Chapter 5– Network items specification

Network Items Specification

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- ✓ Host specifications (Hardware Servers)
- ✓ Network operating Systems
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  - ▪ UNIX
  - ▪ Windows
  - ▪ Novell Netware
- ✓ Database management systems
- ✓ Web, ftp, mail, proxy, directory, multimedia, DNS/DHCP servers

Example server specification Up to 15 Users

- Processor   Intel Dual / Quad Core 2GHz or above
- Memory (RAM) 4GB RAM (Window 2003) / 8GB RAM (Windows 2008)
- Server Network Speed 1gbps
- Storage Allowance 10 - 25 GB *(Excluding Attachments)*
- RAID Level RAID 5 recommended
- SQL Server Edition Microsoft SQL Server Express *(Subject to Survey)*
- Other Spare USB port (non-virtual instances only)

Example server specification Up to 25 Users

- Processor : Intel Quad Core XEON 2GHz or above
- Memory (RAM): 4GB RAM (Window 2003) / 8 – 12 GB RAM (Windows 2008)
- Server Network Speed : Dual 1gbps
- Storage Allowance: 10 - 25 GB *(Excluding Attachments)*
- RAID Level : RAID 5 or better Highly Recommended
- SQL Server Edition: Microsoft SQL Server Standard Edition
- Other Spare USB port (non-virtual instances only)

Network Operating System

- provides an environment in which users, who are aware of multiplicity of machines, can access remote resources either:

    -> logging in to the remote machine* or

    -> transferring data from the remote machine to their own machines
- mostly used with local area networks and wide area networks

Features

- Provides basic operating system features; support for processors, protocols, automatic hardware detection, support multi-processing of applications

- Security features; authentication, authorization, access control

- Provides names and directory services

- Provides files, print, web services, back-up and replication services

- Supports Internetworking such as routing and WAN ports

- User management and support for login and logoff, remote access, system management

- Clustering capabilities, fault tolerant and high availability systems

Overview of NOS Characteristics
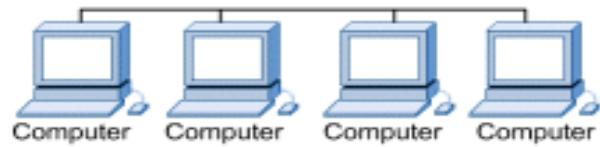

- Network operating systems (NOSs) distribute their functions over a number of networked computers.
- It then adds functions that allow access to shared resources by a number of users concurrently.
- NOS computers take on specialized roles to accomplish concurrent access to shared resources.
- Client systems contain specialized software that allows them to request shared resources that are controlled by server systems responding to a client request.
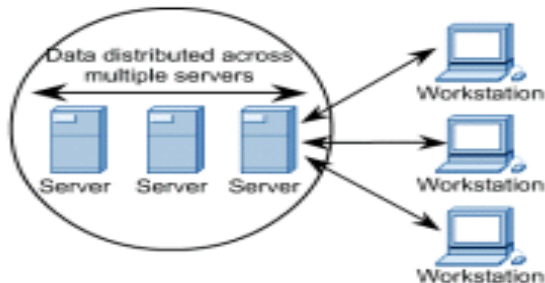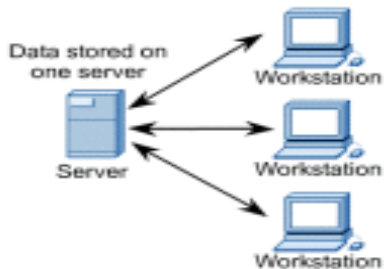
Multiuser, Multitasking, and Multiprocessor Systems
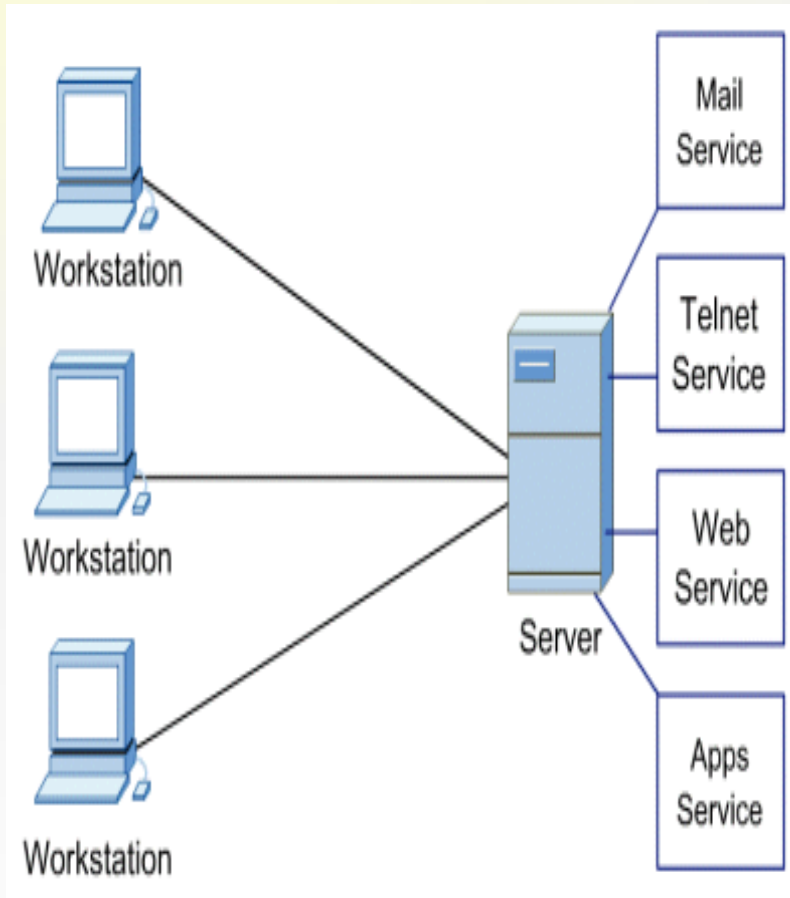
- A NOS server is a multitasking system. Internally, the OS must be capable of executing multiple tasks or processes at the same time.
- Some systems are equipped with more than one processor, called multiprocessing systems.
- They are capable of executing multiple tasks in parallel by assigning each task to a different processor.
- The aggregate amount of work that the server can perform in a given time is greatly enhanced in multiprocessor systems.

