Computer Networks

Topic 10:

Network & Server Software

Computer Networks

Topic 10 – Lecture 1:

Network Software

Scope and Coverage

This topic will cover:

- Network software requirements
- Wireless network software requirements
- Configuring network software

Learning Outcomes

By the end of this topic, students will be able to:

- Identify the software requirements for a computer network
- Install and run appropriate network software according to a design specification.
- Install and run software components for a wireless network.
- Test the correct operation of network and server software

Network Software

- We have already covered some of the essential software for a network:
  - Antivirus
  - Firewall
  - Other security software
- We will concentrate on the operating system (OS) software requirements.
- Networks may require specific software depending upon the business they serve.

Operating Systems (OS)

- Computers use low-level software, an operating system, to run programs.
- An OS is present on:
  - PCs
  - Laptop computers
  - Mobile phones
  - Network routers
  - Embedded devices (e.g. elevator controls)

Personal Computers

- Have familiar OS:
  - Microsoft Windows
  - Mac OS X
  - Linux
- Manages the interactions and processes between the computer and its peripherals (keyboard, mouse, external monitor, printer, etc.)
- This is a network of sorts.
- We consider a network to have many computers.

Equipment Specific OS

- Some OS have been designed for specific types of equipment:
  - Google Android (a variant of Linux) and Symbian for cell phones
  - Solaris, HP-UX, DG-UX, and other variants of Unix for server computers
  - DEC VMS (Virtual Memory System) for mainframe computers

Network Operating Systems (NOS)

- Used to run computers that act as servers
- Provide the capabilities required for network operation
- NOS are also designed for client computers.
- The distinction between network operating systems and stand alone operating systems is not always obvious.

NOS Software

- Typical NOS software includes:
  - An implementation of TCP/IP protocol stack
  - Related utility programs like ping and traceroute
  - Device drivers
  - Software that will automatically enable a device's Ethernet interface
  - Software to enable Wi-Fi, Bluetooth, or other wireless connectivity

NOS General Functions

- File sharing
- Print sharing
- Account administration for users
- Security
- Client/server functionality
- Data sharing
- Back-up facilities

File & Print Sharing

- Access to a network drive where your personal folders are held
- Access to a shared drive where files and folders are shared with other users
- Can read and write to these folders in the same way as if they were on the workstation
  - If the network administrator has provided permission for you to do this
- Printers can be networked and also shared.

User Accounts

- Network users have user accounts.
- Users must be authenticated to access the network.
- Some users are not people, they may be software processes that require network services.
- Authentication method is required
- If passwords are used, there needs to be policy on:
  - How complex passwords should be
  - Frequency of change

Allocating Permissions

- Exact process is OS dependent
- Individual users can be given access to specific folders, subfolders, etc.
- Can be based on user profiles
  - Each user is a specific user type and permissions are allocated on this basis with exceptions where required.
- Can be based on groups/domains
  - Each user belongs to a domain, which could be a combination of job grade and department, and permissions are granted to the domain.

Network Security

- Covered elsewhere in the module.
- User permissions are part of the security system.
- Firewalls and anti-virus are sometimes part of the OS.
- There is usually an automatically created administrator account with a standard password when the OS is installed.
  - *You must delete this or change the username/password combination.*

Client Server Functionality

- Client/server NOS allow the network to centralise functions and applications in dedicated file servers.
- File servers provide access to resources & security.
- Clients have access to the resources available on the file servers.
- The NOS provides the mechanism to integrate all the components of the network and allow multiple users to simultaneously share the same resources.

Data Sharing

- Alongside the sharing of files, directories/folders and system peripherals, a network may also provide access to an organisation's database.
- Database access can be controlled in a number of ways.
  - RBAC is very common
- Usually it is the database management system (DBMS) that manages this.
- The NOS must integrate with the DBMS.

Back-Up Facilities

- Network backup devices are important for safeguarding important data.
- Many organisations use external hard drives or other off-line devices to backup files and data.
- When dealing with business or customer files, an automated backup system is ideal.
- External drives are suitable as they are large and fast.
- Tape is still used.

Computer Networks

Topic 10 – Lecture 2:

Configuring Network Software

Functions of the NOS

- A network operating system can be described as having three main functions:
  - Connecting all computers and peripherals
  - Coordinating the functions of all computers and peripherals
  - Providing security by controlling access to data, computers and peripherals

Client-Server Networks

- Most networks of any size follow the client-server model.
- Typically, client-server networks have software on both clients and server.
- Client network software provides the client with the functions it needs.
- Server network software typically controls many network functions.

Stand-Alone Computers

- When a user types a command that requests the computer to perform a task, the request goes over the computer's local bus to the computer's CPU.

- For example, if you want a directory listing of a local disk, the CPU interprets and executes the request and then displays the results in a directory listing in the window.

Client Software

- In a network environment, when a user initiates a request to use a resource that exists on a server in another part of the network, the request has to be forwarded onto the network, and from there to the server with the requested resource.
- This is done by the ***redirector*.**
- ***Drive designators*** are used by the redirector to locate the network resource.

