

Lecture 14

APPLICATION LAYER

SMTP, POP, IMAP, FTP, HTTP

Topics Covered

- MESSAGE TRANSFER AGENT: SMTP
- Mail Transfer Phases
- SMTP
- MESSAGE ACCESS AGENT: POP AND IMAP
- Post Office Protocol
- Limitations of POP
- IMAP₄
- File Transfer Protocol
- TCP connections for FTP
- HyperText Transfer Protocol (HTTP)
- URL
- APPLICATIONS

MESSAGE TRANSFER AGENT: SMTP

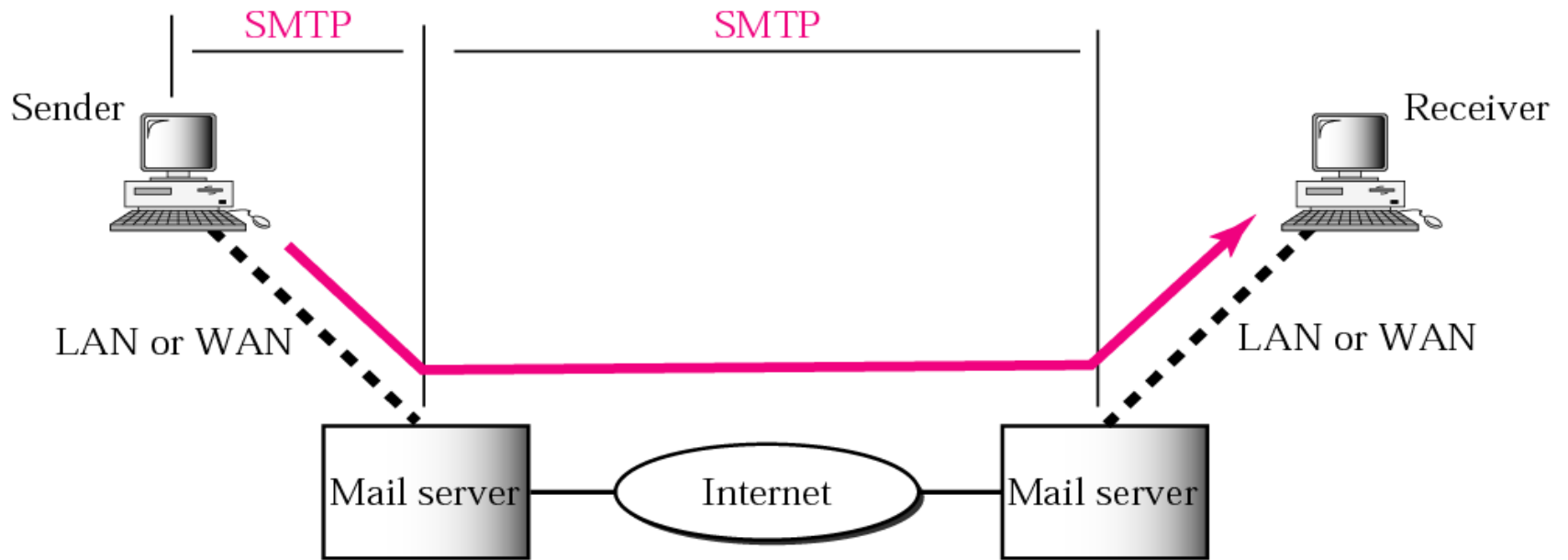
The actual mail transfer requires message transfer agents (MTAs). The protocol that defines the MTA client and server in the Internet is called Simple Mail Transfer Protocol (SMTP).

