Business Data Communications

Student manual containing end-of-chapter questions

This document has been created for the convenience of students who use word processors to work on their assignments. All the end of chapter Review Questions have been provided here. It is hoped that students will find this handy and save them the trouble of having to type the questions in, or to turn in assignments without the questions written down, which makes it very difficult for the instructor to grade the assignments.

Figure : Bloom’s taxonomy



All chapters have four kinds of questions. These questions are designed to give students the opportunity to learn the chapter material more effectively. The format has been motivated by Bloom’s taxonomy,[[1]](#footnote-1) which is shown in Figure 1. Learning is believed to be classified into levels with recall at the lowest layer and increasingly complex and abstract mental levels at higher layers. The challenge is that while most school work requires learning at the *remembering* level, most professional work requires sustained performance at the *evaluating* and *creating* levels.

The review questions at the end of chapter help students develop a base of knowledge at the *remembering* level. The hands-on exercises help students learn at the *understanding* and *applying* levels. The example case in each chapter is intended to facilitate *applying* and *analyzing*. The critical thinking questions are intended to facilitate learning at the evaluating level. Finally, the IT infrastructure design case promotes *evaluation* and *creation*.

The questions do take time to answer. The hands-on exercises and IT infrastructure design cases in particular, can be significantly time consuming. But most students express a strong desire for hands-on activities and fortunately, a lot of information about computer networks can be gathered using simple utilities available on every personal computer. I believe that the time invested in completing these end-of-chapter exercises will be well rewarded at the time of job interviews and in the workplace.

# IT infrastructure design case – data and images icons

An IT infrastructure design case runs throughout the text. The case gives you the opportunity to apply the technologies covered in each chapter to build out a network for a multi-national company. Included here is information about the firm (also provided in chapter 1 of the text) and icons that you can use if you choose to create the design in Word. If you prefer to use Visio, there is also a Visio document available on the companion website with these icons and background. <Your town> refers to the city you live in. While designing the network, please feel free to locate the headquarters of the company near your city.

Table 1: TrendyWidgets office locations and staffing

|  |  |
| --- | --- |
|  *<Your town> - United States** Building #1 with 4 floors, 300 employees: with 100 employees per floor on the first three floors and a lights-out data center on the fourth floor
* Each floor has a dimension of 100 feet X 150 feet with a telecommunications closet located near the center of each floor.
* The two lower floors of this building are used for producing widgets.
* The third floor has various corporate offices for HR, Finance, IT, and Marketing departments.
* Data center hosts data from payroll, accounting, production, and other corporate functions.
* The corporate website is also hosted here.
 | *Amsterdam, The Netherlands** Building #1 with 2 floors, 100 employees on the first floor
* The first floor of this building houses a service center for the EMEA (Europe, Middle-East and Africa) region.
* The firm’s backup database is located on the second floor of the building.
 |
| *Mumbai, India** Building #1 with 2 floors, 200 employees: 100 employees on each floor
* The building houses the company’s primary call center, operating 24 hours a day.
 |
| *Singapore, Singapore** Building #1 with 3 floors, 200 employees: with 100 employees on the first floor and 50 employees each on the other two floors
* The first floor is used by the marketing group for the AP (Asia-Pacific) region. The other two floors house a service center for the AP region.
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Figure 2: IT infrastructure design icons and map

|  |  |
| --- | --- |
|  | call.PNG |
| router.PNG | wan.PNG |
| server.PNG | emea.PNG |
| ap.PNG | firewall.PNG |
| database.PNG | ethernet.PNG |





