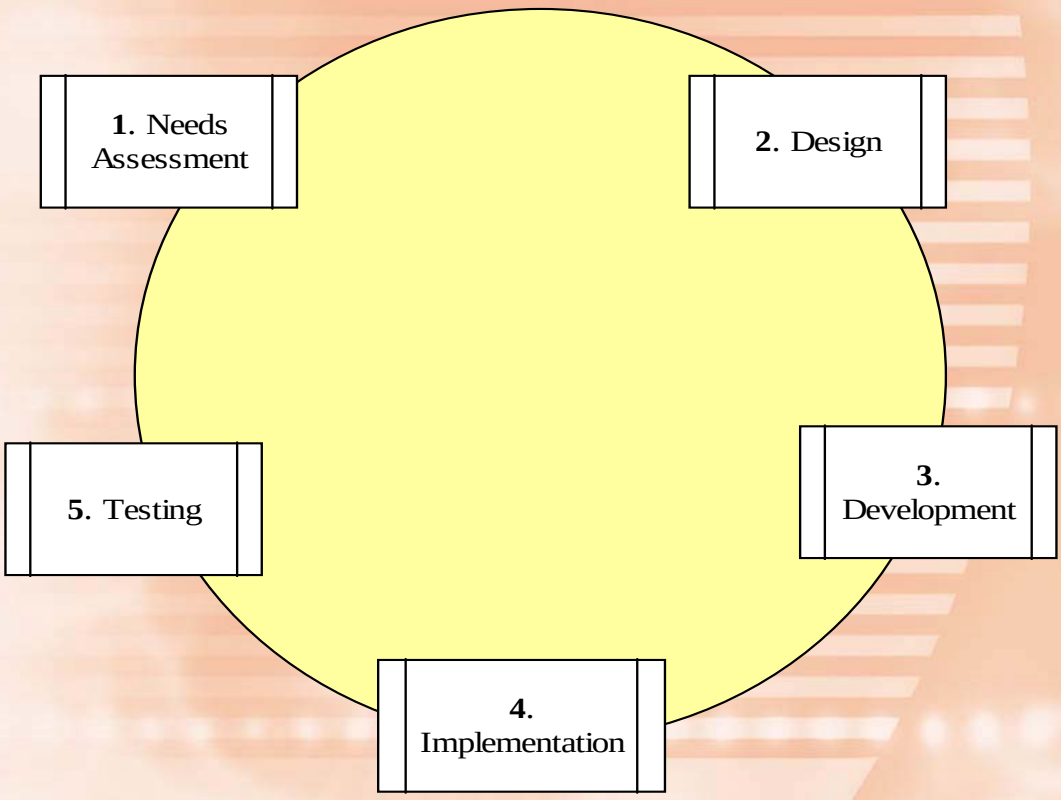
Computer Networks and Communications

Lecture (9):

LAN Design

Preparing for LAN Design



Phases

1. **Needs Assessment** – Focus on the existing network, future plans, problems experienced in the past
2. **Design** – remedy network problems, allow for growth, accommodate current and future network technologies
3. **Development** – company staff have an input, review process, adapt the design in light of this
4. **Implementation** – Install, liaise with staff and contractors, project manage
5. **Evaluation** (Testing) – test before it can be considered operational, test everything especially 'weak links', test/monitor during peaks

Needs Assessment

- Inventory Equipment
- Research current documentation, logs, network performance
- Survey building (layout, cable ducts etc)
- Determine goals of new network
- Interview proposed users for additional information

Equipment Inventory

- MAC address
- Make and Model of NIC
- IP address (if assigned)
- Technical specs
- Network Type

Documentation

- The Planning Process
- The Network Design
- Equipment
- Performance, Trouble Shooting, System Logs
- Network Layout
- Notes of Meetings

Building and Facilities

- Electrical Outlets
- Phone Cabling
- Points of Entry of phones to building
- Ventilation Shafts
- Lighting
- Water Pipes
- False Ceilings/Floors

Assessing User Needs

- How do they currently use the network ?
- What information is shared between employees ?
- What challenges or difficulties exist ?
- What software (apps) is currently in use ?

Creating a Design

- Main considerations are:
  - Network Architecture
  - Topology
  - Network Devices

Architecture

- Peer-to-Peer
  - 10 users or less
  - Users share files and printers
  - Users manage passwords and access
  - Easy to setup
- Client Server
  - Supports large networks (‘000s of users)
  - High Level of Security
  - Dedicated servers, centralised resources
  - Requires centralised management
- Hybrid
  - Users manage their resources, centralised resources managed centrally
  - Incorporates both high and low levels of security

Topology

- See Topology Lecture
- Physical vs Logical Topology
- Star Topology most flexible (daisy chain devices)
- Distribution Layer contains the most powerful hubs to act as the backbone to the network
- Access Layer consists of the hubs that connect to the Distribution Layer – providing access to the end users

Wiring Closet

- All cables come back to one room
- Wiring Closet or Main Distribution Facility (MDF)
- MDF may also contain telephone equipment
- MDF contains Distribution-Layer Devices (such as switches)
- In a multi-storey building an Intermediate Distribution Facility (IDF) may exist on each floor
- Each IDF is connected back to the MDF
- Backbone for IDFs is usually optic fibre

