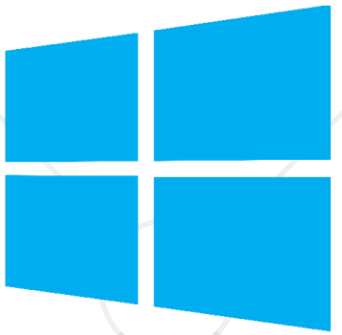


Introduction to Windows Server

Introduction. Installation Options. Basic Tasks



Windows Server

SoftUni Team
Technical Trainers



SoftUni



Software University

<https://softuni.bg>

Have a Question?

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#WSA

facebook.com/groups/

WindowsSystemAdministrationMarch2023/

1. Introduction to Windows (Server)
 - Why Windows (Server)?
 - Windows History and Architecture
 - Current Version
2. Installation and Upgrade
 - Installation Options
 - Upgrade Paths and License Conversion
3. Basic Administration Tasks
 - Approaches and Tools
 - A Tale of Two Shells





Why Windows (Server)?

Why Windows (Server)?

- More than 30 years on the market
 - Went all the way from a **GUI shell** to a **full operating system**
- Can be seen in (almost) every company
 - It covers wide range of company sizes and industries
- Offers many features out-of-the box
- There is **big demand** for Windows skills
- Learning is relatively easy, but can be **challenging** as well 😊

Only Windows (Server)?

- The short answer is **NO**
- Additional solutions by Microsoft
 - Exchange Server, MS SQL Server, SharePoint, ...
- Plus, solutions by other vendors
 - Relational databases, CRM, ERP, ...
- And finally, the real life is **heterogeneous / complex**
 - So **should be our skill-set**



Windows History

- **Windows 1.0**, 11.1985
 - Initial release, **graphical shell** for MSDOS
- **Windows 2.0**, 12.1987
 - Excel and Word for Windows, including **3rd party applications**
- **Windows 3.0**, 05.1990
 - Better **multitasking**, multimedia support, supports 8086/286/386
- **Windows 3.1**, 04.1992
 - TrueType fonts, removed RealMode, **support only for 80286/386**

- **Windows NT3.1**, 07-08.1993
 - Completely rewritten, **stand-alone**, Win32 API, **LAN support**
- **Windows 95**, 08.1995
 - Mixed code base 16/32-bit, partial adoption of Win32 API
- **Windows NT4.0**, 07.1996
 - Improvements over NT3.x, Explorer shell from Windows 95
- **Windows 98**, 06.1998
 - FAT32, USB support

- **Windows 2000 (Server)**, 02.2000
 - **Active Directory**, Terminal Services, DirectX, Windows Media Player, No product activation
- **Windows ME**, 09.2000
 - System Restore, Windows Media Player 7, Internet Explorer 5.5
- **Windows XP**, 10.2001
 - First **NT based** consumer Windows OS
- **Windows Server 2003**, 04.2003
 - Configuration wizard, 32- and 64-bit offering

- **Windows Vista**, 01.2007 and **Windows Server 2008**, 02.2008
 - PowerShell, User Access Control (UAC)
- **Windows 7**, 10.2009 and **Windows Server 2008 R2**, 2009
 - Multi-touch, improved booting and UAC. Client - 32/64-bit, Server – 64-bit
- **Windows 8**, 10.2012 and **Windows Server 2012**, 09.2012
 - New UI, USB 3.0, Windows Store
- **Windows 8.1**, 10.2013 and **Windows Server 2012 R2**, 10.2013
- **Windows 10**, 07.2015 and **Windows Server 2016**, 09.2016
 - Cortana, Edge, Windows Subsystem for Linux, last major version to be released

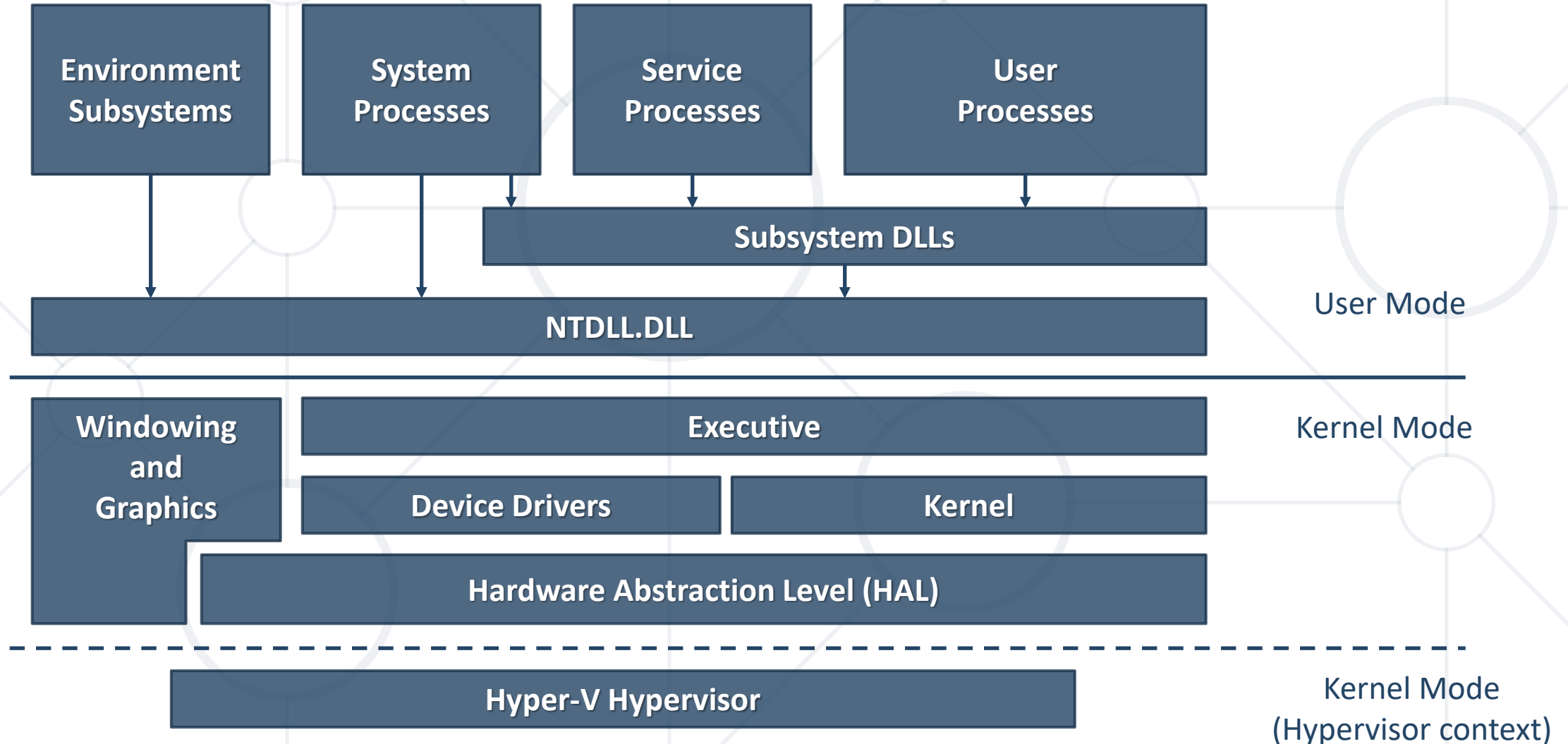
Windows Versions (partial list)

NT10.0	Windows Server 2016/2019/2022 *	Windows 10/11 *
NT6.3	Windows Server 2012 R2	Windows 8.1
NT6.2	Windows Server 2012	Windows 8
NT6.1	Windows Server 2008 R2	Windows 7
NT6.0	Windows Server 2008	Windows Vista
NT5.2	Windows Server 2003 (R2)	Windows XP Professional 64-bit
NT5.1	-	Windows XP
NT5.0	Windows 2000	Windows Server Professional
4.90	-	Windows ME
4.10	-	Windows 98
NT4.0	Windows NT 4.0	Windows NT 4.0 Workstation
4.0	-	Windows 95



Windows Architecture

Architecture Overview



Kernel Mode Components (1) *

- **Hypervisor layer**

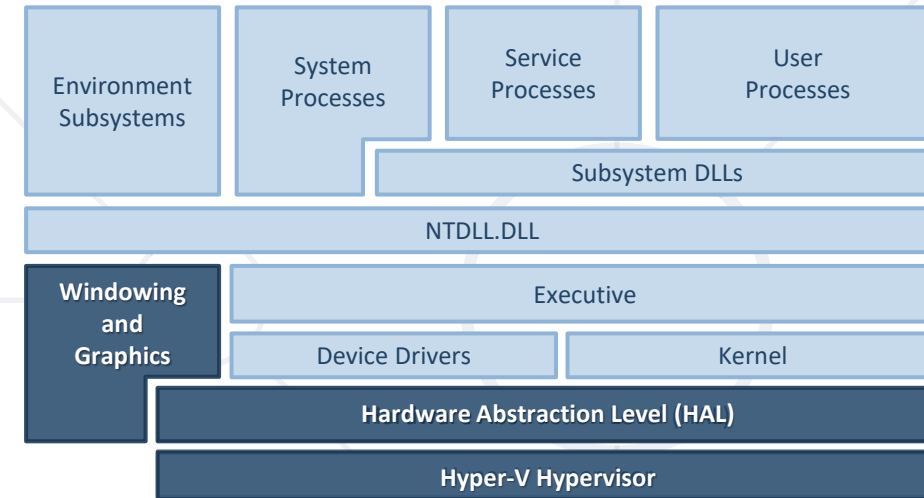
- Hypervisor is composed of multiple internal layers and services

- **Hardware Abstraction Layer (HAL)**

- Isolation layer between kernel, device drivers, and executive and the platform-specific hardware. It is implemented in the **hal.dll**

- **Windowing and graphics system**

- Implements graphical user interface (GUI) functions, also known as the Windows USER and GDI functions



Kernel Mode Components (2) *

- **Device drivers**

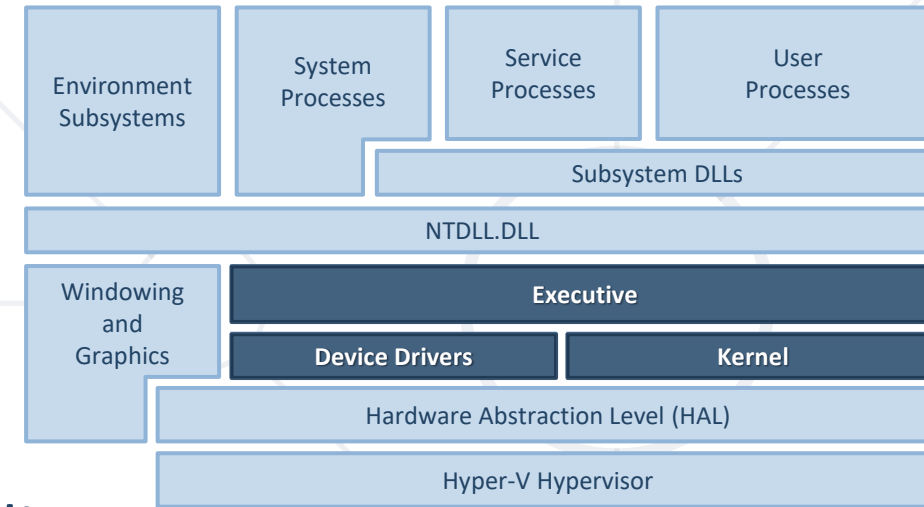
- Both hardware and non-hardware device drivers

