Module 1

Maximizing Hardware Utilization with Windows Server 2012 R2 & Hyper-V

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Organization
Contact details
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Module 1

What you’ll learn.

✓ Server virtualization overview
✓ Understand the technologies that help improve hardware efficiency and VM density when you consolidate physical servers into a virtualized infrastructure
  ✓ Virtual Machine Queue (VMQ)
  ✓ Dynamic Memory
  ✓ New Virtual Hard Disk (VHDX) format and capacity improvements
  ✓ Online VHDX resize
  ✓ VM Monitoring
  ✓ Cluster Aware Updating (CAU)
✓ VM Mobility
✓ Hyper-V Replica overview
Server consolidation overview

Why server consolidation?
• Reduce the number of total servers
• Run workloads at a higher density and better hardware utilization
• Reduce underutilized servers

Virtual machine workloads
• Better use of hardware and pooled resources

Virtualization models
• Hypervisor model (Hyper-V)
  - Based on the host/guest paradigm.
  - Multiple operating systems share a single hardware host
• Virtualization at the operating system level
  - Host runs a single operating system kernel as its core
  - Exports operating system functionality to each guest
  - Guests must run the same operating system as host
# Windows Server scale enhancements

<table>
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<tr>
<th>System</th>
<th>Resource</th>
<th>Maximum number</th>
<th>Improvement factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host</td>
<td>Logical processors on hardware</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Physical memory</td>
<td>1 TB</td>
<td>1 TB</td>
</tr>
<tr>
<td></td>
<td>Virtual processors per host</td>
<td>N/A</td>
<td>512</td>
</tr>
<tr>
<td>Virtual machine</td>
<td>Virtual processors per VM</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Memory per VM</td>
<td>N/A</td>
<td>64 GB</td>
</tr>
<tr>
<td></td>
<td>Virtual disk capacity</td>
<td>N/A</td>
<td>2 TB</td>
</tr>
<tr>
<td></td>
<td>Active VMs</td>
<td>N/A</td>
<td>384</td>
</tr>
<tr>
<td>Cluster</td>
<td>Nodes</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Virtual machines</td>
<td>N/A</td>
<td>1,000</td>
</tr>
</tbody>
</table>
Contoso Travel has about 250 users and has international websites that sell travel packages. They have implemented some Windows Server 2008 R2, and some Windows Server 2012 servers.

Contoso will be replacing its aging fleet of servers with new hardware that support the latest virtualization technology.

The plan is to deploy a proof of concept (PoC) environment to virtualize about 10% of the current server workloads on Windows Server 2012 and Hyper-V, and to evaluate performance, manageability, and stability. If the PoC is successful, then phase 2 will be to move forward deploying a fully virtualized server room.
Hyper-V server basics

Hyper-V Role Installation
✓ Local or remote, using Server Manager or Windows PowerShell.

Hyper-V Server Settings
✓ Live Migration, Hyper-V Replica, default paths, adding hardware
✓ Parent and child partitions

Virtual Switch Manager
✓ Private, internal, external switch types
✓ Not the same as Hyper-V Network Virtualization (HNV) and Software Defined Networking (SDN)

Storage (remote and local storage options)
✓ Host scalability - up to 320 logical processors, 4 TB
Hyper-V Virtual Machine basics

Creating Virtual Machines
✓ Hyper-V Manager or Windows PowerShell
✓ Generation 1 and Generation 2 VMs (Windows Server 2012 R2)

Virtual Machine Settings
✓ Add hardware (disks, NICs, SCSI controllers)
✓ New VHDX files in contrast to VHD files
✓ Online VHDX resize (Windows Server 2012 R2)
✓ Support for 4K sector size disks

VM Scaling
✓ Up to 64 virtual processors.
✓ Up to 1 TB RAM.
Generation 1 & 2 Virtual Machines

**Generation 1**

Provides the same virtual hardware to the virtual machine as in previous versions of Hyper-V

**Generation 2**

Provides the following new functionality on a virtual machine:

- Pre-Boot Execution Environment (PXE) boot, which uses a standard network adapter
- Boot from a SCSI virtual hard disk
- Boot from a SCSI virtual DVD
- Secure Boot (enabled by default)
- UEFI firmware support
Exploring Hyper-V Server and VM Configuration

Module One Demonstration
Contoso Travel is concerned that their workloads, once virtualized, might not have the ability to handle the network IO.

Memory requirements change day to day for the workloads, as well as the number of network IOs during peak times. Contoso Travel needs to know what technologies are included with Hyper-V to support heavy network loads.

All the new servers will have:
- the latest virtualization chipsets
- NUMA support
- dual onboard 10 GB NICs.
Dynamic Memory

Achieve higher levels of density for your Hyper-V hosts

Windows Server 2008 R2 SP1
  • Introduced Dynamic Memory to enable automatic reallocation of memory among running virtual machines

Enhanced in Windows Server 2012 and Windows Server 2012 R2
  • Minimum and startup memory
  • Smart paging
  • Memory ballooning
  • Runtime configuration
Use disk as additional, temporary memory

Hyper-V Smart Paging
- Reliable way to keep a VM running when no physical memory is available
- Performance will be degraded as disk is much slower than memory

Used in the following situations:
- VM restart
- No physical memory is available
- No memory can be reclaimed from other virtual machines on that host

Startup increases memory in use after startup

Memory reclaimed after startup
Scenario:

Contoso has always given each department a budget for servers, software, and consulting as needed. The IT budget is mainly for operational costs like infrastructure servers, power, storage and networking.