NOS Server Hardware
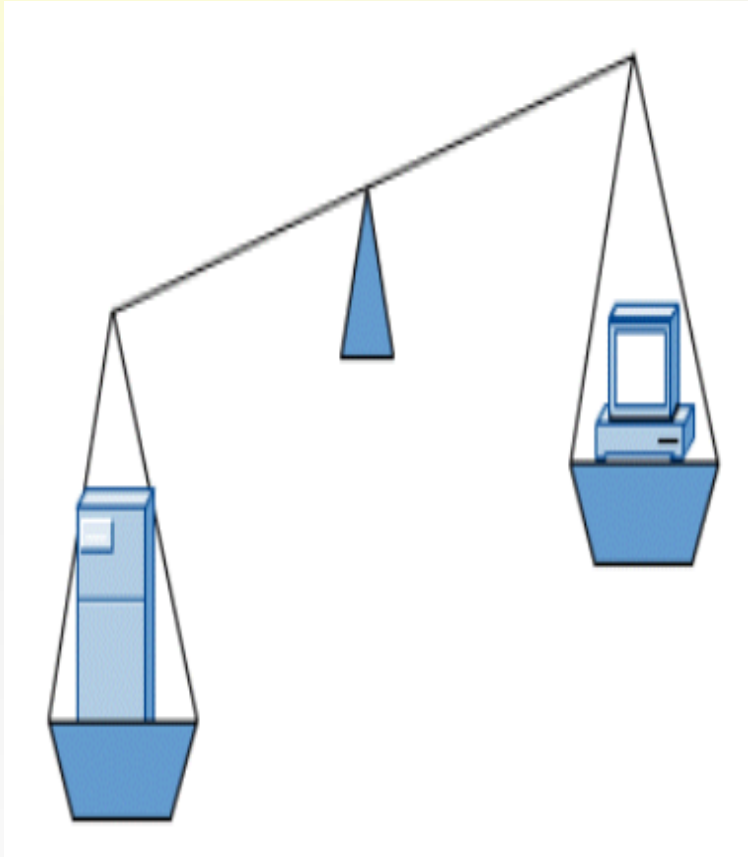
- NOS servers are large systems with additional memory to support multiple tasks that are all active, or resident, in memory at the same time.

- Additional disk space is also required on servers to hold shared files and to function as an extension to the internal memory on the system.

- Because a NOS depends on the continuous operation of its servers, the extra hardware components justify the additional expense.

