Windows Server Operating System

Operating system

1. Server OS - which SERVES - ex: o windows server NT o windows server 2003 o windows server 2008/2008R2 o windows server 2012/2012R2 o windows server 2016 o windows server 2019 o windows server 2022 o windows server 2025	2. Client OS - sends requests - ex: o Windows XP o Windows Vista o Windows 7 o Windows 8 o Windows 8.1 o Windows 10 o Windows 11

Active Directory

- It's a directory service that stores user's information.
- AD performs 2 "A"
    - Authentication
    - Authorization

DHCP

- Dynamic Host Configuration Protocol
- The job is to provide IP address to client dynamically.

DNS

- Domain Name System
- The job of DNS is to resolve names to IP.

Group Policy

- Allow you to manage the users and computers within an organization.

Domain → for companies

- It is a logical administrative boundary of an organization.
- You (admin) can control anything and everything within this boundary.
- If any server/client/computer is domain-joined, then this system is totally controlled by the domain admin.
    - Changing the wallpapers.
    - Disabling the USB ports.
    - Disabling the control panel
    - Enabling/forcing the firewall.

Workgroup → individual users

- It is a standalone machine (its not part of any domain)
- It can be managed by the local admins

After the installation of a new windows server OS: - "**Post Installation Configuration**"

- ✓ Set the IP address.
  - Dynamically using "DHCP server". OR
  - Manually → "ncpa.cpl"
- ✓ Change the date and time zone
- ✓ Disable the firewall (req. in testing environment). Never do this in production.
  - Public Firewall
  - Private firewall
  - Domain firewall (only after the domain joining of the computer).
- ✓ Change the computer/system name → Reboot your computer.

Note – *These settings must be updated on DC, Node01 and Node02 machines.*

For DC machine:

- IP address: 192.168.10.10
- Subnet Mask: 255.255.255.0
- Default gateway: 192.168.10.10
- DNS: 192.168.10.10
- Hostname: DC
- Firewall: OFF

For Node01 machine:

- IP address: 192.168.10.11
- Subnet Mask: 255.255.255.0
- Default gateway: 192.168.10.10
- DNS: 192.168.10.10
- Hostname: Node01
- Firewall: OFF

For Node02 machine:

- IP address: 192.168.10.12
- Subnet Mask: 255.255.255.0
- Default gateway: 192.168.10.10
- DNS: 192.168.10.10
- Hostname: Node02
- Firewall: OFF

Ping using IP/Name

- DC ←→ Node01
- Node01 ←→ Node02
- Node02 ←→ DC

Adding disk(s) on → DC machine

- Add a new disk using VMWare workstation
- Go to disk management console
    - Right-click on Windows icon and select Disk management.
    - Run → “diskmgmt.msc”
- Right-click on the new added disk, select “Online” option.
- Again right-click on this disk and select “Initialize Disk”.
- Right-click on the disk and create a new simple volume.
- Go to this PC and verify.

MBR	GPT
• Master Boot Record • Old way to create partitions on an HDD. • Primary partitions: 4 • Supports HDD capacity up to: 2TB	• GUID (Globally Unique Identifier) Partition Table • New way to create partitions on an HDD. • Primary partitions: 128 • Supports HDD capacity up to: 18Exabytes

Tasks

- Create a total of 3 VMs
    - Domain controller (DC)
    - Nodes (Node01 and Node02)
- Perform the post installation on all the 3 VMs.
- Ping all the 3 VMs using IP address.
- Add 2 disks, each of 10GB and ensure that the disks are in GPT format on domain controller (DC) machine.

Installation methods of Windows Server:

- DVD / ISO file
- WDS (Windows Deployment Service) – Network-based installation
    - WDS is a role and thus it will be installed only on a server OS.
- Pen drives

Server Manager Dashboard Page:

- Dashboard page is a graphical tool (GUI).
- You can manage your local system and remote systems as well.
- We can manage:
    - Local computer (post-installation configuration)
    - Install, uninstall a role or a feature in your local machine.
    - Install, uninstall a role or a feature in your remote machine.
    - Manage disks
    - Look and manage the logs, events.
- Alternative is PowerShell (commands, scripts).

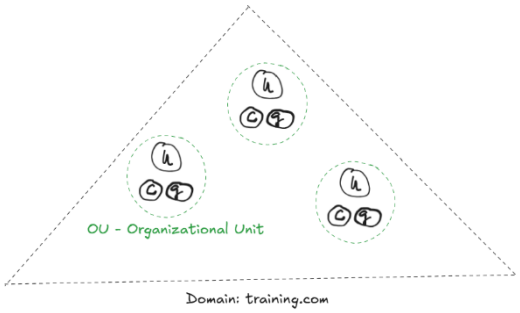
Administrative tools:

- Active directory Administrative Center
    - Manages the users, computers, groups, group policies.
- Active directory users and computers
    - Manages the users (create, modify, delete) and computers.
- DNS Console
    - Manages the DNS records
- Performance Monitor (Perfmon)
    - This looks into the performance of your computers.
- Task Schedular
    - Schedules the task.
- IIS Manager
    - Creating and updating the web pages.
    - Helps in creating the SSL certificates.

Windows Active Directory (WAD):

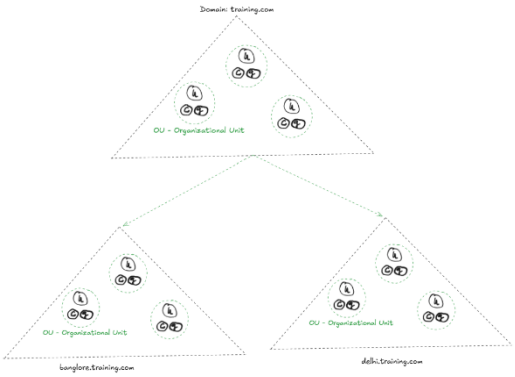
- Aka Active Directory (AD)
- It's a directory service developed by Microsoft.
- To store the users, computers information
- It stores the objects:
    - Users
    - Groups
    - Computers
- AD performs:
    - Authorization
    - Authentication
    - Accounting
- You can manage:
    - Network resources
    - Policies
    - User accounts
    - What users can "access".
- To achieve all this, we need to install a role "**Active Directory Domain Services (AD DS)**".

Terms used in AD / AD Concepts:



Domain

- It is the logical administrative boundary of an organization.
- In a diagram, it is represented by a 'triangle'.
- A domain is a collection of domain objects:
    - Users
    - Computers
    - Groups
- These objects are stored in a database 'NTDS.DIT'.
    - NTDS.DIT = New Technology Directory Service.Directory
- Questions
    - List the domain objects
    - What is the database name of Active Directory.



Tree

- It's the hierarchy of domains and sub-domains
- It's the collection of various sub-domains.

Forest

- Forest is the collection of trees.
- It shares the same schema (blueprint)

Schema

- It's the blueprint
- This defines the type of objects (user, computer and groups) created in the AD.

Organizational Unit (OU)

- It's like a department
- These OU contains
    - Users
    - Computers
    - Groups
- There are some pre-defined OUs created, after creating a domain.

Global Catalog (GC) Server

- GC is a searchable index for quick search of any object within domain.
- This GC gets installed during the promotion of a domain controller.

Site

- It refers to the physical, geo-graphical location within a domain.
- Ex:
    - BLR.training.com, Delhi.training.com, India.training.com

Group Policy

- It's a policy which is applied on the domain objects.
- This policy can centrally manage:
    - Users, Computers, Groups
    - Login time
    - Files and folder access permissions
    - Security, Wallpapers, Drive access.

AD Components:

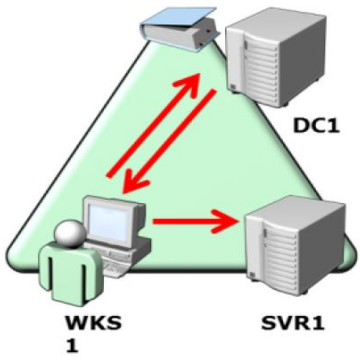
1. **Physical component**
    a. *Domain Controller (DC)*
        i. It controls the domain.
        ii. It's a server machine that manages the complete domain.
        iii. It contains the AD database file (NTDS.DIT)
    b. *Data store*
        i. Data store is a file on domain controller that stores the AD information.
    c. *Global Catalog server*
        i. It's a server that host "read-only copy" of all objects for quick search.
    d. *Read-Only Domain Controller (RODC)*
        i. RODC is a special type of DC.
        ii. We cannot write anything to this RODC, but we can only READ from it.
        iii. RODC is useful in the branch offices.
2. **Logical component**
    a. Partition
        i. Logical sub-division of the NTDS.DIT database.
    b. Domain
        i. Logical admin boundary
    c. Trees
        i. Collection of domains
    d. Forest
        i. Collection of trees
    e. Site
        i. Physical location
    f. OU
        i. Like a department.

