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ENGINEERING FACULTY

DEPARTMENT OF COMPUTER ENGINEERING

METROPOLITAN AREA NETWORK SIMULATION PROJECT

by

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CHAPTER ONE

INTRODUCTION

1.1.Project Definition and Problem Formulation

A metropolitan area network (MAN) is a computer network that connects computers within a metropolitan area, which could be a single large city, multiple cities and towns, or any given large area with multiple buildings. A MAN is larger than a local area network (LAN) but smaller than a wide area network (WAN). The term MAN is applied to the interconnection of local area networks (LANs) in a city into a single larger network which may then also offer efficient connection to a wide area network. The term is also used to describe the interconnection of several local area networks in a metropolitan area through the use of point-to-point connections between them. It is used to mean the interconnection of several local area networks by bridging them with backbone lines.

In our project, communication between different users of a company that has two different branches in a city and three facilities in each of these branches and these users have some duties/features aims to design a metropolitan area network. Users of both branches do not have dedicated servers for their facilities, that is, there is only one server room (system room) and users carry out transactions using these common servers. Each facility has several users with different roles/features. This project also aims to ensure process synchronization and communication between branches, facilities and users here by using ISP and connection methods/tools when necessary.

1.2.The Purpose and Motivation of The Project

While preparing for this project, MAN (Metropolitan Area Network), the goal was to design maximum network users, traffic load with minimum delay, and sufficient hardware support for network expansions (using very popular technologies in the world such as fiber optic technology to provide high network speed) with minimum cost. The designed MAN topology aims to transmit email transactions, browse the internet, file transfer, security protocols such as SSH, and voice transfer using protocols such as VoIP, with low cost and high efficiency, as mentioned before. In this project, two branches and three facilities will be connected to each other through ISP.

Since the project is designed considering the maximum efficiency and minimum cost that can be obtained, there may be some deficiencies, in this case, if there are features that are desired or expected to be developed beyond the desired, in this case the cost will be negatively affected while the performance will be positively affected.

1.3.Term Definitions

Network : Network is a group of two or more devices or nodes that can communicate. The devices or nodes in question can be connected by physical or wireless connections. The key is that there are at least two separate components, and they are connected.

Wireless : Wireless is a term used to define telecommunication and data transmission without wires. In a broad sense, wireless refers to any telecommunications or data transfer in which electromagnetic waves - rather than some form of wire or cable -carry signals over all or part of the data communication path.This refers to a type of network that broadcasts an access signal to the workstations.This allows for transporting laptops and tablet PCs from room to room while maintaining a network connection continuously.

Nodes : Node is a connection point inside a network that can receive, send, create, or store data. Each node requires you to provide some form of identification to receive access, like an IP address. A few examples of nodes include computers, printers, modems, bridges, and switches. A node is essentially any network device that can recognize, process, and transmit information to any other network node.

Ethernet : Ethernet is the standard way to connect computers on a network over a wired connection. It provides a simple interface and for connecting multiple devices, such computers, routers, and switches. With a single router and a few Ethernet cables, you can create a LAN, which allows all connected devices to communicate with each other.

Frame : Frame is a digital data transmission unit in computer networking and telecommunication. In packet switched systems, a frame is a simple container for a single network packet. In other telecommunications systems, a frame is a repeating structure supporting time-division multiplexing.

Access Point : An access point is a device that creates a wireless local area network, or WLAN, usually in an office or large building. An access point connects to a wired router, switch, or hub via an Ethernet cable, and projects a Wi-Fi signal to a designated area.

Switches : A switch is a device that connects other devices and manages node-to-node communication within a network, ensuring data packets reach their ultimate destination. While a router sends information between networks, a switch sends information between nodes in a single network. When discussing computer networks, ‘switching’ refers to how data is transferred between devices in a network.

Router : A router is a physical or virtual device that sends information contained in data packets between networks. Routers analyze data within the packets to determine the best way for the information to reach its ultimate destination. Routers forward data packets until they reach their destination node.

Packet : A packet is a small amount of data sent over a network, such as a LAN or the Internet. Similar to a real-life package, each packet includes a source and destination as well as the content (or data) being transferred. When the packets reach their destination, they are reassembled into a single file or other contiguous block of data. While the exact structure of a packet varies between protocols, a typical packet includes two sections: a header and payload. Information about the packet is stored in the header.

Network Architecture : Network architecture is the complete framework of an organization's computer network. The diagram of the network architecture provides a full picture of the established network with detailed view of all the resources accessible. It

includes hardware components used for communication, cabling and device types, network layout and topologies, physical and wireless connections, implemented areas and future plans. In addition, the software rules and protocols also constitute the network architecture.

Protocol : A protocol is a set of rules for formatting and processing data. Network protocols are like a common language for computers. The computers within a network may use vastly different software and hardware; however, the use of protocols enables them to communicate with each other regardless.

IP address : An IP address is a unique address that identifies a device on the internet or a local network. IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet or local network.They contain location information and make devices accessible for communication. The internet needs a way to differentiate between different computers, routers, and websites.

TCP : The Transmission Control Protocol (TCP) is one of the main protocols of the Internet protocol suite. It originated in the initial network implementation in which it complemented the Internet Protocol (IP). Therefore, the entire suite is commonly referred to as TCP/IP. Major internet applications such as the World Wide Web, email, remote administration, and file transfer rely on TCP, which is part of the Transport Layer of the TCP/IP suite.

Channel : A channel refers either to a physical transmission medium such as a wire, or to a logical connection over a multiplexed medium such as a radio channel in telecommunications and computer networking. A channel is used to convey an information signal, for example a digital bit stream, from one or several senders (or transmitters) to one or several receivers.

Workstation : Workstation, a high-performance computer system that is basically designed for a single user and has advanced graphics capabilities, large storage capacity, and a powerful central processing unit. A workstation is more capable than a personal computer (PC) but is less advanced than a server (which can manage a large network of peripheral PCs or workstations and handle immense data-processing and reporting tasks).

Server : A server is a piece of computer hardware or software (computer program) that provides functionality for other programs or devices, called "clients". This architecture is called the client–server model. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client. Typical servers are database servers, file servers, mail servers, print servers, web servers, game servers, and application servers.

DNS : The Domain Name System is a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network. It associates various information with domain names assigned to each of the participating entities. Most prominently, it translates more readily memorized domain names to the numerical IP addresses needed for locating and identifying computer services and devices with the underlying network protocols.

FTP : File transfer protocol (FTP) is a set of rules that computers follow for the transferring of files from one system to another over the internet. It may be used by a business to transfer files from one computer system to another, or websites may use FTP to upload or download files from a website's server.

HTTP : HTTP is the protocol used to transfer data over the web. It is part of the Internet protocol suite and defines commands and services used for transmitting web page data.
POP : A point of presence (PoP) is an artificial demarcation point or interface point between communicating entities. A common example is an ISP point of presence, the local access point that allows users to connect to the Internet with their Internet service provider (ISP).A PoP typically houses servers, routers, network switches, multiplexers, and other network interface equipment, and is typically located in a data center.
SMTP : Stands for "Simple Mail Transfer Protocol." This is the protocol used for sending e-mail over the Internet. Your email client uses SMTP to send a message to the mail server, and the mail server uses SMTP to relay that message to the correct receiving mail server.

1.4.Related Work

We could not examine other simulation studies on the same subject related to the Metropolitan Area Network Simulation project, but as a result of our research on network simulations over the internet. We were able to observe and evaluate.These reviews are related to different parts rather than the whole project.There were no noticeable differences in the design of the simulation. Devices using the connection type was done by the same logic. There are some differences in the router, switch type and visual design used.Apart from the user devices in our project, various other user devices were also used. The simulation tool used was, in most examples, the Cisco Packet Tracer only a few in the example, we saw the Tp-Link simulation tool, but we did not examine it, thinking that it would not contribute to our project.

CHAPTER TWO

METHOD AND SIMULATION

2.1. Simulation and Modeling Concepts

While creating the network, logical and physical requirements were determined. A construction phase took place from small units to large units, that is, the buttom-up alternative approach was applied. Designing a network with a bottom-up approach enables us to get our network set up much faster.They have a tendency to begin the design process at this level, leaving applications and services as an afterthought to be considered later. In most cases, taking a bottom-up approach tends to require a less thorough initial analysis, and is easier to implement as a quick fix.

In our modeling, workstation users, wireless users, tablet users and smartphone users in the facilities in the branches were created. While users were connecting to each other, they were connected to successfully communicate with switches, routers, wireless routers and connecting cables. We created our servers and assigned IP addresses to the users in each facility using the DHCP server. Network device connections between workstations and network devices are analyzed. At the same time, are the locations of the connection and network tools in the facilities correct in the physical part. Network devices were configured.

While connecting the workstations and other network devices with each other, the cable was automatically selected over the packet tracer simulation and the connection was made with the 'copper straight cable'. Facilities which are located in the same branches are connected to each other with a main switch over a fast ethernet port.Router has been used for two different networks which are commonly used with the same network channel rules/bases. It is provided with a serial ethernet port between routers used for communication between different branches. At the same time, the connection between the routers between different branches is formed by the serial ethernet port. The other significant responsibility of the router is managing the packages; if one of the workstation wants to send something (message/mail or etc.) to another workstation on a different network, the router ensures the package goes to the other network with the help of static routing.

Finally, server farms at the third facility of the first branch office so that users can send/receive mail, browse the web, send/receive files, VoIP Services (sending voice data over an IP between private users/workstations), automatically assigning an IP. created. In the server room, web server, dns server, mail server, ftp server and dhcp server were configured, and the servers were made ready for use and connected to the main switch of the server farm. The server farm switch was connected to the server router. After connecting the common connection router of the three facilities in the second branch to the server router as serial, we created our metropolitan area network by making control trials between the workstations after the connection was established between the two branches.
In summary, although we did not talk about the details of each phase of the metropolitan area network design, we briefly talked about what was done. All of our workstations and other

devices can perform their duties correctly with the network cables/devices we use, thus providing the network of two different branches in the same city.

2.2. Simulation Environment/Tool

Our project was done using Cisco Packet Tracer simulation. Cisco Packet Tracer is a simulation program used by Cisco to configure the necessary configurations before installing router, switch, hub, or security devices on a real network.This tool provides a network simulation to practice simple and complex networks.Cisco Packet Tracer offers two operating modes to envision the network behavior: Real-time and Simulation Mode.Cisco Packet Tracer has two workspaces-logical and physical. The logical workspace allows users to build logical network topologies by placing, connecting, and clustering virtual network devices. The physical workspace provides a graphical physical dimension of the logical network, giving a sense of scale and placement in how network devices such as routers, switches, and hosts would look in a real environment. The physical view also provides geographic representations of networks, including multiple cities, buildings, and wiring closets. The application itself has only a handful of features available inside the actual hardware that runs the Cisco IOS version. It is not suitable for modeling production networks. It has limited command sets, making it impossible to practice all IOS commands required. The software is mainly focused towards Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts.
The benefits of the Cisco Packet Tracer program include:

- It provides a comfortable and well-informed environment.
- It provides multi-user, real-time training laboratories.
- It can prepare exams for students and give points according to what they do.
- Network environment is designed, and network devices are configured using virtual equipment.

To summarize, Cisco Packet Tracer significantly simplifies learning and teaching by supporting multi-user providing a realistic simulation environment for collaboration and exploration, and experiment.

2.3. Network Design Requirements

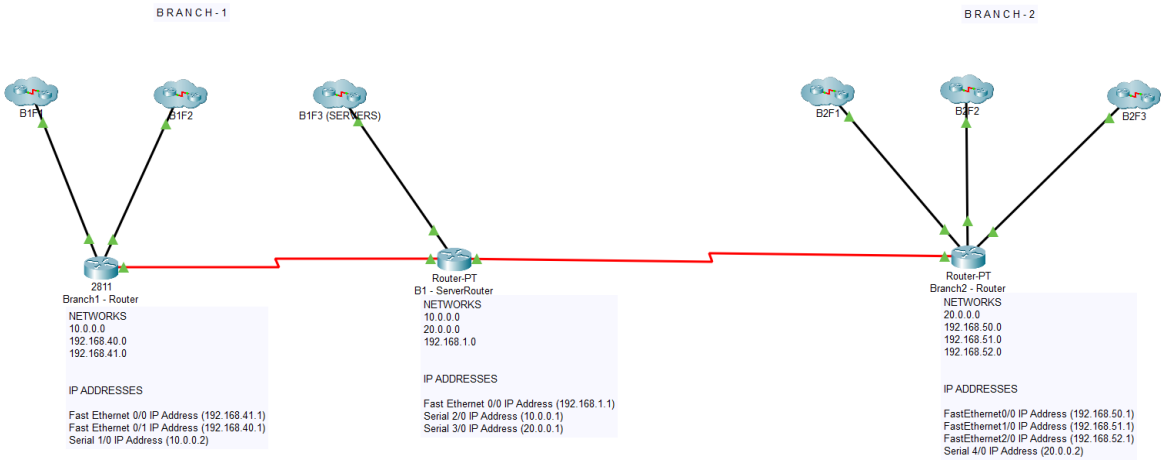
We have realized the most suitable and useful network design for the requirements requested in the project. The network design requirements of our project are as follows.
Server/client architecture was used as the architecture of the network. HTTP, HTTPS, DHCP, DNS, FTP, POP3, TCP, SSH, SMTP protocols were used for the communication between devices. This design used six switches, four access points, three routers, eight servers, forty workstation users, fifteen wireless users, ten smartphone users, ten tablet users, and five IP Phones(for VoIP conference). Star topology is used in the connections. LANs contained in the MAN use the star topology. Connections of star topologies are provided with hybrid topology. Therefore, our general topology can be considered hybrid topology. Laptop (wireless), smartphone and tablet connections are provided with the WRT300N. The connections of the workstations were provided with the 2960-24TT switch. The connections of the servers were provided with the 2960-24TT switch. WRT300Ns are connected to switches, switches are connected to routers, and routers are connected within themselves. Thus, the Metropolitan Area Network has been provided.

2.4. Requirement Analysis

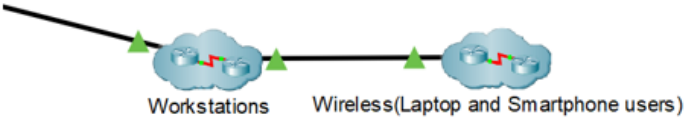
All the necessary requirement analysis for the project were made according to the requested situations. Our requirement analysis is as follows.
Access to servers was granted according to the actions required by the devices.
All devices in the first branch and second branch can access the web servers in the third facility of the first branch. Devices can access sites defined on web servers.
Sending mail to devices in the mail server first facility of the first branch, first facility of the second branch and third facility of the second branch has the authority. Access to the first facility of the first branch mail server and permission to send mail has been granted. first facility of the second branch access to mail server and mail authorized to use the application. Access to the third facility of the second branch mail server and permission to send and receive mail has been granted.
First facility of the first branch, second facility of the first branch and second facility of the second branch access to ftp server and permission to send files have been granted. In this way, devices can transfer files to each other.
All devices in the second facility of the second branch are authorized to edit applications.
Router 2811 was used so that 5 workstations in the second facility of the first branch could hold Voip conferences.
In order to use the project in the most efficient way, we used the right architecture, protocols and topologies considering our requirements. Therefore, the speed and efficiency of our network is sufficient to ensure user satisfaction.

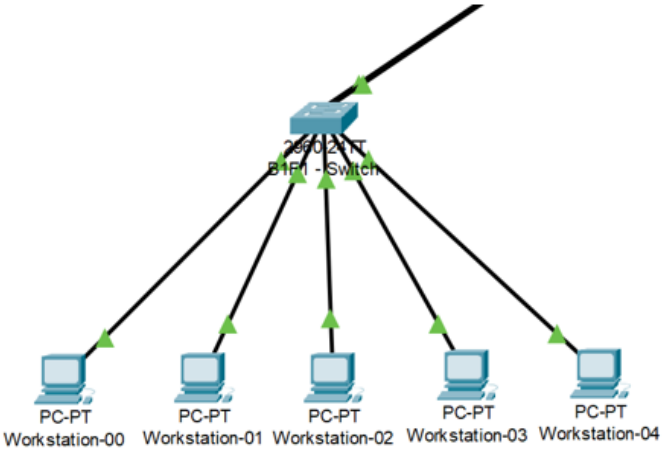
2.5. Definitions of the System/Model

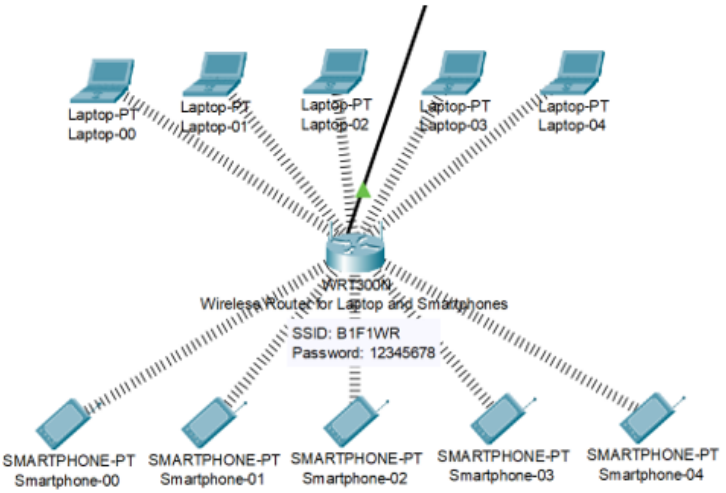
General Design of the System



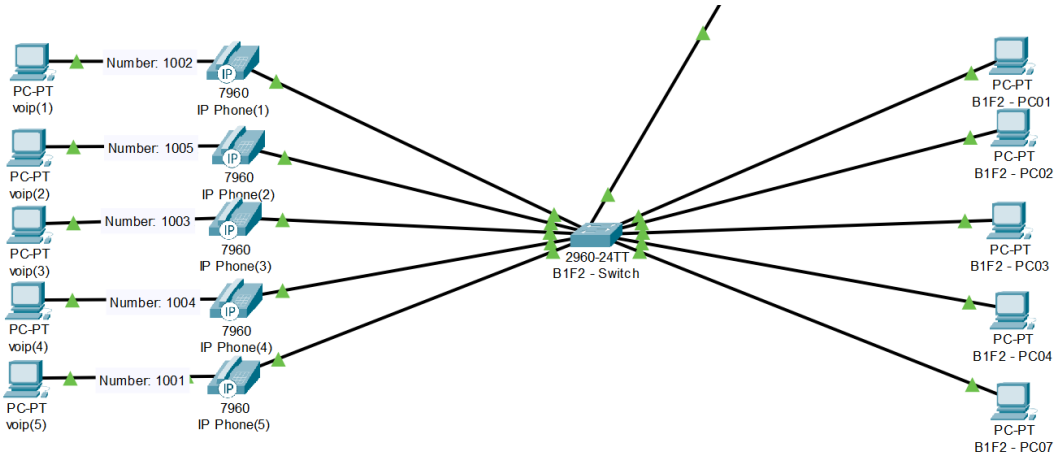
First Branch First Facility



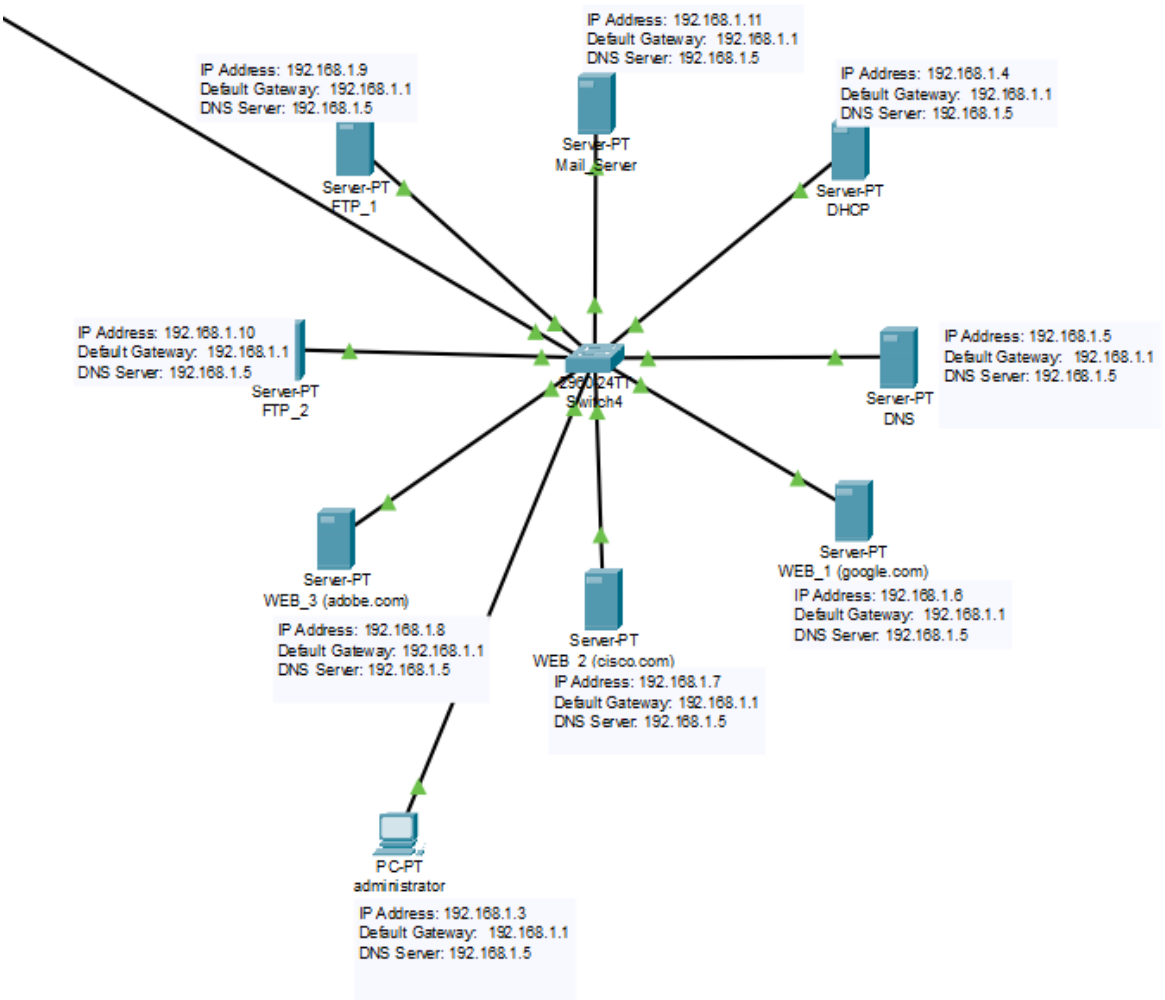




First Branch Second Facility



First Branch Third Facility



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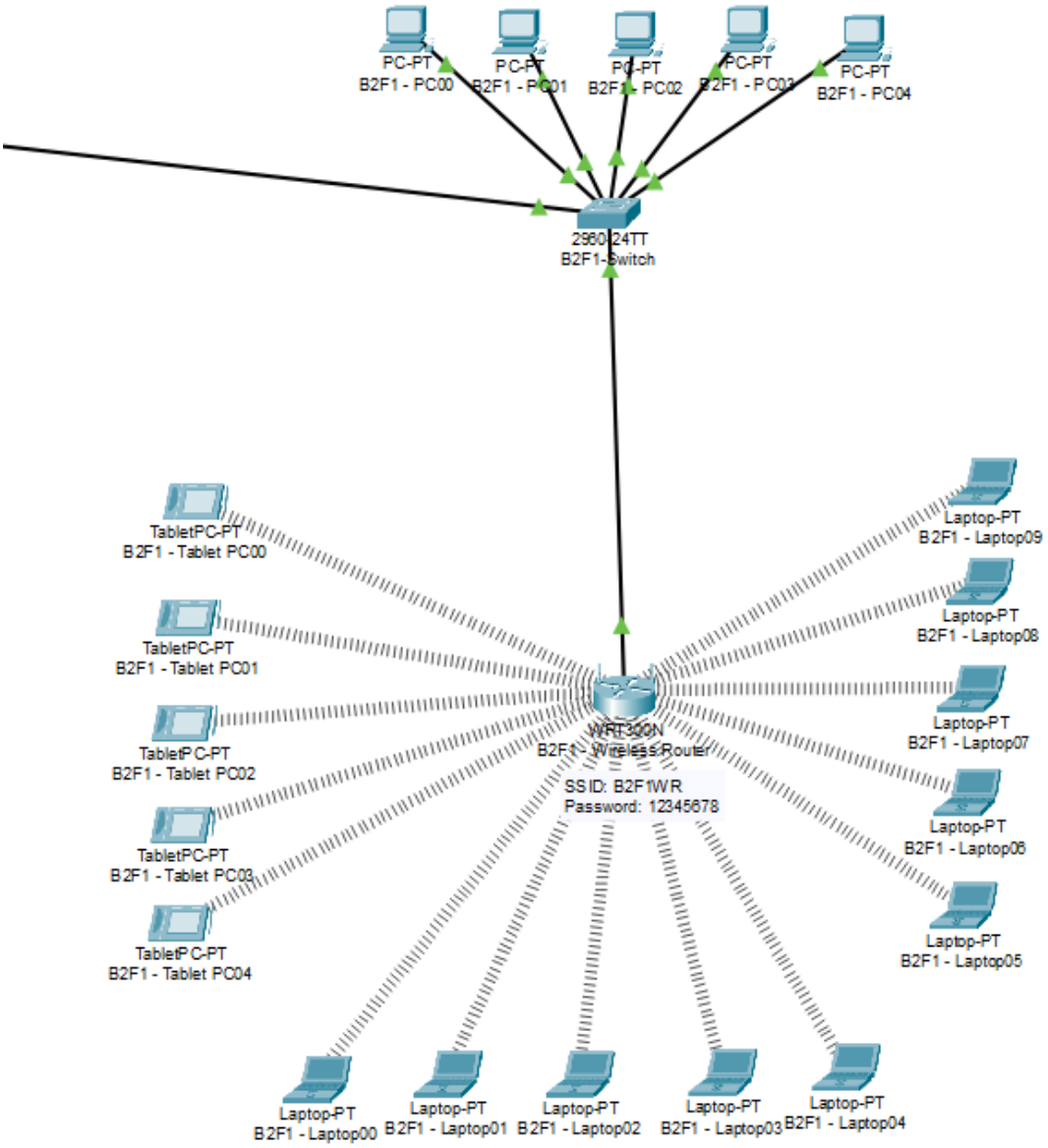
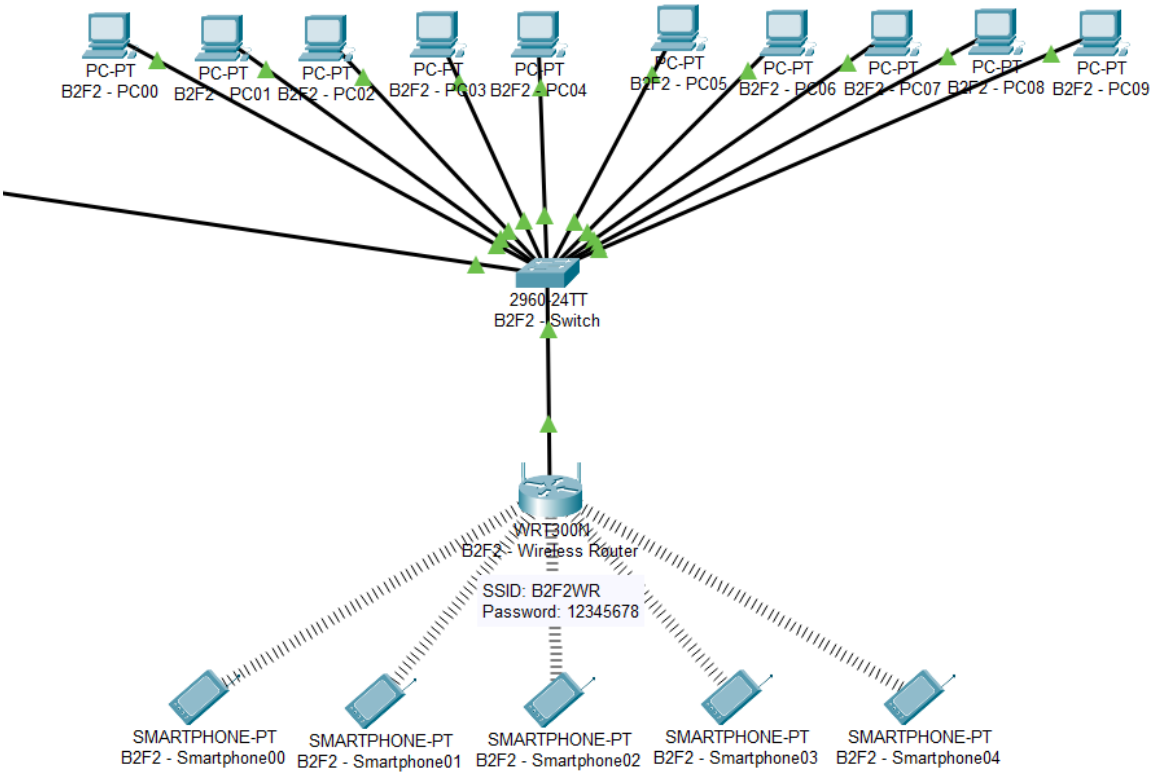
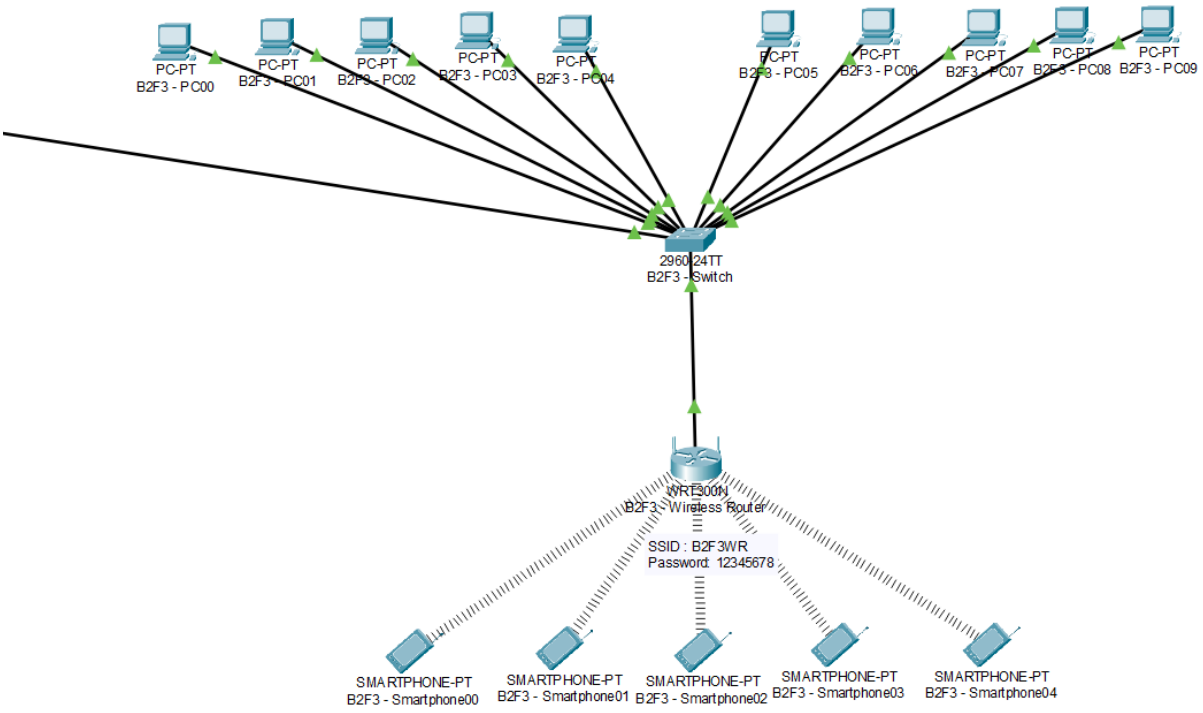


