SNS COLLEGE OF ENGINEERING

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Department of Information Technology

Course Name – 23ITT204 Computer Networks

II Year / III Semester

Unit 1 – Introduction and Application Layer

Topic 8 – E-mail and its Protocols

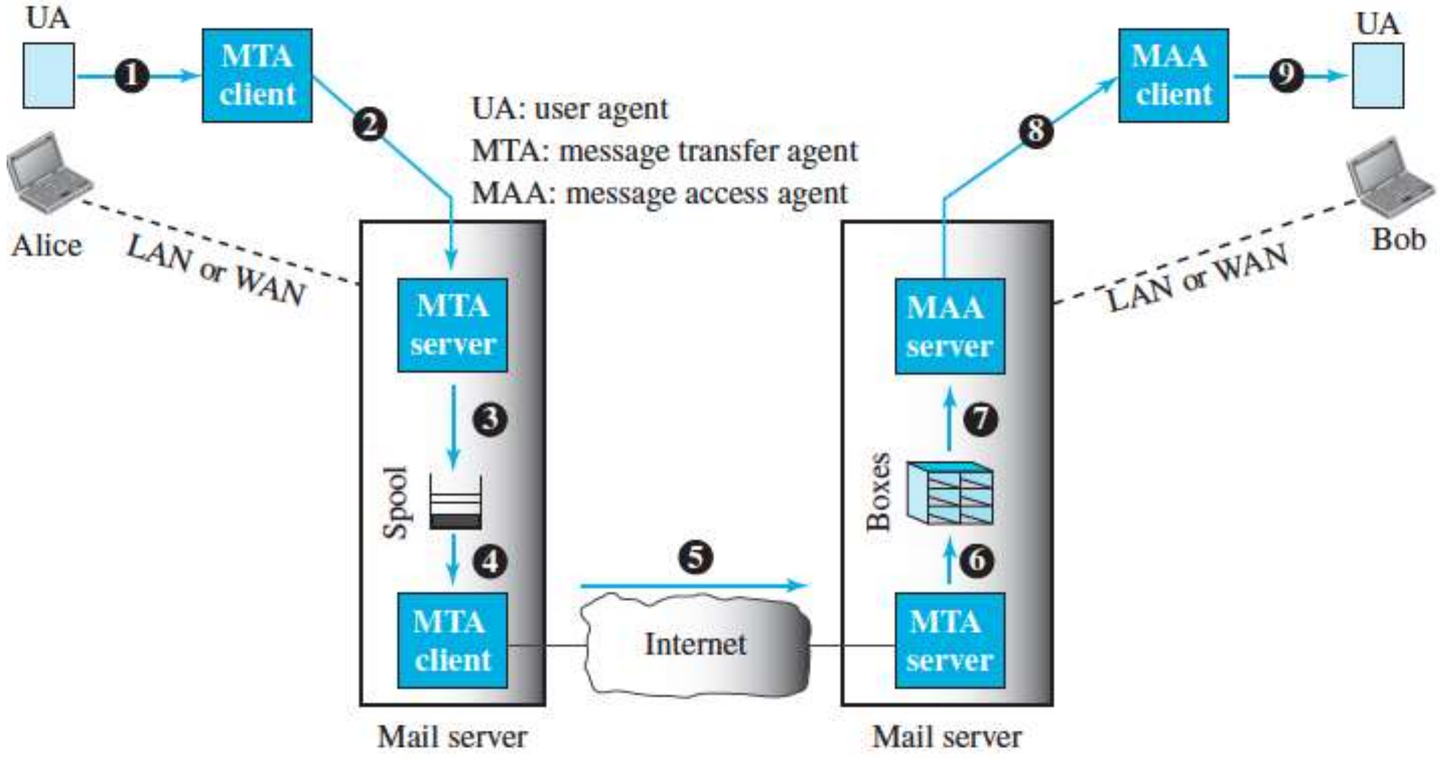
E-Mail

Electronic mail (or e-mail) allows users to exchange messages

Architecture

Three Agents in Email

- A user agent (UA),
- A message transfer agent (MTA), and
- A message access agent (MAA).



