MIRRORING HARD DRIVES IN REAL TIME WITH NO-COST SOFTWARE

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Click on “Meeting Notes”
SUMMARY

You can mirror two or more hard drives in real time using no-cost software to avoid data loss due to inevitable hard drive failures.
TOPICS

• Basic Concept of Real-Time Drive Mirroring With Software
• Demonstration
• Disadvantages of Periodic Backups
• Disadvantages of Drive Mirroring
• Multiple Techniques for Maximum Redundancy
TOPICS (continued)

• Drive Mirroring Details
• Two No-Cost Software Programs:
  o Details of Windows 8's bundled "Storage Spaces" Applet
  o Details of Drive Mirroring with Dynamic Disks in "Windows 7" or "Windows 8"
Basic Concept of Real-Time Hard Drive Mirroring with Software

• From inside an application program or from inside "Windows Explorer"/"File Explorer, you create or modify a data file or folder in a virtual hard drive and your drive mirroring software transparently and automatically copies the data file or folder to two physical hard disk drives immediately.
Your Computer

Left hard drive

Right Hard Drive

Software Application for Mirroring Hard Drives
A DEMONSTRATION OF THE TWO NO-COST PROGRAMS FOR HARD DRIVE MIRRORING IN REAL TIME
Windows key + e brings up "File Explorer" in both the new "Start" screen and the legacy "Desktop"
In "File Explorer" in "Windows 8", the two mirrored dynamic hard disk drives appear as a single "D:" hard drive.
13
In "File Explorer" in "Windows 8", the two mirrored "Storage Spaces" hard disk drives appear as a single "S:" hard drive.
15

Hard Disk Drives (3)

Local Disk (C:)
865 GB free of 979 GB

D_DynMirror (D:)
59.7 GB free of 59.8 GB

S_StorageSpace (S:)
59.0 GB free of 59.1 GB
Windows key + x brings up the Power User's menu in both the new "Start" screen and the legacy "Desktop"
Click on "Control Panel"
Double-click on "Administrative Tools"
Administrative Tools
Double-click on "Computer Management"
Click on "Disk Management"
<table>
<thead>
<tr>
<th>Volume</th>
<th>Layout</th>
<th>Type</th>
<th>File System</th>
<th>Status</th>
<th>Capacity</th>
<th>Free Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C:)</td>
<td>Simple</td>
<td>Basic</td>
<td>NTFS</td>
<td>Healthy (Boot, Page File, Crash Dump, Primary Partition)</td>
<td>579.66 GB</td>
<td>86.31 GB</td>
</tr>
<tr>
<td>D_DynMirror (D:)</td>
<td>Mirror</td>
<td>Dynamic</td>
<td>NTFS</td>
<td>Healthy</td>
<td>59.87 GB</td>
<td>59.77 GB</td>
</tr>
<tr>
<td>S_StorageSpace (S:)</td>
<td>Simple</td>
<td>Basic</td>
<td>NTFS</td>
<td>Healthy (Primary Partition)</td>
<td>59.12 GB</td>
<td>59.08 GB</td>
</tr>
<tr>
<td>System Reserved</td>
<td>Simple</td>
<td>Basic</td>
<td>NTFS</td>
<td>Healthy (System, Active, Primary Partition)</td>
<td>350 MB</td>
<td>100 MB</td>
</tr>
<tr>
<td>Disk 1</td>
<td>Disk 3</td>
<td>Disk 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic</td>
<td>Dynamic</td>
<td>Basic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59.88 GB</td>
<td>59.88 GB</td>
<td>59.13 GB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>Online</td>
<td>Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Path</th>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_DynMirror (D:)</td>
<td>59.87 GB</td>
<td>NTFS</td>
</tr>
<tr>
<td>Healthy</td>
<td></td>
<td></td>
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</thead>
<tbody>
<tr>
<td>S_StorageSpace (S:)</td>
<td>59.12 GB</td>
<td>NTFS</td>
</tr>
<tr>
<td>Healthy (Primary Partition)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In "Disk Management", the two mirrored dynamic hard drives are shown as two "dynamic" hard drives with the exact same label and drive letter:
<table>
<thead>
<tr>
<th>Disk 1</th>
<th>Disk 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dynamic</strong>&lt;br&gt;59.88 GB&lt;br&gt;Online</td>
<td><strong>Dynamic</strong>&lt;br&gt;59.88 GB&lt;br&gt;Online</td>
</tr>
<tr>
<td><strong>D_DynMirror (D:)</strong>&lt;br&gt;59.87 GB NTFS&lt;br&gt;Healthy</td>
<td><strong>D_DynMirror (D:)</strong>&lt;br&gt;59.87 GB NTFS&lt;br&gt;Healthy</td>
</tr>
</tbody>
</table>
In "Disk Management", the two mirrored "Storage Spaces" hard drives are shown as a single "basic" hard drive:
All of the individual physical hard drives are shown separately in the "Disk drives" section of "Device Manager":
Device Manager