The topics discussed in this section include:

Commands and Responses

Mail Transfer Phases

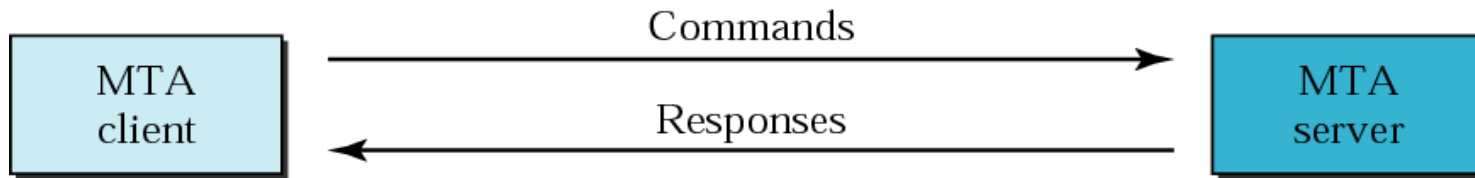
SMTP range



The actual mail transfer is done through message transfer agents. To send mail, a system must have the client MTA, and to receive mail, a system must have a server MTA. The formal protocol that defines the MTA client and server in the Internet is called the Simple Mail Transfer Protocol (SMTP).

Commands and Responses

SMTP uses commands and responses to transfer messages between an MTA client and an MTA server.



Commands are sent from the client to the server . It consists of a keyword followed by zero or more arguments . SMTP defines 14 commands. The first five are mandatory; every implementation must support these five commands. The next three are often used and highly recommended. The last six are seldom used..

Keyword: argument (s)

Commands

<i>Keyword</i>	<i>Argument(s)</i>
HELO	Sender's host name
MAIL FROM	Sender of the message
RCPT TO	Intended recipient of the message
DATA	Body of the mail
QUIT	
RSET	
VERFY	Name of recipient to be verified
NOOP	
TURN	
EXPN	Mailing list to be expanded
HELP	Command name
SEND FROM	Intended recipient of the message
SMOL FROM	Intended recipient of the message
SMAL FROM	Intended recipient of the message

Responses

Responses are sent from the server to the client. A response is a three digit code that may be followed by additional textual information.

<i>Code</i>	<i>Description</i>
Positive Completion Reply	
211	System status or help reply
214	Help message
220	Service ready
221	Service closing transmission channel
250	Request command completed
251	User not local; the message will be forwarded
Positive Intermediate Reply	
354	Start mail input
Transient Negative Completion Reply	
421	Service not available
450	Mailbox not available
451	Command aborted: local error
452	Command aborted; insufficient storage

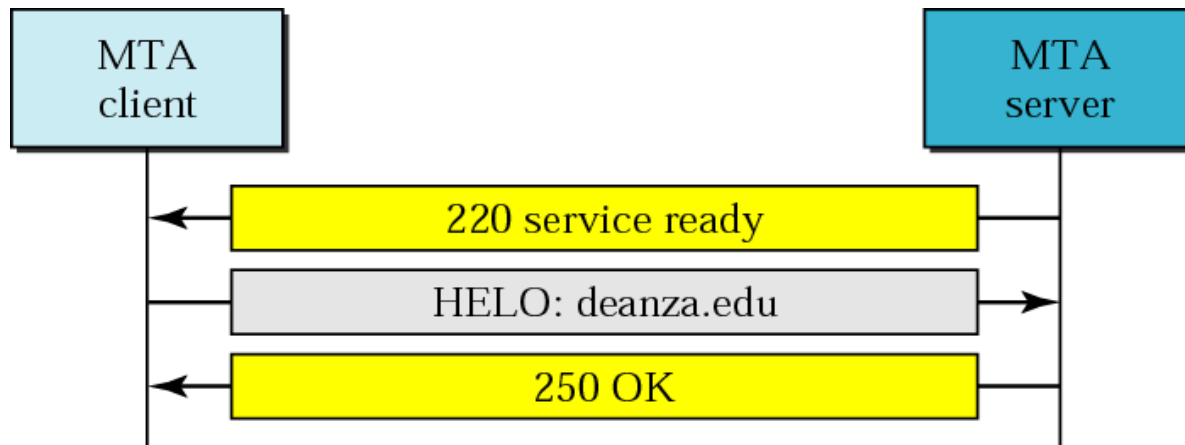
Responses (Continued)

