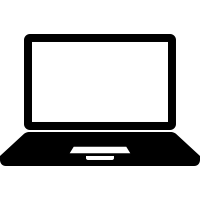
# INFO603 Systems Administration – Practical Project Implementation Book

## Quick Access table

|  |
| --- |
| [Section 1](#_Section_1:_installation) installation and configuration |
| [Section 2](#_Section_2:_Network) Admin tools and network services (DHCP, DNS, WINS, IIS) |
| [Section 3](#_Section_3:_Active) Active Directory |
| [Section 4](#_Section_4:_File,) Files Folders and DFS |
| [Section 5](#_Section_5:_Remote) RDP and monitoring |
| [Section 6](#_Section_6:_Group) Group Policy |
| [Section 7](#_Section_7:_Printing) Printing |
| [Section 8](#_Section_9:_Windows) WDS |
| [Section 9](#_Section_8:_Managing) Hyper-V VMs |

## Project overview

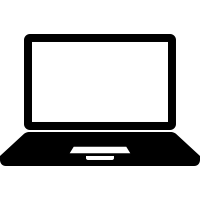
* This project can be done in pairs or individually. Ensure that work is distributed evenly between members.
* It is advised to use your personal laptop to create server virtual machines (VMs) so you can work outside of class as well. If your laptop does not have wired network adapter you can get USB to ethernet adapters.
* If you use the classroom PC you will need to provide your own external drive to store you VMs.
* Bridge any VMs to the physical device’s wired Ethernet adapter and connect to the room’s blue/green port. A standard network switch will be provided to each group.
* The client machine can be a VM on any room PC.
* Do not move your server VM to a different physical host as this is unlikely to work with for a domain controller
* Use VMware workstation professional. Instructions on how to get this on your laptop are provided on Moodle.
* In this project we will be installing many features on each server due to minimize the resources you need. In practice there will be more servers and the domain controller, file server and RD gateway would be on different machines
* Don’t forget to document your project in the project documentation template as you doing the practical work as it is easy to forget what you did.



Server 1 VM



2 Windows 10 Client VMs



Server 2 VM

## Project Diagram

## Section 1: installation and initial configuration

DO NOT use Rexnet network

Use switch provided by tutor

### Goals

Complete the following implementation tasks for both WS1 and WS2:

* Create 2 server virtual machines and install Windows Server 2019 Datacenter.
* Create 1 client machine and install Windows 10
* Set the default administrator user password, time-zone, date-time format and power settings.
* Design a Class B IP addressing scheme for your network and configure the manual IPv4 address configurations.
* Use the control panel to discover and configure settings
* Set a Windows Registry variable
* Turn windows firewall/defender off
* Cable the network and test ping connectivity between devices.

### Implementation steps

1. Install VMware Workstation Professional (VMware) on your laptop/device using the supplementary instructions.
2. Install Windows Server 2019 Data Centre (Desktop experience) virtual machine using VMware and the ISO files provided by your tutor.
   1. Minimum Hard disk size: 40GB
   2. Bridged network adapter – to physical network adapter
   3. Minimum RAM: 4GB
   4. Multi-file
3. Set the following on each server using the control panel:
   1. **Your user and the default Administrator user password: Router01 (**blank by default)
   2. **Give each server a computer name: WS1 or WS2 respectively**
   3. Timezone: Auckland, NZ
   4. Calendar: Gregorian
   5. First day of week: Sunday
   6. Short date format: e.g. 5/4/2021
   7. Long date format: e.g. Wednesday, 5 April 2021
   8. Time format: e.g. 9:40:07 AM
   9. Power: High performance plan
4. Design the IP addressing scheme for your network and manually configure:
   1. IPv4 address
   2. Subnet mask
   3. Leave default gateway blank
   4. DNS server: WS1 IP address
   5. Alternate DNS server: WS2 IP address
5. Turn on Network discovery and file sharing through the control panel
6. Find the default settings for ‘**processor scheduling’** and ‘**Data prevention and execution’** in Control Panel.
7. Update any required drivers for any hardware components highlighted in Device Manager.
8. Set the HKEY\_CLASSES\_ROOT->.ac3 windows registry settings to: **audio**.
9. Cable the network as indicated in the project diagram.
10. Turn Windows firewall/defender off
11. Use command prompt to ensure WS1, WS2 and the client VMs are connected.

