Design of Corporate Communication Systems

Design Principles and Requirements

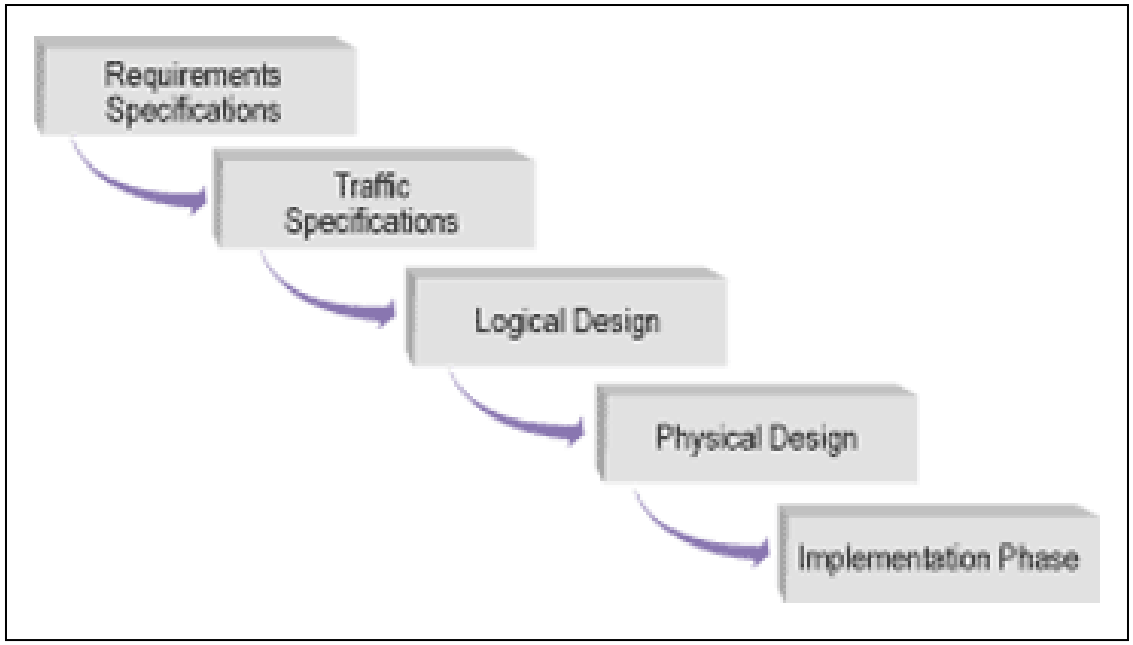
LAN – WAN Technologies

Design science includes:

- Understanding the existing structure
- Understanding the requirements
- Understanding how the features operate
- What are the constraints
- What are the alternative approaches

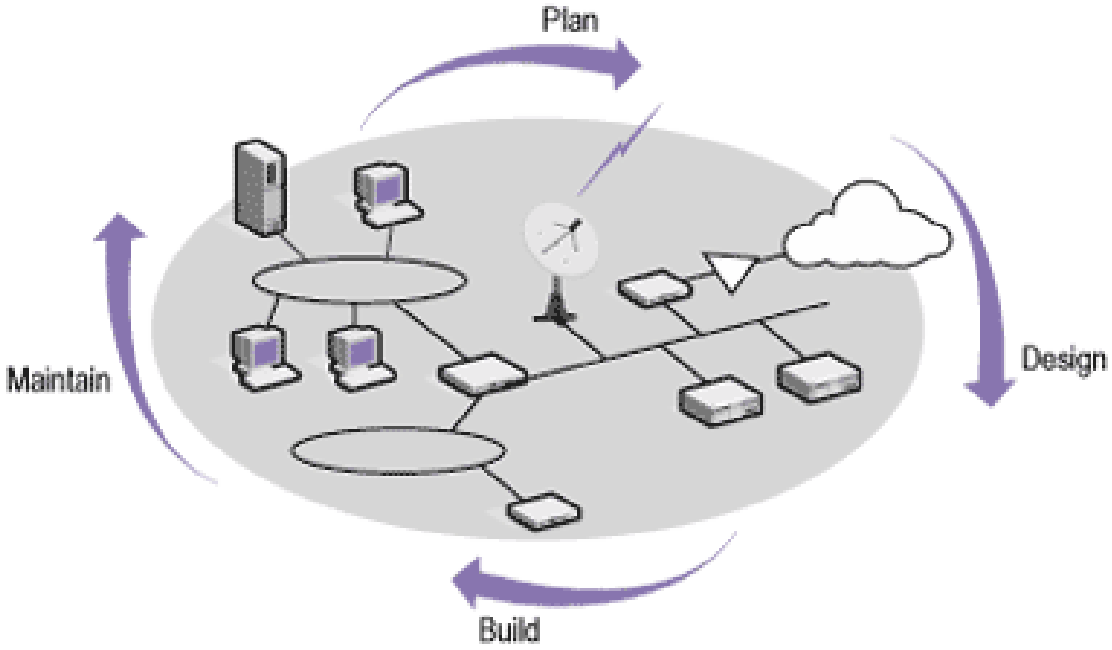
Waterfall Cycle

- Work flows down from one stage into the next.
- Each stage must be completed before the next stage can begin.



