26-2 ELECTRONIC MAIL

One of the most popular Internet services is electronic mail (e-mail). The designers of the Internet probably never imagined the popularity of this application program. Its architecture consists of several components that we discuss in this chapter.
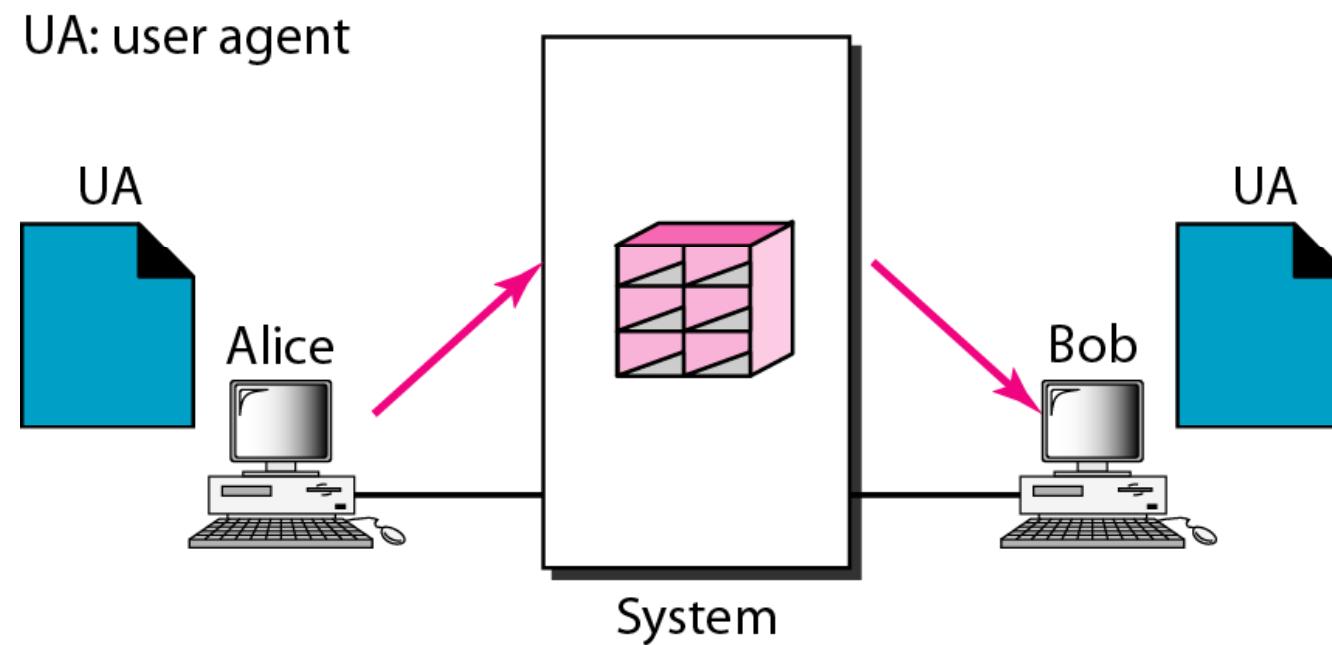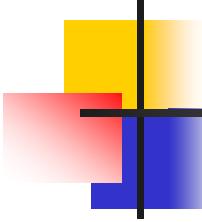
Topics discussed in this section:

Architecture
User Agent
Message Transfer Agent: SMTP
Message Access Agent: POP and IMAP
Web-Based Mail

