Tishk International University
Science Faculty
IT Department

Operating Systems

Lecture 7 Windows

3rd Grade - Fall Semester

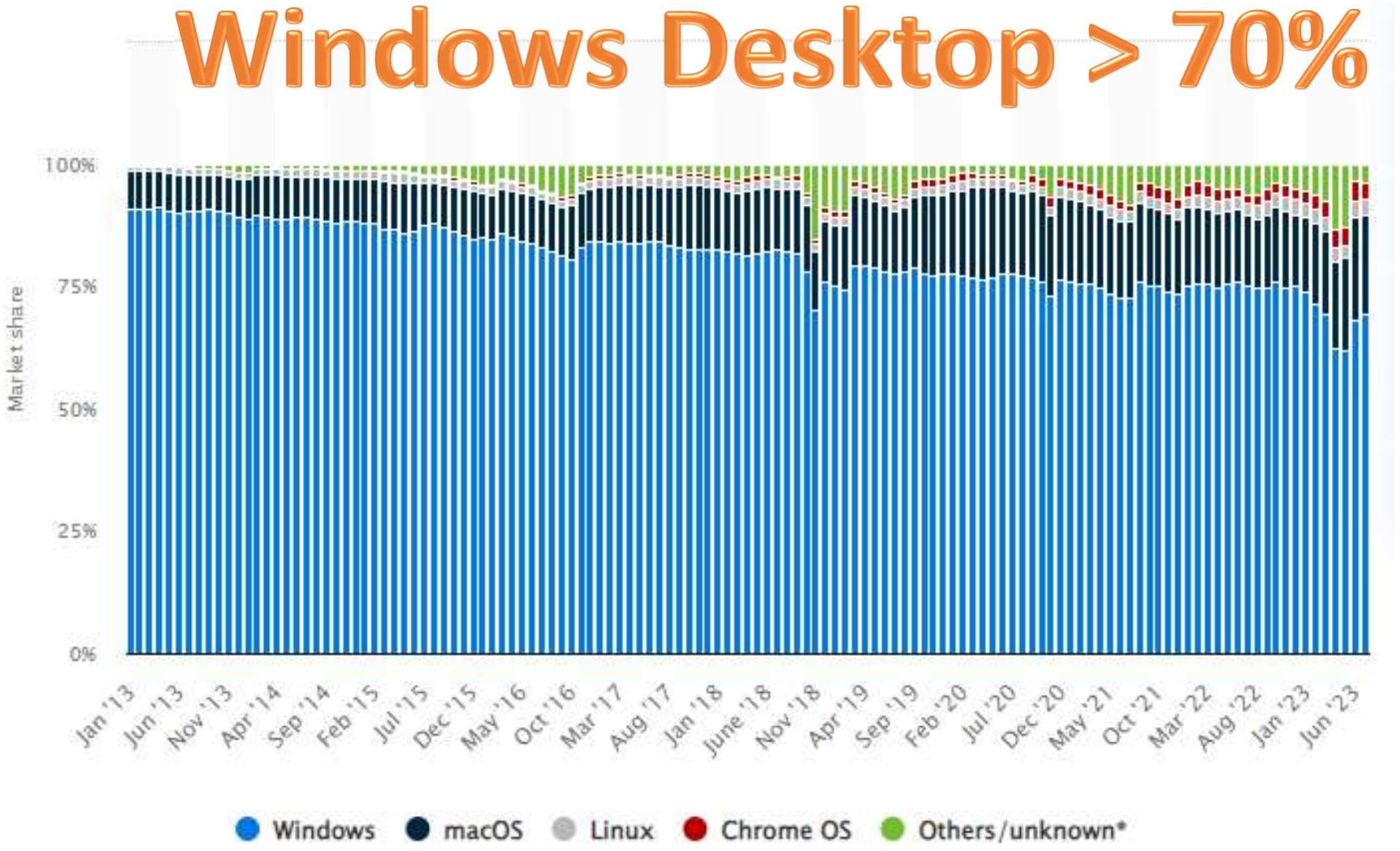
Instructor: Alaa Ghazi

Lecture 6: Windows Agenda

- Part 1: Windows History
- Part 2: Windows 11 and Windows Server 2022
- Part 3: The Registry
- Part 4: Active Directory

PART 1
Windows History

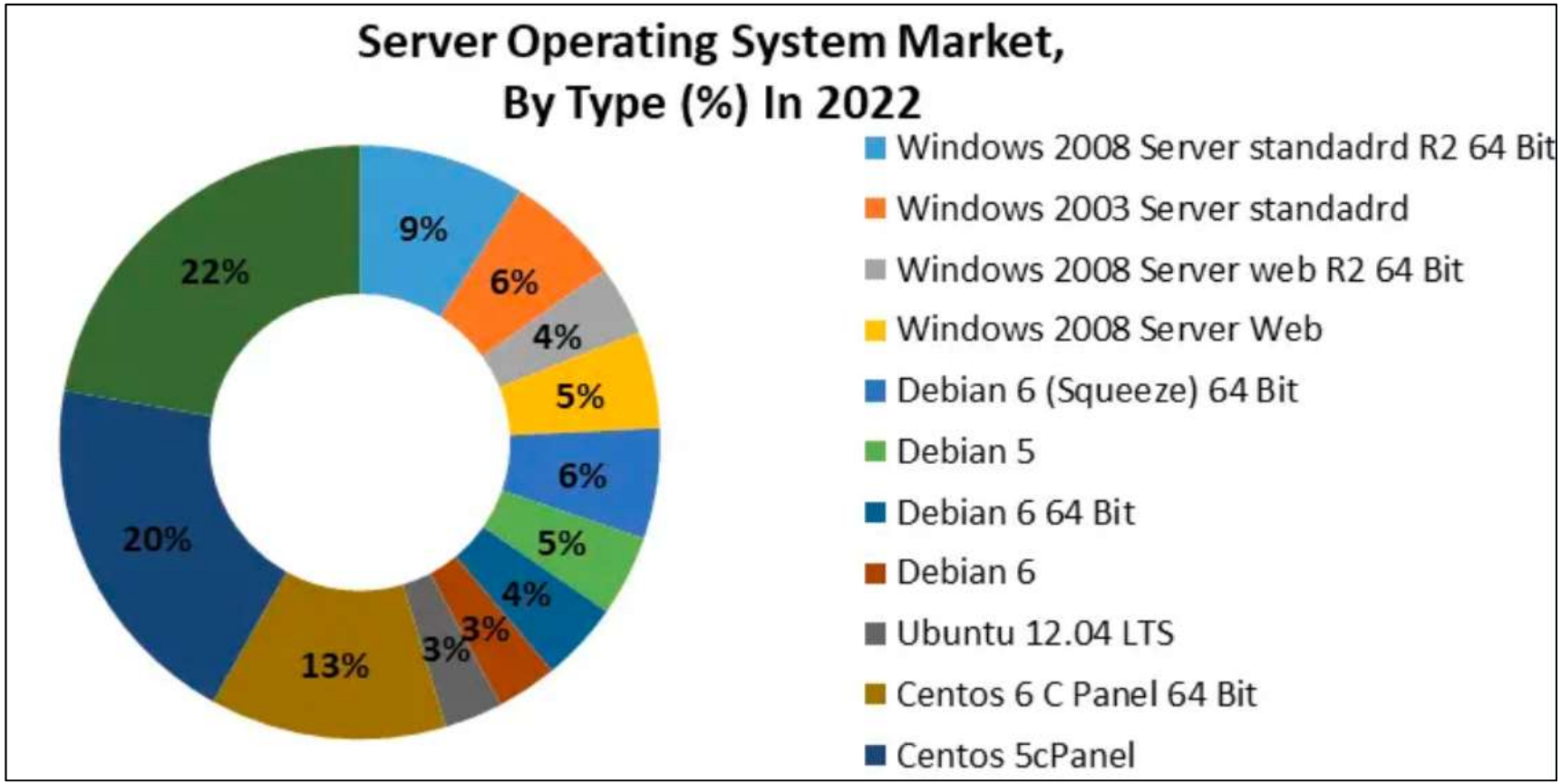
Desktop OS Market Share (Till Jun 2023)



