Chapter 1

Getting Started with Windows Server

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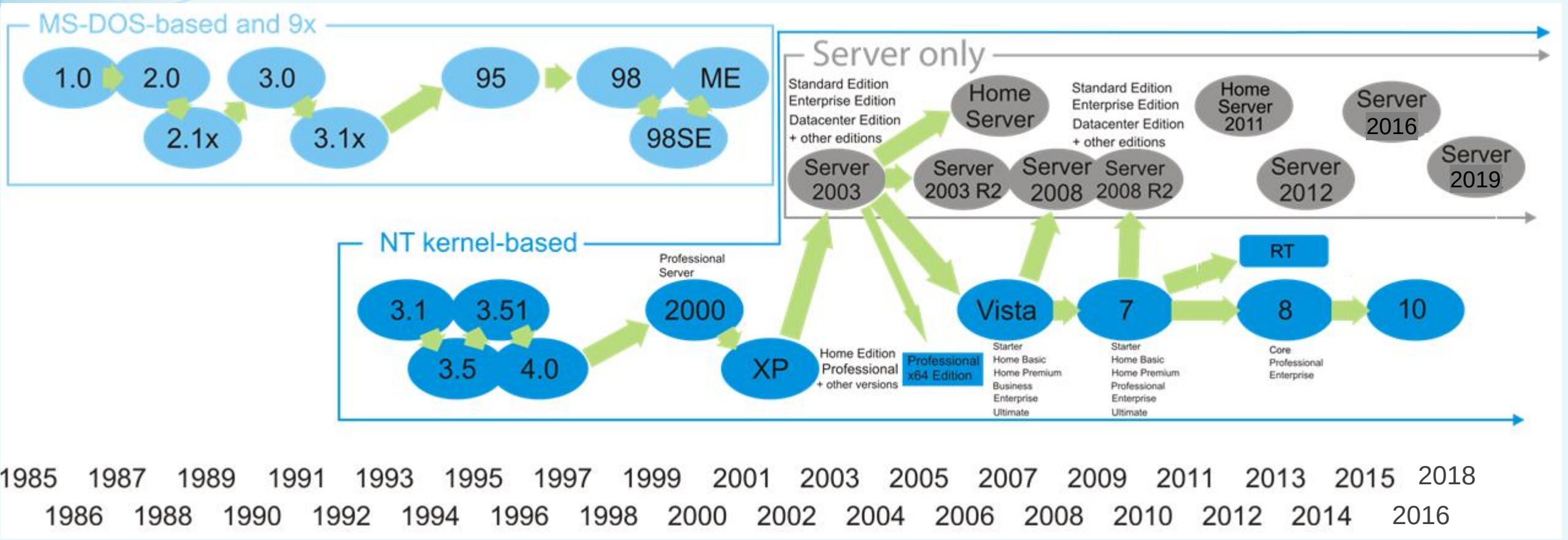
Content

- History of Windows Operating Systems
- Windows OS Architecture and Networking Models
- The purpose of a Windows Server?
- It's getting "cloudy" out there
- Introduction to Windows server 2022

History of Windows

Windows family tree



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History of Windows

Timeline of windows

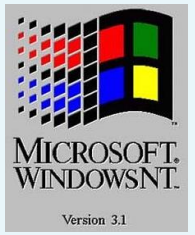
1981

2.0

1987

3.0

1990



1993

1996

History of Windows

Timeline of windows

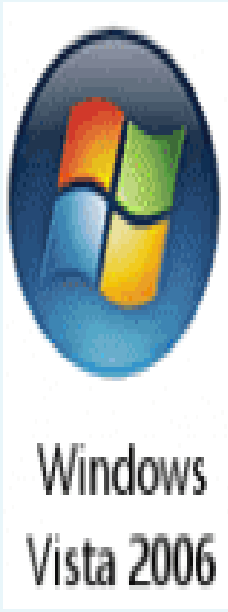
1998

1999

2000

2000

2003



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History of Windows

Timeline of windows

2008

2012

2015

2016

2018

History of Windows

Timeline of windows

2021

2022

2024

History of Windows

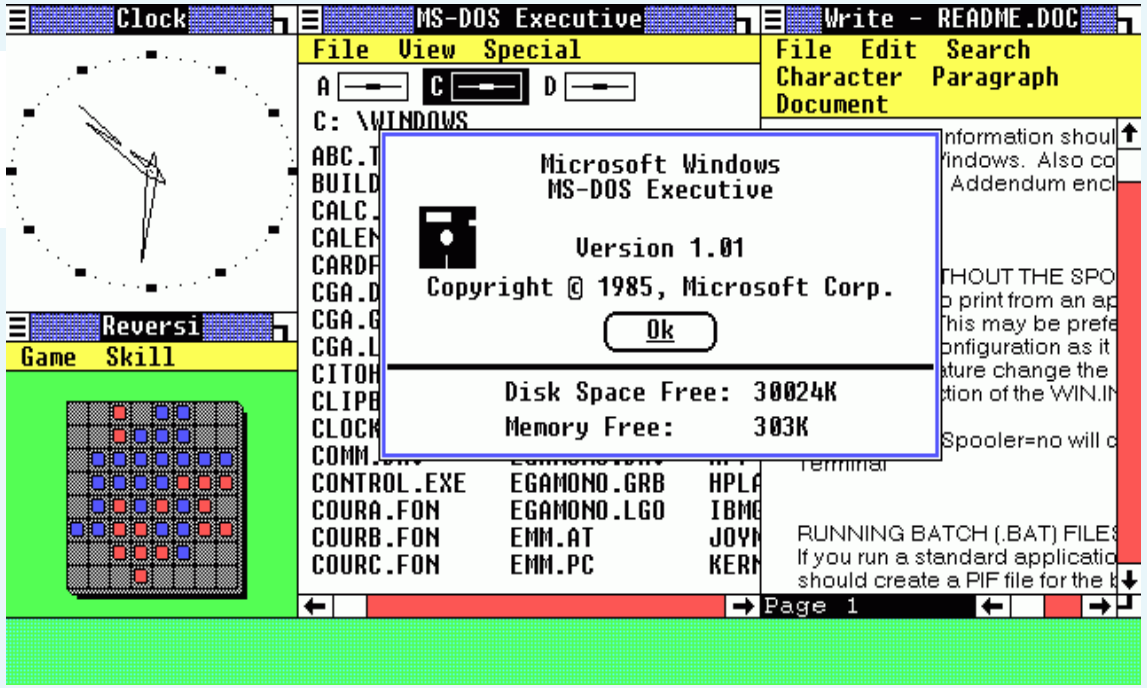
Timeline of windows

Command-line interface (CLI)

1981

1987

- 16-bit multi-tasking on top of MS-DOS
- Limited multi-tasking



History of Windows

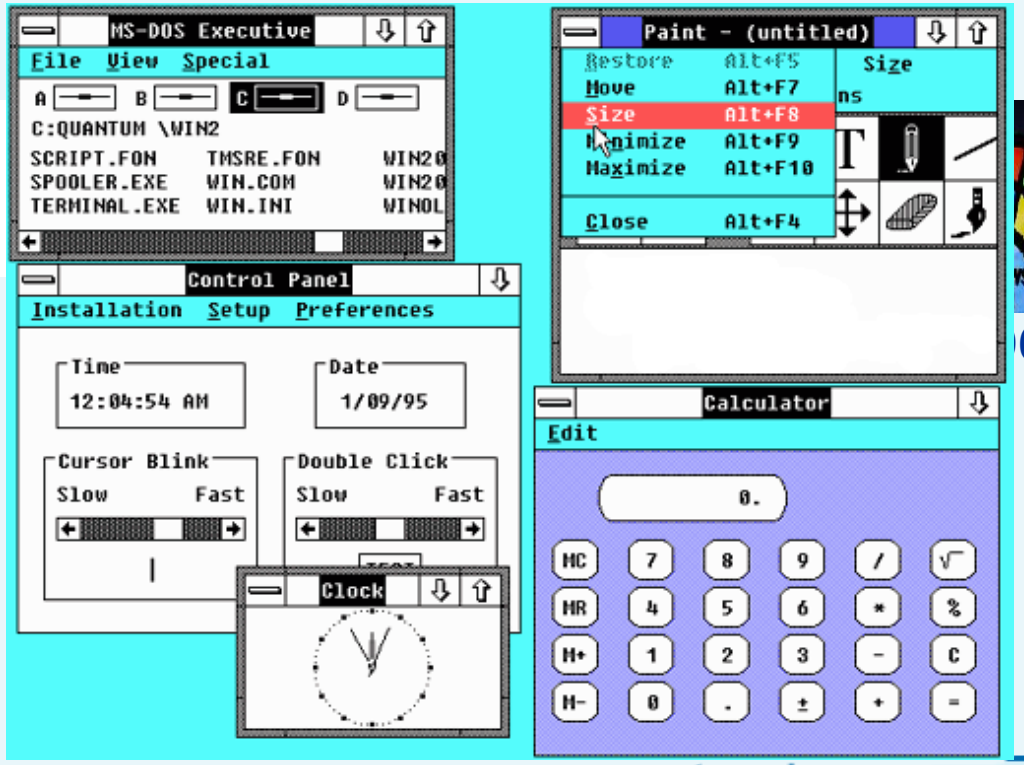
Timeline of windows

- Allows application windows to overlap
- Integra`te the control panel

1981

2.0

1987



History of Windows

Timeline of windows

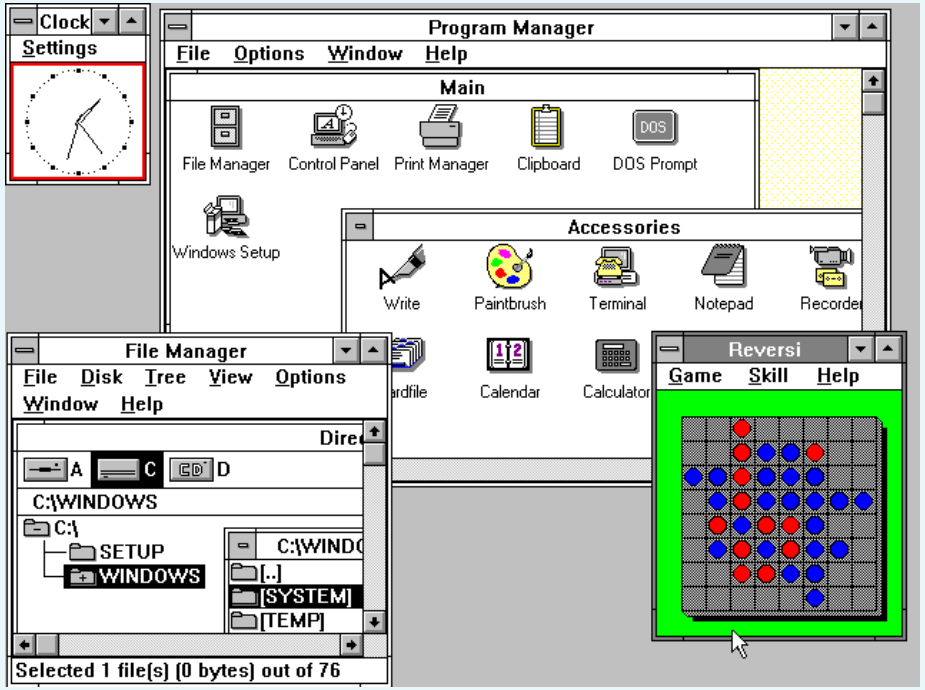
- Enhanced mode to run Windows applications with reduced memory
- Better memory management

MS DOS
1981

Windows 1
1985

MICROSOFT WINDOWS
2.0
1987

MICROSOFT WINDOWS
3.0
1990



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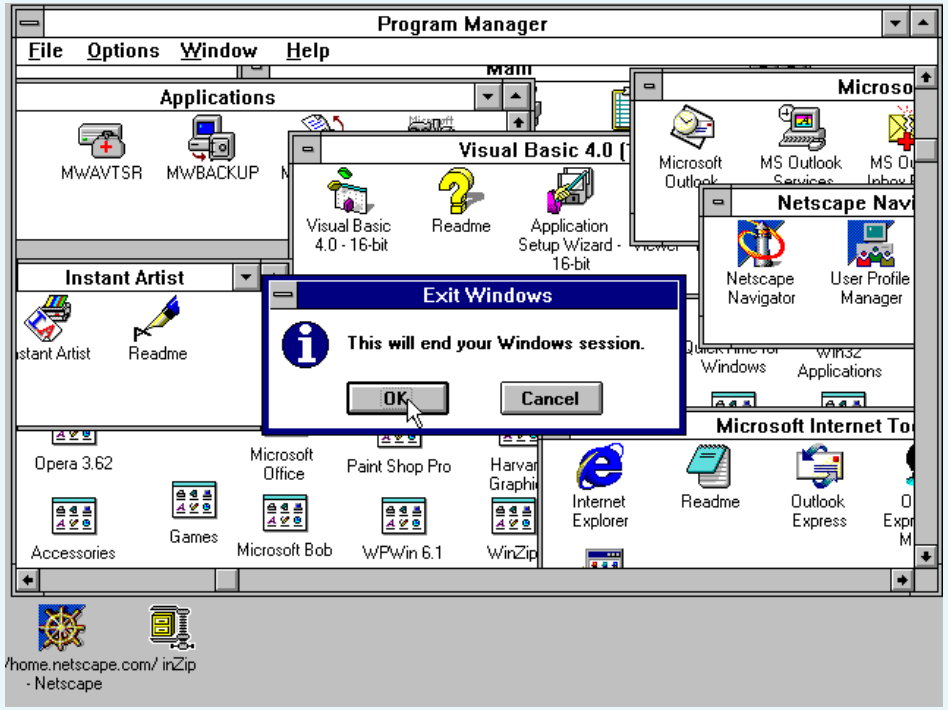
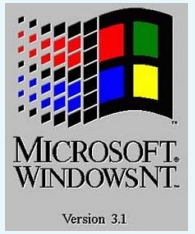
History of Windows

Timeline of windows

- 1024 x 768 pixels resolution with a 24-bit color depth
- Control panel is enriched
- Windows Media Player





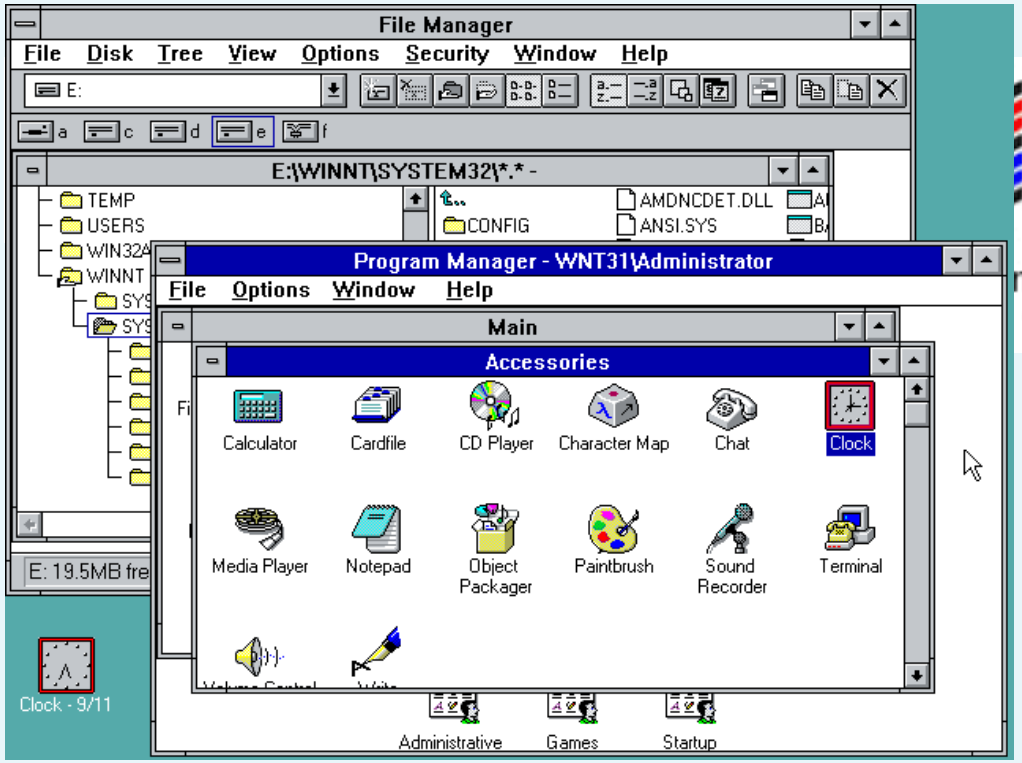
1993

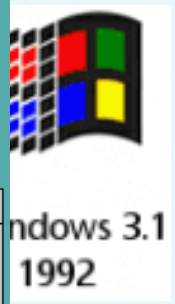
1996

History of Windows

Timeline of windows

- Portability to multiple processor architectures, higher security and stability
- Designed from scratch





1993

1996

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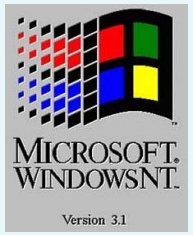
History of Windows

Timeline of windows

- Introduced the taskbar, the 'Start' button, and the way the user navigates
- Multitasked 32-bit architecture



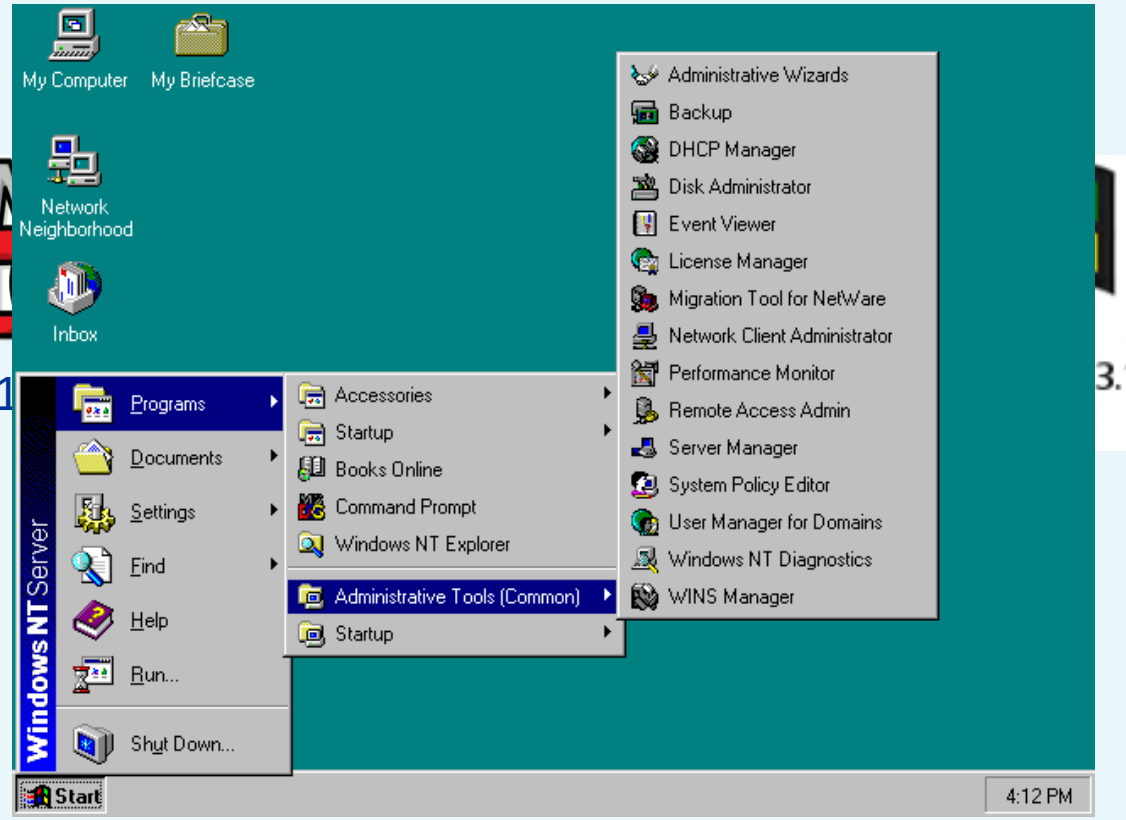
1993

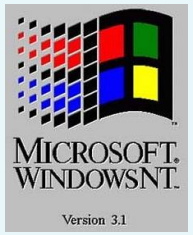
1996

History of Windows

Timeline of windows

- Same interface as Windows 95
- IIS 2.0, Microsoft FrontPage 1.1, Remote Access Service





