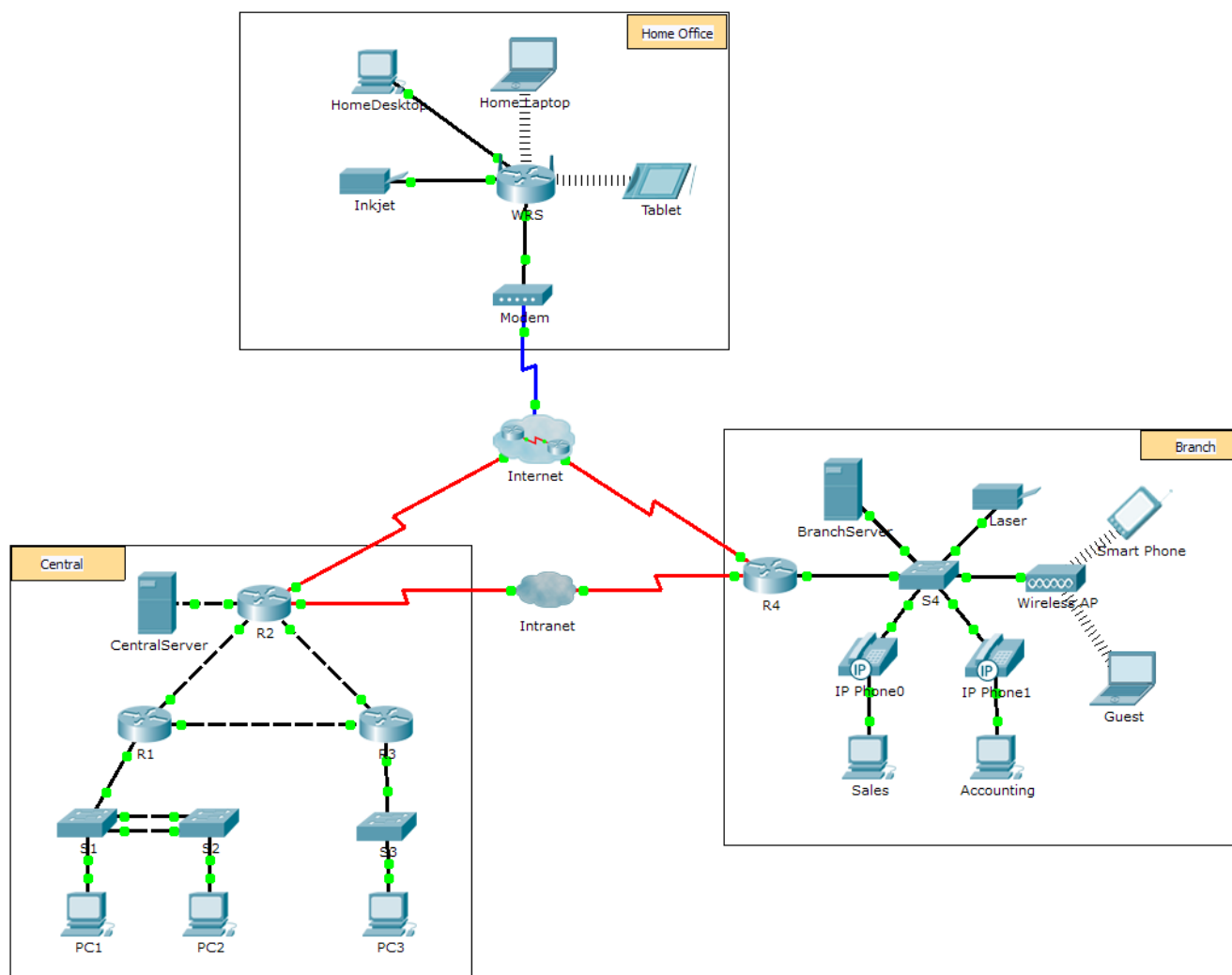


Packet Tracer - Explore a Network

Topology



Objectives

Part 1: Examine Internetwork Traffic at Branch

Part 2: Examine Internetwork Traffic to Central

Part 3: Examine Internet Traffic from Branch

Background

This simulation activity is intended to help you understand the flow of traffic and the contents of data packets as they traverse a complex network. Communications will be examined at three different locations simulating typical business and home networks.

