Course: Cloud and Network Security CNS1 - 2026

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Week one Assignment one:

Class exercise: Examining TCP/IP and OSI Models in Action

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Introduction

The 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.

As data moves through the network, it is broken down into smaller pieces and labeled so that the pieces can be reassembled when they arrive at the destination. Each piece is assigned a specific name (protocol data unit [PDU]) and associated with a particular 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.

Answers to questions

- **Question:** Look at the Web Client web browser page. Did anything change?

  - Answer: Yes, the web browser now displays the message "You have successfully accessed the home page for Web Server".

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

  - The DNS server finds an IP address associated with this domain, www.osi.local. It sends back a response.

- **Question:** What is the Dst Port value for Layer 4 under the Out Layers column?

  - Layer 4:UDP Src Port: 53, Dst Port: 1025

- **Question:** What is the Dest IP value for Layer 3 under the Out Layers column?

  - IP Header Src IP: 192.168.1.254 Dest IP: 192.168.1.1

- **Question:** What information is displayed at Layer 2 under the Out Layers column?

    Source MAC address (client's MAC) and Destination MAC address (server's MAC).

- **Question (Step 2g):** 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?

    o **Answer: Source IP Address and Destination IP Address.** This is associated with **Layer 3** (Network Layer).

- **Question:** 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?

    o **Answer: Source Port and Destination Port.** This is associated with **Layer 4** (Transport Layer).

- **Question:** 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?

    o **Answer:** Host: **www.osi.local**. This is associated with **Layer 7** (Application Layer).

- **Question (Step 2i):** Comparing the information displayed in the In Layers column with that of the Out Layers column, what are the major differences?

    o **Answer: The Source and Destination addresses are swapped.** (The Source IP/MAC in the "In Layers" becomes the Destination IP/MAC in the "Out Layers", and vice versa, because the server is replying to the client).

- **Question (Step 2k):** How many tabs are displayed with this event? Explain.

    o **Answer: Only 2 tabs** (OSI Model and Inbound PDU Details). This is because the packet has reached its final destination (the client), so there is no "Outbound" PDU to send further.

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

Step 1: View Additional Events
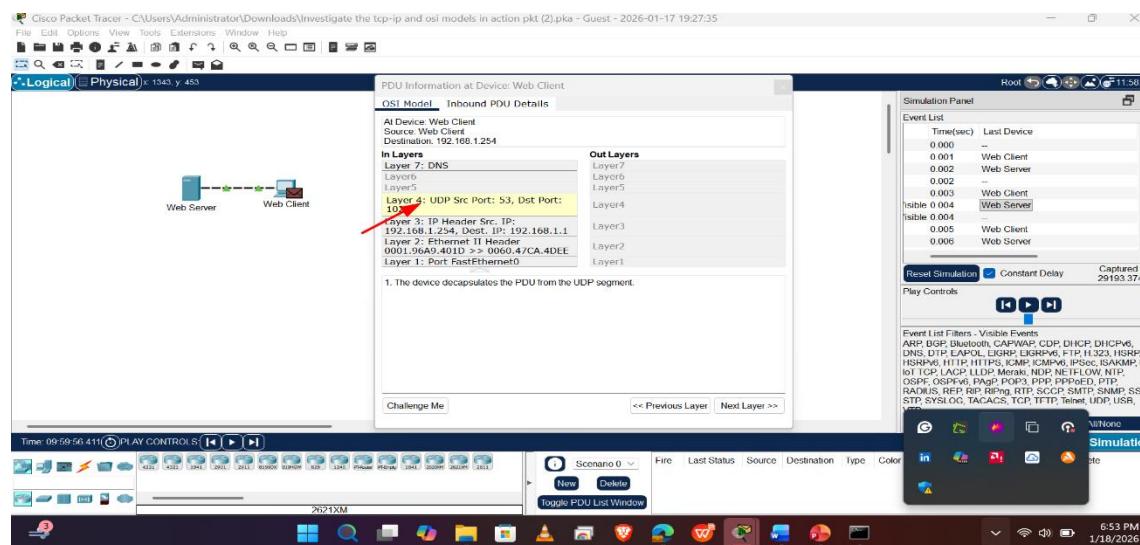
- **Question (Step 1b):** What additional Event Types are displayed?

    o **Answer: ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DNS, TCP**, etc.

- **Question (Step 1d):** What information is listed in the NAME field in the DNS QUERY section?

    o **Answer: www.osi.local**

- **Question:** At which device was the PDU captured?

  - **Answer: Web Client** (It is the DNS reply arriving back at the computer).

- **Question (Step 1e - Second Bullet):** What is the value listed next to ADDRESS: in the DNS ANSWER section of the Inbound PDU Details?

  - **Answer: 192.168.1.254**

- **Question (Step 1f):** In the numbered list directly below the In Layers and Out Layers, what is the information displayed under items 4 and 5?

  - **Answer:**

    - The TCP connection is successful.