File  Action  View  Help

Wn8EnEv20130528

- Audio inputs and outputs
- Batteries
- Computer
- Disk drives
- Display adapters
- DVD/CD-ROM drives
- Floppy disk drives
- Floppy drive controllers
- Human Interface Devices
- IDE ATA/ATAPI controllers
- Keyboards
- Mice and other pointing devices
- Monitors
- Network adapters
- Ports (COM & LPT)
- Print queues
- Processors
- Software devices
- Sound, video and game controllers
- Storage controllers
- System devices
- Universal Serial Bus controllers
Disk drives

- Microsoft Storage Space Device
- VMware, VMware Virtual S SCSI Disk Device
- VMware, VMware Virtual S SCSI Disk Device
- VMware, VMware Virtual S SCSI Disk Device
- VMware, VMware Virtual S SCSI Disk Device
- VMware, VMware Virtual S SCSI Disk Device
- VMware, VMware Virtual S SCSI Disk Device
Windows key + x brings up the Power User's menu in both the new "Start" screen and the legacy "Desktop"
Click on "Control Panel"
Adjust your computer’s settings

- Action Center
- BitLocker Drive Encryption
- Date and Time
- Devices and Printers
- Family Safety
- Folder Options
- Indexing Options
- Language
- Network and Sharing Center
- Performance Information and Tools
- Power Options
- Region
- Speech Recognition
- System
- Troubleshooting
- Windows Defender
- Windows Update

- Administrative Tools
- Color Management
- Default Programs
- Display
- File History
- Fonts
- Internet Options
- Location Settings
- Notification Area Icons
- Personalization
- Programs and Features
- RemoteApp and Desktop Connections
- Storage Spaces
- Tablet PC Settings
- User Accounts
- Windows Firewall
- AutoPlay
- Credential Manager
- Device Manager
- Ease of Access Center
- Flash Player (32-bit)
- HomeGroup
- Keyboard
- Mouse
- Pen and Touch
- Phone and Modem
- Recovery
- Sound
- Sync Center
- Taskbar
- Windows 7 File Recovery
- Windows To Go
Double-click on "Storage Spaces"
RemoteApp and Desktops

Storage Spaces

Task Manager
Manage Storage Spaces

Use Storage Spaces to save files to two or more drives to help protect you from a drive failure. Storage Spaces also lets you easily add more drives if you run low on capacity. If you don’t see task links, click Change settings.

Storage pool

Using 3.00 GB of 118 GB pool capacity

Storage spaces

S_StorageSpace (S:)  Okay
Two-way mirror
59.2 GB
Using 2.00 GB pool capacity

Physical drives
Expand the "Physical drives" section to see the status of the individual hard drives that are being mirrored:
Storage pool

Using 3.00 GB of 118 GB pool capacity

Storage spaces

S_StorageSpace (S:)  Okay
Two-way mirror
59.2 GB
Using 2.00 GB pool capacity

Physical drives

Create a storage space
Add drives
Rename pool

View files
Change
Delete
Use Storage Spaces to save files to two or more drives to help protect you from a drive failure. Storage Spaces also lets you easily add more drives if you run low on capacity. If you don't see task links, click Change settings.

**Storage pool**

Using 3.00 GB of 118 GB pool capacity

- **S_StorageSpace (S:)**
  - Two-way mirror
  - 59.2 GB
  - Using 2.00 GB pool capacity

- **Physical drives**
  - SS-Right-VMware, VMware...
    - Attached via SAS
    - 2.53 % used
    - Providing 59.2 GB pool capacity

- SS-Left-VMware, VMware...
  - Attached via SAS
  - 2.53 % used
  - Providing 59.2 GB pool capacity

See also
- File History
- BitLocker Drive Encryption
Physical drives

SS-Right-VMware, VMware...  Okay
Attached via SAS
2.53 % used
Providing 59.2 GB pool capacity

SS-Left-VMware, VMware...  Okay
Attached via SAS
2.53 % used
Providing 59.2 GB pool capacity
Disadvantage of Periodic Backups
• If your hard drive where you store your in-use data files and folders fails after a periodic backup, you will probably lose the data files that you created or modified after the date and time of the periodic backup.
Disadvantage of Periodic Backups (continued)

• The data files that are not on the last periodic backup MIGHT be recovered by a professional computer technician OR by a cleanup drive recovery operation such as "Drive Savers", a cleanroom service for recovering data from failed hard drives.
Disadvantage of Periodic Backups (continued)

- Our Harry Elver can provide you with the "Drivesavers" services at a discount, but it will still cost you between $1500 and $3500 for their services.