Contoso has recently invested in a SAN to provide storage for some of its mission critical workloads, they mainly rely on direct attached storage (DAS) for most workloads.

Since the IT budget is now supplemented by each department based on resource usage, there needs to be a mechanism in place which will allow the IT department to track and report on resource consumption at a department level.
Resource metering

Features
- Uses resource pools
- Compatible with all Hyper-V operations
- Unaffected by VM movement
- Uses Network Metering Port ACLs

Metrics
- Average CPU use
- Average memory use
- Minimum memory use
- Maximum memory use
- Maximum disk allocation
- Incoming network traffic
- Outgoing network traffic
- Incoming storage IOPS
- Outgoing storage IOPS

Multiple departments sharing a single Infrastructure
<table>
<thead>
<tr>
<th>VMName</th>
<th>AvgCPU(MHz)</th>
<th>AvgRAM(M)</th>
<th>MaxRAM(M)</th>
<th>MinRAM(M)</th>
<th>TotalDisk(M)</th>
<th>NetworkInbound(M)</th>
<th>NetworkOutbound(M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation 2 VM</td>
<td>719</td>
<td>788</td>
<td>2048</td>
<td>2048</td>
<td>130048</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PokerDC</td>
<td>150</td>
<td>778</td>
<td>2048</td>
<td>2048</td>
<td>130048</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PokeSync</td>
<td>93</td>
<td>762</td>
<td>2048</td>
<td>2048</td>
<td>130048</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Server 2012 R2</td>
<td>79</td>
<td>1626</td>
<td>4096</td>
<td>4096</td>
<td>130048</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Windows 81 Preview</td>
<td>131</td>
<td>1668</td>
<td>4096</td>
<td>4096</td>
<td>130048</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Scenario:

Hyper-V 2012 Live Migration and Live Storage Migration can move a workload from one Hyper-V host to another, while the users continue to use the VM.

Contoso Travel does not have the IT budget to buy expensive SAN-based storage for all virtual workloads, so many will continue to use local server storage.

The new servers will be equipped with RDMA NICs to provide maximum network performance from host to host, or host to SMB storage services.

To achieve high levels of availability, Contoso Travel is going to implement scale-out file servers to host VHDX files.
Live Migration

Faster, simultaneous migration of VMs without downtime

- Enables faster live migrations, taking full advantage of available network
- Supports simultaneous live migrations
- Uses SMB Direct if available network bandwidth is more than 10 gigabits
- Supports flexible storage choices
- Does not require clustering if the VM resides on an SMB 3.0 file share

Storage handle moved
Storage Live Migration

Increased flexibility through Live Migration of VM storage

- Move virtual hard disks attached to a running virtual machine
- Manage storage in a cloud environment with greater flexibility and control
- Move storage with no downtime
- Update physical storage available to a virtual machine (such as SMB-based storage)
- Use Windows PowerShell cmdlets
Hyper-V Live Migration settings

Module One Demonstration
Scenario:

Hyper-V will run their most demanding workloads.

They have several SQL Servers, about half of which are running in a production cluster.

Contoso has recently invested in some SAN hardware for their most demanding workloads.

They want to be sure that they can still take advantage of certain SAN features like unmediated access to the FCP fabric and Offloaded Data Transfer (ODX) for management of large file copies from one SAN disk to another, when they move hose workloads to Hyper-V.
Hyper-V Replica

Replicate Hyper-V VMs from a primary to a replica site

• Affordable in-box business continuity and disaster recovery
• Configurable replication frequencies of 30 seconds, 5 minutes, and 15 minutes
• Secure replication across network
• Hardware-agnostic on either site
• No need for other VM replication technologies
• Automatic handling of live migration
• Simpler configuration and management

Primary site

Replica site

Hyper-V role and tools

Hyper-V cmdlets

Hyper-V PS integrated UI

Hyper-V management module tracks and replicates changes for each virtual machine

Send/receive replica traffic

Hyper-V role and tools

Hyper-V cmdlets

Hyper-V PS integrated UI

Hyper-V management module receives and applies the changes to the replica virtual machine
Hyper-V Replica | Extended Replication

Replicate to third location for extra level of resiliency

- Once a VM has been successfully replicated to the replica site, the replica can be replicated to a third location
- Chained replication
- Extended replica contents match the original replication contents
- Extended replica replication frequencies can differ from original replica
- Useful for scenarios such as SMB to service provider to service provider disaster recovery (DR) site
Configuring Hyper-V Replica
Module One Demonstration
Hands-on Lab 1

Virtualizing with the Latest Edition of Hyper-V

Estimated time to complete: 20 min.

- Exploring Hyper-V
- Configuring Hyper-V
- Live Migration settings