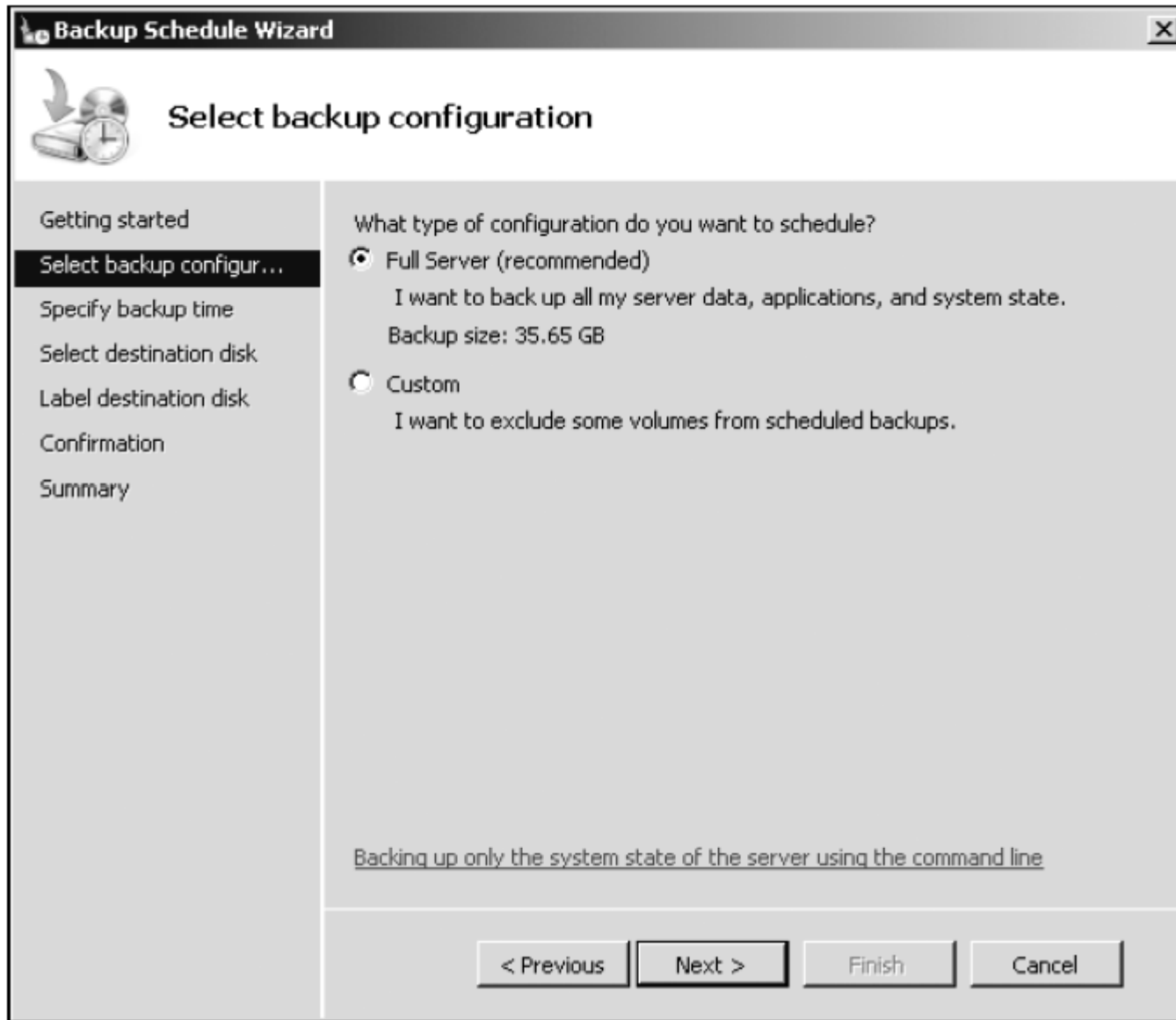
- **Custom backup**
  - Enables you to configure backups differently for each volume
    - Such as doing an incremental backup every time you back up the C drive and a full backup each time you back up the D drive

# Backup Options (continued)

- Activity 7-10: Backing Up a Server
  - Time Required: Approximately 10 to 30 minutes
  - Objective: Perform a full backup

# Scheduling Backups

- Windows Server Backup includes a scheduling capability
  - Can have the server automatically start backups after regular work hours or at a specific time of day



