

CMPE 305 Data and Digital Communication

MP3 – Basic Switch and OSI Model

Delima, Sheena Mae D.

BSCPE 3-3

09/28/2025

3.5.5 Investigate the TCP-IP and OSI Models in Action

Objectives	Background
Part 1: Examine HTTP Web Traffic Part 2: Display Elements of the TCP/IP Protocol Suite	<p>This simulation activity is intended to provide a foundation for understanding the TCP/IP protocol suite and the relationship to the OSI model. Simulation mode allows you to view the data contents being sent across the network at each layer.</p> <p>As data moves through the network, it is broken down into smaller pieces and identified so that the pieces can be put back together when they arrive at the destination. Each piece is assigned a specific name (protocol data unit [PDU]) and associated with a specific layer of the TCP/IP and OSI models. Packet Tracer simulation mode enables you to view each of the layers and the associated PDU. The following steps lead the user through the process of requesting a web page from a web server by using the web browser application available on a client PC.</p> <p>Even though much of the information displayed will be discussed in more detail later, this is an opportunity to explore the functionality of Packet Tracer and be able to visualize the encapsulation process.</p>

Instructions

Part 1: Examine HTTP Web Traffic

In Part 1 of this activity, you will use Packet Tracer (PT) Simulation mode to generate web traffic and examine HTTP.

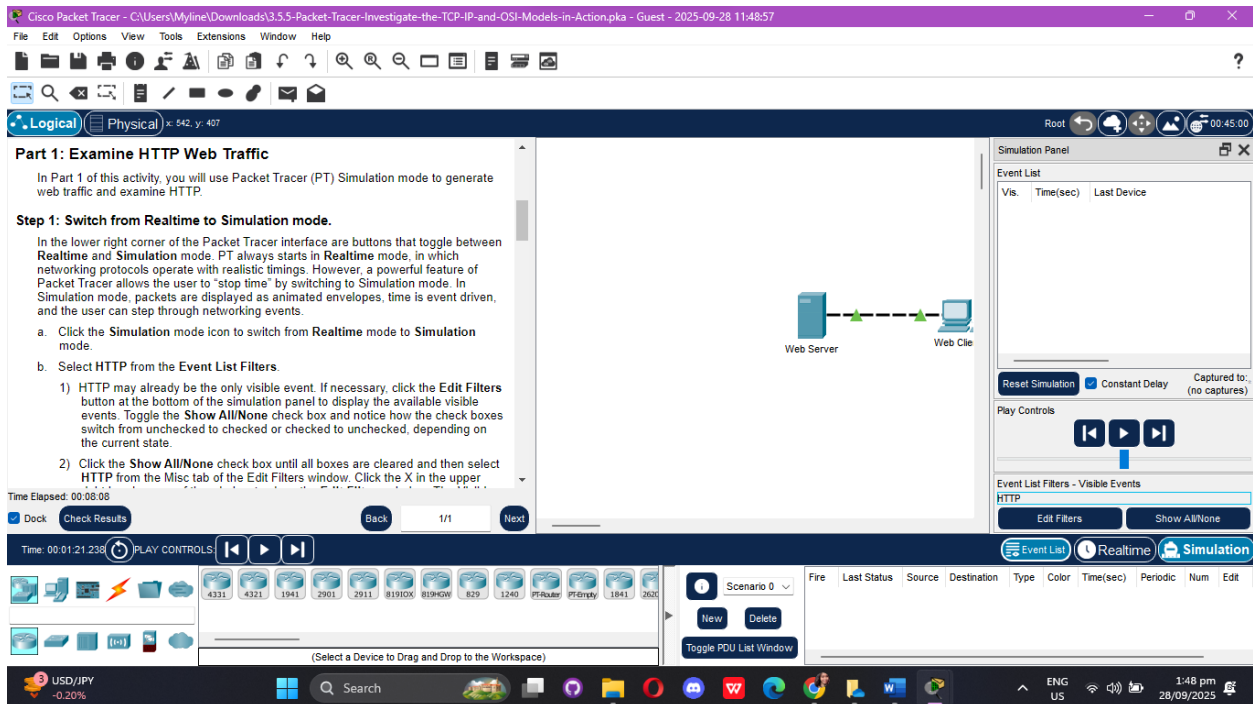
Step 1: Switch from Realtime to Simulation mode.

In the lower right corner of the Packet Tracer interface are buttons that toggle between Realtime and Simulation mode. PT always starts in Realtime mode, in which networking protocols operate with realistic timings. However, a powerful feature of Packet Tracer allows the user to “stop time” by switching to Simulation mode. In Simulation mode, packets are displayed as animated envelopes, time is event driven, and the user can step through networking events.