Permanent Negative Completion Reply	
500	Syntax error; unrecognized command
501	Syntax error in parameters or arguments
502	Command not implemented
503	Bad sequence of commands
504	Command temporarily not implemented
550	Command is not executed; mailbox unavailable
551	User not local
552	Requested action aborted; exceeded storage location
553	Requested action not taken; mailbox name not allowed
554	Transaction failed

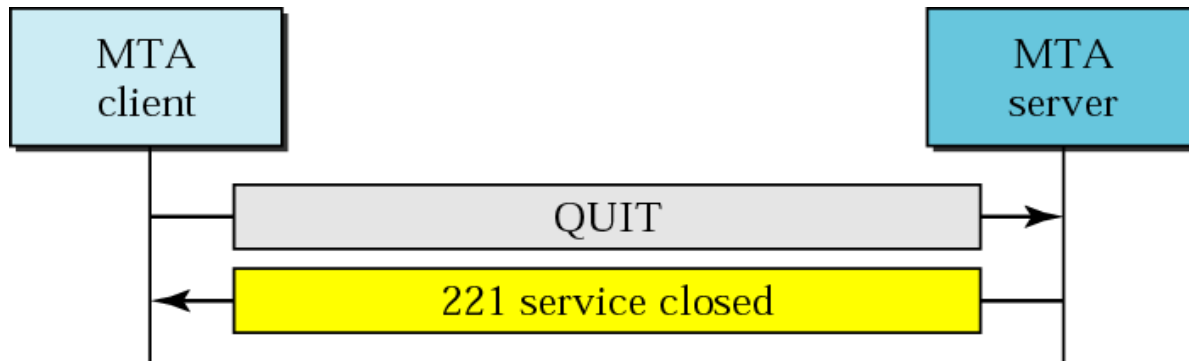
Mail Transfer Phases

- The process of transferring a mail message occurs in three phases:
 - connection establishment
 - mail transfer
 - connection termination.

Connection establishment



Connection termination



SMTP

The SMTP mail system uses the Domain Name System (DNS) to **convert the domain part of an E-mail address to the network address of the machine that maintains the domain,** establishes a communication link with the mail server application on that machine and transfers the message.

Simple Mail Transfer Protocol (SMTP) (contd...)

- SMTP is a simple protocol for mail transfer.

Limitations:

- SMTP can send messages only in NVT 7-bit ASCII format.

E.g.:- it cannot be used for languages that aren't supported by 7-bit ASCII characters (such as French, German, Russian, Chinese, & Japanese).

Also, it cannot be used to send binary files or to send video or audio data.