- Source: https://www.statista.com/

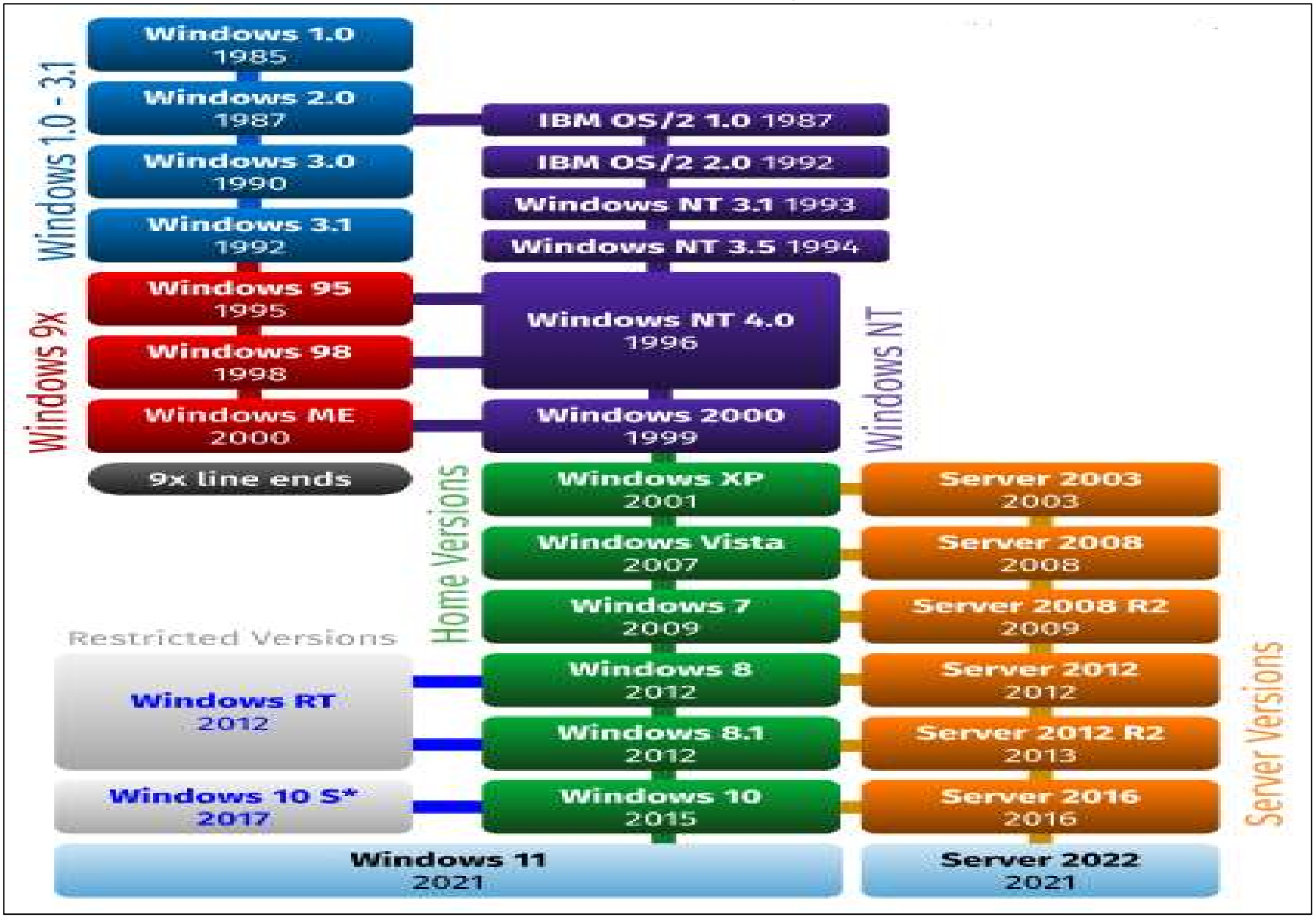
Server OS Market Share (in 2022)

Windows Server < 25%



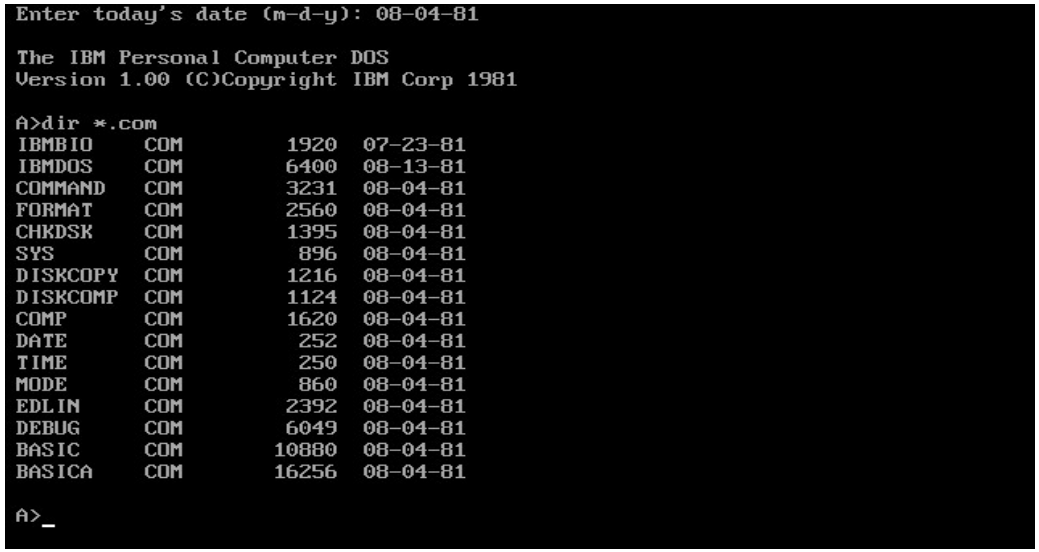
- Source: https://www.maximizemarketresearch.com/

Timeline of Windows (not required in the exam)



MS-DOS (Microsoft-Disk Operating system)

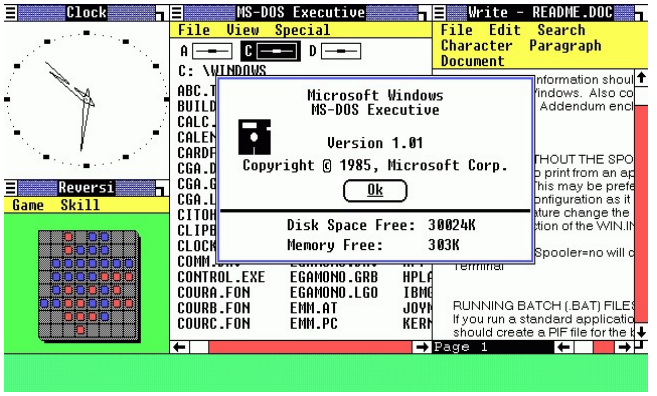
- It was the Microsoft-marketed version of the first widely-installed operating system in personal computers.
- It was essentially the same operating system that (Bill Gates's) young company developed for IBM in 1981.
- It is a non-graphical line-oriented, command driven, single-user, and single-tasking operating system,



Windows 1.0 to 3.0

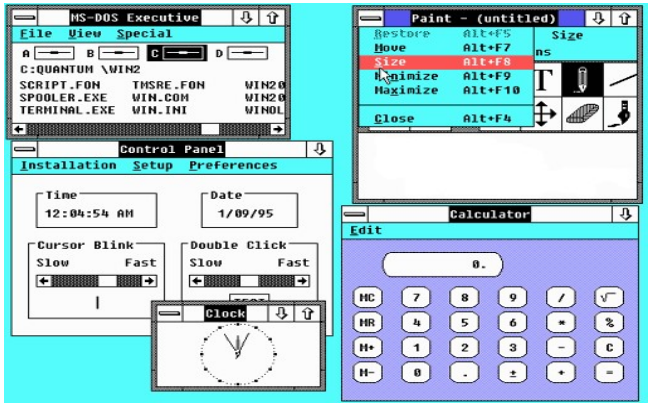
Windows 1.0:

- 16-bit multi-tasking shell on top of an existing MS-DOS installation



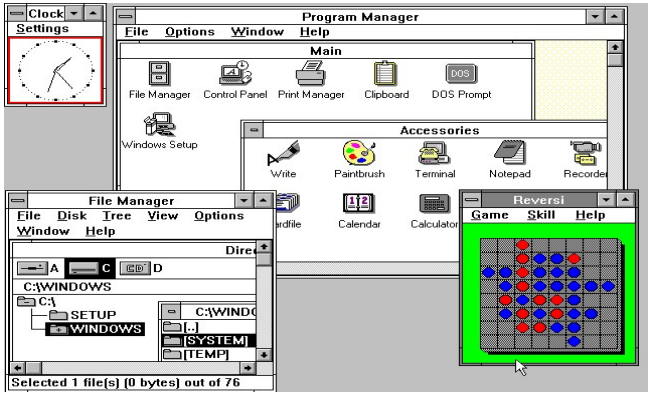
Windows 2.0:

- First version to integrate the control panel.