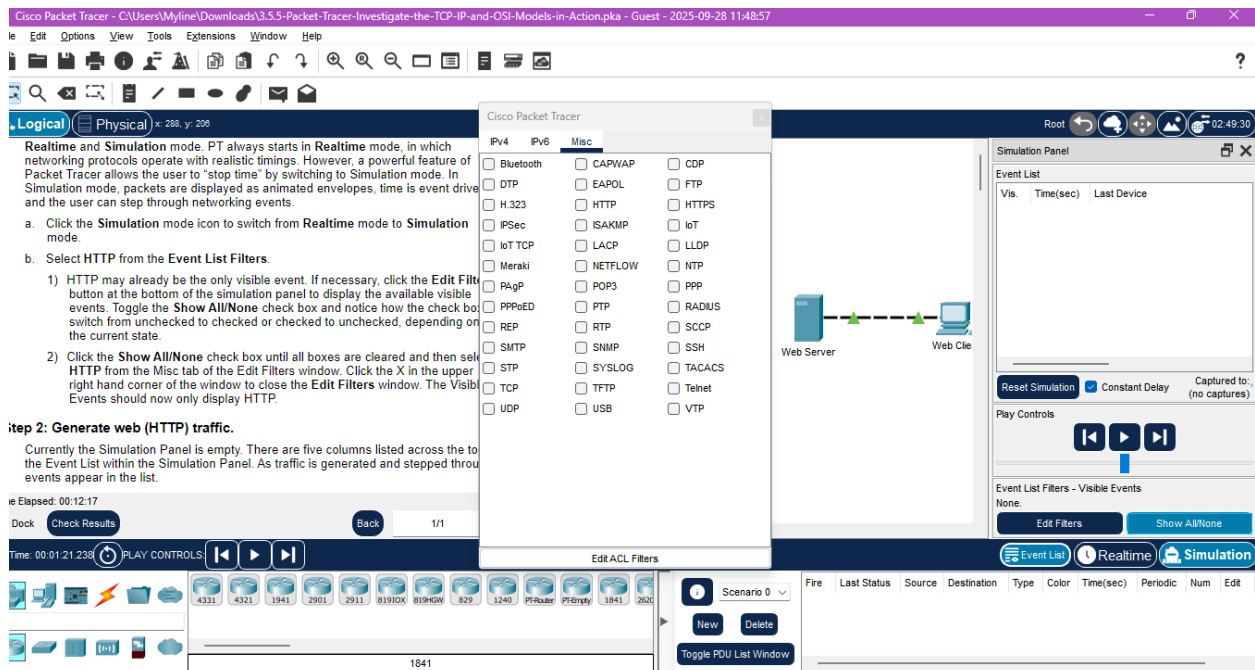
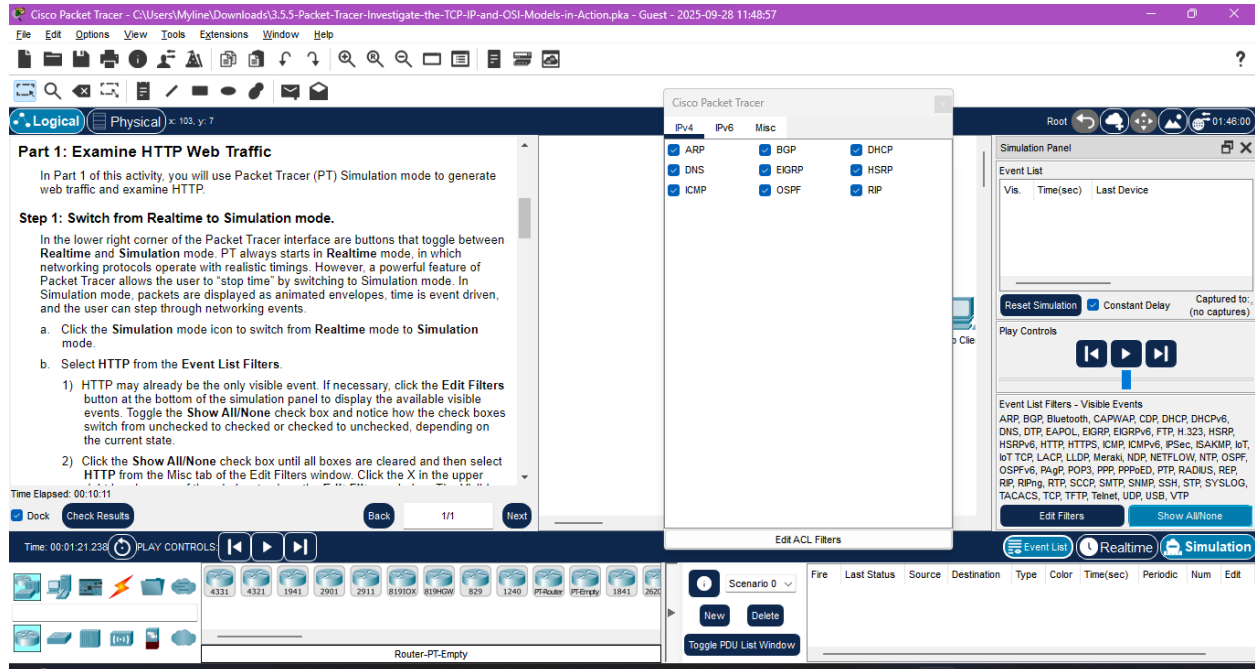
- Click the Simulation mode icon to switch from Realtime mode to Simulation mode.



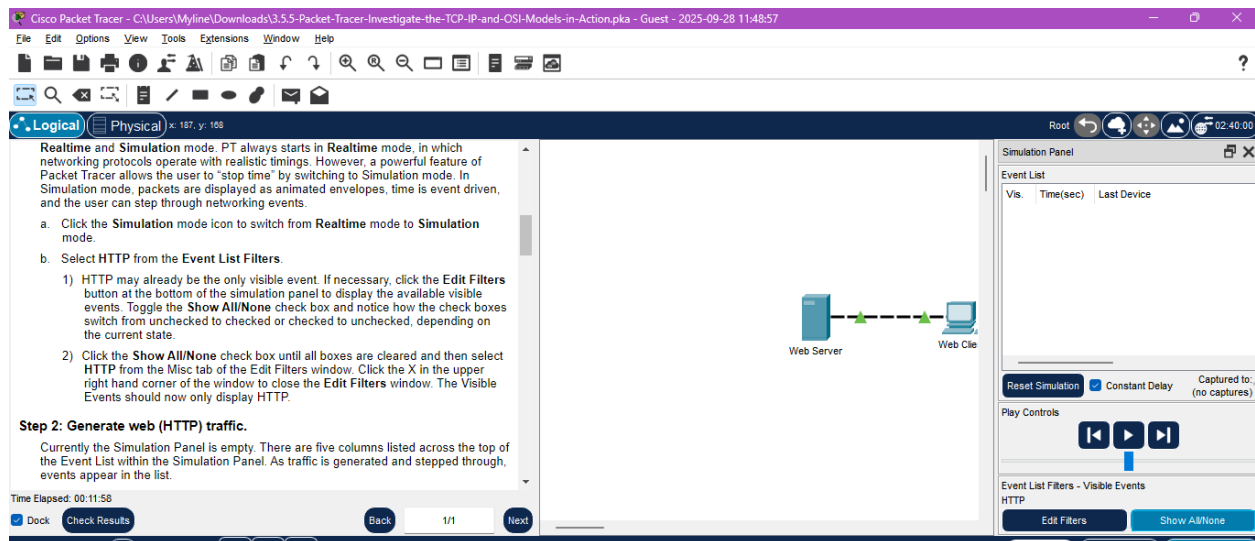
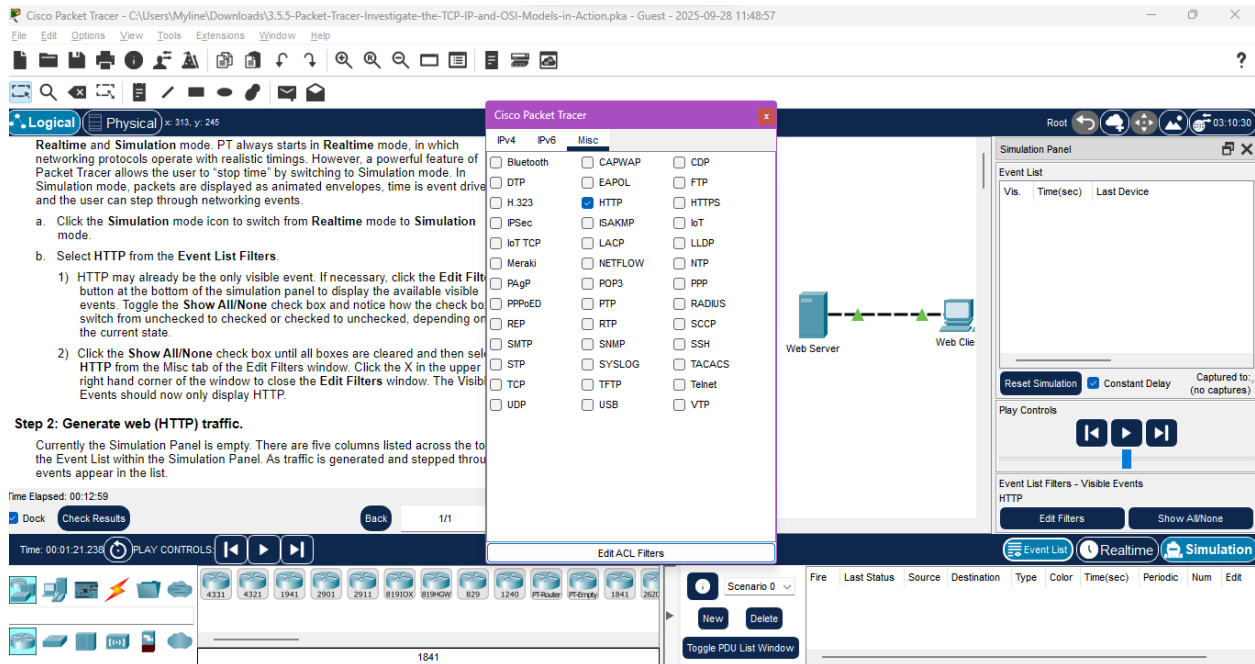
- Select HTTP from the Event List Filters.



