DCNC
Assignment 1

Data Communication & Net-Centric Computing

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Task 1 [Noah & Sebastian]

Overall Network Layout & IP Configuration Explanation

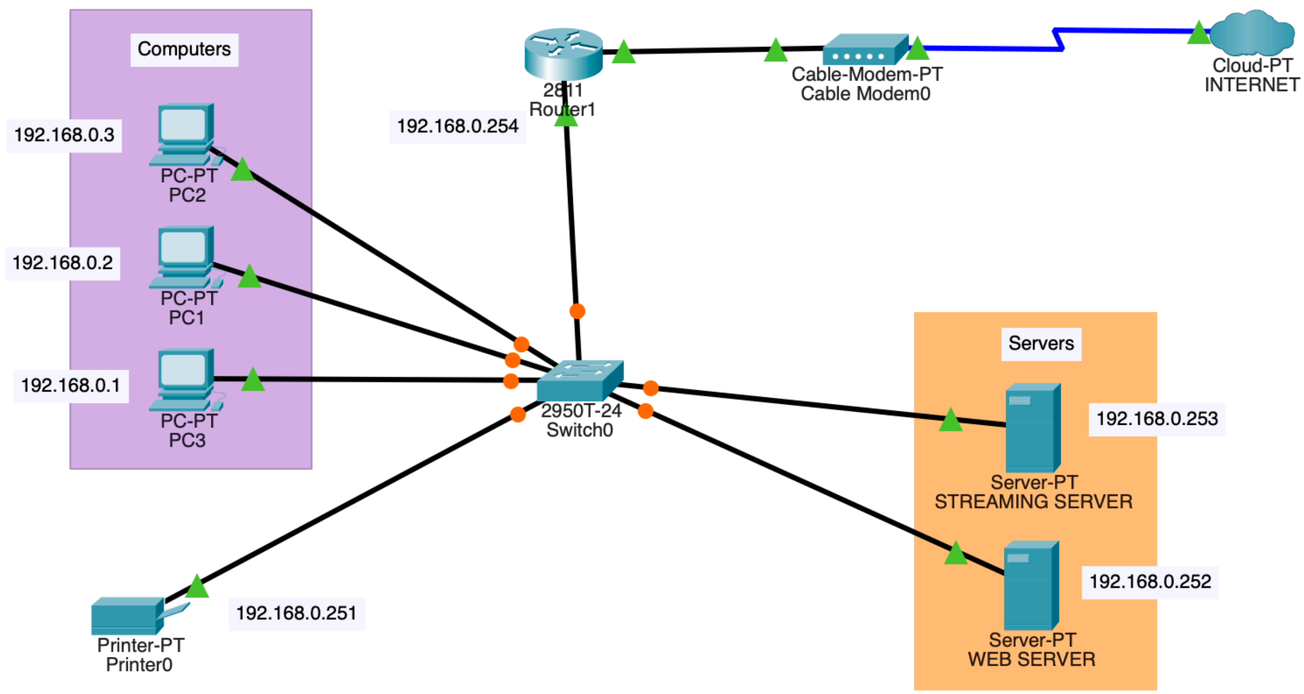

Figure 1.1, Network Layout

Due to the network being deployed at a small scale, many hosts were not required therefore, the subnet mask 255.255.255.0 was utilised. The NetID 192.168 is a private IP address, commonly used within household networks and cannot be contacted through the network (access to a public IP is required). This enhances the level of security within the network. 192.168.0.0 to 192.168.255.255 is a class C address range. The host numbers have been carefully selected with troubleshooting in mind. Devices that are to connect to the network, such as mobile phones, laptops and in this case, PCs are assigned a host number, from 1 and counting. On the other hand, already connected devices such as the router, servers and printer are assigned a host number from 254 and counting down. This system allows the devices to be grouped in the number hierarchy and allows the network engineer to more effective diagnose the device that is having errors during troubleshooting. For example, a packet that cannot reach a host of 252 means that it is an error with an already connected device, and vice versa.