Windows 3.0:

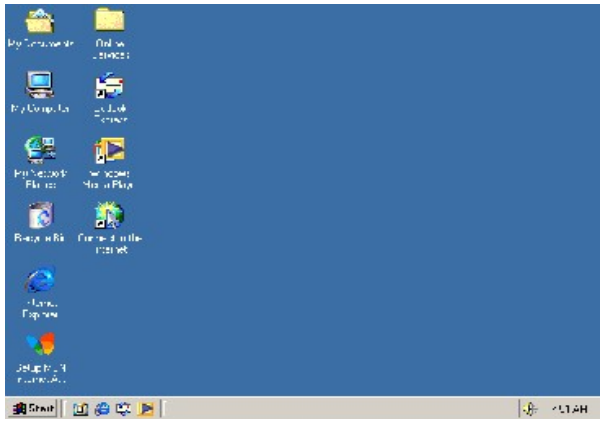
- Protected/Enhanced mode
- Better memory management



Windows 9x

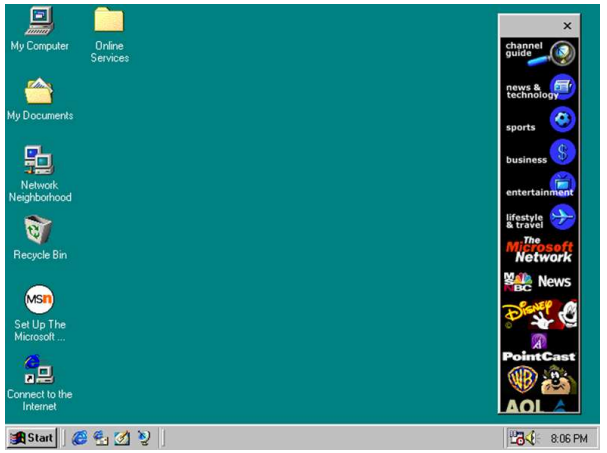
Windows 95:

- Introduced the taskbar, the 'Start' button, and the way the user navigates
- Moved to multitasked 32-bit architecture
- support for mixed-case long filenames.



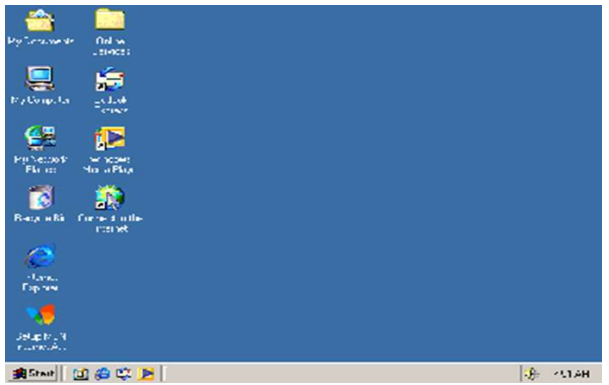
Windows 98:

- Improved power management, network management, and USB support
- Added Standby and Hibernate modes



Windows ME:

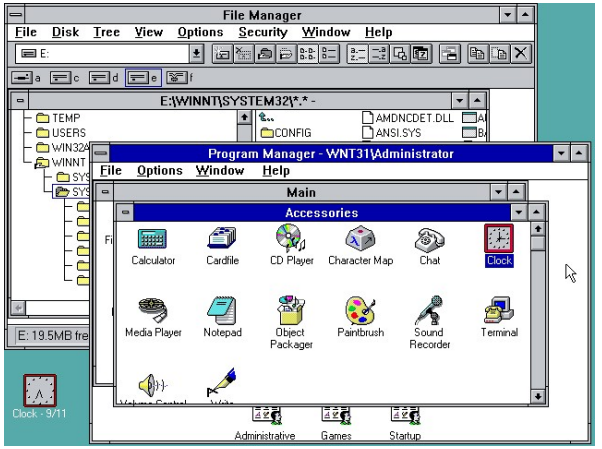
- Introduced a System Restore feature, and improved digital media and networking tools
- Criticized for speed and stability issues



Windows NT and 2000

Windows NT Workstation:

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



Windows 2000 Workstation:

- Added new features like
  - NTFS (New Technology File System) 3.0,
  - Microsoft Management Console (MMC),
  - Active Directory
- A number of new assistive technologies to support for people with disabilities were introduced.

Windows XP, Vista and 7

Windows XP:

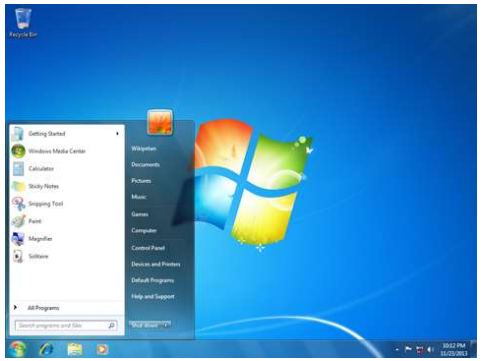
- Improved taskbar and 'Start' menu, better networking features
- Product activation to reduce software piracy.

Windows Visa:

- Introduced Windows Search, Windows Aero, Windows Sidebar, Shadow Copy
- Integrated Speech Recognition
- Lack of compatibility with some pre-Vista hardware and software

Windows 7:

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



Windows 8 and 10

Windows 8:

- Heavier integration with MS online services.
- Faster startup through UEFI integration
- User interface focused on tablets users, including a touch-optimized shell.

Windows 10:

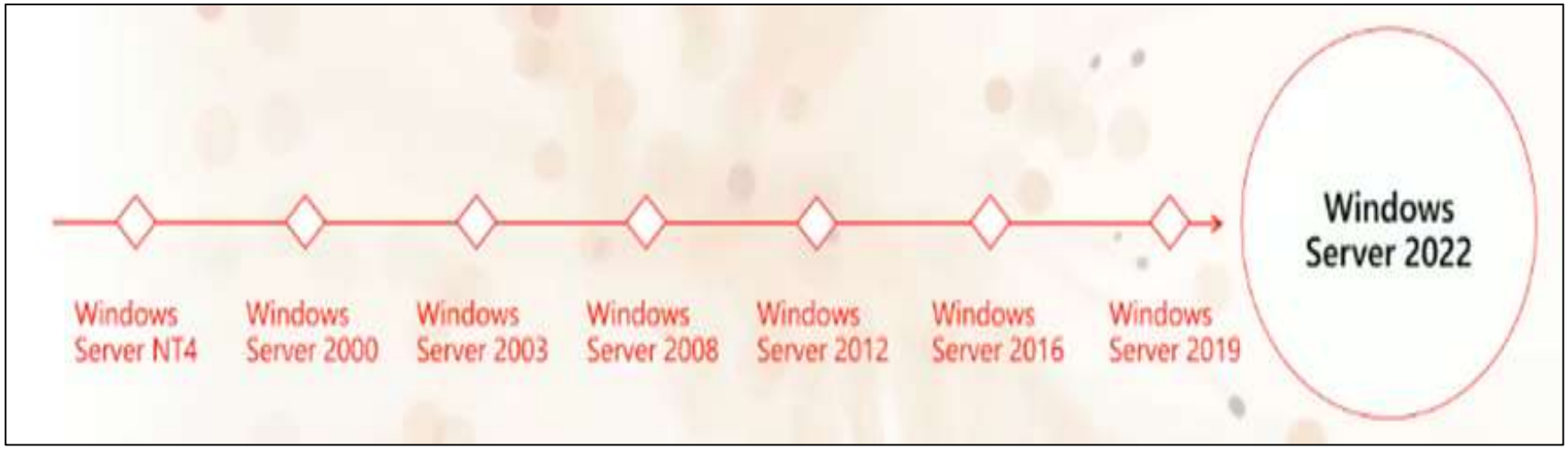
- Return of ‘Start’ button, a virtual desktop system, integration with Windows Phone
- Microsoft's intelligent personal assistant Cortana

