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A VIRTUAL MACHINE  
SELF-SERVICE PORTAL  
FOR UNCW CSIS MASTERS' STUDENTS

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## 1 Abstract

Students starting any new curriculum at UNCW face many challenges. Within the CSIS program these challenges can be even more profound. One of the greatest challenges to a CSIS student is having properly configured software to complete assignments. Preparing to start an initial assignment in a CSIS class involves numerous non-value-added activities. A student must first obtain the software and corresponding license or key, and then the software must be properly installed and configured. Many times this can be accomplished on the first attempt, but a large percentage of time multiple attempts are required which may or may not require the assistance of a professor. This project demonstrates a reference implementation of a system that delivers a set of virtual machines, each pre-configured specifically for individual classes within the CSIS curriculum. This implementation not only reduces non-value-added activities, it allows for a much more robust learning environment. Using virtualization technologies, virtual machines can be created that have added functionalities not possible on a student's personal computer or in a traditional computer lab. This project focuses on creating a virtual machine template for advanced SQL courses. In the current environment a student only has access to one database within a single instance of SQL Server limiting the student to SQL Server Management Studio's database engine. The implementation of this project will make it possible for that student to be the system administrator of their own instance of SQL Server, expanding the student's access to integration services and reporting services.

## 2 Motivation

Students beginning the MS CSIS face many potential hurdles upon entering the program. Many of these hurdles do not relate to the curriculum. Students in the MS CSIS program represent a diverse group of students. Currently these students represent fourteen different universities in five different countries [1]. Student ages range from 22 – 51 [2]. The average age is 34 [2]. This indicates that many are returning to school after a number of years. In addition to school many are also juggling careers and family. Currently, five students work part-time while as many as twenty nine work full time jobs [2]. Still others come from a different field of study, such as chemistry, accounting, economics, business administration, and marketing [2]. Finally financial barriers also create significant obstacles.

A student, regardless of background, has enough obstacles to overcome without the added stress and time consuming process of installing software applications that are tools that are part of the curriculum. "The MSCSIS is an intensive graduate program aimed at preparing the student to take on leadership roles in the development and implementation of computer and information systems [3]." The concentration should be on the curriculum not the tools. Many students struggle getting the configuration of these tools correct prior to beginning their work on assigned lessons. The ultimate goal

of this project is to create an environment that facilitates the immediate access and functionality of these tools.

There are a number of applications that are used within the CSIS curriculum. Included on this list are Eclipse, Microsoft Office Project, SQL Server Management Studio, and Visual Studio. As diverse as the students are, the setups for these products are exponentially diverse. This added complexity makes it increasingly time consuming for faculty to assist students when problems arise. The combination of individual students, using individual setups introduces a multitude of scenarios and problems that may need to be investigated and worked separately. Creating one template to be deployed to all students eliminates this problem. With a set of homogeneous systems, a system problem only needs to be researched once and corrected, reducing non-value-added activities for faculty and students.

Immediate access to these tools will significantly ease the transition into the program by allowing students to concentrate on the assigned lesson. This transition is also simplified by the ability to work from any location that has an internet connection. This will allow students to work from anywhere, anytime of day that is compatible with their individual needs. There is also the potential to give faculty remote access to a student's system to help debug, and even grade assigned projects. This can significantly reduce feedback response time. All these factors will increase the amount of time a student has to spend on assignments and less time juggling when and where they can work on an assignment, thus increasing the potential to not only succeed but to excel at the assigned task.

The Self-Service Vending Machine Portal will provide a prototype of the environment described above. This project started as a joint venture between the CSIS program and ITS and has grown to include the Cameron School of Business and the Computer Science Department. Tony Copeland has made available to the project not only his valuable time but the hardware needed to create a virtual infrastructure for a production environment. It is hoped that this project will nurture and grow the relationship between not only the CSIS program and ITS, but that with UNCW's vendors as well. Equipment for the research was donated by CISCO and SUN. In addition to the equipment donated by CISCO and SUN, a ThinkServer TS130 was provided for the proof-of-concept model by the Cameron School of Business and the Computer Science Department. The ultimate goal is to create a system to demonstrate the viability of a self-service portal for specifically designed virtual machines for students in the CSIS program.

## 3 Technology Review

### 3.1 Virtualization

“Virtualization is the configuration of servers or clients which results in the division of resources into multiple, isolated execution environments, by applying one or more concepts or technologies to reduce costs and enhance flexibility associated with the acquisition, implementation, management, expansion, and recovery of critical business systems [4].” Simply put, virtualization is utilizing one physical computing resource to host multiple diverse “environments” or operating systems running different applications within one physical machine. Virtualization is not a new concept as much as it is one that has been repurposed. The basic concept comes from the 1970’s mainframe environment. By the 1980’s and 1990’s architectures started shifting away from the mainframe environment to an environment with database servers in the data center and client endpoint devices running applications with more data than ever before finding its way onto local hard drives [4]. The continued expansion and innovations of new technology have driven organizations to be more creative and economically resourceful bringing about the current state of virtualization. Virtualization is bringing organizations back to a more central way of managing its IT infrastructure. At a high level this structure is very similar to that of a mainframe. You could say technology has “come full circle.”

When properly planned and managed proactively there are many benefits to virtualization. Current technologies allow data center managers and systems administrators to accomplish tasks that only a few years ago were thought to be impossible. VMware advertises that it can host up to 2048 virtual CPU’s per host [7]. This technology allows one physical server to host multiple servers. As a result CPU processing power can be maximized. Without virtualization a separate physical machine would be needed for each application. Each of these servers would only use up to 10% of its processing capability [7]. With virtualization this percentage goes up to 40% or 50%, significantly reducing the number of physical servers needed [7]. This reduction in physical hardware creates the added benefit of being green. Since there are fewer machines, less electricity is used and less hardware has to be disposed of or repurposed when upgrades take place. In addition the system’s monitoring capabilities are able to transition a virtual machine (VM) to another physical server in order to optimize CPU usage across multiple physical servers on the fly, to balance shifting loads, without any downtime. “Server and client virtualization also provide opportunities to continue to run older environments on hardware with which

they are incompatible. This is possible due to the abstraction of operating environments from the underlying hardware components [7].”

Quick provisioning and tear-down of test environments is another extremely valuable benefit of virtualization. In a traditional environment, it could take weeks or even months to procure and set up a new environment for testing. Virtualization makes it possible within minutes. This same set of tools has many advantages for business continuity planning and disaster recovery. If virtual images of critical system servers are made, it does not matter what hardware is used to recover “as long as the recovery server supports your hypervisor and, if necessary, the load of multiple child partitions [7].” Using clustering technology, it is possible to move a VM on a failing physical server to a new server with no interruption in service. In the event of a total host failure, the VM can be restored to a new host using a copy of the image within minutes. In some configurations failover to the “next” physical machine can occur with no downtime.

Finally, when managed properly, security can be enhanced by virtualization. Virtualization creates an additional layer or compartment around the operating system of the VM. This extra layer makes it more difficult to penetrate into the entire system. First an intruder has to gain access to the physical machine. Once successful, he must gain access to the VM. If he gets into one VM, he can not necessarily get into all of the VMs within the physical server. The intruder has no way of knowing there are multiple machines running side by side, or that he is in a VM. Despite this added layer of protection, virtualization adds a complexity to security that if not well documented can actually make the system less secure. Security within a VM is not that different from a traditional environment, but “the ease with which engineers can build VMs can result in explosive growth of unplanned, unmonitored, and insecure servers [7].” Good change management must be practiced, “policies must be kept updated, and staff must be properly trained on what is and is not acceptable behavior [4].”

Like the security example, virtualization creates an additional layer for maintenance as well. Within a virtual environment, the physical machines require operating system and software updates, antivirus scans and updates, defragmentation, monitoring and logging, and backups. All subsequent VMs must receive the same maintenance. “Then add to that the overhead of managing the hypervisor and associated services [5].” Additionally license management can become an extremely complex and confusing obstacle. Another hurdle to overcome when implementing a virtualization strategy is

application support. Because of the newness of the technology many vendors will not support their applications if hosted on a VM. Like data center sprawl a systems administrator must be aware of VM Sprawl. With the ability to quickly provision new VMs, a poorly managed system will grow exponentially. To prevent waste and undocumented VMs, buildup and teardown protocols must be clearly defined and enforced.

The last area of concern is the need to “foster cross-silo collaboration, and instill an end-to-end mentality [5]”. Within large enterprise systems, oversight of systems have become segregated, creating “divided operational teams, such as Unix, Windows, networks, storage [5]”, and database. Increased complexity of the VM, make it imperative that these teams collaborate. The teams must work together to solve the “whole” problem not just their “part” of it. This also requires more cross training and the ability for team members to wear more than “one hat.”

Like all technologies there are many software and hardware solutions to be considered. Three software providers of virtualization are VMware, Microsoft Hyper V, and Citrix. VMware is currently the leader in the virtualization market with an estimated market share of 67%, followed by Microsoft (12%) and Citrix (3%) [8]. Most IT shops seem to be very loyal to the product first deployed [9]. Microsoft came into the market late but is slowly making up market share and increasing its software’s abilities.

Locally there are several organizations using virtualization software. Some of these include UNCW, PPD, Vision Air, New Hanover Regional Medical Center, Cape Fear Hospice, Cloud Wise, Construction Imaging, and CoastalCare. The majority of these companies are currently using VMware. The exception is Construction Imaging [10]. When interviewed these organizations indicated an initial reason for using virtualization, but quickly realized the benefits were more profound than originally anticipated [10]. Currently the predominant reasons these organizations listed for using virtualization was for testing, cost savings, and Business Continuity Planning (BCP) [10].

Because of the strategic benefits virtualization provides organizations, it is one of the top three sought after skills for new employees (networking and security are first and second) [6]. However, it is fourth for key initiatives taken by organizations in 2010[6]. “Here security, backup and recovery, and continuous data protection surpassed it [6]. 90% of midsize enterprises have some level of virtualization [6]. Most interesting is the fact that 57% of companies use virtualization to run incompatible applications on new platforms [8].

## 3.2 Cisco UCS

The Cisco Unified Computing System (UCS) is much more than hardware; it is an architecture. This architecture includes components specifically designed to work in unison to optimize HA (High Availability) clustering and virtualization technologies. These individual components fuse network virtualization, storage virtualization, and server virtualization, into one network platform that allows the management of an extremely elegant virtualization solution. The hardware is designed with an embedded management system, the UCS Manager (UCSM). The UCSM is accessed through a web portal. A screen shot of the portal can be seen in [Appendix A](#). The Cisco UCS is “the first server completely designed around the concept of Unified Fabric.” This represents a large departure from previous architectures that consisted of many heterogeneous components pieced together over time with no truly comprehensive management tool. The components that are managed by the UCSM are listed below and can be seen in [Appendix B](#).

- Blade server chassis
- Blade and rack servers
- Fabric interconnects
- Fabric extenders
- I/O adapters

The UCSM manages the server blades and rack-mounted servers of a UCS as a single logical domain using an intuitive GUI with both CLI and XML API options. Two screen shots of the many user interfaces available through the UCSM are pictured in [Appendix C](#) and [D](#). A single UCS has the potential to grow as large as 320 blades. These servers can be contained in multiple chassis and racks. The UCSM design allows a hybrid collection of multiple chassis and racks to be managed as one virtual chassis. This user interface combined with web portal access gives a system administrator the ability to manage all components remotely. As long as there is power to the chassis a system administrator can even restart a server that has been completely powered down by clicking the reset icon pictured in [Appendix C](#).

The UCSM uses roles and server profiles to manage these virtual chassis. The UCSM is the only component within the system that contains states. “In a UCS, the identity of the various components (MAC, addresses, UUIDs, WWNs, etc.) are not burned in the hardware, but contained in a configuration file.” Once that server profile is defined it is instantiated on a physical server. The physical server

remains anonymous until it is deployed using the UCSM . This process substantially increases the efficiency of server deployment and management reducing what “once required multiple administrators days or hours to complete to mere minutes. Server and fabric extender configurations are stored in service profiles, or templates, and ready to be deployed almost instantly.

In addition to managing service profiles and user roles the UCSM receives communications from the Chassis Management Controller (CMC) located in the Fabric Extender. The CMC facilitates management through the UCSM of eight main functions:

1. The control of chassis fans
2. Monitors and logs fan speed
3. Monitors and logs ingress and egress temperatures
4. Controls location indication and chassis fault indications
5. Powers up/powers down power supplies
6. Monitoring and logging voltages, currents, and temperatures inside the chassis
7. Detects presence, insertion, and removal of UCS blades
8. Reads the IDs of the chassis, UCS blades, and Fabric Extenders

The UCS 5100 Series Blade Server Chassis is the physical enclosure for the blade servers, fabric extenders, fans, and power supplies, all of which are hot swappable. [Appendix C](#) shows a physical representation of the front side of a Blade Server Chassis that contains two blade servers, two power supplies, and eight fans with Server 1 featured. The back side of the chassis can be seen in [Appendix D](#). In Appendix D Fan Eight is the featured component. Also visible in this view is the UCS Fabric Extender. The chassis ships with eight half slots for server blades, but can be reconfigured by removing a metal sheet separator between each pair of half slots.

The individual servers within a UCS can consist of the UCS B200 Two-Socket Server (half slot), the UCS B250 Extended Memory Server (full slot), the UCS B440 four-Socket Server (full slot), and the UCS C-Series Rack server. A UCS 5108 chassis with four UCS B440s has up to 128 cores, 2 TB of RAM, 16 disks, and 80 Gbps of I/O . The I/O adapter is housed within the server that connects to the fabric extender and then to the Fabric Interconnect, tying everything together to the UCSM.

In summary UCS and its UCSM are designed to manage the deployment, configuration, and management of a large complex system of physical blade and rack servers from one platform as one seamless entity. Its robust design gives it the potential to be an integral part of an elegant and dynamic data center design. This design also gives the UCS and UCSM an integral part to play in a well thought out business continuity and disaster recovery plan. The UCSM however is not a manager of virtual machines or a manager of upstream devices. The UCSM does, maintain and conduct all operations based on an internal configuration database that can be exported to populate CMDBs (Configuration Management Data Bases) and integrate with higher-level software provisioning tools, such as Microsoft System Center Operations Manager (SCOM). This tool allows monitoring of the entire system. Creating, deploying and managing virtual machines within an UCS can be accomplished using Microsoft System Center Virtual Machine Manager (SCVMM), discussed in [Section 2.4](#).

### 3.3 Hyper V

Hyper-V is a role of Windows Server 2008 that can be run in all editions of Windows Server 2008 except the Web Server Edition. Hyper V will only run in the x64Bit version of Windows. When joined to a Microsoft Active Directory environment, the Hyper-V server is managed as any other Windows server system. Administrators do not need to learn a new operating system to manage a Hyper-V guest as it resides in an already familiar interface. Two tools are available to manage Hyper-V guests, the Hyper-V Administration tool built into the Windows Server 2008 platform and SCVMM. SCVMM is an additional piece of software purchased separately and will be discussed in [Section 2.4](#). Using the built in Hyper V Administration tool pictured in [Appendix E](#) an administrator can accomplish the following tasks:

- Create new virtual guest
- Import Virtual Machines
- Start and stop guest sessions
- Take snapshots of sessions for back-up and recovery
- Manage virtual networks
- Connect to virtual and physical networks
- Manage clustering features for both hosts and guests
- Manage non-Windows Clients
- Move guest from one host to another

In addition to these benefits, Microsoft fully supports any of its applications when properly installed in a Hyper-V environment.

Hyper-V's Management Console makes it possible to manage multiple host servers along with all guest sessions in one convenient location. When the Cluster Failover Feature is installed the Hyper V Manager can move virtual guest from one physical server to another with little to no interruption of service. See [Appendix E](#) for a screen shot of the Hyper-V Manager with one Host and multiple Guest running in one environment.

### 3.4 SCVMM

The SCVMM is a software application layered on top of Windows Server Hyper V Role. SCVMM provides a centralized management system for managing physical host servers as well as the guest running on those servers. A SCVMM installation includes the following components:

- VMM Server
- VMM Database
- VMM Windows PowerShell cmdlet interface
- VMM Administrator Console
- VMM Library
- Managed virtualization hosts
- VMM Self-Service Portal

The VMM server acts as a broker of services stored in the VMM database. One VM server can manage up to 400 hosts containing as many as 8,000 virtual machines. A "server agent" is installed on all virtualization hosts and library servers whenever either is added to a configuration. This agent communicates to the VMM Server facilitating the management of multiple physical hosts. The VMM database can be stored locally on the VMM server or on an additional remote database server. It is highly recommended that where ever the database is stored that it is made highly available through failover clustering.

The Administrator Console is the main user interface for managing a virtualized environment using VMM. The Administrator Console provides full access to the managed virtual environment including the creation, deployment, and management of virtual machines and VM libraries. Within the Administrator Console host groups are created to contain the various VMs that align with the organization's needs. These groupings often mimic the geographical or departmental layout of the organization. These groups

are arranged within the console much like a file structure on a share drive in a large enterprise. Users are granted access to the VMs based on the permissions granted to their login profile in Active Directory. The Administrator Console has five main views and one optional view (enabled by integrating VMM with an Operations Manager Server). These views are listed below and can be seen in [Appendix F.](#)

- Hosts views
- Virtual Machine View
- Jobs views
- Library view
- Administration view
- Reporting view (when integrated with the optional Operations Manager)

The VMM Library and the Self Service Portal take Windows Server 2008 Hyper-V to the next level with the VMM Library and the Self Service Portal. The VMM Library and the Self Service Portal are features made available only when using VMM. The VMM Library is the tool that is used to access, store and create the physical resources stored in the VM database listed below. This repository is an integral part of sourcing the Virtual Machine Self Service Portal. A screenshot of the VMM Library can be found in [Appendix G.](#)

- Virtual hard disk files
- PowerShell scripts files
- Sysprep answer files
- ISO images
- Virtual floppy disk files
- Templates
- Hardware profiles
- Guest operation system profiles

The Self-Service Portal is an optional web-based component of SCVMM. Self-Service users use this portal to create, operate, and manage VMs according to the roles and permissions set up by the VMM administrator. Access is granted through the administration of roles and permissions. The VMM administrator sets quotas on resources and defines the host groups and other resources that can be made available to a self-service user. There are three default profiles: Administrator, Delegated

Administrator, and Self-Service User. The Administrator role is automatically created on the account that installs the VMM Server. To add other users this account must be used. The Delegated Administrator is used to narrow the scope of administration to certain resources and host groups within the VMM Server. The Self-Service User role allows the user to login to the SSP (Self-Service Portal) and create, store, and deploy VMs according to the permissions setup by the Administrator or Delegated Administrator.

## 4 Systems Analysis

The following sections describe the necessary components to implement a Self-Service Portal. Two different implementations will be discussed, a proof-of-concept implementation and a production implementation.

### 4.1 Proof-Of-Concept

#### 4.1.1 Configuration

[Appendix I](#) contains a diagram of the logical configuration for a Proof-Of-Concept installation of SCVMM. This model shows all components of SCVMM installed on one virtualized server named VMM. VMM is hosted by an IBM ThinkServer TS130 (ITSCSIS01) with a Windows Server 2008 R2 SP1 operating system with the Hyper-V role installed.

ITSCSIS01 contains one network adapter. In a production environment this would cause significant network latency, but for the Proof-Of-Concept design this configuration is adequate. In a production environment best practice is to have multiple adapters to reduce network latency and improve overall performance. ITSCSIS01 is connected to a Netgear Firewall to create a Private Network. The Netgear Firewall also functions as a Dynamic Host Configuration Protocol (DHCP) Server and DNS Proxy Server. The basic settings for the Netgear Firewall are located in [Appendix L](#). The local area network (LAN) settings are in [Appendix M](#).

Only the Administrator and Self Service roles are valid in the Proof-Of-Concept installation of SCVMM. The Proof-Of-Concept includes two templates, the “WS8R2SQL”, and “win7vs”. The features for these templates are located in [Appendix H](#).

#### 4.1.2 Use Cases

Pictured in [Appendix J](#) is the SCVMM Proof-Of-Concept Use Case Diagram. The SCVMM has two actors, the CSIS Student and the System Administrator. The role of the System Administrator includes the

following task: add ISO's to the SCVMM Library, create VMs to be used as templates, load software and run updates on base VMs, create template from base VMs, and, assign users to roles within SCVMM. The role of the CSIS student is to login to the Self Service Portal and use the templates available to them to create VMs for the purpose of research and completing course work.

## 4.2 Production

### 4.2.1 System Configuration

Research indicates a production environment for CSIS students can be satisfied with an all-in-one install of SCVMM described in [Section 3.1.1](#). When all components are installed on one server, all requirements from each component apply to this computer. See [Appendix O](#) for system requirements for running an all-in-one deployment of SCVMM. According to system specifications and best practices one VMM can manage up to 150 VMs. On average there are approximately forty to fifty students in the CSIS program. If a student is allowed up to no more than two VMs for a total of 100 VMs, theoretically one VMM would be sufficient to satisfy demand created by the CSIS Program. However, due to the nature of the CSIS Program; these specifications may be overly optimistic. The demand placed on a system by a Computer Science Student can be, and probably is quite different than that of the ordinary deployment described in the SCVMM system specifications. This is an area that will need further investigation and research as the CSIS Program continues to grow, to determine the optimal solution for a production environment.

This section describes an all-in-one install of SCVMM deployed within an existing Active Directory Domain environment. The use cases for this deployment would be slightly different than the Proof-Of-Concept Use Case and is illustrated in [Appendix K](#).