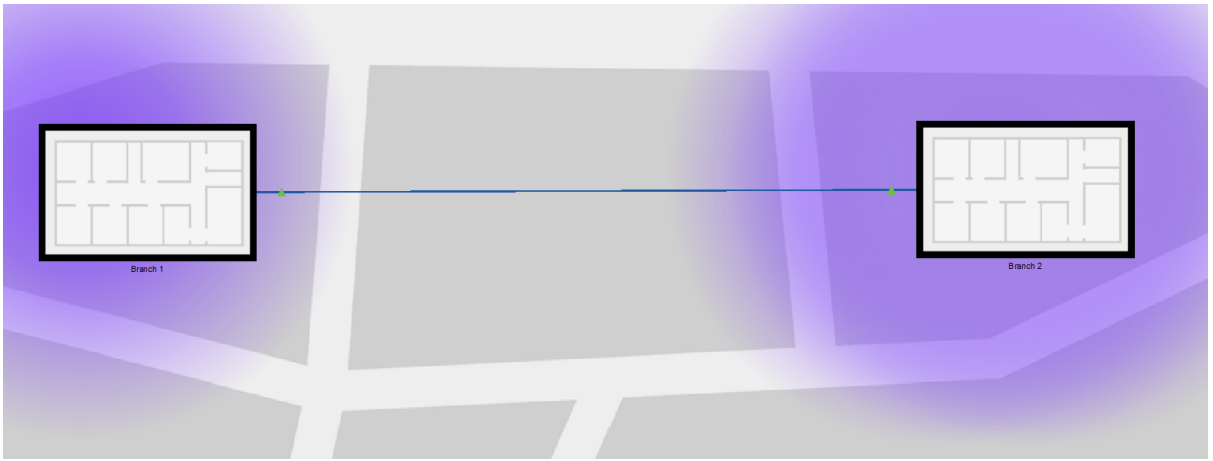
Second Branch Second Facility



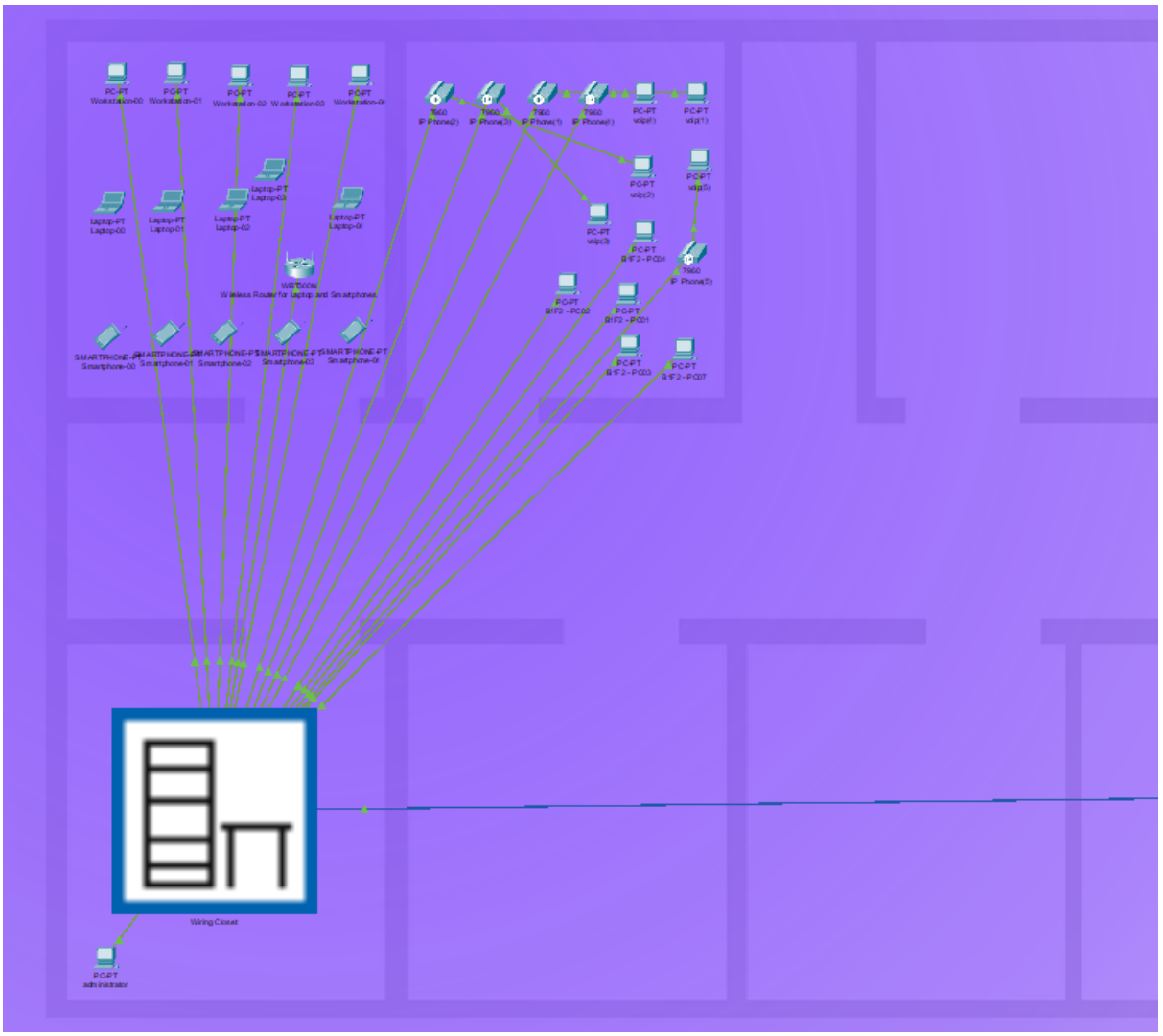
Second Branch Third Facility



Physical Design of the System



First Branch



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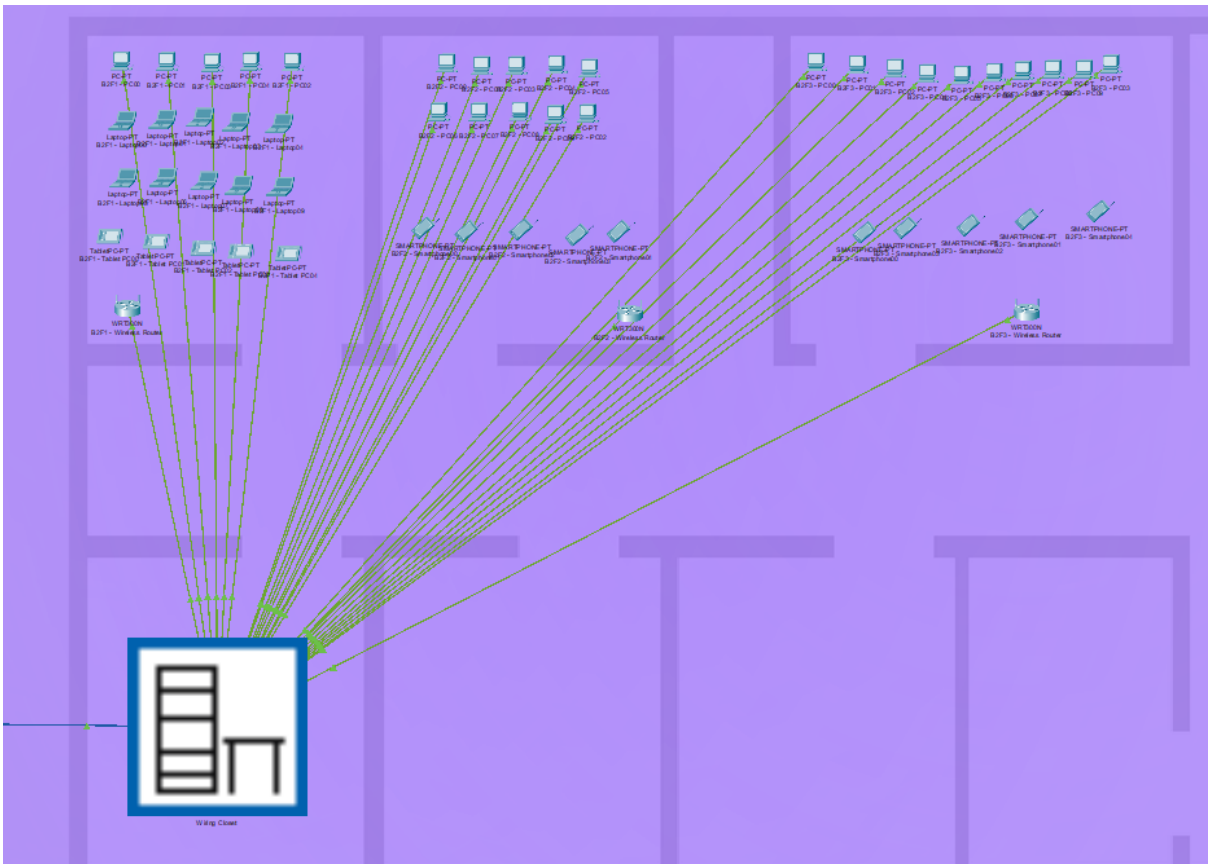
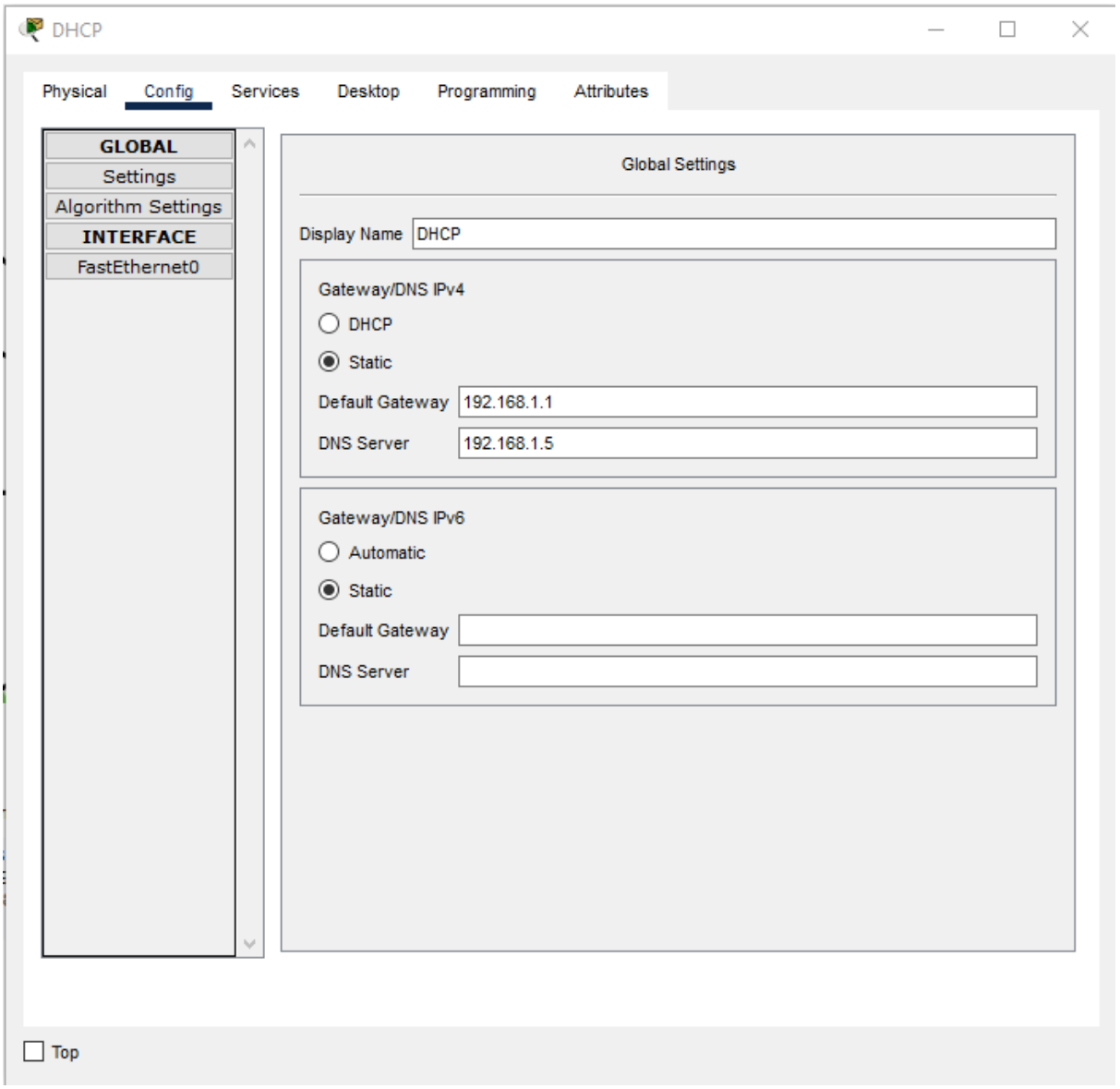
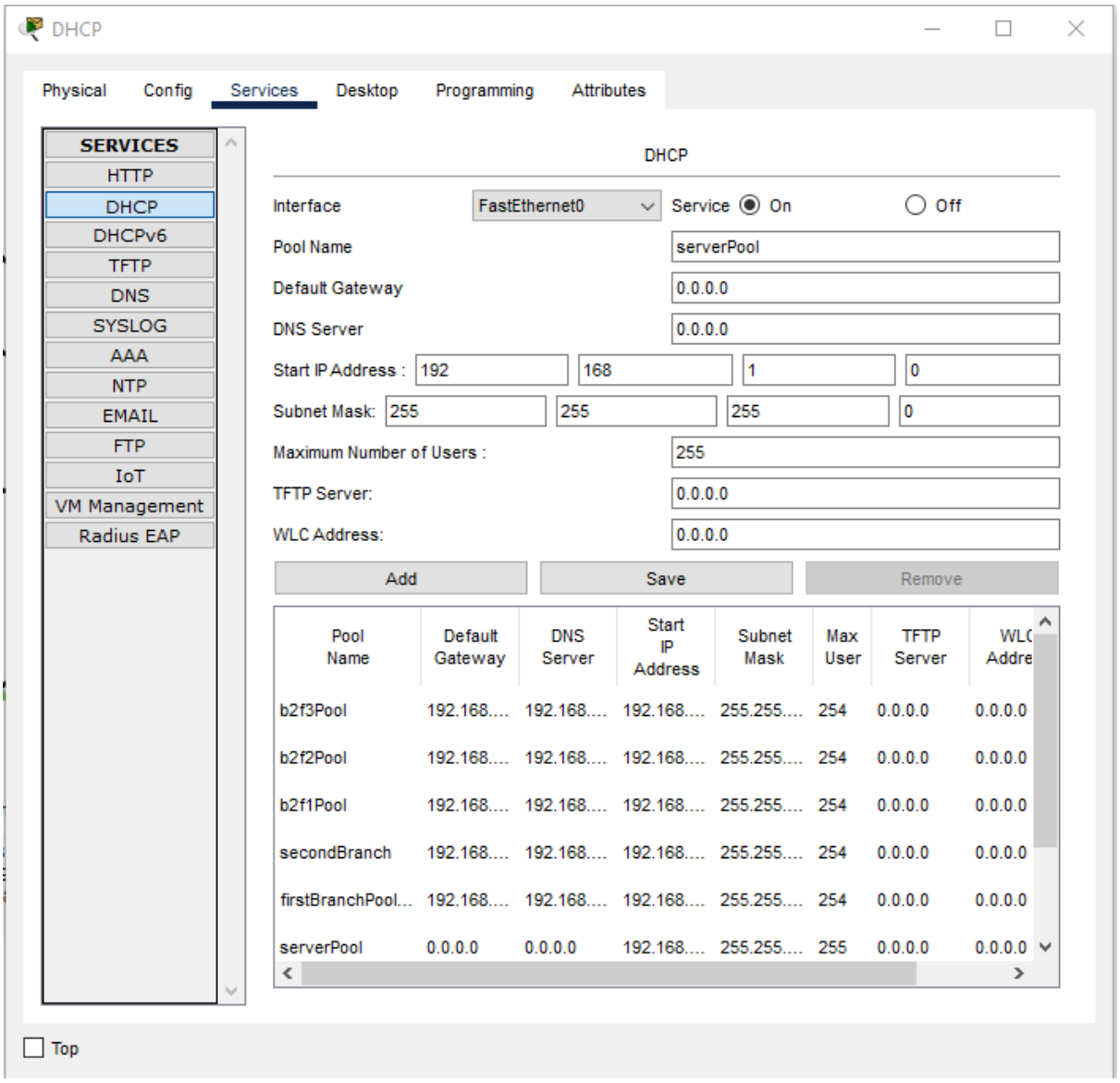


2.6. Simulation Elements

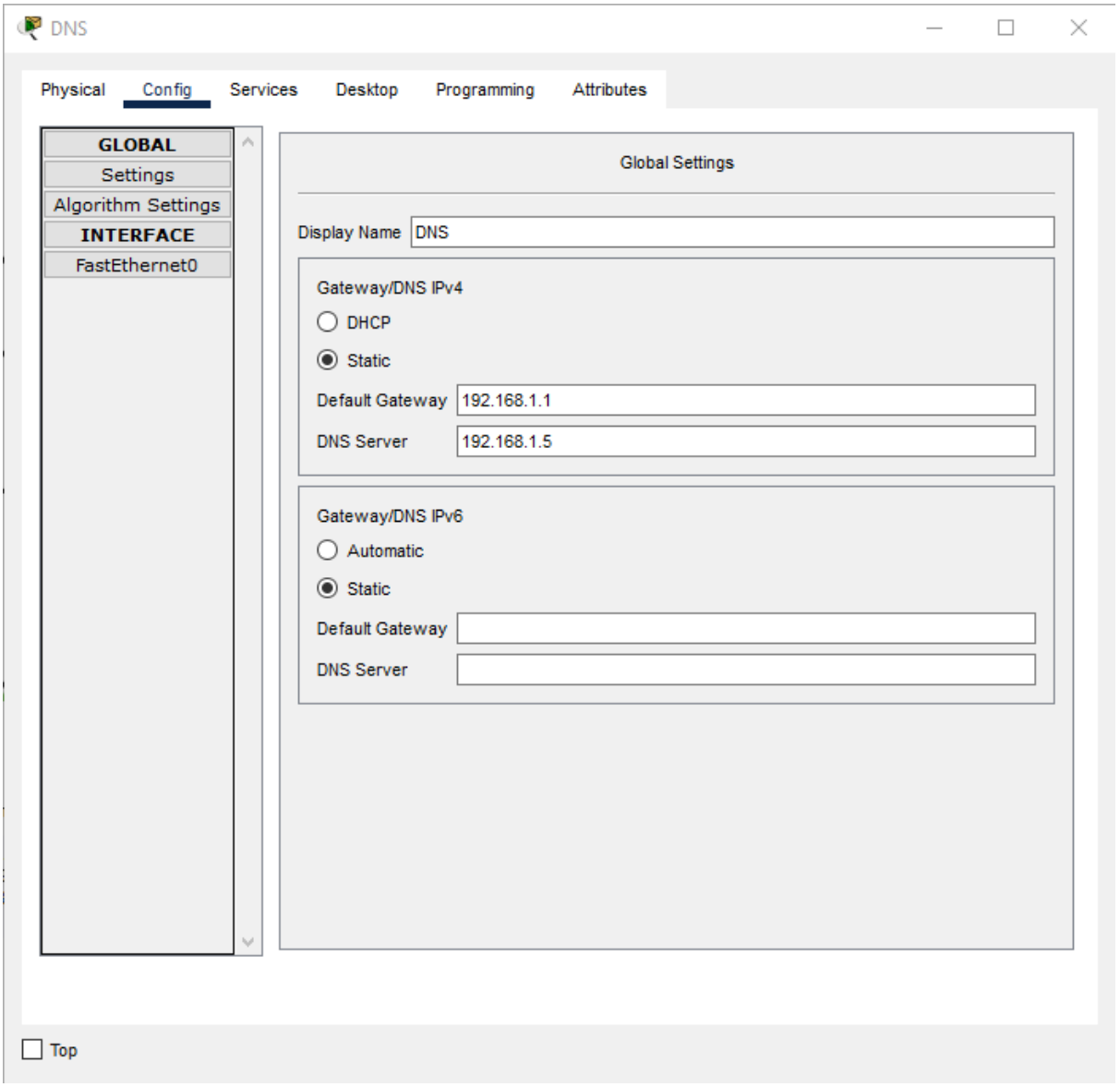
System entities:



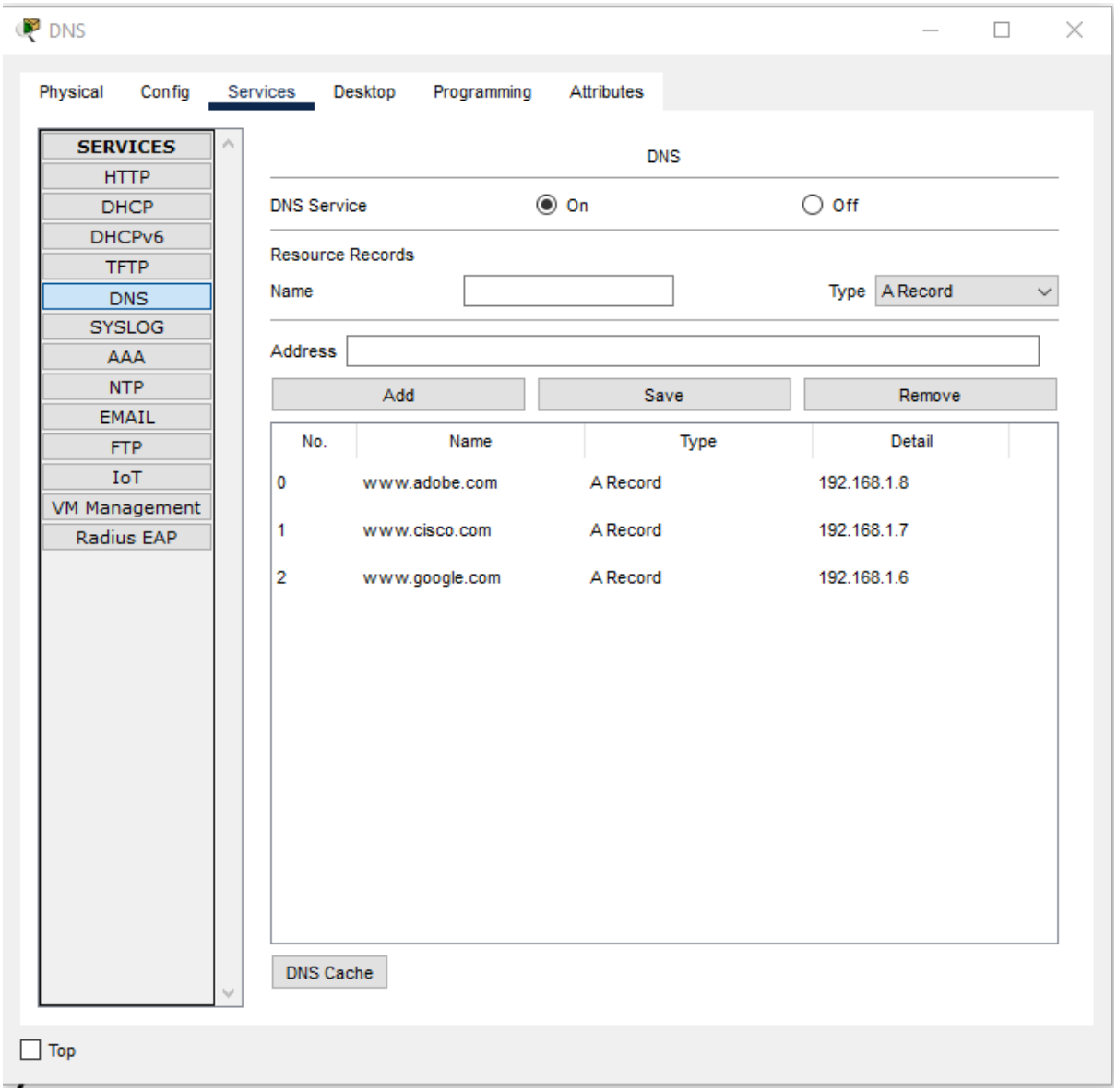
DHCP Server - Config



DHCP Server - Services



DNS Server - Config



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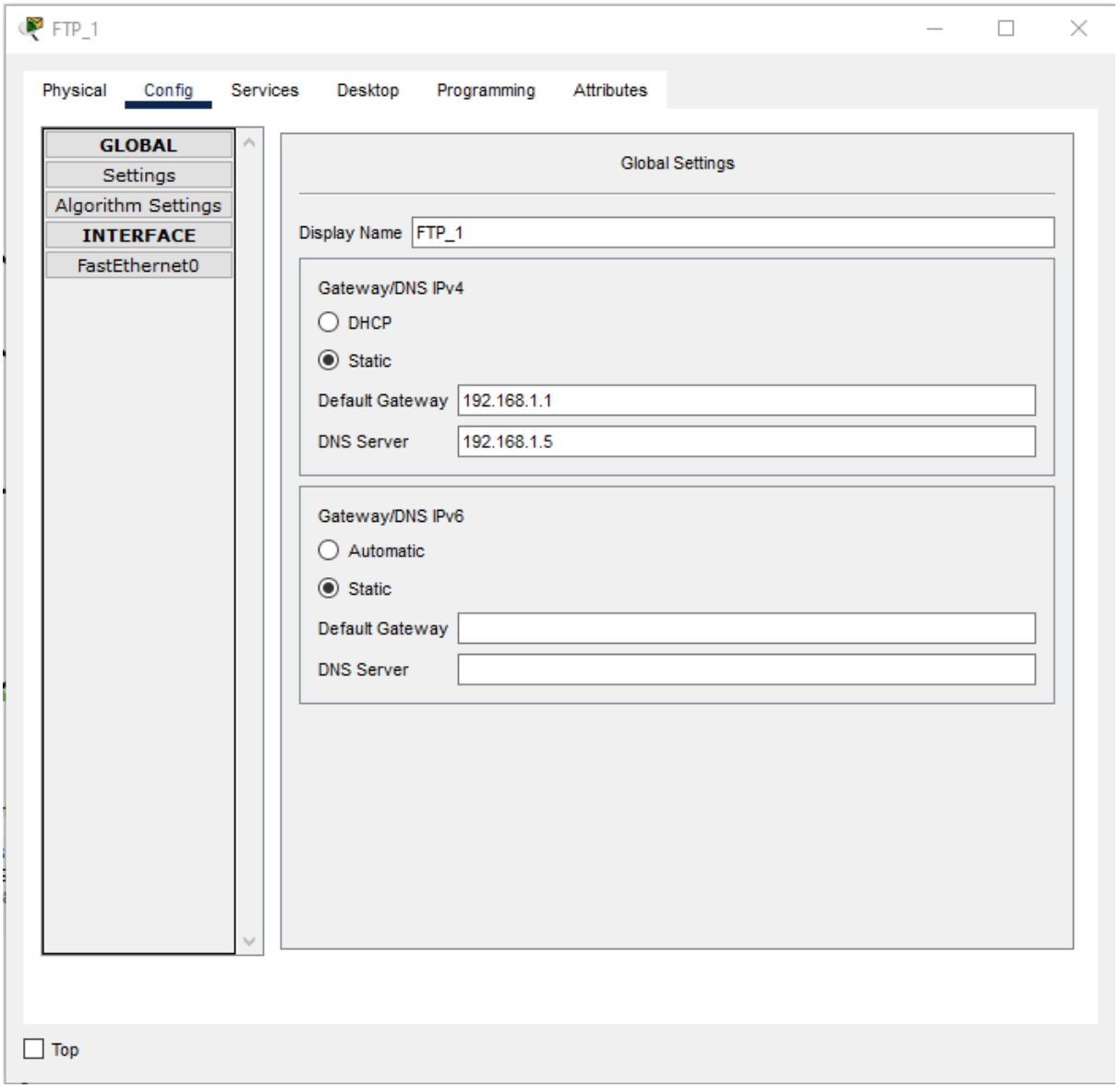
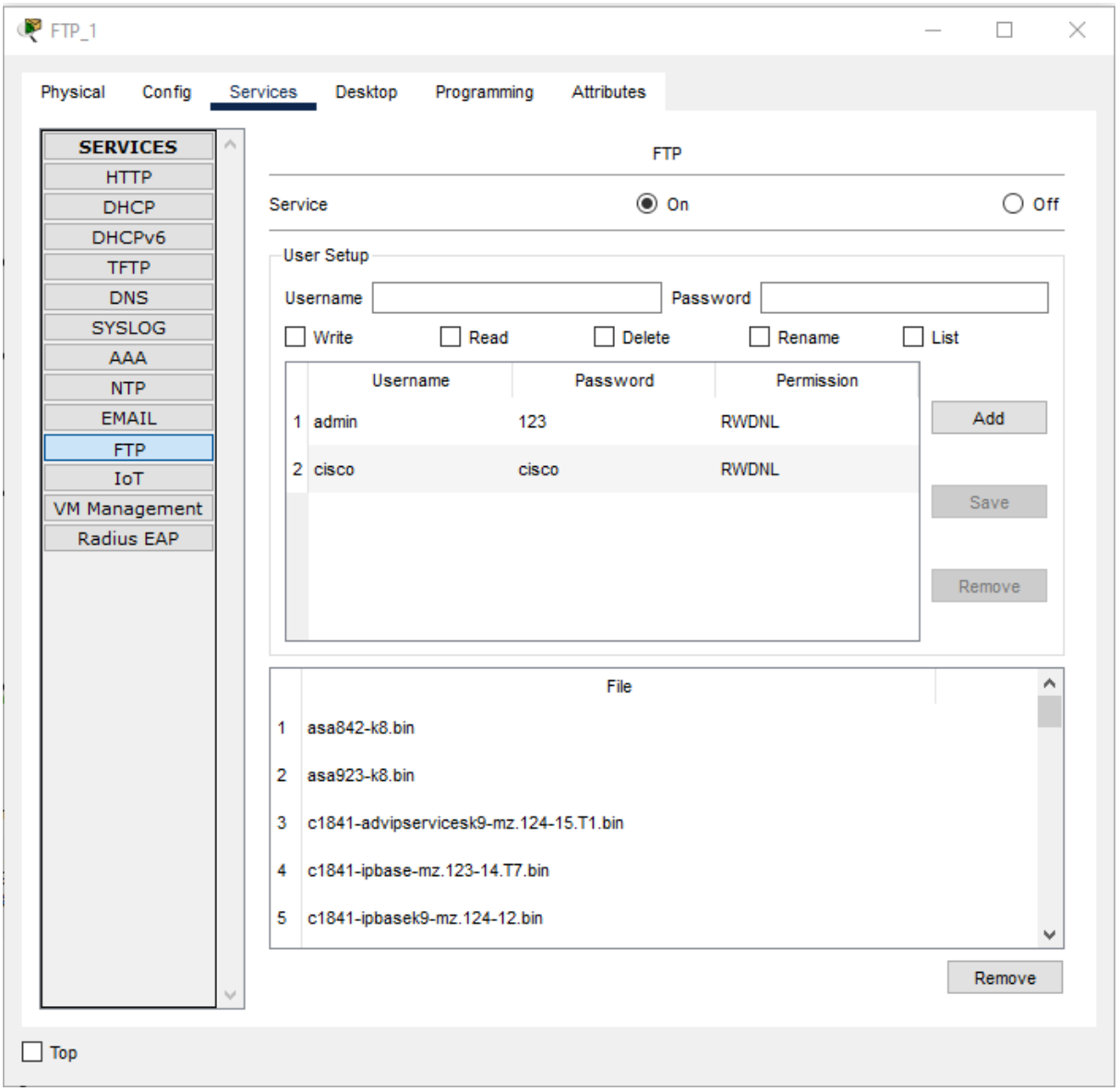


FTP1 Server - Config



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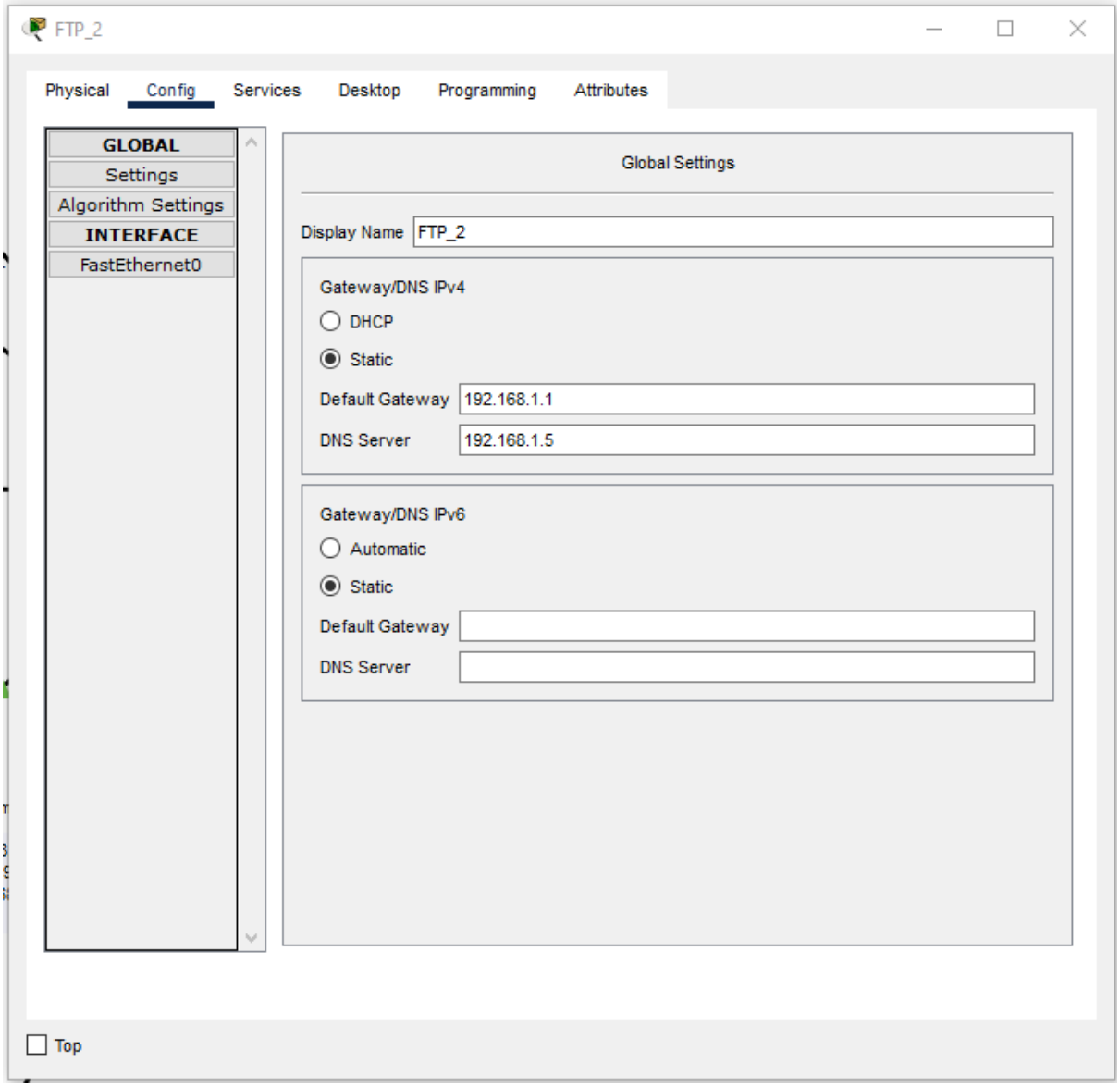

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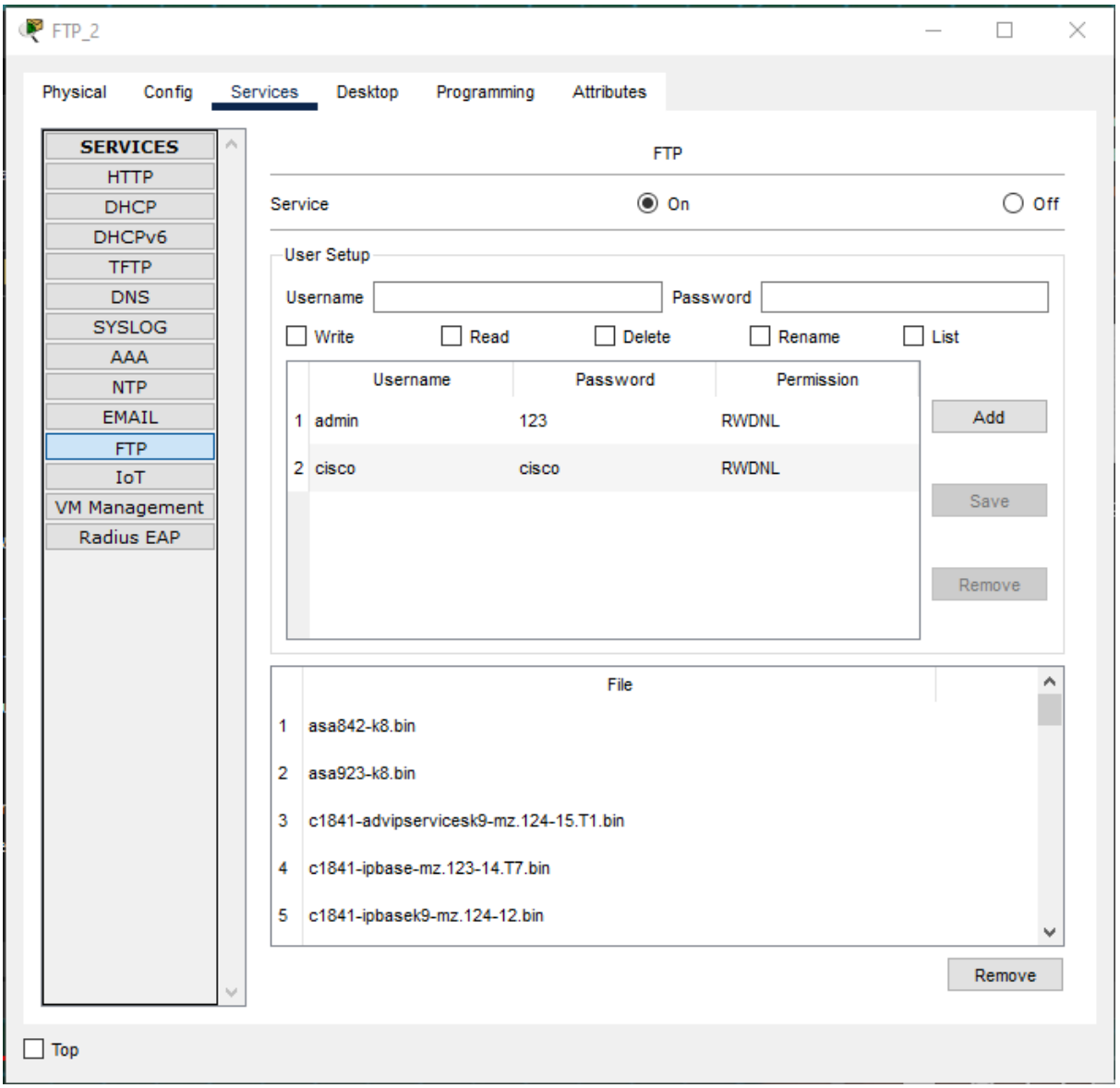