### Internet resources

* Create Virtual machine in VMware
* <https://www.youtube.com/watch?v=BHpRTVP8upg>
  + Alternative: Create a Virtual machine in virtual box
  + <https://www.youtube.com/watch?v=Rag4LDoBUC0>
* Install Window server on VM
* <https://www.youtube.com/watch?v=7LxauswRUoE>
* Date and time format
* <https://www.youtube.com/watch?v=al0aBV6n9O0>
* Windows Power settings
* <https://www.youtube.com/watch?v=y0R8eZ7enwY>
* Control panel settings
* <https://www.microsoftpressstore.com/articles/article.aspx?p=2201312&seqNum=5>
* Device Manager
* <https://docs.microsoft.com/en-us/troubleshoot/windows-server/deployment/use-device-manager-configure-devices>
* Windows Registry
* <https://www.computerhope.com/issues/ch001348.htm>
* IPv4 addressing and subnet masks
* <https://www.youtube.com/watch?v=rsxT4FfRBaM&t=275s>
* <https://www.youtube.com/watch?v=L3dsWxn5RBU>
* <https://www.youtube.com/watch?v=LIzTo6e4FgY>
* <https://www.youtube.com/watch?v=hb2yTNT2rBU>

## Section 2: Network services and admin tools

### Goals

* Configure the following network services on both WS 1:
  + Domain Controller
  + Dynamic Host Configuration Protocol (DHCP)
  + Domain Name System (DNS) – primary
* Configure the following on WS2:
  + Domain controller with a child domain of WS1
  + DNS secondary
  + Windows Internet Name Service (WINS)
  + Webserver: Internet information services (IIS) with a customized webpage for your organization linked to your domain name
* Configure a one-way trust from WS1 to WS2 domain
* Join windows client machine VM to the domain

### Implementation steps

1. Use Server Manager to add AD DS role to WS1
   * Log in as the local Administrator user and ensure the password is set to Router01
   * Make sure your IP address is manually configured and can ping all nodes
   * Install Active directory domain services (AD DS) role
   * Create a unique domain name in a new forest: yourdomainname.com
   * Use the default functional groups. What is the value and purpose of this?
   * What happens to your local user accounts when your make your server a domain controller?
2. Use Server Manager to add the DHCP role on WS1

* Use DHCP manager to configure the following IP address parameters that will be dynamically provided to network clients:
  + Pool range: IPv4 addresses defined by addressing scheme in section 1
  + Exclude the manually IP address of WS1 and WS2 from your pool. Why?
  + SNM: defined by IP addressing scheme
  + Default router: WS1 IP address
  + Domain name: your\_domain.com
  + DNS server: WS1 IP address
  + Alternate DNS server WS2 IP address
  + WINS server WS2 Ip address
  + Verify clients are automatically learning the dynamic IP address configurations using the client’s command prompt and DHCP manager

1. Use Server Manager to add the DNS role on WS1

* Use DNS manager in server manager tools to see the IPv4 Forward lookup zone:
  + This should be automatically configured when you install the role
  + What are the default entries?
  + Primary zone (WS1) to all DNS servers in forest
  + Zone name: yourdomainname.com
  + Do not allow dynamic updates
* Use DNS manager to create new:
  + IPv4 Reverse Lookup zone
  + Create new DNS records: Host A (www) and PTR records linked to your WS1 IP address
  + Use the nslookup command prompt tool to verify the above DNS configurations

1. Add the Windows client to the domain on WS1. Remember to turn off the firewall and check that it is learning the DHCP address before joining the domain
2. Make WS2 a domain controller as well - with a unique child domain names
   * Install Active directory domain services (AD DS) role

* The domain on WS2 will be a child of WS1 e.g child.yourdomain.com.
  + - Child domain will be in the existing forest and site.
    - Will need to be authenticated by parent domain using the administrator domain and password
    - DNS delegation
    - NetBios name: YOURDOMAIN
    - (Create DNS conditional forwarders for each domain controller point to the parent domain and WS1 using the DNS manager)
    - Ensure firewall settings are disabled

1. Install DNS role on WS2 as you did with DS1 and add it as a second name server on WS1
2. Configure a one-way trust with from the Parent to the child domain using the Active directory domains and trusts tool and the following properties:

* External trust (non-transitive)
* One way outgoing
* This domain only
* Selective authentication
* Trust password: Router01
* What is the default trust relationship between and parent and child trust?

