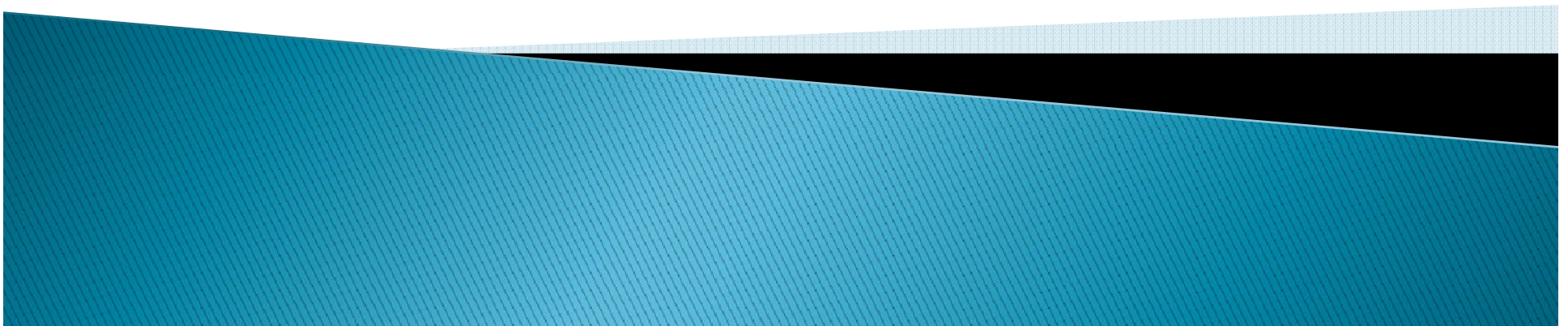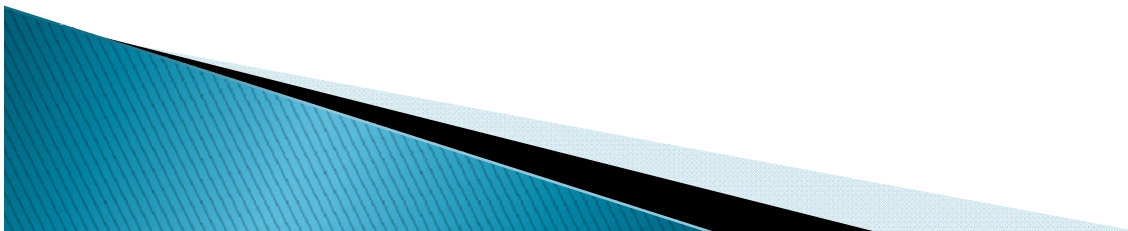# Network Operating Systems