**Figure 7-18** Selecting the backup configuration

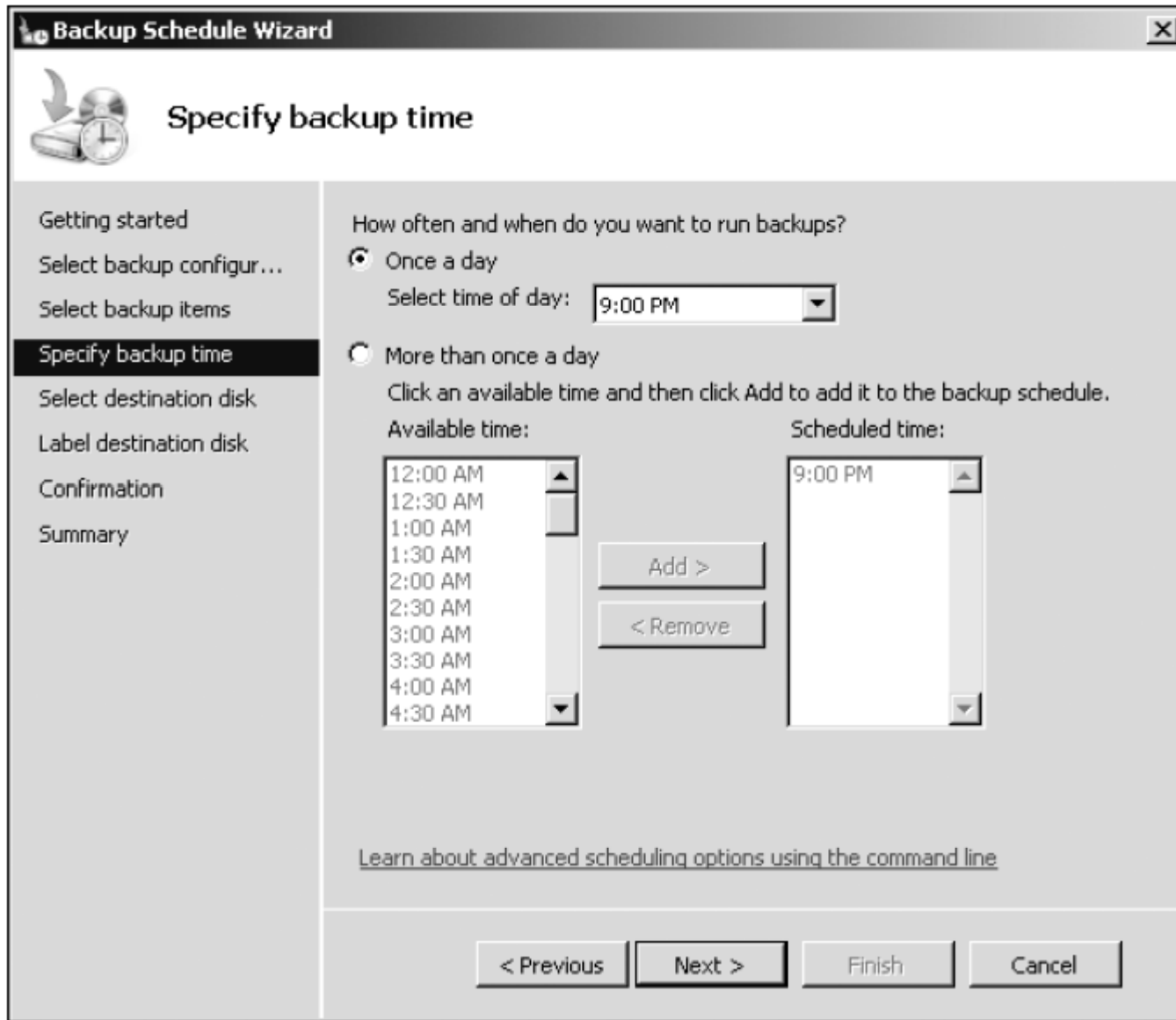
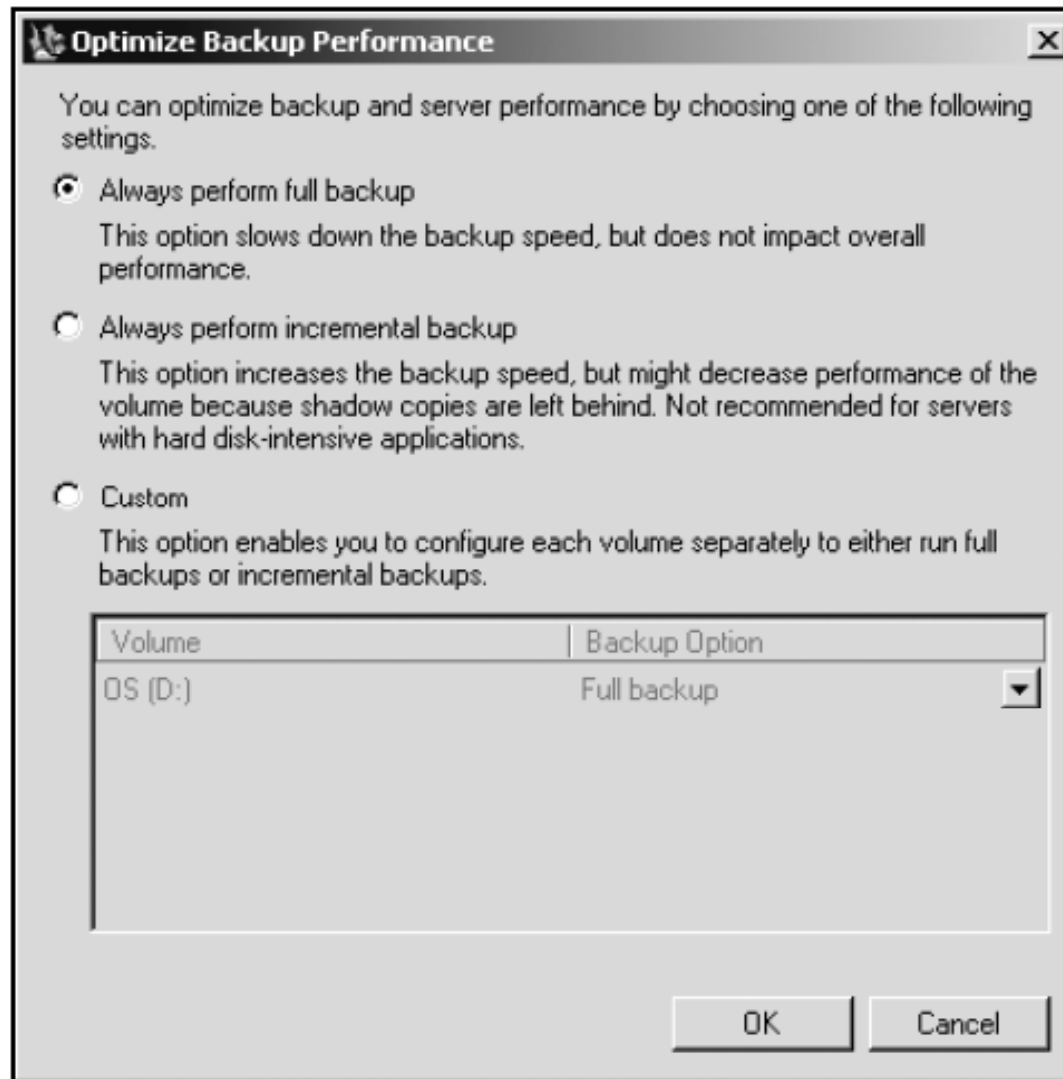


