CS321: Computer Networks

ELECTRONIC MAIL

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Electronic mail (E-mail)

- It allows users to exchange messages.

- In HTTP or FTP, the server program is running all the time, waiting for a request from a client. When the request arrives, the server provides the service.

- In E-mail, the scenario is different:
  - e-mail is considered a one-way transaction. Sender may expect a response, but this is not a mandate.
  - it is neither feasible nor logical for the receiver to run a server program and wait until someone sends an e-mail to him.
  - the idea of client/server programming should be implemented in another way: using some intermediate servers.
  - both the end users run only client programs when they want and the intermediate servers apply the client/server paradigm

Architecture

UA: user agent
MTA: message transfer agent
MAA: message access agent
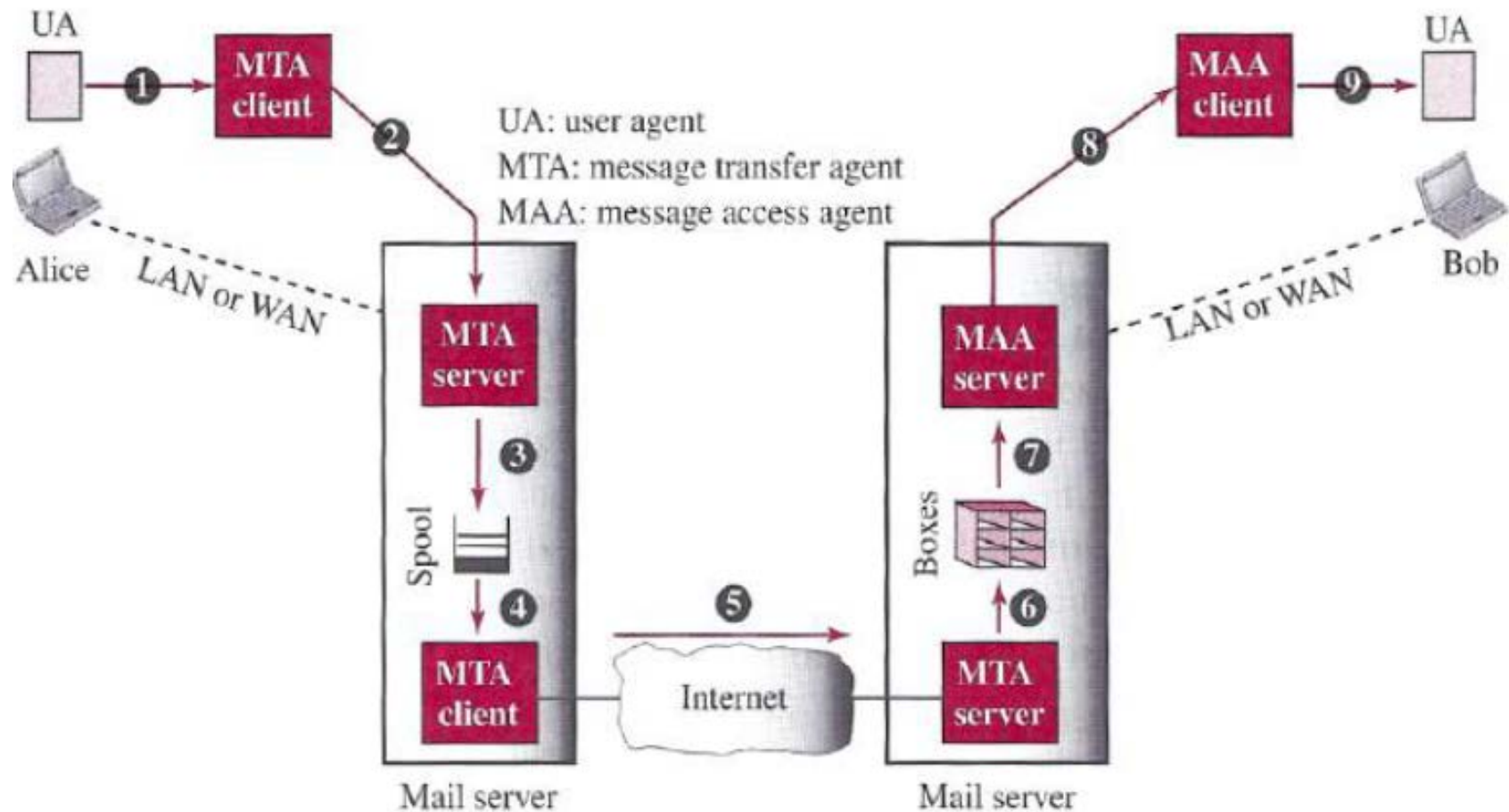
Cont…

- In the example, the sender and the receiver of the e-mail, Alice and Bob respectively, are connected via a LAN or a WAN to two mail servers.

