Tutorial 10 Solutions

Instructions

1. Form ad-hoc groups of 2 to 3 students to solve this week's exercise.
2. Each group must answer the following review Q's
3. Each group will use shared google docs to work with all group members and tutor. The document must include the group members' names and the tutorial sheet number.

Review Questions

1. Explain what multiplexing is, List and Define the three main types of Multiplexing?

   Answer: The Multiplexing is the process where multiple channels are combined for transmission over a common transmission path. Full capacity of data transmission links are not always fully utilized,to make efficient use of high-speed telecommunications lines, some form of multiplexing is used, common application of multiplexing is done in long-haul communications.

   Common forms of multiplexing are:

   - *Frequency Division Multiplexing (FDM),*
     - *Division of a transmission link into multiple channels by splitting the frequency band into multiple slots.*
   - *Wave Division Multiplexing (WDM): The true potential of optical fiber is fully exploited when multiple beams of light at different frequencies are transmitted on the same fiber. This is a form of frequency division multiplexing (FDM) but is commonly called wavelength division multiplexing (WDM).*
   - *Time Division Multiplexing (TDM)*
     - *Synchronous TDM: Time slots on a shared medium are assigned to devices on a fixed, predetermined basis*
     - *Statistical Time-Division Multiplexing*

2. Explain Frequency hopping spread spectrum (FHSS)

   Answer: Frequency-hopping spread spectrum (FHSS) is a method of transmitting radio signals by rapidly switching a carrier among many frequency channels, using a pseudorandom sequence known to both transmitter and receiver.FHSS is a wireless technology that spreads its signal over rapidly changing frequencies.

3. Explain Direct Sequence Spread Spectrum (DSSS)

   ***Answer**: Direct Sequence Spread Spectrum (DSSS) is a spread spectrum technique whereby the original data signal is multiplied with a pseudo random noise spreading code. This spreading code has a higher chip rate (this the bitrate of the code), which results in a wideband time continuous scrambled signal.*

4. How is interference avoided by using frequency division multiplexing?

   Solution: Interference is avoided under frequency division multiplexing by the use of guard bands, which are unused portions of the frequency spectrum between sub-channels.

5. List four common LAN topologies and briefly describe their methods of operation.

   - ***Bus:*** *all stations attach, through appropriate hardware interfacing known as a tap, directly to a linear transmission medium, or bus. Full-duplex operation between the station and the tap allows data to be transmitted onto the bus and received from the bus. A transmission from any station propagates the length of the medium in both directions and can be received by all other stations. At each end of the bus is a terminator, which absorbs any signal, removing it from the bus.*
   - ***Tree****: a generalization of the bus topology. The transmission medium is a branching cable with no closed loops. The tree layout begins at a point known as the headend. One or more cables start at the headend, and each of these may have branches. The branches in turn may have additional branches to allow quite complex layouts. Again, a transmission from any station propagates throughout the medium and can be received by all other stations.*
   - ***Ring:*** *the network consists of a set of repeaters joined by point-to- point links in a closed loop. Each station attaches to the network at a repeater and can transmit data onto the network through the repeater.*
   - ***Star:*** *each station is directly connected to a common central node. Typically, each station attaches to a central node via two point-to-point links, one for transmission and one for reception.*

6. What is the difference between a hub and a layer 2 switch?

   Solution: With a hub, only one attached station may transmit at a time. A switch can accommodate multiple simultaneous transmissions.

7. What is the difference between a store-and-forward switch and a cut-through switch?

   - ***Store-and-forward switch****: The layer 2 switch accepts a frame on an input line, buffers it briefly, and then routes it to the appropriate output line.*
   - ***Cut- through switch:*** *The layer 2 switch takes advantage of the fact that the destination address appears at the beginning of the MAC (medium access control) frame. The layer 2 switch begins repeating the incoming frame onto the appropriate output line as soon as the layer 2 switch recognizes the destination address.*

8. Explain mixed configuration with reference to Ethernet, and other high speed Ethernet technologies?

   Fast Ethernet LANs supports mixture of existing 10-Mbps LANs and newer 100-Mbps LANs
   • supporting older and newer technologies. – e.g. 100-Mbps backbone LAN supports 10-Mbps hubs
   > stations attach to 10-Mbps hubs using 10BASE-T
   > hubs connected to switching hubs using 100BASE-T

> high-capacity workstations and servers attach directly to 10/100 switches
> switches connected to 100-Mbps hubs use 100-Mbpsbackbone links
> 100-Mbps hubs provide building backbone
> connected to router providing connection to WAN Gigabit Ethernet supports mixture of existing 100 Mbps and 10 Mbps
• supporting older and newer technologies
– e.g. 1000-Mbps backbone LAN supports 100-Mbps switches
> stations attach to 10/100-Mbps switch using 100BASE-T
> Standard workstations and servers attach directly to 10/100 switches
> high-capacity workstations and servers attach directly to 1000- Mbps switches
> switches connected to 10/100-Mbps switch use 1000-Mbps backbone links
> 1000-Mbps switches provide building blocks for backbone
> connected to router providing connection to WAN

9. What is Fiber channel and list Fibre channel requirements?

Fibre Channel, or FC, is a high-speed network technology (commonly running at 1, 2, 4, 8, 16, 32, and 128 gigabit per second rates) providing in-order, lossless delivery of raw block data, primarily used to connect computer data storage to servers. Fibre Channel is mainly used in storage area networks (SAN) in commercial data centres. Fibre Channel networks form a switched fabric because they operate in unison as one big switch. Fibre Channel typically runs on optical fiber cables within and between data centres, but can also run on copper cabling.

Full duplex links with two fibers per link
• 1 Gbps to 10 Gbps on single line
– Full duplex 1 Gbps to 128 Gbps per link
• Up to 10 km
• Small connectors
• High-capacity utilization, distance insensitivity
• Multiple cost/performance levels
– Small systems to supercomputers
• Uses generic transport mechanism based on point-to-point links and a switching network
• Supports simple encoding and framing scheme
• In turn supports a variety of channel and network protocols