Introducing Storage Spaces

Storage Spaces is a new feature in Windows Server 2012 that provides for a single server the same storage flexibility provided by a storage area network (SAN) by using inexpensive locally attached disks. Storage Spaces enables you to create storage pools from which you can provision storage as needed.

Once you've created a storage pool by using Storage Spaces, you can provision storage from the pool by creating virtual disks, also called logical unit numbers (LUNs). A virtual disk behaves like a physical disk except that it can span multiple physical disks within the storage pool.

Storage Spaces has the following requirements:

- Windows Server 2012.
- One physical drive is required to create a storage pool; a minimum of two physical drives is required to create a resilient mirror storage space.
- A minimum of three physical drives is required to create a storage space with resiliency through parity or three-way mirroring.
- Drives must be unpartitioned and unformatted.
- Drives must have at least 10 GB capacity.
- Drives can be attached either internally or externally (individually or in a just-a-bunch-of-disks [JBOD] enclosure). The following bus technologies are supported:
  - SATA (not possible to use in a failover cluster)
  - SCSI (not supported in a failover cluster)

- Serial Attached SCSI (SAS) arrays that support SCSI Enclosure Services (SES)
- USB (external drives for local storage only; not possible to use in a failover cluster or recommended for file servers)

Installing Storage Spaces

To install Storage Spaces, use the Add Roles And Features Wizard to add the File Server role service. This role service is found under File and iSCSI Services in the File and Storage Services role. You can also install the File Server role service by using Windows PowerShell as follows:

```
Install-WindowsFeature -Name FS-FileServer
```

> ***NOTE*** **Storage Services, another role service of the File and Storage Services role, is always installed by default on Windows Server 2012 and provides general storage management functionality needed by other server roles.**

To create a storage pool, Storage Spaces requires a server to have at least one attached physical disk of at least 10 GB without any partitions or volumes. Any physical disks that meet these two criteria are automatically added to what is called the server's primordial pool. The primordial pool is the complete set of locally available disks from which a storage pool can be created. Figure 1-17 shows in Server Manager the primordial pools available to the server named WS12-A and WS12-B, respectively.