E-Mail

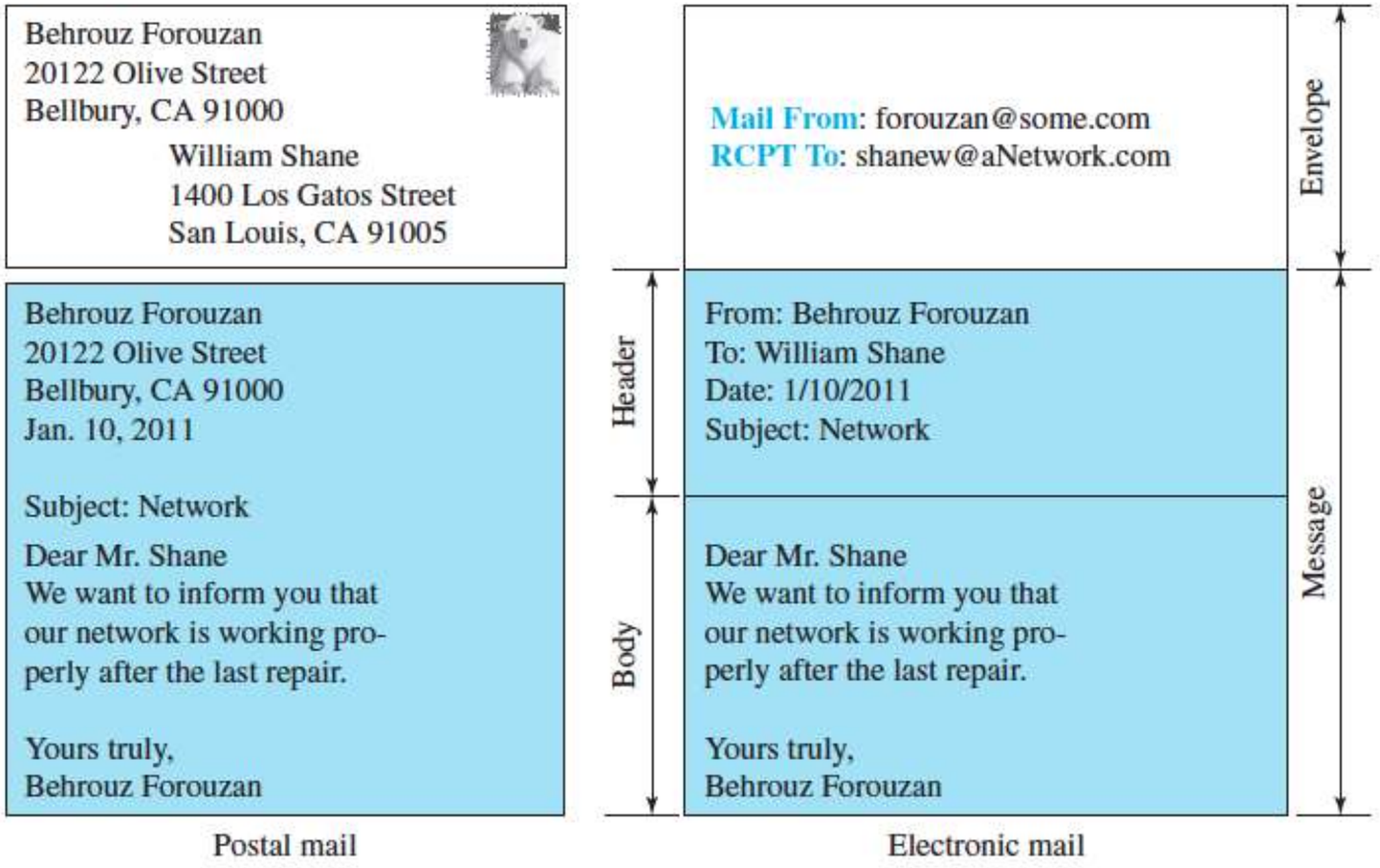
User Agent

- A user agent is a software package (program) that composes, reads, replies to, and forwards messages.
- It also handles local mailboxes on the user computers.
- There are two types of user agents: **command-driven and GUI-based**.
- Command driven user agents belong to the early days of electronic mail.
- Modern user agents are GUI-based. They contain graphical user interface (GUI) components that allow the user to interact with the software by using both the keyboard and the mouse.