# Chapter 1 - Introduction

## Review questions

1. What is business data communications?

< these spaces are for your answers>

1. What are some of the ways in which computer networks are used in large businesses?
2. What are some of the ways in which small businesses can benefit from computer networks?
3. Look at the websites of some departments of your county government. What three services offered at these sites do you find most interesting?
4. Describe how the three online government services you chose could be helpful to you.
5. Describe the major trends in the growth of Internet traffic.
6. What is packetization?
7. Why is packetization useful in business data communication?
8. What are some of the factors that make packet switching more complex technologically than traditional phone circuits (circuit switching)?
9. Provide a high-level overview of the structure of a typical data packet. What are the kinds of information you are likely to find in the header of a typical packet?
10. Consider a typical office memo as a data packet. What information in the memo would be characterized as header information? What information would be characterized as the body of the packet?
11. Why is Internet traffic considered “bursty” compared to voice traffic?
12. What is layering?
13. Why is layering useful in organizations?
14. Why is layering useful in computer networking?
15. What are the five layers of the TCP/ IP model?
16. What are the primary functions of each layer in the TCP/ IP model?
17. TCP is often considered the most important layer of the TCP/ IP model. What are the primary responsibilities of TCP?
18. What devices does a packet typically encounter in its journey from source to destination?
19. What is the OSI model? What was the motivation for the development of the OSI model?
20. How has the OSI model been useful in the development of computer networks?
21. What are the seven layers of the OSI model?
22. What are the primary functions of each of the seven layers of the OSI model?
23. The packets used to transmit voice on the Internet are similar to the packets that are used to send email. What are some of the advantages of this approach?
24. What are the two design principles behind Internet protocols?

# Chapter 2 – Physical layer

## Review questions

1. What is the ATIS telecom glossary? How can it be useful to you?
2. What is the primary responsibility of the physical layer in data communication?
3. Define physical medium in the context of computer networking. What are the common physical media used in computer networks?
4. What properties are required for a material to be suitable for use as a physical medium in computer networks?
5. What is UTP? Why is the copper cable commonly used in computer networks called UTP?
6. What are the common categories of copper cable used in networks? Under what conditions would you prefer to use each category of cable?
7. What factors favor the use of optical fiber as a physical medium over copper?
8. What is total internal reflection? How does it help optical fiber transmit light signals efficiently?
9. What are the two categories of optical fiber? Under what conditions is each category preferred?
10. What are the components of optical fiber? What is the role of each component?
11. Define data.
12. Define signal.
13. What is the need to convert data to signals?
14. What are the properties of a good signal?
15. What is modulation? How does modulation help in data transmission?
16. What is amplitude modulation?
17. How does noise affect signals? What happens if the level of noise becomes too high relative to the strength of the signal?
18. Given a communication channel with a bandwidth of 3,000Hz, and a signal to noise ratio of 1,000. Use Shannon’s theorem to calculate the maximum data rate that can be supported by this channel. (this is close to the traditional phone line)
19. Why is binary representation preferred in computers over common representations such as decimal?
20. Briefly describe the standard procedure used by the physical layer to send and receive data as a signal.
21. What is the ASCII code? Why is it useful in data communication? What is the ASCII code for the letter a? For the letter A?
22. What is multiplexing?
23. What are some examples of multiplexing in day-to-day life?
24. Describe how the interstate system may be seen as a multiplexed transportation system.
25. What are the two categories of multiplexing?

# Chapter 3 – Data link layer

## Review questions

1. What are the primary functions of the data-link layer?
2. Ethernet is the most popular end-user technology at the data-link layer. What is ether in the context of computer networking?
3. What are the components of a typical Ethernet? What are the functions of each component?
4. What is broadcast in the context of Ethernet?
5. What are the advantages of broadcasting data in Ethernet? What are some other examples of communication in day-to-day life that use broadcast?
6. What are the limitations of broadcast as a method of sending data to the intended receiver of communication?
7. What is carrier sensing in Ethernet? What is multiple access? What is a collision and what is collision detection? How are collisions detected in Ethernet?
8. Describe some techniques you have used in the past to ensure error-free communication over the telephone.
9. Provide a lay person’s overview of CRC.
10. Why is CRC preferred over simpler computational techniques?
11. With a divisor of 1101, perform the sender-side computation and calculate the CRC when the data is 1001010.
12. Check your computation by performing the receiver-side computation.
13. What is the size of the smallest Ethernet frame? The largest frame?
14. List the fields in the Ethernet header. What are the roles of each of these fields?
15. The start-of-frame and preamble fields are unique to the data-link layer in that they do not carry any useful information. What is the role of these fields?
16. The SFD field alerts the receiver about the beginning of a data frame. How does the receiver know when the frame ends?
17. What is the structure of a MAC address? What information can be gathered from a MAC address?
18. What is the MAC address of your computer? You can get this information by typing ipconfig /all in Windows, or ifconfig on mac/ linux.
19. What is the hexadecimal notation? How is the number 14 represented in hexadecimal?
20. Write the binary number 01010000 in hex (hint: break the number into two four-bit blocks and represent each four-bit block in hexadecimal notation).
21. What are hubs?
22. What are switches?
23. What are the advantages of switches over hubs in Ethernets? Under what conditions may you prefer to use a hub instead of a switch?
24. What is the spanning tree protocol? What is it used for?
25. What are the common data transfer speeds in Ethernet? What is the maximum possible speed of the network card on your computer? In Windows, you can right-click on the network adapter to check its speed (Control panel → Network connections → <select adapter>)