- The administrator has created one mailbox for each user where the received messages are stored.

- The administrator has also created a queue (spool) to store messages waiting to be sent.

- Alice and Bob use three different agents:
  - a user agent (UA),
  - a message transfer agent (MTA),
  - a message access agent (MAA).

Cont…

1) When Alice needs to send a message to Bob, she runs a UA program to prepare the message and send it to her mail server.

2) The mail server at her site uses a queue (spool) to store messages waiting to be sent.

3) The message, however, needs to be sent through the Internet from Alice's site to Bob's site using an MTA.
   – Here two MTAs are needed: one client and one server.
   – the server needs to run all the time because it does not know when a client will ask for a connection.
   – The client, on the other hand, can be triggered by the system when there is a message in the queue to be sent.

4) Bob uses an MAA client to retrieve the message from an MAA server running on its mail server.

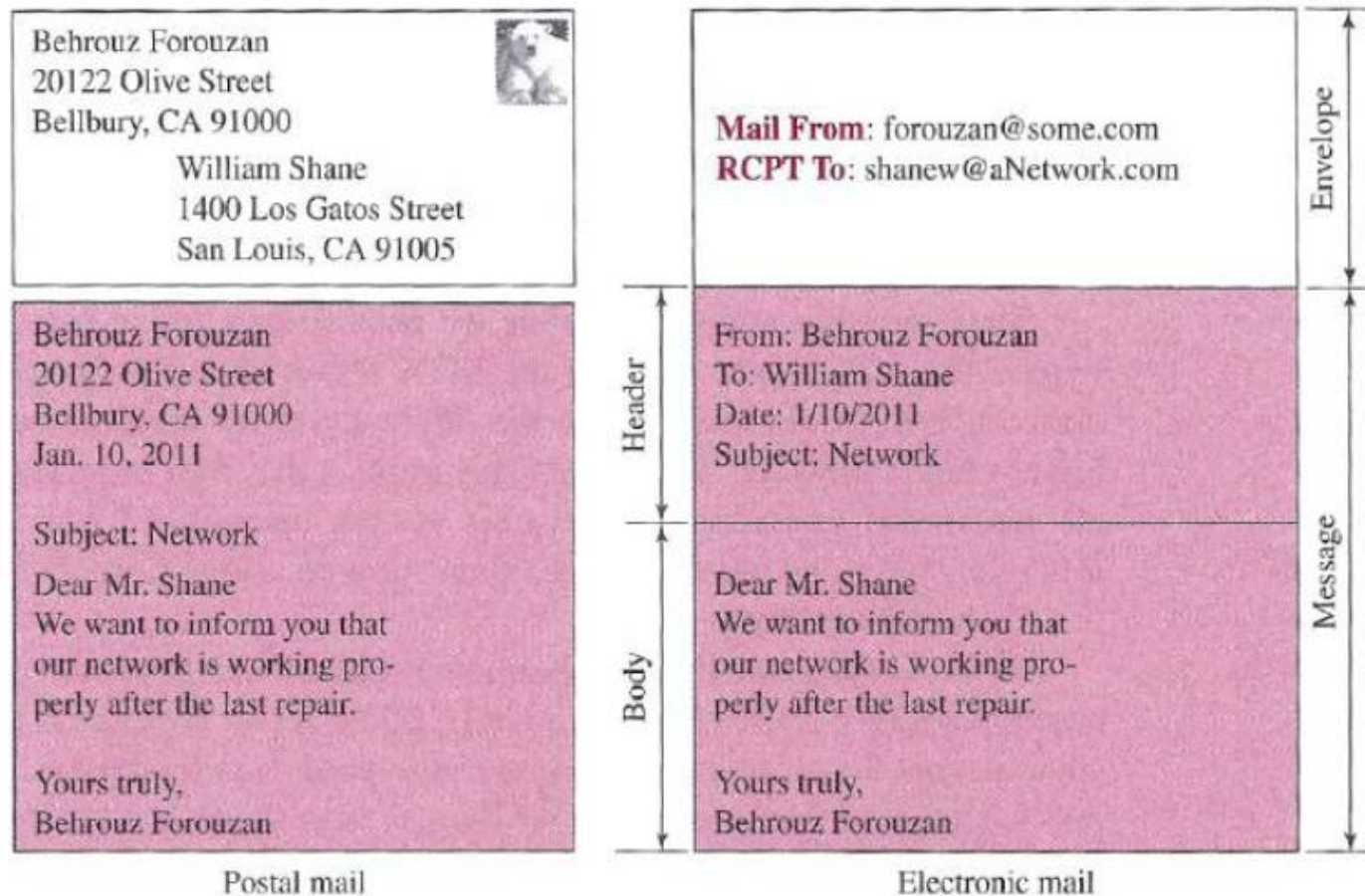5) The UA program at the Bob site allows Bob to read the received message