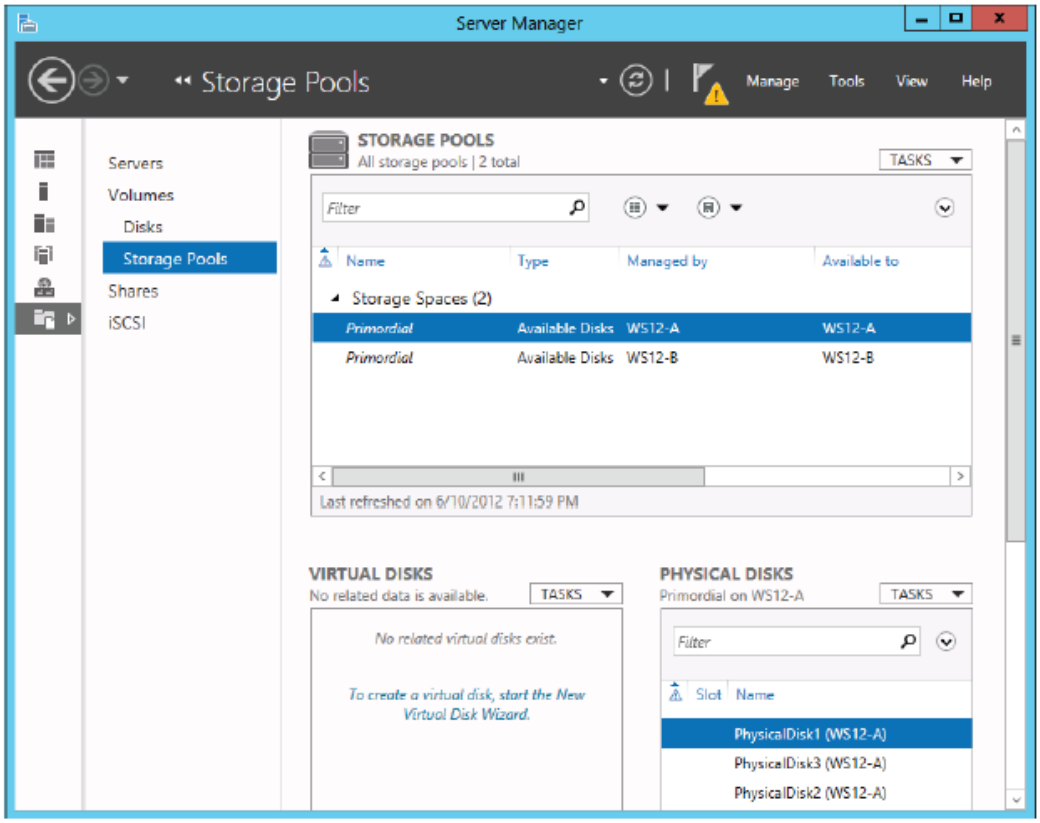

FIGURE 1-17 A primordial pool is composed of all unallocated physical disks larger than 10 GB available to a server.

You can use Server Manager or Windows PowerShell to configure your storage pools from a primordial pool. To create a storage pool in Windows PowerShell, use the New-StoragePool cmdlet. To create a new storage pool by using Server Manager, first make sure that you have navigated to File and Storage Services\Volumes\Storage Pools. Then select New Storage Pool from the Tasks menu in the Storage Pools area, as shown in Figure 1-18.