Take a few moments to study the topology displayed. The Central location has three routers and multiple networks possibly representing different buildings within a campus. The Branch location has only one router with a connection to both the Internet and a dedicated wide-area network (WAN) connection to the Central

location. The Home Office makes use of a cable modem broadband connection to provide access to both the Internet and to corporate resources over the Internet.

The devices at each location use a combination of static and dynamic addressing. The devices are configured with default gateways and Domain Name System (DNS) information, as appropriate.

1. Examine Internetwork Traffic at Branch

In Part 1 of this activity, you will use Simulation mode to generate web traffic and examine the HTTP protocol along with other protocols necessary for communications.

1. Switching from Realtime to Simulation mode.

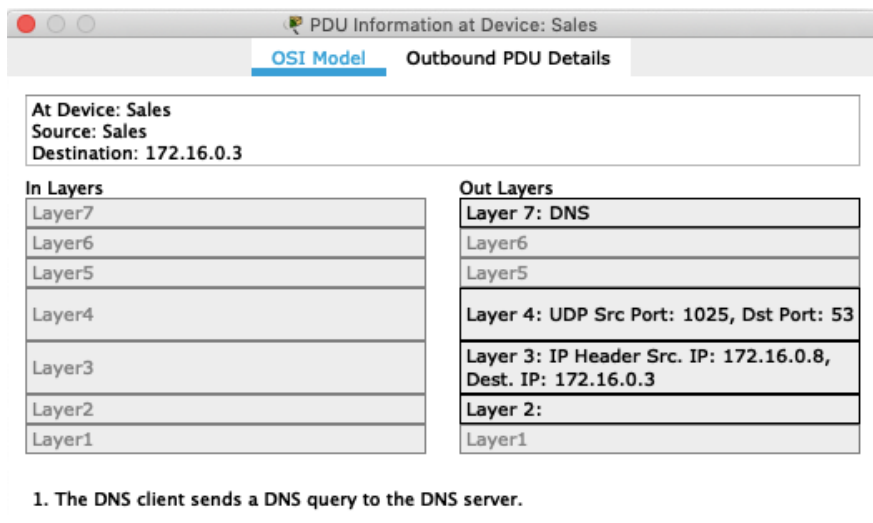
- Click the **Simulation** mode icon to switch from **Realtime** mode to **Simulation** mode.
- Verify that **ARP**, **DNS**, **HTTP**, and **TCP** are selected from the **Event List Filters**.
- Move the slider located below the **Play Controls** buttons (**Back**, **Auto Capture/Play**, **Capture/Forward**) all the way to the right.

2. Generate traffic using a web browser.

Currently the Simulation Panel is empty. In the Event List at the top of the Simulation Panel there are six columns listed across the heading. As traffic is generated and stepped through, events display in the list. The **Info** column is used to inspect the contents of a particular event.

Note: The panel to the left of the Simulation Panel displays the topology. Use the scrollbars to bring the Branch location into the panel, if necessary. The panels can be adjusted in size by hovering next to the scrollbar and dragging left or right.

- Click the **Sales PC** in the far left pane.
- Click the **Desktop** tab and click the **Web Browser** icon to open it.
- In the URL field, enter **http://branchserver.pt.pta** and click **Go**. Look in the Event List in the Simulation Panel. What is the first type of event listed?
-DNS
- Click the **DNS** info box. In the **Out Layers**, DNS is listed for Layer 7. Layer 4 is using UDP to contact the DNS server on port 53 (**Dst Port:**). Both the source and destination IP addresses are listed. What information is missing to communicate with the DNS server?