    - The device sets the connection state to ESTABLISHED**.**

- **Question (Step 1g):** What is the purpose of this event, based on the information provided in the last item in the list?

  - **Answer: Closing the connection** (The device closes the TCP connection).

Challenge Questions

- **Question:** 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?

  - **Answer: 80**

- **Question:** What port is the Web Server listening on for a DNS request?

  - **Answer: 53**
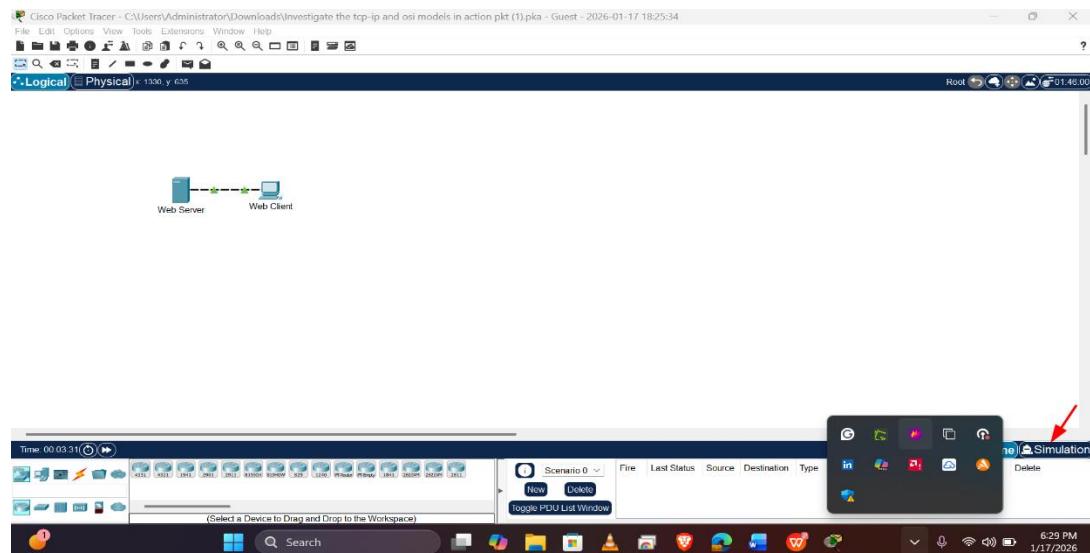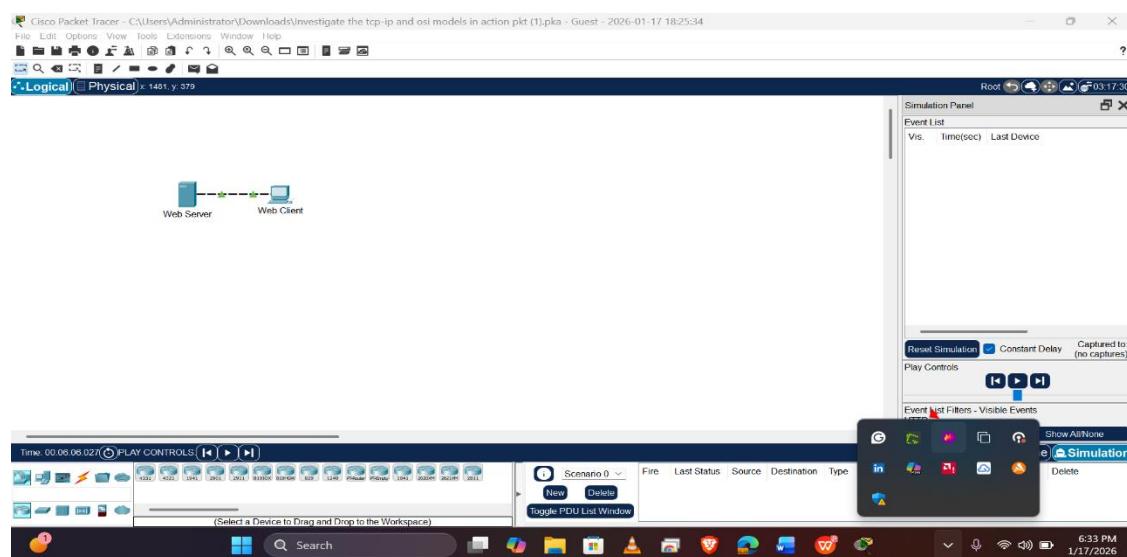
Step 1: Switch from Realtime to Simulation mode.