26.15

Figure 26.6 *First scenario in electronic mail*
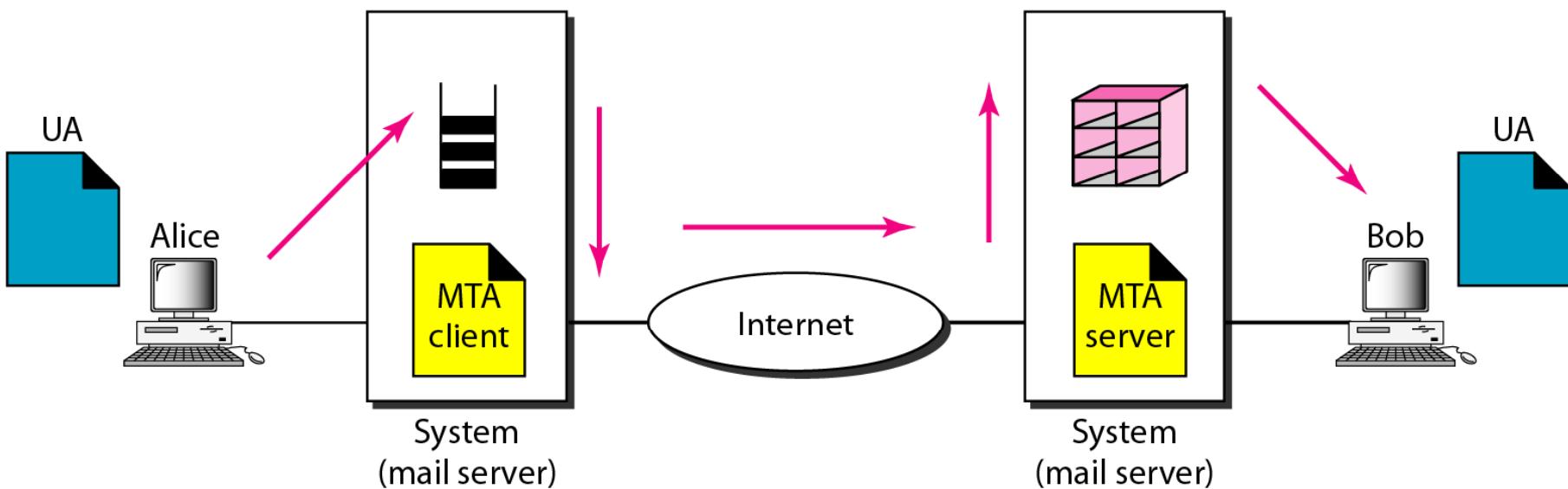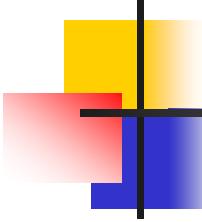
UA: user agent

UA

Alice

System

Bob

UA

When the sender and the receiver of an
e-mail are on the same system,
we need only two user agents.

Figure 26.7 *Second scenario in electronic mail*

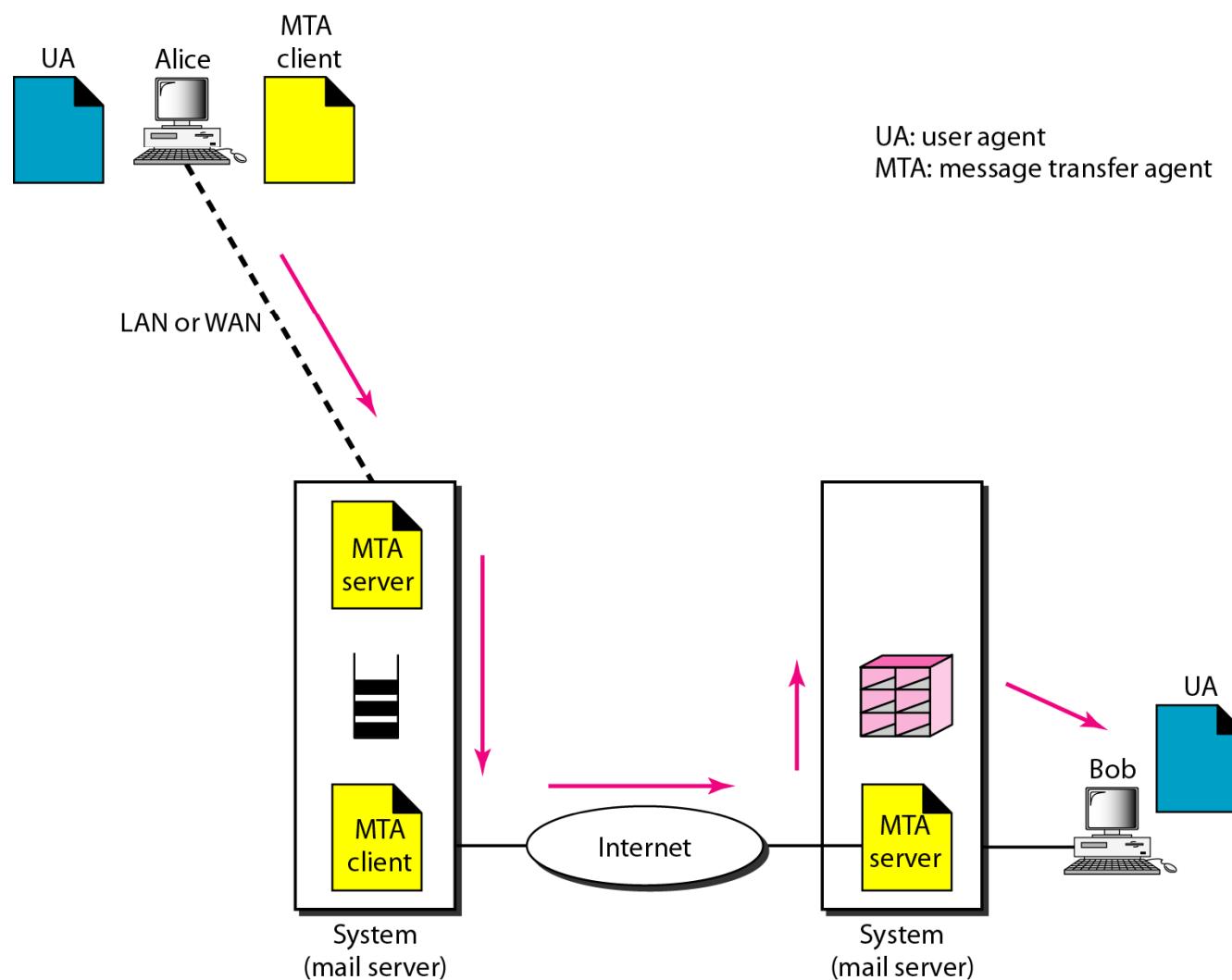UA: user agent
MTA: message transfer agent
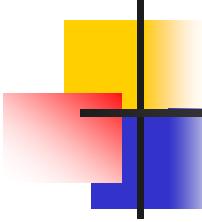
When the sender and the receiver of an e-mail are on different systems, we need two UAs and a pair of MTAs (client and server).

