Microsoft Private Cloud: Evaluation Guide
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Introduction

Using the Evaluation Guide

This Private Cloud Evaluation Guide is built to give you the necessary information to experience the Microsoft Private Cloud built on System Center 2012 SP1 and powered by Windows Server 2012 where you will go through detailed scenarios in a proof of concept environment. This guide is designed to be consumed as you wish and each of the hands-on portions of the guide are designed as “Experiences.” Each of the Experiences are independent so that you may build and test each of them in any order you wish.

This guide is intentionally built so that you can run it on -lower-level hardware for the purpose of evaluation. It is also possible to follow this guide and change the scenario to your own environment and parameters.

Navigating the document on your terms

This document is designed for you to navigate much easier and locate the information that is most relevant to you. Each of the 4 major chapters – Introduction, Setup and deploy, Experiences and Other info – are collapsible and expandable.

You will also find that you may jump to any of the other chapters or experiences from the end of any section. The following navigation window allows you to click on the desired tile which links directly to that point in the document. Simply press “ctrl+v and click” the tile to view that section.

This tile takes you back to the Evaluation Guide Contents page.

Links to other areas of interest

- Introduction
- Setup and deploy your Private Cloud
- Experiences
- Other Info
- Manage Private Cloud Resources
- Manage Private Cloud Capacity
- Private Cloud Automation
- Manage Apps in the Private Cloud
- Reporting insights of the Private Cloud
What is Microsoft’s Private Cloud?

The Microsoft Cloud OS

Cloud computing is happening. It is being driven by the exponential growth in modern applications, data and devices. These trends require organizations to quickly scale and deliver continuous services. Simultaneously, innovation is happening across storage, network and compute technologies. With these new requirements and innovations, IT is under pressure to deliver capacity on demand, whether for short-term projects or longer-term initiatives. At the same time, organizations have higher expectations for service levels – services must be always up, always on, with no planned or unplanned downtime.

To meet these challenges, a new modern platform is required. In the era of cloud computing, Microsoft delivers this with the Cloud OS. The Cloud OS takes on a broader role than just managing a server. Microsoft’s vision for the Cloud OS is focused on the transformation of the datacenter, enabling modern applications, unlocking insights on any data and empowering people-centric IT.

![Cloud OS Diagram]

Figure 1: The Cloud OS delivers on four fundamental tenets of the next generation of IT

The Cloud OS requires a comprehensive execution of vision crossing a wide range of enterprise technologies, including Windows Azure, SQL Server, System Center and Windows Server. This whitepaper sets out a step on that journey by focusing on the transformation of the datacenter. Fundamental to the modern datacenter, is the ability to build private cloud infrastructures and quickly scale within the datacenter as well as agile and secure consumption of Windows Azure and service provider cloud capacity. This paper explains Windows Server 2012 as the foundation for the Private Cloud and how System Center 2012 SP1, makes the management of private and public clouds consistent and seamless.
The Private Cloud in your datacenter

A private cloud aims to deliver many of the characteristics of public cloud computing such as scalability and elasticity, the pooling of shared infrastructure, user self-service, and higher levels of overall application availability and reliability. However, by taking a private cloud approach, organizations can deliver on these goals while still using their own physical resources allowing them to maintain complete control over their data and processes.

With shared infrastructure, compute, storage and even networking assets are virtualized and pooled together. This approach is a shift from today’s model in which an application owner will likely know (and probably fund) the exact hardware on which their application is physically deployed. In a private cloud environment, application owners will only care that adequate capacity to run the application has been provided from the shared pool. Once deployed, services can scale up and down based on demand. IT no longer needs to over-provision infrastructure capacity to accommodate potential spikes in load.

Datacenter administrators and application owners can view resource utilization as well as the chargeback information related to their allocated capacity. By giving application owners better visibility over their resource usage organizations are able to more easily drive and deliver the right behavior to conserve capacity where possible. A self-service interface to which standardized services are published from central IT, empowers application owners and other internal customers to be able to easily provision resources when needed. Automation helps to drive efficiency in service delivery thereby freeing up IT Pros to focus on other tasks. Self-service also frees up application owners as well. They are empowered to directly access resources; no complicated approval process; no need to wait for the overworked IT team to eventually get to the request.

A private cloud deployment captures all of these characteristics, most of which are also in common with public and partner hosted clouds, but, the private cloud also allows organizations to maintain total control over their applications and data. These are common blockers for businesses looking at public cloud solutions. Ultimately, most customers will find portions of their organization that live best in a private deployment, portions that live best in a public deployment and in some cases portions that are best served by partner delivered clouds. The world will exist in a hybrid state for the foreseeable future and it is important for companies to evaluate their particular needs to determine the best combination for them.
Why System Center 2012 SP1 for your Private Cloud

Over the last twenty years, Microsoft has built some of the world’s largest datacenters running many of the world’s largest cloud hosted services. The expertise that has been built up in efficiently running these massive data centers forms the foundation for the Microsoft private cloud offering. Built on System Center 2012 SP1 and Windows Server 2012, a Microsoft private cloud allows datacenter administrators to deploy a flexible and responsive infrastructure that is designed to simplify day-to-day tasks and to enable management of applications at the service level, rather than the level of individual servers.

System Center 2012 SP1 makes it easy for customers to build private clouds while taking advantage of currently deployed IT hardware and building an infrastructure for the future. This comprehensive offering was designed around the following principles.

These principles are surfaced through a core set of capabilities in Windows Server 2012 and System Center 2012 SP1, allowing datacenter administrators and application owners to access and consume IT services from these private clouds.

The rest of this paper will describe the private cloud capabilities provided by System Center 2012 SP1. For the datacenter administrator, this includes infrastructure management, service delivery and automation. For the application owner or business unit IT professional, this includes self-service application management, monitoring and reporting.

The table in Figure 3 highlights these capabilities, how they align to industry concepts and System Center 2012 SP1 components.

<table>
<thead>
<tr>
<th>Customer Scenario</th>
<th>Industry Capability</th>
<th>System Center 2012 Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Management</td>
<td>Application Self-Service</td>
<td>App Controller, Service Manager</td>
</tr>
<tr>
<td></td>
<td>Application Performance Management</td>
<td>Operations Manager</td>
</tr>
<tr>
<td></td>
<td>Application Management Across Clouds</td>
<td>Virtual Machine Manager</td>
</tr>
<tr>
<td>Service Delivery &amp; Automation</td>
<td>IT Service Management &amp; Reporting</td>
<td>Service Manager</td>
</tr>
<tr>
<td></td>
<td>Process Automation &amp; Orchestration</td>
<td>Orchestrator</td>
</tr>
<tr>
<td>Infrastructure Management</td>
<td>Cloud Creation &amp; Delegation</td>
<td>Virtual Machine Manager</td>
</tr>
<tr>
<td></td>
<td>Data Protection &amp; Disaster Recovery</td>
<td>Data Protection Manager, Orchestrator</td>
</tr>
<tr>
<td></td>
<td>Monitoring</td>
<td>Operations Manager</td>
</tr>
<tr>
<td></td>
<td>Configuration &amp; Compliance</td>
<td>Configuration Manager</td>
</tr>
</tbody>
</table>

Figure 3: Mapping of industry cloud computing concepts to System Center 2012 SP1 products and features.
Components of the Private Cloud

Overview

Highly virtualized computing gives you the benefits of increased utilization of your servers, power savings, and reduced server footprint. We are familiar with these as they are in datacenters today. However, this does not equal the private cloud.

A private cloud provides all of those benefits plus highly integrated and automated management, scalable and elastic platforms, and self-service IT infrastructure.

Through a highly automated infrastructure, an organization can reduce operational costs by automating many tasks that previously required manual intervention. Through the service catalog an organization can provide a self-service IT infrastructure to business units and departments with an SLA. This forces service-level discussion and removes the burden to procure, provision, and manage infrastructure on a per-application, ad-hoc basis. With a scalable and elastic infrastructure, an organization can enable faster delivery of capacity as resource needs change. By utilizing a Windows Server 2012 infrastructure along with System Center 2012 SP1, the Microsoft private cloud allows you to deploy a flexible and responsive infrastructure, designed to simplify day-to-day tasks and enable management of applications at the service level, rather than that of individual servers.

With the release of Service Pack 1, many new features have been made available to increase scalability, elasticity and automation of the Private Cloud. Wider integration with many other products including Windows Azure means more options for IT professionals wishing to take advantage of the Public and Private cloud to future proof their business.

Reference Links

- Download Microsoft Windows Server 2012
- Download Microsoft System Center 2012 SP1
- Download SC2012 Configuration Manager and Endpoint Protection SP1
- What’s new in System Center 2012 SP1
- What’s new for Orchestrator in System Center 2012 SP1
- What’s new for App Controller in System Center 2012 SP1
- What’s new for Virtual Machine Manager in System Center 2012 SP1
- What’s new for Operations Manager in System Center 2012 SP1
- What’s new for Service Manager in System Center 2012 SP1
- What’s new for Data Protection Manager in System Center 2012 SP1
Microsoft Windows Server 2012

Microsoft Windows Server 2012 is the operating system that runs your private cloud. In this evaluation guide it will run as the host hypervisor, the OS for the different infrastructure components, and for the application that we will deploy, manage, and monitor.

Hyper-V

Hyper-V is the server virtualization technology within Windows Server 2012. It allows you to run virtual machines on top of the host Operating System when your hardware is capable of running virtualized loads.

System Center Orchestrator

System Center Orchestrator is a workflow engine that allows you to automate the creation, deployment and monitoring of resources in your private cloud. Better said, Orchestrator provides you with orchestration, integration and automation of IT processes. Orchestrator works in conjunction with all the System Center components and can also be used to automate components from 3rd party applications like HP ILO and OA, VMware vSphere and many others (for a full list of Orchestrator 2012 SP1 integration packs see http://technet.microsoft.com/en-us/library/hh295851.aspx).

Included as part of Orchestrator 2012 SP1 is the Service Provider Framework which enables service providers to offer Infrastructure as a Service (IaaS). The provider may have already provided a front-end portal for clients to interact with, and Service Provider Foundation allows those clients access to their resources on the hosting provider’s system without any change to the portal.