MESSAGE ACCESS AGENT: POP AND IMAP

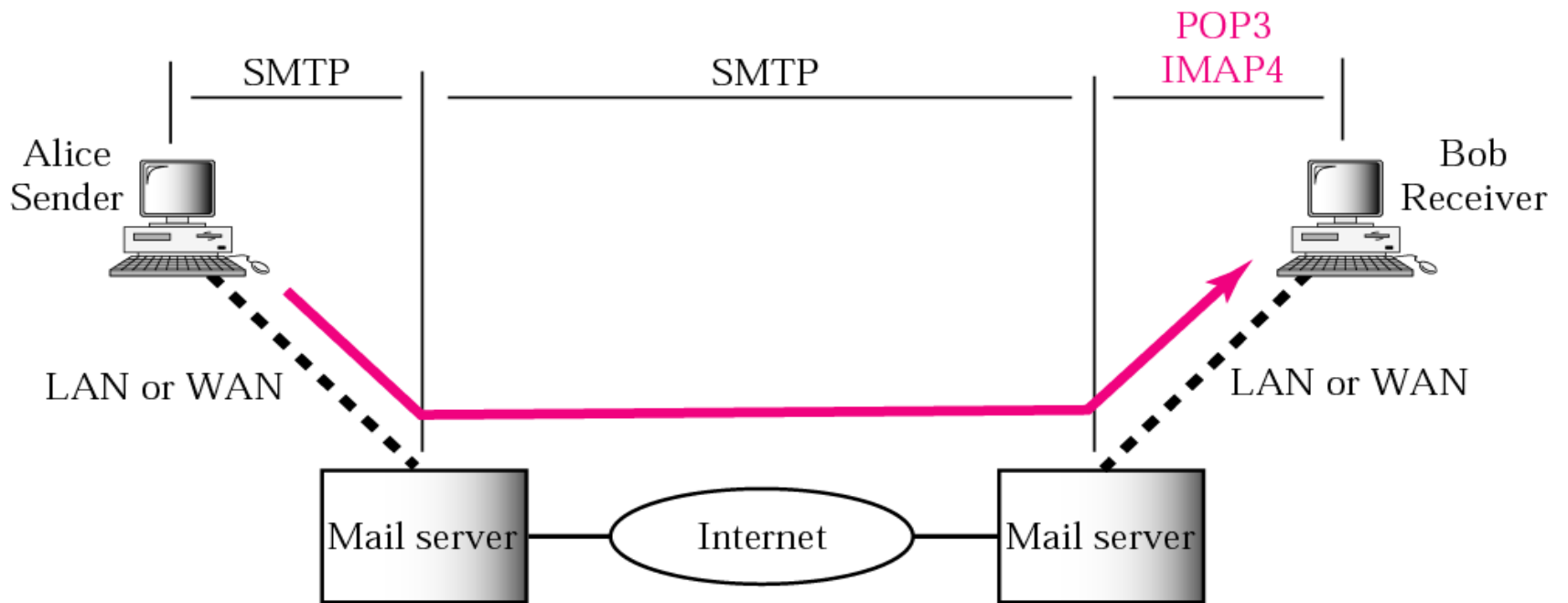
The third stage of mail delivery uses a message access agent; the client must pull messages from the server. Currently two message access protocols are available: Post Office Protocol, version 3 (POP3) and Internet Mail Access Protocol, version 4.

The topics discussed in this section include:

POP3

IMAP4

POP3 and IMAP4



Post Office Protocol

- To collect mail from a mail server, the email client contacts the mail server, and then has to supply an account name and password before the mail server will offer a count of waiting messages for that account.
- Once the email client knows how many messages are waiting, it asks for them one at a time, until all messages are collected.
- After collection, the messages at the mail server will be either deleted or will be marked as being read, depending upon how the email client has been configured.

Post Office Protocol

- There is usually a maximum limit to the number of messages that a mail server will store, both waiting for collection or that have been marked as read.
- Mail is collected from a mail server using the Post Office Protocol (POP), which is currently at version 3.
- A mailbox is sometimes referred to as a POP₃ mailbox, which simply refers to the method of how mail can be collected.

