CS-325 Computer Networks Lab

Assignment - 1

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Study of different types of Network cables

There are 3 types of network cables primarily:

1. **Co-axial network cables**
   These cables are highly resistant to obstruction and work for long lengths of wire. However, they are complex to install.

   They are further divided into:

- Single core: made of single copper conductor
- Multi core: made of multiple strands

The structure of co-axial cables consists of the following (in order from center):

- Conductor: carries the EM signals
- Insulation: protects from interference and noise
- Braiding: protects from interference and noise
- Sheath: protects from physical damage

2. **Fiber optic cables**
   These are super fast cables, capable of carrying signals at speeds of over 100GBPS over almost 40km distance.

These are divided into:

- Single mode: carries only single beam of light. Higher bandwidth, but supports higher distance
- Multi mode: carries multiple beams of light. Higher speed, but supports shorter distance

The structure of fiber optic cable consists of the following (in order from center):

- Core: carries light signals
- Cladding: reflects light back into core
- Buffer protects light from leaking
- Jacket: prevents physical damage

3. **Twisted pair cable**
   This is also known as Ethernet cable. It consists of 4 color-coded insulated copper wire pairs

   It has 2 types: UTP (unshielded twisted pair cable), and STP (shielded twisted pair cable)

- It can transmit at speed ranging from 10MBPS - 10 GBPS
- STP is expensive (more material for shielding)
- STP gives more noise, and EMI resistance
- Max segment length is 100m

Study of different types of Networking Devices

Common network devices are:

- Hub
  Hub connects multiple deices together. It also acts as repeater and amplifies the signal. They do not perform address functions or packet filtering, only forwarding it to all devices. It has 2 types - single port and multi port.
- Switch
  It maintains limited routing information about internal network nodes. Strands of LAN are usually connected through switch. They improve the network efficiency and security. In can work as the *data link* or *network layer* of OSI model.
- Router
  Routers transmit packets to their destination through interconnected networks using different network topologies. Routers maintain tables about destinations and local connections and communicate using *Routing Information Protocol*, *Border Gateway Protocol* and *Open Shortest Path First Protocol*
- Bridge
  Bridge is used to connect two or more network segments together. Bridges store and forward frames between different segments connected by them. They work at the *physical* & *data link* layer of OSI model. Modern switches, called multiport brides have replaced bridges.
- Gateway
  They work at the *transport* & *session* layer of OSI model. It provides translation between technologies like OSI and TCP/IP. It performs all the functions of router, it is basically a router with translation functionality.
- Modem
  Modems, or *modulator-demodulator* are used to transmit digital signal over telephone lines. It converts digital signal to analog over different frequencies and transmits to modem at receiver station. They work on both *physical* and *data link* layer.
- Repeater
  Repeater is an analog device which receives a signal and transmits it at higher level or power so that the signal can cover greater lengths. It works on the *physical* layer.

Study of different types of Network Topologies

Different types of network topologies are:

- Bus Topology
  Every device on a network is connected to solo main cable line. Data is transmitted in single route, from one point to another.

  Benefit: cost effective, least cable length required
  Drawback: entire network fails if main cable collapses, lower performance with multiple nodes

- Ring Topology
  Each computer is connected together with other computers on both sides, forming a ring-like shape. Data is transmitted in sequential mode, i.e. bit by bit, and routes through each node in the network.

  Benefit: cheap installation and expansion, not affected by heavy traffic
  Drawback: difficult to troubleshoot, difficult to add/delete nodes

- Star Topology
  All nodes are connected to a single node called hub, which can be active or passive.

  Benefit: fast performance, due to low traffic, easy to troubleshoot & upgrade
  Drawbacks: high installation cost, all nodes dependent on hub

- Mesh Topology
  All nodes are connected to all other nodes. It is a point to point connection, and requires $\frac{n \times (n-1)}{2}$ network channels to connect =n= nodes. It uses rounding and flooding technique for transmission.

  Benefit: very robust, easy to diagnose fault, provides privacy and security
  Drawback: challenging to install, configuration is difficult, cable cost is very high

- Tree Topology
  All nodes are connected hierarchically to the root node. It is used mostly in WAN and is an extension of *star* and *bus* topology.

  Benefit: easy to expand network, easy to detect and troubleshoot errors
  Drawback: expensive to other technologies, entire networks collapses if root node fails

- Hybrid Topology
  It comprises of two or more different topologies and has the merits and demerits of all the topologies used.

  Benefit: flexible, durable
  Drawback: difficult to design