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Server</td>
<td>The management server is the communication layer between the Runbook Designer and the orchestration database</td>
</tr>
<tr>
<td>Runbook Server</td>
<td>A runbook server is where an instance of a runbook runs. A runbook is a collection of actions bundled together that Orchestrator will run performing various automated actions. Runbook servers communicate directly with the orchestration database. You can deploy multiple runbook servers per Orchestrator installation to increase capacity and redundancy.</td>
</tr>
<tr>
<td>Orchestration Database</td>
<td>The database is a Microsoft SQL Server database that contains all of the deployed runbooks, the status of running runbooks, log files, and configuration data for Orchestrator.</td>
</tr>
<tr>
<td>Runbook Designer</td>
<td>The Runbook Designer is the tool used to build, edit, and manage Orchestrator runbooks. One runbook or different runbooks together form your workflow(s).</td>
</tr>
<tr>
<td>Runbook Tester</td>
<td>Runbook Tester is a run-time tool used to test runbooks developed in the Runbook Designer. This tool allows you to test your runbooks before taking them into production.</td>
</tr>
<tr>
<td>Orchestration Console</td>
<td>The Orchestration console lets you start or stop runbooks and view real-time status on a web browser. This is a Silverlight-based web console.</td>
</tr>
</tbody>
</table>
Orchestrator Web Service | The Orchestrator web service is a Representational State Transfer (REST)-based service that enables custom applications to connect to Orchestrator to start and stop runbooks, and retrieve information about operations by using custom applications or scripts. The Orchestration console uses this web service to interact with Orchestrator.

Deployment Manager | Deployment Manager is a tool used to deploy integration packs (IPs), runbook servers, and Runbook Designers

Integration pack (IP) | An integration pack is a collection of custom activities specific to a product or technology. Microsoft and other companies provide integration packs with activities to interact with their product from an Orchestrator runbook.

Orchestrator Integration Toolkit | The Orchestrator Integration Toolkit lets you extend your library of activities beyond the collection of standard activities and integration packs. The Integration Toolkit has wizard-based tools to create new activities and integration packs for Orchestrator. Developers can also use the Integration Toolkit to create integration packs from custom activities that they build by using the Orchestrator SDK.

New Capabilities
- Exchange Administrator Integration Pack for Orchestrator in System Center 2012 SP1
- Exchange Users Integration Pack for Orchestrator in System Center 2012 SP1
- Representational State Transfer (REST) Integration Pack Guide for Orchestrator in System Center 2012 SP1

System Center App Controller

System Center App Controller is a Silverlight web-based interface that allows you to manage, build, configure and deploy services both on the private and the public cloud. With this interface, you will have a common self-service experience through your different clouds. This interface is mainly used to provide self-service capabilities for your application owners.

The ability to control and manage applications and services within the private cloud is critical. A key requirement, as organizations begin using hybrid apps, will be the ability to connect with services in other clouds and to manage them through a single management experience.

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Controller Server</td>
<td>The App Controller Server runs the web-based Silverlight application to manage, build, configure and deploy services both on your private cloud and the public cloud.</td>
</tr>
<tr>
<td>Database</td>
<td>The database that contains the necessary information for the connection to your Azure subscriptions and your Virtual Machine Manager service(s).</td>
</tr>
<tr>
<td>PowerShell Module</td>
<td>The App Controller PowerShell Module provides administrators with the ability to automate App Controller administration.</td>
</tr>
</tbody>
</table>
New Capabilities

- Upload a virtual hard disk or image to Windows Azure from a VMM library or network share
- Migrate a virtual machine from VMM to Windows Azure
- Add a Service Provider Framework (SPF) hosting provider connection. SPF enables service providers to offer Infrastructure as a Service (IaaS) to their clients.

System Center Virtual Machine Manager

System Center Virtual Machine Manager is the component that provides you with virtual machine management AND service deployment. This component comes with support for multi-hypervisor environments and is the system that allows you to define, create and manage your private cloud environment(s).

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMM Management Server</td>
<td>The computer on which the Virtual Machine Manager service runs and which processes commands and controls communications with the VMM database, the library server, and virtual machine hosts.</td>
</tr>
<tr>
<td>VMM Console</td>
<td>The Virtual Machine Manager Console is the graphical user interface to your VMM environment.</td>
</tr>
<tr>
<td>VMM Self-Service Portal</td>
<td>A website used to deploy and request virtual machines.</td>
</tr>
<tr>
<td>VMM Database</td>
<td>The VMM database stores all the Virtual Machine Manager configuration and information regarding the hosts and virtual guests.</td>
</tr>
<tr>
<td>VMM Library Server</td>
<td>The VMM Library Server is a catalog of resources containing all the ISO files, virtual hard disks, templates and profiles used to deploy virtual machines and services.</td>
</tr>
</tbody>
</table>

New Capabilities

- Support for Network Virtualization with the support for using DHCP to assign customer IP addresses
- Support for VHDX format with functionality to convert from VHD to VHDX
- Support for file shares using SMB 3.0

System Center Operations Manager

System Center Operations Manager provides you with deep application diagnostics and infrastructure monitoring of your private cloud components. It can offer you a thorough overview of the performance and availability of applications deployed in your datacenter, private or public cloud.

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Server</td>
<td>The Operations Manager Management Server is the focal point for administering the management group and communicating with the database. When you open the Operations console and connect to a management group,</td>
</tr>
</tbody>
</table>
you connect to a management server for that management group. Depending on the size of your computing environment, a management group can contain a single management server or multiple management servers.

<table>
<thead>
<tr>
<th>Operations Console</th>
<th>The Operations Manager is the graphical user interface that will give you the single pane of glass monitoring of your private cloud.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations Manager Database</td>
<td>The OpsMgr database is where all the collected data like performance &amp; event data, alerts etc. are stored.</td>
</tr>
<tr>
<td>Operations Manager Data Warehouse</td>
<td>The OpsMgr data warehouse is used for long term reporting.</td>
</tr>
<tr>
<td>Operations Manager Web Console</td>
<td>The OpsMgr web console provides a browser-based alternative to the OpsMgr console.</td>
</tr>
<tr>
<td>Operations Manager Advisor</td>
<td>Browser-based console to provide deep insight in your .Net applications</td>
</tr>
<tr>
<td>Gateway Server</td>
<td>A gateway server is used to monitor untrusted environments like a DMZ Audit Collection Server ACS is used for collecting and auditing security events.</td>
</tr>
</tbody>
</table>

New Capabilities

The diagnostic and monitoring capabilities have been expanded in System Center 2012 Operations Manager SP1. New features include:

- Monitoring Windows Services built on the .NET Framework
- Automatic discovery of ASP.NET MVC3 and MVC Applications
- Enabled APM of SharePoint 2010
- Integration with Team Foundation Server 2010 and 2012

System Center Service Manager

Service Manager provides an integrated platform for automating and adapting your organization’s IT service management best practices, such as those found in Microsoft Operations Framework (MOF) and Information Technology Infrastructure Library (ITIL). It provides built-in processes for incident and problem resolution, change-control, and release management.

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Server</td>
<td>Contains the main software part of a Service Manager installation. You can use the Service Manager management server to manage incidents, changes, users, and tasks.</td>
</tr>
<tr>
<td>Database</td>
<td>The database that contains Service Manager configuration items (CI) from the IT Enterprise; work items, such as incidents, change requests, and the configuration for the product itself. This is the Service Manager implementation of a Configuration Management Database (CMDB).</td>
</tr>
<tr>
<td>Data warehouse management server</td>
<td>The computer that hosts the server piece of the data warehouse.</td>
</tr>
</tbody>
</table>
### Data warehouse databases
Databases that provide long-term storage of the business data that Service Manager generates. These databases are also used for reporting.

### Service Manager console
The user interface (UI) piece that is used by both the help desk analyst and the help desk administrator to perform Service Manager functions, such as incidents, changes, and tasks. This part is installed automatically when you deploy a Service Manager management server. In addition, you can manually install the Service Manager console as a stand-alone part on a computer.

### Self-Service Portal
A web-based interface into Service Manager.

### New Capabilities
- Chargeback helps you can apply cloud-based pricing to your Virtual Machine Manager fabric
- Improved Operations Manager Integration
- SQL Server 2012 Support
- Windows Server 2012 and Windows 8 Support

### System Center Data Protection Manager
Data Protection Manager (DPM) enables disk-based and tape-based data protection and recovery for servers such as SQL Server, Exchange Server, SharePoint, virtual servers, file servers, and support for Windows desktops and laptops. DPM can also centrally manage system state and Bare Metal Recovery (BMR) which will allow us to protect the servers that contain our virtualized infrastructure.

### Components

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The DPM server contains the program files of the Data Protection Manager installation. This server will be responsible for all the protection and recovery jobs.</td>
</tr>
<tr>
<td>The DPM database will contain all the information of your Data Protection Manager environment. All protection group information, agent information, recovery points and so on are stored here.</td>
</tr>
<tr>
<td>Operations Management is used as the platform for the central console and is used to manage your SCDPM server (or multiple DPM servers)</td>
</tr>
<tr>
<td>The Storage Pool contains your storage that will be used to take disk-to-disk backups</td>
</tr>
</tbody>
</table>
New Capabilities

- Cluster Shared Volume (CSV) 2.0 Support for improved performance on backing up virtual machines on CSVs.
- Hyper-V protection over remote SMB Shares.
- Scale Out support for Hyper-V machines.
- Protection of Windows 8 de-duplicated volumes.
- Support for Live Migration.
- Integration with Windows Azure Online Backup.
- Support for SQL 2012 Always-On feature.
- Support for Resilient File System (ReFS).

Summary

In this first chapter, you reviewed the components that are needed to deploy a private cloud. Now you know all the building blocks to start with your evaluation of the Private Cloud.
Setup and deploy your Private Cloud

Architecture

Here is the overview of what hardware we are going to use for our private cloud evaluation. This can be different from your environment but this is the minimum required to evaluate the Private Cloud.
Installing the Private Cloud

Implementing or upgrading your Private Cloud

This document covers two situations where you may be deploying System Center 2012 SP1 into a Lab or sandbox environment for evaluation of the Private Cloud. This may be your first time evaluating System Center 2012 and Windows Server 2012, so you have an environment that is empty. Or this may be a follow up from a previous evaluation using the Private Cloud Evaluation guide that was released with the System Center 2012 RTM package.

In future there will also be an option to install the full System Center 2012 Suite using the Microsoft Cloud Accelerator Toolkit.

Both of these situations can be covered in the Install and Upgrade sections below. If you wish to install a Private Cloud environment from a blank environment, follow the steps outlined below in the Installing the Private Cloud section. If you wish to upgrade an existing Private Cloud evaluation environment delivered via the Unified Installer or the previous Private Cloud Evaluation guide, then follow the steps outlined in the section Upgrading the Private Cloud.

If you have previously deployed the Private Cloud either using the previous Evaluation Guide or using the Unified Installer that was released with System Center 2012 RTM, you may have less hardware than the diagram above. To upgrade an RTM environment to SP1 and implement the scenarios in later sections of the document you will need 2 additional hosts, and 2 network cards per host. Each server must have Windows Server 2012 installed, and the Hyper-V role enabled.

More detail on setting up the hardware can be found in the section labeled Upgrading the Private Cloud.

