

Electronic Commerce, 12th Edition

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Chapter 2 Solutions

Review Questions

1. What is an internet (small “i”)?

Answer: An internet (small “i”) is a group of computer networks that have been interconnected. In fact, “internet” is short for “interconnected network.”

2. Why did the U.S. Department of Defense undertake the research project that would become the Internet?

Answer: In the early 1960s, the U.S. Department of Defense became concerned about the possible effects of nuclear attack on its computing facilities so they began examining ways to connect these computers to each other and also to connect them to weapons installations distributed all over the world. The goal of this research was to design a worldwide network that could remain operational, even if part of the network were destroyed by enemy military action or sabotage. The researchers determined that the best path to accomplishing their goals was to create networks that did not require a central computer to control network operations.

3. What were Bitnet and Janet?

Answer: Bitnet was an independent academic research network developed in the 1980s. Janet is the United Kingdom’s academic research network.

4. On the Internet, what is the function of a network access point?

Answer: Network access points provide the primary connection points for access to the Internet backbone in the United States.

5. Briefly describe one example of how the Internet of Things might be used to reduce costs or increase efficiency in a business.

Answer: Answers will vary but could include examples such as:

- Coca-Cola added Internet-connected voice recognition devices to its inventory control, shipping, and service support systems, saving millions and improving order accuracy
- Many utility companies, such as BC Hydro, an electric utility in British Columbia, Canada, uses Internet-connected smart electric meters and remote

- monitoring devices to manage and measure the flow of electricity
- Argentine bank Banco de Cordoba used the Internet to connect 2600 video cameras, a new network, and digital signs located in 243 branch locations to its central control and security system
 - SK Solutions, a provider of construction safety services in Dubai, uses Internet-connected sensors that continually monitor the weight, position, movement, and inertia of machinery and equipment along with ambient wind speed and temperature to give its customers increased worker safety, faster project completions, and reduced downtime
 - The Rio Tinto coal mining operation in Western Australia uses Internet-connected control systems to operate a fleet of 54 autonomous trucks, an autonomous railway system, and drilling operations, removing safety hazards to the surrounding community and reducing risky work conditions for employees.

6. What is a border router?

Answer: A border router is a computer located at an organization's point of connection to the Internet that decides the best path on which to forward each packet of information as it travels on the Internet to its destination. Synonymous with gateway computer and gateway router.

7. What are the key elements of a private network?

Answer: A private network is a leased-line connection between two companies that physically connects their computers and/or networks to one another. The key elements include the leased-line and the computers.

8. What is a protocol?

Answer: A protocol is a collection of rules for formatting, ordering, and error-checking data sent across a network.

9. Briefly describe what the TCP/IP protocol does for the Internet.

Answer: The TCP/IP protocol provides the basis for the operation of the Internet. The TCP controls the disassembly of a message or a file into packets before it is transmitted over the Internet, and it controls the reassembly of those packets into their original formats when they reach their destinations. The IP specifies the addressing details for each packet, labeling each with the packet's origination and destination addresses.

10. Why was it necessary for the Internet to adopt IPv6?

Answer: In the early days of the Internet, the 4 billion addresses provided by the IPv4 rules certainly seemed to be more addresses than an experimental research network

would ever need. However, the worldwide growth in the number of mobile devices and the Internet of Things has consumed existing IPv4 addresses much faster than anyone had predicted and the last available IPv4 addresses were allocated in the summer of 2015. Thus, the necessity for IPv6. The number of available addresses in IPv6 is 34 followed by 37 zeros—billions of times larger than the address space of IPv4.

11. Briefly describe the function of Web browser software.

Answer: Web browser software is software that lets users read HTML documents and move from one HTML document to another using hyperlinks. Web browser software sends requests for Web page files to other computers, which are called Web servers. The Web server software receives requests from many different Web clients and responds by sending files back to those Web client computers. Each Web client computer's Web browser software then renders those files into a Web page. Examples of popular Web browser software include Google Chrome, Microsoft Internet Explorer, and Mozilla Firefox.

12. What is a Uniform Resource Locator?

Answer: The combination of the protocol name and the domain name is called a Uniform Resource Locator (URL). It contains the protocol used to access the page and the page's location. Used in place of dotted quad notations.

13. In what ways does an HTML document differ from a word-processing document?

Answer: An HTML document differs from a word-processing document in that it does not specify how a particular text element will appear. For example, you might use word processing software to create a document heading by setting the heading text font to Arial, its font size to 14 points, and its position to centered. The document displays these exact settings whenever you open the document in that word processor. In contrast, an HTML document simply includes a heading tag with the heading text. Many different browser programs can read an HTML document. Each program recognizes the heading tag and displays the text in whatever manner each program normally displays headings.

