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Module Practice and Quiz

3.8.1

What did I learn in this module?

The Rules

All communication methods have three elements in common: message source (sender), message destination (receiver), and channel. Sending a message is governed by rules called *protocols*. Protocols must include: an identified sender and receiver, common language and grammar, speed and timing of delivery, and confirmation or acknowledgment requirements. Common computer protocols include these requirements: message encoding, formatting and encapsulation, size, timing, and delivery options. Encoding is the process of converting information into another acceptable form, for transmission. Decoding reverses this process to interpret the information. Message formats depend on the type of message and the channel that is used to deliver the message. Message timing includes flow control, response timeout, and access method. Message delivery options include unicast, multicast, and broadcast.

Protocols

Protocols are implemented by end-devices and intermediary devices in software, hardware, or both. A message sent over a computer network typically requires the use of several protocols, each one with its own functions and format. Each network protocol has its own function, format, and rules for communications. The Ethernet family of protocols includes IP, TCP, HTTP, and many more. Protocols secure data to provide authentication, data integrity, and data encryption: SSH, SSL, and TLS. Protocols enable routers to exchange route information, compare path information, and then to select the best path to the destination network. OSPF and BGP Protocols are used for the automatic detection of devices or services: DHCP and DNS. Computers and network devices use agreed-upon protocols that provide the following functions: addressing, reliability, flow control, sequencing, error-detection, and application interface.

Protocol Suites

A protocol suite is a group of inter-related protocols necessary to perform a communication function. A protocol stack shows how the individual protocols within a suite are implemented. Since the 1970s there have been several different protocol suites, some developed by a standards organization and others developed by various vendors. TCP/IP protocols are available for the application, transport, and internet layers. TCP/IP is the protocol suite used by today's networks and internet. TCP/IP offers two important aspects to vendors and manufacturers: open standard protocol suite, and standards-based protocol suite. The TCP/IP protocol suite communication process enables such processes as a web server encapsulating and sending a web page to a client, as well as the client de-encapsulating the web page for display in a web browser.

Standards Organizations

Open standards encourage interoperability, competition, and innovation. Standards organizations are usually vendor-neutral, non-profit organizations established to develop and promote the concept of open standards. Various organizations have different responsibilities for promoting and creating standards for the internet including: ISO, IAB, IETF, and IRTF. Standards organizations that develop and support TCP/IP include: ICANN and IANA. Electronic and communications standards organizations include: IEEE, EIA, TIA, and ITU-T.

Reference Models

The two reference models that are used to describe network operations are OSI and TCP/IP. The OSI model has seven layers:

7 - Application

6 - Presentation

5 - Session

4 - Transport

3 - Network

2 - Data Link

1 - Physical

The TCP/IP model has four layers:

4 - Application

3 - Transport

2 - Internet

1 - Network Access

Data Encapsulation

Segmenting messages has two primary benefits:

- By sending smaller individual pieces from source to destination, many different conversations can be interleaved on the network. This is called *multiplexing*.
- Segmentation can increase the efficiency of network communications. If part of the message fails to make it to the destination only the missing parts need to be retransmitted.

TCP is responsible for sequencing the individual segments. The form that a piece of data takes at any layer is called a *protocol data unit (PDU)*. During encapsulation, each succeeding layer encapsulates the PDU that it receives from the layer above in accordance with the protocol being used. When sending messages on a network, the encapsulation process works from top to bottom. This process is reversed at the receiving host and is known as *de-encapsulation*. De-encapsulation is the process used by a receiving device to remove one or more of the protocol headers. The data is de-encapsulated as it moves up the stack toward the end-user application.

Data Access

The network and data link layers are responsible for delivering the data from the source device to the destination device. Protocols at both layers contain a source and destination address, but their addresses have different purposes:

- **Network layer source and destination addresses** - Responsible for delivering the IP packet from the original source to the final destination, which may be on the same network or a remote network.
- **Data link layer source and destination addresses** - Responsible for delivering the data link frame from one network interface card (NIC) to another NIC on the same network.

The IP addresses indicate the original source IP address and final destination IP address. An IP address contains two parts: the network portion (IPv4) or Prefix (IPv6) and the host portion (IPv4) or Interface ID (IPv6). When the sender and receiver of the IP packet are on the same network, the data link frame is sent directly to the receiving device. On an Ethernet network, the data link addresses are known as Ethernet Media Access Control (MAC) addresses. When the sender of the packet is on a different network from the receiver, the source and destination IP addresses will represent hosts on different networks. The Ethernet frame must be sent to another device known as the router or default gateway.

Module Quiz - Protocols and Models

1. Which three acronyms/initialisms represent standards organizations? (Choose three.)

- IETF
 MAC
 IEEE
 IANA
 OSI
 TCP/IP

2. What type of communication will send a message to all devices on a local area network?

- multicast
 unicast
 allcast
 broadcast

3. In computer communication, what is the purpose of message encoding?

- to interpret information
 to negotiate correct timing for successful communication
 to break large messages into smaller frames
 to convert information to the appropriate form for transmission

4. Which message delivery option is used when all devices need to receive the same message simultaneously?

- multicast
 broadcast
 duplex
 unicast

5. What are two benefits of using a layered network model? (Choose two.)

- It prevents technology in one layer from affecting other layers.
 It speeds up packet delivery.
 It ensures a device at one layer can function at the next higher layer.
 It prevents designers from creating their own model.
 It assists in protocol design.

6. What is the purpose of protocols in data communications?

- specifying the bandwidth of the channel or medium for each type of communication
 specifying the device operating systems that will support the communication
 providing the rules required for a specific type of communication to occur
 dictating the content of the message sent during communication

7. Which logical address is used for delivery of data to a remote network?

- destination MAC address
 destination port number
 destination IP address
 source MAC address
 source IP address

8. What is the general term that is used to describe a piece of data at any layer of a networking model?

- protocol data unit
 packet
 segment
 frame

9. Which two protocols function at the internet layer? (Choose two.)

- IP
 ICMP
 BOOTP
 POP
 PPP

10. Which layer of the OSI model defines services to segment and reassemble data for individual communications between end devices?

- session
 application
 presentation
 transport
 network

11. Which type of communication will send a message to a group of host destinations simultaneously?

- unicast
 anycast
 broadcast
 multicast

12. What process is used to receive transmitted data and convert it into a readable message?

- decoding
 encapsulation
 flow control
 access control

13. What is done to an IP packet before it is transmitted over the physical medium?

- It is segmented into smaller individual pieces.
 It is encapsulated into a TCP segment.
 It is tagged with information guaranteeing reliable delivery.
 It is encapsulated in a Layer 2 frame.

14. What process is used to place one message inside another message for transfer from the source to the destination?

- decoding
 access control
 flow control
 encapsulation

15. A web client is sending a request for a webpage to a web server. From the perspective of the client, what is the correct order of the protocol stack that is used to prepare the request for transmission?

- Ethernet, TCP, IP, HTTP
 HTTP, IP, TCP, Ethernet
 Ethernet, IP, TCP, HTTP
 HTTP, TCP, IP, Ethernet

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