<table>
<thead>
<tr>
<th>Name</th>
<th>CPU</th>
<th>Memory</th>
<th>Disk</th>
<th>NIC’s</th>
<th>Main IP</th>
<th>Cluster IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>HyperV02</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>2 Physical NICs</td>
<td>192.168.1.2</td>
<td>172.24.100.2</td>
</tr>
<tr>
<td>HyperV03</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>2 Physical NICs</td>
<td>192.168.1.21</td>
<td>172.24.100.21</td>
</tr>
<tr>
<td>HyperV04</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>2 Physical NICs</td>
<td>192.168.1.22</td>
<td>172.24.100.22</td>
</tr>
</tbody>
</table>

All servers have a subnet mask of 255.255.255.0 on both network adapters.
Virtual servers

The following virtual servers are required:

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>CPU</th>
<th>Memory</th>
<th>Disk</th>
<th>IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orchestrator</td>
<td>Orchestrator server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.3</td>
</tr>
<tr>
<td>VMM</td>
<td>Virtual Machine Manager server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>90 GB</td>
<td>192.168.1.4</td>
</tr>
<tr>
<td>AppController</td>
<td>App Controller server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>90 GB</td>
<td>192.168.1.5</td>
</tr>
<tr>
<td>OpsMgr</td>
<td>Operations Manager server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.6</td>
</tr>
<tr>
<td>ServiceMgr</td>
<td>Service Manager server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.7</td>
</tr>
<tr>
<td>ServiceMgrDW</td>
<td>Service Manager Data Warehouse server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.8</td>
</tr>
<tr>
<td>DPM</td>
<td>Data Protection Manager server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.9</td>
</tr>
<tr>
<td>AD</td>
<td>Domain Controller</td>
<td>2 vCPU</td>
<td>2 GB</td>
<td>60 GB</td>
<td>192.168.1.10</td>
</tr>
<tr>
<td>SharePoint</td>
<td>SharePoint 2010 Server</td>
<td>2 vCPU</td>
<td>4 GB</td>
<td>60 GB</td>
<td>192.168.1.11</td>
</tr>
</tbody>
</table>

When you are going to deploy the infrastructure and work through the different exercises, you can use your own IP addresses and better hardware. If you work with different IP ranges, you need to take into account that for some of the exercises, you will also need to change the ranges.
Installing the Private Cloud – fresh install

Requirements

If you are installing the Private Cloud with Server 2012 and System Center 2012 SP1 with a blank environment you will require the following prerequisites:

<table>
<thead>
<tr>
<th>Item</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td>3 Hosts meeting the minimum specification as detailed in the Architecture section</td>
</tr>
</tbody>
</table>
| **Operating Systems** | Windows Server 2012  
Windows Server 2008 R2 SP1  
| **Software**       | System Center 2012 SP1  
SQL 2012 SP1  
SQL 2008 R2 SP2  

Each product within the System Center suite and SQL also have their own prerequisites. Please refer to the documentation for each product for guidance on installation.

Reference Links

- Windows Server
  - Download Windows Server 2012
  - Installing Windows Server 2012
  - How to Install Active Directory Domain Services
- SQL Server
  - Download Microsoft SQL Server 2012 SP1
  - How to install SQL Server 2008 R2
  - Quick Start Installation of SQL Server 2012 SP1
- System Center
  - Download System Center 2012 SP1
  - Install System Center 2012 SP1
  - How to Install Virtual Machine Manager Management Server
  - Single-Server Deployment of Operations Manager
  - Installing Service Manager on Two Computers
  - Self-Service Portal Deployment for System Center 2012 Service Manager
  - How to Install Orchestrator on a Single Computer
  - Installing App Controller
  - Installing Data Protection Manager
Installation process

Once you have the prerequisites downloaded the installation process can commence. Follow each of the steps as detailed in the sequence below.

Install Windows Server 2012 hosts

Install Windows Server 2012 on the two physical hosts.

Once the hosts are built complete the following actions on each host:

- Assign the IPv4 addresses as per the table in the Private Cloud Architecture section in this document
- Rename the hosts to match the naming convention in the Private Cloud Architecture section in this document
- Add the Hyper-V Role (see appendices for detailed instructions)

Once these steps are complete, configure the Virtual Network on each host. It is important that each host has identical Virtual Network settings. To configure the Virtual Network, follow the instructions below on each host:

1. Open the Hyper-V Manager console
2. Click on Connect to Server in the right hand pane
3. Type localhost and click OK
4. Right click on the Host name and select Virtual Switch Manager
5. Select New Virtual Network Switch, click on External and click Create Virtual Switch
6. Set the Name to “External Virtual Network”
7. Ensure the physical network adapter is selected and the tick box allow management operating system to share this network adapter is ticked.
8. Click OK.

Once the Hosts are configured, complete these steps:

1. Create a virtual machine for each of the servers as detailed in the Private Cloud Architecture section, ensuring the settings match the table. (See Appendices for instructions on creating a virtual machine). Ensure when you create these virtual machines that you distribute the machines across the 3 physical hosts HyperV02, HyperV03 and HyperV04.
2. Install Windows Server 2012 on every virtual machine, except the SharePoint server
3. Install Windows Server 2008 R2 on the SharePoint server
4. Configure each virtual machine as per the table in the Private Cloud Architecture section in this document.
5. Configure the network settings on each virtual machine as per the table in the Private Cloud Architecture section. See the appendices for steps on setting the IPv4 address on a Windows 2012 server.
6. Prepare Active Directory on the server “AD”.
7. Add all servers to the new domain. See the appendices for steps on how to add a Windows 2012 server to the domain.

Once these steps are complete, the lab you have constructed will be ready for deploying System Center 2012.

**Group policies**

To make the evaluation easier, we've created a Group Policy on domain level to enable and disable a few settings. By default we disabled all Windows Firewalls on the server machines and enabled remote desktop for easy access. It is not necessary to disable Windows Firewall and you can review the requirements for Windows Firewall on the different TechNet pages for the components.

**Passwords**

All passwords in this evaluation guide are the same. For every account, we are using the password: “pass@word1”

**Installing System Center 2012 SP1**

Now that the lab is ready for System Center 2012, you can start deploying the different products in the suite on each of the virtual machines in the lab. Install each product in the following order:

- Virtual Machine Manager
- Operations Manager
- Service Manager
- Orchestrator
- App Controller
- Data Protection Manager

You'll notice below that all items that should be installed on the virtual machine with that product have been included. If you've already installed that product on the virtual machine, you may skip installing it again.

<table>
<thead>
<tr>
<th><strong>Virtual Machine Installation Guidance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Machine Manager</td>
</tr>
<tr>
<td>Setup and Deploy</td>
</tr>
<tr>
<td>------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Service Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Install SQL 2012 SP1 on the virtual machine designated for Service Manager Data Warehouse using the same instructions. Ensure that as well as the Database engine, that the Reporting Services and Analysis Service are also installed with SQL 2012.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Orchestrator</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>App Controller</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Data Protection Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. DPM has SQL 2008 R2 as part of the product download and this will be installed during the install phase.</td>
</tr>
</tbody>
</table>
Summary

Once you have completed each of the installations as documented above you will have a Private Cloud environment ready to perform the scenarios available in this document. Once you are ready to start these scenarios, please continue to the Scenario Prerequisite section.
Upgrade your existing Private Cloud to SP1

If you have previously deployed System Center 2012, and wish to reuse that environment to re-evaluate the Private Cloud with System Center 2012 SP1, this is entirely possible. To accomplish this you will need to complete several tasks to take the environment to a state where the scenario information in the subsequent sections is possible to complete.

This upgrade process presumes that the environment you are currently running is built using the previous version of the Private Cloud Evaluation Guide that was released with the RTM of System Center 2012. Before starting this process, ensure that all of the latest Windows Updates and Service Packs are applied to the environment. Specifically ensure that all System Center 2012 installations are updated to Update Rollup 2.

Upgrade the hardware

In the previous Evaluation Guide there was a requirement for a single physical host. This is now increased to three physical hosts with the following minimum specification:

<table>
<thead>
<tr>
<th>Name</th>
<th>CPU</th>
<th>Memory</th>
<th>Disk</th>
<th>Network Cards</th>
<th>Main IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>HyperV02</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>1 Physical NIC</td>
<td>192.168.1.2</td>
</tr>
<tr>
<td>HyperV03</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>1 Physical NIC</td>
<td>192.168.1.21</td>
</tr>
<tr>
<td>HyperV04</td>
<td>4</td>
<td>16 GB</td>
<td>1TB</td>
<td>1 Physical NIC</td>
<td>192.168.1.22</td>
</tr>
</tbody>
</table>

To upgrade the hardware, add the two new physical hosts into your Evaluation Lab environment, and build them using Windows Server 2012. Install Windows Server 2012 on the two physical hosts.

Once they have been built, set the IP addresses as per the above table and add them to the domain you have currently in your lab environment. See the Appendices for details on how to edit a Windows Server 2012 server IP settings and add it to a domain.

Once they are built, add the Hyper-V role to each of the Windows Server 2012 hosts and set the Virtual Network settings. It is important that each host has identical Virtual Network settings. To configure the Virtual Network, follow the instructions below on each host:

1. Open the Hyper-V Manager console
2. Click on Connect to Server in the right hand pane
3. Type localhost and click OK
4. Right click on the Host name and select Virtual Switch Manager
5. Select New Virtual Network Switch, click on External and click Create Virtual Switch
6. Set the Name to External Virtual Network

Important Note

Note that each server requires two physical network cards to complete the scenarios detailed in the later sections of this document.
7. Ensure the physical network adapter is selected and the tick box *allow management operating system to share this network adapter* is ticked.

8. Click OK.

Reference Links

- [Description of Update Rollup 2 for System Center 2012](http://technet.microsoft.com/en-us/library/jj628191.aspx)

Upgrade System Center 2012 to SP1

Once the new Windows 2012 Hosts are in place, it’s time to start upgrading the Private Cloud to System Center 2012 SP1. This must be completed in a particular sequence and this sequence is documented in the “Upgrade Sequencing for System Center 2012 Service Pack 1” found [http://technet.microsoft.com/en-us/library/jj628191.aspx](http://technet.microsoft.com/en-us/library/jj628191.aspx). The Installation Guidance below follows this sequence.

<table>
<thead>
<tr>
<th>Installation Guidance</th>
<th>Details</th>
</tr>
</thead>
</table>
Physical hosts

Once the System Center 2012 suite has been upgraded to SP1, migrate each of the virtual machines currently running on HyperV02 to HyperV03 and HyperV04. Once these virtual machines have been removed from HyperV02, rebuild the HyperV02 host to Windows Server 2012.

Summary

Once these upgrades have been completed you should have the following:

- 3 physical hosts with Windows Server 2012
- 7 Virtual Machines with System Center 2012 SP1
Configuring the Private Cloud experiences

This document follows a series of scenarios that a typical business would perform to implement and take advantage of a Server 2012 and System Center 2012 SP1-based private cloud. In these scenarios we will use the personas of Jeff and Debbie.

