

Often, we tend to learn about the OSI and TCP/IP models without really having a visual understanding on how the layers alongside the protocols interact with each other as data goes through the network. In this packet tracer simulation activity that involves requesting a web page from a web server using the web browser application available on the client PC, we are able to see the logical representation of the models and have an in-depth understanding of how data is broken down into pieces known as Protocol Data Unit (PDU) during transmission over the different layers and assembled when they arrive at the destination as well as see and learn of the different information found on each of the layers for both the OSI and TCP/IP models.

It is from the packet tracer simulation activity that I was able to answer the following questions.

Part 1: Examine HTTP Web Traffic

Step 2: Generate web (HTTP) traffic

d) Click Capture/Forward four times. There should be four events in the Event List.

- **Look at the Web Client web browser page. Did anything change?** Yes, the web client successfully communicated with the web server and a web page was returned from the webserver and displayed on the browser of client as show below.



f) Under the Out Layers column, click Layer 7.

- **What information is listed in the numbered steps directly below the In Layers and Out Layers boxes for Layer 7?** A HTTP request is sent from the client to the server

- **What is the Dst Port value for Layer 4 under the Out Layers column?** Port 80 for HTTP
- **What is the Dest. IP value for Layer 3 under the Out Layers column?** 192.168.1.254 which is the IP address for the web server.
- **What information is displayed at Layer 2 under the Out Layers column?** The mac address for the web client (0060.47CA.4DEE) and that of the web server (0001.96A9.401D) is displayed.

PDU Information at Device: Web Client

OSI Model Outbound PDU Details

At Device: Web Client Source: Web Client Destination: HTTP CLIENT	
In Layers	Out Layers
Layer7	Layer 7: HTTP
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: TCP Src Port: 1025, Dst Port: 80
Layer3	Layer 3: IP Header Src. IP: 192.168.1.1, Dest. IP: 192.168.1.254
Layer2	Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer1	Layer 1: Port(s):

1. The HTTP client sends a HTTP request to the server.

g) **Click the Outbound PDU Details tab.**

- **What is the common information listed under the IP section of PDU Details as compared to the information listed under the OSI Model tab? With which layer is it associated?** The web client's source IP address (192.168.1.1) and the web server destination IP address (192.168.1.254)

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IP

0 4 8 16 20 24 Bits

VER:4	IHL:5	DSCP:0x00	TL:122
ID:0x0004		FLA: ^ GS: v	FRAG OFFSET:0x000
TTL:128	PRO:0x06	CHKSUM	
SRC IP:192.168.1.1			
DST IP:192.168.1.254			
DATA (VARIABLE LENGTH)			

OSI Model Outbound PDU Details

At Device: Web Client
Source: Web Client
Destination: HTTP CLIENT

In Layers	Out Layers
Layer7	Layer 7: HTTP
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: TCP Src Port: 1025, Dst Port: 80
Layer3	Layer 3: IP Header Src. IP: 192.168.1.1, Dest. IP: 192.168.1.254
Layer2	Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer1	Layer 1: Port(s):

1. The destination IP address is in the same subnet. The device sets the next-hop to destination.

- What is the common information listed under the TCP section of PDU Details, as compared to the information listed under the OSI Model tab, and with which layer is it associated? The source port (1025) and destination port (80) on layer 4.

TCP

0 4 8 16 20 24 Bits

SOURCE PORT:1025		DESTINATION PORT:80	
SEQUENCE NUMBER:1			
ACKNOWLEDGEMENT NUMBER:1			
OFF ^ SET: v	RES ^ ERV: v	FLAGS:0b000 11000	WINDOW:65535
CHECKSUM:0x0000		URGENT POINTER:0x0000	
OPTION			^ v
DATA (VARIABLE LENGTH)			PADDING: 0

Out Layers

Layer 7: HTTP
Layer6
Layer5
Layer 4: TCP Src Port: 1025, Dst Port: 80
Layer 3: IP Header Src. IP: 192.168.1.1, Dest. IP: 192.168.1.254
Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer 1: Port(s):

r 1, the ACK number 1, and the data length 102.

- What is the Host listed under the HTTP section of the PDU Details? What layer would this information be associated with under the OSI Model tab? The host is www.osi.local and it would be associated with the layer 7 on the OSI model Tab because we are working with http protocol which is found on the application layer(L7) of the OSI.