Spiral Cycle

- Can adapt to new requirements by looping through all stages several times.



Design Principles

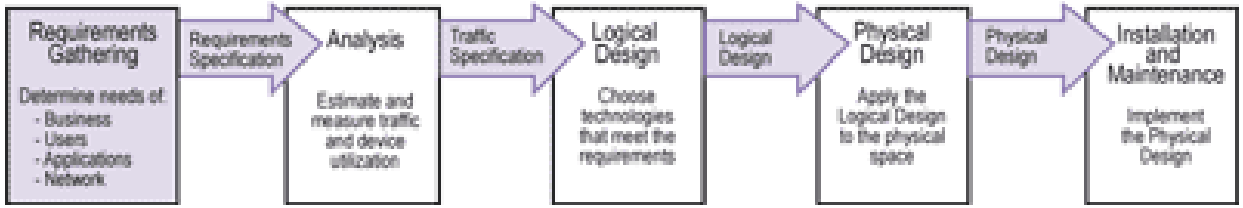
- **Plan phase:** The detailed network requirements are identified, and the existing network is reviewed.
- **Design phase:** The network is designed according to the initial requirements and additional data gathered during analysis of the existing network. The design is refined with the client.
- **Implement phase:** The network is built according to the approved design.

Design Principles (Cont.)

- **Operate phase:** The network is operational and is being monitored. This phase is the ultimate test of the design.
- **Optimize phase:** During this phase, issues are detected and corrected, either before problems arise or, if no problems are found, after a failure has occurred. Redesign might be required if too many problems exist.

Network Design Process

1. Requirements Gathering
2. Analysis of the Existing Network
3. Logical Design (also referred to as Conceptual Design)
4. Physical Design (also referred to as Final Design)
5. Installation and Maintenance



Requirements Gathering

- This is the most crucial phase in the development process, because requirements provide the target your network design must hit.
  - ✓Better view of current network
  - ✓Objective decision-making
  - ✓Ability to plan for network migration
  - ✓Ability to deliver appropriate resources to all users

Analysis of the Existing Network

- The Analysis phase complements the Requirements Gathering phase; requirements show you *where you need to be*, and analysis tells you *where you currently are*.
- A thorough analysis should gather both qualitative information (such as user estimates of storage and traffic) and quantitative data (such as traffic measurements and network management statistics)

Analysis phase deliverables

1. Logical diagram of the current topology
2. Estimated traffic volumes and patterns that describe the network capacity required for each application, each network segment, and the network as a whole
3. Detailed statistics, baseline measurements, and any other direct measurements that describe the network's current level of performance
4. A report on the quality of service provided by suppliers of Internet connections or wide area network (WAN) links
5. A list of design constraints, such as the need to use existing cabling or devices

Logical Design

- The Logical Design describes what the network must do, and how it must perform, to meet the requirements.
  - ✓ Logical network diagrams
  - ✓ Addressing strategy
  - ✓ Security scheme
  - ✓ Specification of hardware components, software, WAN links, and general services
  - ✓ Specification of new hires or training for the network staff
  - ✓ Initial cost estimates for hardware, software, services, personnel, and training

Physical Design

- The Physical Design shows how to make the Logical Design work in the real world.
- The network designer creates a detailed specification of the hardware, software, links, services, and cabling necessary to implement the Logical Design.

Physical Design Outputs

1. Physical network diagrams and to-scale wiring plans
2. Detailed lists of equipment and parts
3. Cost estimates for hardware, software, and installation labor
4. Installation schedule that specifies the time and duration of physical or service disruptions
5. Post-installation testing plan
6. User training plan

Installation and Maintenance

- The main output of the Installation phase is the network itself.
- However, a good installation should also produce:
  - ✓Updated diagrams (logical and physical) that include all last-minute changes
  - ✓Cabling, connections, and devices that are clearly labeled
  - ✓Any notes or documents that can simplify later maintenance or troubleshooting, such as test results or new traffic measurements

Requirements

- Business Requirements
- User Requirements
- Application Requirements
- Computing Platform Requirements
- Network Requirements

Network Requirements

- In this part of the Requirements Gathering phase, the existing network is examined to understand its *current* topologies, performance, and software. We also consider other broad requirements that should be reflected in the new network design.