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.

    a.   Click the **Simulation** mode icon to switch from **Realtime** mode to **Simulation** mode.
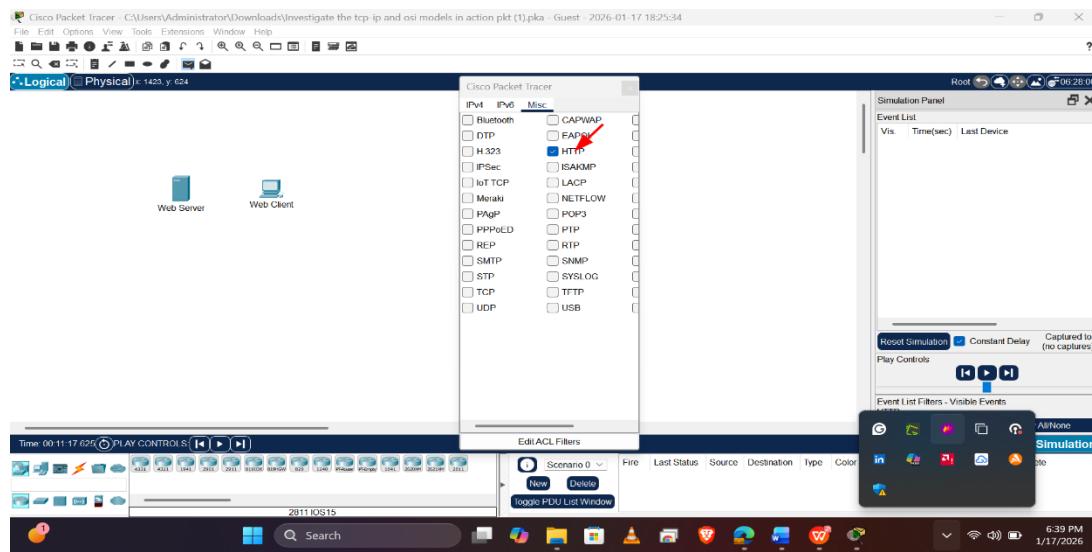

    b.   Select **HTTP** from the **Event List Filters**.

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.
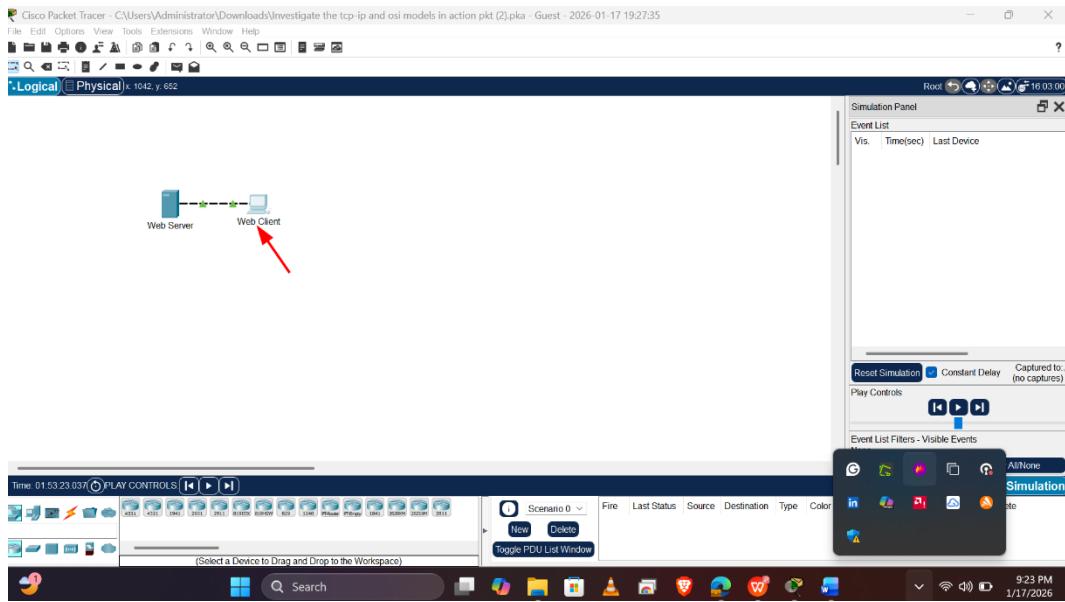

Step 2: Generate web (HTTP) traffic.