Types of domain controllers (DCs)

- Domain controller (DC)
- Additional Domain Controller (ADC)
- Backup Domain Controller (BDC)
- Read-Only Domain Controller (RODC)
- Primary Domain Controller (PDC)

AD Logon process:

- User provides username and password and then it gets authenticated by DC.
- DC returns the TGT (Ticket Granting Token).
- Using this TGT, client/user applies to login to the WKS.
- Client is then allowed to login to SVR1



Operation Masters

- Aka FSMO (Flexible Single Master Operation) roles
- This is a special type of domain controller role, that allows only one DC to perform any job without any conflict.
- There are 5 FSMO roles
- These FSMO roles are applied on
    - Forest-level
        - Domain Naming Master
        - Schema Master
    - Domain-level
        - RID Master
        - PDC Emulator/Master
        - Infrastructure Master

Domain Naming Master

- ✓ Adding a new domain to the forest.
- ✓ Removing an existing domain from the forest.
- ✓ Present One-Per Forest.

Schema Master

- ✓ Present One-Per Forest.
- ✓ Control all the updates and modifications to the AD schema.
- ✓ One-blue print through-out forest.

RID Master

- ✓ Relative Identity (ID) Master
- ✓ One-per domain
- ✓ It provides a set of (500 RID) and allocate these individuals RIDs to every domain object.
- ✓ Without RID, you cannot create new users, computers or groups within a domain.

PDC Emulator

- ✓ Makes your machine back compatible.
- ✓ It handles the password change.
- ✓ It also manages the account lockout.
- ✓ It maintains the time across the domain.
- ✓ Useful during the authentication of the user, GPO updates, time sync.
- ✓ One-per domain

Infrastructure Master

- ✓ Related to the updates of objects in another domain.
- ✓ Cross-domain object reference.
- ✓ One-per domain

How to create a Domain Controller (DC):

- ✓ You need to install a Windows Server OS.
- ✓ Then perform the post-installation configuration:
  - Change computer name → DC
  - Change the IP to static IP → 192.168.10.10
  - Change the firewall → OFF
  - Change the time zone → +05:30 …
- ✓ You need to install the AD DS role on DC machine.
  - GUI → Server Manager Dashboard page
  - CLI → PowerShell command
- ✓ Promote this server to "Domain Controller"
- ✓ Fill the details of domain:
  - Domain name: Training.com
  - GC, RODC …
- ✓ Restart the DC machine, and after restart login with domain admin.
  - Local administrator → administrator
  - Domain administrator → domain_name\administrator
    - Ex: training\administrator OR
    - administrator@training.com

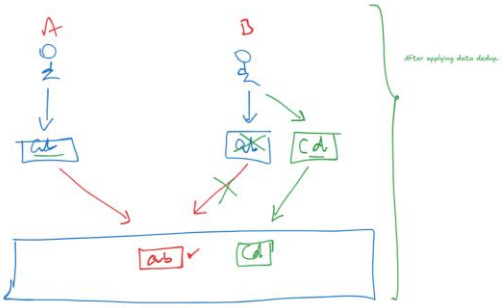
Storage Spaces:

- Storage spaces allow you to virtualize the storage on your server.
- In this, we pool (club/combine) multiple disks together to form one single-unit.
- Storage pool – is a collection of various physical disks.
- Thin provisioning – allocate the disk size as per requirement.
- Minimum requirement:
    - 2 identical disks are needed for simple/mirror volume.
    - 3 identical disks are needed for parity disks.
- To manage storage spaces:
    - Server manager dashboard page
    - PowerShell cmdlets
    - Windows Admin Center
- Steps to create a storage space → "DC machine"
    - Add 2 physical disks to you DC machine → "Unallocated disks"
    - Create a "storage pool" from these 2 disks.
    - Create a "virtual disk" (storage space) from this pool.
    - Select resiliency, size, provisioning type.
    - Format this new disk into required file system
        - FAT32 (File Allocation Table)
        - NTFS (New Technology File System)
        - ReFS (Resilient File System)
    - Assign a drive letter to it.
    - Then start using it.

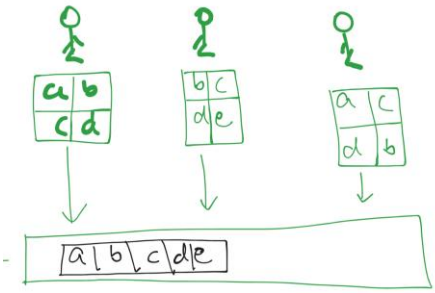
Question – add 3 disks on windows server and create one storage space volume from it and ensure to use a parity to create a disk. Link

Data Deduplication

- It's a built-in feature.
- Aka "Dedup".
- It helps in identifying and removing the duplicates from the HDD, allowing us to save only ONE copy of the data.
- Useful in:
    - Backed up file and directories
    - File shares
    - Shared folders
- Dedup is of 2 types:
    - File-level deduplication



        - It maintains copy of every single version.
        - It consumes more space.
    - Block-level deduplication
        - It breaks the whole data into various blocks
        - Then it stores only the unique data.
        - It utilizes less spaces.



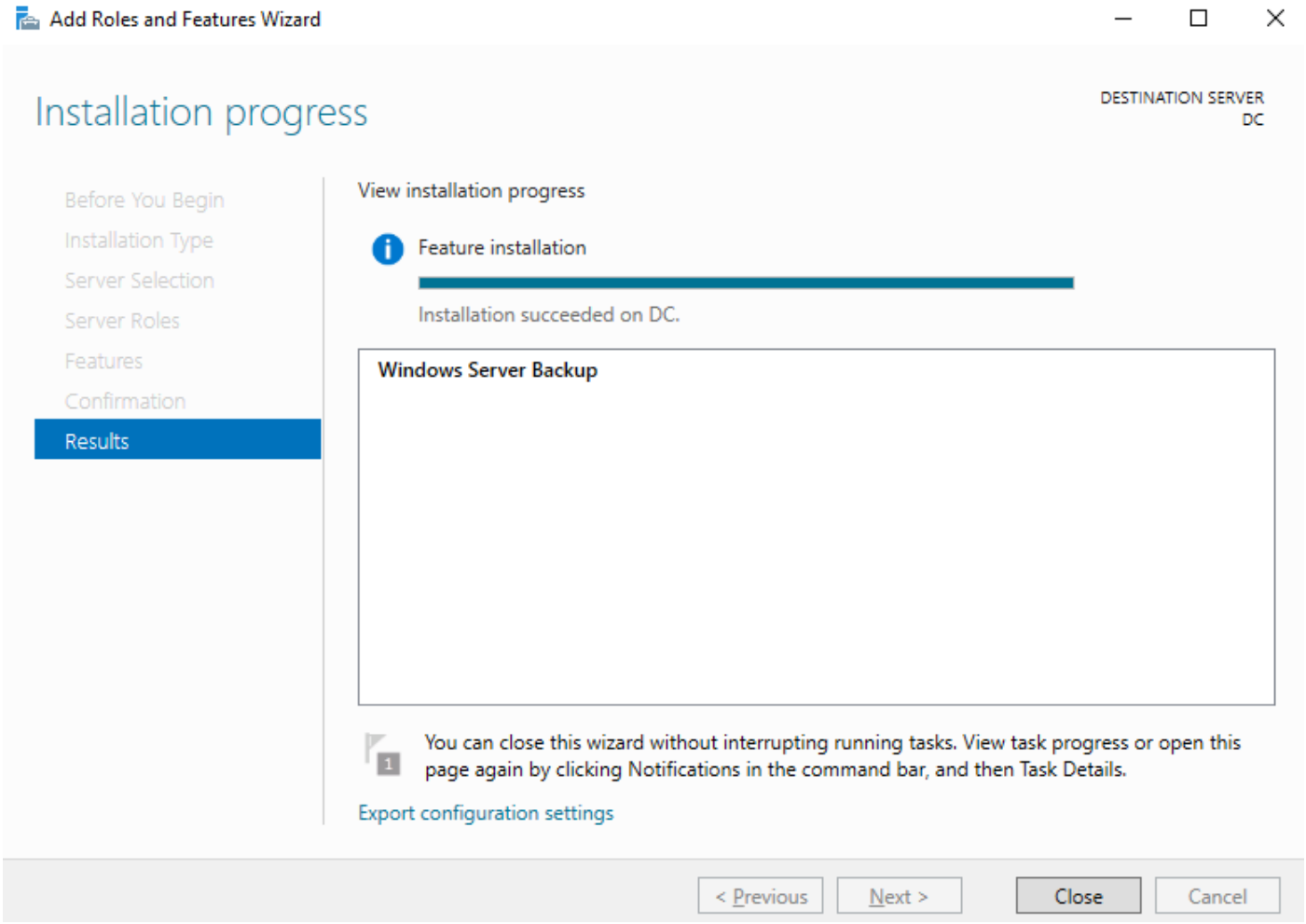
- Install the data deduplication feature
    - Server Manager Dashboard page
        - Manage → Add Roles and Features → Files and Storage Services → (✓) Data Duplication
    - PowerShell cmdlet
        - Install-WindowsFeature -Name FS-DATA-DEDUPLICATION

Windows Server Backup (WSB):