Jeff is the Data Center admin for Contoso Electronics, a small firm that is growing rapidly beyond its current infrastructure. Increased sales and market share means the current IT infrastructure cannot cope with the requirements for the business, and Jeff needs to take advantage of many of the features of the private cloud to increase the ability of the companies' infrastructure to respond to growing demand.

Debbie is a Business Unit owner and leads a team of developers responsible for delivering new retail applications to the business. She maintains several environments for developing the new applications and requires the infrastructure to be made available at short notice when new projects are provisioned. She also needs to keep an eye on the cost of these environments as each project must be charged on the resources they consume.

During these scenarios, these people will be involved in decision making and taking advantage of the new capabilities of System Center 2012 SP1, and Server 2012.

Prerequisites

The following prerequisites are required to be in place before you can start the evaluation of the Microsoft private cloud solution. All of these steps will take place on HyperV02, HyperV03 or Hyperv04. It is assumed that the Hyper-V role has already been added to these hosts, that they have been added to the Contoso.com, and they have the same IP address as outlined in the hardware recommendations in the previous chapter.

Required software for scenarios

The following software will be required for to complete the following stories. The software can be obtained from the Microsoft website and links are provided.

- Windows Server 2012

Microsoft Windows Server 2012 Evaluation VHD. This is required for the build of Guest01 and should be downloaded and extracted to the folder C:\VirtualMachines on HyperV02.


- SQL Server 2012 SP1
Microsoft SQL Server 2012 with SP1 Evaluation. This is require for the build of **Guest01** and should be downloaded and extracted to the folder `C:\VirtualMachines` on HyperV02.


- SysInternals Tools

Microsoft Sys Internals VHDTool. This is required for the generation of a large VHD on **Guest01**. To make the file easily accessible to **Guest01**, the file should be stored on the SMB 3.0 share `\HyperV02\SMB3Share` on HyperV02

http://archive.msdn.microsoft.com/vhdtool

### Configuring a SMB 3.0 share

Before **Jeff** can implement a highly available private cloud solution he is going to need a commonly accessible storage platform that can host his highly available services. There are numerous ways that this can be achieved but for the purposes of his evaluation Jeff would like to use a new feature in **Microsoft Windows Server 2012**. That feature is **SMB 3.0** and is available as an installable feature.

The following steps should be completed on the server **HyperV02**

Create a SMB 3.0 share

1. Open Server Manager, confirm that the Dashboard is open and select Add Roles and Features
1. In the **Before You Begin** screen, select **Next**

![Before You Begin screenshot](image1)

**Before you begin**

This wizard helps you install roles, role services, or features. You determine which roles, role services, or features to install based on the computing needs of your organization, such as sharing documents, or hosting a website.

To remove roles, role services, or features:
1. Start the Remove Roles and Features Wizard.
2. Before you continue, verify that the following tasks have been completed:
   - The Administration account has a strong password
   - Network settings, such as static IP addresses, are configured
   - The most current security updates from Windows Update are installed

If you must verify that any of the preceding prerequisites have been completed, close the wizard, complete the steps, and then run the wizard again.

To continue, click **Next**.

![Add Roles and Features Wizard](image2)

2. In the **Installation Type** screen, tick **Role-based or feature-based installation**. Then select **Next**

![Add Roles and Features Wizard](image3)

**Select installation type**

Select the installation type. You can install roles and features on a running physical computer or virtual machine, or on an offline virtual hard disk (VHD).

- **Role-based or feature-based installation**
  - Configure a single server by adding roles, role services, and features.

- **Remote Desktop Services installation**
  - Install required role services for Virtual Desktop Infrastructure (VDI) to create a virtual machine-based or session-based desktop deployment.
3. In the Server Selection screen select HyperV02 from the Server Pool, select Next.

4. In the Server Roles screen, expand File and Storage Services, tick File and iSCSI Services, select Next.
5. In the **Features** screen select **Next**

6. In the **Confirmation** screen click on **Install**
7. On the **Results** screen confirm that the installation was successful. Then select **Close**.

8. In Server Manager select File and Storage Services.
9. Click **Shares**

10. Select **Tasks** and then **New Share...**
11. On the Select Profile screen, select SMB Share – Applications

![Select Profile Screen]

12. In the Share Location screen select HyperV02, then select the drive that you would like to host your share on (ensure the drive has 100GB of free space). Then select Next

![Select Server and Path Screen]
13. In the **Share Name** screen, input the share name **SMB3Share**. Then select **Next**

![Specify share name](image1)

14. On the **Other Settings** screen select **Next** without changing any settings

![Configure share settings](image2)
15. On the Permissions screen page select Customize Permissions

Specify permissions to control access

If this share will be used for Hyper-V, you may need to enable constrained delegation to enable remote management of the Hyper-V host.
For more information refer to the constrained validation help topic.

Permissions to access the files on a share are set using a combination of folder permissions, share permissions, and, optionally, a central access policy.

Share permissions: Everyone Full Control

Folder permissions:

<table>
<thead>
<tr>
<th>Type</th>
<th>Principal</th>
<th>Access</th>
<th>Applies To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow</td>
<td>BUILTIN\Users</td>
<td>Special</td>
<td>This folder and subfolders</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Administrators</td>
<td>Read &amp; execute</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>Creator Owner</td>
<td>Full Control</td>
<td>Subfolders and files only</td>
</tr>
<tr>
<td>Allow</td>
<td>NT AUTHORITY\SYSTEM</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Administrators</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Administrators</td>
<td>Full Control</td>
<td>This folder only</td>
</tr>
</tbody>
</table>

Customize permissions...

16. In the Advanced Security Settings for SMB3Share window, select Add

Advanced Security Settings for SMB3Share

Name: R:\Shared\SMB3Share
Owner: Administrators (Hyper-V2\Administrators) Change

Permissions | Share | Auditing | Effective Access |
-------------|-------|----------|-----------------|

For additional information, double-click a permission entry. To modify a permission entry, select the entry and click Edit (if available).

Permission entries:

<table>
<thead>
<tr>
<th>Type</th>
<th>Principal</th>
<th>Access</th>
<th>Inherited from</th>
<th>Applies To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow</td>
<td>BUILTIN\Users</td>
<td>Full control</td>
<td>None</td>
<td>This folder only</td>
</tr>
<tr>
<td>Allow</td>
<td>Administrators (Hyper-V2\Administrators)</td>
<td>Full control</td>
<td>None</td>
<td>This folder, subfolders and files</td>
</tr>
<tr>
<td>Allow</td>
<td>SYSTEM</td>
<td>Full control</td>
<td>None</td>
<td>This folder, subfolders and files</td>
</tr>
<tr>
<td>Allow</td>
<td>Creator Owner</td>
<td>Full control</td>
<td>None</td>
<td>This folder, subfolders and files</td>
</tr>
<tr>
<td>Allow</td>
<td>Users (Hyper-V2\Users)</td>
<td>Read &amp; execute</td>
<td>None</td>
<td>This folder, subfolders and files</td>
</tr>
<tr>
<td>Allow</td>
<td>Users (Hyper-V2\Users)</td>
<td>Special</td>
<td>None</td>
<td>This folder and subfolders</td>
</tr>
</tbody>
</table>

Add  Remove  View

Disable inheritance

Replace all child object permission entries with inheritable permission entries from this object.

OK  Cancel  Apply
17. Click on Select a Principal

![Permission dialog box]

18. Select Object Types

![Select User, Computer, Service Account, or Group dialog box]

19. Tick **Computers** select **OK**

![Object Types dialog box]
20. Fill in the name of your first Hyper-V host (in this example HyperV03), then select **Check Names**.

![Select User, Computer, Service Account, or Group](image)

21. Confirm the servers name has been found correctly then click on **OK**.

![Select User, Computer, Service Account, or Group](image)
22. This will return you to the permissions for **SMB3Share**, tick **Full Control**, select **OK**

![Permission Entry for SMB3Share](image)

23. Repeat above steps 18-22 for **HyperV04**

24. Confirm that **HyperV03** and **HyperV04** are listed in the permissions, select **OK**

![Advanced Security Settings for SMB3Share](image)
25. On the **Permissions** screen click on **Next**

Specify permissions to control access

<table>
<thead>
<tr>
<th>Type</th>
<th>Principal</th>
<th>Access</th>
<th>Applies To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow</td>
<td>BUILTIN\Users</td>
<td>Special</td>
<td>This folder and subfolders</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Users</td>
<td>Read &amp; execute</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>CREATOR\OWNER</td>
<td>Full Control</td>
<td>Subfolders and files only</td>
</tr>
<tr>
<td>Allow</td>
<td>NT AUTHORITY\SYSTEM</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Administrators</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>CONTOSO\HYPERVER01</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>CONTOSO\HYPERVER01</td>
<td>Full Control</td>
<td>This folder, subfolders, and files</td>
</tr>
<tr>
<td>Allow</td>
<td>BUILTIN\Administrators</td>
<td>Full Control</td>
<td>This folder only</td>
</tr>
</tbody>
</table>

Customize permissions...

26. On the **Confirmation** screen click on **Create**

Confirm selections

**SHARE LOCATION**
- Server: HYPERVER02
- Cluster role: Not Custered
- Local path: \NAS\Shared\SMB3Share

**SHARE PROPERTIES**
- Server name: SMB3Share
- Protocol: SMB
- Access-based enumeration: Disabled
- Caching: Disabled
- BranchCaches: Disabled
- Encrypt data: Disabled
27. Confirm that the action has been completed successfully. Select **Close**

![New Share Wizard](image)

The share was successfully created.