By Nidhi Jindal
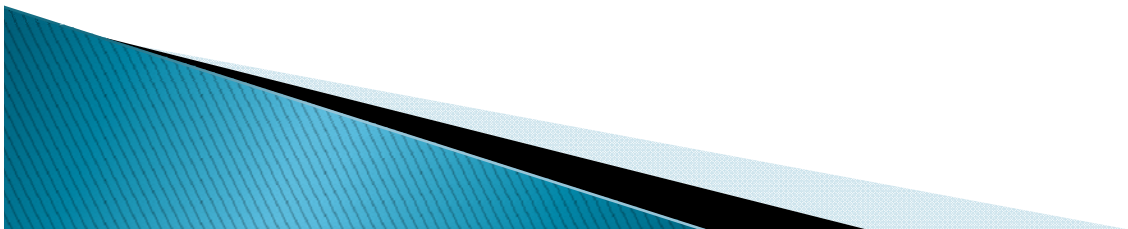
Introduction

- Network operating systems typically are used to run computers that act as servers. They provide the capabilities required for network operation.
- Network operating systems are also designed for client computers and provide functions so the distinction between network operating systems and stand alone operating systems is not always obvious.
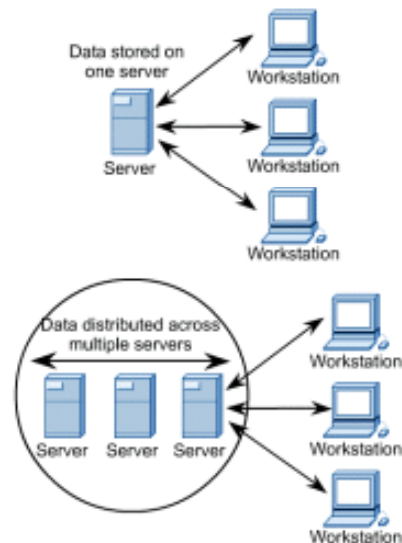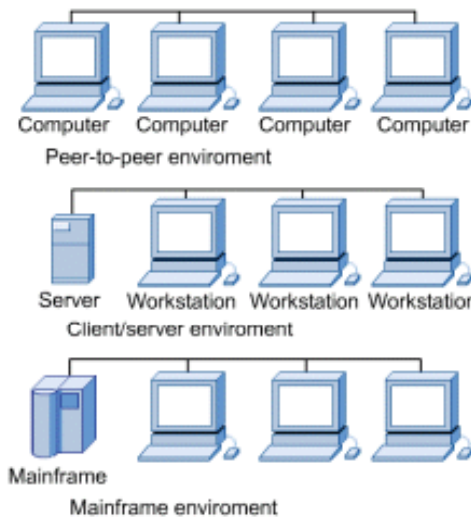
Functions of NOS

- Account Administration for users
- Security
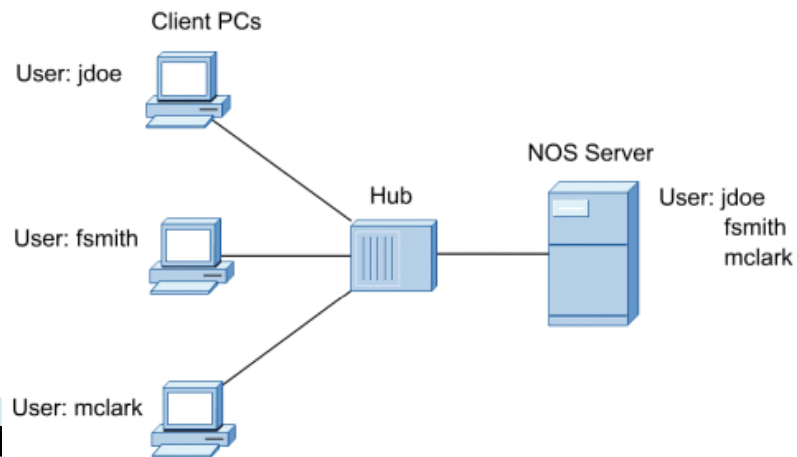- File and print sharing
- Network services
- Backing up data

Overview of NOS Characteristics

Computer Computer Computer Computer
Peer-to-peer enviroment

Server Workstation Workstation Workstation
Client/server enviroment

Mainframe
Mainframe enviroment

Data stored on one server
Server
Workstation
Workstation
Workstation

Data distributed across multiple servers
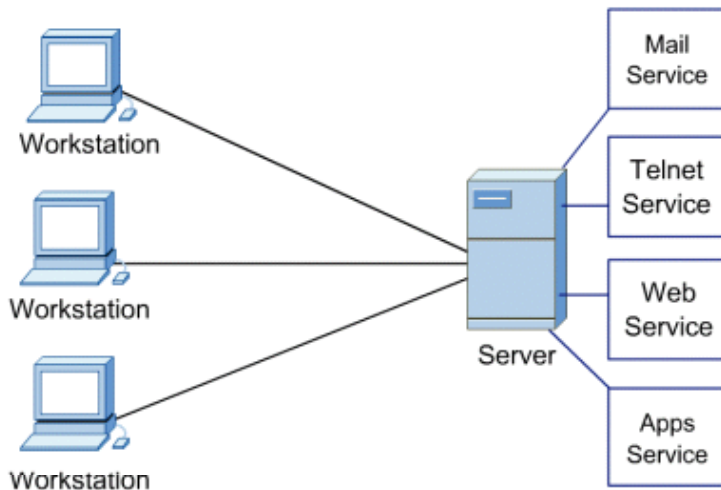Server Server Server
Workstation
Workstation
Workstation

- 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.

Differences Between PC and a NOS

- The NOS enhances the reach of the client PC by making remote services available as extensions of the local native operating system.
- Although a number of users may have accounts on a PC, only a single account is active on the system at any given time.
- NOS supports multiple user accounts at the same time and enables concurrent access to shared resources by multiple clients.