1) HTTP may already be the only visible event. If necessary, click the Edit Filters button at the bottom of the simulation panel to display the available visible events. Toggle the Show All/None check box and notice how the check boxes switch from unchecked to checked or checked to unchecked, depending on the current state.



2) Click the Show All/None check box until all boxes are cleared and then select HTTP from the Misc tab of the Edit Filters window. Click the X in the upper right hand corner of the window to close the Edit Filters window. The Visible Events should now only display HTTP.

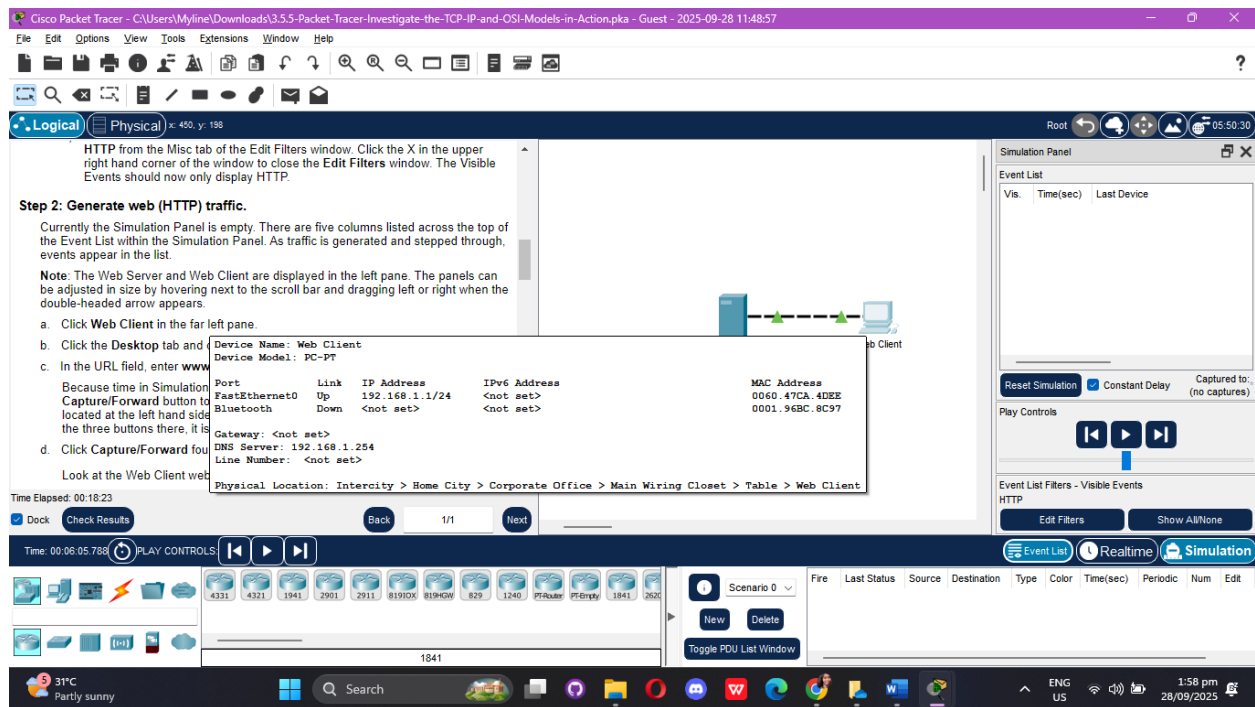


Step 2: Generate web (HTTP) traffic.

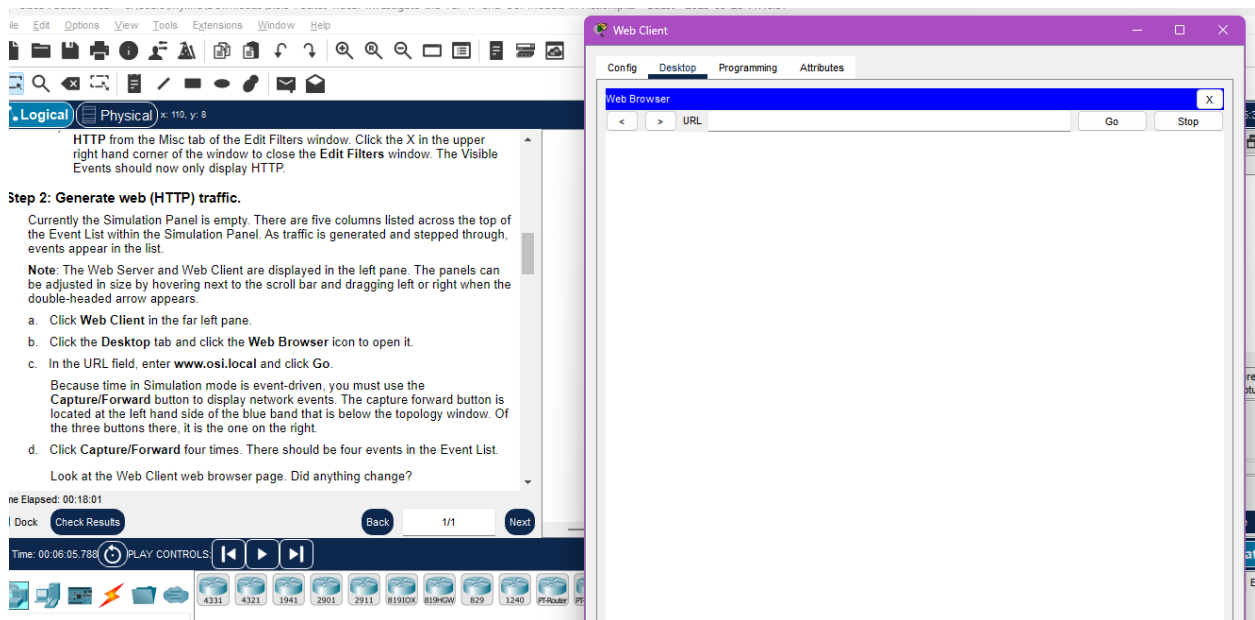
Currently the Simulation Panel is empty. There are five columns listed across the top of the Event List within the Simulation Panel. As traffic is generated and stepped through, events appear in the list.