- WSB is a backup and restore built-in utility.
- We can take the backup of:
  - Full server backup
  - Custom backup

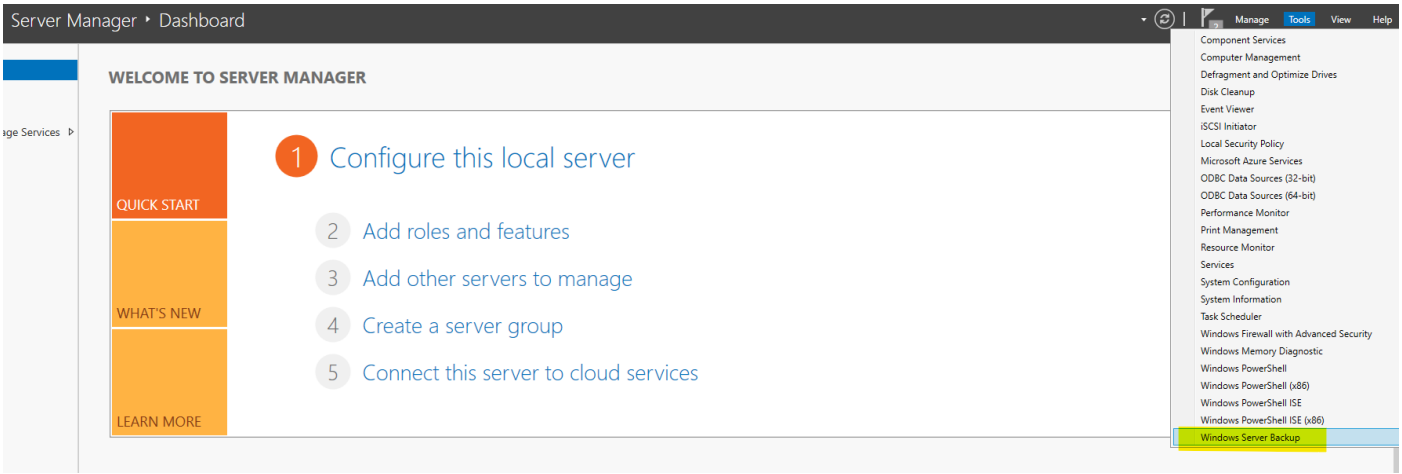
Step 1: Install the Windows Server Backup feature using dashboard page:

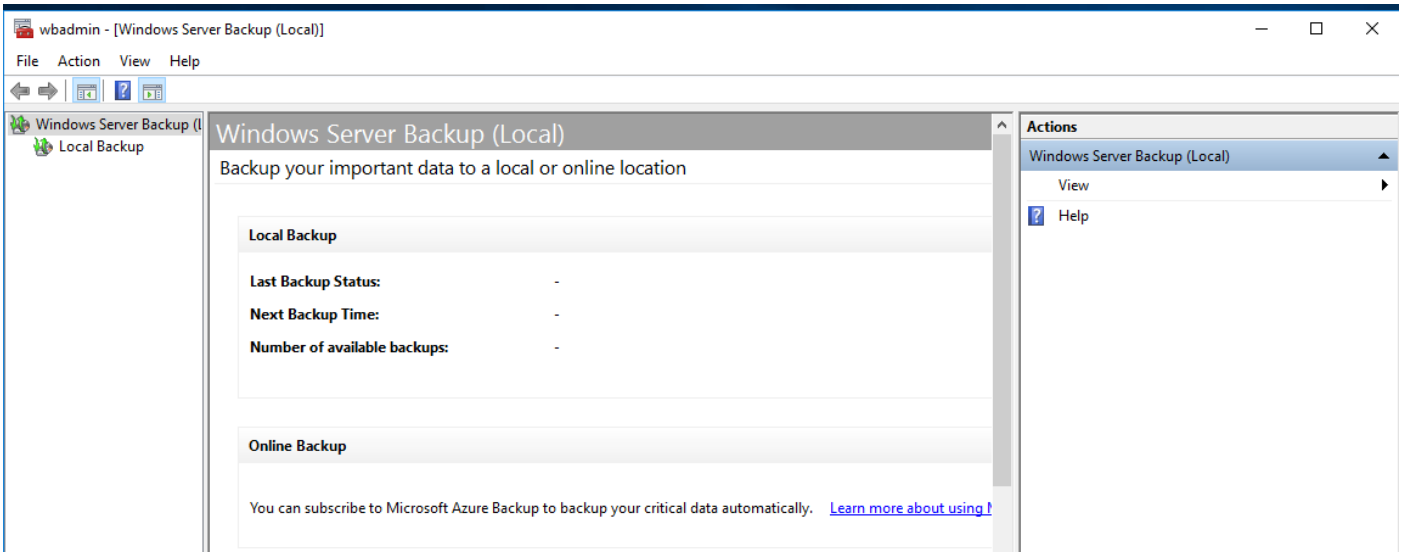
DC → Dashboard Page → Manage → Add Roles and Features → Feature (**Windows Server Backup**) → Install



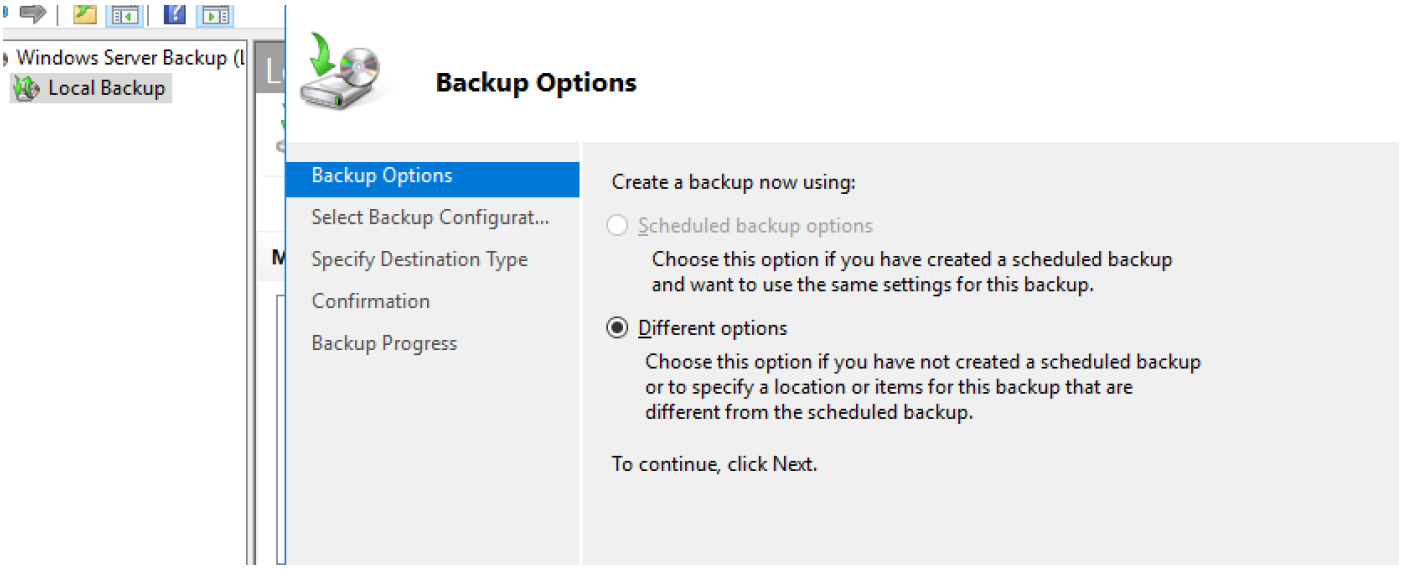
Now, we need to configure the WSB:

DC → Dashboard Page → Tools →Windows Server Backup

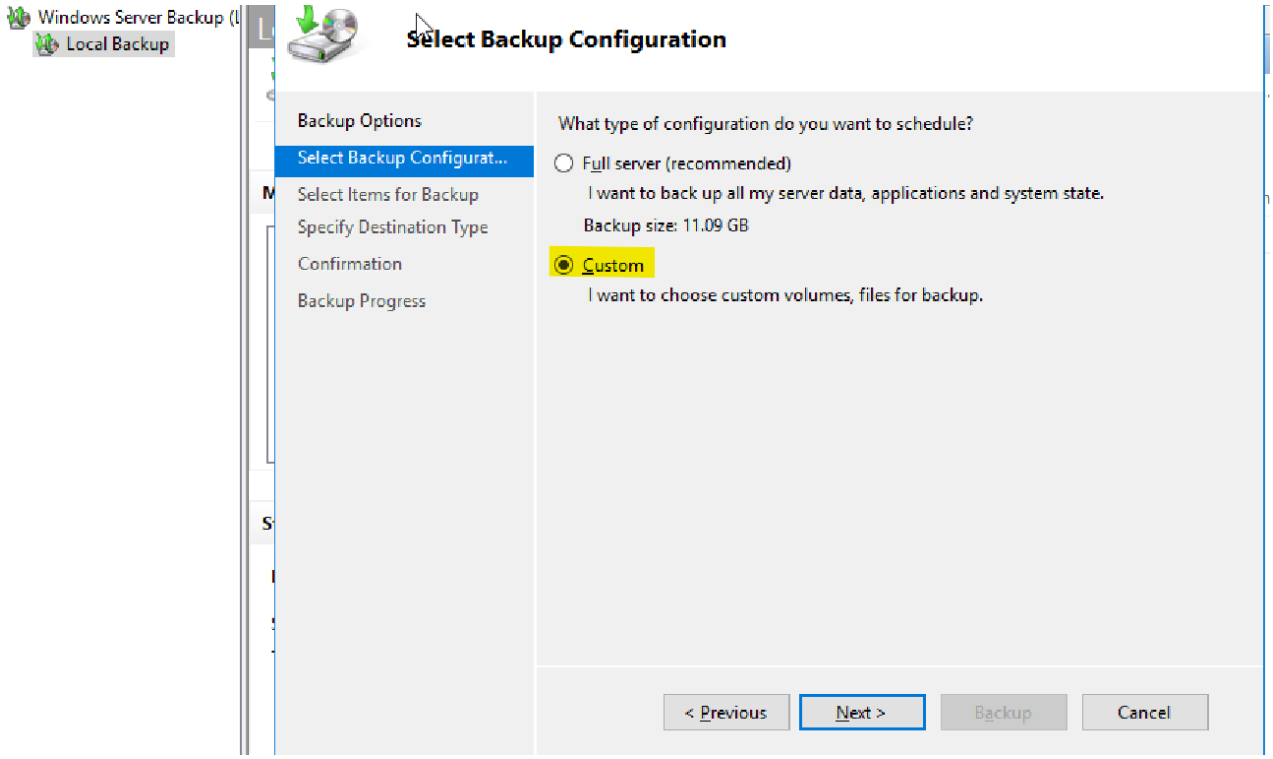




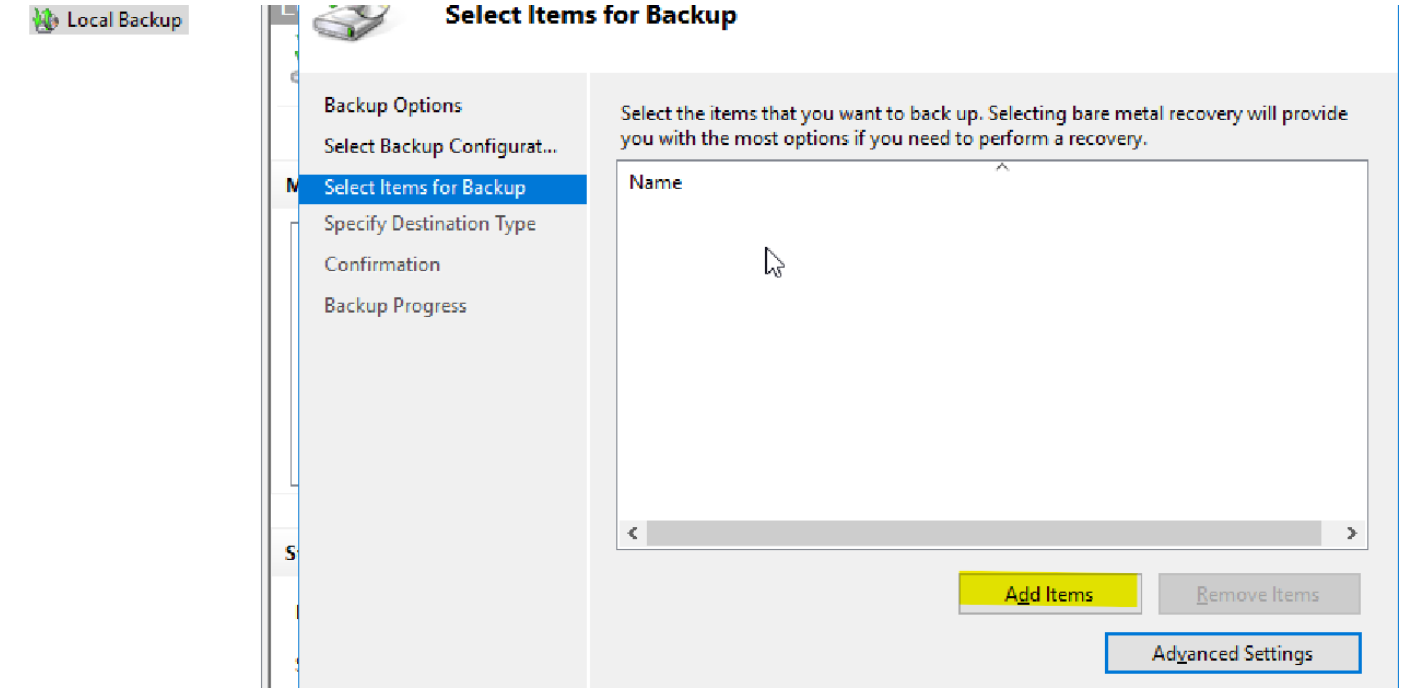
Windows Server Backup → Local (left-hand) → Backup Once (right-side)