Client PCs

User: jdoe

NOS Server

Hub

User: jdoe
fsmith
mclark

User: fsmith

User: mclark

Multiuser, Multitasking, and Multiprocessor Systems

Mail Service

Telnet Service

Web Service
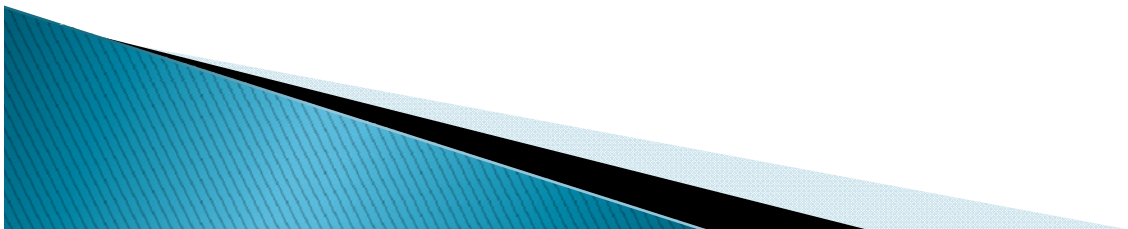
Apps Service

Server

Workstation

Workstation

Workstation

- 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.
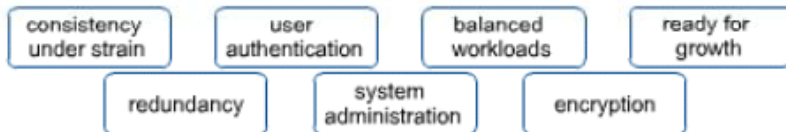
NOS Server Hardware
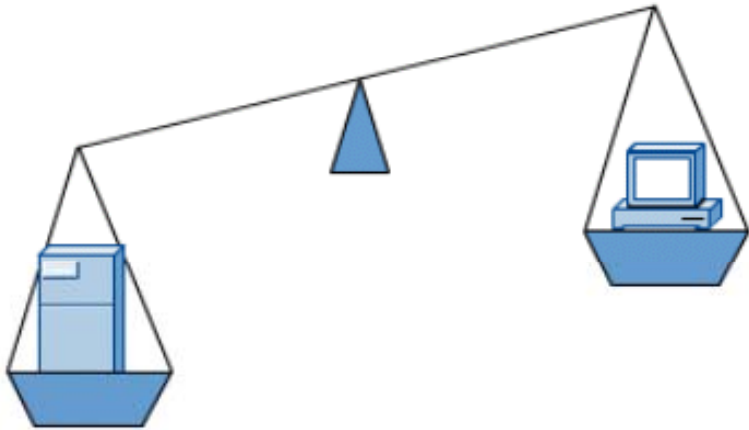
- NOS servers are large systems with additional memory to support multiple tasks that are all active, or resident, in memory at the same time.
- Additional disk space is also required on servers to hold shared files and to function as an extension to the internal memory on the system.
- Because a NOS 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
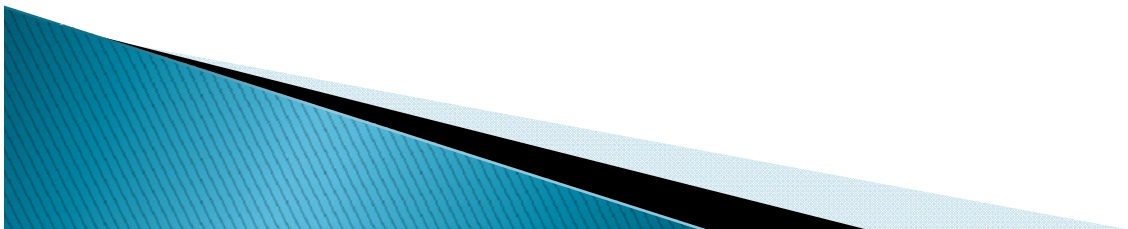
Types of NOS
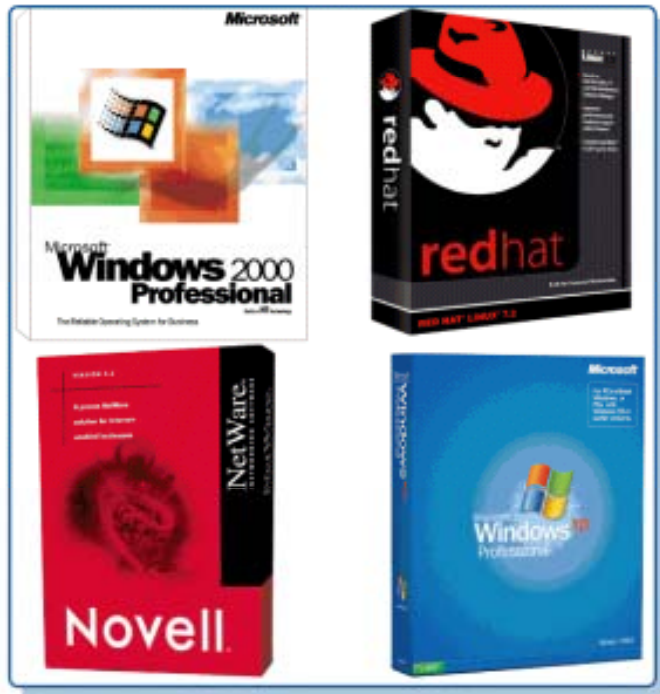