Windows 11:

- Explained in Part 2

Windows Server Family

- It’s a family of operating systems intended specifically for managing and maintaining corporate and enterprise environments (networks and applications).
- Several editions are available, each designed for different types of organizations.
- It includes features and tools for managing and maintaining networks, such as Active Directory and Group Policy.
- It can host a variety of applications and is scalable and flexible.



PART 2
Windows 11
and
Windows Server 2022

Windows 11 Overview

- Microsoft Windows 11 is designed to boost employee productivity and encourage team collaboration. It’s also built to be more secure than previous versions of Windows, and to deliver a more consistent experience for users on the front end and IT staff on the back end.
- It's more of an evolution of Windows 10. Featuring a fresh look (and a different look at startup), Windows 11 is still consistent with Windows 10 to give users and IT a predictable experience.
- Windows 11 also delivers the security and management features needed for hybrid work. It can be deployed alongside Windows 10 devices without interrupting business operations.

Windows 11 Hardware Requirements

- **Processor**: 1 gigahertz (GHz) or faster with at least two cores on a compatible 64-bit processor or system on a chip (SoC).
- **RAM**: 4 gigabytes (GB) minimum.
- **Storage**: 64 GB or greater available disk space. - Additional storage may be required to download updates and enable certain features.
- **Graphics Card**: Compatible with DirectX 12 or higher, with a WDDM 2.0 driver.
- **System firmware**: UEFI, secure boot
- **TPM**: Trusted Platform Module (TPM) version 2.0
- **Display device**: HD (720p), 8 bits per color
- **Internet Connection**

Windows 11 Features

Microsoft Windows 11 is designed to boost productivity and encourage team collaboration through below features:

- **Increased Productivity**

It has a little bit of a Mac look and feel. It features the Start Menus in the middle of the screen instead of off to the left-hand side, and has an elegant look and focus right in the middle of the screen.

- **Easier Collaboration**

It offers greater collaboration functionality by embedding Microsoft Teams into the operating system.

- **Greater Consistency**

It offers the same functionality used in Windows 10, so there is no a steep learning curve.

Windows 11 Security

Microsoft has built security into the functionality right at the ground level by developing baseline systems to help mitigate threats and block them before they become a risk to your company.

Trusted Platform Module: is a security chip that can be embedded in a laptop or plugged into most desktop PCs. It's basically a lockbox for keys, as well as an encryption device a PC can use to boost its security.

Virtualization-Based Security: Kernel Data Protection that makes Kernel Memory read-only, which protects Windows Kernel Drivers from being tampered with.

Application Guard: For Microsoft Edge, Application Guard helps to isolate enterprise-defined untrusted sites, protecting the organization while the employees browse the Internet.

Credential Guard: is the local security authenticator authority subsystem and a virtual container. It stops attackers from dumping credentials.

Windows Server 2022 Editions

- **Windows Server 2022 Standard:** The most popular option for most businesses. Requires User or Device CALs to be purchased separately.
- **Windows Server 2022 Datacenter:** For highly virtualized environments typically found in the datacenter.
- **Windows Server 2022 Essentials:** A popular option for small businesses or branch offices, Essentials is limited to a maximum of 25 users and 50 devices. Restricted to single-CPU servers with 10 or fewer cores.
- **What are CALs?**

- A Client Access License (CAL) is a license to allow either a **user or a device** to access a Windows Server domain.
- Typically if you have more devices than users, it is best to license the users - and vice versa - if you have more users than devices, it's better to license the devices.

Future of Windows

Cloud-Powered Operating System: users can access their personalized Windows experience from any device, regardless of its hardware specifications.

Enhanced Integration with AI: We can expect Windows to be equipped with AI-driven features, such as intelligent personal assistants, enhanced security measures, and improved productivity tools.

Enhanced Security and Privacy: advanced security features, including built-in encryption, secure boot, and real-time threat protection

PART 3
Windows Registry

What is Registry?

- The registry is a database file used by the Windows OS to store hardware and software configuration information, user preferences and setup information.
- The registry is used by all windows operating systems that followed Win95.
- The correct registry is essential for correct windows performance and functioning, this is why the registry is usually attacked by viruses and other malicious software.

Registry vs. File System

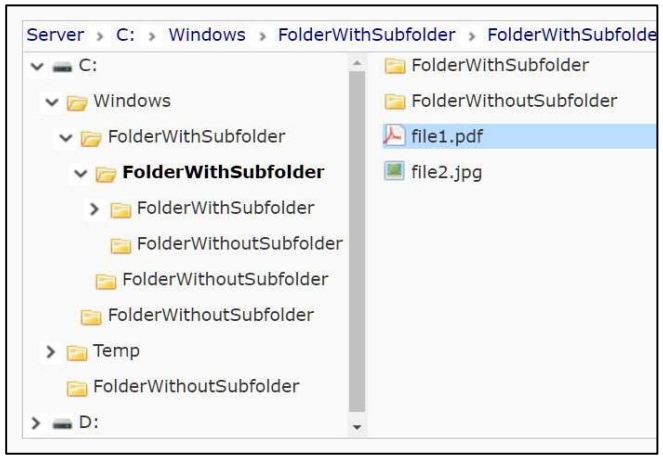
- The registry is analogous to a file system.

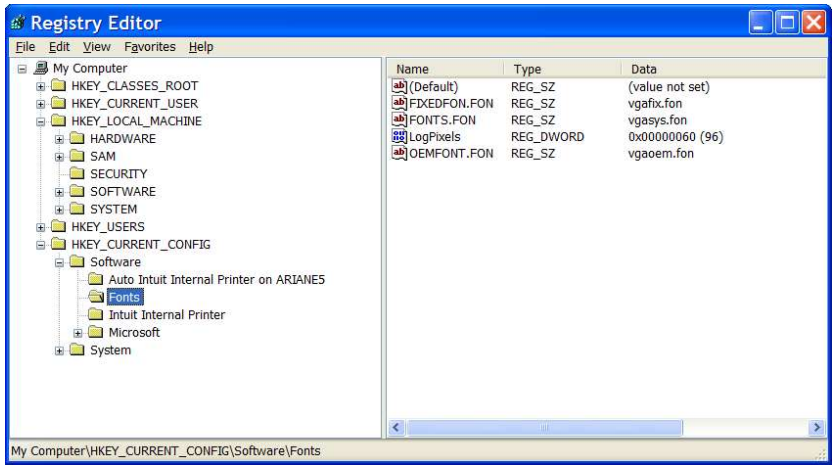
File system:

- Folders: contains other folders or files

Registry:

- Keys have inside them either other keys or name/value pairs.