1. If resources are available: Join a separate windows 10 client machine VM to the Child domain and verify all rights and configurations are correct.
2. Use Server Manager to add the WINS role on WS2
   * Add the WS1 IP address to the manual IPv4 properties settings (Advanced->WINS tab)
   * Use the WINS tool to display the current active registrations
3. Use Server Manager to add the IIS role on WS2
   * Create an customized index.html file and store it in the webservers root directory
   * Use IIS manager->default website
   * Remove iistart.html file and add your index.html file in the ‘Default documents’ section
   * Access webpage from your client’s web-browser

### Internet resources

* Server Manager
* <https://www.youtube.com/watch?v=mpQZVYPuDGU>
* <https://www.youtube.com/watch?v=rq-Dqjb_LGU>
* Create Domain controller
* <https://www.youtube.com/watch?v=Wa7yqCNAlBo>
* DHCP configuration
* <https://www.youtube.com/watch?v=fUK6d3s1Im4>
* Join a client to a domain
* <https://www.youtube.com/watch?v=86TU6wZfPfk>
* DNS configuration
* <https://www.youtube.com/watch?v=-TsqAHUWdQU>
* nslookup CMD tool for DNS
* <https://www.youtube.com/watch?v=_6q3wiYzbXg>
* WINS configuration
  + <https://www.youtube.com/watch?v=CBsU92nraDk>
* Create Parent-child domains and AD replication
* <https://www.youtube.com/watch?v=1vWSKLX0Xrk>
* Create One-way trust
* <https://www.youtube.com/watch?v=URamc3rfv1Y&t=252s>
* IIS webserver configuration
* <https://www.youtube.com/watch?v=gEn8j9vkaMU>

Other useful configuration links for your reference – not directly used in this configuration

* Create two-way forest trusts
* <https://www.youtube.com/watch?v=Cud41sE2KHI>
* Sites and subnets
* <https://www.youtube.com/watch?v=Hk_nrQ6T_sE>

## Section 3: Active Directory

All group members work together for this section

### Goals

* Use Windows Admin Center to manager a domain controller
* Remove child domain and have two DCs on a single domain
* AD replication between domain controllers
  + Specify AD replication interval and schedule
* Make WS1 the Global catalog server
* Configure AD OU, groups and users according to a defined company structure on WS1
* Restrict user access to weekdays only
* Use Best Practices Analyser (BPA) scan to ensure services from the previous section is working properly
* Create a checkpoint of server VMs

### Implementation steps

1. Use BPA scan on WS1 - start BPA scan
   * What information is received?
2. Delete child domain from WS2
3. Use Windows Admin Centre (WAC) on WS2
   * Google search for WAC and download the latest version and install it
     + Generate a self-sign certificate
     + Use default port number 443
     + What is the URL provided to access WAC for your server?
   * Note this cannot be added to a domain controller
   * Access it from a client web-browser
     + Add the server name WS1
     + Create a new folder in WS1 and download it WS2
     + Restart the DHCP service on WS1 via WAC
     + What information cab be changed at the menu items: firewall, network, roles, updates, files, devices, services, and local users & Groups?
4. Remove WAC role once confirmed that is working correctly from WS2 as we want to make a domain controller now
5. Make WS2 a second domain controller in the dileep1 domain
6. Ensure AD replication between the domain controllers (Every 180 minutes)
7. Remove the WS2 global catalog ability from WS2 but leave it on WS1
8. Check the current domain and forest functional levels to Windows server 2016 user Server manager using the Active directory domains and trusts tool
9. User AD sites and services to remove global catalog from WS2 (it should be enabled for WS1 only
10. Use Active directory users and computers to:
    1. Verify that the client computers have been added to the domain
    2. Verify that WS1 and WS2 are domain controllers for the same domain
    3. Configure AD OU, groups and users (one user per group) on WS2
       * OU Staff
         + Universal user that can log in to both domains
         + OU: DevelopersOU
         + Group: Developers
       * OU: ManagersOU
         + Group: Managers
       * OU: AccountsOU
         + Group: Accounts
11. Restrict Developer user access to weekdays only
12. Test that users can log correctly from the client node
13. Use VMware to create a checkpoint of WS1 and WS2. May need to revert back to this if any issues happen in project 4