Example
Outlook, Eudora, Mail

E-Mail

Format of Email



It has an **envelope and a message**

The envelope contains the **sender address, the receiver address, and other information.**

Message contains the **header and the body.**

The header of the message defines the **sender, the receiver, the subject of the message**, and some other information.

The body of the message contains the actual information to be read by the recipient.

E-Mail

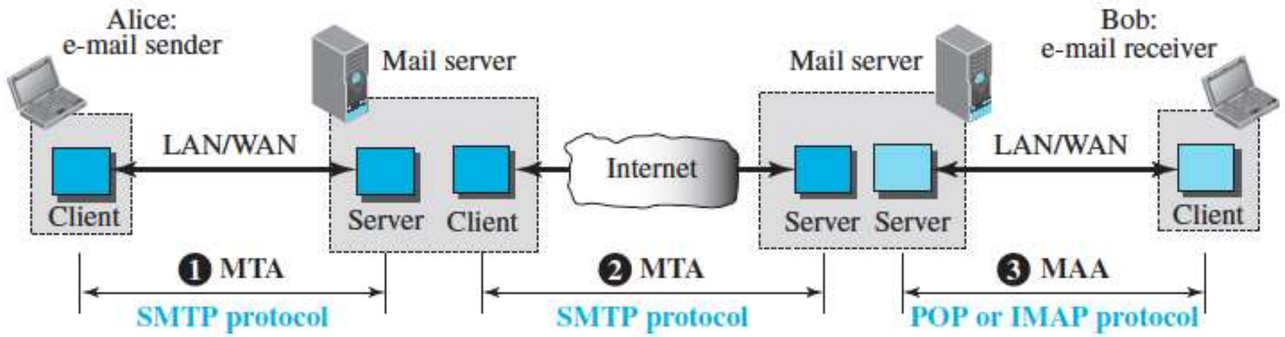
Address Format

- In the Internet, the address consists of two parts: **a local part and a domain name**, separated by an @ sign.
- The local part defines the name of a special file, called the user mailbox, where all the mail received for a user is stored for retrieval by the message access agent.
- An organization usually selects one or more hosts to receive and send e-mail; they are sometimes called mail servers or exchangers.
- The domain name assigned to each mail exchanger either comes from the DNS database or is a logical name.

E-Mail - SMTP

Message Transfer Agent: SMTP

- The formal protocol that defines the MTA client and server in the Internet is called Simple Mail Transfer Protocol (SMTP).
- SMTP is used two times, between the sender and the sender's mail server and between the two mail servers.
- SMTP simply defines how commands and responses must be sent back and forth.
- SMTP uses TCP connection on port 25 to forward the entire message and store at intermediate mail servers/mail gateways until it reaches the recipient mail server



E-Mail - SMTP

Message Transfer Agent: SMTP
Commands and Responses

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

- The command is from an MTA client to an MTA server; the response is from an MTA server to the MTA client.

- SMTP defines 14 commands

Keyword	*Argument(s)*	*Description*
HELO	Sender's host name	Identifies itself
MAIL FROM	Sender of the message	Identifies the sender of the message
RCPT TO	Intended recipient	Identifies the recipient of the message
DATA	Body of the mail	Sends the actual message
QUIT		Terminates the message
RSET		Aborts the current mail transaction
VRFY	Name of recipient	Verifies the address of the recipient
NOOP		Checks the status of the recipient
TURN		Switches the sender and the recipient
EXPN	Mailing list	Asks the recipient to expand the mailing list
HELP	Command name	Asks the recipient to send information about the command sent as the argument
SEND FROM	Intended recipient	Specifies that the mail be delivered only to the terminal of the recipient, and not to the mailbox
SMOL FROM	Intended recipient	Specifies that the mail be delivered to the terminal *or* the mailbox of the recipient
SMAL FROM	Intended recipient	Specifies that the mail be delivered to the terminal *and* the mailbox of the recipient

E-Mail - SMTP

Message Transfer Agent: SMTP

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.

