

**THOMSON**



**COURSE TECHNOLOGY**

# **Network+ Guide to Networks, Fourth Edition**

## **Chapter 8**

### **Network Operating Systems and Windows Server 2003-Based Networking**

# Objectives

- Discuss the functions and features of a network operating system
- Define the requirements for a Windows Server 2003 network environment
- Describe how Windows Server 2003 fits into an enterprise-wide network

# Objectives (continued)

- Perform a simple Windows Server 2003 installation
- Manage simple user, group, and rights parameters in Windows Server 2003
- Understand how Windows Server 2003 integrates with other popular network operating systems

# Introduction to Network Operating Systems

- A NOS must:
  - Centrally manage network resources, such as programs, data, and devices
  - Secure access to a network
  - Allow remote users to connect to a network
  - Allow users to connect to other networks
  - Back up data and make sure it's always available

# Introduction to Network Operating Systems (continued)

- An NOS must (continued):
  - Allow for simple additions of clients and resources
  - Monitor status and functionality of network elements
  - Distribute programs and software updates to clients
  - Ensure efficient use of a server's capabilities
  - Provide fault tolerance in case of a hardware or software problem

# Selecting a Network Operating System

- Decision will depend largely on OSs and applications running on LAN
- Consider:
  - Compatibility with existing infrastructure
  - Security
  - Whether applications will run smoothly
  - Scalability
  - Additional services
  - Budget
  - Training
  - Support

# Network Operating Systems and Servers

- Most networks rely on servers that exceed minimum hardware requirements suggested by software vendor
- Considerations to determine optimal hardware:
  - Number of connecting clients
  - Applications
  - Storage requirements
  - Acceptable downtime
  - Cost versus budget

# Network Operating System Services and Features: Client Support

- Client support includes following tasks:
  - Creating and managing client accounts
  - Enabling clients to connect to the network
  - Allowing clients to share resources
  - Managing clients' access to shared resources
  - Facilitating communication between clients

# Client/Server Communication

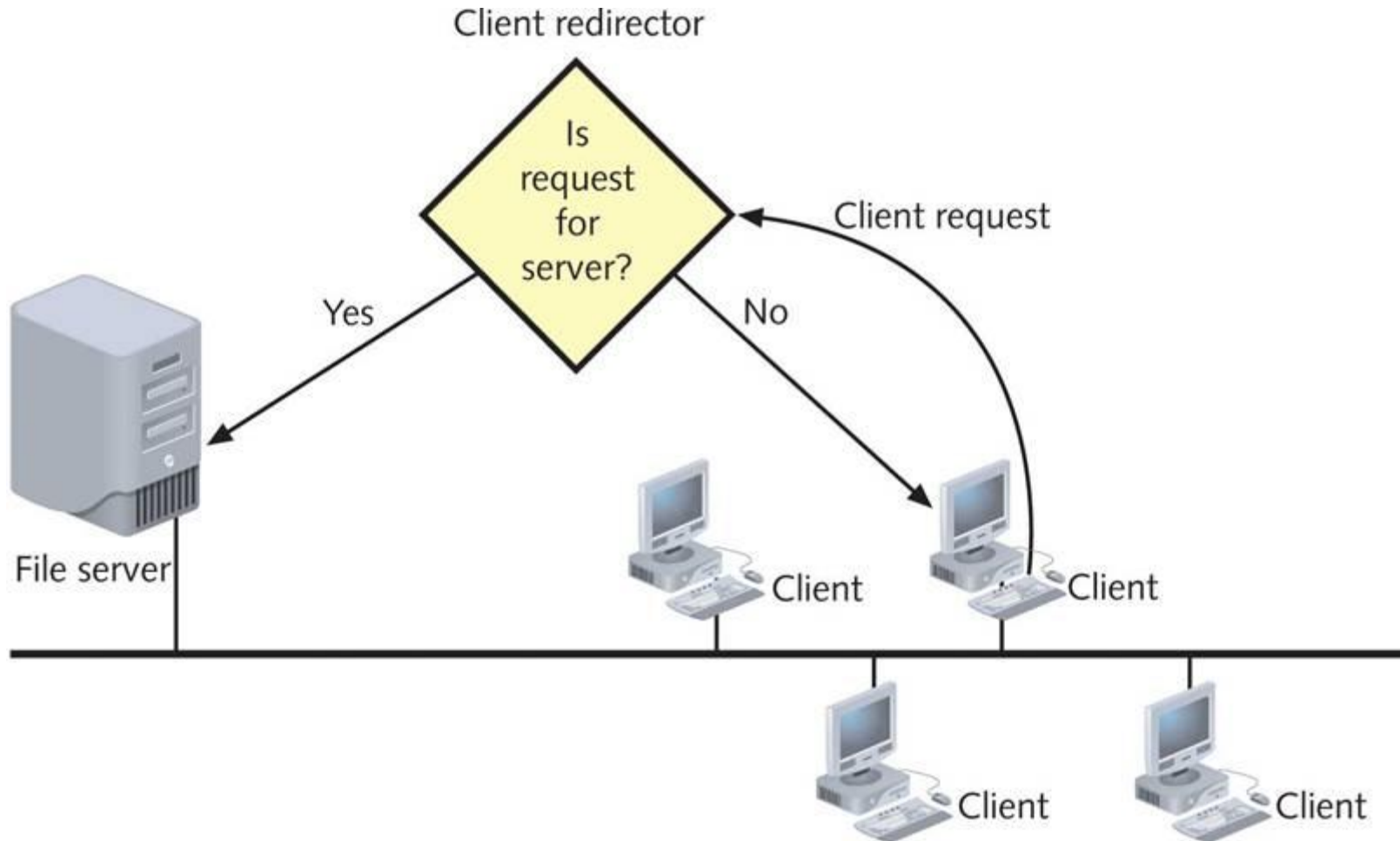


Figure 8-1: A client connecting to a NOS

# Client/Server Communication (continued)

- To expedite access to directories whose files are frequently required, map a drive to that directory
- File access protocol enables one system to access resources stored on another system
  - Common Internet File System (CIFS)
  - Server Message Block (SMB)
  - AppleTalk Filing Protocol (AFP)
- Middleware: software used to translate requests and responses between client and server