Figure 26.8 *Third scenario in electronic mail*

UA Alice MTA client

UA: user agent
MTA: message transfer agent

LAN or WAN

MTA server

MTA client

System (mail server)

Internet

MTA server

Bob

UA

System (mail server)

Note

When the sender is connected to the
mail server via a LAN or a WAN,
we need two UAs and two pairs
of MTAs (client and server).

Figure 26.9 *Fourth scenario in electronic mail*

UA: user agent
MTA: message transfer agent
MAA: message access agent
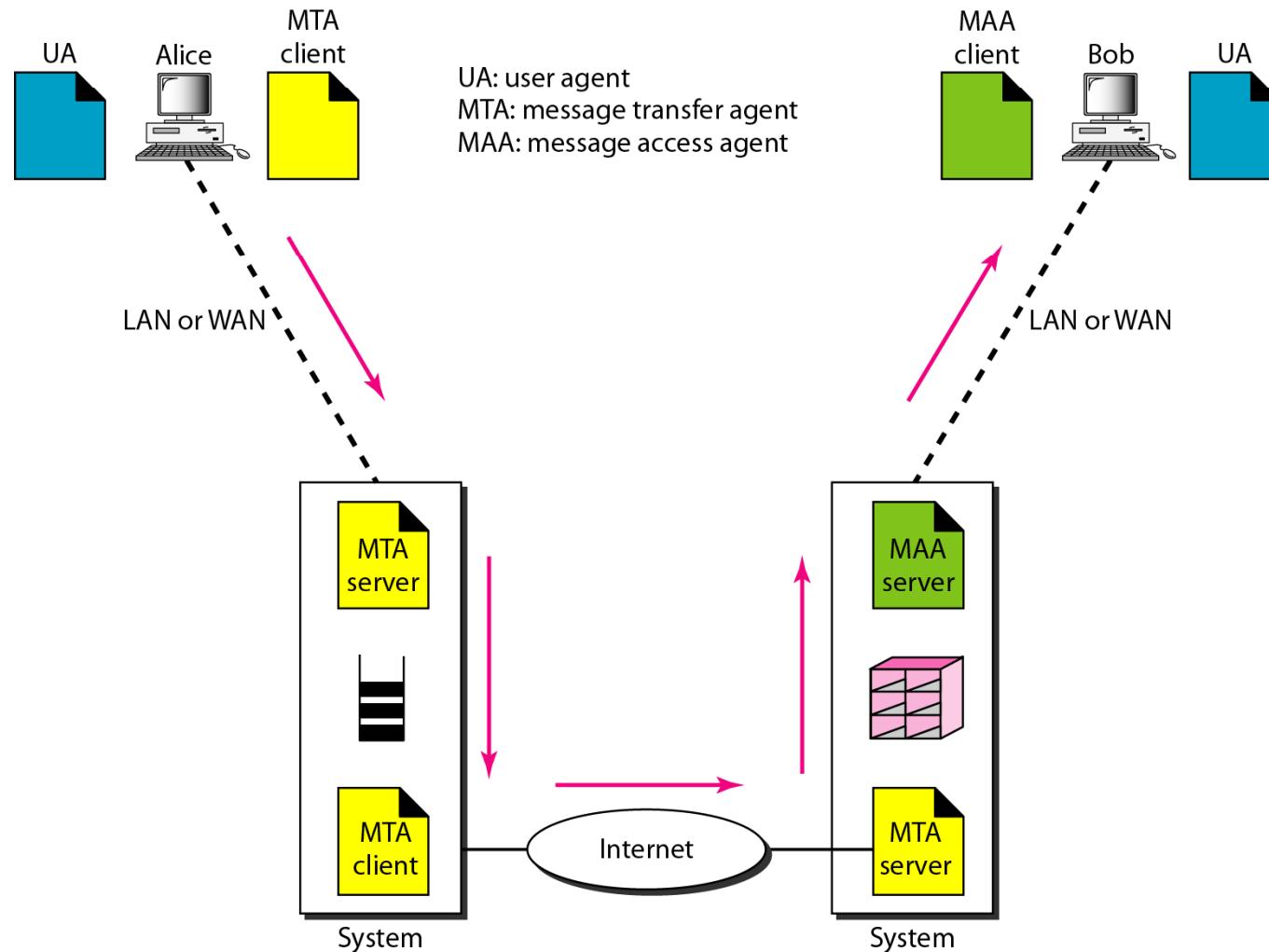
26.22
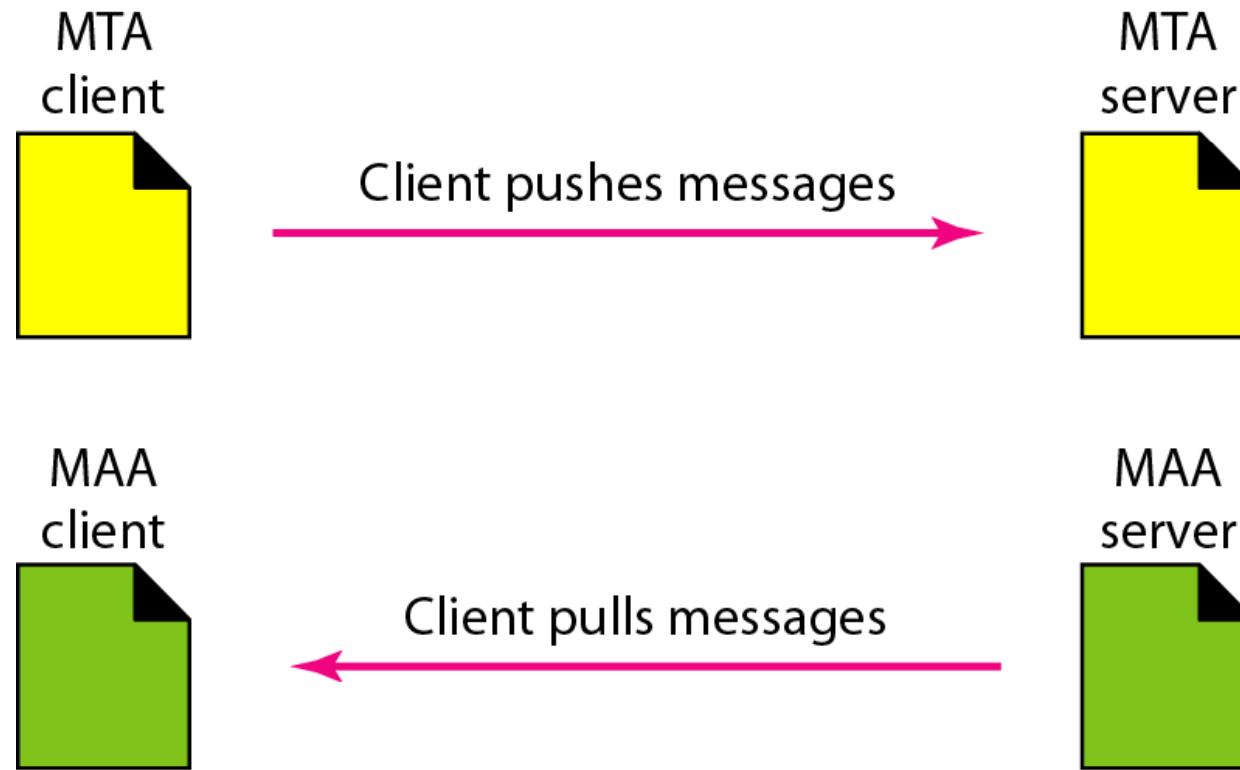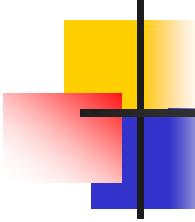
Figure 26.10 *Push versus pull in electronic email*

When both sender and receiver are connected to the mail server via a LAN or a WAN, we need two UAs, two pairs of MTAs and a pair of MAAs.
This is the most common situation today.