14. Briefly explain how the deep Web contains hidden information.

Answer: The deep Web is information that is stored in databases and is accessible to users through Web interfaces. The deep Web can be difficult or impossible to search because its information is not stored on the Web, but in databases that provide results only when a user requests specific information through the Web site that maintains the database. Available data that is never requested remains hidden.

15. Describe, in general, the function of HTML tags.

Answer: The tags in an HTML document are interpreted by the Web browser and used by it to format the display of the text enclosed by the tags. In HTML, the tags are enclosed in angle brackets (<>).

16. Describe, in general, the function of XML tags.

Answer: Unlike HTML, XML is not a markup language with defined tags. It is a framework within which individuals, companies, and other organizations can create their own sets of tags. Therefore, XML tags do not specify how text appears on a Web page. The tags convey the meaning (the semantics) of the information included within them.

17. What is bandwidth and why do people often think of it as a measure of connection speed?

Answer: Bandwidth is the amount of data that can be transmitted in a fixed amount of time. The higher the bandwidth, the more data can be transmitted in each second and the faster Web pages appear on your screen; this is probably why it is thought of as a measure of connection speed. Each connection option offers different bandwidths, and each ISP offers varying bandwidths for each connection option.

18. List the Internet connection options that might be suitable for a small business in an urban location with five employees.

Answer: A DS0 leased digital line or a fixed-point wireless connection would probably be suitable in this situation.

19. What is the main function of a wireless access point?

Answer: The main function of a wireless access point (WAP) is to transmit network packets between Wi-Fi-equipped computers and other devices that are within its range.

20. What is roaming?

Answer: Roaming is the shifting of Wi-Fi devices from one WAP to another without requiring intervention by the user.

21. What is mesh routing?

Answer: Mesh routing is a version of fixed-point wireless that directly transmits Wi-Fi packets through hundreds of short-range transceivers that are located close to each other.

22. Briefly describe the goals of the Internet2 project.

Answer: Internet2 is focused on technology development. As an experimental test bed for new networking technologies that is separate from the original Internet, Internet2 serves as a proving ground for new technologies and applications of those technologies that will eventually find their way to the Internet.

23. List some commercial applications that have emerged from the Semantic Web research project.

Answer: Web browser software is software that lets users read HTML documents and move from one HTML document to another using hyperlinks. Web browser software sends requests for Web page files to other computers, which are called Web servers. The Web server software receives requests from many different Web clients and responds by sending files back to those Web client computers. Each Web client computer's Web browser software then renders those files into a Web page. Examples of popular Web browser software include Google Chrome, Microsoft Internet Explorer, and Mozilla Firefox.

Exercises

1. In a paragraph or two, evaluate the NSF's 1989 decision to introduce limited commercial activity on the Defense Department network that would eventually become the Internet.

Answer: In 1989, the NSF permitted two commercial e-mail services, MCI Mail and CompuServe, to establish limited connections to the Internet for the sole purpose of exchanging e-mail transmissions with users of the Internet. These connections allowed commercial enterprises to send e-mail directly to Internet addresses, and allowed members of the research and education communities on the Internet to send e-mail directly to MCI Mail and CompuServe addresses. The NSF justified this limited commercial use of the Internet as a service that would primarily benefit the Internet's noncommercial users. As the 1990s began, people from all walks of life—not just scientists or academic researchers—started thinking of these networks as the global resource that we now know as the Internet.

2. In about 100 words, outline the advantages and disadvantages of using circuit-switched and packet-switched networks to transmit data.

Answer: Responses will vary. Students could mention that circuit-switching is simple and intuitive and usually once the connection is established performance can be guaranteed. On the downside, a break in any one of the connected circuits causes the circuit to be interrupted and data to be lost. With packet switching files and messages are broken into packets which travel from computer to computer along the interconnected networks until they reach their destinations; a dedicated circuit is not needed. If any packets are missing, the destination computer can request that the transmission be resent so it can reconstruct the sent file or message. The main

disadvantage here is that on the receiving end the packets need to be reassembled.

3. In about 100 words, briefly describe the function of each type of router that might exist in an interconnected network.

Answer: There are border routers, also known as edge routers, are located at an organization's point of connection to the Internet that decide the best path on which to forward each packet of information as it travels on the Internet to its destination. Synonymous with gateway computer and gateway router. Backbone routers handle packet traffic along the Internet's main connecting points; they can each handle more than 50 million packets per second. Other routers used might be routers that are inside the WANs and LANs or the routers that connect them to each other within the organization.

