

# NATIONAL UNIVERSITY OF COMPUTER & EMERGINGSCIENCE

## Computer Network Lab (CL3001)Lab

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### Session 05

#### **Objective:**

- Introduction to DNS & configuration of DNS in Cisco Packet Tracer
- Introduction to SMTP & FTP in Cisco Packet Tracer

### **DNS in Cisco Packet Tracer**

#### **1. Introduction to DNS:**

The Domain Name System (DNS) is a hierarchical and distributed naming system for computers, services, and other resources in the Internet or other Internet Protocol (IP) networks. It associates various information with domain names assigned to each of the associated entities. Most prominently, it translates readily memorized domain names to the numerical IP addresses needed for locating and identifying computer services and devices with the underlying network protocols.[1] The Domain Name System has been an essential component of the functionality of the Internet since 1985.

The Domain Name System distributes the responsibility of assigning domain names and mapping those names to IP addresses by designating authoritative name servers for each domain. Authoritative name servers are assigned to be responsible for their supported domains, and may delegate authority over sub domains to other name servers. This mechanism provides distributed and fault tolerant service and was designed to avoid the need for a single central database.

Some common DNS record types are:

#### **a) A record:**

The A record is one of the most commonly used record types in any DNS system. An A record is actually an address record, which means it maps a fully qualified domain name (FQDN) to an IP address. For example, an A record is used to point a domain name, such as "google.com", to the IP address of Google's hosting server, "74.125.224.147". This allows the end user to type in a human-readable domain, while the computer can continue working with numbers. The name in the A record is the host for your domain, and the domain name is automatically attached to your name.

**b) CNAME record:**

Canonical name records, or CNAME records, are often called alias records because they map an alias to the canonical name. When a name server finds a CNAME record, it replaces the name with the canonical name and looks up the new name. This allows pointing multiple systems to one IP without assigning an A record to each host name. It means that if you decide to change your IP address, you will only have to change one A record.

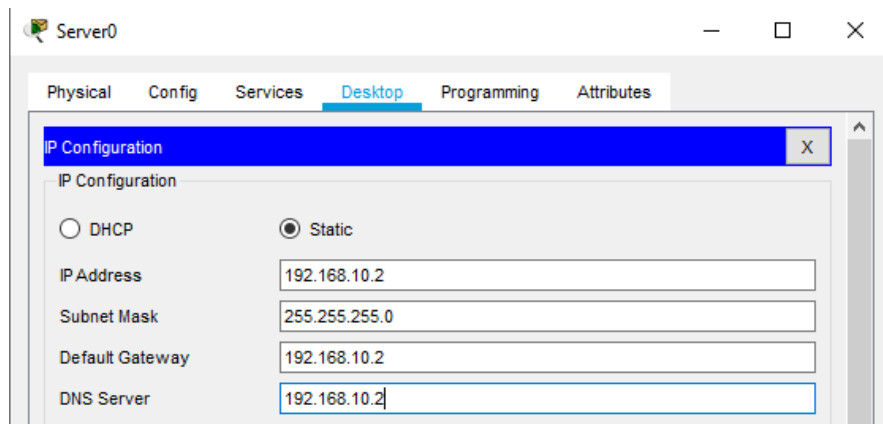
**c) NS record:**

An NS record identifies which DNS server is authoritative for a particular zone. The "NS" stands for "name server". NS records that do not exist on the apex of a domain are primarily used for splitting up the management of records on sub-domains.

**d) SOA record:**

The SOA or Start of Authority record for a domain stores information about the name of the server that supplies the data for the zone, the administrator of the zone and the current version of the data. It also provides information about the number of seconds a secondary name server should wait before checking for updates or before retrying a failed zone transfer.

Assigning IP to DNS server & PCs.



*Fig-1: DNS server*

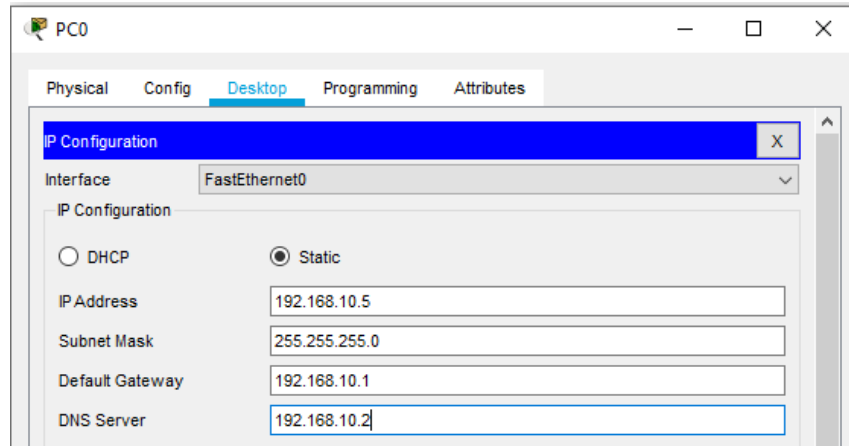


Fig-1: Provide IP to system through static IP

## 2. DNS Configuration & Simulation:

Now using the DNS service on DNS Server. Go to server services DNS.

First, we add A record. We assign the web server IP against our Domain name

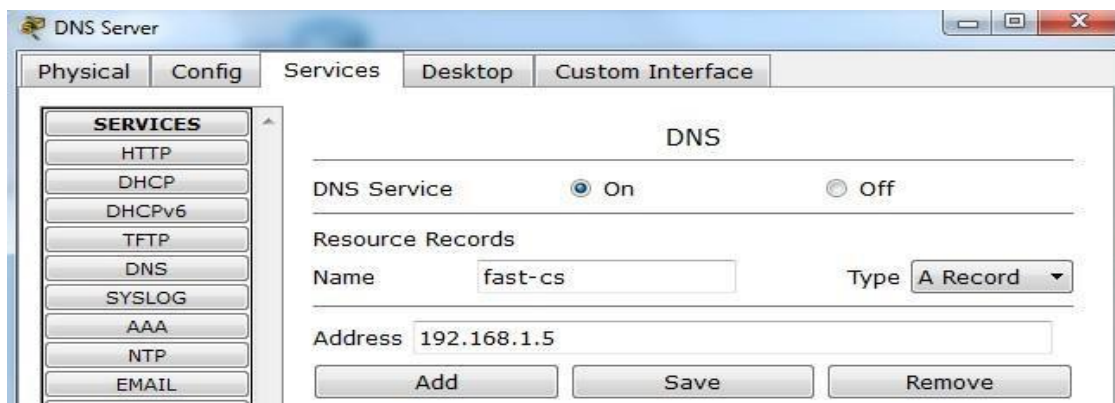


Fig-3: DNS server configuration adding a record

Now click on Add.