### Internet resources

* BPA scan
* <https://docs.microsoft.com/en-us/windows-server/administration/server-manager/run-best-practices-analyzer-scans-and-manage-scan-results>
* Add DC to exisiting domain and AD replication
* <https://www.youtube.com/watch?v=-R7Ryy7-4e0>
* Set Functional levels
* <https://www.youtube.com/watch?v=-R7Ryy7-4e0>
* Global catalog
* <https://www.rebeladmin.com/2015/07/how-to-enable-universal-group-membership-caching-ugmc/>
* Create AD objects: OU, groups, users
* <https://www.youtube.com/watch?v=cETbT22TWEE>
* Windows admin center
* <https://www.youtube.com/watch?v=E39_MzvCFXA>

## Section 4: File, folders and DFS

### Goals

* AD group rights/permissions to folders.
* Specify a file attribute.
* Create a Distributed File System (DFS).
* Create Shared folders (SMB, NFS and published in AD).
* Create and apply quota and filescreen restriction templates.
* Configure data deduplication.
* Configure the Windows server backup utility according a daily schedule.

### Implementation steps

1. Create a companyDocs folder on C drive of WS2
2. Inside companyDocs - Create three folders with a file in each folder

* Developers folder
* Managers folder
* Accounts folder

1. Assign the following AD group permissions/rights for each folder:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Developers group** | **Manager Group** | **Accounts Group** |
| **Developers folder** | Full | Full | Read only |
| **Managers folder** | No Access | Full | Read only |
| **Accounts folder** | No Access | Read only | Full |

1. Enable the ‘encrypt’ attribute for the managers and accounts folders
2. Log in as each user on the windows client and test the access to these folders is correct
3. Create a Distributed File System (DFS)

* Create DFS domain-based namespace
* Add both WS1 and WS2 as namespace servers
* Create new target that points to the companyDocs folder
* Create a folder of WS2 called companyDocs Replica
* Replicate DFS namespace on both servers
* Test that folders created locally on both servers are replicated on the other

1. Create three shared folders on WS1. Each folders is shared in a different way:

* Server Message Block (SMB) using server manager – Called ‘WDS images’ – will be used in section 9
* Network File System (NFS) - called LinuxFiles with read and write permissions
* Folder called ‘Applications’ published in AD – used in section 6
* What is the difference between these sharing methods?
* Access shared folder from a network client machine

1. Configure the following for restrictions and save them as templates:

* Folder quota for the Developers and all shared folders: 1GB
* Filescreen for the Accounts folder: audio, video, backup, image, office and text files only

1. Configure data deduplication

* Add additional virtual hard drive to vm using VM settings
* Create new volume E:\ to this drive
* Create a folder called dataDedup on this new volume
* Enable and configure

1. Configure Windows server backup of all shared folders on WS1 to WS2

* Create a folder on ws2 where backups will occur called ‘shareFoldersWindowsBackup’
* Custom backup of C drive
* Fast performance
* Schedule for backup to happen at demonstration and then once everyday