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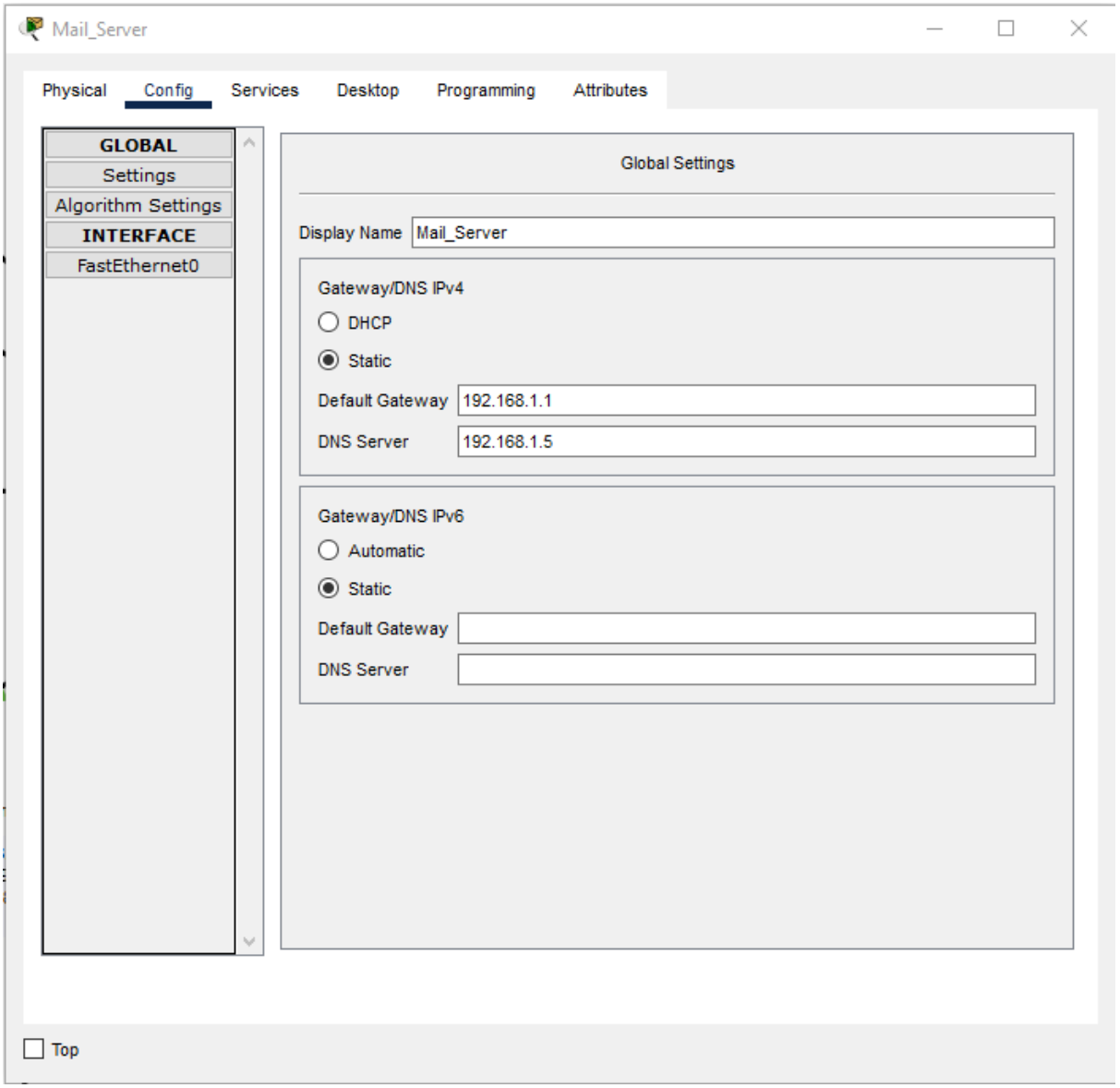
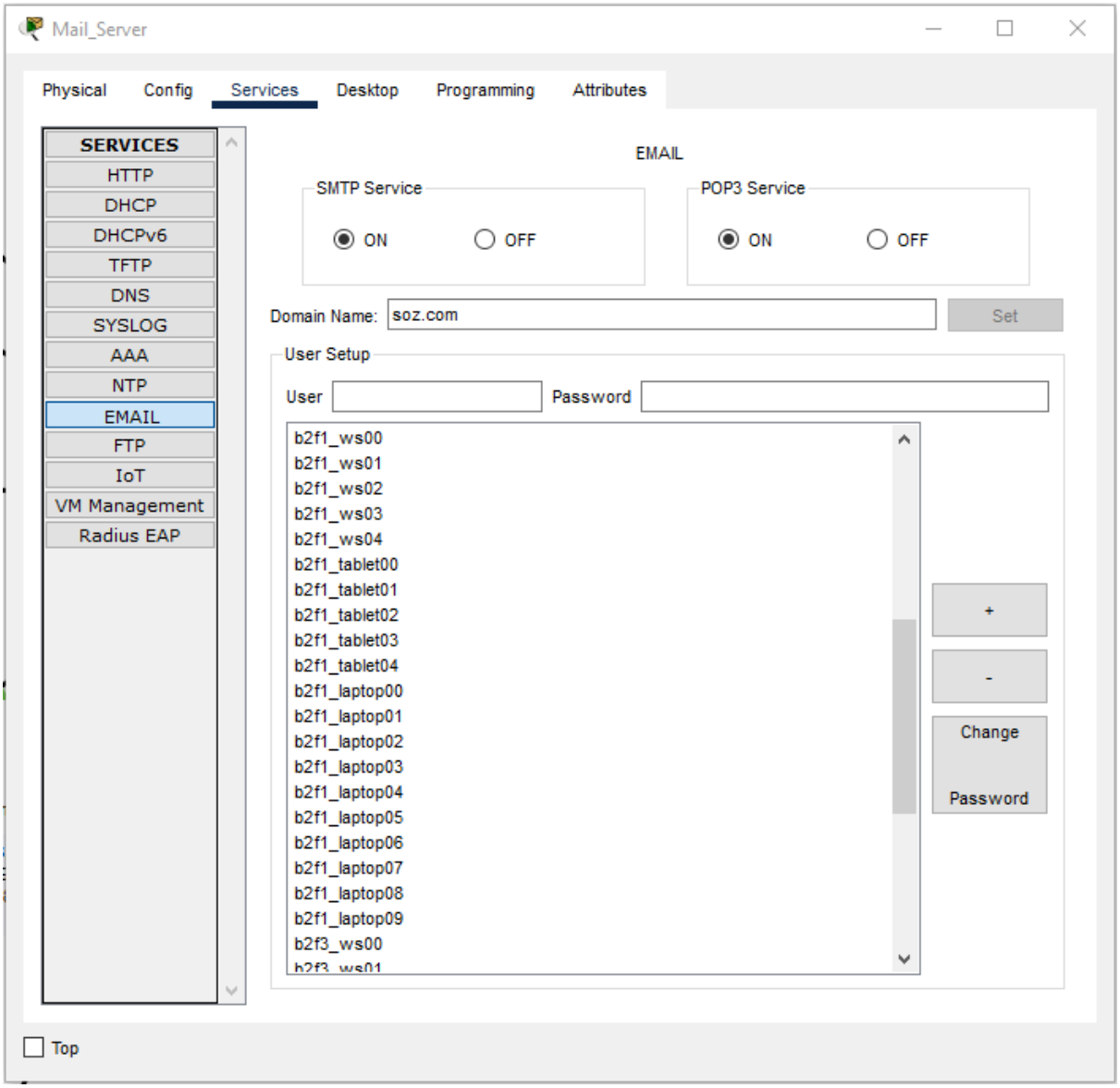
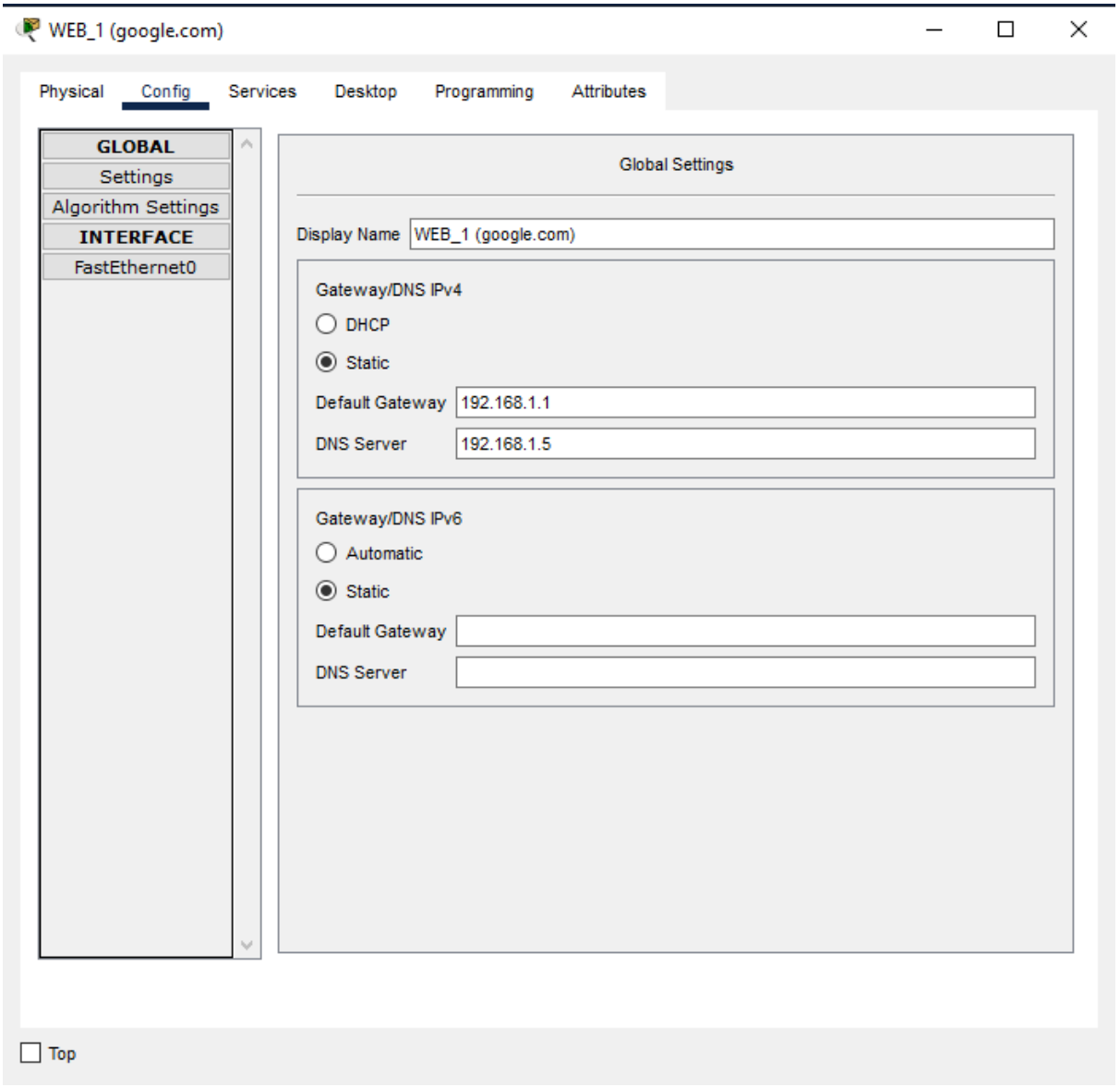


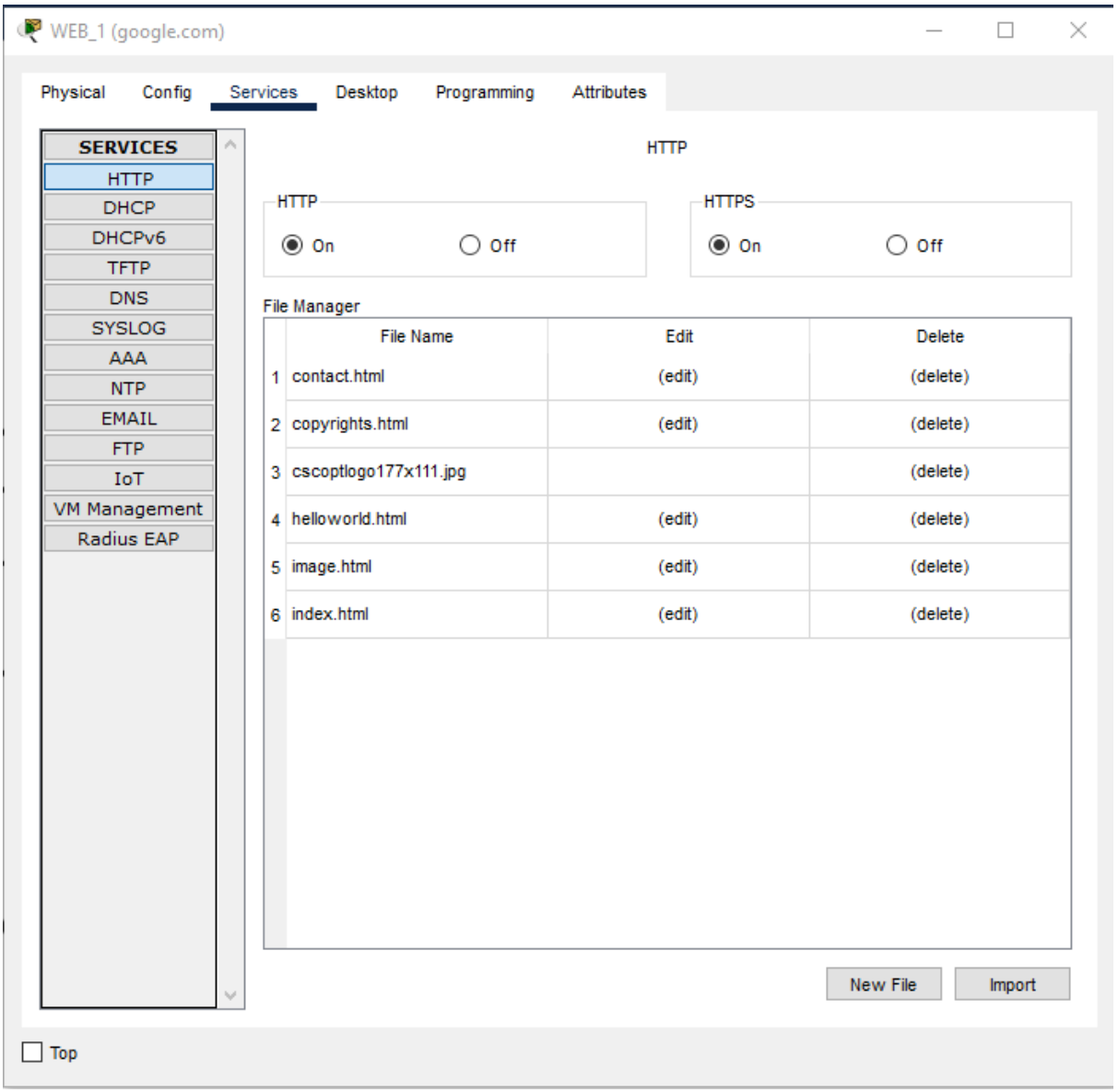
Mail Server - Config



Mail Server - Services



WEB1 Server - Config



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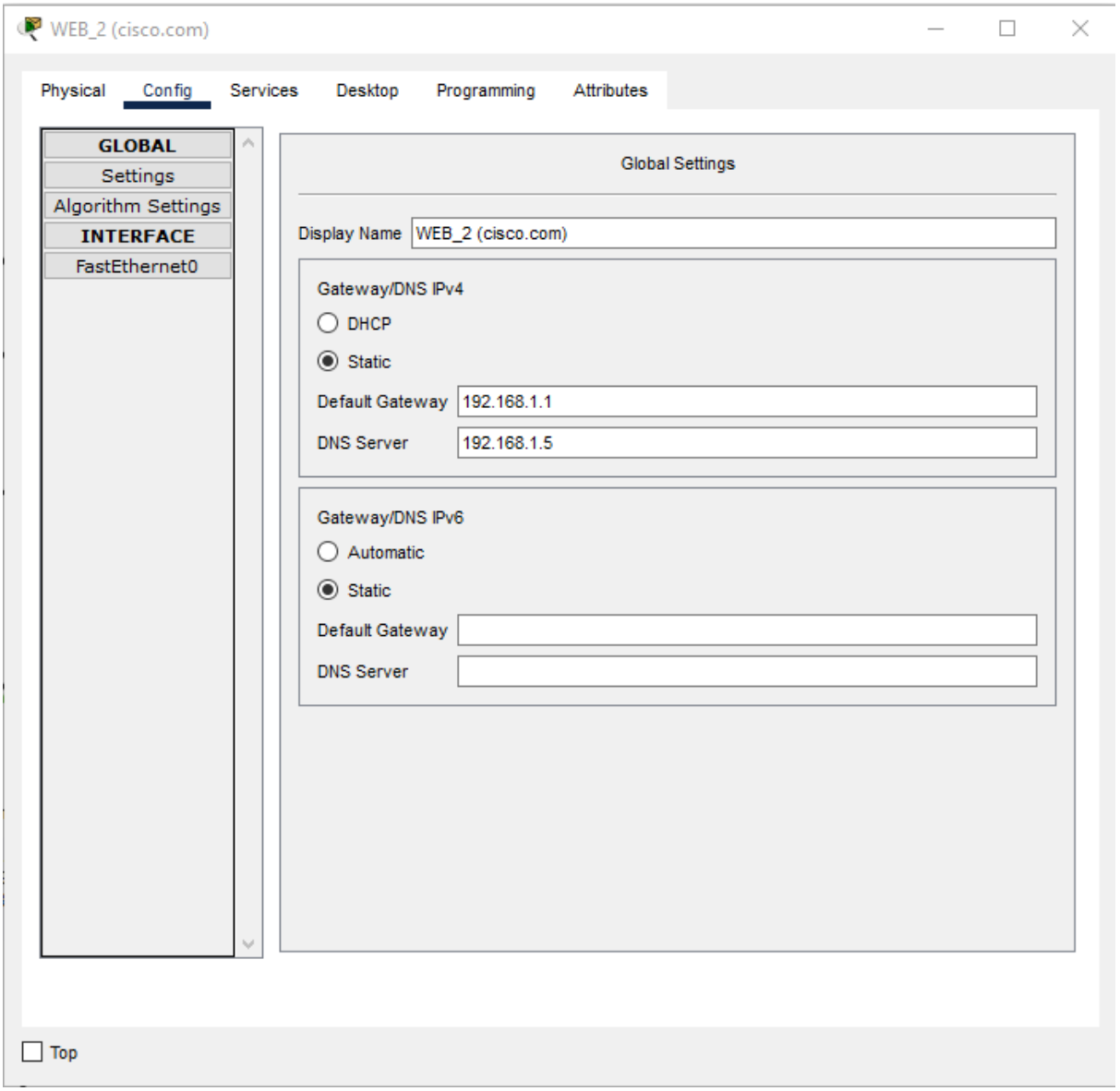

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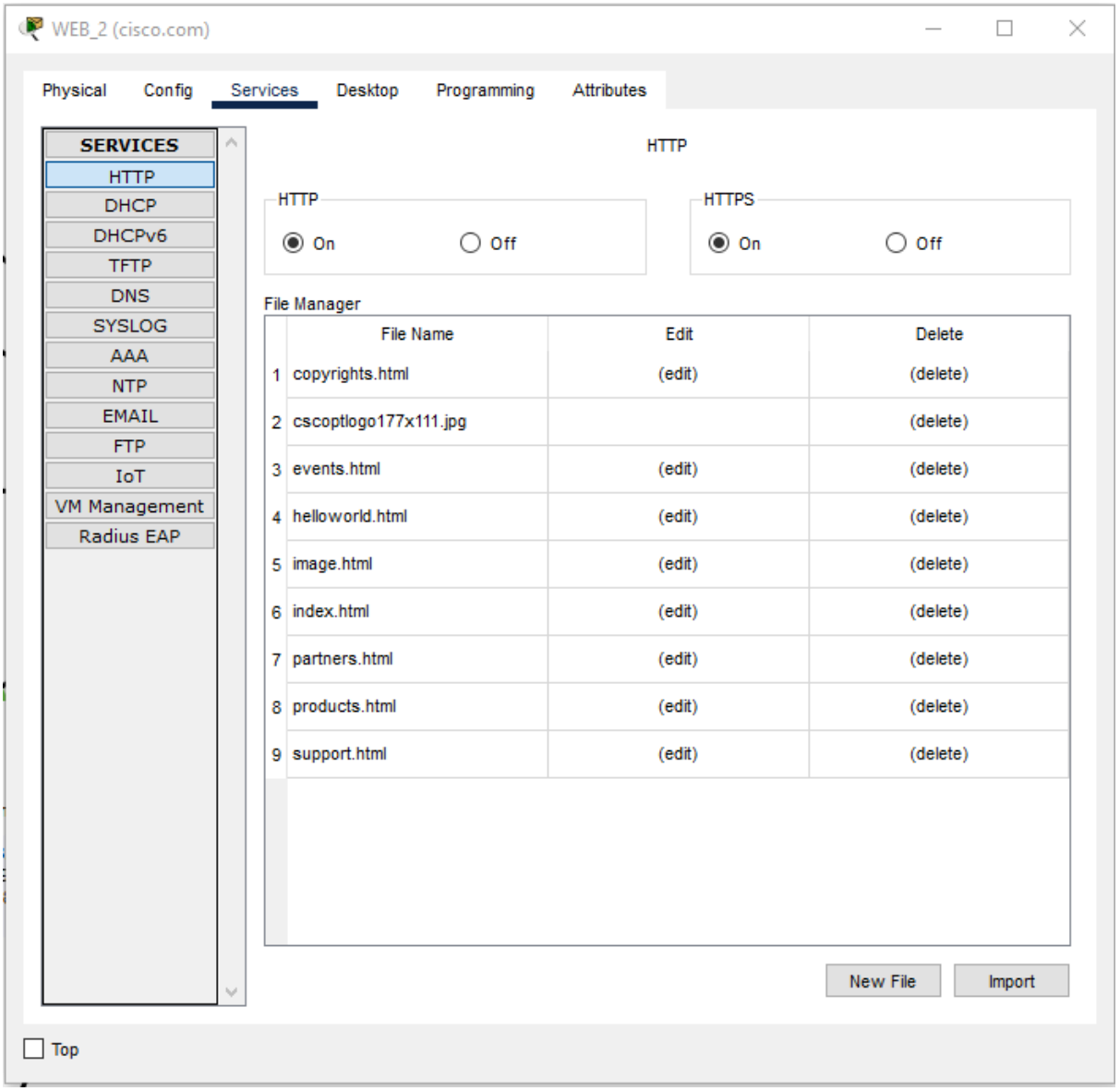
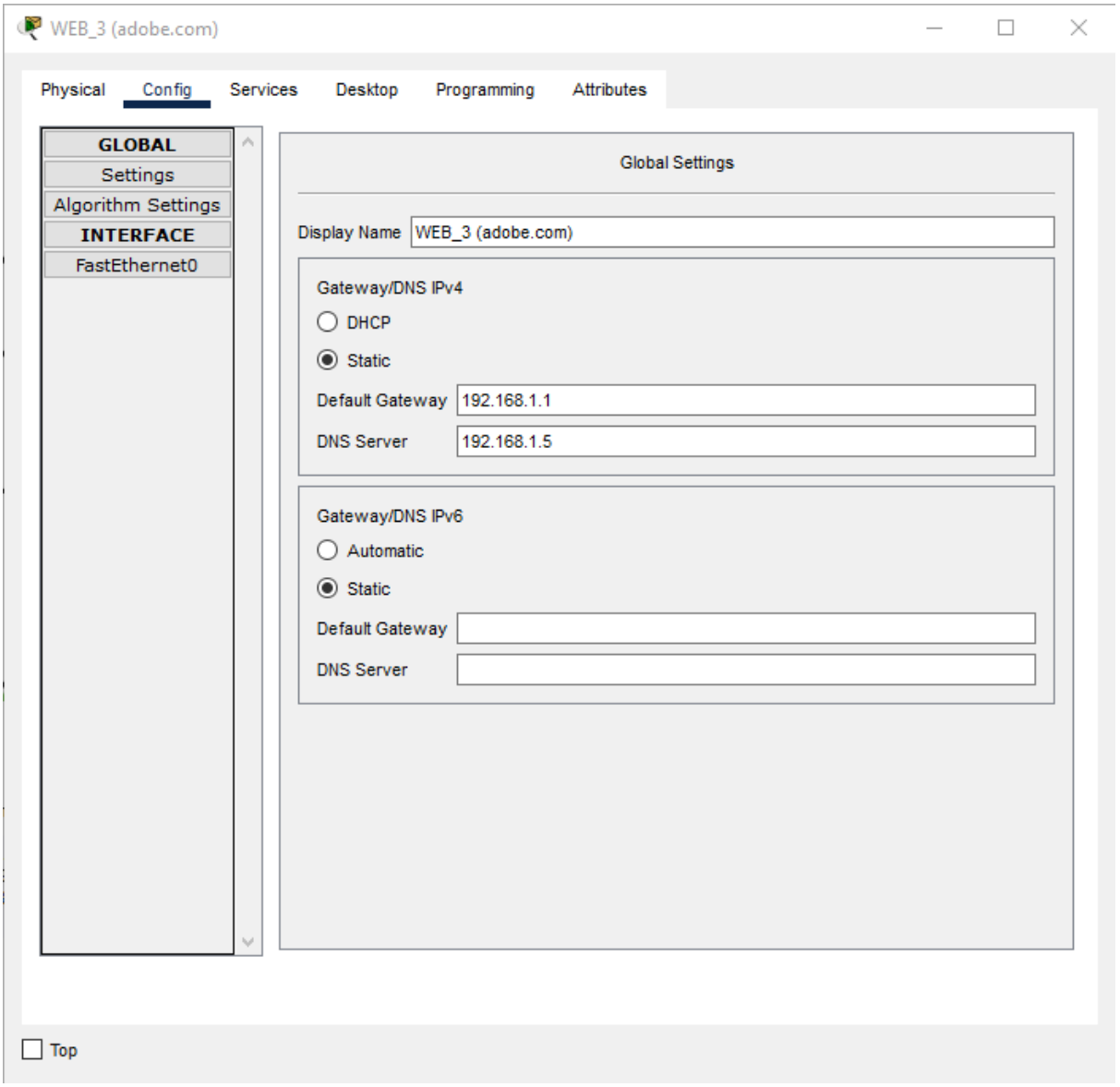
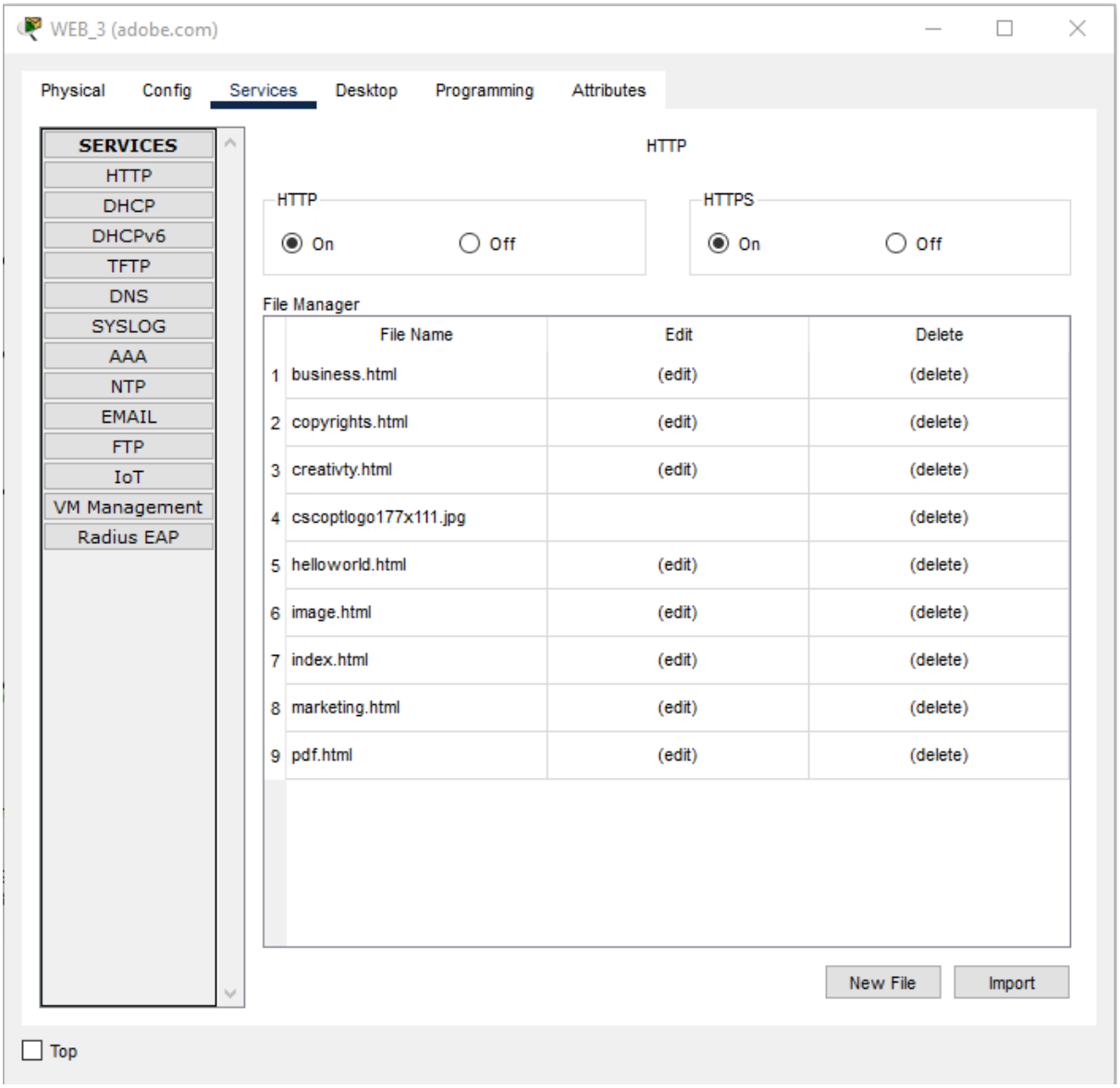


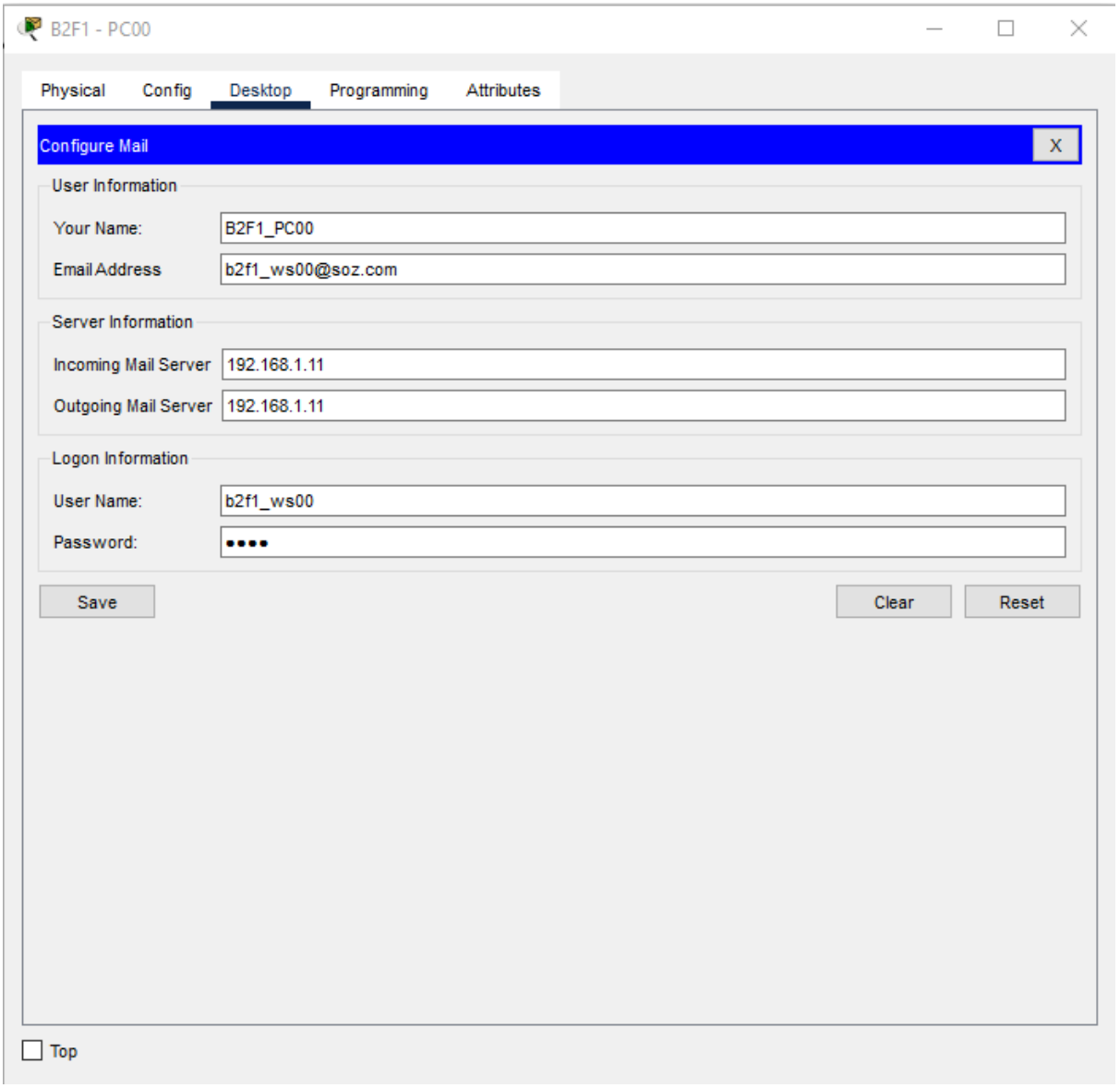
WEB2 Server - Services



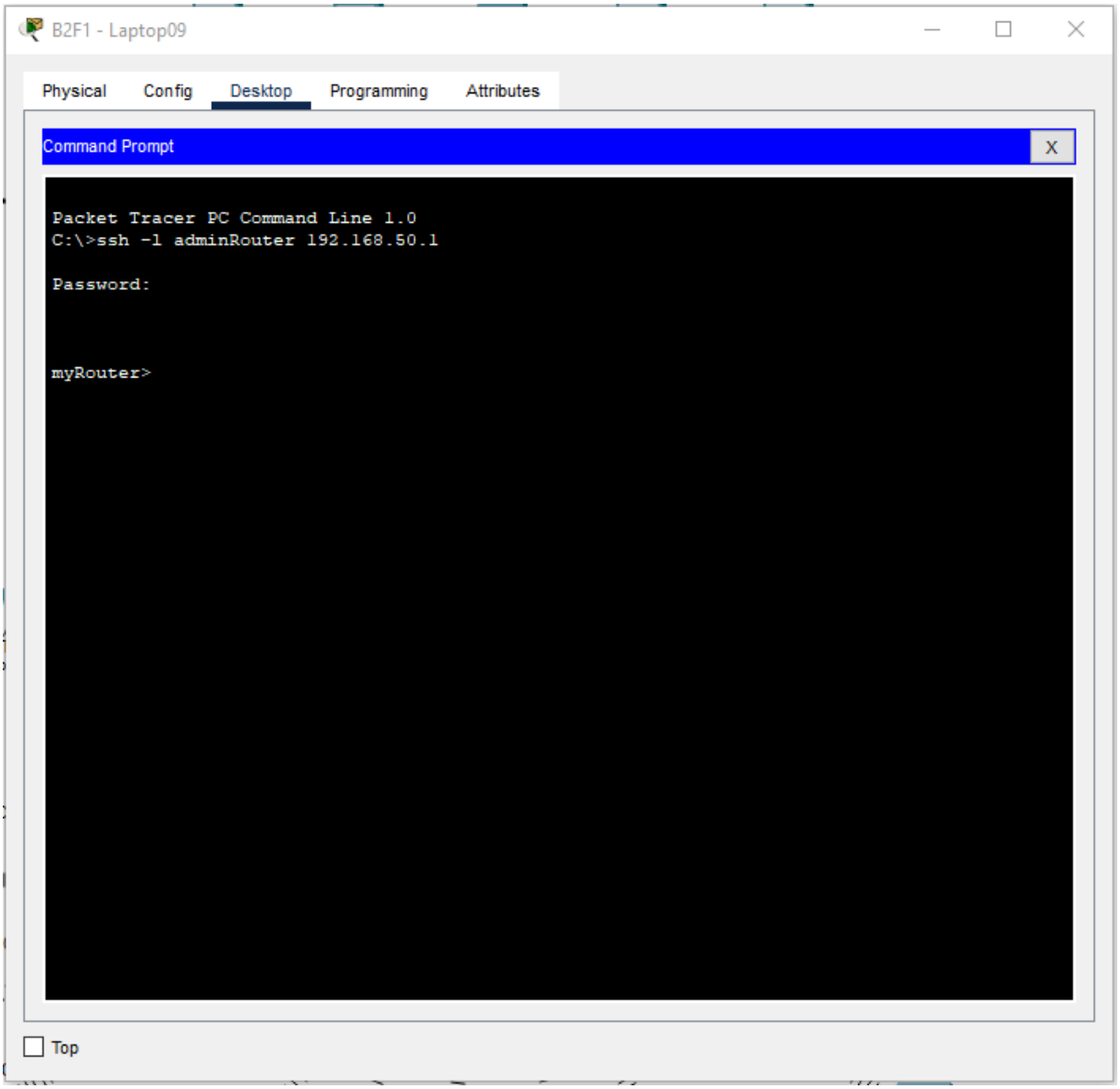
WEB3 Server - Config



WEB3 Server - Services



E-Mail Configuration Example



SSH Login Example

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	--	B2F1 ...	Mail_Server	ICMP		56.289	N	0	(edit)	
	In Progress	B2F1 ...	Mail_Server	ICMP		0.000	N	1	(edit)	

Scnario Output Example

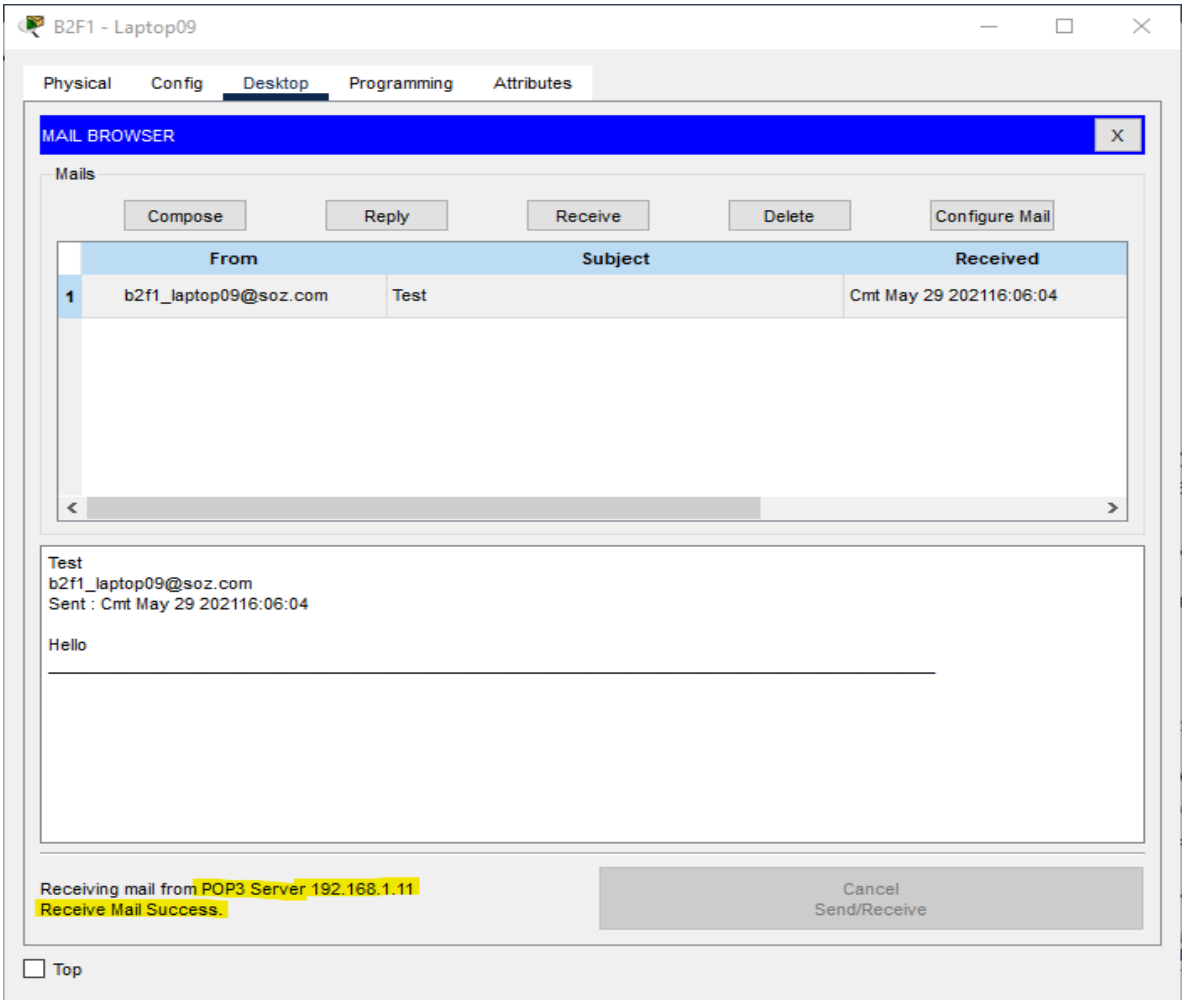
CHAPTER THREE

TRAFFIC ANALYSIS AND SIMULATION RESULTS

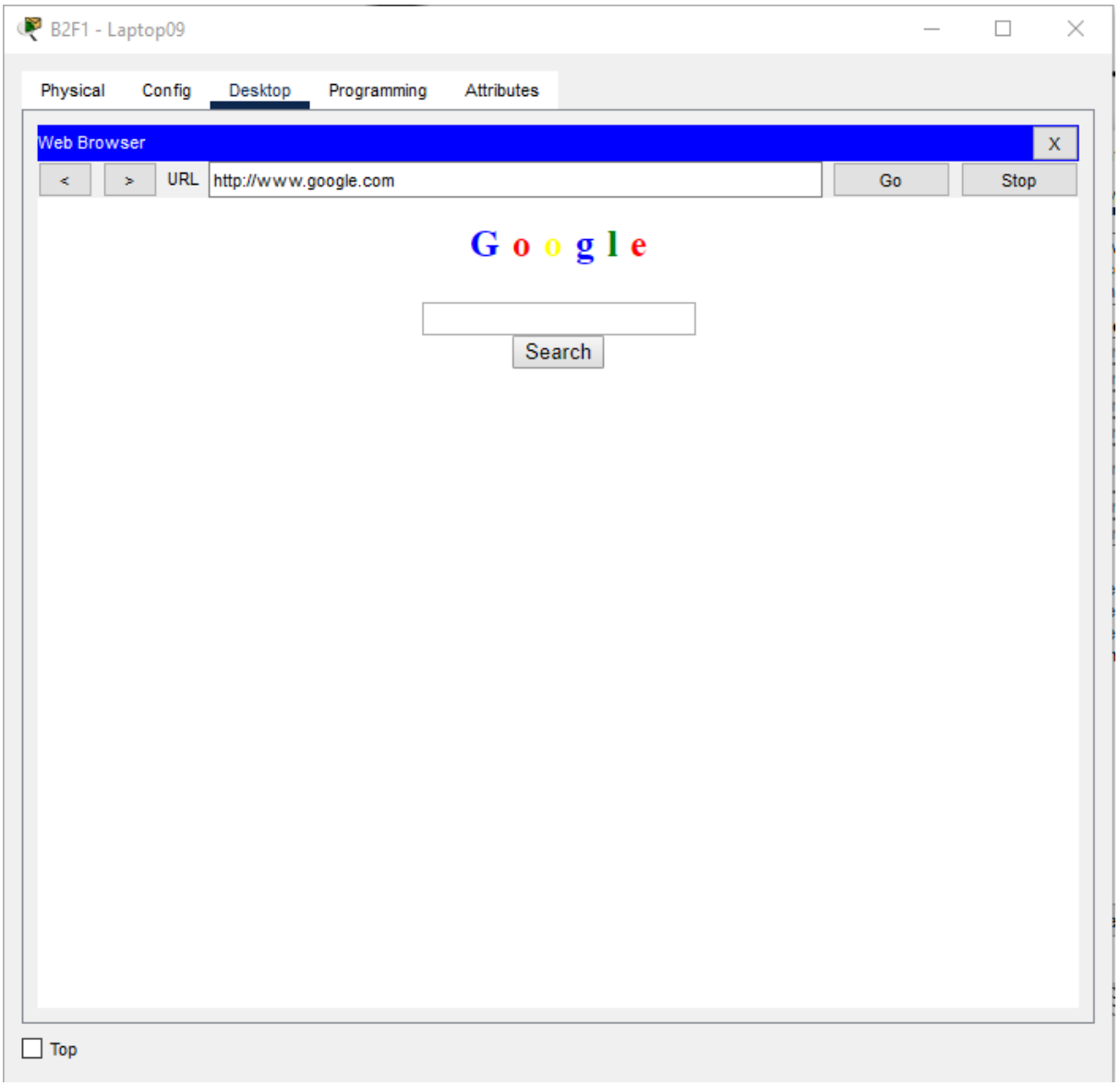
Scenario 1: A wireless user from first facility of second branch wants to read emails and browse Web.