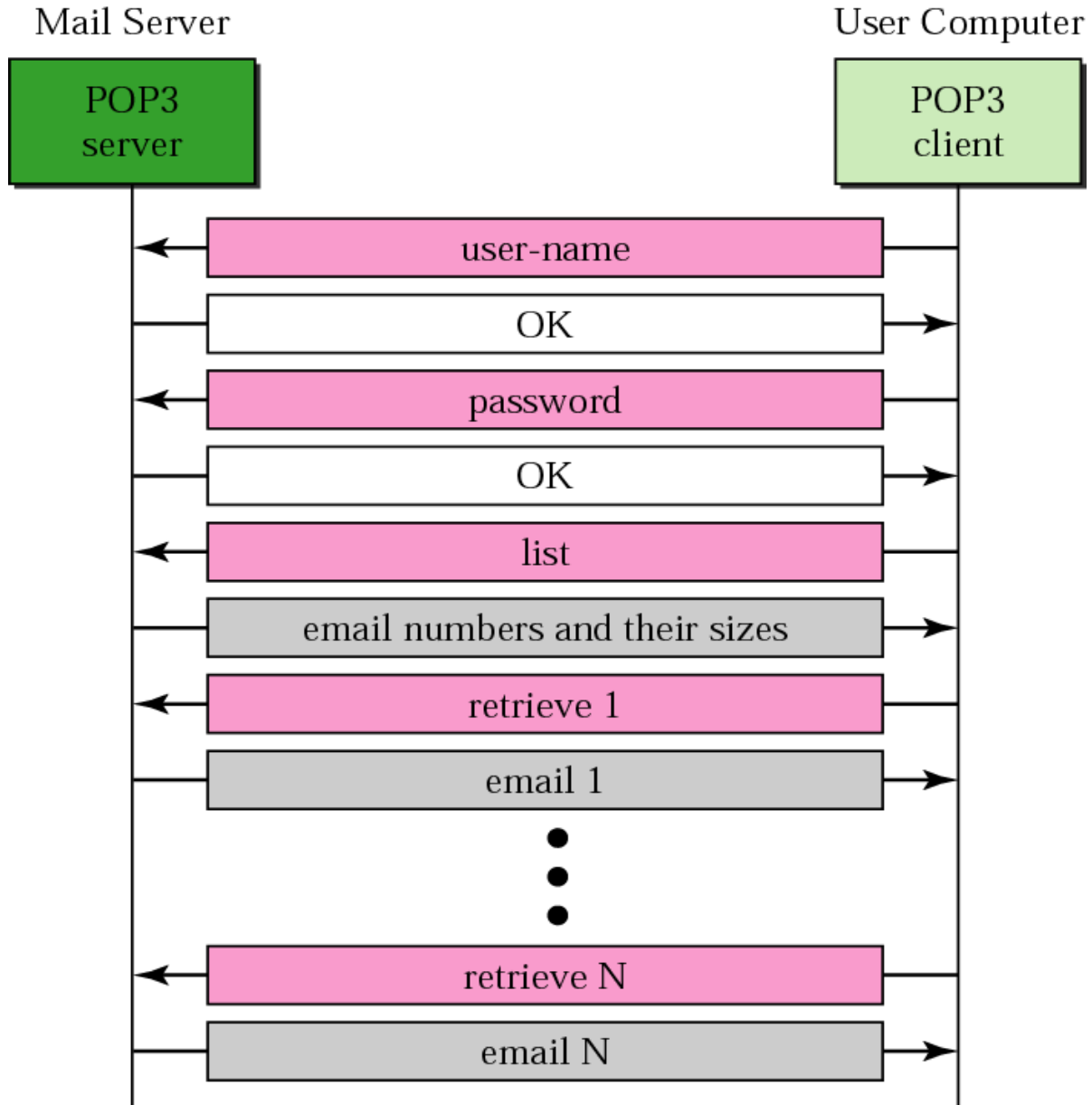
Post Office Protocol

- It can be used to collect mail from any mail server that can be contacted from the client email application.
- POP₃, which initiates the connection to the mail server and therefore can be used from any address, can be used to collect mail through any connection to the Internet.
- In order to collect mail from an account, POP₃ expects an account name and a password to be supplied, before any transactions can be made

Post Office Protocol

- POP, version 3 has Two Modes: The Delete Mode & the Keep Mode.
- Delete Mode: mail is deleted from the mailbox after each retrieval. It is used when the user is working at her permanent location & can save/organize the received mail after reading/replying.
- Keep Mode : mail remains in the mailbox after retrieval. Used when user accesses her mail away from her primary computer. Eg. A Laptop.
- Keeping & deleting modes only comes in action when we want to use an option of keeping & deleting of Junk mails, spam, viruses, email messages.