Note: The Web Server and Web Client are displayed in the left pane. The panels can be adjusted in size by hovering next to the scroll bar and dragging left or right when the double-headed arrow appears.

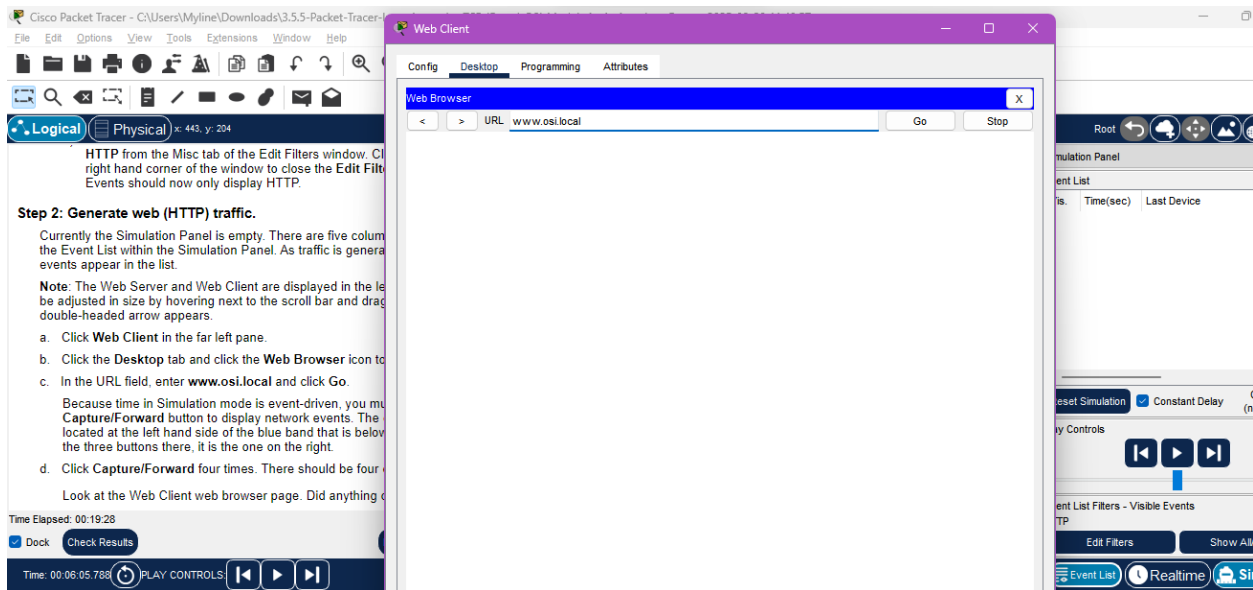
- Click Web Client in the far left pane.



b. Click the Desktop tab and click the Web Browser icon to open it.



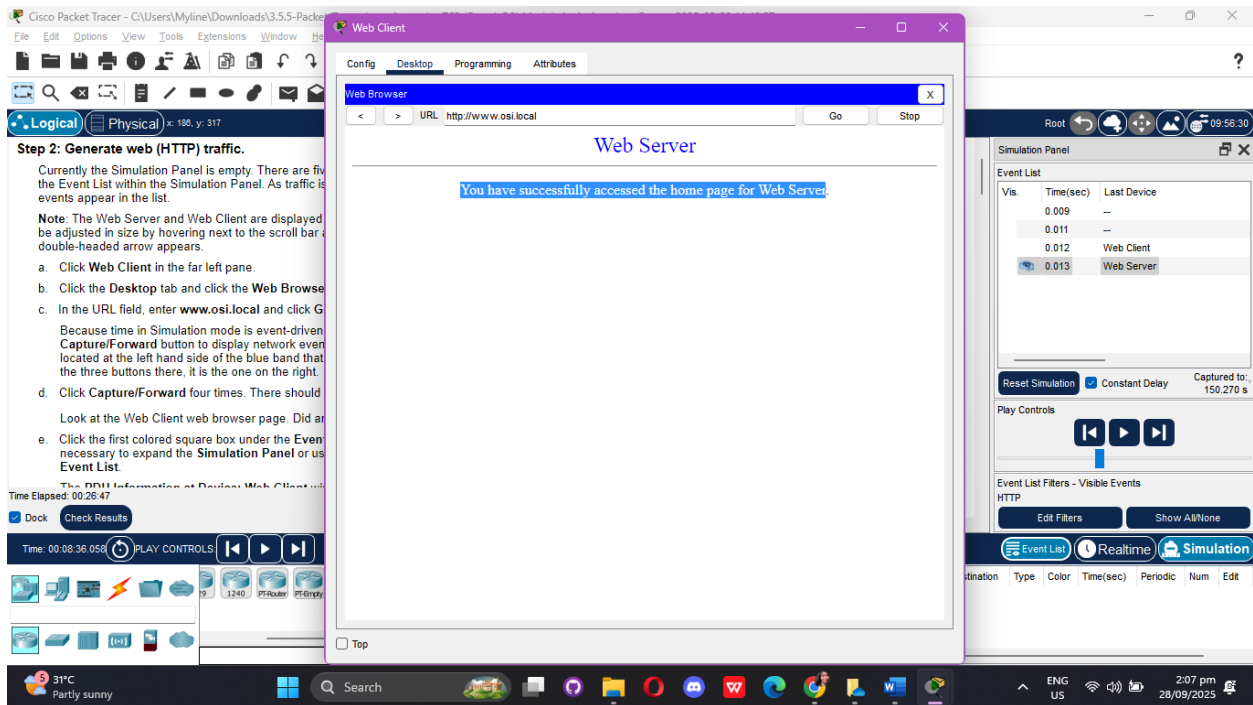
c. In the URL field, enter www.osi.local and click Go.



Because time in Simulation mode is event-driven, you must use the Capture/Forward button to display network events. The capture forward button is located at the left hand side of the blue band that is below the topology window. Of the three buttons there, it is the one on the right.