<table>
<thead>
<tr>
<th>Task</th>
<th>Progress</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create SMB share</td>
<td></td>
<td>Completed</td>
</tr>
<tr>
<td>Set SMB permissions</td>
<td></td>
<td>Completed</td>
</tr>
</tbody>
</table>

This now completes the creation of an SMB 3.0 share. This will be used as the storage target for the cluster which will be configured in the next step.
Install the Microsoft Failover Cluster

1. Load Server Manager, confirm that the Dashboard is open and then select Add roles and features.

2. On the Before You Begin window click Next.

3. In the Installation Type screen, tick Role-based or feature-based installation. Then select Next.
4. On the **Server Selection** screen select **HyperV03** from the **Server Pool**, then select **Next**

5. On the **Server Roles** screen, click on **Next**
6. In the Features screen tick Failover Clustering

7. The Add features that are required for Failover Clustering window will open, click on Add Features
8. On the **Features** screen select **Next**

9. In the **Confirmation** screen click **Install**
10. Review the **Results** to confirm that the installation was successful. Click on **Close** then reboot **HyperV03**

11. Once **HyperV03** has finished its reboot, log in as **administrator** to finalize the install

12. Repeat steps **1-10** on **HyperV04**
Configuring the Microsoft **Failover Cluster** on HyperV03 and HyperV04

1. From **HyperV03** open **Server Manager** and confirm that the **Dashboard** is open. From the **Tools** menu items, select **Failover Cluster Manager**

```
<table>
<thead>
<tr>
<th>Manage</th>
<th>Tools</th>
<th>View</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Failover Cluster Manager</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iSCSI Initiator</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local Security Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ODBC Data Sources (32-bit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ODBC Data Sources (64-bit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performance Monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resource Monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Security Configuration Wizard</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>System Configuration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>System Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task Scheduler</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows Firewall with Advanced Security</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows Memory Diagnostic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows PowerShell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows PowerShell (x64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows PowerShell ISE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows PowerShell ISE (x64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windows Server Backup</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

2. Once the Failover Cluster Manager loads, Click on Create Cluster and click Next
3. In the **Create Cluster Wizard**, Type **HyperV03; HyperV04** and click **Add**. The server names will verify and then press **Next**

4. On the **Create Cluster Wizard** click **Next** to run cluster validation checks against **HyperV03** and **HyperV04**

---

**Important Note**

You now have the option to validate the cluster. Microsoft Support will depend on the outcome of this validation test. It is recommended to familiarize yourself with the process during this evaluation guide.
5. On the **Before You Begin** screen of the Validate a Configuration Wizard, click Next

6. On the **Testing Options** screen click **Next** to run all tests
7. On the **Confirmation** screen click **Next**

8. On the **Summary** screen make sure both nodes are validated and click **Finish**. (In this example warnings are expected due to hardware limitations of the environment)
9. On the Access Point for Administering the Cluster screen of the Create Cluster Wizard, enter the cluster name EvalCluster, enter the IP address 192.168.1.30 and click Next.

10. On the **Confirmation** screen, review the entries are correct and click **Next**.
11. On the **Summary** screen click **Finish**

![Create Cluster Wizard]

You have successfully completed the Create Cluster Wizard.

**Create Cluster**

- **Cluster:** EvalCluster
- **Node:** HyperV04.contoso.com
- **Node:** HyperV03.contoso.com
- **IP Address:** 192.168.1.30

To view the report created by the wizard, click View Report. To close the wizard, click Finish.

12. The cluster is now created, from the **Failover Cluster Manager** you should see the resources online.

<table>
<thead>
<tr>
<th>Cluster Core Resources</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: EvalCluster</td>
<td>Online</td>
</tr>
<tr>
<td>IP Address: 192.168.1.30</td>
<td>Online</td>
</tr>
</tbody>
</table>

At the end of this exercise we have created a Microsoft Failover Cluster. This technology will allow you to build resilient and fault redundant applications in your private cloud.
Configure Microsoft Hyper-V Replication

As HyperV03 and HyperV04 are already part of a Failover Cluster, the standard Hyper-V replication between two hosts cannot be used. Instead a Hyper-V Replica Broker will need to be used. The Hyper-V Replica Broker is an additional role that needs to be added to the Failover Cluster:

1. From HyperV03 open Server Manager and confirm that the Dashboard is open. From the Tools menu items, select Failover Cluster Manager
2. In the Failover Cluster Console click on EvalCluster, then in the Actions column select Configure Role

3. In the High Availability Wizard, on the Before You Begin window, click on Next
4. Select Hyper-V Replica Broker, then select Next

5. In the Client Access Point screen, type in the name EvalBroker, and for the IP address input 192.168.1.31. Then select Next
6. On the **Confirmation** screen click **Next**.

7. On the **Summary** screen click on **Finish**.
8. From HyperV03 open Server Manager and confirm that the Dashboard is open. From the Tools menu items, select Failover Cluster Manager

9. Expand EvalCluster, then click on Roles
10. Right click on EvalBroker then select Replication Settings

![Replication Settings](image)

11. Tick the Enable this cluster as a Replica server, the Use Kerberos (HTTP), and the Allow replication from any authenticated server boxes. In the Specify the default location to store Replica files box input `\HyperV02\SMB3Share` then select OK

![Hyper-V Replica Broker Configuration](image)
12. Take note of the **Inbound traffic needs to be allowed in the Firewall** information box. As **Windows Firewall** has been disabled on all hosts this information can be disregarded. Select **OK**

The next step is to configure the other end of the replication partnership. This is to be completed on **HyperV02**.

13. Open **Hyper-V Manager** on **HyperV02**, right click on **HyperV02** in the left hand column, and then select **Hyper-V Settings...**
14. On the Hyper-V Settings for HyperV02 window, select Replication Configuration. Tick the boxes Enable this computer as a Replica server, then Use Kerberos (HTTP), and Allow replication from any authenticated server. In the Specify the default location to store Replica files: box input C:\VirtualMachines (create the C:\VirtualMachines folder if it does not already exist). Select OK.

15. Take note of the **Inbound traffic needs to be allowed in the Firewall** information box. As **Windows Firewall** has been disabled on all hosts this information can be disregarded. Select **OK**.

This concludes the configuration of the replication partnership between **EvalCluster** and **HyperV02**. No Hyper-V guests will be replicated until it has been configured accordingly. The configuration of the guests will be covered in **Story 1 Scenario 4**.
Add EvalCluster and HyperV02 to System Center 2012 VMM SP1

1. Login to the VMM server using the Contoso\Jeff account that was previously created and start Virtual Machine Manager

2. In the Virtual Machine Manager console click on Settings in the left hand column
3. Click on **Create Run As Account** in the top ribbon (if not there, expand **Security**, Click on **Run As Accounts**, click on **Create Run As Account**)

![Create Run As Account](image)

4. For this **Create Run As Account** we will be using the previously created Domain Admin contoso\VMM_RunAs. For the **Name** and **Description** type VMM_RunAs_Contoso. The **User name** will be **Contoso\VMM_Runas** with the **password** set to **pass@word1**, click on **OK** and the account is now created.

![Create Run As Account](image)
5. From the VMM server log in using the contoso\Jeff account and start the Virtual Machine Manager console. Click on VMs and Services in the left column.
6. Right click on All Hosts and choose the add Hyper-V Hosts and Clusters option

7. On the **Add Resource Wizard** ensure the Windows Server computers in a trusted Active Directory domain is chosen and click Next
8. On the Credentials screen ensure Use an existing Run As Account is checked and click on Browse

9. On the Select a Run As account options choose the user VMM_RunAs_Contoso and hit OK
10. Choose **Next** to ok the Run As account

![Credentials screen](image1)

Specify the credentials to use for discovery

The Run As account or credentials will be used to discover computers and to install the Hyper-V role and the Virtual Machine Manager agent if necessary.

- Use an existing Run As account
  - Run As account: VMMA_RunsAs_Contoso
  - Browse...

- Manually enter the credentials
  - User name: contoso\domainuser
  - Password:

The above provided credentials or Run As account should be a local administrator on the host machines. If a Run As account is provided, then it will be used while adding the host as well as for providing future access to the host during its lifetime. If credentials are entered manually, then they will only be used while adding the host. Once the host has been successfully added, the VMM service account will be added as local administrator on the host and used to provide any future access to it.

11. In the **Discovery scope** screen add the servers **HyperV02** and **HyperV03** and click **Next**

![Discovery scope](image2)

Specify the search scope for virtual machine host candidates

Search for computers by whole or partial names, FQDNs, and IP addresses. Alternatively, you may generate an Active Directory query to discover the desired computers.

- Specify Windows Server computers by names
- Specify an Active Directory query to search for Windows Server computers

Enter the computer names of the hosts or host candidates that you want VMM to manage. Each computer name must be on a separate line.

- **HyperV02**
- **HyperV03**

[Example: `server1
server1.contoso.com
192.168.1.1
2601:11:01:e:3:188f:9b4:423`]

Setup and deploy- Configuring the Private Cloud experiences 65
12. The *Virtual Machine Manager* will now confirm the computer names entered. Notice in this example that although *HyperV03* was selected as a single host, *Virtual Machine Manager* detects it as a *Cluster* and allows you to select it as a whole entity. Tick the boxes for both *HyperV02* and *EvalCluster* and click *Next*. 

![Add Resource Wizard](image)

**Target resources**

<table>
<thead>
<tr>
<th>Computer Name</th>
<th>Operating System</th>
<th>Hypervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>hyperV02.contoso.com</td>
<td>Windows Server 2012 Standard</td>
<td>Hyper-V</td>
</tr>
<tr>
<td>EvalCluster.contoso.com</td>
<td>Windows Server 2012 Standard</td>
<td>Hyper-V</td>
</tr>
<tr>
<td>HyperV03.contoso.com</td>
<td>Windows Server 2012 Standard</td>
<td>Hyper-V</td>
</tr>
</tbody>
</table>
13. On the **Host Settings** options just click **Next**

14. On Migration Settings tick the Turn on incoming and outgoing live migrations. Tick Use Kerberos and click **Next**
15. Review the **Summary** page and click **Finish**

16. You will now see the jobs running and complete. In this example you will receive warnings around Multipath IO not being enabled; this is to be expected and can be ignored. Close this window
Create a Virtual Guest on HyperV02

Log onto HyperV02 as an administrator, copy the previously downloaded Server 2012 Evaluation VHD from Microsoft website (http://technet.microsoft.com/en-nz/evalcenter/hh670538.aspx) to an easily accessible location. In this example we are using the folder C:\VirtualMachines

1. On HyperV02, open the Hyper-V Manager console from Server Manager

![Hyper-V Manager console](image)

2. On the Actions column (right hand side), click on New, then select Virtual Machine...
3. In the **Before You Begin** screen, select **Next**

![Before You Begin Screen](image1)

4. On the **Specify Name and Location** window, in the **Name**: box input Guest01. Tick **Store Virtual Machine in a different location**, and in the **Location**: box, input C:\VirtualMachines. Select **Next**

![Specify Name and Location Screen](image2)
5. On the **Assign Memory** window leave all settings at default (do not change default of **512MB** or tick the box **Use Dynamic Memory for this Virtual Machine**). Select **Next**

6. On the **Configure Networking** window, select the network **External Virtual Network** from the drop down box. Select **Next**
7. Tick the Use an existing virtual hard disk, then select Browse...

8. Browse to C:\VirtualMachines, select the Microsoft Windows server 2012 Evaluation VHD file, then select Open
9. Select **Finish**

10. Within **Hyper-V Manager** on **HyperV02** right click **Guest01** and then click on **Settings...**
11. Within the Window Settings for Guest01 on HYPERV02, under the Hardware column expand Processor, select Compatibility, and tick the box Migrate to a physical computer with a different processor version. Click on OK.

12. Within Hyper-V Manager on HyperV02 right click Guest01 and then click on Start.
13. Connect to Guest01 by double clicking its name in Hyper-V Manager. Wait for OS to load and the License Agreement to be displayed, tick I accept the license terms for using Windows. Then click on Accept.