- It is important to know the basics about popular NOS families.
- Many networks now include more than one server type, and knowing how to get these diverse systems to interoperate is an important skill for a network administrator.
- Operating systems on the network have their own language.
- Different NOS vendors use the same terms in different ways.
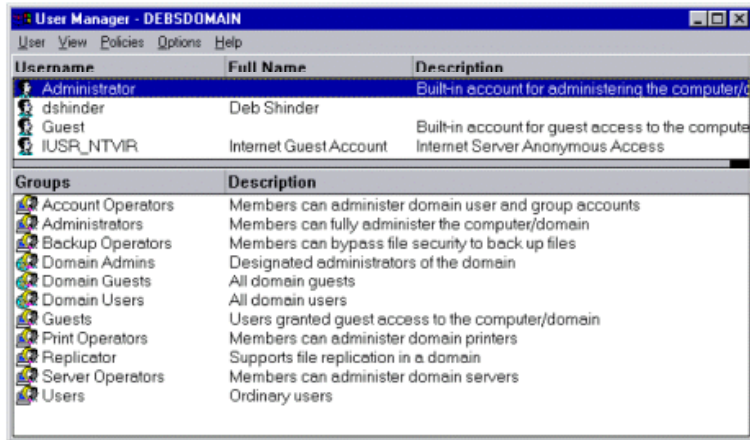
Windows

Windows Terminology
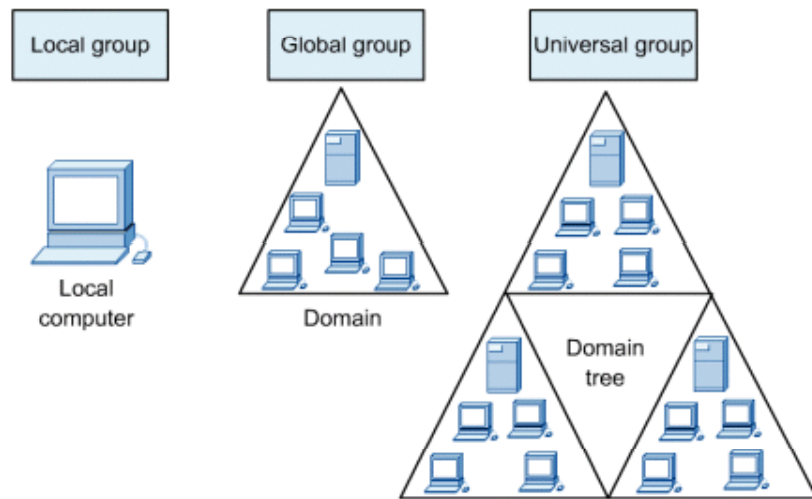
- Windows server-based networks that run Windows NT Server or Windows 2000 Server are based on the concept of the domain.
- A domain is a group of computers and users that serves as a boundary of administrative authority.
- Windows NT domains and Windows 2000 domains, although similar in function, interact with one another differently.

Windows NT 4.0

- ▸ The Domain Structure of Windows NT was entirely different from the Domain Structure in Windows 2000.
- ▸ Instead of Active Directory, Windows NT provides an administrative tool called the User Manager for Domains.
- ▸ It is accessed from the domain controller and is used to create, manage, and remove domain user accounts.