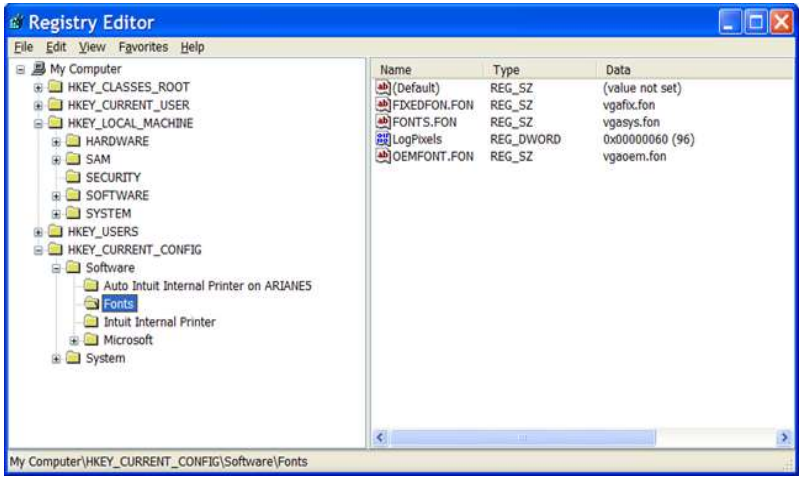




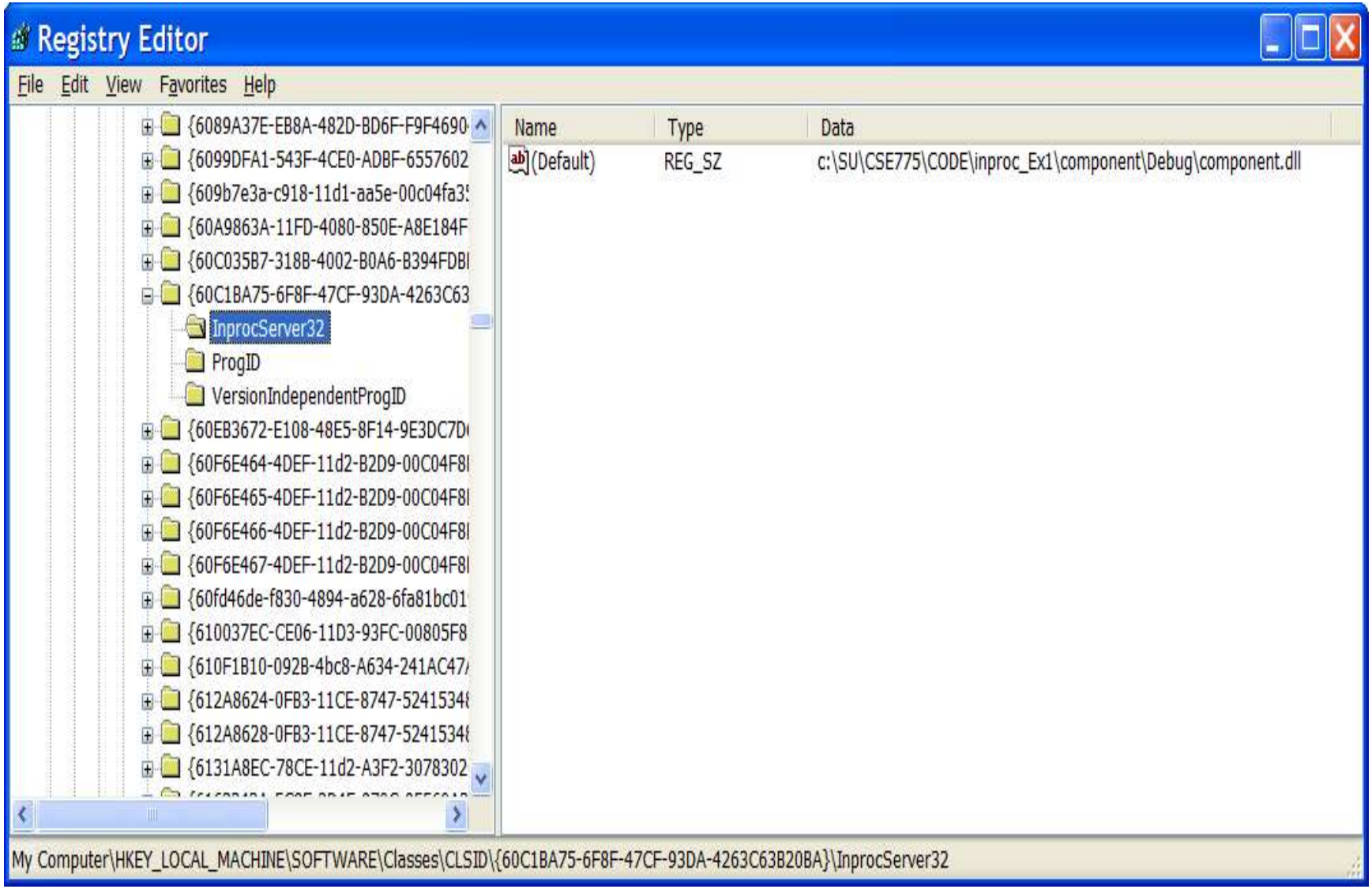
Registry Structure

- Registry has five top level branches or Hives:
  - **HKEY_CLASSES_ROOT**: Contains file types and OLE information for all OLE-aware applications
  - **HKEY_CURRENT-USER**: Logged in user name, desktop, start menu
  - **HKEY_LOCAL_MACHINE**: Hardware, software, preferences for all users
  - **HKEY_USERS**: Individual preferences for each user, represented by Security ID (SID)
  - **HKEY_CURRENT_CONFIG**: Links to part of KEY_LOCAL_MACHINE for current hardware

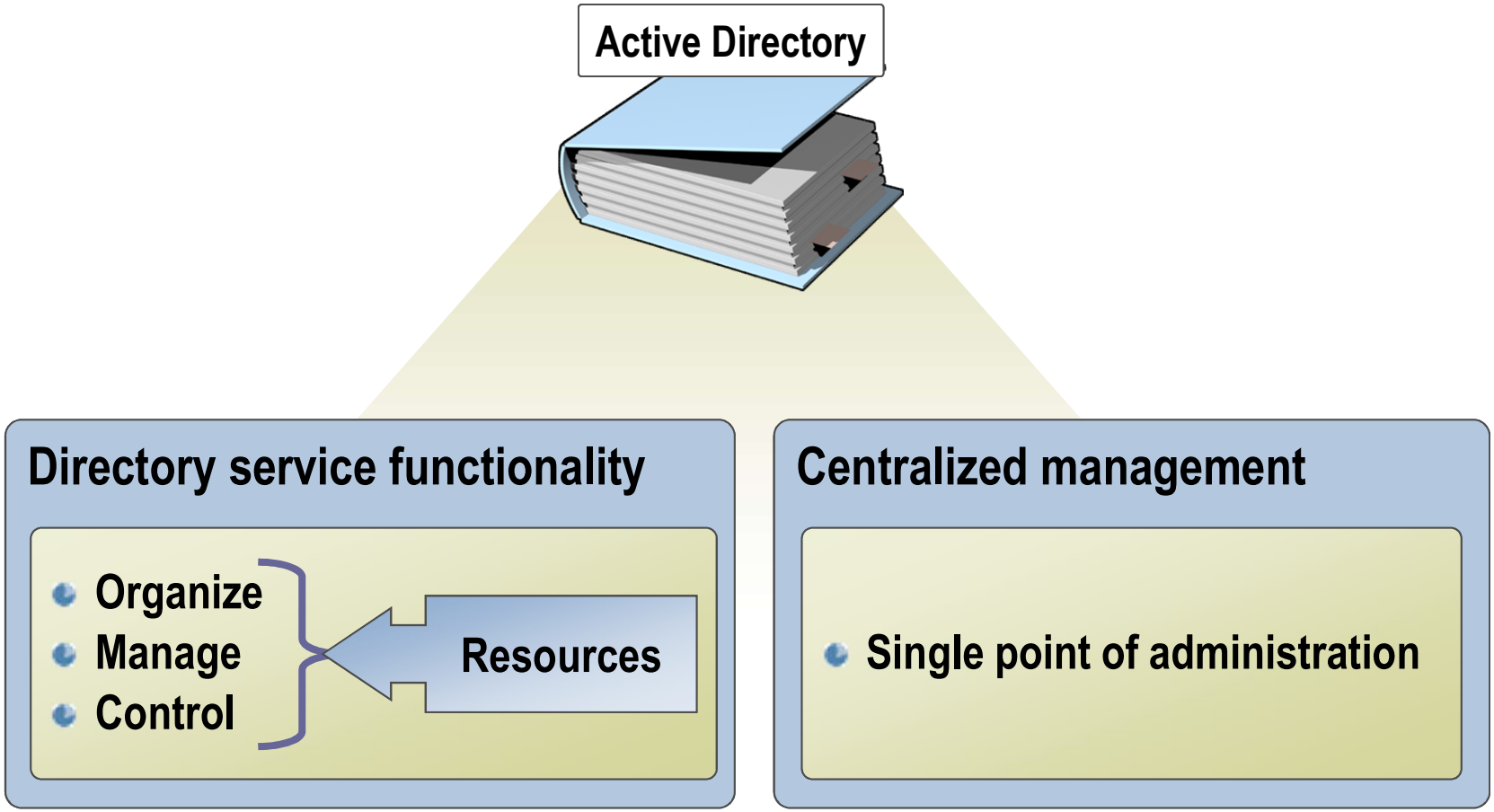
OLE is a mechanism that allows users to create and edit documents containing items or "objects" created by multiple application.



