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9/8/24

COSC350-001

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Homework #1

Question 1:

Explain how data communication occurs from Host A in one organization to Host B in another organization, highlighting the key components (layers involved and what it does) and processes involved.

A:

Data communication between two hosts occurs through the use of the TCP/IP protocol stack. The stack has five layers: application, transport, network, link, and physical. The application layer is the top-most layer, and the one that end-users interact with (typically as websites or email clients). It uses protocols like HTTP, IMAP, SMTP, and DNS. It relies on the second layer, the transport layer, to add a TCP or UDP header into any outgoing packets so that they can be transported between processes reliably. The next layer, the network layer, is in charge of routing messages between hosts through the use of IP and routing protocols. The link layer packs all of the header info and the message from the above layers into a single frame, and sends each frame to neighboring hosts on the route to the destination using protocols like Ethernet, 802.11 (WiFi)/ cellular, and PPP. At the lowest layer, the physical layer, are the bits being transported “on the wire” between all relevant devices on the way from host A to host B. Once a message makes it to Host B, the above process is reversed to give the end user just the original message, without all the added header information.

Question 2:

Describe how a packet generated from a host computer in one organization travels throughout the internet and delivered to another host computer in another organization in terms of the medium they use. The sending host will use wireless communication. List all equipment used to forward packets.

A:

Sending packets over the internet utilizes a myriad of devices. The entire path from host A to host B, using wireless communication, typically looks something like this:

1. Wireless Network interface Card (NIC) in Host A
2. Wireless Access Point in Organization A
3. Ethernet Switches in Organization A’s LAN
4. Edge Router at Organization A
5. Modem (Cable, DSL, or Fiber) in Organization A’s network
6. ISP Routers
7. Core Routers on the Internet Backbone
8. Modem (Cable, DSL, or Fiber) in Organization B’s network
9. Edge Router at Organization B
10. Ethernet Switches in organization B’s LAN
11. Wireless Access Point in Organization B
12. Wireless NIC in Host B

Key features of this path include NICs being physical components on the host machines that can communicate over WiFi to the wireless access point. The wireless access point is then connected with an ethernet cable to ethernet switches in an organization’s LAN. The ethernet switch then sends the message to a router (again over ethernet), which connects to other routers in other networks, and determines the most efficient path for the message to follow. The message is passed through a modem to translate the digital signal to analog, allowing for more efficient and forgiving communication over longer distances through mediums such as cable, DSL, or fiber optic. Once the message is routed over ISP routers and other core routers on the internet backbone, the process is ran in reverse at organization B in order for Host B to read the original message.

Question 3:

Describe how a packet generated from a host computer in one organization, using wireless communication, travels through the internet and is delivered to another host computer in another organization. Focus on the mediums and types of networks used throughout the journey. For this, you must use “tracert” command to justify your answer in each step.

A:

Following the explanation in question 2, we can track a packet sent from my home computer to cambridge university’s website in the UK with the attached image below. The packet is sent from my PC’s NIC to my wireless access point/router in step 1, then to the modem in step 2. These first two steps constitute my apartment’s LAN environment. From there, the packet travels along my ISP’s routers in steps 3-5, before crossing the Atlantic Ocean in step 6 (noted by the sharp increase in travel time). The packet then travels through various UK based regional ISP networks in steps 7-11, before reaching Cambridge’s network, with their modem in step 12, their edge router in 13, their ethernet switches in 14-17, their wireless AP in 18, and finally the NIC of the server I requested in 19. The transport mediums are largely the same as what was described in step 2, so I omit them here.

