Chapter 1 Review Questions

# SECTION 1.1

R1. What is the difference between a host and an end system? List several different types of end systems. Is a Web server an end system?

Answer.

Host là bất kỳ thiết bị nào có thể gửi và nhận dữ liệu thông qua network. Nó thường là thiết bị tính toán với địa chỉ IP và có thể chạy các ứng dụng. Nó bao gồm các thiết bị như máy tính, server, smartphone và các thiết bị IoT.

End system là các thiết bị biên của network mà đóng vai trò là nguồn hoặc đích của truyền tải dữ liệu. Nó là điểm mà dữ liệu đi vào hoặc đi ra khỏi network.

Tất cả các end system là host nhưng host chưa chắc là end system.

R2. The word protocol is often used to describe diplomatic relations. How does Wikipedia describe diplomatic protocol?

R3. Why are standards important for protocols?

Answer.

Các giao thức đảm bảo khả năng tương thích của các hệ thống và thiết bị khác nhau. Khi tuân thủ các tiêu chuẩn đó, các thiết bị mạng có thể giao tiếp hiệu quả với nhau bất kể nhà sản xuất hay công nghệ được sử dụng. Điều này giúp duy trì tính tương thích, độ tin cậy và trao đổi dữ liệu hiệu quả.

# SECTION 1.2

R4. List four access technologies. Classify each one as home access, enterprise access, or wide-area wireless access.

Answer.

DSL (Digital Subscribe Line):

Classify: home access

Dùng để cung cấp internet tốc độ cao qua đường dây điện thoại

Ethernet:

Classify: enterprise access

Thường dùng ở các công ty, cung cấp mạng cục bộ tốc độ cao.

Fiber-to-the-Home (FTTH):

Classify: home access

4G/5G

Classify: Wide-arena wireless access

Cung cấp mạng di động

R5. Is HFC transmission rate dedicated or shared among users? Are collisions possible in a downstream HFC channel? Why or why not?

R6. List the available residential access technologies in your city. For each type of access, provide the advertised downstream rate, upstream rate, and monthly price.

R7. What is the transmission rate of Ethernet LANs?

R8. What are some of the physical media that Ethernet can run over?

R9. 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.

R10. Describe the most popular wireless Internet access technologies today. Compare and contrast them.

# SECTION 1.3

R11. 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.)  
Answer.

Transmission delay from sending host to switch: L/R1

Transmission delay from switch to receiving host: L/R2

Total end-to-end delay: L/R1 + L/R2

R12. What advantage does a circuit-switched network have over a packet-switched network? What advantages does TDM have over FDM in a circuit-switched network?

Answer.

Circuit-switched network cung cấp đường trường cố định nên đảm bảo băng thông và không bị nhiễu bởi người dùng khác, độ trễ có thể dự đoán và kết nối luôn ổn định cho đến khi ngắt kết nối.

TDM chia thời gian thành các slot, cho phép nhiều tín hiệu dùng chung kênh mà không chồng chéo, dễ đồng bộ nhưng cần bọ lọc và quản lý tần số.

R13. 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. (See the discussion of statistical multiplexing in Section 1.3.)

1. When circuit switching is used, how many users can be supported?

Đường truyền 2 Mbps, 1 người dùng 1 Mbps => có thể hỗ trợ 2 người một lúc.

1. For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queuing delay before the link if two or fewer users transmit at the same time? Why will there be a queuing delay if three users transmit at the same time?

Nếu có 2 hoặc ít hơn 2 người dùng cùng lúc thì băng thông nhỏ hơn hoặc bằng 2 Mbps, nếu có thêm 1 người dùng thì tổng băng thông cần là 3 Mbps, vượt quá băng thông mà đường truyền cung cấp, do đó sẽ có độ trễ hàng đợi.

c. Find the probability that a given user is transmitting.

d. Suppose now there are three users. Find the probability that at any given time, all three users are transmitting simultaneously. Find the fraction of time during which the queue grows.

Xác suất cả 3 người truyền 1 lúc : P = 0.2 \* 0.2 \* 0.2 = 0.008

R14. Why will two ISPs at the same level of the hierarchy often peer with each other? How does an IXP earn money?