Disadvantage of Drive Mirroring

• Both hard drives catch the same malware at the same time

• Operator error occurs on both hard drives at the same time
Multiple Techniques for Maximum Redundancy

• For maximum reliability, you can combine drive mirroring, periodic backups (such as Macrium, Clonezilla or Acronis), and manual copying of data files and folders to mitigate against the disadvantages of the various redundancy techniques.
Drive Mirroring Details

• "Drive mirroring" means that two or more hard drives are kept matched up with the exact same set of data files and folders.

• "Real time" means that changes to data files and folders on one hard drive are almost simultaneous with your pressing on the Enter key or clicking on "Save".
Drive Mirroring Details (continued)

- When drive mirroring is not "real time" and there is a time lag between the two or more mirrored hard drives, a drive failure in the first updated hard drive will probably result in the permanent loss of data that was not written to the second+ hard drive.
• Hard drive mirroring is also known as "RAID 1":
Drive Mirroring Details (continued)

- According to Wikipedia: ..in some environments, it is possible to "split the mirror",..., then a new disk can be substituted so that the inactive disk can be kept in much the same way as traditional backup.
Two No-Cost Software Programs for Mirroring Hard Drives in Real Time

- "Storage Spaces" Applet in "Windows 8"
- "Mirroring of Dynamic Hard Drives" in "Windows 7" and "Windows 8"
"Storage Spaces" Applet in "Windows 8"

- No cost: Bundled with all editions of "Windows 8" except for "Windows RT"
- GUI applet is easy to use
- Mirrored drives are formatted in a proprietary format that is difficult to recover data from
- Mirrored drives cannot be accessed with prior versions of "Windows"
"Storage Spaces" Applet in "Windows 8" (continued)

- External mirrored drives can be connected with eSATA, USB 2, USB 3, or SCSI.
- Storage spaces cannot be used with "dynamic" hard drives or "dynamic" hard drive partitions. ("Dynamic" hard drives or "dynamic" hard drive partitions are proprietary to "Windows")
Mirroring of Dynamic Hard Drives
• No cost: Bundled in with some versions and editions of "Windows."

• "Disk Management" applet or "diskpart" in a command prompt window is hard to use

• Mirrored drives are formatted in a format that is easy to recover data from

• Mirrored drives can be accessed with many versions and editions of "Windows"

• External mirrored drives can be connected with SATA, eSATA, or SCSI.

• External mirrored drives cannot be connected with USB 1 or USB 2 or USB 3.
Mirroring of Dynamic Hard Drives (continued)

- "Windows.." cannot mirror "simple" hard drives or "simple" hard drive partitions: You have to convert "simple" hard drives or "simple" hard drive partitions to "Windows"-proprietary "dynamic" hard drives or "dynamic" hard drive partitions before you can mirror them.
Details of Drive Mirroring With "Storage Spaces" of "Windows 8"

- See http://aztcs.org/meeting_notes/winhardsig/win8/StorageSpaces-howto.pdf
Details of Drive Mirroring with Dynamic Disks

• See
  http://aztcs.org/meeting_notes/DriveMirroring/dynamicdisks.pdf


Details of Drive Mirroring with Dynamic Disks (continued)

- http://buildegg.com/bewp/?p=44
Details of Drive Mirroring with Dynamic Disks (continued)

- External mirrored drives can be connected with SATA, eSATA, or SCSI.
Details of Drive Mirroring with Dynamic Disks (continued)

- External mirrored drives cannot be connected with USB 1 or USB 2 or USB 3:
Virtual Disk Manager

The operation is not supported by the object.

OK
Details of Drive Mirroring with Dynamic Disks (continued)

- When one of the mirrored drives is physically removed/disconnected (by you), the "virtual disk service" breaks the mirror and when you reconnect the drive, you do not see the mirror in "Disk Management" anymore.