Windows NT 4.0

- Each NT domain requires one Primary Domain Controller (PDC).
- This is a "master" server that contains the Security Accounts Management Database (SAM).
- A domain can also have one or more Backup Domain Controllers (BDCs), each of which contains a read-only copy of the SAM.
- The SAM is what controls the authentication process when a user logs onto the domain.
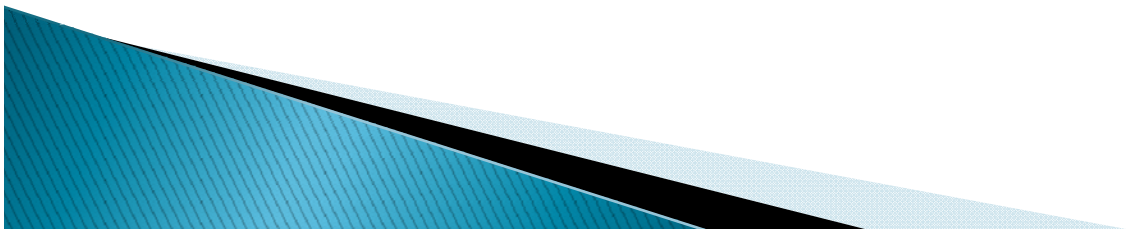
Windows 2000 and XP Operating System
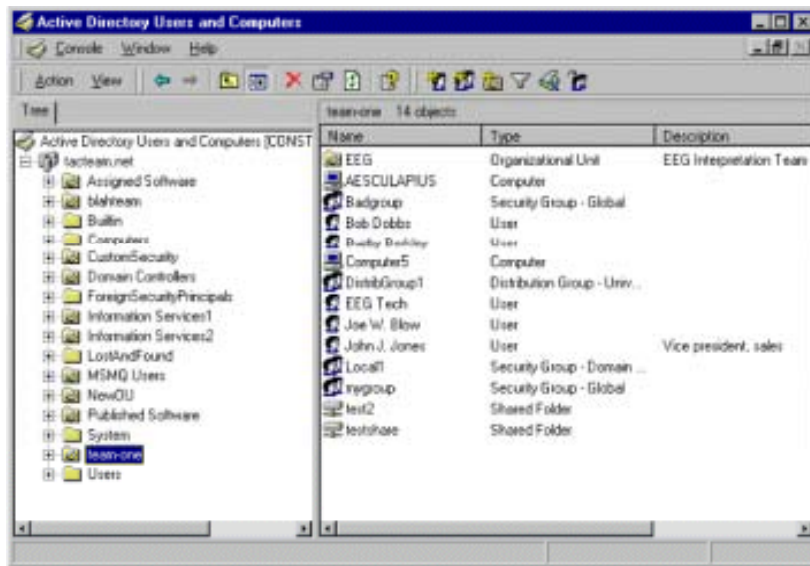
- The offline folders feature enables users to copy and synchronize documents from the network to the local system so that they can be accessed when the computer is not connected to the network.
- The Internet Printing Protocol (IPP) enables users to print to a URL and manage printers through a web browser interface.
- Built-in disk defragmenters and other tools and utilities help users maintain and manage the operating system.
- It supports Kerberos security (developing standard for authenticating network users), and the features of a Windows 2000 domain as an Active Directory client.
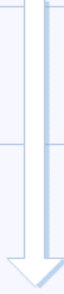
Windows 2000 and XP Operating System

XP also offers:

- More extensive hardware and driver support.
- More user-friendly file-sharing and network configuration for setting up home networks.
- Enhanced wireless network features
- Increased security
- Remote Desktop control
- Overall improvements to the GUI, including the welcome screen additions, start menu improvements.
- Enhanced multimedia support for digital video, audio, and pictures.
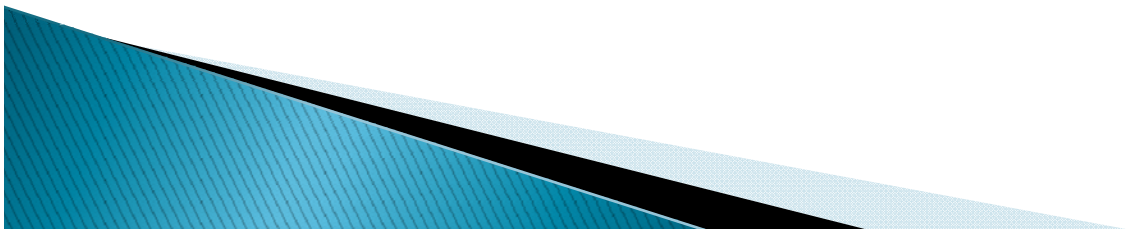
Windows 2000 and 2003 Family of Operating Systems

NOS	Features	Usage	Price
Windows 2000 Professional	Dual-processor support Limited server capabilities	Client workstations, small web servers	Least Expensive
Windows 2000 Server	Dual-processor support Expanded server capabilities Active Directory, SMP	Small to Medium sized organizations	
Windows 2000 Advanced Server	Full server capabilities including applications server Increased hardware support	Large organizations	
Windows 2000 .NET Server	Robust Internet server	Enterprise Internet	Most Expensive