R15. Some content providers have created their own networks. Describe Google’s network. What motivates content providers to create these networks?

# SECTION 1.4

R16. 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?

Answer.

Transmission delay: thời gian gửi toàn bộ gói tin qua một link

Processing delay: thời gian thiết bị cần để xử lý gói tin (kiểm tra tiêu đề, định tuyến)

Propagation delay: thời gian gói tin cần để di chuyển từ điểm này đến điểm khác trên đường link

Queuing delay: thời gian gói tin chờ trong hàng đợi tại router trước khi được xử lý -> biến đổi

R17. Visit the Transmission Versus Propagation Delay interactive animation at the companion Web site. Among the rates, propagation delay, and packet sizes available, find a combination for which the sender finishes transmitting before the first bit of the packet reaches the receiver. Find another combination for which the first bit of the packet reaches the receiver before the sender finishes transmitting.

R18. How long does it take a packet of length 1,000 bytes to propagate over a link of distance 2,500 km, propagation speed 2.5 # 108 m/s, and transmission rate 2 Mbps? More generally, how long does it take a packet of length L to propagate over a link of distance d, propagation speed s, and transmission rate R bps? Does this delay depend on packet length? Does this delay depend on the transmission rate?

Answer.

Độ dài gói tin = 1000 bytes = 8000 bits

Transmission rate R = 2.000.000 bits per second

Propagation speed s = 250.000.000 meters per second

Distance d = 2.500.000 meters

Propagation delay = distance / propagation speed = 0.01 seconds

Transmission delay = độ dài gói / transmission rate = 0.004 seconds

Tổng thời gian trễ = 0.01 + 0.004 = 0.014 seconds

R19. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1 = 500 Kbps, R2 = 2 Mbps, and R3 = 1 Mbps.

1. Assuming no other traffic in the network, what is the throughput for the file transfer?

Thông lượng của đường truyền có nhiều link sẽ bị giới hạn bởi link có tốc độ truyền nhỏ nhất (bottle neck), do đó thông lượng của truyền tải file là min(R1, R2, R3) = 500 Kbps.

1. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

4 triệu bytes = 32 \* 10^6 bits

Throughput = 500 Kbps = 500 \* 10^3 bits per second

Thời gian truyền = (32 \* 10^6) \ (500 \* 10^3) = 64 seconds

1. Repeat (a) and (b), but now with R2 reduced to 100 Kbps.

R2 giảm còn 100 Kbps, khi đó throughput = 100 Kbps = 100 \* 10^3 bits per second

Thời gian truyền = (32 \* 10^6) \ (100\* 10^3) = 320 seconds

R20. Suppose end system A wants to send a large file to end system B. At a very high level, describe how end system A creates packets from the file. When one of these packets arrives to a router, what information in the packet does the router use to determine the link onto which the packet is forwarded? Why is packet switching on the Internet analogous to driving from one city to another and asking for directions along the way?

R21. Visit the Queuing and Loss interactive animation at the companion Web site. What is the maximum emission rate and the minimum transmission rate? With those rates, what is the traffic intensity? Run the interactive animation with these rates and determine how long it takes for packet loss to occur. Then repeat the experiment a second time and determine again how long it takes for packet loss to occur. Are the values different? Why or why not?

# SECTION 1.5

R22. List five tasks that a layer can perform. Is it possible that one (or more) of these tasks could be performed by two (or more) layers?

R23. What are the five layers in the Internet protocol stack? What are the principal responsibilities of each of these layers?

R24. What is an application-layer message? A transport-layer segment? A network-layer datagram? A link-layer frame?

R25. Which layers in the Internet protocol stack does a router process? Which layers does a link-layer switch process? Which layers does a host process?

# SECTION 1.6

R26. What is self-replicating malware?

R27. Describe how a botnet can be created and how it can be used for a DDoS attack.

R28. Suppose Alice and Bob are sending packets to each other over a computer network. Suppose Trudy positions herself in the network so that she can capture all the packets sent by Alice and send whatever she wants to Bob; she can also capture all the packets sent by Bob and send whatever she wants to Alice. List some of the malicious things Trudy can do from this position.