### Internet resources

* SMB
* <https://www.youtube.com/watch?v=37Kx9oiJKTQ>
* NFS
* <https://support.microfocus.com/kb/doc.php?id=7020834>
* <https://www.youtube.com/watch?v=PQIMg-Xc2es>
* Publish shared folder in AD
* <https://www.youtube.com/watch?v=jxyvJGNzNJU>
* <https://www.youtube.com/watch?v=aS-gW3yusgU>
* AD group permissions to folders
* <https://www.youtube.com/watch?v=gdmq5qOrVck>
* DFS
* <https://www.youtube.com/watch?v=yDvbOsJIFpE>
* Folder quotas
* <https://www.youtube.com/watch?v=XLhqTV3GgoI>
* <https://www.youtube.com/watch?v=1btOISN4gE4>
* Filescreen
* <https://www.youtube.com/watch?v=kZiUe6HxsmE>
* Window server backup
* <https://www.youtube.com/watch?v=lqjrF7f_eI4>
* Data Deduplication – need multiple drives
* <https://www.youtube.com/watch?v=_jYOWx1Gg0A>

## Section 5: Remote access and monitoring

### Goals

* Configure and use Remote Desktop (RD) Session-based desktop deployment on WS2
* Configure and use RD web access on WS2
* Configure and use RD connection broker for WS2
* Restrict RD access to specific AD groups
* Make WS1 and RD gateway to R2 and connect from Rexnet/Wintec computer
* Use the following built-in server monitoring tools:
  + Performance monitor
  + Task Manager
  + Resource Manager
  + Event viewer
  + Reliability monitor
  + Set local server performance alerts

### Implementation steps

1. Ensure WS1 has two network adapters. One connected to the Rexnet network and one connected to your internal network. It should also be a domain controller and IIS webserver.
2. Create a shared folder called certificates on WS1 that can be accessed by all users from the domain.
   * Can be accessed from WS2
3. Add the remote desktop service on WS2
   * Note this is the service not the role
   * Standard deployment
   * Enable the following services:
     + RD web access
     + session-based desktop deployment
     + connection broker
4. Add servers: WS1 to WS2 and vice versa
5. Add RD gateway role to WS1.
   * Specify WS1 to be the RD gateway
   * Specify the SSL certificate name (you will create this later): WS1\_hostname.your\_domain
   * It takes time to install but once it is done you will see this role appear on WS1
6. Create a self-signed certificate with the name from the previous step and save it in the shared folder. Name it the same as the FQDN of WS1
7. Create CAP and WAP policy that restricts access - so only Manager and accounts users can use RD to access WS2
8. Use the remote desktop application on a random Rexnet/wireless client to RDP into WS2 through the RD Gateway.
   * Hints: use FQDN of WS1 for the RD gateway settings, which should be the same as the certificate you created
   * You may need to add an entry on the rexnet client’s local machine linking the FQDN of WS1 and it’s external IP address
   * Save the SSL certificate to the trusted root certification authorities folder on the rexnet client when prompted
9. Access WS2 from an internal client using RD web
   * Add RDApp programs that are accessible via the internet e.g. calculator and Server Manager
   * Add SSL certificate to the RD web and client PC
10. Use the following server monitoring tools on both servers and take screenshots at that point in time
    * Task Manager and resource manager
      + What application is using the most CPU and memory?
      + Which user is using the most CPU and memory?
      + Disk usage statistics
      + Network TCP connections
    * Performance monitor
      + Add three features to monitor and explain why you chose them
      + Collect system diagnostic data
      + Create a new user-defined data collection set
        - collect data
        - Set performance counter alert-> processor time and log entries in the application event log
    * Event viewer
      + See errors for the data collection set defined above
    * Reliability monitor
      + What is the average rating value (between one and ten) for your server over the last week?
      + Were there any major fluctuations?
    * Set local server performance alerts
      + Set two alerts and explain why you chose them

### Internet resources

* Remote desktop
* <https://www.youtube.com/watch?v=oIos0TbZfjY>
* RD gateway
* <https://www.youtube.com/watch?v=WD2jUQy32DI&t=921s>
* <https://www.youtube.com/watch?v=h080znhuj8o>
* RD Web Access
* <https://www.youtube.com/watch?v=2PTQIm9jmD4>
* WS built-in monitoring tools
* <https://www.youtube.com/watch?v=w_3E5w7qzHY>
* Performance monitor
* <https://www.youtube.com/watch?v=CagTiRYmj58>
* Monitoring Tools
* <https://www.youtube.com/watch?v=w_3E5w7qzHY>