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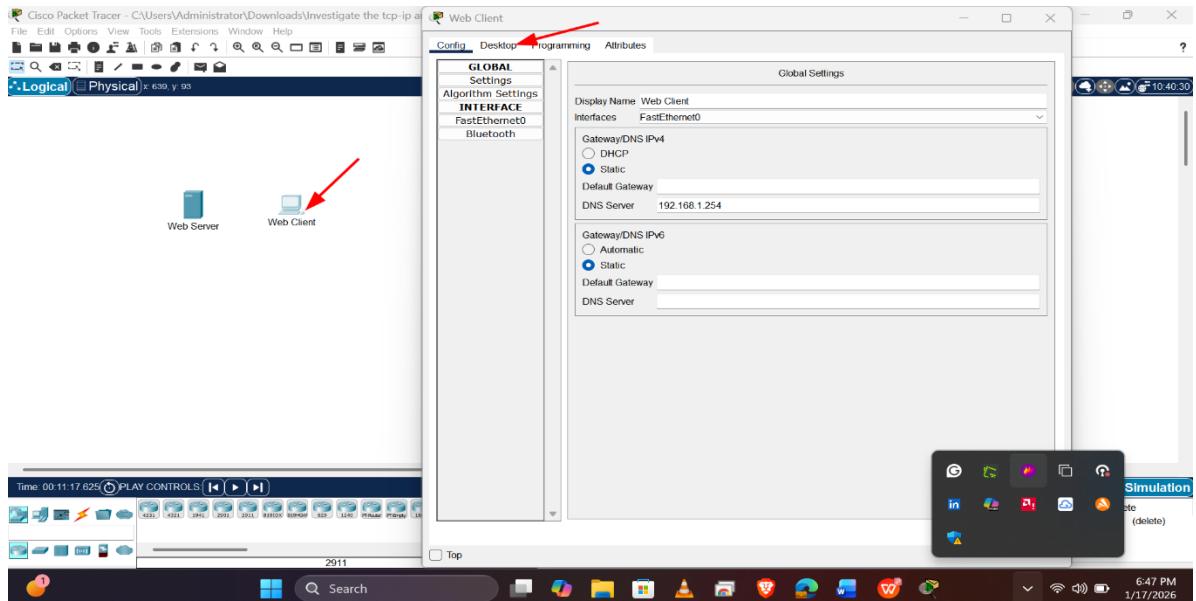
Note: The Web Server and Web Client are displayed in the left pane. The panels can be adjusted in size by hovering next to the scroll bar and dragging left or right when the double-headed arrow appears.