# Client/Server Communication (continued)

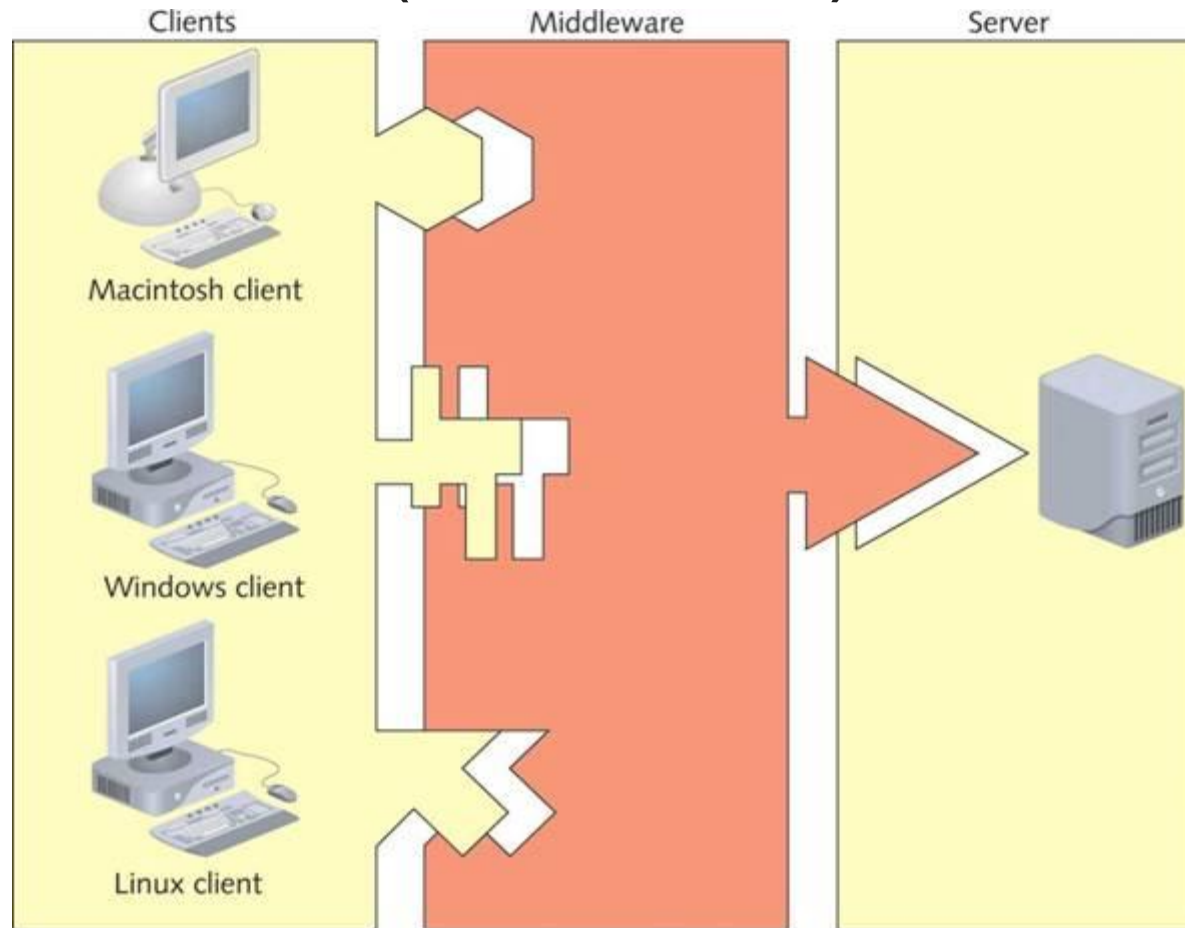


Figure 8-2: Middleware between clients and a server  
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# Users and Groups

- Combine users with similar needs and restrictions into groups
  - Form basis for resource and account management
  - Assign different file or directory access rights groups
  - Can be nested or arranged hierarchically
    - Inherited permissions

Group	Rights to PROGRAMS	Rights to GRADES	Rights to STAFF
Teachers	Read, modify	Full control	No access
Students	Read	No access	No access
Administrators	No access	Read, modify	Full control

Table 8-1: Providing security through groups

# Identifying and Organizing Network Elements

- Directory: list that organizes resources and associates them with their characteristics
- Lightweight Directory Access Protocol (LDAP): used to access information stored in a directory
  - Recent NOSs use directories that adhere to LDAP's standard structures and naming conventions
    - Thing or person associated with network represented by an object
    - Objects may have many attributes

# Identifying and Organizing Network Elements (continued)

- Schema: set of definitions of kinds of objects and object-related information that the database can contain
  - Classes and attributes
- To better organize and manage objects, objects placed in organizational units (OUs)
- Tree: logical representation of multiple, hierarchical levels within a directory
  - Branches and leaf objects

# Identifying and Organizing Network Elements (continued)

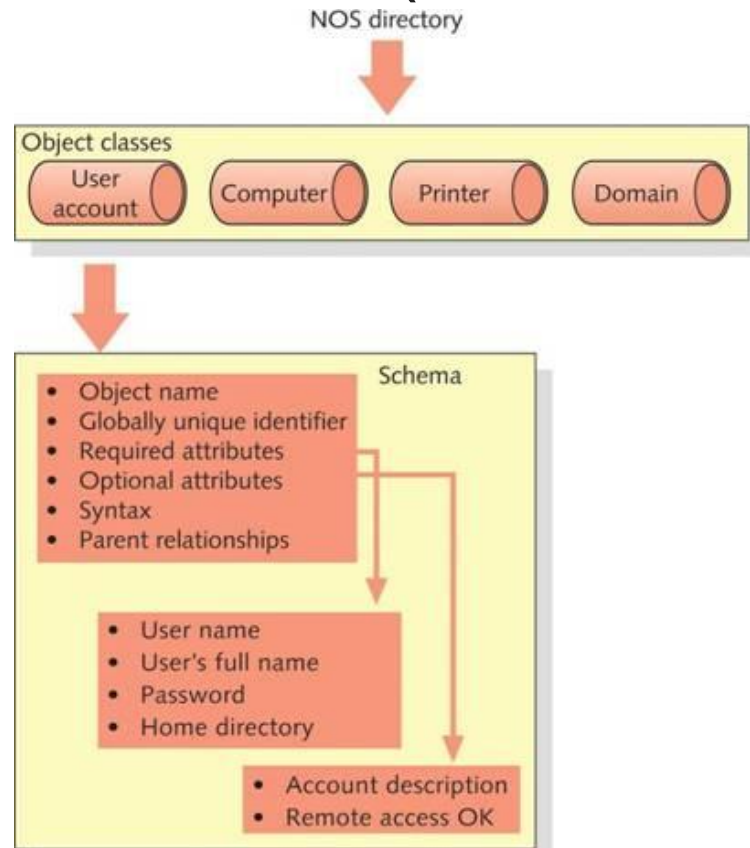


Figure 8-3: Schema elements associated with a User account object

# Identifying and Organizing Network Elements (continued)

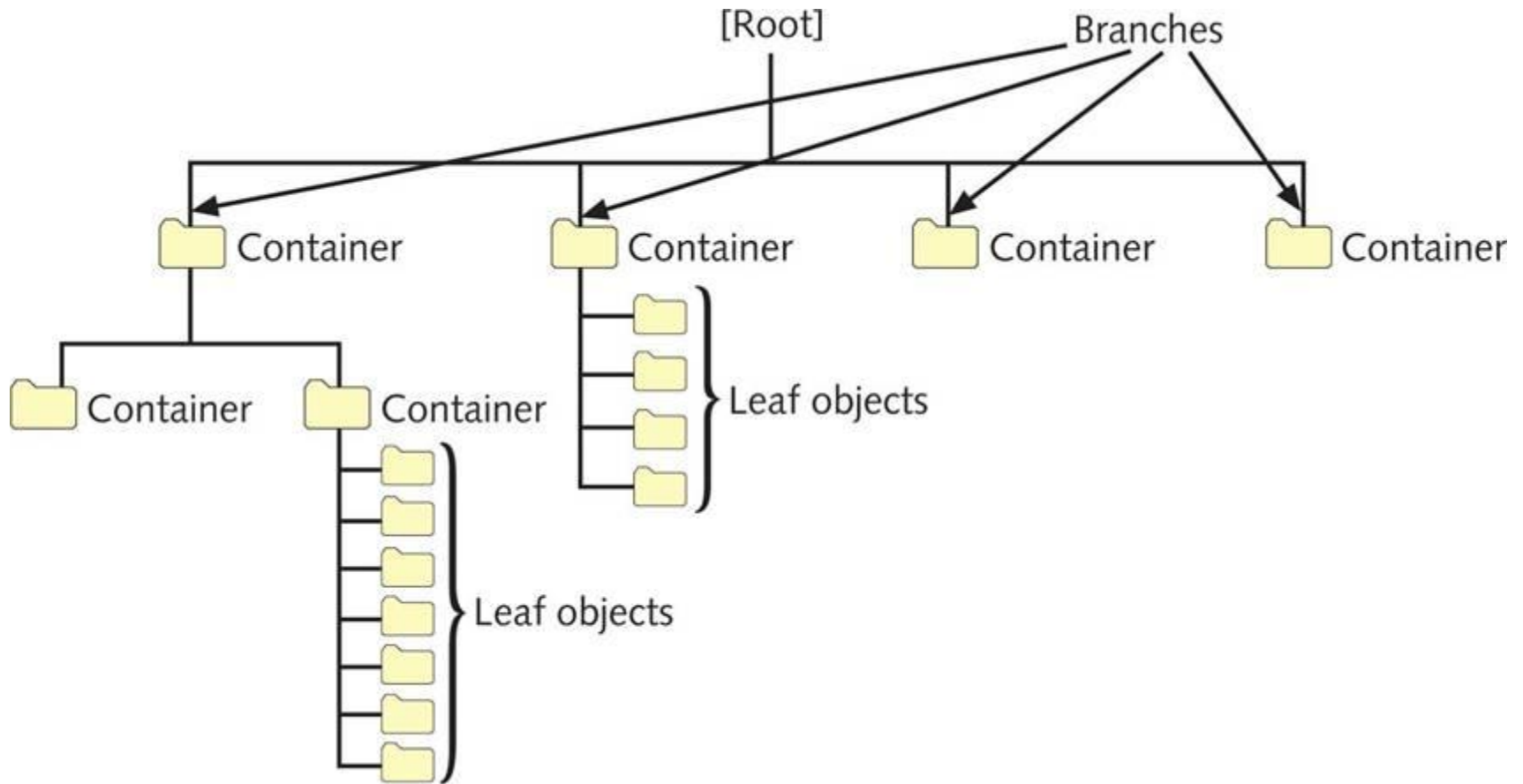


Figure 8-4: A directory tree  
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# Sharing Applications