1993

1995

1996

History of Windows

Timeline of windows

- Same interface as Windows 95
- Improved power management, network management, and USB support
- Added Standby and Hibernate modes

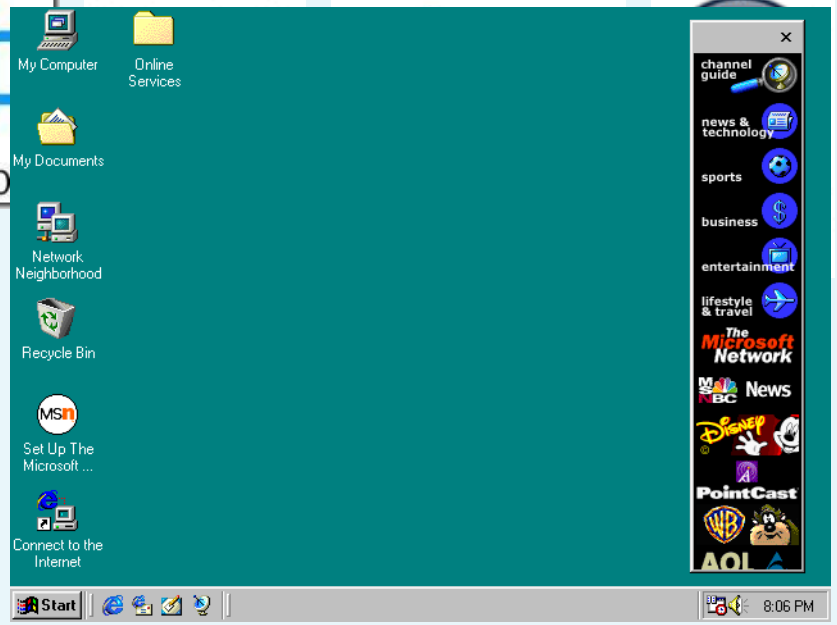
1998

1999

2000

2000

- IIS 2.0, Microsoft FrontPage 1.1,
- Remote Access Service,..



History of Windows

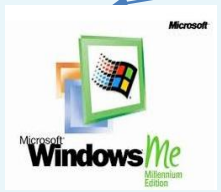
Timeline of windows

For embedded systems

- IE 5.5, Windows Media Player 7 and Windows Movie Maker
- System Restore

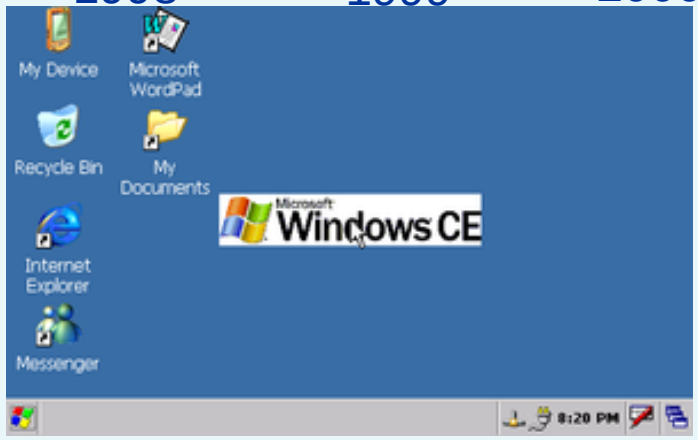
1998

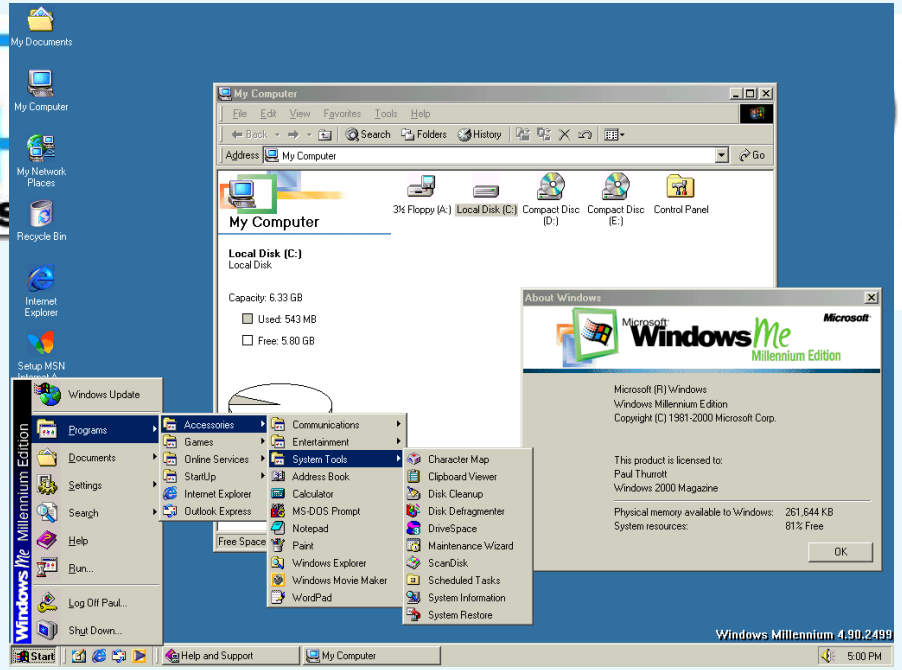
1999



2000

2000





History of Windows

Timeline of windows

- Based on Microsoft's business-orientated system Windows NT
- Active Directory Domain

2000

Windows XP 2001

2003

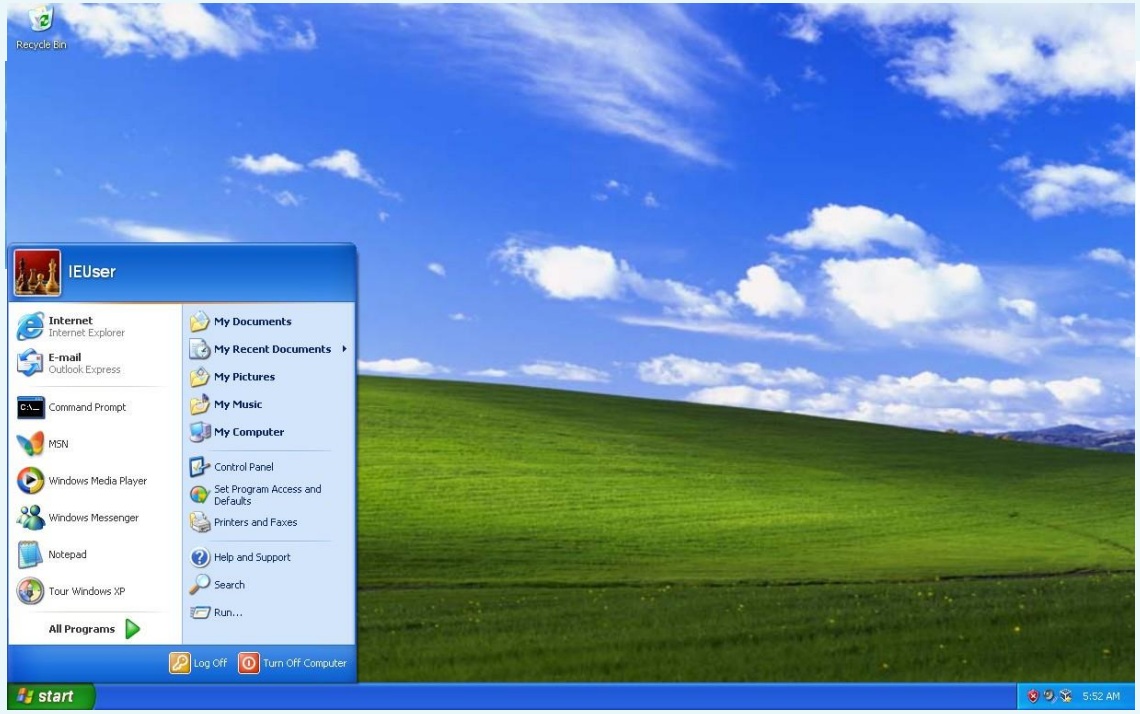
Windows Vista 2006

Professional, Server, Advanced Server, Datacenter Server and Small Business Server

History of Windows

Timeline of windows

- Improved taskbar and ‘Start’ menu, better networking features
- Newly improved user interface



Windows XP
2001

Windows Server 2003

2003

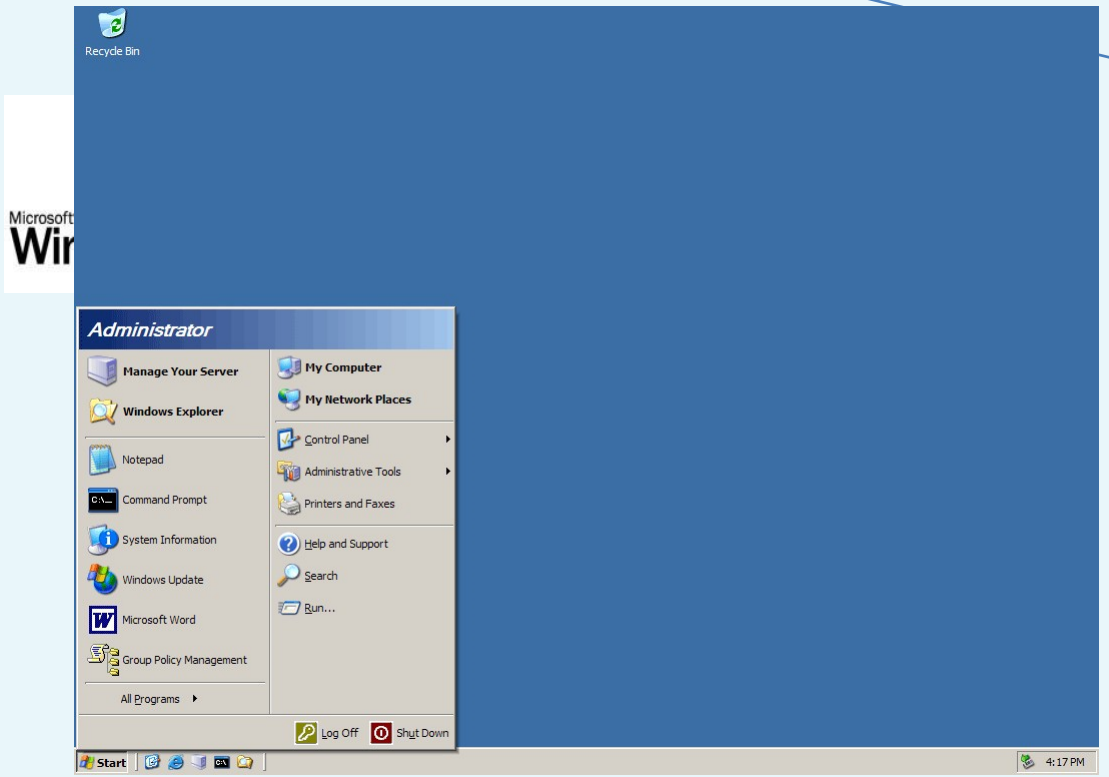
Windows
Vista 2006

History of Windows

Timeline of windows

- Integrated support for the .NET Common Language Runtime (CLR)
- Improve AD, Remote server administration,…

1998



2003

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History of Windows

Timeline of windows

- Introducing Windows Search, Windows Aero, Windows Sidebar, Shadow Copy
- Integrated Speech Recognition

Microsoft Windows98

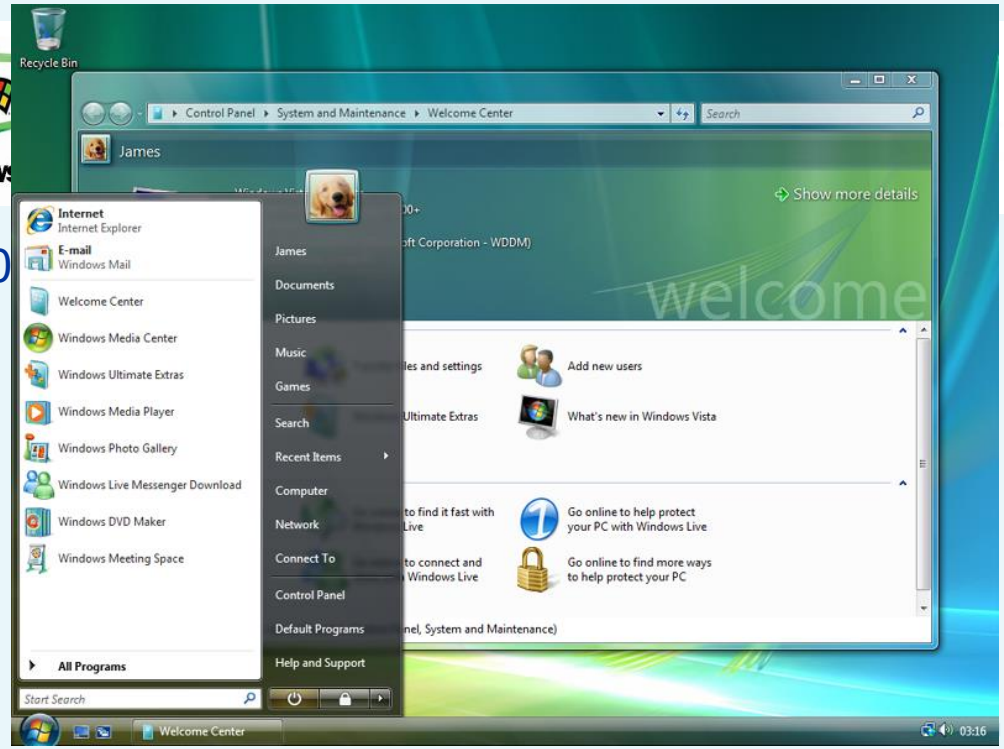
1998

Microsoft Windows CE

1999

Microsoft Windows

200



Windows Vista 2006

History of Windows

Timeline of windows

- Virtualization
- Read Only Domain Controllers (RODC)
- Bitlocker, Windows PowerShell

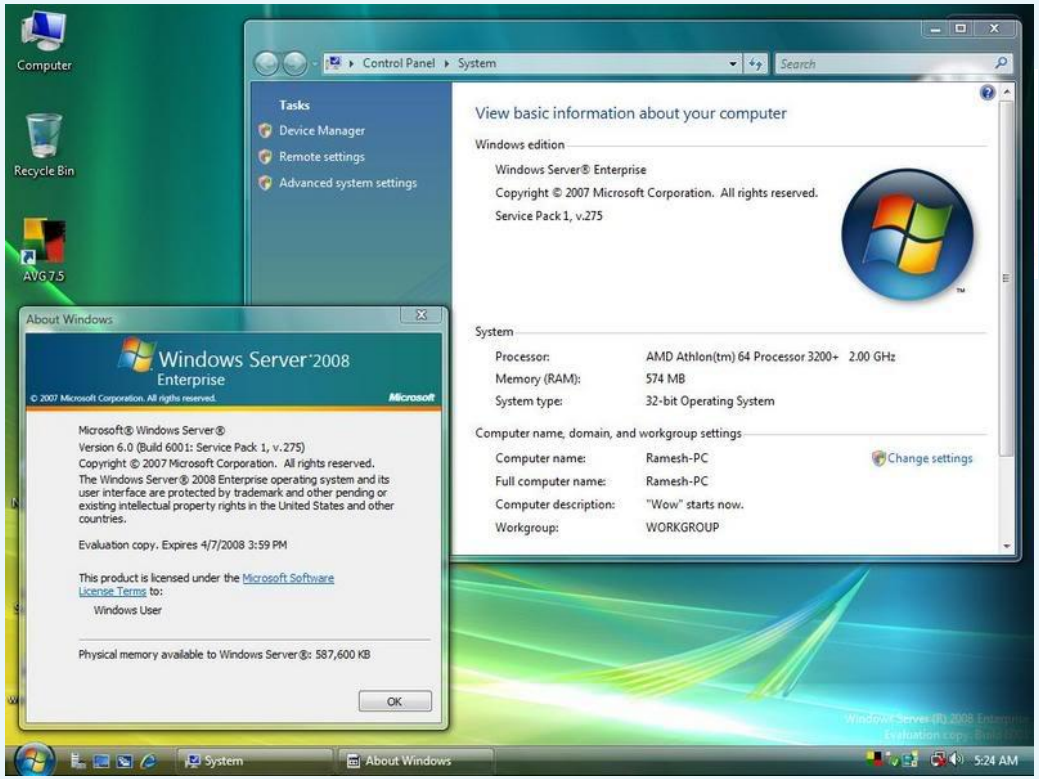
Windows Server 2008

2008

Windows 7 2009

Windows Server 2012

2012



History of Windows

Timeline of windows

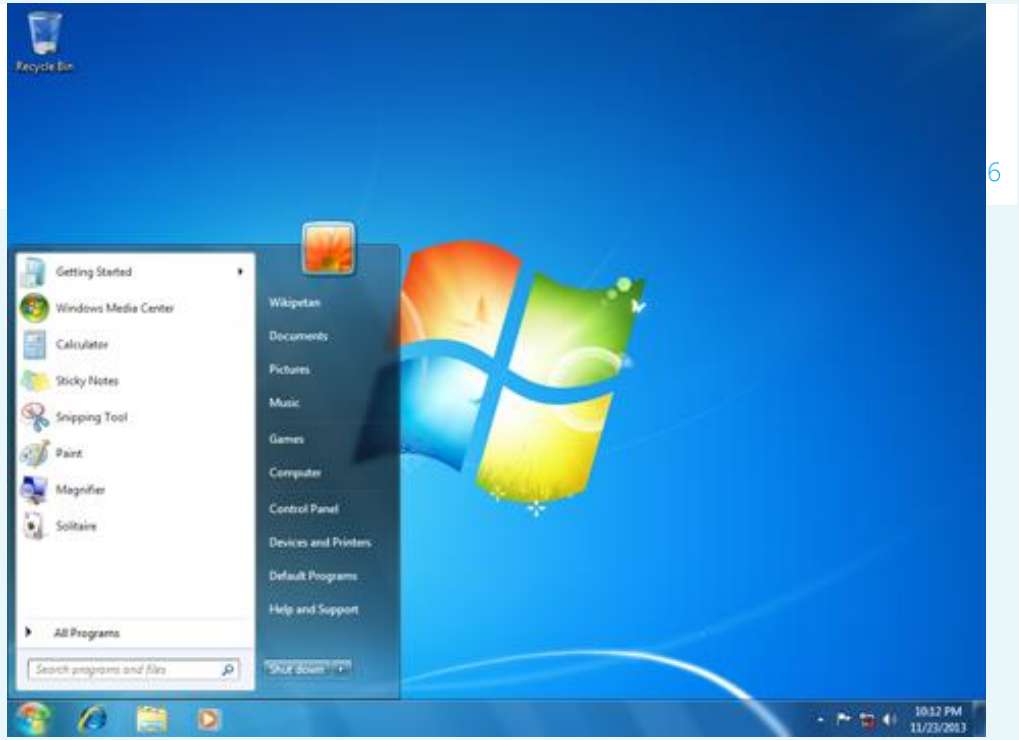
- Support for virtual hard disks, better multi-core processors performance, and kernel
- Improved touch and handwriting recognition