PDU Information at Device: Sales

OSI Model Outbound PDU Details

At Device: Sales
Source: Sales
Destination: 172.16.0.3

In Layers	Out Layers
Layer7	Layer 7: DNS
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: UDP Src Port: 1025, Dst Port: 53
Layer3	Layer 3: IP Header Src. IP: 172.16.0.8, Dest. IP: 172.16.0.3
Layer2	Layer 2:
Layer1	Layer1

1. The DNS client sends a DNS query to the DNS server.

- e. Click **Auto Capture/Play**. In approximately 45 seconds, a window displays, indicating the completion of the current simulation. Click the **View Previous Events** button. Scroll back to the top of the list and note the number of **ARP** events. Looking at the Device column in Event list, how many of the devices in the Branch location does the **ARP** request pass through?

PDU Information at Device: BranchServer

At Device: BranchServer
Source: Sales
Destination: Broadcast

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer4
Layer3	Layer3
Layer 2: Ethernet II Header 00D0.D3D7.5B29 >> FFFF.FFFF.FFFF ARP Packet Src. IP: 172.16.0.9, Dest. IP: 172.16.0.3	Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29 ARP Packet Src. IP: 172.16.0.3, Dest. IP: 172.16.0.9
Layer 1: Port FastEthernet0	Layer 1: Port(s): FastEthernet0

1. FastEthernet0 receives the frame.

- f. Scroll down the events in the list to the series of **DNS** events. Select the **DNS** event that has the "At Device" listed as **BranchServer**. Click the square box in the **Info** column. What can be determined by selecting Layer 7 in the **OSI Model**? (Look at the results displayed directly below **In Layers**.)

PDU Information at Device: BranchServer

At Device: BranchServer
Source: Sales
Destination: 172.16.0.3

In Layers	Out Layers
Layer 7: DNS	Layer 7: DNS
Layer6	Layer6
Layer5	Layer5
Layer 4: UDP Src Port: 1025, Dst Port: 53	Layer 4: UDP Src Port: 53, Dst Port: 1025
Layer 3: IP Header Src. IP: 172.16.0.9, Dest. IP: 172.16.0.3	Layer 3: IP Header Src. IP: 172.16.0.3, Dest. IP: 172.16.0.9
Layer 2: Ethernet II Header 00D0.D3D7.5B29 >> 0060.5C93.13A4	Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29
Layer 1: Port FastEthernet0	Layer 1: Port(s): FastEthernet0

1. The DNS server receives a DNS query.
2. The name queried resolved locally

- g. Click the **Outbound PDU Details** tab. Scroll to the bottom of the window and locate the DNS Answer section. What is the address displayed?

DNS Answer	
NAME:branchserver.pt.pta	
TYPE:4	CLASS:1
TTL:86400	
LENGTH:4	IP:172.16.0.3

- h. The next several events are **TCP** events enabling a communications channel to be established. Select the last **TCP** event at device **Sales** just prior to the **HTTP** event. Click the colored square Info box to display the PDU information. Highlight Layer 4 in the **In Layers** column. Looking at item 6 in the list directly below the **In Layers** column, what is the connection state?

Packet Tracer - Explore a Network

PDU Information at Device: Sales

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Sales
Source: Sales
Destination: 172.16.0.3

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer 4: TCP Src Port: 80, Dst Port: 1028	Layer 4: TCP Src Port: 1028, Dst Port: 80
Layer 3: IP Header Src. IP: 172.16.0.3, Dest. IP: 172.16.0.9	Layer 3: IP Header Src. IP: 172.16.0.9, Dest. IP: 172.16.0.3
Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29	Layer 2: Ethernet II Header 00D0.D3D7.5B29 >> 0060.5C93.13A4
Layer 1: Port FastEthernet0	Layer 1: Port(s): FastEthernet0

- The device receives a TCP FIN+ACK segment on the connection to 172.16.0.3 on port 80.
- Received segment information: the sequence number 279, the ACK number 110, and the data length 20.
- The TCP segment has the expected peer sequence number.
- The device sets the connection state to CLOSING.