Code	*Description*
	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
	Permanent Negative Completion Reply
500	Syntax error; unrecognized command

Code	*Description*
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

E-Mail - SMTP

Message Transfer Agent: SMTP

Mail Transfer Phases

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

Connection Establishment

After a client has made a TCP connection to the wellknown port 25, the SMTP server starts the connection phase.

This phase involves the following three steps:

1. The server sends code 220 (service ready) to tell the client that it is ready to receive mail. If the server is not ready, it sends code 421 (service not available).
2. The client sends the HELO message to identify itself, using its domain name address. This step is necessary to inform the server of the domain name of the client.
3. The server responds with code 250 (request command completed) or some other code depending on the situation.

E-Mail

Message Transfer Agent: SMTP

Message Transfer

After connection has been established between the SMTP client and server, a single message between a sender and one or more recipients can be exchanged.

This phase involves eight steps.

1. The client sends the MAIL FROM message to introduce the sender of the message. It includes the mail address of the sender (mailbox and the domain name).
2. The server responds with code 250 or some other appropriate code.
3. The client sends the RCPT TO (recipient) message, which includes the mail address of the recipient.
4. The server responds with code 250 or some other appropriate code.
5. The client sends the DATA message to initialize the message transfer.
6. The server responds with code 354 (start mail input) or some other appropriate message.
7. The client sends the contents of the message in consecutive lines. Each line is terminated by a two-character end-of-line token (carriage return and line feed). The message is terminated by a line containing just one period.
8. The server responds with code 250 (OK) or some other appropriate code.