Windows Server 2008

2008

Windows 7

2009



Windows Server 2019

2018

History of Windows

Timeline of windows

- IP Address Management (IPAM)
- Storage pools and spaces

Windows Server 2008

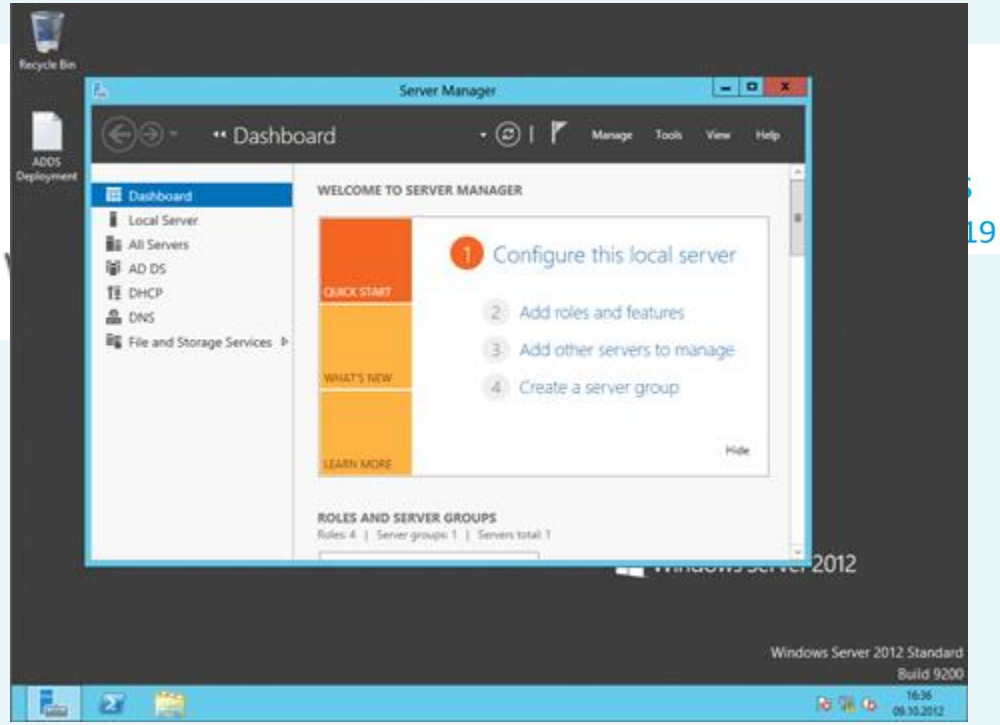
2008

Windows 7

2009

Windows Server 2012

2012



History of Windows

Timeline of windows

2008

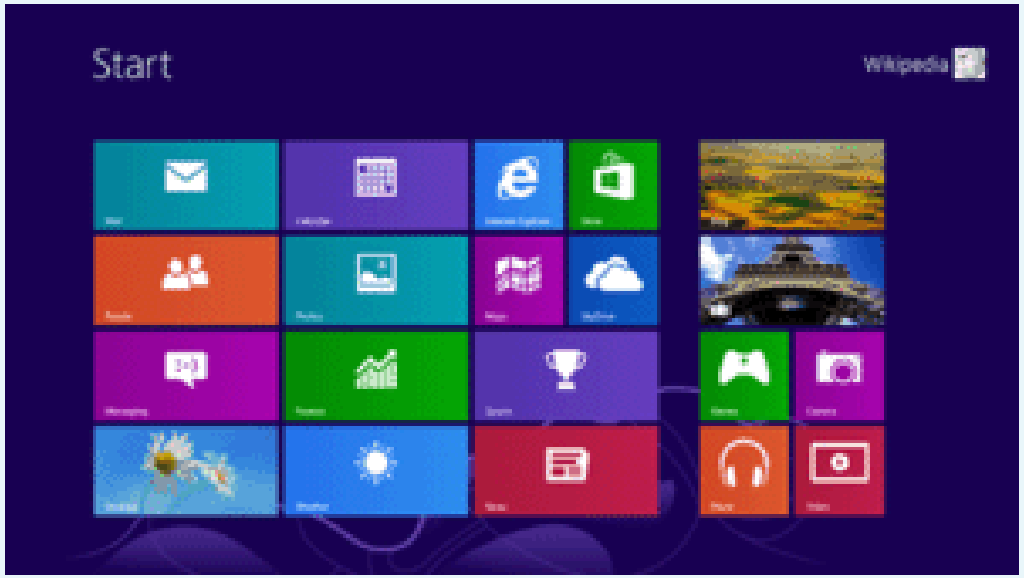
2012

2015

2016

2018

- integration with online services from Microsoft and others (Skydrive, Xbox)
- User interface focused on tablets users, including a touch-optimized shell
- New 'Start' screen (No ‘Start button)



History of Windows

Timeline of windows

Windows Server 2008 — 2008

Windows 7 — 2009

Windows Server 2012 — 2012

Windows 8 — 2012

Windows 10 — 2015

Windows Server 2016 — 2016

Windows Server 2019 — 2018

- Return of ‘Start’ button, a virtual desktop system, integration with Windows Phone
- Device dependent interface

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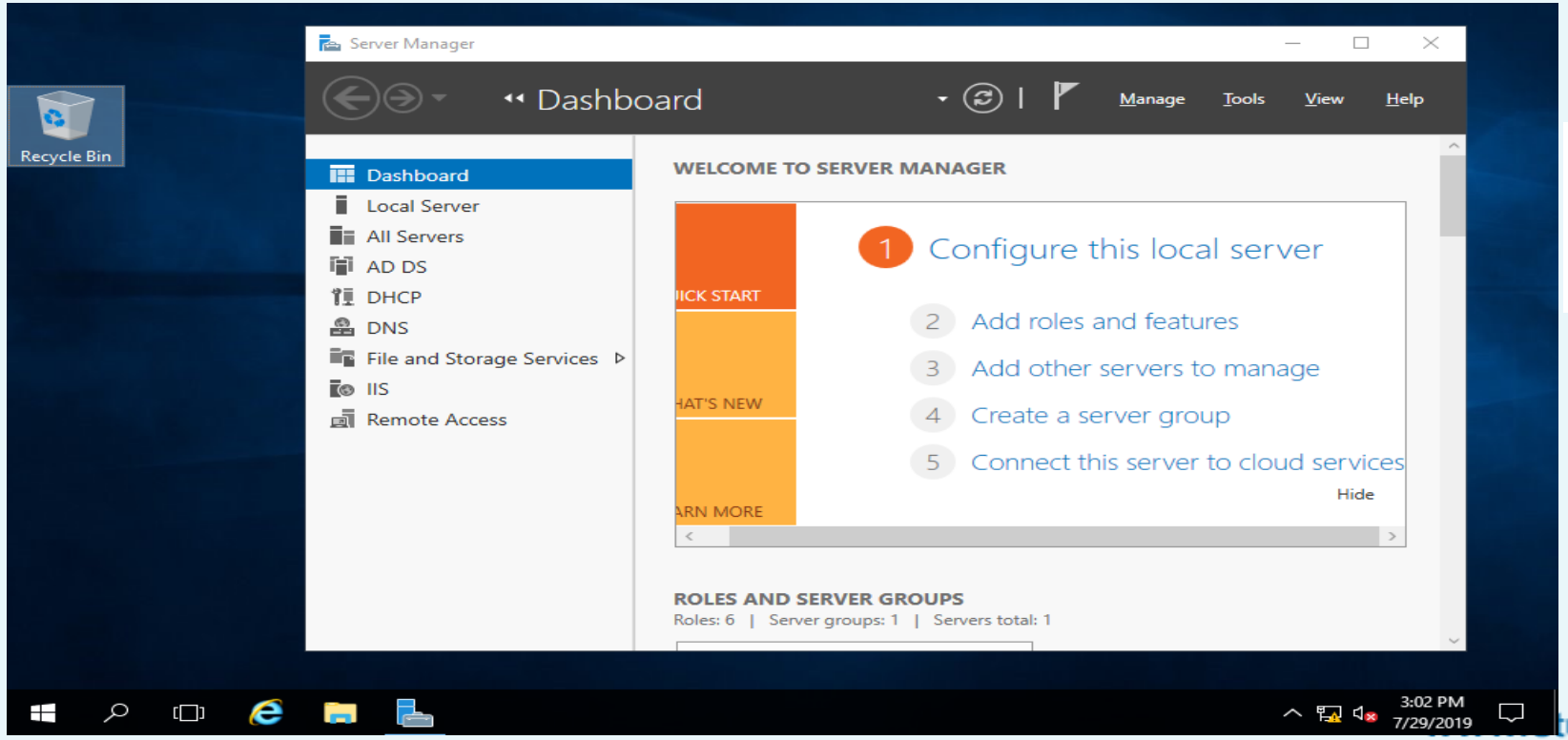
History of Windows

Timeline of windows

- Windows Defender installed and enabled by default
- IIS 10: Support for HTTP/2
- Windows Server Containers



Windows Server 2016

2016

Windows Server 2019

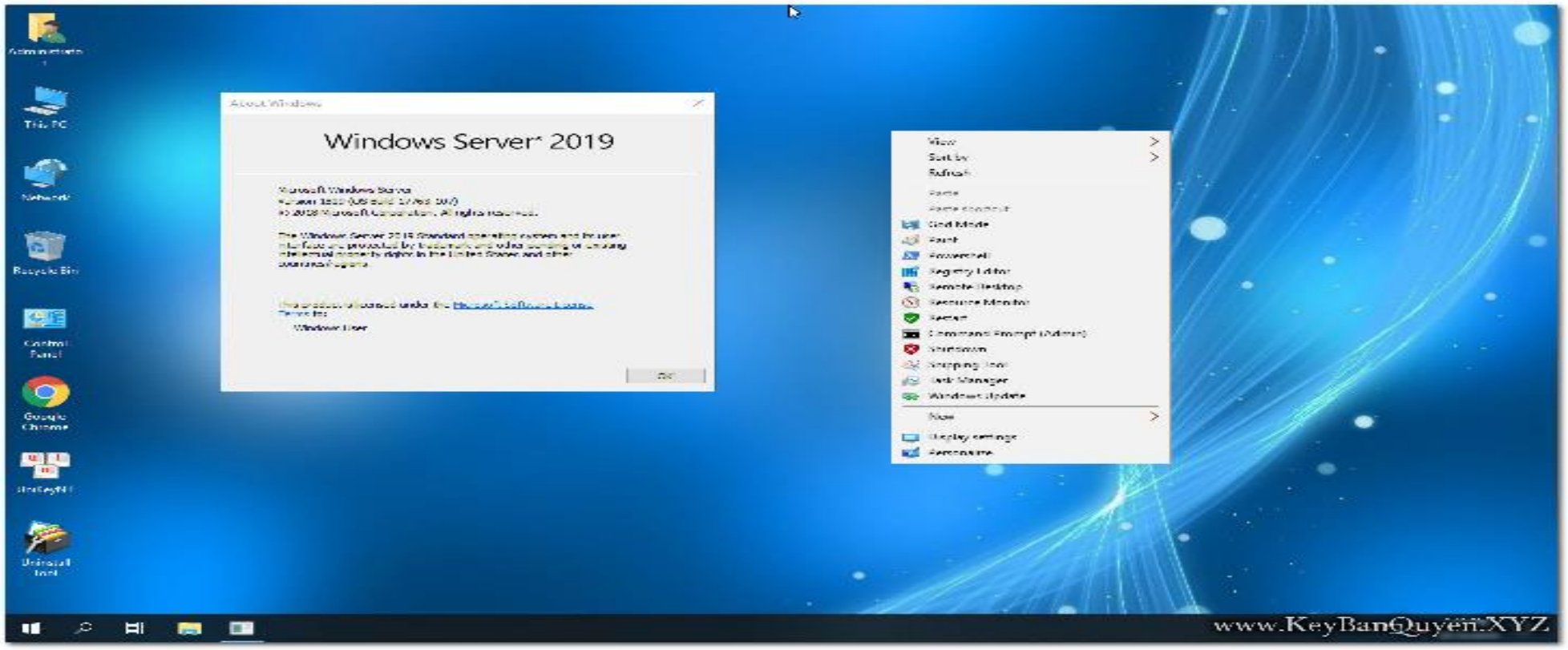
2018

History of Windows

Timeline of windows

- offers even more roles for servers
- better security
- new desktop features

- easier server management
- more reliable computing



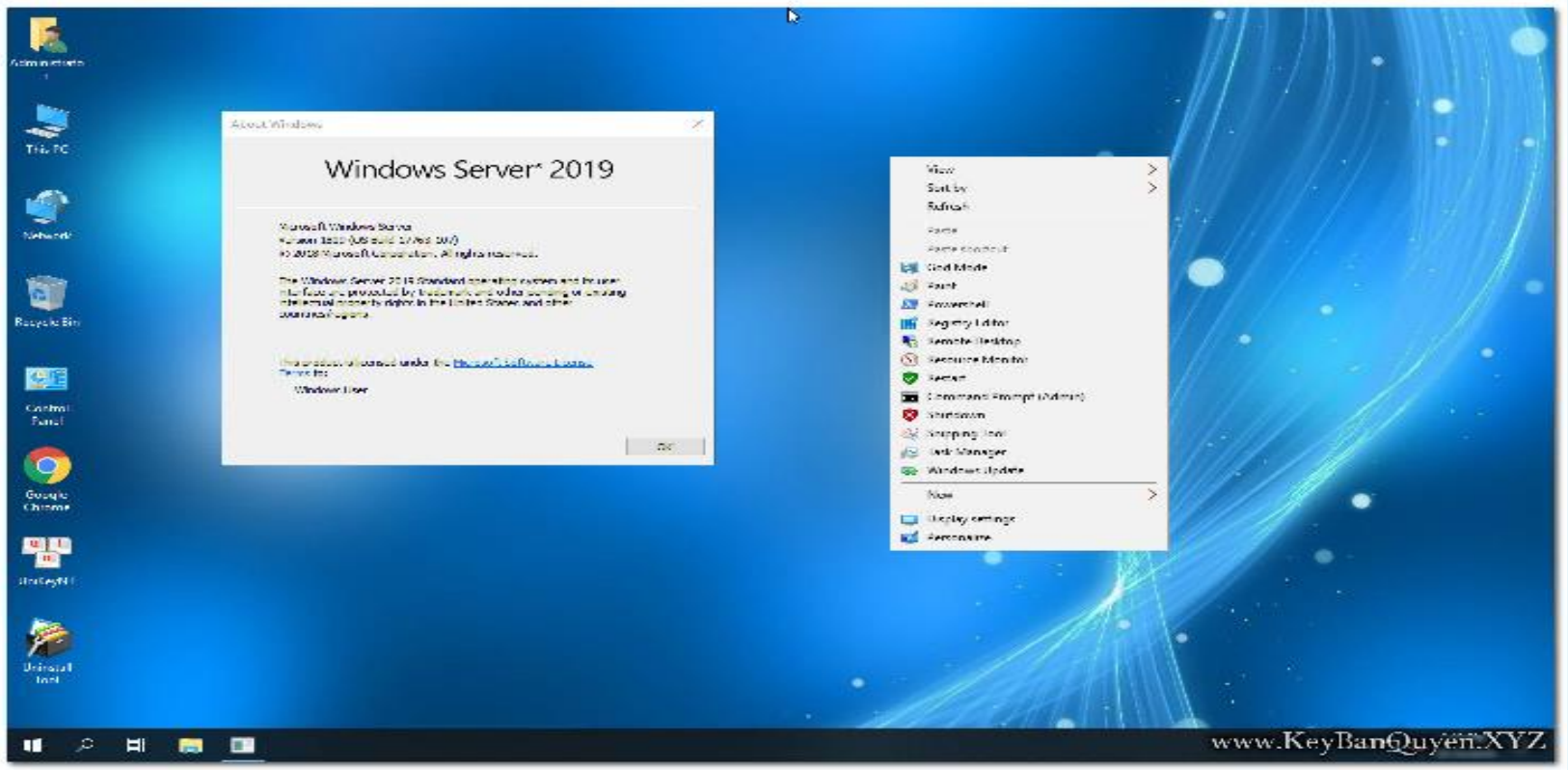
Windows Server 2019

2018

History of Windows

Timeline of windows

- Linux containers on Windows
- Improved Windows Defender Advanced Threat Protection (ATP)
- Windows Admin Center