Typical Registry Entry



PART 4
Active Directory



Active Directory Overview

- **A directory service (DS)** is a software application- or a set of applications - that stores and organizes information about a computer network's users and network resources.
- **Active Directory** is Microsoft Directory Service which Contains Information of all User Accounts and Shared Recourses on a Network.
- Act as an abstraction layer between users and shared resources
- Initially released in 1999 with Windows 2000 Server
- Users make use of directory services to find resources
- Directory services provide a centralized management tool, but due to complexity, requires careful planning prior to setup.

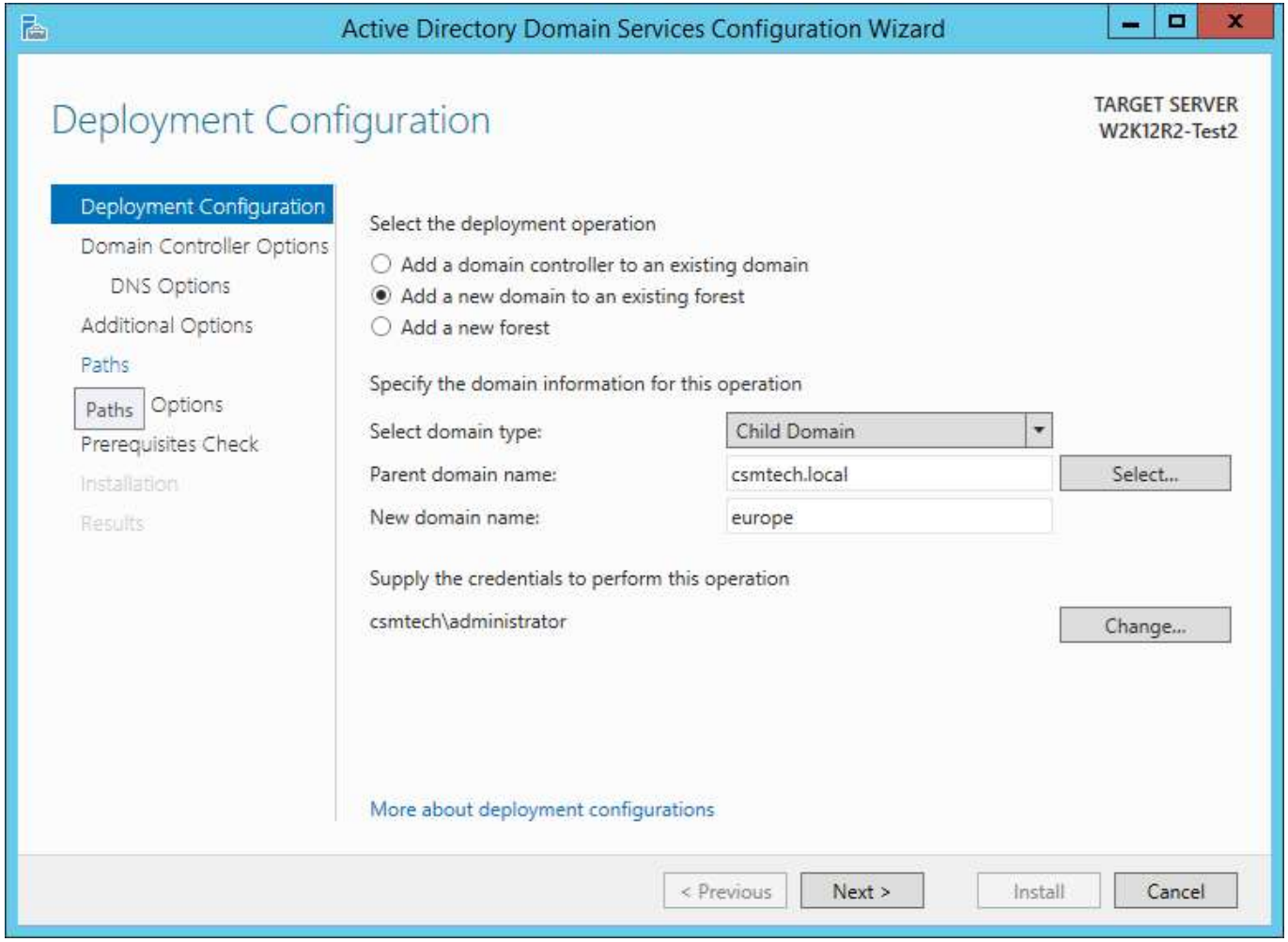
Active Directory Features

1) **Hierarchical organization**: enables administrators to organize users and network resources to reflect the organization structure.
2) **Centralized but distributed database**: All network data is centrally located, but it can be distributed among many servers for fast, easy access to information from any location. Automatic replication of information also provides load balancing and fault tolerance.
3) **Scalability**: Advanced indexing technology provides high-performance data access even if there are millions of objects.
4) **Security**: secure authentication protocols with fine-grained access controls enable administrators to control access to each directory object and its properties.
5) **Flexibility**: new objects can be added for a customized solution.
6) **Policy-based administration**: Administrators can define policies to ensure a secure and consistent environment for users.

Active Directory's Physical Structure

- **AD Physical structure** consists of sites and servers configured as domain controllers.
- **AD SITE** is simply a physical location in which domain controllers communicate and replicate information regularly
- Each **Domain Controller (DC)** contains a full replica (copy) of the objects that make up the domain and is responsible for:
  - **Storing a copy of the domain data** and replicating changes to that data to all other domain controllers in the domain
  - **Providing data search and retrieval functions** for users attempting to locate objects in the directory
  - **Providing authentication and authorization services for users** who log on to the domain and attempt to access network resources
- Microsoft recommends at least **two DCs** in every domain for fault tolerance and load balancing, named as:
  - Primary Domain Controller (PDC) and
  - Backup Domain Controller (BDC).