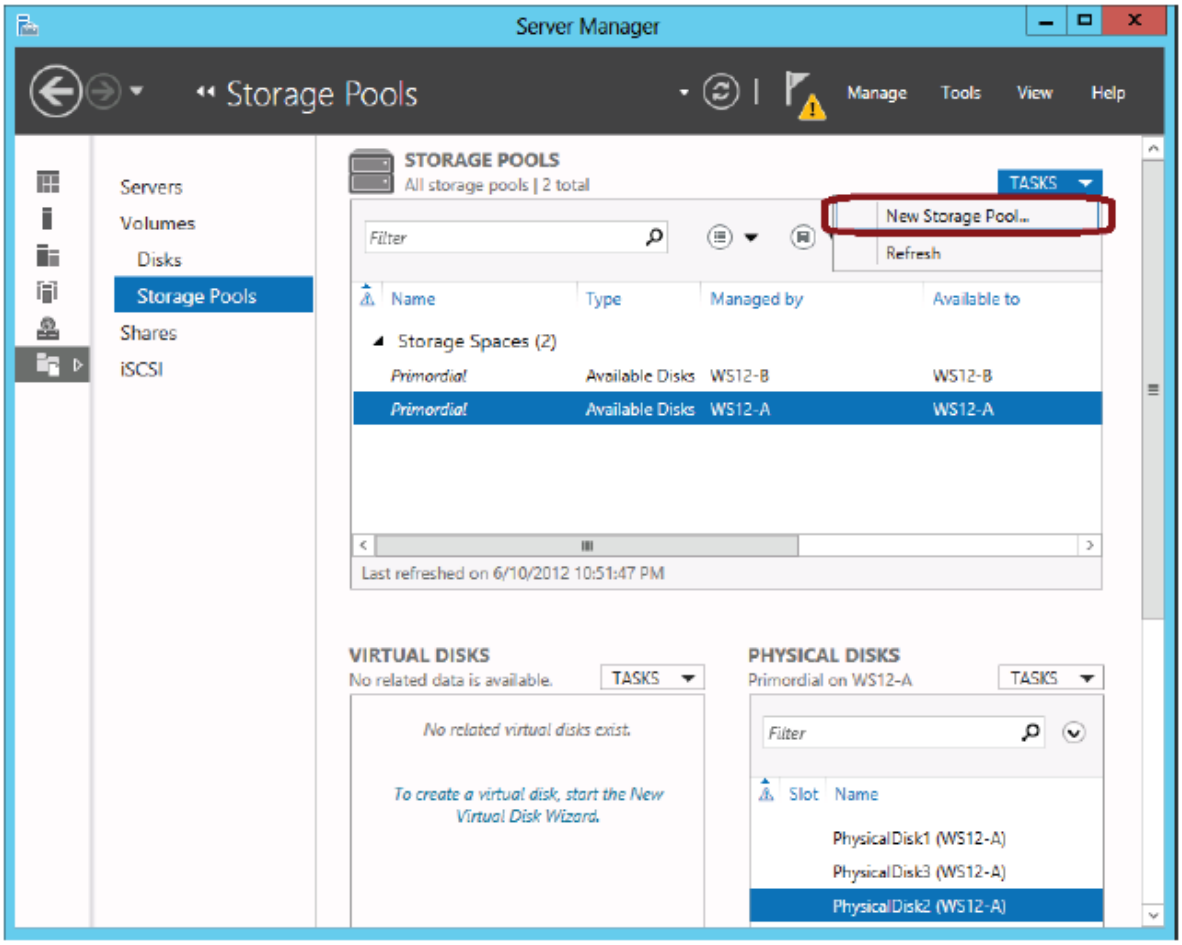

FIGURE 1-18 Creating a new storage pool.

This step opens the New Storage Pool Wizard. After specifying a server (primordial pool) and name for your new pool, you can select the physical disks you want to include in your pool, as shown in Figure 1-19.