- **Kernel**

- Low-level OS functions such as thread scheduling, interrupt and exception dispatching, and multiprocessor synchronization

- **Executive**

- Base OS services like memory management, process and thread management, security, I/O, networking, and IPC



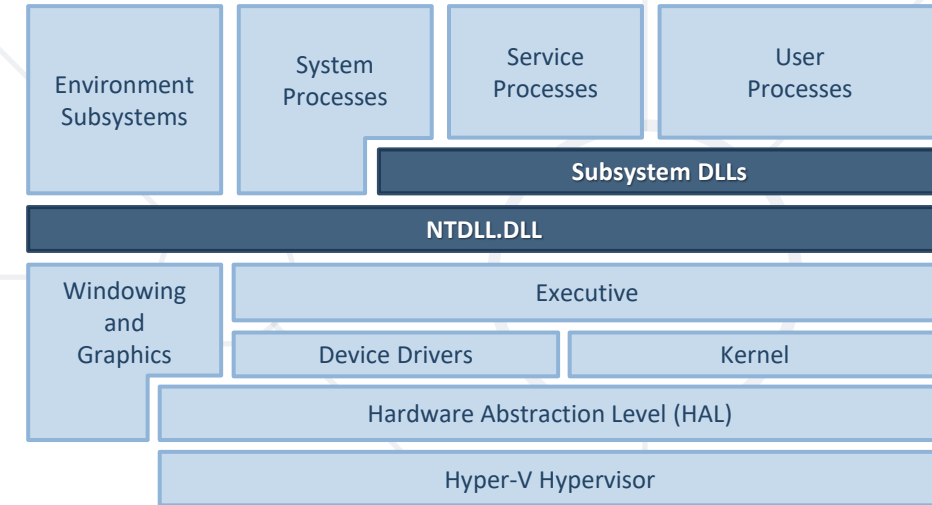
User Mode Components (1) *

- **NTDLL.DLL**

- Exports the **Windows Native API** and it the interface used by user-mode components of the operating system that must run without support from Win32 or other API

- **Subsystem DLLs**

- Subsystem libraries implement various subsets of the **Win32 API**. Here we can find **KERNEL32.DLL**, **USER32.DLL**, **GDI32.DLL**, etc.



User Mode Components (2) *

- **Environment Subsystems**

- Originally shipped three subsystems:
Windows, OS/2, and POSIX

- **System Processes**

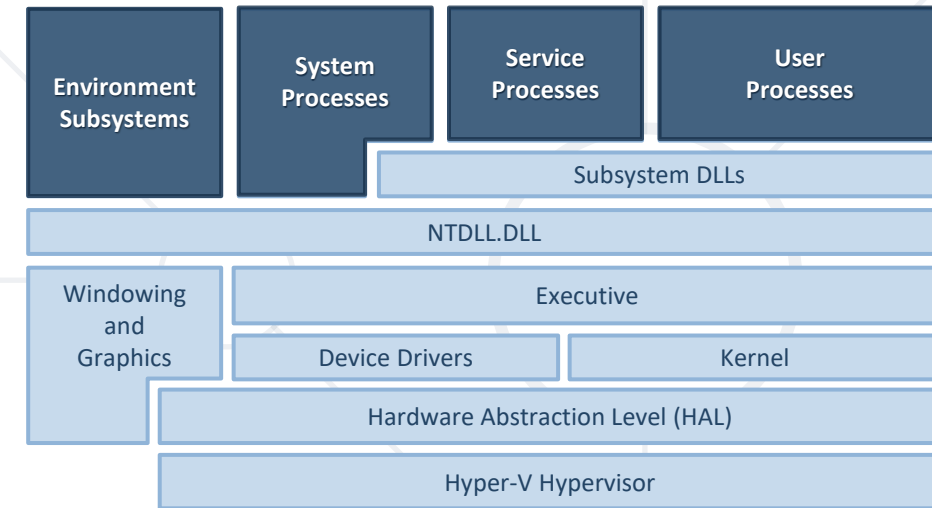
- Services like **logon**, not started by **Service Control Manager**

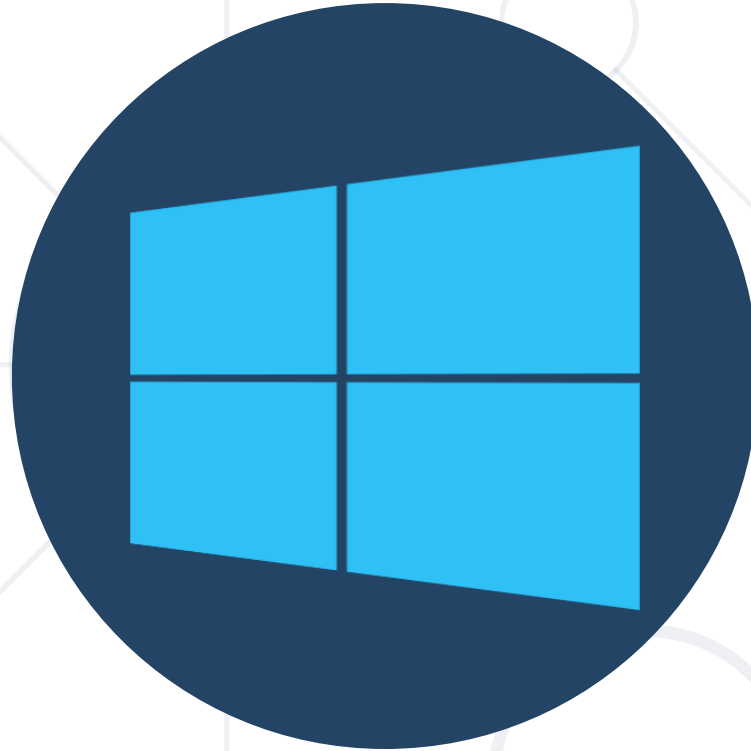
- **Service Processes**

- Host **Windows services**, that run independently of user logons

- **User Processes**

- Windows 32- or 64-bit processes





Windows Server
(2016, 2019 and 2022)

- CPU
 - **1.4 GHz 64-bit** processor
 - NX, DEP, CMPXCHG16b, LAHF/SAHF, PrefetchW, SLAT (EPT or NPT)
- RAM
 - **512 MB*** (**2 GB** for Desktop Experience), ECC
- HDD
 - PCI Express compliant storage adapter
 - **32 GB*** system partition
- Network
 - One Ethernet adapter (at least Gigabit)

■ Windows Server Essentials

- Purpose: Small businesses with basic IT requirements; very small or no IT department
- Virtualization: No, **one physical or one virtual installation**
- Licensing model: **Server-based** (up to **25 users** and **50 devices**)
- CAL requirements: **No CAL required**
- RAM limit: **max. 64 GB**
- CPU limit: **max. 2 CPUs**

(!) Available only in 2016/2019

(!!) In 2022 it is Standard with special license

- **Windows Server Standard**

- Purpose: For all companies that require advanced features and virtualize to a lesser extent
- Virtualization: **2 virtual machines** or **2 Hyper-V Containers**
- Licensing model: **Core-based**
- CAL requirements: **Windows Server CAL** (required for every user or device accessing a server)
- RAM limit: **max. 24 TB (48 TB in 2022)**
- CPU limit: **max. 512 logical cores**

- **Windows Server Datacenter**

- Purpose: For all companies with high requirements on IT workloads with large number of virtual systems
- Virtualization: **Unlimited virtual machines and Hyper-V Containers**
- Licensing model: **Core-based**
- CAL requirements: **Windows Server CAL** (required for every user or device accessing a server)
- RAM limit: **max. 24 TB (48 TB in 2022)**
- CPU limit: **max. 512 logical cores**

<https://www.microsoft.com/en-us/licensing/product-licensing/windows-server>

Windows Server 2016 Changes *

- Windows Server containers and Hyper-V containers
- Docker integration (for Windows and Linux containers)
- Rolling upgrades for Hyper-V and storage clusters
- Hot add/remove of virtual memory/network adapters from VM
- Nested virtualization (Intel only)
- PowerShell Direct and PowerShell DSC
- *Nano Server (only for containers since Windows, version 1709+)*

Windows Server 2019 Changes *

- General (GUI is still here)
- Hybrid Cloud
- Security (Windows Defender ATP, HTTP/2)
- Storage (Migration Service)
- Failover Clustering
- Application Platform (Linux Containers, Kubernetes)

Windows Server 2022 Changes *

- Improved security
- Improved network performance
- Even better cloud integration
- Container and Kubernetes related improvements
- Nested virtualization for AMD processors as well
- New edition – Datacenter: Azure Edition
- New product – Azure Stack HCI



New Approach to Versions

Two Servicing Channels

Long-Term Servicing Channel

- New release every 2-3 years
- Supported for 5 + 5 years
- All available editions
- Core and Desktop Experience
- Windows Server YYYY

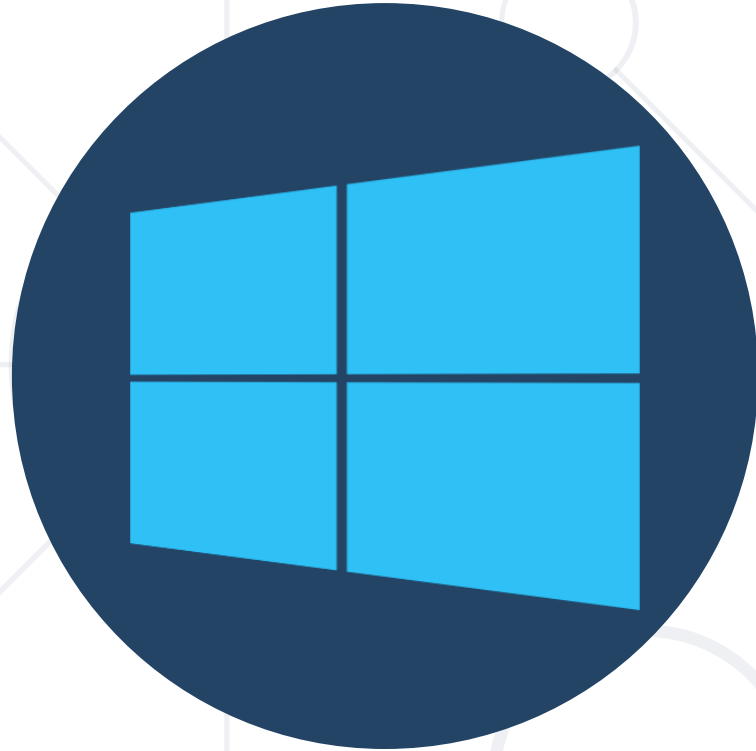
Semi-Annual Channel

- New release every 6 months
- Supported for 18 months
- Only Standard and Datacenter
- Core and Nano
- Windows Server, version YYMM





