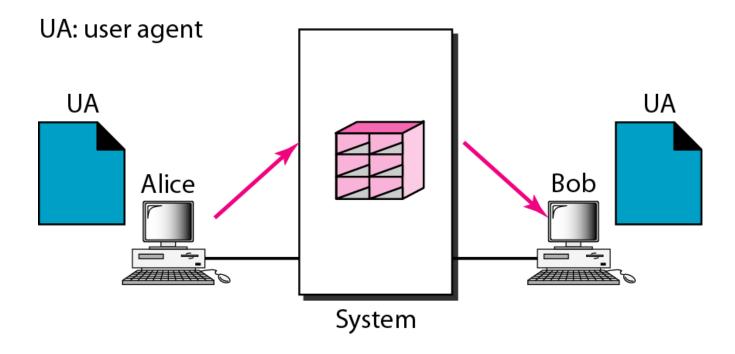# ELECTRONIC MAIL

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.

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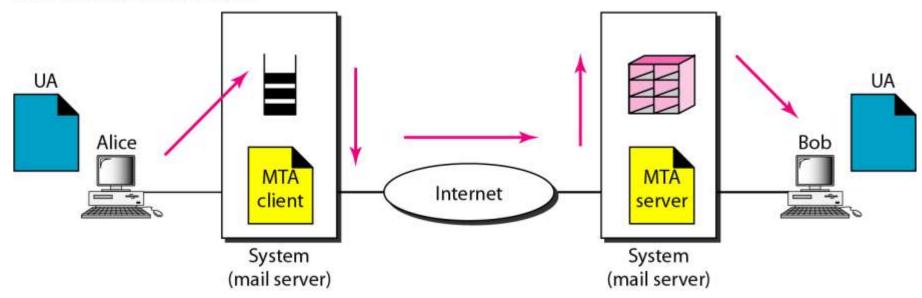
UA: user agent

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.

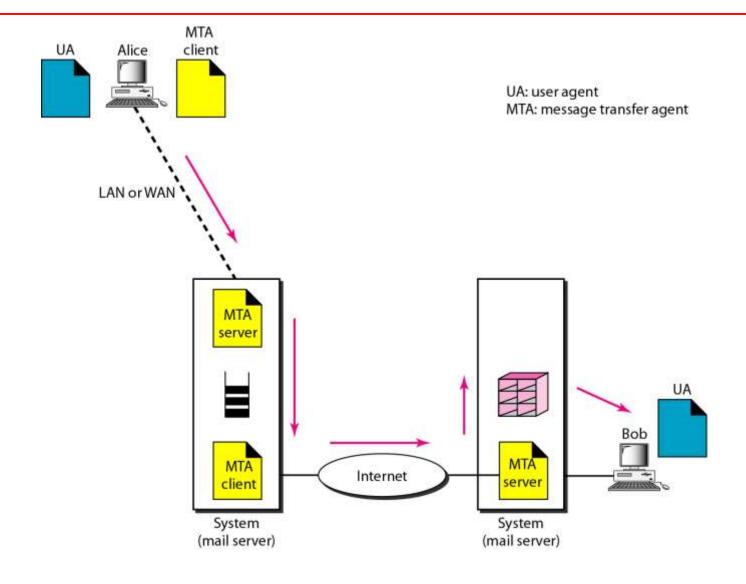# Figure 26.7 *Second scenario in electronic mail*