Research for this section was completed using 2 CISCO UCS B200-M1 Blade Servers attached to a SUN 7410 Unified Storage System. Logical and Physical diagrams of this setup are located in [Appendix P](#) and [Appendix Q](#). Due to permission and equipment location constraints, the initial setup was completed by Tony Copeland, ITS Director at UNCW. His setup notes are located in [Appendix R](#). Once setup on the base servers was complete and the servers placed in the UNCW Active Directory Domain, Amy Wells was made the administrator on the two CISCO UCS Servers, the storage array, and the CISCO UCS Manager (UCSM).

## 4.2.2 SCVMM Setup and Configuration

Initially SCVMM was installed directly on one of the blade servers. This approach did not work and further research revealed this to be counter to best practices. With the VMM installed on the host machine the VMM was unable to “see” other VMs deployed on the same Server, and therefore was unable to manage the VMs as intended. A VM hosted on one of the blade servers was then created with the Windows 2008 Operating System and the Hyper-V role activated. SCVMM was then installed with all components on this VM. At this point, since I did not have UNCW domain administrator privileges, I needed Mr. Copeland’s assistance to place the two host machines, the new VMM, and csisvportal.uncw.edu in UNCW’s DNS Server. He also provided a security certificate csisvportal.uncw.edu.

At this point all the needed components were in place to complete the production environment. The user roles were assigned within SCVMM and a user was able to login to the portal and select a VM for use. The only remaining tasks were to create the templates for use within the portal. Unfortunately the project was side tracked by outside obligations, which limited work on the project for a significant amount of time. When work resumed, Mr. Copeland had moved on to a new position outside of UNCW and the storage array that was being used was exhibiting strange behavior and ultimately failed.

Despite the setbacks the research had demonstrated that the system would work. Going forward the project was scoped back to the proof-of-concept design described in [Section 3.1](#). Using the knowledge gained from the CISCO environment, steps were taken to create an all-inclusive “inside the box; one box” approach.

## 4.2.3 Self Service Vending Machine Policies Procedures and Expectations

The following sections will describe suggested Policies and Procedures for a production environment. This section will also define what type of system support will and will not be provided to a Portal User.

### 4.2.3.1 Policies and Procedures

Over time template OSs will need to be updated. Each semester new templates should be created from the most recently updated clone/template in the VM Library. All clones should have a name with the word clone appended to the end, i.e. winServDevClone. When the template is created it should have the same name but with the word template appended to the end. For example a cloned machine with the name win7vsClone would be used to create the template, win7vsTemplate. In addition amend the

date of creation to the name of the template or clone; for example win7vsTemplate20140120. As of this writing a new install of Window Server 2008 R2 SP1 has 117 updates that need to be installed that takes approximately three hours to install. Using the previous template as the building block for the next template keeps the administrator from having to start from a new image each time and significantly reduces the time it takes to create a template.

An alternative to manually updating offline machines and templates is to install the Virtual Machine Servicing Tool (VMST) 3.0. This software works in conjunction with SCVMM to simplify and automate updates. This tool works with Windows Task Scheduler to determine when to run assigned jobs. Research will need to be completed to insure that the product performs as expected.

The existing groups from UNCW's AD representing the MS CSIS class groups should be added to the self-service user role in VMM. This will facilitate assigning rights to a particular template according to Class i.e. MIS55501, MIS59201, CSC53201, etc. Templates should be created based on course requirements as specified by the professor. At the end of the semester any Student VMs created will be archived. In addition to class specific templates and user groups a group should be created for Capstone Projects. These VM's will be kept until the completion of the project.

#### **4.2.3.2 Portal User Expectations**

- No backups performed on guest; user is responsible for their own backups.
- Can Only Restore System to original image
- No technical assistance will be provided inside a running guest
- Templates will be created with system updates current as of the time of creation; subsequent updates are the responsibility of the creator.
- Operating System is not activated when the VM is deployed through the SSP. It will be the responsibility of the creator to ensure its activation.
- These policies should be included in a read me file located on the desk top of each VM.

#### **4.2.4 Licensing**

To facilitate self-service portal creation and deployment, need a license that is appropriate for lab installs so that it can be used multiple times.

## 5 Project Description

This project will implement the Proof-Of-Concept design discussed in [Section 3.1](#). While a great deal of research has been completed towards the Production design discussed in [Section 3.2](#), this design is out-of-scope at this time. This project is designed to demonstrate the use and viability of System Center Virtual Machine Manager.

### 5.1 Install Windows Server 2008 R2 SP 1 on stand-alone server (ITSCSIS01)

A ThinkServer TS130 will be used to demonstrate the project. The machine has no operating system installed. The initial configuration only contains 4 GB of RAM. The Windows Server 2008 R2 SP1 Data Center Edition Operating System (OS) will be installed. Once the OS is installed and activated, networking will be configured and the system rebooted multiple times to install updates. At that time the machine will be powered down and 12 GB of RAM added.

### 5.2 Configure Private Network

ITSCSIS01 is connected to the internet using a Netgear FVS318v3 firewall. The firewall is configured to run as a DNS proxy server and DHCP Server. See [Appendix L](#) for Netgear basic settings and [Appendix M](#) for Local Area Network (LAN) settings. [Appendix N](#) contains static IP addresses used.

### 5.3 Install Hyper-V Role

In order to install the Hyper-V Role on ITSCSIS, it is necessary to enable virtualization in the BIOS. This feature is disabled by default. Once virtualization is enabled in the BIOS, the Hyper-V Role is added to ITSCSIS01. Once again, checks for updates are completed and any updates are installed. The Best Practices Analyzer is run at this time. Two warnings are returned: Need more than one network adapter, and Server Core Install Recommended. These should not have any significant adverse effects on the non-production environment. In a production environment steps would need to be taken to add sufficient network adapters to facilitate multiple Private, Internal and External Networks. This configuration will only use the Private Network. The choice for a server core install should be made in a production environment that gives consideration to various security concerns, corporate policy, and administrator preference.

### 5.4 Create Virtual Machine named DNSAD hosted by ITSCSIS01

To facilitate the user roles that will be activated once the Self Service Portal is running a VM needs to be created to run DNS and Active Directory. Once the machine is with Windows Server 2008 R2 the Active

Directory and DNS roles need to be activated. Navigate to Roles within the Server Manager and click on roles and click Active Directory Domain Services to proceed with the installation wizard. During this process if there is no DNS server installed, the wizard will prompt for the creation of the DNS. The local domain csc.local will be created.

Best Practices Analyzer is run on these roles and the following warning received: All domains should have at least two functioning domain controllers for redundancy. In this non-production environment, this is not a concern.

## 5.5 Create Virtual Machine named VMM hosted by ITSCSIS01

The system is now ready to create the virtual machine that will be used to host the System Center Virtual Machine Manager (SCVMM) software. This machine will be hosted by ITSCSIS01. This machine will be named VMM and placed in the csc domain created earlier. VMM will have Windows Server 2008 R2 SP1 for an operating system with the Hyper-V Role installed. Once the operating system is installed and the Hyper-V Role selected updates need to be checked and installed.

## 5.6 Install System Center Virtual Machine Manager on VMM

- Install Baseline Configuration Analyzer
- Install and configure VMM Server
- Install and configure the VMM Administrator Console
- Install and configure VMM
- Install and configure the VMM Self-Service Portal
- Configure Roles and users (integrated with Active Directory)

## 5.7 Create Two Virtual Machine using VMM

Two machines will be created one with a Windows 7 Operating System (OS) and the other a Windows Server 2008 OS. These machines are created by VMM, but are hosted on ITSCSIS01, not VMM. The templates for these machines will be contained in the MSSCVMMLibrary on VMM until they are used. The machines created from the templates will run on ITSCSIS01. This can be seen in [Appendix E](#) and [F](#). Appendix E shows the Hyper V interface and Appendix F shows the SCVMM interface. These two machines will have the features listed below.

- Windows 7 OS (win7vs)
  - Visual Studio

- Microsoft Security Essentials
- Windows Server 2008 R2 SP1 (winServDev)
  - SQL Server 2008
  - Microsoft Security Essentials
  - Northwind and Adventure Works Database and Data warehouse

Once these machines are created they need to be stopped and cloned to prepare them for template creation. After the templates are created the templates need to be added to the Self-Service Users list of available templates. At this point a Self-Service User can login to the portal and create a VM using the templates created.

## 5.8 Deliverables

- Demonstrate the SSP and Administrator Console
- Demonstrate the Self-Service User Role
- Create Portal User Guide
- Create VMM Administrator User Guide

## 6 Predictions

It is hoped that this project will successfully demonstrate the proof-of-concept implementation outlined in [Section 3.1](#) of this paper, and that this demonstration will facilitate moving forward to the production implementation outlined in [Section 3.2](#). This system once fully implemented should significantly reduce the non-value added activities related to system tools that students currently manage to complete assigned course work and research.

## 7 Implementation

This project was completed over a period of more than two years. Many challenges including the loss of a key member of my support team, my personal obligations, and hardware failure ultimately affected the outcome of this project. The following sections outline Plan A, the original plan to create a productions system and Plan B, a proof-of-concept model using a standalone desktop server.

### 7.1 Plan A

Preliminary work for this project started September 2011. During this semester Mr. Copeland set up the infrastructure for the CISCO UCS environment illustrated in Appendices [P](#), [Q](#), and [R](#). I began research on the project and began the initial setup of SCVMM. At this phase of the project all the prerequisites for running SCVMM were in place, including active directory, domain name services (DNS), fail over

clustering to facilitate high availability, storage area network(SAN), and a properly configured network. The physical equipment included two CISCO UCS Servers (ITSCSIS01 and ITSCSIS02), and a 1TB Oracle 7410 Storage Disk.

I began by creating several virtual machines on the two servers and experimented with live migrations by moving VMs from one host server to the other. I created VMs with different operating systems, and other distinct features that I thought would be useful to MSCSIS students. Once I was comfortable navigating the Hyper- V Role on the main servers I installed the SCVMM application on one of the base servers, ITSCSIS01, as described in [Section 3.1.1](#). Once I learned this configuration would not work I created a VM hosted by ITSCSIS01. I named this machine CSIS-VMM1 and configured it with the following components:

- Operating System: Windows Server 2008 R2 SP1 Data Center Edition
- Roles:
  - File Services to facilitate file sharing between the host machine (ITSCSIS01) and the VMM Server (CSIS-VMM1)
  - Web Server to facilitate the Self Service User Web Site
- All-in-one installation of SCVMM
  - VMM Server – I accepted default of local system for the service account. I would learn later that this prevents portal VMS from deploying to the domain. For this a unique user with domain access should be set up in Active Directory and used as the service account when setting up the VMM Server. This could only be done by Mr. Copeland.
  - VMM Administrator Console
  - VMM Library – default installation
  - VMM database – default instance of SQL Server 2005 Express
  - VMM Self-Service Portal
    - Default installation
    - Portal url: csisvmportal.uncw.edu

Once this machine was created I asked Mr. Copeland to join it to the UNCW domain for me. He also added the portal name to DNS. The two host ITSCSIS01 and ITSCSIS02 were added to SCVMM as shown in [Appendix R-2](#). I was now able to manage the host and any VMs created not only through the Hyper V management console on each of the base servers, but in the Administrator Console of the SCVMM application.

I then added roles in the VMM console, created VMs, and created VM templates to be used from the self-service portal. A user was able to login to the portal and create a VM for themselves and remote to the machine within the portal. However since the machine was not deploying to the domain a user could not remote to the machine using Remote Desktop Protocol as intended. Further research was needed to determine how to accomplish this.

Over the course of the next 2 semesters, Spring 2012 and Fall 2012, I was unable to devote a significant amount of time to the project due to outside obligations. During this time Mr. Copeland left UNCW for another job and I started a new job as well. By Fall 2013, when I was able to re-engage, the storage array was performing erratically and ultimately a drive in the array failed.

My new contact at ITS, Ms. Ellen Gurganious, worked with me to export the templates I had created and to make a copy of CSIS-VMM1 before the system was ultimately shut down. Despite these setbacks, I learned a great deal during this time and was able to move forward with a newly requisitioned standalone server. Plan B was created. This plan called for a proof-of-concept model to demonstrate the viability of the Self-Service Portal. High availability and clustering in a production environment would no longer be in scope. The idea would now be to use one desktop server to create an all-inclusive environment that I had total control.

## **7.2 Plan B**

A ThinkServer TS130 was received late August of 2013 and I began the process of configuring this server for the proof-of-concept model outlined in [Section 3.1](#). The following section will describe the steps taken to configure the ThinkServer TS130, the subsequent VMs created, and an explanation of the configurations.

### **7.2.1 Physical and Virtual Machine Hierarchy and Descriptions**

#### **7.2.1.1 DHCP – NetGear Router (Physical Machine)**

A NetGear ProSafe VPN Firewall was used to create a local area network to facilitate the creation of a local private domain. The router was set up with an IP address of 192.168.0.1. The router was also set up to act as the network's Domain Host Configuration Protocol (DHCP) server. On the wide area network (WAN) the router functions as a gateway to the external internet and on the local area network (LAN) it functions as the DHCP. See Appendices [L](#), [M](#), and [N](#) for specific setup information.

### 7.2.1.2 ITSCSIS01 (Physical Machine)

This resides directly on the ThinkServer TS130. All other VMs will be hosted by this desktop server, including the administrative VMs, DNSAD and VMM, and the VMs created through the self-service portal. The roles activated on ITSCSIS01 include File Services Role to facilitate file sharing between VMM Server and ITSCSIS01, and between the Portal VMs and the Hyper V Role to facilitate creation and management of VMs. The file structure for ITSCSIS01 is segregated into two partitions, Local Disk Drive C and Hyper V Data Store Drive F. Local C is for the physical machine ITSCSIS01. The Hyper V Data Store is used as a directory to deploy VMs. The Hyper V Data Store contains an additional partition specifically for VMs created in the self-service portal. Administrative VMs are located on the root of Hyper V Data Store. See [Appendix H](#) for a screen shot of this file structure.

### 7.2.1.3 DNSAD (Virtual Machine)

This machine has the roles of DNS and Active Directory Servers Once these roles were set up the following accounts and users were created. These accounts are used in the SCVMM Administrator's Console to provision VM templates. These accounts are listed in [Appendix O](#).

#### User Accounts

- Student User Accounts
  - Amy Fowler
  - Amy Wells
  - Sheldon Cooper
  - Leonard Hofstadter
  - Howard Wolowitz
- VMMDomain: service account for VMM Server

#### Security Groups:

- VMMAdministrator : Users assigned to this group can administer VMM Server
- VMMSelfServiceUser: Group used to assign templates to in VMM Administrator's Console
- MIS592
  - Group used to assign templates to in VMM Administrator's Console
  - Assigned students listed above to this group

### 7.2.1.4 VMM (Virtual Machine)

Once Active Directory and DNS were set up I attempted to import CSIS-VMM1 from the UCS environment. Unfortunately the file was corrupted and the import failed. I then created a new VM to

be used as the Virtual Machine Manager and named it VMM. This VM has file services role and web server role installed to facilitate file sharing between ITSCSIS01 and VMM, and the VM web portal. All components of SCVMM are installed on this VM. These five components are listed below:

- VM Server
- Library Server
- Administrator Console
- VM database
- Self-Service Portal

Installing these components successfully took two attempts. The first attempt was completed using all the defaults. Accepting the default service account for the VMM server prevented me setting up templates to deploy VMs to the domain. It took about a week to resolve this issue. Once the problem was understood I attempted to re-install only the VMM server component; this failed. I then deleted VMM and proceeded to create VMM once again, this time using the service account, vmmdomain, created specifically to be used as a service account for the VMM Server. Once again I loaded the ISO's to be used in the Library Server and created two base machines. One machine was configured with a Windows 7 operating system the other with the Windows Server 2008 R2 SP1 Data Center Edition operating system. For each machine I spent almost an entire day configuring and installing updates. The Windows 7 operating system required 117 updates which took a large portion of the day simply waiting for the updates to download and install. I then created clones of these base machines and created templates from the clones. The student users were then assigned roles and template permissions in the Administrators console. The steps used to complete this are outlined in [Appendix T](#).

The structure of the Library Server and its contents are outlined below:

ISOs

- Visual Studio 2010 Ultimate
- Visual Studio 2012 Ultimate
- Windows 7 Professional 64 bit SP1
- Windows Server 2008 R2 SP2
- SQL Server 2008 Enterprise Edition

## Templates

- W7BVS
  - Windows 7
  - Virtual Studio
- WS8R2B
  - Windows 2008 R2 SP1 Data Center Edition
  - No roles or software
- WS8R2SQL
  - Windows 2008 R2 SP1 Data Center Edition
  - SQL Server 2008 Enterprise Edition

## Clones

- Windows Sever Base
  - Windows 2008 R2 SP1 Data Center Edition
  - No roles or software
- Windows7Base
  - Windows 7
  - No Software
- W7BVS
  - Windows 7
  - Virtual Studio

In the VMM Administrator I added the VMM Administrator, MIS592, and VMMselfservice user accounts from Active Directory to the Administrator and Self-Service User Profiles as seen in [Appendix O](#). I then edited the user profiles and added templates to these roles.

Getting the self-service portal working properly was another difficult area. It took several tries to get the portal working. Like the other components of SCVMM I had used the default settings when setting up the portal. This made it necessary to manually name the url to be used in the WebServer. Once this was done in Web Services and the url name was manually added to DNS the portal functioned as designed. A user from the MIS592 user group could now login to the portal using either the IP address 192.168.0.7 or csisvmportal.csc.local and create VMs using templates assigned to them.

### 7.3 Areas of Concern

At the time of my proposal presentation I still had a few areas of concern:

- VMs deployed through the portal were not deploying to the domain
- Needed assistance setting up Certificate Authority to prevent certificate errors when using encrypted login to VM Portal
- Only 500 GB Drive on ThinkServer
- Licensing

Shortly after the proposal presentation I met with Dr. Kline to discuss my concerns. Prior to this I had been attempting to use one time run commands and scripting when creating a VM through the portal but was still having trouble automating domain placement. Dr. Kline was able to determine an incorrect setting in my DHCP configuration was causing this issue. DHCP was not pointing to the local DNS server, it was pointing to the outside DNS server. Once corrected this problem was resolved.

It was at this time that setting up a Certificate Authority was deemed to be out of scope for the project. The system is in a closed private network so there were no concerns about certificate warnings as long as the login was encrypted by using SSL through port 443.

Concerns of running out of space were managed by creating only three templates and creating a limited number of portal VMs. Due to the fact that this is only a proof-of-concept model there is no need for additional hard drive space. Moving into a production or development environment will definitely require more disk space.

I was able to manage licensing issues by using trial versions and licenses obtained from the MSDNA web site. However the license for Windows Server 2008 running on the host machine (ITSCSIS01) was invalid due to activating too many times. I was able to work around this by re-arming the license for activation. As of this writing I can re-arm three additional times for a total of ninety days before Windows Server quits working, at which time this project should be complete.

During this time I also installed Windows System Update Services to facilitate the installation and use of VM Servicing Tool 3.0. These tools would allow for automating system updates on all VMs and templates. The VM Servicing Tool also contains functionality to update offline VMs and templates, greatly increasing the efficiency of managing the environment. I was continuing work on this piece when Dr. Kline indicated that this would be out of scope as well.

I now turned my attention to cleaning up the VMM Server and templates and writing the Administrator's and User's guides. While creating these guides I created one final template, WS8R2SQL outlined in Plan B and used this template when creating the Self-Service Users Guide as an example.

## 8 Discussion

When I first started this project, I had a basic understanding of the components contained in this project. However my knowledge base for setting up or administering DNS, AD, DHCP, Windows Server, or SCVMM was very limited. This journey has been one with many twists, turns, and at times major setbacks. All that being said, if things had not happened exactly as they did, I feel strongly I would not have the robust skill set that I now have.

If I had started the job I now have earlier, prior to the beginning of this project, the selected project would more than likely have been in a completely different area. This would have been an area more closely related to Business Intelligence Development that I currently work. I now have the skills to do both.

The start of a new job slowed the process of completing my project considerably. However the things I have learned in my current work environment about file shares and SQL Server have served me well while completing this project. Without this knowledge I would have had a much more difficult time setting up the SQL server template in the self-service portal created and setting up the share files on ITSCSIS01 and VMM. Or as embarrassing as this is, how to add a computer to an existing domain.

If Plan A to create a small production environment had not failed, I would not have learned how to set up a domain or, AD and DNS, or how to administer them. I would not have learned the intricacies of setting up DHCP and networking on that domain. Configuration, configuration, configuration is everything. If the configuration is not correct nothing works.

Most importantly I have learned SCVMM. I have shown that this tool can be used to solve the original problem outlined in this project, reducing non value added activities for professors and students in the MSCSIS program. Students and professors can have ready access to VMs that are provisioned with the tools necessary to complete assignments or research. Students and professors no longer have to spend an inordinate amount of time configuring a computer or software appropriately. An upfront investment of time only needs to be spent on the original template. Once the template is built students and professors will be able to work on homogeneous equipment, eliminating having to trouble shot multiple diverse equipment setups.

## 9 Conclusions

The ultimate goal of this project was to reduce non-value added time of students and professors. This project provides a reference environment for creating a production system that meets this goal. Currently students and professors alike spend a significant amount of time setting up and

troubleshooting system configurations before actually working on the first assignment. In this environment all students will be working within an identically created image designed specifically for their class. When problems occur the problem will only have to be de-bugged once.

Currently when a student begins a class with a new application there are a number of things a student must do before completing the first assignment that can be extremely time consuming.