- Shared applications often installed on file server specifically designed to run applications
- Network Administrator must purchase license for application that allows it to be shared
  - Per user licensing
  - Per seat licensing
  - Site license
- Must assign users rights to directories where application's files installed
- NOS and/or middleware responsible for arbitrating access to files

# Sharing Printers

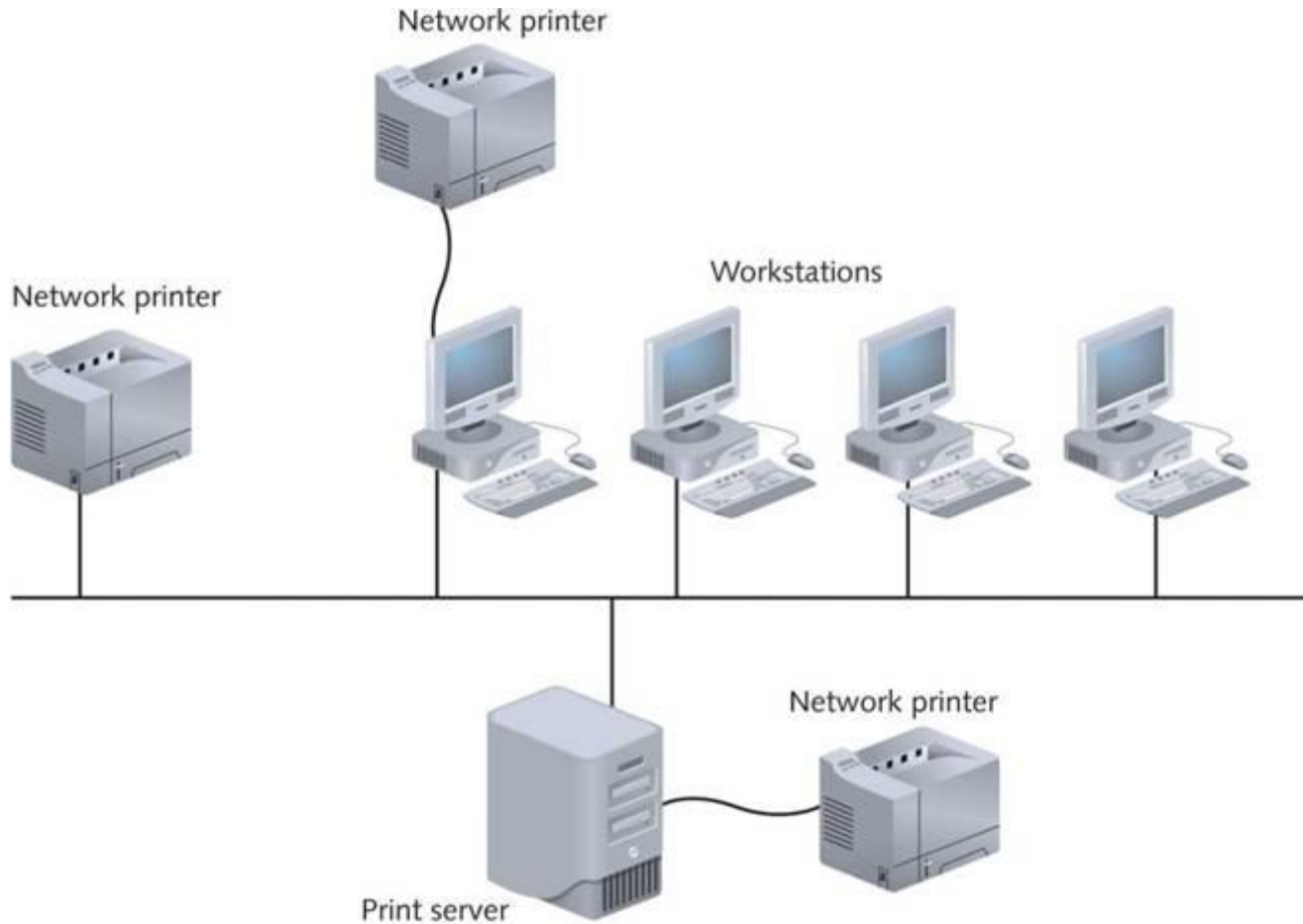


Figure 8-6: Shared printers on a network  
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# Sharing Printers (continued)

- All NOSs can:
  - Create an object that identifies the printer to rest of network
  - Assign the printer a unique name
  - Install drivers associated with the printer
  - Set printer attributes
  - Establish or limit access to the printer
  - Remotely test and monitor printer functionality
  - Update and maintain printer drivers
  - Manage print jobs

# Managing System Resources: Memory

- Physical memory: RAM chips installed on computer's system board
  - Provide memory to that machine
- Virtual memory: Stored on hard disk as a page file
  - Managed by OS
  - Paging: When system exceeds available RAM, blocks of information (pages) moved into virtual memory
  - Expands available memory
  - Slows system performance

# Multitasking

- Ability of a processor to perform many different operations in a brief period of time
  - Programs take turns loading and running
    - Preemptive multitasking or Time sharing

# Multiprocessing

- Process: routine of sequential instructions that runs until it has achieved its goal
- Thread: self-contained, well-defined task within a process
  - Single processor can handle one thread at a time
- Multiprocessing: support and use of multiple processors to handle multiple threads
  - Symmetric multiprocessing: splits operations equally among two or more processors
  - Asymmetric multiprocessing: assigns each subtask to a specific processor

# Introduction to Windows Server 2003

- Graphical user interface (GUI): Pictorial representation of computer functions
  - Enables administrators to manage files, users, groups, security, printers, etc.
- Four Windows Server 2003 editions:
  - Standard Edition
  - Web Edition
  - Enterprise Edition
  - Datacenter Edition

# Introduction to Windows Server 2003 (continued)

- General benefits of Standard Edition:
  - Multiprocessor, multitasking, symmetric multiprocessing
  - Active Directory
  - Microsoft Management Console (MMC)
  - Integrated Web development and delivery services
  - Support for modern protocols and security standards
  - Integration with other NOSs
  - Integrated remote client services
  - Monitoring and improving server performance
  - High-performance, large-scale storage support

# Windows Server 2003 Hardware Requirements

Component	Requirement
Processor	133 MHz or higher Pentium or Pentium-compatible processor; 550 MHz recommended. Windows Server 2003, Standard Edition supports up to four CPUs in one server.
Memory	128 MB of RAM is the absolute minimum, but at least 256 MB is recommended. A computer running Windows Server 2003 may hold a maximum of 4 GB of memory.
Hard disk drive	A hard drive supported by Windows Server 2003 (as specified in the HCL) with a minimum of 1.5 GB of free space available for system files.
NIC	Although a NIC is not required by Windows Server 2003, it is required to connect to a network. Use a NIC found on the HCL. The NOS can support the use of more than one NIC.
CD-ROM	A CD-ROM drive found on the HCL is required unless the installation will take place over the network.
Pointing device	A mouse or other pointing device found on the HCL.
Floppy disk drive	Not required.