    a. Click **Web Client** in the far-left pane.
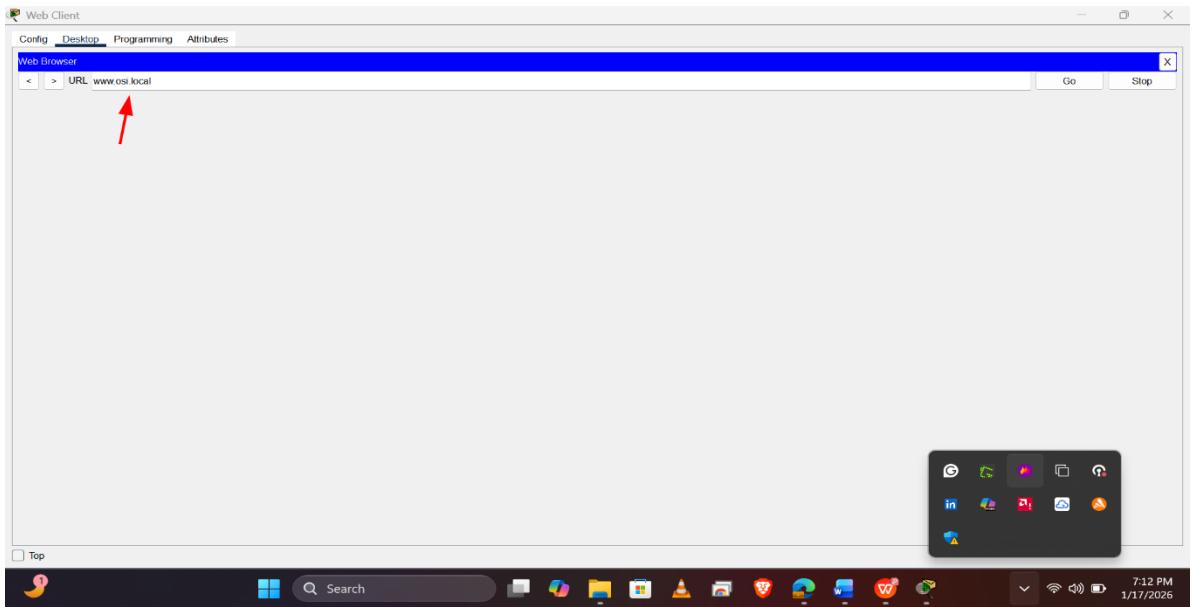
b. Click the **Desktop** tab and click the **Web Browser** icon to open it.
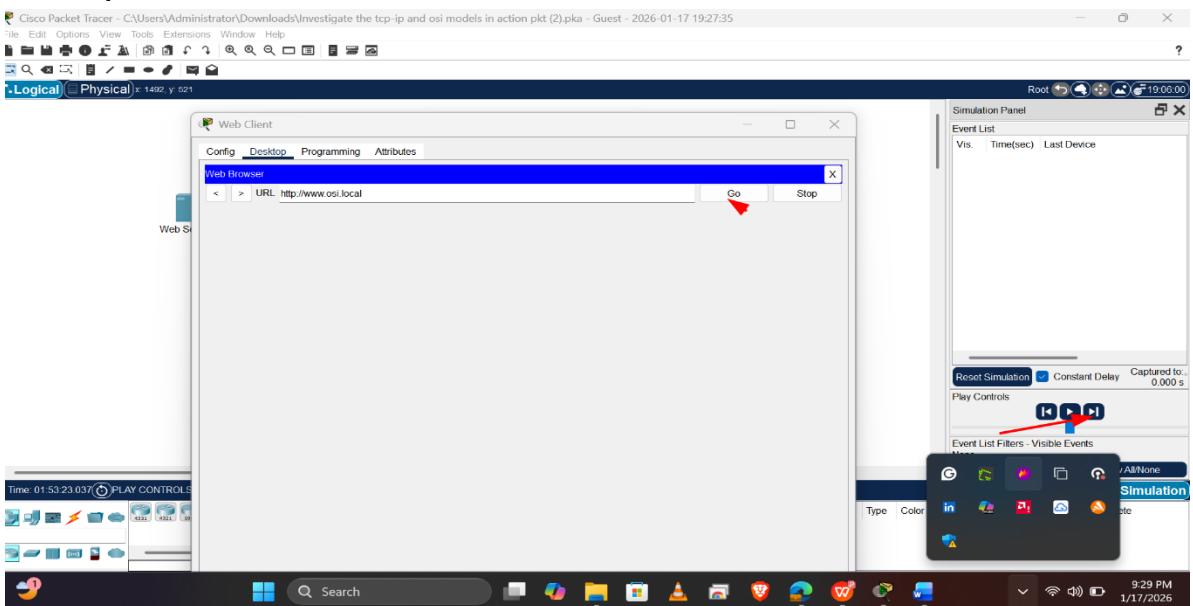
c. In the URL field, enter **www.osi.local** and click **Go**.
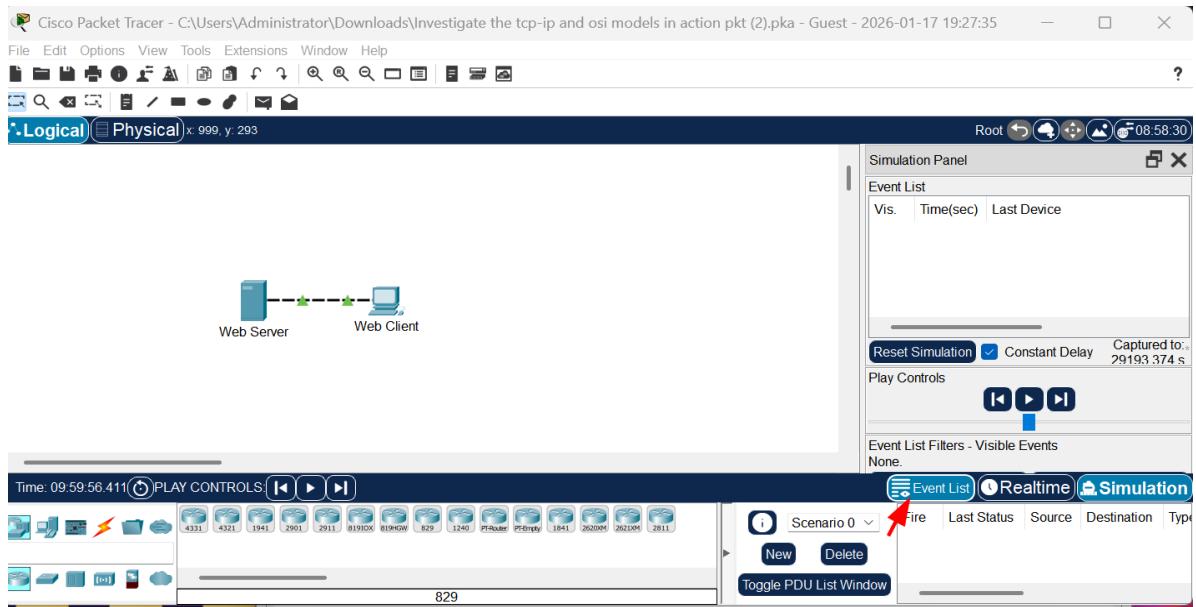
Because time in Simulation mode is event-driven, you must use the **Capture/Forward** button to display network events. The capture forward button is located at the left-hand side of the blue band that is below the topology window. Of the three buttons there, it is the one on the right.