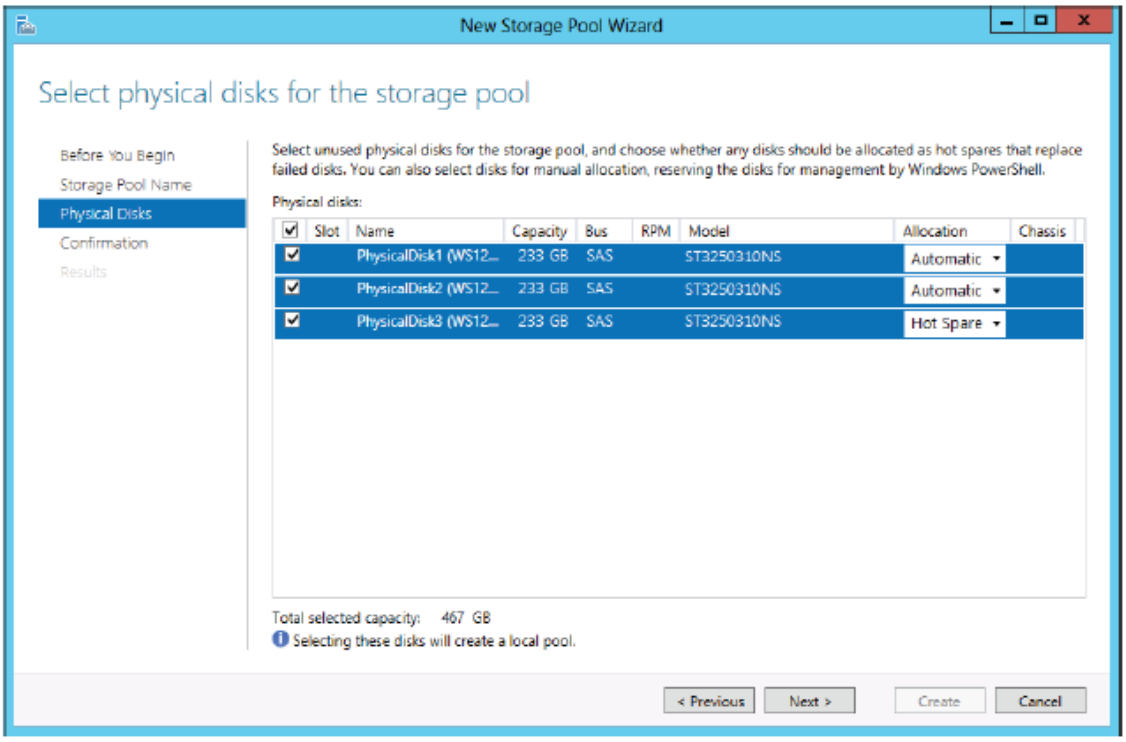

FIGURE 1-19 Selecting the physical disks to add to the storage pool.

EXAM TIP

Remember that if you want the storage pool to support failover clusters, you have to use SAS storage arrays that support SES.

For each disk that you add to the pool, you can choose one of the following allocation types:

- **Automatic** This is the default setting. For this allocation type, the capacity on drives is set automatically.
- **Hot Spare** Physical disks added as hot spares to a pool act as reserves that are not available for provisioning in the creation of virtual disks. If a failure occurs on a drive in a pool that has an available hot spare, the spare will be brought online to replace the failed drive.

EXAM TIP

Remember that hot spares are not available later for disk provisioning. If you want to add a hot spare to your storage pool and plan to create a mirrored drive later, you need at least three physical disks in the storage pool: one for the hot spare and two to support the mirror.

Creating virtual disks

After a storage pool is created, you can use Server Manager to provision new virtual disks from this new available storage. These new virtual disks will appear as unallocated disks in Disk

Management, from which you can then create volumes. Note that a virtual disk is the representation of virtualized storage and should not be confused with the VHD that is used in the context of Hyper-V or the iSCSI Target Server.

To create a virtual disk in Windows Powershell, use the New-VirtualDisk cmdlet.

To create a virtual disk in Server Manager, complete the following steps:

1. In Server Manager, choose File And Storage Services and then Storage Pools.
2. Locate a storage pool (not a primordial pool) that you want to use to support the new virtual disk.
3. Right-click the storage pool and select New Virtual Disk to start the New Virtual Disk Wizard, as shown in Figure 1-20.

