ï»¿# Review Questions for Intro to Networking

These are the weekly review questions.

## Outcomes

At the conclusion of this homework you will have covered the basic introduction to the internet and networking. You will be able to describe what an protocol is, what access networks are, what the network edge and core are, what packet switching, delay, protocols, and layered service models. These concepts are the building blocks of networking and being able to explain the functioning of the internet.

### Questions

There are twenty questions

1. Why are standards important for protocols?

i) Standards are important for protocols so that people can create networking systems and products that interoperate.

1. List four access technologies. Classify each one as home access, enterprise access, or wide-area wireless access.

i) Here are four access technologies classified by their typical usage:

1. Cable Modem: Home access

2. Fiber-optic Ethernet: Enterprise access

3. T1 Line: Enterprise access

4. 4G/5G Wireless: Wide-area wireless access

1. List the available residential access technologies in your city. For each type of access, provide the advertised downstream rate, upstream rate, and monthly price.

i) In most American cities, the current possibilities include: dial-up; DSL; cable modem; fiber-to-the-home.

1. What are the ranges of transmission rate for Ethernet LANs?

i) Ethernet LANs have transmission rates of 10 Mbps, 100 Mbps, 1 Gbps

1. What are some of the physical media that Ethernet can run over?

i) Today, Ethernet most commonly runs over twisted-pair copper wire. It also can run over fibers optic links.

1. HFC, DSL, and FTTH are all used for residential access. For each of these access technologies, provide a range of transmission rates and comment on whether the transmission rate is shared or dedicated.

i) Dial up modems: up to 56 Kbps, bandwidth is dedicated; ADSL: up to 24 Mbps downstream and 2.5 Mbps upstream, bandwidth is dedicated; HFC, rates up to 42.8 Mbps and upstream rates of up to 30.7 Mbps, bandwidth is shared. FTTH: 2-10Mbps upload; 10-20 Mbps download; bandwidth is not shared.

1. Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are R1 and R2, respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.)

i) At time to the sending host begins to transmit. At time t = L/R1, the sending host completes transmission and the entire packet is received at the router (no propagation delay). Because the router has the entire packet at time ti, it can begin to transmit the packet to the receiving host at time ti. At time t2 = t1 + L/R2, the router completes transmission and the entire packet is received at the receiving host (again, no propagation delay). Thus, the end-to-end delay is L/R1 + L/R2.

1. What advantage does a circuit-switched network have over a packet-switched network?

i) A circuit-switched network can guarantee a certain amount of end-to-end bandwidth for the duration of a call. Most packet-switched networks today (including the Internet) cannot make any end-to-end guarantees for bandwidth.

1. Suppose users share a 2 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20 percent of the time. Why will there be a queuing delay if three users transmit at the same time?

i) There will be a queuing delay when three users transmit at the same time because the total demand for the 2 Mbps link exceeds its capacity. Each user transmits at 1 Mbps, so when three users transmit simultaneously, they collectively require 3 Mbps of bandwidth (3 users x 1 Mbps each).

Since the link capacity is only 2 Mbps, there is an excess demand of 1 Mbps (3 Mbps demand - 2 Mbps capacity). This excess demand leads to a queue of data packets forming, waiting for their turn to be transmitted. This queue introduces a delay for the packets in the queue, resulting in queuing delay. The queuing delay occurs because the link cannot accommodate the simultaneous data transmission requests from all three users, so packets have to wait their turn, causing latency.

1. Why will two ISPs at the same level of the hierarchy often peer with each other? How does an IXP earn money?

i) If the two ISPs do not peer with each other, then when they send traffic to each other they have to send the traffic through a provider ISP (intermediary), to which they have to pay for carrying the traffic. By peering with each other directly, the two ISPs can reduce their payments to their provider ISPs. An Internet Exchange Points (IXP) (typically in a standalone building with its own switches) is a meeting point where multiple ISPS can connect and/or peer together. An ISP earns its money by charging each of the the ISPs that connect to the IXP a relatively small fee, which may depend on the amount of traffic sent to or received from the IXP.