▸ The Windows 2000 family of operating systems includes:
  ◦ Windows 2000 Professional
  ◦ Windows 2000 Server
  ◦ Windows 2000 Advanced Server
▸ The specific needs of the network will determine the best version of Windows 2000 for the installation.
▸ The Windows 2003 family of operating systems includes:
  ◦ Standard Edition
  ◦ Enterprise Edition
  ◦ Datacenter Edition
  ◦ Web Edition
  ◦ Small Business Server Edition
▸ 2003 Server release is the available support for 64-bit systems in order to compete in the enterprise level server arena.
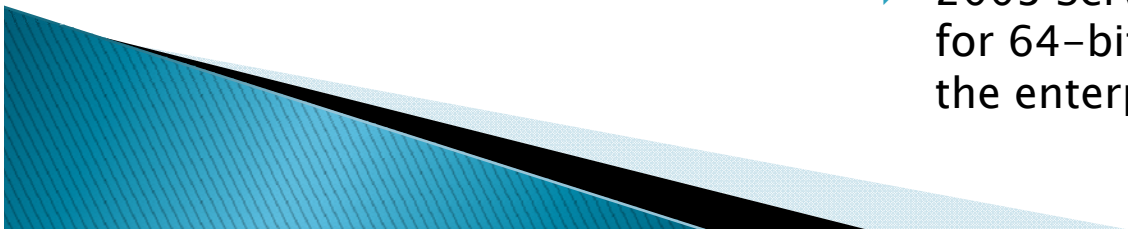
Linux

History of Linux

- Linux is an operating system similar to UNIX. It runs on many different computers and was first released in 1991.
- Linux is portable, which means versions can be found running on name brand or clone PCs.
- Linux offers many features adopted from other versions of UNIX.

1980 Dutch professor Andrew Tanenbaum creates an operating system called MINIX to help his students learn the complexities of UNIX.

1991 A student at the University of Helsinki, Linus Tovalds, begins experimenting with ways to make MINIX better.

1994 Tovalds' work leads to the development and first public release of Linux, version 1.0. A dedicated fan-base erupts consisting primarily of programmers and power users.

Today Linux popularity continues to grow with the release of versions 2.0 and 2.2 distributed by dozens of vendors. Its cost-effective power is increasingly attractive to both businesses and personal users.
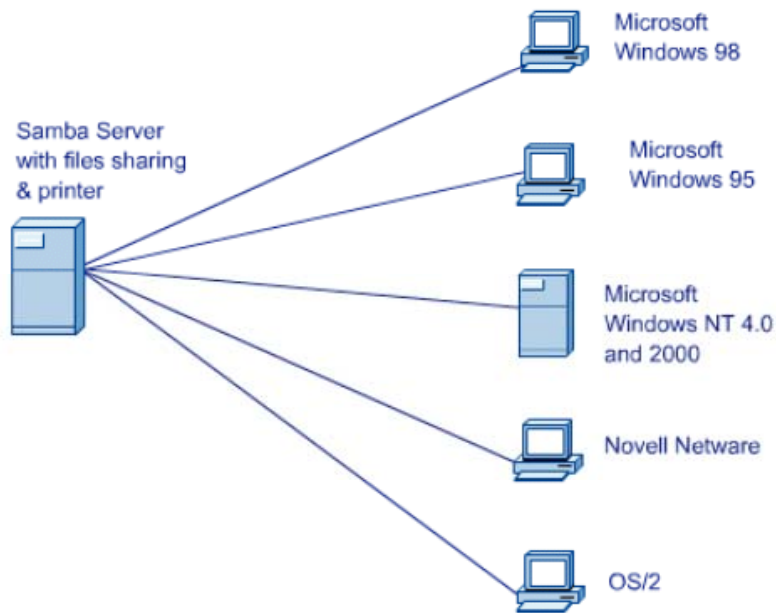
What is UNIX?

UNIX is primarily a CLI that is capable of running a GUI front-end known as the X Window System. This figure shows an early version of the X Window System.

- The UNIX NOS was developed in 1969, and it has evolved into many varieties.
- The source code is opened, that is, available at no cost to anyone who wants to modify it.
- It is written in C programming language so businesses, academic institutions, and even individuals can develop their own versions.
- There are hundreds of different versions of UNIX.