Windows Server 2019

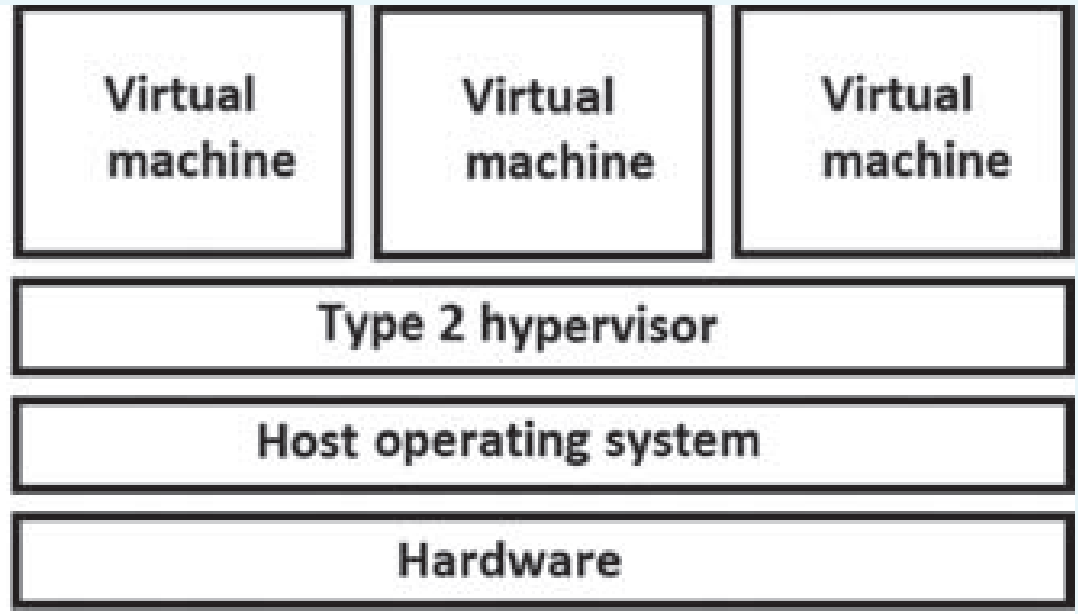
2018

Windows Server Virtualization

Virtualization

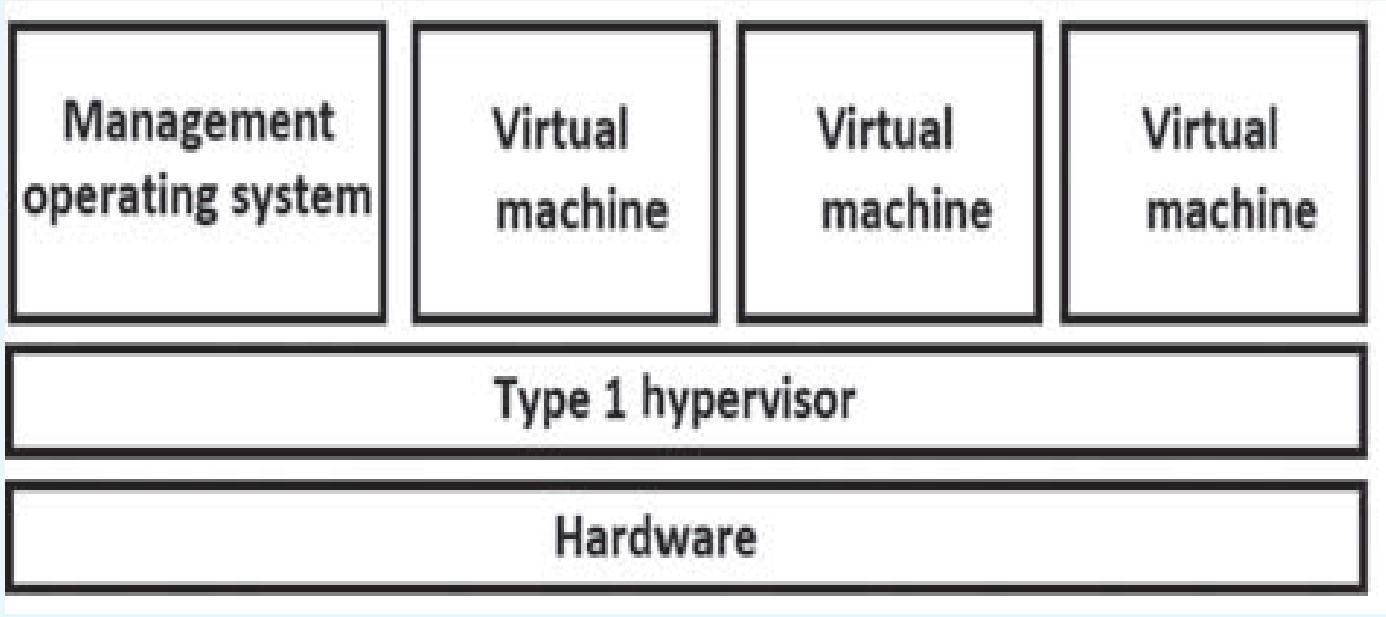
- The process of running more than one OS at the same time on a single computer
- software allowing the hardware to host multiple operating systems: hypervisor

- Type 2 hypervisors:
  - run on top of an existing workstation OS: referred to as the host OS
  - guest OS or VMs: access the hardware through both the hypervisor and underlying host OS
  - Common for software testing and development
  - Example: VMWare Workstation, Oracle VirtualBox



Windows Server Virtualization

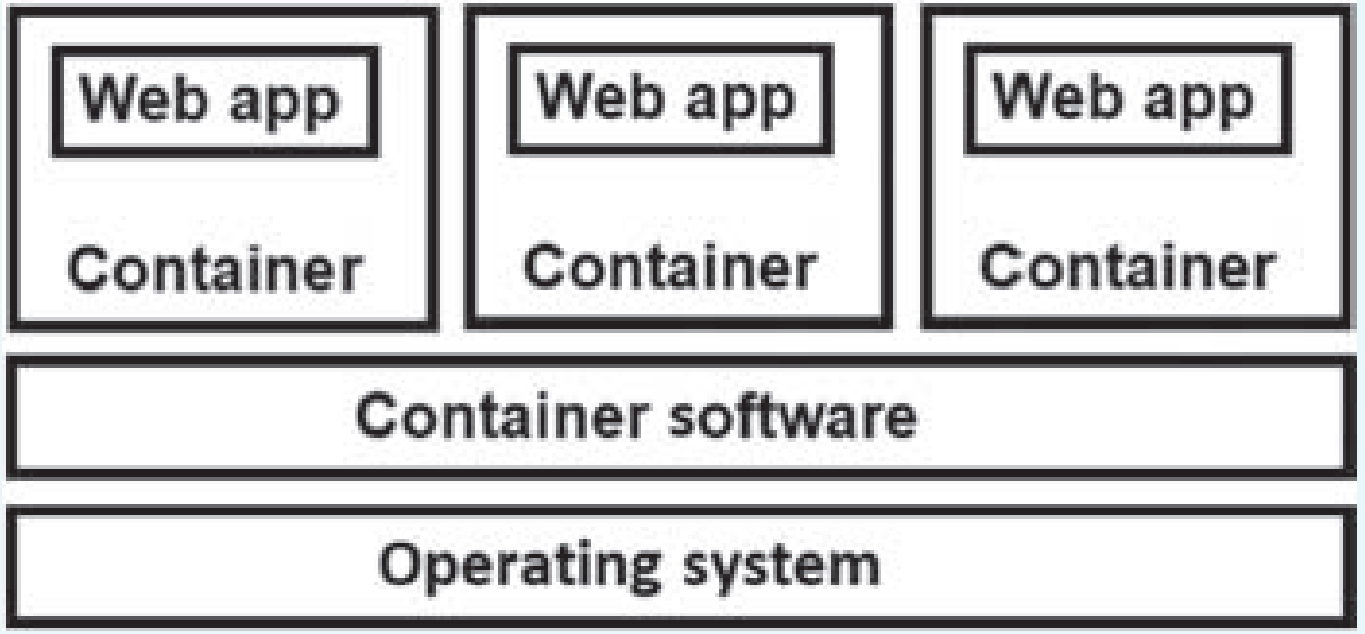
- Type 1 hypervisor: ensure that each virtual machine runs as efficiently as possible.
  - interacts with the hardware directly
  - contain a small OS to manage the hypervisor configuration and VMs
  - Example: Microsoft Hyper-V, VMWare ESX/ESXi and Linux KVM



Windows Containers

- virtualization makes more efficient use of server hardware
- But each virtual machine running on a hypervisor is a complete operating system
- Unlike virtual machines, containers do not have a complete operating system.

- A container: a subset of an OS composed of one or more Web apps and the supporting OSS files needed by those Web apps only.
- Containers must be run on an existing operating system



Windows Containers

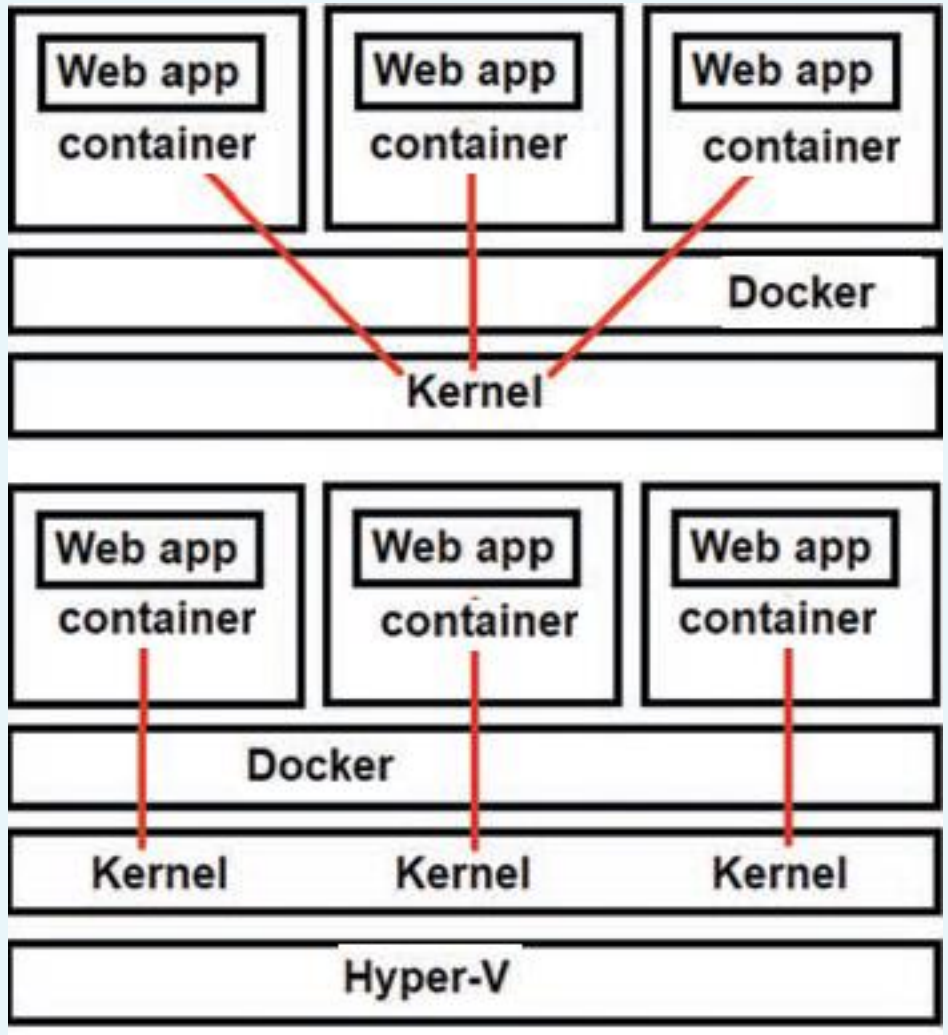
- The enclosed Web apps executed isolated from Web apps running within other containers and the underlying operating system.
- called sandboxing.
- To allow each Web app to be uniquely identified on the network, each container functions as a virtual operating system with a unique name and IP address.
- Containers are much smaller and use far fewer underlying system resources
- The most common container software used to implement containers on operating
- systems today is Docker

Windows Containers

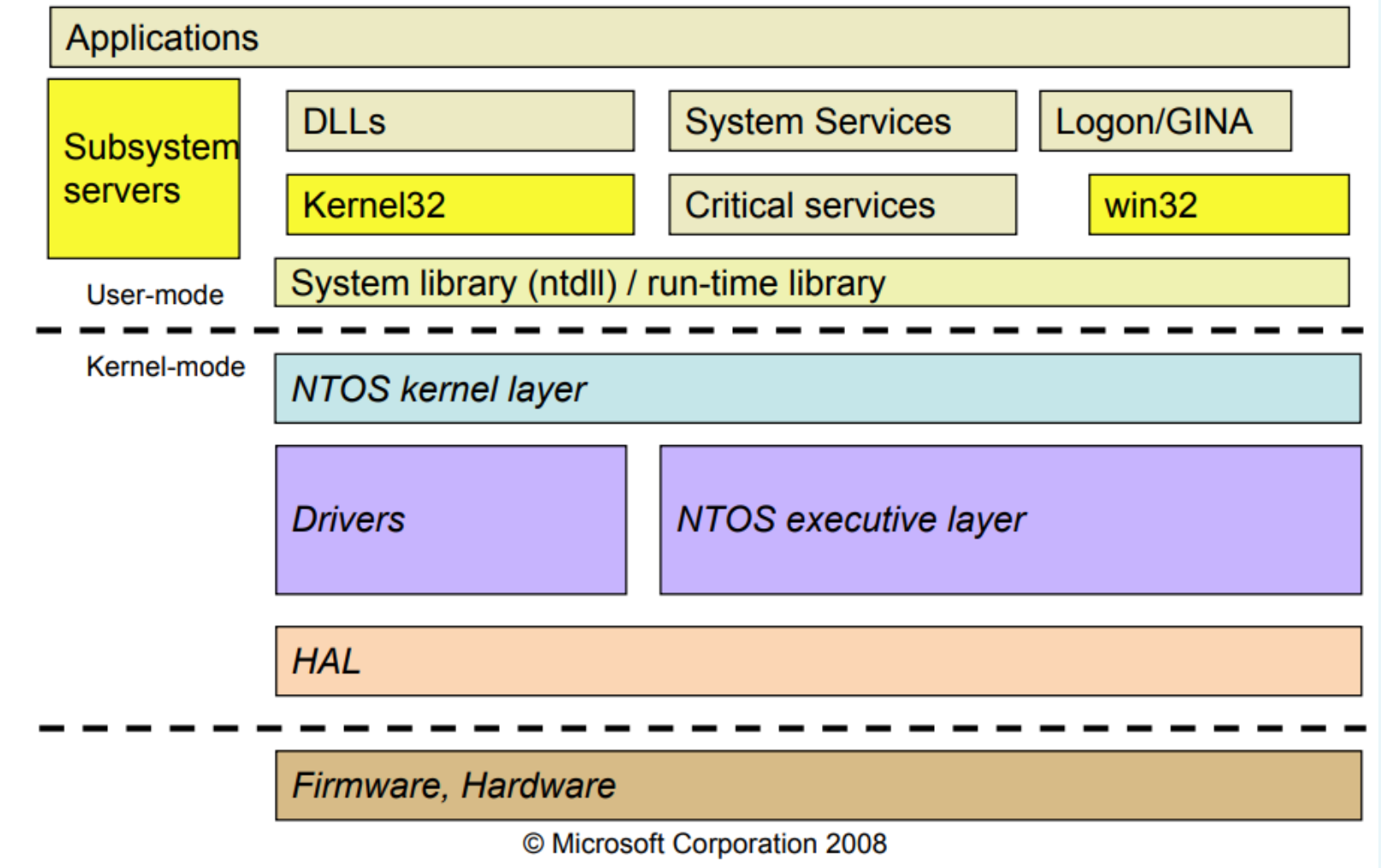
- The core component of an OS is the kernel.
- Containers do not contain a kernel, and thus must rely on the kernel in the underlying operating system to execute Web apps that they host.
- This means that the Web apps must be written for the Windows OS and run within a Windows container if they use an underlying Windows Os kernel for execution.
- Underlying OS kernel is a single point of failure; too many containers on a single underlying OS may slow down the performance of the kernel or cause it to crash

Windows Containers

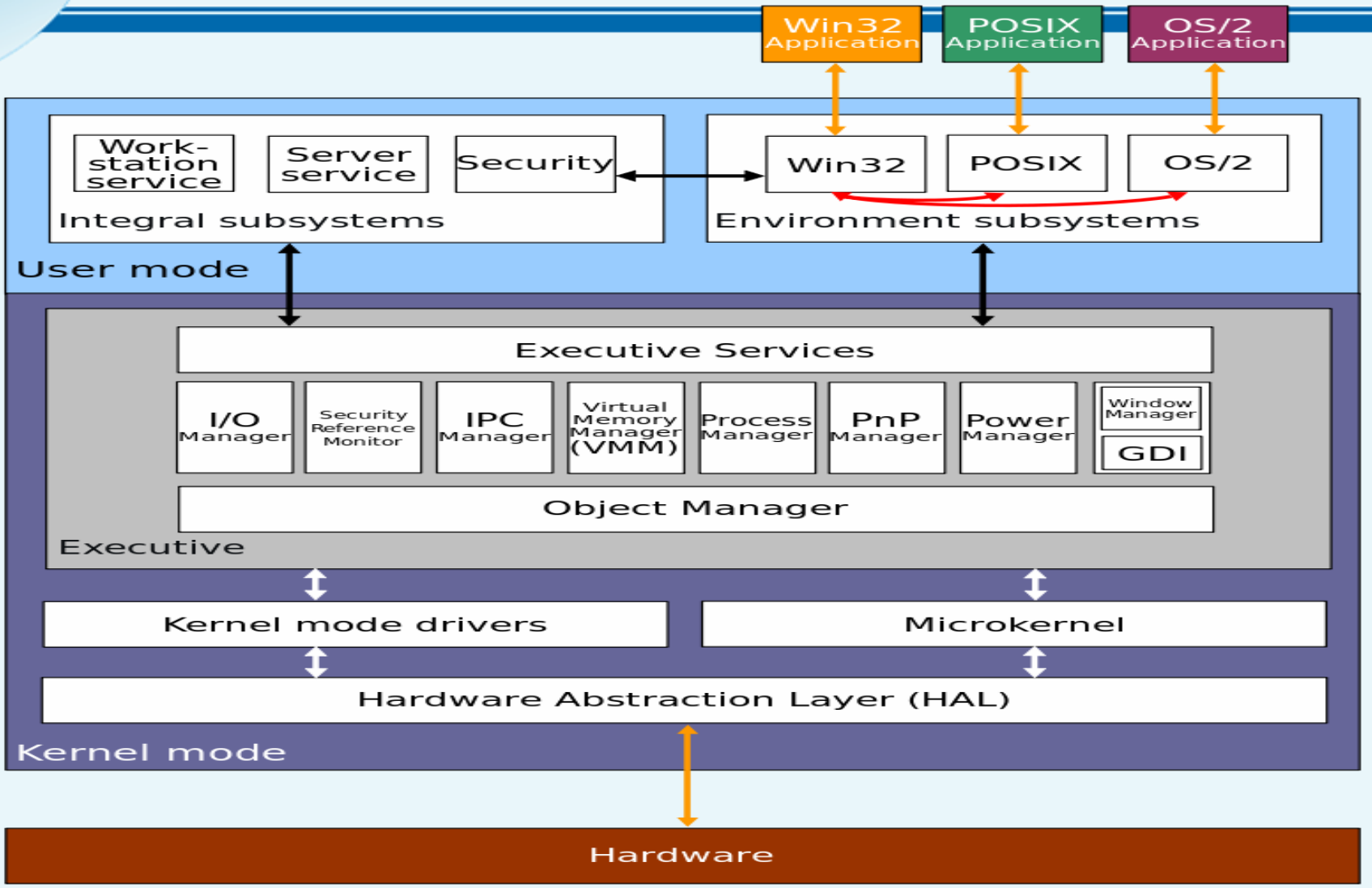
- Hyper-V can provide a separate copy of the underlying kernel to each container
  - provide additional performance and security features to Web apps that are run within containers on Windows Server



Windows Architecture



Windows Architecture



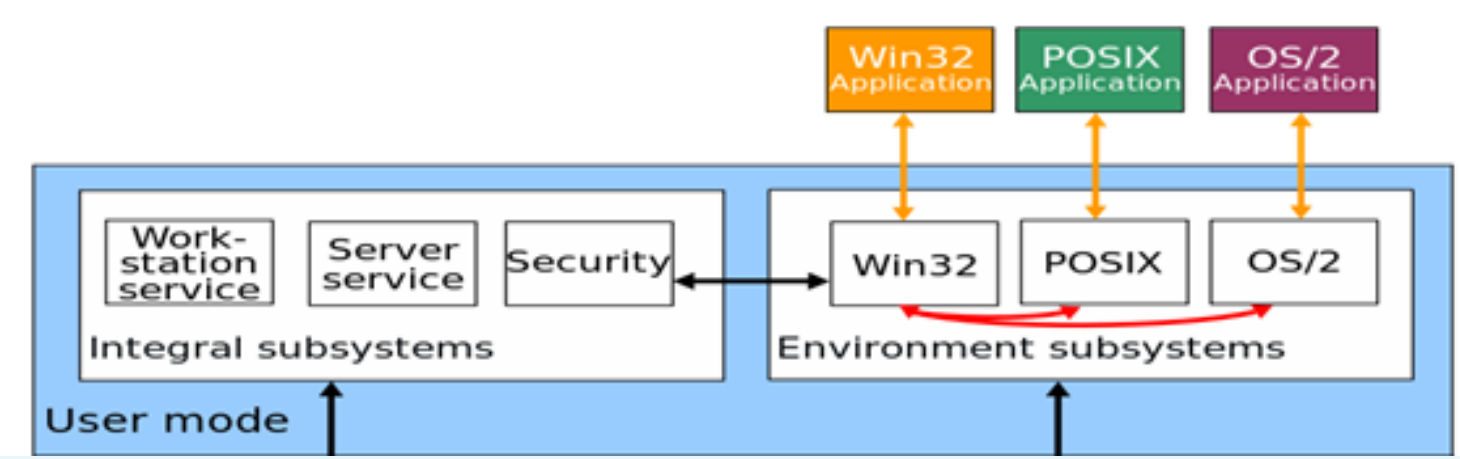
Windows Architecture

User-mode

- Using well-defined operating system application program interfaces (APIs) to request system services.
- A User mode process:
  - Have no direct access to hardware or kernel memory
  - Is limited to an assigned address space
  - Can be paged out of physical memory into virtual RAM on a hard disk
  - Lower priority than kernel mode components
  - Cannot access another user process address space