Website Retrieval Demonstration

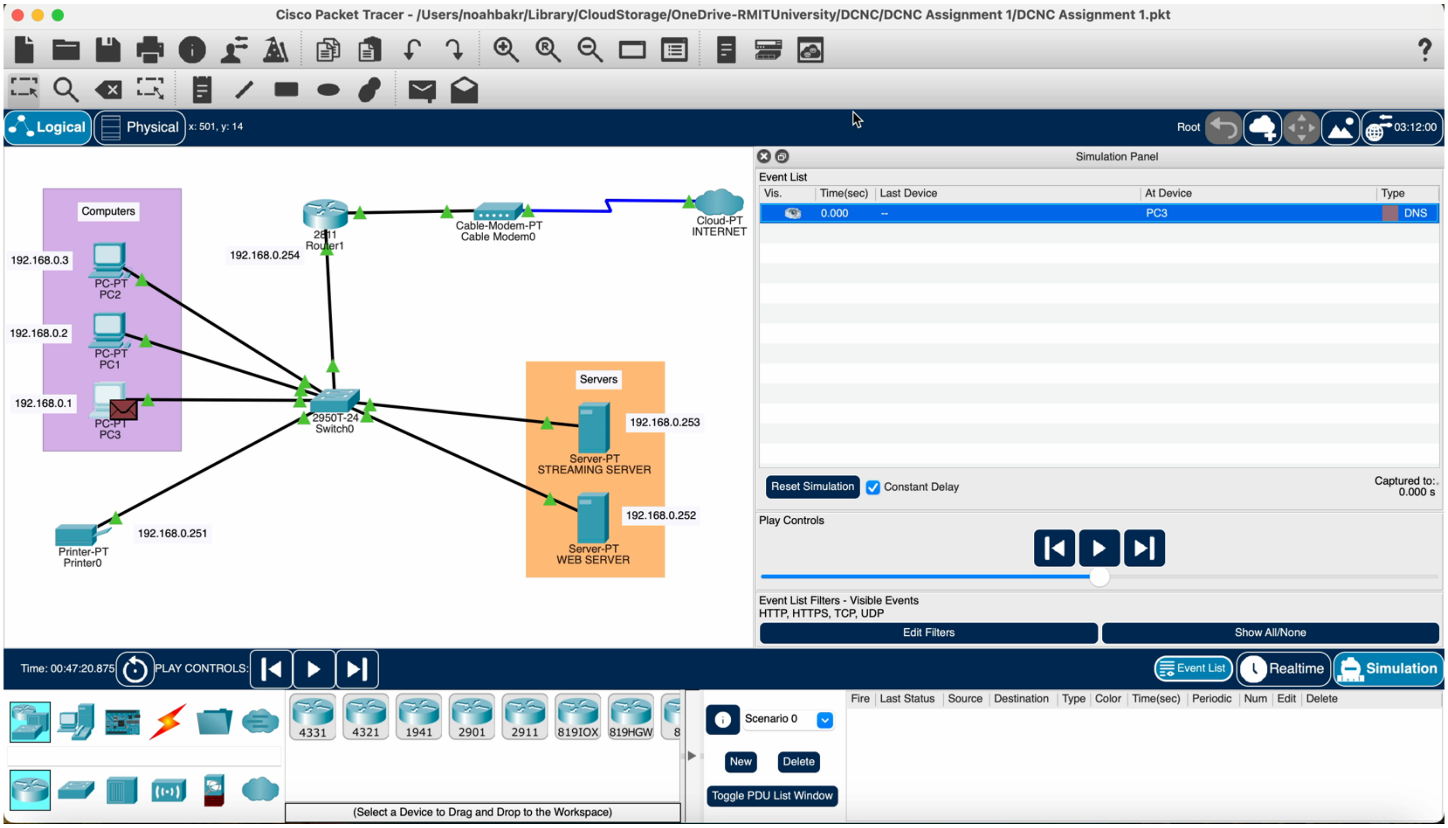

Figure 1.2, NOTE: if there are issues playing this video, the file will be attached.