# Chapter 4 – Network layer

## Review questions

1. Briefly describe routing — the primary function of the network layer.
2. How are IP addresses similar to MAC addresses? In what ways are the two addresses different?
3. What is the need for a computer address at the IP layer when computers also have a MAC address?
4. What are the advantages of designing the Internet in such a way that specialized devices called routers handle all the details of routing? What may be the possible disadvantages?
5. What are the advantages of designing IP as a best-effort protocol?
6. What are RFCs? Read RFC 791 that defines IP, and briefly describe one thing in the RFC that caught your attention? (this is not a trick question, just a way for you to express what you personally found interesting)
7. Which, in your opinion, are the three most important fields in the IP header? Briefly describe the functions of these fields.
8. What is the need for the time-to-live field in the IP header?
9. What is the size of the largest possible IP packet?
10. How many objects can be uniquely labeled with 10-bit address labels?
11. You wish to assign unique labels to 200 objects using binary numbers. What is the minimum number of bits needed?
12. How would you represent 217 in binary? 168?
13. What decimal number does the binary number 10001101 represent? 11011001?
14. What is dotted decimal notation?
15. What information is conveyed by each part of a two-part IP address?
16. How are the 32 bits of an IP address organized in a typical large network?
17. Find the IP addresses of any five department websites at your school. Do you observe any patterns in the IP addresses of the websites? (You can find the IP addresses for URLs in many ways. Many websites will give you the IP address if you provide a URL. An example is http://www.selfseo.com/find\_ip\_address\_of\_a\_website.php. Alternately, you can open a command prompt or terminal window and type in nslookup <URL>, for example, nslookup [www.msu.edu](http://www.msu.edu).)
18. In what way are the 32 bits of an IP address organized similarly to the 10 digits of phone numbers? In what way are they different?
19. What were the three address classes in early IP networks? How many hosts (computers) could be accommodated in a network in each address class?
20. What are the disadvantages of using address classes? How does CIDR overcome these disadvantages?
21. What is registry in the context of IP addresses?
22. What requirements must an organization satisfy in order to obtain IP addresses directly from a registry?
23. What is the correct representation of the IPv6 address, as specified by RFC 5952 - 2607:FE50:0010:0000:0000:1000:0101:abcd?
24. On your home computer, what is the IP address reported by ipconfig /all (Windows) or ifconfig (MAC/ Linux)?
25. From your home computer, go to www.whatismyip.com and make a note of your IP address. Type this address into the search box at www.arin.net. Who is the owner of that address block?