   d.   Click **Capture/Forward** four times. There should be four events in the Event List.
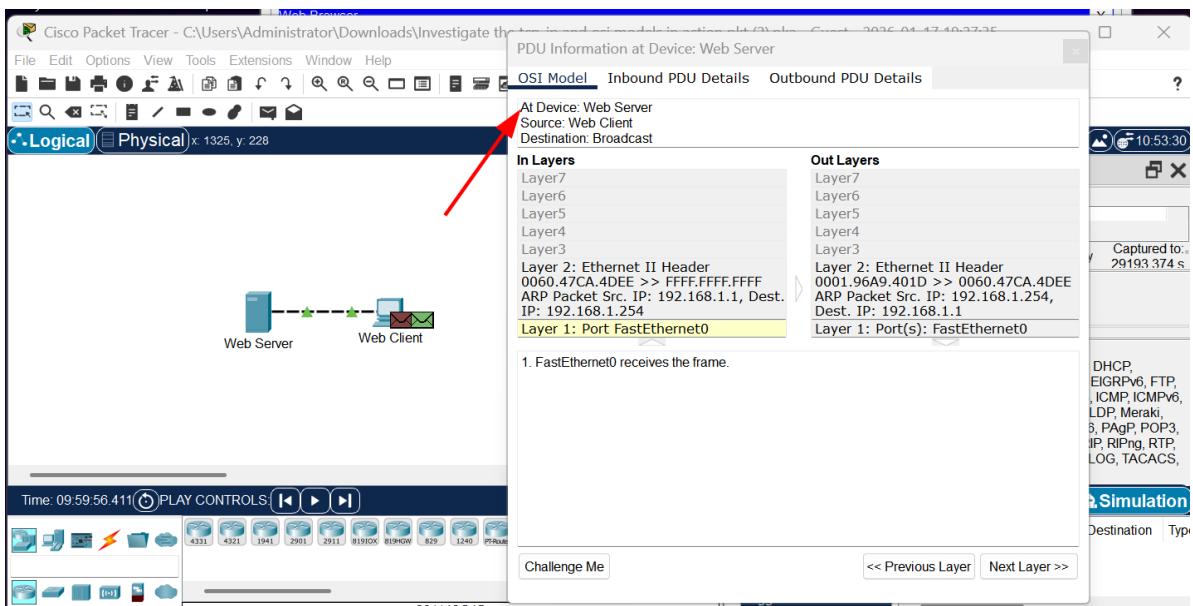
    e.   Click the first colored square box under the **Event List > Type** column. It may be necessary to expand the **Simulation Panel** or use the scrollbar directly below the **Event List**.
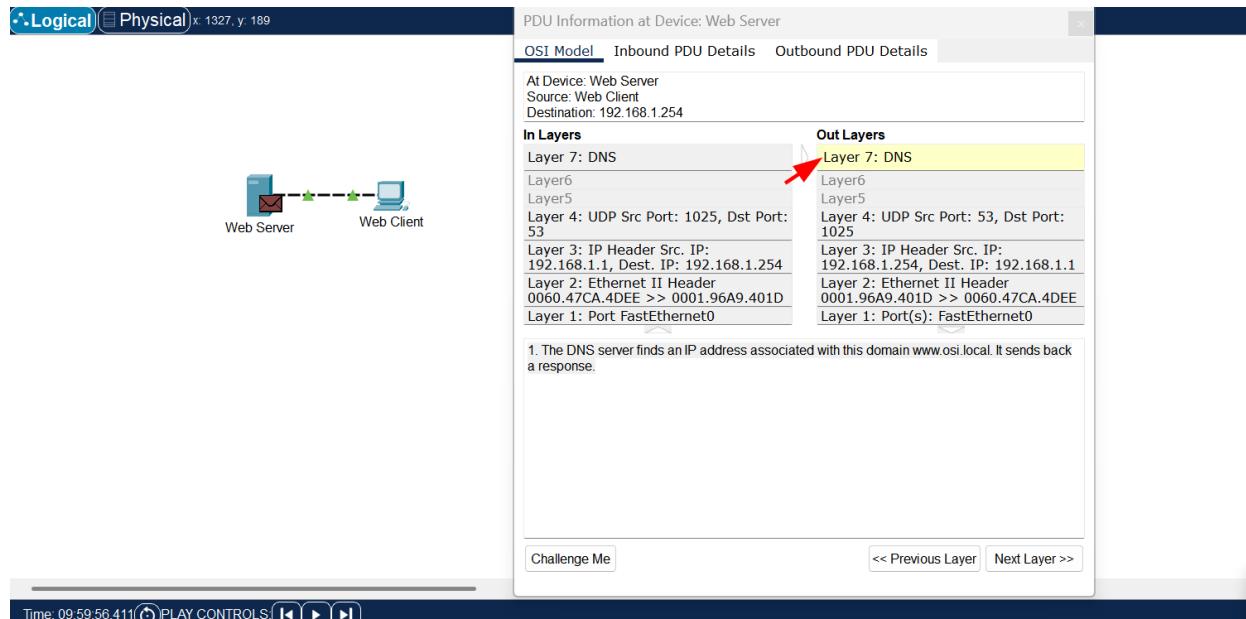
The **PDU Information at Device: Web Client** window displays. In this window, there are only two tabs (**OSI Model** and **Outbound PDU Details**) because this is the start of the transmission. As more events are examined, there will be three tabs displayed, adding a tab for **Inbound PDU Details**. 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.
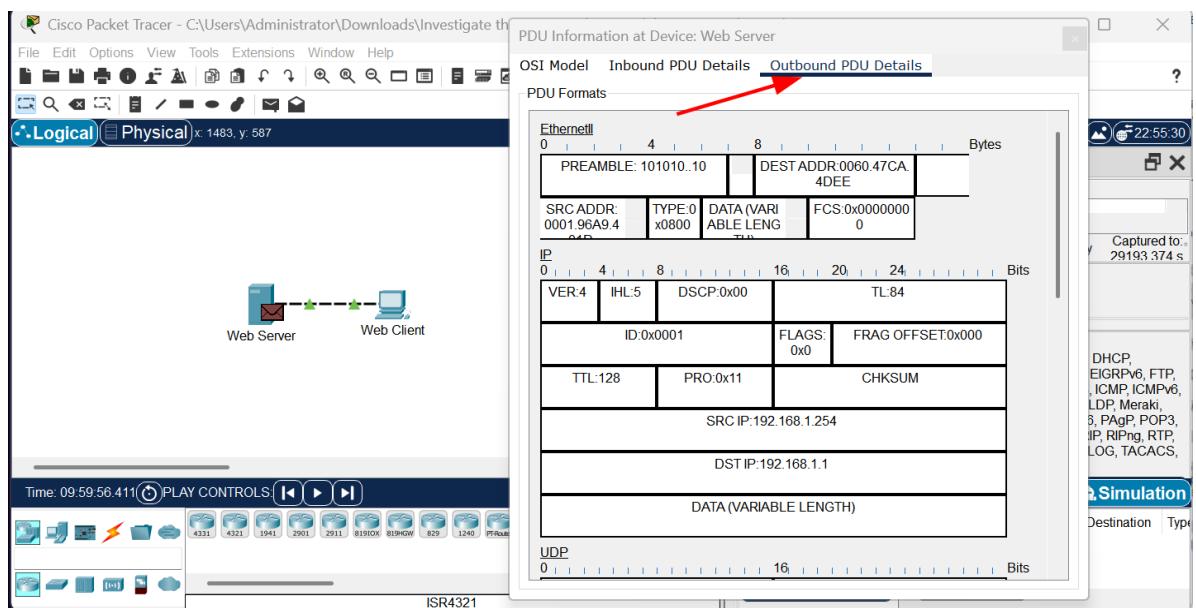
Under the **Out Layers** column, click **Layer 7**.