Table 8-2: Minimum hardware requirements for Windows Server 2003, Standard Edition

# A Closer Look at Windows Server 2003: Windows Server 2003 Memory Model

- 32-bit and 64-bit addressing schemes supported
  - Require different versions of Windows Server 2003
  - Require different types of processors
  - The larger the addressing size, the more efficiently instructions can be processed
- Each application (or process) assigned own 32-bit memory area
  - Helps prevent processes from interfering with each other
- Virtual Memory dialog box allows increase or decrease of paging file size

# Windows Server 2003 File Systems: FAT (File Allocation Table)

- Original PC file system
- Disks divided into allocation units (clusters)
  - Represent small portion of disk's space
- Allocation units combine to form partitions
  - Logically separate area of storage
- FAT table: hidden file at beginning of a partition
  - Basis of FAT file system
  - Keeps track of used and unused allocation units
  - Contains information about files within each directory

# Windows Server 2003 File Systems: FAT (continued)

- FAT16 uses 16-bit allocation units
  - Partitions or files cannot exceed 2 GB
  - 16-bit fields store file size information
  - Filenames have maximum of eight characters
  - Read, Write, System, Hidden, and Archive Files
  - Stores data in noncontiguous blocks
    - Uses links between fragments to ensure that data belongs to the same file
    - Unreliable and inefficient
  - Can write data to disk quickly

# Windows Server 2003 File Systems: FAT (continued)

- FAT32 uses disk space more efficiently
  - Uses 28-bit fields to store file size information
  - Supports long filenames
  - Theoretically supports 2 Terabyte (TB) partitions
    - Max 32 GB in Windows Server 2003
  - Can be easily resized without damaging data
  - Greater security than FAT16
- FAT32 preferred over FAT16 for modern OSs

# CDFS (CD-ROM File System) and UDF (Universal Disk Format)

- CDFS: file system used to read from and write to CD-ROM discs
- UDF: used on CD-ROM and DVD (digital versatile disc) media

# NTFS (New Technology File System)

- NTFS features:
  - Filename maximum of 255 characters
  - Stores file size information in 64-bit fields
  - Files or partitions up to 16 exabytes
  - Required for Macintosh connectivity
  - Sophisticated, customizable compression routines
  - Log of file system activity
  - Required for encryption and advanced access security for files, user accounts, and processes
  - Improves fault tolerance through RAID and system file redundancy

# MMC (Microsoft Management Console)

- Integrates all administrative tools for Windows Server 2003
- Snap-ins: tools added to MMC interface
- Must create custom console by running MMC program and adding selections
- Operates in two modes:
  - Author mode: allows full access for adding, deleting, and modifying snap-ins
  - User mode: limited user privileges

# Active Directory: Workgroups

- Active Directory: Windows Server 2003's directory service
- Workgroup: group of interconnected computers that share resources without relying on a server
  - Peer-to-peer
  - Each computer has own database of user accounts and security privileges
  - Significantly more administration effort than a client/server Windows Server 2003 network
  - Best solution for home or small office networks in which security concerns are minimal

# Domains

- Domain: group of users, servers, and other resources sharing centralized database of account and security information
  - Organize and manage resources and security
- Domain controller: computer with directory containing info about domain objects
  - Should use at least two on each network
- Member servers: Windows Server 2003 computers that do not store directory information
- Replication: copying directory data to multiple domain controllers