Time for a Break
(and preparation for the next part)



Installation Options

- Three Main Product Lines with Multiple Editions

- Windows Server

- Essentials

- Standard

- Datacenter

- Windows Storage Server

- Workgroup

- Standard

- Microsoft Hyper-V Server

Since version 2012. Not a separate product in 2022

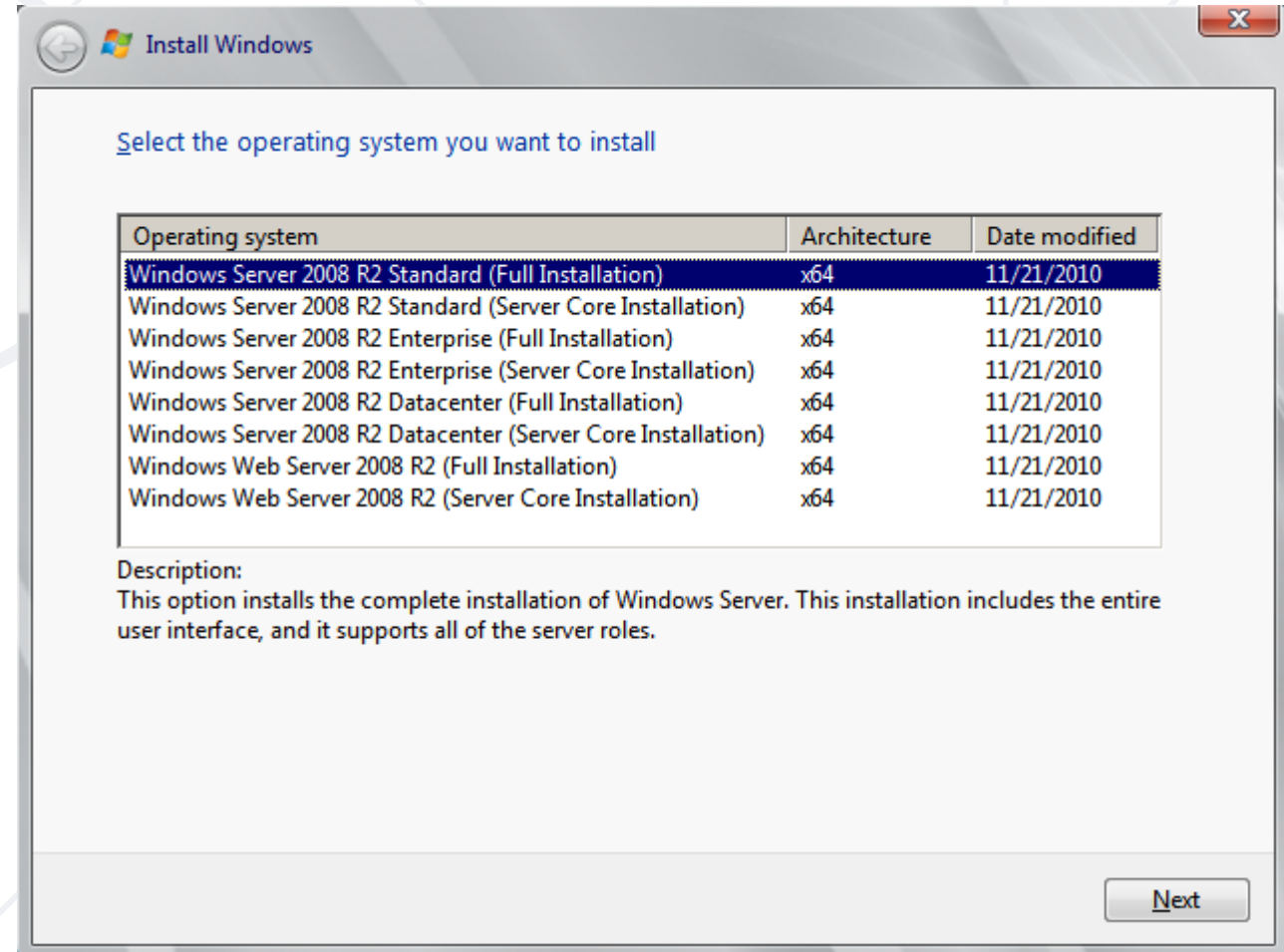
OEM partners only
2012 (R2) / 2016

Since version 2008 R2. Last version is 2019

- Target profile
 - Core, Desktop Experience, or *Nano (only as container)*
- Included features
 - Default or Customized
- Installation process
 - Interactive, Unattended, or Auto-deployed
- Target infrastructure
 - Bare metal (physical hardware) or Virtual machine

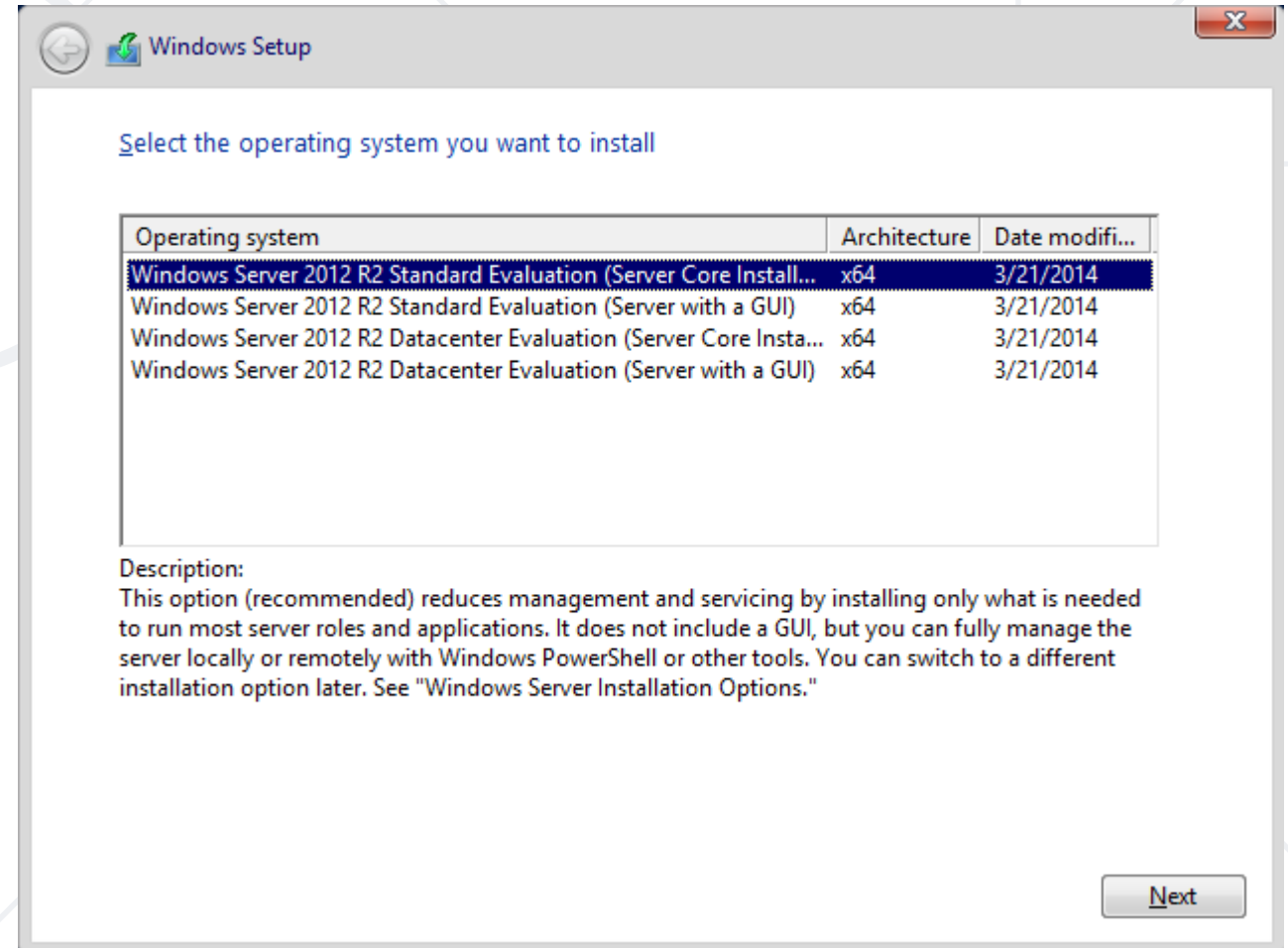
Windows Server 2008 R2

- Editions: Foundation, Web, Standard, Enterprise, Datacenter, Itanium, HPC
- Options: Core, Full
- Default: Full