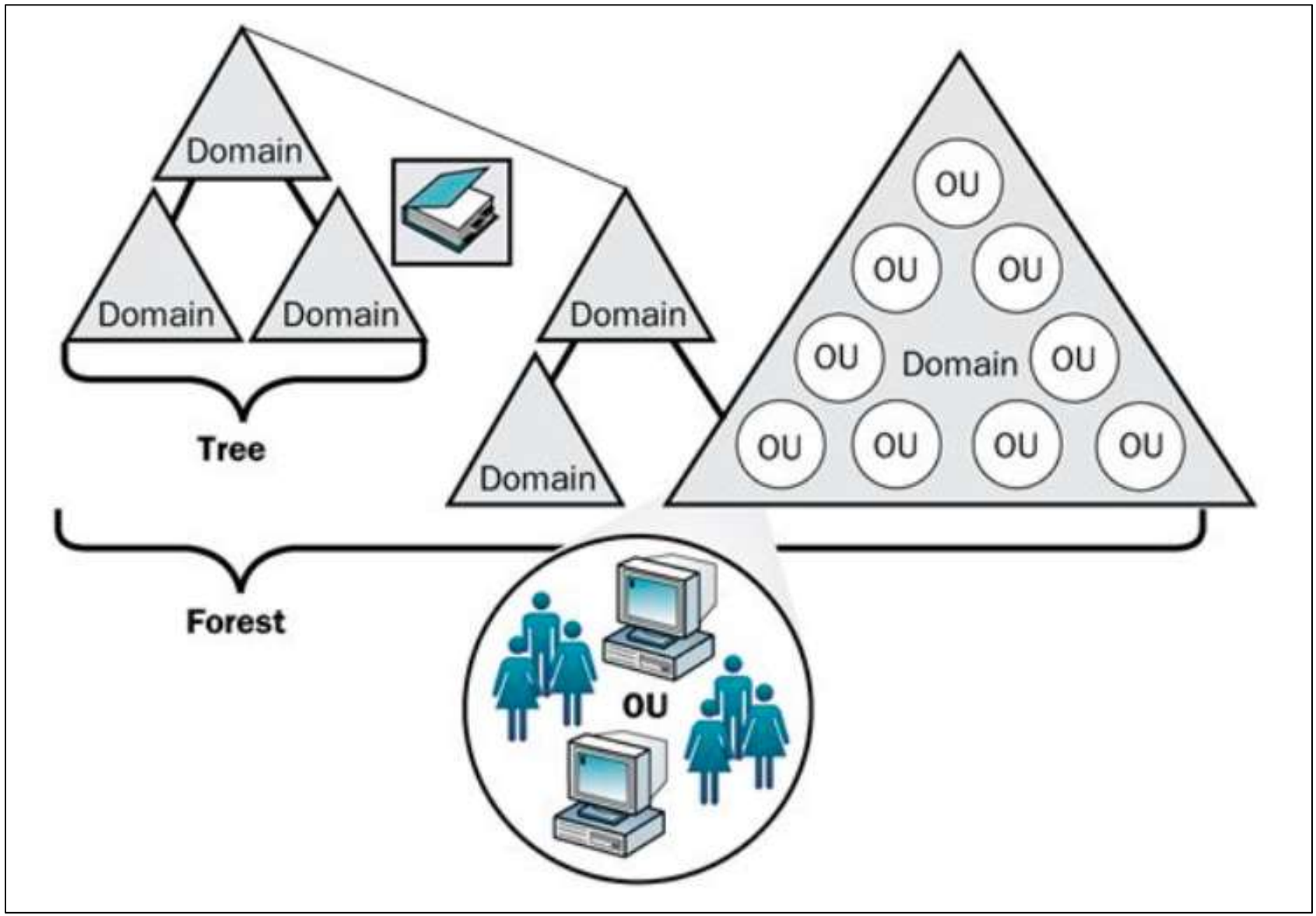
Installing New Domain Controller



Active Directory's Logical Structure

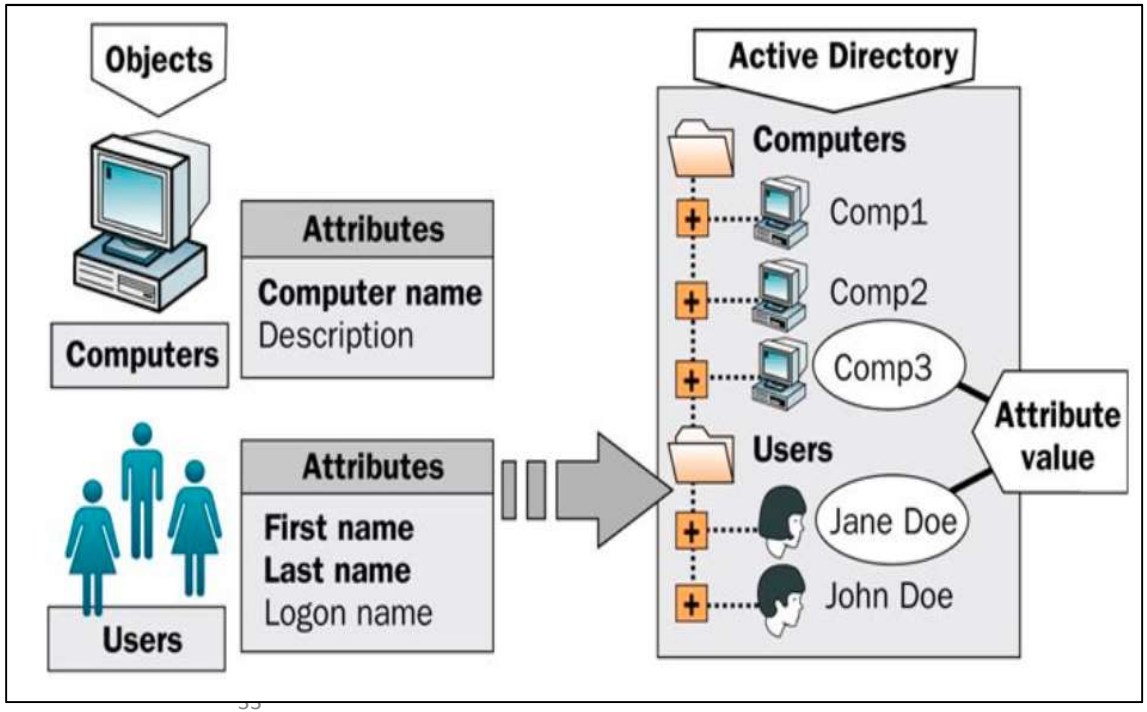
- Four organizing components of Active Directory:
  - Organizational Units (OUs)
  - Domains
  - Trees
  - Forests

Active Directory Logical Structure



Organizational Unit (OU)

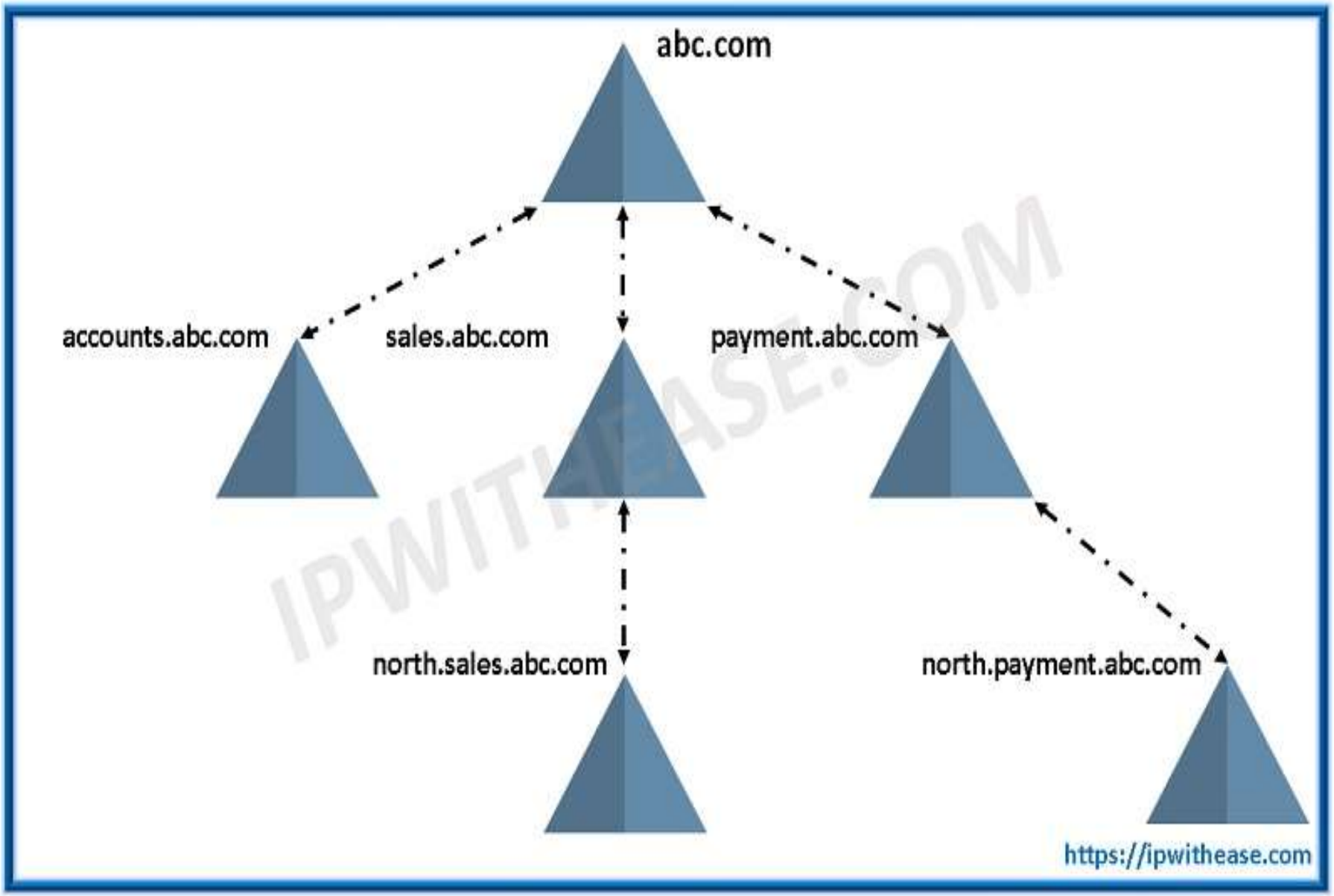
- The **organizational unit (OU)** is an Active Directory container used to organize a network's users and resources into logical administrative units.
- An OU contains Active Directory objects, such as:
  - User accounts
  - Groups
  - Computer accounts
  - Printers
  - Shared folders
  - Applications
  - Servers
  - Domain controllers



