# Windows Server

# What is Windows Server?

- Windows Server is a *server operating system* developed by Microsoft, designed to manage enterprise-level networks, users, applications, and services.
- It provides essential infrastructure and administrative tools for IT environments, including
  - Active Directory,
  - DHCP,
  - DNS,
  - Group Policy,
  - File Sharing, and more.

# Core Concepts

| | |
|---|---|
| **Server OS** | Designed to provide services to multiple clients (unlike desktop OS) |
| **Domain vs Workgroup** | Domain allows centralized management via Active Directory; Workgroup is peer-to-peer |
| **Client-Server Model** | Windows Server acts as a central server managing clients (e.g., PCs, printers) |

# Roles & Features

- **Role**
  - A role is a major function that a server performs.
  - Installing a role means the server is configured to perform that core service for users, devices, or other servers in the network.
- **Feature**
  - A feature is a supplementary component that supports or enhances server roles or provides standalone functionality.
    - A feature adds capabilities.
    - Some features are required for certain roles to function.
    - Features can be installed independently or along with roles.

# Examples of Server Roles

| Role Name | Description |
|---|---|
| Active Directory Domain Services (AD DS) | Provides centralized authentication, authorization, and directory services. |
| DNS Server | Resolves domain names to IP addresses. |
| DHCP Server | Assigns IP addresses dynamically to clients. |
| Web Server (IIS) | Hosts websites and web applications. |
| Hyper-V | Enables virtualization and management of virtual machines. |
| File and Storage Services | Manages shared folders, storage pools, and disk management. |
| Print and Document Services | Manages network printers and print queues. |
| Remote Desktop Services (RDS) | Provides remote desktop access to users. |

# Examples of Server Features

| Feature Name | Description |
|---|---|
| .NET Framework 3.5/4.8 | Required for running applications developed using .NET. |
| Group Policy Management | Enables editing and managing Group Policy Objects (GPOs). |
| Failover Clustering | Supports high availability of services and applications. |
| Windows Server Backup | Provides backup and recovery tools. |
| Telnet Client | Allows remote command-line access via Telnet. |
| BitLocker Drive Encryption | Enables encryption for drives to enhance security. |
| Windows Defender Features | Adds anti-malware and security capabilities. |

# Windows Server Editions

- Windows Server 2019 Standard edition
- Windows Server 2019 Datacenter edition
- Windows Server 2019 Essentials edition
- Windows Server 2019 Hyper-V edition

# Windows Server 2019 Standard Edition

- *Purpose:*
  - Designed for physical or minimally virtualized environments.
- *Key Features:*
  - Supports 2 virtual machines and 1 Hyper-V host per license.
- *Includes core roles like:*
  - Active Directory Domain Services (AD DS), DNS, DHCP, File and Storage Services
  - Print Services, Remote Desktop Services (with CALs)
- *Limitations:*
  - No Storage Replica full feature (limited to 1 partnership and 2 TB)
  - No Shielded Virtual Machines, No Software-defined Networking (SDN)

# Windows Server 2019 Datacenter Edition

- Purpose:
  - Ideal for highly virtualized data centers and cloud environments.
- Key Features:
  - Unlimited VMs on a licensed host.
  - All Standard Edition features plus:
    - Storage Replica (no limit)
    - Shielded VMs
    - Software-defined Networking (SDN)
    - Storage Spaces Direct
    - Host Guardian Service
- Ideal for:
  - Enterprises with large-scale virtualization needs.
  - Private cloud and hybrid deployments.

# Windows Server 2019 Essentials Edition

- Purpose:
  - Designed for small businesses with up to 25 users and 50 devices.
- Key Features:
  - Simplified management (limited server roles)
  - No need for CALs,
  - Single physical or virtual instance
- Basic support for:
  - AD DS, File sharing, Print services, Remote access
- Limitations:
  - No Hyper-V, Storage Replica, Containers, or SDN
  - No Server Core installation option
  - Limited scalability and expandability

# Windows Server 2019 Hyper-V Edition

- Purpose:
  - A free edition designed only for Hyper-V virtualization.
- Key Features:
  - No GUI (core-only interface)
  - Supports unlimited virtual machines
  - Minimal installation footprint for better performance
  - No other server roles (e.g., no AD DS, DNS, DHCP, etc.)
- Limitations:
  - Cannot act as a domain controller or file server
  - Managed via PowerShell, SCVMM, or Remote Admin Tools