# Chapter 5 – Transport layer

## Review questions

1. What are the functions of the transport layer?
2. Why are two protocols, TCP and UDP, defined at the transport layer instead of just TCP?
3. What is segmentation?
4. Why is segmentation useful?
5. What is reliability in the context of the transport layer?
6. What are the important potential problems with reliability that are handled by the transport layer?
7. How does TCP provide reliability?
8. What is flow control?
9. Why is it more useful to allow the receiver to control flow speed, rather than the sender?
10. How is flow control implemented?
11. What is sliding window in the context of flow control? Describe its operation.
12. What is multiplexing in the context of the transport layer?
13. How is the multiplexing at the transport layer different from the multiplexing at the physical layer?
14. What is a socket?
15. What is a port?
16. Why is it necessary to define port numbers at the receiving end for network services (such as web, email, etc.)?
17. From the /etc/services file on your computer, list any five standard ports not listed in the text.
18. If you were developing an application that provided services over the network, could you have your application listen to client requests on port 80 (the port for web servers)? If yes, do you think it would be a good idea? Why, or why not?
19. What is connection establishment in TCP? Why is it necessary?
20. Describe the three-way handshake used in TCP.
21. What is the largest possible TCP port number?
22. Why is the initial sequence number for a connection chosen at random?
23. A receiver sends an acknowledgment packet with the number 2817 in the acknowledgment number field. What inference can the sender draw from this packet?
24. What is the function of the window-size field in TCP?
25. What are some application scenarios where UDP may be more useful than TCP? Why?

# Chapter 6 – Application layer

## Review questions

1. What are the functions of the application layer? How were the earliest application-layer protocols defined? What application do you spend the most time on?
2. How has the web been most useful to you?
3. What are the three most popular websites in the world today? What primary service does each site offer?
4. Describe some changes in the patterns of Internet usage based on changes in the list of most popular websites globally.
5. Why is the web gaining popularity as a marketing tool over traditional methods such as yellow pages?
6. What is a hyperlink? What is an inlink? What information about a web page can be inferred from inlinks to the page?
7. What is an inlink? What information about a web page can be inferred from inlinks to the page?
8. What is HTML?
9. Provide an overview of the structure of a web page.
10. What is URL? Describe the parts of a typical web URL.
11. What is a killer application?
12. In what ways do you use e-mail in your daily life? When do you prefer to use e-mail over the postal system? When do you prefer the postal system over e-mail?
13. Describe the differences between pull and push forms of communication, using the web and e-mail as examples.
14. Using examples from your own life, describe some advantages of e-mail as a communication medium compared to your other choices (such as cell phones, meetings).
15. What are some potential disadvantages with e-mail as a communication medium? Can you describe some occasions when you have run into these disadvantages of e-mail?
16. What is flaming?
17. Describe the high-level structure of the e-mail system.
18. What are an MTA and an MUA in the context of e-mail?
19. What is the role of SMTP in e-mail?
20. What is the role of POP/ IMAP in e-mail?
21. What are some important differences between POP and IMAP?
22. What is FTP?
23. How is FTP different from HTTP?
24. What is instant messaging? How is IM different from e-mail?
25. What is presence in the context of IM?

# Chapter 7 – Support services

## Review questions

1. What is DHCP? Why is it useful?
2. What are some of the reasons for the inefficiencies in allocating the available IP addresses?
3. What are the three types of address allocation schemes in DHCP? Under what conditions is each of these categories of address allocation preferred?
4. What is address leasing in DHCP?
5. Use ipconfig /all at the command prompt of a Windows computer. What is the lease duration of the IP address?
6. Briefly describe the sequence of operations that allow a freshly booted DHCP client to obtain an IP address from a DHCP server on the network.
7. What are non-routable IP addresses?
8. IP addresses are used for routing. Why are non-routable IP addresses useful?
9. Why can’t a computer with an RFC 1918 IP address be used as a public-facing web server?
10. What is network address translation? Why is it useful?
11. How do DHCP, non-routable addresses, and NAT help improve the efficiency of utilizing IP addresses and reduce the shortage of IP addresses?
12. What is NAPT? How can it improve the efficiency of utilizing IP addresses, compared to NAT, without port translation?
13. Describe the NAPT operation, i.e., describe how the IP addresses in a packet change as a request packet travels from a source with an RFC 1918 address to a destination and the reply comes back to the source.
14. What is ARP? What is it used for?
15. Briefly describe the operation of ARP.
16. List the entries in the ASP cache of your computer using the arp –a command.
17. What is DNS? What is it used for?
18. Describe the hierarchical organization of domains on the Internet.
19. Why is it useful to organize domain names such as www.usf.edu hierarchically as they are done in DNS?
20. What are the different kinds of top-level domains?
21. Describe the process used by a name server to resolve the IP address of a URL typed by a user.
22. What is a zone in the context of DNS?
23. What is a recursive query in DNS? When does it become necessary?
24. What are the different network services provided by the typical home wireless router provided by ISPs?
25. Use the nslookup command to obtain the IP address of www.google.com. (You may have to type in ”.” after com.) Which name server performed the name resolution for you — your local name server or the Google name server?