4. In a paragraph or two, describe how a VPN maintains security over data transmitted through it.

Answer: A virtual private network (VPN) is a connection that uses public networks and their protocols to send data in a way that protects the data as well as a private network would, but at a lower cost. IP tunneling creates a private passageway through the public Internet that provides secure transmission from one computer to another. The passageway is created by VPN software that encrypts the packet content and then places the encrypted packets inside another packet in a process called encapsulation. The computer that receives the packet unwraps it and decrypts the message using VPN software that is the same as, or is compatible with, the VPN software used to encrypt and encapsulate the packet at the sending end.

5. In a paragraph, briefly explain the differences between closed and open architectures; then, in an additional two or three paragraphs, outline the reasons an open architecture was chosen for the Internet.

Answer: The first packet-switched network, the ARPANET, connected only a few universities and research centers. Following its inception in 1969, this experimental network grew during the next few years and began using the Network Control Protocol (NCP). In the early days of computing, each computer manufacturer created its own protocol, so computers made by different manufacturers could not be connected to each other. This practice was called proprietary architecture or closed architecture. NCP was designed so it could be used by any computer manufacturer and was made available to any company that wanted it. This open architecture philosophy that was developed for the evolving ARPANET, included the use of a common protocol for all computers connected to the Internet and four key rules for message handling:

- Independent networks should not require any internal changes to be connected to the network.
- Packets that do not arrive at their destinations must be retransmitted from their source network.

- Router computers act as receive-and-forward devices; they do not retain information about the packets that they handle.
- No global control exists over the network.

The open architecture approach has contributed to the success of the Internet because computers manufactured by different companies (Apple, Dell, Hewlett-Packard, and so on) can be interconnected.

6. In about 100 words, explain why the IMAP e-mail protocol is better than the POP e-mail protocol.

Answer: IMAP performs the same basic functions as POP, but includes additional features. For example, IMAP can instruct the e-mail server to send only selected e-mail messages to the client instead of all messages. IMAP also allows the user to view only the header and the e-mail sender's name before deciding to download the entire message, which avoids the POP requirement that users download e-mail messages to their computers before they can search, read, forward, delete, or reply to those messages.

IMAP lets users create and manipulate e-mail folders and individual messages while the messages are still on the e-mail server; the user doesn't need to download e-mail before working with it. This also allows users to access e-mail from any computer, which is important to people who access their e-mail from different computers at different times.

7. In a paragraph or two, explain why the Web is often described as having a client/server architecture.

Answer: The Web is software that runs on computers that are connected to each other through the Internet. Web client computers run software called Web client software or Web browser software. Web browser software sends requests for Web page files to other computers, which are called Web servers. A Web server computer runs software called Web server software. Web server software receives requests from many different Web clients and responds by sending files back to those Web client computers. Each Web client computer's Web client software renders those files into a Web page. This combination of client computers running Web client software and server computers running Web server software is an example of a client/server architecture.

8. In a paragraph or two, explain how Vannevar Bush's idea of a Memex machine presaged the Web.

Answer: In 1945, Vannevar Bush, who was director of the U.S. Office of Scientific Research and Development, wrote an article in *The Atlantic Monthly* about ways that scientists could apply the skills they learned during World War II to peacetime

activities. Bush speculated that engineers would eventually build a machine that he called the Memex, a memory extension device that would store all of a person's books, records, letters, and research results on microfilm. Bush's Memex would include mechanical aids such as microfilm readers and indexes that would help users quickly and flexibly consult their collected knowledge.

9. In about 100 words, explain how top-level Web domain names are proposed and approved.

Answer: Since 1998, ICANN has had the responsibility of managing domain names and coordinating them with the IP address registrars. ICANN is also responsible for setting standards for the router computers that make up the Internet. Since taking over these responsibilities, ICANN has added a number of new TLDs. Some of these TLDs are generic top-level domains (gTLDs), which are available to specified categories of users. ICANN is itself responsible for the maintenance of gTLDs.

Other new domains are sponsored top-level domains (sTLDs), which are TLDs for which an organization other than ICANN is responsible. The sponsor of a specific sTLD must be a recognized institution that has expertise regarding and is familiar with the community that uses the sTLD. For example, the .aero sTLD is sponsored by SITA, an air transport industry association. Individual countries are permitted to maintain their own TLDs, which their residents can use alone or in combination with other TLDs.

Although ICANN has always chosen new gTLDs after much deliberation and careful consideration, many people have been highly critical of the selections. In 2011, ICANN decided to stop managing the addition of new gTLDs so tightly. Since 2012, individuals and businesses have been able to petition for just about any TLD they would like to have.