# Summary

| Feature / Capability | Standard | Datacenter | Essentials | Hyper-V |
|---|---|---|---|---|
| Target Use | Mid-level | Enterprise / Datacenter | Small business | Hyper-V host only |
| VMs Supported | 2 | Unlimited | 1 | Unlimited |
| CALs Needed | Yes | Yes | No | No |
| GUI | Yes | Yes | Yes | No |
| Roles Available | Most | All | Limited | Only Hyper-V |
| Licensing | Core-based | Core-based | Server-based | Free |
| Storage Replica | Limited | Full | ❌ | ❌ |
| Shielded VMs | ❌ | ✅ | ❌ | ❌ |

# Installing windows server 2016/19

- **Desktop Experience**
  - It's a fully functional GUI/Graphical operating system
- **Core**
  - It’s a fully functional CLI operating system
- **Nano**
  - It’s a CLI server that runs on PowerShell cmd (cmdlets)

# Recommended requirements for Windows server 2019

| Component | Recommended |
|---|---|
| CPU | 2 GHz or faster, multi-core (Xeon-class for datacenter) |
| RAM | - 8 GB or more (Standard/Datacenter)- 16+ GB for Hyper-V workloads |
| Disk | - 64 GB+ SSD/HDD (faster disk improves performance) |
| Network | Dual NICs or Teaming (for redundancy and bandwidth) |
| GPU | Optional for remote desktop or virtualization graphics acceleration |

# Windows Server activation models

- Key-Based Activation
- Volume Activation
- Active Directory-Based Activation (ADBA)
- Automatic Virtual Machine Activation (AVMA)

# Key-Based Activation

## A. Retail Activation (Product Key)

- Used in: Purchased retail versions (from a store or online)
- Activated using a 25-character product key
- Manual activation via:
  - Internet (online)
  - Telephone (offline)

## B. OEM Activation

- Pre-installed by server hardware vendors (Dell, HP, etc.)
- Activation is tied to the hardware's BIOS
- Cannot be transferred to another machine
- Usually includes branding

# Volume Activation

A. **KMS (Key Management Service)**
   - Requires a KMS host on the network
   - Clients (Windows Servers or PCs) contact the KMS host to activate
   - Activation is valid for 180 days, auto-renews every 7 days
   - Needs minimum 5 servers or 25 clients to initiate KMS

B. **MAK (Multiple Activation Key)**
   - One-time activation per device
   - Can be activated:
     - Online
     - Via proxy
     - By telephone (offline)
   - Limited number of activations based on agreement

# Active Directory-Based Activation (ADBA)

- Introduced in Windows Server 2012
- **Activation occurs when a domain-joined server boots**
- No need for individual KMS or MAK keys
- Requires:
  - Volume licensing
  - Schema version 2012 or later
  - Activation object in AD
- Good for organizations with hybrid environments.

# Automatic Virtual Machine Activation (AVMA)

- Used with Windows Server Datacenter Edition
- Automatically activates guest VMs running on a licensed host
- Requirements:
  - Host must be Windows Server Datacenter edition
  - Guest VMs must be compatible Windows Server editions (e.g., Standard, 2019)
  - No Internet or KMS needed for guest activation

# Server Core Operating System Commands

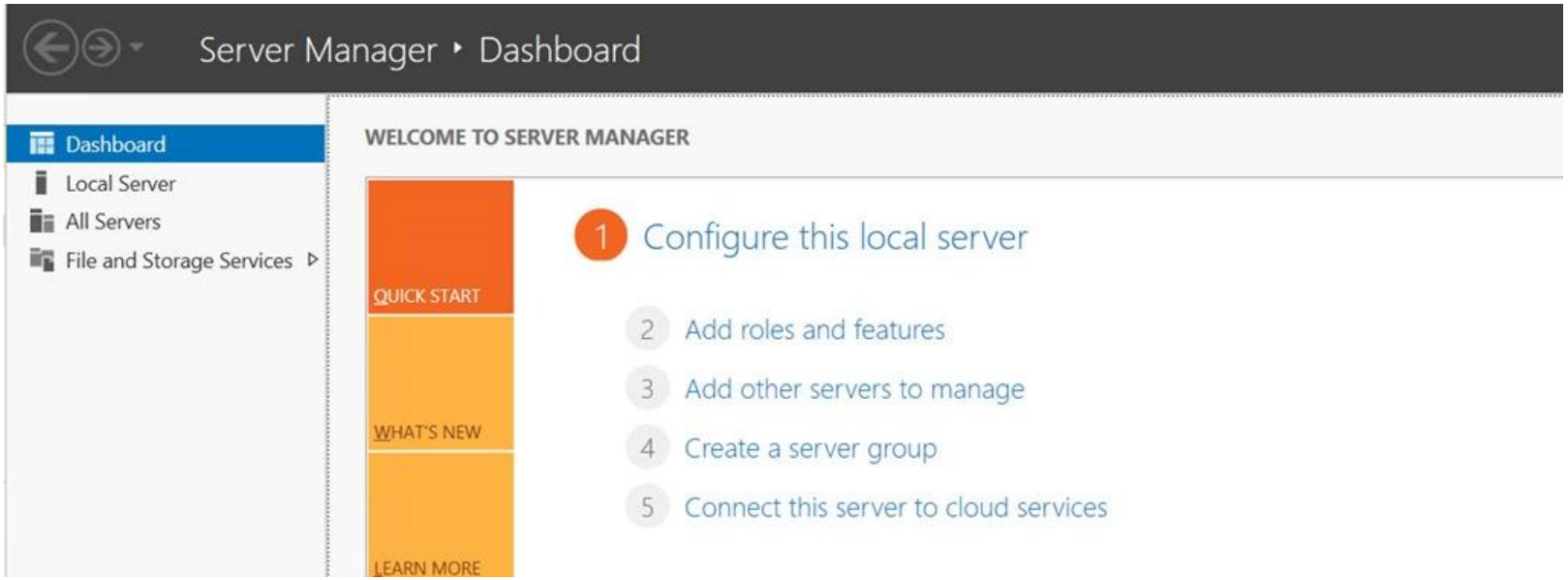
- **sconfig.cmd**
  - this is a menu-driven cmd to manage your computer.
- **cmd.exe**
  - to work with command prompt
- **powershell.exe**
  - to work with powershell
- **msinfo32.exe**
  - allow you to view systems information
- **taskmgr.exe**
  - launches the task manager
- **SCregEdit.wsf**
  - to enable remote desktop on server core