POP3



Limitations of POP

POP₃ is deficient in several ways.

- It does not allow the user to organize her mail on the server; the user cannot have different folders on the server. (Of course, the user can create folders on her own computer.)
- POP₃ does not allow the user to partially check the contents of the mail before downloading.

IMAP₄

Internet Mail Access Protocol, version 4 (IMAP₄) is similar to POP₃, but it has more features; IMAP₄ is **more powerful and more complex** . IMAP₄ provides the following extra functions:

- A user can check the e-mail header prior to downloading.
- A user can search the contents of the e-mail for a specific string of characters prior to downloading.

IMAP4

- A user can partially download e-mail. This is especially useful if bandwidth is limited and the e-mail contains multimedia with high bandwidth requirements.
- A user can create, delete, or rename mailboxes on the mail server.
- A user can create a hierarchy of mailboxes in a folder for e-mail storage

File Transfer Protocol

- When you want to copy files between two computers that are on the same local network, often you can simply "share" a drive or folder, and copy the files the same way you would copy files from one place to another on your own PC.
- *What if you want to copy files from one computer to another that is halfway around the world?*

File Transfer Protocol

- You would probably use your Internet connection.
- However, for security reasons, it is very uncommon to share folders over the Internet.
- File transfers over the Internet use special techniques, of which one of the oldest and most widely-used is FTP.
- **FTP**, short for "**File Transfer Protocol**," can transfer files between any computers that have an Internet connection.

File Transfer Protocol

- Transferring files from a client computer to a server computer is called **"uploading"** and transferring from a server to a client is **"downloading"**.
- FTP is the standard mechanism provided by TCP/IP for copying a file from one host to another.