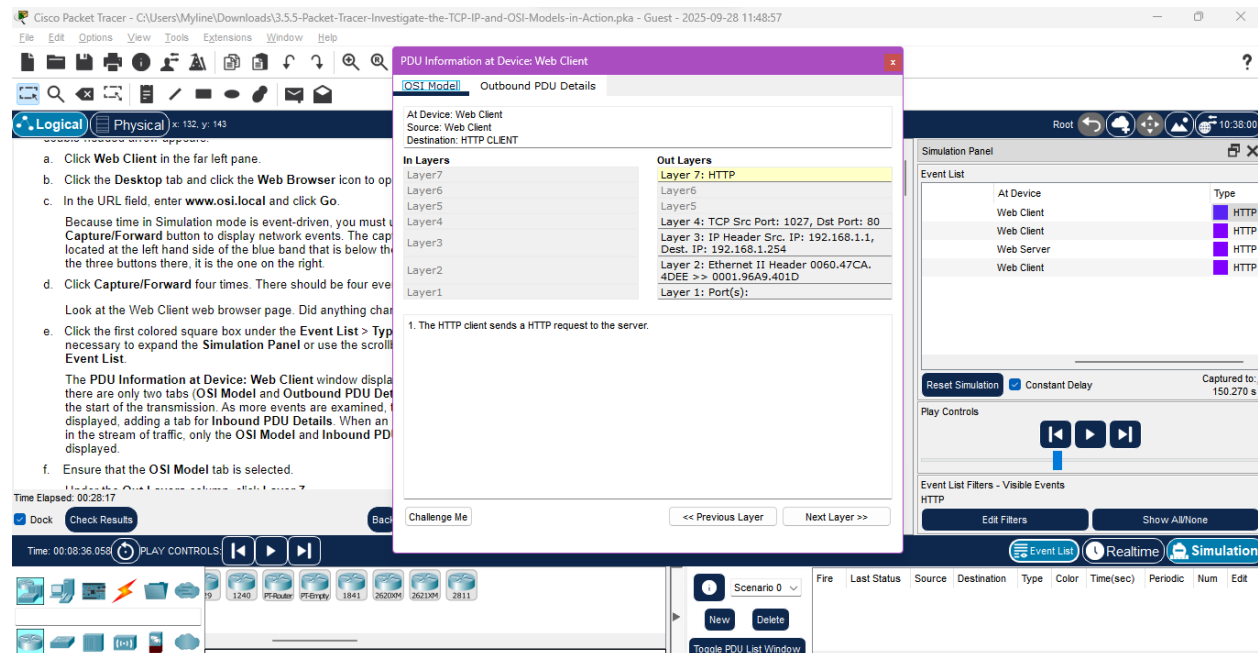
- d. Click Capture/Forward four times. There should be four events in the Event List.

Question: Look at the Web Client web browser page. Did anything change? **Yes, there is. It displayed "You have successfully accessed the home page for Web Server"**



e. Click the first colored square box under the Event List > Type column. It may be necessary to expand the Simulation Panel or use the scrollbar directly below the Event List.

The PDU Information at Device: Web Client window displays. In this window, there are only two tabs (OSI Model and Outbound PDU Details) because this is the start of the transmission. As more events are examined, there will be three tabs displayed, adding a tab for Inbound PDU Details. When an event is the last event in the stream of traffic, only the OSI Model and Inbound PDU Details tabs are displayed.



f. Ensure that the OSI Model tab is selected.

Under the Out Layers column, click Layer 7.

Questions:

What information is listed in the numbered steps directly below the In Layers and Out Layers boxes for Layer 7?

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

What is the Dst Port value for Layer 4 under the Out Layers column?

Dst Port: 80

What is the Dest. IP value for Layer 3 under the Out Layers column?

Dest. IP: 192.168.1.254

What information is displayed at Layer 2 under the Out Layers column? **Ethernet II Header 0060.47CA.4DEE >> 0001.96A9.401D**

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

>>

The screenshot shows the Cisco Packet Tracer interface with the PDU Information at Device: Web Client window open. The window has two tabs: OSI Model and Outbound PDU Details. The Outbound PDU Details tab is active, showing a list of layers (Layer 7 to Layer 1) and their corresponding protocols. Layer 7 is HTTP, Layer 4 is TCP, Layer 3 is IP, and Layer 2 is Ethernet II. The Ethernet II header shows the source MAC address 0060.47CA.4DEE and the destination MAC address 0001.96A9.401D. The Out Layers column is highlighted in yellow.

g. Click the Outbound PDU Details tab.

Information listed under the PDU Formats is reflective of the layers within the TCP/IP model.

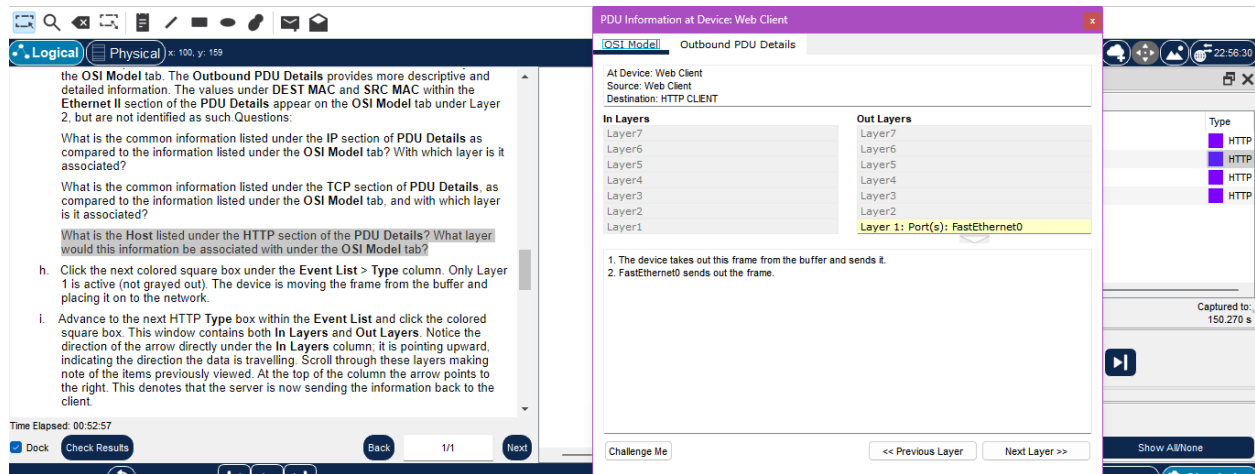
Note: The information listed under the Ethernet II section of the Outbound PDU Details tab provides even more detailed information than is listed under Layer 2 on the OSI Model tab. The Outbound PDU Details provides more descriptive and detailed information. The values under DEST MAC and SRC MAC within the Ethernet II section of the PDU Details appear on the OSI Model tab under Layer 2, but are not identified as such.

Questions:

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?

Common info listed under the IP section of the PDU Details tab and the OSI model tab is the source and destination IP addresses.

h. Click the next colored square box under the Event List > Type column. Only Layer 1 is active (not grayed out). The device is moving the frame from the buffer and placing it on to the network.



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.