1. Obtain application software from lab or DreamSpark
2. Obtain a key for the software
3. Properly install the software
4. Get assistance from professor when software is not installed properly

SQL Server for example has many components and options. In some situations a full install creating a SQL instance on the local machine is needed. However, for a beginning database class what may be needed is SQL Server Management Studio and the ability to connect to the SQL Server setup by the professor. Correcting SQL Server install problems can be a very tedious and frustrating process. The Self Service Portal eliminates this frustration. A student logs into the portal, selects the appropriate template, creates a VM and in approximately twenty minutes can be working on the assignment using remote desktop. The time savings per student can be many hours. A savings of just three hours per student for a class of twenty represents a total savings of sixty hours in one semester. This also saves the professor from assisting with poorly executed installs that at an hour per student represents twenty hours per semester.

In addition to time savings, the portal also facilitates a more robust learning environment. Currently a SQL database student only has access to one pre-configured database in a SQL instance set up by the professor. With a virtual machine created in the portal, a student can have his own SQL server that he is the administrator. The portal also creates an environment for setting up multiple machines that can interact with each other simulating real life scenarios. Opportunities for learning SQL are expanded from querying a data base, but to administration, data base tuning, integration services, and reporting services.

Key points to remember when implementing this project into production include the following:

- A special user needs to be created in Active Directory to be used as the service account when administering VMM.
- This account should be used when installing SCVMM and should be used as the service account when installing the Virtual Machine Manager component of SCVMM rather than the default local system, or VMs created through the portal will not deploy to the domain.
- Insure that the network is configured properly or VMs will not deploy to the domain.

Looking forward I welcome the opportunity to work with current and future students to implement this project into production. During this project Mr. Tyler Loftis has also been working on a project that is

similar in scope to this one. He has built an infrastructure that could be used to implement SCVMM and its Self-Service Portal.

I would suggest creating a new VM in Mr. Loftis's environment for the purpose of installing SCVMM. I would not import the machine that is in my project. My SCVMM has the Library Server on VMM root C drive. The Library Server should be segregated on its own share. The easiest way to accomplish this is to build a new instance of SCVMM with the drives configured accordingly. Once this is done the templates from my project could be imported into this machine.

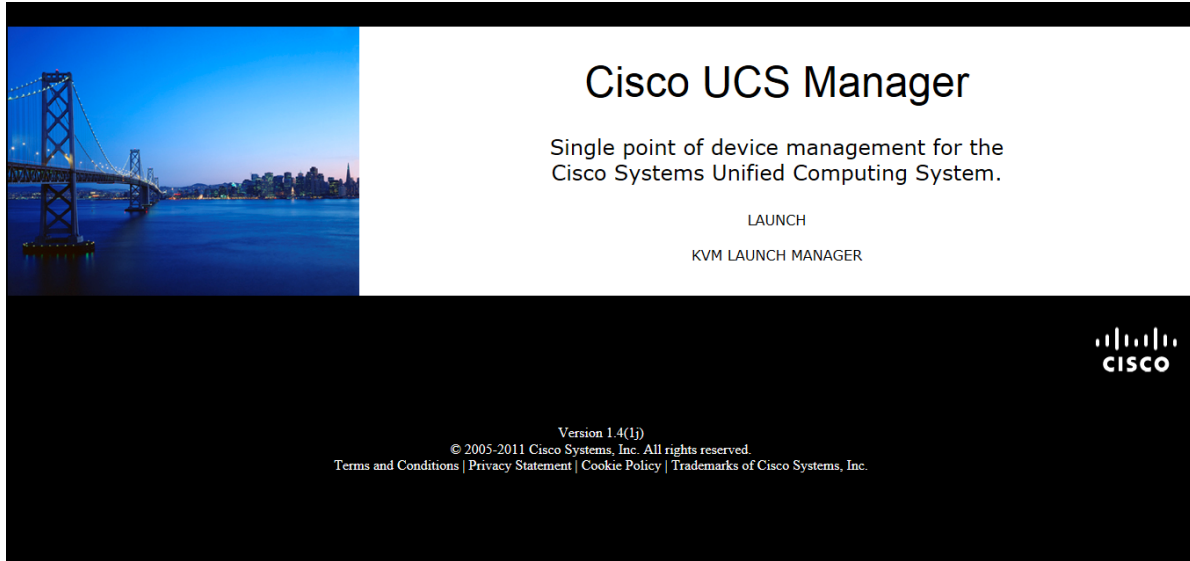
The tricky part of this concept will be setting up a subdomain with the appropriate configurations and permissions that will allow students to access the Self-Service Portal.

## 10 References

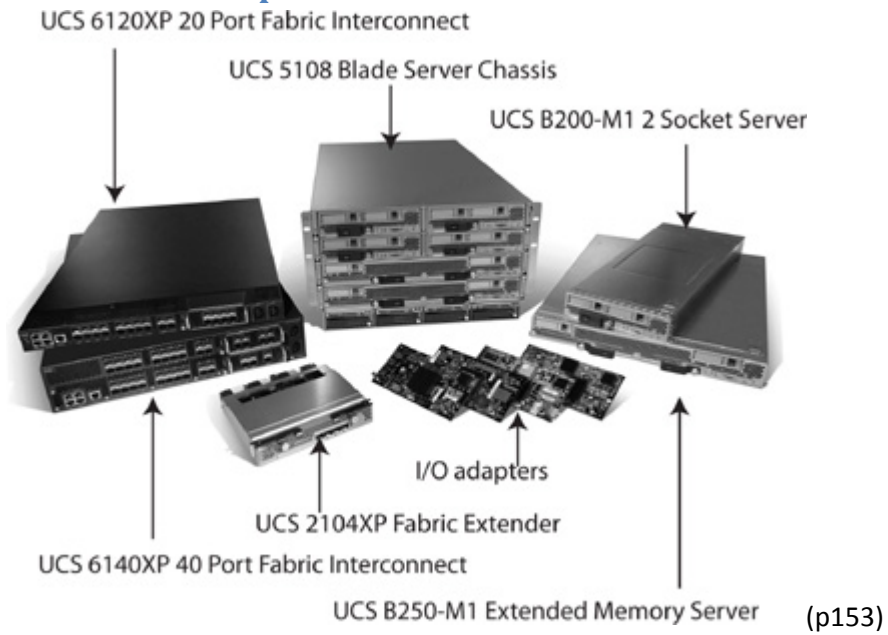
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# 11 Appendices

## Appendix A: Cisco UCS Manager Portal



## Appendix B: Cisco UCS Components



# Appendix C: Cisco UCS Interface (front)

The screenshot displays the Cisco Unified Computing System Manager (UNCWUCS) interface. On the left, a navigation tree shows the hierarchy: Equipment > Chassis > Chassis 1 > Servers > Server 1. The main area is divided into several sections:

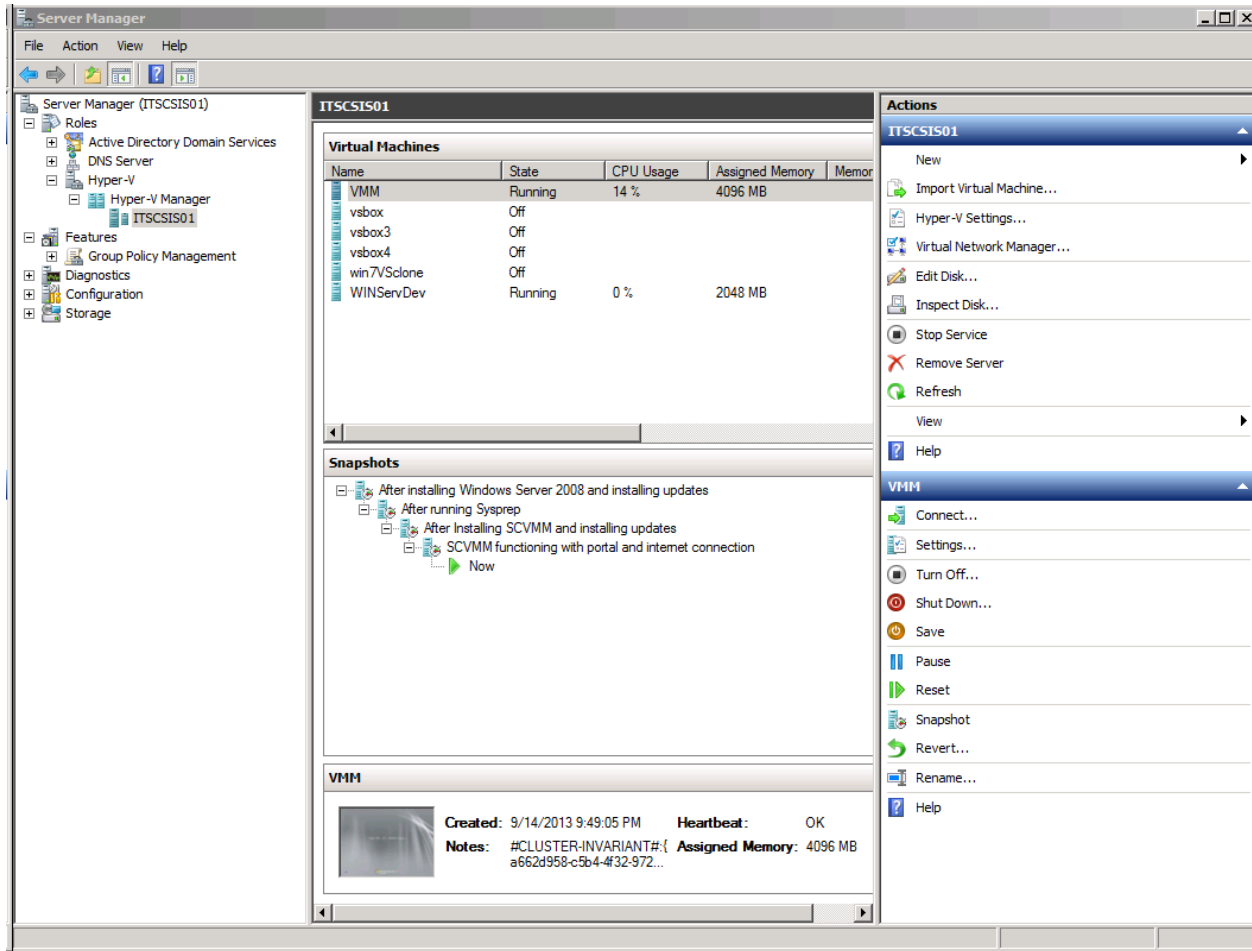
- Fault Summary:** Shows overall status as 'degraded' with 3 warnings and 2 errors. A configuration error 'memory-inoperable' is listed.
- Physical Display:** A visual representation of the server chassis. Red boxes highlight the top server blade (labeled 'Featured Server') and two power supply units (labeled '2 Power Supplies').
- Properties:** Lists server details such as Slot ID (1), Product Name (Cisco UCS B200 M1), and various hardware specifications.
- Actions:** A list of management tasks. The 'Reset' button is circled in red and labeled 'Reset Button'.

At the bottom, the interface shows the user is logged in as 'localadmin@152.20.240.70' and the system time is '2013-08-29T11:27'.

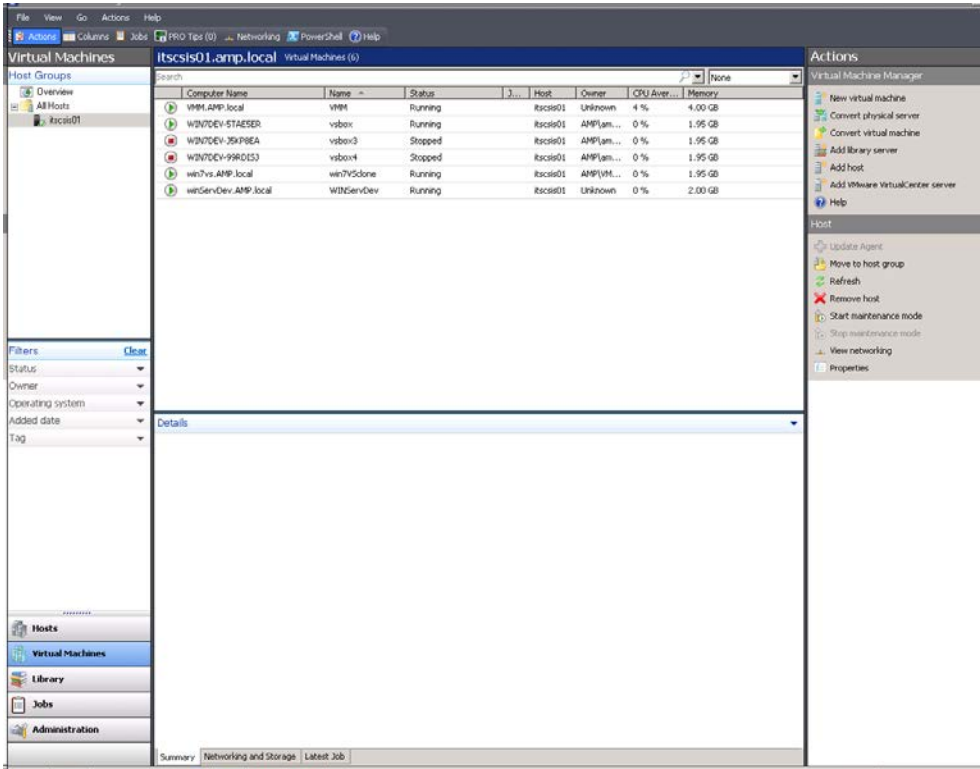
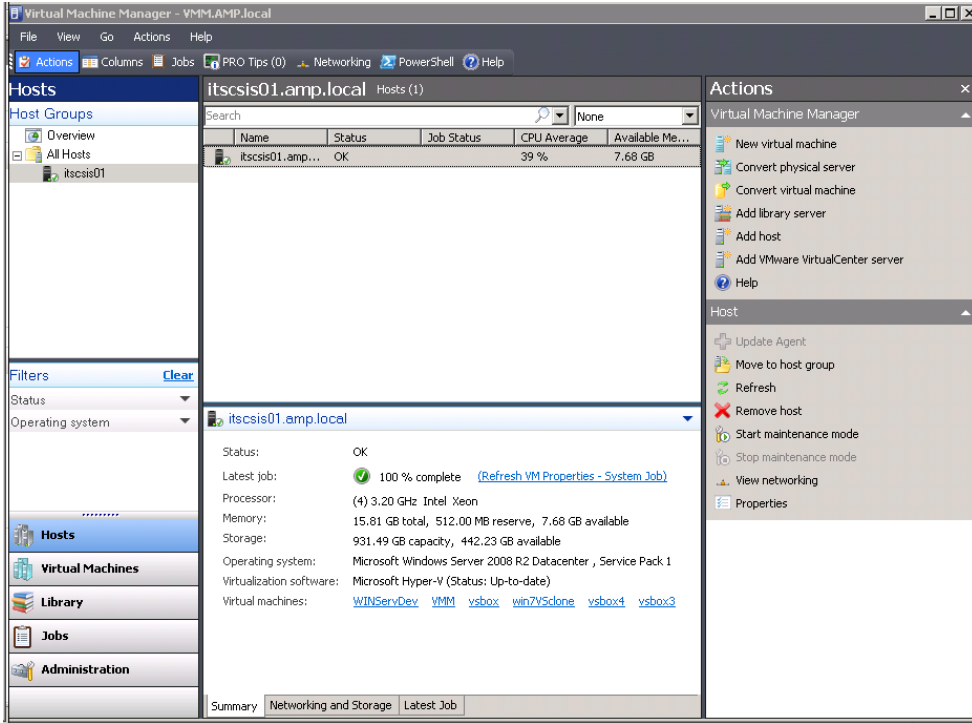
# Appendix D: Cisco UCS Interface (Back)

The screenshot displays the Cisco Unified Computing System Manager (UCSM) interface. On the left is a navigation tree showing the hierarchy: Equipment > Chassis 1 > Fans > Fan Module 8. The main panel shows the configuration for Fan Module 8. At the top left, a 'Fault Summary' section shows 2 critical faults (red X), 9 warnings (yellow triangle), 7 errors (yellow triangle), and 13 informational messages (green triangle). Below this, the 'Status' section indicates the overall status is 'operable'. The 'Physical Display' section shows a 3D view of the server chassis with Fan Module 8 highlighted by a red box and labeled 'Fan Module 8'. A red arrow points from the 'Fabric Extender' label to a specific area in the chassis view. The 'Properties' section lists: ID: 8, Tray: 1, Product Name: Fan Module for UCS 5108 Blade Server Chassis, Vendor: Cisco Systems Inc, PID: N20-FANS, Revision: 0, and Serial Number (SN): NWG134207G2. The bottom status bar shows 'Logged in as localadmin@152.20.240.70' and 'System Time: 2013-08-29T12:07'.

## Appendix E: Hyper-V Manager



# Appendix F: Virtual Machine Manager



## Appendix G: Library Server

The screenshot displays the Virtual Machine Manager (VMM) interface for VMM.AMP.local. The main window is titled "Virtual Machine Manager - VMM.AMP.local" and features a menu bar (File, View, Go, Actions, Help) and a toolbar (Actions, Columns, Jobs, PRO Tips (0), Networking, PowerShell, Help).

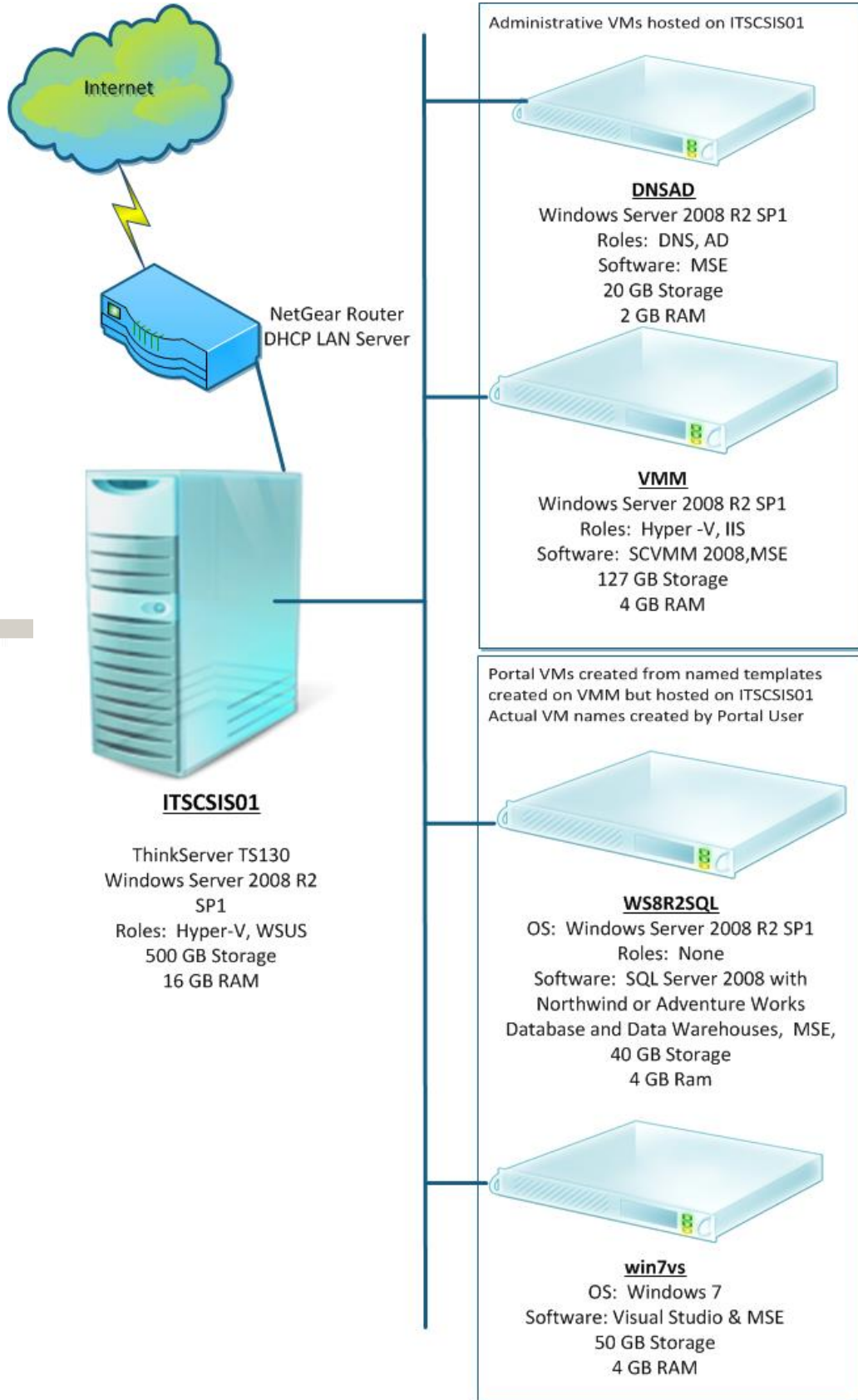
The interface is divided into three main sections:

- Library (Left Pane):** Contains a tree view with "Library Servers" expanded to show "VMM.AMP.local", "MSSCVMMLibrary", and "VMs and Templates". Below the tree is a "Filters" section with "Clear" and dropdowns for "Type", "Owner", and "Added date". At the bottom are buttons for "Hosts", "Virtual Machines", "Library" (selected), "Jobs", and "Administration".
- Library Servers (Center Pane):** Displays a table of "Library Objects (10)". The table has columns for Name, Library, Type, Operati..., Owner, and Status. The data is as follows:

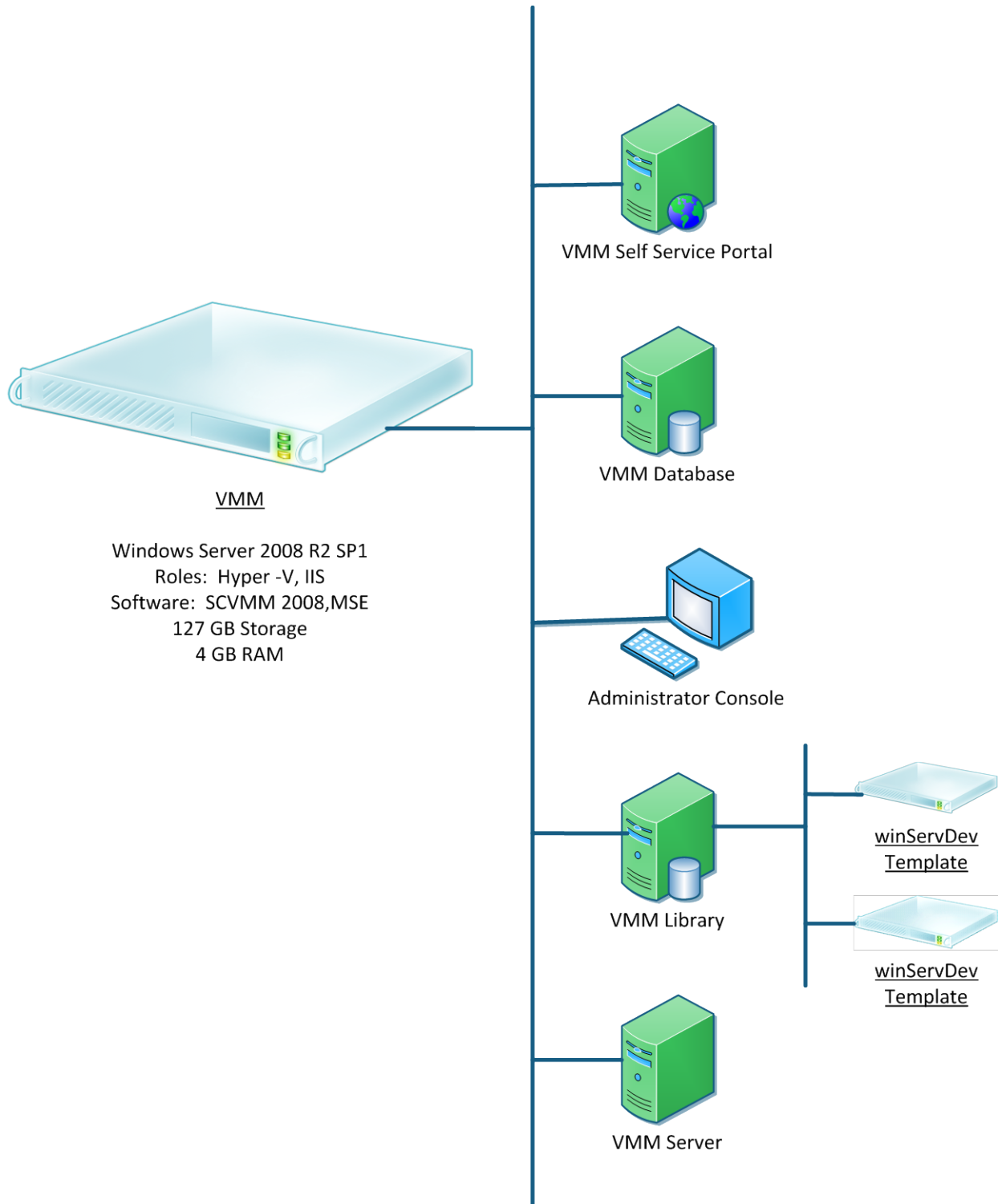
Name	Library ...	Type	Operati...	Owner	Status
win7devClone	VMM.AM...	Virtual M...	64-bit e...	AMP\ad...	Stored
win7devTemplate	VMM.AM...	Template	64-bit e...	AMP\VM...	OK
Blank Disk - Large	VMM.AM...	Virtual H...	None	AMP\ad...	OK
Windows 7 Base Mac...	VMM.AM...	Virtual H...	64-bit e...	AMP\ad...	OK
Blank Disk - Small	VMM.AM...	Virtual H...	None	AMP\ad...	OK
win7dev_Blank Disk - ...	VMM.AM...	Virtual H...	Unknown	AMP\ad...	OK
en_win_srv_2008_r...	VMM.AM...	ISO Image		AMP\ad...	OK
en_windows_7_prof...	VMM.AM...	ISO Image		AMP\ad...	OK
en_sql_server_2008...	VMM.AM...	ISO Image		AMP\ad...	OK
mu_visual_studio_20...	VMM.AM...	ISO Image		AMP\ad...	OK
- Actions (Right Pane):** Contains a list of actions for "Virtual Machine Manager" and "Library Actions". The "Virtual Machine Manager" actions include: "New virtual machine", "Convert physical server", "Convert virtual machine", "Add library server", "Add host", "Add VMware VirtualCenter server", and "Help". The "Library Actions" include: "New template", "New hardware profile", "New guest OS profile", and "Library settings".

At the bottom of the center pane, there is a "Details" section and a "Summary" tab with a "Latest Job" button.

## Appendix H: Logical Configuration for Proof of Concept



## Appendix I: VMM Logical Configuration



# Appendix J: Proof-Of-Concept Use Case Diagram



## Appendix K: Production Use Case Diagram



# Appendix L: Netgear Basic Settings

**NETGEAR ProSafe VPN Firewall FVS318v3 settings**

**Basic Settings**

Does Your Internet Connection Require A Login?  
 No  
 Yes

Account Name (If Required)   
Domain Name (If Required)

**Internet IP Address**  
 Get Dynamically From ISP  
 Use Static IP Address  
IP Address  .  .  .   
IP Subnet Mask  .  .  .   
Gateway IP Address  .  .  .

**Domain Name Server (DNS) Address**  
 Get Automatically From ISP  
 Use These DNS Servers  
Primary DNS  .  .  .   
Secondary DNS  .  .  .

**DHCP Client Renew Mechanism**  
 Release / Renew when 'DNS lookup' failed

**Router's MAC Address**  
 Use Default Address  
 Use This Computer's MAC  
 Use This MAC Address

**Help Text:**  
If you log in to your service or your ISP did not provide you with a fixed IP address, the router will find an IP address for you automatically when you connect. Select **Get dynamically from ISP**.  
If you have a fixed (static, permanent) IP address, your ISP will have provided you with the required information. Select **Use static IP address** and type the IP Address, Subnet Mask and Gateway IP Address into the correct boxes.  
The IP Address is your personal address, and the Gateway IP Address is the address of your ISP's router. If you can't determine your subnet mask, try 255.255.255.0.  
**Domain Name Server (DNS) Address**  
The DNS server is used to look up site addresses based on their names.  
If your ISP gave you one or two DNS addresses, select **Use these DNS servers** and type the primary and secondary addresses.  
Otherwise, select **Get automatically from ISP**.  
**Note:** If you get 'Address not found' errors when you go to a Web site, it is likely that your DNS servers aren't set up properly. You should contact your ISP to get DNS server addresses.  
**Router's MAC Address**  
Each computer or router on your network has a unique 32-bit local Ethernet address. This is also referred to as the computer's MAC (Media Access Control) address.  
Usually, select **Use default address**.  
If your ISP requires MAC authentication, then select either **Use this Computer's MAC address** to have the router use the MAC address of the computer you are now using, or **Use This MAC Address** to manually type in the MAC address that your ISP expects.  
The format for the MAC address is XX:XX:XX:XX:XX:XX. If you select **Use This MAC Address** and type in a MAC address, do not then select **Use this Computer's MAC address** or your entry will be overwritten.  
**Apply, Cancel and Test Buttons**  
Click **Apply** when you finish changing the settings.  
Click **Cancel** to return to the original settings.  
Click **Test** to connect to the NETGEAR Web site. If you connect successfully, your settings work and you may click **Logout** to exit these pages and enjoy surfing the 'net!  
If you don't connect successfully,  

- Go through the settings and make sure you've selected the correct options and typed everything correctly.
- Contact your ISP to verify the configuration information.
- On the Resource CD, read the Troubleshooting chapter in the Reference Manual.
- Contact NETGEAR Technical Support.

## Appendix M: LAN Settings

**NETGEAR ProSafe VPN Firewall FVS318v3**

### settings

**LAN IP Setup**

Enable UPnP

---

**LAN TCP/IP Setup**

IP Address: 192 . 168 . 0 . 1

IP Subnet Mask: 255 . 255 . 255 . 0

RIP Direction: None

RIP Version: Disabled

---

**MTU Size**

Default (1500)  Custom 1500

---

**LAN IP Address Management**

Disable DHCP Server

Use External DHCP Server

Use Router as DHCP Server

---

**DHCP Server Info**

Starting IP Address: 192 . 168 . 0 . 2

Ending IP Address: 192 . 168 . 0 . 51

DNS Server Address

Router is DNS Proxy

Use These DNS Servers

Primary DNS: 192 . 168 . 0 . 3

Secondary DNS: . . . .

WINS Server

Lease Time (hours): 24

---

**Reserved IP Table**

	#	IP Address	Mac Address	Device Name
<input type="radio"/>	1	192.168.0.4	00:1E:DE:F7:D9:65	Amy-PC
<input type="radio"/>	2	192.168.0.2	44:37:E6:C4:83:85	ITSCSIS01
<input type="radio"/>	3	192.168.0.3	00:15:5D:00:05:13	DNSAD
<input type="radio"/>	4	192.168.0.7	00:15:5D:00:05:12	VMM
<input type="radio"/>	5	192.168.0.5	00:15:5D:00:05:1D	Internal Networ

## Appendix N: Static IP Addresses

**Reserved IP Table**

	#	IP Address	Mac Address	Device Name
<input type="radio"/>	1	192.168.0.4	00:1E:DE:F7:D9:65	Amy-PC
<input type="radio"/>	2	192.168.0.2	44:37:E6:C4:83:85	ITSCSIS01
<input type="radio"/>	3	192.168.0.3	00:15:5D:00:05:13	DNSAD
<input type="radio"/>	4	192.168.0.7	00:15:5D:00:05:12	VMM
<input type="radio"/>	5	192.168.0.5	00:15:5D:00:05:1D	Internal Networ

## Appendix O: Systems Analysis Notes

### List of Machines

Machine	RAM	HD	License	OS License Source	OS License Expiration	IP Address
NetGear ProSafe VPN Firewall FVS318v3						192.168.0.1
ITSCSIS01 Windows Server 2008 R2 SP1	16 GB	500 GB		MSDNA	2/27/2014 Install limit reached unable to activate	192.168.0.2
VMM Windows Server 2008 R2 SP1 System Center VMM	4GB	200 GB <i>Originally 127 GB but expanded later in project after running out of space</i>	Trail Version	Microsoft Download Center	7/24/2014	192.168.0.7
DNSAD Windows Server 2008 R2 SP1	2GB	20 GB	Trail Version	Microsoft Download Center	7/24/2014	192.168.0.3
Windows7Base Windows 7 Professional SP1	2GB	40GB		MSDNA	Install limit reached unable to activate	Assigned by NeatGear
WS8B Windows Server 2008 R2 SP1	2 GB	40 GB		Trail Version From Microsoft Download Center	7/24/2014	Assigned by NeatGear
WS8SQL Windows Server 2008 R2 SP1 SQL Server 2008	2GB	40GB		Trail Version From Microsoft Download Center	7/24/2014	Assigned by NeatGear
W7VS Windows 7 Professional SP1 Visual Studio	2GB	40GB		MSDNA	Install limit reached unable to activate	Assigned by NeatGear

## Software Licenses

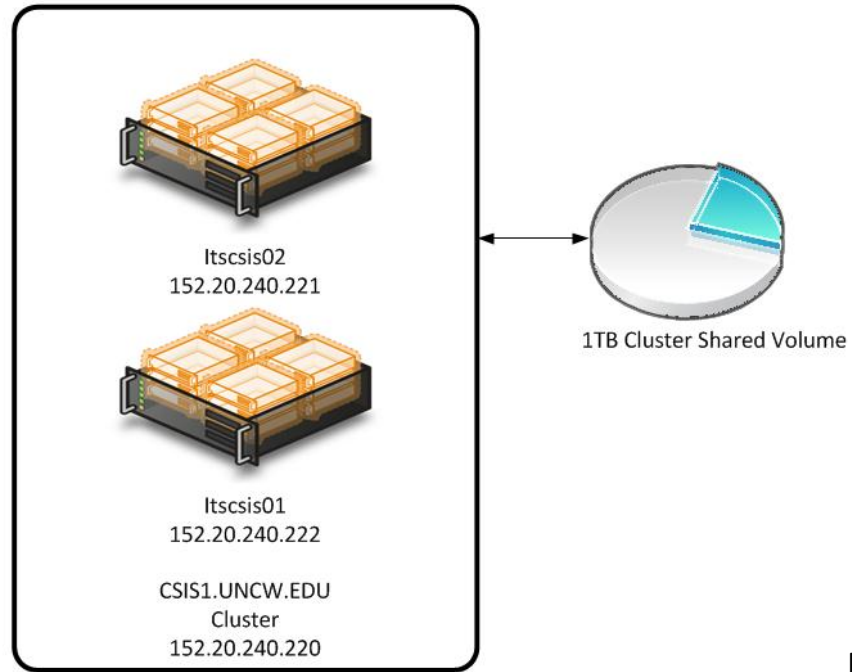
Software	License	Source
Visual Studio 2010 SP1		MSDNNA
System Center VMM 2008 R2 SP1		MSDNNA
SQL Server R2 Enterprise		MSDNNA

## Operating System and Software Hardware Requirements

OS or Software	Processor Speed Minimum/ Recommended	RAM Minimum/ Recommended	Hard Drive Minimum/ Recommended	ISO Size
Windows Server 2008 R2 SP1 Data Center 64 Bit	1GHz/2GHz+	512 MB/2GB+ <i>1TBMax</i>	10GB/40GB+	3GB
Server Roles:				
Active Directory				
DNS				
DHCP				
Hyper V				
Windows 7 Professional SP1	1GHz	2GB	20GB	3.2GB
MS System Center Virtual Machine Manager <i>all in one configuration for &lt; 50host License expires 2/12/2014</i>	2.8GHz/2.8GHz+	2GB/4GB+	14GB/50GB+	3.5GB
SCVMM Components < 50 host				
VMM Manager	2GHz/2GHz+	2GB/4GB+	14GB/50GB+	
VMM Database Server	2GHz/2GHz+	2GB/4GB+	80GB/150GB+	
VMM Library Server	2.8GHz/3.2GHz	2GB/2GB+	2GB/depends on size of library resources stored	
VMM Administrator Console	550MHz/1GHz+	512MB/1GB+	512MB/1GB+	
VMM Self Service Portal	2.8GHz/2.8GHz+	2GB/2GB+	512MB/20	
MS Visual Studio 2010 Ultimate <i>YCFHQ-9DWCY-DKV88-T2TMH-G7BHP</i>	1.6GHz+	1024 MB	34GB+	2.3GB
MS SQL Server 2008 R2 Enterprise <i>License Expires 01/30/2016</i>	1 GHz/2.0GHz+	1GB/4GB 2TB Max or OS Max whichever is lower	Depend on System Configuration and features installed	3GB

## Appendix P: Hyper-V Virtualization Diagram

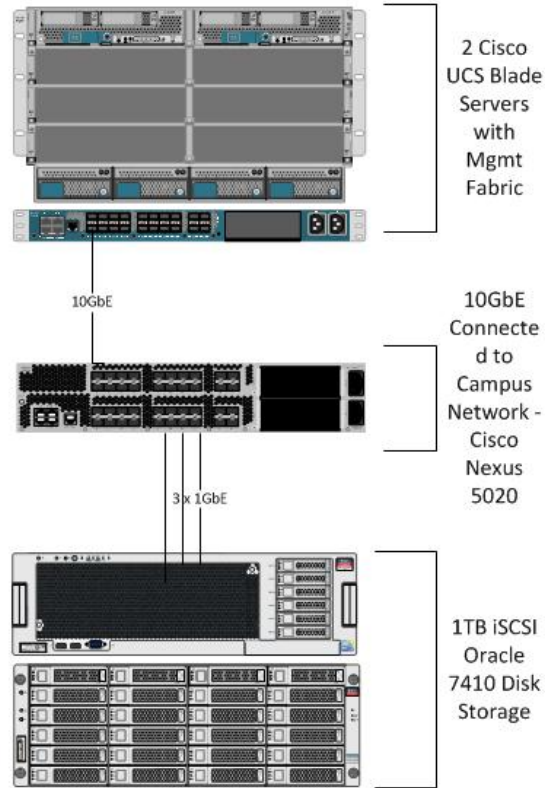
### Hyper-V Virtualization Diagram



[14]

## Appendix Q: UCS Physical Equipment Diagram

# Physical Equipment Diagram



[14]

## Appendix R: CISCO UCS System Setup Notes Provided by Tony Copeland

### Base Operating System install – repeat for every server

- Install Windows Server 2008 R2 Data Center Edition to allow unlimited number of Virtual Machines
- Load Cisco network drivers (iso version 1.4) from Cisco.com
- Run windows updates (lots of downloads, reboots, check for updates - repeat 5 or 6 times)
- Setup two network interfaces on the blade; network (152.20.240.x) and storage (152.20.5.x)
- Storage Configuration – Multipath iSCSI lun

### Setup Sun/Oracle storage

- Configuration -> SAN -> iscsi initiators
- Add iqn.1991-05.com.microsoft:itscsis01.uncw.edu and iqn.1991-05.com.microsoft:itscsis02.uncw.edu iqn's for both servers
- Create an initiator group call itscsis by dragging the iqns to the right of the management application
- Next rename the group to itscsis
- Configuration -> SAN -> iscsi Target
- Create a new target that includes the 3 152.20.5.x network adapters.
- Drag the target into the group to the right in the management application.
- Make a note of the group target iscsi iqn (iqn.1986-03.com.sun:02:54748cb2...) as it will be needed to connect the luns to the servers.
- Shares -> Projects
- Hit + to add project "itscsis\_project"
- Click Luns -> +
- Add the desired lun capacity to create the disk drives, be certain to make sure you select the iscsi target and initiator groups. The thin provisioning checkbox should be selected.

### Setup iSCSI initiator on the servers – repeat for every server

- [http://technet.microsoft.com/en-us/library/ee338477\(W.S.10\).aspx](http://technet.microsoft.com/en-us/library/ee338477(W.S.10).aspx)
- Note the quick connect iscsi dialog in the servers does not enable multipathing. You may need to disconnect, close/remove all sessions, and reconnect to the target group iqn AND check the multipathing check box. When this happens, remove the extra device line put in the favorites tab.
- Click the auto discovery of luns and the storage should appear.
- I added all the public ip addresses as portals in the iscsi configuration, but I do not believe this is required.

### Hyper-V Setup – repeat for every server

- Install Hyper-V Role
  - Select "network" labeled nic for Hyper V traffic
- Install Failover cluster feature

- Bring new shared cluster disks online in server disk management - right-click init, online, create volume - then online on other node for cluster quorum
- Run the cluster validation wizard
- Create cluster adding 152.20.240.223
- Now bring hyper-v data drive online in server disk management - init, online, create volume - then online on other node
- Enable the Shared Cluster Volumes in the cluster configuration, to allow both servers to see shared storage.

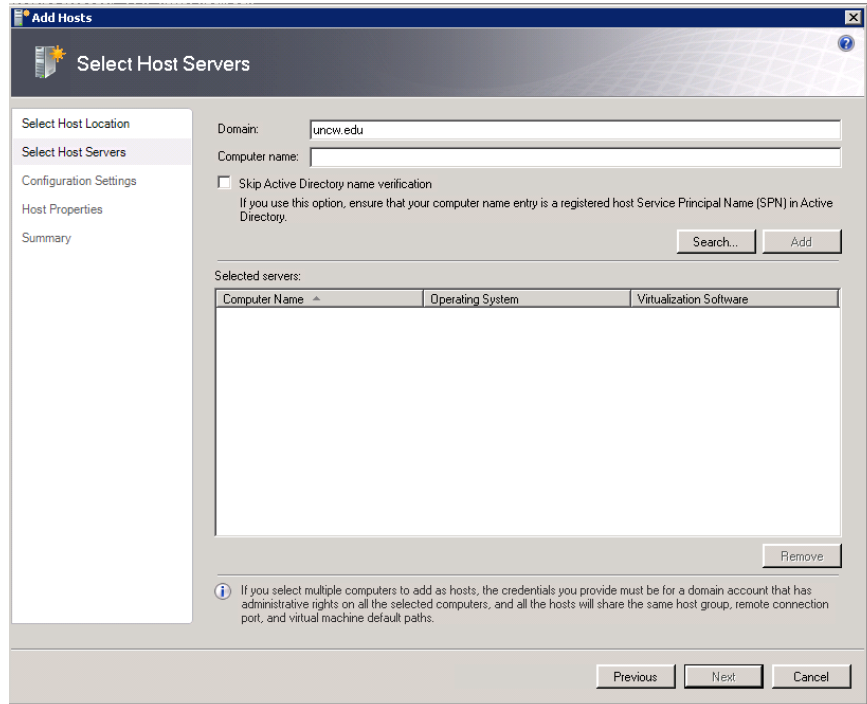
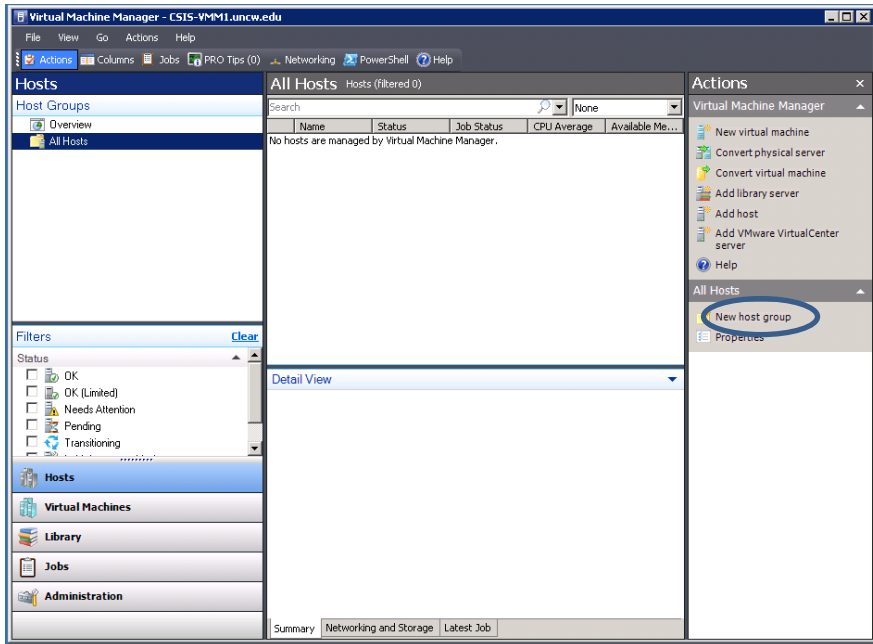
### Reference

- Hyper-V and Shared Cluster Volumes
- [http://technet.microsoft.com/en-us/library/dd446679\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/dd446679(WS.10).aspx)
- Hyper-V High Availability Checklist
- <http://technet.microsoft.com/en-us/library/cc753787.aspx>
- Using Hyper-V and failover clustering
- [http://technet.microsoft.com/en-us/library/cc732181\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc732181(WS.10).aspx)

### Open the Hyper-V Management Console

- Edit Hyper-V settings
- Create a virtual hard disk folder in the C:\clusterstorage shared storage
- Create a hyper-v folder for the virtual machine configuration in the c:\clusterstorage share storage
- Reconfigure the settings to point to these new folder locations.
- To create a virtual machine, use the new VM wizard.
- To make a virtual machine highly available you have to add it to the services configuration in the cluster manager.
- Run the Best Practices Analyzer to validate the Hyper-V setup. Our setup came out clean with the exception that we should have used the Server Core version of the install.