# Chapter 8 - Routing

## Review questions

1. What is routing?
2. LANs use broadcasting to ensure that data reaches its destination. Why is it not advisable to use broadcasting between LANs?
3. What are routers? Find three carrier-grade router models made by the major vendors. What is the range of list prices on these routers?
4. What are the important similarities between switching and routing?
5. What are the important differences between routing and switching?
6. Consider a router at the interface of two networks; say your university and its ISP. Draw a figure showing the IP addresses of the two interfaces of the router and the CIDR address blocks of the two networks. (You may need to use tracert to obtain the IP addresses at the two interfaces and arin.net to obtain the address blocks of the two networks.)
7. What is an autonomous system?
8. How are post offices like autonomous systems?
9. Briefly describe how routing works.
10. What is a routing table? What information is stored in a routing table?
11. One route from the routing table at the Route Views project is shown below. What does each term in the route indicate?

128.210.0.0/16 194.85.4.55 0 3277 3267 9002 11537 19782 17 i

1. Use the AS numbers website ([www.cidr-report.org/as2.0/autnums.html](file:///%5C%5Cforest.usf.edu%5Cdata%5Cudrive%5Cmagrawal%5CTeaching_Common%5CDatacommText_2ndEd%5Cwww.cidr-report.org%5Cas2.0%5Cautnums.html)) to find the names of all the autonomous systems referred to in Question 11
2. What is a routing metric? How is the routing metric used to select the path when multiple paths are available?
3. Use the tracert utility to record the route from your home computer to your university’s home page.
4. What are routing protocols?
5. What are the two kinds of routing protocols? Give an example of each of the two kinds of routing protocols.
6. Provide an overview of how exterior routing protocols work.
7. What is route aggregation?
8. Why is route aggregation useful?
9. Give an example of routes before and after route aggregation.
10. What is software defined networking? Where is it most useful?
11. What is MPLS?
12. What is the motivation for the development of MPLS?
13. What is a label in MPLS? Where is the label attached to a packet? Where is it removed?
14. What is a forwarding equivalence class (FEC) in MPLS? Give an example of two packets that may be assigned the same FEC even though they are addressed to two destinations.

# Chapter 9 - Subnetting

## Review questions

1. What is subnetting?
2. What is the organizational motivation for subnetting?
3. In large organizations, what are some disadvantages with allocating IP addresses on a first-come, first-served basis?
4. How do you determine the number of subnets needed in an organization?
5. Using an example, describe the three-part interpretation of IP addresses when subnetting is used.
6. Describe how subnetting is similar to the three-part organization of telephone numbers.
7. Describe how subnetting is similar to the multi-part organization of zip codes.
8. How does the three-part numbering system used in telephones facilitate the switching of long distance calls?
9. How does the multi-part numbering scheme used in zip codes simplify the mail handling tasks at a typical post office?
10. What are the three IP addresses on any network that are not available for allocation to hosts?
11. What factors determine the subnet structure of an organization? For example, if you have a Class B address, how will you determine if you should have 512 subnets, 256 subnets, 128 subnets, 64 subnets, or some other number of subnets?
12. What is a subnet mask?
13. Why are subnet masks needed?
14. What do the 1s and 0s in a subnet mask represent?
15. Can 255.255.253.0 be a subnet mask? Why or why not?
16. What information about a network can be gathered by looking at its subnet mask?
17. Say you have a /14 network address. You are asked to create subnets with at least 1,000 hosts/ subnet. What subnet mask should you use?
18. How many subnets can you have on the network in the question above?
19. The broadcast address on a subnet is obtained by replacing the bits in the host part with 1s instead of 0s. What is the broadcast address of the subnet 192.168.1.192/28?
20. How many hosts can a /18 network support?
21. Say you have a /15 network address. You are asked to create subnets with at least 1,000 hosts/ subnet. What is the maximum number of such subnets you can create?
22. What is the subnet mask you will use for the question above?
23. Consider two IP addresses: 192.168.35.56 and 192.168.36.135. If the subnet mask used is 255.255.252.0, what are the masked IP addresses (subnet IDs) for the two IP addresses?
24. How is subnetting in IPv6 different from subnetting in IPv4?
25. How can subnetting help limit network traffic at routers?