Choosing a NOS

Security	
Robustness	
Performance	
Scalability	
Management	

consistency under strain	user authentication	balanced workloads	ready for growth

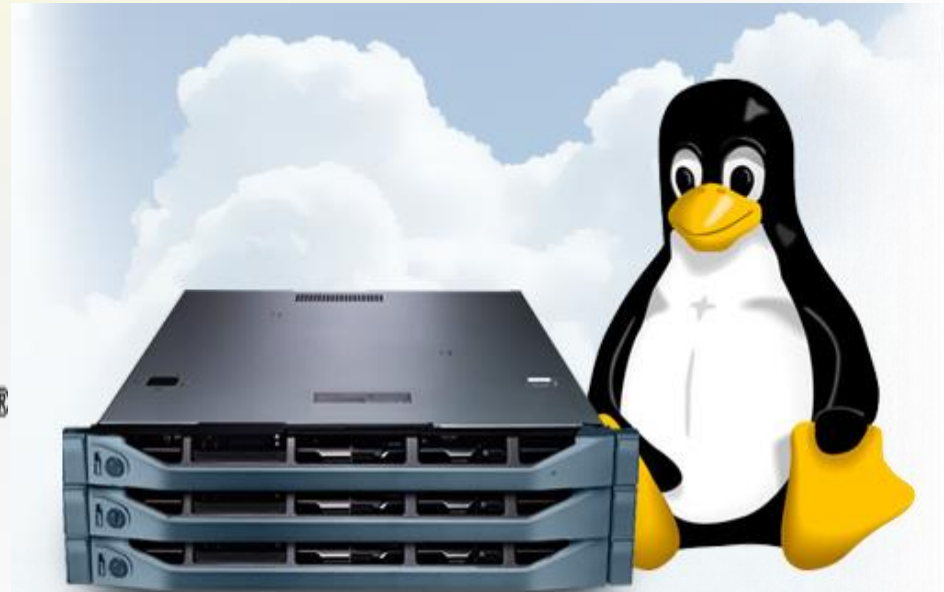| redundancy	system administration	encryption
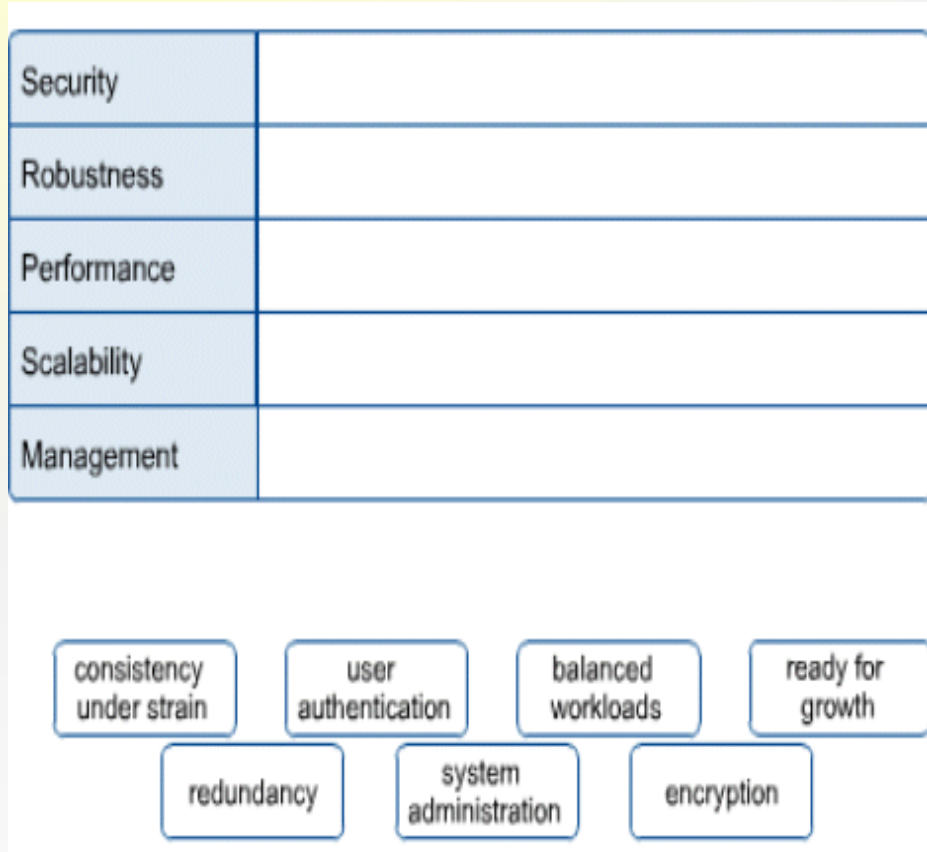
- The main features to consider when selecting a NOS include:
  - Performance
  - Management and monitoring tools
  - Security
  - Scalability
  - Robustness/fault tolerance

Windows Server and Linux Server

What is Window Server?