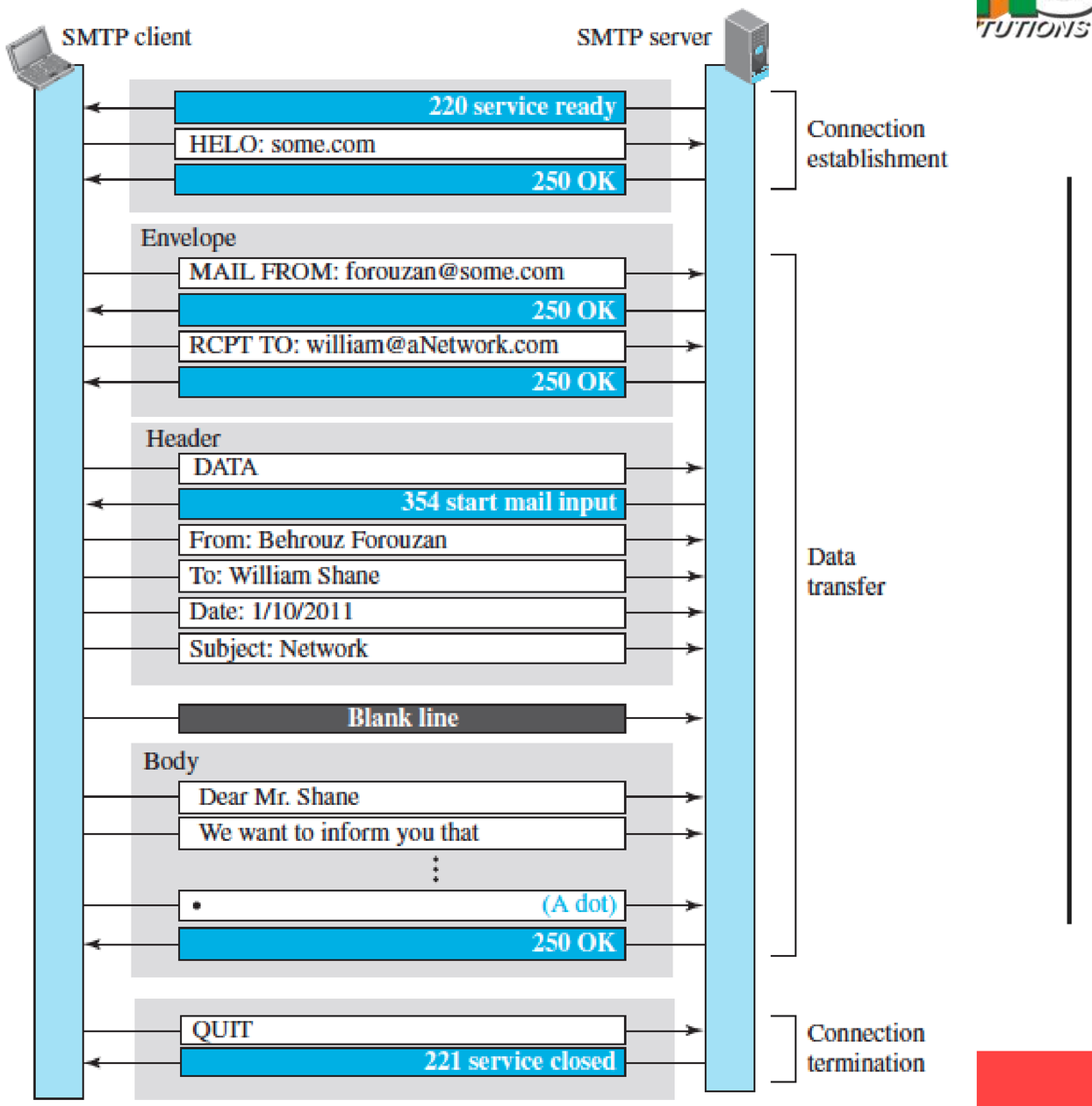
E-Mail

Message Transfer Agent: SMTP

Connection Termination

After the message is transferred successfully, the client terminates the connection. This phase involves two steps.

1. The client sends the QUIT command.
2. The server responds with code 221 or some other appropriate code.



E-Mail – POP - IMAP

Message Access Agent: POP and IMAP

MAA or mail reader allows user to retrieve messages from the mailbox, so that user can perform actions such as reply, forwarding, etc.

Currently two message access protocols are available:

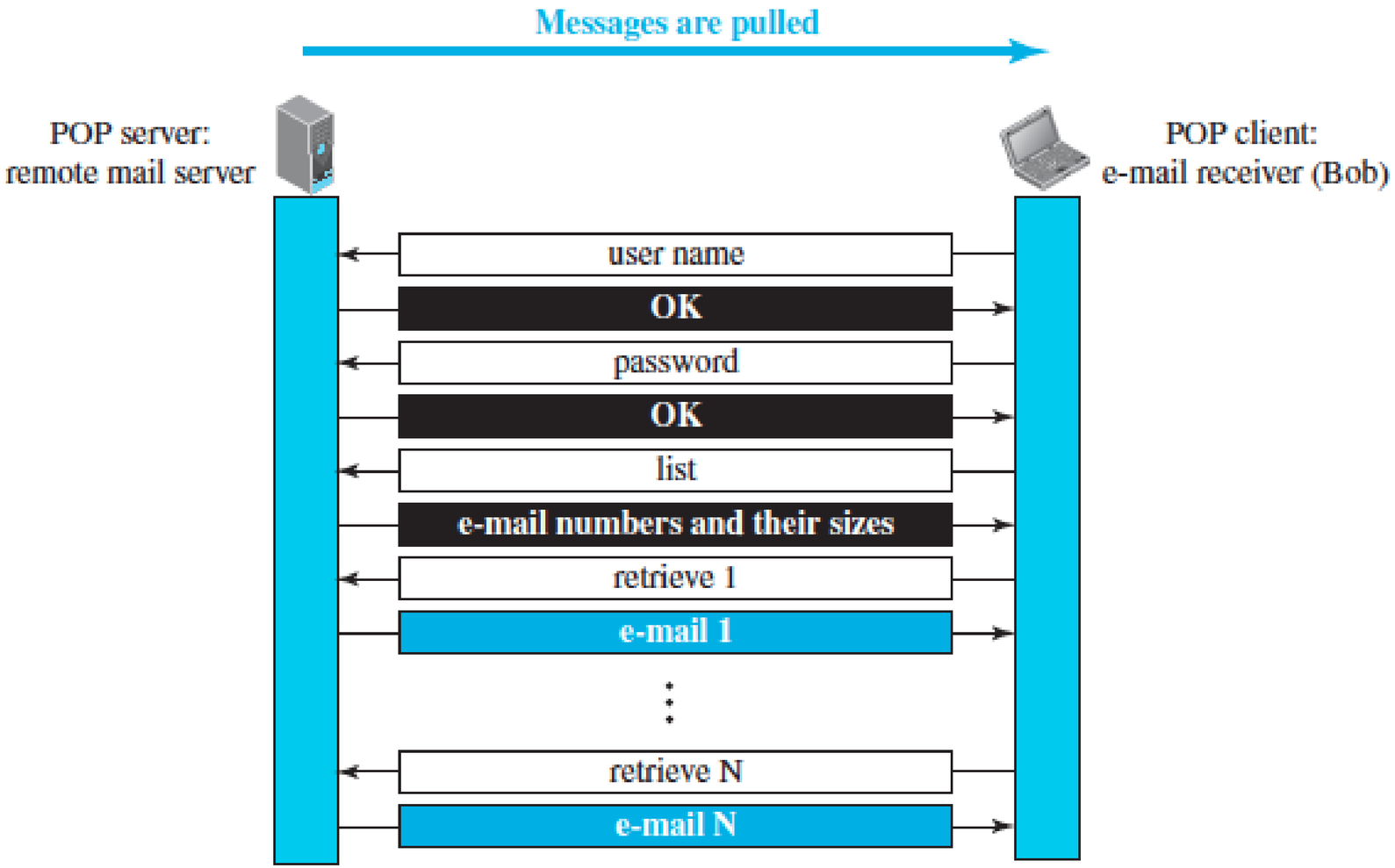
1. Post Office Protocol, version 3 (POP3) and
2. Internet Mail Access Protocol, version 4 (IMAP4).

POP3

- Post Office Protocol, version 3 (POP3) is simple but limited in functionality.
- The client POP3 software is installed on the recipient computer; the server POP3 software is installed on the mail server.
- Mail access starts with the client when the user needs to download its e-mail from the mailbox on the mail server. The client opens a connection to the server on **TCP port 110**.
- It then sends its user name and password to access the mailbox. The user can then list and retrieve the mail messages, one by one.
- POP3 has two modes: **the delete mode and the keep mode.**
- In **the delete mode**, the mail is deleted from the mailbox after each retrieval.
- In **the keep mode**, the mail remains in the mailbox after retrieval.

E-Mail – POP

MAA -POP3



E-Mail – IMAP

IMAP4

- Another mail access protocol is Internet Mail Access Protocol, version 4 (IMAP4) .
- IMAP4 is similar to POP3, but it has more features; IMAP4 is more powerful and more complex.

Limitations of POP3

- It does not allow the user to organize her mail on the server; the user cannot have different folders on the server.
- In addition, POP3 does not allow the user to partially check the contents of the mail before downloading.

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.
- 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.

E-Mail – MIME

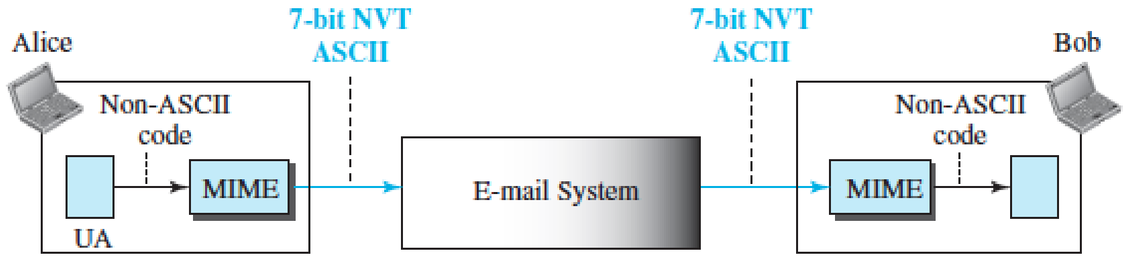
Electronic mail has a simple structure. Its simplicity, however, comes with a price.