Windows Architecture

User-mode



- Subsystems: Allows to run applications written for different OS
- Integral subsystem: perform essential operating system functions:
  - Security: create security token and rights; permission to user account; accept user login request and initiate authentication
  - Workstation service: Allow computer to access network

Windows Architecture

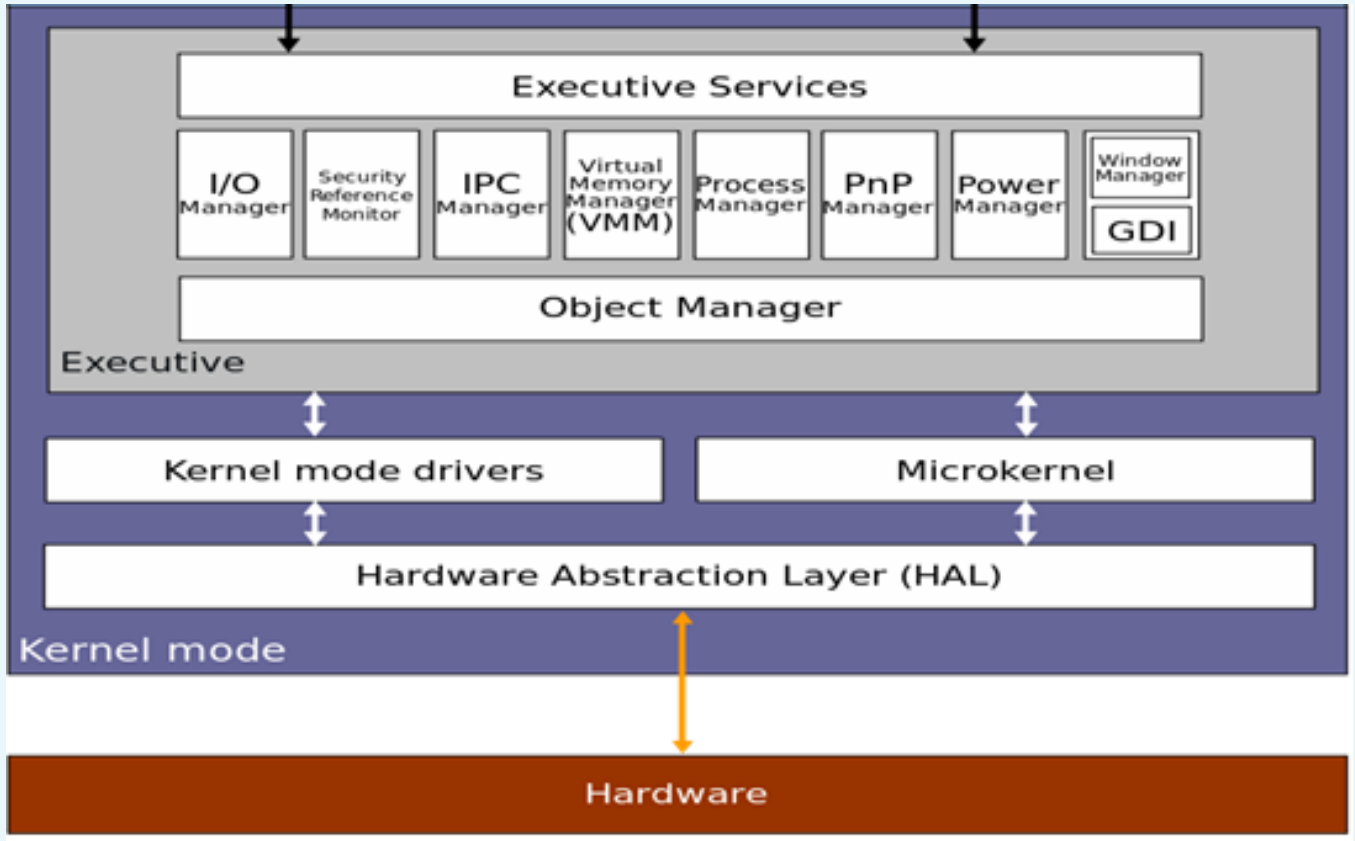
Kernel-mode

- The privileged mode of operation
- The code has direct access to all hardware and all memory, including the address spaces of all user mode processes
- **Kernel mode** components:
  - Can access hardware directly
  - Can access all of the memory on the computer.
  - Are not moved to the virtual memory page file on the hard disk.
  - Process at a higher priority than user mode processes.

Windows Architecture

Kernel-mode

- Comprise of Executive, kernel, and hardware abstraction layer (HAL).

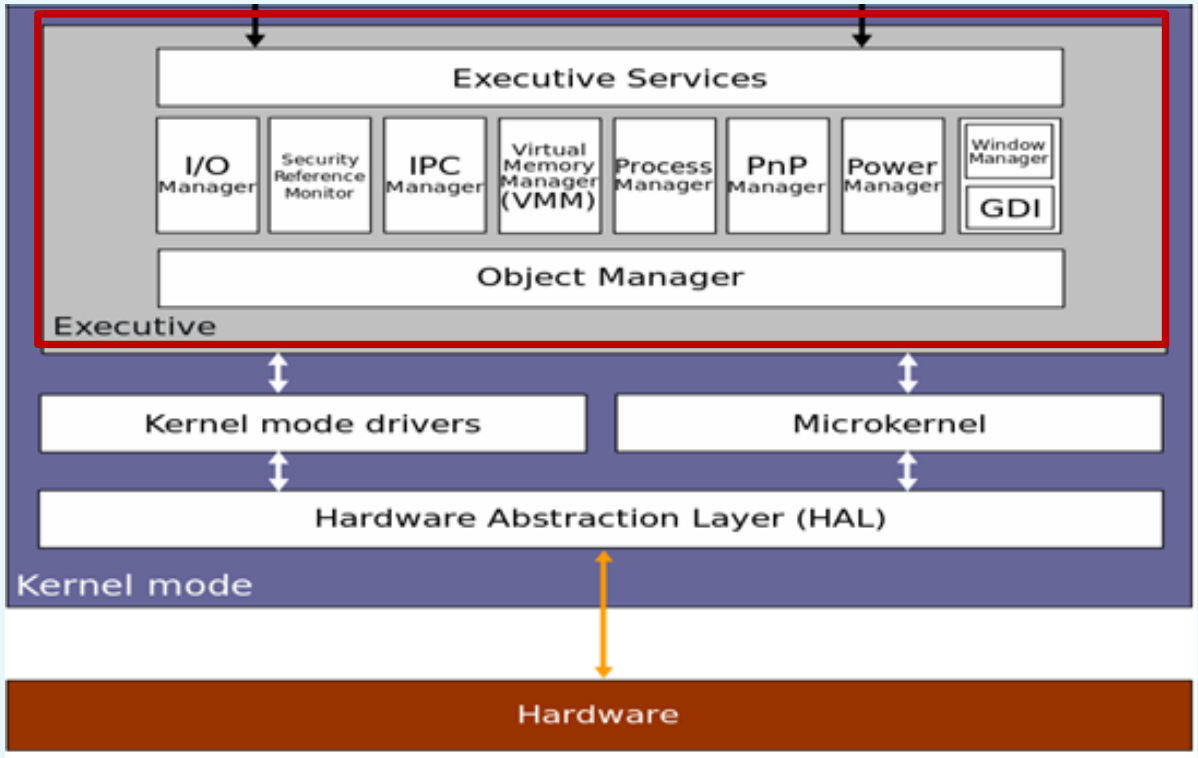


- Executive provides core OS services
- Kernel consists of a set of functions in Ntoskrnl.exe provides the most basic operating system services
- A hardware abstraction layer (HAL):, implemented in software, between the physical hardware and the software running on that computer

Windows Architecture

Kernel-mode

- The executive provides core OS services that user can use
- Interact with Input/output devices, Object management, process management and the system security



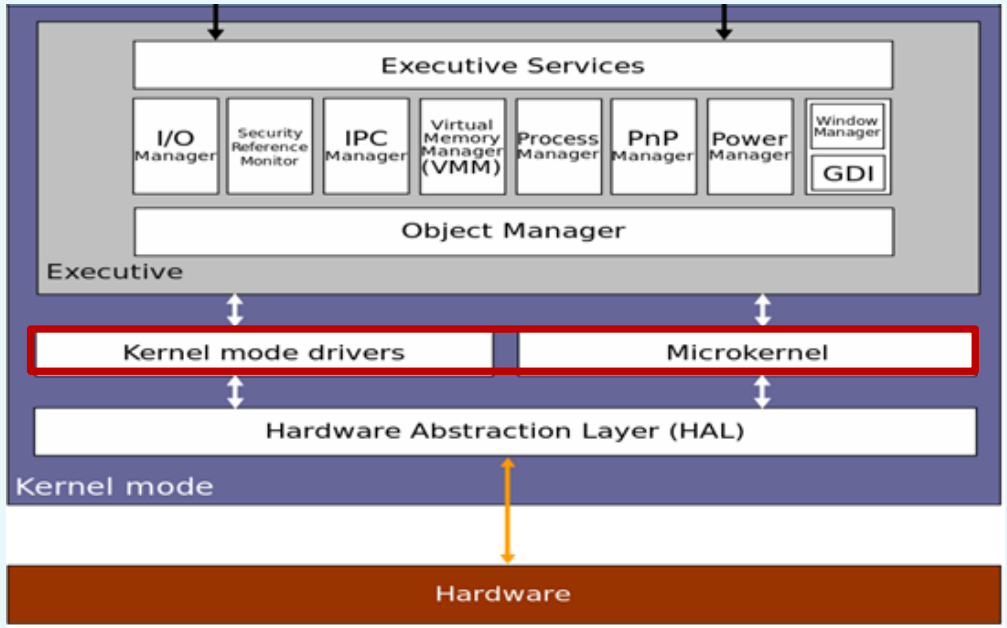
Components of executive services:

- I/O Manager
- Process Manager
- Power Manager
- Object Manager
- Virtual Memory Manager
- …

Windows Architecture

Kernel-mode

- Kernel: Schedule the activities to be performed by CPU
- Synchronize the activity among processors to optimize performance

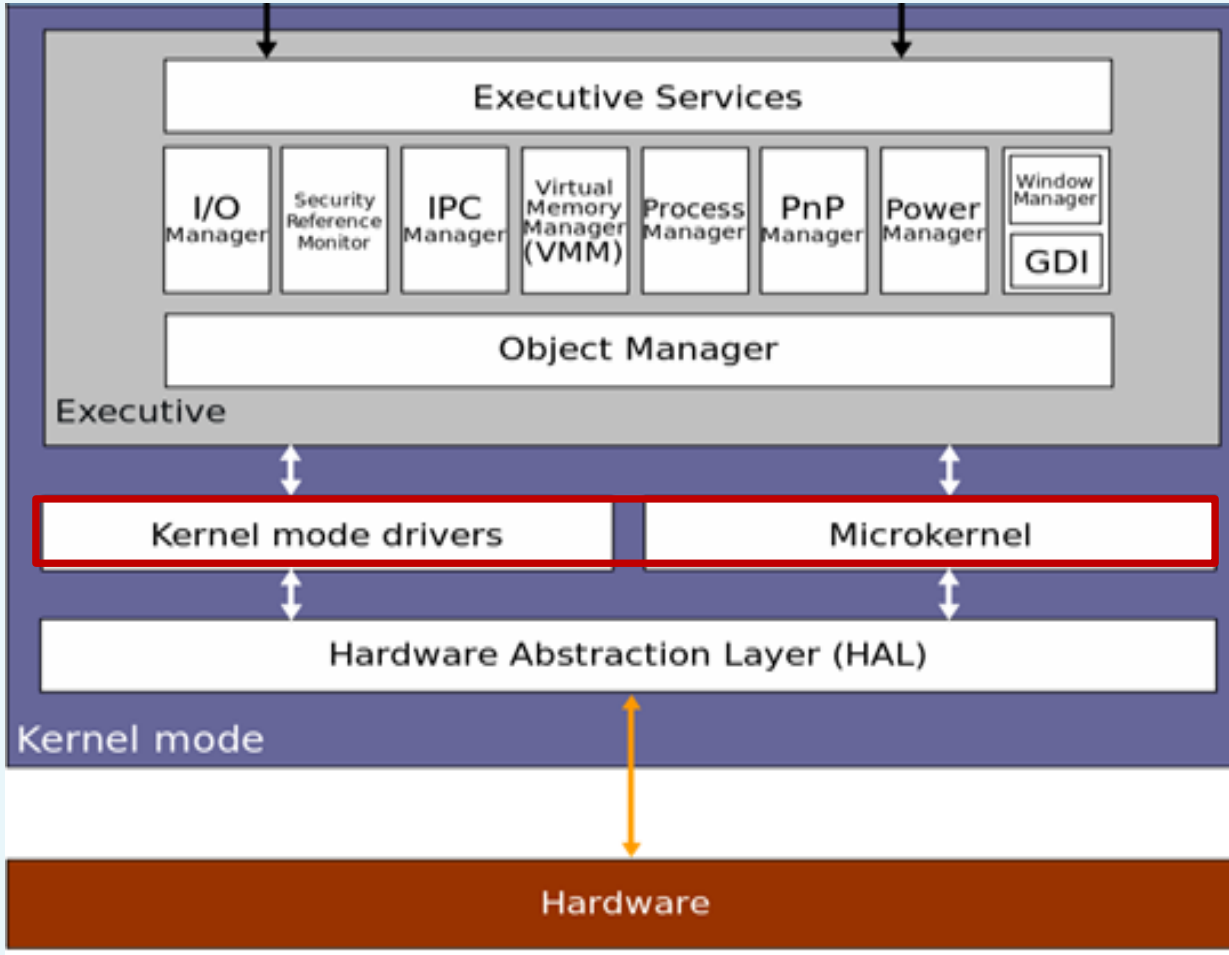


- Stop user mode services and applications from access critical areas of OS
- Microkernel: collection of programs provide tasks such as address space management, thread management, Inter-process communication (IPC)

Windows Architecture

Kernel-mode

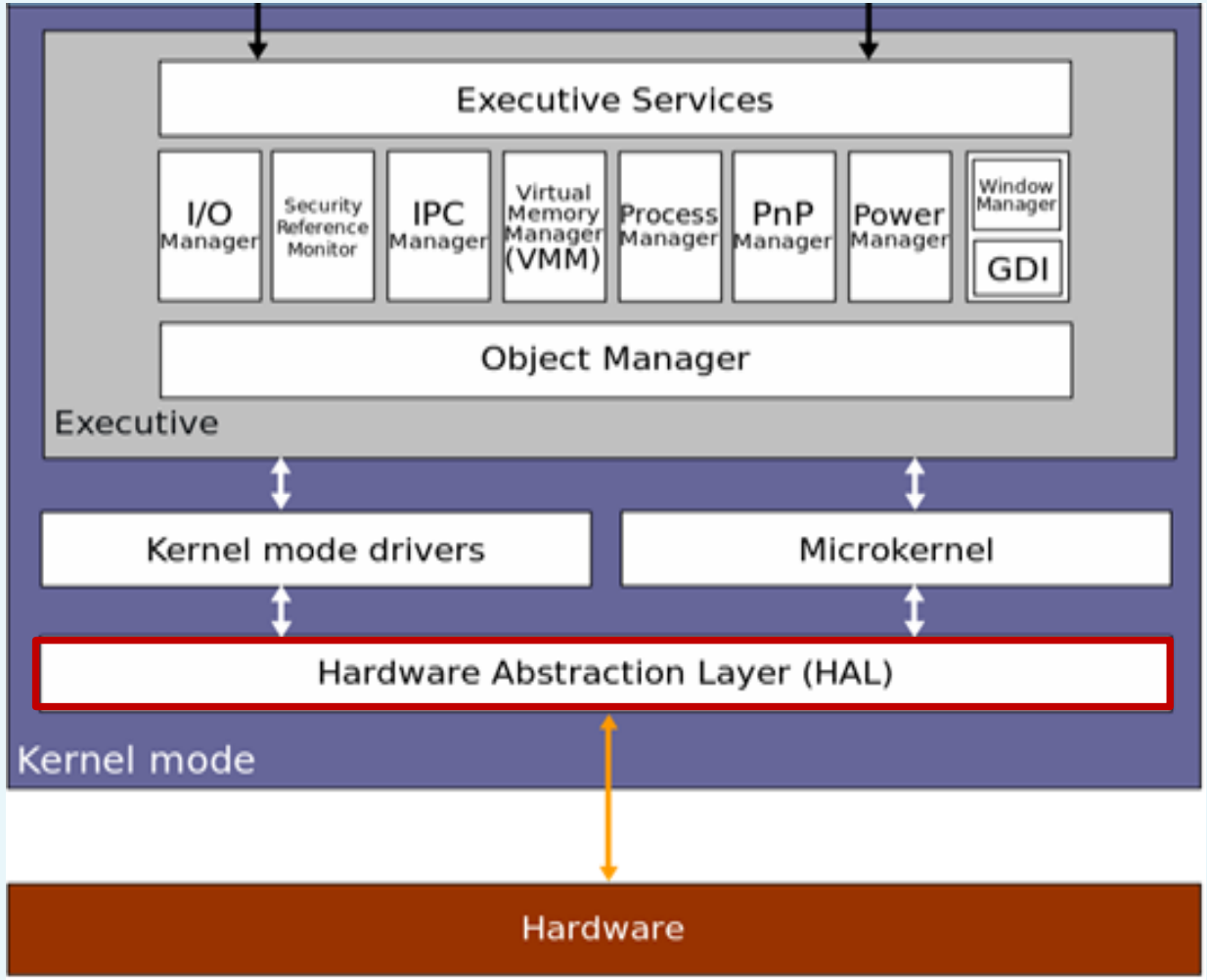
- Four main responsibilities of Kernel:
  - Thread scheduling
  - Interrupt Handling
  - Low-level processor synchronization
  - Recovery after Power failure