1. Some content providers have created their own networks. Describe what motivates content providers, like Netflix and Google, to create these networks?

i) Googleâ€™s private network connects together all its data centers, big and small. Traffic between the Google data centers passes over its private network rather than over the public Internet. Many of these data centers are located in, or close to, lower tier ISPs. Therefore, when Google delivers content to a user, it often can bypass higher tier ISPs.

1. Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constant and which are variable?

i) The delay components are processing delays, transmission delays, propagation delays, and queuing delays. All of these delays are fixed, except for the queuing delays, which are variable.

1. What are the five layers in the Internet protocol stack?

i) The five layers in the Internet protocol stack are from top to bottom - the application layer, - the transport layer, the network layer, the link layer, and the physical layer.

1. Briefly explain the period: The Development of Packet Switching: 1961â€“1972

i) The period of "The Development of Packet Switching: 1961â€“1972" marks the crucial years when the concept and technology of packet switching were pioneered and refined. This approach to data transmission involves breaking information into small packets that can be sent independently across a network, leading to the foundation of the modern internet. Key milestones during this period include Paul Baran's work on distributed communication networks and the implementation of ARPANET, the precursor to today's internet.

1. Briefly explain the period: Proprietary Networks and Internetworking: 1972â€“1980

i) During the period of 1972 to 1980, known as the era of "Proprietary Networks and Internetworking," there was a significant shift in computer networking. Initially, most networks were proprietary, meaning they were designed and operated by individual organizations, often with unique protocols and technologies.

However, during this period, the concept of internetworking emerged. This involved the development of protocols and technologies that allowed different proprietary networks to communicate and share information with each other. Notably, the Transmission Control Protocol (TCP) and Internet Protocol (IP) were developed, forming the foundation of what we now know as the Internet.

1. Breifly explain the period: A Proliferation of Networks: 1980â€“1990

i) The period from 1980 to 1990, known as "A Proliferation of Networks," was marked by a rapid expansion of computer networks and the early development of what would become the modern internet. During this time, various network technologies, such as ARPANET, Ethernet, and the emergence of TCP/IP protocol, laid the foundation for connecting computers and enabling information exchange on a global scale. It was a crucial decade in the evolution of networking, setting the stage for the internet's explosive growth in the years that followed.

1. Breifly explain the period: The Internet Explosion: The 1990s

i) The 1990s marked the period of the "Internet Explosion." It was a time when the World Wide Web became accessible to the public, leading to a surge in internet usage, the creation of websites, and the development of online services. This era witnessed the rapid growth of technology companies like Amazon, Google, and the widespread adoption of email and web browsing, laying the foundation for the digital age we live in today.

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1. Which layers does a link-layer switch process?

i) Link layer switches process link and physical layers (layers 1 through2).

1. Breifly explain a distributed DoS (DDoS) attack?

i) A Distributed Denial of Service (DDoS) attack is a malicious attempt to disrupt the normal functioning of a network, service, or website by overwhelming it with a flood of traffic from multiple sources. Unlike a regular DoS attack, where a single source generates the traffic, a DDoS attack involves a network of compromised computers, often referred to as a "botnet," that coordinate their efforts to flood the target with an excessive volume of requests. This makes it much more challenging to defend against because the attack traffic comes from various locations, making it harder to filter out and mitigate. The goal of a DDoS attack is to make the targeted system or network unavailable to legitimate users, causing service disruptions or downtime.

## Deliverable

Download this template. In your local repo create a sub-folder named \*\*week-03\*\* under the \*\*itmo-540\*\* folder. Answer all the questions, placing your answers on the sub-bullet starting. Watch for spelling, grammar, and punctuation. Worth 10 points, .5 points per question.

Due on Wednesday the 13th 6:00 PM Central Standard Time.