Windows Server

- Windows Server is designed by Microsoft that supports enterprise-level management, data storage, applications, and communications.

- Previous versions of Windows Server have focused on stability, security, networking, and various improvements to the file system.

- Other improvements also have included improvements to deployment technologies, as well as increased hardware support.

- Windows Server 2012 R2 is the latest release of Windows Server, and focuses on cloud computing.

Versions of Windows Server

- Windows Server 2012 R2
- Windows Server 2012
- Windows Server 2008 R2
- Windows Server 2008
- Windows Server 2003 R2
- Windows Server 2003
- Windows Server 2000
- Windows NT 4.0
- Windows NT 3.51
- Windows NT 3.5
- Windows NT 3.1

What is Linux Server

Linux Server

- A Linux server is a high-powered variant of the Linux open source operating system that's designed to handle the more demanding needs of business applications such as network and system administration, database management and Web services.

- Linux servers are frequently selected over other server operating systems for their stability, security and flexibility advantages.

Linux Operating System

- Linux is sometimes referred to as "UNIX Lite", and it is designed to run on Intel-compatible PCs.
- However, Linux will run on other machines as well.
- Linux brings the advantages of UNIX to home and small business computers.
- The following are a few of the most popular types:
    - Red Hat Linux
    - Linux Mandrake
    - Caldera eDesktop and eServer
    - Debian GNU/Linux
    - Corel Linux
    - Turbo Linux

Novell NetWare

- Is a NOS
- Used cooperative multitasking to run several services on a PC
- File sharing instead of disk sharing
- NDS (Novell Directory Services)
- Server administration
- Desktop Management
- Software distribution
- Integrated cache
- Enhanced security

Activity: Difference between Operating System and Network Operating System?

Network Services

Network services are the foundation of a networked computing environment. Generally network services are installed on one or more servers to provide shared resources to client computers.

- DNS
- DHCP
- FTP
- SMTP
- Proxy
- WWW
- Active Directory Services

DNS – Domain Name System

- DNS allows users (software) to **use domain names** instead of **IP addresses.**

Resolver

- DNS client programs used to look up DNS name information.

Name Resolution

- The two types of queries that a DNS resolver (either a DNS client or another DNS server) can make to a DNS server are the following:

Recursive queries

- Queries performed by Host to Local DNS Server

Iterative queries

- Queries performed by Local DNS server to other servers.

DNS Name Resolution

- User types **http://www.example.com**

Step 1.

- The DNS resolver on the DNS client sends a recursive query to its configured **Local DNS server**.
- The DNS server for that client is responsible for resolving the name
  - **Cannot refer the DNS client to another DNS server.**

Step 2.

- Local DNS Server **forwards** the query to a **Root DNS server**.

Step 3.

- Root DNS server
  - Makes note of **.com** suffix
  - Returns a list of IP addresses for **TLD** (Top Level Domain Servers) responsible for **.com**.

DNS Name Resolution

Step 4.

- The **local DNS server** sends query for www.example.com to one of the **TLD servers**.

Step 5.

- TLD Server
  - Makes note of **example.com**
  - Returns **IP address** for **authoritative server** example.com (such as dns.example.com server)

Step 6.

- **Local DNS server** sends query for www.example.com directly to DNS server for example.com

Step 7.

- example.com DNS server responds with its IP address for www.example.com

Step 8.

- **Local DNS server** sends the IP address of www.example.com to the **DNS client**.