## Appendix R-2: Adding a host to VMM Server



**Computer Search**

Search criteria

Domain:

Computer name:

Limit the search to computers with the following virtualization software:

Virtual Server


Hyper-V

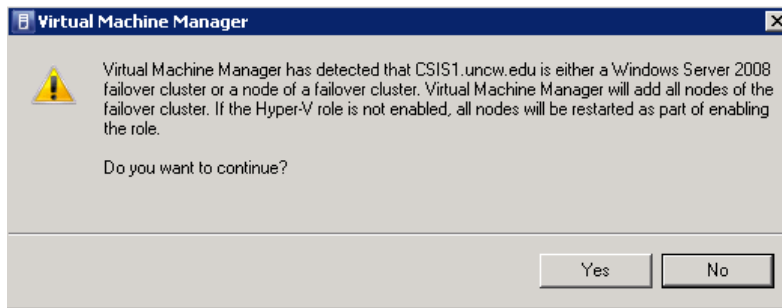
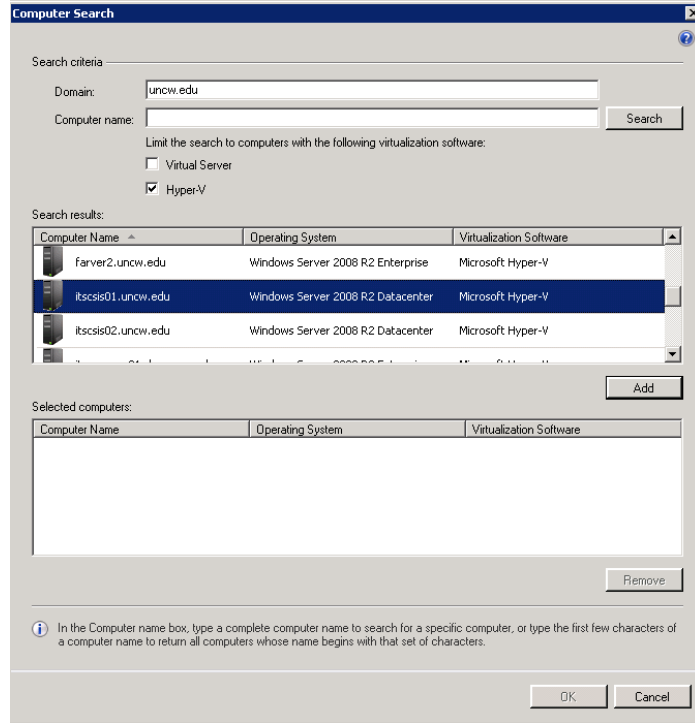
Search results:

Computer Name	Operating System	Virtualization Software
---------------	------------------	-------------------------

Selected computers:

Computer Name	Operating System	Virtualization Software
---------------	------------------	-------------------------

 In the Computer name box, type a complete computer name to search for a specific computer, or type the first few characters of a computer name to return all computers whose name begins with that set of characters.



**Computer Search**

Search criteria

Domain:

Computer name:

Limit the search to computers with the following virtualization software:

Virtual Server

Hyper-V

Search results:

Computer Name	Operating System	Virtualization Software
farver2.uncw.edu	Windows Server 2008 R2 Enterprise	Microsoft Hyper-V
itscsis01.uncw.edu	Windows Server 2008 R2 Datacenter	Microsoft Hyper-V
itscsis02.uncw.edu	Windows Server 2008 R2 Datacenter	Microsoft Hyper-V

Selected computers:

Computer Name	Operating System	Virtualization Software
CSIS1 (ITSCSIS01, ITSCSIS02)	Windows Server 2008 R2 Datacenter	Microsoft Hyper-V

**i** In the Computer name box, type a complete computer name to search for a specific computer, or type the first few characters of a computer name to return all computers whose name begins with that set of characters.

**Add Hosts**

**Select Host Servers**

Select Host Location

Select Host Servers

Configuration Settings

Host Properties

Summary

Domain:

Computer name:

Skip Active Directory name verification

If you use this option, ensure that your computer name entry is a registered host Service Principal Name (SPN) in Active Directory.

Selected servers:

Computer Name	Operating System	Virtualization Software
CSIS1 (ITSCSIS01, ITSCSIS02)	Windows Server 2008 R2 Datacenter	Microsoft Hyper-V

**i** If you select multiple computers to add as hosts, the credentials you provide must be for a domain account that has administrative rights on all the selected computers, and all the hosts will share the same host group, remote connection port, and virtual machine default paths.

**w** Members of VMM user roles may not have remote access to virtual machines that already exist on the selected Hyper-V hosts. To restore remote access for those users, you must stop, shut down, or save state for the virtual machines and then restart the virtual machines.

**Add Hosts** Configuration Settings

Select Host Location  
 Select Host Servers  
**Configuration Settings**  
 Host Properties  
 Summary

Host group  
 Add the selected new hosts to the following host group:  
 All Hosts

Host reassociation  
 If any of the selected hosts are currently managed by another Virtual Machine Manager server, select this option to reassociate the hosts with this Virtual Machine Manager server.  
 Reassociate host with this Virtual Machine Manager server

Previous Next Cancel

**Add Hosts** Host Properties

Select Host Location  
 Select Host Servers  
**Configuration Settings**  
**Host Properties**  
 Summary

Add a virtual machine path or use default paths.  
 Virtual Machine Manager uses virtual machine paths as default locations to store virtual machines placed on a host. Virtual Machine Manager will add default virtual machine paths for the available storage on all host clusters automatically.  
[About virtual machine default paths](#)

Add the following path:  
 Add

Default virtual machine paths:  
 Remove

Remote connection  
 Remote connection port: 2179

Previous Next Cancel

**Add Hosts**

**Summary**

Select Host Location  
 Select Host Servers  
 Configuration Settings  
 Host Properties  
 Summary

Review the host settings.

Settings:

Property	Value
Host	Adding host cluster CS151.uncw.edu
Remote control	Enabled

[View Script](#)

**i** When you add these hosts, Virtual Machine Manager installs a VMM agent and, if needed, installs or enables the virtualization software on the hosts. VMM will also attempt to create a Windows Firewall exception on the hosts if needed.

Previous Add Hosts Cancel

**Jobs**

Name	Status	Start Time	Result Name	Owner
<b>Refresh host cluster</b>	<b>37 %</b>	<b>11/3/2012 11:43:...</b>	<b>CS151.uncw.edu</b>	<b>UNCW\amw3529</b>
✗ Add virtual machine host	Failed	11/3/2012 11:43:55 ...	ITSCS1502.uncw.edu	UNCW\amw3529
⚠ Add virtual machine host	Completed w/ Info	11/3/2012 11:43:55 ...	ITSCS1501.uncw.edu	UNCW\amw3529
✓ Create new host cluster	Completed	11/3/2012 11:43:53 ...	CS151.uncw.edu	UNCW\amw3529
✓ Discover clusters and their nodes	Completed	11/3/2012 11:43:52 ...	CS151.uncw.edu	UNCW\amw3529
✓ Remove virtual machine host group	Completed	11/3/2012 11:29:25 ...	New host group	UNCW\amw3529
✓ Create virtual machine host group	Completed	11/3/2012 11:29:16 ...	New host group	UNCW\amw3529
✓ Change properties of user role	Completed	11/3/2012 11:28:21 ...	Administrator	UNCW\amw3529
✓ Remove virtual machine host group	Completed	11/3/2012 11:26:47 ...	New host group	UNCW\amw3529
✓ Create virtual machine host group	Completed	11/3/2012 11:26:29 ...	New host group	UNCW\amw3529
✓ Change properties of virtual machine host group	Completed	11/3/2012 11:22:06 ...	All Hosts	UNCW\amw3529
✓ Remove virtual machine host group	Completed	11/3/2012 11:20:33 ...	New host group	UNCW\amw3529

**Add virtual machine host**

Status: **Failed**

Command: Add-VMHostCluster

Result name: ITSCS1502.uncw.edu

Started: 11/3/2012 11:43:55 AM

Duration: 00:00:02

Owner: UNCW\amw3529

Progress: **0 % complete**

Current step: Add virtual machine host

**Error (409)**  
 ITSCS1502.uncw.edu is already associated with a different Virtual Machine Manager server. A computer can only be associated with one Virtual Machine Manager server at a time.

**Recommended Action**  
 Remove the association of ITSCS1502.uncw.edu from its current Virtual Machine Manager server or uninstall the Virtual Machine Manager agent using Add or Remove Programs on ITSCS1502.uncw.edu and try the operation again.

Summary Details Change Tracking

Show this window when new objects are created

Restart Job Cancel Job

## Appendix S: Original Logical Diagram for Proof of Concept System

Windows 2008 R2 Data Center Edition with the following roles:

Hyper-V \* AD/DNS \* DHCP

(I am not sure if it is feasible to run all these services on one box need to research best practices. If not, plan to virtualize on separate machines.)

Virtualized Windows 2008 Data Center w/ Roles:

- Hyper-V
- IIS

With SCVMM software installed

- Management Console
- Web Portal / “Vending Machine”
- VM template Library
- Application Library
- OS Library

Student Virtual Desktops

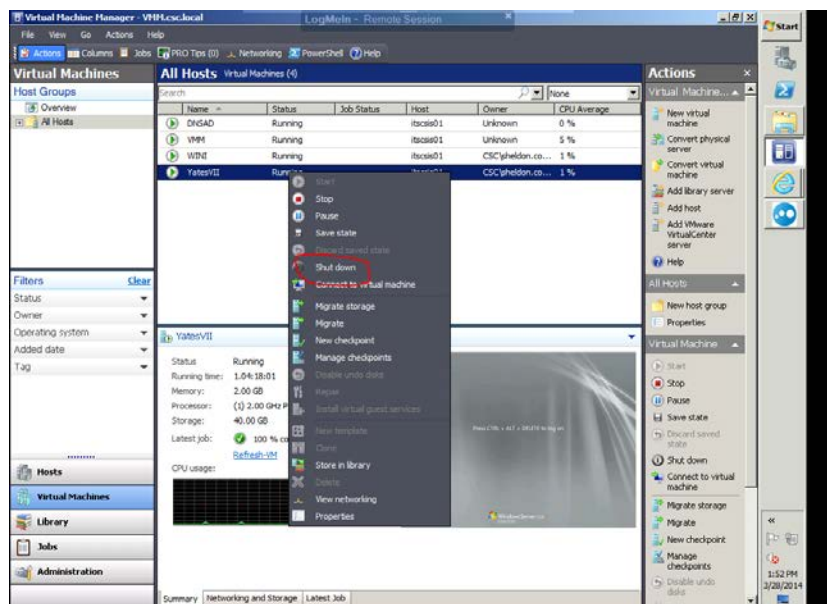
## Appendix T: VMM Administrator User Guide

### Overview

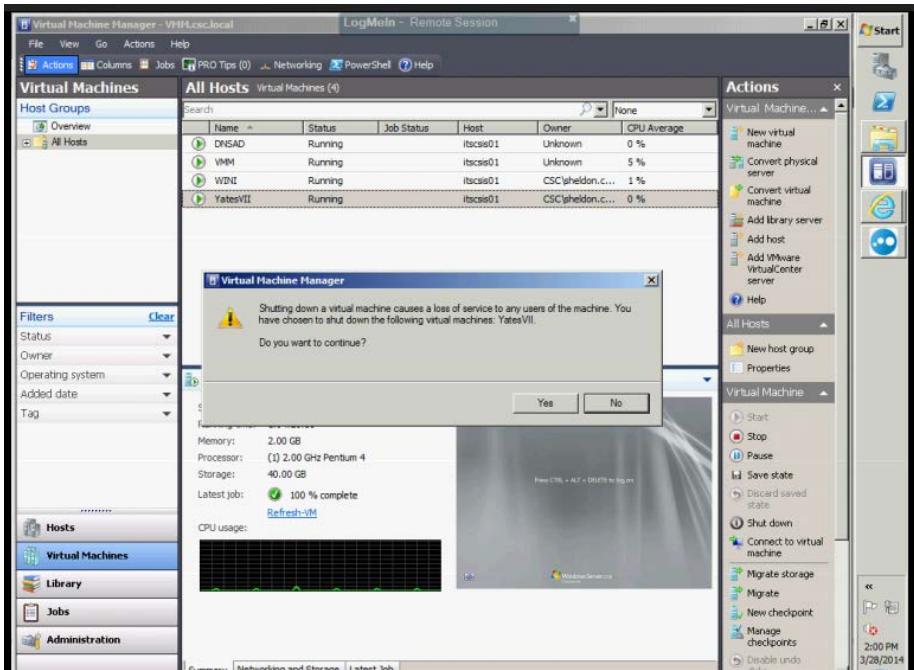
This user guide assumes that the VMM Administrator has domain administrator credentials. If the VMM Administrator does not have domain administrator credentials, the steps requiring these credentials can be skipped and edited at a later time by the domain administrator. The beginning of the user guide will incorporate a number of screen shots. As the guide progresses it will be assumed that the user will become more comfortable navigating the VMM administrator console and fewer screen shots will be used. The VMM Administrator, likely a Graduate Assistant, will have these roles; Assign User Roles, Create Machine Templates, Grant Users permission to use templates, and Monitoring and managing VM updates and provisioning. This user guide addresses all of the above except monitoring and managing VM updates and provisioning as this is out of scope for this project.

### Template Creation

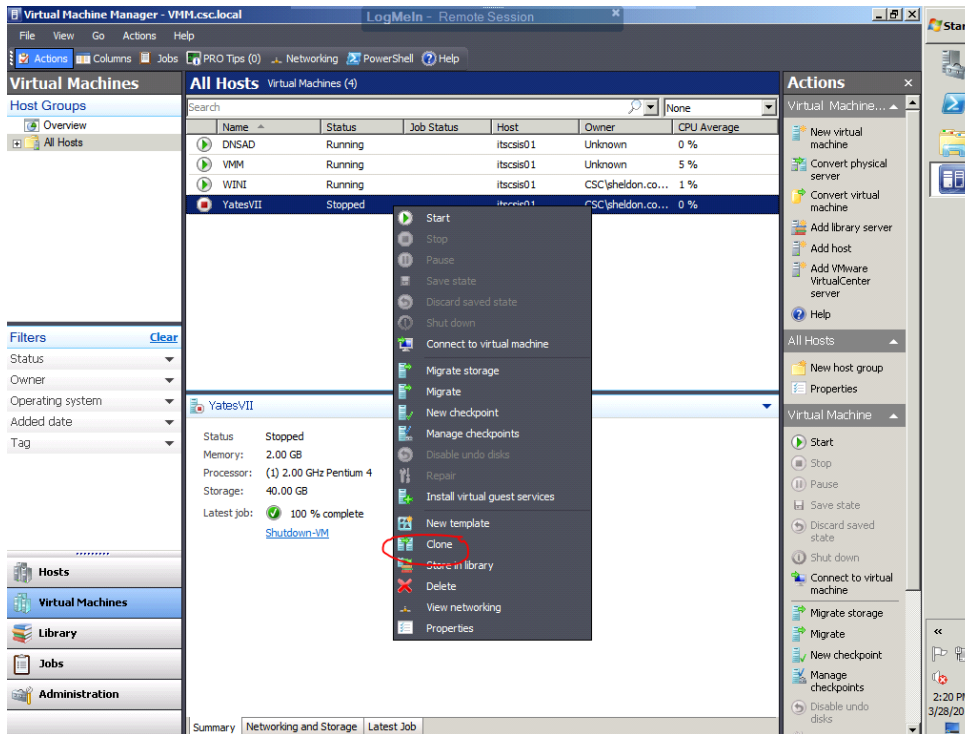
1. Best Practice is to use existing machine
2. Prepare existing machine to required specifications and perform any required updates
3. Shut Down Machine by right clicking on the desired machine and select shut down



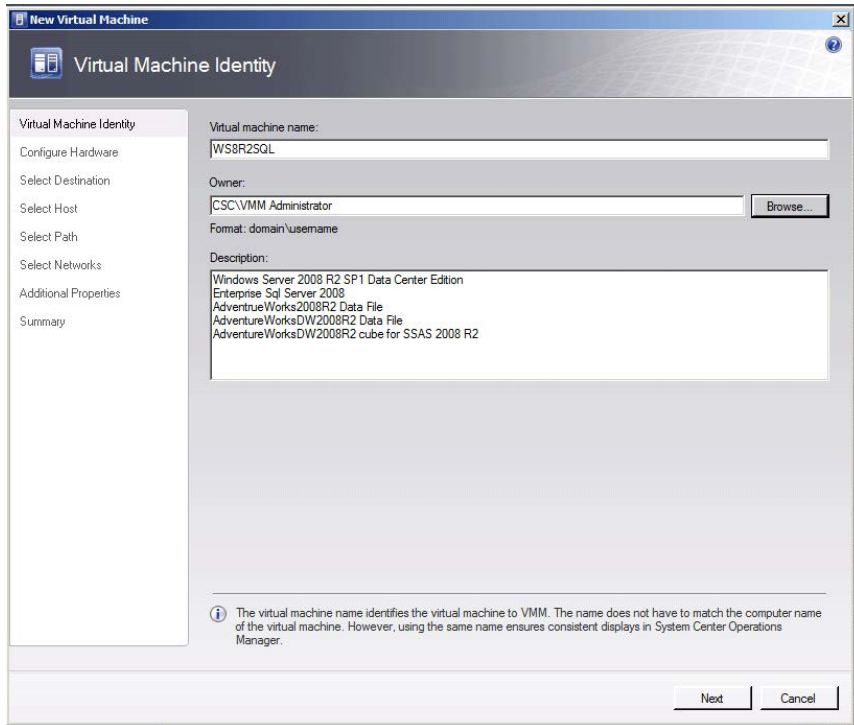
4. You will receive warning message as seen below. Click the yes button.



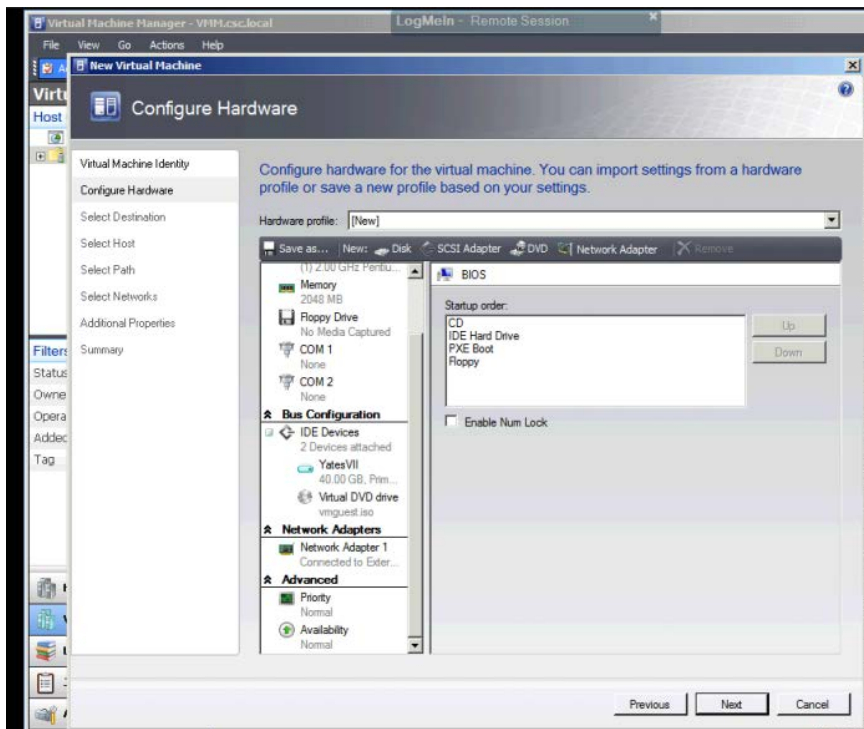
5. Once machine has stopped right click on the machine and select clone.