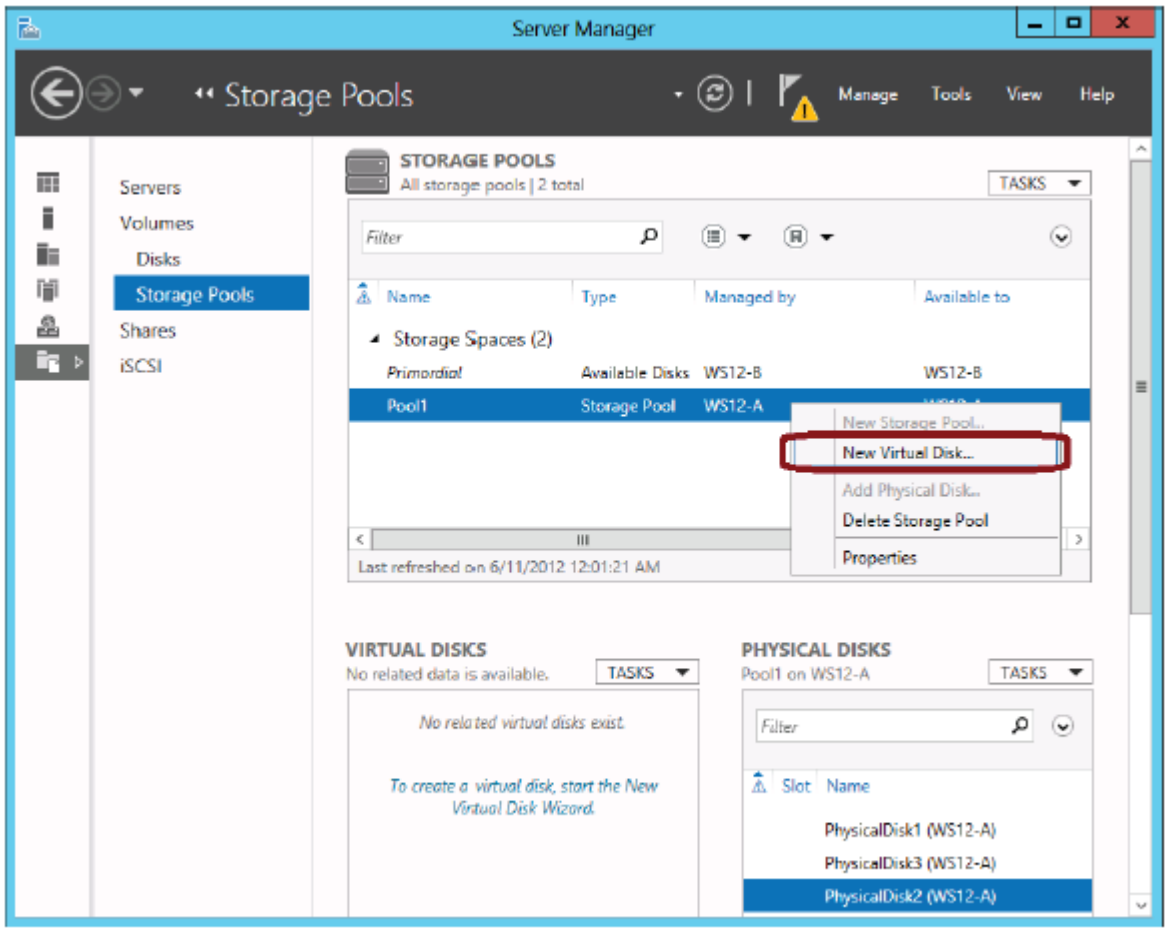

FIGURE 1-20 Creating a new virtual disk in a storage pool.

4. On the first pages of the wizard, verify that the correct server and storage pool are selected and provide a name and description for the new virtual disk.
5. On the Select The Storage Layout page (Figure 1-21), specify one of the following three data redundancy types for the virtual disk:
    - **Simple** A simple virtual disk provides data striping across physical disks but does not provide redundancy. Administrators should not host irreplaceable user data on a simple space. A simple space maximizes capacity and throughput and therefore can be good for hosting temp files or easily re-created data at a reduced cost.

- **Parity** A parity virtual disk is similar to a hardware Redundant Array of Inexpensive Disks (RAID5). Data, along with parity information, is striped across multiple physical disks. Parity enables Storage Spaces to continue to service read and write requests even when a drive has failed. A minimum of three physical disks is required for a parity virtual disk. Note that a parity disk cannot be used in a failover cluster.
- **Mirror** A mirror virtual disk maintains either two or three copies of the data it hosts: two data copies for two-way mirror spaces and three data copies for three-way mirror spaces. All data writes are repeated on all physical disks to ensure that the copies are always current. Mirror spaces are attractive due to their greater data throughput and lower access latency compared to parity disks.