## Section 6: Group policy and security

### Goals

* Configure and test Group Policy objects (GPOs) for Software settings, Windows settings and Administrative templates
* Link GPOs to AD objects
* Enforce GPO inheritance
* Configure Windows server update services (WSUS) on WS1
* Configure and test Windows defender firewall rules

### Implementation steps

1. Where do you find and edit GPOs? What are the default GPOs present before any custom configurations?
2. Enforce the Default Domain policy inheritance. What does this do?
3. Configure Group Policy objects and link to the appropriate AD objects (OU/group) on WS2:
   * Note you may need to delete the Filescreens created in a previous section to be able to do the following. The VM will also require a restart.
   * Administrative templates
     + Create a shared folder called wallpaper and save two .jpg files. All groups read access
     + Create **group-specific** desktop wallpaper for each group
     + Disable access to the Control panel and command prompt for Accounts users only
   * Windows settings
     + Set maximum password age and length for all users
     + Set account lockout threshold and reset lock counter values
   * Software settings :
     + User configurations: set one application to be assigned for the developers group only
       - Create a shared folder and assign all groups to have read access to it
       - Save and application .exe in the shared folder called ‘applications’ in section 4
       - Convert .exe to .msi using a free third-party tool and save it to the applications folder
       - What is the difference between assigned and published applications?
4. Apply GPOs using the Command prompt
5. Login as different users to test the GPOs above
6. Configure Windows server update services (WSUS) on WS1
   * Add WSUS role to WS1
   * Ensure WS1 has a second virtual network adapter that is bridged to a physical adapter connected to the internet e.g. your wireless adapter on your laptop
   * Configure such that updates are
     + Save to E: drive (second virtual hard-drive you created in project 4)
     + Synchronised with Microsoft
     + no proxy
7. Create a new Windows Defender Firewall inbound rules to only allow traffic required by the previous sections of this project and block any other traffic
   * What ports did you allow and why?
8. Test that expected traffic is allowed into the server and unwanted traffic is blocked

### Internet resources

* Create and Link GPOs
* <https://www.pcwdld.com/group-policy-management>
* GPO Administrative templates
* <https://www.youtube.com/watch?v=Afzd9AgU57U>
* GPO Desktop wallpaper
* [Deploy Desktop Background Wallpaper using Group Policy](https://www.youtube.com/watch?v=GWe1xZr0llc)
* GPO Windows settings
* <http://woshub.com/password-policy-active-directory/>
* GPO Password
* <https://www.youtube.com/watch?v=buZewCeg_cY>
* GPO Account lock
* <https://www.youtube.com/watch?v=lMwYUW-0iDA>
* GPO software settings
* <https://www.youtube.com/watch?v=fMk31AcMF0Q>
* <https://community.spiceworks.com/how_to/159566-how-to-deploy-software-packages-via-gpo>
* WSUS
* <https://www.youtube.com/watch?v=2olvZOgn0LQ>
* WSUS GPO
* <https://www.youtube.com/watch?v=Yv0qjxdX5yw&t=441s>
* Windows Defender firewall
* <https://www.youtube.com/watch?v=o4KXp9Wefbw>

## Section 7: Printing

### Goals

* Install and configure a print server on WS2
* Add a shared printer

### Implementation steps

* WS2 is already a server but if not, you would need to make sure the Print server machine is in the server’s OU in Active directory
* Add Print and document services role with server manager and select the printer server option when required
* Use print management tool
* Add drivers for the printer
* Add port and IP address of printer
* Add printer device to the server
* Add printer device to the client machine

### Internet resources

<https://www.youtube.com/watch?v=pqxvlkuITfE>

## Section 8: Windows Deployment Services (WDS)

### Goals

* Deploy an Operating system image to blank VM client using WDS
* Create a customised image using sysprep and WDS capture images