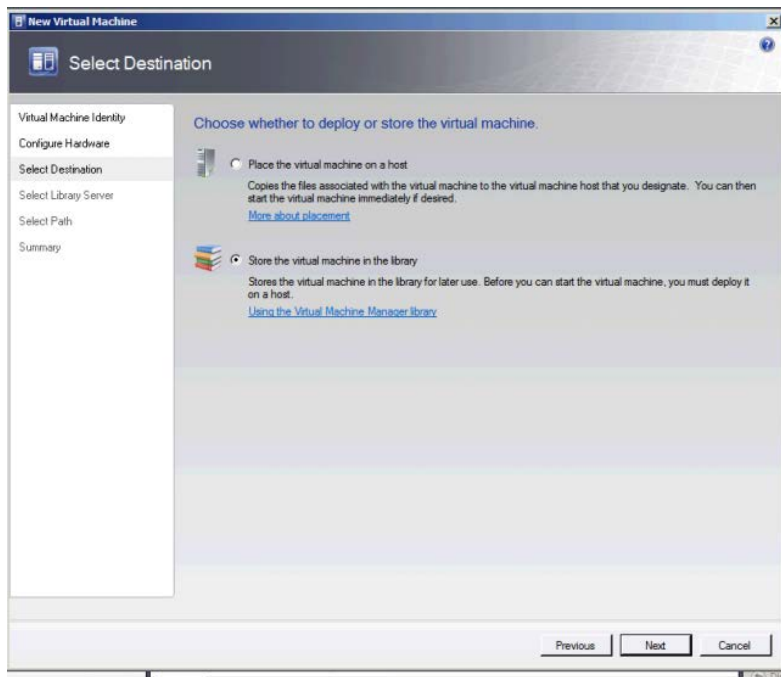
- Assign a name to the machine clone, enter CSC\VMM Administrator as the owner, enter a description of the clone to be created, and click next.



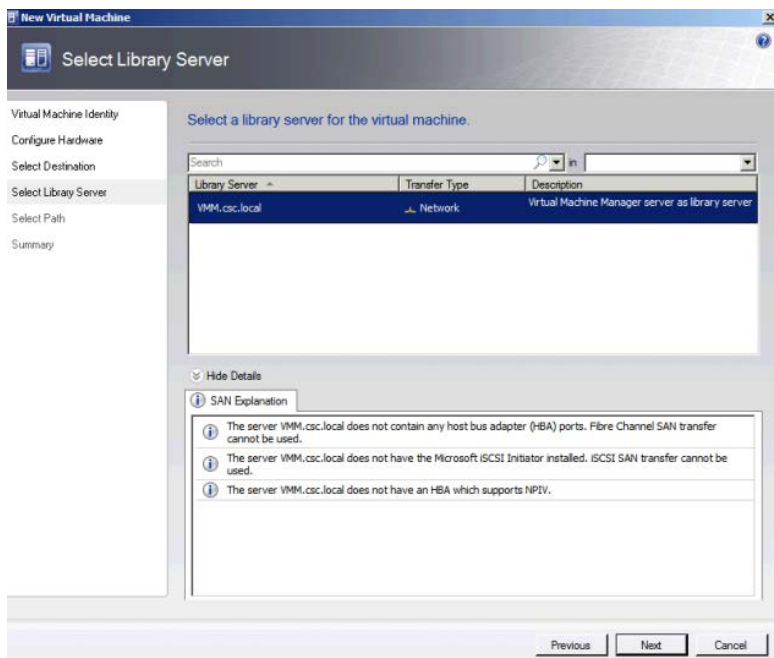
- Configure Hardware; Assign desired properties and click next.



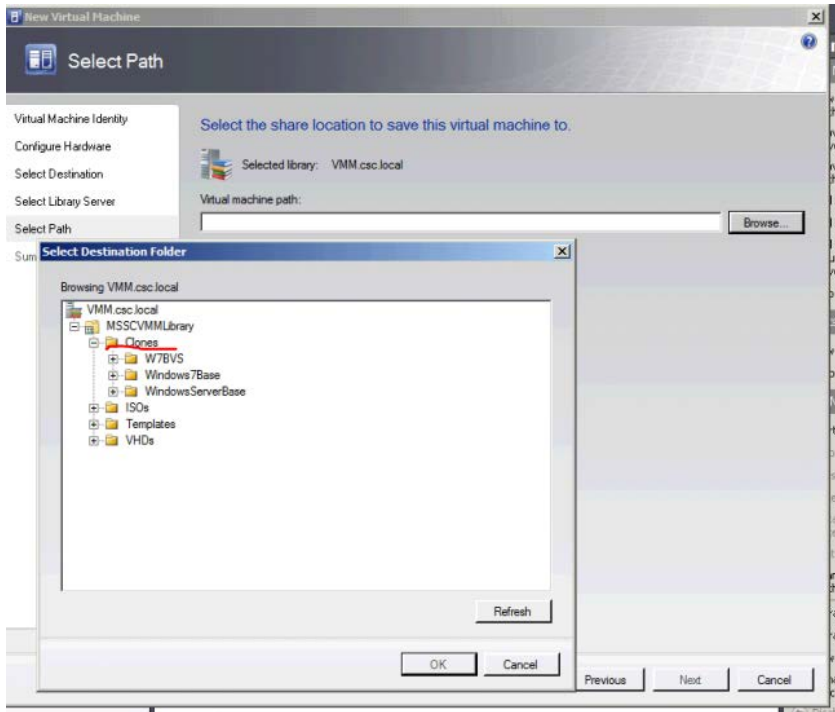
8. Select Destination; change selection from place the virtual machine on a host, to store virtual machine in the library, click next.



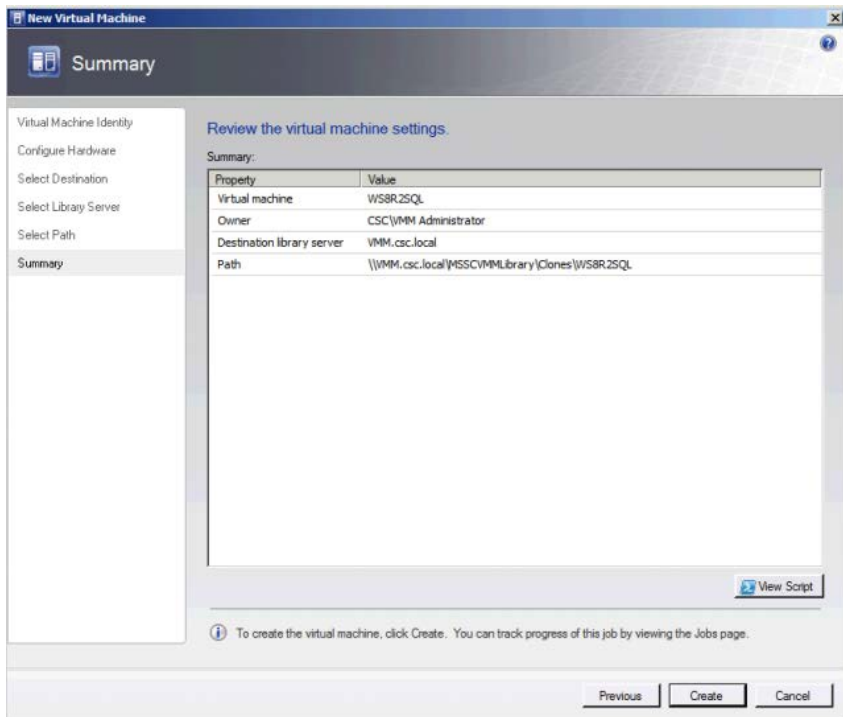
9. Select Library Server; In this case there is only one, select VMM.csc.local, and click next.



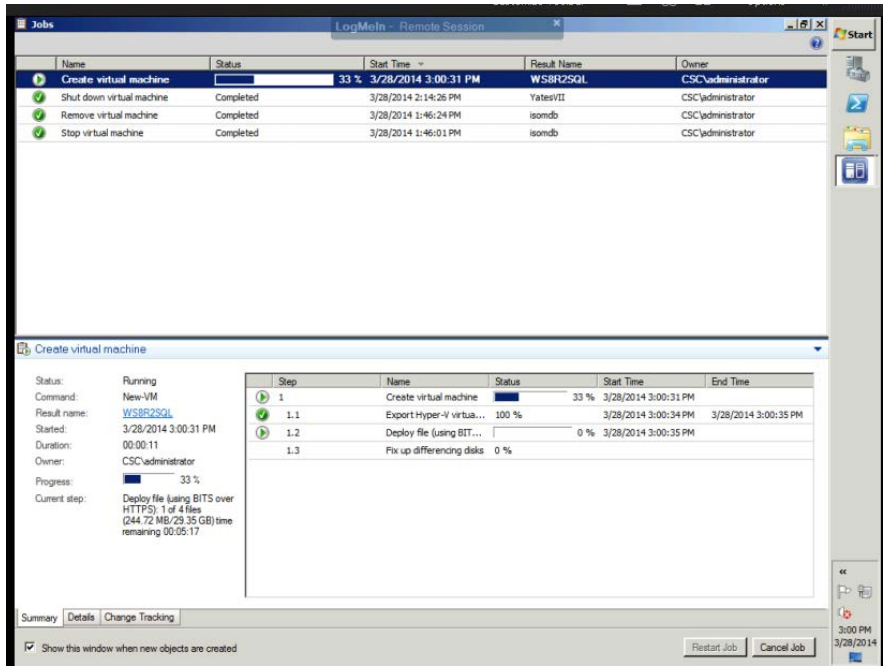
10. Select Path; select browse and navigate to the desired folder in the Library Server to place clone, click ok, click next.



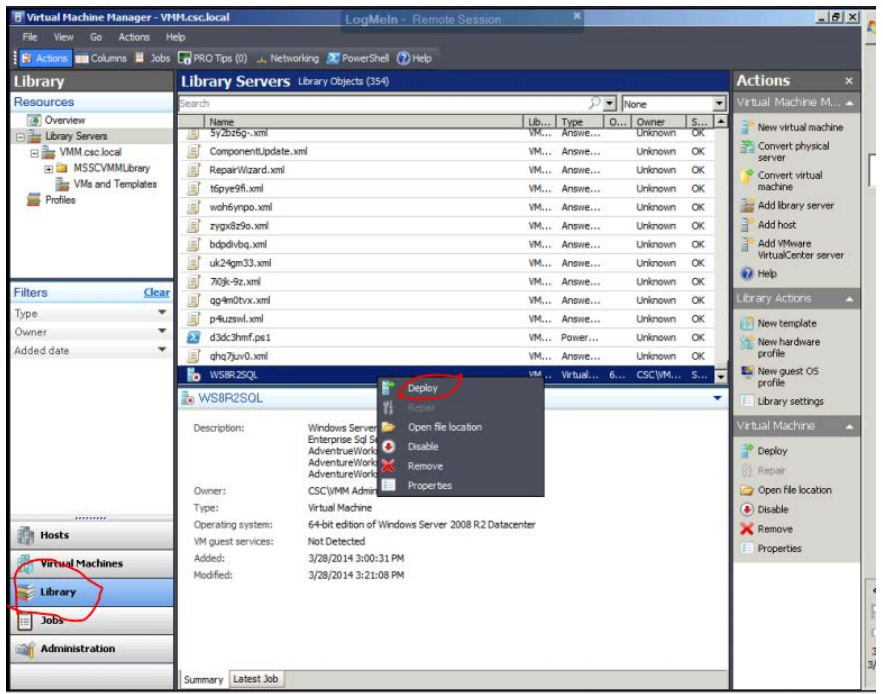
11. Summary; make a note of clone settings and click create



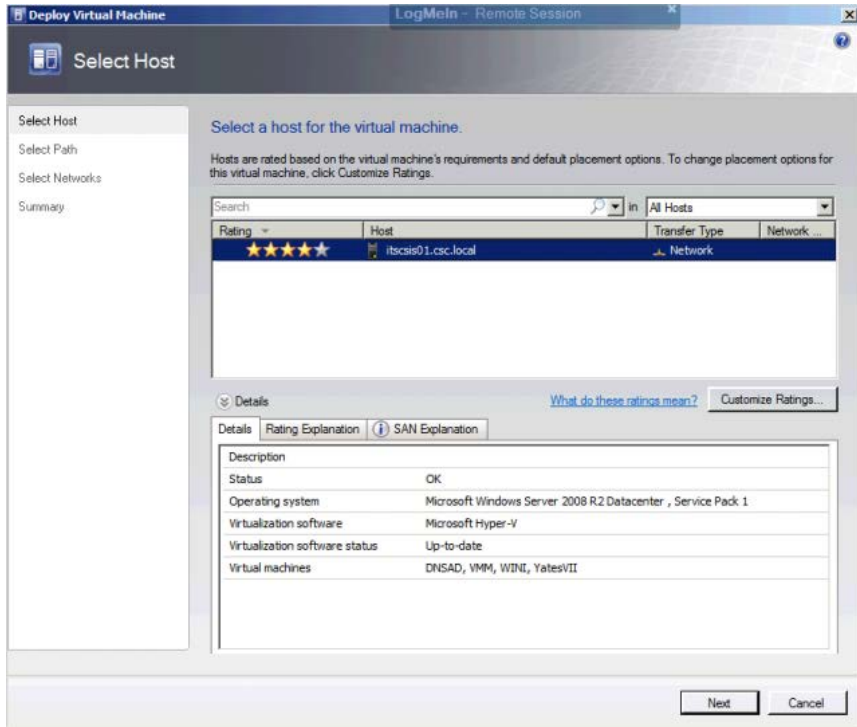
- Monitor machine creation in the VMM console. This could take some time depending on the parameters of the clone being created. Be prepared to wait as much as 30 minutes.



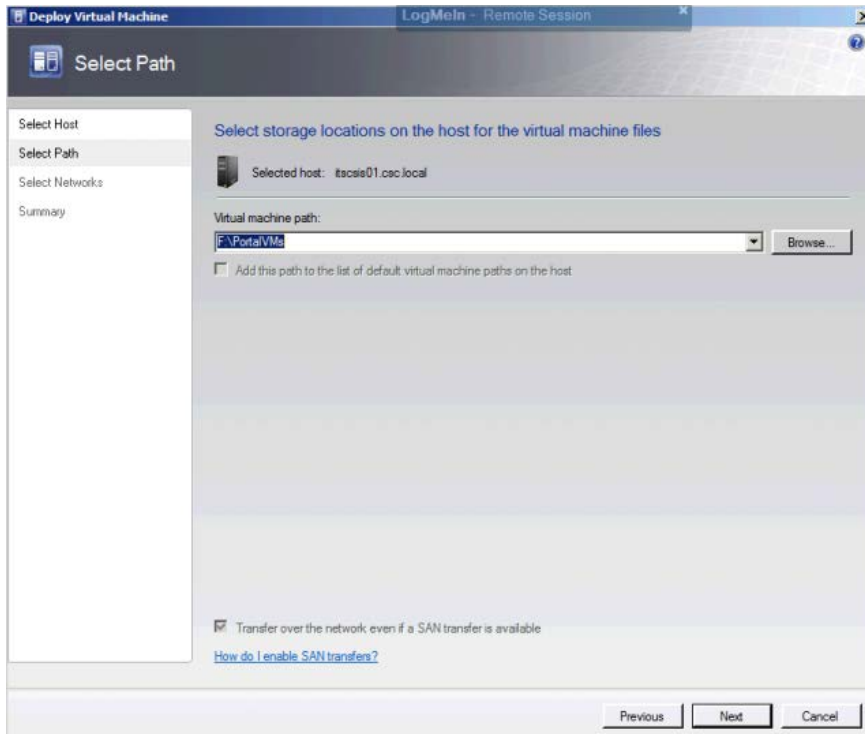
- Once machine is created, navigate to the Library in the VMM Console and select the machine that was just created and right click on that machine and select deploy.



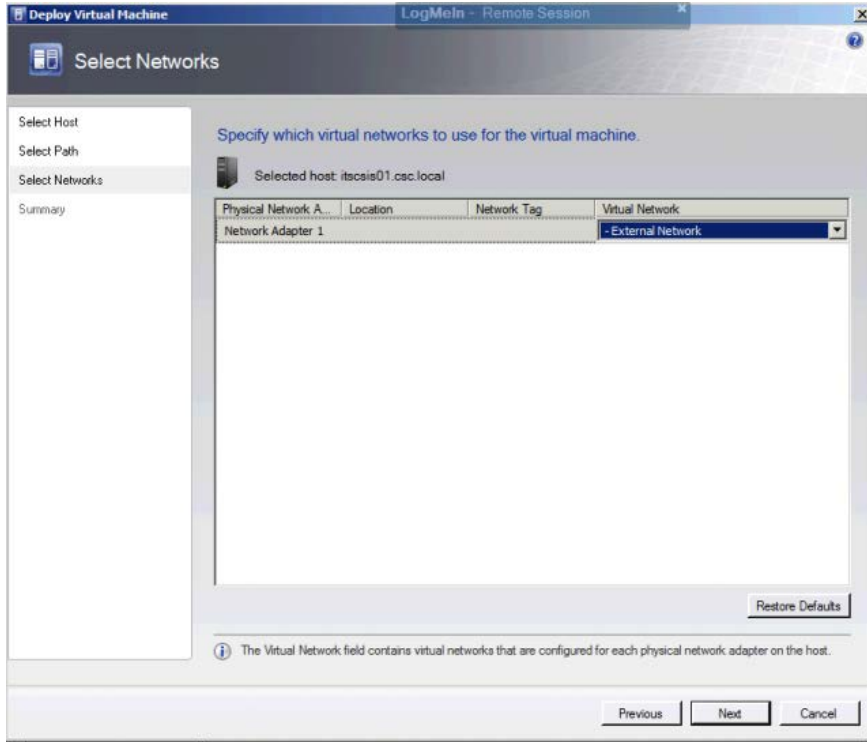
14. Select ITSCSIS01 and then click next.



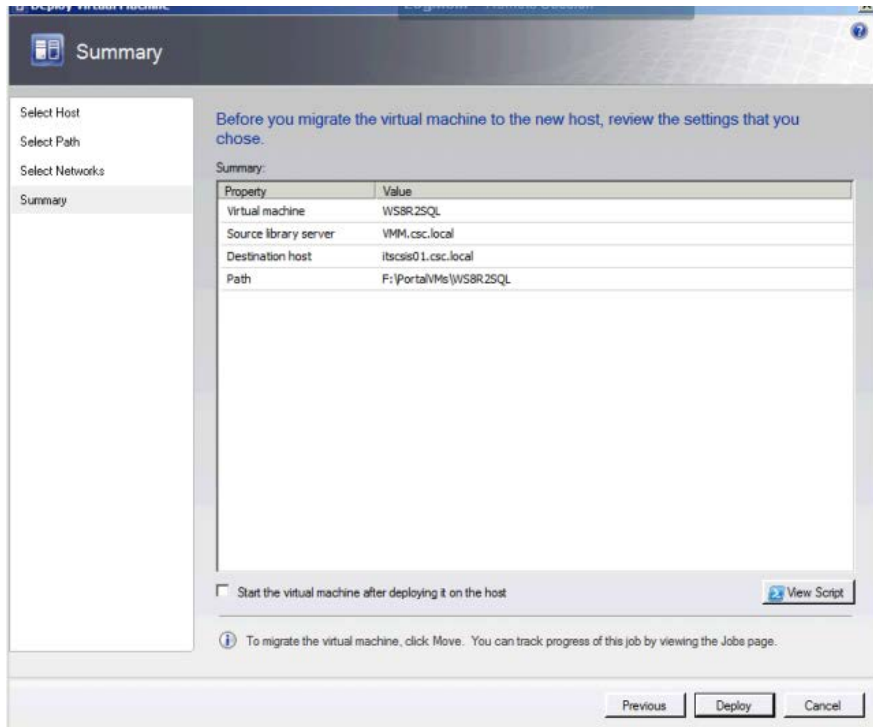
15. Browse to the folder where you would like to place clone and click next.



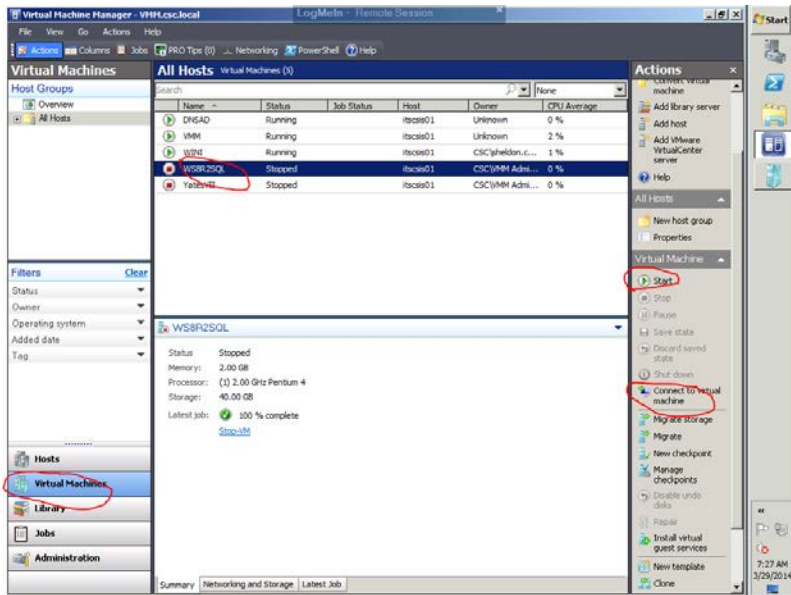
16. Select appropriate network, click next.