Active Directory's Logical Structure

- **Domain** - The core structural unit of an Active Directory which contains OUs and represents administrative, security, and policy boundaries
- Small to medium companies usually have one domain; larger companies may have several domains to separate geographical regions or administrative responsibilities
- A **tree** is a grouping of domains that share a common naming structure which consists of a parent domain and possibly one or more child domains.
- **Forest** - A collection of one or more Active Directory trees that provide a common Active Directory environment.
  - All domains in all trees can communicate and share information
  - The Forest can consist of a single tree with a single domain, or it can contain several trees, each with a hierarchy of parent and child domains

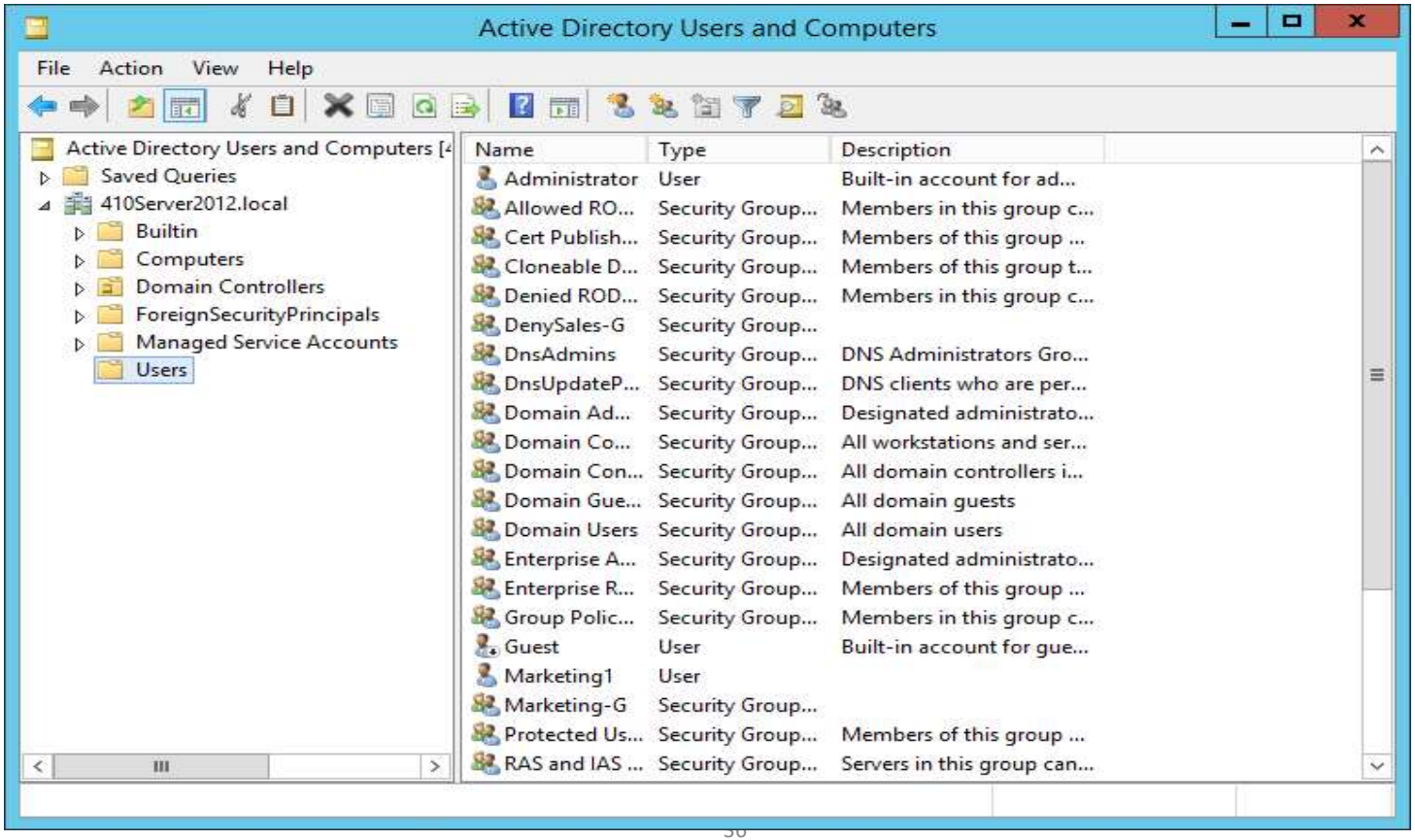
Active Directory Tree



Managing Active Directory

- To manage Active Directory, two tools can be used:

1. Active Directory Administrative Center (ADAC) or
2. Active Directory Users and Computers



User Accounts and Groups

- **User account object** contains information such as group memberships, account restrictions, profile path, and dial-in permissions
- **Authentication** confirms a user's identity, the account is then assigned permissions and rights and it provides a single logon for users to access all resources in the domain.
- Windows Domain creates two **built-in user accounts:** Administrator and Guest
- A group object represents a collection of users with common permissions or rights
- **Permissions** - define which resources users can access and what level of access they have
- **Right** - specifies what types of actions a user can perform on a computer or network
- **Groups** are used to assign members permissions and rights which is more efficient than assigning permissions and rights to each user separately.

Computer Accounts

- **A computer account object** represents a computer that's a domain controller or domain member and used to identify, authenticate, and manage computers in the domain
- Computer accounts are created automatically when AD is installed on a server
- The computer account object's name must match the name of the computer that the account represents

Domain Security

- The domain administrator creates, deletes, and manages the accounts and passwords using the User Manager for Domains program that comes with Windows Server.
- Each **user** who wishes to access services on the network must have a a **user account** and **password** and set up within the domain.
- Windows Server has the following security levels for each item under its control for each user account.:
  1. **no access.**
  2. **access that restricts the user to read only capabilities.**
  3. **access that allows read and write usage.**
  4. **access that allows you to change access permissions for network users.**

Group Policy Object (GPO)

- **GPO** is a list of settings that administrators use to configure user and computer operating environments remotely.
- Group policies functions are:
  1. specify security settings,
  2. deploy software,
  3. configure a user's desktop.
- They can be configured to affect an entire domain, a site, and, most commonly, users or computers in an OU.
- The objects a GPO affects are said to be within that GPO's scope.
- When Active Directory is installed, two GPOs are created and linked to two containers:

  1) **Default Domain Policy**—This GPO settings affect all users and computers in the domain.

  2) **Default Domain Controllers Policy**—This GPO settings affect all domain controllers in the domain

Trust Relationships

- In Active Directory, a **trust relationship** defines whether and how accounts from one domain can access network resources in another domain.
- Trust relationships are established automatically between all domains in the forest.
- When there is no trust between domains, no access across domains is possible