The read mail process was performed by communicating between the Laptop09 user and the mail server. The network path followed for this scenario is as follows.
B2F1-Laptop09, B2F1-Wireless Router, B2F1-Switch, Branch2-Router, B1-ServerRouter, Server Switch, Mail_Server The network path was repeated more than once to make the scenario happen.

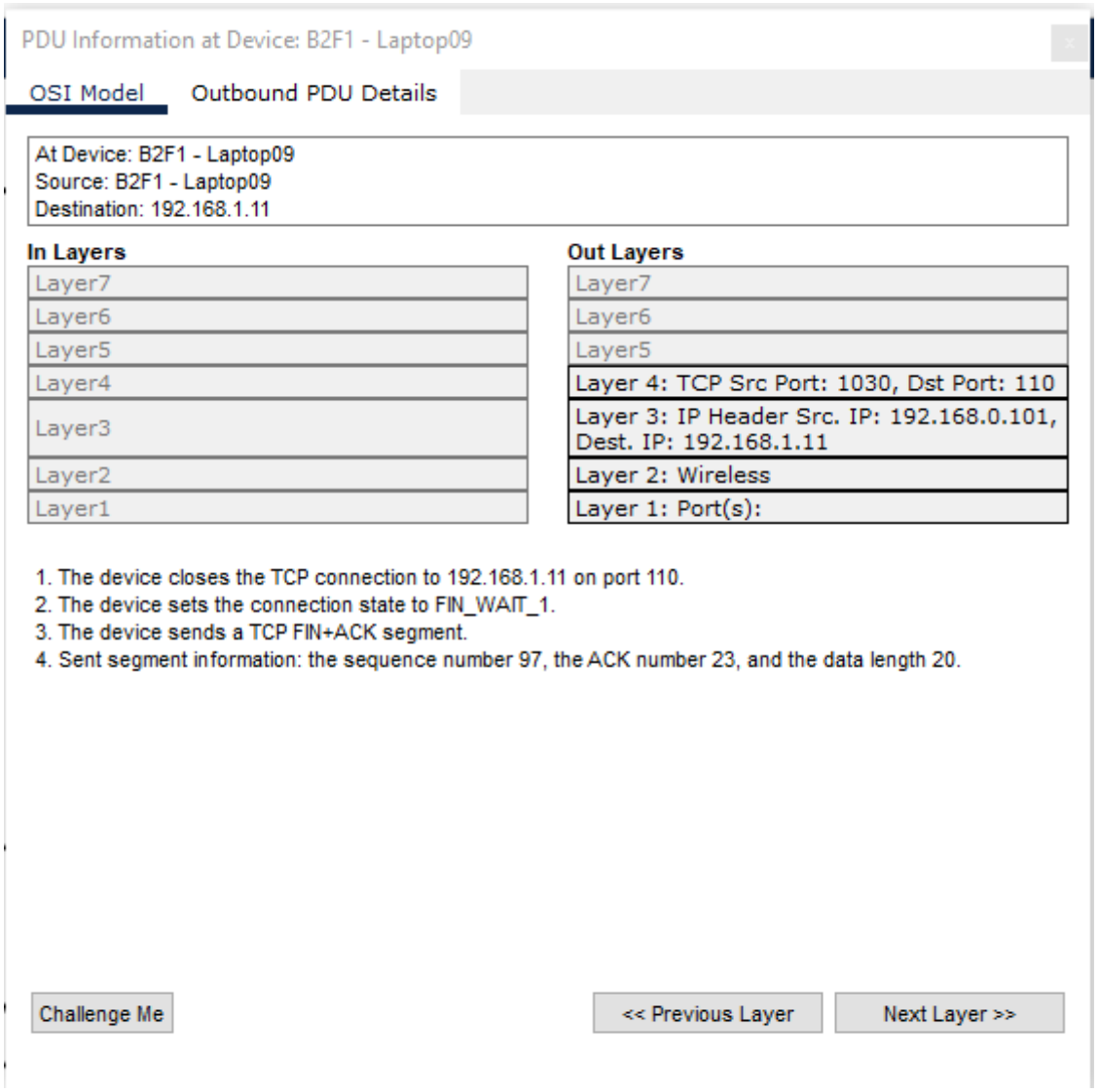
By providing communication between Laptop09 user and web server, browse web operation was performed. The network path followed for this scenario is as follows.
B2F1-Laptop09, B2F1-Wireless Router, B2F1-Switch, Branch2-Router, B1-ServerRouter, Server Switch, WEB_1 The network path was repeated more than once to make the scenario happen.



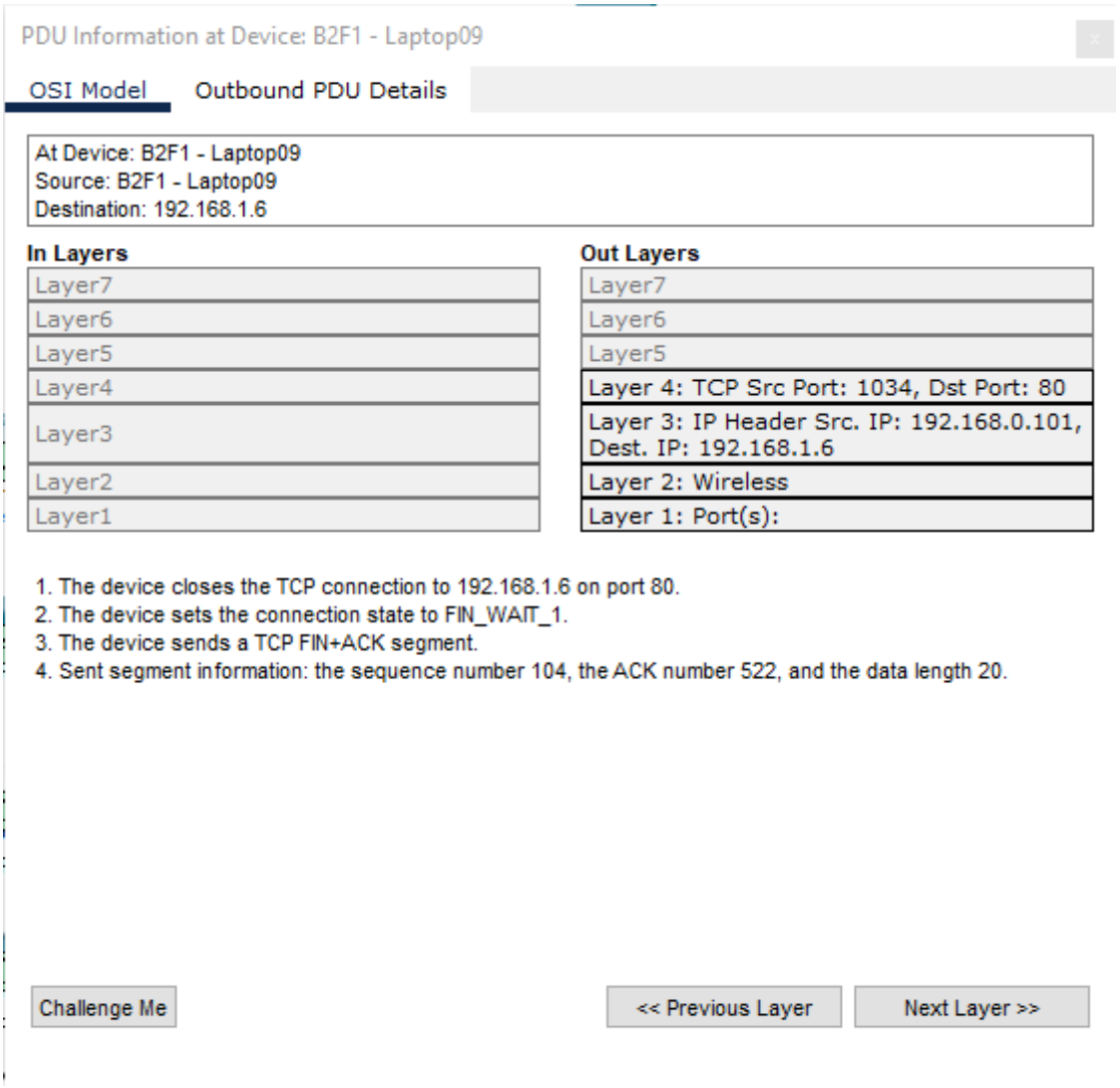
Result of Scenario 1 for read mail



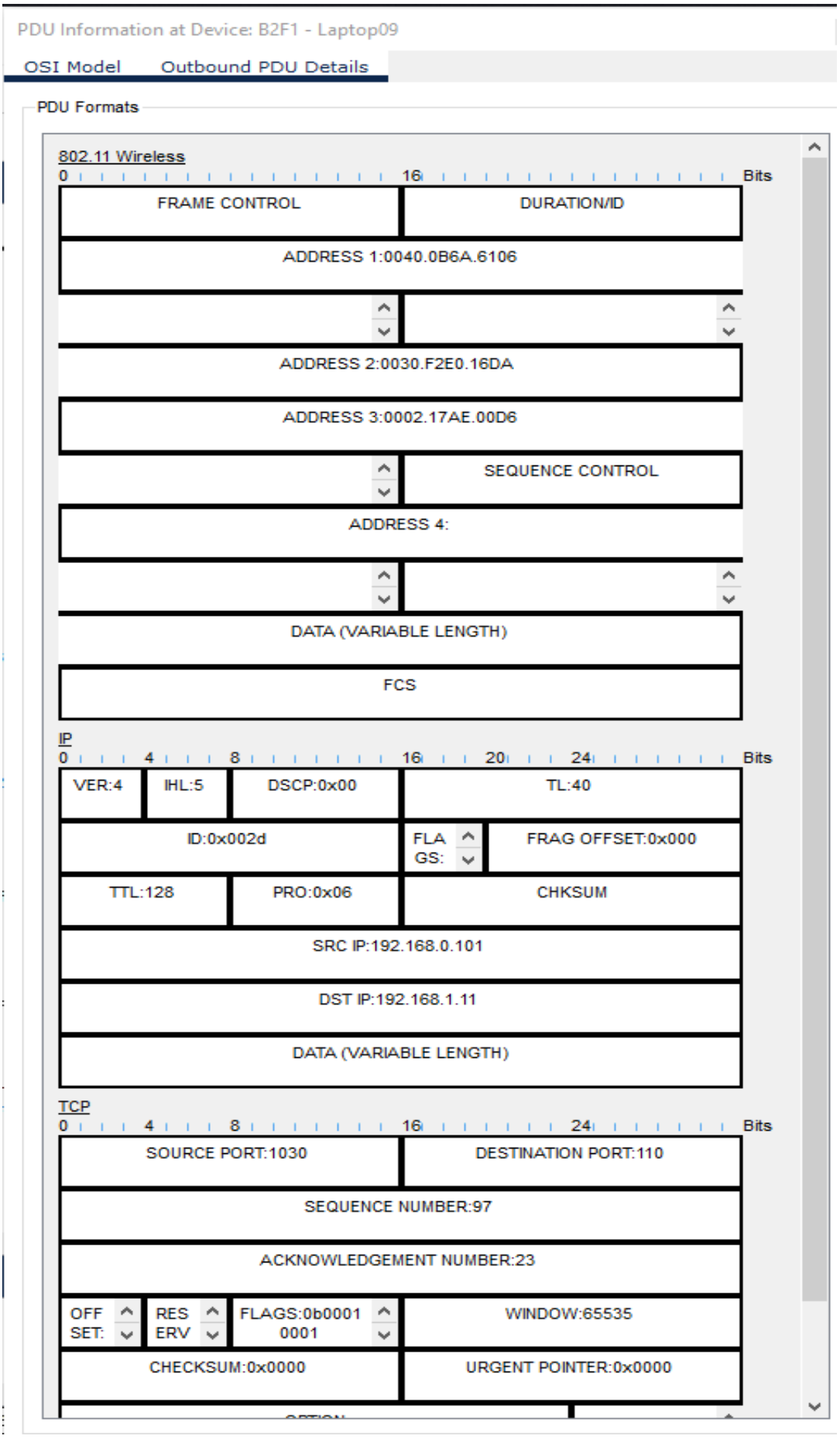
Result of Scenario 1 for browse Web



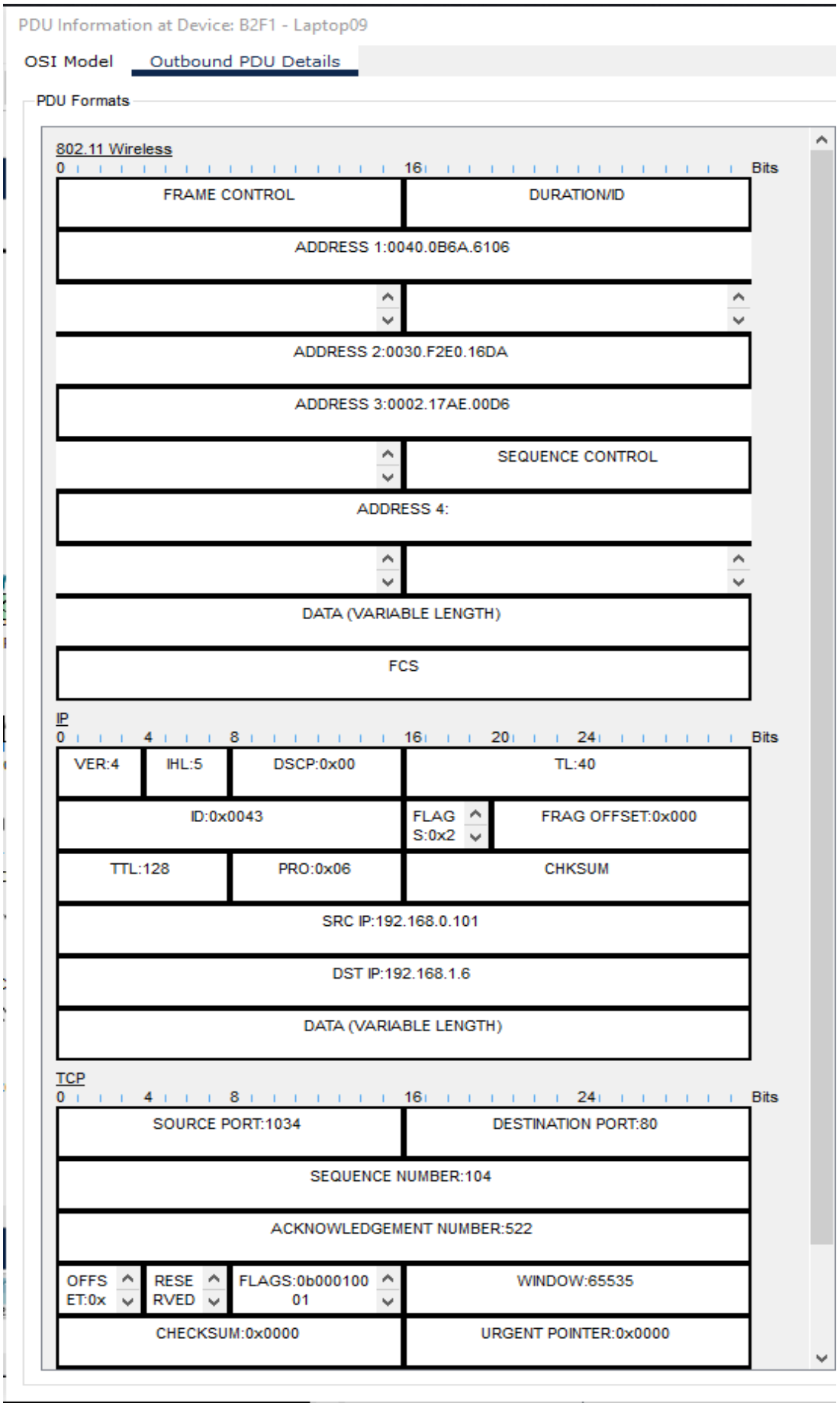
OSI Model of Scenario 1 for read mail



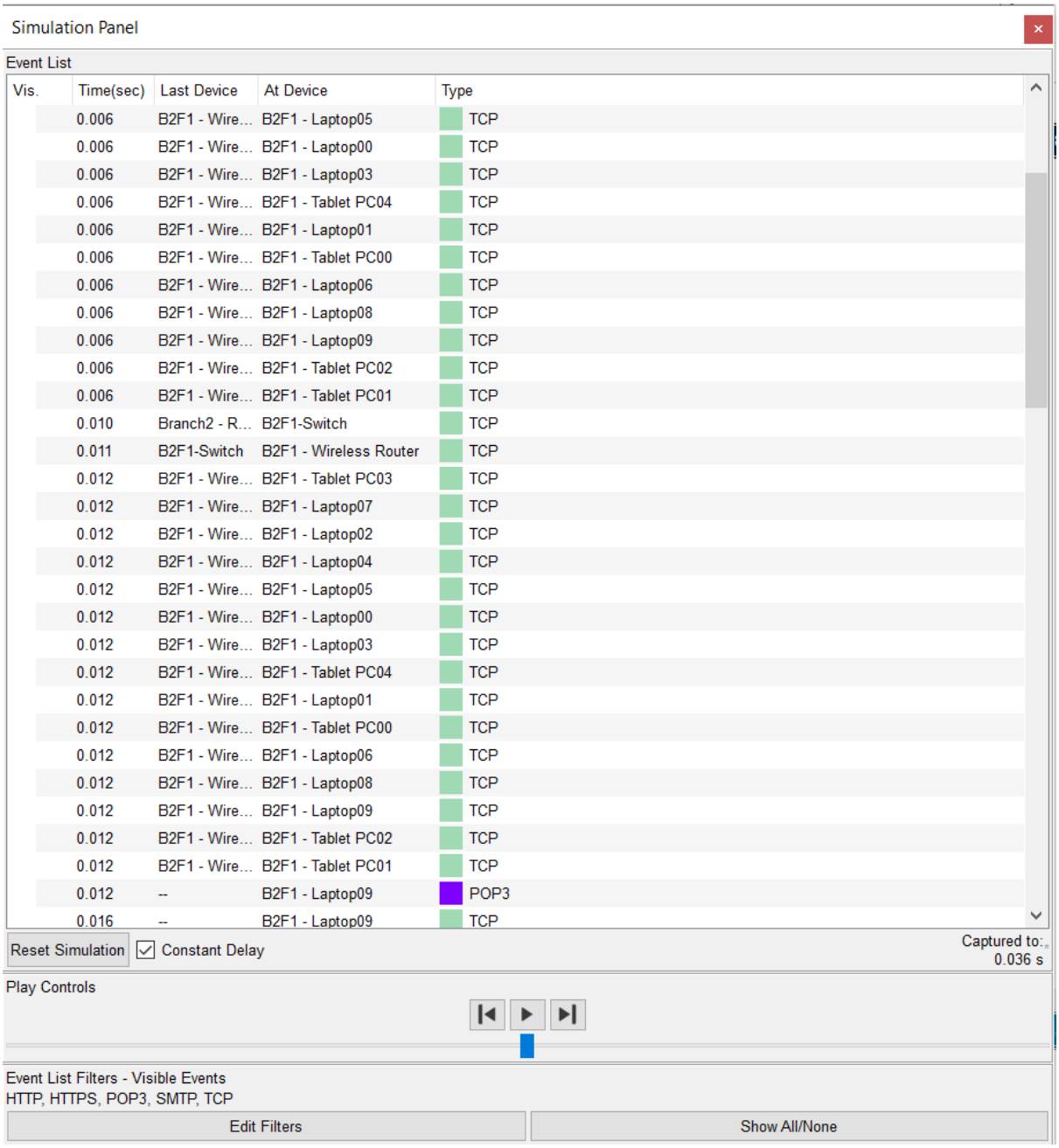
OSI Model of Scenario 1 for browse Web



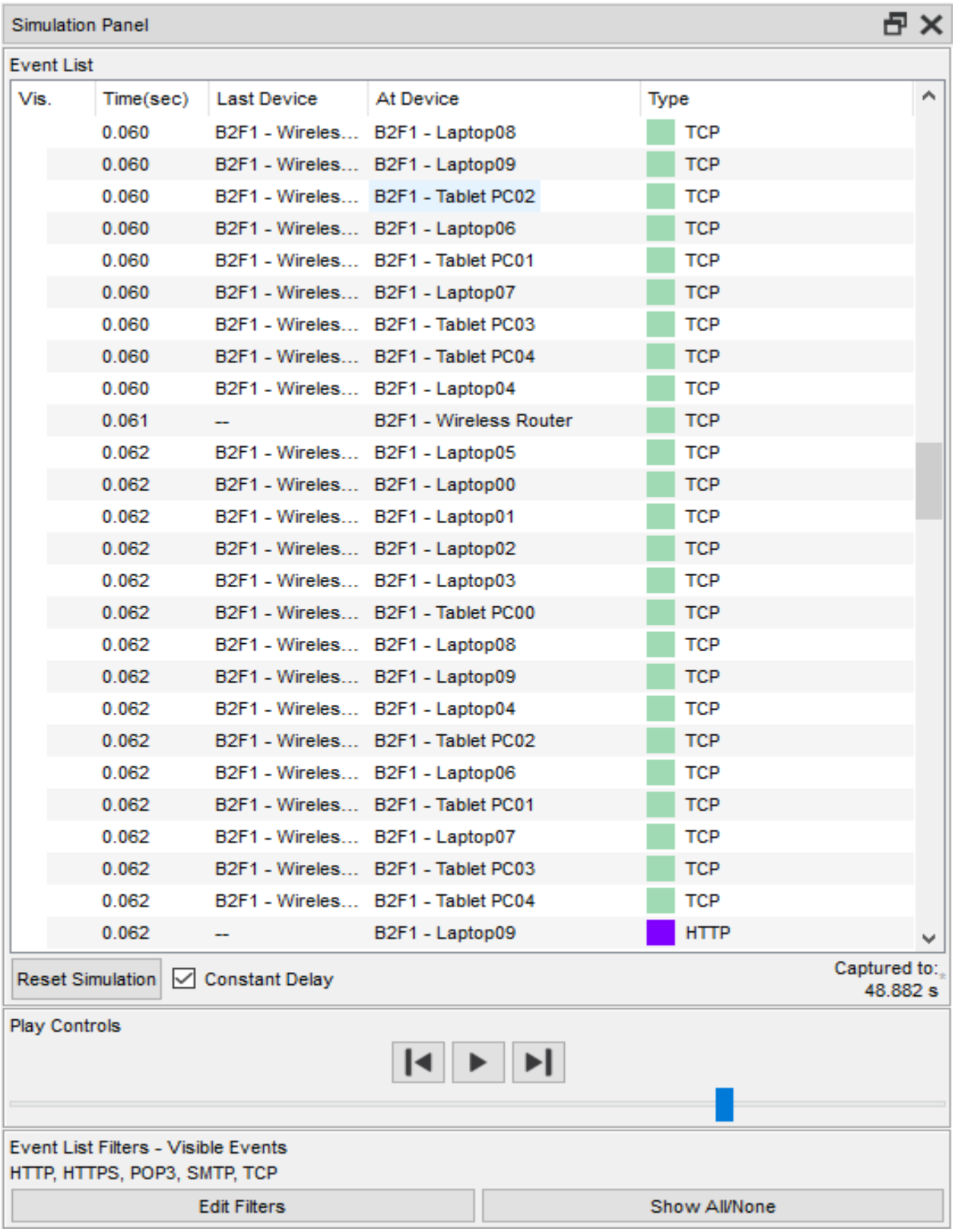
PDU Output of Scenario 1 for read mail



PDU Output of Scenario 1 for browse Web



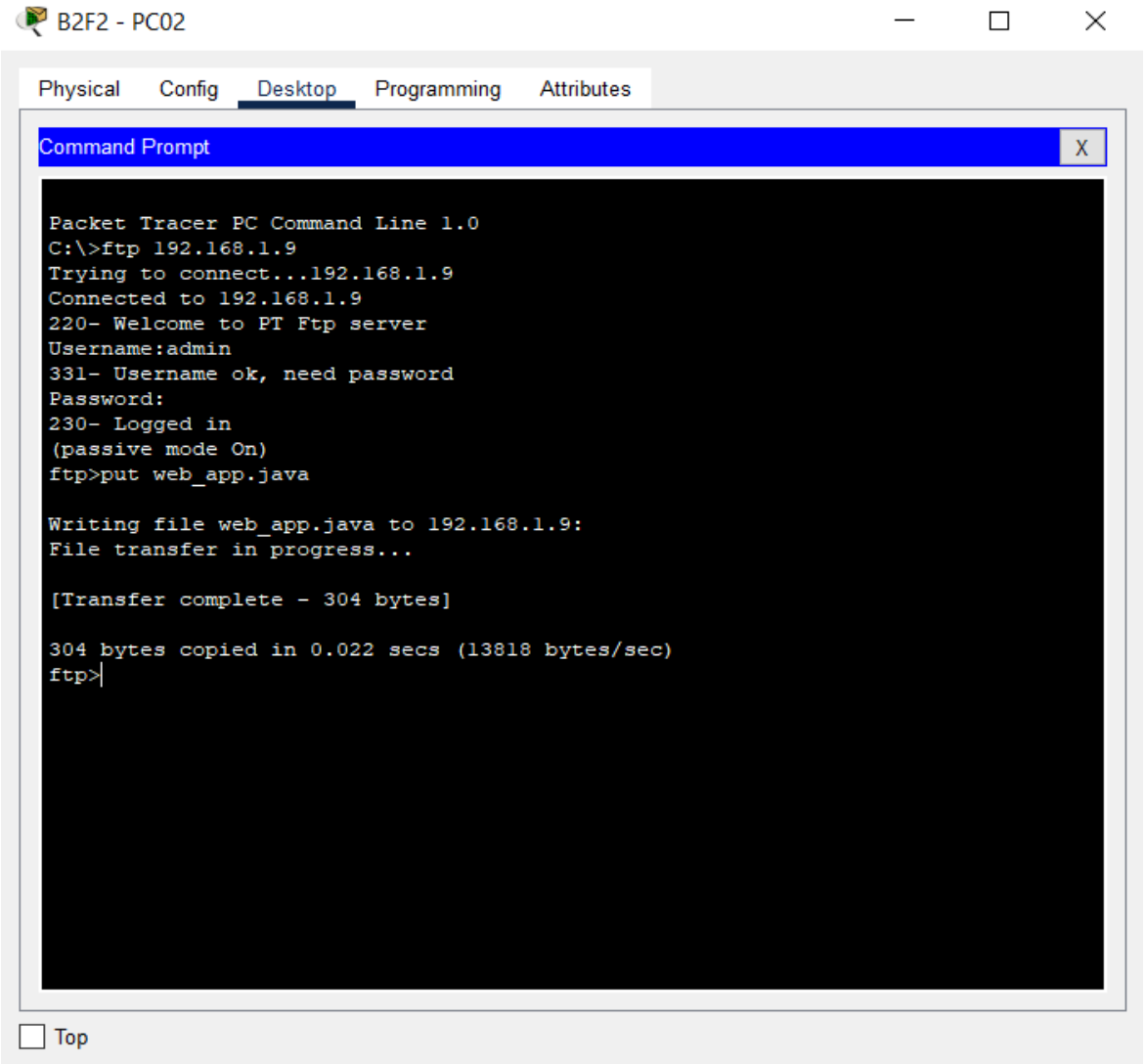
Event List of Scenario 1 for read mail



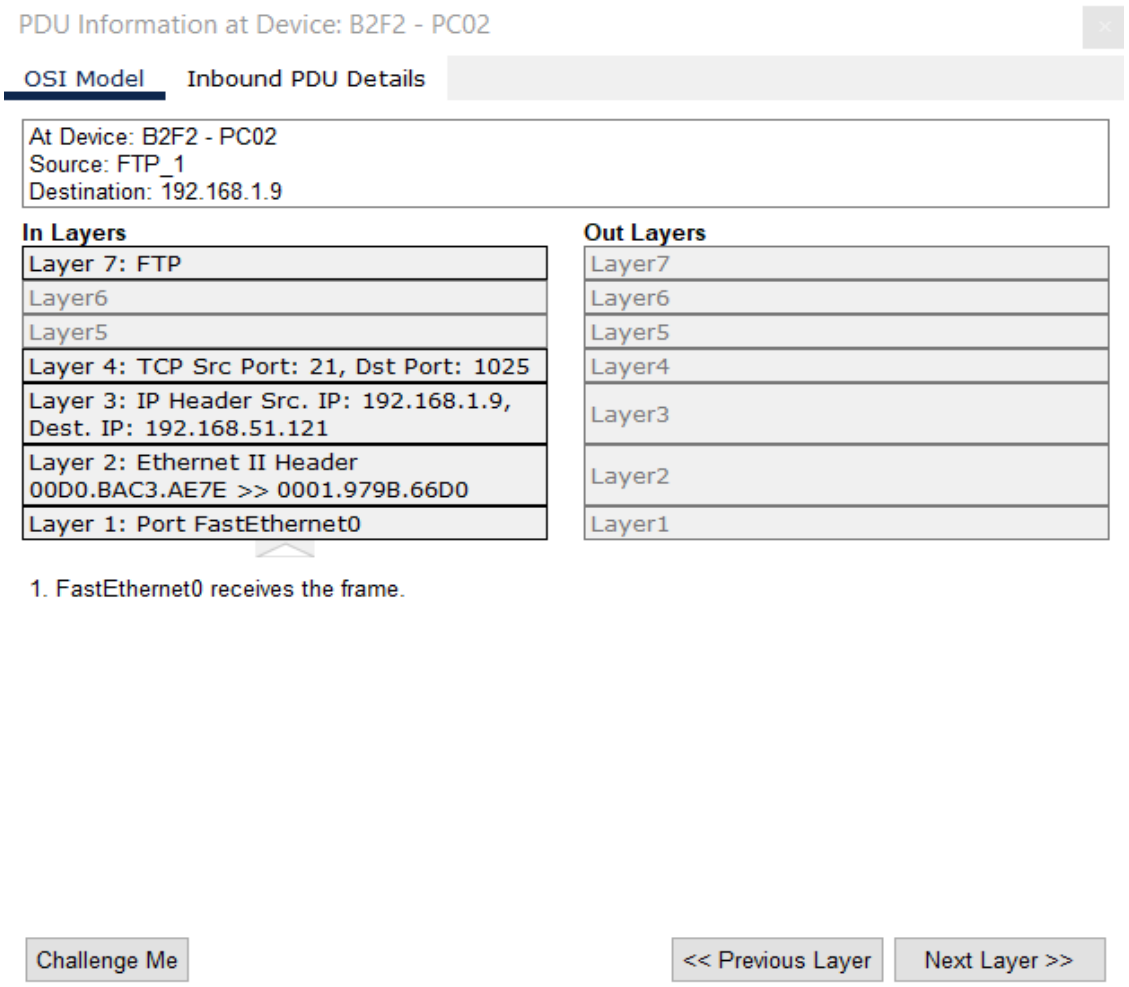
Event List of Scenario 1 for browse Web

Scenario 2 : A computer engineer from second facility of second branch developed a web application and wants to send her code files to FTP server in the third facility of first branch.

