Networks: Connecting Nodes

Each time you use the telephone, you use the world’s largest computer network - the telephone system.

A telephone is an endpoint, or a node, connected to a network of computers that routes your voice signals to any one of the 500 million telephones (other nodes) in the world.

In a computer network the node can be a terminal, a computer, or any destination/source device (for example, a printer, an automatic teller machine, or even a telephone).
Within an organization, computer networks are set up to meet the specific requirements of that organization. Some have five nodes; others have 10,000 nodes. We have already seen the hardware and transmission media used to link nodes in a network. In this section we put it all together and explain how networks are actually created and how they function.
Network Topologies: Star, Ring, and Bus

A network topology is a description of the possible physical connections within a network. The topology is the configuration of the hardware and shows which pairs of nodes can communicate. The basic computer network topologies - star, ring, and bus - are illustrated in Figure 11-1.

However, a pure form of any of these three basic topologies is seldom found in practice. Most computer networks are hybrids-combinations of these topologies.
Star Topology

The *star topology* involves a centralized host computer connected to several other computer systems, which are usually smaller than the host. The smaller computer systems communicate with one another through the host and usually share the host computer’s database.

The host could be anything from a PC to a supercomputer.

Any computer can communicate with any other computer in the network.

Banks often have a large home-office computer system with a star network of smaller mainframe systems in the branch banks.
Ring Topology

The **ring topology** involves computer systems of approximately the same size, with no one computer system as the focal point of the network.

When one system routes a message to another system, it is passed around the ring until it reaches its destination address.

Bus Topology

The **bus topology** permits the connection of terminals, peripheral devices, and microcomputers along a common cable called a **network bus**.
The term bus is used because people on a bus can get off at any stop along the route.

In a bus topology a signal is broadcast to all nodes, but only the destination node responds to the signal. It is easy to add devices or delete them from the network, as devices are simply daisy-chained along the network bus.

Bus topologies are most appropriate when the linked devices are physically close to one another.
Most computers, even PCs, exist as part of a network of computers.

In this section we discuss the processing relationship between them.

Centralized Computing: A By gone Era.

Through the 1980s, mainframes performed most of the processing activity within a computer network.
Back then, the shared use of a centralized mainframe offered the greatest return for the hardware/software cost.

Today, PCs and workstations offer more computing capacity economically than do mainframe computers. This reversal of hardware economics has caused IT professionals to rethink the way they design and use computer networks.

During the era of centralized mainframe computers, users communicated with a centralized host computer through dumb terminals with little or no processing capability.
The mainframe performed the processing for all users, sometimes numbering in the thousands.  

Now, the trend in the design of computer networks is toward client/server computing.  

**Decentralizing and Downsizing:**  
A Growing Trend.  

In **client/server computing**, processing capabilities are distributed throughout the network, closer to the people who need and use them.  

A server computer supports many client computers.
In the client/server environment, both client and server computers perform processing to optimize application efficiency.

For example, the client computer system might run a database application locally (on the client computer) and access data on a remote (not local) server computer system.

In client/server computing, applications software has two parts - the front end and the back end.
• The client computer runs **front-end applications software**, which performs processing associated with the user interface and applications processing that can be done locally (for example, database and word processing).

• The server computer’s **back-end applications software** performs processing tasks in support of its client computers.

  For example, the server might accomplish those tasks associated with storage and maintenance of a centralized corporate database.
In a client/server database application (see Figure 11-2), users at client PCs run front-end software to download (server-to-client) parts of the database from the server for processing. Upon receiving the requested data, perhaps sales data on customers in the mid-Atlantic region, the client user runs front-end software to work with the data. After local processing, the client computer may upload (client-to-server) updated data to the server’s back-end software for processing.
The server then updates the customer database. The database application is popular in client/server computing, but the scope and variety of applications are growing daily.

**Network Line Control: Rules for Data Transmission**

**Communications Protocols: Transmitting by the Rules.**
Communications protocols describe how data are transmitted in a computer network. Communications protocols are defined in layers, the first of which is the physical layer.
The physical layer defines the manner in which nodes in a network are connected to one another.
Subsequent layers, the number of which vary between protocols, describe how messages are packaged for transmission, how messages are routed through the network, security procedures, and the manner in which messages are displayed.

Asynchronous and Synchronous Transmission

Protocols fall into two general classifications: asynchronous and synchronous.

In **asynchronous transmission**, data are transmitted at irregular intervals on an as-needed basis. A modem is usually involved in asynchronous transmission.
Start/stop bits are appended to the beginning and end of each message.

The start/stop bits signal the receiving terminal/computer at the beginning and end of the message.

In PC data communications, the message is a single byte or character.

Asynchronous transmission, sometimes called start/stop transmission, is best suited for data communications involving low-speed I/O devices, such as serial printers and PCs functioning as remote terminals.
In **synchronous transmission**, the source and destination operate in timed synchronization to enable high-speed transfer.

Start/stop bits are not required in synchronous transmission.

Data transmission between computers, routers, multiplexors, and front-end processors is normally synchronous.

(Christine Kemp: pp. 153—182)
A. Put “T” for true and “F” for false statements. Justify your answers.

1. The star topology involves a centralized host computer connected to several other computer systems of the same size. **F**
2. In a client/server computing, processing capabilities are distributed throughout a network such that a client computer requests processing or some other type of service from a server computer.