# Chapter 10 – Wide area networks

1. What are WANs?
2. Why can’t we use broadcast on WANs as is done on LANs?
3. Why is Ethernet unsuitable as a WAN technology?
4. What are some similarities between the interstate system and WANs?
5. What are some similarities between neighborhood roads and LANs?
6. What are the main categories of WANs?
7. How is the phone network used as a wide-area computer-networking technology?
8. What are T-carriers?
9. What are the common data rates of T-carriers?
10. What are DS signals?
11. T-carriers are used to create a full mesh network with five nodes. How many links will be required?
12. What are the limitations of point-to-point WANs such as T-carriers?
13. What is statistical multiplexing?
14. How is statistical multiplexing useful in WANs?
15. How does statistical multiplexing reduce burstiness of traffic in the physical medium?
16. What are virtual circuits?
17. What is a circuit? How is a virtual circuit like a circuit? How is a virtual circuit different from a circuit?
18. Why are IP addresses not used for addressing within virtual circuits?
19. What is X.25? What are some salient features of the technology?
20. What is Frame Relay? What are some salient features of the technology?
21. What is ATM? What are some salient features of the technology?
22. What is time-division multiplexing? How is TDM useful in WANs?
23. What are some standard data rates of SONET, the popular TDM WAN technology?
24. What is frequency-division multiplexing (FDM)? How is FDM used in WANs?
25. Describe how WANs may be considered a data-link- layer technology.

# Chapter 11 – Network security

## Review questions

1. What is information security? Why is it important?
2. What are vulnerabilities? Give some examples.
3. What are threats? Give some examples.
4. What are controls? Give some examples.
5. What is confidentiality? Give some examples showing a violation of confidentiality.
6. What is integrity? Give some examples showing a violation of integrity.
7. What is availability? Give some examples showing a violation of availability.
8. What is network security? Why is it important?
9. What controls can be used to ensure confidentiality from incoming threats?
10. How does authorization offer additional protection after authentication?
11. What controls can be used to ensure integrity in the presence of incoming threats?
12. What is a demilitarized zone? What are some of the network services offered in the demilitarized zone? What network services are not recommended to be offered in the demilitarized zone?
13. Recall your visit to a store that also includes a pharmacy. Describe how the organization of the store is similar to the two-tier firewall architecture used in network security.
14. What is a firewall? What are the capabilities of firewalls?
15. What are the major limitations of firewalls?
16. What controls can be used to ensure availability in the presence of incoming threats?
17. How are viruses different from worms? Give an example of a well-known virus and a well-known worm.
18. What are denial-of-service attacks? What can you do to reduce the losses from denial-of-service attacks on your network?
19. What controls can be used to ensure confidentiality of outgoing information?
20. What is encryption? What is an encryption algorithm? What is an encryption key?
21. What are the advantages and limitations of symmetric key encryption?
22. What are the advantages and limitations of asymmetric key encryption? What is the most popular asymmetric-key-encryption technology?
23. Briefly describe how you can use asymmetric key encryption to ensure the confidentiality of outgoing information. Clearly show the sender, receiver, and how the two keys are used to provide confidentiality.
24. Briefly describe how you can use asymmetric key encryption to ensure the integrity of outgoing information. Clearly show the sender, receiver, and how the two keys are used to provide confidentiality.
25. What controls can be used to ensure availability of outgoing information?