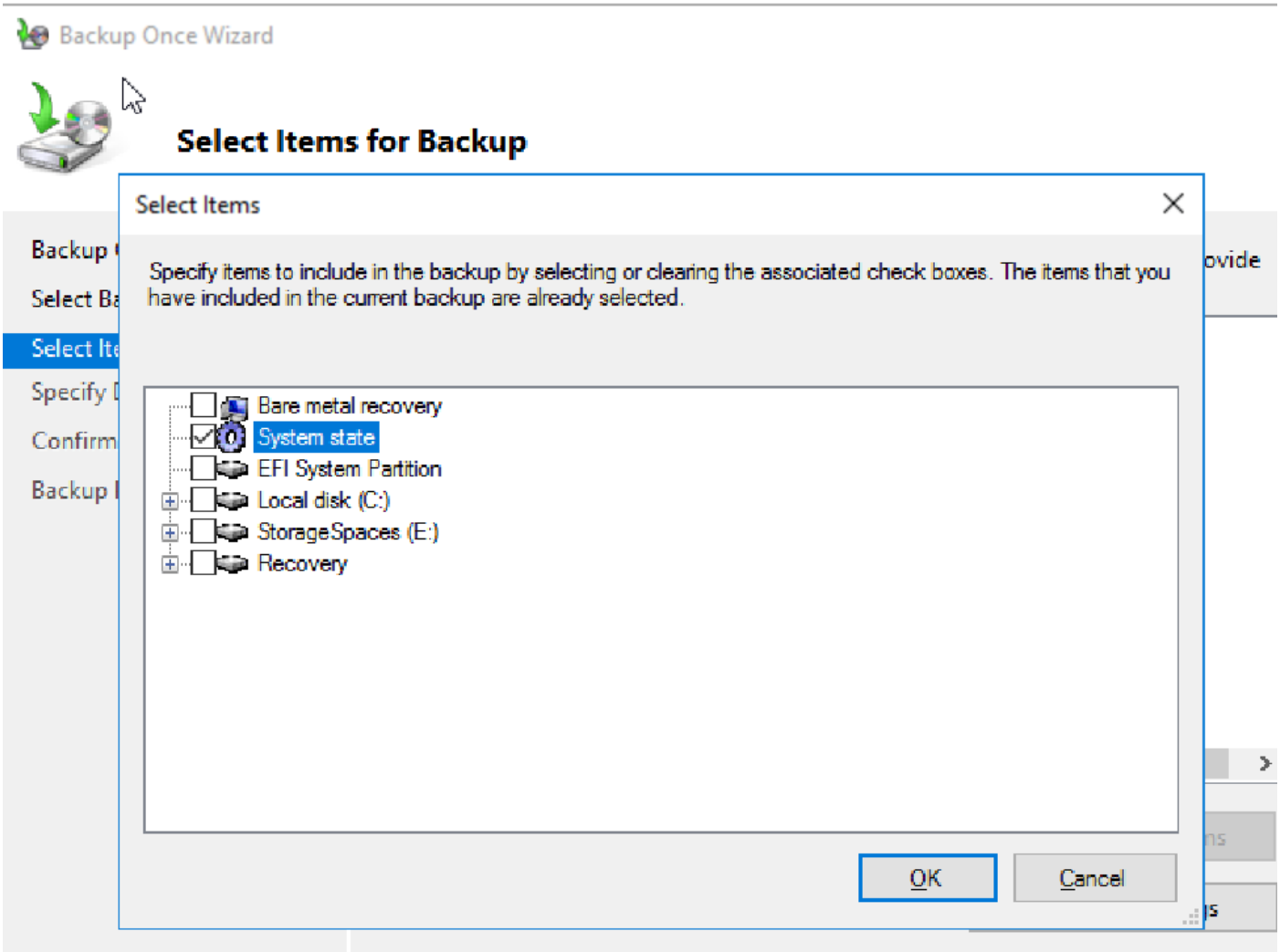


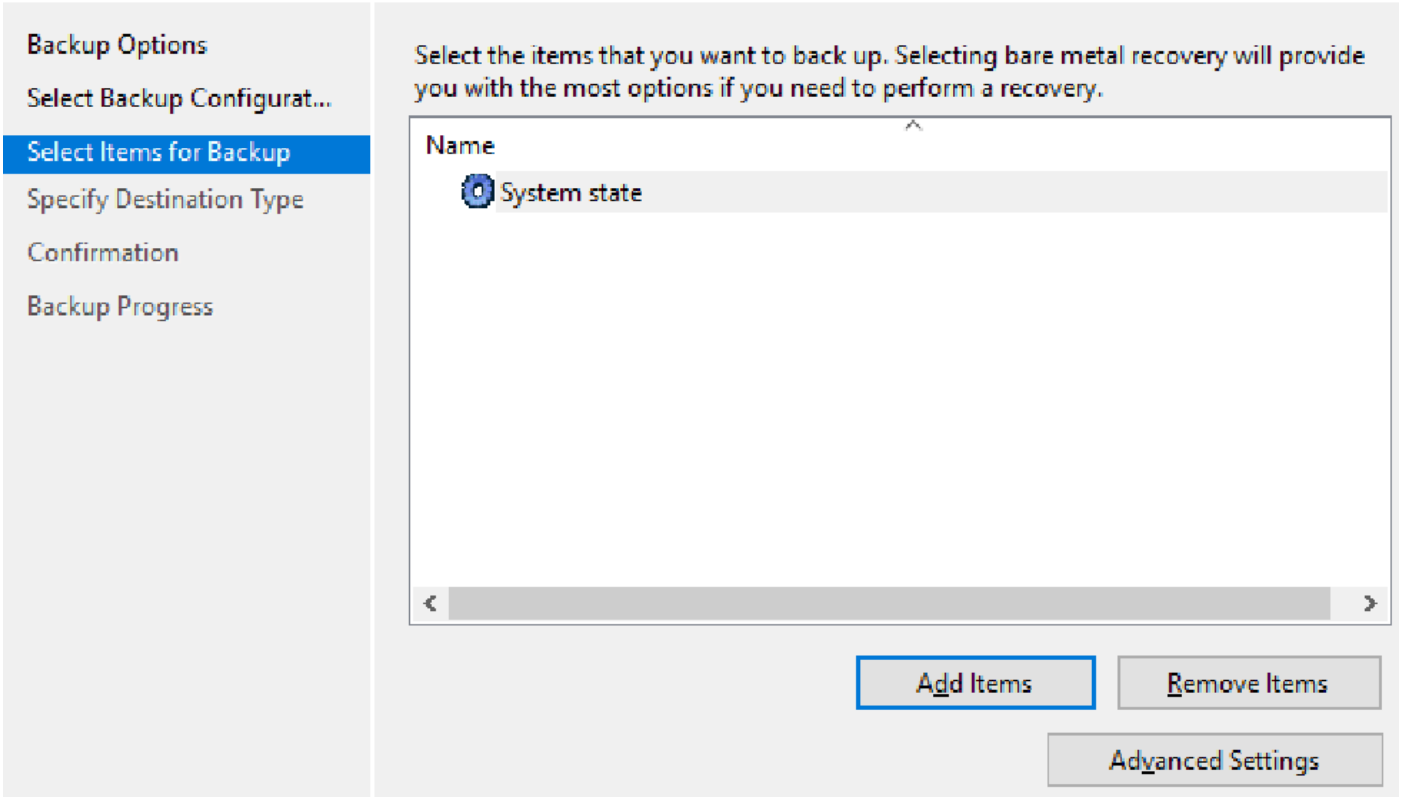
And click “Next” and then select “Custom”

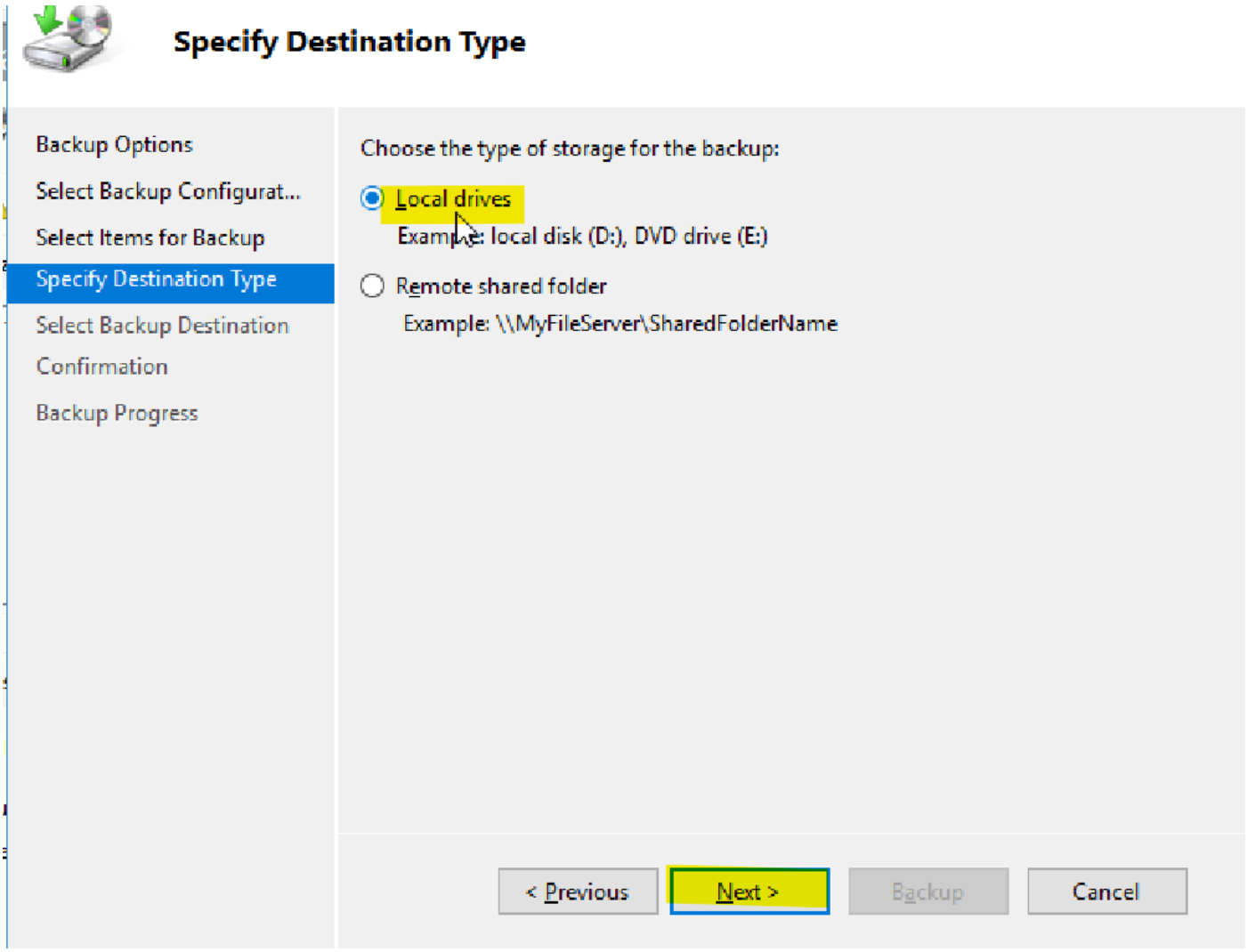


Under the “select the backup items”, select “system state:

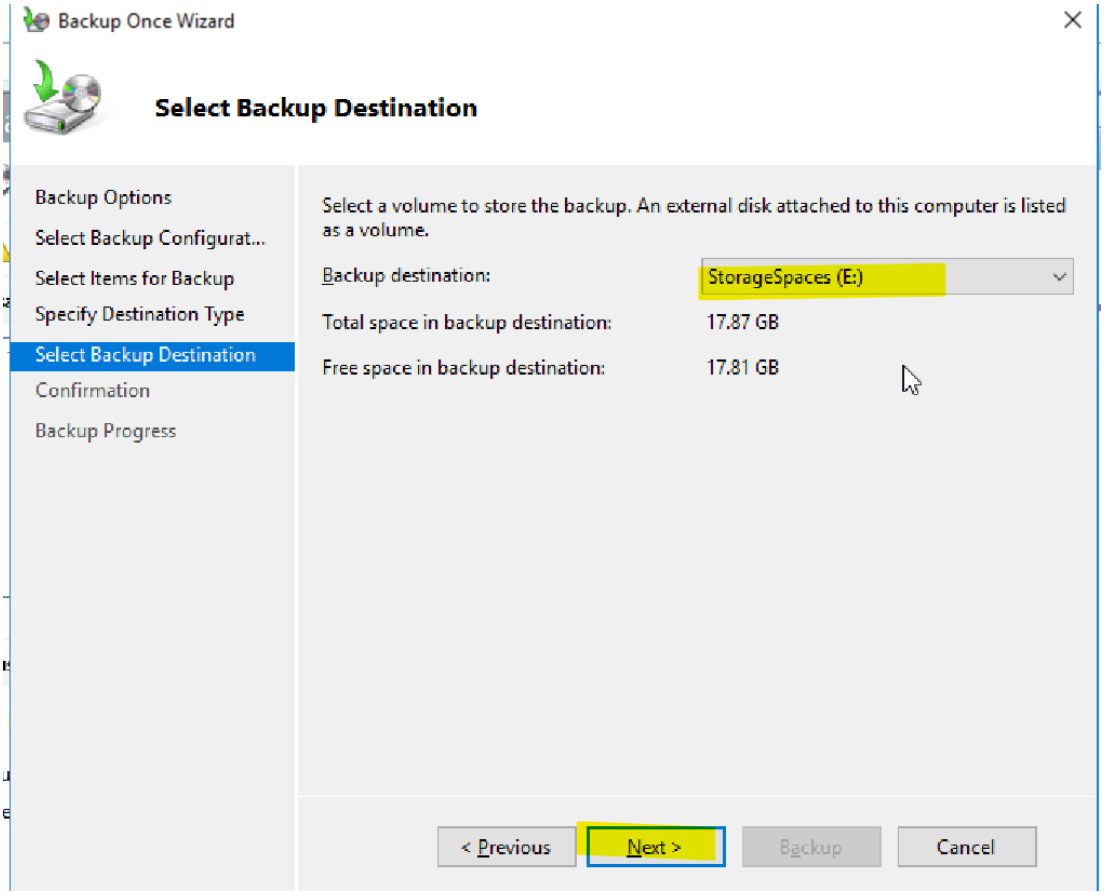




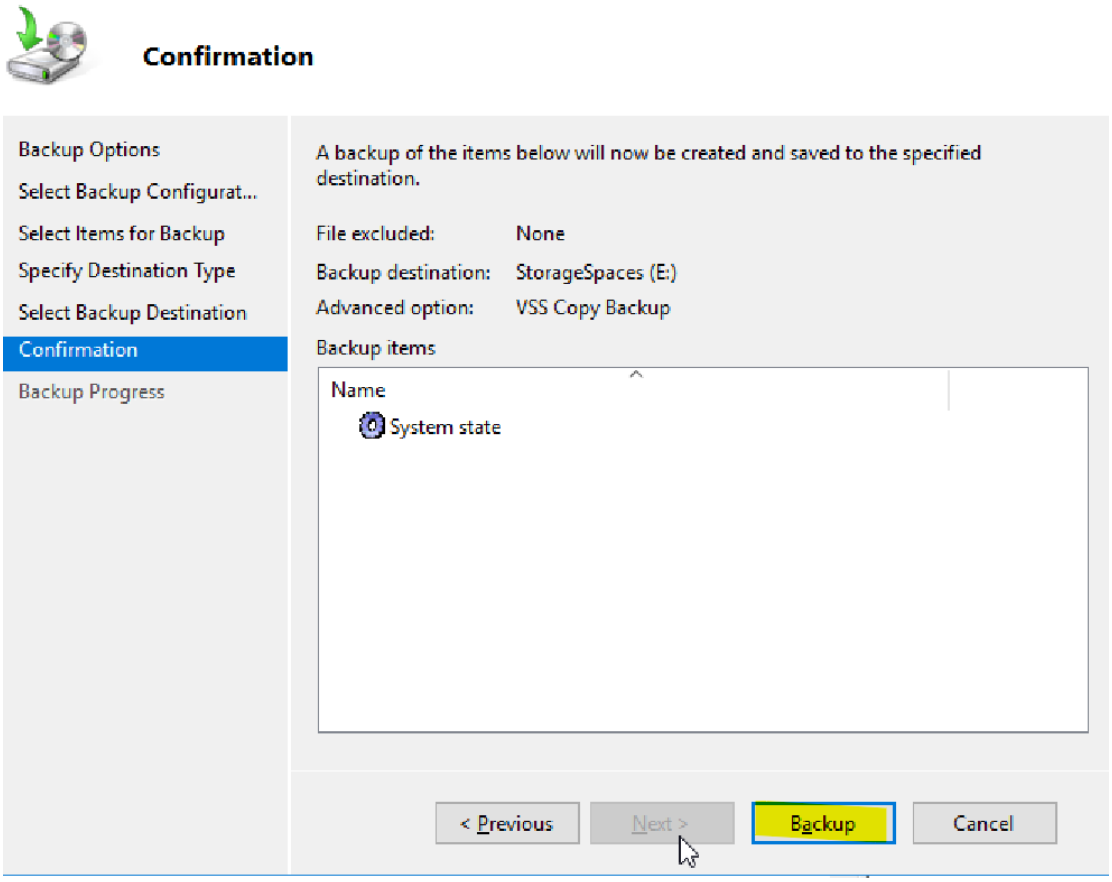

Backup Options
Select Backup Configurat...
Select Items for Backup
Specify Destination Type
Confirmation
Backup Progress
Select the items that you want to back up. Selecting bare metal recovery will provide you with the most options if you need to perform a recovery.
Name
System state
Add Items
Remove Items
Advanced Settings


Specify Destination Type
Backup Options
Select Backup Configurat...
Select Items for Backup
Specify Destination Type
Select Backup Destination
Confirmation
Backup Progress
Choose the type of storage for the backup:
Local drives
Example: local disk (D:), DVD drive (E:)
Remote shared folder
Example: \\MyFileServer\SharedFolderName
< Previous
Next >
Backup
Cancel

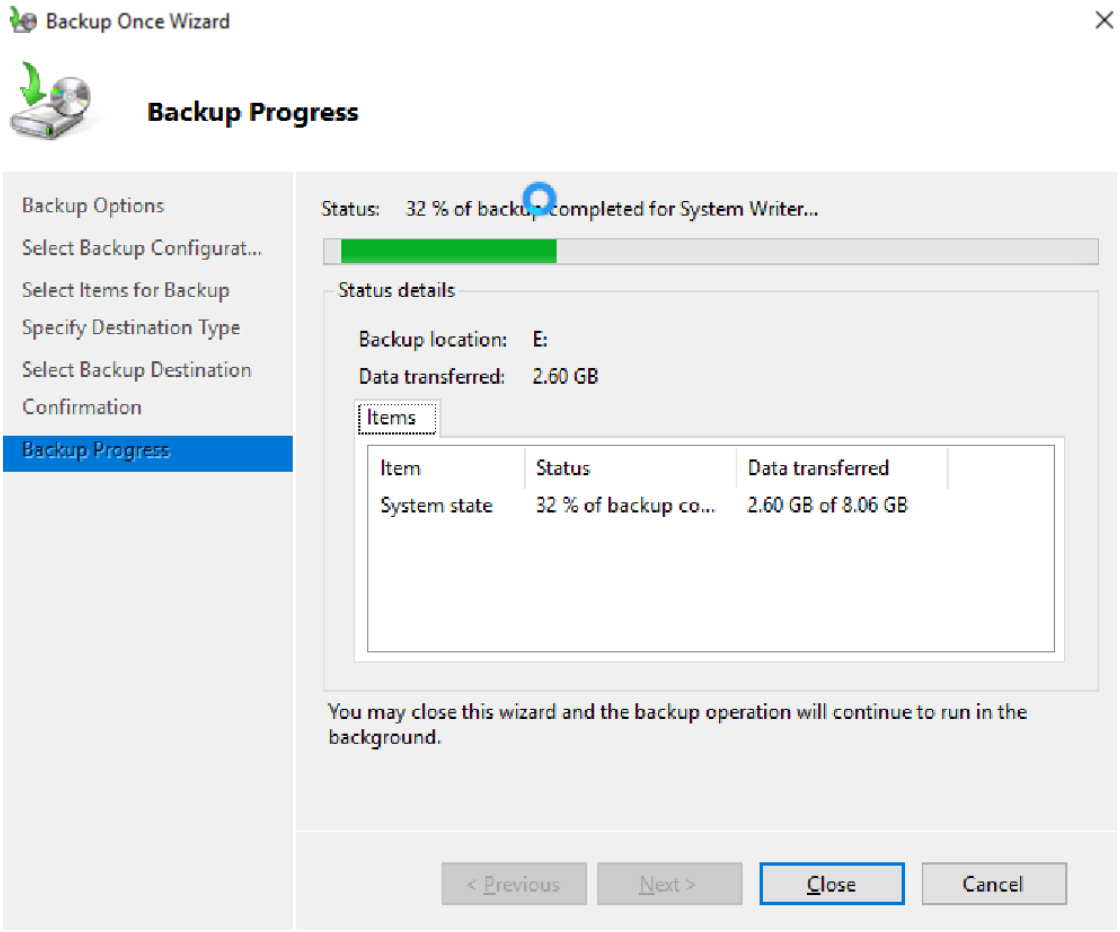
Select storage spaces (E:\)

