

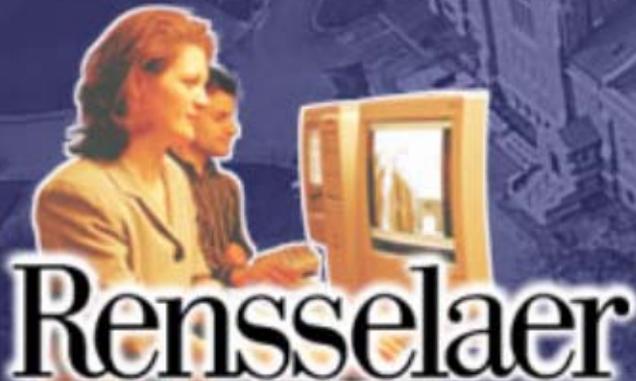
ECSE-6660: Broadband Networks

Homework 2

Please Submit Online in the WebCT dropbox

Deadline : 19th Feb (non-tape-delayed)

Feb 26th (tape-delayed)



I. Reading Assignment & Quick Questions (100%)

Reading assignments count for a substantial part of homework credit

Carefully review slide sets 3,4,5; Read Chapter 4, 15 of S. Keshav's book, and Chap 6, 13, Secs: 10.1/10.2 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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- "Switched" services offer the capability to "dial-up" a data service between two points
- Switched services usually offer distance-sensitive pricing plans just like T-carrier services
- Signaling and path-pinning is an important commonality between the "virtual-circuit" and "circuit-switched" network architectures
- The data-plane "labels" used in virtual circuits have a global meaning, I.e. they represent identifiers that can be interpreted in the same way by any node in the network

- □ QoS capabilities are mandatory in virtual-circuit based networks
- □ X.25 uses a connectionless packet-switching approach and does not nail down paths before transmitting data
- □ X.25 is an example of a heavyweight protocol design where similar functions are found in multiple layers.
- □ The internet architecture tends to “couple” a variety of protocol design issues (eg: combines QoS with routing with signaling etc)
- □ The difference between “connection-oriented” (eg: TCP) and “virtual circuit” (eg: frame relay or ATM) method is that the former only establishes an end-to-end state association, whereas the latter establishes state at nodes along the path.
- □ X.25’s link layer (LAP-B) is derived from HDLC
- □ X.25 uses LAP-B and ISDN uses LAP-D, both of which are derived from HDLC
- □ LAP-B uses the balanced configuration mode of HDLC where both nodes can act as a transmitter or receiver
- □ X.25 “sets-up” a link before transmitting packets similar to how telephony would “setup” an end-to-end circuit before transmitting
- □ Frame relay dramatically simplifies the link layer equivalent of X.25
- □ Frame relay & frame switching implement LAP-F control protocol at all nodes
- □ The PRI service of ISDN offers 128 kbps and a D-control channel
- □ ISDN, like SONET, offers both channelized and concatenated channels

- □ ISDN extends the concept of digital modulation, digital transmission and common channel signaling all the way to the home.
- □ X.25 and frame relay offer a significant cost advantage over leased lines, but offer reduced or no QoS guarantees; and a packet-switching service instead of a circuit-switching service
- □ Frame relay uses one control VC for all its data VCs; X.25 uses in-band control signaling leading to a complex frame format
- □ The CIR parameter of frame relay represents the maximum rate at which a user may transmit; all packets above this rate are dropped
- □ A user may transmit an unbounded number of simultaneous frames at the rate PIR.
- □ The DE bit if set does not guarantee that the packet will be dropped, but assigns it a higher effective drop probability during congestion
- □ The frame-relay receiver responds to FECN bit settings by reducing its transmission rate
- □ In BECN, an intermediate relay device could immediately inform the source about congestion rather than mark a bit on a forward-going packet.
- □ ATM networks were designed to offer the best of the two worlds of telephony (eg: reliability, QoS) and data networking (lower cost, flexibility, statistical multiplexing gains)
- □ ATM uses variable sized packets
- □ The 53-byte cell is an efficient way to packetize data
- □ The term UNI refers to the user-to-network interface
- □ PNNI is an example of a network-to-network interface protocol
- □ One of the important functions of AAL is segmentation-and-reassembly (SAR)
- □ ATM's HEC field serves dual-use as a cell-boundary-synchronization hook and for header error detection

- □ A signaling protocol fundamentally maps global addresses (and path specifications) to local labels (it may optionally reserve resources)
- □ An SVC is an example of an “on-demand” or “dial-up” virtual circuit, whereas a PVC is a more permanent VC.
- □ ATM switches swap incoming labels with outgoing labels on ATM cells (unlike IP routers which do not change the IP address fields on IP packets)
- □ Fixed sized cells tend to reduce average queuing delay in underloaded, bursty systems and also make it easier to build fast switches
- □ The CBR service is most useful for variable-bit-rate, adaptive data transport
- □ The key difference between GFR and UBR is that the former allows the minimum frame rates (instead of minimum cell rates) and emulates an equivalent of a frame-relay VC
- □ ABR provides a feedback-based traffic management feature that is not available in UBR
- □ In a signaled architecture, routing is used to guide the signaling call
- □ PNNI does not support QoS routing
- □ ATM uses a 20-byte global address during the signaling phase and 4-byte labels in the data-plane (I.e. in cells)
- □ Ethernet uses flat addresses whereas IP and ATM use hierarchical addressing
- □ Unlike IP routing ATM also allows peer-group IDs to be encoded within the ATM address
- □ Like IP, ATM uses hop-by-hop routing and avoids the use of source-routing
- □ A DTL is a stack-like mechanism to specify a source-route in PNNI

- □ A node at the lowest level of the PNNI hierarchy can see only the internal topology of the peer group it is in.
- □ Call admission control (CAC) is needed only if QoS is required
- □ Crank-back is a process where the signaling can backtrack to a prior node if CAC fails at a node
- □ ATM traffic management offers a combination of both open-loop and closed-loop mechanisms
- □ GCRA is implemented using leaky buckets and is an example of a traffic shaping method
- □ ATM inter-networking can happen at the link-layer (LANE), network layer (RFC 1577, MPOA, NHRP)
- □ A fundamental problem in IP-over-ATM inter-networking is how to do address resolution (I.e. IP address to ATM address mapping) and the answer is usually a server-based approach
- □ ATM LANE offers virtual LAN capabilities
- □ RFC 1577 specifies packet encapsulation and RFC 1483 specifies address resolution methods
- □ The problem with RFC 1577 LIS structure is that two hosts on the same ATM network, but different LIS'es will need to go through (a potentially slow) router to communicate
- □ NHRP allows servers to relay address-resolution across LIS'es
- □ MPOA attempts to integrate the benefits of LANE and NHRP
- □ MPLS solves both the data-plane and control-plane IP-over-ATM mapping woes by abandoning the overlay model in favor of a hybrid mapping model
- □ A key problem in traffic engineering is to define traffic aggregates and then map them to an explicitly setup path