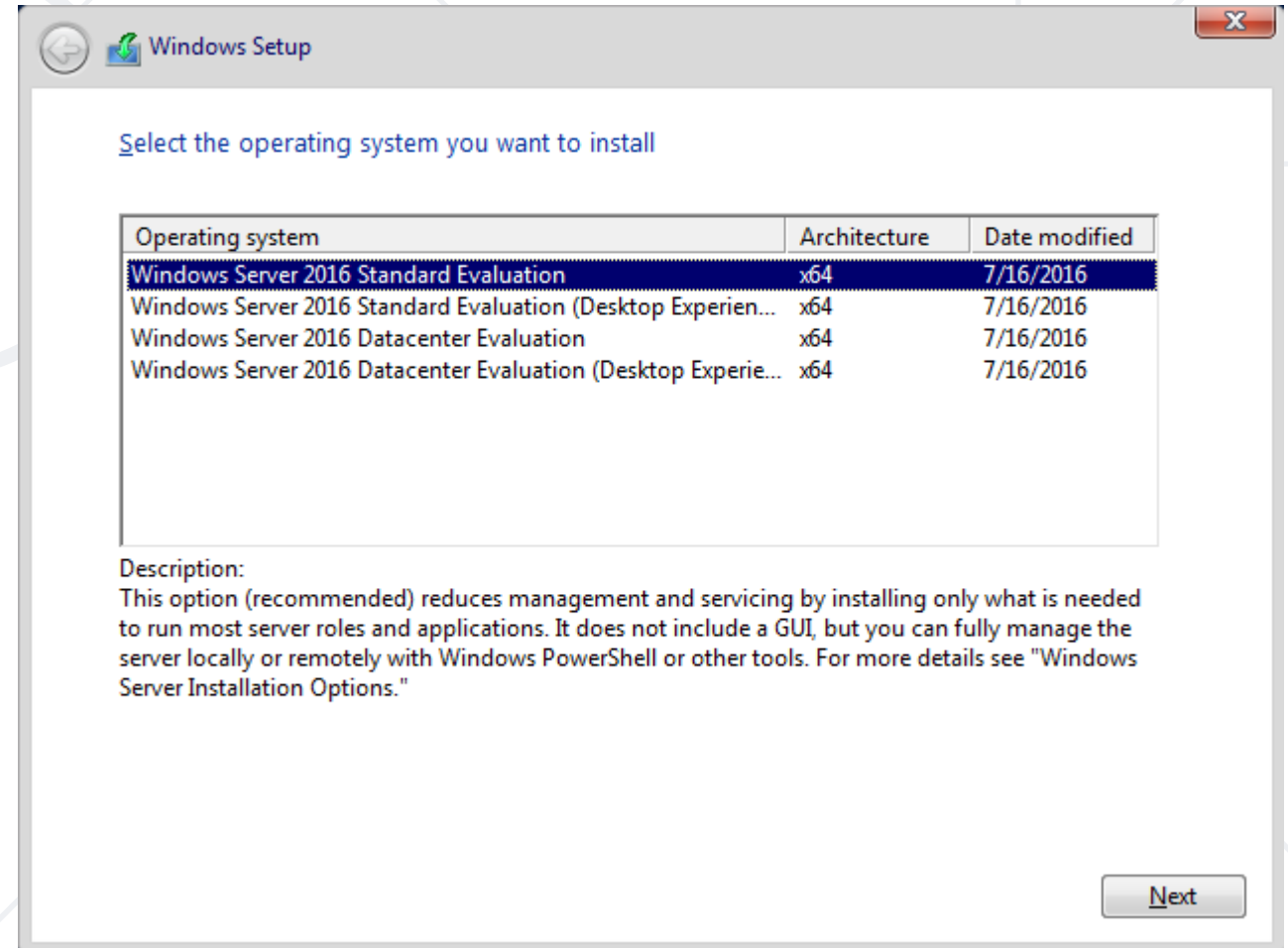
Windows Server 2012 R2

- Editions: Foundation, Essentials, Standard, Datacenter
- Options: Core, With GUI
- Default: Core



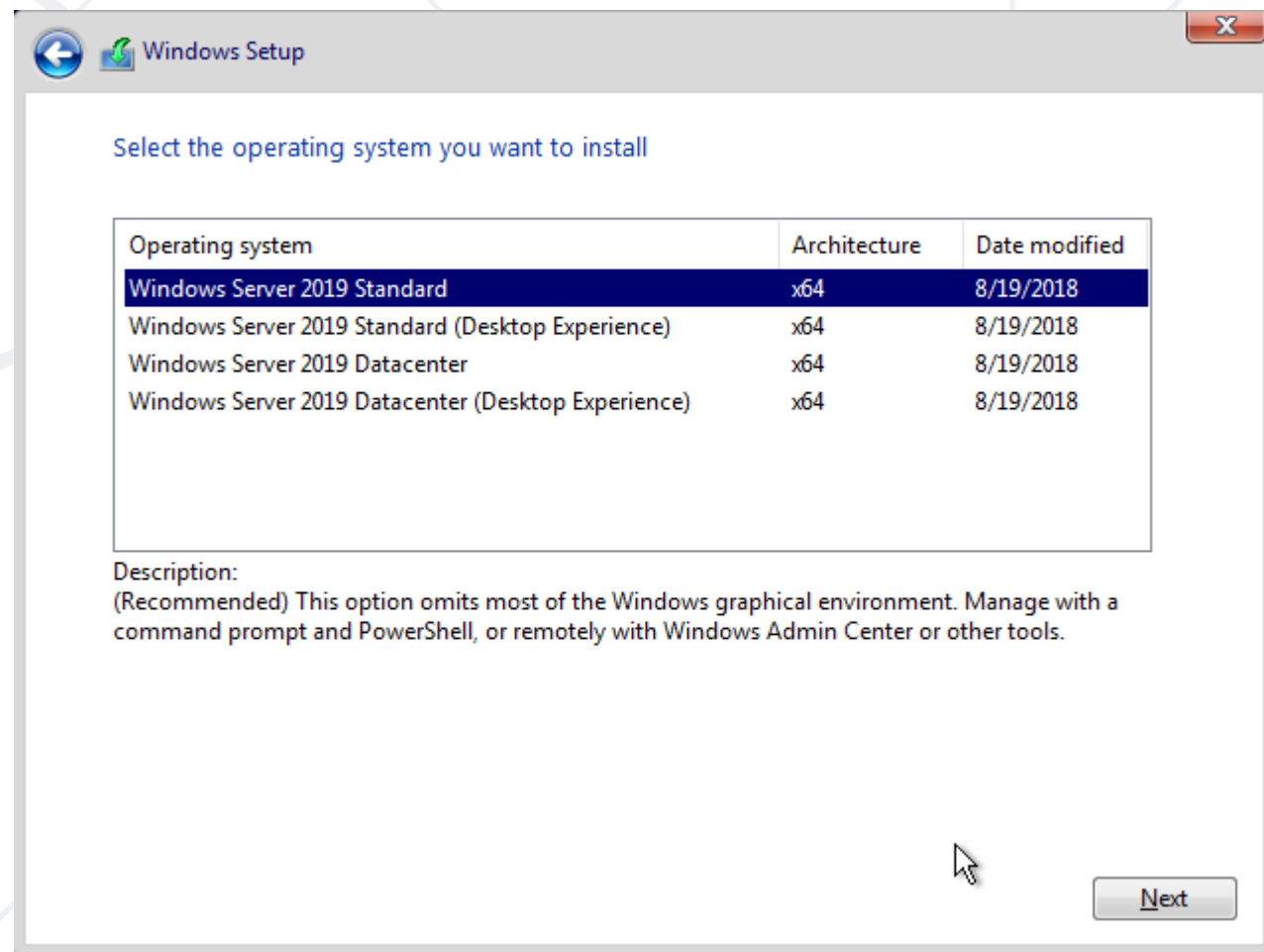
Windows Server 2016

- Editions: Essentials, Standard, Datacenter
- Options: Core, With GUI
- Default: Core



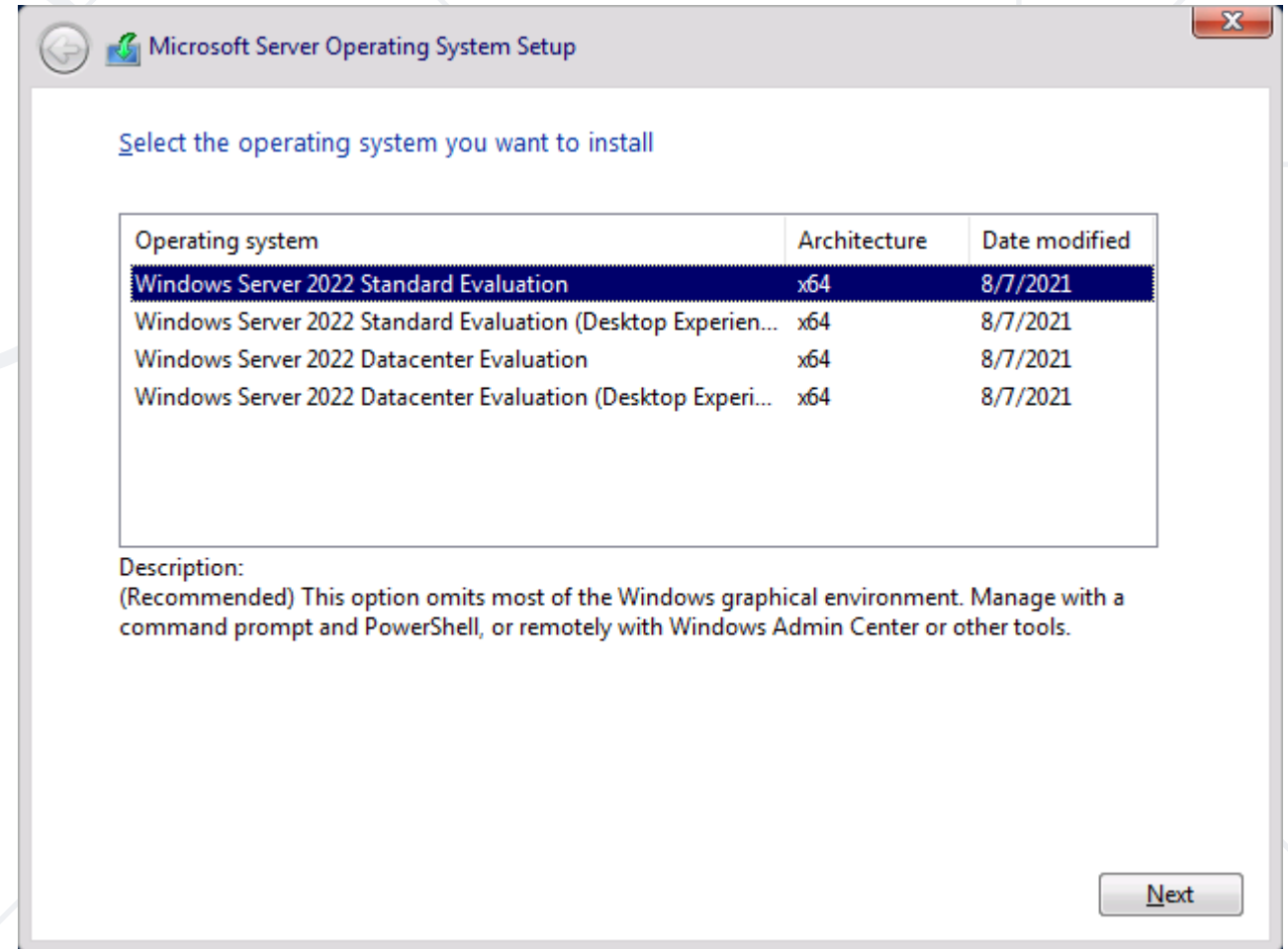
Windows Server 2019

- Editions: Essentials, Standard, Datacenter
- Options: Core, With GUI
- Default: Core