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

Linux Clients

Samba Server with files sharing & printer

Microsoft Windows 98

Microsoft Windows 95

Microsoft Windows NT 4.0 and 2000

Novell Netware

OS/2

- ‣ Windows clients can access Linux servers without client software if the UNIX servers run Samba, which is a program that uses the Server Message Block (SMB) application layer protocol.
- ‣ Windows computers use SMB for file access across the network.
- ‣ Samba permits them to see the Linux file system.

Determining Software Requirements for a Linux NOS

Workstation Software and Programs
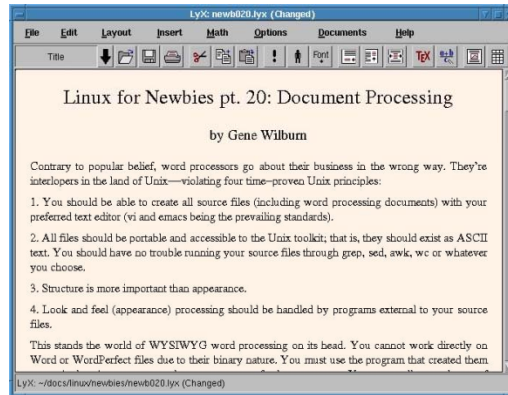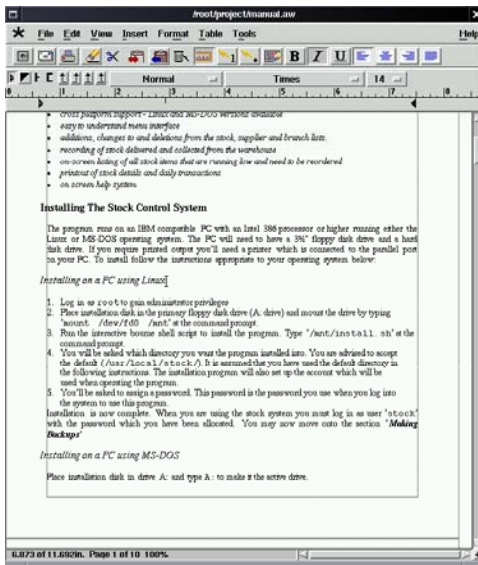
- The X Window System is what comprises the Linux GUI environment.
- Corel's WordPerfect and Sun StarOffice are the top two office suites capable of running on Linux.
- There also single packages rather than full office suits that come shipped with Linux and some are installed by default during the installation process.
- Some examples of these are LyX and AbiWord.

Workstation Software and Programs
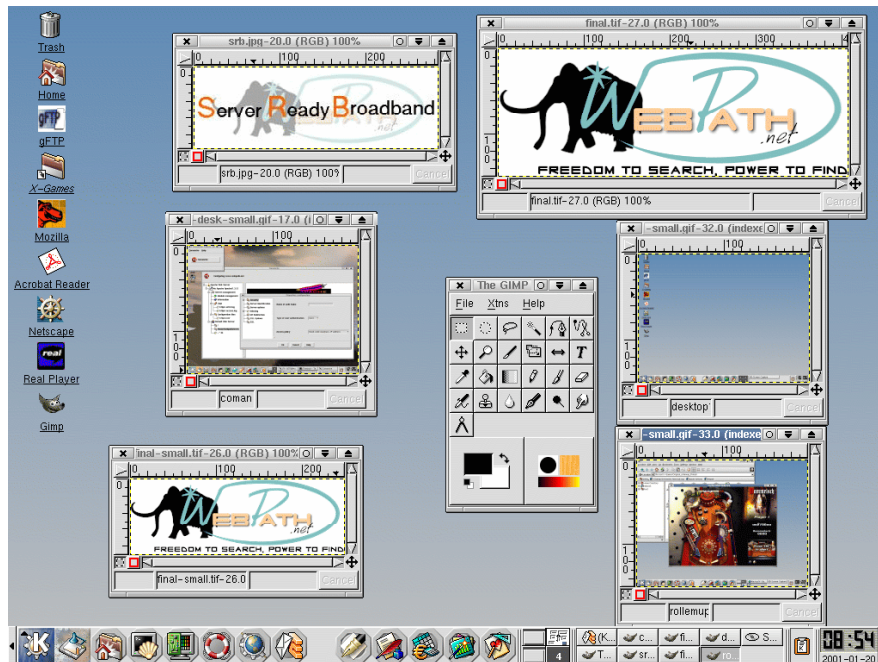
- Some of the popular audio and visual programs available for Linux include tools for viewing and editing graphics like XV and GIMP.