10. In two or three paragraphs, explain the hyperlinked structure of the Web and why it is important.

Answer: In 1989, Tim Berners-Lee was trying to improve the laboratory research document handling procedures for his employer, CERN. CERN had been connected to the Internet for two years, but its scientists wanted to find better ways to circulate their scientific papers and data among the high-energy physics research community throughout the world. Berners-Lee proposed and developed the code for a hypertext server program and made it available on the Internet. He called his system of hyperlinked HTML documents the World Wide Web. The Web caught on quickly in the scientific research community, but few people outside that community had software that could read the HTML documents. In 1993, a team of students led by Marc Andreessen at the University of Illinois wrote Mosaic, the first GUI program that could read HTML and use HTML hyperlinks to navigate from page to page on computers anywhere on the Internet. Mosaic was the first Web browser that became widely available for personal computers, and some Web surfers still use it

today.

Programmers quickly realized that a system of pages connected by hypertext links would provide many new Internet users with an easy way to access information on the Internet. Businesses recognized the profit-making potential offered by a worldwide network of easy-to-use computers. In 1994, Andreessen and other members of the Mosaic team joined with James Clark of Silicon Graphics to found Netscape Communications. Its first product, the Netscape Navigator Web browser program based on Mosaic, was an instant success. Netscape became one of the fastest-growing software companies ever. Microsoft created its Internet Explorer Web browser and entered the market soon after Netscape's success became apparent. Internet Explorer and Mozilla Firefox, a descendant of Netscape Navigator, are still widely used along with Web browsers such as Google's Chrome and Apple's Safari.

The number of Web sites has grown even more rapidly than the Internet itself. The number of Web sites is currently estimated at more than 800 million, and individual Web pages likely number more than a trillion (each Web site might include hundreds or even thousands of individual Web pages). Figure 2-3 shows the overall rapid growth rate of the Web. Noteworthy is the increase from 2010 to 2011, a year in which the number of Web sites doubled. This growth was driven in part by the large number of new Web sites opening in developing countries, primarily in Asia and Eastern Europe.

11. HTML and XML are both markup languages, but they have very different objectives. In about 100 words, describe the objectives of each and provide at least one example of when using XML would be preferable to using HTML.

Answer: HTML was derived from the more generic meta language SGML. HTML defines the structure and content of Web pages using markup symbols called tags. Over time, HTML has evolved to include a large number of tags that accommodate graphics, CSS, and other page elements.

XML is also derived from SGML, but differs from HTML in two important respects. First, XML is not a markup language with defined tags. It is a framework within which individuals, companies, and other organizations can create their own sets of tags. Second, XML tags do not specify how text appears on a Web page; the tags convey the meaning of the information included within them.

A company that sells products on the Web might have Web pages that contain descriptions and photos of the products it sells. The Web pages are marked up with HTML tags, but the product information elements themselves, such as prices, identification numbers, and quantities on hand, are marked up with XML tags.

12. In about 100 words, describe two or three situations (business or personal) in which you might find a personal area network to be useful.

Answer: Answers will vary. Some examples might include:

- Print to a local Bluetooth-enabled printer without logging into the network
- Play video files that are stored on a laptop on the nearby television

Cases

C1. Internet Access in Hyderabad

1. Responses will vary. The most obvious implication of low Internet access is the creation of a digital divide. That is, the citizens of Hyderabad will not have access to information, goods, and services that are accessible through this technology and will therefore not be able to compete effectively in the world economy.

2. Trends in the growth of Internet-capable phones are as follows:

- *Smartphone penetration in India is expected to grow to 520 million by 2020, making India one of the largest smartphone economies in the world.*
- *Broadband penetration will increase from 14% today to 40% by 2020.*
- *The next wave of growth in India's internet penetration is expected to come from tier II and tier III cities, where wireless mobile internet shall play a pivotal role thus enabling the growth of vernacular and regional content.*

Source: [http://www.ey.com/Publication/vwLUAssets/ey-future-of-digital-january-2016/\\$FILE/ey-future-of-digital-january-2016.pdf](http://www.ey.com/Publication/vwLUAssets/ey-future-of-digital-january-2016/$FILE/ey-future-of-digital-january-2016.pdf)

3. Responses will vary. The government of Hyderabad could consider developing:

- Broadband connections
 - High speed DSL
- Wireless connections
 - Personal area networks
 - Wireless Ethernet (Wi-Fi)
 - Mobile telephone networks

C2. Quick Fix Repair Systems

1. Answers will vary. Remote access solutions worth considering include:

- Virtual private network (VPN)
- Cloud based remote access service

2. Student responses will vary. Two options for connecting a smartphone include the use of remote desktop apps and cloud storage.

3. Responses will vary. The Nest Learning Thermostat is a sensor-driven, Wi-Fi enabled, self-learning programmable thermostat. The tools required to repair this device include a universal driver adapter, inspection scope, anti-static mat, frictionless ratchet, and an iFixit lock pick set.