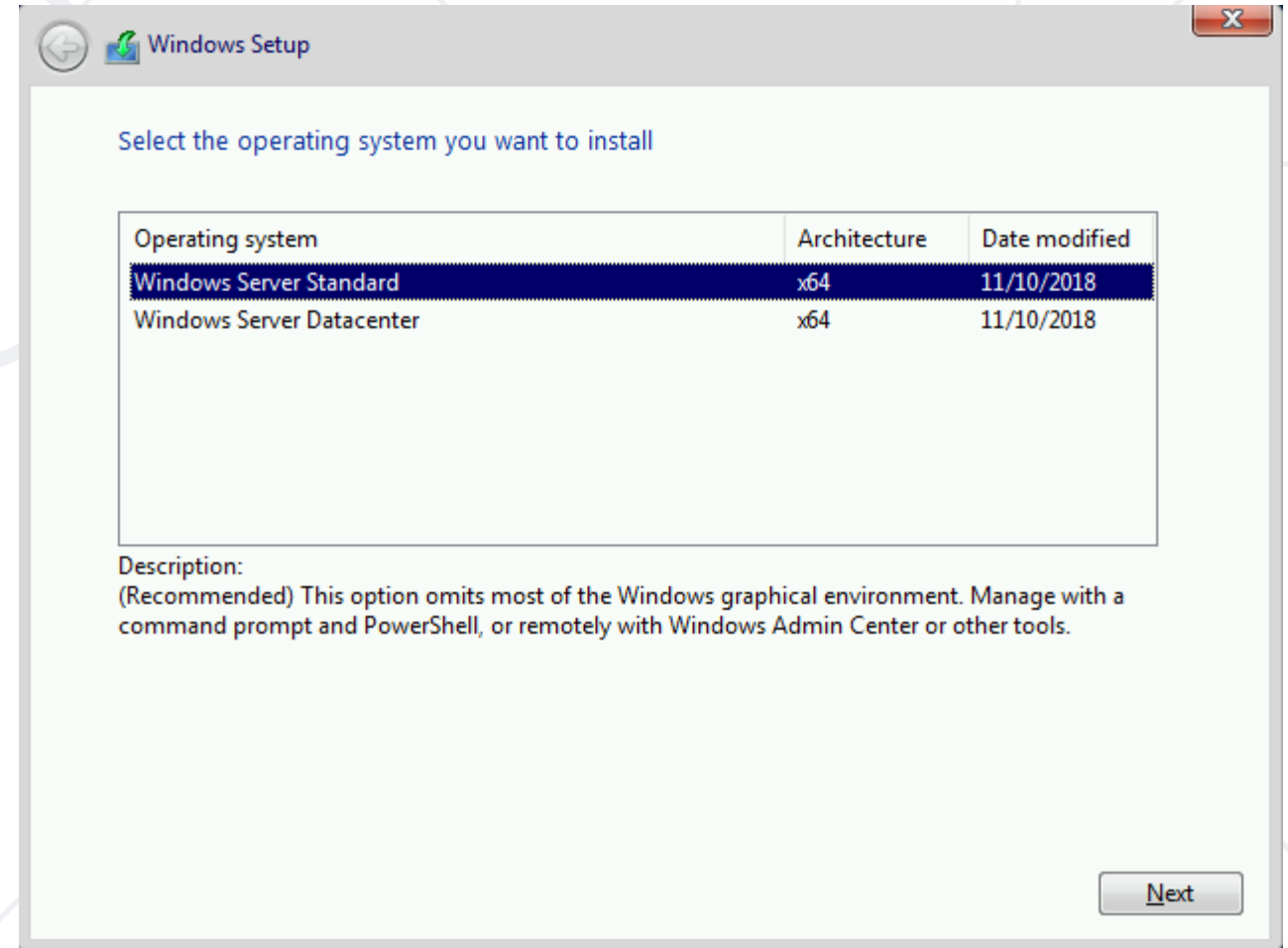
Windows Server 2022

- Editions: Essentials, Standard, Datacenter
- Options: Core, With GUI
- Default: Core



Windows Server (Semi-Annual Channel)*

- Editions: Standard, Datacenter
- Options: Core
- Default: Core





Upgrade Paths

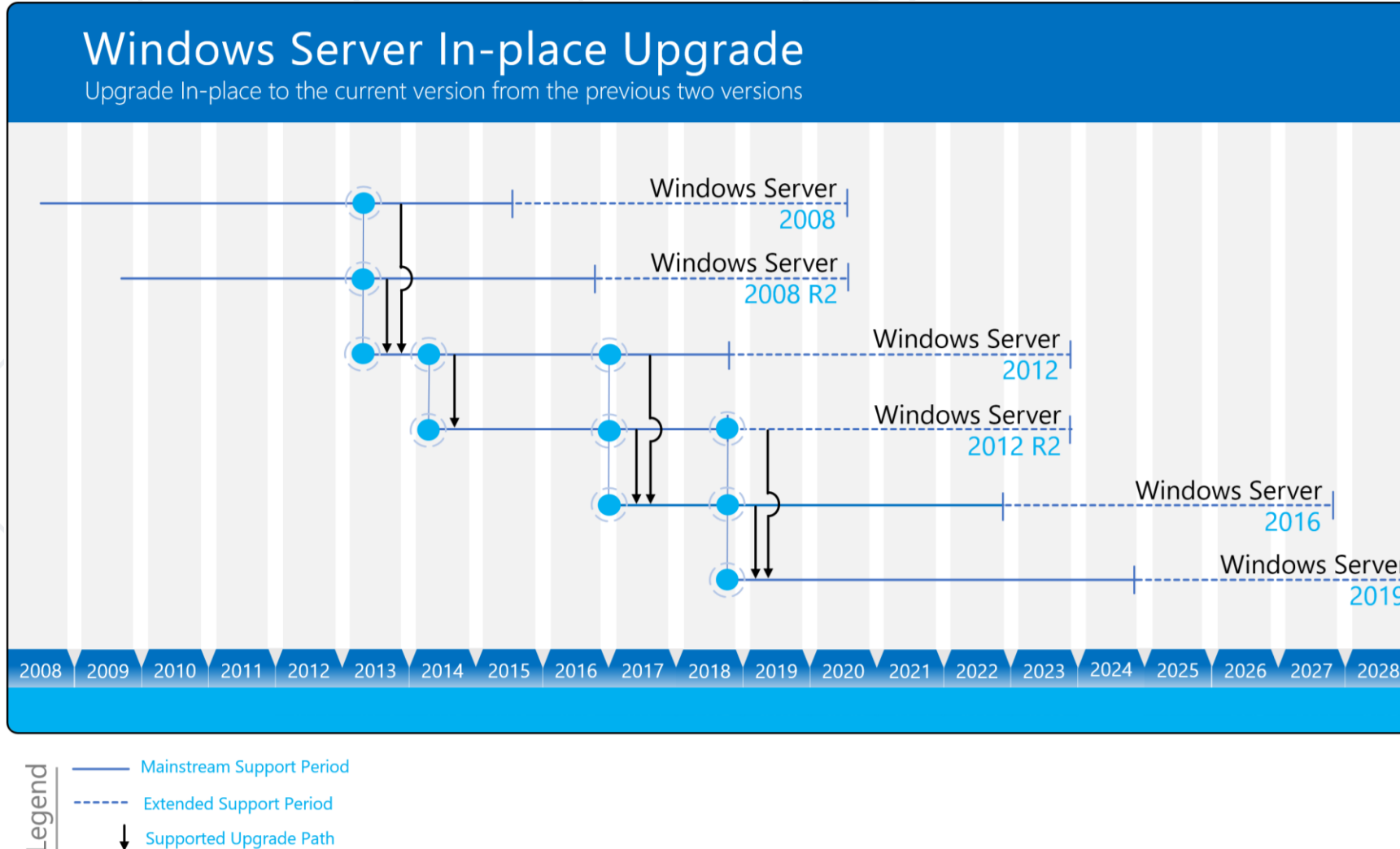
State of Support

Windows Server 2022	Supported
Windows Server 2019	Supported
Windows Server 2016	Supported
Windows Server 2012 R2	Until 10.10.2023
Windows Server 2012	Until 10.10.2023
Windows Server 2008 R2	Until 14.01.2020
Windows Server 2008	Until 14.01.2020

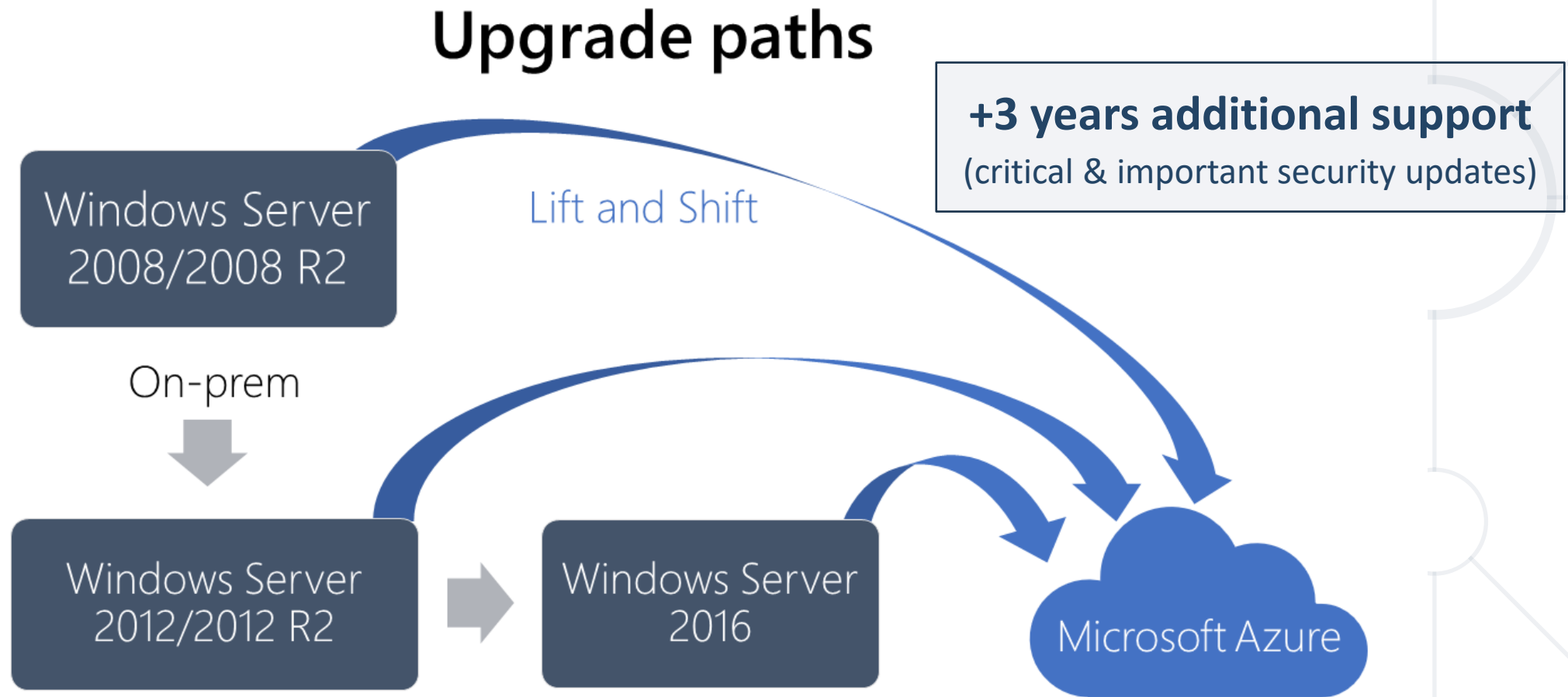
Many Ways to Get There

- **Clean Install**
 - Move from a previous version on the same hardware w/o keeping the data
- **In-place Upgrade**
 - Move from a previous version on the same hardware and keeping the data
- **Migration**
 - Move existing installation to a new hardware (or VM)
- **Cluster OS Rolling Upgrade**
 - Gradually upgrade of Windows Server 2012 R2 or Windows Server 2016 cluster nodes