- i. The next several events are **HTTP** events. Select any of the **HTTP** events at an intermediary device (IP Phone or Switch). How many layers are active at one of these devices, and why?

PDU Information at Device: IP Phone0

OSI Model Inbound PDU Details Outbound PDU Details

At Device: IP Phone0
Source: Sales
Destination: HTTP CLIENT

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer4
Layer3	Layer3
Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29	Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29
Layer 1: Port Switch	Layer 1: Port(s): PC

1. Switch receives the frame.

- The individual protocols are organized in layers using the TCP/IP protocol model: Application, Transport, Internet, and Network Access Layers. TCP/IP protocols are specific to the Application, Transport, and Internet layers. The network access layer protocols are responsible for delivering the IP packet over the physical medium. These lower layer protocols are developed by various standards organizations.
- TCP/IP Protocol Suite (3.2.2.3)
- Introduction to Networks v6

- j. Select the last **HTTP** event at the Sales PC. Select the uppermost layer from the **OSI Model** tab. What is the result listed below the **In Layers** column?

PDU Information at Device: Sales

OSI Model Outbound PDU Details

At Device: Sales
Source: Sales
Destination: HTTP CLIENT

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer4
Layer3	Layer3
Layer2	Layer2
Layer1	Layer 1: Port(s): FastEthernet0

- The device takes out this frame from the buffer and sends it.
- FastEthernet0 sends out the frame.

2. Examine Internetwork Traffic to Central

In Part 2 of this activity, you will use Packet Tracer (PT) Simulation mode to view and examine how traffic leaving the local network is handled.

1. Set up for traffic capture to the Central web server.

- Close any open PDU Information windows.
- Click **Reset Simulation** (located near the middle of the Simulation Panel).
- Type **http://centralserver.pt.pta** in the web browser of the Sales PC.
- Click **Auto Capture/Play**; in approximately 75 seconds, a window displays, indicating the completion of the current simulation. Click **View Previous Events**. Scroll back to the top of the list; note that the first series of events are **DNS** and there are no **ARP** entries prior to contacting the **BranchServer**. Based on what you have learned so far, why is this the case?

-The Branch Server connects to a switch as type DNS first.

-Network Access Layer:

-Address Resolution Protocol (ARP): Provide dynamic address mapping between an IP address and a hardware address.

- TCP/IP Protocol Suite (3.2.2.3)

- Introduction to Networks v6

- Click the last DNS event in the **Info** column. Select **Layer 7** in the **OSI Model** tab.

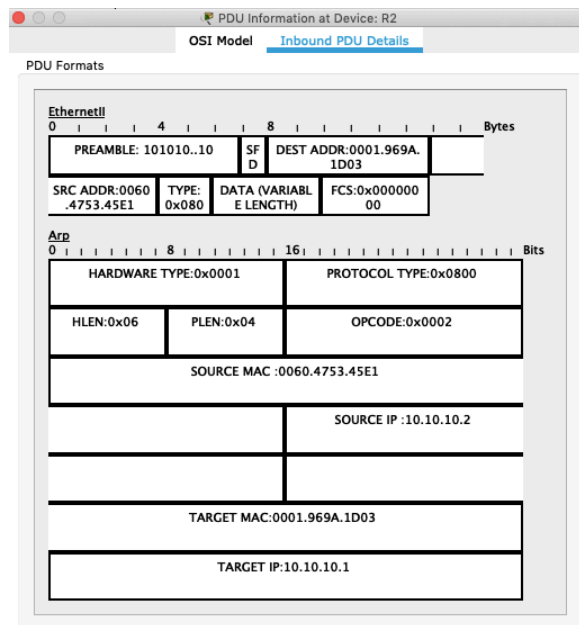
By looking at the information provided, what can be determined about the DNS results?