PDU Information at Device: Web Client

OSI Model Outbound PDU Details

At Device: Web Client
Source: Web Client
Destination: HTTP CLIENT


In Layers

Layer7
Layer6
Layer5
Layer4
Layer3
Layer2
Layer1

Out Layers

Layer 7: HTTP
Layer6
Layer5
Layer 4: TCP Src Port: 1025, Dst Port: 80
Layer 3: IP Header Src. IP: 192.168.1.1, Dest. IP: 192.168.1.254
Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer 1: Port(s):

1. The HTTP client sends a HTTP request to the server.



i) Advance to the next HTTP Type box within the Event List and click the colored square box. This window contains both In Layers and Out Layers. Notice the direction of the arrow directly under the In Layers column; it is pointing upward, indicating the direction the data is travelling. Scroll through these layers making note of the items previously viewed. At the top of the column the arrow points to the right. This denotes that the server is now sending the information back to the client.

- Comparing the information displayed in the In Layers column with that of the Out Layers column, what are the major differences?

Data travels from layer 1 through layer 7 in in layer while in out layer it travels from layer 7 to layer 1 shown by the arrows.

PDU Information at Device: Web Server

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Web Server
Source: Web Client
Destination: HTTP CLIENT

In Layers

Layer 7: HTTP
Layer6
Layer5
Layer 4: TCP Src Port: 1025, Dst Port: 80
Layer 3: IP Header Src. IP: 192.168.1.1, Dest. IP: 192.168.1.254
Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer 1: Port FastEthernet0

Out Layers

Layer 7: HTTP
Layer6
Layer5
Layer 4: TCP Src Port: 80, Dst Port: 1025
Layer 3: IP Header Src. IP: 192.168.1.254, Dest. IP: 192.168.1.1
Layer 2: Ethernet II Header 0001.96A9.401D >> 0060.47CA.4DEE
Layer 1: Port(s): FastEthernet0

In Layer 7 the server receives a HTTP request from the client whereas for Layer 7 out layer the server replies to the HTTP to the client

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PDU Information at Device: Web Server

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Web Server
Source: Web Client
Destination: HTTP CLIENT

In Layers

Layer 7: HTTP

Layer 6

Layer 5

Layer 4: TCP Src Port: 1025, Dst Port: 80

Layer 3: IP Header Src. IP: 192.168.1.1,
Dest. IP: 192.168.1.254

Layer 2: Ethernet II Header 0060.47CA.
4DEE >> 0001.96A9.401D

Layer 1: Port FastEthernet0

In Layers

Layer 7: HTTP

Layer 6

Layer 5

Layer 4: TCP Src Port: 1025, Dst Port: 80

Layer 3: IP Header Src. IP: 192.168.1.1,
Dest. IP: 192.168.1.254

Layer 2: Ethernet II Header 0060.47CA.
4DEE >> 0001.96A9.401D

Layer 1: Port FastEthernet0

Out Layers

Layer 7: HTTP

Layer 6

Layer 5

Layer 4: TCP Src Port: 80, Dst Port: 1025

Layer 3: IP Header Src. IP:
192.168.1.254, Dest. IP: 192.168.1.1

Layer 2: Ethernet II Header
0001.96A9.401D >> 0060.47CA.4DEE

Layer 1: Port(s): FastEthernet0

1. The server receives a HTTP request.

1. The server sends back a HTTP reply to the client.

In layer 4, the inbound TCP source port is 1025(web server) and destination port is 80 while the out layer, the TCP source port is 80(web client) while the destination port is 1025.

Layer 4: TCP Src Port: 1025, Dst Port: 80

Layer 4: TCP Src Port: 80, Dst Port: 1025

At layer 3 in layer, the source IP is 192.168.1.1(client) and the destination IP is 192.168.1.254(server) because the web client is sending out a request to the server therefore the web client will have the above source IP and the server will have the destination IP while in the out layer, the source IP is 192.168.1.254 and the destination IP is 192.168.1.1 since the web server is sending out the reply to the request it will have the source IP address as shown above.

Layer 3: IP Header Src. IP: 192.168.1.1,
Dest. IP: 192.168.1.254

Layer 3: IP Header Src. IP:
192.168.1.254, Dest. IP: 192.168.1.1

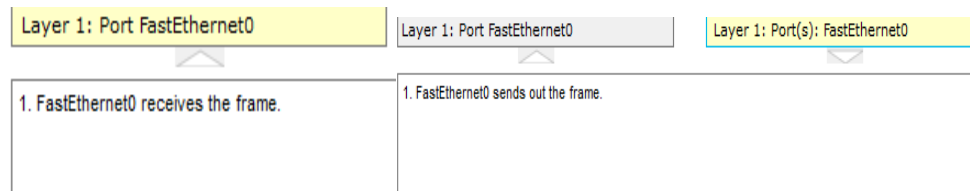
In layer 2 in layer, the source mac address is 0060.47CA4DEE while the destination is 0001.96A9.401D while in the out layer, the source mac address is 0001.96A9.401D and the destination mac address is 0060.47CA4DEE.

