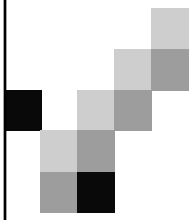

Understanding Complex Networks

Chapter 9

Learning Objectives

- Discuss interconnectivity issues in multivendor environment
- Define various options to implement multivendor network environment
- Discuss differences between centralized and client/server computing
- Define client/server networking environment
- Discuss basics of Web-based computing environments

Interconnectivity in Multivendor Environments

- Today's networks include computers and equipment from various vendors
- Big dilemma is connecting systems using different network operating systems
  - Server's operating system, client's operating system, and redirectors must be compatible
- Figure 9-1 shows that Windows 2000 supports many different client operating systems

Windows 2000 Server Supports Many Clients

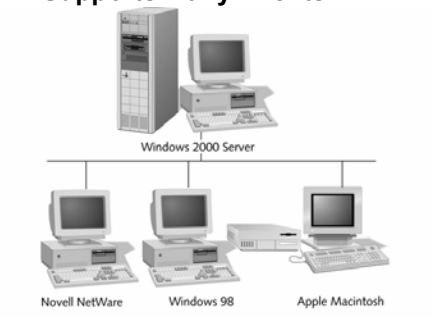

Figure 9-1 Windows 2000 Server can support many clients

Implementing Multivendor Solutions

- Two basic ways to handle multivendor connectivity
  - From client end
  - From server end

Client-Based Solutions

- Client's redirector intercepts messages and forwards them to correct server
- Client-based multivendor solution
  - Multiple redirectors loaded onto single client
  - Allows connections to different vendor's servers
- Figure 9-2 shows redirectors in multivendor environment

Redirectors Make Multivendor Connectivity Possible

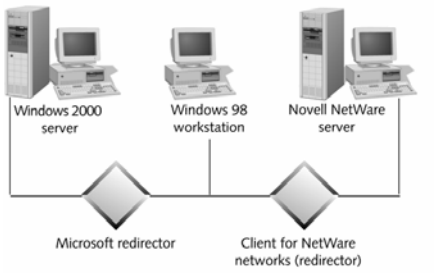

Figure 9-2 Redirectors make multivendor connectivity possible

Server-Based Solutions

- Server-based multivendor solution
  - Software loaded on server to provide service to particular client
- Service for Macintosh installed on Windows server allows Macintosh clients
  - Service automatically converts files to Macintosh format when retrieving them from server
  - See Figure 9-3

Service for Macintosh on Windows 2000 Server

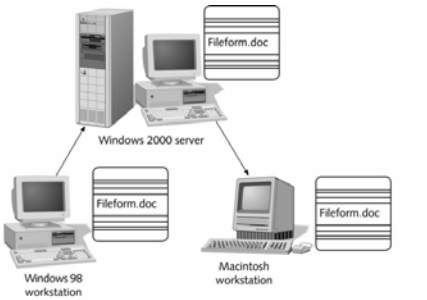

Figure 9-3 File conversion is automatic with Services for Macintosh on the Windows 2000 server

Vendor Options

- Many NOSs are available from vendors
- Four most popular networking product vendors are:
  - **Microsoft**
  - **Novell**
  - **Linux**
  - **Apple**
- Many include utilities to allow simple interconnectivity
  - See Figure 9-4

Easy Client and Server Connectivity

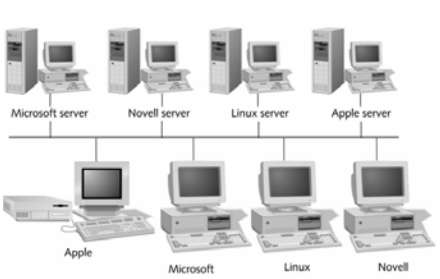

Figure 9-4 Major networking vendors provide easy client and server connectivity

Microsoft Redirector

- Microsoft redirector included with most Microsoft operating systems
  - Automatically installed when operating system is installed
  - Allow users to share resources with others on network (peer-to-peer networking)

Microsoft in a Novell Network

- Many products allow Windows client to connect to Novell NetWare network, including:
  - **NWLink**
  - **Client Service for NetWare** (CSNW)
  - **Microsoft Service for NetWare Directory Services**

MS-DOS Clients

- Utilities allow MS-DOS client to connect to servers of different NOS vendors, including
  - **AppleShare PC**
  - **LocalTalk card** with firmware
  - **UNIX-derived client software**, such as Sun Microsystem's PC-NFS
  - **Samba**, add-on Linux server

Novell Networks

- Provides file and print services for following clients:
  - MS-DOS-based
  - Windows 9x and ME
  - Windows 2000, XP, and NT
  - Apple Macintosh
  - UNIX/Linux
- NetWare 6 includes platform-independent method for accessing file and print servers, as seen in Figure 9-5

NetWare WebAccess

Figure 9-5 NetWare WebAccess screen

Linux Networks

- **Network File System** (NFS)
  - Lets networked machine export portion of local file system to authorized users on network
  - Exported part known as mount point or NFS volume
- Preferred method of interconnection is adding Samba service to Linux servers
  - Open-source server-based solution
  - Allows Linux machine to masquerade as native Microsoft network server

Apple Macintosh

- Includes OS files to communicate with AppleTalk network
- AppleShare automatically provides file sharing
  - Includes print server to share printers

Mac OS-X

- Newest version is major departure from previous Mac OS versions
- Includes client software for Windows and UNIX environment
- Built on UNIX core
- Backward compatible support