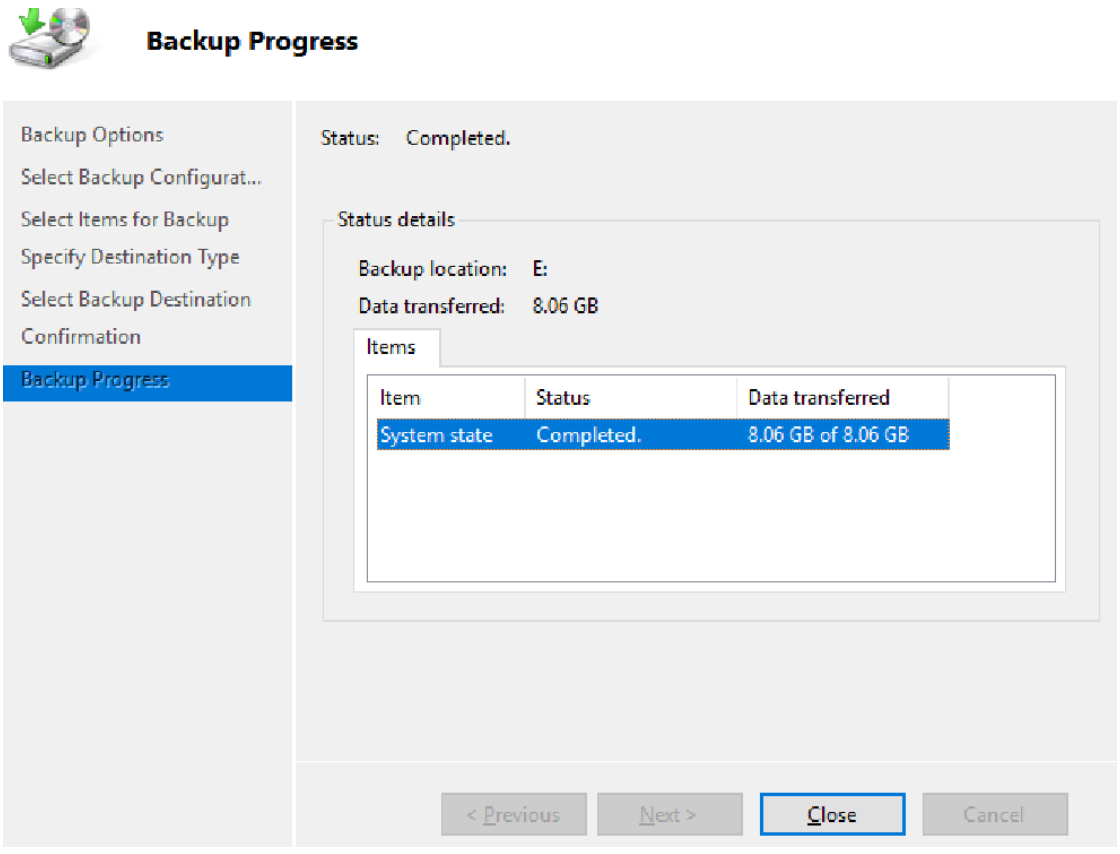


Then click “Backup”



Wait for some time…





Ques – Install and configure window server backup on Node01 machine and perform the backup of "System State".

Levels of availability in Windows Server:

- It basically defines the resiliency of a system and its services.
- A server and its services must be available every time.
- There are different levels of availability:
    - **High Availability (HA)**
        - The services must be available every time with minimum downtime.
        - We can achieve this by applying:
            - Clustering
            - Redundancy
            - Automatic Failover
        - Technologies for HA:
            - Failover Clustering (FC)
            - Network Load Balancing (NLB)
            - Hyper-V replica
    - **Fault Tolerence (FT)**
        - No interruptions during the hardware failure.
        - This requires hardware-level redundancy:
            - Redundant RAID
            - Redundant Power supply
            - Redundant Networks
    - **Disaster Recovery (DR)**
        - Restoring the services after major failure.
        - Focuses on backups and replications.
    - **Continuous Availability**
        - No downtime AT ALL.
        - Like:
            - Storage spaces
            - Clusters
            - MPIO-based storages (SAN Storage)
                - MPIO – Multi-Path Input Output

Setting up the Domain Controller (DC) machine:

- ✓ Install a windows server operating system (2016/2019/2022/2025)
- ✓ Perform post-installation configuration:
  - Setting up the IP address (Static) → 192.168.10.10/24
  - Change the computer name → DC
  - Turn off the firewall → netsh advfirewall set allprofiles state off
  - Set the time zone
- ✓ Install the Active Directory Domain Service (ADDS) role
  - Dashboard → Manage → Add roles and features → select ADDS role. → Install
- ✓ Promote this server as a domain controller.

Task – create a new user by copying the administrator (name: node2admin). Domain join the Node02 machine to the domain controller and after reboot, login using the same username (as node2admin).

Cmds

- To check the computer/server-name: **hostname**
- To list the logged-in username: **whoami**

Failover clustering (FC):

We need to install the failover cluster feature to:

- Node01.training.com
- Node02.training.com

On node01, create a cluster with IP address as 192.168.10.100 and using name “mycluster01”.

Network load balancer (NLB)

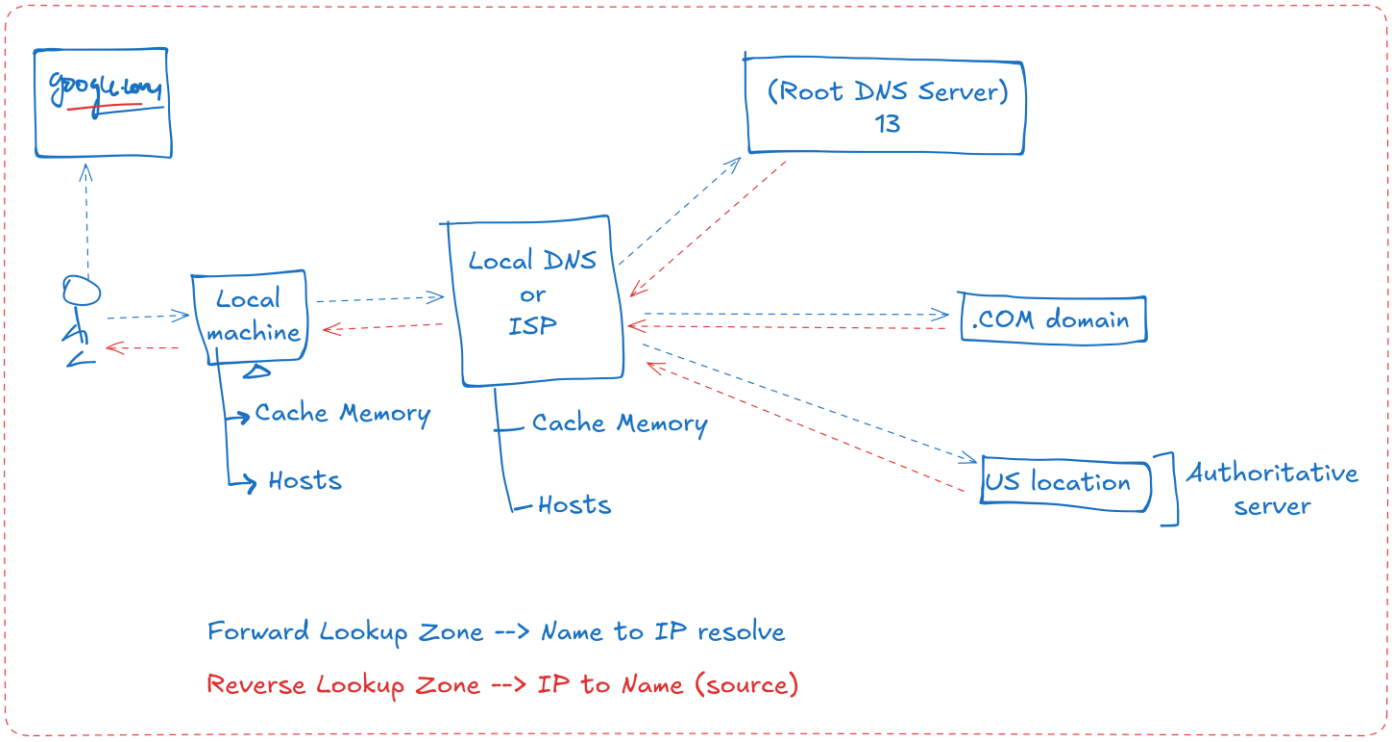
Steps:

1. Install IIS web server on Node01
2. Install IIS web server on Node02
3. Edit the webpages for both the server Node01 and Node02
4. Install NLB on both Node01 & Node02
5. Create a cluster on Node01 for NLB
6. Create a DNS – A record for the cluster
7. Go to Node01 and add Node02 to existing cluster.

DNS

- Domain Name System
- It is used for name resolution (Name ←→ IP address)
- Port number: 53/TCP and 53/UDP
    - TCP – connection oriented (Phone).
    - UDP – connectionless oriented (Radio).
- DNS is a major utility for any domain environment.
- When you install ADDS role, DNS also gets installed in the backend.