Layer 2: Ethernet II Header 0060.47CA.
4DEE >> 0001.96A9.401D

Layer 2: Ethernet II Header
0001.96A9.401D >> 0060.47CA.4DEE

In the in layer, the layer 1 Fast Ethernet0 receives the frame while in the out layer1 Fast Ethernet0 sends out the frame

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k) Click the last-colored square box under the Info column.

- **How many tabs are displayed with this event? Explain.** There are two tabs displayed that is the OSI model and the inbound PDU details. The reason there are two is because the server replies to the http request by displaying a page on the client web browser then closing the connection afterwards.

PDU Information at Device: Web Client

OSI Model Inbound PDU Details

At Device: Web Client
Source: Web Client
Destination: HTTP CLIENT

In Layers

Layer 7: HTTP
Layer 6
Layer 5
Layer 4: TCP Src Port: 80, Dst Port: 1025
Layer 3: IP Header Src. IP: 192.168.1.254, Dest. IP: 192.168.1.1
Layer 2: Ethernet II Header 0001.96A9.401D >> 0060.47CA.4DEE
Layer 1: Port FastEthernet0

Out Layers

Layer 7
Layer 6
Layer 5
Layer 4
Layer 3
Layer 2
Layer 1

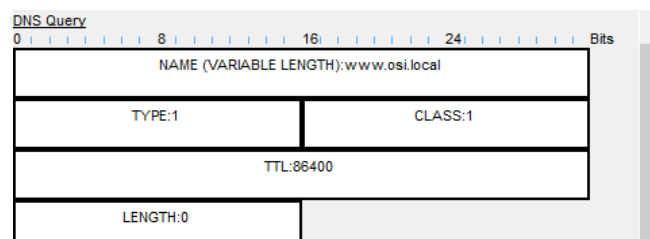
Part 2: Display Elements of the TCP/IP Protocol Suite

Step 1: View Additional Events

d) Click the Outbound PDU Details tab.

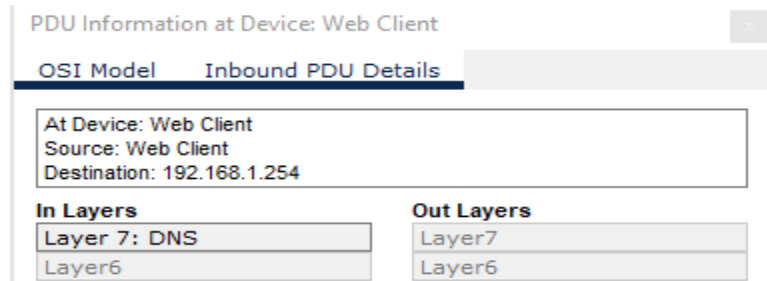
- **What information is listed in the NAME field: in the DNS QUERY section?**

www.osi.local

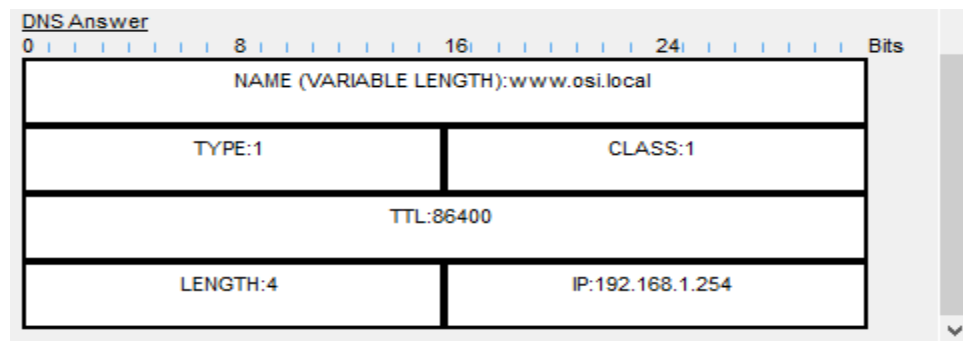


e) Click the last DNS Info colored square box in the event list.

- **At which device was the PDU captured?** Web Client derived from the information at the top of the PDU tab.



- **What is the value listed next to ADDRESS: in the DNS ANSWER section of the Inbound PDU Details?** The address is 192.168.1.254



f) Find the first **HTTP** event in the list and click the colored square box of the **TCP** event immediately following this event. Highlight **Layer 4** in the **OSI Model** tab.

- **In the numbered list directly below the In Layers and Out Layers, what is the information displayed under items 4 and 5?**

Item 4: The TCP connection is successful

Item5: The device sets the connection state to established.