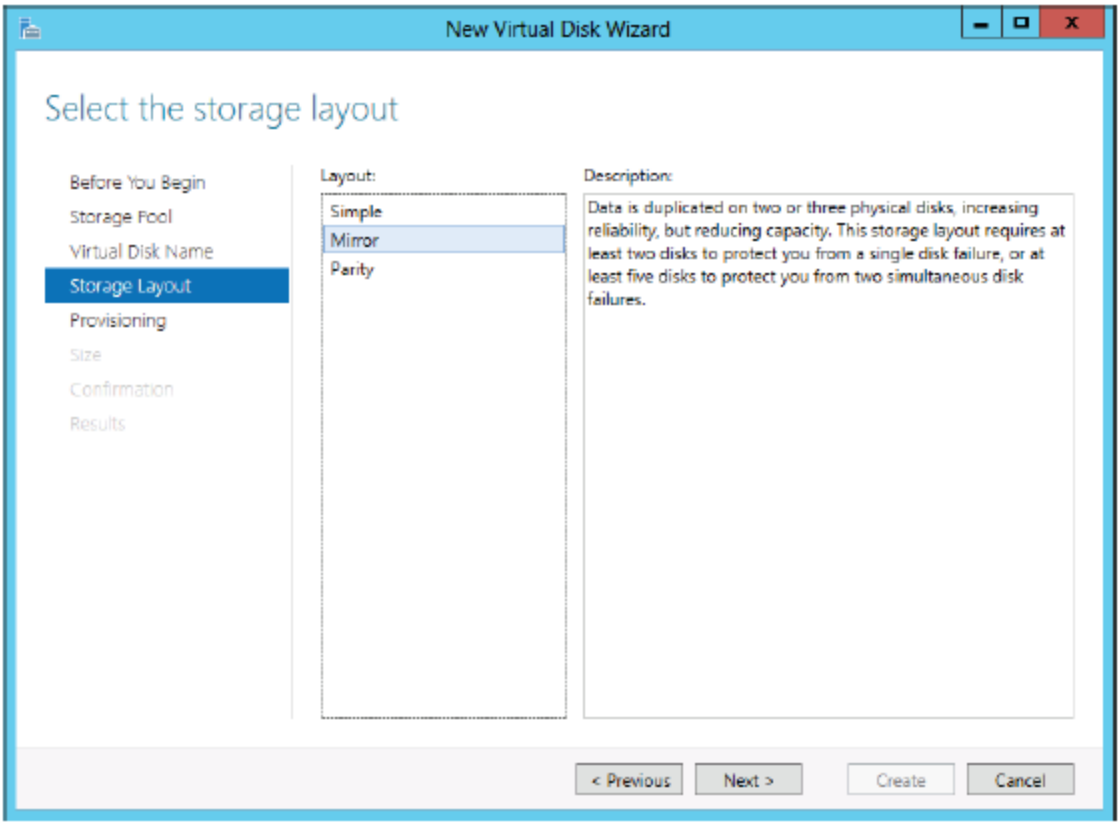

FIGURE 1-21 Selecting a storage layout.

6. On the Specify The Provisioning Type page, choose one of the following provisioning types:
   - **Thin** Thin provisioning is a mechanism that enables storage capacity to remain unallocated until datasets require the storage. You specify a maximum size for the virtual disk, and the capacity of the virtual disk grows as needed. Thin provisioning optimizes utilization of available storage, but it adds a few extra I/Os that can cause an occasional latency increase.
   - **Fixed** A fixed provisioned space allocates storage capacity upfront, at the time the space is created.
7. On the Specify The Size Of The Virtual Disk page, choose a size for the virtual disk.
8. Confirm all the selections and then click Create.

The new virtual disk appears in both Server Manager and Disk Management. The view in Server Manager is shown in Figure 1-22.