Limitations of E-Mail

- It can send messages only in NVT 7-bit ASCII format.
- It cannot be used for languages other than English (such as French, German, Hebrew, Russian, Chinese, and Japanese).
- Also, it cannot be used to send binary files or video or audio data.

MIME

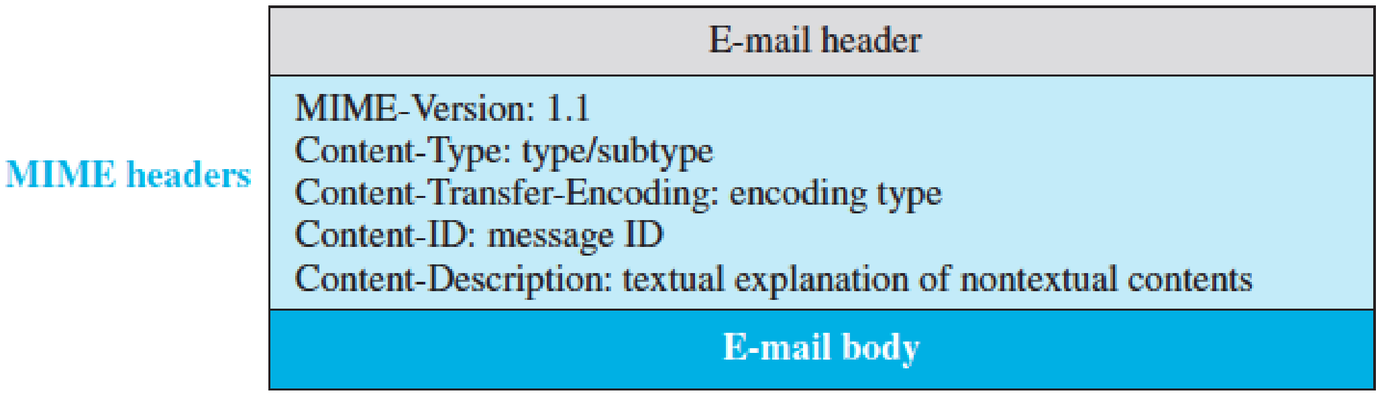
- Multipurpose Internet Mail Extensions (MIME) is a supplementary protocol that allows non-ASCII data to be sent through e-mail.
- MIME transforms non-ASCII data at the sender site to NVT ASCII data and delivers it to the client MTA to be sent through the Internet.
- The message at the receiving site is transformed back to the original data.



E-Mail – MIME

MIME Headers

MIME defines five header



MIME-Version - This header defines the version of MIME used. The current version is 1.1.

Content-Type - This header defines the type of data used in the body of the message.
The content type and the content subtype are separated by a slash. Depending on the subtype, the header may contain other parameters. MIME allows seven different types of data.

E-Mail – MIME

MIME – Content Type

Type	*Subtype*	*Description*
Text	Plain	Unformatted
	HTML	HTML format (see Appendix C)
Multipart	Mixed	Body contains ordered parts of different data types
	Parallel	Same as above, but no order
	Digest	Similar to Mixed, but the default is message/RFC822
	Alternative	Parts are different versions of the same message
Message	RFC822	Body is an encapsulated message
	Partial	Body is a fragment of a bigger message
	External-Body	Body is a reference to another message
Image	JPEG	Image is in JPEG format
	GIF	Image is in GIF format
Video	MPEG	Video is in MPEG format
Audio	Basic	Single channel encoding of voice at 8 KHz
Application	PostScript	Adobe PostScript
	Octet-stream	General binary data (eight-bit bytes)