Packet Transfer Step by Step Process

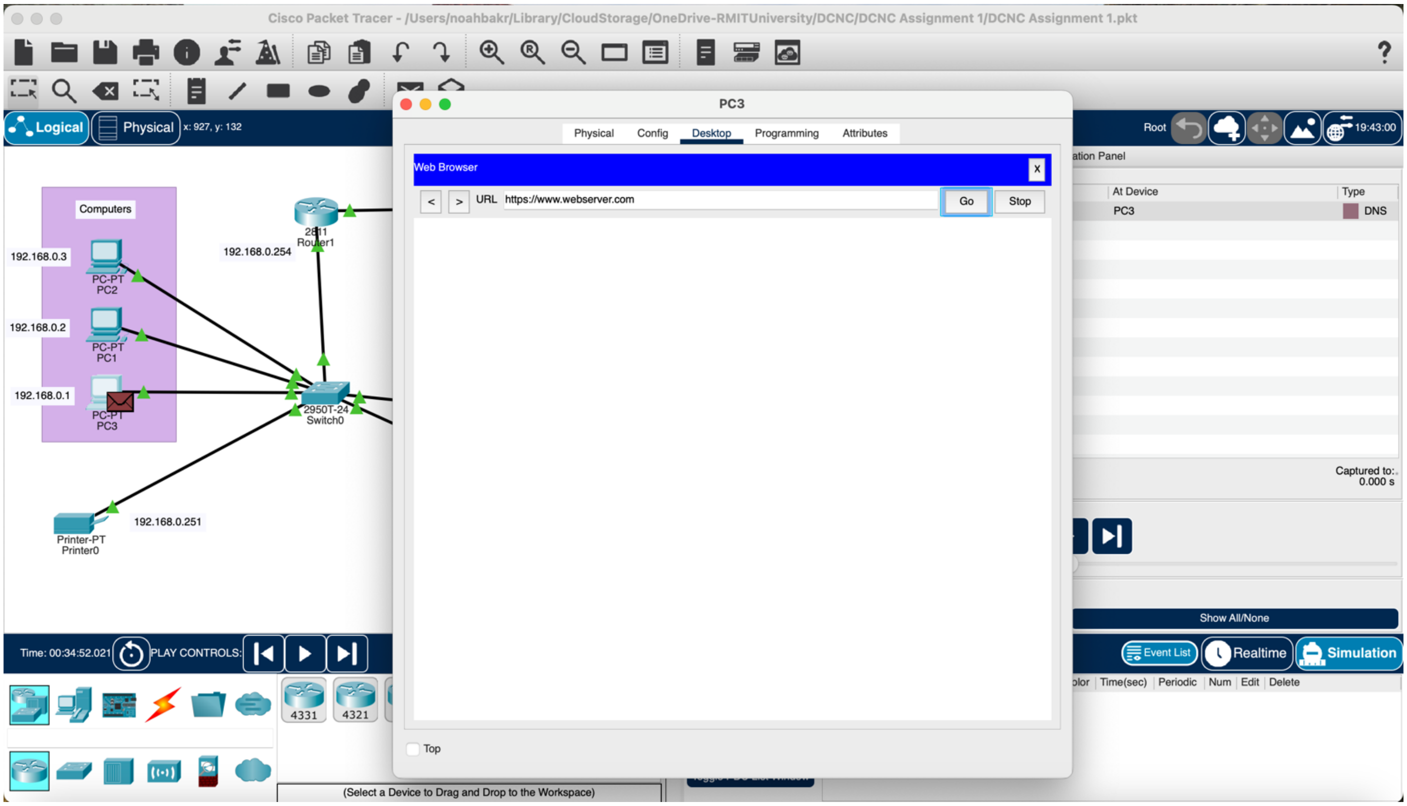

Figure 1.3, PC3 attempts to connect to https://www.webserver.com, hosted by the DNS server.

To initiate the packet transfer demonstration, PC3 attempts to connect to https://www.webserver.com, the domain is hosted by the DNS server, which should reroute the request to the web server.

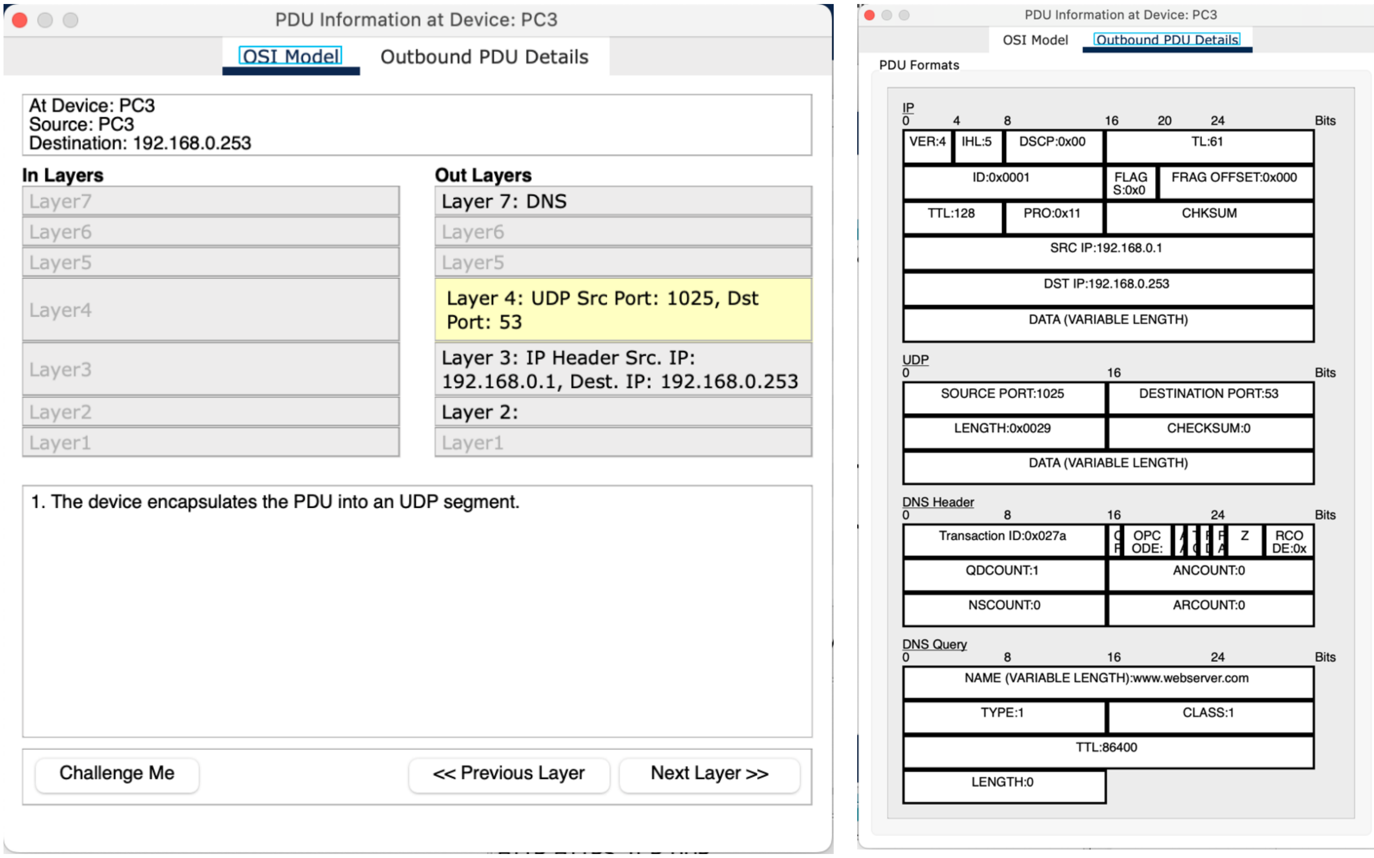

Figure 1.4-1.5, PDU information at PC3 for packet data. The packet transfer is using the User Datagram Protocol (UDP)

The first DNS packet that is sent utilises the User Datagram Protocol (UDP), this can be seen from the OSI Model (Layer 4) and the Outbound PDU Details, where UDP is present.