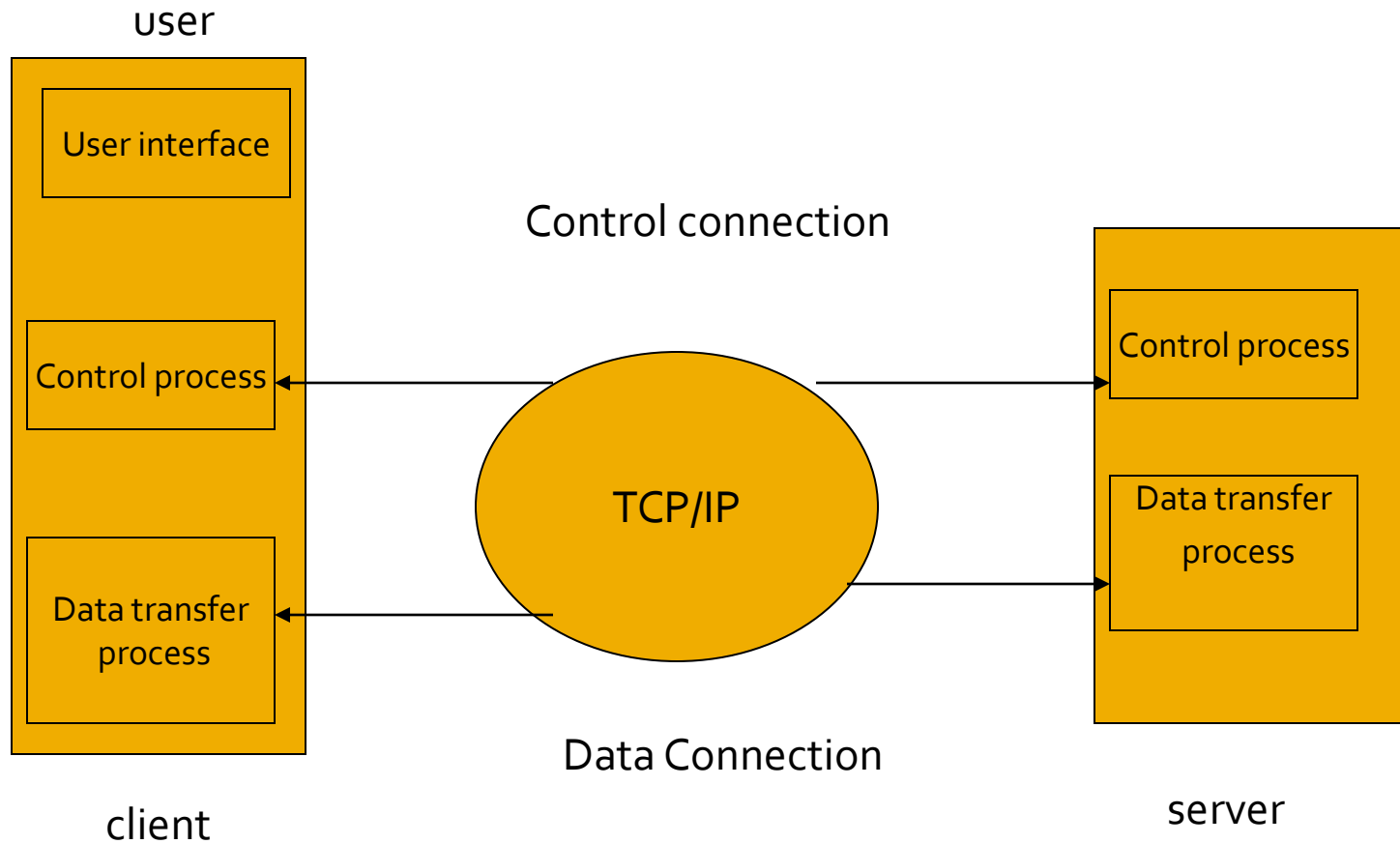
Problems in File Transfer

- Although transferring files from one system to another seems simple & straight-forward, some problems must be dealt with first.
- E.g.,
 - 2 systems may use different file name conventions.
 - 2 systems may have different ways to represent text & data.
 - 2 systems may have different directory structures.
- **All of these problems have been solved by FTP in a very simple & elegant approach.**

TCP connections for FTP

- FTP establishes two connections between the hosts
 - One is for data transfer
 - Other is for control information
- Control connection is made between control processes
- Data connection is made between data transfer processes
- Control connection remains connected during the entire interactive FTP session
- Data Connection is opened and closed for each file transferred. It is opened when control connection gives the command for file transfer and closes once the file is transferred

TCP connections for FTP



TCP connections for FTP

- FTP uses the services of TCP. It needs two TCP connection.
- The well known **port 21** is used for control connection and **port 20** is for data connection

HyperText Transfer Protocol (HTTP)

- The HTTP is a protocol used mainly to access data on the www.
- The protocol transfers data in the form of plain text, hypertext, audio, video, and so on.
- However, it is called the HTTP because its efficiency allows its use in a hypertext environment where there are rapid jumps from one document to another.

