

Answers to the mid-term examination on Introduction to the Internet

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1 Review questions

1. *What advantage does a circuit-switched network have over a packet-switched network? What advantage does TDM have over FDM in a circuit-switched network?*

A circuit-switched network can guarantee a certain amount of end-to-end bandwidth for the duration of the call. Most packet-switched networks today (including the internet) cannot make any end-to-end guarantees for bandwidth. In a circuit-switched network using TDM, an application can use the full bandwidth at periodical moments.

2. *Why is it that packet switching is said to employ statistical multiplexing? Contrast statistical multiplexing with the multiplexing that takes place in TDM.*

In a packet-switched network, the packets from different sources flowing into a link do not follow any fixed pattern, or route. This is why packet switching is said to employ statistical multiplexing. In case of TDM circuit switching, each host gets the same slot in a revolving TDM frame: this is completely predictable.

3. *What is meant by connection state information in a virtual circuit network?*

In a virtual circuit network, each packet switch keeps in memory some information (like a table translating interface numbers to virtual circuit numbers) about the virtual circuits passing through them.

4. *Suppose you are developing a standard for a new type of network. You need to decide whether your network will use VCs or datagram routing. What are the pros and cons for using VCs?*

The cons of VC's include

- the need to have a signaling protocol to set up and teardown the VCs;
- the need to maintain connection state in the packet switches.

The main advantage of VC networks is that they allow to guarantee an end-to-end delay.

5. *What are the advantages of message segmentation in packet-switched networks? What are the disadvantages?*

One advantage of message segmentation is that it allows for pipelined transmission over a series of links. Another advantage is that, without it, small messages would be stuck behind much bigger ones in routers. The main disadvantage is that message segmentation usually requires many headers, thus increasing the ratio control/data, thus reducing the end-to-end delay a bit.

6. *What is the key distinguishing difference between a tier-1 ISP (backbone) and a tier-2 ISP?*

A tier-1 ISP connects to all other tier-1 ISPs; a tier-2 ISP connects to only a few tier-1 ISPs. Also, a tier-2 ISP is a customer of one or more tier-1 ISPs.

7. *Is HFC bandwidth dedicated or shared among users? Are collisions possible in a downstream HFC channel?*

HFC bandwidth is shared among the users. On the downstream channel all the packets emanate from a single source, called the head end, so there are no collisions on this channel.

8. *Consider sending a series of packets from a sending host to a receiving host over a fixed route. List the delay components in the end-to-end delay for a single packet. Which of these delays are constant and which are variable?*

The delay components are nodal processing delays, transmission delays, propagation delays and queuing delays. Over a fixed route, all these delays are fixed, except the queuing delay, which is unpredictable.

9. *List five tasks that a protocol layer can perform. Is it possible that one (or more) of these tasks could be performed by two (or more) layers?*

Five generic tasks are error control, flow control, segmentation and reassembly, multiplexing and connections set-up. These tasks can be duplicated at different levels. For example, error control is often provided at more than one layer.