g. Click the **Outbound PDU Details** tab.
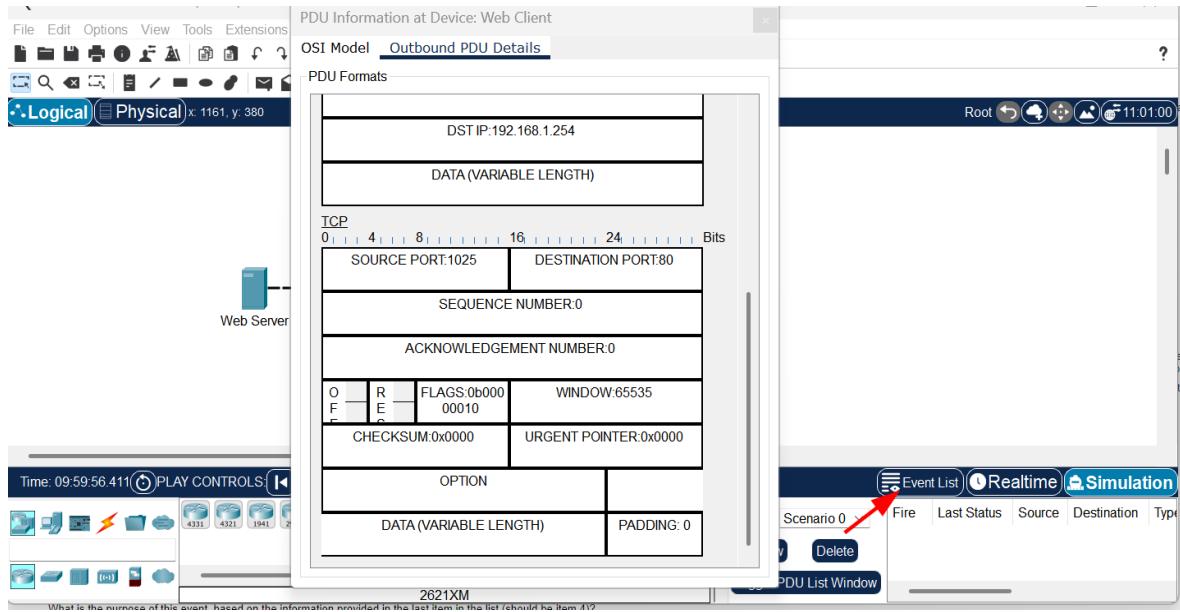
Information listed under the **PDU Formats** is reflective of the layers within the TCP/IP model.

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.

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.