3. We can conclude from the text that downsizing refers to the trend toward increased reliance on smaller computers for personal as well as enterprise-wide processing tasks.
4. Communications protocols are the rules established to govern the way data in a computer network are transmitted.

5. Synchronous transmission is best suited for data communications involving low-speed I/O devices.
6. The client computer runs front-end applications software.
B. Choose a, b, c, or d which best completes each item.

1. We can conclude from the first paragraph that a computer network is an integration of

   a. destination/source devices
   b. telephones, terminals, and computer systems
   c. computer systems, terminals, and communications links
   d. telephone nodes all over the world
2. An endpoint in a network of computers is called
   a. a break point  b. a node  
   c. a stop bit  d. a PC

3. The central cable called a network bus is most closely associated with topology.
   a. ring  b. star  c. bus  d. train
4. The trend in the design of computer network is toward computing.
   a. Centralized             b. hybrid
   c. source-data             d. client/server

5. A client computer requests processing support or another type of service from one or more
   a. sister computers
   b. server computers
   c. customer computers
   d. IT managers
6. It can be inferred from the text that

a. because client/server computers have their own software and processing capability, they request only needed data, resulting in reduced traffic over communications channels and increased speed and efficiency throughout the network

b. migration toward client/server computing has reduced the speed and efficiency throughout the network

c. the ever-increasing database applications in client/server computing has brought about various problems so that the companies are moving back again toward the shared use of centralized mainframes

d. economy has been the only reason to encourage IT professionals to design computer systems working together
C. Answer the following questions orally.

1. What similarity does the author see between a bus and a bus topology?
2. Explain the mechanism of centralized computing.
3. Why is client/server computing more economical than centralized mainframe computing?
4. How does client/server computing increase application efficiency?
5. Explain the function of the back-end applications software.
Part II. Language Practice

A. Choose a, b, c, or d which best completes each item.

1. The topology involves computer systems connected in a closed loop with no one computer system the focal point of the network.

   a. Ring                  b. bus
   c. star                    d. none of the above
2. The performs processing associated with the user interface and applications processing that can be done locally.

   a. front-end applications software
   b. back-end applications software
   c. server computer
   d. client computer
3. Asynchronous data transmission the message is typically
   a. transmission control protocol
   b. Internet protocol
   c. synchronous transmission
   d. asynchronous transmission

4. transmission permits the source and destination to communicate in timed synchronization for high-speed data transmission.
   a. Synchronous
   b. Asynchronous
   d. Serial
   d. parallel
5. There is a mass migration toward client/server computing and away from …………….. networks.

   a. Tiny area   b. neutral
   c. Wide area   d. host-based
B. Fill in the blanks with the appropriate form of the words given.

1. **Function**

   a. Learning to program is a **functional** part of any course in computer science.

   b. In order for the computer to **function** properly, there should be no fluctuation in the electric current.
c. Argument refers to that portion of a **function** that identifies the data to be operated on.

d. Connectivity pertains to the degree to which hardware devices, software's, and databases can be functionally linked to one another.

2. **Combine**

a. To represent the 16 different Combinations of four binary digits, the hexadecimal system uses the digits 0 to 9 and A, B, C, D, E, and F.
b. Today’s microcomputers are almost as powerful as yesterday’s minis, mainly because of man’s creativity combined with the advancement in chip technology.

3. **Respond**

   a. The arithmetic/logic unit responds to commands from the control unit.

   b. The components of a computer system operate only in response to commands from the control unit.
c. The time required between a user’s request at a computer terminal and the computer’s reply is called response time.

4. **Centralize**
   
   a. Centralization of authority in an organization refers to a concentration of the important decision-making powers in the hands of relatively few executives.

   b. A management information system can support a greater degree of centralized control because top executives can be given information from dispersed departments in time to decide on appropriate action.
c. The degree to which authority is centralized or decentralized in an organization is determined more by managerial philosophy and judgment than by necessity.

5. Distribute

a. An organization’s data entry function is distributed to the sites where transactions occur.

b. Some organizations combine distributed data entry for some applications with centralized data input for others.
C. Fill in the blanks with the following words.

magazine    within    thinking
Stories    say    school
Telecommute    goes    puts out
Tired

Everyone has a different reason for wanting to telecommute. A programmer with two school-age children says, “I want to say good-bye when the kids leave for school and greet them when they return.” A writer goes into the office once a week, the day before the magazine goes to press. She says, “I write all of my stories from the comfort of my home. An office that puts out a weekly magazine is not conductive to creative thinking.”
’A company president states emphatically, “I got sick and ………………….. of spending nights up in my office. By telecommuting, I’m at least ……………...... earshot of my wife and kids.”
D. Put the following sentences in the right order to form a paragraph. Write the corresponding letters in the boxes provided.

a. Telecommuters routinely interact with clients and colleagues over the telephone and e-mail.

b. Working at home is not the answer for all workers.

c. Telecommuting is not possible when job requirements demand daily face-to-face meetings.
d. Some people are easily distracted and need the ready access to management and the routine of the office to maintain a business focus.

e. However, those arguing against telecommuting say that this type of interaction does not permit ‘pressing of the flesh’ and the transmittal of the nonverbal cues that are essential to personal interaction.
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