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PDU Information at Device: Web Server

OSI Model Inbound PDU Details

At Device: Web Server Source: Web Client Destination: 192.168.1.254	
In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4: TCP Src Port: 1026, Dst Port: 80	Layer4
Layer3: IP Header Src. IP: 192.168.1.1, Dst. IP: 192.168.1.254	Layer3
Layer2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D	Layer2
Layer1: Port FastEthernet0	Layer1

1. The device receives a TCP ACK segment on the connection to 192.168.1.1 on port 1026.
2. Received segment information: the sequence number 1, the ACK number 1, and the data length 20.
3. The TCP segment has the expected peer sequence number.
4. The TCP connection is successful.
5. The device sets the connection state to ESTABLISHED.

g) Click the last TCP event. Highlight Layer 4 in the OSI Model tab. Examine the steps listed directly below In Layers and Out Layers.

- What is the purpose of this event, based on the information provided in the last item in the list (should be item 4)? This is to show the closing of a connection after the server receives an acknowledgement from the client.

PDU Information at Device: Web Server

OSI Model Inbound PDU Details

At Device: Web Server Source: Web Client Destination: 192.168.1.254	
In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4: TCP Src Port: 1026, Dst Port: 80	Layer4
Layer3: IP Header Src. IP: 192.168.1.1, Dst. IP: 192.168.1.254	Layer3
Layer2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D	Layer2
Layer1: Port FastEthernet0	Layer1

1. The device receives a TCP ACK segment on the connection to 192.168.1.1 on port 1026.
2. Received segment information: the sequence number 104, the ACK number 273, and the data length 20.
3. The TCP segment has the expected peer sequence number.
4. The device sets the connection state to CLOSED.

Challenge Questions

- a) This simulation provided an example of a web session between a client and a server on a local area network (LAN). The client makes requests to specific services running on the server. The server must be set up to listen on specific ports for a client request. (Hint: Look at Layer 4 in the OSI Model tab for port information.)
- Based on the information that was inspected during the Packet Tracer capture, what port number is the Web Server listening on for the web request? Port 80

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PDU Information at Device: Web Client

OSI Model **Outbound PDU Details**

At Device: Web Client Source: Web Client Destination: HTTP CLIENT	
In Layers	Out Layers
Layer7	Layer 7: HTTP
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: TCP Src Port: 1026, Dst Port: 80
Layer3	Layer 3: IP Header Src. IP: 192.168.1.1, Dst. IP: 192.168.1.254
Layer2	Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer1	Layer 1: Port(s):

1. Sent segment information: the sequence number 1, the ACK number 1, and the data length 102.

- What port is the Web Server listening on for a DNS request? Port 63

PDU Information at Device: Web Client

OSI Model **Outbound PDU Details**

At Device: Web Client Source: Web Client Destination: 192.168.1.254	
In Layers	Out Layers
Layer7	Layer 7: DNS
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: UDP Src Port: 1026, Dst Port: 53
Layer3	Layer 3: IP Header Src. IP: 192.168.1.1, Dst. IP: 192.168.1.254
Layer2	Layer 2: Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D
Layer1	Layer 1: Port(s): FastEthernet0

1. The device encapsulates the PDU into an UDP segment.

In conclusion, the practical packet tracer simulation has enabled me learn how to switch from real-time to simulation mode which is event driven. I got to understand how a web server and web client interact over the internet by practically having to request a web page from the webserver through the client web browser. I got to see packet traffic being captured from the web client to the web server on the simulation event list. I also interacted with the various protocols for example http when requesting for a web page and its respective port number which was port 80. I also got to see and learn how the packet travels through the various layers of both the OSI and the TCP/IP models. And how information between the two layer varies, where during the TCP/IP the information across the various layers is more compared to what information is found on the OSI model. For example, upon requesting a web page from web client to webserver, I saw the layer 7(application layer) sending out a http request to the server, and later at layer 4(transport layer) I saw the TCP protocol come to play by establishing a reliable connection and saw the various port numbers for the source and destination devices. Later at layer 3 I saw the source and destination Ip addresses and at layer 2, I got to see both the inbound and outbound mac address and later learning of how the FastEthernet0 sends out the

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frame at layer 1 (physical layer). I learnt of how both the mac and IP addresses change depending on whether it is a request or it is a response. I also logically saw the three-way handshake being implemented and finally how a connection is closed. I got an understanding of how DNS work and the port at which it works from which is port 53. I saw the difference between the HTTP and DNS where the HTTP uses TCP (connection-oriented) protocol and the DNS pdu is encapsulated into a UDP (connectionless) segment at layer 4. Overall, I did enjoy seeing in real-time the logical working of OSI and TCP/IP models, the protocols found on each layer, their port number as well as being able to learn what happens on each of the layers,