Figure 7-19 Specifying the backup time

# Configuring Backup Performance

- Configuring the backup performance options enables you to specify which types of backups to perform: full, incremental, and custom
- The default is to always perform full backups



**Figure 7-20** Optimizing backup performance



# Performing a Recovery

- The Windows Server Backup tool enables you to recover any of the following:
  - Files
  - Folders
  - Volumes
  - Applications and application data
  - The backup catalog (of information in the backup)
  - The operating system (to the same computer or to another computer using identical hardware)

# Performing a Recovery (continued)

- Before you start, determine the following information:
  - Date of the backup from which to recover
  - Type of recovery, such as files and folders or applications
  - What to recover
  - Where to recover, such as in the original location or another location

# Summary

- Windows Server 2008 uses basic and dynamic disks
- Dynamic disks can be configured as simple, spanned, striped, mirrored, and RAID-5 volumes
- If you need to recover space from a basic or dynamic disk, you can shrink the disk
- The Disk Management tool enables you to create basic and dynamic disks
- For optimum disk performance, plan to set up a schedule to regularly defragment disks on a server

# Summary (continued)

- Use the Disk Check and *chkdsk* tools to find and repair disk problems
- RAID provides fault tolerance for hard disks
- RAID level 0 is disk striping
- With disk mirroring or duplexing (RAID level 1), the same data is written to a partition on each of the two disks included in the mirror
- With RAID level 5, data is written across a minimum of three disks

# Summary (continued)

- Windows Server Backup offers features to schedule backups, perform full or incremental backups (or a combination of both), and recover data from backups