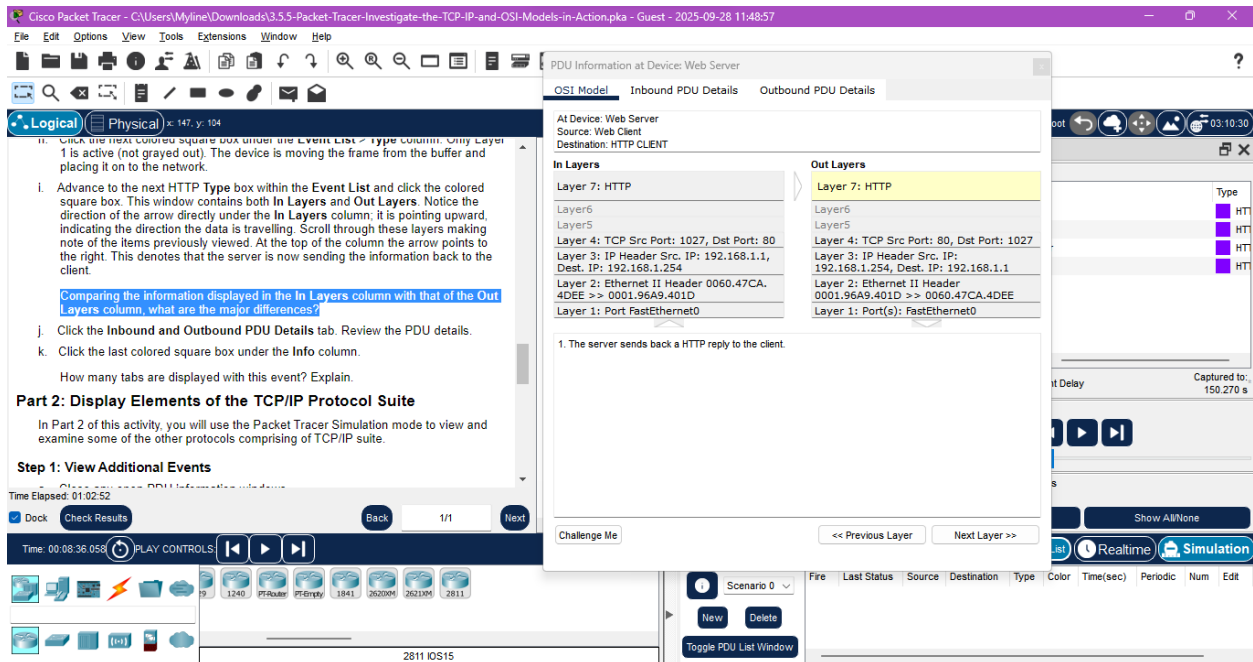
Question:

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

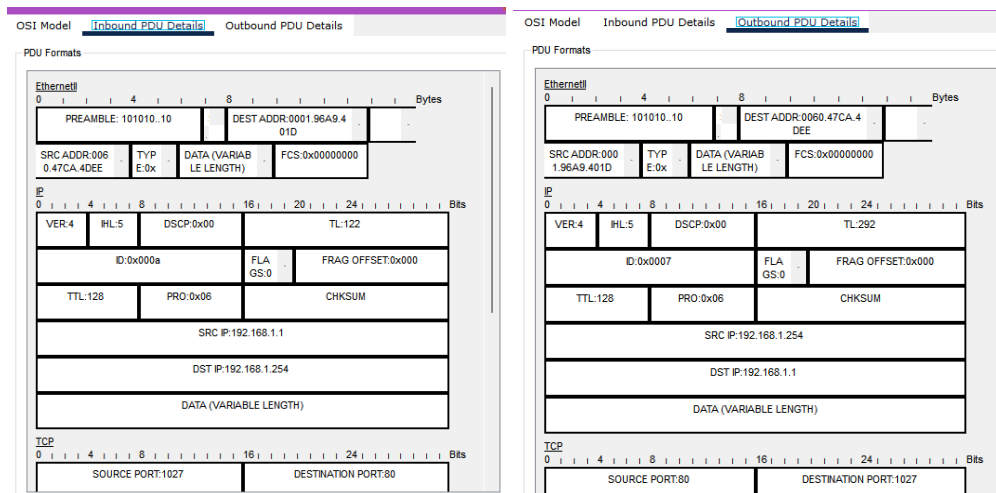
The key differences between In Layers and Out Layers are the direction of data flow and the swapping of addresses.

- In Layers shows the decapsulation process, where a device receives and "unpacks" data from lower layers to higher layers.
- Out Layers shows the encapsulation process, where the device "builds" a packet from higher layers down to lower layers for sending.

Additionally, the addresses are swapped: in the Out Layers, the source address becomes the destination and vice versa, preparing the packet for its return journey.



j. Click the Inbound and Outbound PDU Details tab. Review the PDU details.



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

Question:

How many tabs are displayed with this event? Explain.

This event shows two tabs: the **OSI Model** tab and the Inbound **PDU Details** tab. When an event is the last event in the stream of traffic, only the OSI Model and Inbound PDU Details tabs are displayed. Likewise, this is because the packet has completed its journey from the server and is now being received by the client. The OSI Model tab shows the process

of the client un-packing the data, moving from Layer 1 up to Layer 7. The Inbound PDU Details tab shows the packet in its final, raw form as it was received.

The screenshot displays the Cisco Packet Tracer interface with the following components:

- Top Bar:** Cisco Packet Tracer - C:\Users\Myline\Downloads\3.5.5-Packet-Tracer-Investigate-the-TCP-IP-and-OSI-Models-in-Action.pka - Guest - 2025-09-28 11:48:57
- Menu Bar:** File, Edit, Options, View, Tools, Extensions, Window, Help
- Toolbar:** Standard icons for file operations, navigation, and simulation controls.
- Left Panel:** Logical and Physical tabs. The Logical tab is active, showing a network diagram with a square box labeled 'x: 451, y: 131'.
- Central Panel:** PDU Information at Device: Web Client. The Inbound PDU Details tab is selected, showing the following information:
 - 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, Dest Port: 1027
 - 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
- Right Panel:** Simulation Panel. The Event List tab is active, showing a list of events with columns for At Device, Type, and Captured t. The events are:
 - At Device: Web Client, Type: HTTP, Captured t: 150.270
 - Web Client, Type: HTTP, Captured t: 150.270
 - Web Server, Type: HTTP, Captured t: 150.270
 - Web Client, Type: HTTP, Captured t: 150.270
- Bottom Bar:** Time: 00:08:36.058, PLAY CONTROLS (Play, Stop, Previous, Next), Challenge Me, << Previous Layer, Next Layer >>

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

In Part 2 of this activity, you will use the Packet Tracer Simulation mode to view and examine some of the other protocols comprising of TCP/IP suite.

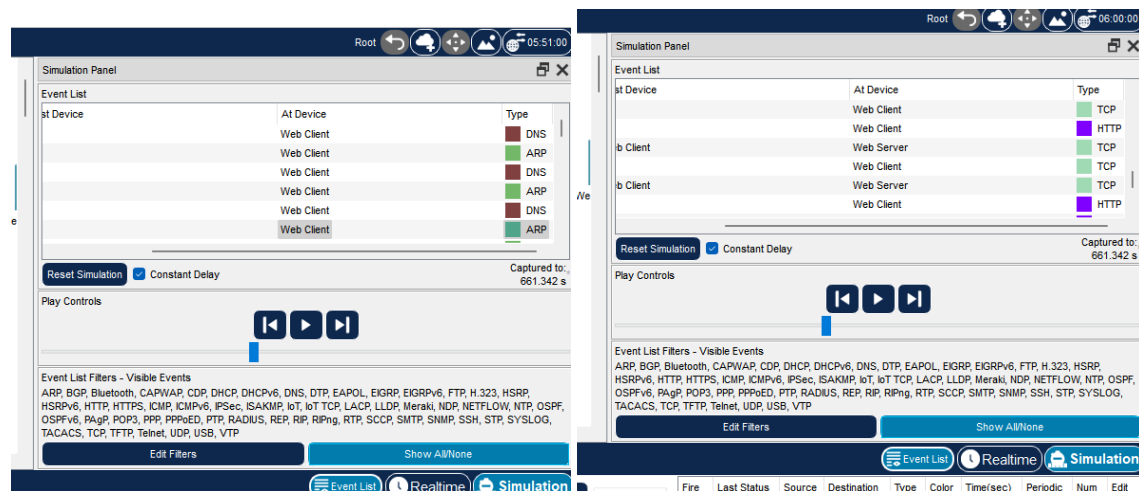
Step 1: View Additional Events

- Close any open PDU information windows.
- In the Event List Filters > Visible Events section, click Show All/None.