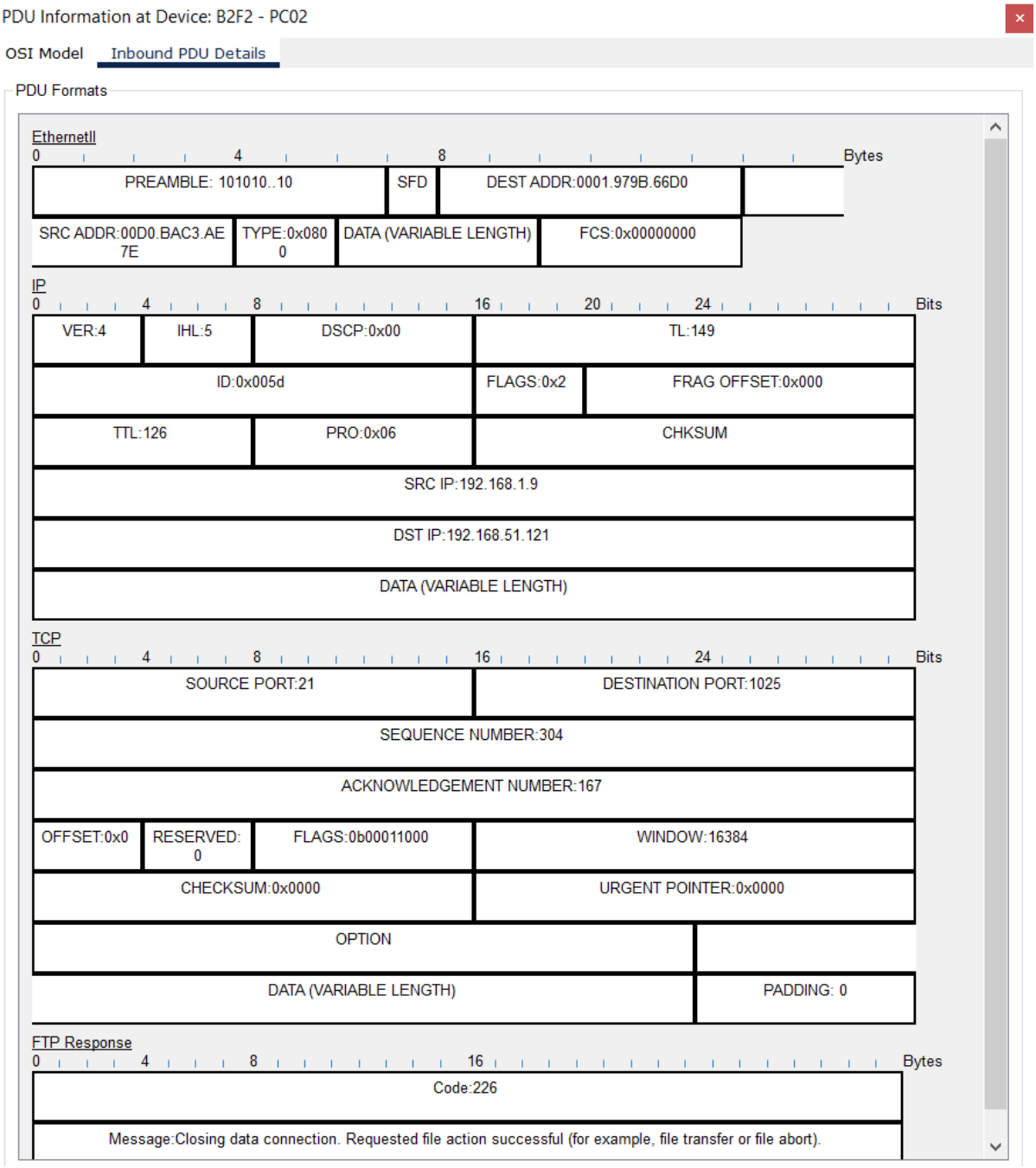
Network connection established between FTP server and PC02 user. The network path followed when sending files to the FTP server of the PC02 user is as follows.
B2F2-PC02,B2F2-Switch,Branch2-Router,B1-ServerRouter,Server Switch,FTP_1,Server Switch,B1-ServerRouter,Branch2-Router,B2F2-Switch,B2F2-PC02
This network path was repeated more than once until the process was finished.



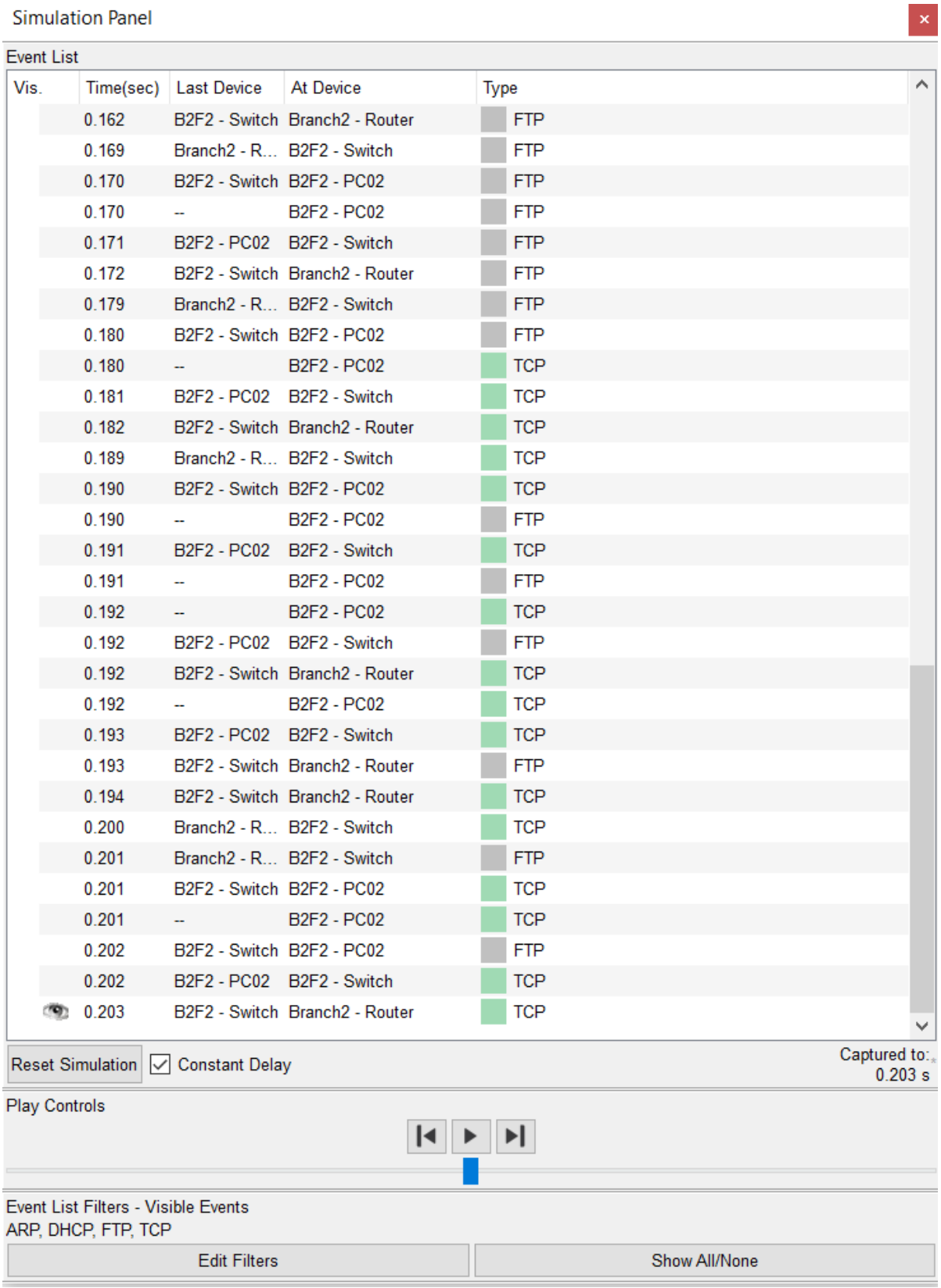
Result of Scenario 2



OSI Model of Scenario 2



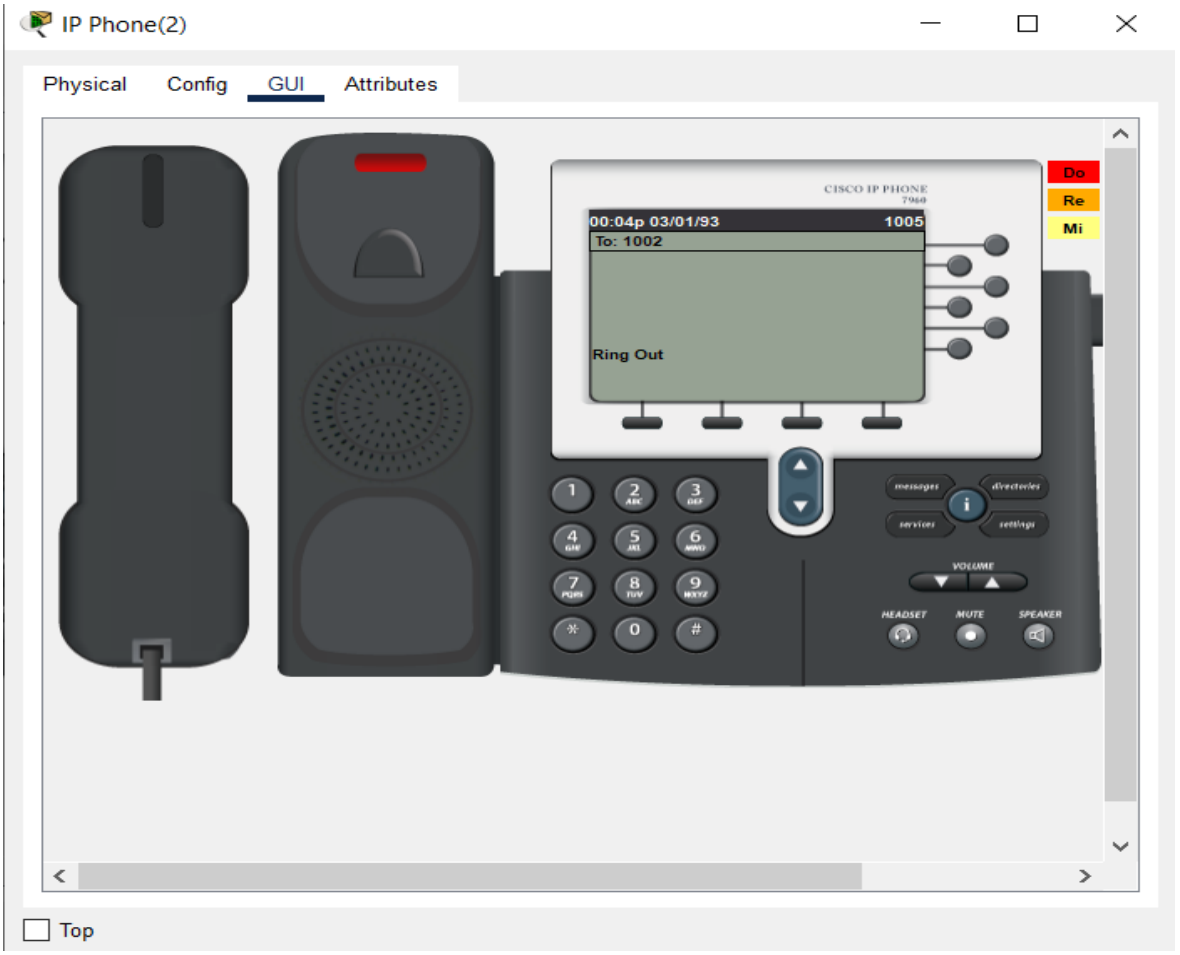
PDU Output of Scenario 2



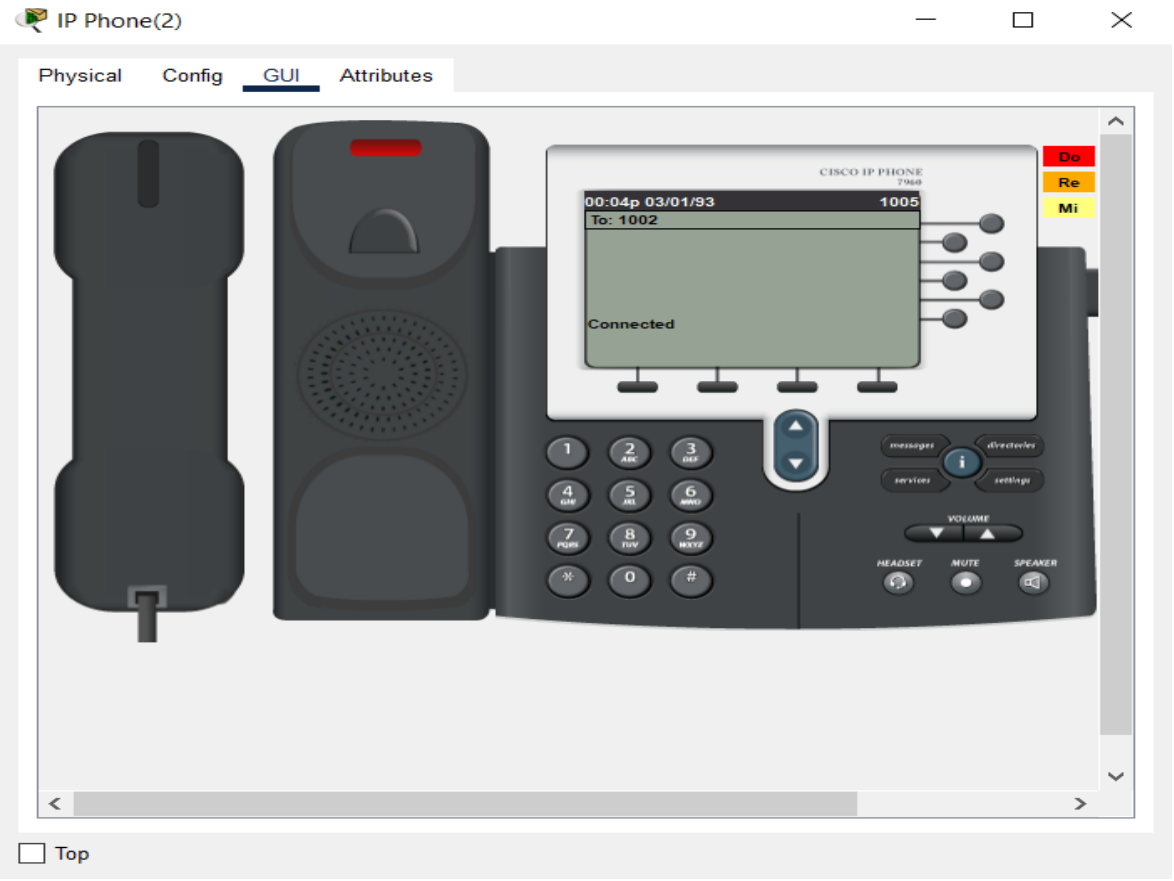
Event List of Scenario 2

Scenario 3 : Two users from second facility of first branch want to talk via VoIP.

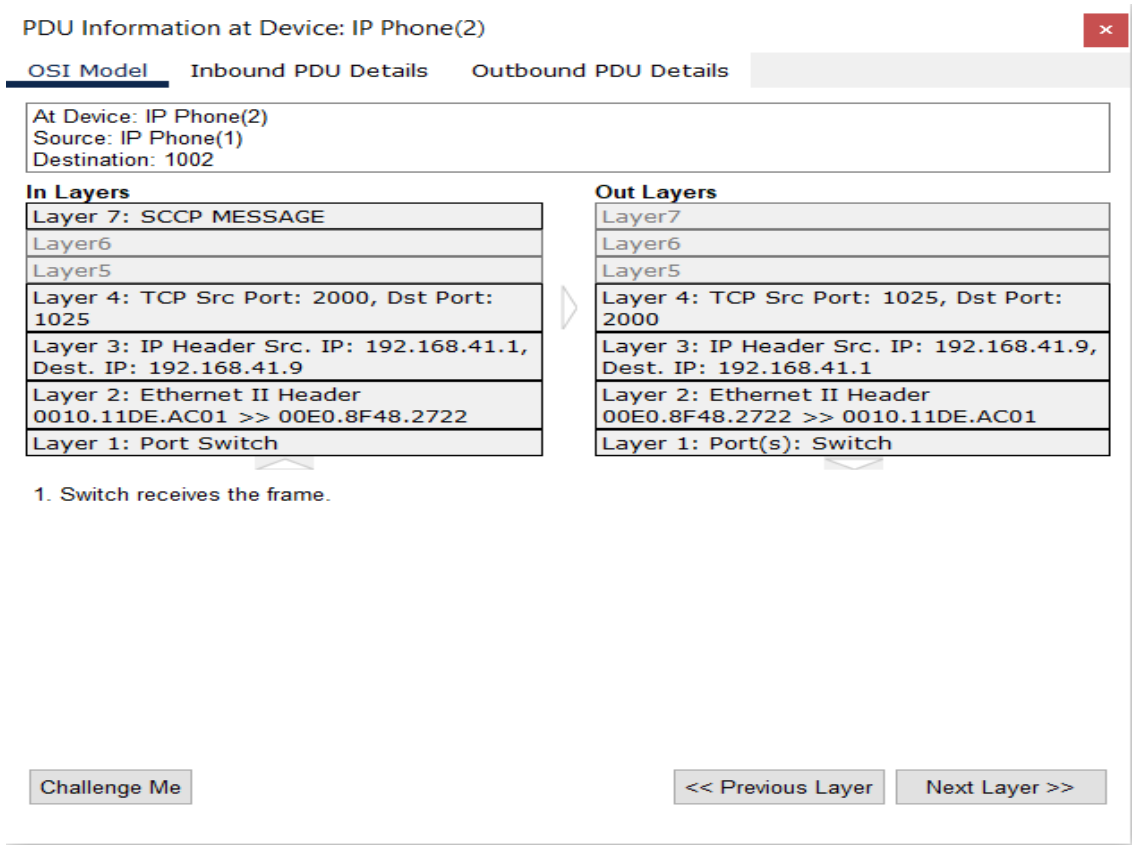
VoIP conference was held between IP Phone(2) user and IP Phone(1) user. The network path followed for this scenario is as follows. B1F2-Switch, Branch1-Router, B1F2-Switch, IP Phone(2), B1F2-Switch, Branch1-Router, B1F2-Switch, IP Phone(1), IP Phone(2), B1F2-Switch(twice for IP Phones), Branch1-Router, IP Phone(2), IP Phone(1)



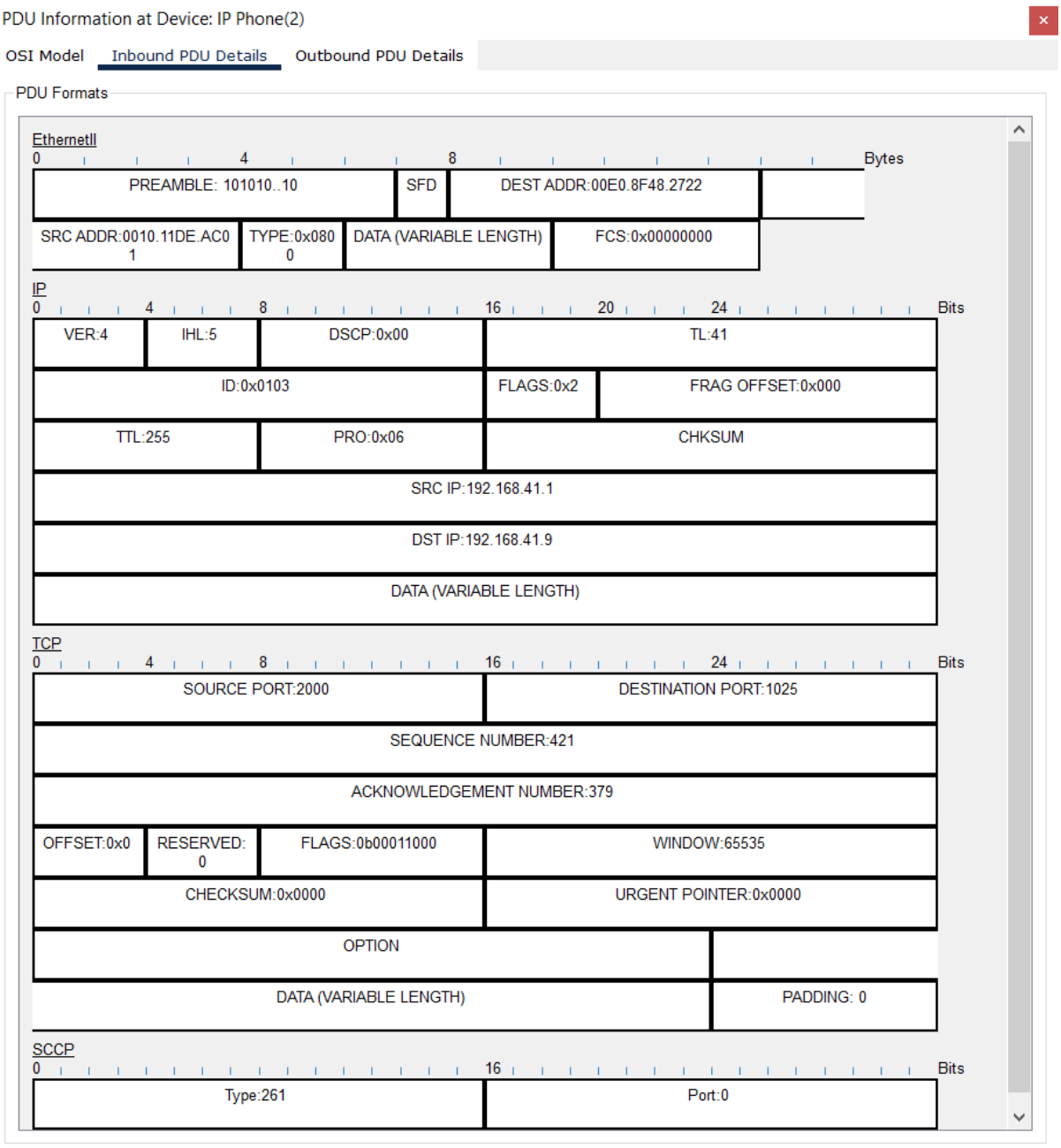
Result of Scenario 3



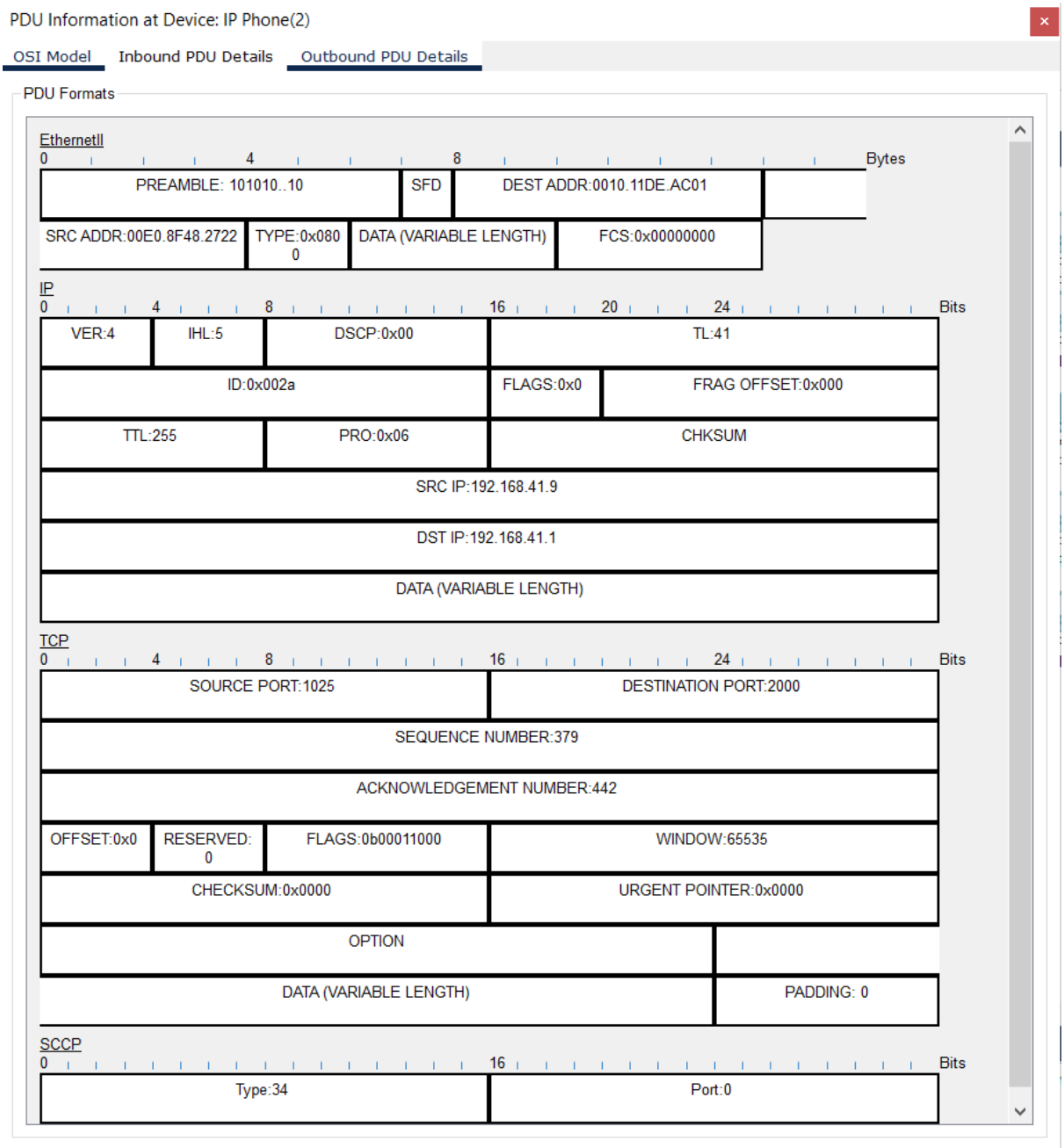
Result of Scenario 3



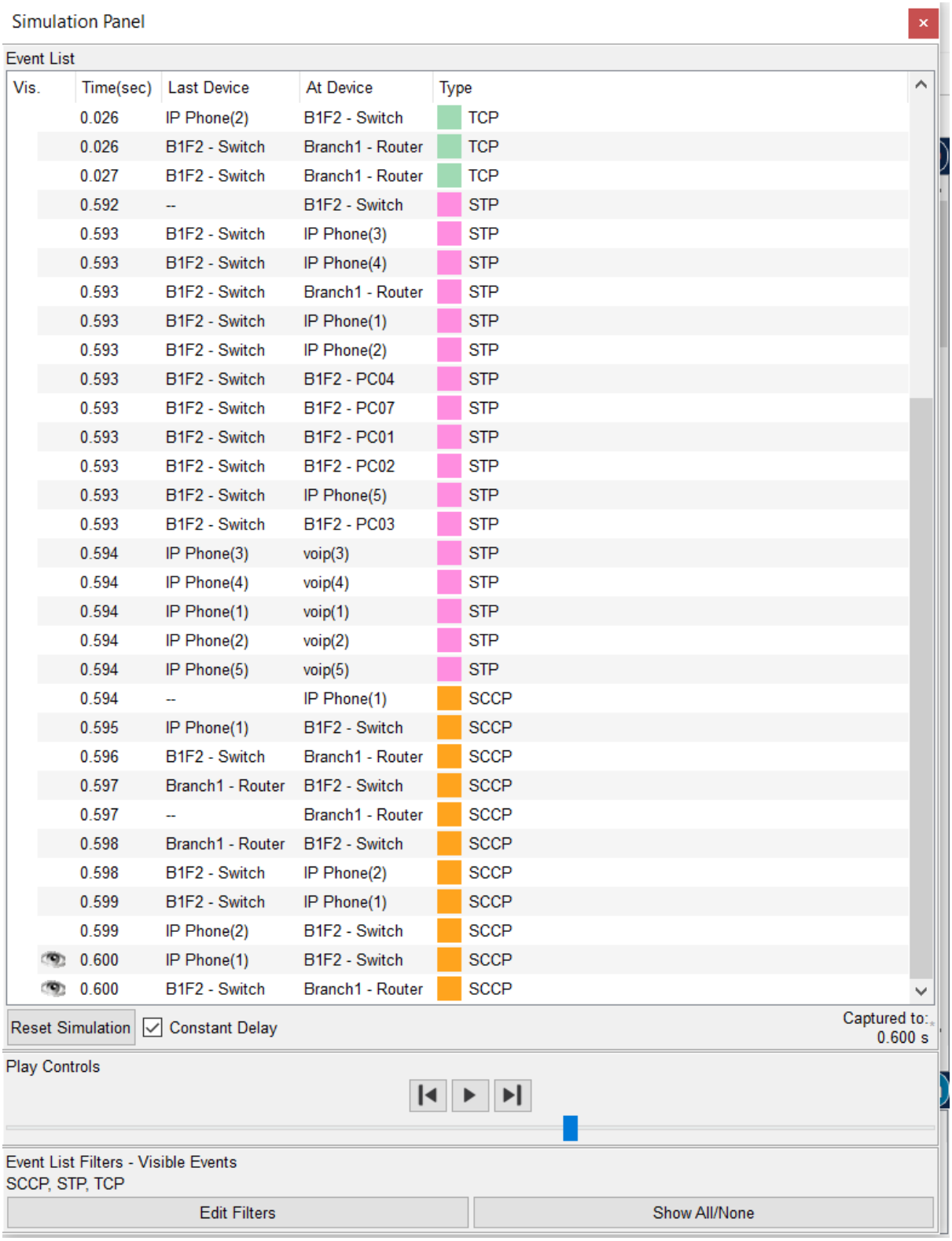
OSI Model of Scenario 3



PDU Output of Scenario 3



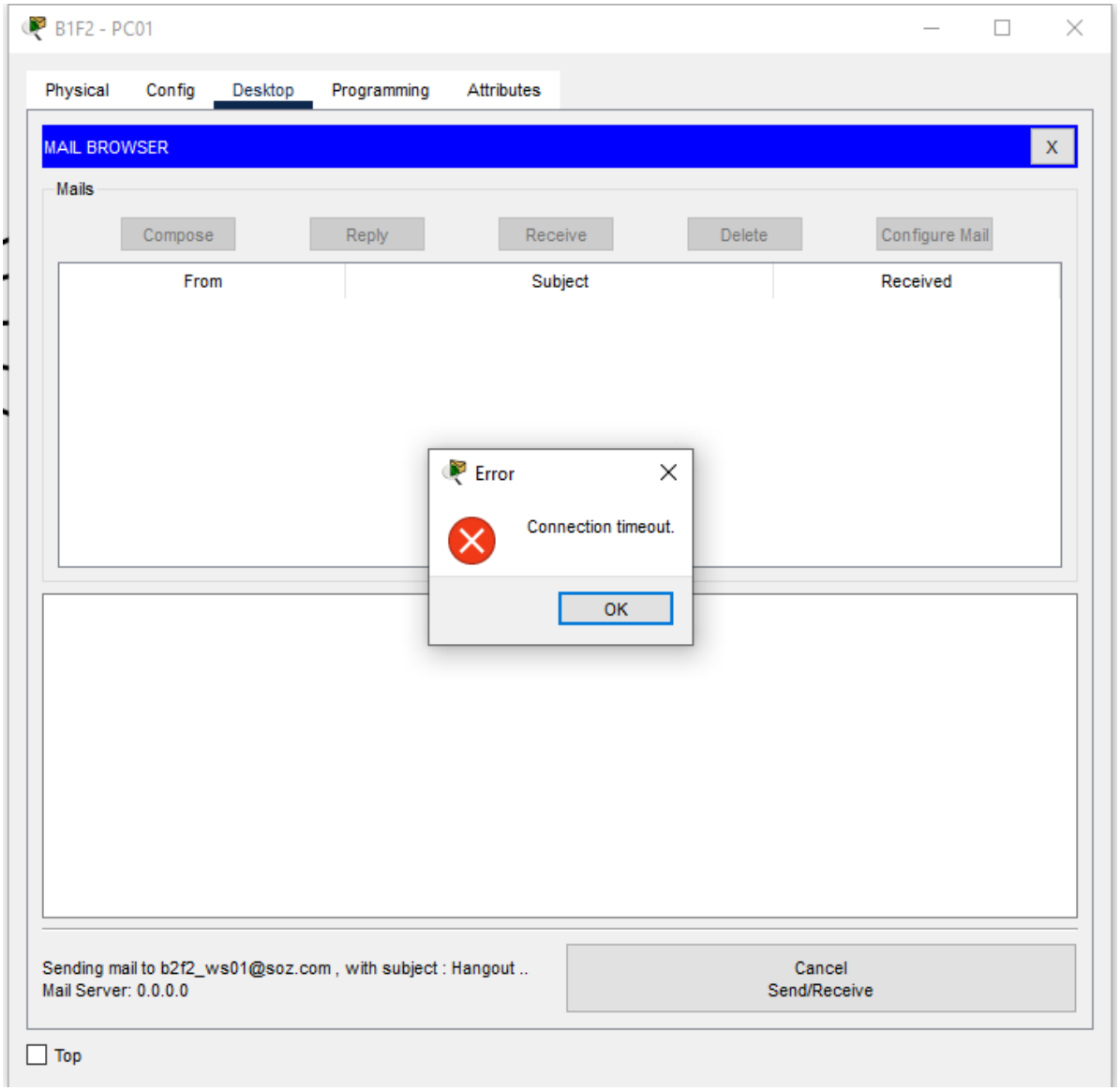
PDU Output of Scenario 3



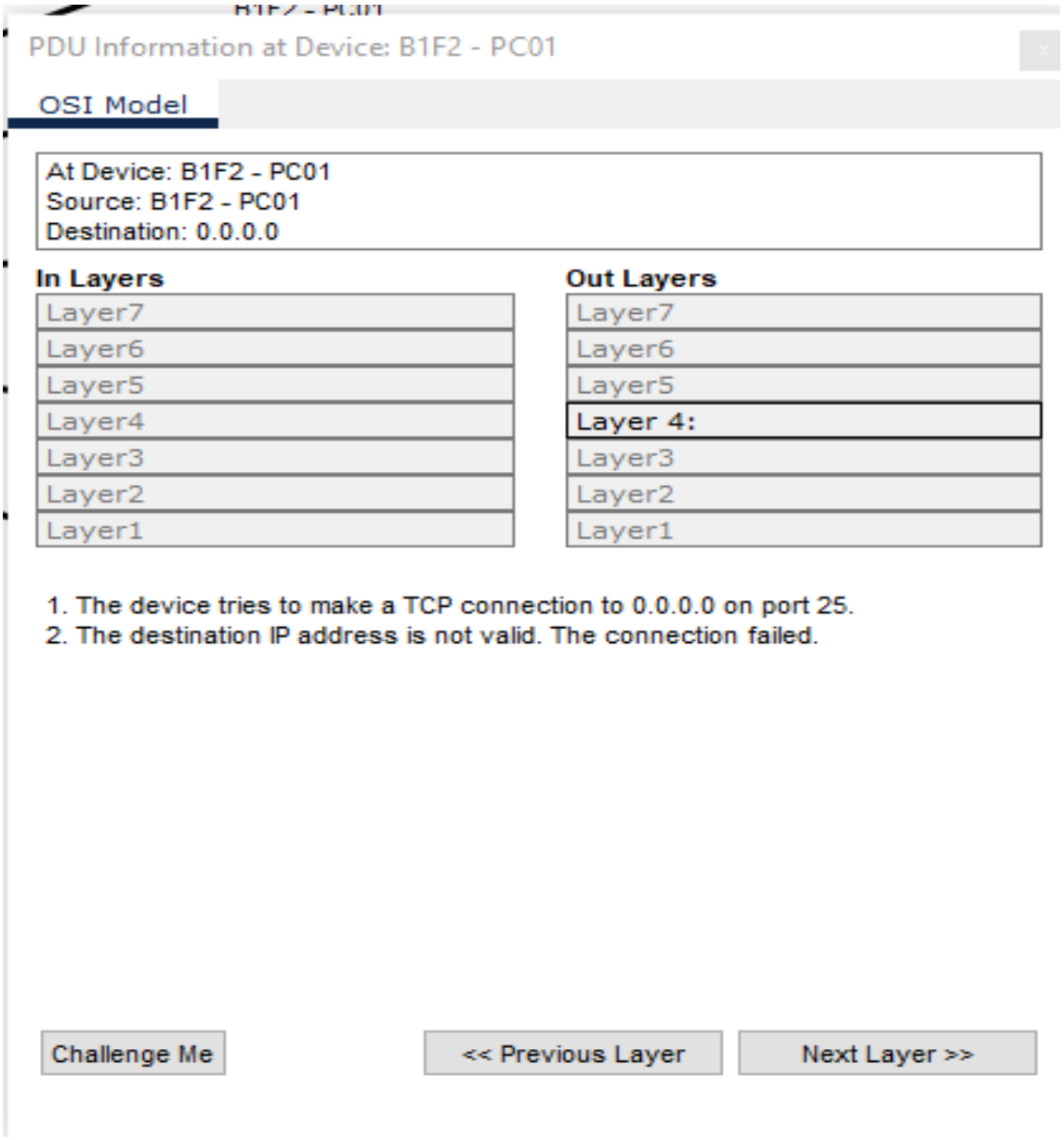
Event List of Scenario 3

Scenario 4: A user in the second facility of first branch wants to send an email message to his friend in the second facility of second branch.