Windows Architecture

Kernel-mode

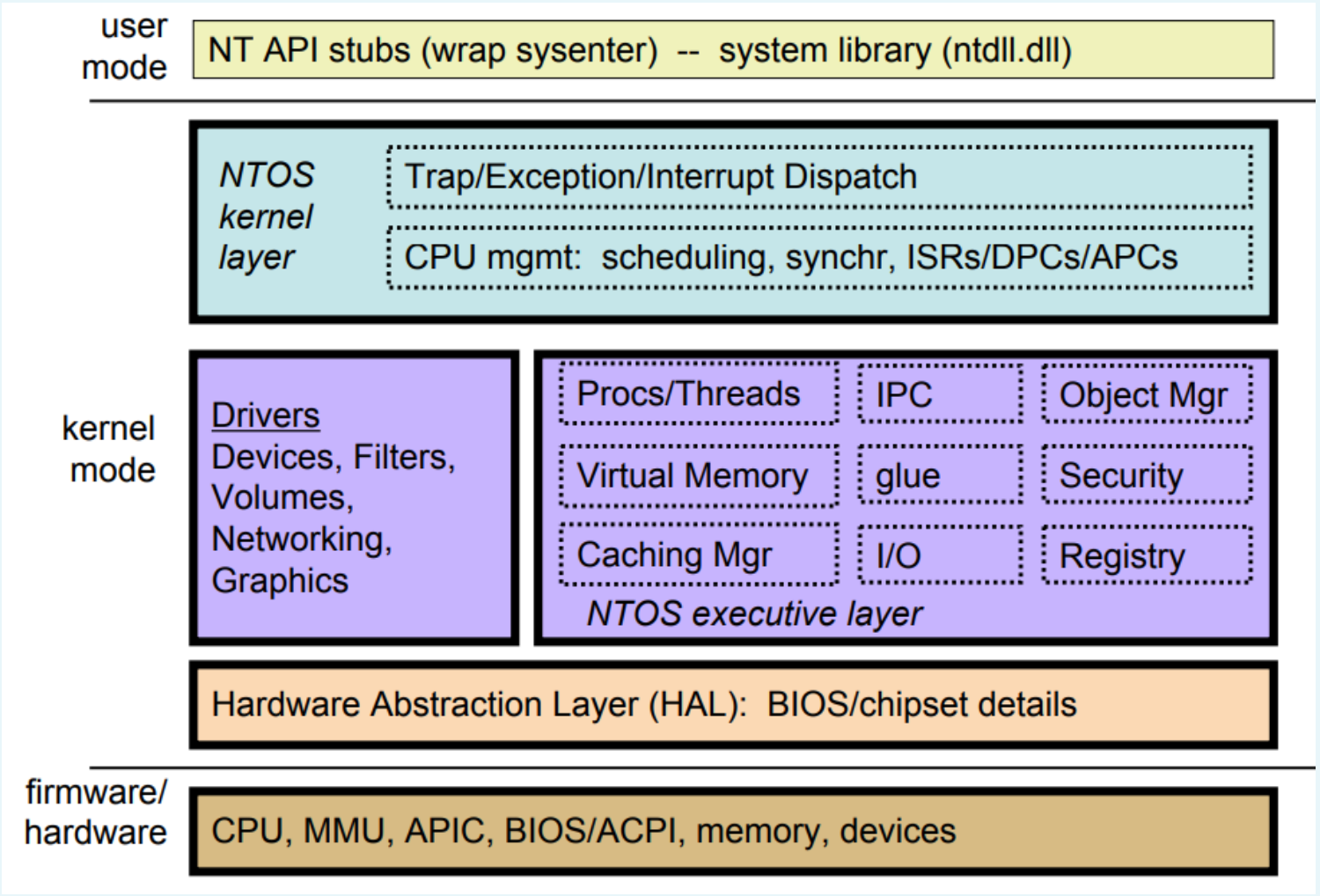
- The HAL is a loadable kernel-mode module (Hal.dll) enables the same operating system to run on different platforms with different processors.



- Hides Chipset/BIOS details

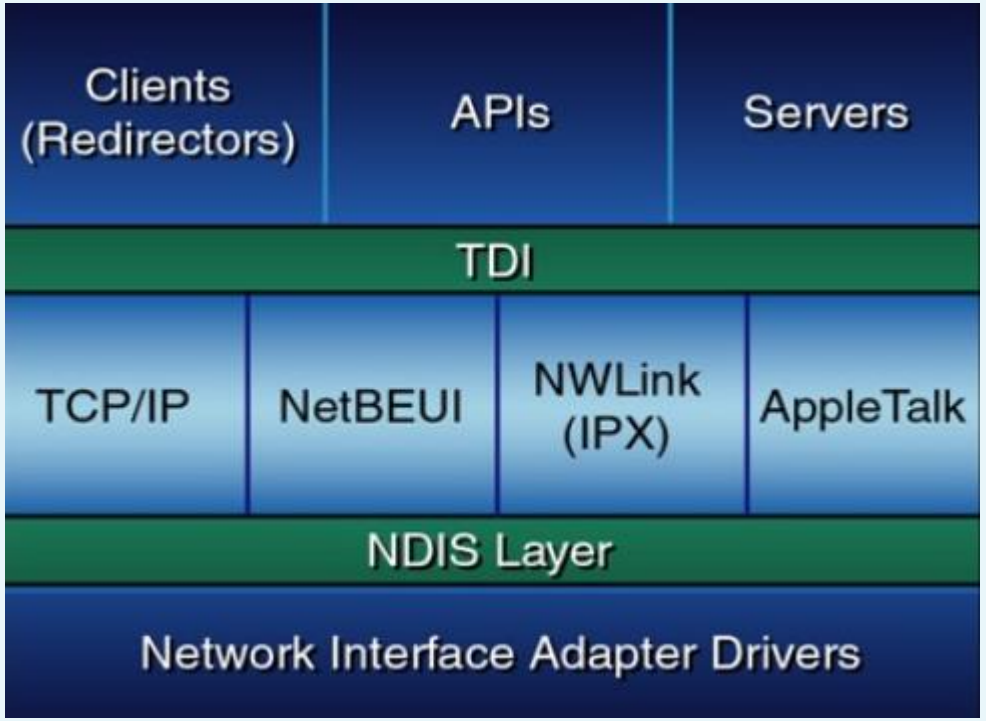
Windows Architecture

Kernel-mode



Windows Networking Model

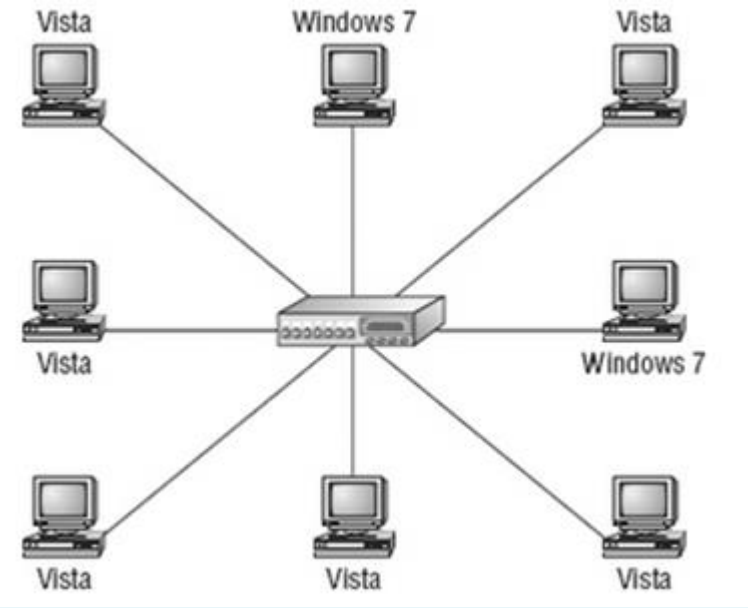
- Two basic networking models used with windows server and its clients: peer-to-peer model and client-server model



Windows Networking Model

Peer-to-peer networking

- Simplest way to configure a network and often used for home offices and small businesses
- Workstations used to share resources such as files and printers and to connect to resources on other computers



- No special computer needed to enable workstations to communicate and share resources

Windows Networking Model

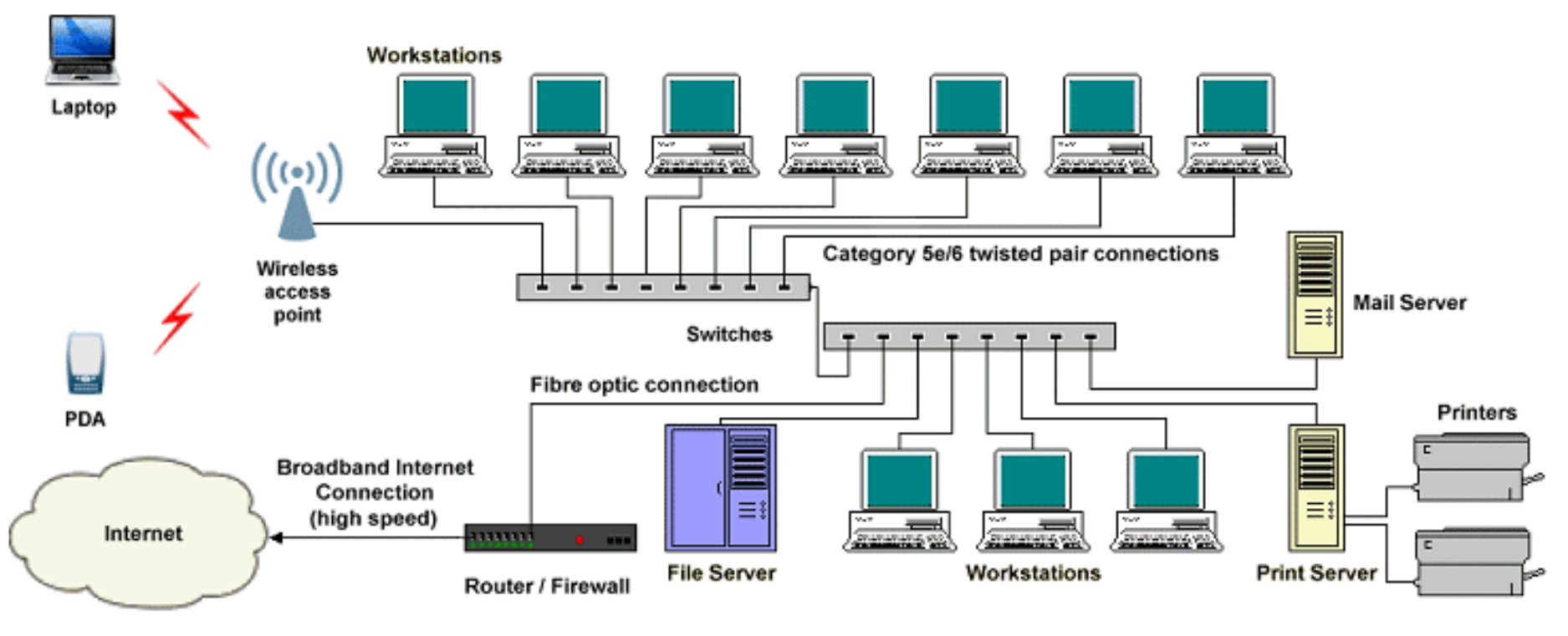
peer-to-peer networking

- Files, Folders, printers, applications and devices on one computer shared and make available for others to access
- Designed for networks about 10 workstations or less
- User account information managed on each workstation
- Microsoft Windows **workgroups** organize PCs as peer-to-peer local networks to facilitate easier sharing of files, internet access, printers, and other local network resources.

Windows Networking Model

server-based networking

- A server: a single computer provides extensive multi-user access to network resources, e.g., file server, email server, web server, database server, print server, …



Windows Networking Model

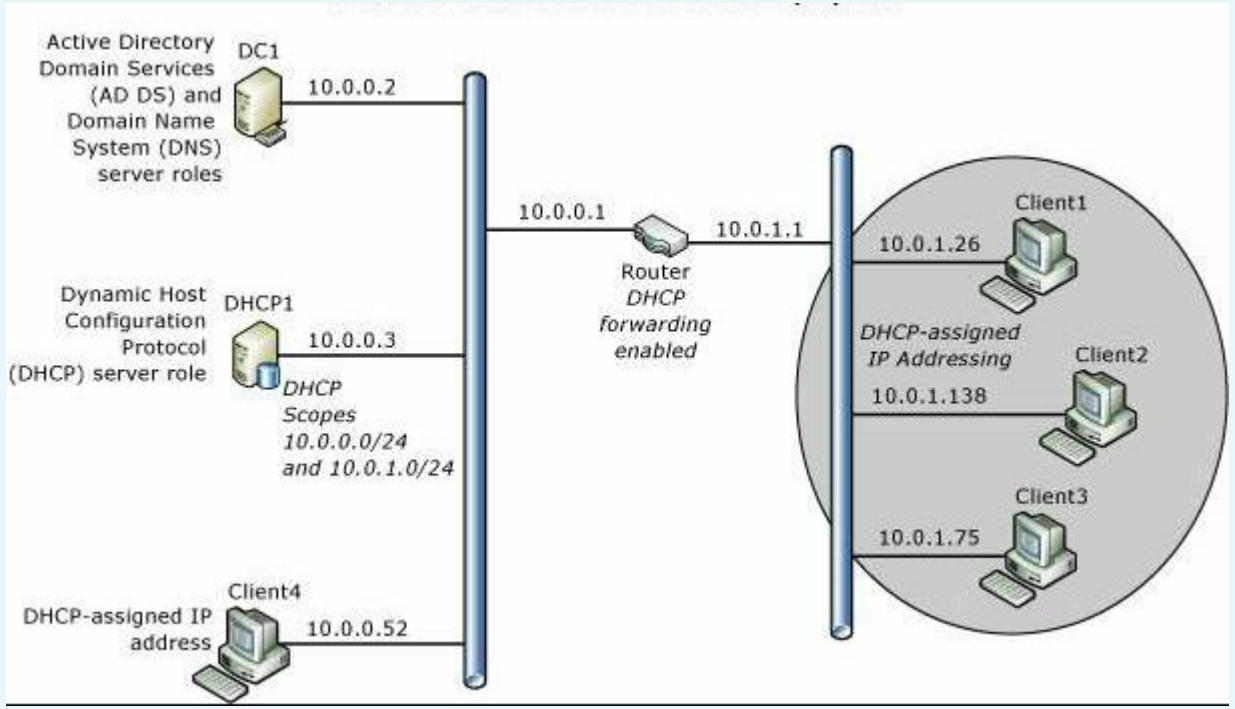
server-based networking

- User need only to sign in once to gain access to network resources
- Stronger security: access to shared resources and network managed from one place
- Client-server networks are highly scalable. As the number of users increases, additional servers can be added to cope with the additional workload.

Windows Networking Model

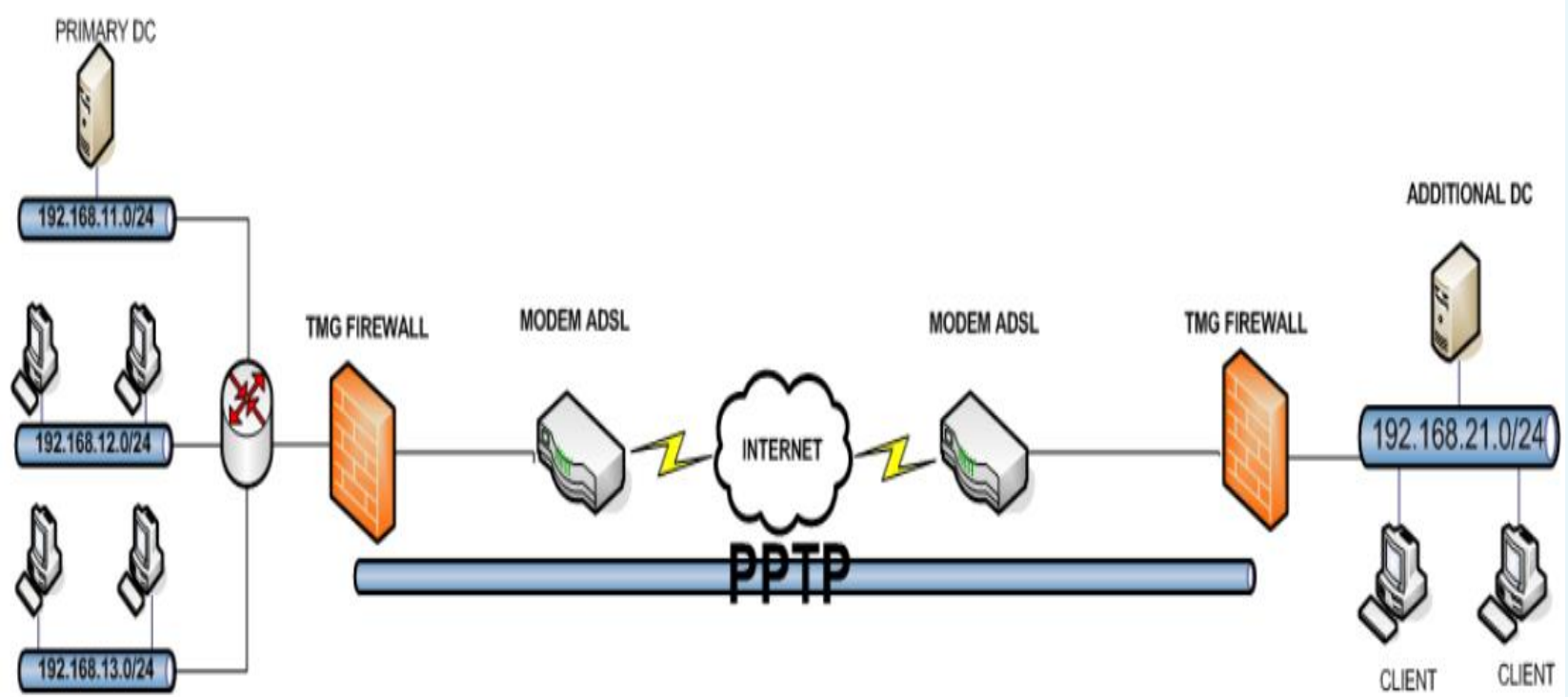
Domain model

- Using a centralized approach to resource management
- A domain controller (DC): a server responds to security authentication requests within a domain



Windows Networking Model

Domain model



Introduction to Windows server 2022

The purpose of Windows Server?