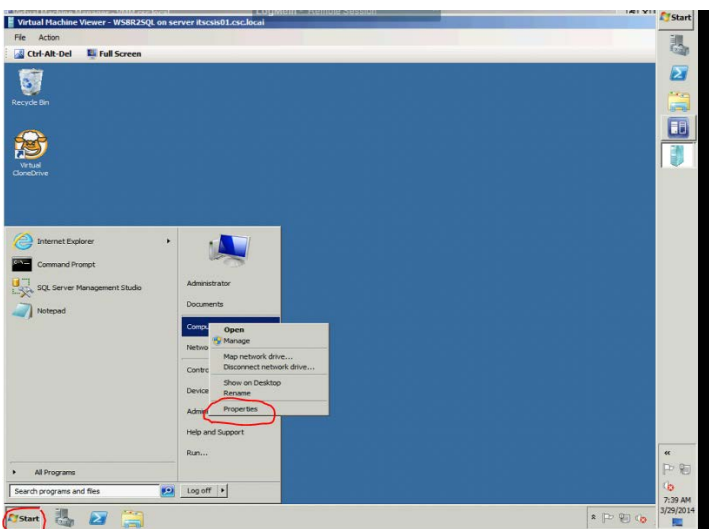
17. Select Deploy, this will take some time expect at least 30 minutes depending on the parameters of the machine being deployed.



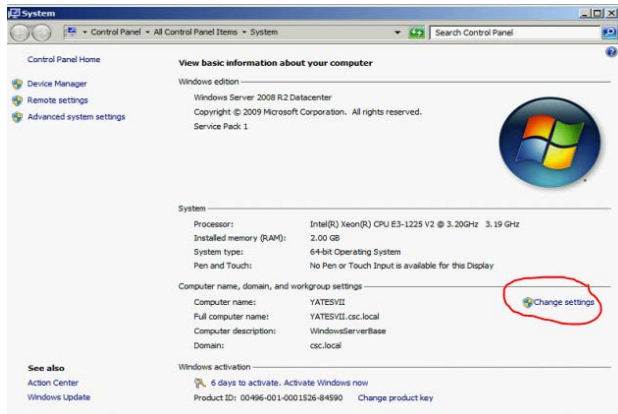
18. Once Machine is moved to ITSCSIS01 select the machine in the VMM management Console click start, then click Connect to virtual machine.



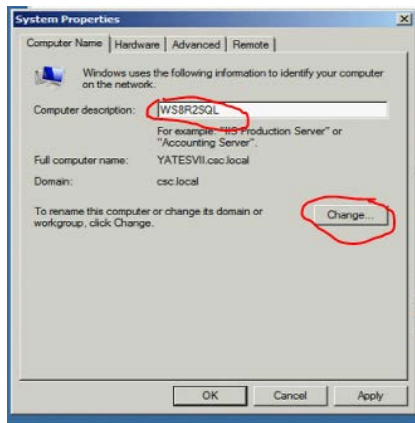
19. Then login using the original local administrator user ID and password for the machine used to make the clone.
20. Steps 20 - 29 require Domain Administrator Credentials. It is ok to skip these steps if you do not have these credentials as long as the original machine the clone was created from is not running. (The original machine was shut down in step 3.) If it is still running it will appear to DNS as if there are two machines with the same name. At this point the machine is exactly like the machine it was cloned from including the name of the machine. These steps rename the computer. Navigate to computer properties by clicking the Start Button, right click Computer, and then select properties.



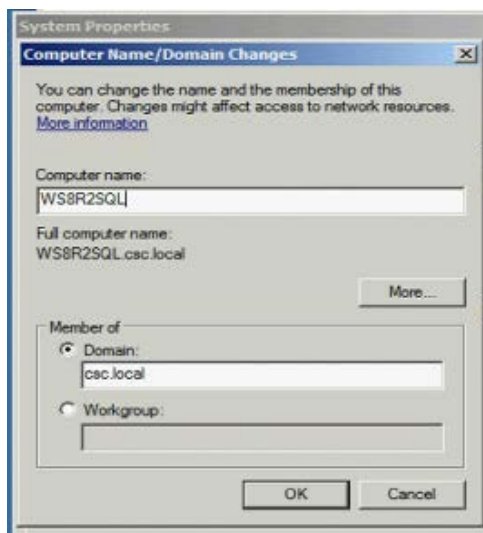
21. Click Change Settings.



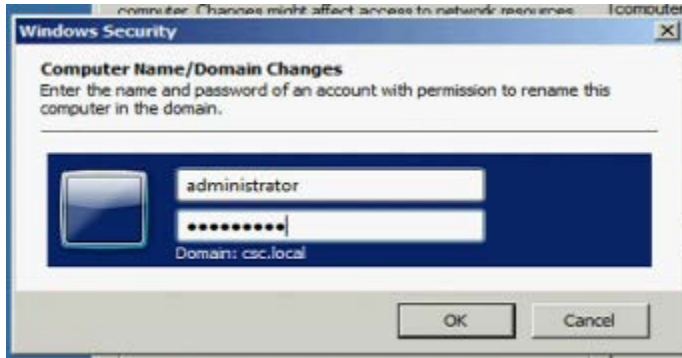
22. Enter new computer description and click Change



23. Change computer name and click OK.



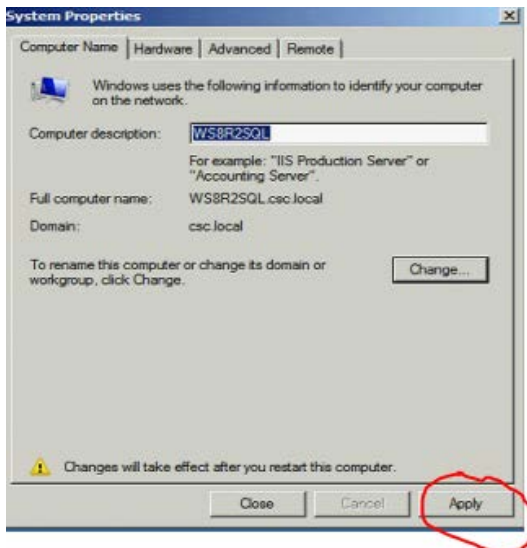
24. Enter Domain Administrators credentials and click ok.



25. Click ok.



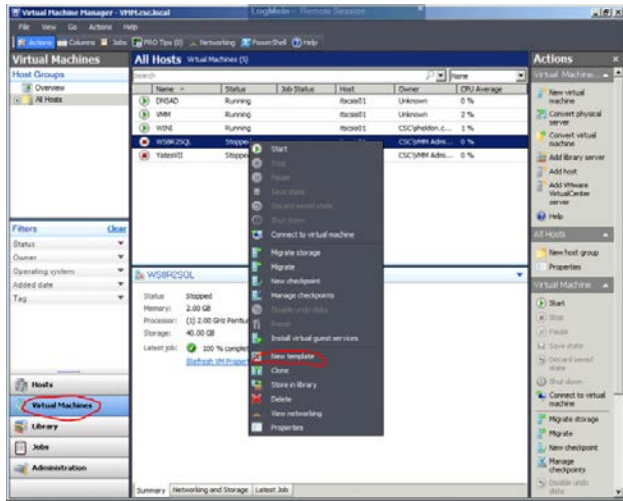
26. Click Apply, and then restart machine for changes to take affect



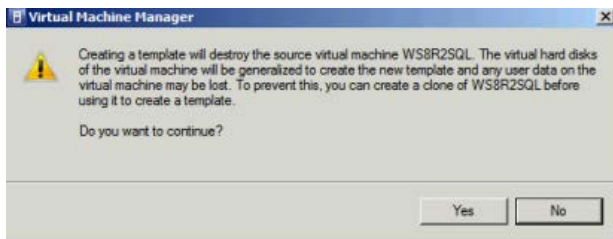
27. Once machine restarts verify that name change was successful, then shut down virtual machine. You may be prompted for a comment about why the machine is being shut down. Enter a description such as "to create machine template."

28. Once machine is shut down close the Virtual Machine Viewer.

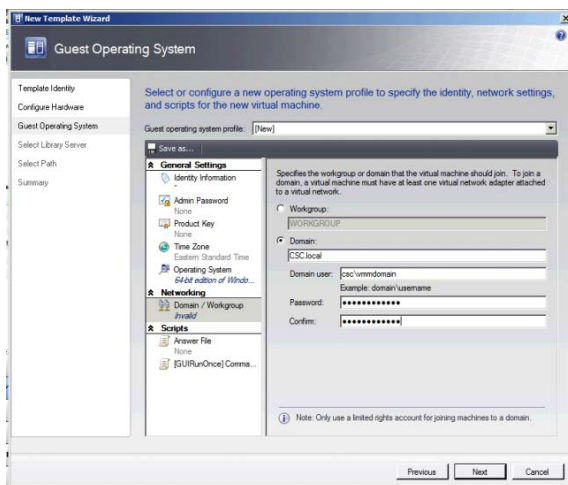
- Right click the machine in Virtual Machine Manager Virtual Machines Console and select New Template.



- You will receive a warning message, click yes.



- Repeat steps 6 and 7 above.
- Enter appropriate information in each of the General Settings Tabs for the template being sure to enter the appropriate domain credentials in the Networking tab. Without this you will be unable to deploy Portal Machines to the domain. You or the domain administrator can edit these at a later time if you do not have domain credentials. Click Next.

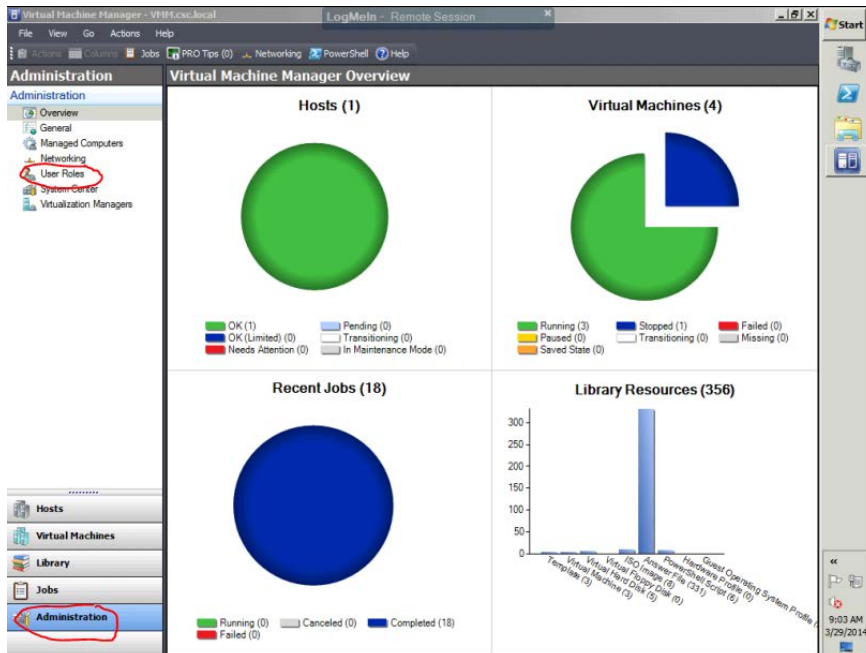


33. Select Library Server in this case there is only one VMM.csc.local, and click next.
34. Browse to the folder in the Library Server where you would like to place the template, in this case Templates, then click ok, then click next.
35. Verify settings on the Summary page and click Create.
36. Once Creation job has completed there is a new template. This process could take up to 30 minutes or more depending upon the parameters of the template being created.

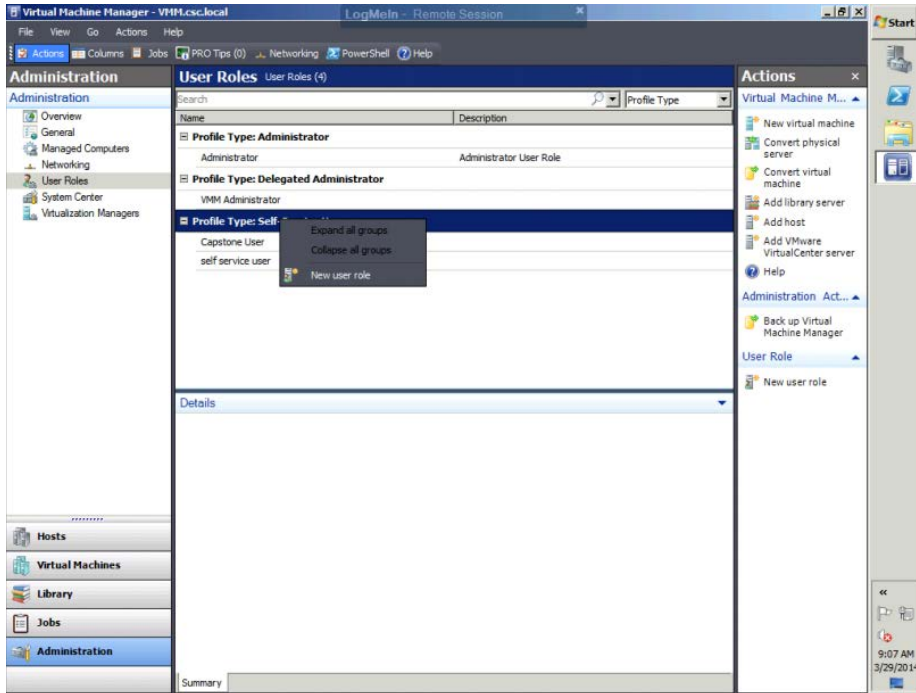
### Creation and Assignment of User Roles and Templates

The assignment and creation of user roles requires that the users or user groups that will be used within the VMM Console have already been created in Active Directory. The example outlined below walks you through creating a role in VMM for the MIS592 class and then giving this role access to the WS8R2SQL template created in the previous tutorial.

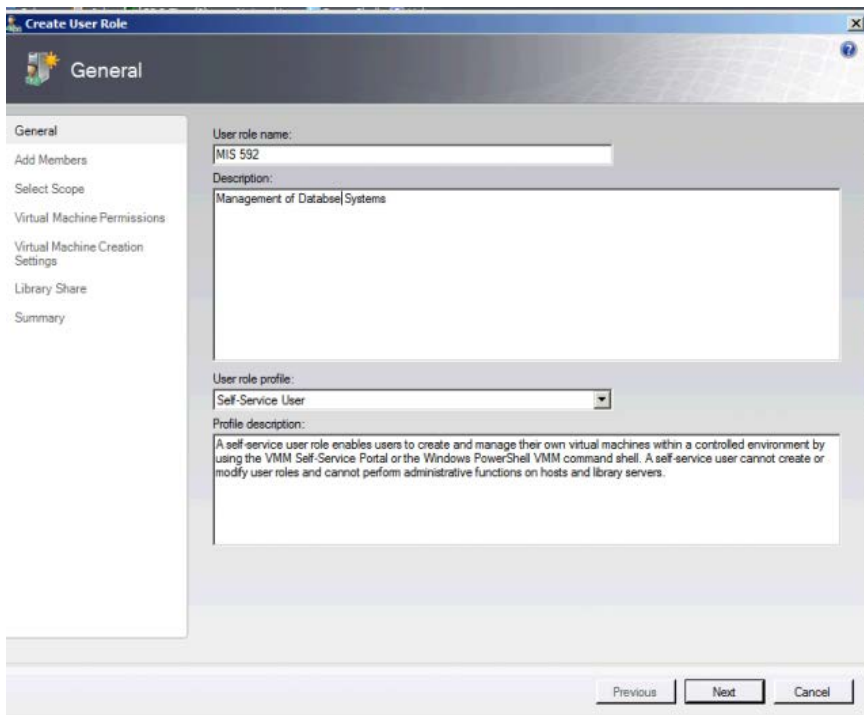
1. Navigate to User Roles in the Administration tab of VMM console



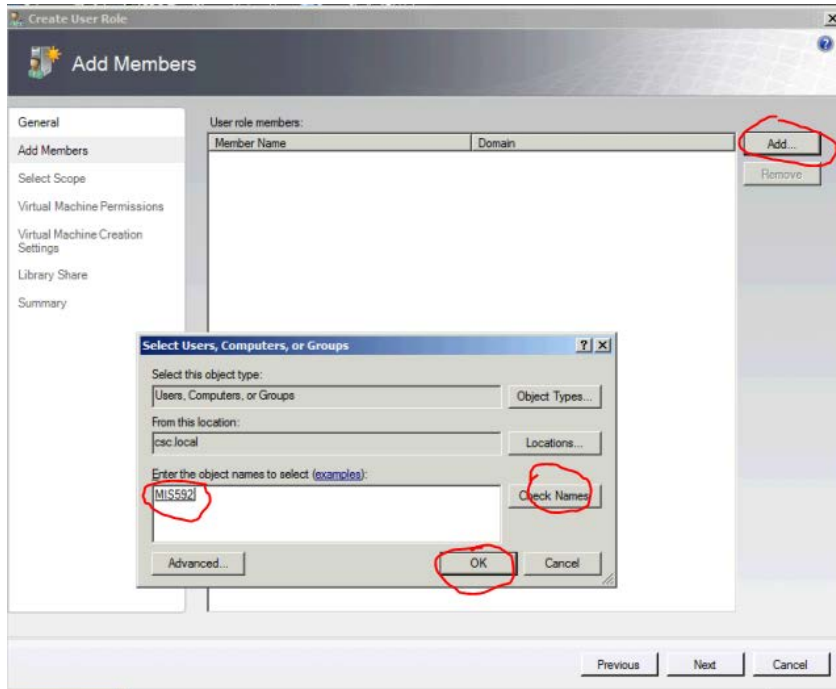
2. Right Click Profile Type: Self Service User, select new user role.



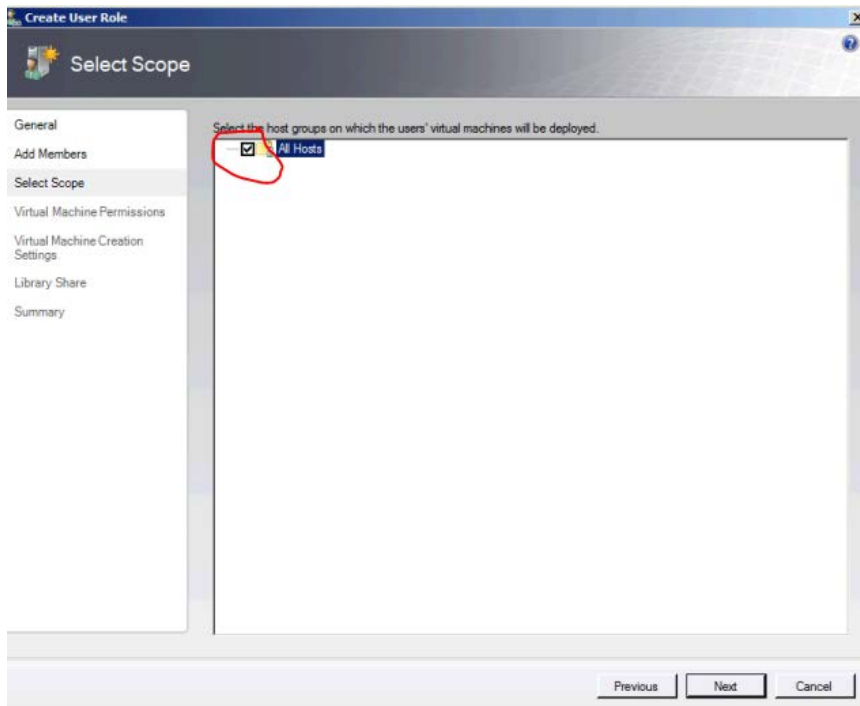
3. Enter User role name and description, leave User role profile set to Self-Service User, and click next.



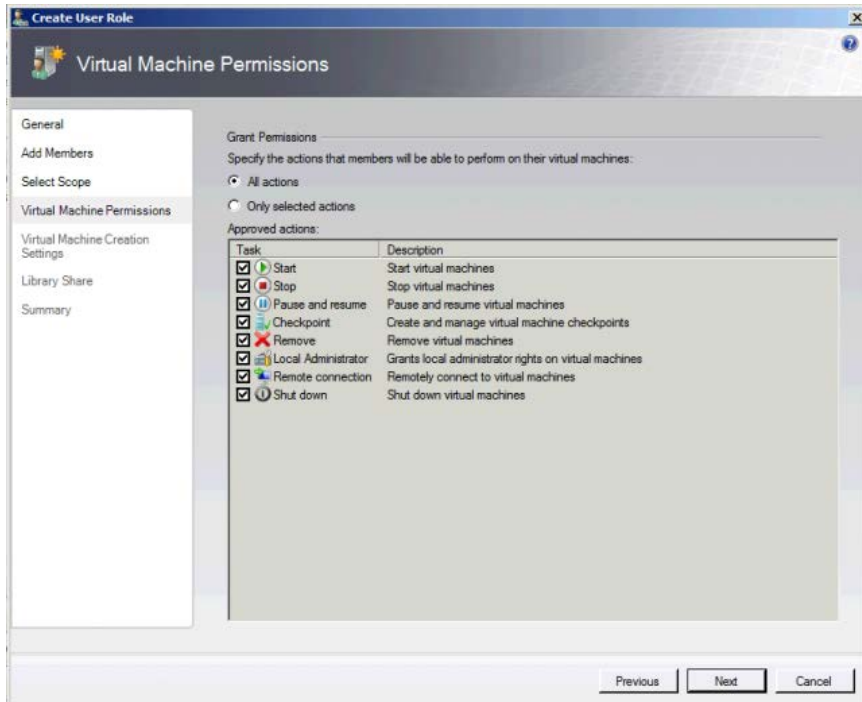
4. Add appropriate user or group to role members. Click add, enter name to search for, click check names, click ok.