E-Mail – MIME

Content-Transfer-Encoding

This header defines the method used to encode the messages into 0s and 1s for transport.
The five types of encoding methods are

Type	*Description*
7-bit	NVT ASCII characters with each line less than 1000 characters
8-bit	Non-ASCII characters with each line less than 1000 characters
Binary	Non-ASCII characters with unlimited-length lines
Base64	6-bit blocks of data encoded into 8-bit ASCII characters
Quoted-printable	Non-ASCII characters encoded as an equal sign plus an ASCII code

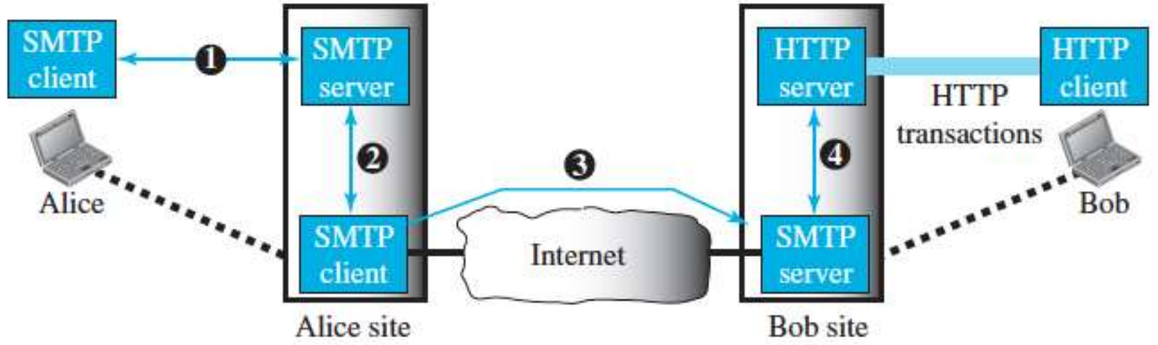
Content-ID - This header uniquely identifies the whole message in a multiple message environment.

Content-Description - This header defines whether the body is image, audio, or video.

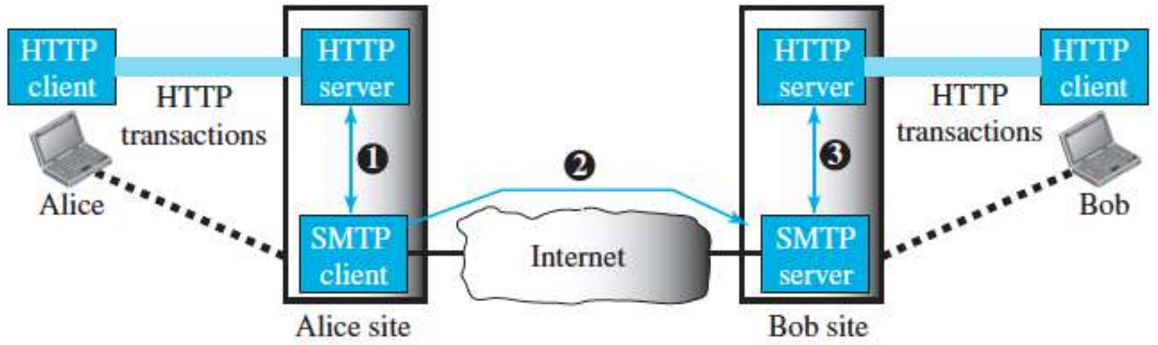
E-Mail – Web Based Mail

Web-Based Mail

E-mail is such a common application that some websites today provide this service to anyone who accesses the site. Three common sites are Hotmail, Yahoo, and Google mail.



Case 1: Only receiver uses HTTP



Case 2: Both sender and receiver use HTTP

E-Mail Security

E-Mail Security

E-mail exchanges can be secured using two application-layer securities designed in particular for e-mail systems.

Two of these protocols**, Pretty Good Privacy (PGP)** and **Secure/Multipurpose Internet Mail Extensions (S/MIME).**

THANK YOU