Cont…

- Two important points:
  - Bob cannot bypass the mail server and use the MTA server directly. To use the MTA server directly, Bob would need to run the MTA server all the time because he does not know when a message will arrive.
  - Bob needs another pair of client-server programs: message access programs. This is because an MTA client-server program is a *push* program. Bob needs a *pull* program.

- So, the e-mail system needs two UAs, two pairs of MTAs (client and server), and a pair of MAAs (client and server).

User Agent (UA)

- It provides service to the user to make the process of sending and receiving a message easier.

- 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 : e.g., *mail, pine,* and *elm*
  - GUI-based : e.g., *Eudora, Outlook*

Cont…

- To **send mail**, the user, through the UA, creates mail that looks very similar to postal mail.

Behrouz Forouzan
20122 Olive Street
Bellbury, CA 91000

William Shane
1400 Los Gatos Street
San Louis, CA 91005

Behrouz Forouzan
20122 Olive Street
Bellbury, CA 91000
Jan. 10, 2011

Subject: Network

Dear Mr. Shane
We want to inform you that
our network is working pro-
perly after the last repair.

Yours truly,
Behrouz Forouzan

Postal mail

Mail From: forouzan@some.com
RCPT To: shanew@aNetwork.com

From: Behrouz Forouzan
To: William Shane
Date: 1/10/2011
Subject: Network

Dear Mr. Shane
We want to inform you that
our network is working pro-
perly after the last repair.

Yours truly,
Behrouz Forouzan

Electronic mail

Envelope

Header

Body

Message

Cont…

- The UA is triggered by the user (or a timer).
- If a user has mail, the UA informs the user with a notice.
- If the user is ready to read the mail, a list is displayed.
- The user can select any of the messages and display its contents on the screen.

- To deliver mail, a mail handling system must use an addressing system with unique addresses.

Local part	@	Domain name
Mailbox address of the recipient		The domain name of the mail server

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 sender's mail server
  - Between the two mail servers
- POP or IMAP is used between the receiver and receiver's mail server
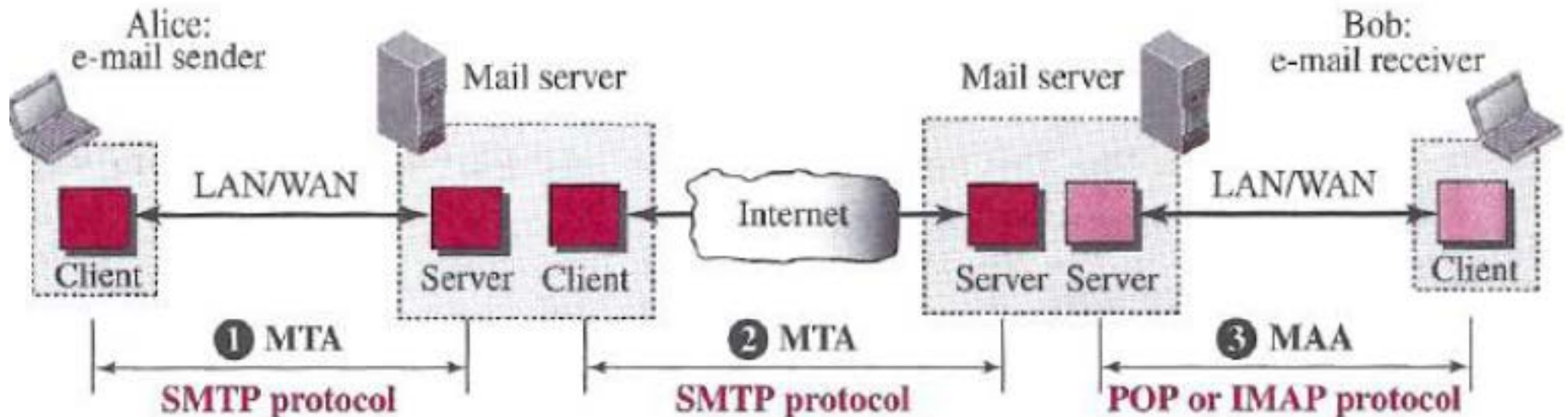
Cont...

