Section 2:Network Models

1.Introduction

2.What is a model? CompTIA Network+ Objective 1.2(Explain Devices, applications, protocols, and services at their appropriate OSI layer)

-Simplified processes that allow us to represent the real thing.
Two Networking models:
1.OSI 7-layer model
2.TCP/IP model

3.OSI VS TCP/IP Model

OSI - Older more detailed
1.Physical Layer (Cables, etc)
2.Data Link (Anything that works with a MAC address, NIC, Switches, etc)
3.Network (logical addresses, IP, routers, etc)
4.Transport (Data is large, travels in small bits, this layer disassembles and assembles data)
5.Session (Connection between two systems)
6.Presentation (Used to be used to convert data into a format that your computer can read)
7.Application (smarts in the applications that make the network aware (API - application program interface))

TCP/IP Model - Newer less detail
1.Network Interface (physical cabling, network cabling, etc. most all hardware (except routers))
2.Internet (IP addresses, routers or anything with IP)
3.Transport (all the assembly and disassembly. TCP/UDP)
4.Application (Old osi Application)(TCP looks at Applications as applications)

!Need to know both models for Network+ Exam!

4.Walking through OSI and TCP/IP

Taking an incoming ethernet frame and turned it into usable data:
1.A Network card strips the mac address and the data link and a IP Packet is left(OSI 1&2, TCP/IP 1.)
2.IP address gets stripped and A TCP segment is left (OSI 3, TCP/IP 2)
3.Data is chopped into smaller pieces and/or putting them together using the sequencing number (The sequencing number is stripped off here). Port numbers and data are left over (OSI 4, TCP/IP 3)
4.looking at port numbers and stripping them and sends data to the software application (OSI 5,6,7, TCP/IP 4)

Receiving data from an application and sending it to the ethernet frame:
4.Takes the port numbers and connects them to the data (OSI 5,6,7, TCP/IP 4)
3.looks at the data and adds the sequencing numbers.(OSI 4, TCP/IP 3)
2.Takes the IP from original incoming data and puts it with the data, port numbers, and sequencing numbers (OSI 3, TCP/IP 2)
1.Puts on the mac addresses, runs frame check sequence (OSI 1,2, TCP/IP 1)

5.Meet the frame
NIC (Network Interface Card) <--cable--> "Hub"
LAN (Local Area Network)
Binary Data is sent in chunks refferred to as frames or chucks (Packetized Data)
A single frame and be up to 1500 bytes long (8bits (binary 1's and 0's) to a byte)

Data comes into the NIC and turns data into a frame and shoots it into the network.
Also, as a frame comes into a NIC the data is pulled away and set to software and then is wiped out from the NIC itself.

6.The MAC Address (Media Access Control Address)
How do frames know how to get to the right computer
Hub=Repeater (Takes one signal and repeats it to send to all the connection on the hub)
The frame payload does not identify the destination

ipconfig/all to find the IP (Windows Powershell/CMD Prompt)

```
Physical Address. . . . . . . . . : 00-0C-29-D5-86-ED
```

This is 48 bit address. hexidecimal values (12), Each Hexidecimal character is 4 binary characters.
The first three pairs are the OEM (Original Equipment Manufacturer) numbers.
The last six values are burned to each card (Unique ID)
Every NIC has a Unique ID (Unique MAC Address)

CRC (Cyclic Redudancy Check) - Used as a way to verify that the data is good.

Each NIC recognizes its MAC Address. When it recieves a packet if it recognizes its MAC Addres is pulls out the data and sends it to the machine. If it does not recognized the MAC address it sends it back.

7.Broadcast vs. Unicast

Unicast - NIC receives the exact MAC address as its own.
Broadcast - NIC receives a destination MAC address that is generic so that every NIC will use the data
MAC Address for a broadcast is all F's (FF.FF.FF.FF.FF.FF)

When a computer does not know a MAC address of a computer its trying to find. It sends out a broadcast asking for a frame from that computer on an (LAN). This is called a broadcast domain.

8.Introduction to IP Addressing
Logical Addressing - lots of forms, but IP is the most common

IP Addresses are not fixed to a NIC.
IP Addresses are used to identify every computer on a particular broadcast domain.

A Router is used to connect all these things together.

Router is connected to a switch. (Often home routers are combined with switches in the same hardware)
You can connect multiple networks that are interconnected to multiple routers.

IP Packet (sits within a frame-Destination IP, Origin IP, and Data)
Frame (Destination MAC, Origin MAC, and CRC)

Routers look at IP address to send data to proper networks.
IP packets always sit within frames.

9.Packets and Ports

Port Numbers are added to the IP Packet
Port numbers are unique to individual applications all over the internet ex. port 80 is HTTP
The first 1024 ports are known as "Well known ports" These are reserved
There are port numbers up to 0-65535

A Packet contains a 'piece of data'. Not the entire thing. This is where TCP comes into play
TCP - Transmission Control Protocol - a connection oriented converstation between two computers to make sure that data gets to you complete and in order.

TCP is made up of two things
1.Sequencing Number
2.Acknowledgement

UDP - User Data Protocol - Not connection oriented 'connectionless'

TCP - Transmission Control Protocol - Connection oriented
UDP - User Data Protocol - Connectionless

QUIZ

1.Which best describes a model?
a. A duplicated of a real object or process
b. A representation of a real object or process
c. Multiple steps of a process converted into a single step
d. The expansion of a single process step into multiple steps

2.The OSI model has ___ layers and the TCP/IP model has ___ layers
a. 4 and 4
b. 7 and 7
c. 7 and 4
d. 4 and 7

3.The Internet layer of the TCP model corresponds to which layer(s) of the OSI model?
a. Network
b. Transport
c. Session Lock
d. Session, Presentation, and Application

4.What is a chuck of data that has been sent out of a NIC called?
a. Packet
b. Segment

c. Frame

d. MAC

5.Where does a computer get the MAC address?

a. It is generated by the frame

b. It is built into the NIC (Network Interface Card)

c. The MAC address is another term fro the IP address

d. The receiving computer applies a MAC to each inbound frame

6.Which protocol is connectionless

a.UDP

b.TCP

c.Port Number

d.Well-Known port