14. Select the correct Regional and Language settings, select Next.
15. Input the password **pass@word1** twice, then click on **Finish**

16. Log into the **Guest01**, open **Windows Firewall** and disable the firewall for **Private** and **Public**. Click on **OK**

17. Log off of **Guest01**
Install SQL 2012 SP1

All the experiences in this guide will use SQL Server 2012 SP1 in their scenarios. To install SQL Server 2012 complete the following instructions:

1. Log onto Guest01 as GUEST01\ADMINISTRATOR and the password pass@word1
2. Install SQL 2012 SP1 on the Guest01 virtual machine from the media downloaded previously. For further information on the prerequisites and installing SQL Server 2012 refer to the following articles on MSDN:

<table>
<thead>
<tr>
<th>Reference Links</th>
<th>Links</th>
</tr>
</thead>
</table>

3. Ensure the following roles and features are installed during the SQL Server installation
   a. Database services
   b. Management Tools – Complete

Synopsis

Jeff has now configured his infrastructure to take advantage of many of the new and exciting features of Server 2012 and System Center 2102 SP1. So far he has accomplished the following:

- Set up a new failover cluster which will give him the ability to create Highly Available virtual infrastructure
- Configured a connection broker which will allow him to configure Hyper-V Replicas of his virtual machines
- Configured a SMB 3.0 share for storing virtual machine operating files
- Configured Virtual Machine Manager to manage his virtual infrastructure
- Built a virtual guest to host new applications and services
These roles and features that Jeff has configured will allow him to start taking advantage of many of the new capabilities available when Windows Server 2012 and System Center 2012 SP1 come together. The following scenarios will walk Jeff through step by step guides of how to configure and utilize features such as:

- Shared Nothing Live Migration
- Storage Pooling using Just a Bunch Of Disks (JBOD)
- Business Continuity through High Availability and Hyper-V Replica
- Network Traffic management through Quality of Service in Hyper-V
Experiences

The following experiences are designed to help you experience the key features of System Center 2012 SP1 and Windows Server 2012. They highlight the most important new functionality of System Center and take you through how you might use these features in your own network.

The experiences are designed to be consumed as you wish— you can go through them systematically or start with the one that intrigues you the most and try out others as you wish. They can be done in any order, at any time. You will want to ensure that you’ve installed and configured your network as described in “Setup and Deploy your Private Cloud.” The steps included in “Configuring the Private Cloud Experiences” are important to be able to successfully follow the step-by-step instructions.

The five experiences are:

1. Manage Private Cloud resources
2. Manage Private Cloud capacity
3. Private Cloud automation
4. Manage Apps in the Private Cloud
5. Reporting insights of the Private Cloud

Inside each Experience are scenarios. Each of the scenarios will allow you to evaluate and identify how the System Center Private Cloud can assist in alleviating problems in the current environment, or provide you with the basis for a plan to take advantage of Windows Server 2012 and System Center 2012.
Experience 1: Manage Private Cloud resources

This experience will take you through some of the features that are provided by the Microsoft Private Cloud. These features will be invaluable in creating a robust, low cost and resilient infrastructure, while also delivering on the core tenets of the Private Cloud:

- Scalable and Elastic
- Shared Resources
- Always Up, Always On

Prerequisites

To evaluate this experience you will require the following resources in place in your Eval Guide lab. Refer to the Scenario Prerequisites for additional information on how to configure these items:

- The HyperV role installed on HyperV02, HyperV03, and HyperV04
- An SMB3.0 share on HyperV02
- A Failover Cluster installed and configured on HyperV03 and HyperV04
- The Hyper-V Cluster Broker installed and configured on the Failover Cluster
- Guest01 prebuilt and running on HyperV02

Scenario: Verifying VM storage infrastructure

Jeff has identified that his virtual infrastructure appears to require alteration to take advantage of the new features of the private cloud he is implementing. He investigates the current configuration of his virtual infrastructure to see where he can best implement these features.

In this scenario Jeff will take a look at the resources of Guest01 which is currently hosted on HyperV02. This is typical non-highly available Hyper-V installation running local, non-shared direct attached storage. In this scenario Jeff will confirm the location of the storage for Guest01.

1. From HyperV02 open Server Manager and confirm that the Dashboard is open. From the Tools menu items, select Hyper-V Manager
2. If HyperV02 is not listed under Hyper-V Manager, right click Hyper-V Manager, then select Connect to Server...

3. Tick Local computer, select OK
4. This will return you to the **Hyper-V Manager**. Select the Virtual Machine **Guest01**, and in the right hand column click on **Settings...**
5. Expand **IDE Controller 0** in the **Hardware** column and select **Hard Drive**

6. Take note of the path under **Virtual hard disk**.

As Jeff can see the storage for this particular virtual machine is located on the local C: drive of the server **HyperV02**. In the event of an interruption to service, this virtual machine would not be available, and in the case of a hardware failure, the data may well be lost. Through the following steps Jeff will migrate the storage of **Guest01** to a shared storage platform and host the virtual machine on a Microsoft Failover Cluster to take advantage of the Availability and Resiliency that clustering gives.
Scenario: Migrating VM storage with SMB 3.0

Debbie has discussed with Jeff the importance of a particular server in the Contoso environment that houses much of the code and development work her project team are preparing for release. Debbie needs to ensure that the data is always available to her project teams who work in several locations and in different time zones, so high availability is very important. She also needs to ensure that in the event of hardware fault, the server will continue operating.

Jeff decides to migrate the server Guest01 to the cluster to ensure that the server is always on, even if one physical server fails, and also if he needs to shut down hosts for maintenance. He also decides to take advantage of the SMB 3.0 storage for the virtual machines, reducing the cost of implementing the highly available solution.

In this scenario Jeff will migrate the server Guest01 from HyperV02, to the cluster EvalCluster. The purpose for this is to provide a stable, highly available platform that is resilient to hardware failure and loss of service. Prior to configuring this, some specific changes have to be made to the SMB 3.0 share. These changes will allow live migration to take place to and from the SMB 3.0 Share.

Storage of Virtual Machines on remote SMB 3.0 shares is a new feature in Hyper-V 3.0 and provides the following features:

- Ease of provisioning and management. You can manage file shares instead of storage fabric and logical unit numbers (LUNs).
- Increased flexibility. You can dynamically migrate virtual machines or databases in the data center.
- Ability to take advantage of existing investment in a converged network. You can use your existing converged network with no specialized storage networking hardware.
- Reduced capital expenditures. Capital expenses (acquisition costs) are reduced.
- Reduced operating expenditures. You can reduce operating costs because there is no need for specialized storage expertise.

1. Connect to the Active Directory server AD as an administrator and load Active Directory Users and Computers.
2. Click on View and tick Advanced Features

3. Next, right click the **Contoso.com** domain and select **Find**

4. Change the Find: box from Users, Contacts and Groups to Computers
5. Type in **HyperV02**, then click on **Find Now**

![Find Computers](image)

6. Right click on **HyperV02** then select **Properties**

![Properties](image)
7. Click on the Delegation tab, tick Trust this computer for delegation to specified services only, and tick Use Kerberos only. Click Add...

8. Click Users or Computers...
9. In the object name box, type in **HyperV03; HyperV04**, click **OK**

10. Scroll down and select **Microsoft Virtual System Migration Service** for **HyperV03** and **HyperV04** (hold the ctrl key to select multiple items), click **OK**
11. Click **OK** to close the **HyperV02** properties.

12. Repeat the above steps 5 – 11 for **HyperV03** and **HyperV04**. The following delegation roles will need to be added to each server:

<table>
<thead>
<tr>
<th>Service Type</th>
<th>User or Computer</th>
<th>Port</th>
<th>Service ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft V...</td>
<td>HyperV03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsoft V...</td>
<td>HyperV04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. **HyperV03**
   a. CIFS
   b. Microsoft Virtual System Migration Service
   c. Microsoft Virtual System Migration Service

14. **HyperV04**
   a. CIFS
   b. Microsoft Virtual System Migration Service
   c. Microsoft Virtual System Migration Service
Next Jeff will need confirmation that Guest01 experiences no loss of service during the migration. A simple way to check this is to set up a persistent ping to Guest01 and confirm that no pings are dropped during the transfer.

1. From HyperV02 open Server Manager and confirm that the Dashboard is open. From the Tools menu items, select Hyper-V Manager

![Server Manager](image)

2. Click on Guest01 in the Virtual Machines pane

![Virtual Machines Table](image)
3. In the **Guest01** box at the bottom of the console, click on the **Networking** tab, and take a note of the IP address. This IP address is the network address for **Guest01** and will be used in the next step. In this example the IP address is **192.168.1.109**

4. On **HyperV02**, load the **Command Prompt**, and type in the command `ping <Guest01 IP> -t` then press return. This will now set up a persistent ping to the **Guest01**. In the previous step the IP address was **192.168.1.109**, so in this example the command used would be `ping 192.168.1.109 -t`

5. Leave the **Command Prompt** box open so you can review the results of the ping

![Command Prompt screenshot]

**Experience 1: Manage Private Cloud resources**
The next steps will make the SMB 3.0 share available to the HyperV cluster. This will be used for the shared storage of **Guest01**

1. Load the Virtual Machine Management Console and log in as Jeff. Click on VMs and Services

![VMs and Services](image)

2. Expand **All Hosts**, right click on **EvalCluster**, then select **Properties**

![All Hosts](image)
3. Click on File Share Storage, click on Add

4. On the Add file share window in the File share path, type `\\Hyperv02\SMB3Share` click OK
5. Click on the **Browse** button next to the **Run As account** box, select **VMM_RunAs_Contoso** Click on **OK**

6. Confirm your settings then click on **OK**
This final step will start the migration of **Guest01** from **HyperV02** to **EvalCluster**.

1. Load the Virtual Machine Management Console and log in as Jeff. Expand All Hosts, click on HyperV02

2. In the **VMs** pane right click on **Guest01** then select **Migrate Virtual Machine**
3. Wait for **Virtual Machine Manager** to assess your servers and provide the scores for each of your hosts. Tick the box **Make this VM Highly available**, and **Virtual Machine Manager** will now reassess the servers and score their suitability from a high availability perspective. Select **HyperV03** then click on **Next**.

4. Confirm that the **SMB 3.0** share on **HyperV02** is being used, don’t change any other settings, click **Next**.
5. On the **Select Networks** window, leave the settings as default then click **Next**

6. Review your settings, then finally click **Move**
While migration is taking place, look at the ping results in the command prompt on HyperV02. You should find that there are very little, if any dropped network packets during the migration. Small fluctuations in ping times and a small number of dropped packets are expected during the final handover of the migration.

*With the completion of this step Jeff has successfully migrated the non-highly available Guest01 to the newly created highly available failover cluster. Not only is Guest01 now highly available, but it was migrated with no downtime or loss of service. The virtual machine was also migrated with no shared storage between the two nodes – an excellent example of Shared Nothing Live Migration. Virtual machines can be migrated between different Hyper-V 3.0 hosts that share no commonly accessible storage with no downtime.*

**Scenario: Using remote SMB storage shares on a VHD**

Now that Jeff has performed the migration, he investigates the virtual machine settings in his recently implemented Virtual Machine Manager environment. Jeff will confirm that the storage of Guest01 is now located on the SMB 3.0 share located on HyperV02, and that the VM is running on the cluster EvalCluster.

1. Load the Virtual Machine Management console and enter the username CONTOSO\Jeff and the password pass@word1. Click on Connect

![Virtual Machine Management Console](image1.png)

2. Click on VMs and Services

![VMs and Services](image2.png)
3. Expand All Hosts and click on EvalCluster

4. Right click on Guest01

5. Left click on Guest01 and select Properties then click on Hardware Configuration
6. Click on the Hard Drive 0 under IDE Controller

7. Confirm that the location of the drive is now `\HyperV02\SMB3Share`

8. Click on **OK**

At the end of this scenario Jeff has confirmed that **Guest01** has been migrated from **HyperV02** to **EvalCluster** and is utilizing a remote SMB Share for storage of the virtual hard disk.