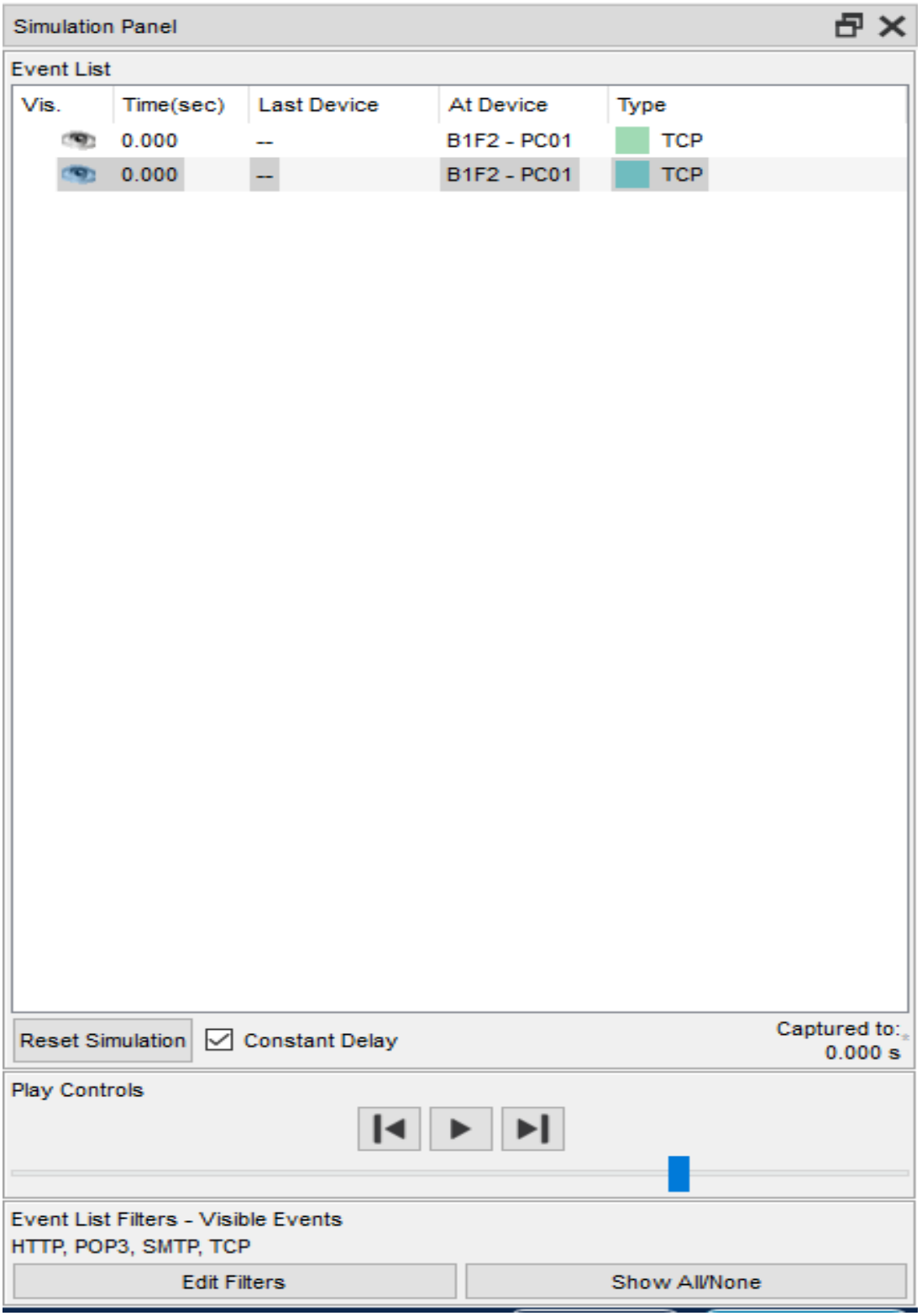
Users in the second facility of first branch and second facility of second branch are not authorized to send or receive mail. So the workstation user in the second facility of first branch could not send an email to the workstation user in the second facility of the second branch.



Result of Scenario 4



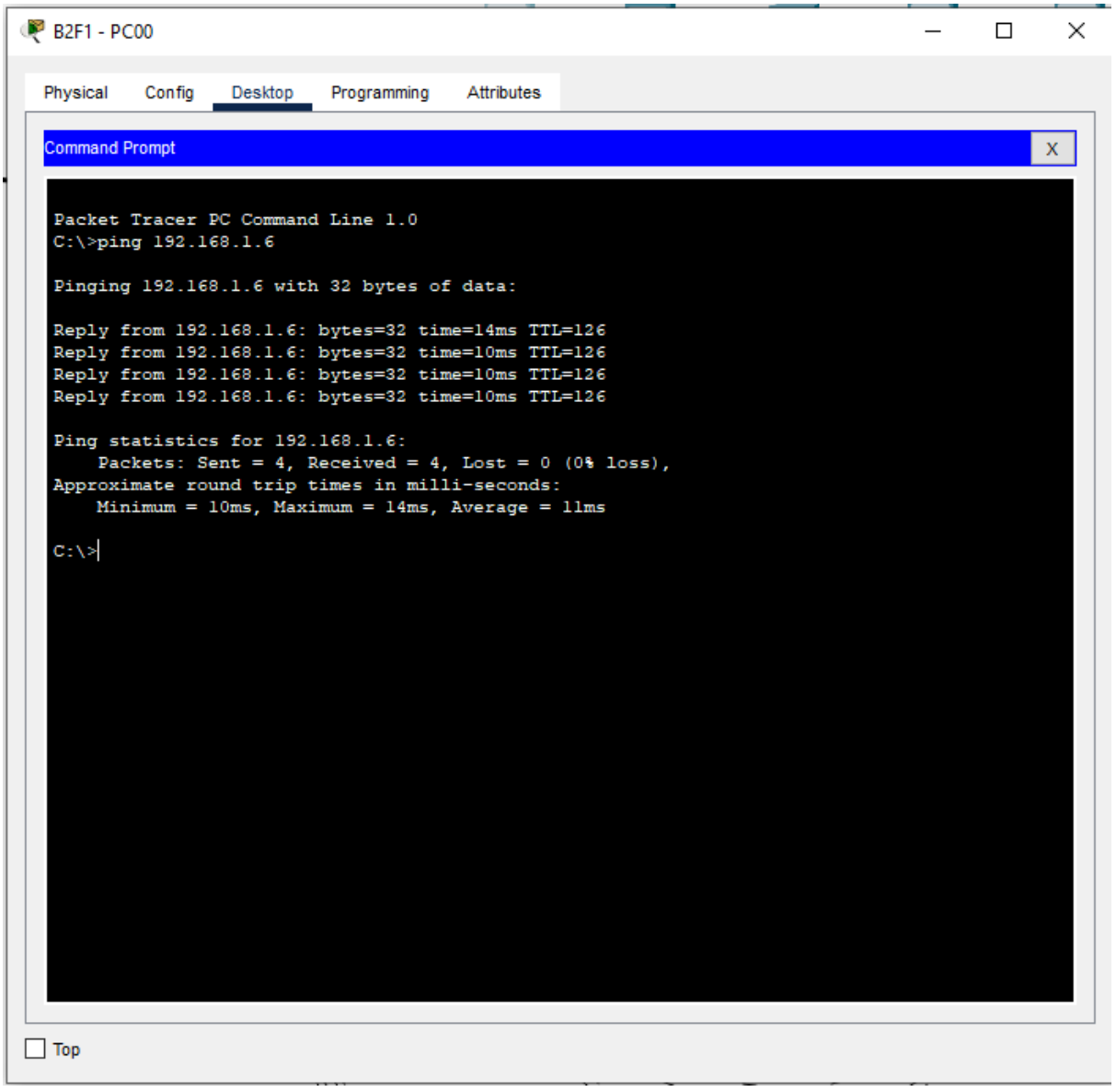
OSI Model of Scenario 4



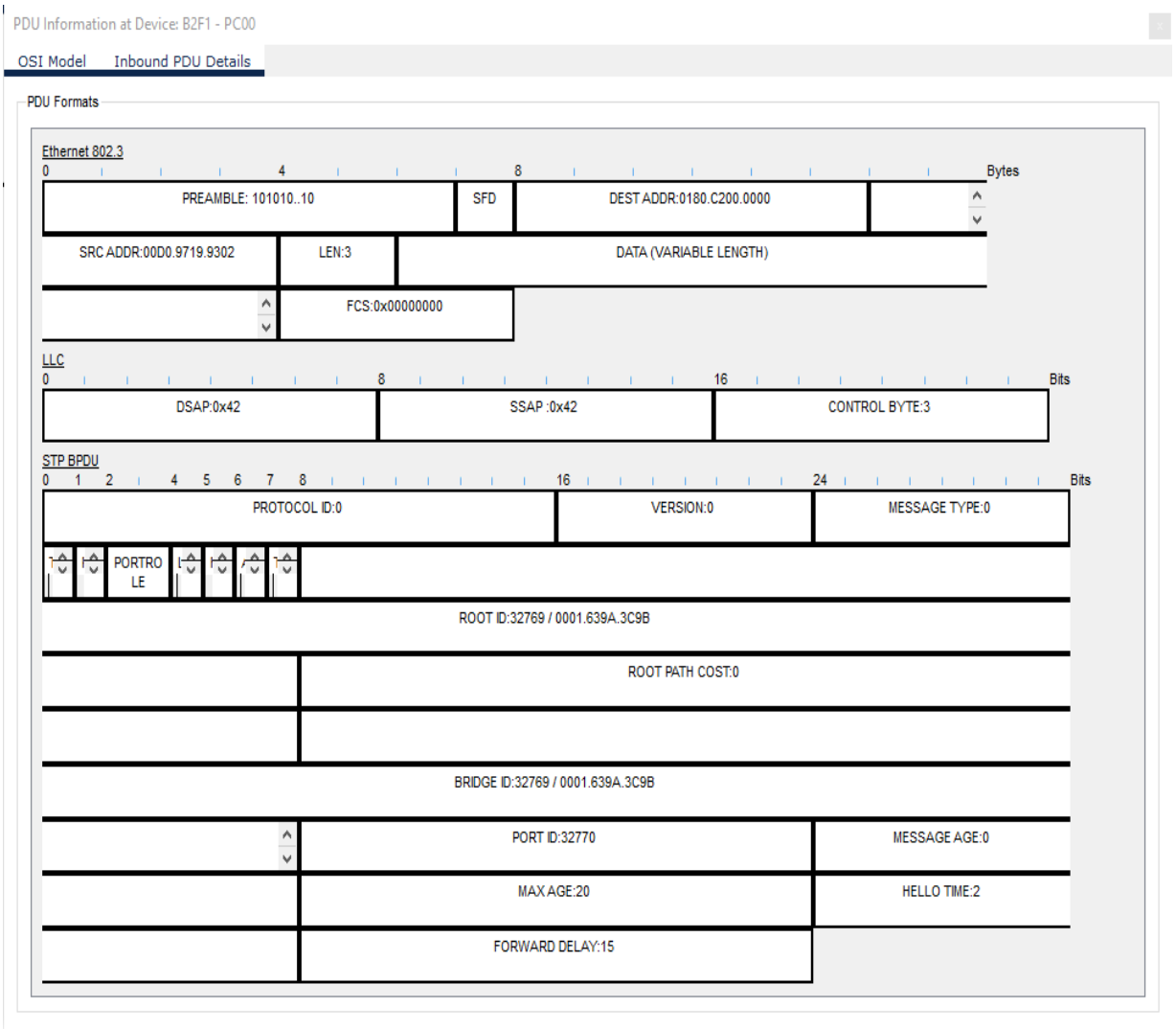
Event List of Scenario 4

Scenario 5: A user from first facility of second branch pings Web server of second facility of first branch.

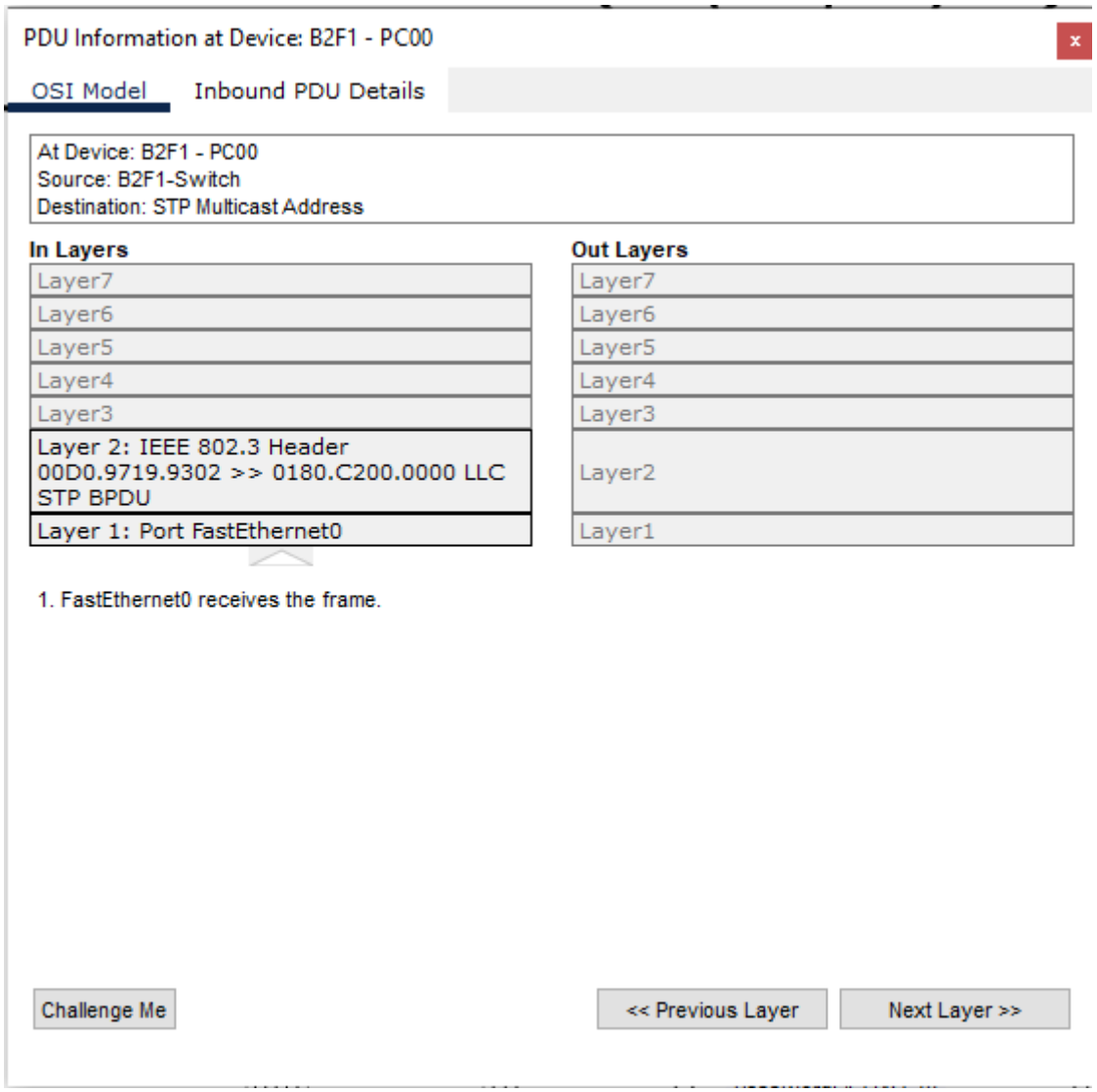
A ping has been performed between the web server and the PC00 user. The network path followed for this scenario is as follows.
B2F1-PC00, B2F1-Wireless Router, B2F1-Switch, Branch2-Router, B1-ServerRouter, Server Switch, WEB_1



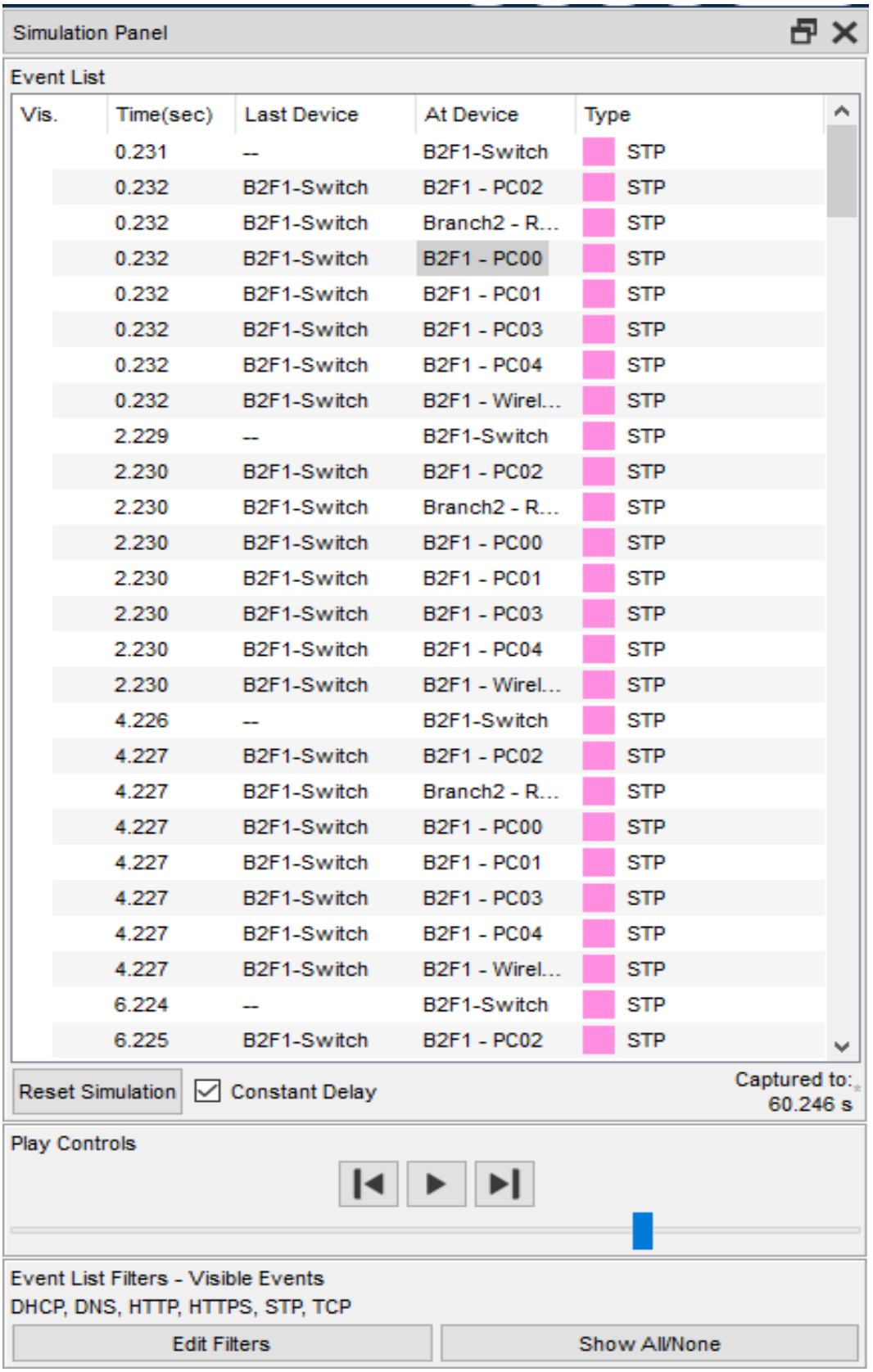
Result of Scenario 5



PDU Output of Scenario 5



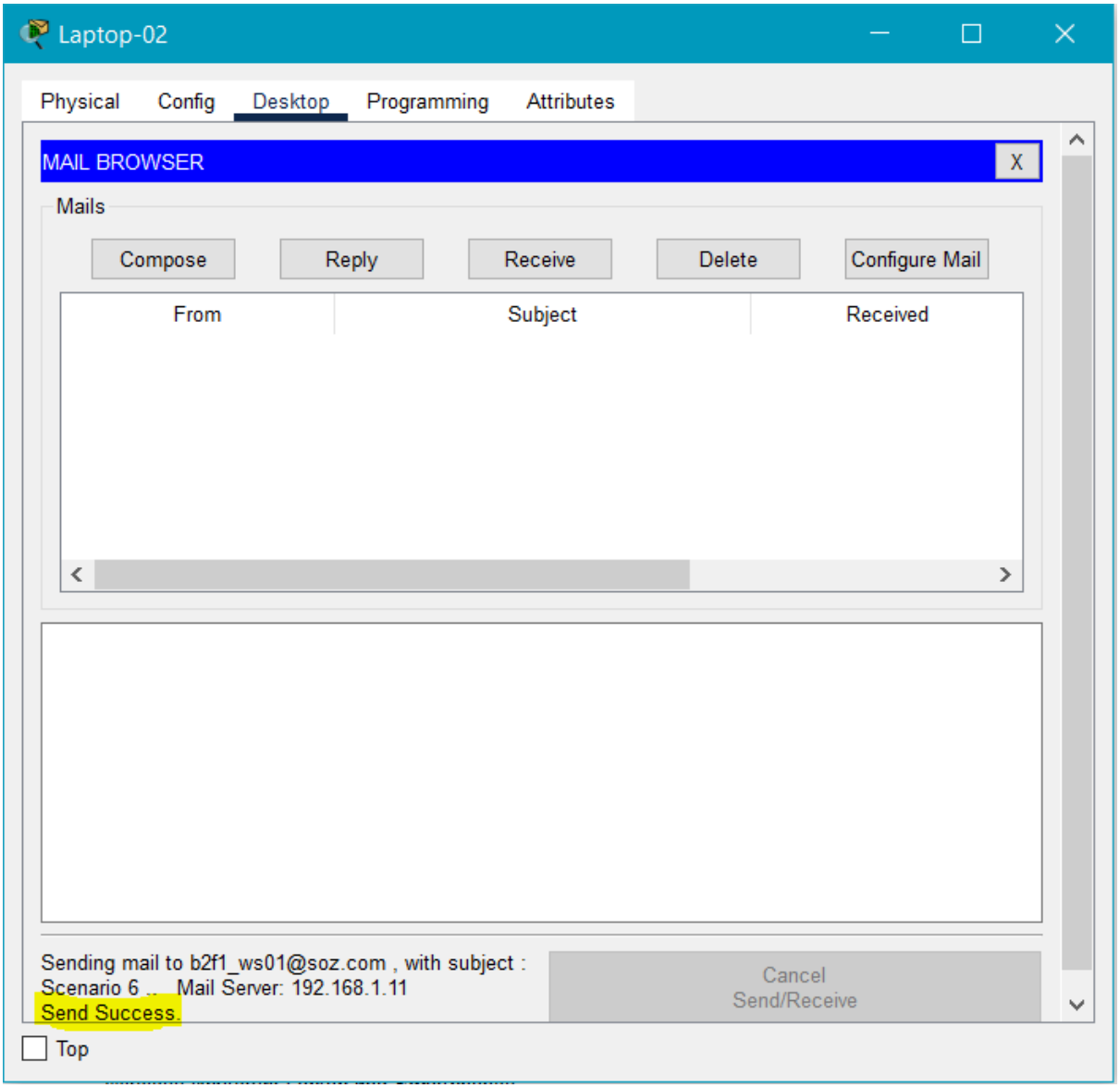
OSI Model for Scenario 5



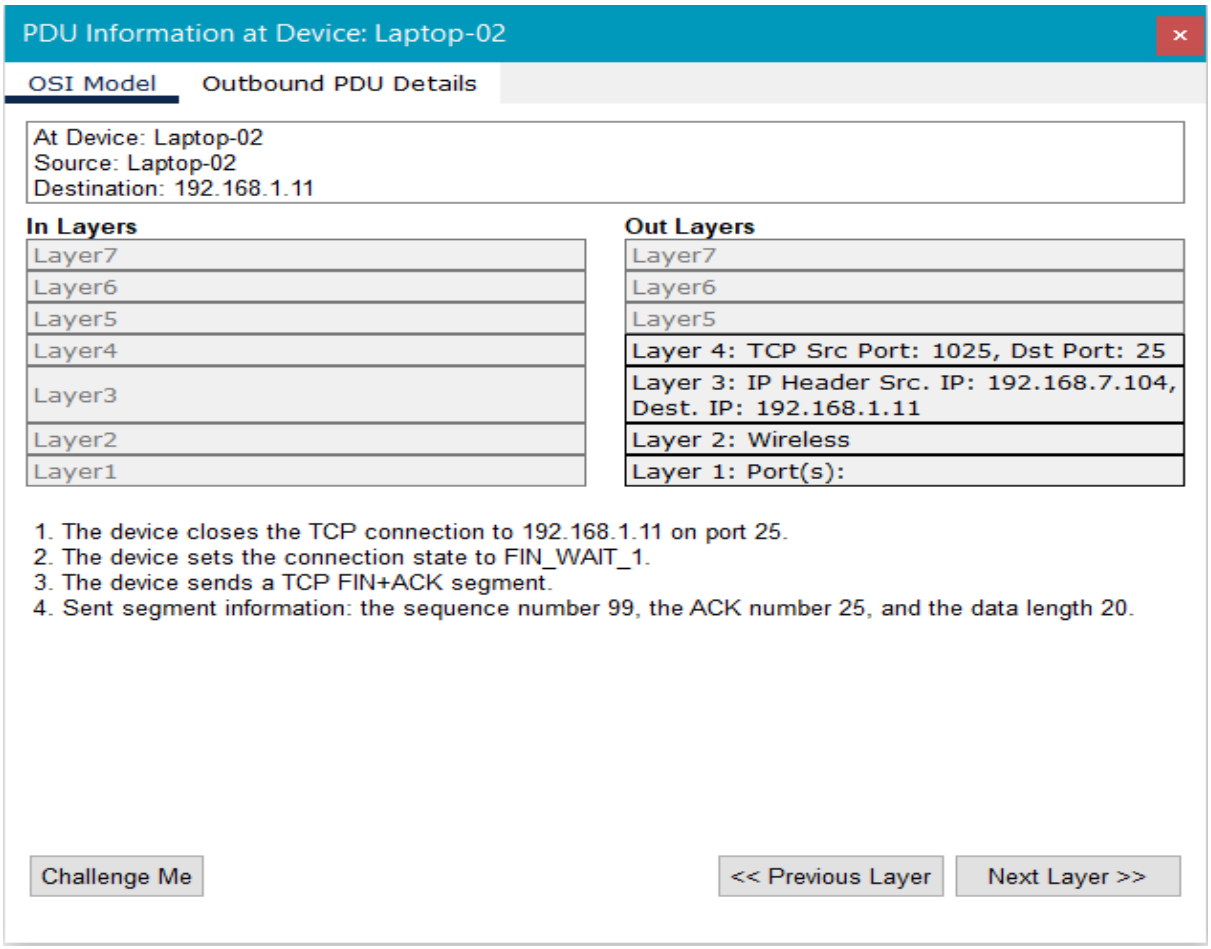
Event List of Scenario 5

Scenario 6 : A laptop user from first facility of first branch office wants to send email to her friend in the first facility of second branch office.

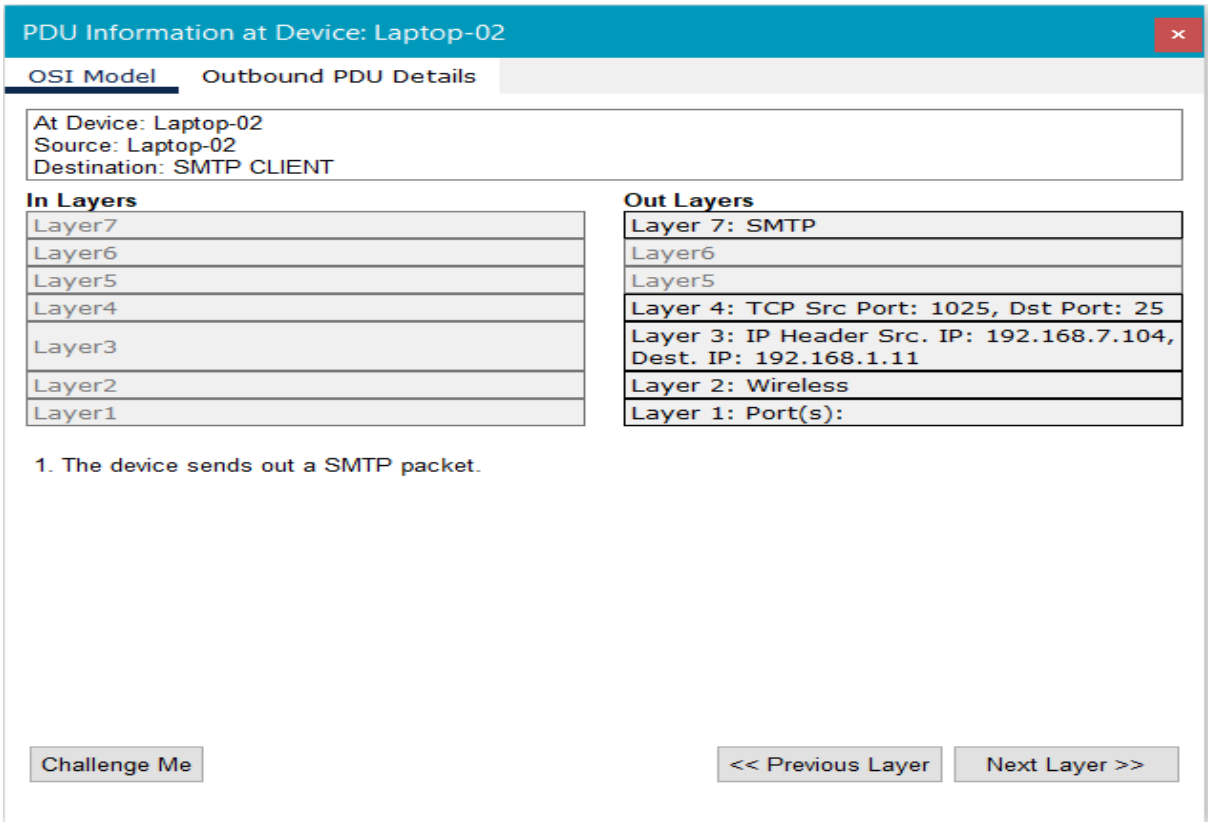
The user named "Laptop-02" in the first facility of the first branch, the user in the first facility of the second branch when sending an e-mail to the "b2f1_ws01" workstation user, Wireless Router for Laptop and Smartphones, B1F1-Switch in Workstations cluster, B1-ServerRouter to which servers are connected after Branch1-Router, B1F3(SERVERS) cluster our mail sent to the Server Switch inside, ıt comes to the mail server . The user to be sent in the server user name and domain name are determined. After Mail Server, Server Switch, B1-ServerRouter, common router of facilities in the second branch the mail reaching the Branch2-Router, using the ip address of the user to be sent, within the cluster of the first facility of the second branch, after the B2F1-Switch found, it reaches the computer of the user named "b2f1-ws01", that is, B2F1-PC01. While all these processes are taking place, DHCP, DTP, STP, TCP and SMTP protocols related to sending mail are involved.



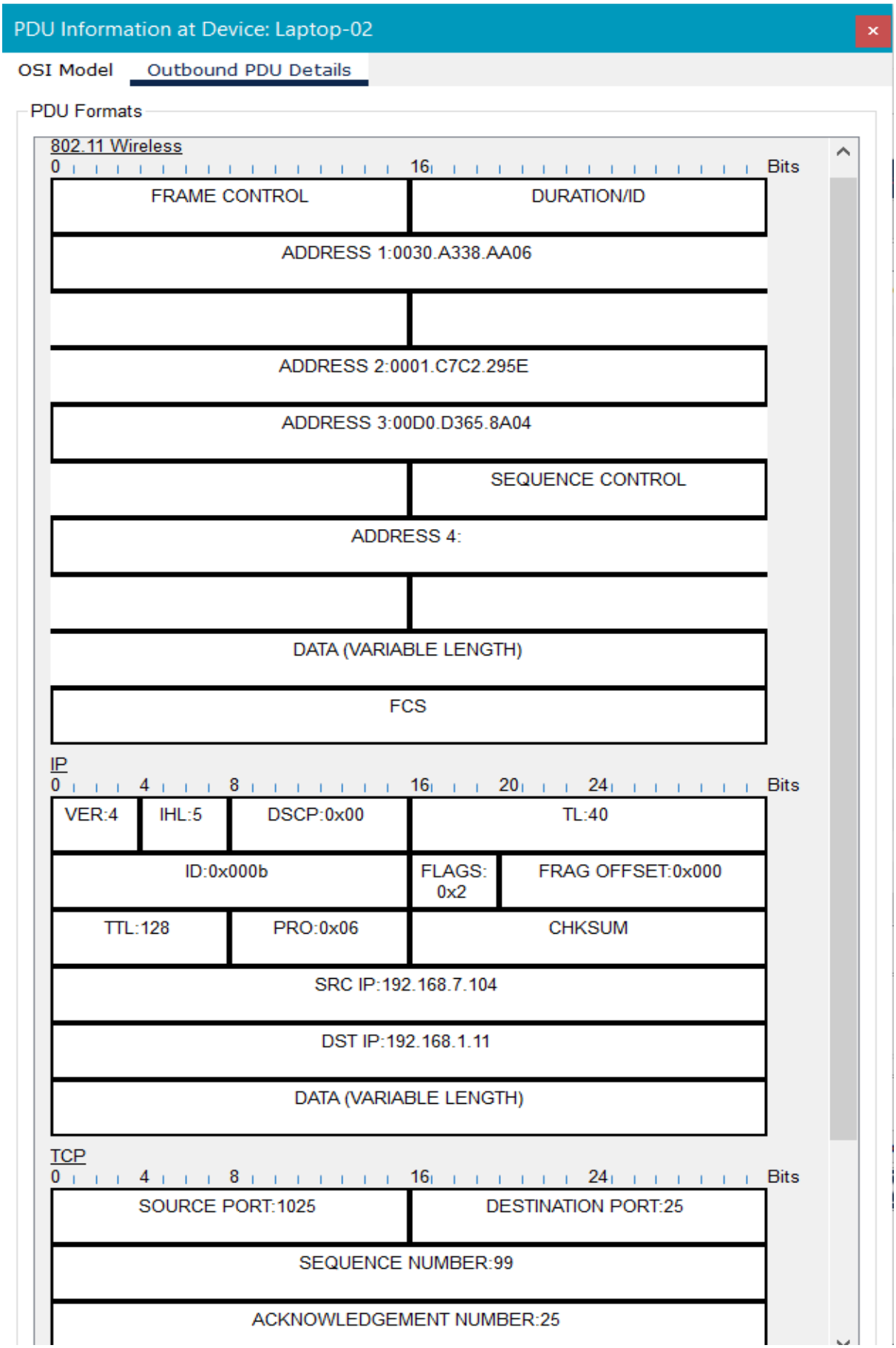
Result of Scenario 6



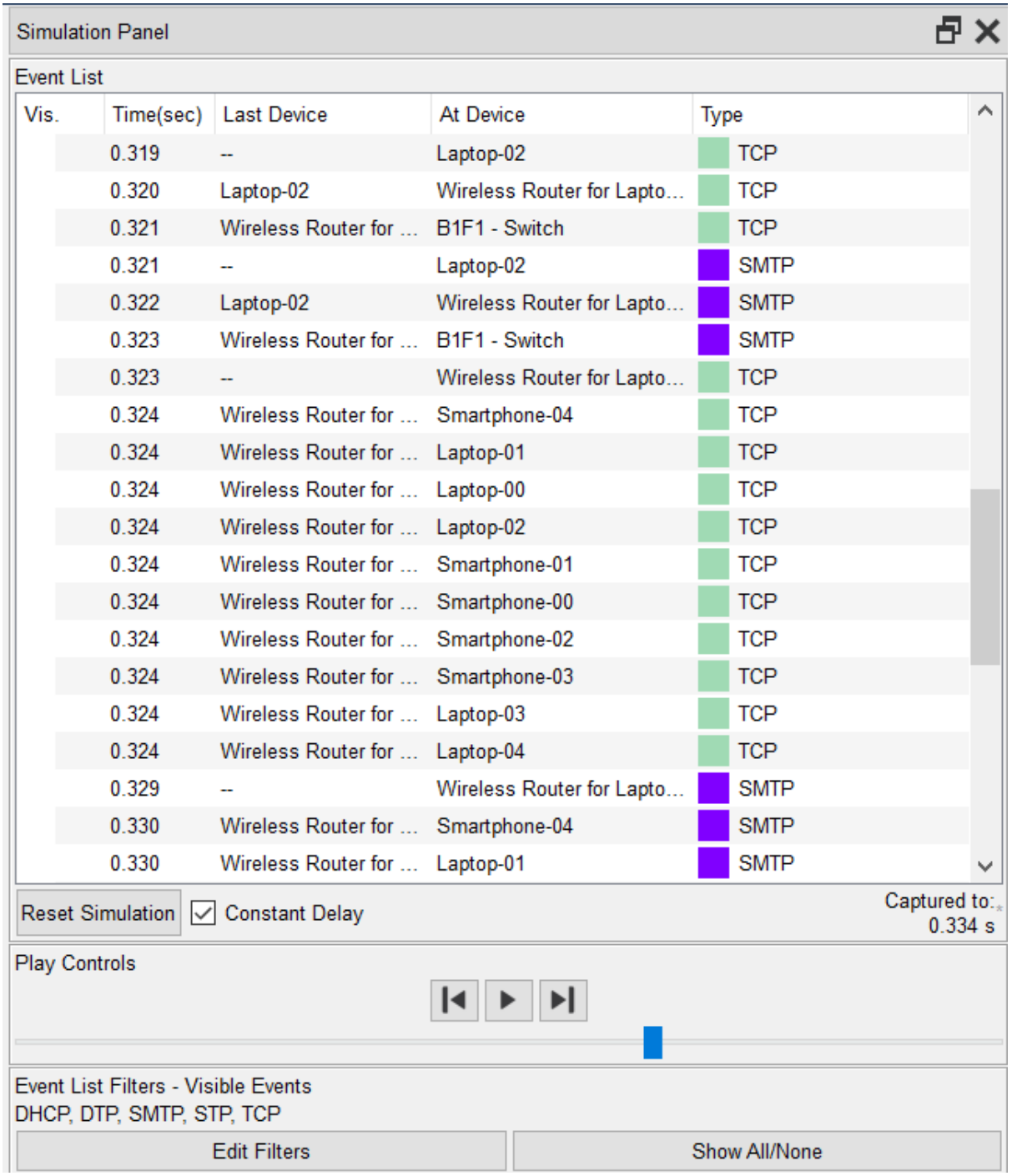
OSI Model of Scenario 6 (TCP)



OSI Model of Scenario 6 (SMTP)