# Domains (continued)

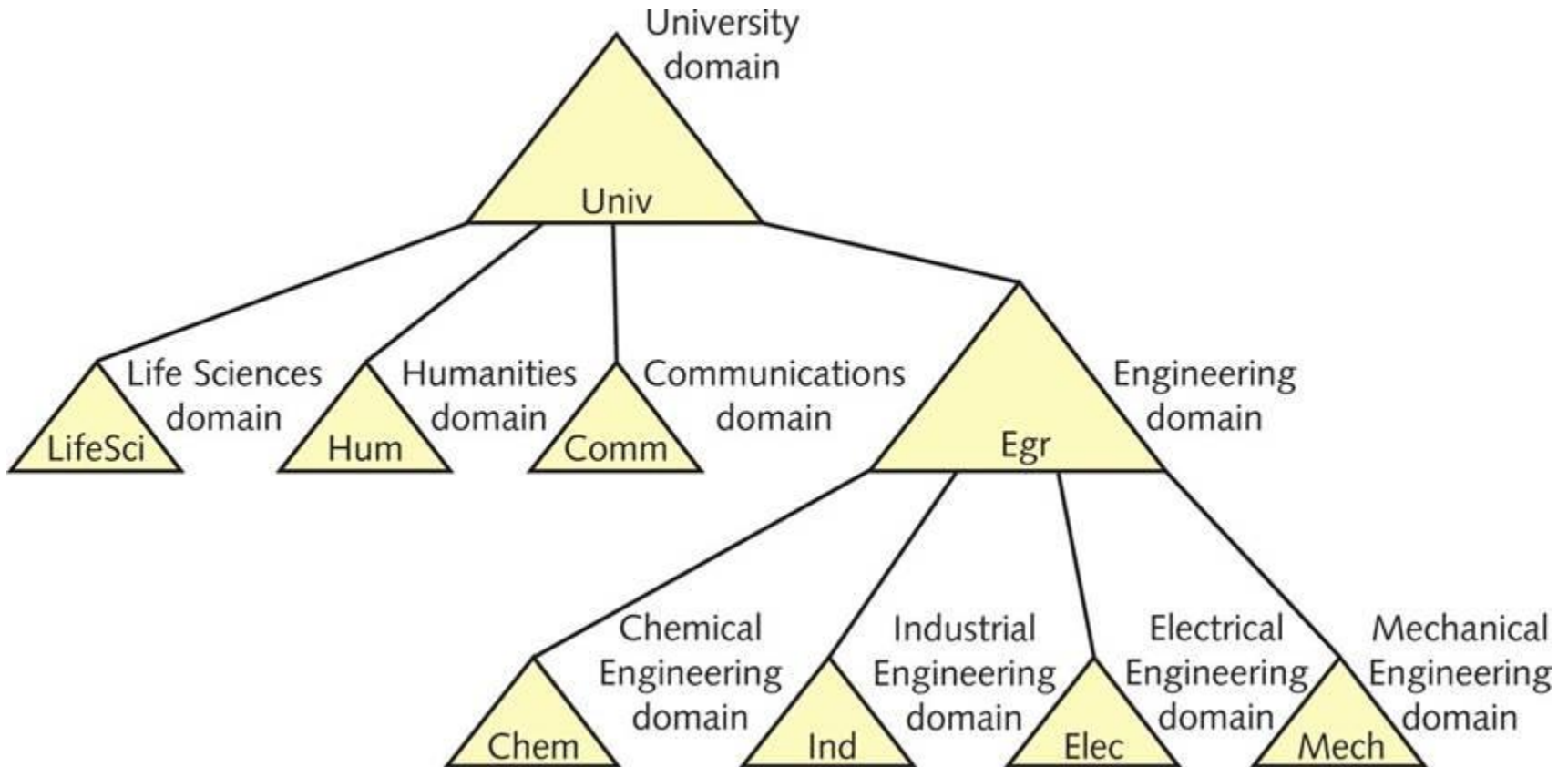


Figure 8-10: Multiple domains in one organization

# Domains (continued)

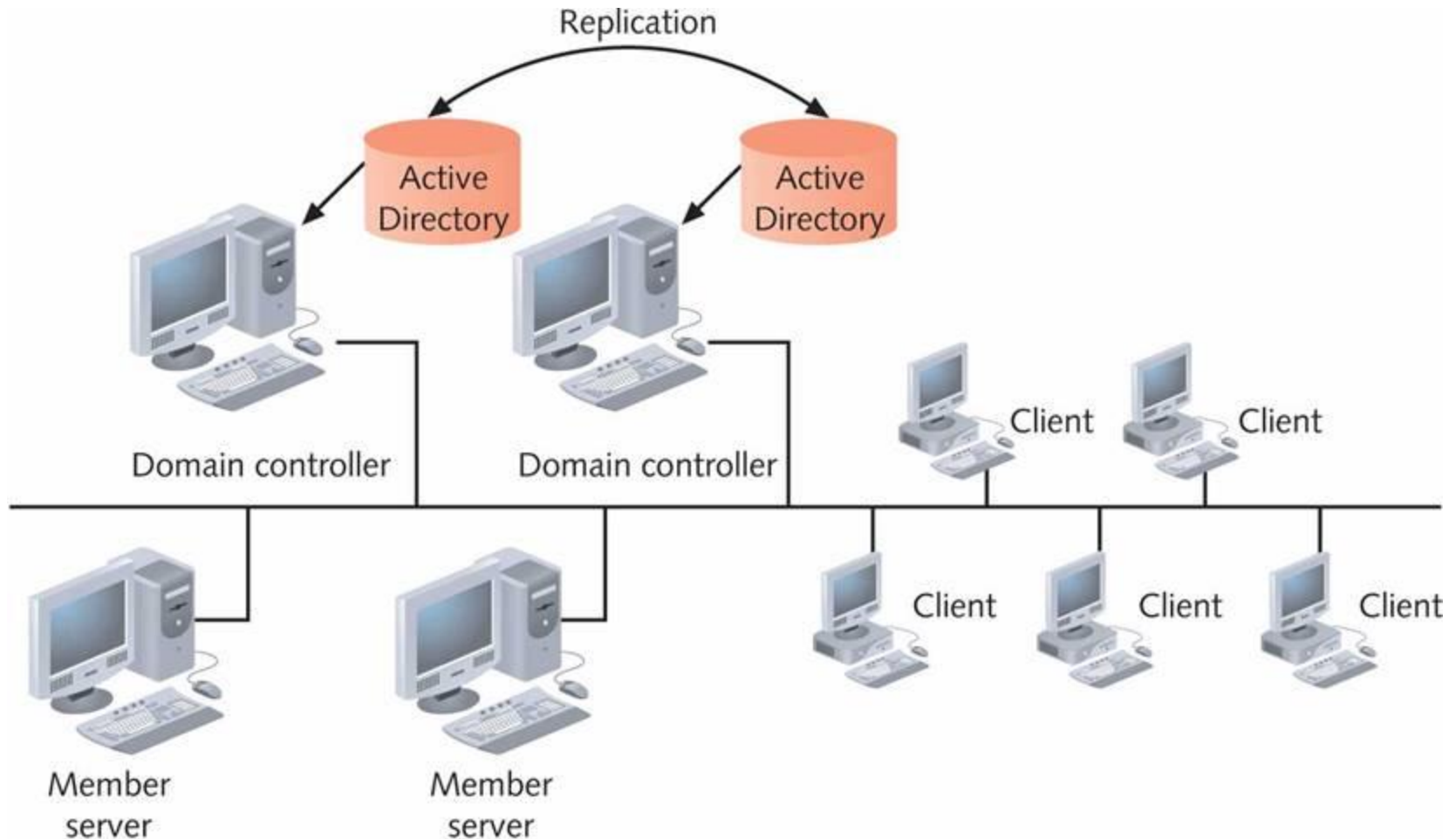


Figure 8-11: Domain model on a Windows Server 2003 network  
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# OUs (Organizational Units)

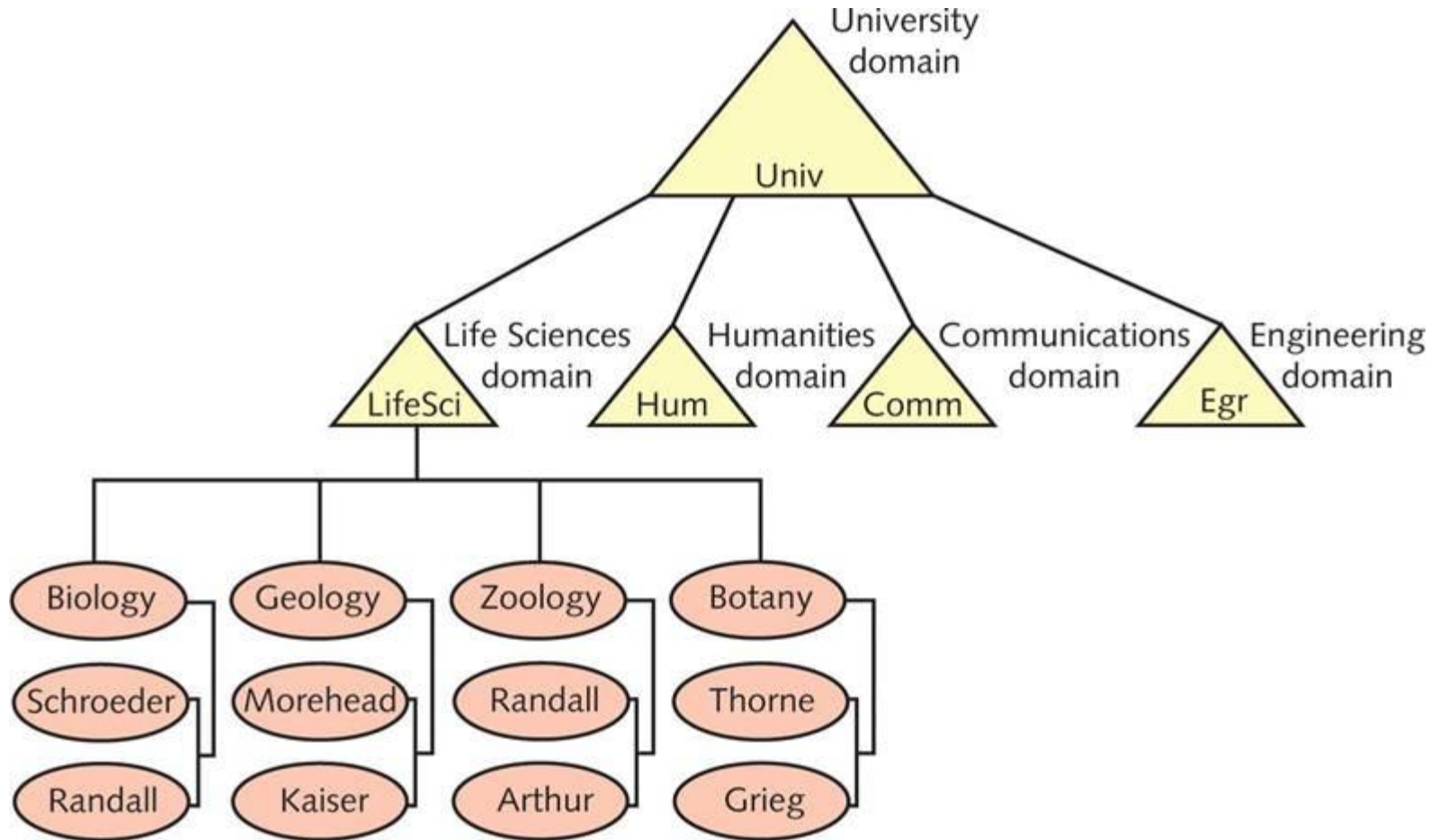


Figure 8-12: A tree with multiple domains and OUs  
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# Trees and Forests

- Active Directory organizes multiple domains hierarchically in a domain tree
  - Root domain: base of Active Directory tree
  - Child domains: branch out to separate groups of objects with same policies
  - Underneath child domains, multiple organizational units branch out to further subdivide network's systems and objects
- Forest: collection of one or more domain trees
  - All trees share common schema
  - Domains can communicate