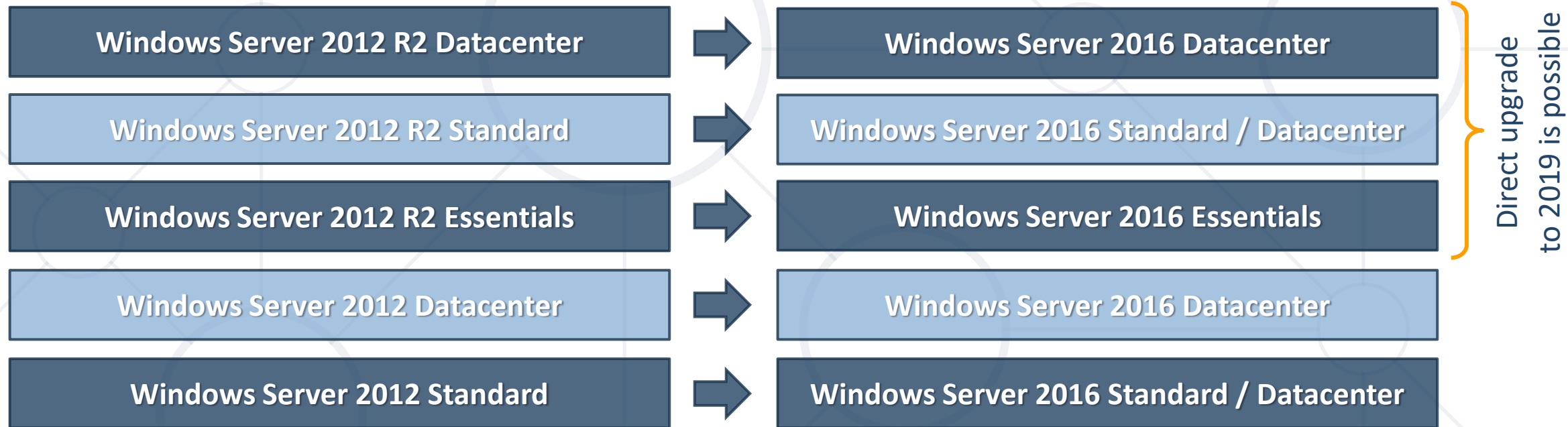
In-place Upgrade Options



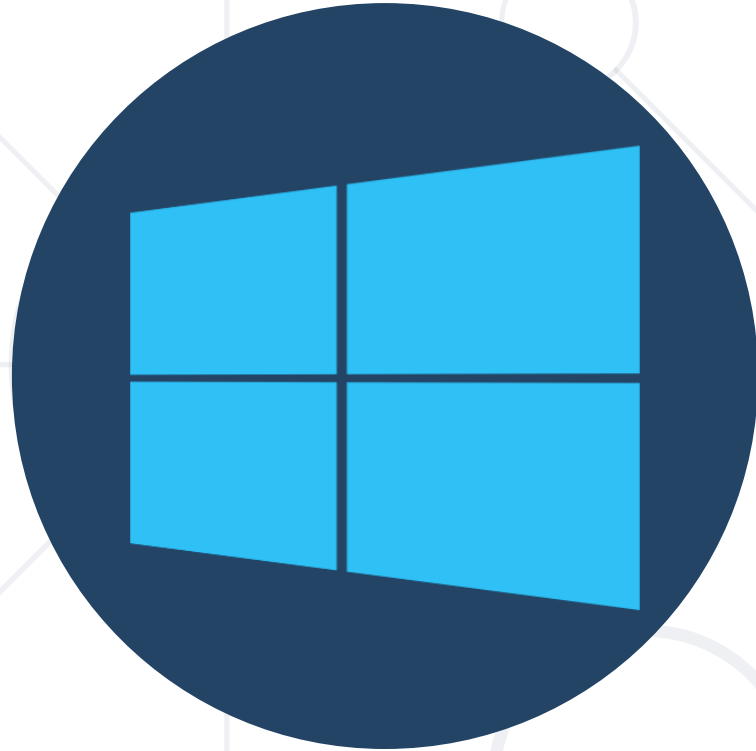
Alternative Upgrade Options



Upgrade Options - 2012 (R2) to 2016 (2019)



- **All editions** of Windows Server 2016 / 2019 / 2022 are **64-bit**
- **No upgrade** between **language** versions
- **No upgrade** between installation types (**Core->GUI or vice versa**)
- **No direct upgrade** from Windows Server 2008 (R2)
- Even if upgrade is supported, certain server **roles may need reconfiguration**
- Even though a valid option, sometimes a **clean install is preferred**



Licenses and Conversion

- **Retail** or **Full Packaged Product (FPP)** or **"boxed"**
 - We buy the product key, and we can transfer it to another computer, as long as we deactivate the old device.
- **Volume**
 - It is designed for a large business, education, and government institutions. Usually, a Volume license allows organizations to use one master product key to activate any installation of the operating system. Volume license keys (VLK) may not be transferred with the computer if the computer changes ownership.
- **OEM (Original Equipment Manufacturer)**
 - Product keys are issued by the manufacturer and cannot be sold or transferred to another computer. They may be transferred with the computer if the computer is transferred to new ownership.

- **Microsoft Product Activation** is a **digital rights management (DRM)** technology
- It is applicable to Windows, Windows Server, Office, etc.
- **Prohibits** or **limits** the **product usage** until the license is confirmed
- It is based on **combined information** coming from some **hardware components** and the **product key**
- Usually, a **grace period** is allowed which varies amongst products
- **Reactivation will be required** if a significant change in the hardware is detected, or the product key is changed
- Volume activation can be done in three ways - **Active Directory-based** activation, **Key Management Services (KMS)** activation, **Multiple Activation Key (MAK)** activation

- Convert Evaluation edition to Retail edition
 - Standard (eval) to Standard (retail) or Datacenter (retail)
 - Datacenter (eval) to Datacenter (retail)
- Switch between Licensing Schemes
 - Choose from retail, volume-licensing, and OEM
- Prior to **14393.0.161119-1705.RS1_REFRESH**, conversion from evaluation to retail was supported only for installations with Desktop Experience option

- Check current license

```
C:\> slmgr /dlv
```

- Determine current edition

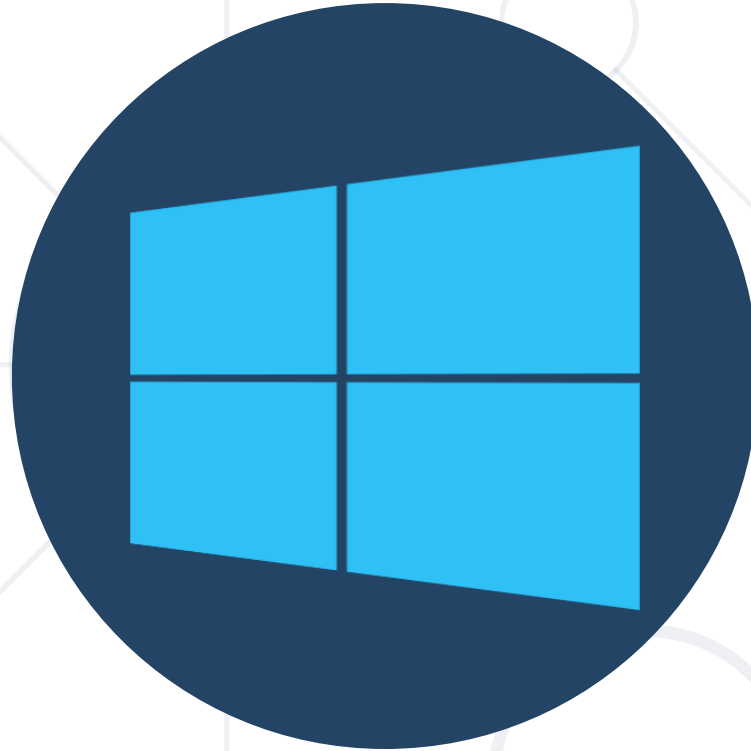
```
C:\> dism /Online /Get-CurrentEdition
```

- Change the edition

```
C:\> dism /Online /Set-Edition:<EID> /ProductKey:<KEY> /AcceptEULA
```

- Convert between licensing schemes (retail, volume, OEM)

```
C:\> slmgr /ipk <KEY>
```



Practice: Windows Server Installation

Live Demonstration in Class

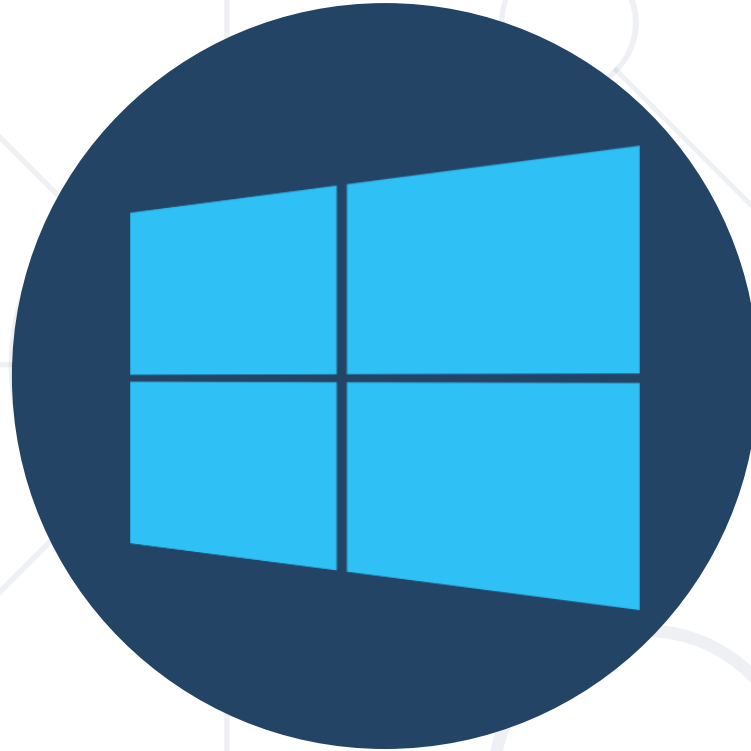


Windows Administration

Approaches. Tools. Tasks

- Approaches
 - **Local** or **Remote**
 - **Standalone** or **Centralized**
 - **GUI Applications** or **Command Line Tools**
- Tools
 - Command Line Tools – **net**, **wmic**, PowerShell **cmdlets**, ...
 - Microsoft Management Console Snap-ins (***.msc**)
 - Control Panel Applets (***.cpl**)
 - **ServerManager.exe**
 - **Windows Admin Center**