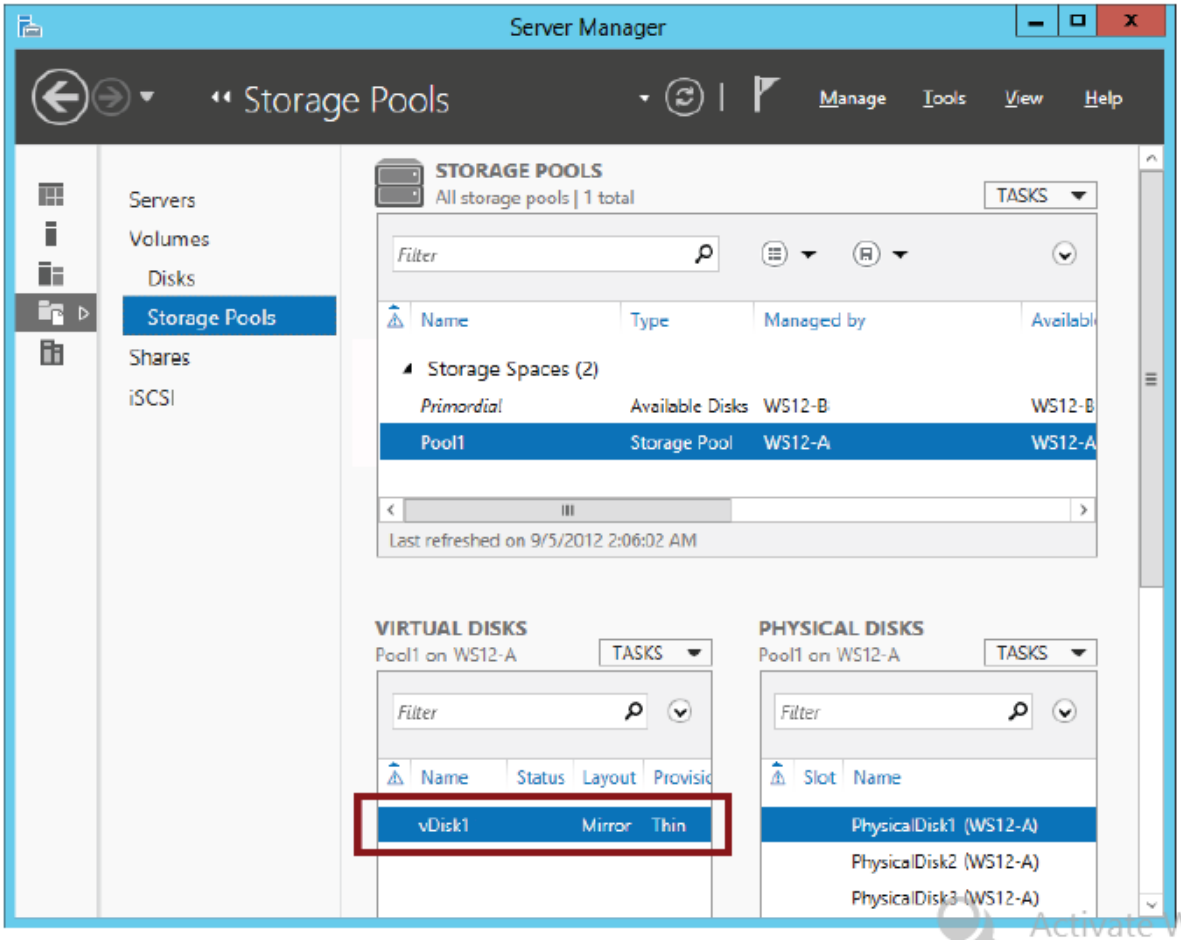

FIGURE 1-22 A new virtual disk created from a storage pool in Server Manager.

Objective summary

- Storage Spaces is a new feature in Windows Server 2012 that provides flexible provisioning of local storage to a server.
- All locally attached, unpartitioned physical disks with a capacity of at least 10 GB are automatically added to a server's primordial pool. A primordial pool is the complete set of locally available disks from which a storage pool can be created.
- Storage pools can be created from one or more physical disks. If you want to be able to create a mirrored virtual disk later from a storage pool, you need to add at least two physical disks to that storage pool. If you want to be able to create a virtual disk

with parity later from a storage pool, you need to add at least three physical disks to that storage pool. In addition to these requirements, you need to add one physical disk to a storage pool for each hot spare you want to be available to the storage.

- Thin provisioning is a new feature in Windows Server 2012 that enables you to create drives that don't require all their storage capacity to be allocated immediately. Thin provisioning optimizes available storage capacity for virtual disks.
- When you create new virtual disks from a storage pool, they appear in Disk Management as new, unallocated disks.