DNS Name Resolution

- **Root DNS Servers**
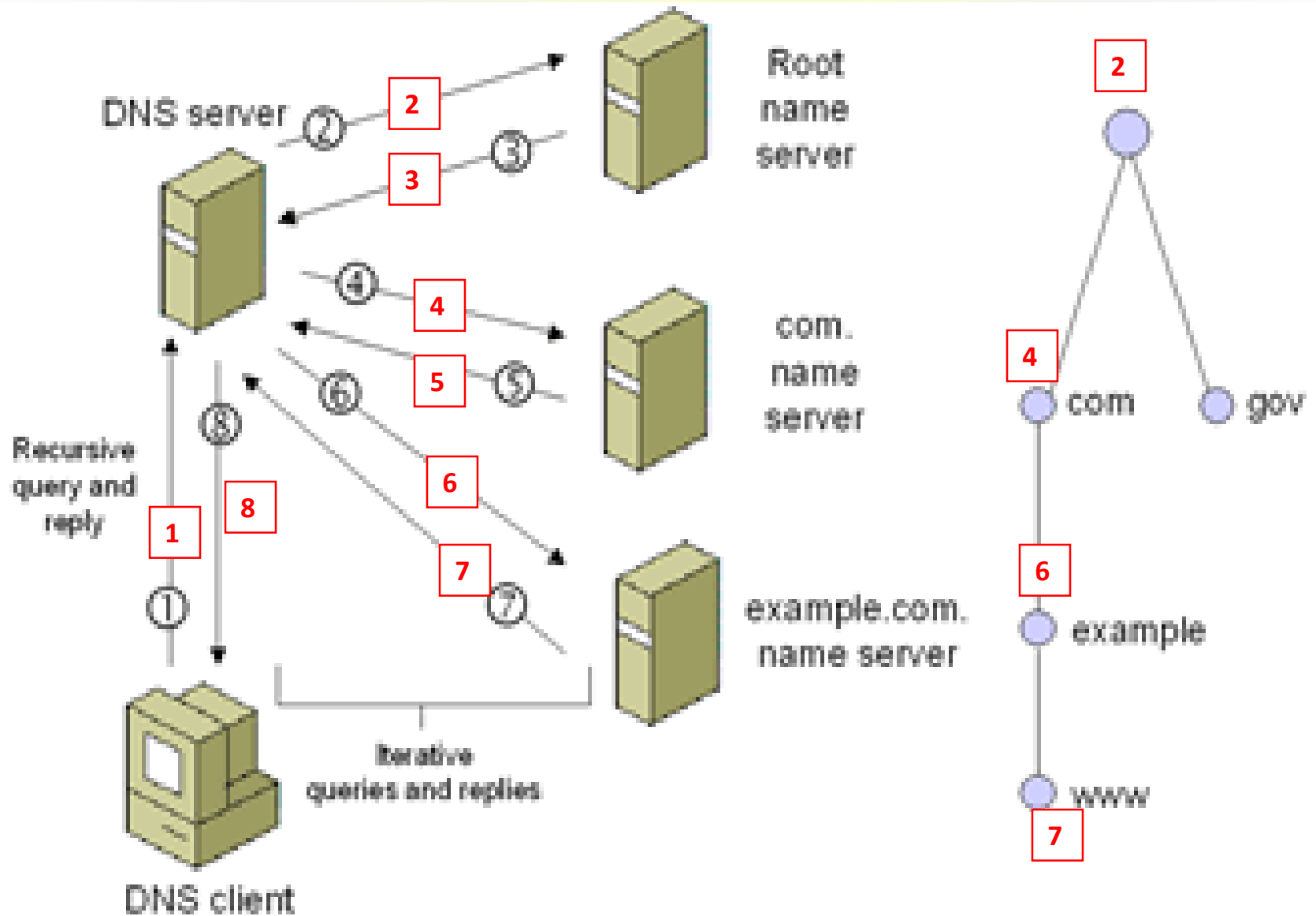 - There are **13 Root DNS servers** (labeled A through M)
- **TLD Servers**
  - Responsible for domains such as .com, edu, org, .net, .uk, jp, fr
  - Network Solutions maintains TLD servers for .com
  - Educause maintains TLD servers for .edu
  - There are redundant servers throughout the world.

DNS Name Resolution

DNS Caching

- When a DNS server receives a DNS reply (mapping hostname to an IP address) it can **cache the information in its local memory.**

- DNS servers discard cached information after a period of time (usually 2 days)

DNS server

Root name server

com. name server

example.com. name server

DNS client

Recursive query and reply

Iterative queries and replies

com   gov

example

www

DHCP – Dynamic Host Configuration Protocol

- IP addresses and other information can be obtained:
    - Statically
    - Dynamically (DHCP)
- DHCP Information can include:
    - IP address
    - Subnet mask
    - Default gateway
    - Domain name
    - DNS Server
- DHCP servers can be:
    - Server on LAN
    - Router
    - Server at ISP

FTP (File Transfer Protocol)

- FTP was developed to allow for **file transfers** between a client and a server.
- Used to **push** and **pull** files from a **server running the FTP daemon** (FTPd).
- **Client initiates** a TCP control connection with FTP server using **port 21**.
  - This **connection remains open until** the user **quits** the FTP application.
  - **TCP port 21** connection includes:
    - **Username** and **password** is sent over TCP port 21.
    - **Remote directory changes**
      - This state information significantly reduces total number of sessions on server.
- For **each file transferred**, TCP **opens and closes** a **TCP data connection on port 20**.