# Trust Relationships

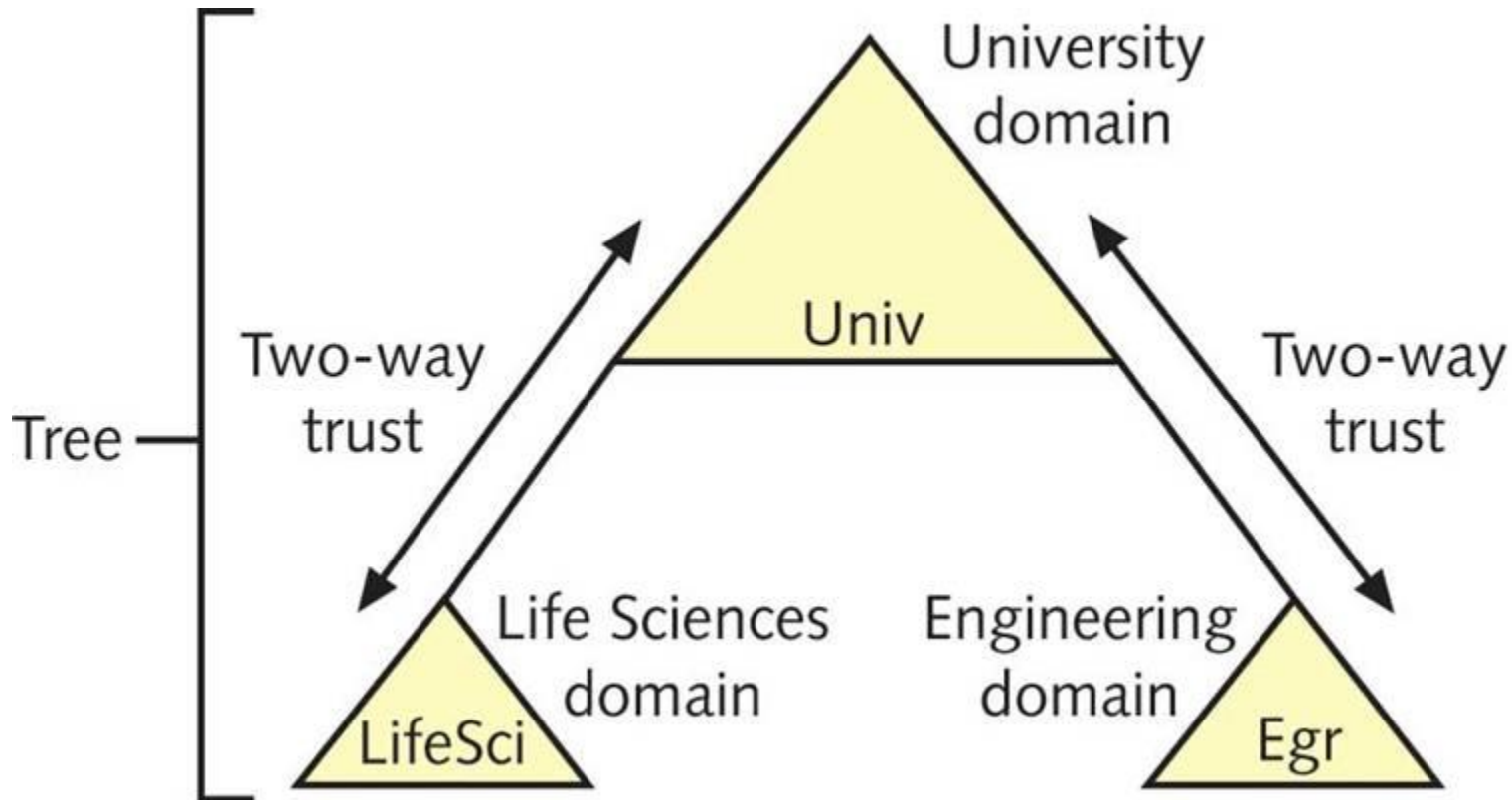


Figure 8-13: Two-way trusts between domains in a tree

# Trust Relationships (continued)

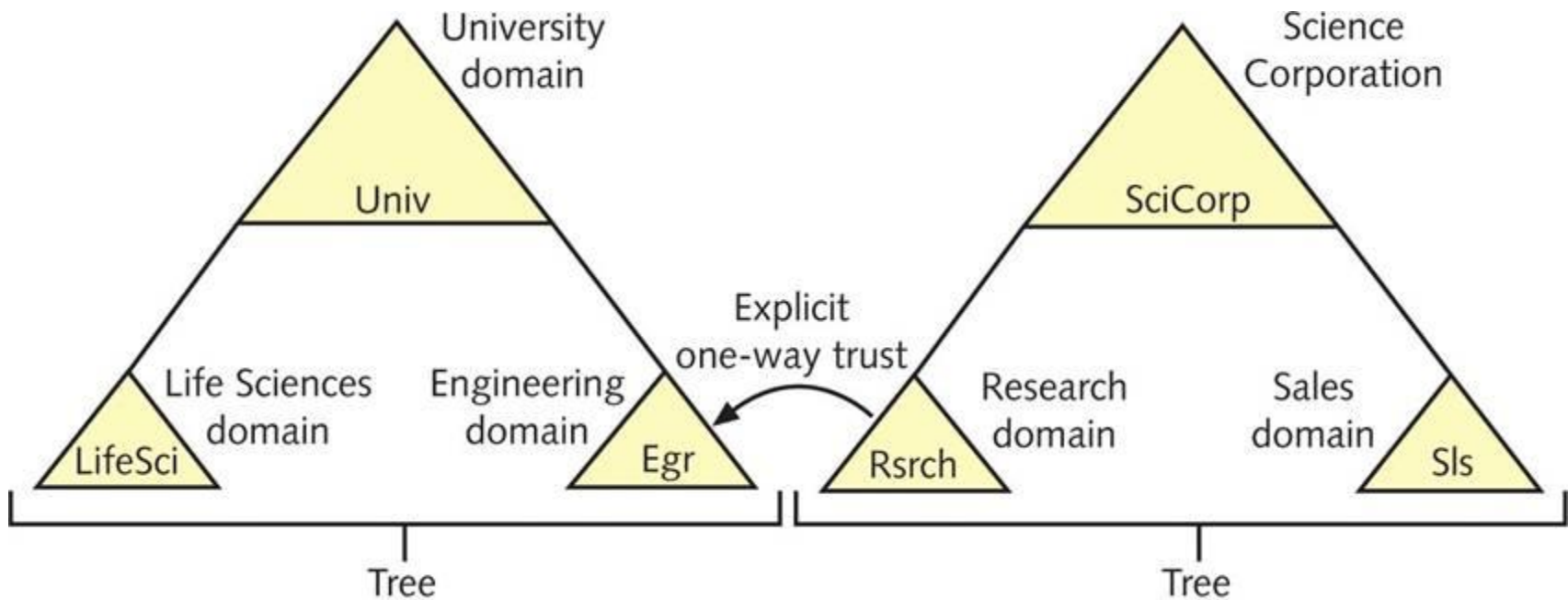


Figure 8-14: Explicit one-way trust between domains in different trees

# Naming Conventions

- Naming (addressing) conventions based on LDAP naming conventions
- Namespace refers to collection of object names and associated places in Windows 2000 Server or Windows Server 2003 network
- Internet and Active Directory namespaces are compatible

# Naming Conventions (continued)

- Each Windows Server 2003 network object can have three names
  - Distinguished name (DN)
    - Domain component (DC) name
    - Organizational unit (OU) name
    - Common name (CN): unique within a container
  - Relative distinguished name (RDN): uniquely identifies an object within a container
  - User principal name (UPN): preferred naming convention for users in e-mail, Internet services
- Globally unique identifier (GUID): 128-bit number ensuring that no two objects have duplicate names