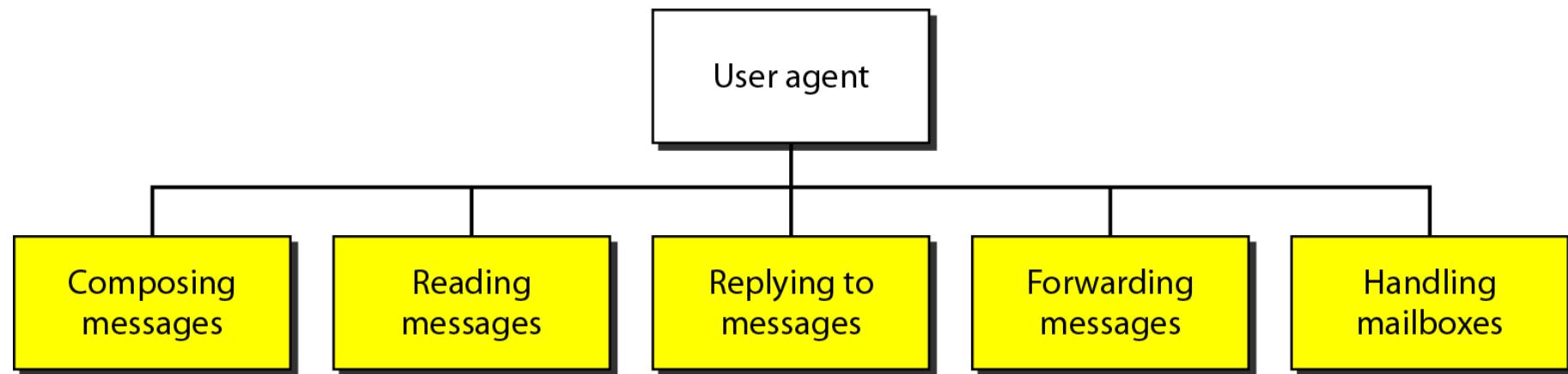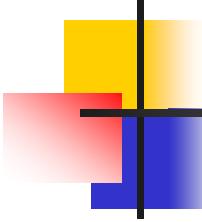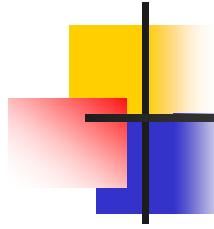# Figure 26.11 *Services of user agent*

Note

Some examples of command-driven
user agents are *mail*, *pine*,
and *elm*.

Note

Some examples of GUI-based user agents are *Eudora*, *Outlook*, and *Netscape*.

Figure 26.12 *Format of an e-mail*

Behrouz Forouzan
De Anza College
Cupertino, CA 96014

Sophia Fegan
Com-Net
Cupertino, CA 95014

Sophia Fegan
Com-Net
Cupertino, CA 95014
Jan. 5, 2005

Subject: Network

Dear Ms. Fegan:
We want to inform you that
our network is working pro-
perly after the last repair.

Yours truly,
Behrouz Forouzan

a. Postal mail

Mail From: forouzan@deanza.edu
RCPT To: fegan@comnet.com

From: Behrouz Forouzan
To: Sophia Fegan
Date: 1/5/05
Subject: Network

Dear Ms. Fegan:
We want to inform you that
our network is working pro-
perly after the last repair.

Yours truly,
Behrouz Forouzan

b. Electronic mail

Envelope

Header

Body

Message

Figure 26.13 *E-mail address*
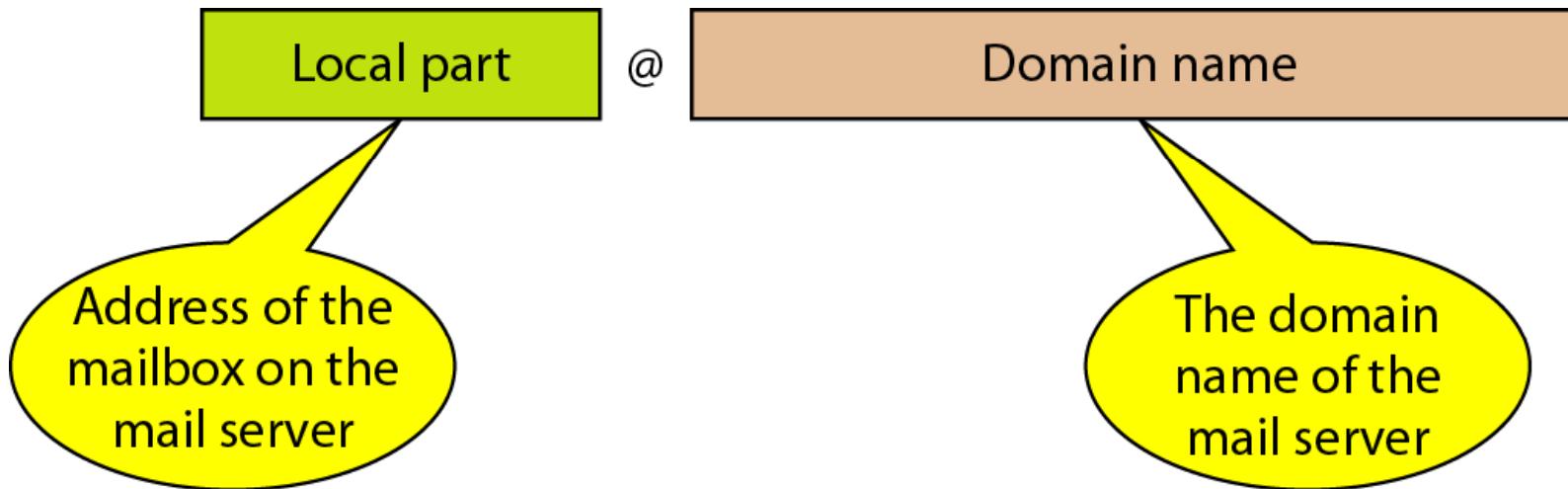
Table 26.5 *Data types and subtypes in MIME*