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

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

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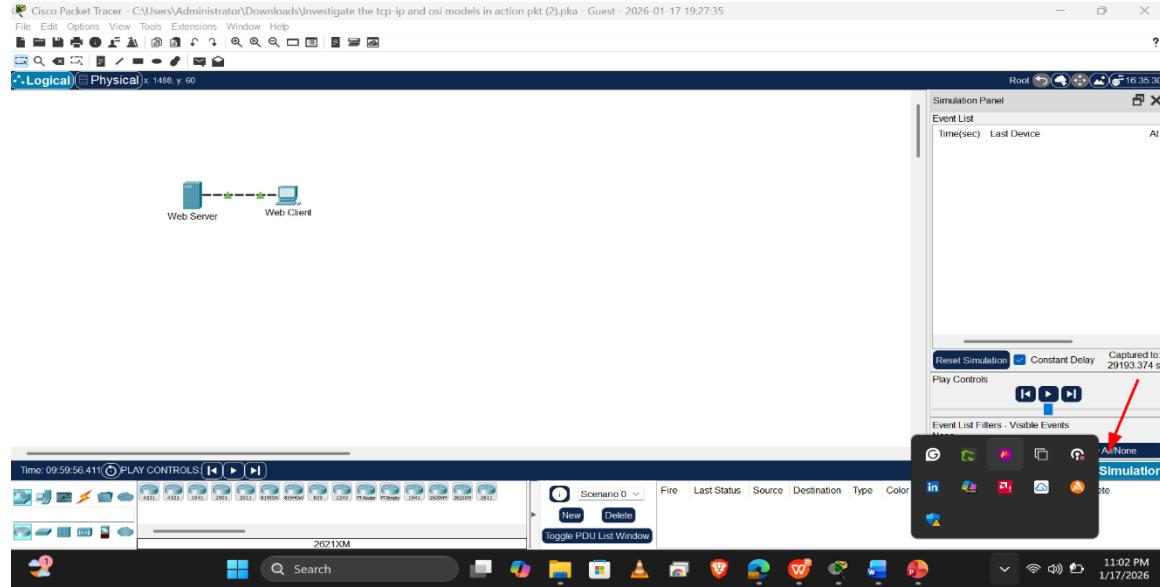
Part 2: Display Elements of the TCP/IP Protocol Suite

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
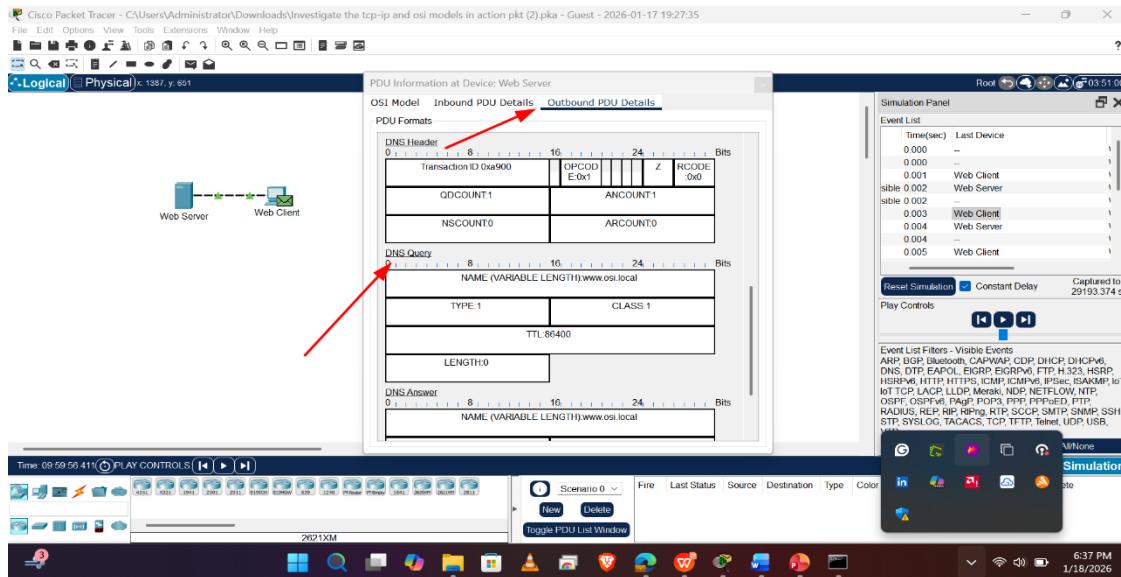
a.   Close any open PDU information windows.

b.   In the **Event List Filters** > **Visible Events** section, click **Show All/None**.

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 communication 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.

c.   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.

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

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.

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**.

Conclusion

This lab provided practical insight into the layered architecture of network communication. Using Packet Tracer's simulation, I observed the encapsulation process as an HTTP request traversed the TCP/IP and OSI layers. Analyzing the PDUs clarified the distinct roles of protocols like DNS, TCP, and ARP in establishing connections and translating addresses. The activity effectively demonstrated how abstract models correspond to real data transmission, reinforcing core concepts such as port numbers and addressing at different layers. This foundational visualization is crucial for understanding complex network operations.