Scenario: Using replication for shared nothing failovers

Now that the Guest01 server hosting the critical data is highly available, Jeff decides to implement another feature of Hyper-V in Server 2012 to ensure business continuity in event of a total site failure. Setting up a replica allows for a shared nothing failover to another Hyper-V host using Windows Server 2012. This means a quick and simple way of ensuring continuity with the virtual infrastructure, especially if the hosts are in different geographic locations.

Jeff also notes that one of the features of Hyper-V Replica is the ability to change the IP address of the virtual machine when the failover occurs. This ensures the server can communicate on a different subnet with no intervention from the administrators during failover.

In this scenario we will replicate Guest01 from EvalCluster back to HyperV02.

1. Load the Hyper-V console on HyperV03

![Hyper-V console on HyperV03]

2. Right click Guest01 and select Enable Replication

![Right click Guest01 and select Enable Replication]
3. Click on **Next**

4. Type in the name **HyperV02**

5. Click on **Next**
6. Click on **Next**

7. Click on **Next**

8. Leave these settings default, click on **Next**. (For the purposes of the evaluation guide these settings can be kept at default, although it would be good to familiarize yourself with the delivery options for your initial replication.)
9. Click on Finish

At the end of this scenario we have successfully replicated Guest01 from EvalCluster to HyperV02. Hyper-V replication is not a point-in-time snapshot and the data will be constantly replicated from EvalCluster to HyperV02.

Now that the replica has been configured, Jeff has successfully implemented a robust business continuity solution without having to purchase additional hardware of software. This will ensure the cost of business continuity for Contoso Electronics is kept low.

Synopsis

Jeff has successfully implemented several features that will allow the Contoso Electronics company to continue to work in the event of hardware failure, or if maintenance is required. Previously, work would stop for several hours when Jeff needed to patch his servers or upgrade hardware. Now he can implement improvements and configuration changes to his infrastructure without interrupting the business. This is critical as it allows Jeff to ensure the infrastructure continues to supply the business with always on and efficient supply of computing power to continue to grow and operate.

Links to other areas of interest

Introduction | Setup and deploy your Private Cloud | Experiences | Other Info |
--- | --- | --- | --- |
Manage Private Cloud Resources | Manage Private Cloud Capacity | Private Cloud Automation | Manage Apps in the Private Cloud | Reporting insights of the Private Cloud
Experience 2: Manage Private Cloud capacity

Once Jeff has a Private Cloud in place it’s time to take advantage of the features of Windows Server 2012 and System Center 2012 SP1 to increase your capacity or manage your workloads dynamically without downtime.

In this Experience we’ll step through three scenarios:

- Dynamically expand storage for workloads
- Modifying network resources of VM’s
- Using dynamic memory to improve workloads

Scenario: Dynamically expand storage for workloads

In this scenario we can see how the Jeff can dynamically expand the storage capacity of a server utilizing the Storage Spaces features in Windows Server 2012 without interrupting service.

Debbie has informed Jeff of upcoming projects that will require large amounts of disk capacity for storing SQL databases for a new Sales application that is being developed. Jeff assesses the current capacity and identifies that it will not meet the needs of the business. Jeff also realizes that he does not have enough budget this month to purchase new disk for his storage server.

Jeff identifies that he has a pool of different size disks left over from previous projects and hardware upgrades that is still functional, but because they are all different sizes they cannot be included in a typical RAID volume. Jeff decides to take advantage of the Just a Bunch Of Disks (JBOD) features of Server 2012 and present these disks in a pool to the project team for storage. He will also allow for growth on the volume in case the project overruns.

1. Load the Virtual Machine Manager console, select Use current Microsoft Windows session identity and click Connect
2. Click on VMs and Services and click on All Hosts

3. Click on **Guest01**

4. Right click **Guest01** and click on **Properties**
5. Click on Hardware Configuration

6. We will be adding 3 SCSI disks to Guest01 as it will allow us to hot-add storage without rebooting the guest OS.

7. Scroll down until you can see SCSI Adapter under the Bus Configuration and select SCSI Adapter

8. At the top, click on New: Disk, change the size of the disk to 10 GB and click on OK
9. Wait for the VM to finish updating, then repeat the above steps to add an additional 2 disks. These disks will need to be 12GB and 15GB in size.

10. At the end of this you will have three additional disks assigned to Guest01, these will be 10GB, 12GB, and 15GB in size. When we created the disks, VMM will automatically place the created disks in the same location as the current Guest01 VHDX files. If you look at the SMB3Share on HyperV02 you will notice the newly created VHDX files.

11. Connect to Guest01 and within Server Manager, click on File and Storage Services.

12. Click on Storage Pools

13. In the Physical Disks section click on Tasks and click New Storage Pool
14. In the Before you begin screen click Next

15. In the **Storage Pool Name** screen, type **Pool01** into the **Name** field, click on **Next**

16. In the **Physical Disks** screen tick the **12 GB** and **15 GB** disk. Do **NOT** select the **10 GB** disk. Click **Next**
17. Click **Create**

18. Once completed, tick the box that says **Create a virtual disk when this wizard closes** and then click on **Close**

19. The **New Virtual Disk Wizard** will now open. Click on **Next**
20. Select **Pool01** and click **Next**

21. Name the virtual disk **VirtualDisk01** and click **Next**

22. Select **Simple** and click **Next**
23. Ensure that **Fixed** is selected and click **Next**

24. Tick the box **Maximum size** and click **Next**

25. Click **Create**
26. Ensure that the Create a Volume when this wizard closes box is ticked, click on Close

27. The **New Volume Wizard** will now open. Click **Next**

28. Review the settings and click **Next**
29. Confirm the size of the disk as 21.9GB and click Next

30. Select the drive letter E: and click Next

31. Change the Volume Label to Data and click Next
32. Click on Create

33. This will now create you a new Volume. Click Close

34. Within Server Manager, click on File and Storage Services and click on Volumes

Confirm that your new volume is listed there and the free space is correctly reported. If you did not give your newly created drive the drive letter of E: then take note of the Volume letter here. This information is required for the next step.

35. Copy the VHDtool.exe Application from \HyperV02\SMB3Share to the folder C:\Tools on Guest01
36. Open a **command prompt** by moving to the bottom left hand corner of the screen, opening the **Start screen** and typing **CMD**. Click on the **Command Prompt** icon. Browse to the folder that VHDtool was downloaded to by typing **cd c:\tools**.

![Image of command prompt](image1.png)

37. Type in the following: **VHDTOOL /Create E:\Test.VHD 22987654321** and press enter. If you created your new drive with a different drive letter then change the above command accordingly.

![Image of command prompt output](image2.png)

38. You will now have **21.4GB** VHD file on your volume. Close the **command prompt**.

39. Load Server Manager, click on File and Storage Services then Volumes

![Image of Server Manager](image3.png)

40. Take note of the free space on the **E:** drive and the fact that the **Percent Used** is now in a red **emergency** state

41. Click on Storage Pools

![Image of Storage Pools](image4.png)
42. Right click on **Pool01** under **Storage Spaces**

43. Select Add Physical Disk

44. **Tick the box** next to the **10GB** disk and click on **OK**

45. Right click on **VirtualDisk01** under the **Virtual Disks** panel

46. Left click on Extend Virtual Disk

Experience 2: Manage Private Cloud capacity
47. Input a new value of **28GB** and click on **OK**

48. Click on **Volumes** in the left hand pane

49. Right click the **E:** drive and select **Extend Volume**

50. Input the number listed under **Maximum size** (i.e. **27.9GB**) and click on **OK**

51. Once completed, confirm that the **E:** drive has now additional free space.
At the end of this scenario Jeff has created a single virtual volume that spans multiple physical drives of varying sizes. This allowed him to utilize the disparate disks and combine them into a single pool of storage for the developers to utilize.

He then added additional storage to the pool and extended out logical volume when they over-utilized their assigned capacity.

This highlights the ability of administrators to take advantage of disparate disks they may have in different locations to create large pools of storage. JBOD can become an inexpensive way to ensure that environments can extend their disk resource with little new investment in infrastructure.

**Important Note**

Do not delete the created VHD file as this will be used in the following scenario.
Scenario: Modifying network resources of VM’s

Jeff has noticed that a new server that has been implemented into Production that hosts the new sales application is performing at capacity. In fact it appears to be utilizing much of the network resources of the underlying physical infrastructure to the detriment of other virtual servers hosted on the same server.

Jeff needs to alter the configuration of the virtual machine without interrupting the service to reduce the network throughput to allow other servers equal access to network resources.

In this example, the network load is generated using a large file copy.

1. Connect to Guest01
2. Using File Explorer browser to the virtual volume file created in the previous scenario in the E:\ drive labelled Test

3. Right click on the file and select Copy

4. Browse to \HyperV02\SMB3Share, right click and select paste
The Windows Copy dialogue box will now open and show you the speed at which you are transferring your file. Click on More Details as this will show you a graph that displays the current speed of the transfer.

On a 100MB network this should be around 11.4MB/s on a 1000MB network this should be around 110MB/s. Confirm the current speed that the file is copying at and take a note of it.

5. With this window still open, open the HyperV Manager console on HyperV03

6. Select then Guest01 virtual machine and right click it then select Settings
7. Click on Network Adapter

8. Under Bandwidth Management, tick the box Enable bandwidth management
9. In the **Maximum Bandwidth** box type **10**. This will reduce the network to a **1MB/s** network. Click on **Apply**.

10. Go back to **Guest01** and confirm that the speed of your transfer has been reduced. It should be approximately **1MB/s**.

11. Once you have confirmed this, go back to the **Hyper-V Manager** console and remove the tick from the **Enable Bandwidth Management** tick box and click **OK**.
12. Once **Bandwidth Management** has been disabled, if you monitor the file transfer of **Guest01** you will notice that it will have returned to its original speed.

At the end of this scenario Jeff has successfully throttled the network bandwidth of **Guest01**. This will ensure that one virtual machine in the infrastructure will can be prevented from impacting other virtual machines hosted on the same physical host.

**Important Note**

The minimum setting is another important feature as it can ensure that an important server can continue to receive a minimum amount of bandwidth in times when all servers hosted on the same infrastructure are under load. This can be utilized to ensure that business critical applications continue to operate at critical times of business flux.
Scenario: Using dynamic memory to improve workloads

Jeff has noticed that at times of load the Sales application in production becomes non-responsive. During one of these periods he investigates the SQL Server and finds that it has consumed all of the available memory. Jeff decides to utilize the Dynamic Memory features of Hyper-V and SQL Server 2012 to allow the server to consume more memory resources as it requires.

1. Log onto the Hyper-V server HyperV03, open the Hyper-V Manager and Select Guest01
2. Right click and select Shutdown
3. Once the server has shutdown, right click and select **Settings** and select **Memory** from the hardware section.

4. Set the following memory configuration and press **OK**

<table>
<thead>
<tr>
<th>Dynamic Memory</th>
<th>Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum RAM</td>
<td>512MB</td>
</tr>
<tr>
<td>Maximum RAM</td>
<td>1024MB</td>
</tr>
<tr>
<td>Memory Buffer</td>
<td>20%</td>
</tr>
</tbody>
</table>
Experience 2: Manage Private Cloud capacity
5. Select **Guest01**, right click and select **Start**

6. Select **Guest01**, right click and select **Connect**

7. Logon as **administrator** with the password **pass@word1**
8. Download and extract, the Adventure Works 2012 sample database from codeplex website: http://msftdbprodsamples.codeplex.com/releases/view/93587

9. Copy the downloaded database files to C:\Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA

10. Start SQL Server Management Studio and click Connect
11. Select **Databases**, Right click and select **Attach**

12. Click **Add**
13. Browse to C:\Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA and click OK
14. Click **OK** to attach the *AdventureWorks2012* database
15. Select the *AdventureWorks2012* database by expanding the *Databases* section in *Object Explorer*, right click and choose *New Query*

16. Copy and paste the following commands into the query window:

```
--create the table
create table bigtable (  
id integer not null identity(1,1), --8 bytes
pad char(192) default '' not null, --192 bytes
PRIMARY KEY (id) --? bytes
);

go

--fill with data
create procedure bootstrap_database
as
```
begin
declare @cur integer = 0,
@block integer = 1000,
@table_max integer = 55 * 100000, --approx 1 GB every 5,500,000 rows
@sql nvarchar(max) = 'insert into bigtable (pad) values ' 

while @cur < @block
begin
set @sql = @sql + N'("qqqqqqqqqqwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww您好'),'','
set @cur = @cur + 1
end

--trim trailing ,
set @sql = substring(@sql, 0, len(@sql))
set @cur = 1

declare @handle integer;
exec sp_prepare @handle output, N'', @sql

while IDENT_CURRENT('bigtable') < @table_max
begin
exec sp_execute @handle
set @cur = @cur + @block
end

exec sp_unprepare @handle
end

exec bootstrap_database
17. Click **Execute** – this will take a few minutes to complete
18. Once the script has completed, right click on Guest01 (SQL SERVER ......) from within Object Explorer and select Properties
19. Note the **Memory** allocated to the SQL Server instance

![Server Properties - GUEST01](image)

20. Click **OK**
21. Select the AdventureWorks2012 database again, right click and choose New Query

22. Enter the text in the box below into the new Query window, then Execute Query

```
declare @table_max int = 55 * 100000;  --approx 1 GB every 5,500,000 rows
declare @random_id int = cast(rand() * @table_max as int)

select * from bigtable where id > @random_id and id < @random_id + 50000;
```
23. Monitor the memory usage on Guest01 with Task Manager and opening up the Performance tab.

24. Notice that the memory on the server is now consumed by the SQL Server.

25. Change to the Hyper-V Manager console on HyperV03.
26. Right click on Guest01, click **Settings** and change the memory values as defined below

<table>
<thead>
<tr>
<th>Minimum RAM</th>
<th>512MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum RAM</td>
<td>4096MB</td>
</tr>
</tbody>
</table>

Right click on Guest01, click **Settings** and change the memory values as defined below.

- **Minimum RAM**: 512MB
- **Maximum RAM**: 4096MB

27. Click **OK**

28. Change back to the guest virtual machine **Guest01**
29. Execute the previous SQL Query again still in the SQL Server Management Studio

```sql
DECLARE @table_max INT = 55 * 100000; --approx 1 GB every 5,500,000 rows
DECLARE @random_id INT = CAST(RAND() * (@table_max as INT))
SELECT * FROM bigtable WHERE id > @random_id and id < @random_id + 50000;
```

30. Using Task Manager, check the server's memory by selecting the Performance tab, and selecting Memory

![Task Manager Memory](image.png)
31. Notice that the system memory has increased **dynamically**.

![Task Manager Window](image)

**Task Manager**

**Memory**

- **In use**: 1.7 GB
- **Available**: 1.7 GB
- **Slots used**: N/A
- **Hardware reserved**: 0 MB
- **Maximum memory**: 4.0 GB
- **Committed**: 1.1 GB
- **Cached**: 541 MB
- **Paged pool**: 1.4 GB
- **Non-paged pool**: 2.7 GB
- **Physical memory**: 122 MB
- **Virtual memory**: 33.9 MB

**Experience 2: Manage Private Cloud capacity**
32. Using the SQL Server Management Studio, right click on Guest01 (SQL SERVER ……) and select Properties.

Jeff has successfully implemented Dynamic Memory and as it was seen in the scenario, SQL 2012 automatically consumed the memory hot-added to it without stopping the background processing of transactions. This is a major advantage in the ability to respond quickly to performance problems within Server environments where resources are required to be added without interrupting an application. SQL 2012 combined with Server 2012 and Hyper-V Dynamic Memory allows administrators to rectify issues of resource constraint immediately.

Important Note

Note the Memory allocated to the SQL Server instance has also increased dynamically, allowing the SQL Server instance to consume the additional memory allocated to the operating system, without taking the server offline.
<table>
<thead>
<tr>
<th>Links to other areas of interest</th>
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</thead>
<tbody>
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<td>Introduction</td>
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<tr>
<td>Setup and deploy your Private Cloud</td>
</tr>
<tr>
<td>Experiences</td>
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<tr>
<td>Other Info</td>
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<tr>
<td>Manage Private Cloud Resources</td>
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<tr>
<td>Manage Private Cloud Capacity</td>
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<tr>
<td>Private Cloud Automation</td>
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<tr>
<td>Manage Apps in the Private Cloud</td>
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<tr>
<td>Reporting insights of the Private Cloud</td>
</tr>
</tbody>
</table>

Experience 2: Manage Private Cloud capacity
Experience 3: Private Cloud automation

This experience focuses on how to gain operation efficiencies through automation, control through self-service and delegation and delivers a consistent management experience of the infrastructure. Organizations will have a perspective of both the business unit owner to make requests for cloud resources as well as the datacenter admin perspective of building extreme automation to control the environment effectively with little overhead. The key components that are leveraged in this experience will be Service Manager, Orchestrator, App Controller and Virtual Machine Manager.

Coming Soon! Check back at the end of January 2013 for this new experience

Experience 4: Manage Apps in the Private Cloud

This experience will show how System Center 2012 SP1 improves datacenter service levels with dynamic reporting and monitoring to provide deep application insight. Ultimately, organizations will be able to improve root-cause analysis processes while reducing the mean time to service restoration. You can now leverage Operations Manager and Global Service Monitoring to deliver better application support. The scenarios to follow will visualize how Operations Manager, Visual Studio and Virtual Machine Manager provides seamless integration and simplifies IT oversight of the infrastructure and applications.

Coming Soon! Check back at the end of January 2013 for this new experience

Experience 5: Reporting insights of the Private Cloud

This experience walks organizations through setting up reporting to delivery virtually no downtime with better business continuity and higher SLA. IT is able to provide deep insight into infrastructure performance and utilization via Chargeback which drives lower operational costs. Operations Manager, Virtual Machine Manager and Service Manager will be used in the scenarios in this experience.

Coming Soon! Check back at the end of January 2013 for this new experience
Experiences

**Introduction**

Setup and deploy your Private Cloud

**Experiences**

Manage Private Cloud Resources

**Private Cloud Automation**

Manage Apps in the Private Cloud

**Other Info**

Reporting insights of the Private Cloud

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How to add a role or feature to Windows 2012

1. Open the **Server Manager** console

2. Click on **Local Server**

3. Click on **Manage** and select **Add Roles and Features**
4. Click **Next**

5. Select Role-based or feature based installation and click next
6. On the Server Selection step click Next

7. Select the Role you wish to install and click Next
8. Select any **Features** you wish to install and click **Next**

![Select features](image)

9. Some Roles may require extra configuration at this point. Follow the wizard through, answer all questions and click next until the **Confirm Installation** screen appears and click **Install**

![Confirm installation selections](image)
How to set an IPV4 address

1. Open the **Server Manager** console

![Server Manager console](image1)

2. Click on Local Server

![Local Server properties](image2)
3. Click on the entry next to Ethernet (usually IPv4 Address assigned by DHCP if there is a DHCP server present). The Network Connections window will open.

4. Right click the network icon labelled Ethernet and select Properties.
5. Click on Internet Protocol Version 4 (TCP/IPv4) and click the Properties button.

6. Enter the appropriate network information. Note that this information can be different in your environment. Click on OK.

The static IP address has now been set.
How to join the domain

1. Open the **Server Manager** console

   ![Server Manager Console](image)

   - Open the **Local Server** console,
   - Then click on **WORKGROUP**

   ![Local Server Properties](image)
3. Click on **Change**...

![System Properties dialog box](image)

4. Input the name you would like to use, click the **Domain** radio button, then type the name of your domain e.g. **Contoso.com**. Click on **OK**

![Computer Name/Domain Changes dialog box](image)
5. When prompted input the domain administrator credentials in the **Windows Security** dialog box. Click on **OK**

![Windows Security dialog box](image1)

6. Click **OK**

![Computer Name/Domain Changes](image2)

7. Click **OK**

![Computer Name/Domain Changes](image3)
8. Click **Close**

![System Properties](image1)

9. Click **Restart Now**

![Microsoft Windows Restart](image2)

10. Now the server is a member of the domain and any group policies you have created will be applied.

![Links to other areas of interest](image3)

Other Info

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