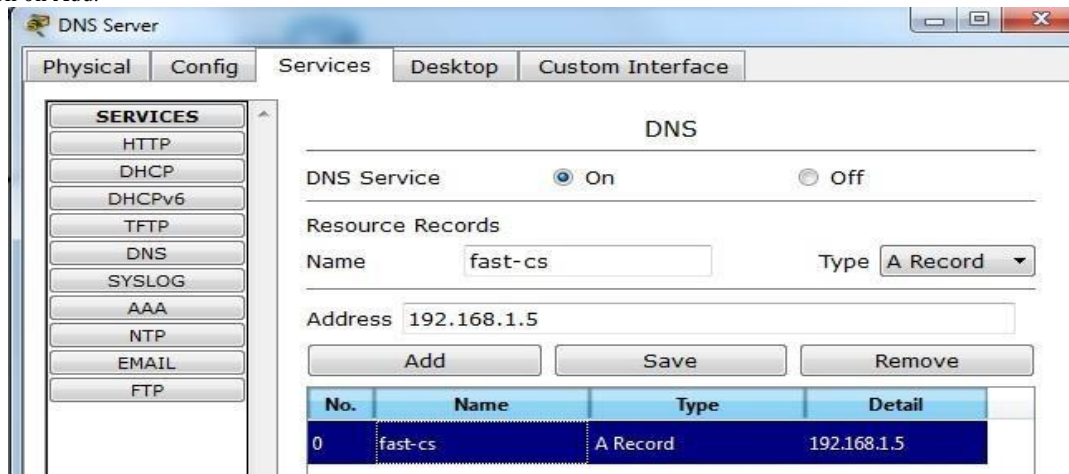


Fig-3: Record is added in DNS server

Now add Cname record.

The screenshot shows the 'DNS Server' configuration window with the 'Services' tab selected. On the left, a 'SERVICES' list includes HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, and FTP. The main area is titled 'DNS' and shows 'DNS Service' as 'On'. Under 'Resource Records', the 'Name' field contains 'fast' and the 'Type' is set to 'CNAME'. The 'Host Name' field contains 'fast-cs'. Below these fields are 'Add', 'Save', and 'Remove' buttons. A table at the bottom lists existing records:

No.	Name	Type	Detail
0	fast-cs	A Record	192.168.1.5

Fig-4: Adding CNAME record in DNS server

Now click on Add

The screenshot shows the same 'DNS Server' configuration window after clicking the 'Add' button. The 'Name' field is now empty, and the 'Host Name' field is also empty. The table at the bottom now contains two records:

No.	Name	Type	Detail
0	fast	CNAME	fast-cs
1	fast-cs	A Record	192.168.1.5

Fig-5: CNAME record is added in DNS server

Now go to PC4 → Desktop → web browser → type fast-cs and see how DNS works.



*Fig-6: Opening website*

Start simulation.

Event List					
Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.000	--	PC4	DNS	
	0.001	PC4	Switch1	DNS	
	0.002	Switch1	DNS Ser...	DNS	
	0.003	DNS Server	Switch1	DNS	
	0.004	--	PC4	TCP	
	0.004	Switch1	PC4	DNS	
	0.004	--	PC4	TCP	
	0.005	PC4	Switch1	TCP	
	0.006	Switch1	Web Ser...	TCP	

*Fig-7: Packets exchange in DNS simulation*

Click on DNS packet. See how DNS server resolved the name.

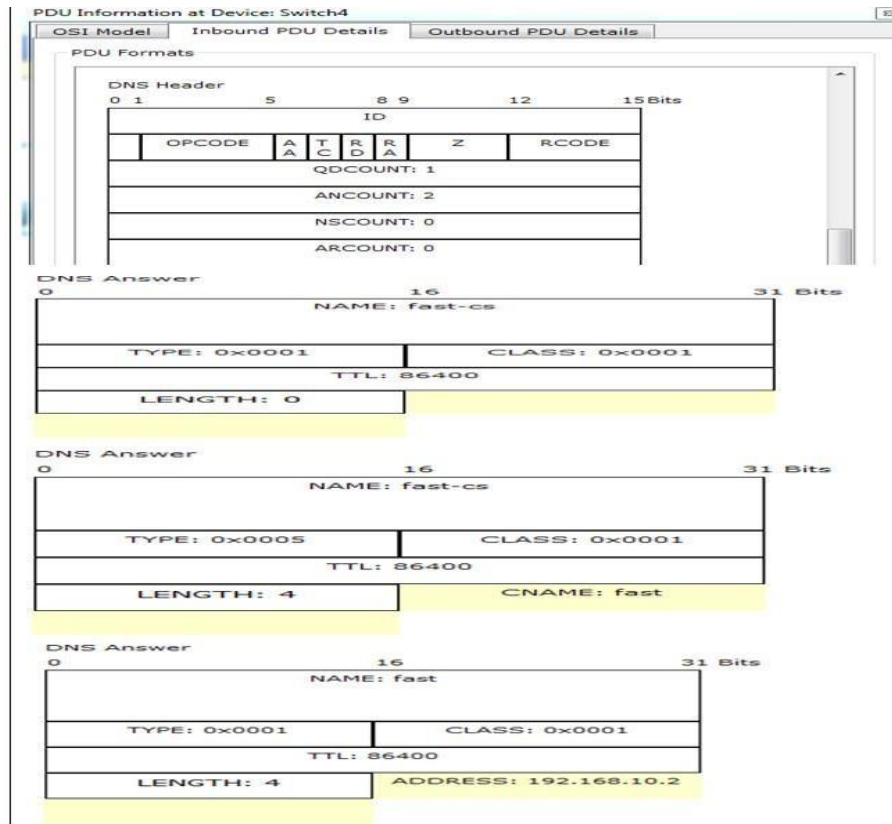


Fig-8: DNS header request & reply to resolve domain name

### Shows OSI layers involved in transmission.

The popped up window (below) will enable you to trace the content of the message through the OSI layer and what changes will occur at each layer (use next and previous buttons to trace each layer content).

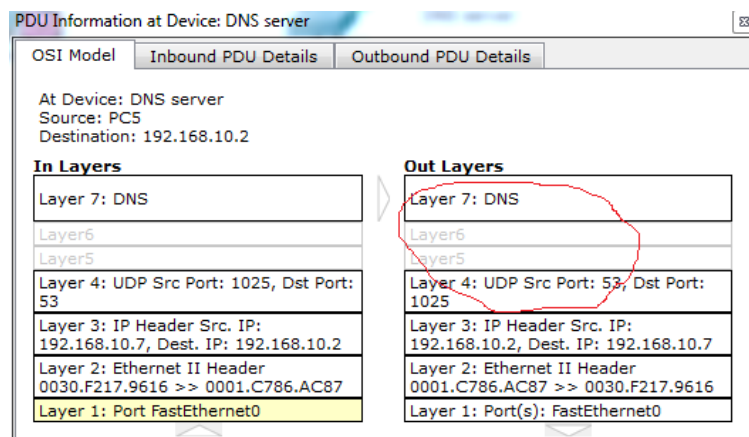
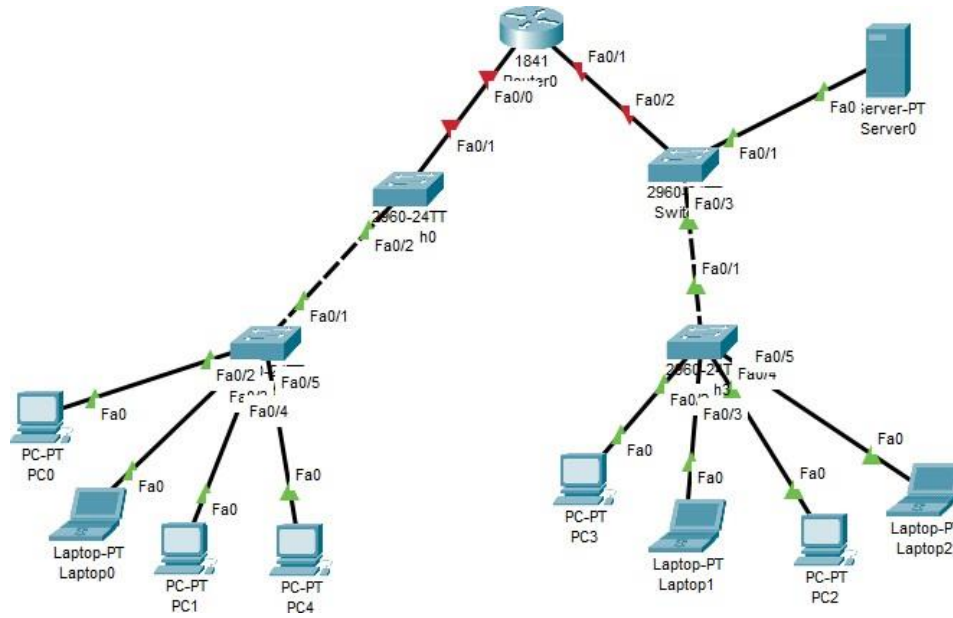


Fig-9: Showing OSI layer involvement in DNS

## LAB EXERCISE:

1. Implement the given topology.
2. Add some web servers in your network.
3. Implement DNS & add records of your web servers.