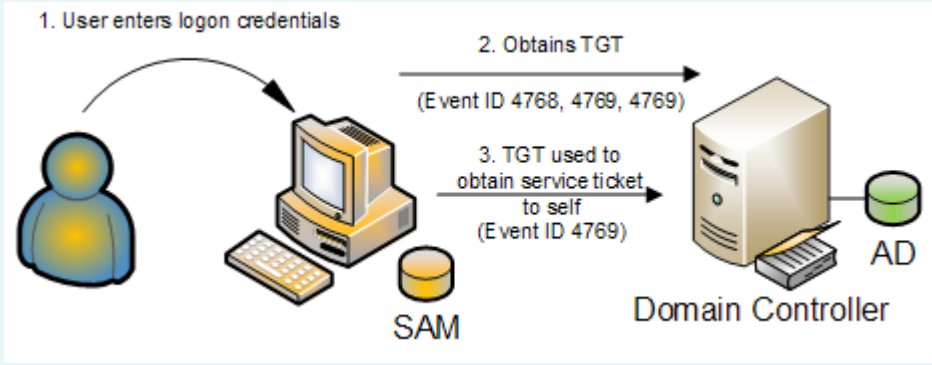
- Everything revolves around data in business today
- Windows client: a requestor, consumer, and contributor of data
- Windows servers: housing, protecting, and serving up the data

- A client-server model

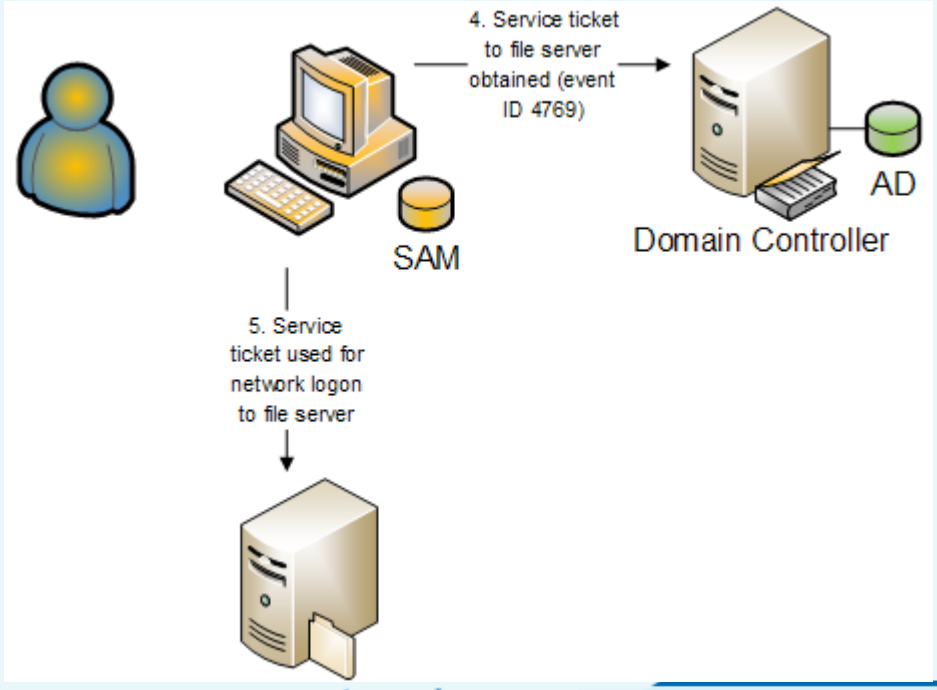
The purpose of Windows Server

Some example of Server roles

- The user log in to the workstation and DC handles the logon



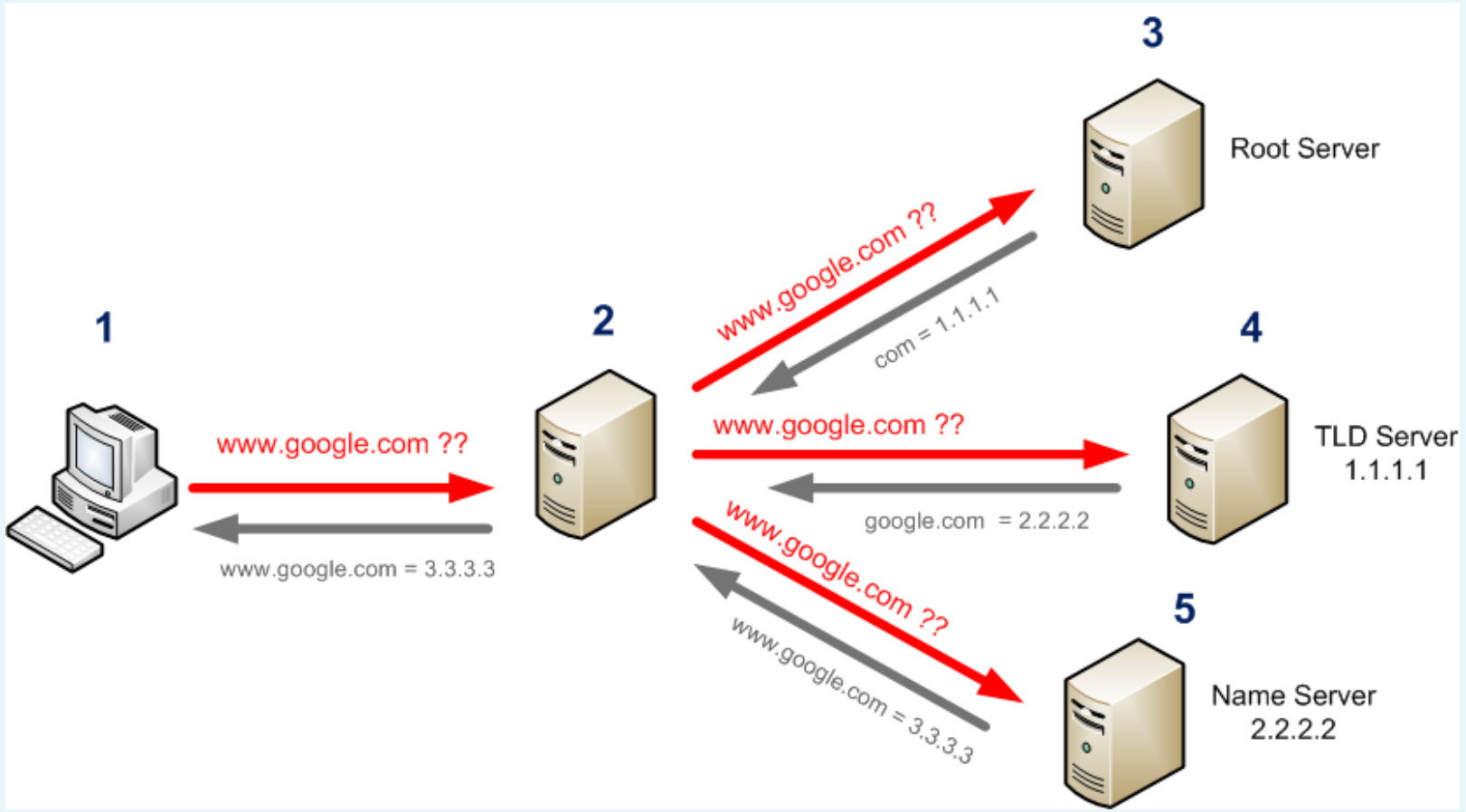
- When user accesses other servers, DC will issue a service ticket



The purpose of Windows Server

Some example of Server roles (con't)

- When you need to contact a resource by name, your computer asks a DNS server how to get there



The purpose of Windows Server

- In most organizations, many different servers needed to provide the required capabilities
- Each service inside Windows Server provided as, or as part of, a Role
- A server without any roles installed is useless
- Windows also contains many Features that can be installed
- Features: add functionality to the base operating system such as Telnet Client, or to a server to enhance an existing role

Getting to the cloud

- A cloud fabric is referred to virtual resources: virtual machines, virtual disks, and even virtual networks
- It enables the ability:
  - to spin up new servers on a whim
  - for particular services themselves to increase or decrease their needed resources automatically, based on utilization.
- The total cost of such a website or service can be drastically decreased

Getting to the cloud

Private cloud

- Install the same public cloud fabric inside our datacenter
- Provide our organization with cloud benefits:
  - the ability to spin resources up and down,
  - running everything virtualized
  - implement all of the neat tips and tricks of cloud environments
- Installing our own private cloud get the best of both worlds

Windows Server 2022 Editions

Essentials Edition

- For a business or organization with up to 25 users
- Hardware and connection limits: 2 processor socket; 64 GB of memory, and only 50 concurrent remote access connections are allowed.
- Cannot join an existing Active Directory domain, but can host a single, small Active Directory domain with a single domain controller.
- Provides most but not all server roles.
  - not provide the Hyper-V role for hosting and managing virtual machines.
  - can be installed as a virtual machine on an existing hypervisor

Windows Server 2022

Standard versus Datacenter

- Windows Server 2022 Standard
  - the default option
  - includes most of traditional Windows Server roles
  - the cheaper option
- Windows Server 2022 Standard
  - the luxury model
  - some roles and feature only work with the Datacenter version, e.g., Storage Spaces Direct (S2D)
  - cost significantly more money than Standard

Windows Server 2022 Editions

Standard Edition: Some other key features

- A modern desktop user interface
- An improved Windows Defender
- Easier configuration, management, and security options for applications, files, networking, and Active Directory
- Desired State Configuration: quickly configure multiple servers using a template file listing required software and configuration items
- Intelligent storage features for volumes that use multiple physical storage devices
- Ability to use Storage Replicas
- Ability to create upto two Hyper-V VMs under the default Windows Server license
- Ability to create an unlimited number of Windows Containers, and up to two Hyper-V containers

Windows Server 2022 Editions

Datacenter Edition

- Designed for environments with:
  - Mission critical applications
  - Very large databases
  - Very large virtualization requirements
  - Cloud computing
  - Information access requiring high availability
- Allow to create an unlimited number of VMs and unlimited number of containers
- Also comes with additional Software Defined Networking (SDN) features, such as Network Controller role: to monitor and manage virtual networks used by large numbers of virtual machines.

Windows Server 2022 Editions

Standard Edition

- Designed to meet the everyday needs of most businesses and organizations
- Providing:
  - File and print services
  - Secure Internet connectivity,
  - Centralized management of users
  - Centralized management of applications and network resources.

Windows Server 2022 Editions

Datacenter: Azure Edition

- Host virtual machines in Azure: the option of selecting new VM to run Azure Edition
- Some cool new features only on Azure Edition: Hot Patch and SMB via QUIC

Windows Server 2022

Standard versus Datacenter

SOFTTRADER SOFTWARE TRADER IN PRE-OWNED LICENSES	Windows Server 2022 Standard Edition	Windows Server 2022 Datacenter Edition	Windows Server 2022 Datacenter: Azure Edition
Basic Windows Server 2022 features	✓	✓	✓
Number of virtual machines (VMs)	2	Unlimited	Unlimited
Hyper-V hosts	1	1	1
Software-defined Networking		✓	✓
Storage Replica		✓	✓
Storage Spaces Direct		✓	✓
Host Guardian Hyper-V Support		✓	✓
Shielded Virtual Machines		✓	✓
Supported on Azure			✓
Hotpatching			✓
SMB over QUIC			✓
Azure Extended Networking			✓
Extra menu's in Admin Center			✓

Windows Server 2022

Three different user interfaces

- Desktop Experience: The point-and-click interface with a traditional look and feel
- Server Core: a command-line interface (namely PowerShell)
- Nano Server – now only for containers

Windows Server 2022

Licensing models

- Long-Term Servicing Channel (LTSC)
  - ✓ previous called Long-Term Servicing Branch (LTSB)
  - ✓ continue to be released every 2–3 years
  - ✓ five years of mainstream support followed by five years of available extended support.
- Semi-Annual Channel (SAC)
  - ✓ now retiring
  - ✓ two major releases every year
  - ✓ SAC versions of Windows Server lasted for a short 18 months

Windows Server 2022

License purchase and packs

- Core Packs
  - ✓ license each physical server based on the amount of processor cores
  - ✓ One Core Pack covers two CPU cores. E.g., If the servers has two CPUs, each with four cores => require four core packs to be compliant.
  - ✓ the rules of a minimum license purchase:
    - Any physical server requires a minimum of 8 core packs
    - if server has fewer than 16 cores: license for at least 16 cores
    - Every physical CPU requires at least four core packs

Windows Server 2022

License purchase and packs

- At what point do I turn to Datacenter?
  - Windows Server 2022 Standard allows for the running of two VMs
  - Not a technical limitation and more VMs were possible. The way that Windows Server is licensed
  - Purchase a Standard License => purchasing the rights to install Server 2022 Standard onto one physical piece of hardware to run two VWs
  - Repurchase Standard licensing for every two additional VMs that you need to run
  - Datacenter costs a lot more than Standard. If need to run more than 12 VMs, purchasing a single (16 core) Datacenter license will be your cheaper option

Windows Server 2022

License purchase and packs

- Client Access Licenses (CALs)
  - Windows Server licensing, just for the server side
  - purchase and own CALs to cover any user who needs to connect to resources on that server
  - Oftentimes when purchase Windows Server licensing, you will find options that combine server and CAL licensing, such as “Server 2022 16 core licenses + 25 CALs.”

Windows Server 2022

Overview of new and updated features

- Hardware security
  - improvements to TPM interoperability: the assurance that your server started with legitimate code.
  - UEFI secure boot and virtualization-based security: protecting servers from rootkits and crypto mining attacks

Windows Server 2022

Overview of new and updated features

- Network security:
  - Protocol updates:
    - security enhancements to both TCP and UDP
    - SMB now works with AES-256
    - TLS 1.3 enabled by default
  - DNS-over-HTTPS
    - official name for this is actually Secure DNS
    - enable DNS lookups to be encrypted using HTTPS
    - help to prevent eavesdropping and man-in-the-middle attacks

Windows Server 2022

Overview of new and updated features

- Azure integrations: ways to help interact with and migrate to the Azure platform
  - An Azure-specific version of the OS:
  - Azure Stack HCI: building your own private cloud using Azure Stack HCI
  - Hotpatching: patch servers on the fly, without requiring OS restarts.
  - SMB over QUIC:
    - be able to map network drives natively, over the internet
    - carry SMB traffic utilizes TLS 1.3, thereby making it safe and secure to flow across the internet
- Windows Admin Center: enables to do a lot of normal, everyday tasks with your servers, all from a single interface.

Windows Server 2022

Overview of new and updated features

- Storage: numerous improvements to the storage subsystem
  - Storage Spaces and Storage Spaces Direct
  - snapshotting with the ReFS filesystem
  - SMB protocol being used to transfer those files over the network can now self-compress on the fly.
- Containerization
  - the size of container images shrunk and image startup time decreased
  - integrated with Kubernetes
  - compatible with IPv6

Windows Server 2022

Overview of new and updated features

- The Windows 10 experience continued: looks, feels, and drives like Windows 10
- Hyper-Converged Infrastructure (HCI):
  - a culmination of a number of different technologies work together and be managed together for the purpose of creating the mentality of a Software-Defined Datacenter
  - the combination of Hyper-V and S2D on the same cluster of servers
  - a software-defined datacenter is Software-Defined Networking (SDN): shifting the design and administration of the networks to be virtual and managed by the Windows Server platform

Windows Server 2022

Overview of new and updated features

- Microsoft Edge: replacing Internet Explorer
- Windows Defender Advanced Threat Protection: a cloud-based service that you tap your machines into (some AI)
- Integration with Linux: the ability to run Linux VMs within our Microsoft Hyper-V
  - Linux-based containers can also be run on top of your Windows Server
- System Insights
  - predictive analytics engine that runs locally on the servers
  - capturing information about the server itself and keeping historical data for up to a year
  - Can be translated and manipulated with Windows Admin Center, or PowerShell, to find patterns and trends.

Windows Server 2022

Overview of new and updated features

- Features deprecated: have no plans to make future improvements to these technologies
  - Semi-Annual Channel (SAC) releases
  - Windows Internet Name Service (WINS)
  - Internet Storage Name Service (iSNS) servers
    - iSNS used for the automatic discoveryof iSCSI devices on your network
    - still retains the ability to make connections to iSCSI devices
    - iSNS service removed and no longer utilized for that automatic discovery

Windows Server 2022

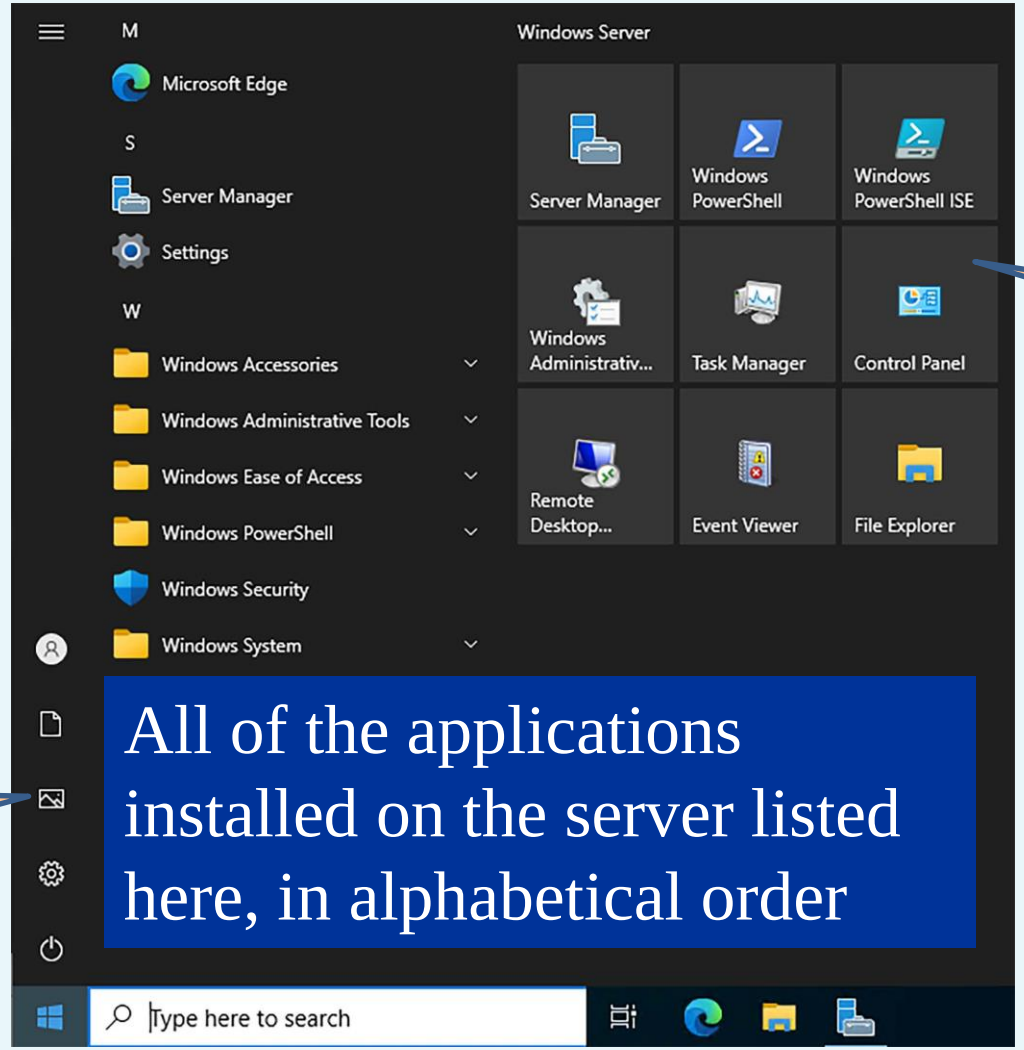
Overview of new and updated features

- Features deprecated (con't):
  - Guarded fabric and Shielded VMs
  - Windows Deployment Services (WDS) partial deprecation
    - workflows that utilize boot.wim files will now be blocked
    - newer deployment platforms: Microsoft Endpoint Configuration Manager or the Microsoft Deployment Toolkit (MDT)

Windows Server 2022

Navigating the interface

- The updated Start menu



buttons for quick access to items

All of the applications installed on the server listed here, in alphabetical order

Pinning items here to give easy-access location for items commonly launch on the server