SMTP – Simple Mail Transfer Protocol

- **Internet mail involves:**
  - **User agents**
    - Allows users to read, reply, compose, forward, save, etc., mail messages
    - GUI user agents: Outlook, Eudora, Messenger
    - Text user agents: mail, pine, elm
  - **Mail servers**
    - Stores user mail boxes, communicates with local user agents and other mail servers.
  - **SMTP**
    - Principle application layer protocol for Internet mail
    - Sent over TCP
  - **Mail access protocols**: POP3, IMAP, HTTP
- **SMTP**
  - Transfers messages **from sender's mail server to recipient's mail server**
  - **Push protocol**, not a pull protocol
    - Push (from client to server or server to server)
    - Pull (from server to client)
- **Retrieving email**
  - Historically, users would log into local mail server to read mail.
  - Since early 1990's, clients use mail access protocols:
    - POP3, IMAP, HTTP

Proxy Servers

- Part of an overall Firewall strategy
- Sits between the local network and the external network
  - Originally used primarily as a caching strategy to minimize outgoing URL requests and increase perceived browser performance
  - Primary mission is now to insure anonymity of internal users
    - Still used for caching of frequently requested files
    - Also used for content filtering
- Acts as a go-between, submitting your requests to the external network
  - Requests are translated from your IP address to the Proxy's IP address
  - E-mail addresses of internal users are removed from request headers
  - Cause an actual break in the flow of communications

Con't

A proxy server has a large variety of potential purposes, including:

- To keep machines behind it anonymous (mainly for security).
- To speed up access to resources (using caching). Web proxies are commonly used to cache web pages from a web server.
- To apply access policy to network services or content, e.g. to block undesired sites.
- To log / audit usage, i.e. to provide company employee Internet usage reporting.
- To bypass security/ parental controls.
- To scan transmitted content for malware before delivery.
- To scan outbound content, e.g., for data leak protection.
- To circumvent regional restrictions.

WWW (World Wide Web)

- The **World Wide Web**, abbreviated as **WWW** and commonly known as **the Web**, is a system of interlinked hypertext documents accessed via the Internet.

- With a web browser, one can view web pages that may contain text, images, videos, and other multimedia and navigate between them by using hyperlinks.

Web Hosting

- A **web hosting service** is a type of Internet hosting service that allows individuals and organizations to make their own website accessible via the World Wide Web.

- Web hosts are companies that provide space on a server they own or lease for use by their clients as well as providing Internet connectivity, typically in a data center.

- Web hosts can also provide data center space and connectivity to the Internet for servers they do not own to be located in their data center, called colocation.

Active Directory

- An active directory is a directory structure used on Microsoft Windows based computers and servers to store information and data about networks and domains

- An active directory (sometimes referred to as an AD) does a variety of functions including the ability to provide information on objects, helps organize these objects for easy retrieval and access, allows access by end users and administrators and allows the administrator to set security up for the directory.

- Administrators use an active directory to apply policies to objects (computers and users)

Structure

- **Objects**

  Everything that Active Directory tracks is considered an object.

- An object is any user, system, computer, resource, or service tracked within Active Directory.

- **Sites** A **Site** object in Active Directory represents a geographic location in that hosts networks.

- **Forests, trees, and domains**

  A forest is a collection of Trees; Trees are a collection of one or more Domains.

Domain vs Workgroup

Domain

- It is a group of computers and devices on a network that are administered as a unit with common rules and procedures.
- Within the Internet, domains are defined by the *IP address*. All devices sharing a common part of the IP address are said to be in the same domain.

Workgroup

- In computer networking, a **workgroup** is a collection of computers on a local area network (LAN) that share common resources and responsibilities.

- Workgroups provide easy sharing of files, printers and other network resources.

- The Microsoft Windows family of operating systems supports assigning of computers to named workgroups.

Quiz 1

1. Define the following terms based on the network service.

   a. DNS   b. DHCP   c. FTP d. SMTP

1. What is proxy server?
2. What is the main d/c b/ n Nos and OS?
3. Workgroup vs domain?