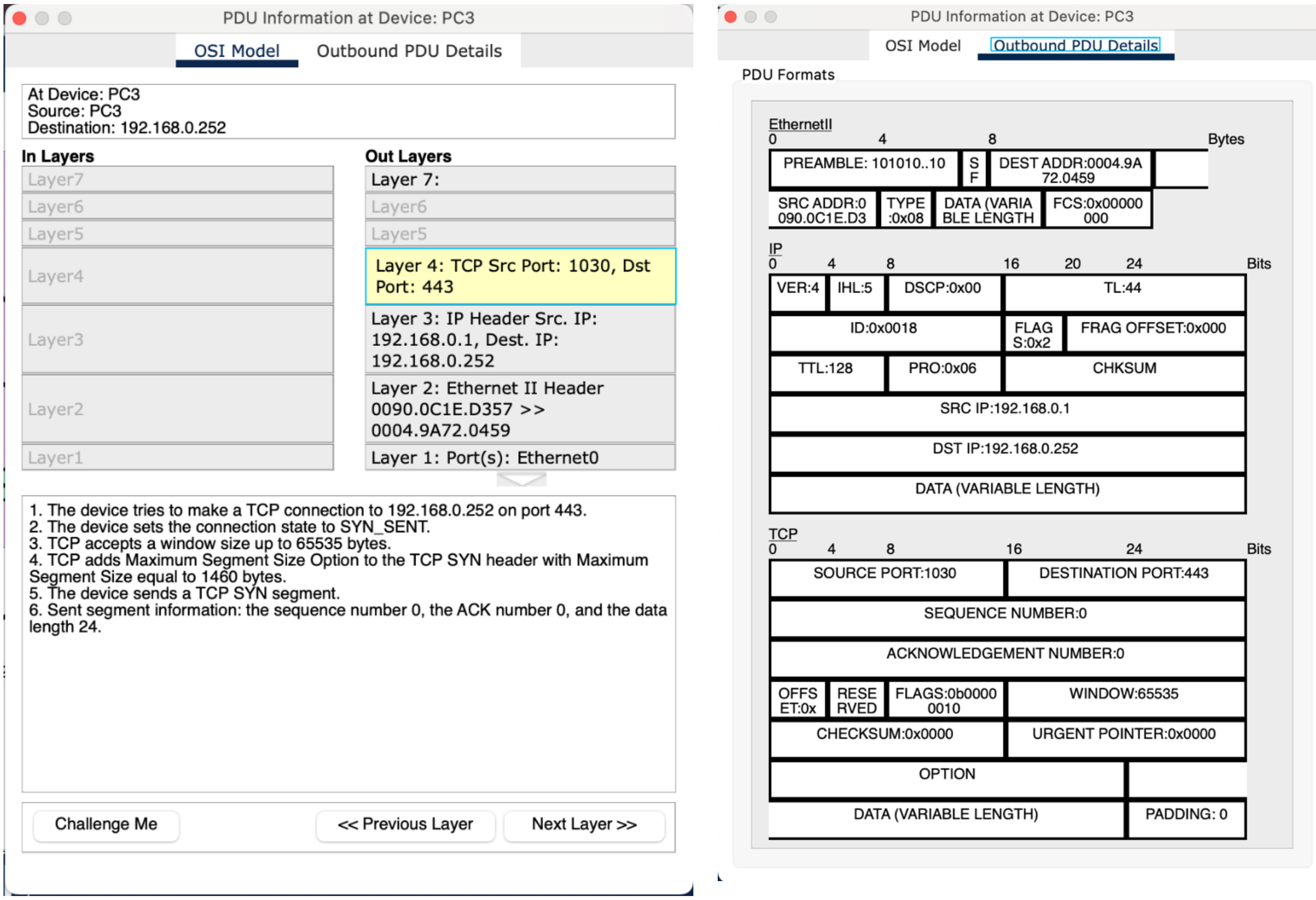

Figure 1.6-1.7, PDU information at PC3 for packet data. The packet transfer is using the Transmission Control Protocol (TCP)

Once the PC3 device has sent its DNS packet to the DNS server and has received the IP address of the webserver (that was previously masked by the DNS hosted domain name), a three-way handshake under the TCP is initiated between the PC3 device and the webserver. The first TCP packet that is sent utilises the Transmission Control Protocol (TCP), his can be seen from the OSI Model (Layer 4) and the Outbound PDU Details, where TCP is present.