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

Table 26.6 *SMTP 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

Table 26.7 *Responses*

Code	Description
	Positive Completion Reply
211	System status or help reply
214	Help message
220	Service ready
221	Service closing transmission channel

Mail Transfer Phases

- The process of transferring a mail message occurs in three phases:
  - connection establishment,
  - mail transfer,
  - connection termination.
- After a client has made a TCP connection to the well-known port 25, the SMTP protocol starts its connection phase.
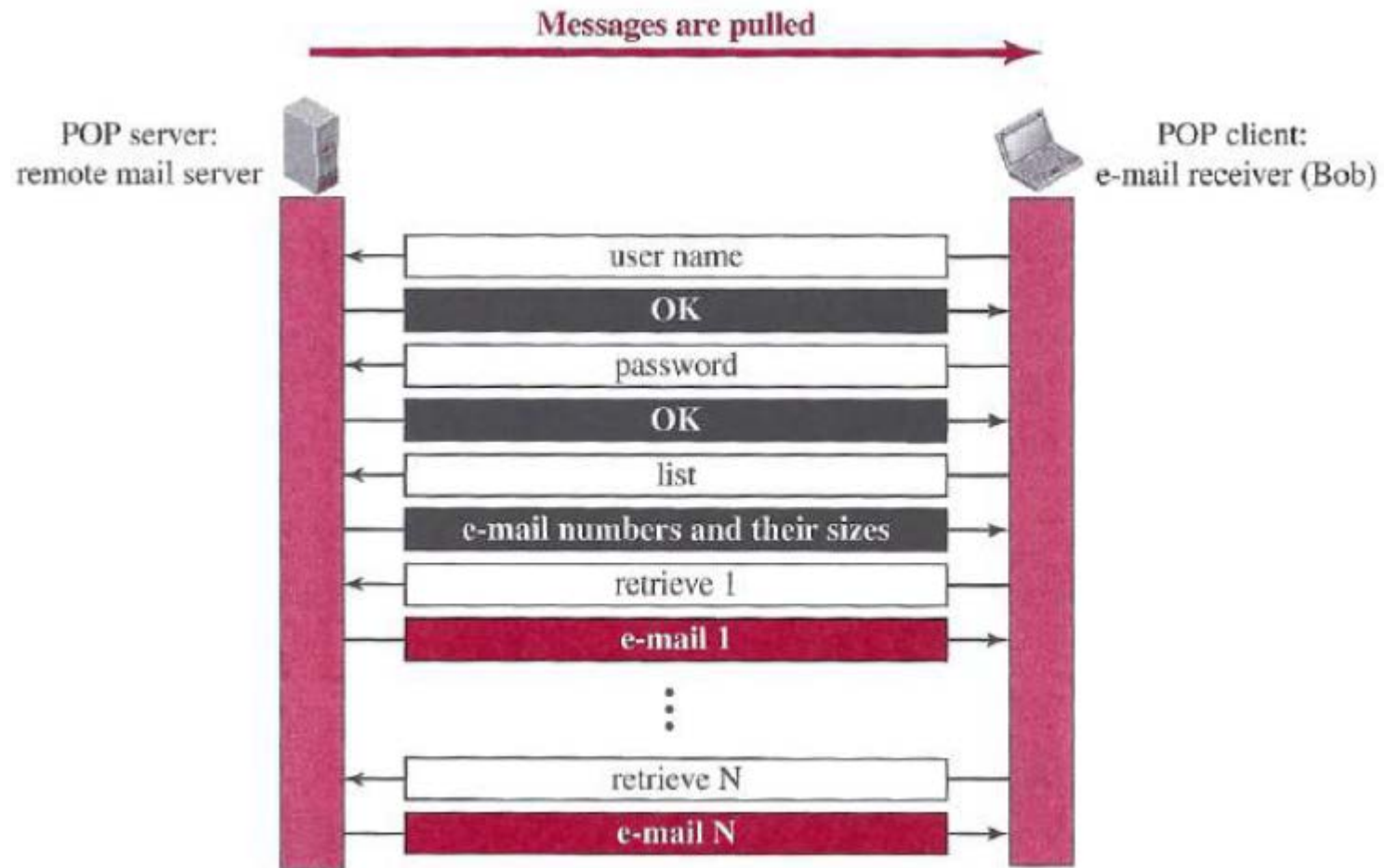
Cont…
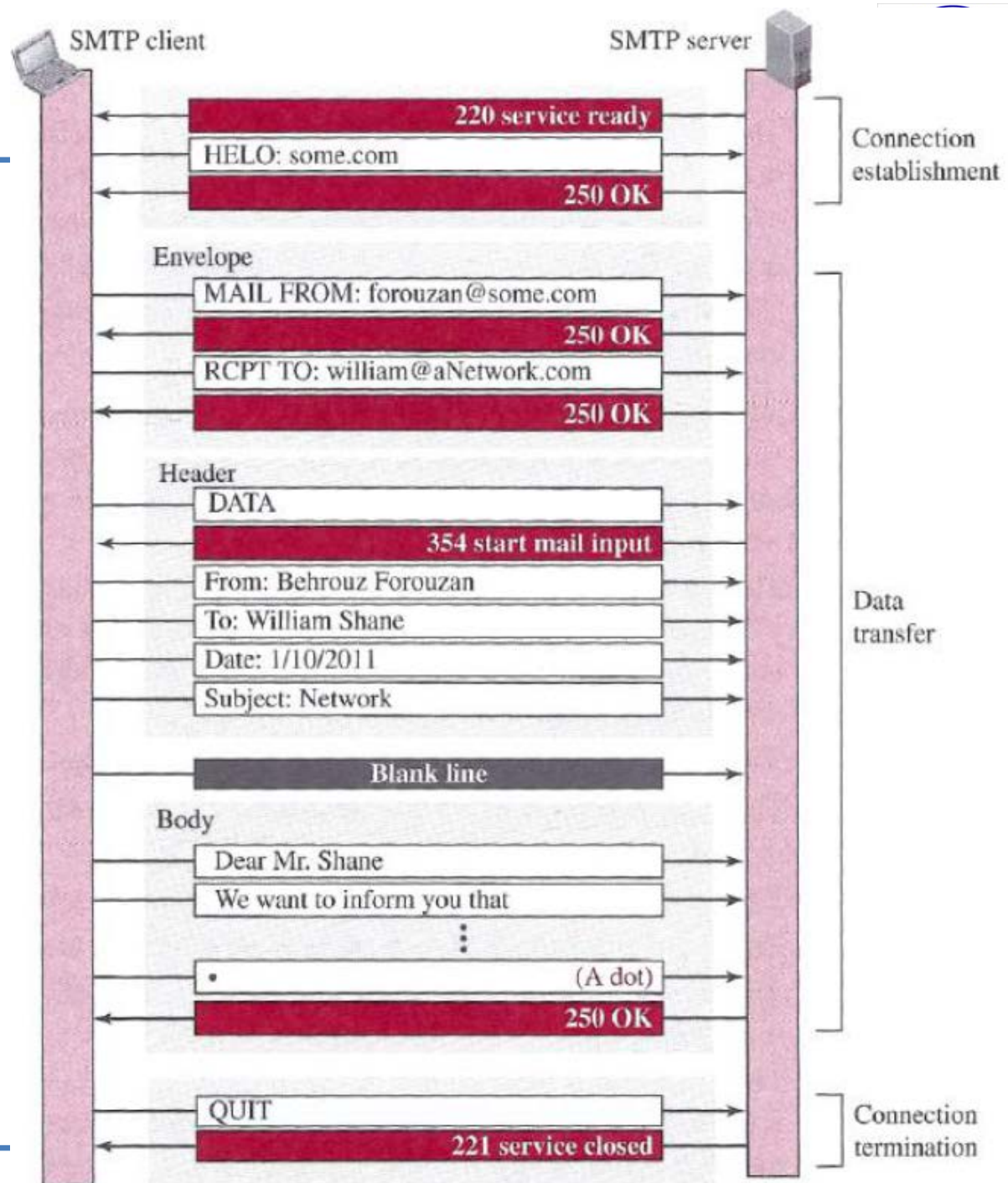
Message Access Agent: POP/IMAP

- In the third stage we needs a *pull* protocol; the client must pull messages from the server.