# Server Manager Dashboard Page

Server Manager Dashboard Page is a graphical tool for managing local or remote computers in windows servers

**What we can do?**

- Install/uninstall roles
- Install/uninstall features
- Manage local machine
  - Computer name
  - IP address
  - Firewall
  - Clock
- Manage remote computers



# Preparation steps for upgrades and migration

**1. Assessing and Planning**

- check the hardware inventory
- identify incompatible hardware, drivers or applications
- decide the type of:
- in-place upgrade (same hardware)
- migrate (new hardware)

**2. Understand the upgrade/migration path:**

- in-place
- migration
- cluster OS rolling upgrade
- cross-forest/domain migration

**3. Testing**

- set up a small/testing environment
- validate applications, services or custom scripts.

**4. backup & recovery planning**

- take full system backup
- backup documents, setting
- validate restore procedure before upgrading

# Preparation steps for upgrades and migration

**5. prepare the target environment**

- install & patch the targeted windows server
- join the system to domain, configure roles/services
- ensure the hardware, drivers & firmware are updated
- install the migration tools (windows server migration tool)

**6. perform upgrade/migration**

- follow the check-list
- use migration tools:
- windows server migration tool
- Active Directory migration tool (ADMT)
- storage migration services
- Hyper-v live migration

**7. post migration tasks**

- validate all services like DHCP, DNS are functioning
- update the group policies, scripts, monitoring tools.
- remove old server roles & decommission it.
- update the stakeholders.

# Understanding iSCSI & FCIP

**iSCSI -** Internet Small Computer System Interface

- iSCSI is a networking protocol that allows data transfer over IP (TCP/IP) networks.
- it enables SCSI commands to be sent over the ethernet channel.
- we need
  - A client (initiator), who needs
  - storage device (target)
- cost-effective setup over fiber channel

**FCIP -** Fiber Channel over IP

- FCIP is a networking protocol that uses fiber channel over IP networking
- aka IP storage tunnelling
- it is helpful in geo-graphical sharing
- used in datacenters

# Understanding iSNS, DCB & MPIO:

1. **iSNS -** Internet Storage Name Service
   - to help discover, manage & configure iSCSI and FCIP devices in large environment
   - it provides naming & discovery for iSCSI target and initiator.
   - it provides centralized iSCSI storage

2. **DCB -** Data Center Bridging
   - to make ethernet lossless and suitable for storage traffic in data centers.
   - it ensures high reliable & zero data loss over ethernet

3. **MPIO -** Multi-path Input Output
   - to provide redundancy, high availability & performance for storage path
   - used in SAN storages
   - ensures the fault tolerance

# Data Deduplication (Dedup)

- Dedup is a built-in windows feature introduced in server 2012.
- The feature help in optimizing storage by identifying and removing the duplicate data from the storage
- Best suited for:
  - file server (home directories, shared folders
  - backups
  - VHD/VHDX files
  - not recommended for:
  - database
  - exchange server
  - hyper-vms

types of dedup:

1. **file-level deduplication**
   - it maintains the single copy of every version
   - consumes more space.
2. **block-level deduplication**
   - it breaks down the whole data into various blocks &
   - then stores only unique data blocks
   - much more efficient
   - consumes less space.


That's all Folks!