The screenshot shows the 'PDU Information at Device: Sales' window with the 'OSI Model' tab selected. It displays the details of a DNS response received at the Sales device. The 'In Layers' section shows Layer 7: DNS, Layer 6, Layer 5, Layer 4: UDP Src Port: 53, Dst Port: 1029, Layer 3: IP Header Src. IP: 172.16.0.3, Dest. IP: 172.16.0.9, Layer 2: Ethernet II Header 0060.5C93.13A4 >> 00D0.D3D7.5B29, and Layer 1: Port FastEthernet0. The 'Out Layers' section shows Layer7, Layer6, Layer5, Layer4, Layer3, Layer2, and Layer1. Below the layers, two numbered points explain the DNS response: 1. The DNS client receives a DNS response. 2. The received DNS response contains a resolved IP address for the queried domain.

- Click the **Inbound PDU Details** tab. Scroll down to the **DNS ANSWER** section. What is the address listed for centralserver.pt.pta?

The screenshot shows the 'DNS Answer' section of the 'Inbound PDU Details' window. It displays a bit field for the DNS answer with a bit length of 32 bits. The fields are: NAME:centralserver.pt.pta, TYPE:4, CLASS:1, TTL:86400, LENGTH:4, and IP:10.10.10.2.

- g. The next several events are **ARP** events. Click the colored square Info box of the last **ARP** event. Click the **Inbound PDU Details** tab and note the MAC address. Based on the information in the ARP section, what device is providing the ARP reply?

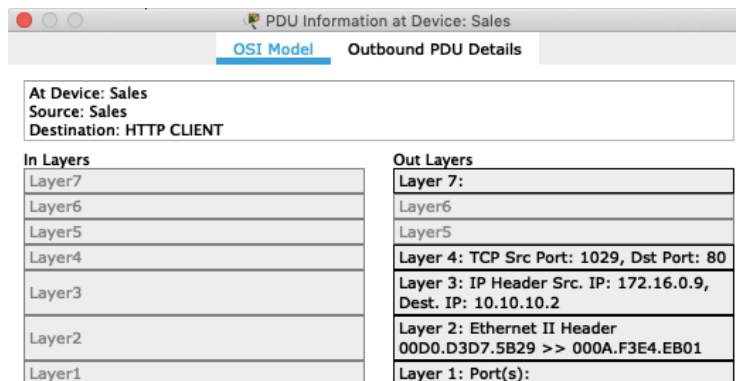


-Source MAC address – The Ethernet MAC address of the sending device, PC1. The MAC address of the Ethernet interface of PC1 is AAAA-AA-AA-AA-AA.

-Source MAC address – This is the data link address, or the Ethernet MAC address, of the device that sends the data link frame with the encapsulated IP packet. The MAC address of the Ethernet NIC of PC1 is AA-AA-AA-AA-AA-AA, written in hexadecimal notation.

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- h. The next several events are **TCP** events, once again preparing to set up a communications channel. Find the first **HTTP** event in the Event List. Click the colored square box of the **HTTP** event. Highlight Layer 2 in the **OSI Model** tab. What can be determined about the destination MAC address?



1. The next-hop IP address is a unicast. The ARP process looks it up in the ARP table.
2. The next-hop IP address is in the ARP table. The ARP process sets the frame's destination MAC address to the one found in the table.
3. The device encapsulates the PDU into an Ethernet frame.

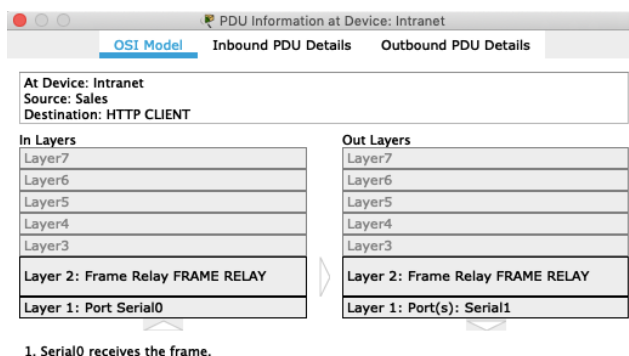
Packet Tracer - Explore a Network

- Destination MAC address – When the receiving device, the destination IP address, is on a different network from the sending device, the sending device uses the Ethernet MAC address of the default gateway or router. In this example, the destination MAC address is the MAC address of R1's Ethernet interface, 11-11-11-11-11-11. This is the interface that is attached to the same network as PC1.