Type	Subtype	Description
Text	Plain	Unformatted
	HTML	HTML format (see Chapter 27)
Multipart	Mixed	Body contains ordered parts of different data types
	Parallel	Same as above, but no order
	Digest	Similar to mixed subtypes, 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 (8-bit bytes)

26.32

Table 26.6 *Content-transfer-encoding*

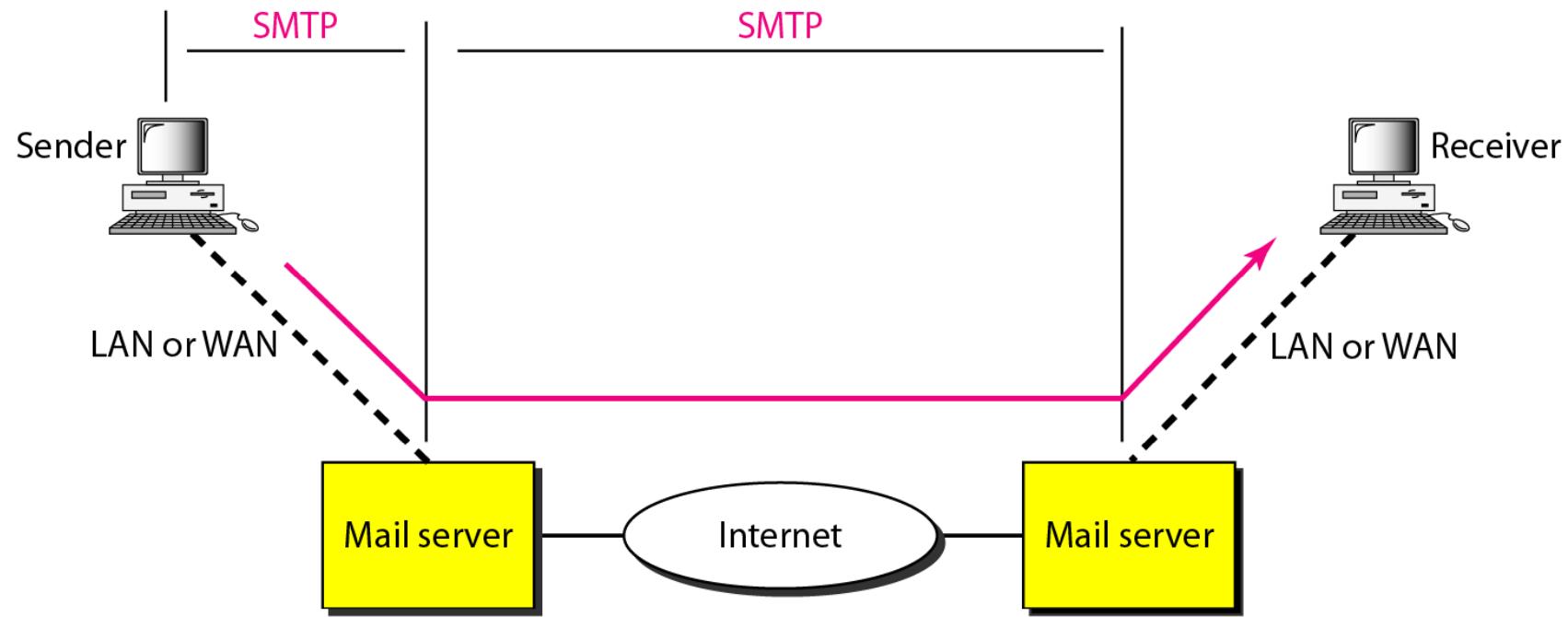| Type	Description
7-bit	NVT ASCII characters and short lines
8-bit	Non-ASCII characters and short lines
Binary	Non-ASCII characters with unlimited-length lines
Base-64	6-bit blocks of data encoded into 8-bit ASCII characters
Quoted-printable	Non-ASCII characters encoded as an equals sign followed by an ASCII code

