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LAB 4-1

UDP AND TCP PORT NUMBERS

Port number 53 represents DNS that associates domain name with IP address. Port 80 is for HTTP that supports web pages. HTTP uses TCP and DNS uses UDP.

PC & DNS

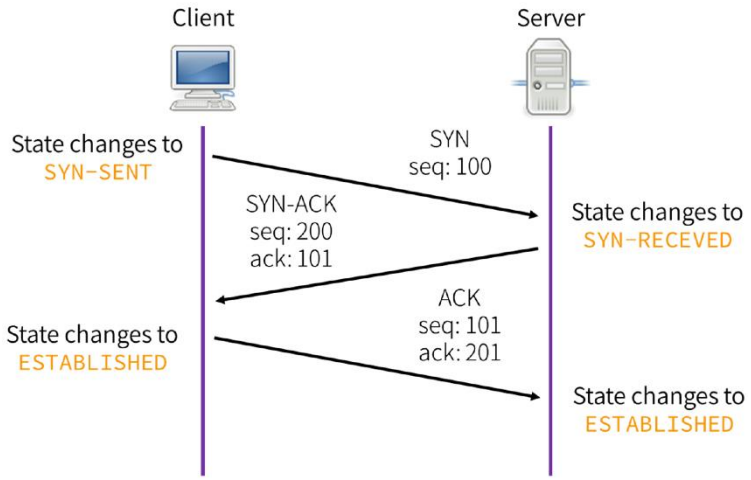
1. The device (PC) encapsulates the PDU into an UDP segment.
2. The DNS client (PC) sends a DNS query to the DNS server.
3. The DNS server receives a DNS query and the name queried (udptcpexample.com) is resolved locally.
4. DNS client receives a DNS response that contain a resolved IP address (192.168.1.2) for the queried domain.

PC & HTTP

5. The HTTP client sends a HTTP request to the server (port 80) which to open the web browser.
6. Sent segment information: the sequence number 1, the ACK number 1, and the data length 106.
7. As HTTP server uses TCP, it will receive a TCP PUSH+ACK segment on the connection to 192.168.1.1 on port 1027.
8. The server receives a HTTP request.
9. The server sends back a HTTP reply to the client.
10. Then, at the device, it will receive TCP PUSH+ACK segment on the connection to 192.168.1.2 on port 80.
11. Received segment: the sequence number 1, the ACK number 1, and the data length 106.
12. The HTTP client receives a HTTP reply from the server. It displays the page in the web browser.

LAB 4-2

TCP SESSION ESTABLISHMENT AND TERMINATION



Three-way handshake

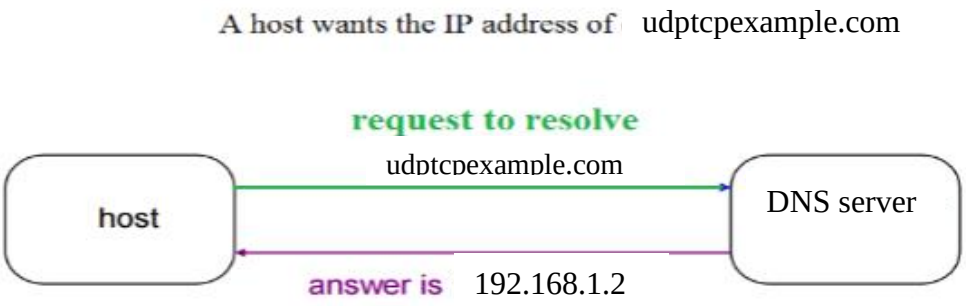
1. First, the PC client tries to make a TCP connection to 192.168.1.2 on port 80 (HTTP). The device sets the connection state to SYN_SENT.
2. TCP accepts a window size up to 65535 bytes and add Maximum Segment Size Option to the TCP SYN header equal to 1460 bytes.
3. After that, the device sends a TCP SYN segment that contains the sequence number=0, the ACK number 0, and the data length 24.
4. The HTTP client connects to the server.
5. The server receives a TCP SYN segment. The connection request is accepted. The device sets the connection state to SYN_RECEIVED.
6. TCP accepts and add the Maximum Segment Size Option to the TCP SYN-ACK header that the size is equal to 536 bytes.
7. Next, it sends a TCP SYN+ACK segment that contains the seq. number =0, ack number =1, and the data length 24.
8. The PC client receives a TCP ACK segment on the connection to 192.168.1.1 on port 1026. TCP already has the expected peer seq. number, so the TCP connection is successful.
9. The connection state changes to ESTABLISHED.
10. The server receives a HTTP request and then sends back a HTTP reply to the client.
11. The client receives a HTTP reply from the server and it displays the page in web browser.

LAB 4-3

UDP OPERATION

Domain Name System (DNS) uses UDP as its transport protocol. When a web page is requested using a URL, the IP address must be learned from a DNS server before a web request can be encapsulated in an IP packet.

a. The device (PC) encapsulates the PDU into an UDP segment.
b. The DNS client (PC) sends a DNS query to the DNS server.
c. The DNS server receives a DNS query and the name queried (udptcpexample.com) is resolved locally.
d. The PC decapsulates the PDU from the UDP segment.
e. DNS client receives a DNS response that contain a resolved IP address (192.168.1.2) for the queried domain.
f. The web browser is displayed.



LAB 4-4

APPLICATION AND TRANSPORT LAYER PROTOCOLS EXAMINATION

A DNS request needed to resolve the URL to the IP address of the server and an ARP request needed to resolve the IP address of the server to its hardware MAC address.

i. For DNS request, the device (PC) encapsulates the PDU into an UDP segment and then it sends a DNS query to the DNS server.
ii. The ARP process constructs a request for the target IP address and the device encapsulates the PDU into an Ethernet frame.
iii. The frame's destination MAC address matches the receiving port's MAC address so the device decapsulates the PDU from the Ethernet frame.
iv. The frame is an ARP frame, so it is processed by the ARP process and a request to update the ARP table with the target IP address and the receiving port's IP address.
v. After that, at the PC, the ARP frame is a reply, so the ARP process takes out and sends buffer packets waiting for this ARP reply.
vi. DNS takes part when the client requests a DNS query. The server resolved the name locally and send back a reply.
vii. The client receives the reply that contains a resolved IP address for the queried domain.
viii. Next, there will be TCP connection to be established using three-way handshake. (refer to lab 4-2).
ix. The HTTP client sends a HTTP request to the server and receive a reply. It displays the page in the web browser.

LAB 4-5

ANALYZING THE APPLICATION AND TRANSPORT LAYERS LEARNING OBJECTIVE

a. After entering the domain, “ftmk.utem.edu.my” in the web browser PC 1A, DNS query is sent from the PC to the server to get the IP address.
b. The frame source MAC address was found in the MAC table of Switch. Then, Switch sends the frame out of the port.
c. The device looks up the destination IP address in the CEF table. But it does not have an entry for the destination IP address. So, the device looks up the destination IP address in the routing table.
d. The routing table finds a routing entry to the destination IP address and the device decrements the TTL on the packet.
e. At the next router, the device looks up the destination IP address in the CEF table and turns out the CEF table has an entry for that. The device decrements the TTL on the packet.
f. When it reaches the DNS server, using UDP protocol will check and resolve locally. Then it sends back a reply containing IP address for the queried domain.
g. Now that we have the IP address, it will initiate a TCP connection to that. Once the connection is established, it will send a request on port 80 (HTTP).
h. The response will be received, and the web browser is displayed.