*Fig-10: Network topology for task*

# SMTP

## 1. Introduction:

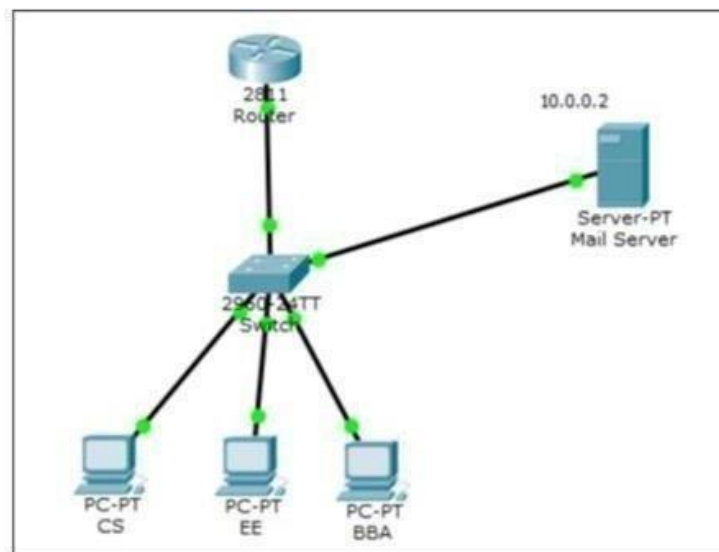
Simple Mail Transfer Protocol (SMTP) is an Internet standard for electronic mail (email) transmission. First defined by RFC 821 in 1982, it was last updated in 2008 with Extended SMTP additions by RFC 5321, which is the protocol in widespread use today. Although electronic mail servers and other mail transfer agents use SMTP to send and receive mail messages, user-level client mail applications typically use SMTP only for sending messages to a mail server for relaying. For retrieving messages, client applications usually use either IMAP or POP3.

SMTP communication between mail servers uses port 25. Mail clients on the other hand, often submit their outgoing emails to a mail server on port 587. Despite being deprecated, mail providers sometimes still permit the use of nonstandard port 465 for this purpose. SMTP runs over TCP.

## 2. Implementation:

### **Topology:**

Construct the topology shown in figure 1. Turn on router interface & assign IP's to PC using DHCP through router as done in previous lab. Assign static IP to email server.





### **Configure and Verify Email Services**

- Click on Mail server
- Go to services & then email services
- Enable SMTP & POP3 Service
- Set Domain name fast.com
- Add following users

Username	Password
CS	123
BBA	456
EE	789

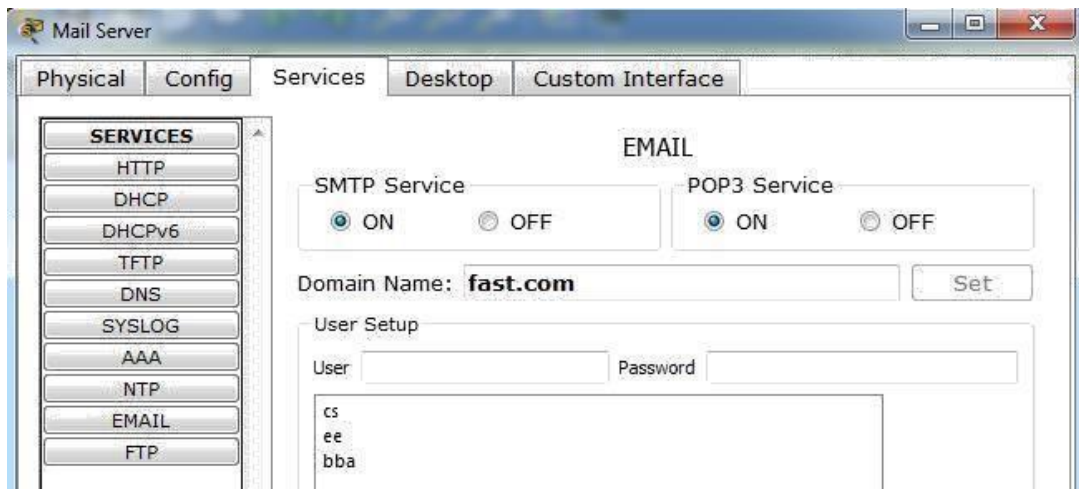
*Table-1: User name & their passwords*

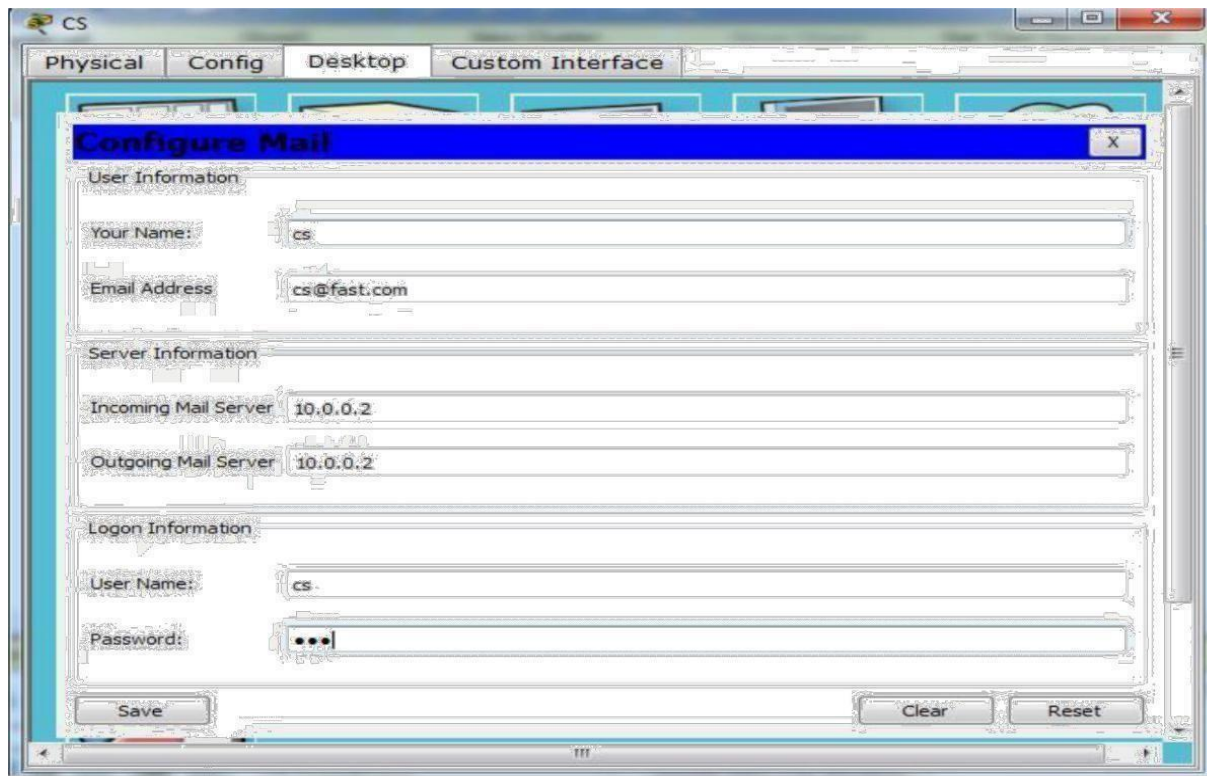
Now configure user email account.