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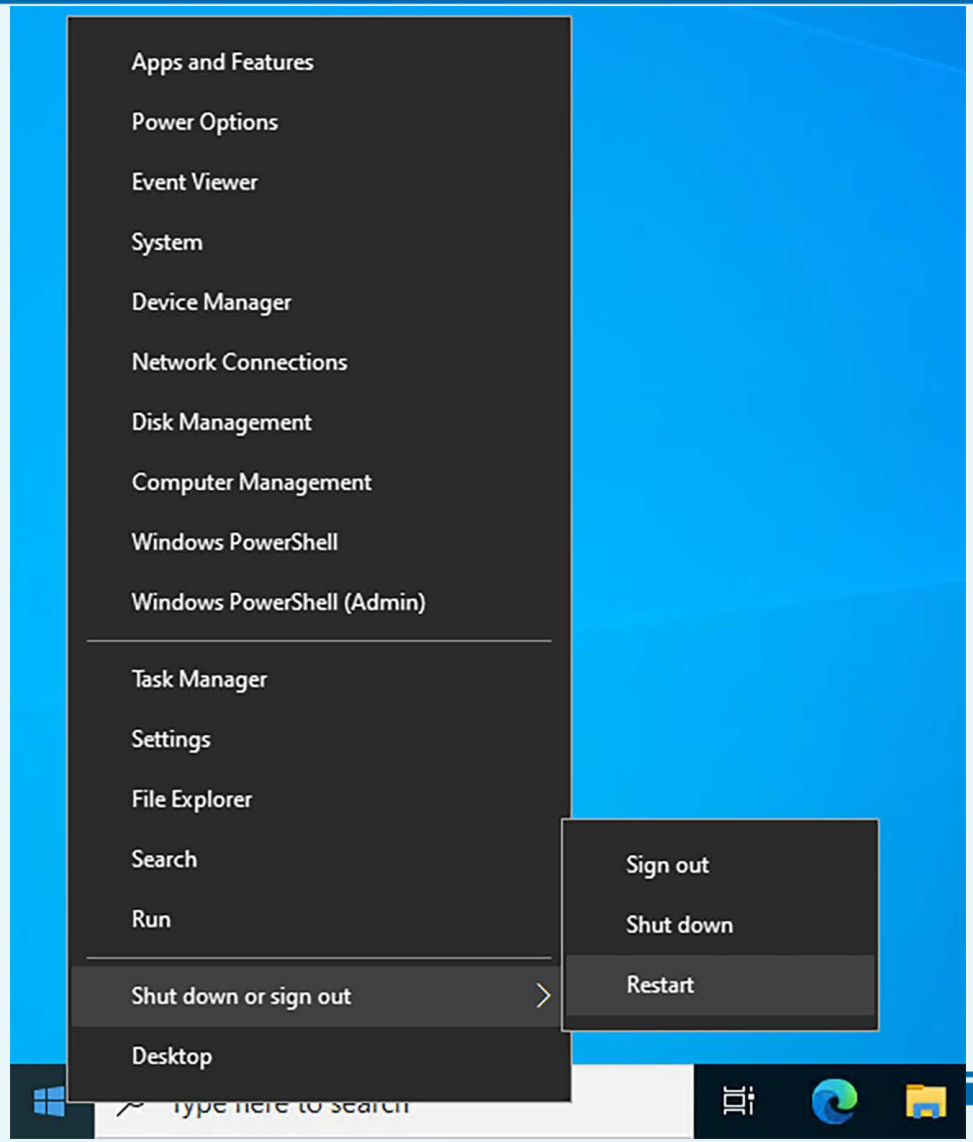
Windows Server 2022

Navigating the interface

- The Quick Admin Tasks menu
  - open by right-clicking on the Start button
  - Quick links to do things like open Event Viewer, view the System properties, check Device Manager, and even Shut down or Restart the server



Windows Server 2022

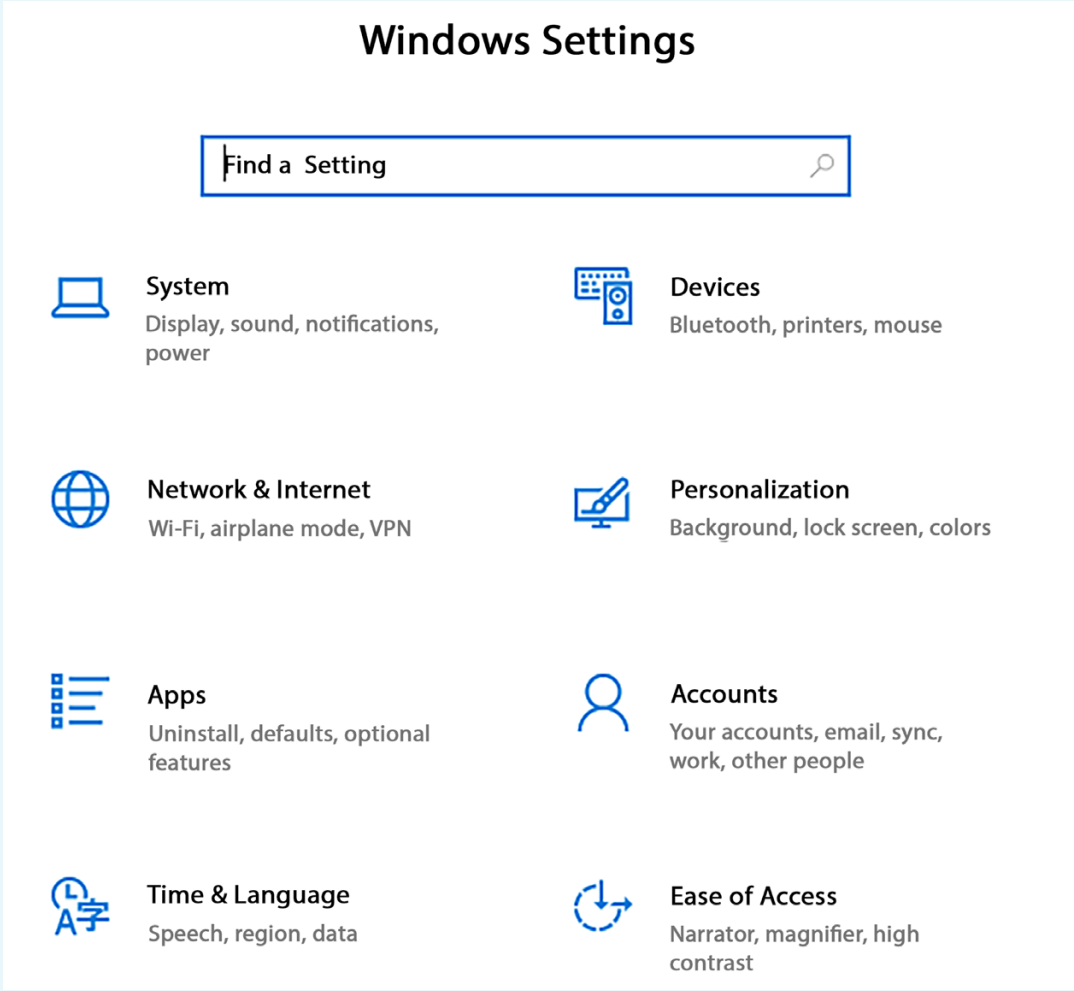
Navigating the interface

- Using the Search function
  - a powerful tool for interfacing with literally anything on your Windows Server
- Pinning programs to the taskbar
  - right-click on the program and choose Pin to taskbar to stick a permanent shortcut to that application in the taskbar
- The power of right-clicking
  - small context menus displayed upon a right-click
  - more right-click functionality into application launchers themselves

Windows Server 2022

Using the newer Settings screen

- an interface to configure various settings within the operating system.



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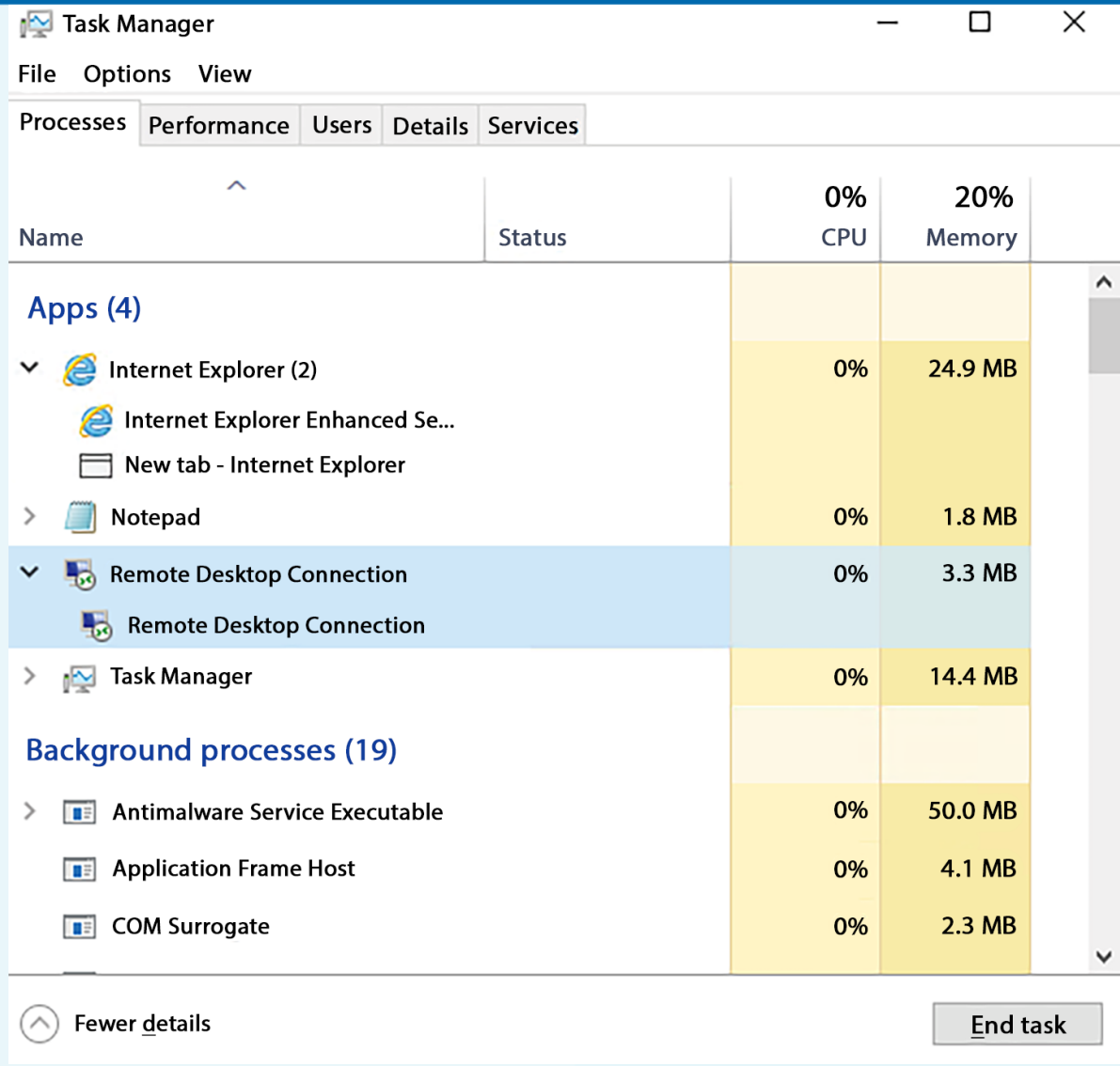
Windows Server 2022

Task Manager

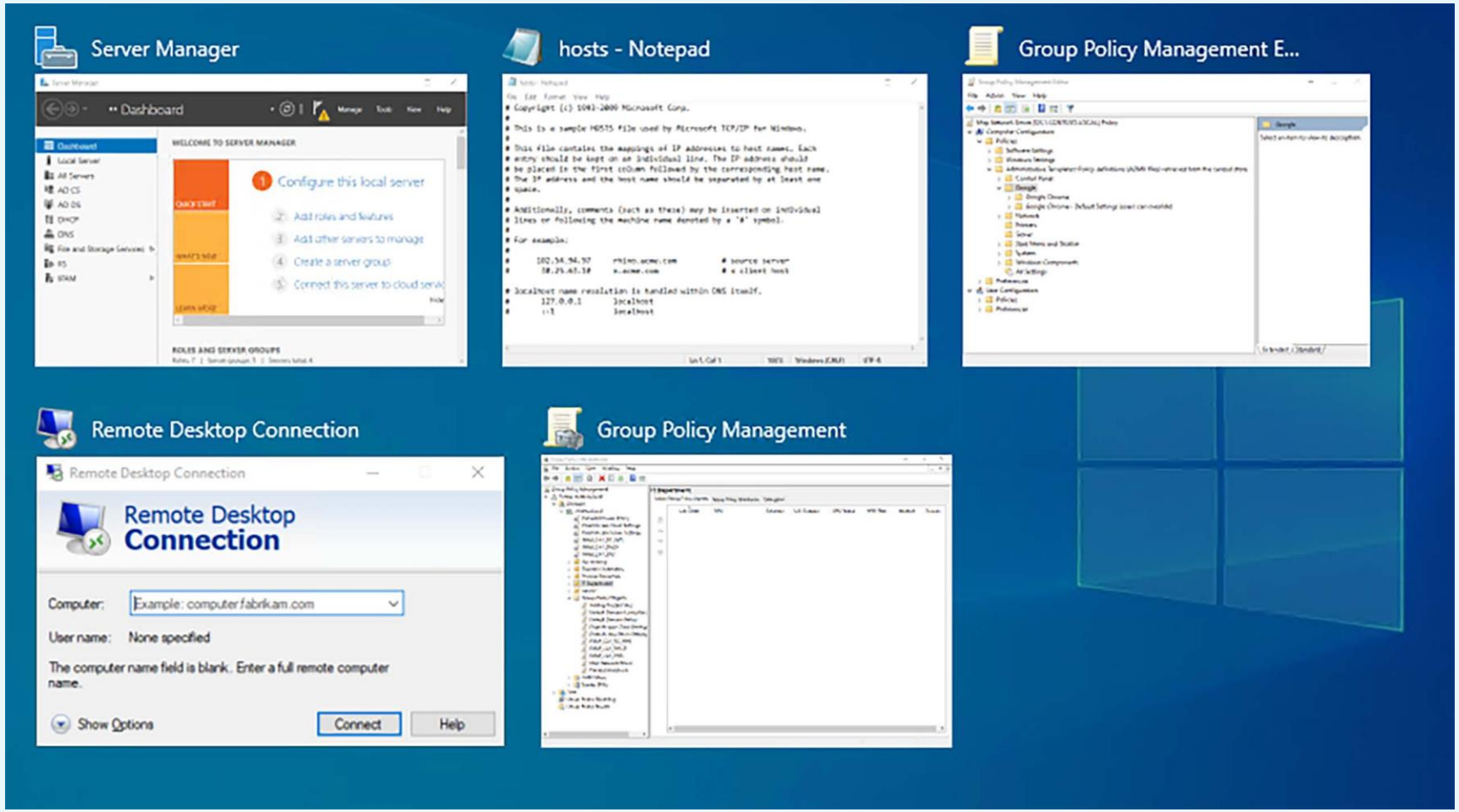
- Users: show a list of currently logged-in users and the amount of hardware resources the user sessions consuming



Windows Server 2022

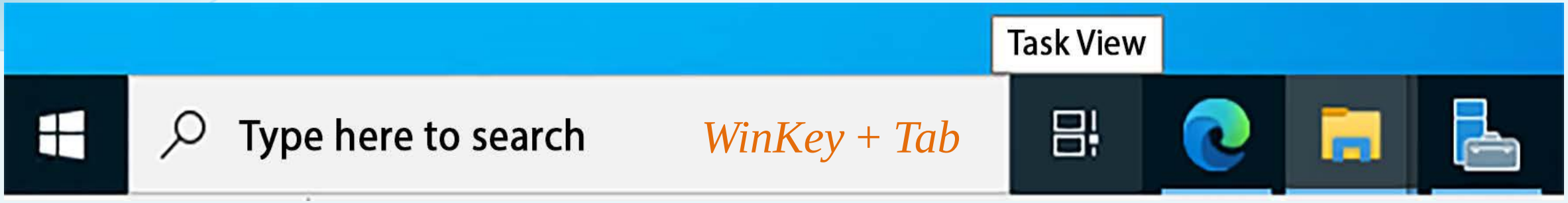
Task View

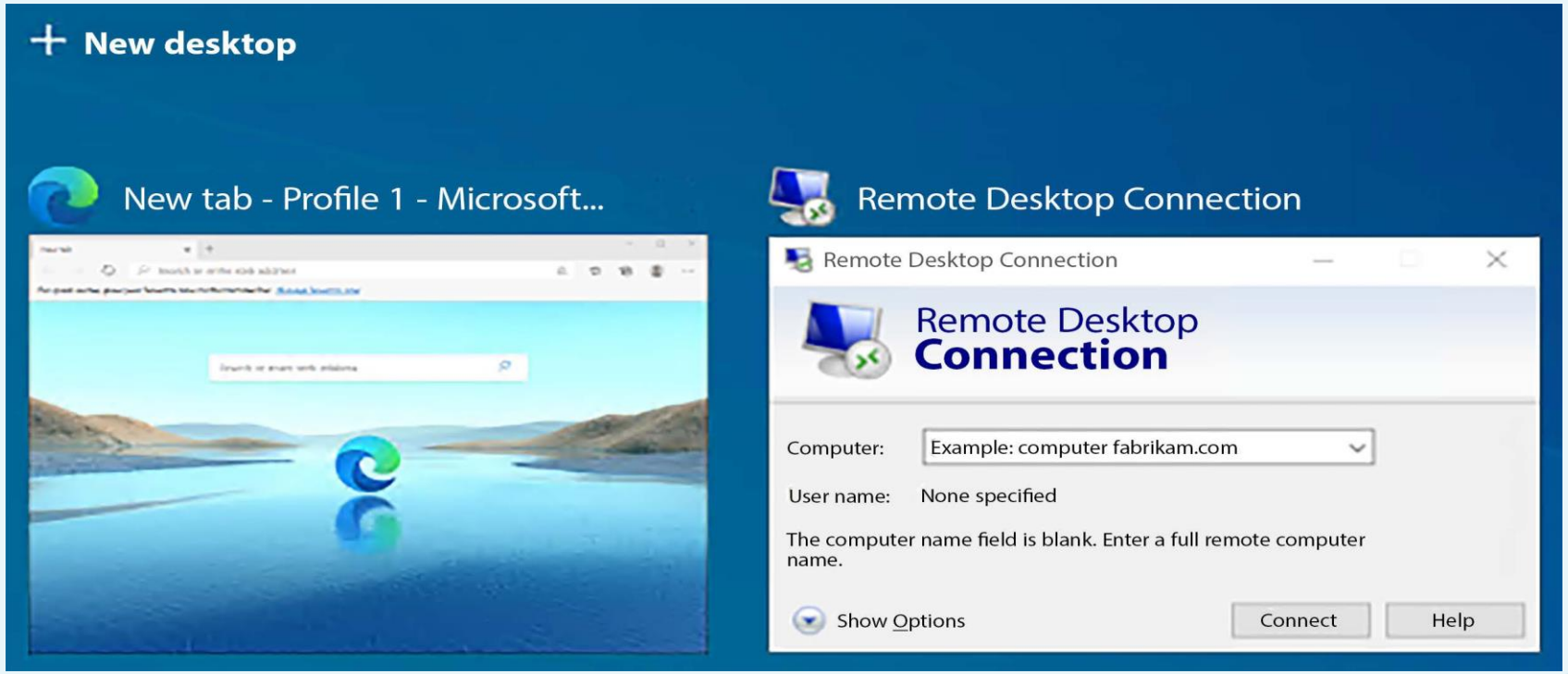
adds the capability of managing multiple full desktops' worth of windows and applications



Windows Server 2022

Task View





Summary

- Quick introduction of history of Windows OS; the architecture of Microsoft windows OS and networking models
- Windows Server 2022 Editions
- Windows Server 2022 Features
- Navigating the intefrface
- Task Manager and Task View

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Q & A