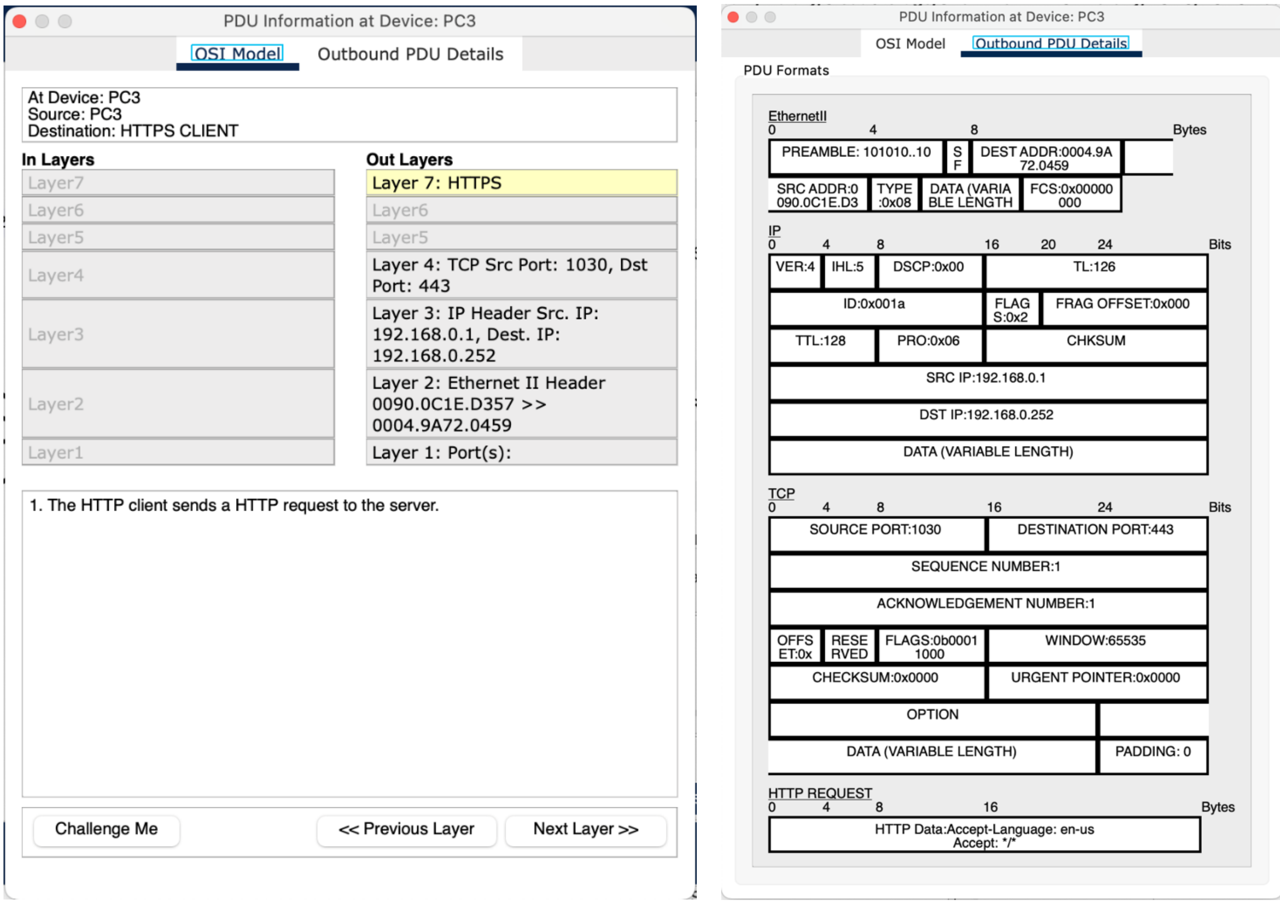

Figure 1.8-1.9, PDU information at PC3 for packet data. The packet transfer is using the Transmission Control Protocol (TCP)

Once both the Web Server and PC3 devices accept and acknowledge the three-way handshake, the HTTPS packet is sent to the PC3 device through the TCP. This packet will contain a portion of the data from the website. The first HTTPS packet that is sent utilises the Transmission Control Protocol (TCP), his can be seen from the OSI Model (Layer 4) and the Outbound PDU Details, where TCP is present.

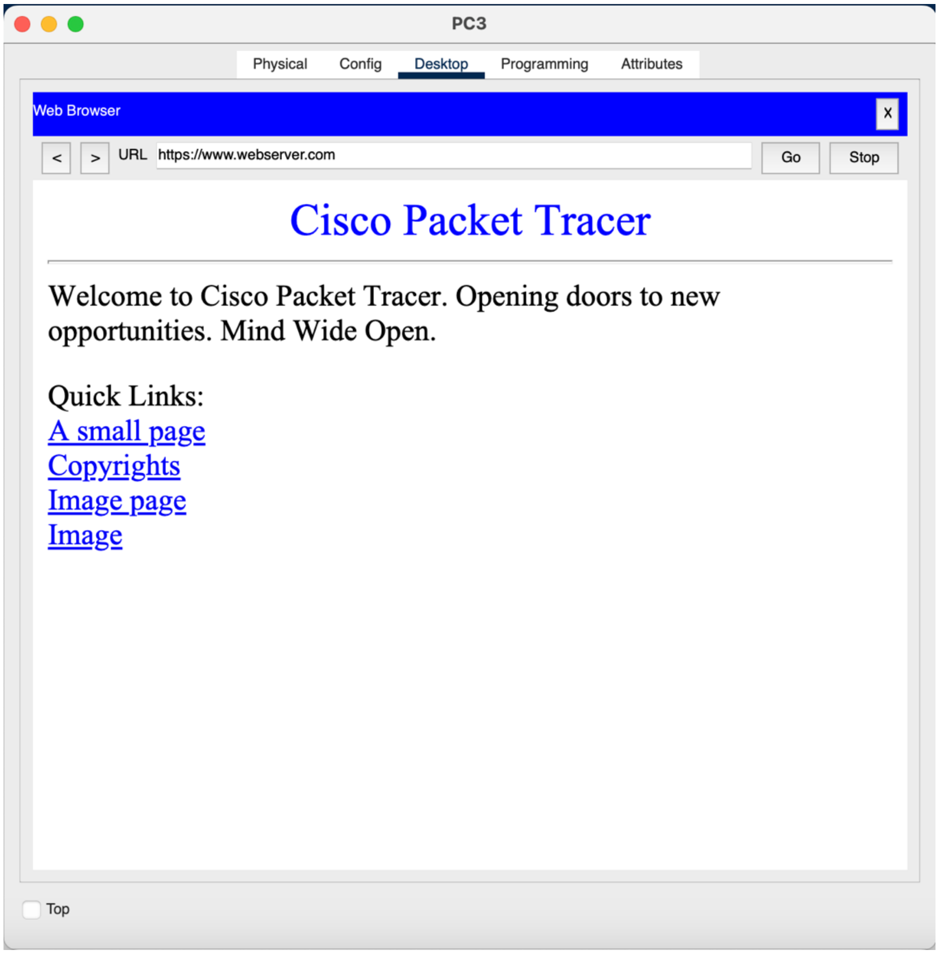

Figure 1.10, PC3 has received all HTTPS packets and now presents the full website

Once all HTTPS packets are received and acknowledged by the PC3 device, the https://www.webserver.com website can be presented.