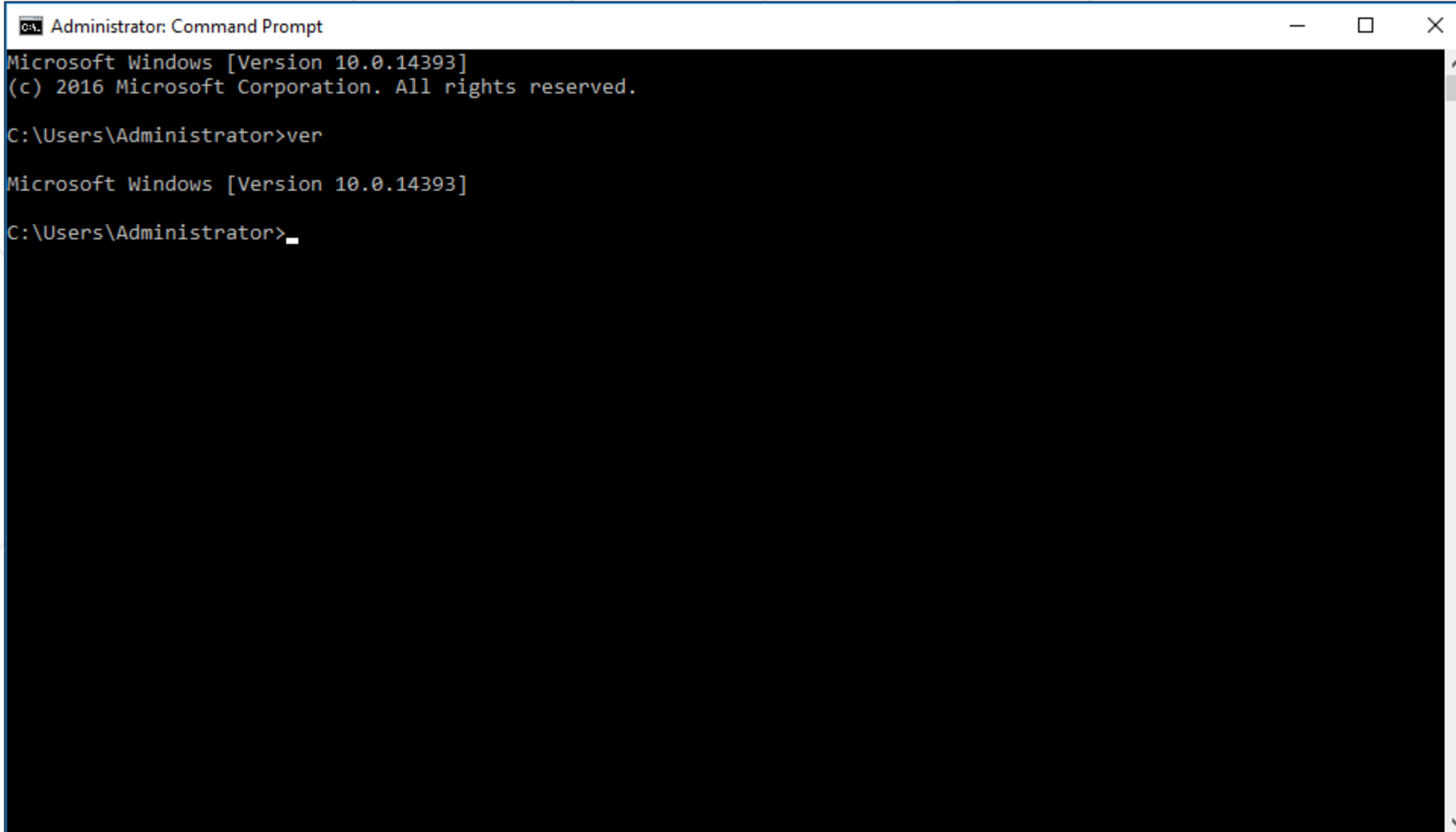
- General System Settings
 - Name, Date and Time, ...
- Hardware Management
 - Disks, Networking, Printers, ...
- Users and Groups Management
- Software Management
 - Installation and/or Modification, Applying Updates
- Services Management
- Monitoring



Command Shell

Look and Feel. Basic Commands

Command Shell (cmd.exe)



```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>ver

Microsoft Windows [Version 10.0.14393]

C:\Users\Administrator>
```

* Arrow keys
are here to
help you

* Tab key
can help you
as well

- Internal Commands

```
C:\> help  
C:\> help ver
```

- Internal and External Commands

```
C:\> dir /?  
C:\> net /?
```

- Some External Commands

```
C:\> net help [sub-command]
```

- Get list of environment variables and their values

```
C:\> set  
...  
COMPUTERNAME=WIN-8U972IB04EE  
ComSpec=C:\Windows\system32\cmd.exe  
HOMEDRIVE=C:  
...
```

- Show variable value

```
C:\> echo %COMPUTERNAME%
```

- Description
 - Display information about Windows version
- Example

```
:: Display dialog with Windows version  
C:\> winver
```

- Description
 - Display operating system information configuration information for a local or remote machine, including service pack levels

- Example

```
:: Display operating system information  
C:\> systeminfo
```

- Description
 - Power-off or restart the system. Log-off the logged user
- Example

:: Turn off the computer

```
C:\> shutdown /p
```

:: Shutdown the computer after 15 seconds

```
C:\> shutdown /s /t 15
```

:: Abort system shutdown during the time-out period

```
C:\> shutdown /a
```

- Description
 - Used for managing users, groups, shares, ...
- Example

```
:: List local users  
C:\> net user  
:: List local groups  
C:\> net localgroup  
:: Show user information  
C:\> net user administrator
```

More Examples: net.exe

- Add local user

```
C:\> net user developer Password1 /add
```

- Delete local user

```
C:\> net user developer /delete
```

- Add local group with comment

```
C:\> net localgroup Developers /add /comment:"..."
```

- Add user to a group

```
C:\> net localgroup Developers developer /add
```

- Description
 - Windows Management Instrumentation Command-line
- Example

```
:: List local users
C:\> wmic useraccount list brief
:: List local groups
C:\> wmic group list brief
:: Lock/unlock user account
C:\> wmic useraccount where name='username' set
disabled={true|false}
```


- Rename computer

```
C:\> wmic computersystem  
where name="%computername%"  
call rename name="MY-SERVER"
```

- Change computer workgroup

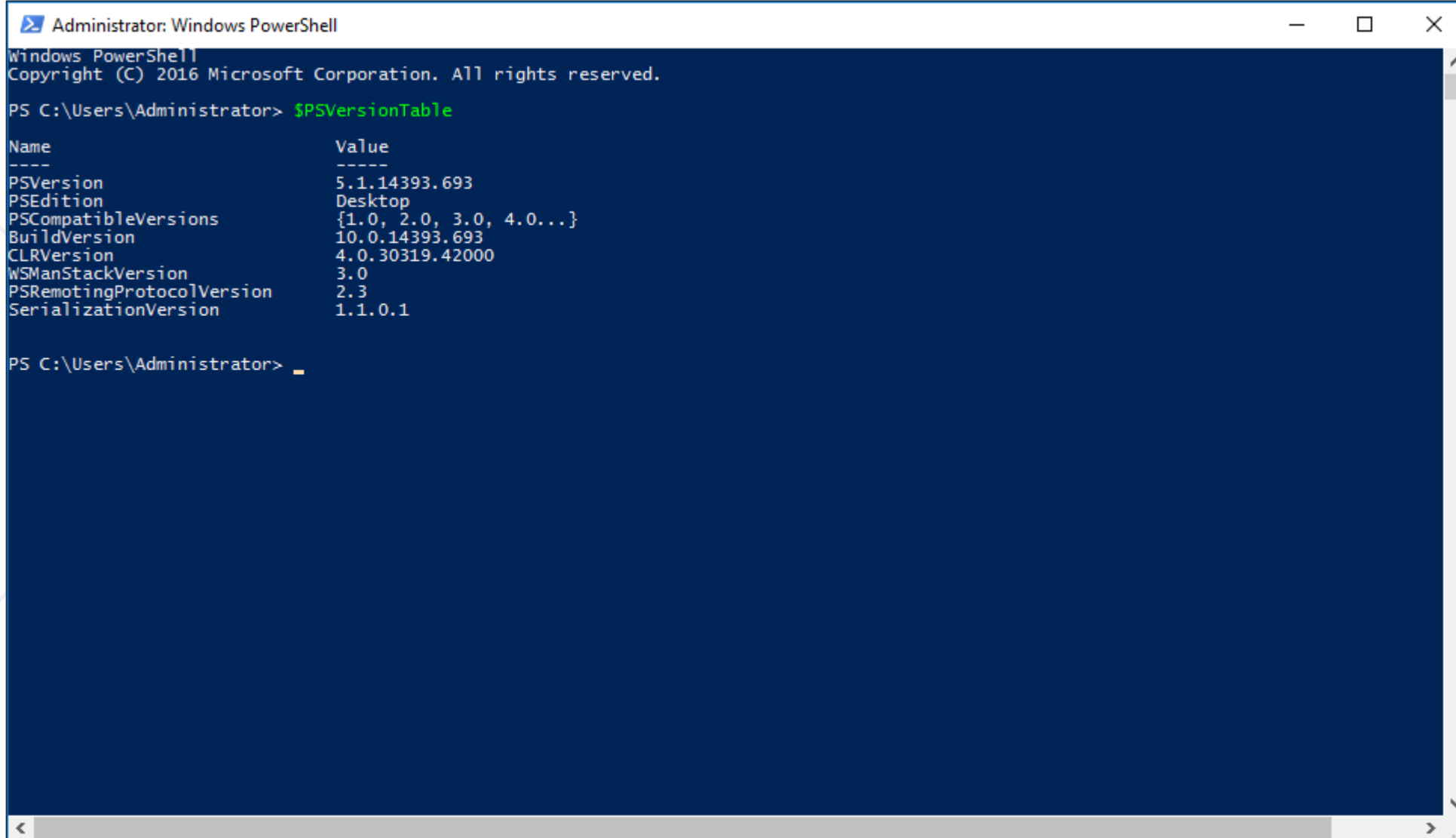
```
C:\> wmic computersystem  
where name="%computername%"  
call joindomainorworkgroup name="WSA"
```



PowerShell

Look and Feel. Basic cmdlets

PowerShell (powershell.exe)



A screenshot of a Windows PowerShell console window titled "Administrator: Windows PowerShell". The window has a dark blue background and a white border. The text inside shows the PowerShell version and edition information, followed by a command to display the \$PSVersionTable. The output is a table with two columns: Name and Value. The command prompt is at the bottom, waiting for input.