26.33

Figure 26.16 *SMTP range*

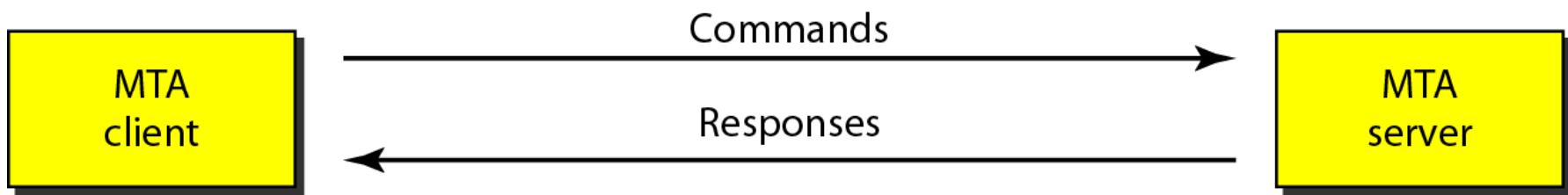# Figure 26.17 *Commands and responses*

Figure 26.18 *Command format*

Keyword: argument(s)

Table 26.7 *Commands*

Keyword	Argument(s)
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	
VRFY	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

26.37

Table 26.8 *Responses*

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

26.38

Table 26.8 *Responses* *(continued)*

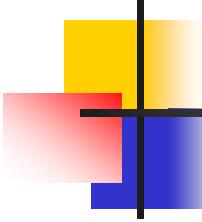| Code	Description
	Permanent Negative Completion Reply
500	Syntax error; unrecognized command
501	Syntax error in parameters or arguments
502	Command not implemented
503	Bad sequence of commands
504	Command temporarily not implemented
550	Command is not executed; mailbox unavailable
551	User not local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

26.39

26-3   FILE TRANSFER

Transferring files from one computer to another is one of the most common tasks expected from a networking or internetworking environment. As a matter of fact, the greatest volume of data exchange in the Internet today is due to file transfer.

Topics discussed in this section:

File Transfer Protocol (FTP)
Anonymous FTP

26.46

FTP uses the services of TCP. It needs two TCP connections.

The well-known port 21 is used for the control connection and the well-known port 20 for the data connection.
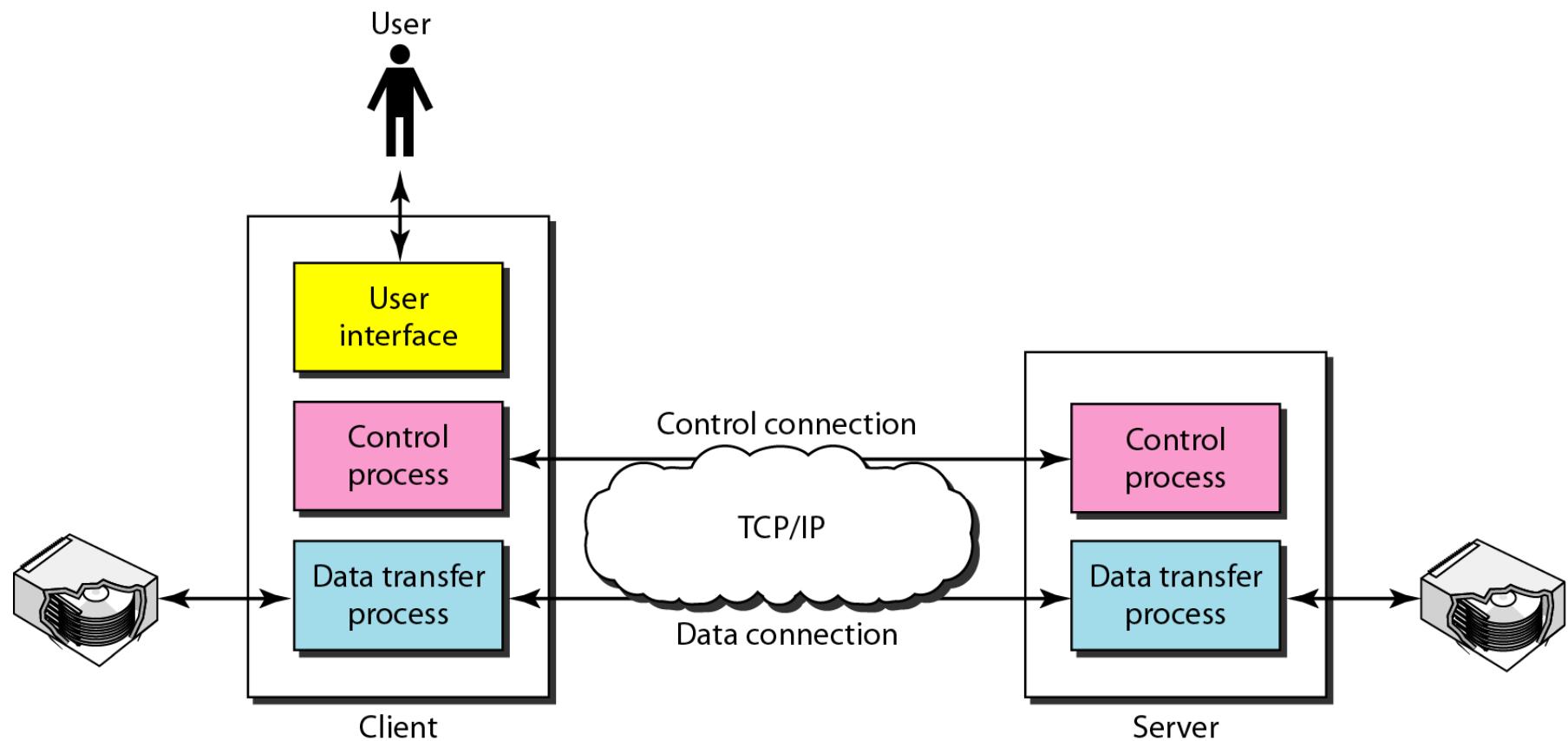
Figure 26.21 *FTP*