Goto PC → Desktop → Email

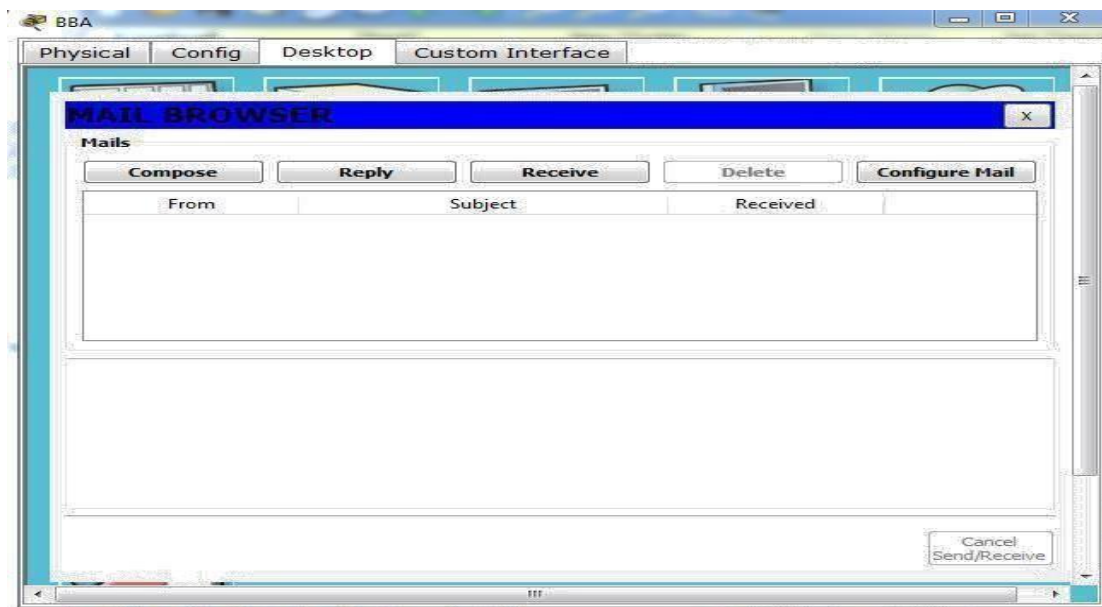
Fill the following fields as shown in figure 3.

Click “Save” to save the configurations and do the same for EE and BBA.





*Fig-3: User Email configuration*

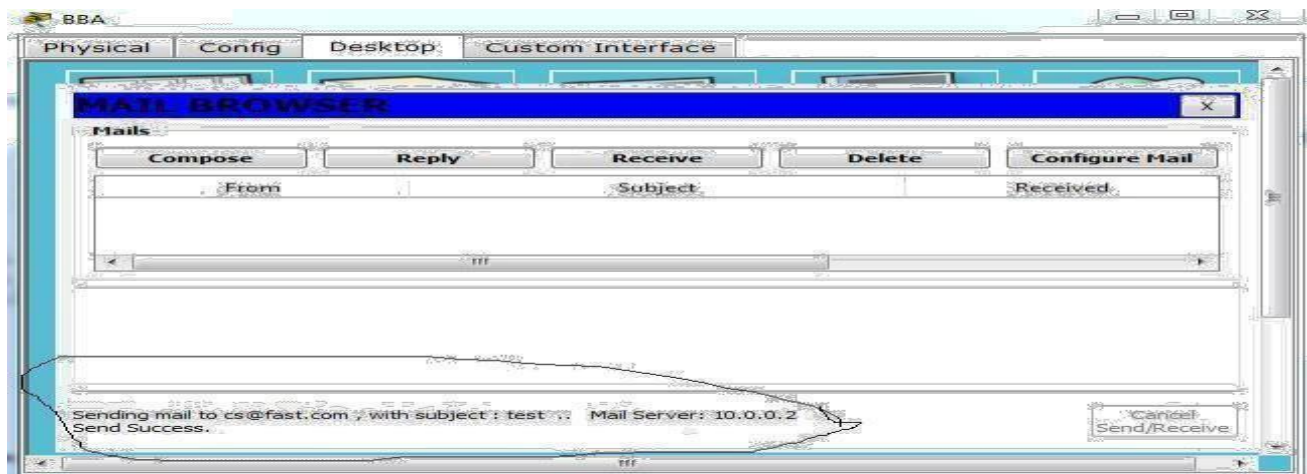


*Fig-4: Mail browser view of user PC after mail configuration*

Now compose email [cs@fast.com](mailto:cs@fast.com)

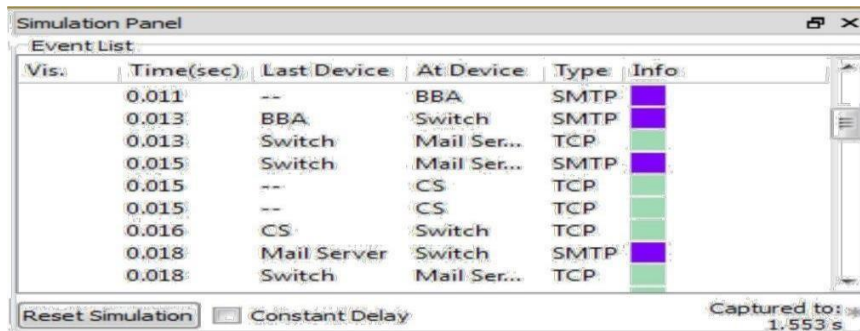


Click on “Send” to send Email.



### **Simulation:**

To note POP 3 header format information, go to simulation mode ☐ edit filters & check SMTP & POP 3 boxes. After that click on capture/forward button. Now see how mail server works



The Simulation Panel Event List shows a sequence of network events. The table has columns for Visibility, Time in seconds, Last Device, At Device, Type, and Info. The events include SMTP and TCP connections between BBA, Switch, Mail Server, and CS.

Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.011	--	BBA	SMTP	
	0.013	BBA	Switch	SMTP	
	0.013	Switch	Mail Ser...	TCP	
	0.015	Switch	Mail Ser...	SMTP	
	0.015	--	CS	TCP	
	0.015	--	CS	TCP	
	0.016	CS	Switch	TCP	
	0.018	Mail Server	Switch	SMTP	
	0.018	Switch	Mail Ser...	TCP	

Reset Simulation ☐ Constant Delay Captured to: 1.553 s

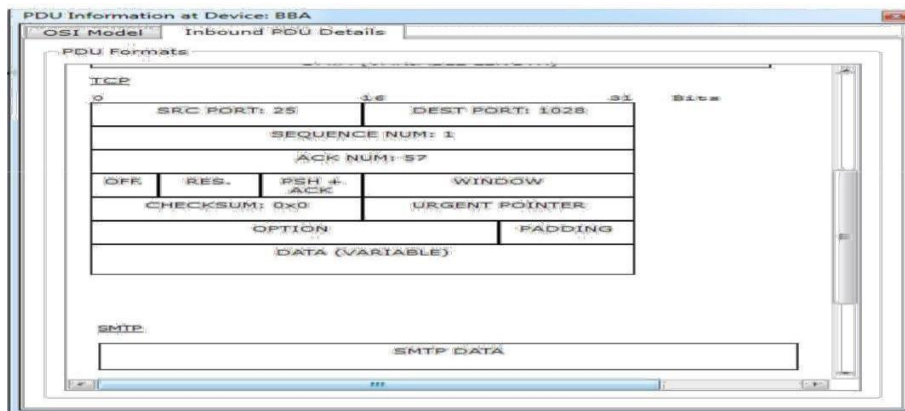


Fig-7: Packets capture in simulation mode & their PDU detail

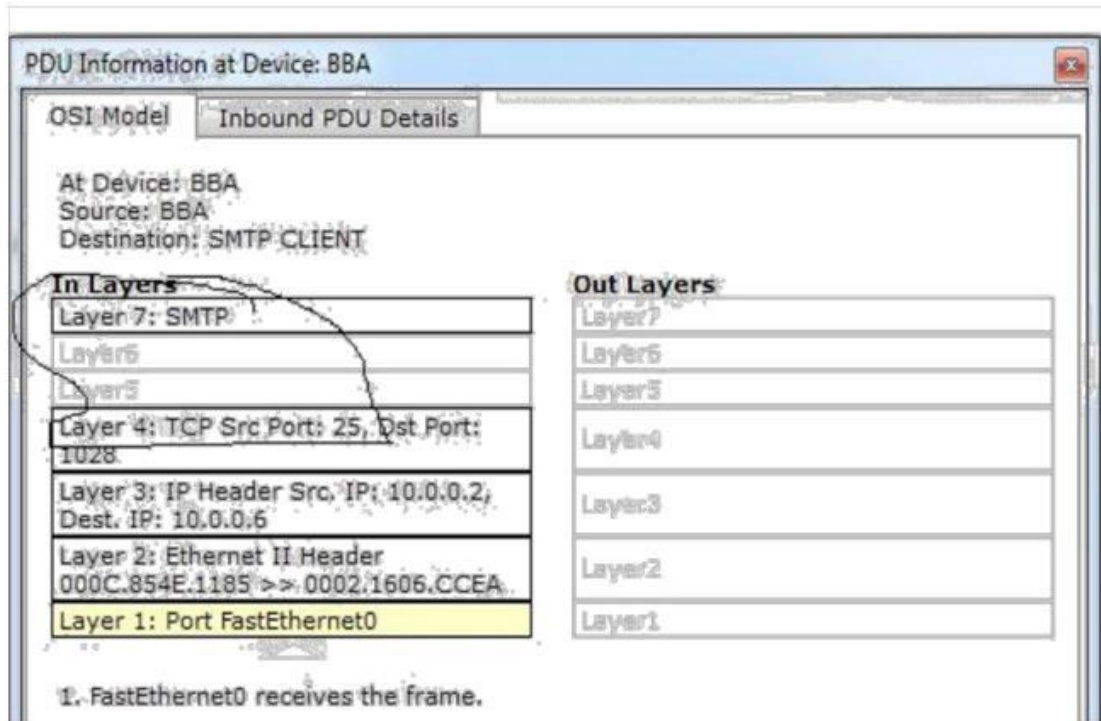
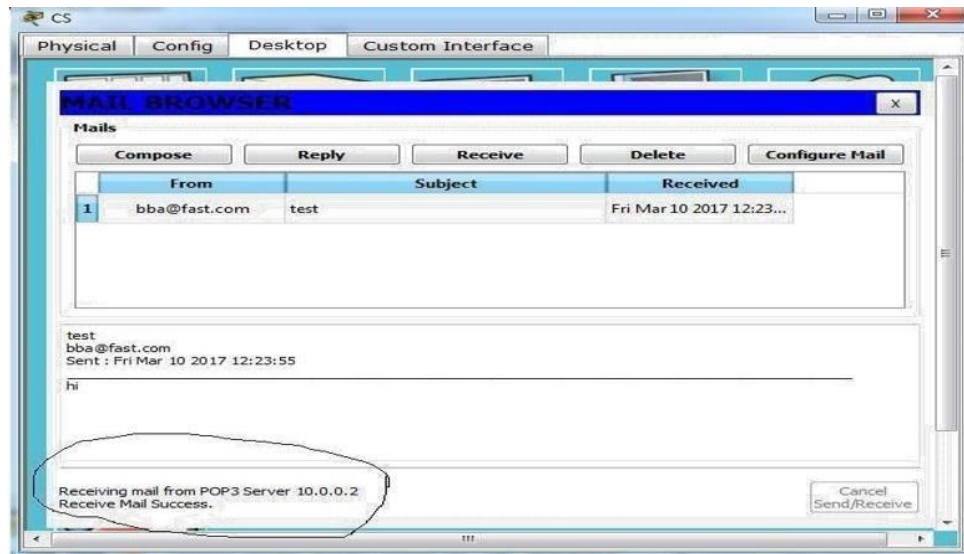


Fig-8: OSI layer information about protocols at each layer in sending mail packet.



# **FTP**

## **Introduction:**

The File Transfer Protocol (FTP) is a standard network protocol used to transfer computer files between a client and server on a computer network. FTP is built on client-server model architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that protects the username and password, and encrypts the content, FTP is often secured with SSL/TLS (FTPS) or replaced with SSH File Transfer Protocol (SFTP). FTP uses TCP as its under layer transport protocol for data reliability transfer. It uses port 21.

FTP may run in active or passive mode, which determines how the data connection is established.

- In active mode, the client starts listening for incoming data connections from the server on port M. It sends the FTP command PORT M to inform the server on which port it is listening. The server then initiates a data channel to the client from its port 20, the FTP server data port.
- In situations where the client is behind a firewall and unable to accept incoming TCP connections, passive mode may be used. In this mode, the client uses the control connection to send a PASV command to the server and then receives a server IP address and server port number from the server, which the client then uses to open a data connection from an arbitrary client port to the server IP address and server port number received.

Both modes were updated in September 1998 to support IPv6. Further changes were introduced to the passive mode at that time, updating it to extended passive mode.

## **Implementation:**

In this activity, you will configure FTP server in Cisco Packet Tracer. After configuration you will transferfile between client & server. This activity is divided into 3 parts. First Construct the figure 10 topology & repeat all essential steps which we are done in pervious section.

### **Part 1: Configure FTP services on server**

- a) Click Server > Config tab > FTP.
- b) Click On to enable FTP service.
- c) In User Setup, create the following user accounts. Click the + button to add the account:

Username	Password	Permissions
Fast	123	limited to Read, write and List

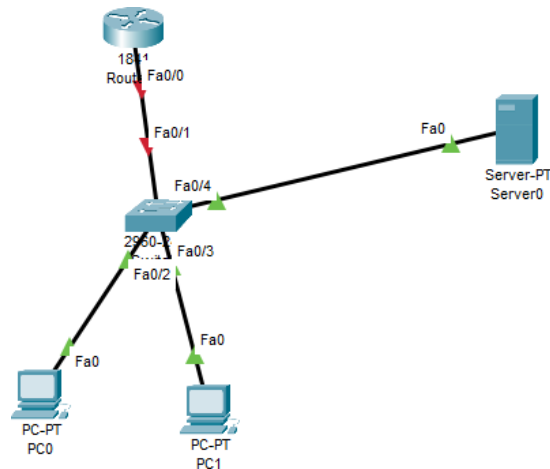


Fig-10: Topology

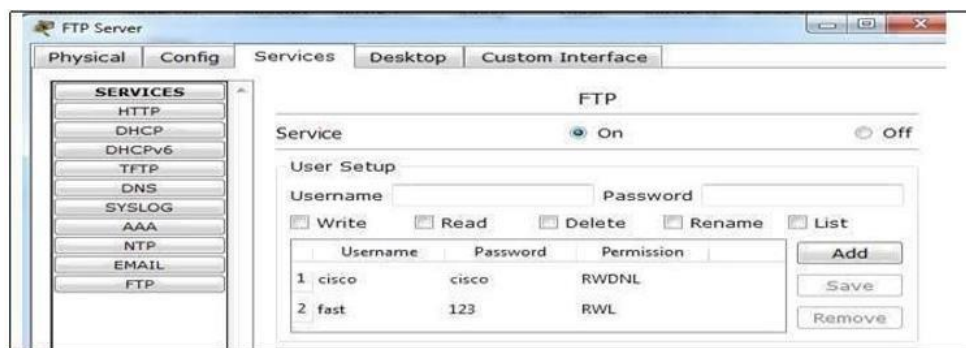


Fig-11: Enabling FTP services on server

Now go to PC Desktop command prompt. Connect with the FTP server using username & password assigned to FTP server.

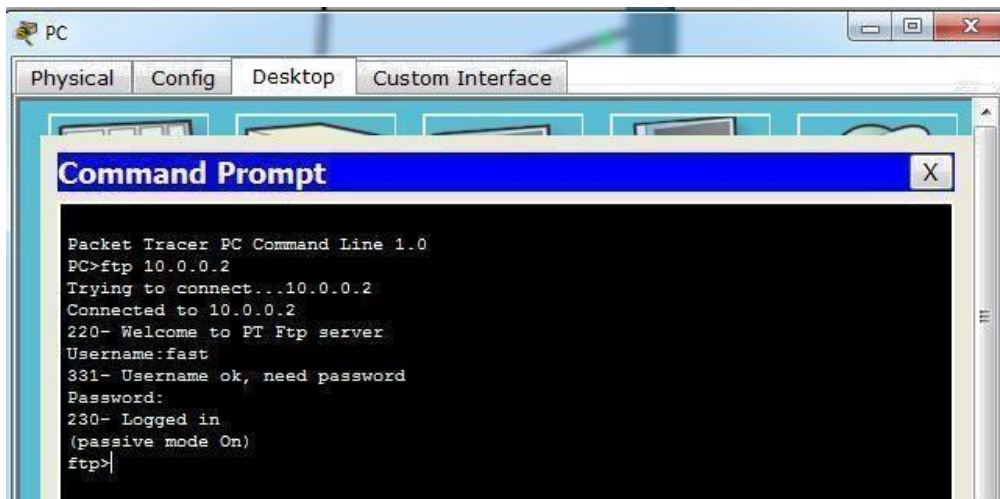


Fig-12: PC established connection with FTP server



## Part 2: Upload the file to FTP server

Go to PC Desktop text editor create file named test.bin

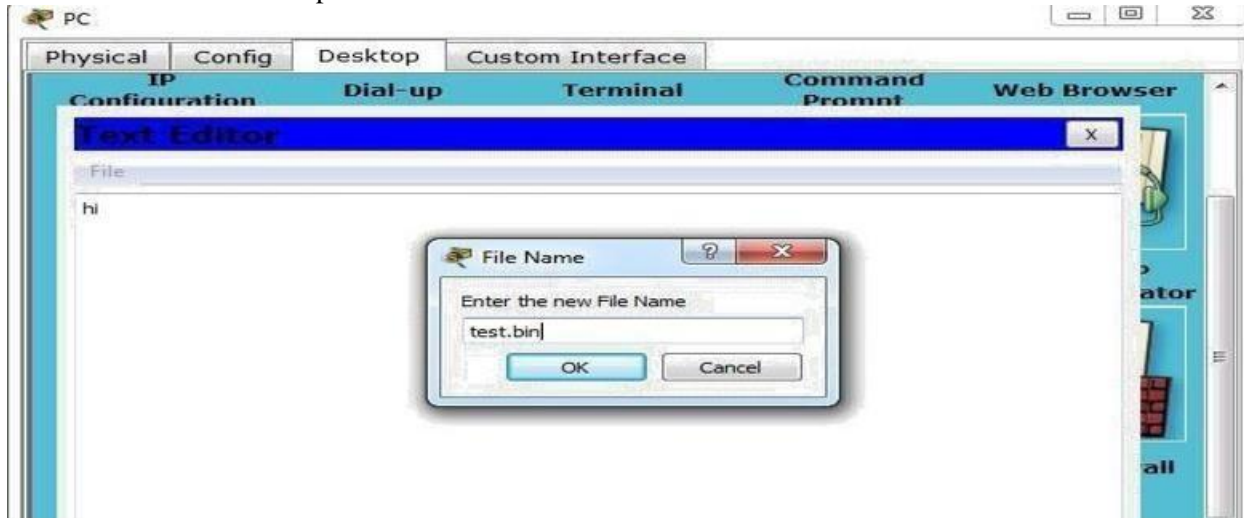


Fig-13: Creating text file in PC

After creating the file go to PC Desktop command prompt and write the following command to transfer file from PC to FTP server.