# Chapter 12 – Computing infrastructures

## Review questions

1. What was the von Neumann report? What is its significance to the modern IT industry?
2. What are the 5 significant parts of a computer? Briefly describe each part of a computer and its role to computing.
3. In what ways does the structure of a modern computer create challenges for students trying to enter the professional workforce?
4. What is the role of an operating system in modern computers?
5. What is a system call?
6. Why are some tasks reserved for the operating system?
7. What is the dual mode of operation of computers? Why is it useful?
8. What is multi-tasking? Why is it useful for operating systems? Why is multi-tasking increasingly being considered harmful for people to attempt in their personal lives[[2]](#footnote-2)?
9. What is a computer process? What are the contents of a process?
10. What is a process state? What are the different states in which a process can be in a computer?
11. What are threads? How are they different from processes?
12. What is memory? Why is it necessary on a computer?
13. What is virtual memory? Why is it useful? Why is it useful to minimize the use of virtual memory?
14. What is the file system? What services does it provide?
15. What are the important fundamental security design principles used to protect operating systems from harm?
16. What is the sequence of operations involved when a computer is powered on?
17. What is big data? How does it affect organizational IT infrastructures?
18. What is virtualization? Why is it useful? What are the two types of virtualization?
19. What are the important security concerns with virtualization?
20. What is a warehouse scale computer? How is a WSC different from high performance computers (HPCs)?
21. What are the important requirements of WSCs?
22. What are some important economic advantages obtained from WSCs?
23. What is cloud computing? Why is it useful? How is cloud computing related to WSCs?
24. What are the important characteristics of cloud computing?

# Chapter 13 – IT services delivery

1. What is IT services management? What is its objective?
2. What are some common frameworks that can be used for ITSM? What are their principal advantages and disadvantages?
3. What are the 5 service delivery disciplines as defined by ITILv2? In your opinion, which of these disciplines is most important for efficient service delivery? Why?
4. What is service level management? Why is it important?
5. What is a service level agreement? Why is it useful?
6. What are some of the important components of a SLA? In your opinion, which of these components is most important for effective relations between provider and client? Why?
7. What is capacity management? Why is it important?
8. What is continuity management? Why is it important?
9. What is availability management? Why is it important?
10. What is IT financial management? Why is it important?
11. What is high availability? Why is it important?
12. What are the four characteristics of high availability system designs?
13. What are some of the important costs associated with transitioning to high availability systems?
14. What is business impact analysis? How does it affect high availability?
15. What is cost of downtime? How does it affect high availability?
16. How are local high availability solutions different from disaster recovery solutions? How are they similar?
17. What are active-active systems? When would you use an active-active high-availability system over an active-passive high availability system?
18. What are fault-tolerant servers?
19. What is an application server cluster? How does it improve availability?
20. What are the common ways of achieving high availability database operations?
21. What is business continuity planning?
22. What is disaster recovery? How is it related to business continuity?
23. What is the distinction between stateful and stateless workloads? How does it affect high availability design?
24. What are multi-site clusters? How do they improve availability?
25. What is the most likely natural disaster likely to occur in your area? If you were preparing a business continuity plan for your organization, what are some of the most useful items of information you can find?

# Chapter 14 – Managerial issues

## Review questions

1. What are the goals of IT infrastructure design and implementation?
2. What are some of the important pieces of information you should gather during the requirements-analysis phase of IT infrastructure design?
3. What is a logical IT infrastructure design?
4. Why is it useful to represent the logical IT infrastructure design as a drawing?
5. What are some important pieces of information you should show in a drawing of the logical IT infrastructure design?
6. What is a physical IT infrastructure design?
7. What is a building network? What data-link-layer technology are you most likely to see in a building network?
8. Why is it useful to develop a standardized design for the building network and to use it as a building block to network every building, even buildings that have much lower network demands?
9. What is a campus network?
10. What is the core layer in a campus network? What is the role of the core layer?
11. What is the distribution layer in a campus network? What are the roles of the distribution layer?
12. What is the access layer in a campus network? What service is offered by the access layer?
13. Which layer in the campus network is most suitable to provide Internet connectivity? Why?
14. What is an enterprise network?
15. What is network maintenance? What are the important activities in network maintenance?
16. What is SNMP? Briefly describe how it is used to maintain network hardware.
17. What is the management information base (MIB)? What are some pieces of information you are likely to find in an MIB?
18. What are the typical concerns in software maintenance on the network?
19. What are standards? How are they useful?
20. What is the typical procedure by which a standard is developed?
21. How did the government facilitate the development of the technologies (TCP and IP) on which the Internet is based?
22. What are standards essential patents? What are some regulations on their use?
23. How did the government facilitate the creation of the Internet?
24. What has been the role of the government in the evolution of the phone industry?
25. What are the general ways in which the government influences the development of the data communication industry?