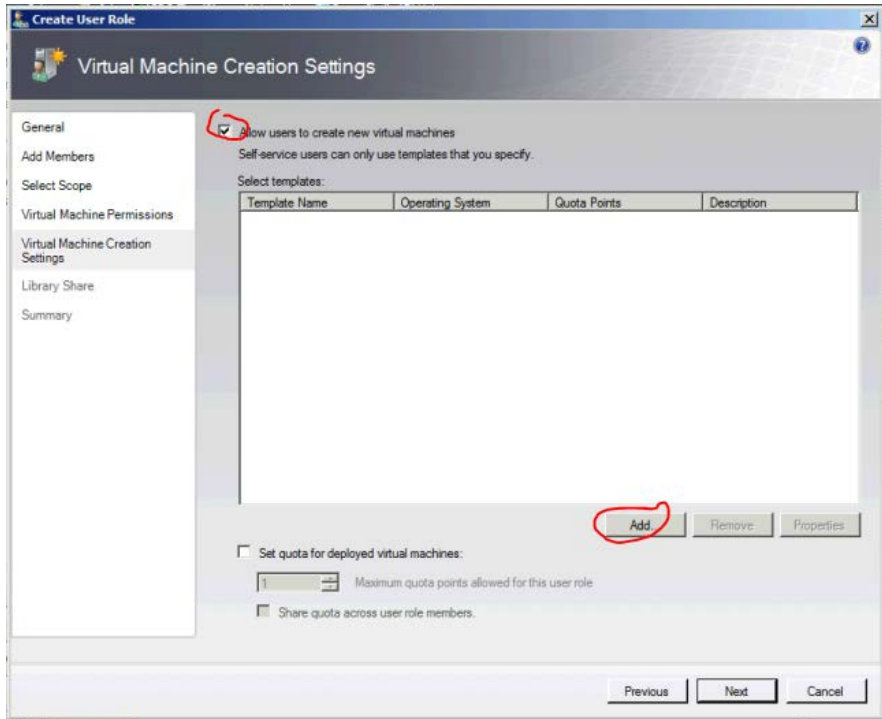
5. Click next, select host, click next.



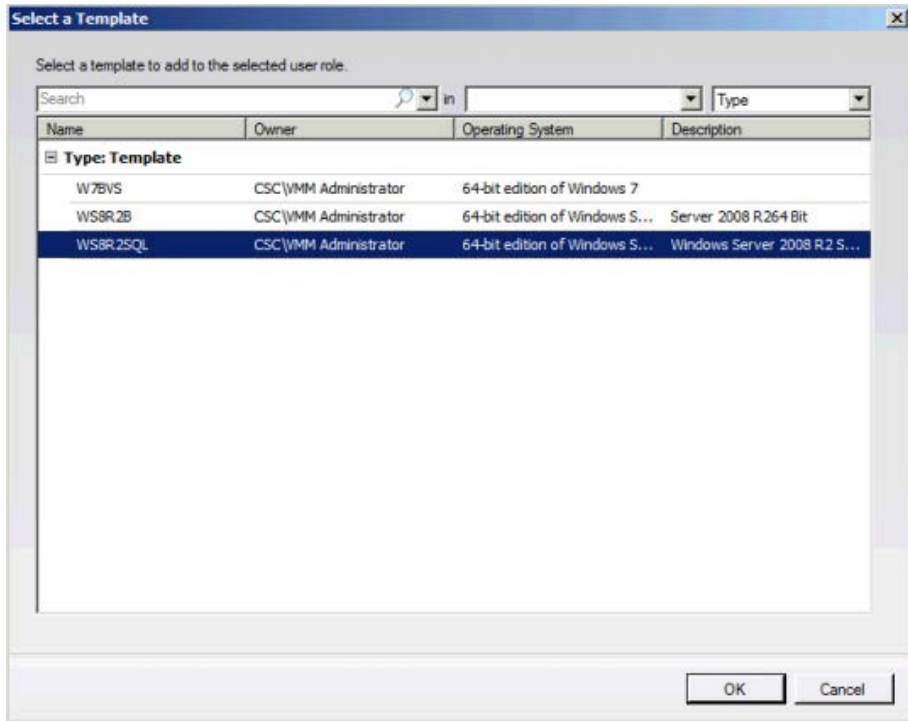
6. Assign permissions, click next.



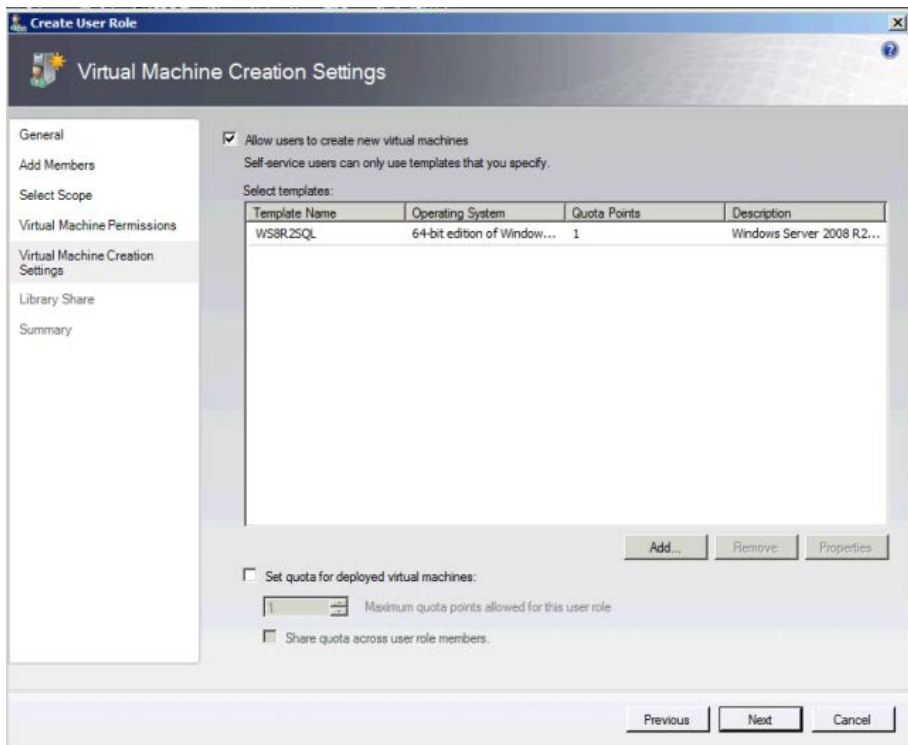
7. Select "Allow users to create new virtual machines" and click add.



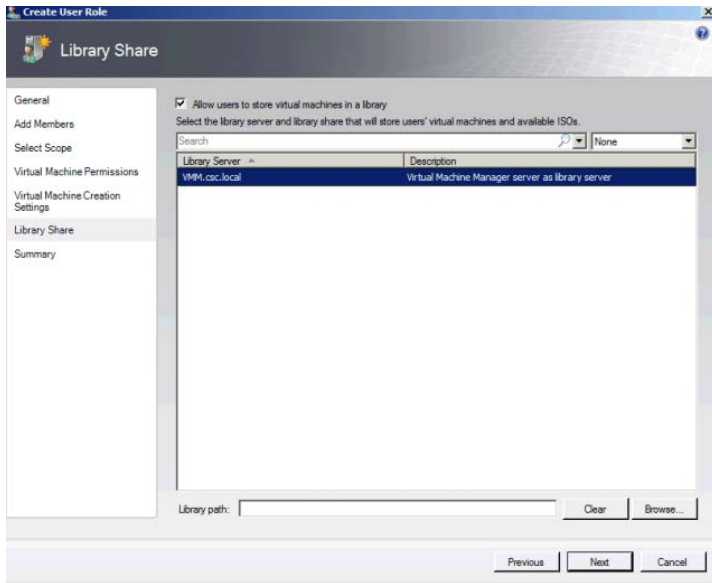
8. Select template to add to user role, click ok.



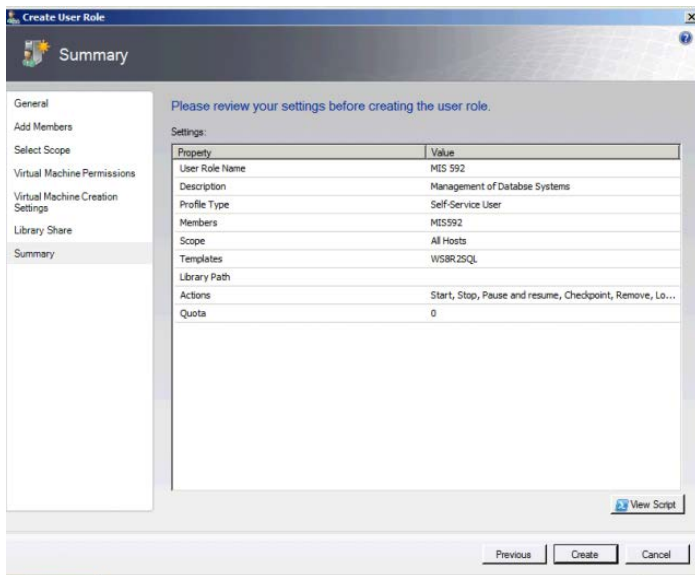
9. Click next.



10. Select “Allow users to store virtual machines in a library”, click next.



11. Verify settings and click create.



### Add Users to an existing role

1. Right click the user role to assign member.
2. Select properties.
3. Select the Members tab
4. Click add
5. Enter the individual or group to assign to the role, click ok.

## Add existing template to an existing role

1. Right click the user role to assign template.
2. Select properties.
3. Select the Create VM tab
4. Click add.
5. Select the desired template and click ok.
6. Click ok again.

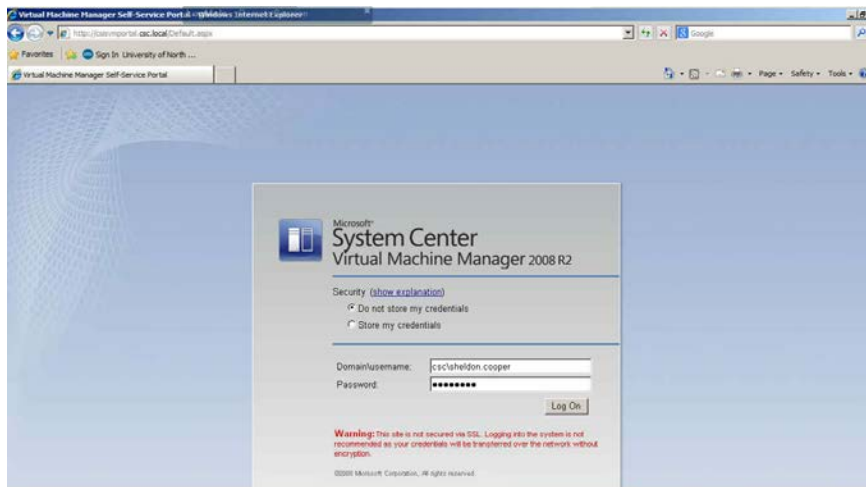
## Appendix U: Portal User Guide

### Portal User Expectations

- No backups performed on guest; user is responsible for their own backups.
- Can Only Restore System to original image
- No technical assistance will be provided inside a running guest
- Templates will be created with system updates current as of the time of creation; subsequent updates are the responsibility of the creator.
- Operating System is not activated when the VM is deployed through the SSP. It will be the responsibility of the creator to ensure its activation.

### VM Creation

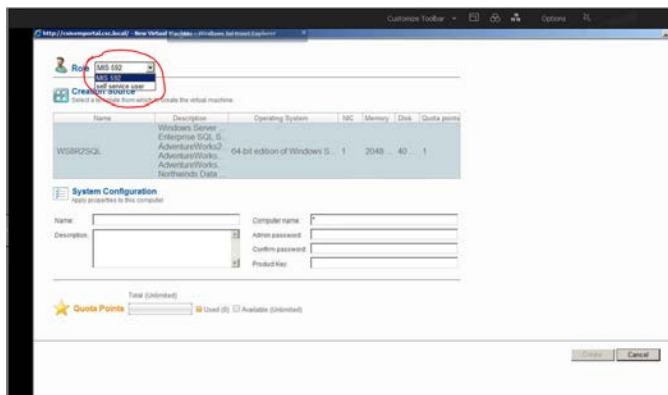
1. Navigate to the Self-Service Portal <http://csismportal.csc.local>
2. Enter username and password, click Log On.



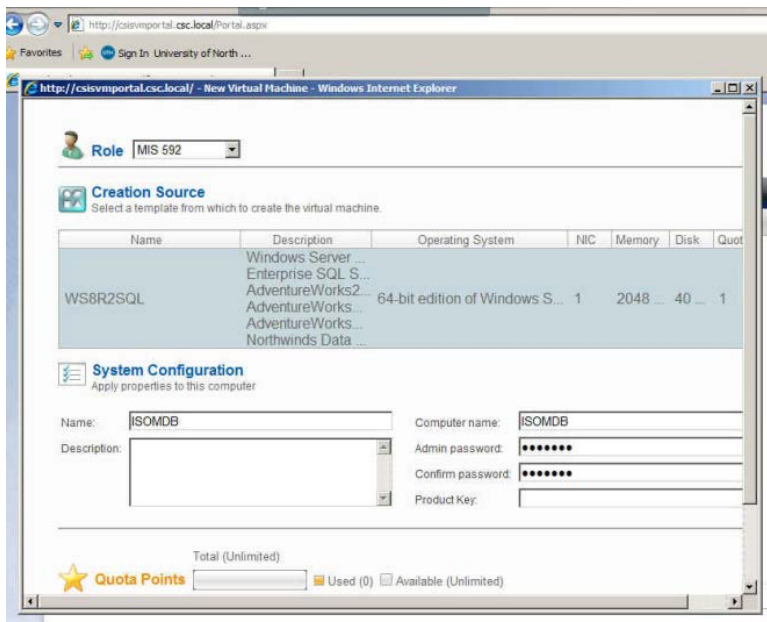
3. Click New Computer



4. Select appropriate role.



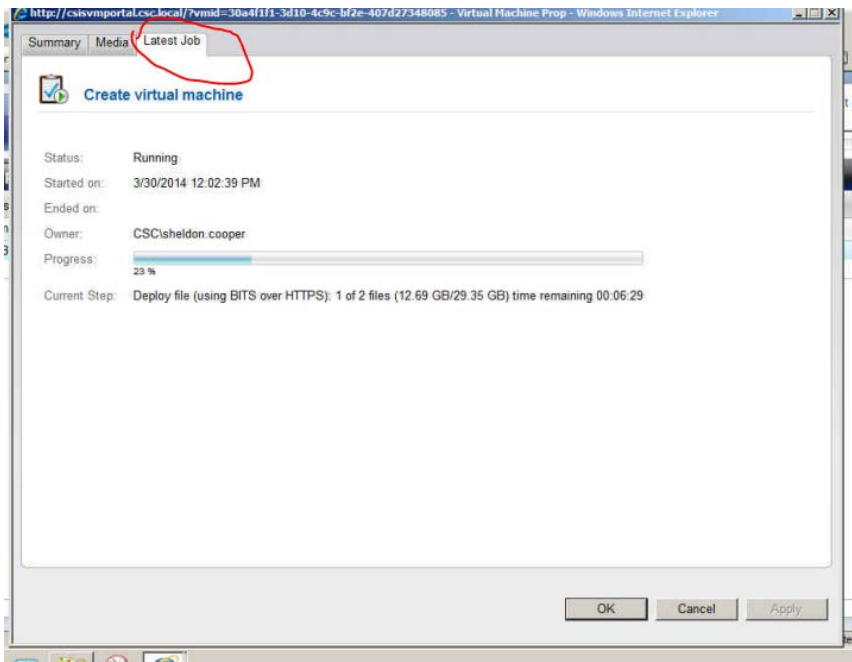
5. Select template, in this case there is only one, WS8R2SQL, Name Computer to be Created, assign password, click create, click ok.



6. Portal now shows the status as creating...

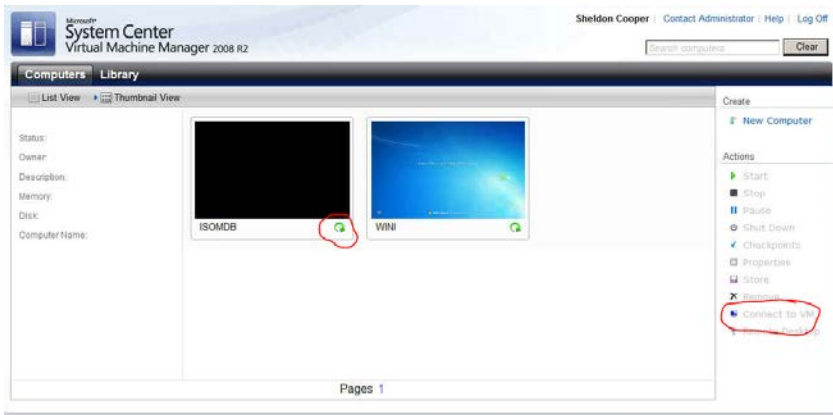


7. To view the status of the creation select the VM being created, and click on properties (You may receive a permission warning click ok to proceed), then select the Latest Job Tab, click ok.

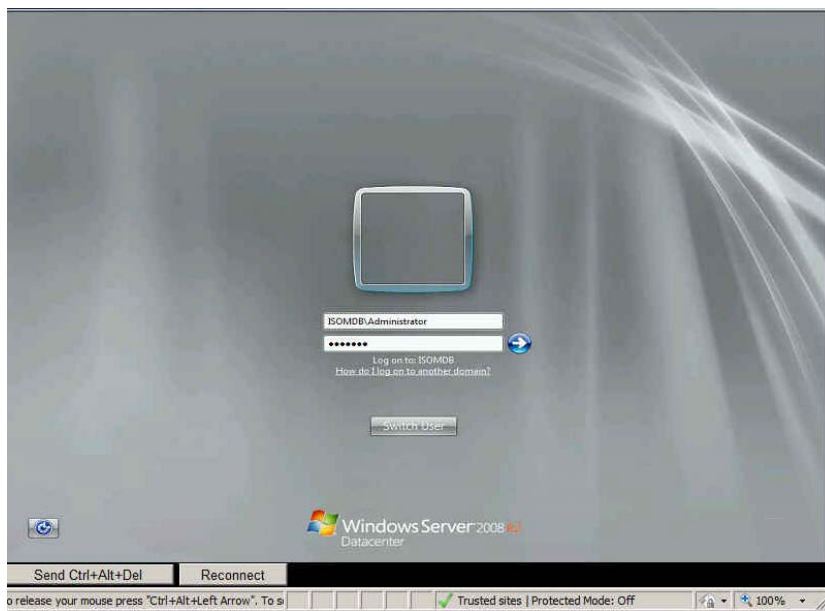


8. The time for the machine to create varies depending upon the parameters of the machine being created. For this particular template it takes approximately 20 minutes.

9. Once the machine has completed creating click Start, click Thumbnail View, click the reconnect icon, click Connect to VM.



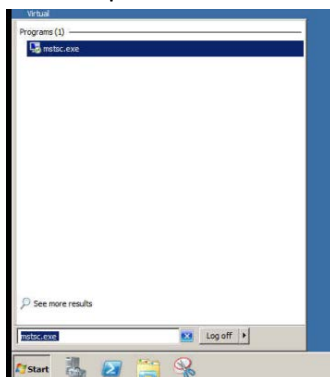
10. Click Send Ctrl+Alt+Del, login using the password and computer name used to create VM.



11. You can now log out and log on from any remote desktop using RDP.

12. Log out of SSP

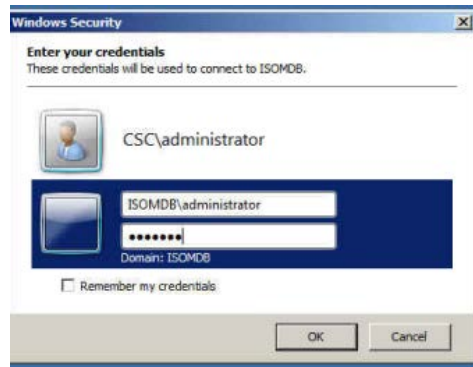
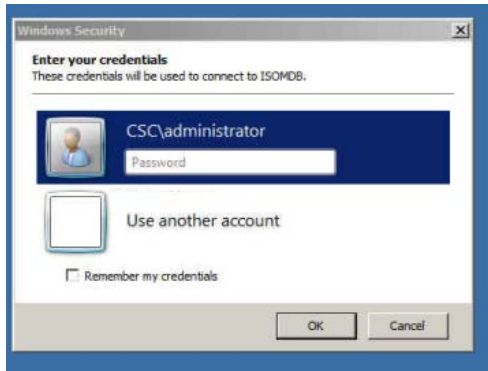
13. Start a Remote Desktop Session using RDP, click the start button, and type mstsc.exe in the search box and press enter.



14. Enter the name of the VM you created and click connect



15. Click Use another account to enter local administrator credentials you set up when creating the VM, click ok, enter local administrator user id and password, click ok.



16. Accept the warning message by clicking yes



You are now the administrator on your very own Windows Server 2008 Virtual Machine.

To access SQL Server Management Studio connect using SQL Server Authentication with the user ID sa and password pa55w0rd!

## Appendix V: VM Creation Swimlane Diagram