Figure 26.22 *Using the control connection*

Local code

Local code

Control process
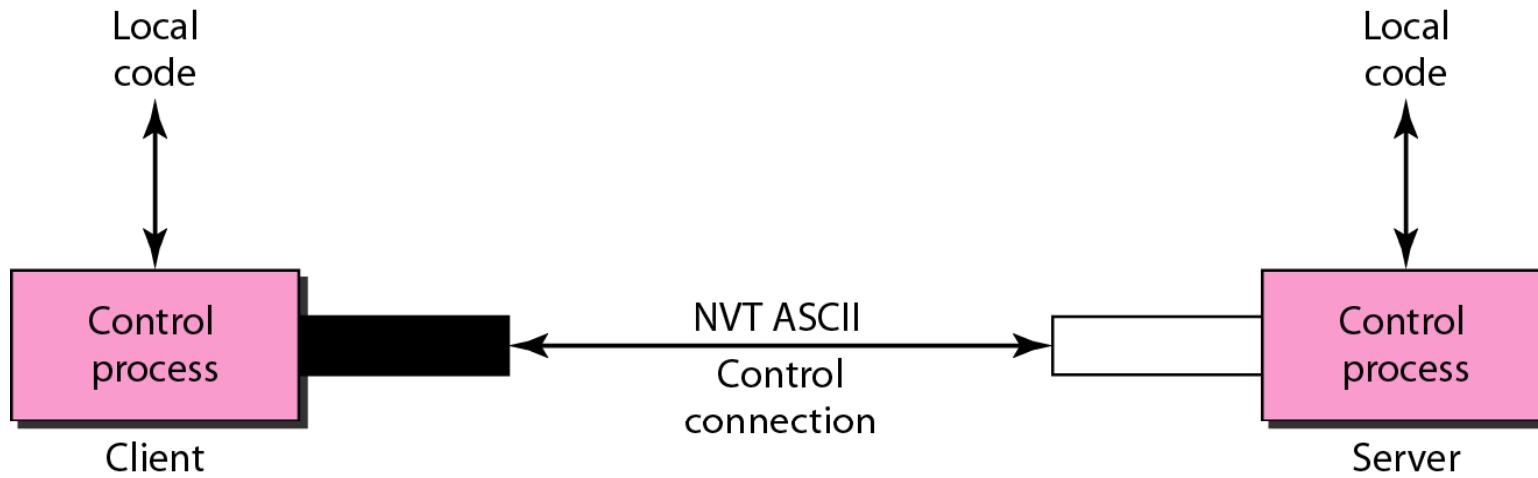
NVT ASCII
Control connection

Control process

Client

Server

Figure 26.23 *Using the data connection*

File type, data structure,
and transmission mode
are defined by the client

Local data type
and structure

Data transfer
process

Client

Data
connection

Data transfer
process

Server

Local data type
and structure