How DNS works?

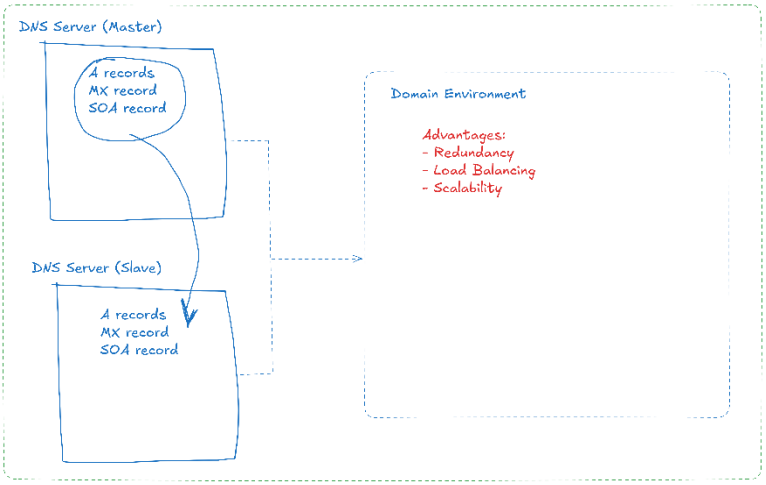


Types of DNS records:

- **A record** – stores Ipv4 IP address
- **AAAA record** – stores IPv6 IP Address
- **MX record** – Mail Exchange
- **SOA record** – Start of Authority
- **CNAME record** – Canonical Name (Alias)
- **NS record** – Name Server
- **TXT record** – Text record / information
- **PTR record** – Pointer record (points back to the source)

DNS Zone Transfer:

- It is a process of copying the DNS records from one DNS to another.
- Basically, it's a Master-Slave concept.
- Advantages:
    - Redundancy
    - Load Balancing
    - Scalability



Types of zone transfers:

1. AXFR
    - Full Zone transfer
    - It transfers all the DNS records.
    - This is used when you are creating a secondary (Slave) server for the 1st time.
2. IXFR
    - Incremental Zone Transfer
    - It transfers ‘only the changes’ made since last update.

Active Directory (AD) replication:

- AD Replication is an automatic process of synchronizing the data across multiple domain controllers (DCs).
- Throughout domain or forest, it ensures that the data like:
    - Users
    - Computers
    - Groups
    - Group policies
        - Gets replicated properly.
- Types of replications
    - Intra-site replication
        - Occurs between DCs in the same site (physical location)
        - By default, time for sync is: 15 Seconds
    - Inter-site replication
        - Occurs between DCs in different sites.
        - By default, time for sync is: 180 Minutes

Group Policy:

- Group policy is a Windows server feature that allows you to centrally manage:
    - Operating system
    - Applications
    - User settings
- Within the domain environment.

Types of group policy settings:

- **Computer settings**
    - Software installation
    - Security settings
    - Scripts
    - Registry settings
- **User configuration**
    - Desktop settings
    - Folder redirection
    - Login/logout scripts

Components of Group Policy:

- Group Policy Object (GPO)
    - It's a container of policy settings
- Group Policy Container (GPC)
    - It's the AD part of GPO
- Group Policy Template (GPT)
    - The templates stored in SYSVOL folder.
- Group Policy Editor (GPMC – Group Policy Management Console)
    - It's a tool to create, modify and manage the GPO.
- Group Policy Processing Engine
    - The client-side component that applies the policy.

Tools used for GPO:

- **GPMC** – to create, modify and manage the GPO
- **GPME** – GUI editor to define the settings within GPO
- "**gpupdate**" – command to forcefully apply the group policy
- "**gpresult /rs /h**" – shows applied GPOs
- **RSoP** – Resultant Set of Policy – tool to get GPO report

Group Policy Hierarchy (Processing Order)

1. Local computer (lowest priority)
2. Site-level GPO
3. Domain-level GPO
4. OU-level GPO (highest priority)

Settings within a group policy:

- **Inheritance** – GPO applied at higher level are inherited to lower level.
- **Block Inheritance** – block/stop GPO from higher level to lower level.
- **Enforced (Force)** – ensure a GPO is applied.

Steps to create and apply Wallpaper GPO

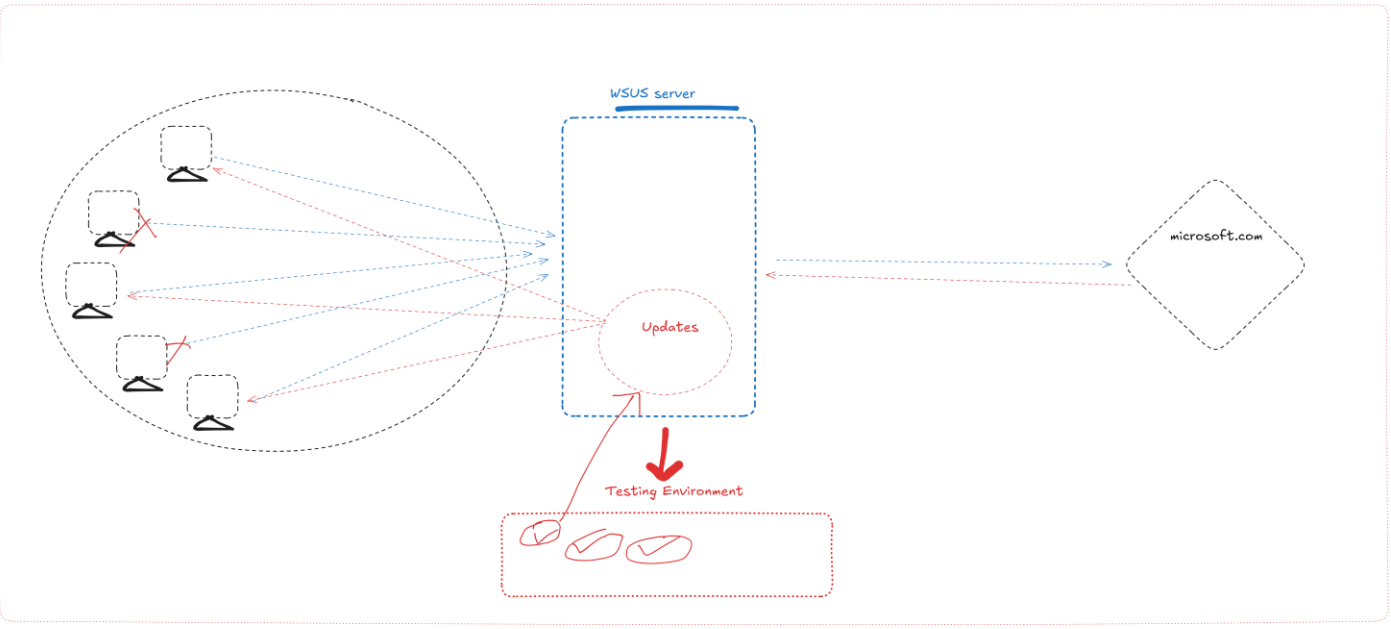
- Create/download a wallpaper and save this in a folder with JPG/PNG extension.
- Convert this folder into an NFS (Network File Sharing) folder.
- To deploy a GPO:
    - ✓ Create a GPO using GPMC
    - ✓ Edit the GPO
    - ✓ Link the GPO to an OU/domain/site
    - ✓ Forcefully apply the policy
        - Run command manually (gpupdate /force command)
            - Powershell → gpupdate /force
            - Manually sign-out and sign-in again.
                - On DC, Node01 and Node02
        - Logout and login again.
        - Restart the computer.
        - Within 90-120 minutes, automatically it will be applied.
    - ✓ Verify
        - Use command → gpresult /r

Folder redirection:

- Folder redirection is a feature of group policy.
- Folder redirection allows you (administrator) to redirect the path of a certain user profile folders (like document, downloads, desktop, etc…) from a Node machine to the network file server.
- What can be redirected:
    - ✓ Desktop
    - ✓ Documents
    - ✓ Menu
    - ✓ Pictures
    - ✓ Videos
- To create a folder redirection:
    - ✓ To create an NFS folder
    - ✓ Create a GPO for folder redirection
    - ✓ Apply the GPO
    - ✓ Verify the GPO

WSUS:

- Windows Server Update Service
- WSUS is a centralized management and windows update (security patches, bug fixes, feature updates) console for the corporate networks.
- It allows administrators to approve, schedule and deploy the updates to the OS (windows) within the network.
- It reduces the bandwidth usage.



PowerShell:

- Here we have “Cmdlets”,
  - ✓ In command prompt, we run “commands”
- Cmdlets → VERB-NOUN

Cmdlets:

```
# to list today's date and time.
Get-Date

# to list all services
Get-Service

# to list all running processes
Get-Process

# to list all current cmdlets
Get-Command

# to list the total number of cmdlets
Get-Command | measure

# list the powershell version
$PSVersionTable

# altenative for checking the PS version
$host.version
```