Question:

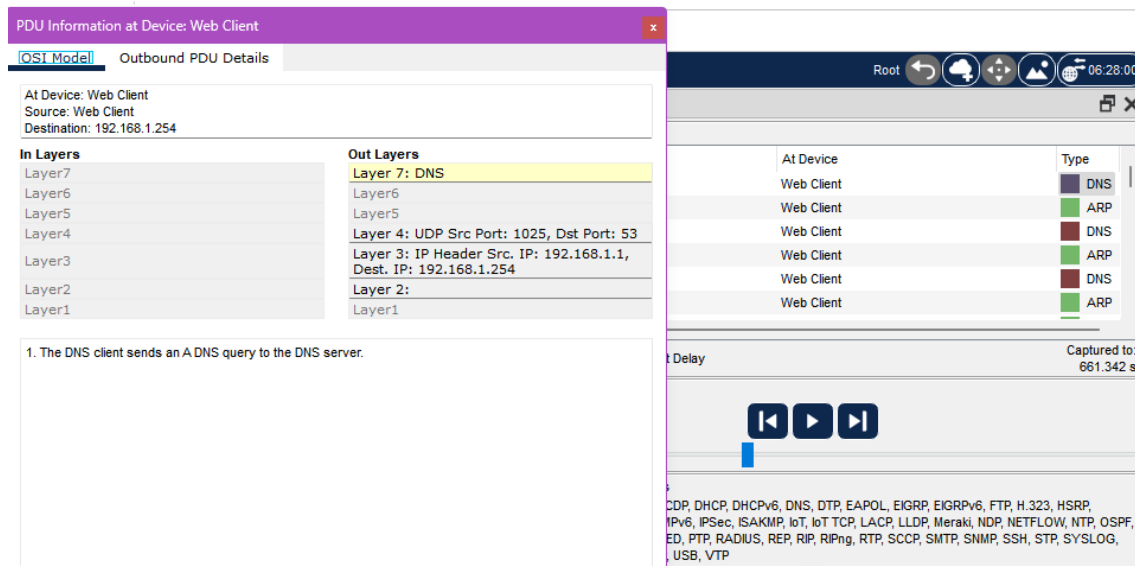
What additional Event Types are displayed?

DNS, ARP, TCP, HTTP



These extra entries play various roles within the TCP/IP suite. Address Resolution Protocol (ARP) requests MAC addresses for destination hosts. DNS is responsible for converting a name (for example, www.osi.local) to an IP address. The additional TCP events are responsible for connecting, agreeing on communication parameters, and disconnecting the communications sessions between the devices. These protocols have been mentioned previously and will be further discussed as the course progresses. Currently there are over 35 possible protocols (event types) available for capture within Packet Tracer.

- Click the first DNS event in the Type column. Explore the OSI Model and PDU Detail tabs and note the encapsulation process. As you look at the OSI Model tab with Layer 7 highlighted, a description of what is occurring is listed directly below the In Layers and Out Layers (“1. The DNS client sends a DNS query to the DNS server.”). This is very useful information to help understand what is occurring during the communication process.

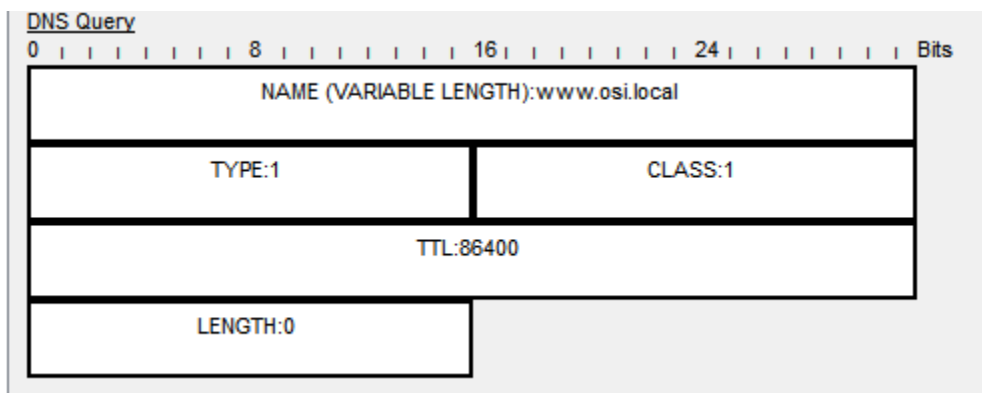


d. Click the Outbound PDU Details tab.

Question:

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

www.osi.local

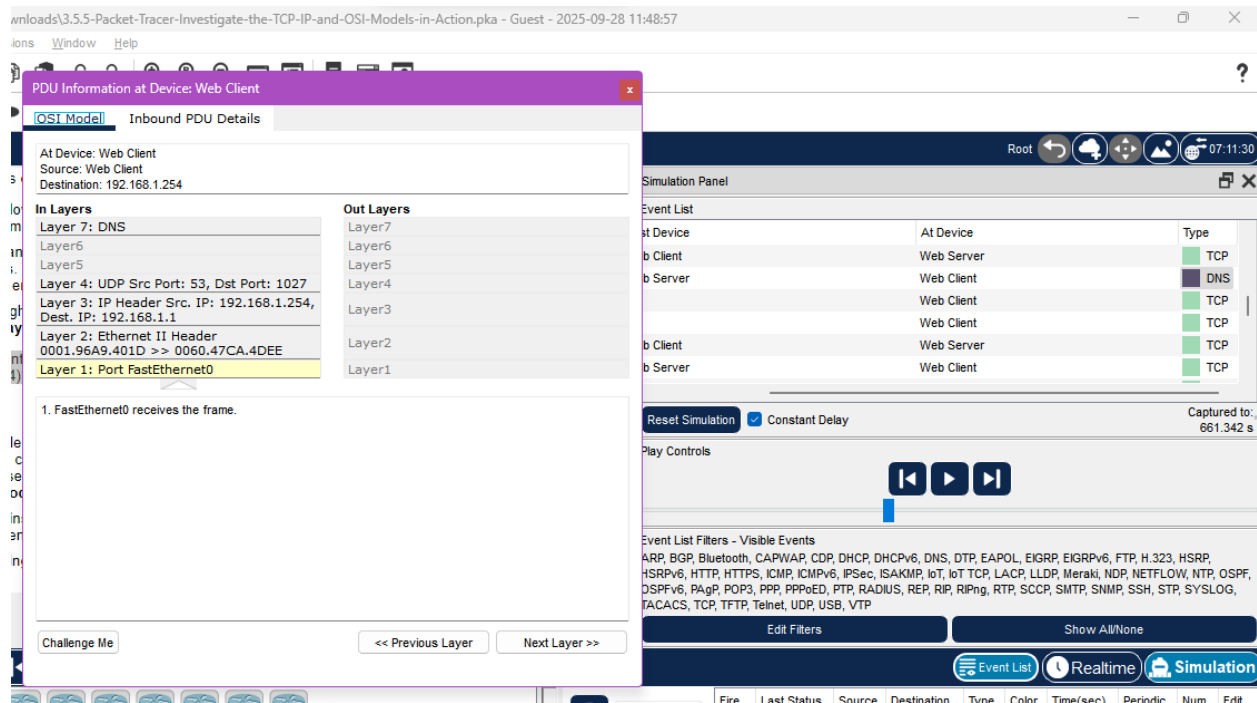


e. Click the last DNS Info colored square box in the event list.