***PUT test.bin***

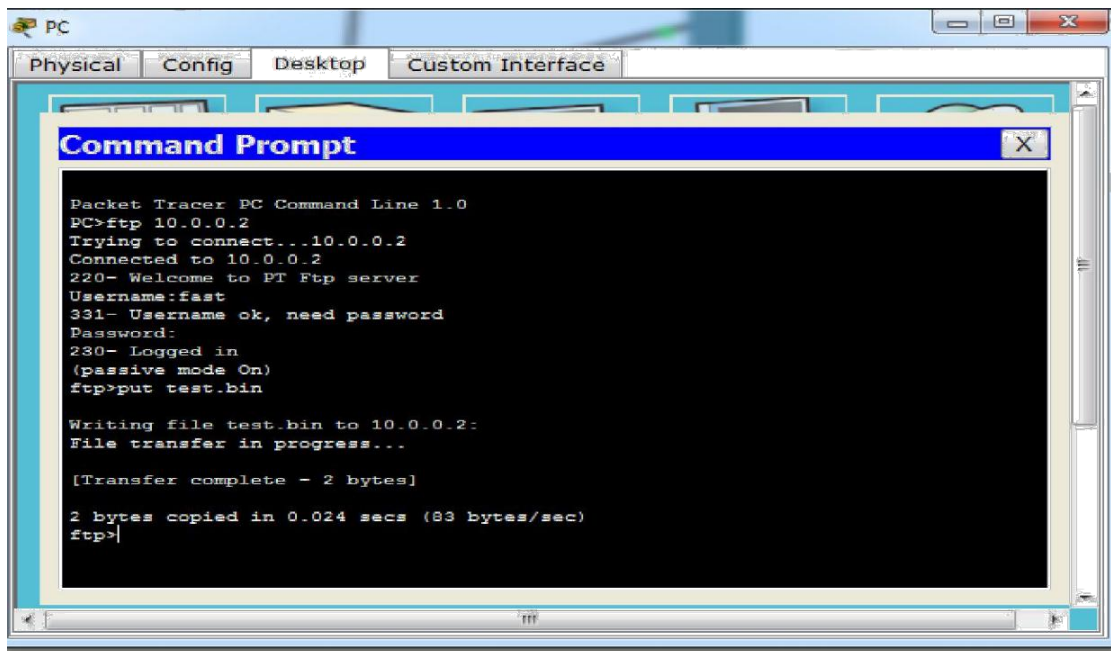
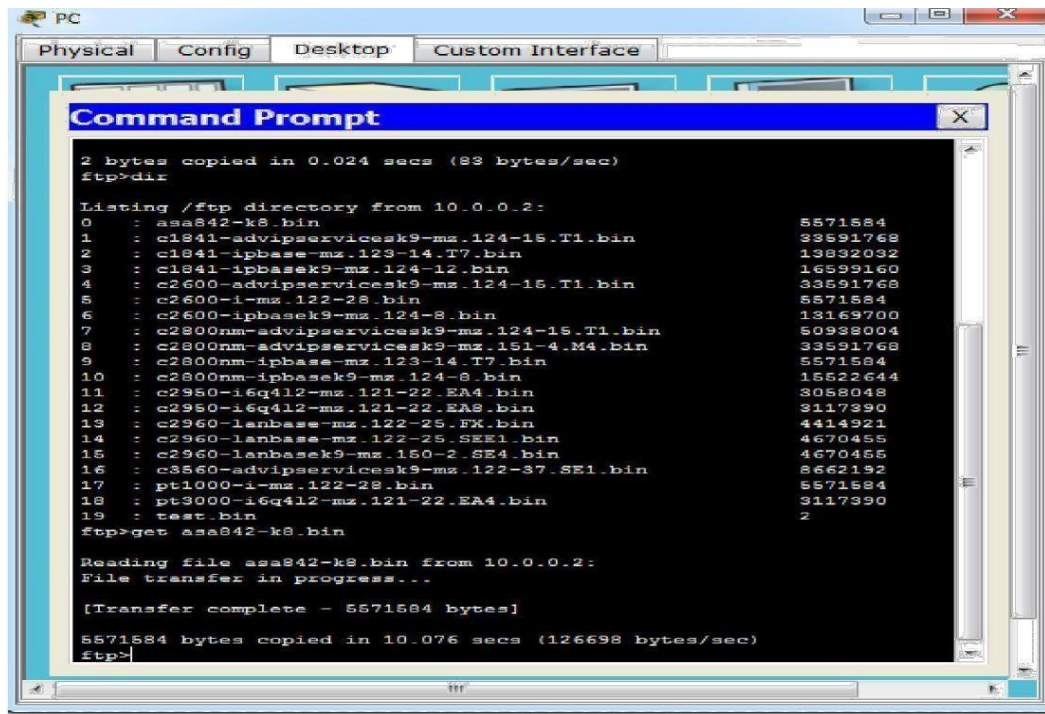


Fig-14: transfer of file from PC to FTP server



### Part 3: Download the file from FTP server

Now go to other PC desktop command prompt. Established connection with FTP server and then write the *dir* command to see the files in FTP server.



The screenshot shows a PC desktop with a 'PC' window. Inside the 'PC' window, there is a 'Command Prompt' window. The Command Prompt shows the following text:

```
2 bytes copied in 0.024 secs (83 bytes/sec)
ftp>dir

Listing /ftp directory from 10.0.0.2:
 0 : asa842-k8.bin                               5571584
 1 : c1841-advipservicesk9-mz.124-15.T1.bin      33591768
 2 : c1841-ipbase-mz.123-14.T7.bin               13832032
 3 : c1841-ipbasek9-mz.124-12.bin                 16599160
 4 : c2600-advipservicesk9-mz.124-15.T1.bin      33591768
 5 : c2600-i-mz.122-28.bin                        5571584
 6 : c2600-ipbasek9-mz.124-8.bin                  13169700
 7 : c2800nm-advipservicesk9-mz.124-15.T1.bin     50938004
 8 : c2800nm-advipservicesk9-mz.151-4.M4.bin      33591768
 9 : c2800nm-ipbase-mz.123-14.T7.bin              5571584
10 : c2800nm-ipbasek9-mz.124-8.bin                15522644
11 : c2950-i6q412-mz.121-22.EA4.bin              3058048
12 : c2950-i6q412-mz.121-22.EA8.bin              3117390
13 : c2960-lanbase-mz.122-25.EK4.bin              4414921
14 : c2960-lanbase-mz.122-25.SEK1.bin             4670455
15 : c2960-lanbasek9-mz.150-2.SE4.bin             4670455
16 : c3560-advipservicesk9-mz.122-37.SE1.bin      8662192
17 : pt1000-i-mz.122-28.bin                       5571584
18 : pt3000-i6q412-mz.121-22.EA4.bin              3117390
19 : test.bin                                       2

ftp>get asa842-k8.bin

Reading file asa842-k8.bin from 10.0.0.2:
File transfer in progress...

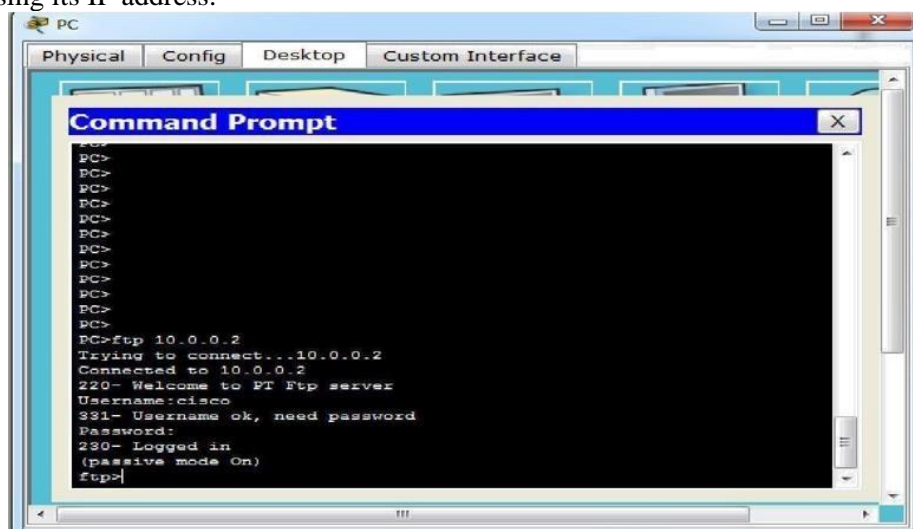
[Transfer complete - 5571584 bytes]

5571584 bytes copied in 10.076 secs (126698 bytes/sec)
ftp>
```

Fig-15: List of current Files in FTP server

### Simulation

Select the simulation mode. Go to PC desktop command prompt again make connection with FTP server using its IP address.



The screenshot shows a PC desktop with a 'PC' window. Inside the 'PC' window, there is a 'Command Prompt' window. The Command Prompt shows the following text:

```
PC>
PC>
PC>
PC>
PC>
PC>
PC>
PC>
PC>
PC>
PC>
PC>ftp 10.0.0.2
Trying to connect...10.0.0.2
Connected to 10.0.0.2
220- Welcome to FT Ftp server
Username:cisco
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>
```

Now to note the FTP header format information go to simulation mode edit filters and click on FTP check box then click on capture/forward button.

How FTP server resolves the login request.

The figure displays a simulation environment with an event list and four captured FTP packets. The event list shows a sequence of events between a PC, a switch, and an FTP server. The captured packets show the FTP login process: a 220 'Welcome to PT Ftp server' message, a 331 'Username ok, need password' request, a password submission, and a final 230 'Logged in' confirmation.