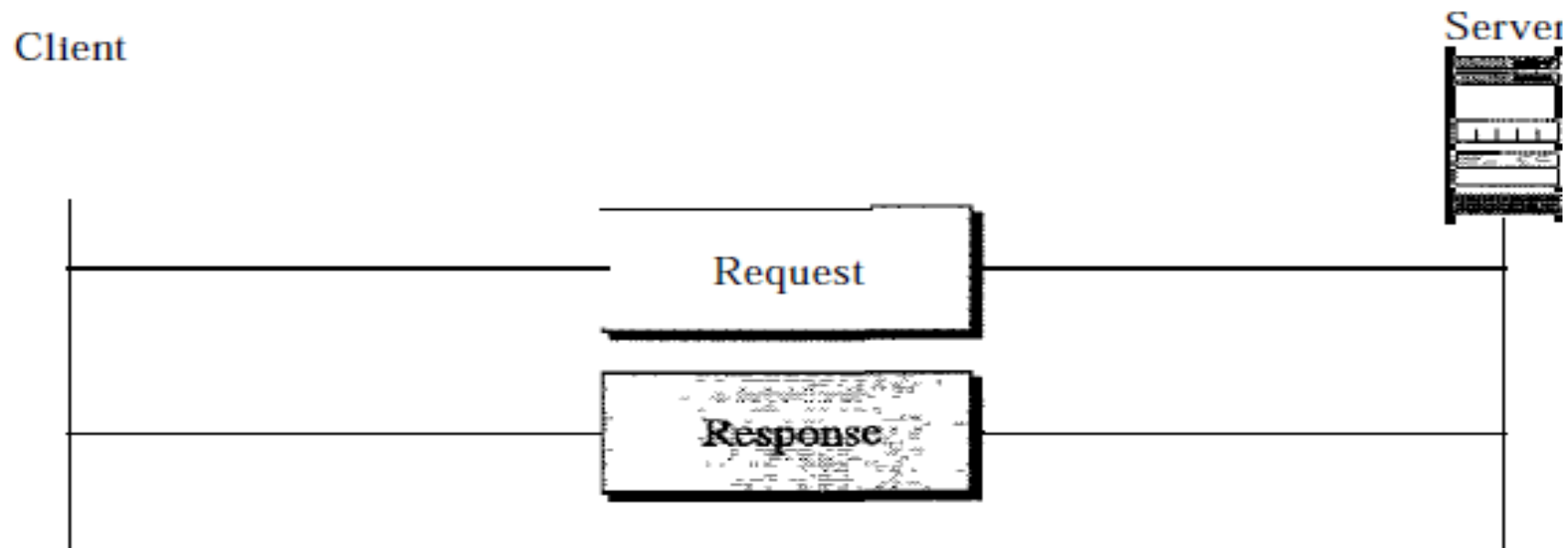
Hyper Text Transfer Protocol (HTTP)

- HTTP functions as a combination of FTP & SMTP.
- It is similar to FTP because it transfers files & uses the services of TCP.
- HTTP is like SMTP because the data transferred b/w the client & the server look like SMTP messages.
- In addition, the format of the messages is controlled by MIME- like headers.

HTTP TRANSACTION

- A client sends a request, which looks like mail, to the server. The server sends the response, which looks like a mail reply to the client . The request & response messages carry data in the form of a letter with MIME-like format
- The client initializes the transaction by sending a request message. The server replies by sending a response.

HTTP TRANSACTION



HTTP MESSAGES

- There are 2 types of HTTP messages:
 - Request
 - Response
- **Request Messages-** consists of a request line, headers, & sometimes a body.
- **Response Messages-** consists of a status line, headers, & sometimes a body.

URL

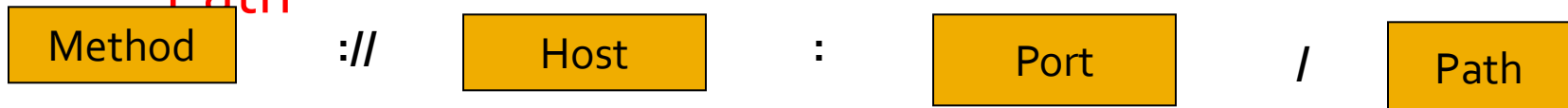
- **Uniform Resource Locator**

- A client that wants to access a document needs an address. To facilitate the access of documents distributed throughout the world, HTTP uses the concept of locators.

- The URL is a standard for specifying any kind of information on the internet.

The URL defines 4 things:

- Method
- Host computer
- Port
- Path



APPLICATIONS

- Application layer protocols are used to give an application interface to the user to transmit different type of data over the networks.
- SMTP is used to transfer mails from one server to another.
- IMAP and POP are used to extract the mails from mail server.
- FTP is used to transfer files to remote computer.
- HTTP is used to transmit hypertext over networks from client to server and also from server to client.

Scope of Research

- Securing FTP using Secure Socket Layer