# Naming Conventions (continued)

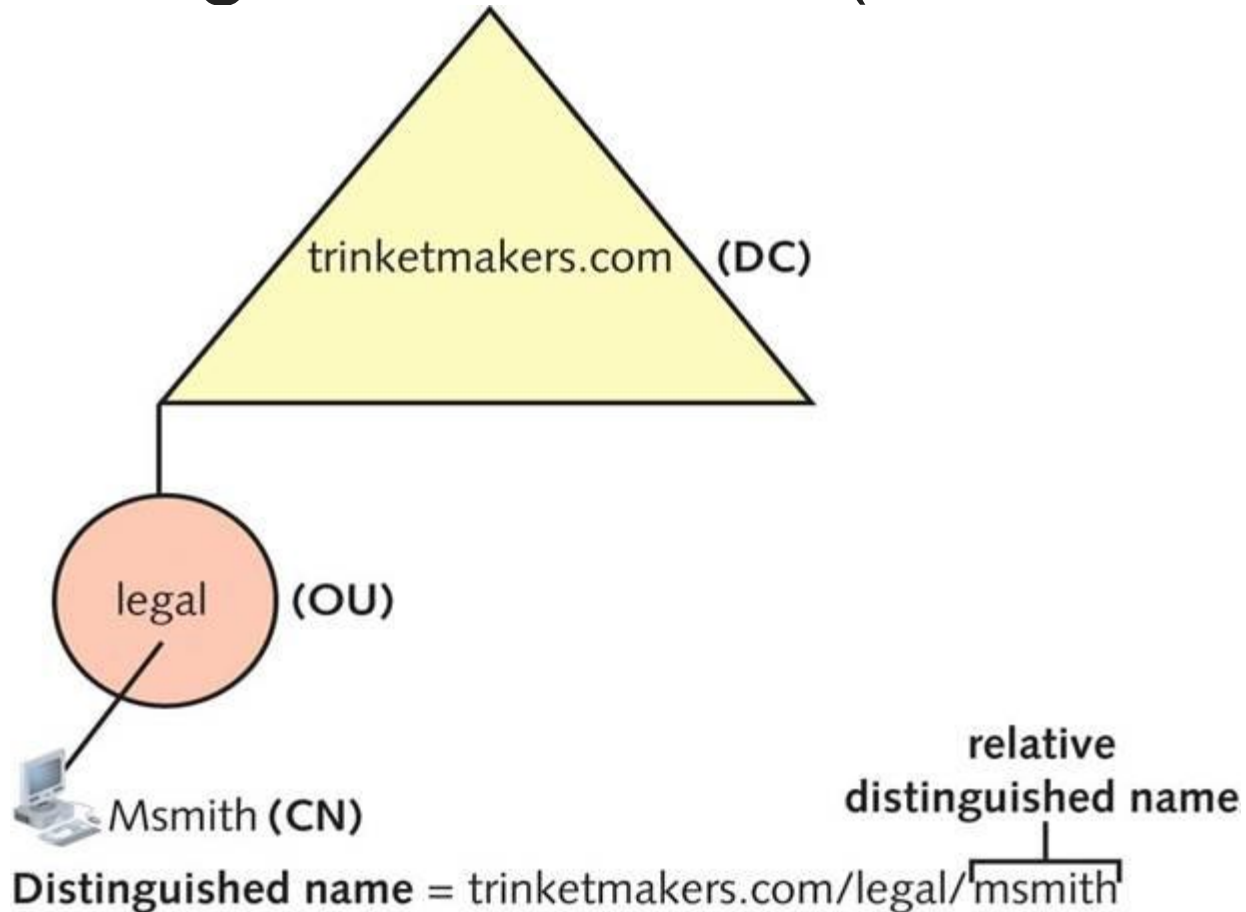


Figure 8-15: Distinguished name and relative distinguished name

# Planning For Installation

- Critical preinstallation decisions:
  - How many, how large, and what kind of partitions will the server require?
  - What type of file system will the server use?
  - What will you name the server?
  - Which protocols and network services should the server use?

# Planning For Installation (continued)

- Critical preinstallation decisions (continued):
  - What will the Administrator password be?
  - Should the network use domains or workgroups and, if so, what will they be called?
  - Will the server support additional services?
  - Which licensing mode will you use?
  - How can I remember all of this information?

# Installing and Configuring a Windows Server 2003 Server: The Installation Process

- Can install from CD-ROM or remotely
- Attended and unattended modes
  - Unattended installations rely on an installation script
    - Must be carefully planned

# Initial Configuration

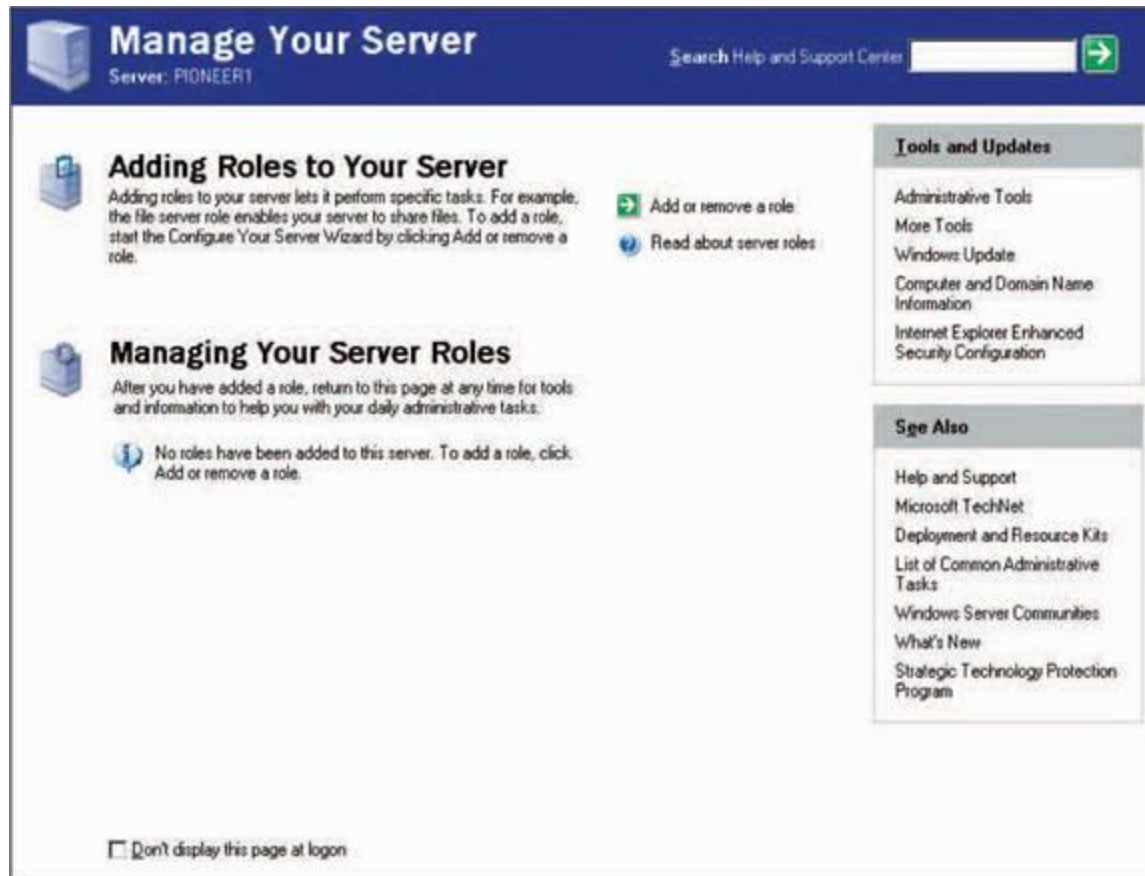
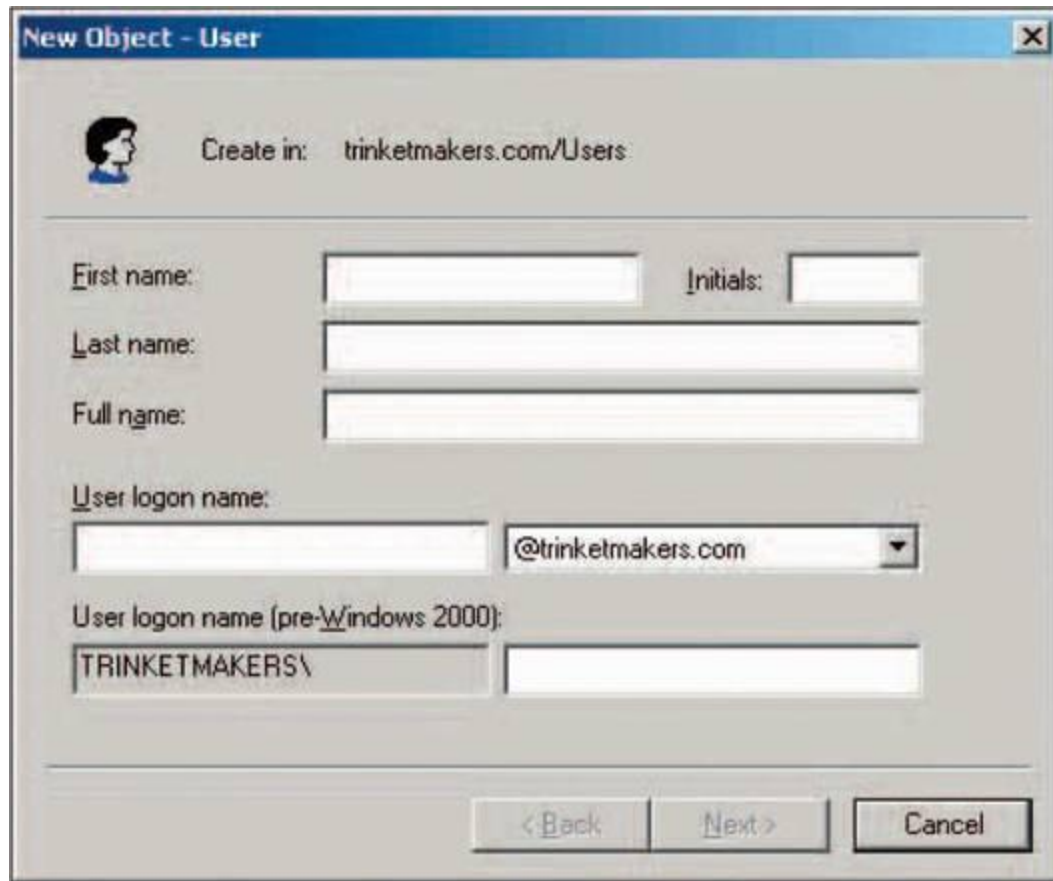