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*

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).
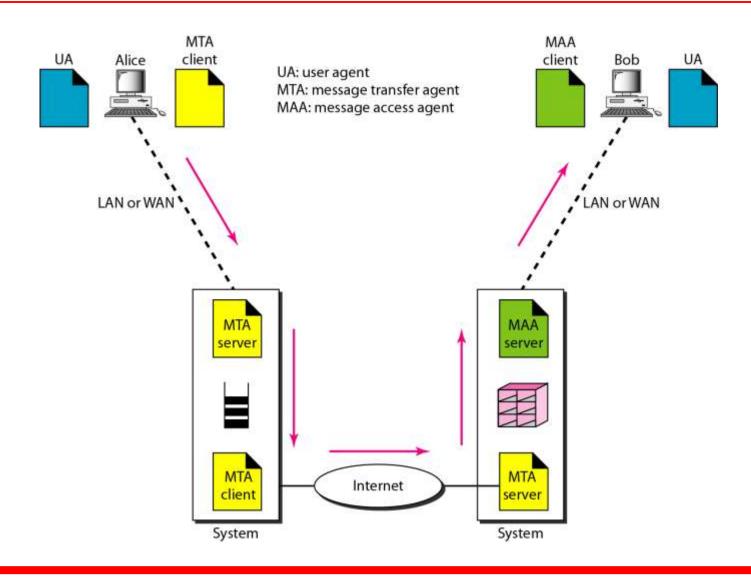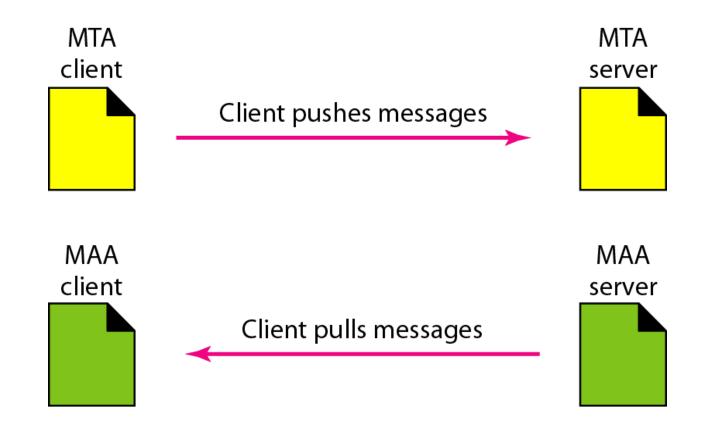
Figure 26.9 *Fourth scenario in electronic mail*

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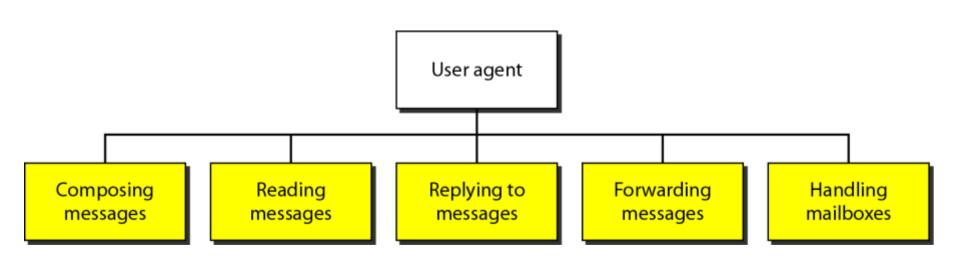
Figure 26.10 *Push versus pull in electronic email*

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*

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

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

Figure 26.12 *Format of an e-mail*

a. Postal 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

b. Electronic 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-
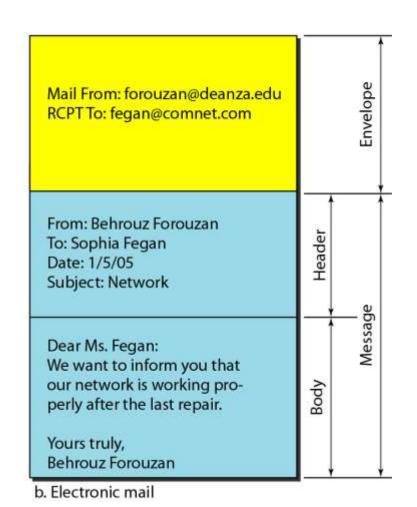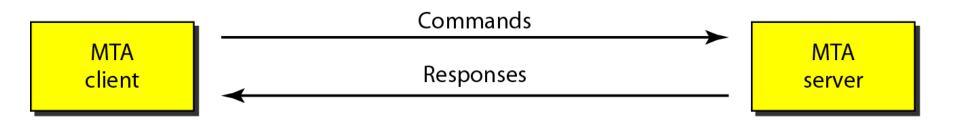perly after the last repair.