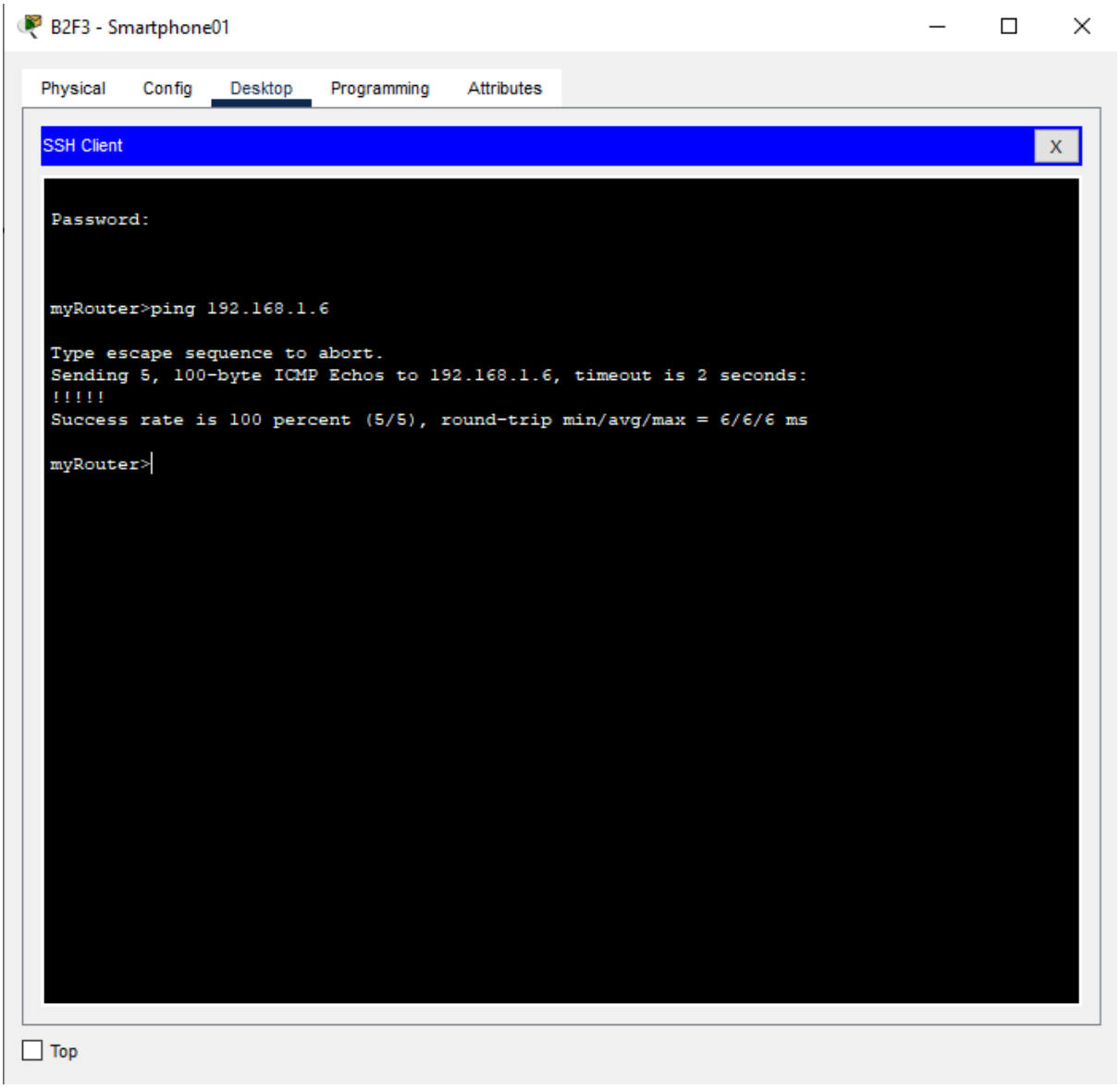


PDU Output of Scenario 6

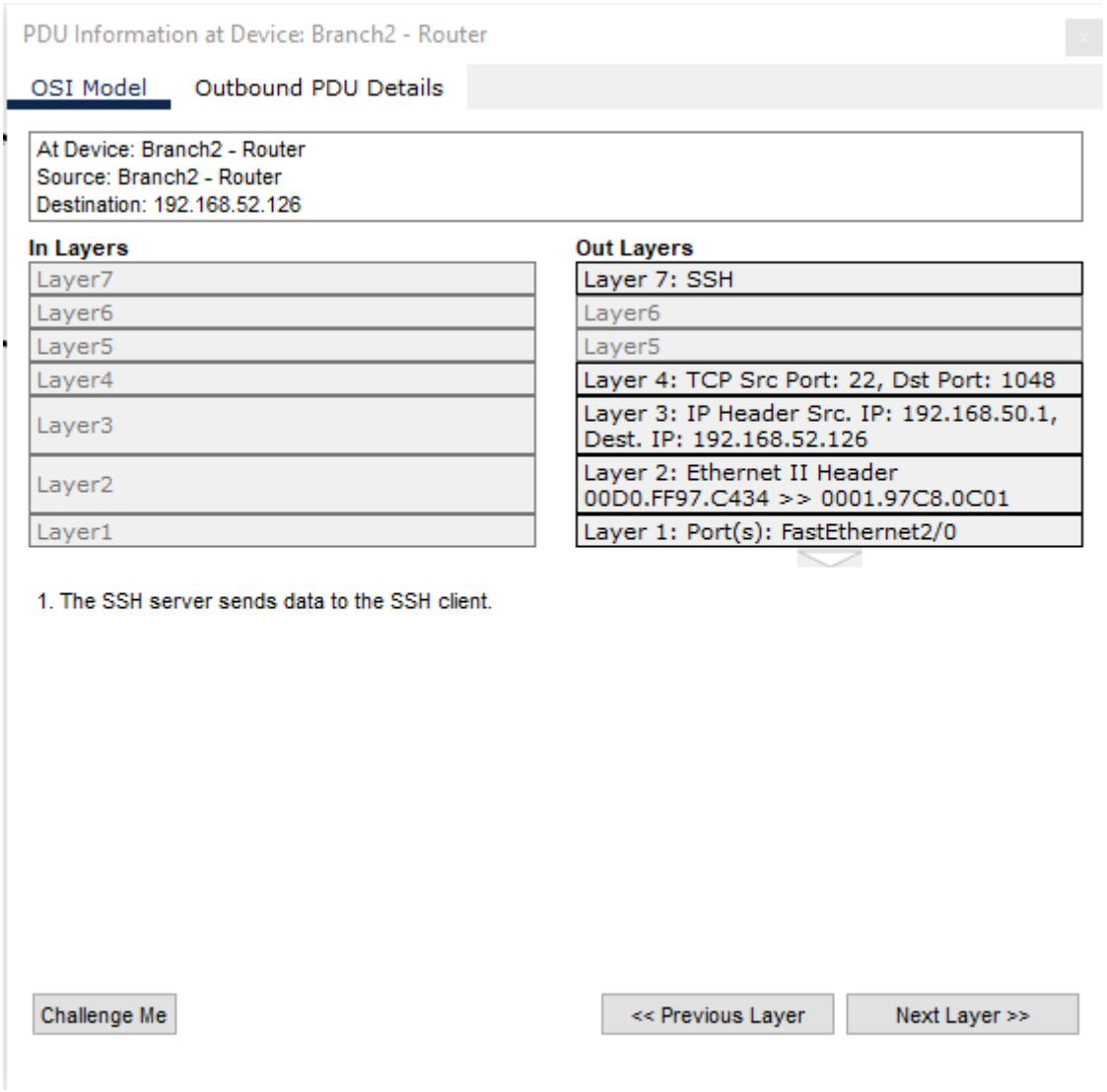


Event List of Scenario 6

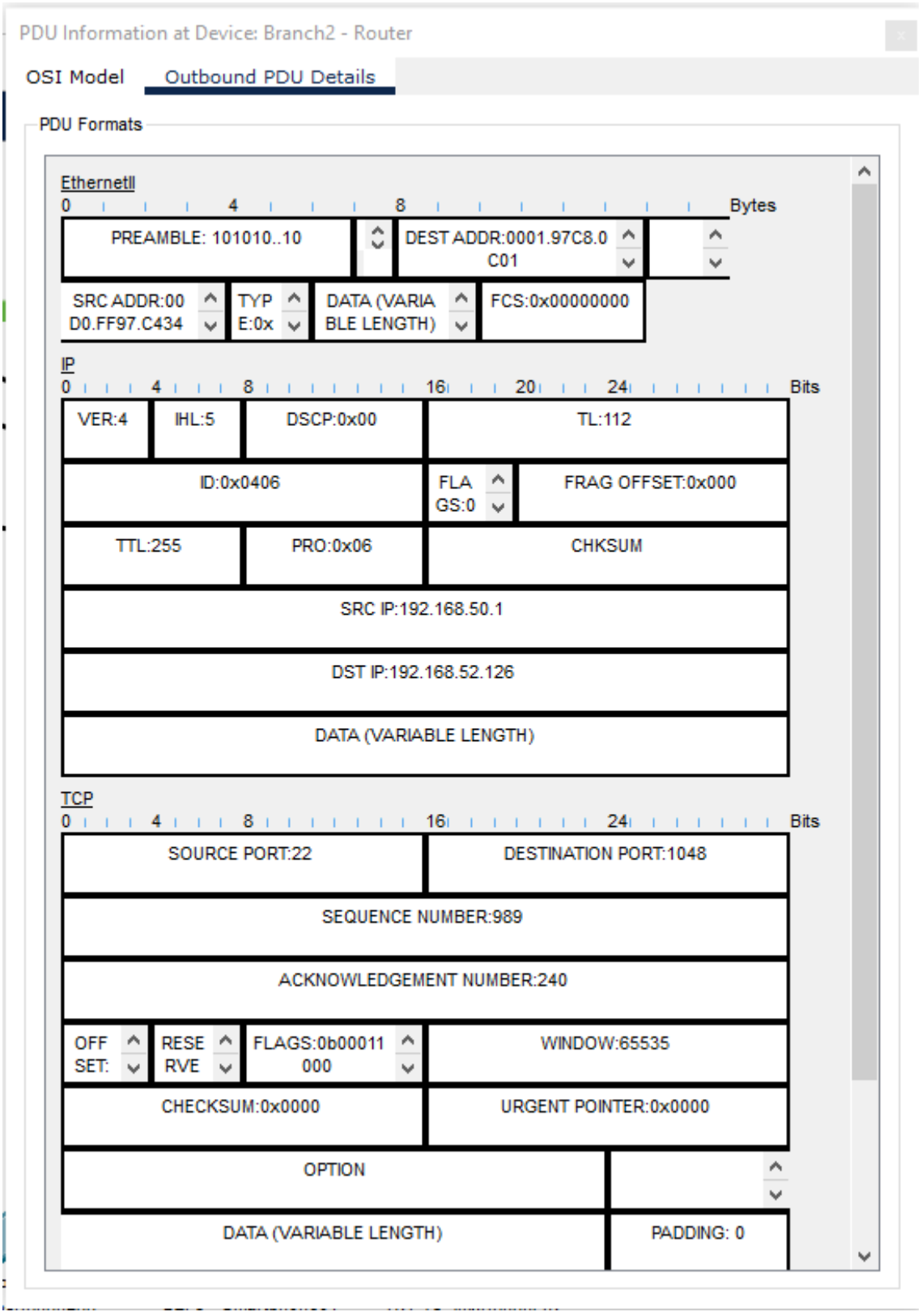
Scenario 7 : A smartphone user from third facility of second branch office wants to use ssh to connect to a Web server in the third facility of first branch office.



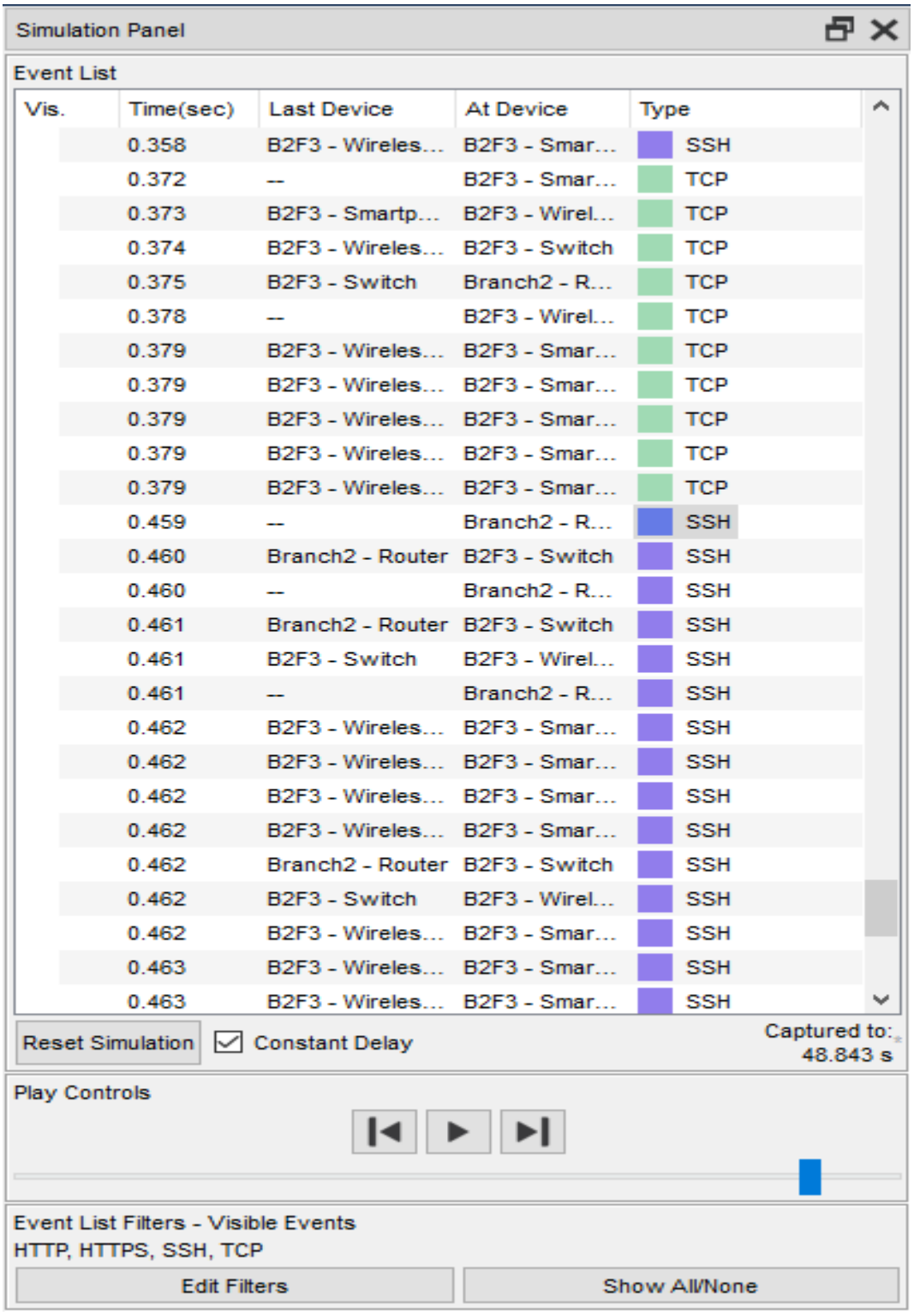
Result of Scenario 7



OSI Model of Scenario 7



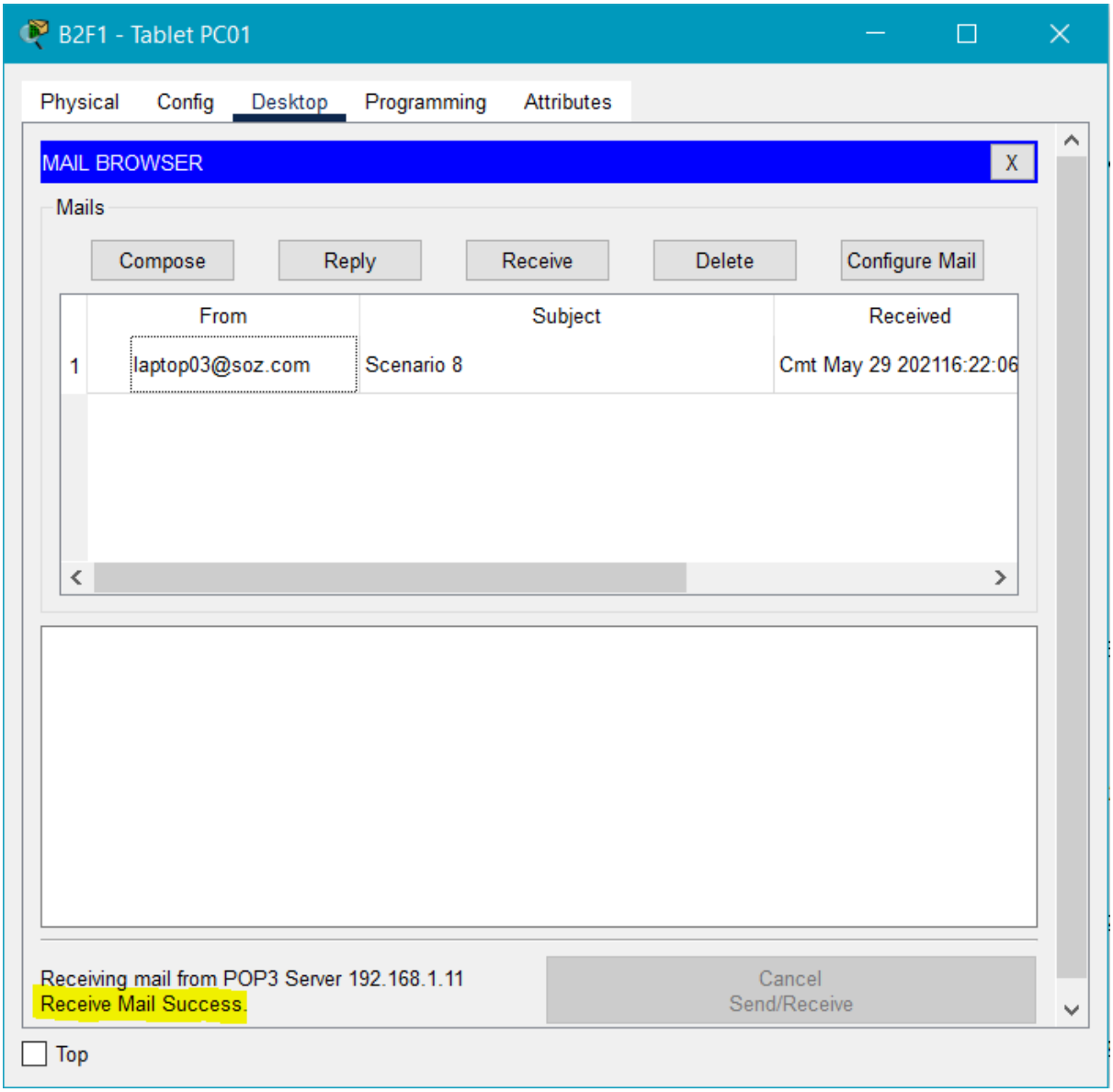
PDU Output of Scenario 7



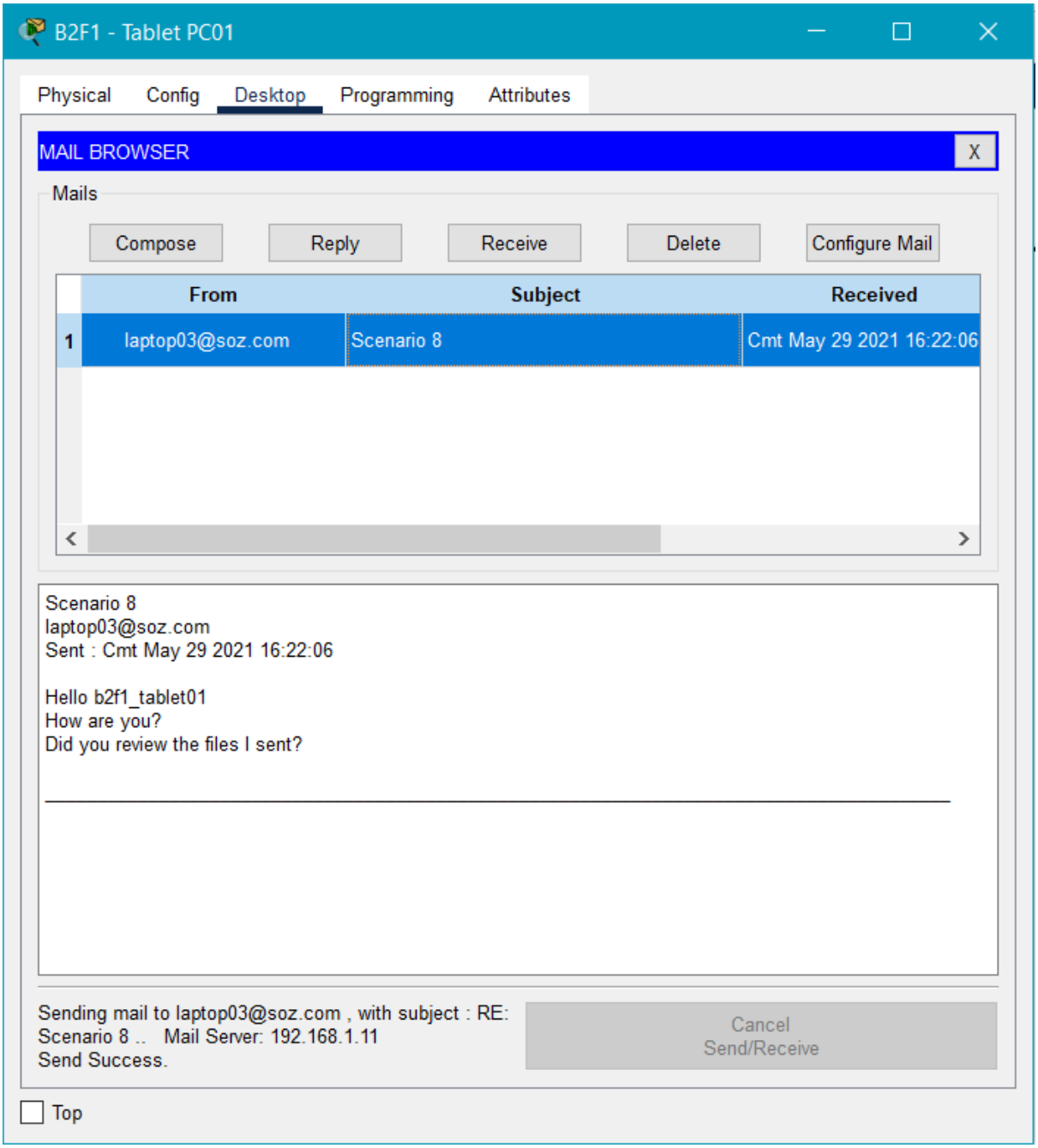
Event List of Scenario 7

Scenario 8: A tablet user from the first facility of the second branch wants to receive and reply to a message.

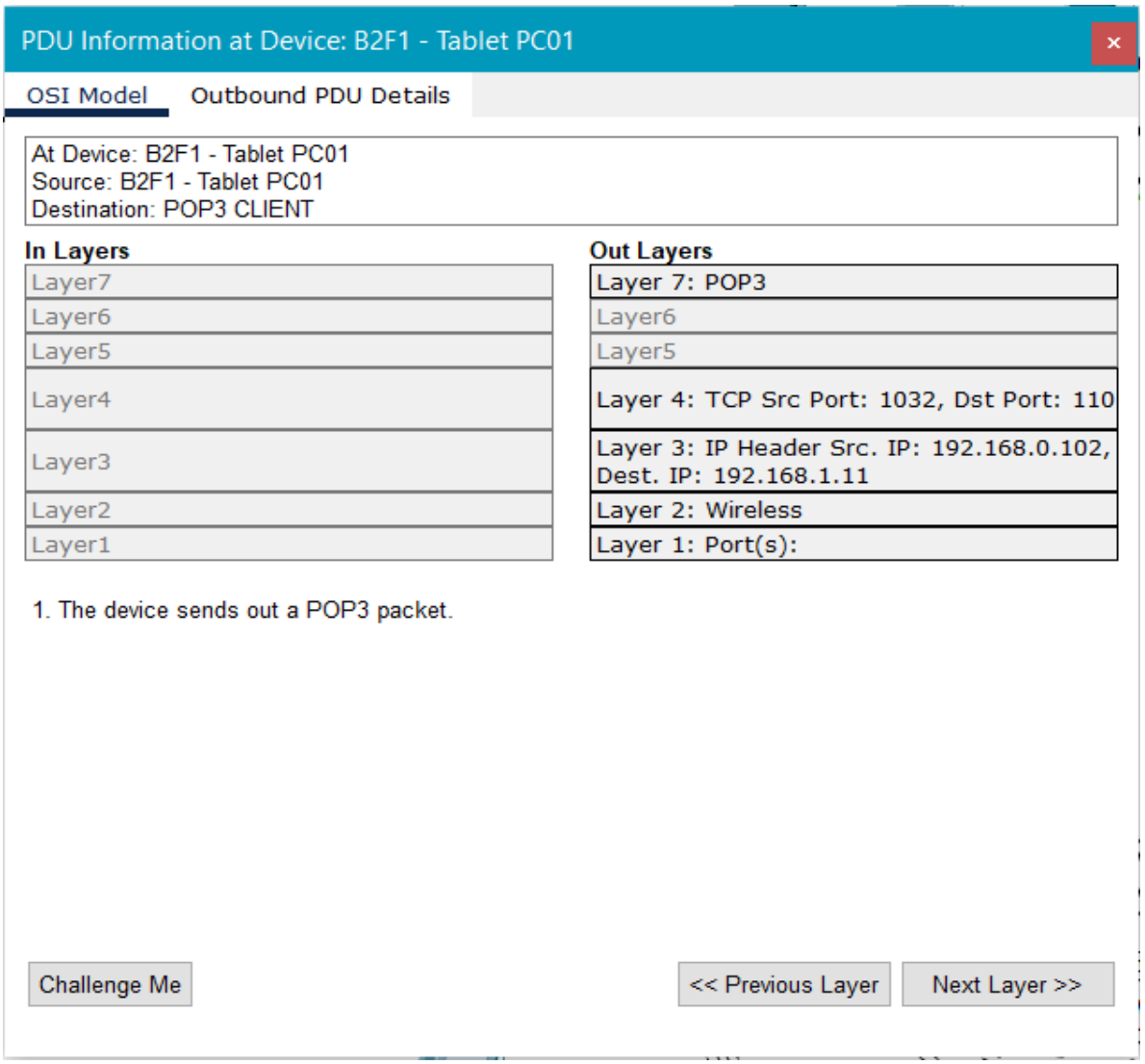
In the first facility of the second branch, the tablet user clicks reply to reply to the message sent to him after receiving it from the mailbox to reply to the e-mail he received, and the answer is B2F1 Wireless Router , B2F1-Switch, Branch2-Router to which B2F1 cluster is connected, reply mail to B1-ServerRouter where servers are located after the user name, domain name and ip address of the user to whom the reply is sent from the mail server to which it is connected Server Switch, B1F3 (SERVERS) cluster, B1-ServerRouter. After B1-ServerRouter, a reply is sent to the target user with username and ip address. DHCP, DNS, TCP, POP3 and SMTP protocols took part in these processes.