Figure 8-16: Manage Your Server window

# Establishing Users and Groups

- Installation process creates two accounts
  - Guest account: predefined user account with limited privileges
  - Administrator account: predefined user account with extensive privileges for resources on the computer and on the domain that it controls
- Local accounts: only have rights on server they are logged on to
- Domain accounts: have rights throughout the domain

# Establishing Users and Groups (continued)



New Object - User

Create in: trinketmakers.com/Users

First name:  Initials:

Last name:

Full name:

User logon name:  @trinketmakers.com

User logon name (pre-Windows 2000): TRINKETMAKERS\

< Back Next > Cancel

Figure 8-18: New Object—User dialog box

# Establishing Users and Groups (continued)

- Group's scope identifies how broadly across the network its privileges reach
- Domain local group allows access to resources within a single domain
- Global group also allows access to resources within a single domain
  - Usually contains user accounts
  - Can be inserted into domain local groups
- Universal group allows access to resources across multiple domains and forests

# Establishing Users and Groups (continued)

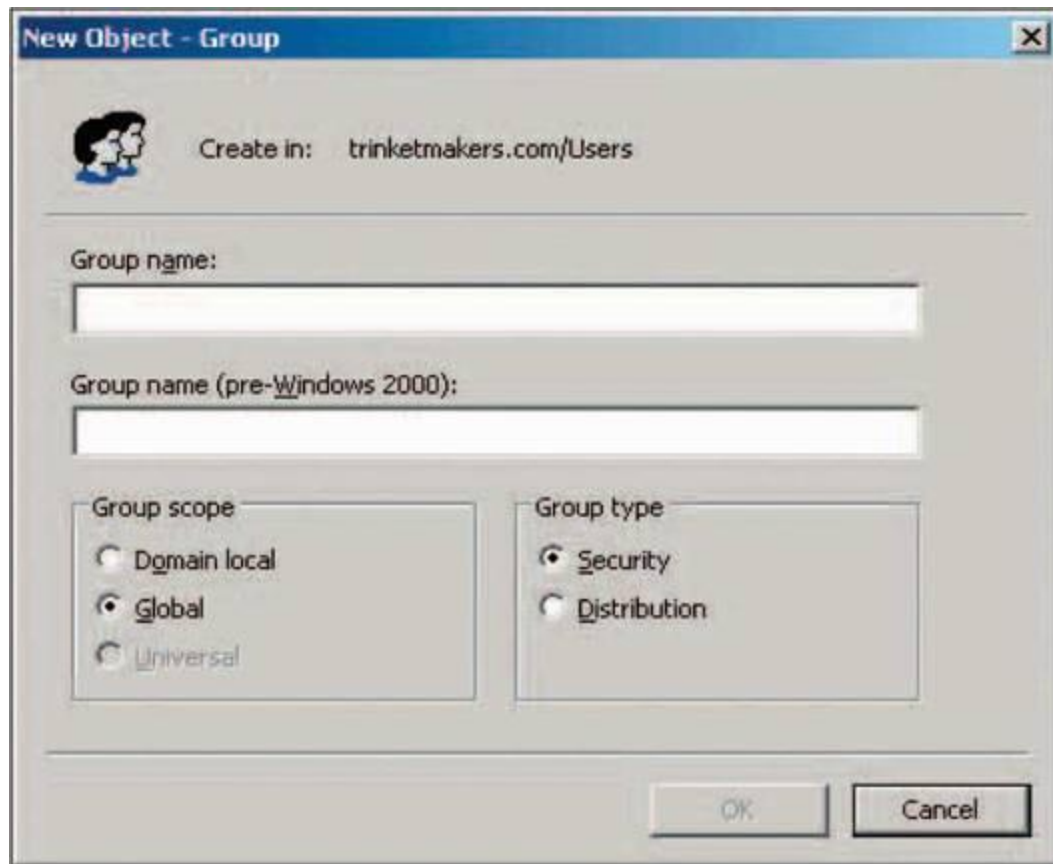


Figure 8-20: New Object—Group dialog box

# Internetworking with Other Network Operating Systems

- Windows Server 2003 can communicate with almost any client and, given proper software and configuration, with other major NOSs
  - Matching protocols only part of the equation
- File and Print Services for NetWare: Windows server appears to NetWare clients as another NetWare file or print server
  - Belongs to Microsoft Windows Services for NetWare package
    - Simplifies integration of Windows Server 2003 servers and NetWare servers

# Internetworking with Other Network Operating Systems (continued)

- Microsoft Directory Synchronization Services (MSDSS) synchronize information between an Active Directory database and a NetWare eDirectory database
- Client Services for NetWare (CSNW) enables client to log on directly to NetWare server
  - Useful if NetWare uses IPX/SPX
- Interconnecting with UNIX, Linux, or Mac OS X Server
  - Assume reliance on TCP/IP
  - Don't assume same directory structure

# Summary

- NOSs are entirely software-based and can run on a number of different hardware platforms and network topologies
- Directories are an NOS's method of organizing and managing objects, such as users, printers, server volumes, and applications
- A file system is an OS's method of organizing, managing, and accessing files through logical structures and software routines

# Summary (continued)

- For clients to share a server application, the network administrator must assign users rights to the directories where the application's files are installed
- For clients to share a network printer, the printer must be created as an object, assigned a name and properties, and then shared among clients
- The type of multitasking supported by NetWare, UNIX, Linux, Mac OS X Server, and Windows Server 2003 is called preemptive multitasking

# Summary (continued)

- Multiprocessing splits tasks among multiple processors to expedite the completion of any single instruction
- The Windows Server 2003 memory model assigns each process its own 32-bit (or, in some versions, 64-bit) memory area
- Domains define a group of systems and resources sharing common security and management policies
- To collect domains into logical groups, Windows Server 2003 uses a domain tree

# Summary (continued)

- Prior to installation, you need to make a number of decisions regarding your server and network pertaining to the domain or workgroup characteristics, file system, disk partitioning, optional services to be installed, administrator password, protocols to be installed, and server name
- Adding users and groups is accomplished through an administrative tool called Active Directory Users and Computers