# Chapter 15 – Wireless networks

## Review questions

1. What are wireless networks? Why are they useful?
2. Some cities took up projects to setup wireless LANs all over the city. Read about the project taken up by one such city. Was the project a success? Why, or why not?
3. What are some of the concerns with using wireless networks?
4. What are ISM frequency bands? Why are they useful?
5. What are some differences between wired and wireless LANs? How do they impact the design of the wireless LAN header?
6. What is a basic service set? A basic service area?
7. What is an access point? What are some reasons why you would prefer access points to wireless routers to create a wireless network in your organization?
8. What is a distribution system in wireless LANs?
9. What is an extended service set?
10. What is a portal in a wireless LAN?
11. What are some differences between the physical layers in wireless and wired LANs?
12. What are the common wireless LAN categories? What are the important differences between them?
13. What is 802.11 n? What are some likely advantages of 802.11 n over the traditional wireless LANs? How does 802.11 n obtain these advantages?
14. What are personal area networks? How are they different from LANs?
15. What are some important characteristics of Bluetooth?
16. What is a piconet? What are some differences between a piconet and a basic service set?
17. What are master and slave devices in a piconet?
18. What is a scatternet?
19. What are some advantages of having distinct physical channels in Bluetooth?
20. Why is device discovery useful in Bluetooth? How is device discovery accomplished? Why is device discovery not needed in wireless LANs?
21. Describe the mechanisms that have been defined for WLANs and WPANs to coexist at the same frequency bands without interfering with each other.
22. What are the different categories of Bluetooth? What are they used for?
23. What are wireless MANs? What are their primary uses?
24. What data rates and ranges are likely to be available on wireless MANs?
25. What are the differences between wireless LANs and wireless MANs?

# Chapter 16 – Phone networks

## Review questions

1. What are some of the ways in which the phone network has been important for data communications over the years?
2. What are some of the important landmarks in the development of phone service?
3. What is circuit switching?
4. How has the adoption of landline telephony evolved in the last decade?
5. What is the local loop in the context of phone service?
6. What is the central office or the end office?
7. What are inter-exchange carriers (IXC)? What are some similarities and differences between the local loop and IXC links?
8. What is hertz?
9. Why is the phone system designed to carry signals in the frequency range 33 Hz – 3,400 Hz?
10. What is digital subscriber line (DSL)?
11. What was the motivation for the development of DSL technology?
12. What are the three kinds of signals on a cable providing DSL and phone service? What are the frequency ranges used by the three signals?
13. Why do most ISPs provide much higher downstream data rates than upstream data rates?
14. Why is the modified final judgment important to the development of phone service in the United States?
15. What was the outcome of the modified final judgment?
16. What were the circumstances that led to the Telecommunications Act of 1996?
17. What were some of the implications of the Telecommunications Act of 1996?
18. What is cellular telephony?
19. What are the three generations of cellular telephony service? Describe the important features of each generation of cell-phone service.
20. What is frequency reuse in the context of cellular telephony? Why is frequency reuse necessary for cellular telephony?
21. Why are service areas divided into small cells for cellular telephony?
22. What is the MTSO in cell-phone service? What are the important roles of the MTSO?
23. What is handoff? Why is handoff important? How does it work?
24. What is CDMA?
25. How is CDMA better suited than TDM or FDM for cellular telephony?
1. http://www.odu.edu/educ/roverbau/Bloom/blooms\_taxonomy.htm (accessed 11/18/2010) [↑](#footnote-ref-1)
2. To answer the last part of the question, you may have to look up the Internet for research on the subject. One relevant article is by Christopher Mims, “Say no to the distraction-industrial complex,” WSJ, 6/30/14 [↑](#footnote-ref-2)