- Destination MAC address – When the receiving device is on the same network as the sending device, this is the data link address of the receiving device. In this example, the destination MAC address is the MAC address of the FTP server: CC-CC-CC-CC-CC-CC, written in hexadecimal notation.

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- i. Click the **HTTP** event at device **R4**. Notice that Layer 2 contains an Ethernet II header. Click the **HTTP** event at device **Intranet**. What is the Layer 2 listed at this device?



Notice that there are only two active layers, as opposed to three active layers when moving through the router. This is a WAN connection, which will be discussed in a later course.

3. Examine Internet Traffic from Branch

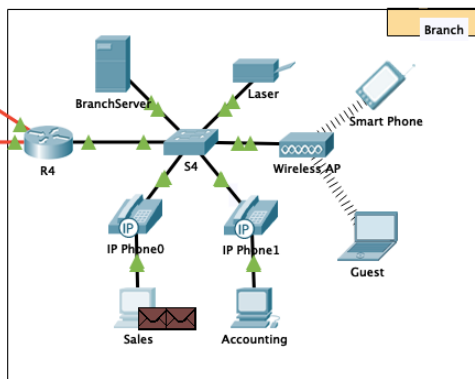
In Part 3 of this activity, you will clear the events and start a new web request that will make use of the Internet.

1. Set up for traffic capture to an Internet web server.

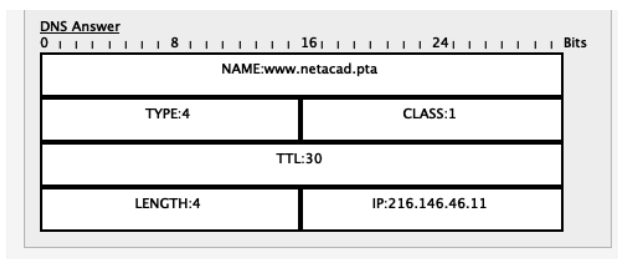
- a. Close any open PDU information windows.
- b. Click **Reset Simulation** near the middle of the Simulation Panel. Type **http://www.netacad.pta** in the web browser of the Sales PC.
- c. Click **Auto Capture/Play**; in approximately 75 seconds, a window displays, indicating the completion of the current simulation. Click **View Previous Events**. Scroll back to the top of the list; notice that the first series of events are **DNS**. What do you notice about the number of **DNS** events?

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	Sales	DNS
	0.000	--	Sales	DNS
	0.001	Sales	IP Phone0	DNS
	0.001	--	Sales	DNS
	0.002	Sales	IP Phone0	DNS
	0.002	IP Phone0	S4	DNS
	0.003	IP Phone0	S4	DNS
	0.003	S4	BranchServer	DNS
	0.003	--	BranchServer	DNS

- d. Observe some of the devices that the **DNS** events travel through on the way to a DNS server. Where are these devices located?



- e. Click the last **DNS** event. Click the **Inbound PDU Details** tab and scroll down to the last DNS Answer section. What is the address listed for www.netacad.pta?



- f. When routers move the **HTTP** event through the network, there are three layers active in both the **In Layers** and **Out Layers** in the **OSI Model** tab. Based on that information, how many routers are passed through?