The Redirector - 1

- Sometimes referred to as the shell or the requester
- A small section of code in the NOS that:
  - Intercepts requests in the computer
  - Determines if the requests should continue in the local computer's bus or be redirected to another server
- Redirector activity originates in a client computer when the user issues a request for a network resource or service

The Redirector - 2

- The user's computer is referred to as a client, because it is making a request of a server.
- The request is intercepted by the redirector and forwarded out onto the network.
- The server processes the connection requested by client redirectors and gives them access to the resources they request.
- In other words, the server services the request made by the client.

Drive Designators

- Associated with shared network resources
- Used by the redirector to locate network resources
  - A shared directory on a remote computer can have a letter of the alphabet, e.g. W, assigned to it.
  - You can then refer to the shared directory on the remote computer as W and the redirector will locate it.
  - Designators mean users have no need to worry about the location of data or peripherals.
- Designators can also refer to the local printer or the network printer.

Peripherals

- Redirectors can send requests to peripherals as well as to shared directories, for example:
  - A local computer sends a request to a print server
  - The request is redirected away from the originating computer and sent over the network to the target
  - In this case, the target is the print server
- Using the redirector, users don't need to be concerned with the actual location of data or peripherals, or with the complexities of making a connection.

Server Software

- Users on client computers can share the server's data and peripherals including:
  - Printers
  - Plotters
  - Directories
- E.g. a user requests a directory listing on a shared hard disk.
  - Request is forwarded by the redirector onto the network.
  - It is passed to the file server with the shared directory.
  - Request is granted and the directory listing is provided.

Resource Sharing

- Makes it possible for users on machines to share the server's data and peripherals
- Also determines the degree of sharing:
  - Allowing different users different levels of access to the resources, e.g. a file server could give *Read*, *Write*, or *Read AND Write* permissions to different users.
- Coordinates access to resources to ensure that two users do not use the same resource at the same time.

Managing Users - 1

- Allow an administrator to determine which people, or groups, can access network resources.
  - Create user privileges, tracked by the NOS that indicate who gets to use the network.
  - Grant or deny user privileges on the network.
  - Add or remove users.

Managing Users - 2

- Allow the creation of user groups
  - By classifying individuals into groups, the administrator can assign privileges to the group. When a user joins the network, the administrator can assign the new user to the appropriate group, with its accompanying rights and privileges.

Managing the Network

- Some NOS include management tools to help administrators keep track of network behaviour.
- If a problem develops on the network, management tools can detect signs of trouble and present the details.
- With these tools, the network manager can take corrective action before the problem halts the network.

Choosing a NOS

- Network planning takes into account the services and resources required of the network.
- Those resources, and how they are shared and accessed, are determined by the network operating system.
- It is likely a client-server model will be used.
- You need to determine how elements of the network will operate together (***interoperability***).

Interoperability

- Each NOS addresses interoperability differently.
- Interoperability will be dealt with:
  - as a service on the network server.
  - as a client application on each networked computer.
- Server-based interoperability is easier to manage because it is centrally located.
- It is not uncommon to find both methods (a network service on the server and network client applications at each computer) in a single network.

Network Services

- When choosing a NOS, first determine the networking services that will be required.
- Standard services include:
  - Security
  - File sharing
  - Printing
  - Messaging
- For any given NOS, determine which interoperability services or networking clients are best implemented to suit your needs.

Small Business Server Software

- We will only briefly consider some common network server software for small businesses.
- Other solutions are available for large enterprises.
- Common server solutions include:
  - Microsoft Windows Small Business Server
  - Novell Open Enterprise
  - Mac OS X Server
- In reality, these are large software packages that include many individual items of software.

Windows Small Business Server - 1

- Integrated server suite from Microsoft designed for running the network of small and medium enterprises having no more than 75 workstations or users.
- Offers features such as:
  - Integrated setup
  - Enhanced network monitoring
  - Single management console
  - Remote access

Windows Small Business Server - 2

- Really a bundle of server technologies
- Includes:
  - Mail server
  - Web server
  - File sharing applications
  - Mail client
  - Fax server
  - Centralised updating across the network

Novell Open Enterprise Server

- Can be run over a Novell Netware or Linux kernel
- Can include nodes that have both types of kernel, giving flexibility of use
- An upgrade of a very commonly used Novell Netware OS
- Offers features similar to the Windows server

Mac OS X Server

- Apple's server software
- A Unix-based server
- Has the same architecture as its desktop counterpart, but with additional features for a server such as:
  - Workgroup management tools.
  - Administration tools.
- Many additional services in later versions, such as calendar, wiki and chat servers

References

- Price, B. (ed) (2003). *Networking Complete,* 3rd edition. Sybex.
- Lowe, D. (2009). *Networking for Dummies,* 9th edition. John Wiley & Sons.

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Any Questions?