Types of Network Requirements

- LAN functions
- Physical topologies
- Performance
- Networking software
- Security
- Economy and cost control
- Metropolitan area network (MAN) / WAN options

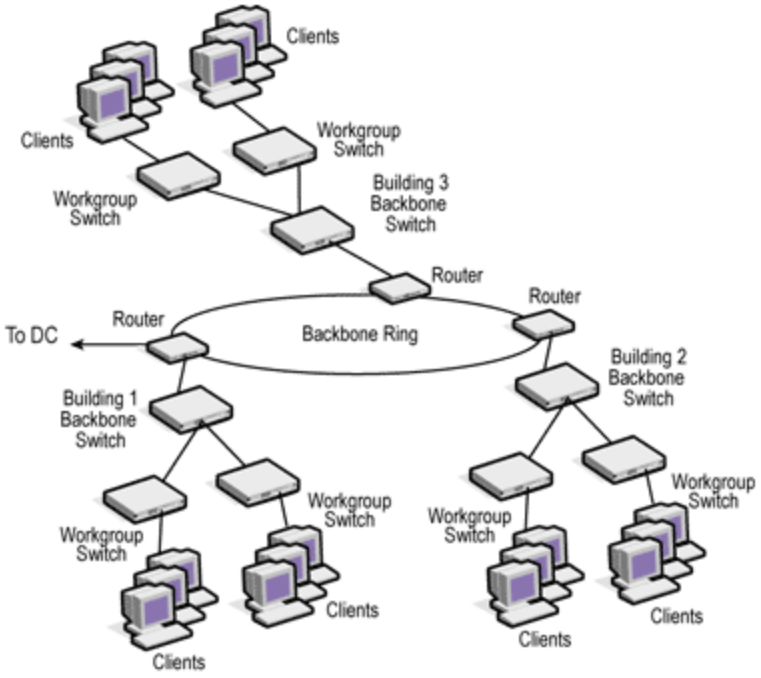
LAN Functions

- A good starting point is to summarize the functions necessary for the LAN to meet the particular organizational needs.

Function	Segment X Rate Value (1-10)	Segment Y Rate Value (1-10)	Segment Z Rate Value (1-10)
File Services			
Print Services			
E-Mail Services			
Maintenance			
Reliability			
Security			
Management			
Scalability			
Redundancy			
Fault Tolerance			
Application Compatibility			
Wide Area Compatibility			
Backup Capabilities			
Performance			
Fax Services			

Physical Topologies

- Networks are physically configured in many different ways, and a single network typically consists of multiple topologies. Most organizations will have a diagram of the existing network, that can provide some initial insight into its logical structure.



Performance

- Several performance metrics should always be considered by the designers, including:
  - Capacity and response time
  - Availability
  - Recoverability

Networking Software

- NOS
  - Novell's NetWare
  - Microsoft's NT / 2000/2003/2008 Server
  - UNIX / Linux
  - AppleTalk
- Backup management and archiving
- Virus Protection
- Network management
  - Remote management

Security

- All data flowing through networks, or cached temporarily on network nodes, is at risk.
  - By identifying the points of greatest network vulnerability, steps can be taken to protect and monitor those areas for intrusion.
- Network security involves deploying physical products and operating procedures to protect the integrity, accessibility, and reliability of networks and systems

Security (Cont.)

- The goal of network security is resource protection. A secure network can be defined by the following three attributes:
    - Confidentiality--Data is kept private.
    - Integrity--Data cannot be changed without authorization.
    - Authenticity--Data, or information about data (such as a sender's name), cannot be falsified.

Economy and Cost Control

- Hardware and software account for approximately 25 percent of the total cost of a network. Therefore, the design of a network can significantly affect the budget.
  - You can have a peer-to-peer LAN for less than half the cost of a full-scale LAN. However, the peer-to-peer LAN may be hard to expand.
  - Peer-to-peer LANs are fine for small offices.
  - Do not forget to include the cost of user licenses, which are required for most network operating systems.

Economy and Cost Control

- Administration is the biggest hidden cost of a LAN. Administration of a peer-to-peer NOS is minimal. Most peer-to-peer LAN owners rely on their vendor for support, in the form of a maintenance or service contract.
  - Be sure your supplier is certified by the manufacturer to service, train, and support your NOS.
- Typically, one full-time support person is needed for every 50 to 75 users. (The range varies dramatically, depending in part on user skill levels, required availability, topological layout, and need for internetworking).

WAN / MAN Links

- There are many ways to turn LANs into MANs and WANs.
- A MAN uses public transmission facilities but only covers one city.
- A WAN spans multiple sites that are geographically dispersed, typically using local and long distance carrier facilities.

WAN / MAN Links (Cont.)

- To create MANs and WANs, communication links must be purchased to connect the remote sites.
- Such as bridges, routers, channel service units/data service units (CSUs/DSUs), and modems are also necessary, depending on the type of link used.
- When using public facilities, two types of links are available:
    - Point-to-point circuit-switching services (dial-up lines or leased lines)
    - Packet-switching services