Selecting an MDF Location

- Room Size
- Power
- Lighting
- Ventilation
- Security
- Plumbing

Device Selection (Hubs)

- Easy to daisy-chain users
- Ethernet is a 'shared medium' – performance degrades as no. of users increases (increased collisions)
- RJ-45 Ports, 10Mbps, 100Mbps, 10/100Mbps (auto-sensing)

Managed vs Unmanaged

- Unmanaged
  - Do not require management of ports
  - Offer lowest cost per port
  - Suitable for low bandwidth demand, with little need for growth
  - Easiest and least expensive solution to LAN access
- Managed
  - Low cost, but not as low as unmanaged
  - Function as Access Layer devices for direct connection to computers and printers
  - Individual ports and traffic can be managed
  - Suitable for low bandwidth demand, with little need for growth

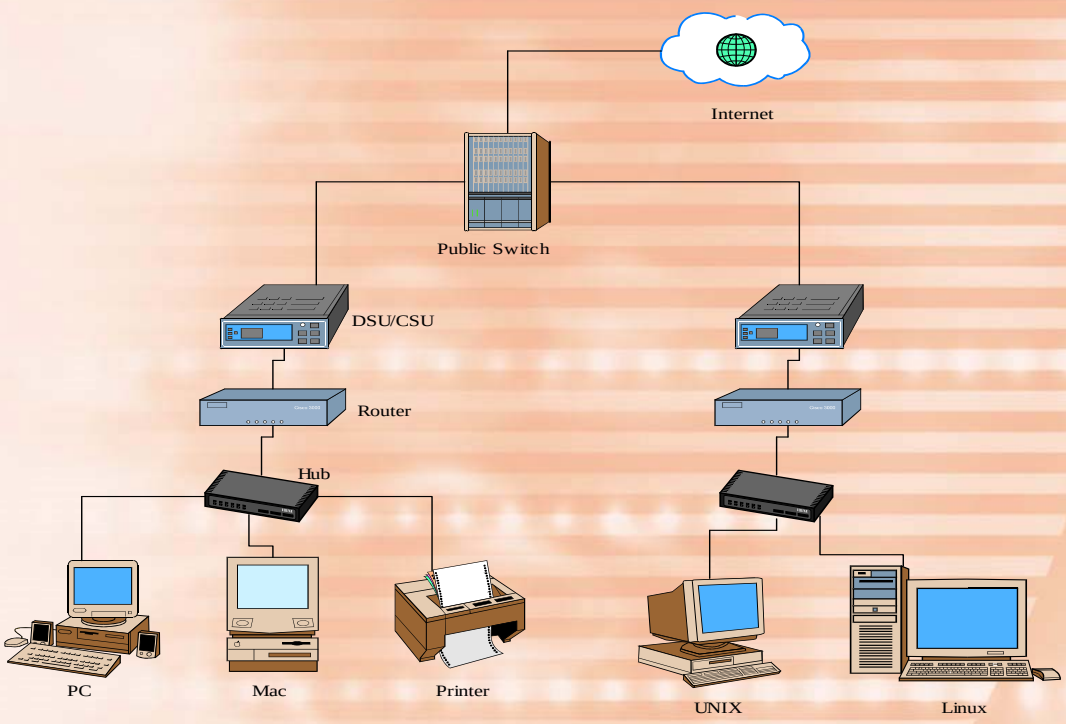
Switches

- Improve performance on backbone
- Function as Distribution Layer Device (centre of network, hubs extend from them)
- Can also function as Access Layer Device to improve performance
- Minimise collisions on the network
- May be used with SNMP functionality
- Advice – purchase all switches from same manufacturer

Routers

- Provides network segmentation in large networks, improving performance and management
- Provides access to company networks on other sites, and to the Internet
- Cisco 1600 offers a solution for the SOHO market
- Cisco 3600 routers have much faster processors, more RAM and offer many more features

Connecting to a WAN



Connecting to a WAN (2)

- To connect to the Internet through an ISP requires a company router
- The type of leased line must be decided
- Leased line, modem or DSL
- Additional equipment may be required, DSU
- A firewall is essential in these circumstances

- ***C**hannel **S**ervice **U**nit/**D**ata **S**ervice **U**nit.* The CSU is a device that connects a terminal to a digital line. Typically, the two devices are packaged as a single unit. The DSU is a device that performs protective and diagnostic functions for a telecommunications line. You can think of it as a very high-powered and expensive modem. Such a device is required for both ends of a T-1 or T-3 connection, and the units at both ends must be set to the same communication standard.

Summary

- Needs assessment involves research and documentation of both current and future needs
- A full facility assessment is required to include rooms, conduits, electricity, plumbing and telecoms
- A visual inspection of all rooms will be necessary to plan cable drops etc
- Interview all users they will know more than management on the day-to-day issues

Summary (2)

- Design includes architecture, topology and devices
- Larger companies will require a client-server approach
- Choose appropriate locations for the MDF and IDFs
- Carefully document the cabling – best of all subcontract the work to a specialist company
- Managed hubs can provide security and monitoring features
- Switches should be used between hubs
- Routers can provide Internet access as well as segmenting networks

Summary (3)

- Be aware of total length of cable runs, limitations are there for a purpose !
- Fibre-optic links between floors is a specialist job
- Cables should be certified, and a test certificate of the installation produced