Configuration Settings Process

The configuration settings and choice explanation for IP address allocation and subnets (masking inclusive) have been previously stated.

Configuration Settings Process

Router IPv4 Address Allocation Process

In the configuration window of the Router device, the FastEthernet0/0 port is selected and configured as this is the established connection between the Router itself and the switch. To use the router as a default gateway for the other devices, and to connect to the internet, the IPv4 address was assigned to this port. The NetID is consistent with the choice of a private home network however, the host number 254 was utilised as that is the highest number port that can be allocated in this subnet mask. The choice for using a host number on the larger side was previously explained.

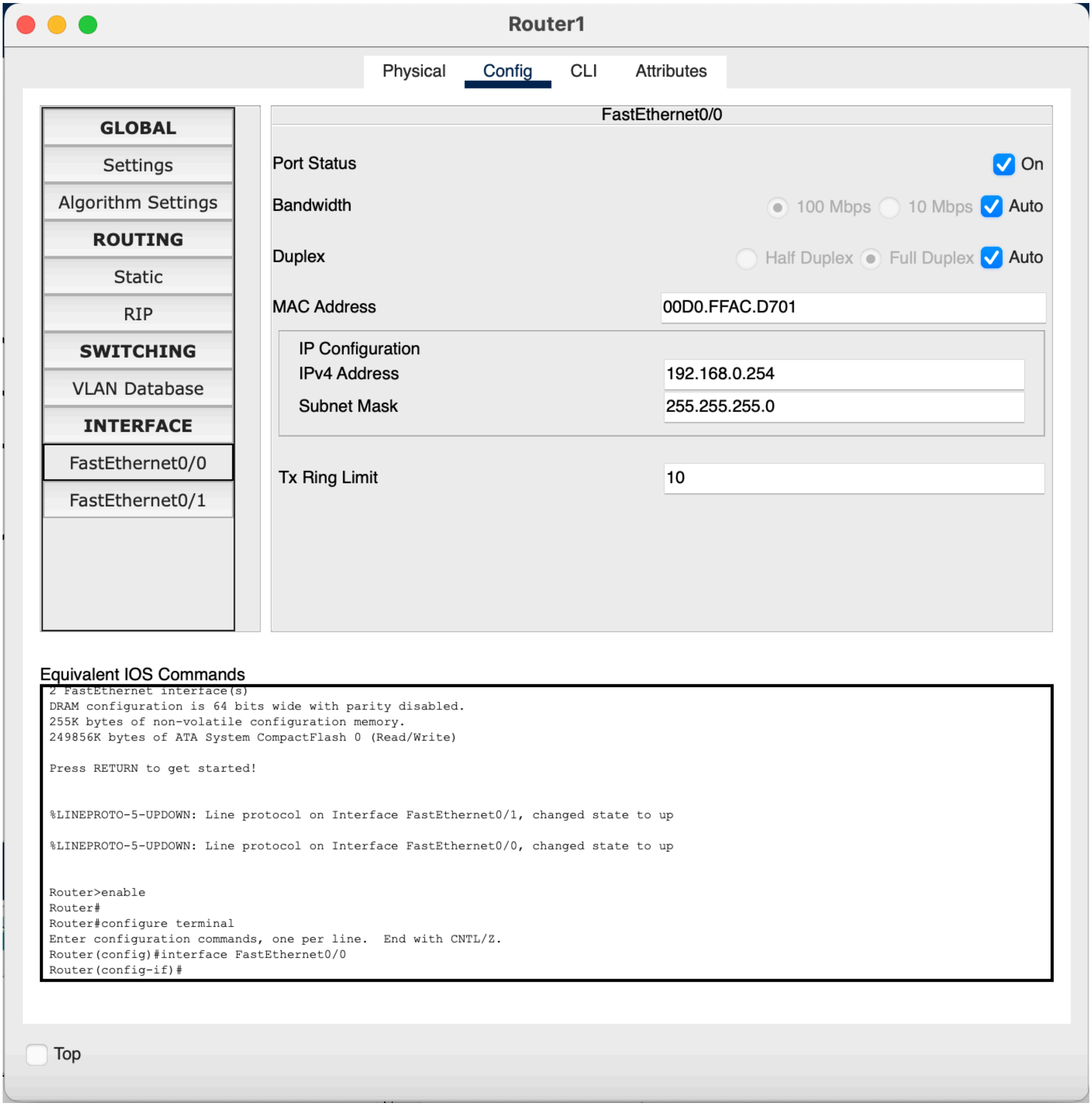

Figure 1.11, Router config settings

Default Gateway & DNS Server Allocation Process

This allocation (the settings) is present across all devices in the network therefore, only an example of PC3 is used. For all devices, the Default Gateway address is set to the IPv4 address of the FastEthernet0/0 port of the Router. This allows devices to get forwarded to the internet if their specified IP address is not present in the network. Furthermore, for all devices, the DNS Server address is set to the IPv4 address of the DNS server device

