ECSE-6660: Broadband Networks

Homework 1

Please Submit Online in the WebCT dropbox

Deadline : 29th Jan (non-tape-delayed)

Feb 5th (tape-delayed)

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I. Reading Assignment & Quick Questions (100%)

Reading assignments count for a substantial part of homework credit

Carefully review slide sets 1,2,3; Read Chapter 2, 3, 5, 6 of S. Keshav's book, and Chap 1 (upto sec 1.4), 11 (upto sec 11.2), Sec 13.1 and Sec 6.1 of Ramaswami/Sivarajan.

Then answer the following quick true/false questions that test your knowledge. Please submit the electronic version of this powerpoint file with your answers. (Cut-and-paste the tick (√) over the appropriate boxes on the left)

[60 questions; 5/3 points per question]

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☐ ☐ The connectivity provided by the Internet is equivalent in performance to that of a physical link.

☐ ☐ The connectivity provided by the telephone network is equivalent in performance to that of a physical link.

☐ ☐ Switches and routers are used to provide indirect connectivity.

☐ ☐ The problem with direct connectivity is that it does not scale to support large networks

☐ ☐ The telephone network has a simple hierarchical structure with a fully connected core to simplify routing issues.

- Echoes and sidetones are similar (reflection of signal to the sender), except that the former is more perceptible and annoying due to the 20 ms+ delays
- FDM is a form of digital multiplexing
- TDM is a form of digital multiplexing.
- Twisted pair wire guage of 26 is thicker and carry voice for longer distances compared to guage 19.
- Step-by-step switches integrate both the control and switching parts unlike modern electronic switches (eg: 5ESS)
- A crossbar is an example of a time-division-switch
- SS7 is an example of an in-band signaling protocol
- Common channel signaling refers to the use of a separate control channel into which all the signaling functions are consolidated.
- Internet routers are in general more reliable than telephony switches
- The “common carrier” regulatory concept refers to a model where the telephone operator (carrier) controls both the content and the conduit.
- Cable TV networks maintain reasonable control of both the cable conduit and content, indicating a different regulatory treatment compared to LECs
- IXCs refer to local bell operating companies that provide local and in-state calling services
- LECs and IXCs interconnect at POPs
- Tandem switches are primarily used in the full-mesh toll.(core) networks

- The tree-and-branch architecture of cable networks is well-suited for offering switched network services to individual subscribers
- Though the co-axial cable by itself has over 1 Ghz of bandwidth, only 550-750Mhz is used in practice due to noise accumulation in cable amplifiers
- The fiber-optic technology used in cable uses digital transmission just like that used in telephony fiber-optic deployments.
- HFC deployment not only increases performance of the cable plant, but also allows the deployment of multiple services in an overlaid fashion
- SLIP is an example of a bare-bones link-layer protocol
- PPP adds protocol multiplexing, error detection and capabilities negotiation features to SLIP.
- Timeout is an essential mechanism in the temporal redundancy model, to handle the case when all data and/or control information is lost.
- Stop-and-wait ARQ is more efficient than sliding-window ARQ protocols
- Go-back-N ARQ performance is comparable to Selective-Repeat ARQ for small window sizes
- Virtualization involves a combination of multiplexing and indirection.
- Statistical multiplexing is most useful when the peak rate is close to the average rate
- Congestion control is essential to maintain the stability and performance of a large, distributed multiplexed system
- Packet-switching trades off delay and packet loss (performance parameters) for reduced link/switch cost ($$)

- Circuit switching using TDM is highly dependent upon timing, and hence avoids the need for meta-data seen in packet headers.
- Packet switching implies a store-and-forward architecture, involving queueing.
- Circuit switching in its basic form offers both spatial and temporal multiplexing gains
- TDMA and FDMA are examples of random access MAC approaches
- Token passing is similar to round-robin scheduling, only done in a distributed manner
- Gigabit Ethernet uses the CSMA/CD arbitration procedure
- Layer 2 switches are used in Ethernet to reduce the size of collision domains
- A router demarcates the end of a broadcast domain
- A hub is a layer 1 device (essentially a multi-port repeater)
- Layer 2 devices set up their forwarding tables using a distributed routing algorithm
- The structure inherent in IEEE 802 address is used by bridges for filtering purposes
- Name/address resolution are examples of functions needed to overcome the heterogeneity of inter-connected networks to offer universal connectivity
- A subnet mask helps identify the encoded network address within an IP address
- IP address encode area IDs and autonomous system IDs in addition to network addresses and interface IDs

- Inter-domain routing in the Internet primarily focusses on the issues of global connectivity and hooks for policy-based routing.
- Traffic engineering is an important consideration for small networks operating the RIP routing protocol.
- The objective of congestion avoidance protocols is to operate around the “knee” of the throughput-delay curve.
- Network instability in terms of traffic loading is captured by the concept of “congestion collapse”
- The AIMD policy is a distributed technique to achieve the goals of efficiency and fairness.
- One of the fundamental problems in QoS is that FIFO queueing convolutes the service experienced by different streams with their arrival patterns
- Traffic conditioning is an important control-plane function in QoS.
- The T-carrier uses bit-interleaving whereas SONET uses byte-interleaving
- Prior to SONET, DS-4 and fiber-multiplexing was done using proprietary methods
- The pointer mechanism in SONET dramatically simplifies synchronization and multiplexing functions
- The primary difference between OC-N and STS-N is scrambling.
- STS-N frames are all of size 810 bytes.
- STS-Nc involves byte-interleaving of lower speed STS payloads
- Virtual tributaries allow easy add-dropping of lower-speed DS circuits