~2;

11.330	--	Sales	IP Phone0	HTTP
11.331	Sales	IP Phone0	IP Phone0	TCP
11.331	--	Sales	IP Phone0	HTTP
11.332	Sales	IP Phone0	IP Phone0	HTTP
11.332	IP Phone0	S4	IP Phone0	TCP
11.333	IP Phone0	S4	IP Phone0	HTTP
11.333	S4	R4	IP Phone0	TCP
11.334	S4	R4	IP Phone0	HTTP
11.334	R4	ISP-Tier3a	IP Phone0	TCP
11.335	R4	ISP-Tier3a	IP Phone0	HTTP
11.340	ISP-Tier3a	R4	IP Phone0	HTTP
11.341	R4	S4	IP Phone0	HTTP
11.342	S4	IP Phone0	IP Phone0	HTTP
11.343	IP Phone0	Sales	IP Phone0	HTTP

- g. Click the **TCP** event just prior to the last **HTTP** event. Based on the information displayed, what is the purpose of this event?

PDU Information at Device: Sales

OSI Model Outbound PDU Details

At Device: Sales
Source: Sales
Destination: 216.146.46.11

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer 4: TCP Src Port: 1030, Dst Port: 80
Layer3	Layer 3: IP Header Src. IP: 172.16.0.9, Dest. IP: 216.146.46.11
Layer2	Layer 2: Ethernet II Header 00D0.D3D7.5B29 >> 000A.F3E4.EB01
Layer1	Layer 1: Port(s): FastEthernet0

1. The device closes the TCP connection to 216.146.46.11 on port 80.
2. The device sets the connection state to FIN_WAIT_1.
3. The device sends a TCP FIN+ACK segment.
4. Sent segment information: the sequence number 105, the ACK number 452, and the data length 20.

- h. There are several more **TCP** events listed. Locate the **TCP** event where the *Last Device* is **IP Phone** and the *Device At* is **Sales**. Click the colored square Info box and select **Layer 4** in the **OSI Model** tab. Based on the information from the output, what is the connection state set to?

PDU Information at Device: Sales

OSI Model Inbound PDU Details Outbound PDU Details

At Device: Sales
Source: Sales
Destination: 216.146.46.11

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer 4: TCP Src Port: 80, Dst Port: 1031	Layer 4: TCP Src Port: 1031, Dst Port: 80
Layer 3: IP Header Src. IP: 216.146.46.11, Dest. IP: 172.16.0.9	Layer 3: IP Header Src. IP: 172.16.0.9, Dest. IP: 216.146.46.11
Layer 2: Ethernet II Header 000A.F3E4.EB01 >> 00D0.D3D7.5B29	Layer 2: Ethernet II Header 00D0.D3D7.5B29 >> 000A.F3E4.EB01
Layer 1: Port FastEthernet0	Layer 1: Port(s): FastEthernet0

1. The device receives a TCP SYN+ACK segment on the connection to 216.146.46.11 on port 80.
2. Received segment information: the sequence number 0, the ACK number 1, and the data length 24.
3. The TCP segment has the expected peer sequence number.
4. The TCP connection is successful.
5. TCP retrieves the MSS value of 536 bytes from the Maximum Segment Size Option in the TCP header.
6. The device sets the connection state to ESTABLISHED.

Suggested Scoring Rubric

Activity Section	Question Location	Possible Points	Earned Points
Part 1: Examine Internetwork Traffic at Branch	Step 2c	5	
	Step 2d	5	
	Step 2e	5	
	Step 2f	5	
	Step 2g	5	
	Step 2h	5	
	Step 2i	5	
	Step 2j	5	
Part 1 Total		40	
Part 2: Examine Internetwork Traffic to Central	Step 1c	5	
	Step 1d	5	
	Step 1e	5	
	Step 1f	5	
	Step 1g	5	
	Step 1h	5	
Part 2 Total		30	
Part 3: Examine Internet Traffic from Branch	Step 1c	5	
	Step 1d	5	
	Step 1e	5	
	Step 1f	5	
	Step 1g	5	
	Step 1h	5	
Part 3 Total		30	
Total Score		100	