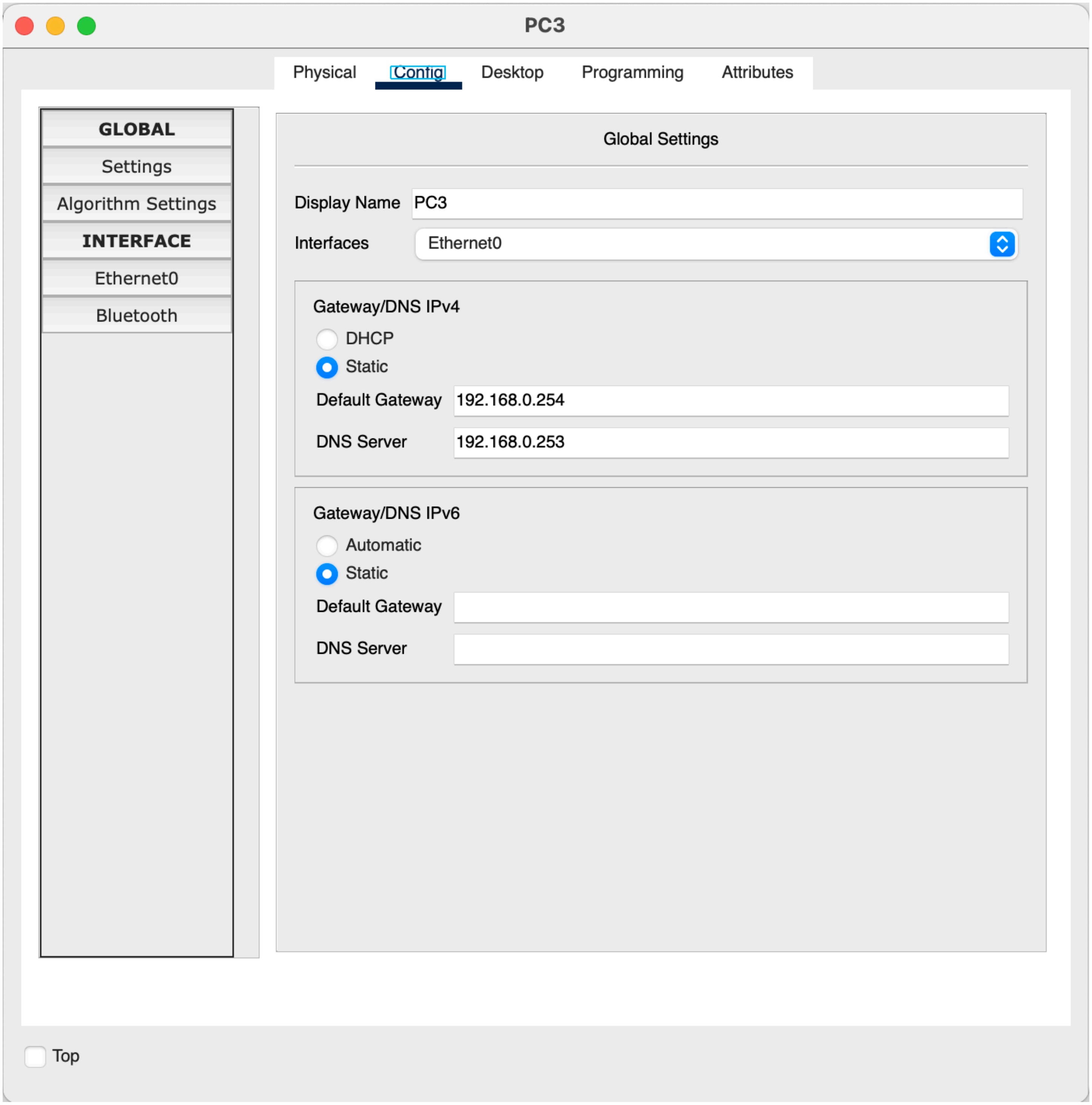

Figure 1.12, PC3 config settings

Task 2.1 [Kyle]

The original network is a /26 prefix meaning the first 26 bits are for the network the remaining 6 are for the host. This gives us 2^6 = 64 total IP addresses.

Because we need 4 subnets we will need to split the available IP addresses, meaning we will need 2 more bits for the subnet part. The original /26 prefix will be extended by 2 bits for the subnets making /28.

The new subnet mask is 255.255.255.240 (/28). Each /28 subnet has 4 bits for the host part (32 total bits - 28 network bits = 4 host bits). This gives us 2^4 = 16 2 4 =16 IP addresses per subnet.

	NetID	Subnet	Host number
Subnet 1	128.119.40.128/28	255.255.255.240/28	129 - 142
Subnet 2	128.119.40.144/28	255.255.255.240/28	143 - 158
Subnet 3	128.119.40.160/28	255.255.255.240/28	161 - 174
Subnet 4	128.119.40.176/28	255.255.255.240/28	177 - 190

Task 2.2 [Noah & Kyle]

Student ID	Converted binary	Potential host	Department
s4003110	1111010000001111010110	129 - 142	Marketing
s4095646	1111100110111110011110	143 - 158	Admin
s3949420	1111000011101110001110 0	161 - 174	Technical

Task 2.3 [Noah & Sebastian]

Investigate how data is transferred reliably between two members of your group that work in two different subnets. You are required to answer each sub-question in less than 200 words. (5 marks).

Question 1: Show the host-to-host (higher-layer) and hop to hop (lower-layer) processing using a figure (cite references where needed, you are not encouraged to use figures from DCNC lecture notes). Give details about which layers the processing is associate with?