Server Software and Programs

- A popular use of a Linux system is a web server.
- Web server software uses Hypertext Transfer Protocol (HTTP) to deliver files to users that request them, using a web browser from their workstation.
- A Mail Server is a system that is configured with the proper programs and services that enable handling the exchange of e-mail sent from one client to another.
- The Linux operating system provides file server either in a Linux environment or in a cross-platform environment consisting of Windows, Macintosh, UNIX, or OS/2 workstation.

Additional Software and Programs

- There are some programs and software that are essential to add to a Linux system regardless of whether it is configured as a workstation or a server.
- Text editors are essential for performing any type of maintenance tasks that a user or an administrator may need to do.
- Some examples of text editors available in Linux are vi, jed, pico, or

Additional Software and Programs

▸ Programming tools are helpful Linux servers as well to specific users at workstations if they are programmers.

▸ These programming tools are also referred to as compilers or interpreters.

▸ A complier converts the program source code, which is written by the programmer into binary form the computer can read.

▸ Common scripting languages include Javascript, Python, and Perl.

▸ Every Linux system relies on a library called the C library (libc). Linux systems rely on the C library for the routines that are necessary for C programs to run in Linux.

Verifying Software Compatibility

- When installing a package, the first step should be to always check and make sure that the operating system supports the package.
- Generally, any Linux software and package can be installed on any UNIX-like operating system.
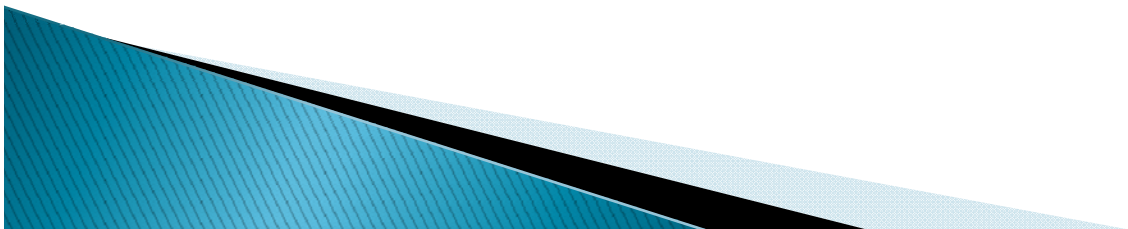- Check CPU requirements, library requirements, and development tools.
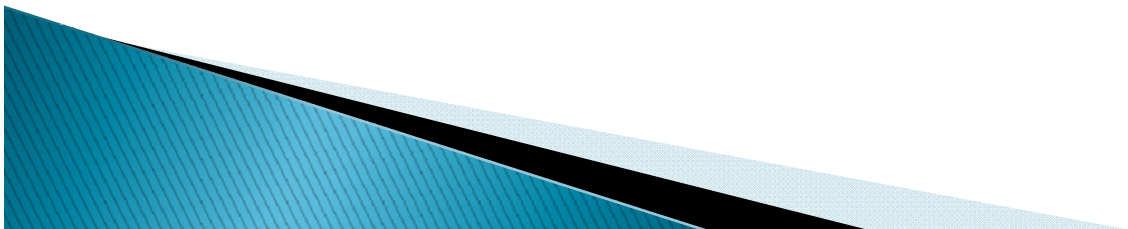
Scope of Research

- Research in this field is continuous. Modifications in existing NOS and replacing them with new one is continuous based on new protocols coming to support networking and data communication.
- For example, earlier versions of NOS were supporting only IPv4, newer are supporting both IPv4 and IPv6.
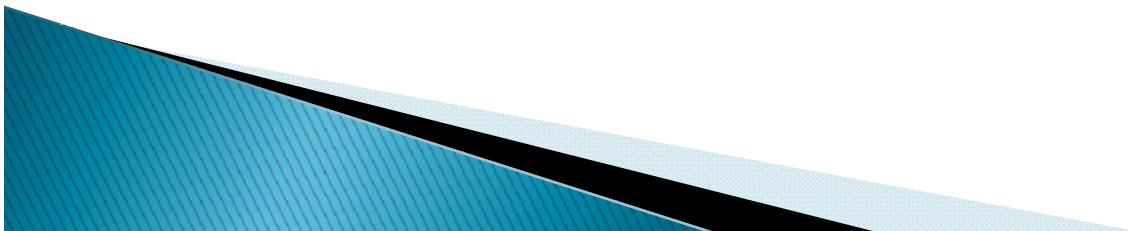
Assignment 29

- What are the main functions of NOS?
- Explain the client-server infrastructure of NOSs.