- Two message access protocols are available:
  - Post Office Protocol (POP)
 - Internet Mail Access Protocol (IMAP)

POP3

- POP3 has two modes:
 - the *delete* mode and the *keep* mode

IMAP4

- 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.
  - 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.

Web-Based Mail

- Some websites today provide this service to anyone who accesses the site. E.g., Hotmail, Yahoo, and Google mail.
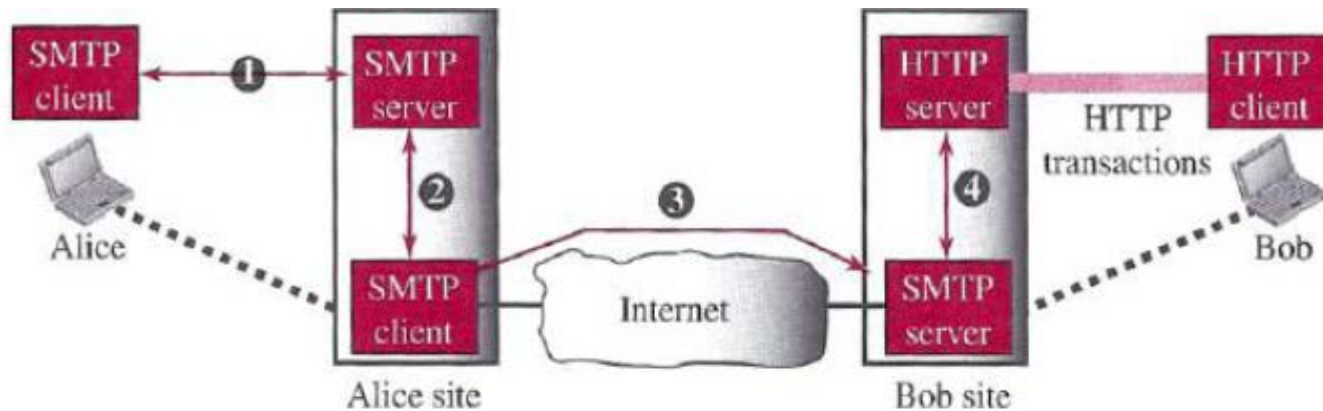
Case 1: Only receiver uses HTTP
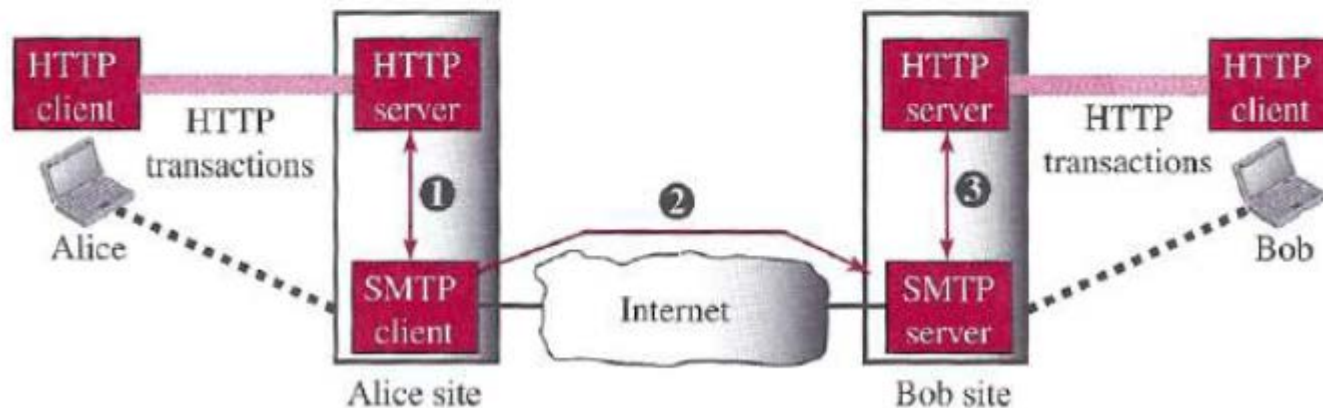
Case 2: Both sender and receiver use HTTP

E-Mail Security

- The protocol discussed so far does not provide any security provisions per se.

- e-mail exchanges can be secured using two application-layer securities designed in particular for e-mail systems
  - Pretty Good Privacy (PGP)
  - Secure/Multipurpose Internet Mail Extensions (S/MIME)

Thanks!