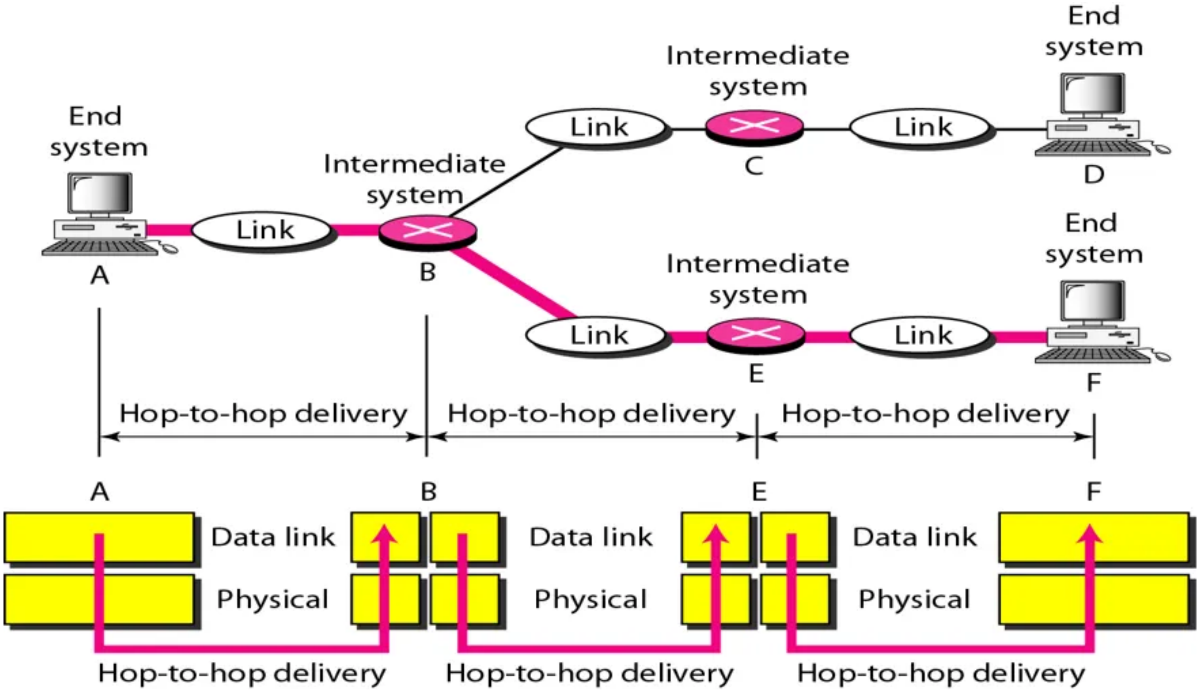

Figure 2.1, host-to-host (higher-layer) and hop to hop (lower-layer) processing

Host-to-host (higher-layer) processing is associated with the fourth layer of the OSI model, this is the transport layer. The transport layer handles network traffic that is between the hosts. It deals with end-to-end issues such as segmenting message for network transport; it also maintains the logical connections between the hosts.

Hop to hop (lower layer) processing is associated with the sixth layer of the OSI model, this is the data link layer. The data link layer oversees message delineation, error control and network medium access control. It specifically delivers packets from one node to another, hence as to why it is associated with hop to hop.

Question 2: Discuss the processing inside a router and how a router decides next hop for sending messages towards the destination.

A router employs routing protocols to establish a path/route to pass packets between the source and destination. A routing table holds the information about the available paths and their costs to the destination. A router will utilize its routing table to decide where to send the next data packet and therefore the next hop. A hop happens between every node (device) until the packet reaches its destination. The routing table essentially holds the costs of each hop between nodes on a given path. Common routing protocol used to determine the path of the packet are fixed and dynamic. Fixed routing provides the router with multiple paths, where the best one is chosen until another path is needed, whereas dynamic routing allows us to take the path of least cost at every hop as the information the router receives is updated to show the best direction. Other protocols are flooding and adaptive routing. The example this question is within is about data transfer between two different subnets, this is an example of internal routing as the two students are still on the same network, whereas external routing would be the transfer of data between different networks.

Question 3: Explore how the higher-layers and the lower-layers complement each other to achieve the reliable end-to-end data communication between sender and receiver.

Open systems Interconnection (OSI) is a framework that standardizes telecommunication functions into 7 layers and connects the application and hardware. layers provide protocols for and rely on the following layers services in the procedure. OSI has application, presentation, session, transport, network, datalink and physical layers. The session layer passes data to the transport layer, data is broken into pieces and a header containing the sender and receiver's ports is added. This encapsulated data is called segments or datagrams if transmitted using TCP or UDP, respectively. The network layer receives this data, then another header containing the sender and receiver's IPs is added, the data are called packets. The data link layer receives the packets and a trailer containing the receiver and sender's mac addresses is added. The physical layer then receives the data, now called bits. This is encapsulation, the data is receivable, but will need to be decapsulated, opposite procedure for the receiver to obtain data. However, Transport Control Protocol/Internet Protocol (TCP/IP) is more streamlined and contains 4 layers, the application layer (containing application, presentation and session layers), transport layer, network layer and network access layer (containing data link and physical layers).

[**Figure 2.1**] www.faceprep.in. (n.d.). FACE Prep | The right place to prepare for placements. [online] Available at: https://www.faceprep.in/computer-networks/computer-networks-osi-layers/ [Accessed 25 May 2024].