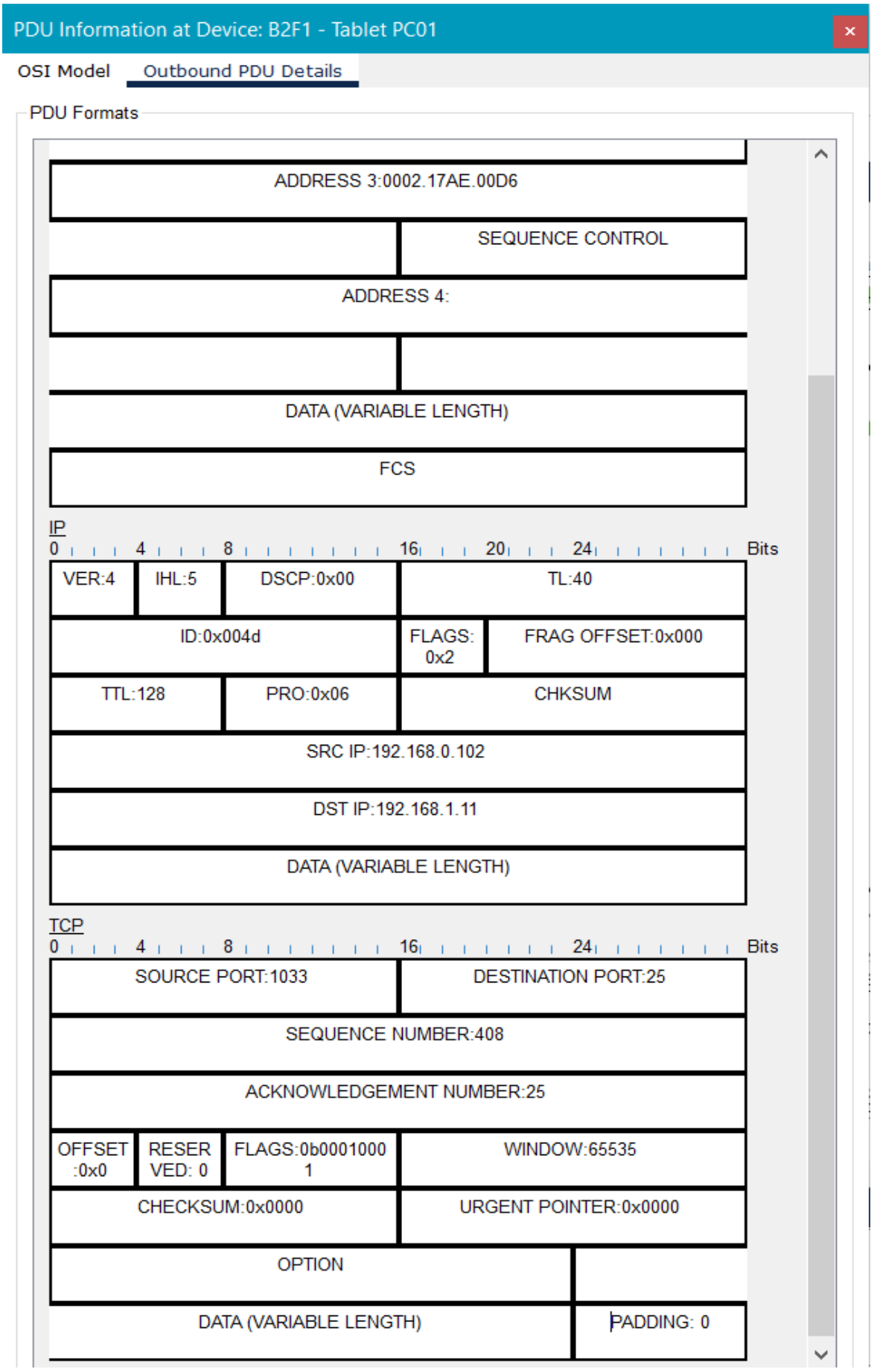
Result of Scenario 8



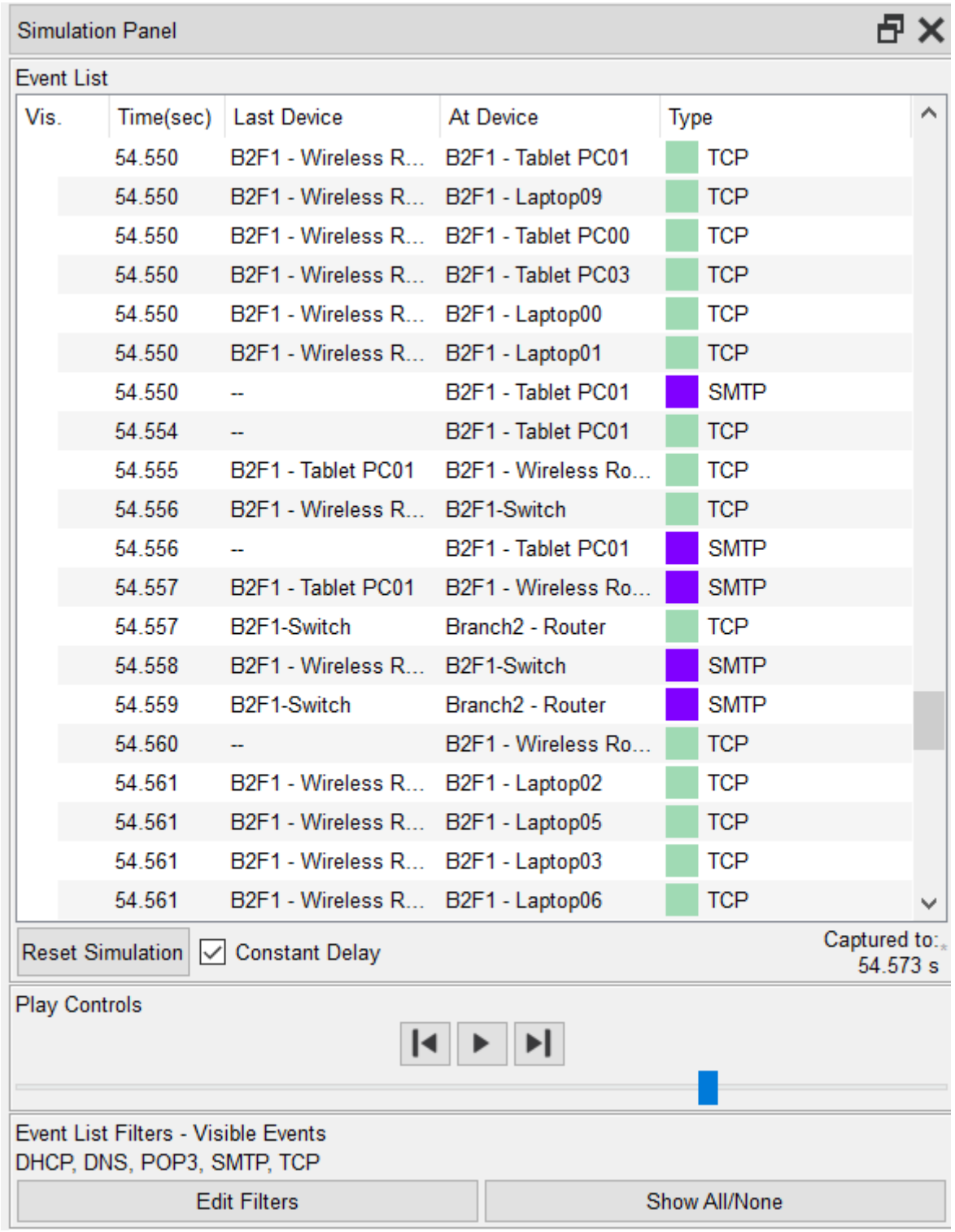
Result of Scenario 8



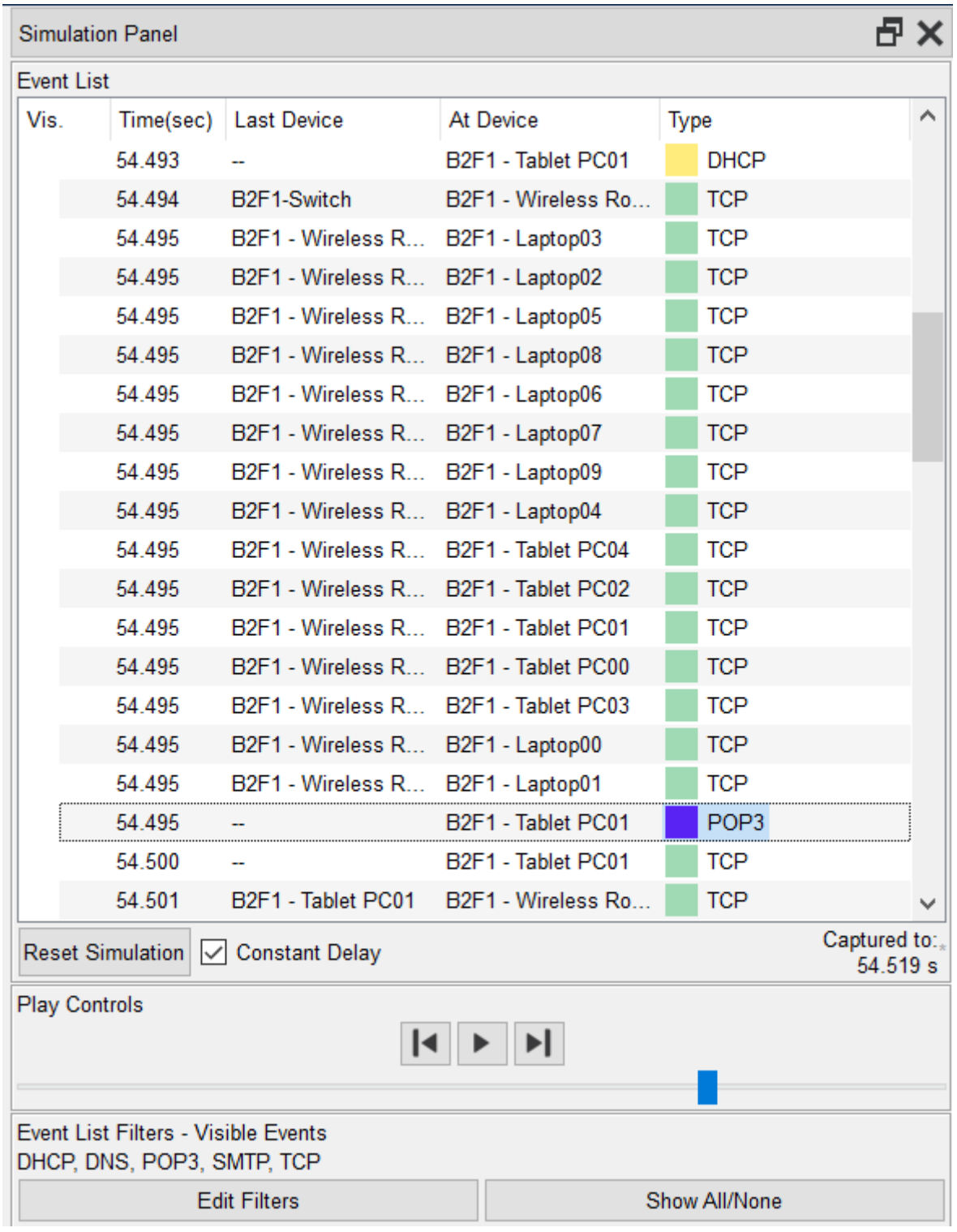
OSI Model of Scenario 8



PDU Output of Scenario 8



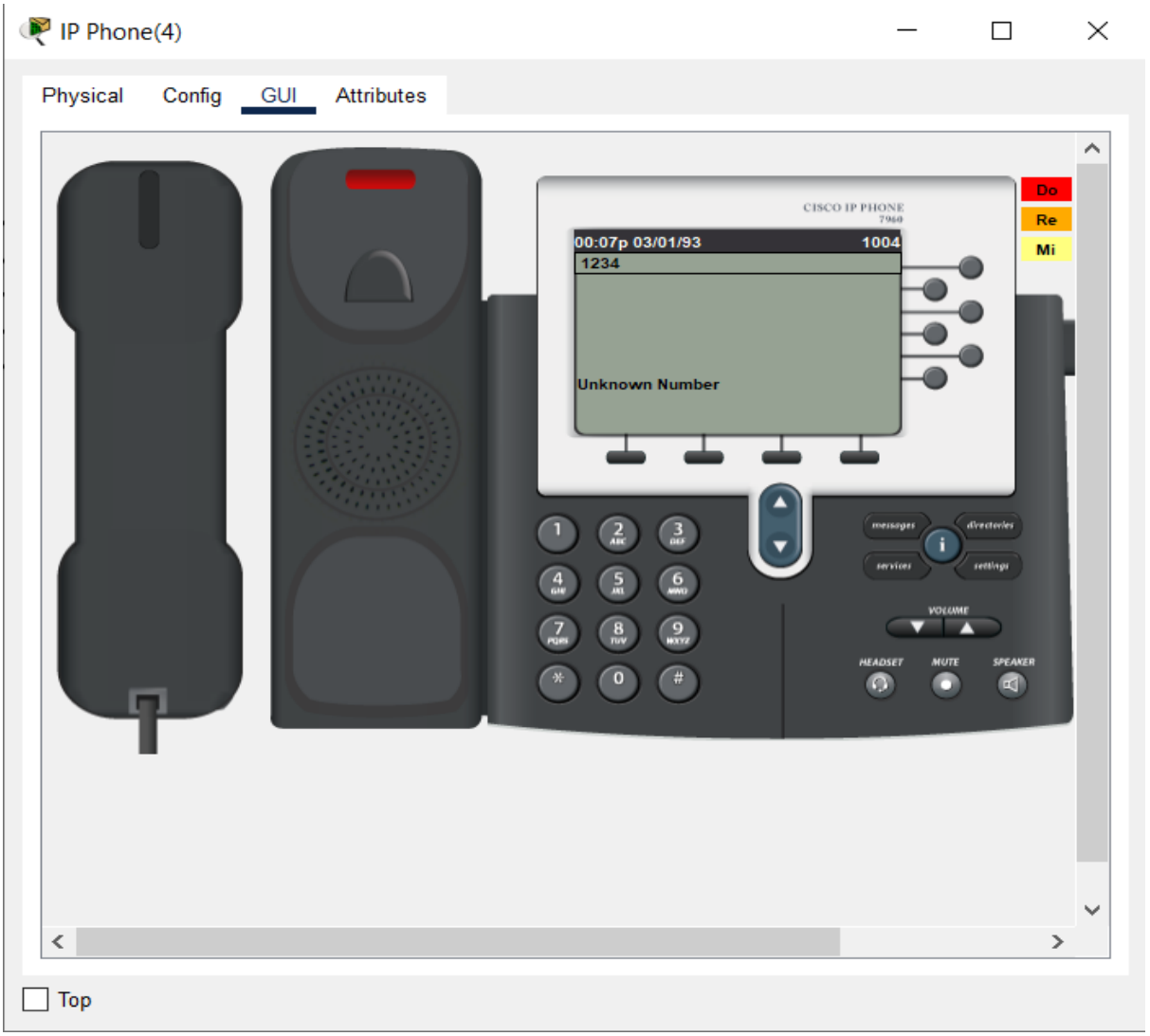
Event List of Scenario 8



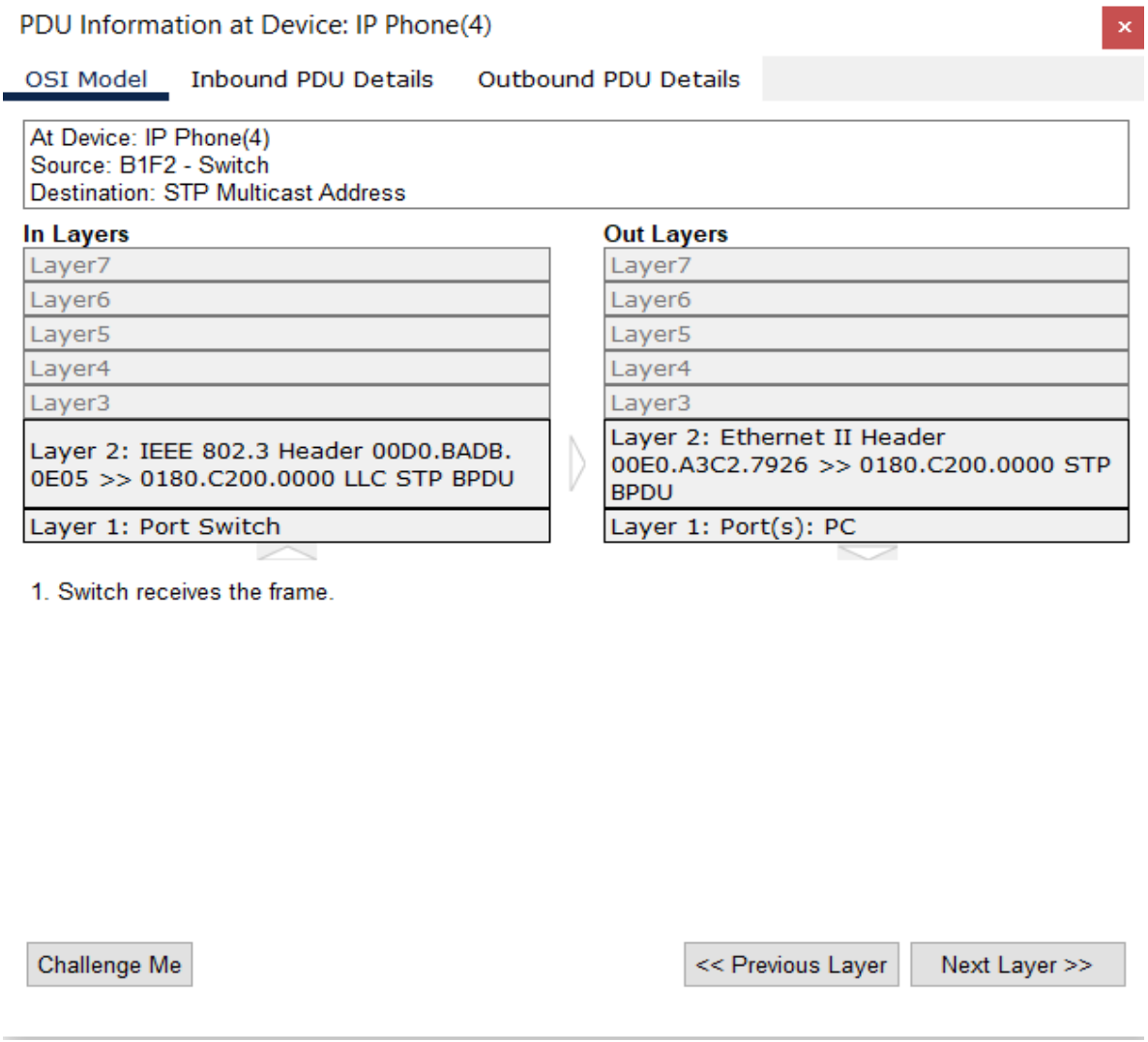
Event List of Scenario 8

Scenario 9 : User from the first branch of the first facility call an unidentified number.

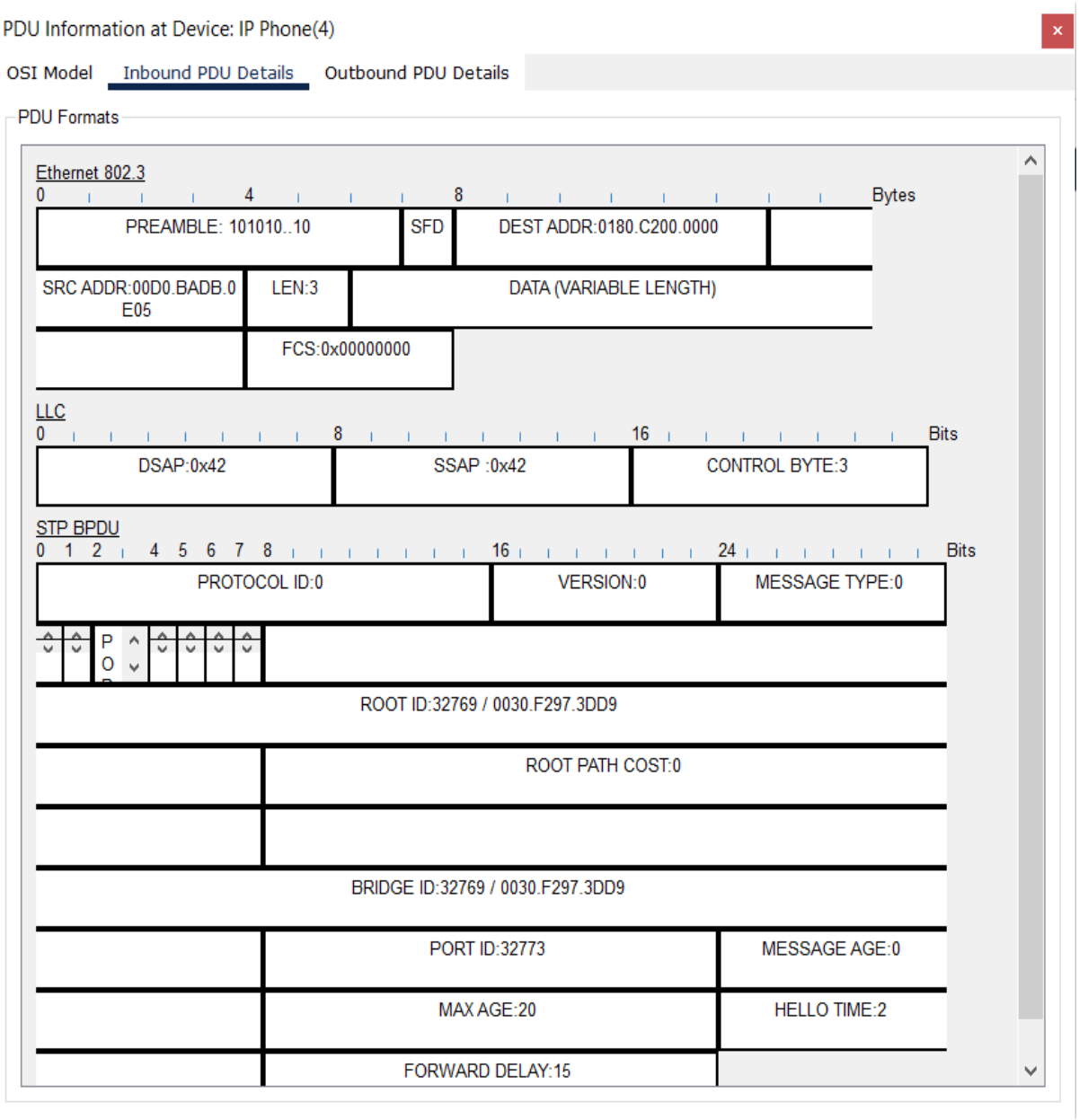
The IP Phone(4) user held a VoIP conference with an unknown number (1234). However, an unknown number notification was received because the number was not identified.
The network path followed for this scenario is as follows. B1F2-Switch, IP Phone(4), Branch1-Router, B1F2-Switch, Branch1-Router, B1F2-Switch, IP Phone(4),



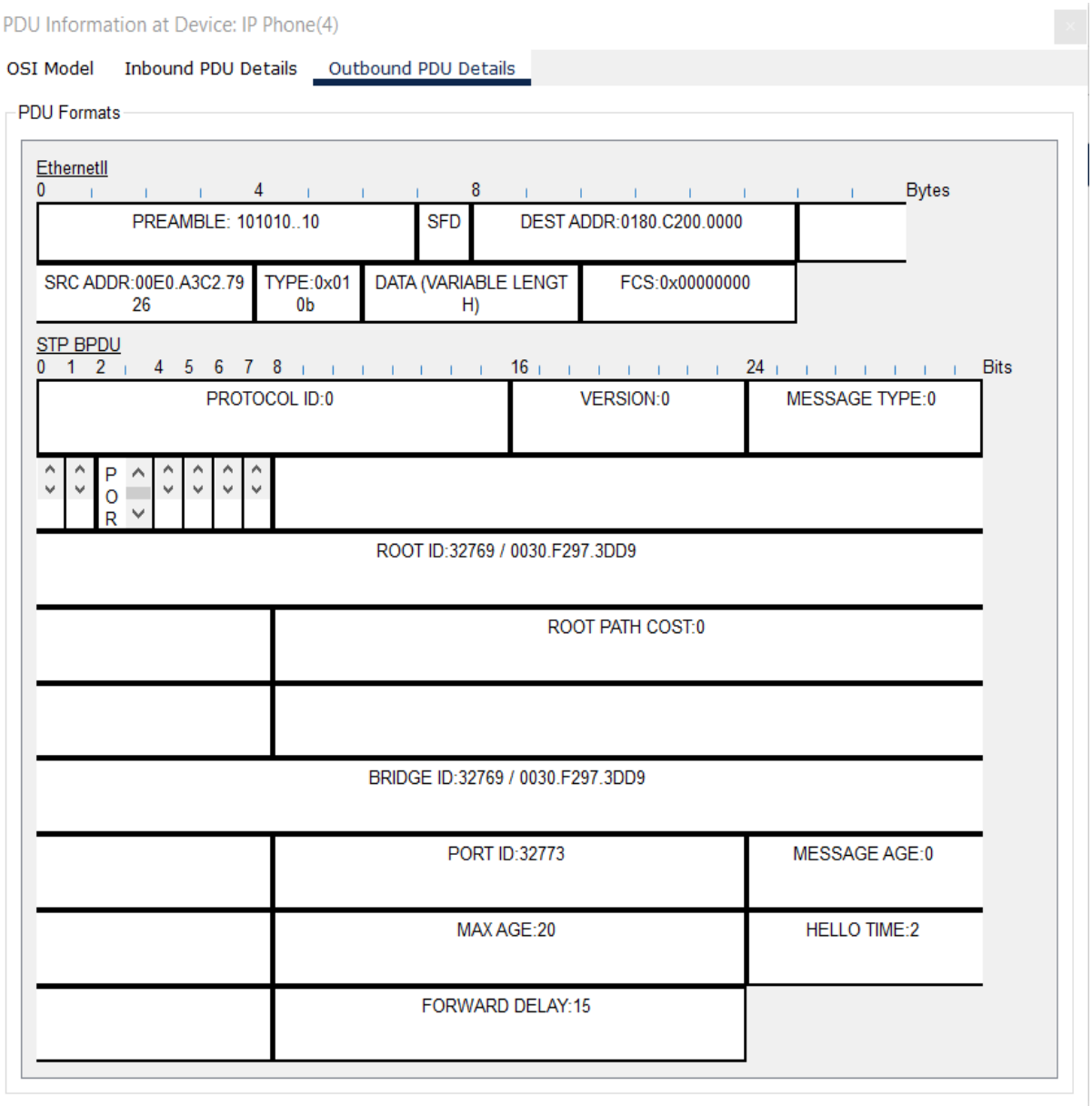
Result of Scenario 9



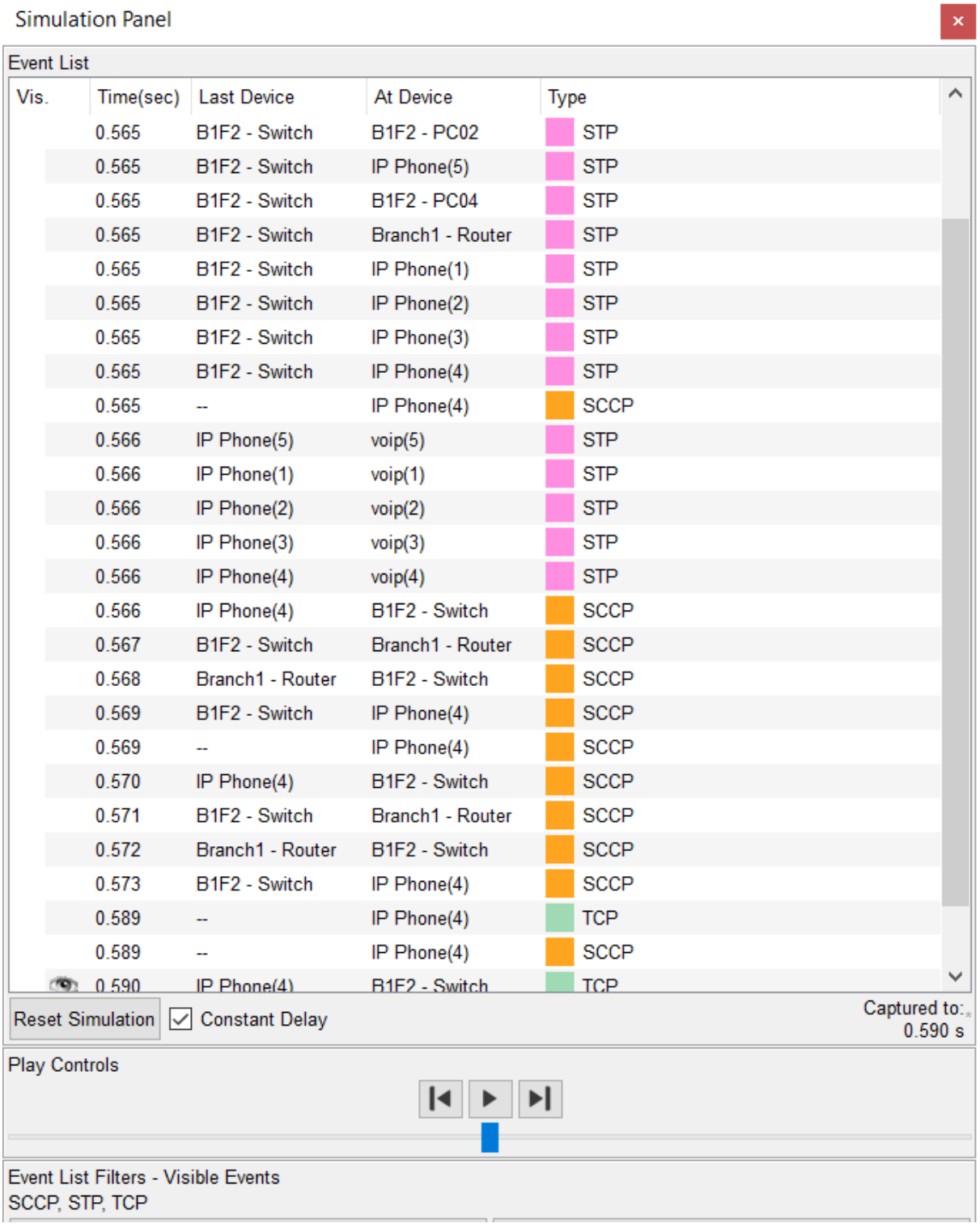
OSI Model of Scenario 9



PDU Output of Scenario 9



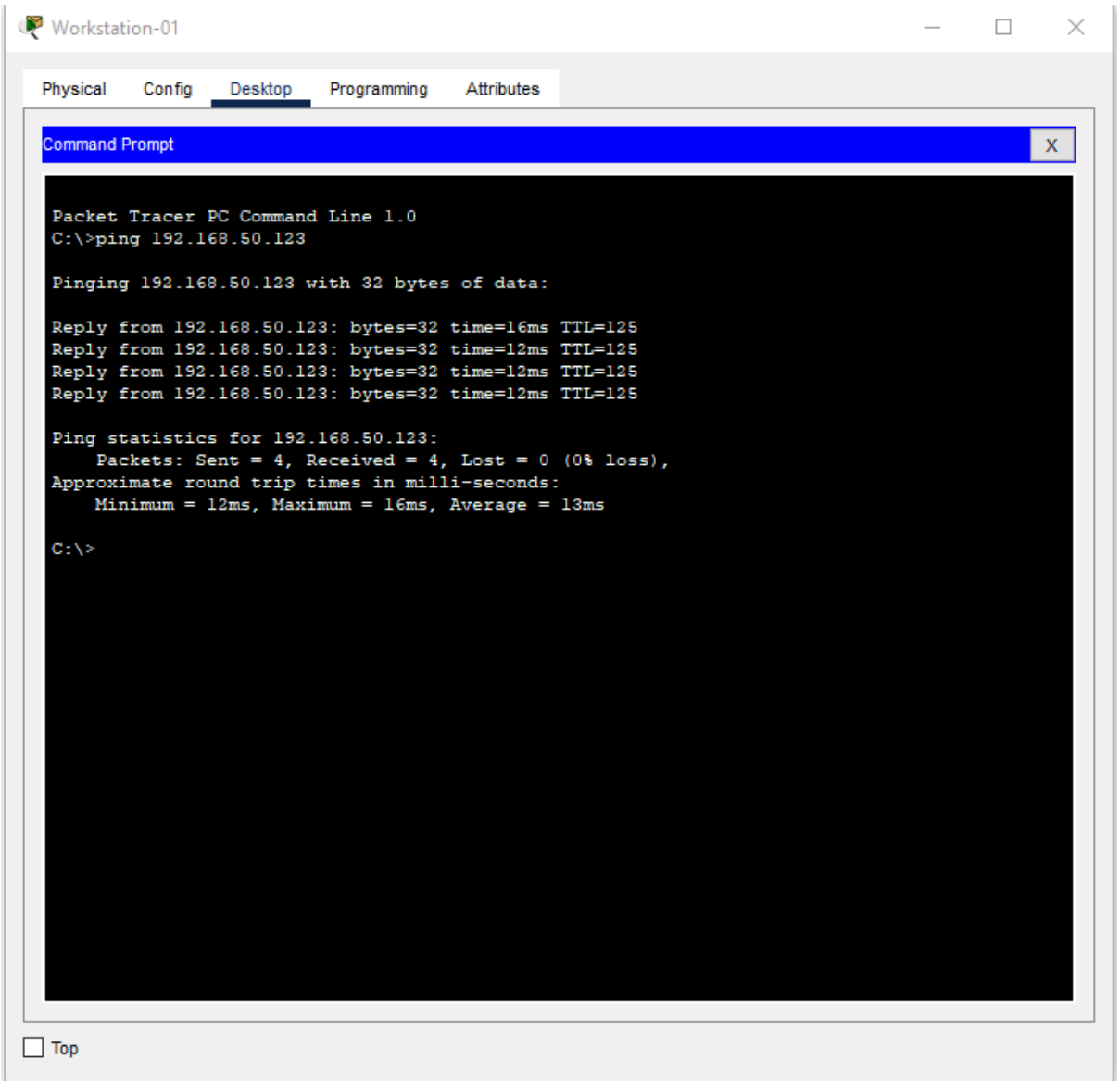
PDU Output of Scenario 9



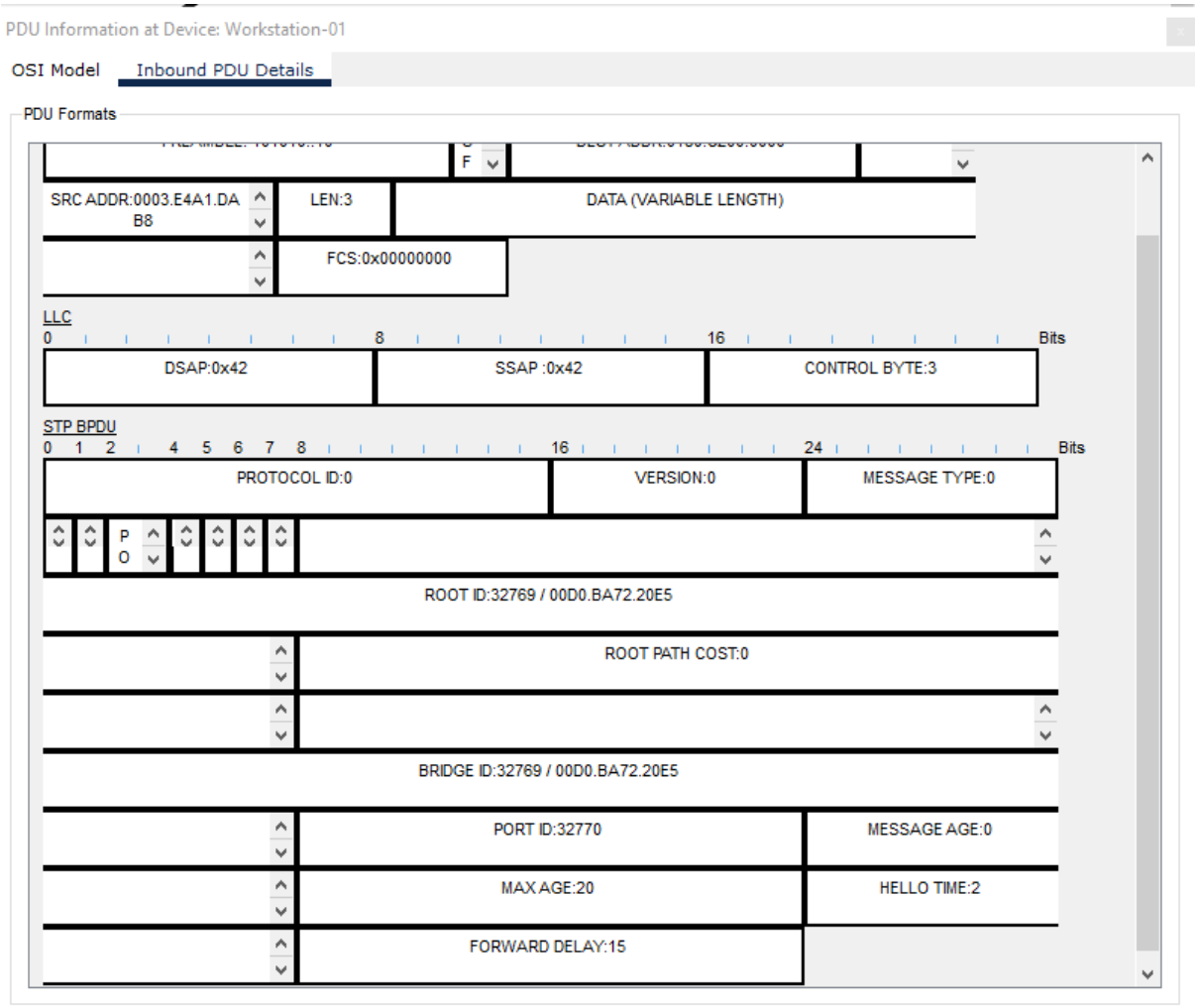
Event List of Scenario 9

Scenario 10: A workstation user from first facility first branch ping to workstation user from first facility second branch

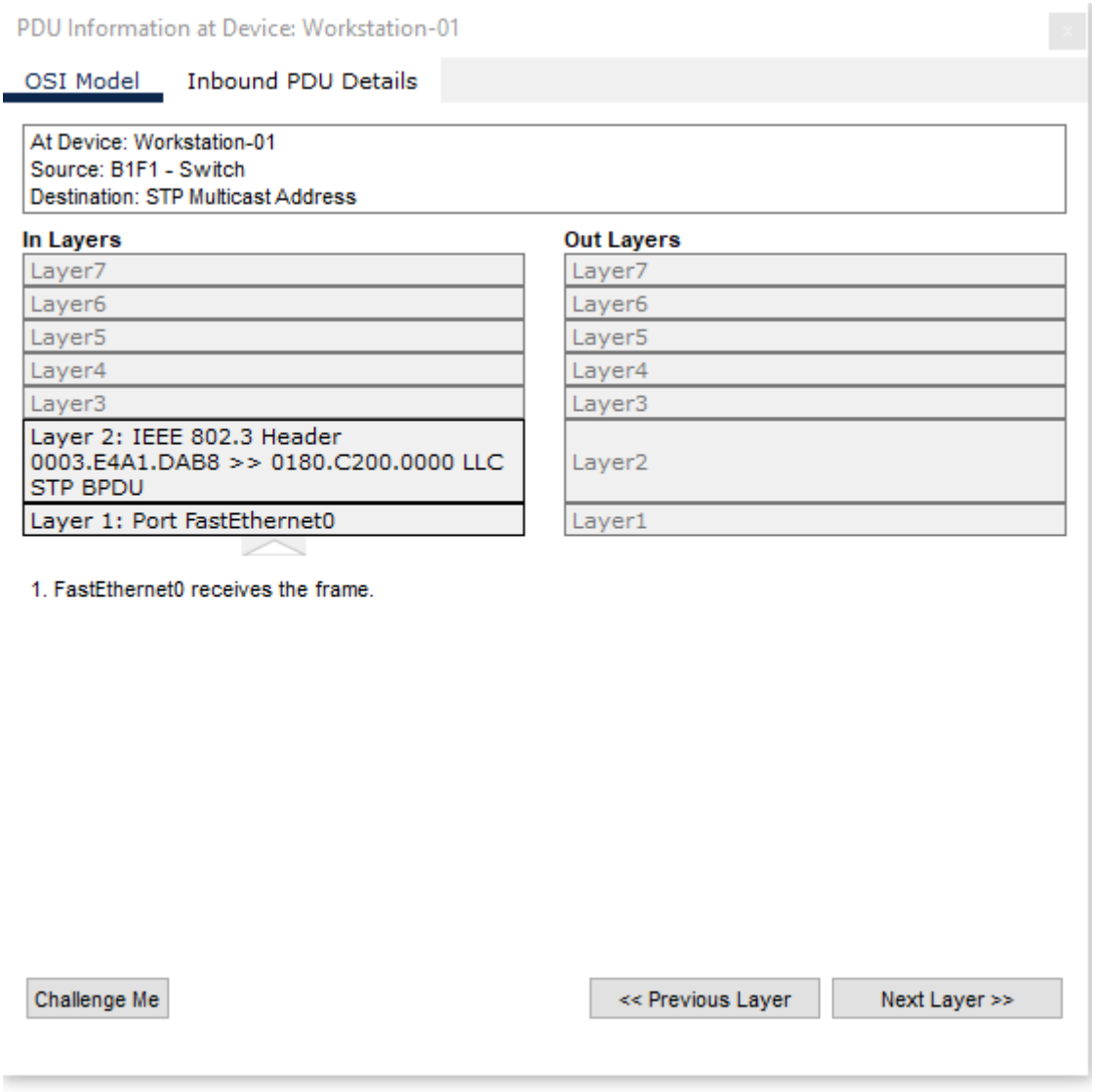
Pinging was performed between the Workstation-01 user and the B2F1-PC00 user.



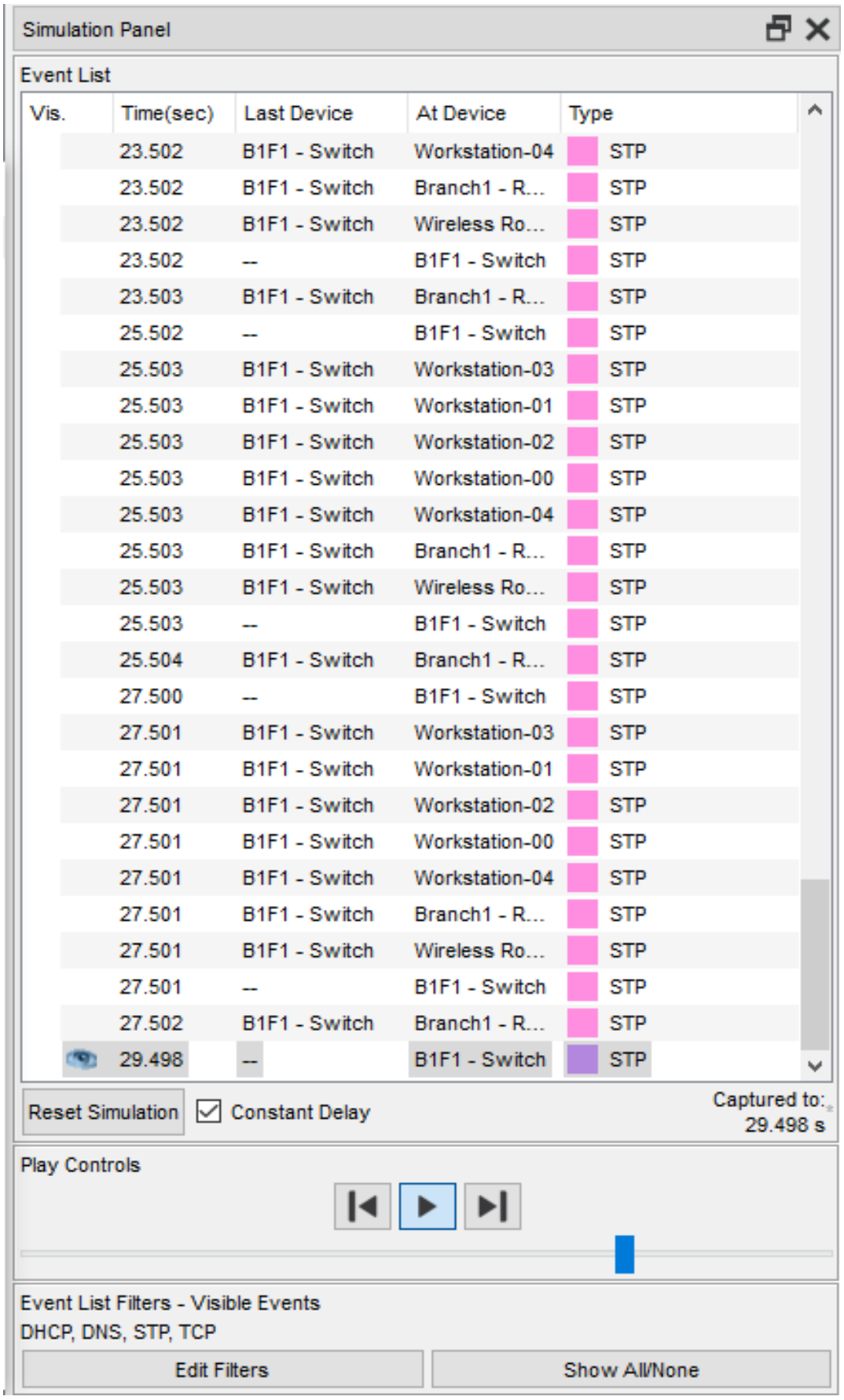
Result of Scenario 10



PDU Details of Scenario 10



OSI Model of Scenario 10



Event List of Scenario 10

CHAPTER FOUR

PROBLEMS ENCOUNTERED

When starting to use the Cisco Packet Tracer software, the interface was unfamiliar, but it started to be used effectively in a short time.

The capabilities of each facility were determined differently from each other. In a facility where voice transmission will be made over IP using VoIP, there was a problem in assigning the internal numbers to the phones, but this problem was overcome with a few commands written on the Router and Switch.

Another problem encountered was when we got an APIPA error while assigning IP to computers in the facilities via DHCP. This problem was solved by distributing the generated DHCP Pools via the Router with a few commands.

There were two different branches and these branches were added in the physical interface using Cisco Packet Tracer, but the entities in it were added in the logical interface, which caused the branch 2 created in the physical interface to be empty and all the added entities were added in branch 1. Later, a wiring closet was added to branch 2 via the physical interface, and routers and switches were placed in it. Other devices such as computers, tablets and laptops were added to branch 2 via the physical interface, and the connection operations were made again in the logical interface.

CHAPTER FIVE

CONCLUSION

In the Metropolitan Area Network Simulation project, two branches, each of which has three facilities, included features and tasks such as communication between different users, file transfer, web browsing. Between users for the project to work properly, necessary devices providing connections and their configuration also had to be provided.The information we learned, the research we did, the accuracy check at every step of the project, the project was completed as a result of the trials and healthy communication of the group members. The desired scenarios of the project, the analysis and tests on it, the desired features and tasks of the topology and architecture selection was observed by the group members that he successfully performed. The use of metropolitan area network instead of wide area network provided the desired security and speed. The network was successful in providing the requested services using the protocols outlined in the report. As a result, users in each facility can fulfill their own tasks, communication was provided between users at the same facility, different facility or different branches of different branches with the ability to communicate with each other and the servers in the project could be used jointly for both branches.

In this long-term project, the project team focused on network design, protocols, servers, users and binding devices, Cisco Packet Tracer etc. gained ideas and experience as a result of the synchronization of the group members with each other and their task sharing on the subjects.The project started on May 18, 2021 and we finished it on June 10, 2021 with its reporting.

CHAPTER SIX

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