Questions:

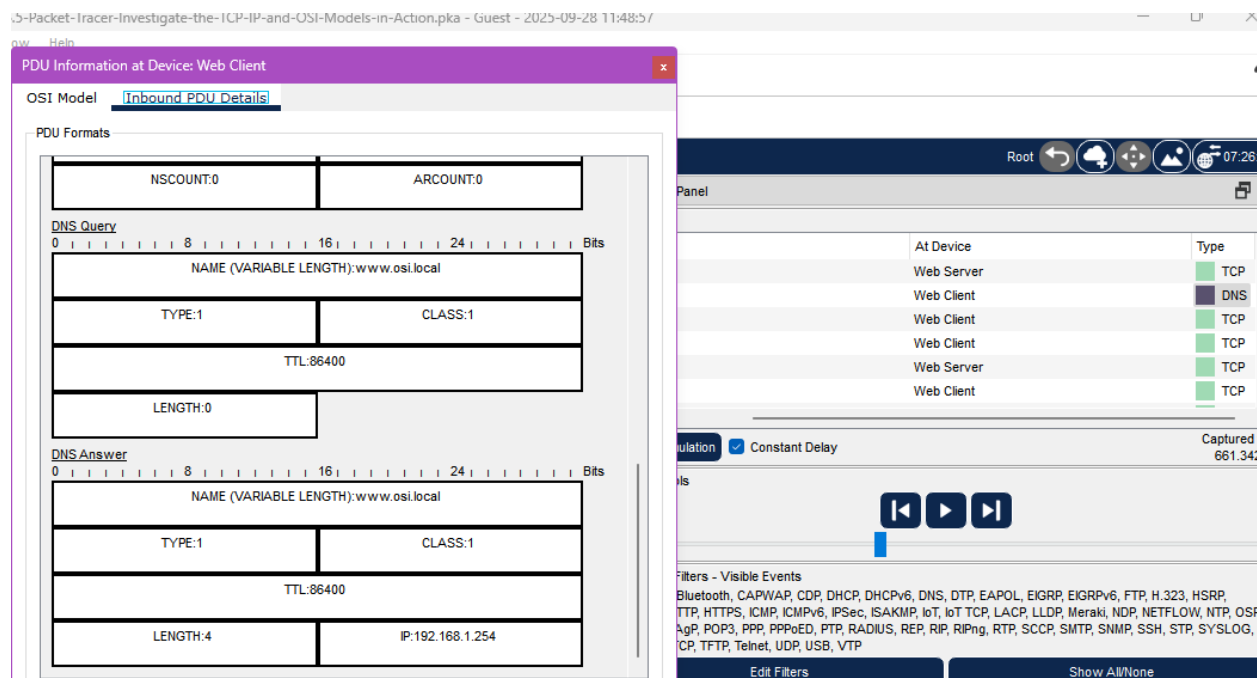
At which device was the PDU captured?

Web Client



What is the value listed next to ADDRESS: in the DNS ANSWER section of the Inbound PDU Details?

IP: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.

Question:

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

4. The TCP connection is successful.

5. The device sets the connection state to ESTABLISHED.

Investigate-the-TCP-IP-and-OSI-Models-in-Action.pka - Guest - 2025-09-28 11:48:57

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.

Challenge Me << Previous Layer Next Layer >>

At Device Type

Web Client	TCP
Web Client	HTTP
Web Server	TCP
Web Client	TCP
Web Server	TCP
Web Client	HTTP

Captured to: 661.342 s

Delay

CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, IPv6, IPSec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, USB, VTP

Show All/None

Event List Realtime Simulation

Source Destination Type Color Time(sec) Periodic Num Edit

TCP manages the connecting and disconnecting of the communications channel along with other responsibilities. This particular event shows that the communication channel has been 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.

Question:

What is the purpose of this event, based on the information provided in the last item in the list (should be item 4)?

The purpose of this event is to **close the TCP connection**. This event marks the final step in the communication session between the Web Client and the Web Server.

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

Layer7

Layer6

Layer5

Layer 4: TCP Src Port: 1027, 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

Layer7

Layer6

Layer5

Layer4

Layer3

Layer2

Layer1

1. The device receives a TCPACK segment on the connection to 192.168.1.1 on port 1027.

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 Me

<< Previous Layer

Next Layer >>

Root

18:56:30

Simulation Panel

Event List

At Device	Type
Web Client	TCP
Web Server	TCP
Web Client	TCP
Web Server	TCP

Reset Simulation

☒ Constant Delay

Captured to: 150.270 s

Play Controls

<

▶

⏸

Event List Filters - Visible Events

ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, IoT, IoT TCP, LACP, LLDP, Meraki, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, PPP, PPPoE, PTP, RADIUS, REP, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP

Edit Filters

Show All/None

Event List

Realtime

Simulation

Challenge Questions

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**

The screenshot shows the 'OSI Model' tab for an 'Inbound PDU Details' at a 'Web Client'. The 'In Layers' list on the left shows Layer 4 highlighted with the text 'Layer 4: TCP Src Port: 80, Dst Port: 1027'. The 'Out Layers' list on the right shows Layer 7 through Layer 1. Below the lists, a status message reads: '1. The device receives a TCP PUSH+ACK segment on the connection to 192.168.1.254 on port 80.'

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: 1027
Layer 3: IP Header Src. IP: 192.168.1.254, Dst. 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

1. The device receives a TCP PUSH+ACK segment on the connection to 192.168.1.254 on port 80.

What port is the Web Server listening on for a DNS request? **Port 53**

The screenshot shows two overlapping windows. The 'PDU Information at Device: Web Client' window displays the 'Outbound PDU Details' with 'Layer 4: UDP Src Port: 1025, Dst Port: 53' highlighted. The 'Simulation Panel' window shows an 'Event List' with five entries, all from 'Web Client' with types 'DNS', 'ARP', 'DNS', 'ARP', and 'DNS'. The 'Play Controls' section includes buttons for 'Reset Simulation', 'Constant Delay', and a play button. The status bar indicates 'Captured to: 661.342 s'.

At Device	Type
Web Client	DNS
Web Client	ARP
Web Client	DNS
Web Client	ARP
Web Client	DNS

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