### Implementation steps

1. Ensure the Active Directory Domain Services (Domain controller), DHCP and DNS server roles from section 2 are working properly on WS1
2. Extract the ‘boot.wim’ file and all ‘install.wim’ files from from a Windows 10 ISO file
3. Extract install.wim file from a Hyper-V server core ISO file
4. Add the WDS role to WS1
5. Use the WDS manager tool to install one boot image and multiple install images into one install group
6. Create a new client VM on the network with no OS or iso file connected
   * Ensure it is bridged correctly to the receive information from your physical network
   * It should receive a DHCP address
   * Press f12 to PXE boot from the network
   * Log into to your domain
   * Select the Windows 10 install image i.e. the operating system you wish to install on this new VM node
7. Make some changes on the new VM and save changes to Sysprep (this creates a customised image)
   * Create a capture image in WDS Manager boot images folder and save to specific folder
   * Reboot your client -> pxe boot->select capture image to create a customised image
     + Specify to upload to WDS server to shared folder (WDS images created in section 4)
   * Reboot-> PXE boot and select the original boot image to see the customised image

### Internet resources

WDS

* <https://www.youtube.com/watch?v=8Dyt14tFk0M>
* <https://www.youtube.com/watch?v=VNyk2zlhZpg>
* [http://www.technig.com/how-to-install-and-configure-wds-in-Windows-server-2012-r2/](http://www.technig.com/how-to-install-and-configure-wds-in-windows-server-2012-r2/)

Sysprep capture image

* <https://www.youtube.com/watch?v=Q4mWs-slUag>

## Section 9: Managing VMs

### Goals

* Create a Linux virtual machine (VM) using Hyper-V manager
* Create a VM Checkpoint
* Replicate the VM
* Configure and perform a Live Migration of a VM
* Create a VM template using Sys prep utility

### Implementation steps

1. Ensure your Virtual machine settings have Intel-VT or AMD-V Virtualisation extensions enabled
2. Use Server Manager to install the Hyper-V server role on both servers
   * Link to physical network adapter
3. May need to reset manual IP addresses of servers after Hpyer-V manager installation
4. Create an external virtual switch that is bridged to the physical network card using Hyper-v manager if not done by default
5. Create a Generation 2 virtual machine (VM) using Hyper-v manager
   * Connect to your external virtual switch
   * Use a Linux ISO file (free download) e.g. Tiny core or Ubuntu
6. Change some settings on the Linux VM and create a VM Checkpoint using Hyper-v manager
7. Replicate the VM on to the other server WS1 using Hyper-v manager
   * Enable WS2 as a Replica server in the Hyper-V settings of the VM (Replication configuration)
     1. User Kerberos (HTTP) authentication on port 80
     2. Use default path to specify a location to store replica files
   * On WS1:
     1. Select enable replication on the VM in Hyper-V manager
     2. Choose the WS2 replica server
     3. Specify the replication frequency to be 15 minutes
     4. Maintain only the latest recovery point (24 hours)
     5. Send initial copy over the network
8. Configure and perform a Live Migration of a VM from WS2 to WS1
   * Start the VM on WS2
   * Add the Microsoft Virtual System Migration Service to the AD computer properties of WS2
   * Enable incoming and outgoing live migrations in the Hyper-V settings of the VM
   * Add IP address of both servers
   * Ensure the firewall allows this service
   * Create folder on WS1 where the VM will be transferred to
   * Restart WS1
   * On WS1 choose the Move option and choose the option to move to a single location
9. Create a VM template
   * Install Sys prep utility (out of box experience, reboot)
   * Export the VM in Hyper-V manager and save template to specific location
   * Create a VM based on that template

### Internet resources

* Create virtual switch
* <https://www.youtube.com/watch?v=cGlrw4P-VUQ>
* Create VM in Hyper-V manager
* <https://www.youtube.com/watch?v=_liDPu7zz3I>
* Create Checkpoint
* <https://www.youtube.com/watch?v=ZioPE02_j1w>
* Create VM templates
* <https://www.youtube.com/watch?v=mPQF2PhkA_0>
* Perform VM replication
* <https://www.youtube.com/watch?v=HyAmfRXp6hc>
* Perform VM Live migration
* <https://www.youtube.com/watch?v=zD1ua3wQlRs>