Vis.	Time(sec)	Last Device	At Device	Type	Info
	6.413	--	PC	FTP	
	6.415	PC	Switch	FTP	
	6.417	Switch	FTP Server	FTP	
	6.417	--	FTP Server	FTP	
	6.419	FTP Server	Switch	FTP	
	6.421	Switch	PC	FTP	
	6.441	--	PC	TCP	
	6.442	PC	Switch	TCP	
	6.444	Switch	FTP Server	TCP	

**FTP**

220

Welcome to PT Ftp server

**FTP**

USER

cisco

**FTP**

331

Username ok, need password

**FTP**

PASS

cisco

**FTP**

230

Logged in

Fig-17: Packets capture in simulation mode

Now click on the FTP packet, you can note that the destination port is 21.

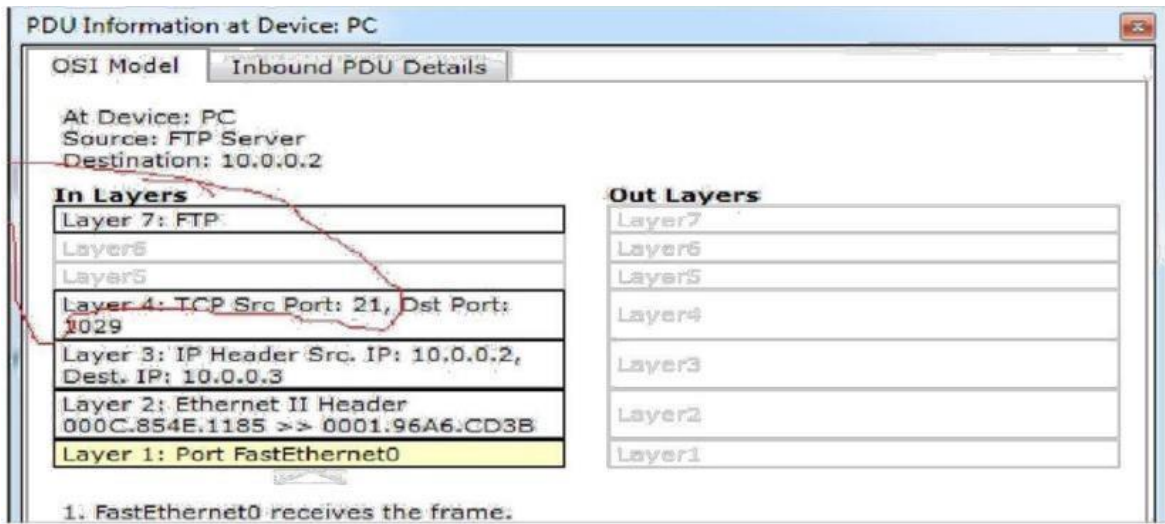


Fig-18: PDU information at PC

Now scroll the Outbound PDU Details, you can see the FTP PDU

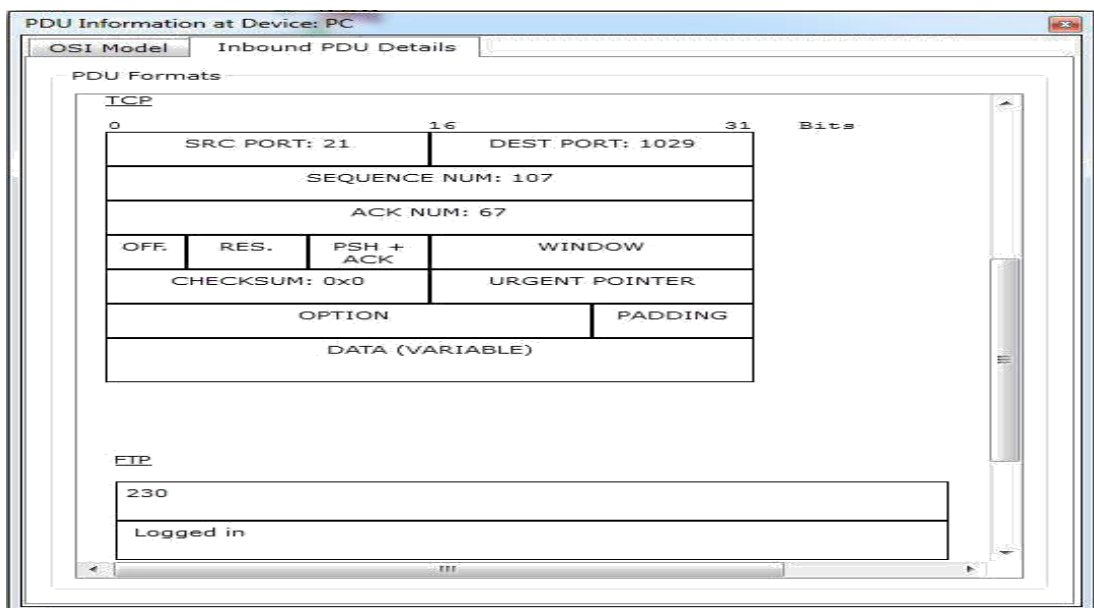
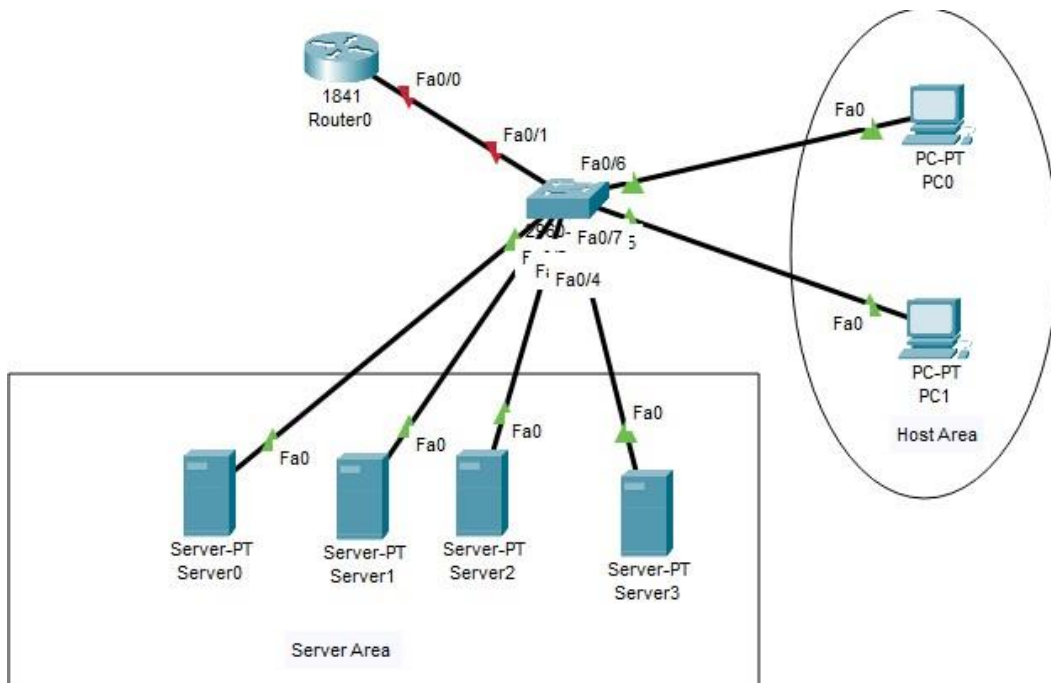


Fig-19: PDU details

## **Lab Exercise:**

Let's suppose your organization need to create it's on small server (for provide some services) basednetwork. With bellow mentioned topology and instructions:

- Configure SMTP (create account with your last name) send mail from PC-A to PC-B.
- Configure FTP server create account with your first name, password with your roll number and filename with your last name (.bin extension) show all connection results.



*Fig-20: Lab Exercise Topology*