Handheld Computing Environment

- Fragmented market with no clear hardware or software standard
- Challenge to integrate handheld devices into corporate computing environment
  - Devices rarely connect to corporate LAN, but most offer Ethernet connection
  - Concern for security and data integrity
- Software companies have programs for handling synchronization, backup, and application loading

Centralized versus Client/Server Computing

- **Centralized computing**
  - Mainframes perform all processing
  - Dumb terminals connect directly to mainframe
  - PCs and “thin clients” attach to terminal server
  - Greatly increases network traffic
- **Client/server computing**
  - Replacing many centralized applications

Understanding Terminal Services

- Allows clients to run complex applications on thin client or bare bones PC
  - Transfers burden of processing to server
  - Server sends screen updates to client
  - Good for older PCs, thin clients, and remote users on slow connections
  - Requires servers with large amounts of RAM, extensive hard disk space, and powerful CPUs

Thin-Client Computing

- Thin-Clients connect to server to access resources and run applications
- Many advantages of thin clients, including
  - No removable storage so employees cannot copy files or introduce viruses
  - No hard drive reduces viruses and provides better reliability
  - Lower total cost than desktop PCs

Back to the Future: The Mainframe Environment

- Today, certain transaction-intensive applications work well with mainframes
  - Uses include large-scale airline, hotel, and rental car applications
- Mainframes remain viable processing model
  - Still important computing resource today and for foreseeable future

Client/Server Environment

- Most popular network communications method
  - Easy implementation and scalability
- Client requests access to shared network resources from server
  - Usually both client and server share processing
- World Wide Web is most prominent client/server model

Client/Server Model in a Database Environment

- Database management systems (DBMSs) are example of efficient client/storage model
  - Client uses **Structured Query Language** (SQL) to manipulate data using English-based language instead of cryptic programming language
- Two major components in SQL environment
  - **Application**, referred to as front end or client
  - **Database server**, referred to as back end or server
- See Figure 9-6

Front-End and Back-End Systems in a DBMS

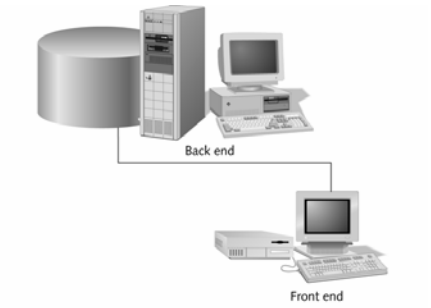

Figure 9-6 Front-end and back-end systems in a DBMS

Client/Server Architecture

- Number of ways to implement client/server environment
- Figure 9-7 shows two of most common:
  - Single database server
  - Multiple database servers (distributed or multitiered database)

Single Versus Multiple Servers in a Database Environment

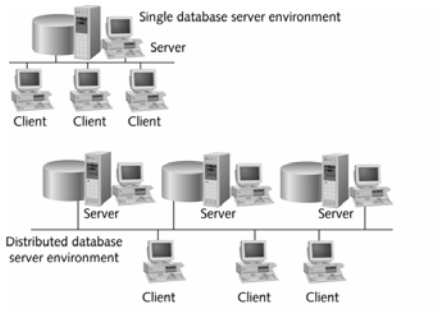

Figure 9-7 Single versus multiple servers in a database environment

Advantages of Working in a Client/Server Environment

- Uses computers more efficiently, both front end and back end
- Client computer can have smaller hard drive and less RAM than server
- Centralized location of data on server provides more security
- Simplifies back-up process

Web-Based Computing Environments

- Many operating systems, such as Novell NetWare 6, make file and print server available over Web browser
- WebDAV is emerging technology that provides single framework for all client and server platforms
  - Extension to HTTP protocol lets browser do traditional file system tasks, including reads, writes, locking, and version control
- In future, WebDAV may eliminate redirectors, FTP, and e-mail clients
- See www.webdav.org for more information

Chapter Summary

- Interconnectivity between multiple-vendor operating systems is becoming increasingly necessary in networking
- Two ways to connect multivendor environments ease the stress of making these connections
- Client-based multivendor network environment relies on client computer's redirectors to decide which server should be sent the request

Chapter Summary

- If a computer requires connections to both NetWare server and Windows 2000 server, load software to connect to both servers
- In server-based solution, server supports multiple client types
- Computer running Windows 2000 Server can support Microsoft, Novell, or Apple clients
- Four major networking product vendors and organizations—Microsoft, Novell, Linux, and Apple—support connectivity to each other's NOSs

Chapter Summary

- Using processing power of mainframe computer creates centralized computer environment
- Centralized computing can generate large amounts of network traffic without exploiting the power of today's PCs
- It is not well suited for typical user productivity applications, such as word processing, spreadsheets, and e-mail

Chapter Summary

- Mainframes still play valid role in modern networks, especially for large-scale, transaction-oriented applications
- Server-based terminal service provide useful access to networks and centralized server-based resources for remote users or for single-user workstations
- Handheld computing environment is growing

Chapter Summary

- Non-standardized hardware and software used with handheld devices pose challenges
- In client/server environment, PC and server share processing and use resources of both machines more efficiently
- WWW is good example of client/server networking environment
- When you ask for Web page, browser in client asks server to send page

Chapter Summary

- Client/server environment reduces network traffic
- Most database management systems use SQL as query language.
- Database application resides on client or front end, while server or back end stores and maintains data

Chapter Summary

- Trend in today's networking environment is to remove obstacles and incompatibilities of working in multivendor environment
- WebDAV, a promising new technology, hopes to make any Web-enabled device a client to file-sharing, e-mail, and calendaring applications