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator> $PSVersionTable

Name                Value
----                -
PSVersion           5.1.14393.693
PSEdition            Desktop
PSCompatibleVersions {1.0, 2.0, 3.0, 4.0...}
BuildVersion        10.0.14393.693
CLRVersion           4.0.30319.42000
WSManStackVersion    3.0
PSRemotingProtocolVersion 2.3
SerializationVersion 1.1.0.1

PS C:\Users\Administrator> 
```

* Arrow keys
are here to
help you

* Tab key is
your best
friend 😊

- Description
 - Update help information
- Example

```
PS C:\> Update-Help
...
Updating Help for module ...
...
```

- Description
 - Show help information about cmdlet
- Example

```
# Get brief help about Update-Help cmdlet
PS C:\> Get-Help Update-Help
# Get very detailed help about Update-Help cmdlet
PS C:\> Get-Help Update-Help -Full
# Get examples about Update-Help cmdlet
PS C:\> Get-Help Update-Help -Examples
```

- Description
 - Show list of all commands that are installed on the system
- Example

```
# List of all commands in a module
PS C:\> Get-Command -Module *LocalAccounts
# List of all command with specific action
PS C:\> Get-Command -Verb Set
# List of all commands containing specific word
PS C:\> Get-Command -Name *Time*
```

- Description
 - Display dialog window to build a command
- Example

```
# Construct command for Get-Help cmdlet
PS C:\> Show-Command Get-Help
...
PS C:\> Get-Help -Category Cmdlet^M
...
```

- Description
 - Add local or remote computer to a domain or workgroup
- Example

```
# Add local computer to a workgroup  
PS C:\> Add-Computer -WorkGroupName MY-GROUP  
...
```


- Description
 - Rename local or remote computer
- Example

```
# Rename local computer  
PS C:\> Rename-Computer -NewName MY-SERVER  
...
```

- Description
 - Convert encrypted standard or plain string to secure string
- Example

```
# Convert plain-text string to secure string  
PS C:\> ConvertTo-SecureString -AsPlain "Password1"  
-Force  
...
```

- Description
 - Create a local user account
- Example

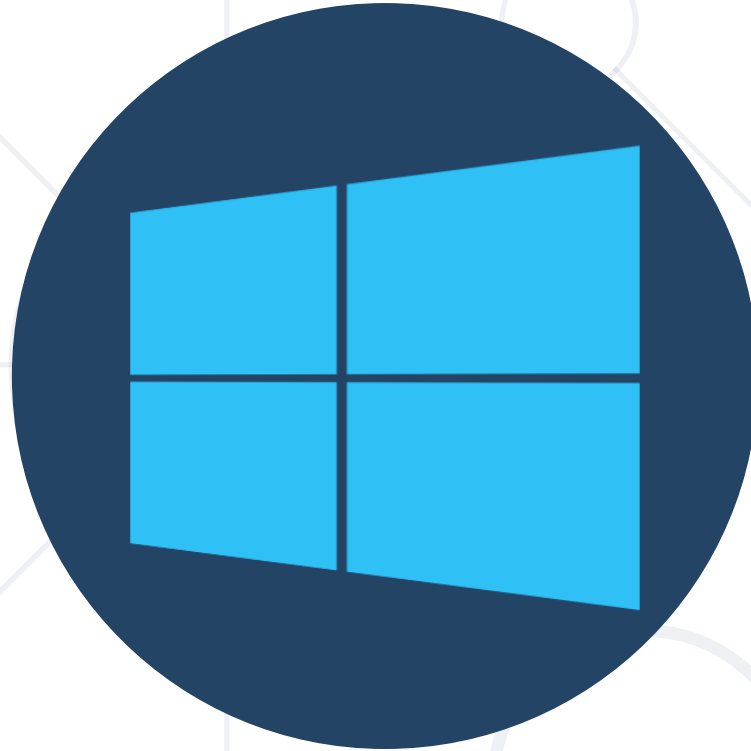
```
# Add a local user  
PS C:\> New-LocalUser -Name Admin -Password (ConvertTo-  
SecureString -AsPlainText "Password1" -Force)  
...
```

- Description
 - Create a local group
- Example

```
# Add a local group  
PS C:\> New-LocalGroup -Name LocalAdmins  
...
```

- Description
 - Add user or group as member of a local group
- Example

```
# Add two users to a local group  
PS C:\> Add-LocalGroupMember -Group LocalAdmins -Member  
Admin1, Admin2  
...
```



Practice: Basic Administration Tasks

Live Demonstration in Class

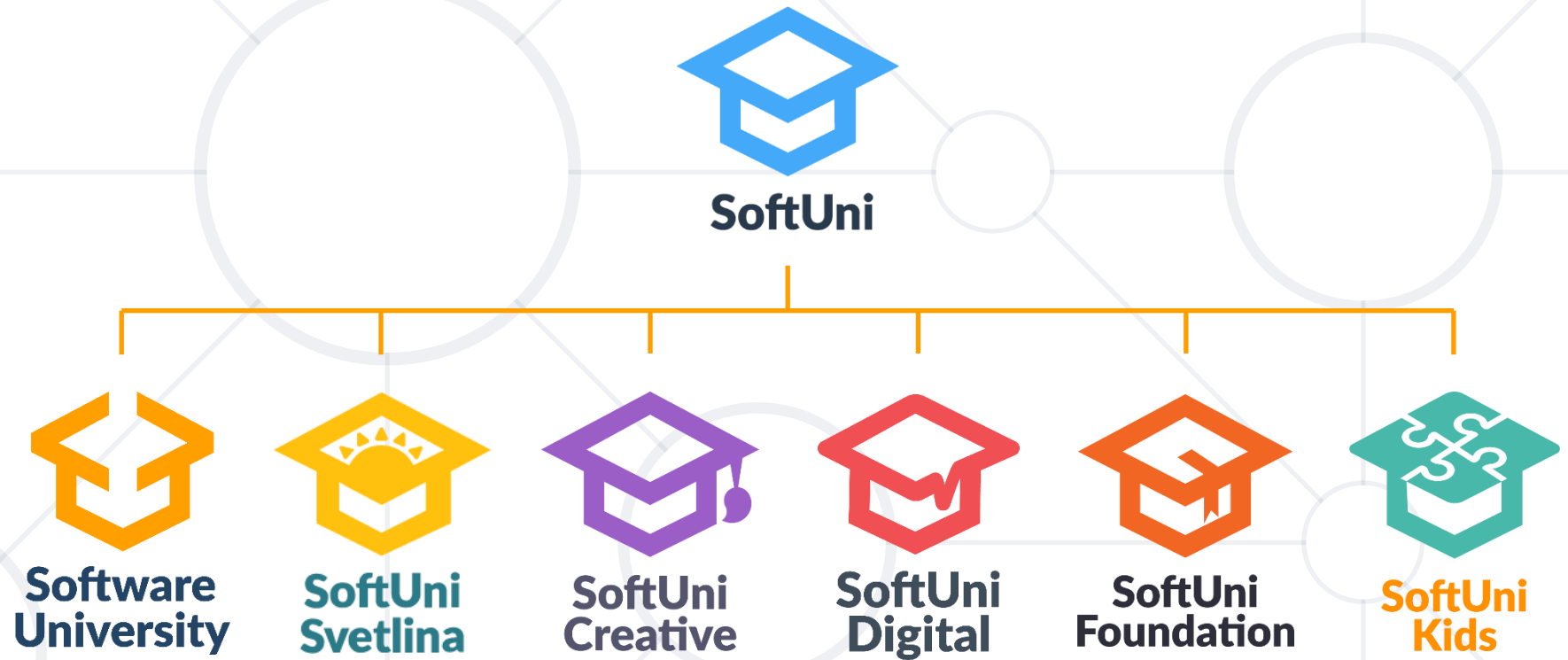
- Windows Server has huge install base
- Still many installations of 2008 (R2) / 2012 (R2)
- Latest version is Windows Server 2022
- There are three license offerings
- Installations vary by License level and Installation type
- There are different upgrade paths
- Upgrade is not always the best option
- System Administration can be
 - Local or Remote
 - GUI or Command Line Tools



- Windows Server Documentation
<https://docs.microsoft.com/en-us/windows-server/>
- Microsoft Evaluation Center (for Windows ISO download)
<https://www.microsoft.com/en-us/evalcenter/>
- Windows Server Feature Comparison (2008 R2 - 2019)
<https://www.microsoft.com/en-us/cloud-platform/windows-server-comparison>
- Windows Server 2016 Products and Editions
<https://docs.microsoft.com/en-us/windows-server/get-started/2016-edition-comparison>
- Windows Server 2019 Products and Editions
<https://docs.microsoft.com/en-us/windows-server/get-started-19/editions-comparison-19>
- Get started with Windows Server Essentials
<https://docs.microsoft.com/en-us/windows-server-essentials/get-started/get-started>



Questions?



SoftUni Diamond Partners

SCHWARZ



Coca-Cola HBC
Bulgaria



Postbank

Решения за твоето утре



POKERSTARS



CAREERS



AMBITIONED

DXC
TECHNOLOGY



**SOFTWARE
GROUP**

Bosch.IO

INDEAVR
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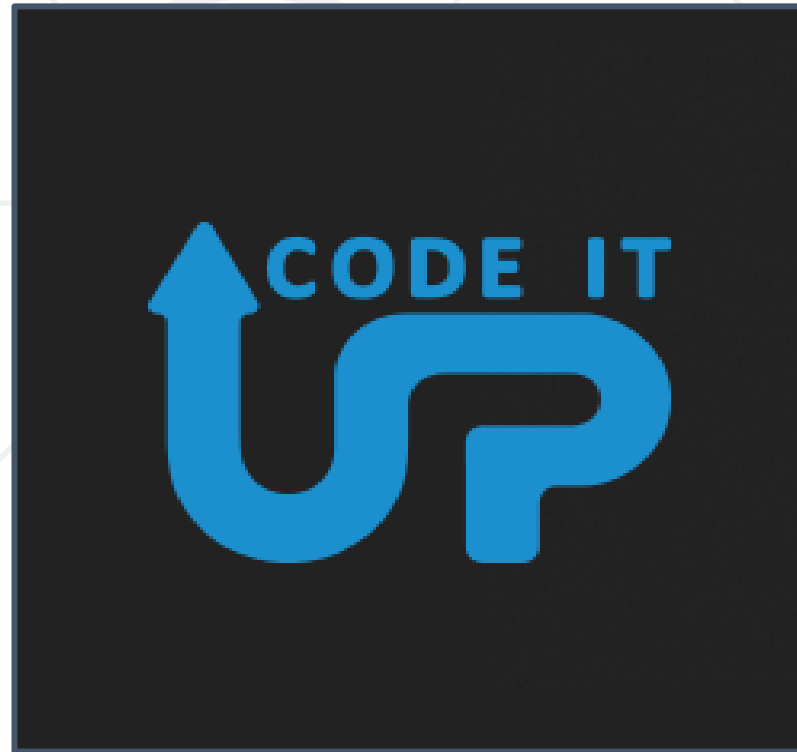
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