Yours truly,
Behrouz Forouzan

Envelope

Header

Body

Message

Figure 26.13 *E-mail address*

Figure 26.17 *Commands and responses*

Protocols used in Email
Message Transfer Agent: SMTP
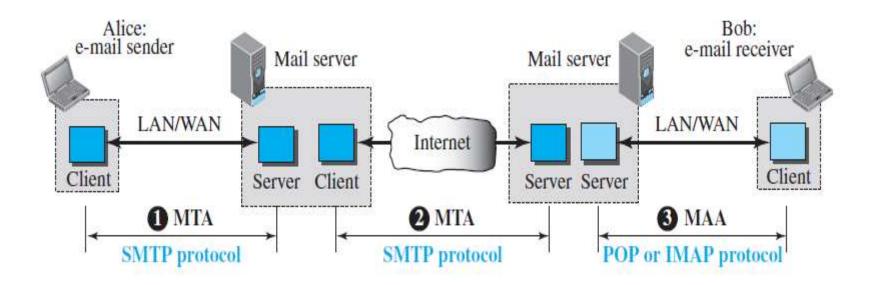
Figure 26.18 *Command format*

Keyword: argument(s)

Table 26.7 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
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

NAME SPACE

To be unambiguous, the names assigned to machines must be carefully selected from a name space with complete control over the binding between the names and IP addresses.

DOMAIN NAME SPACE

To have a hierarchical name space, a domain name space was designed. In this design the names are defined in an inverted-tree structure with the root at the top. The tree can have only 128 levels: level 0 (root) to level 127.
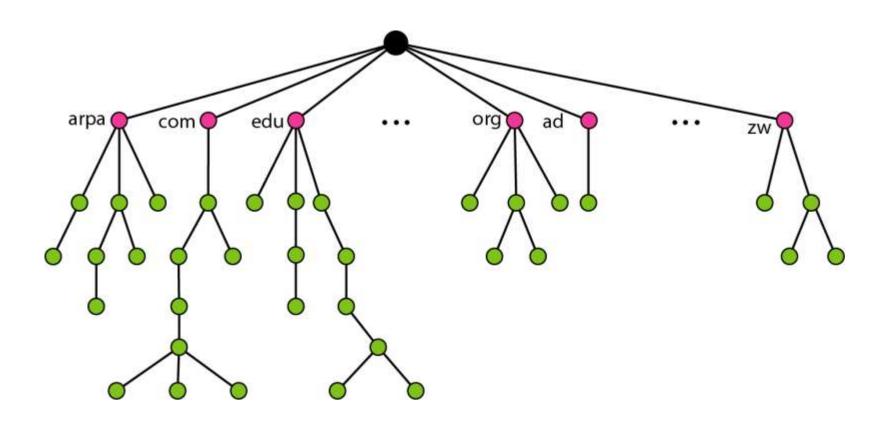
Figure 25.2 *Domain name space*

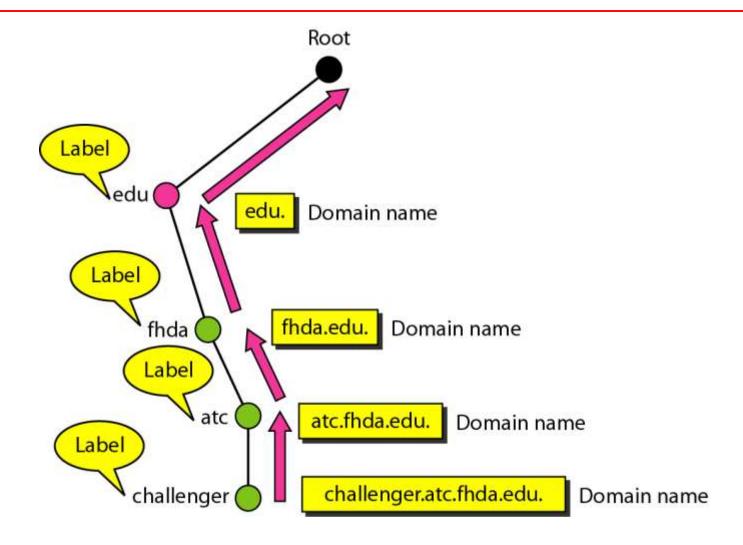# Figure 25.3 *Domain names and labels*
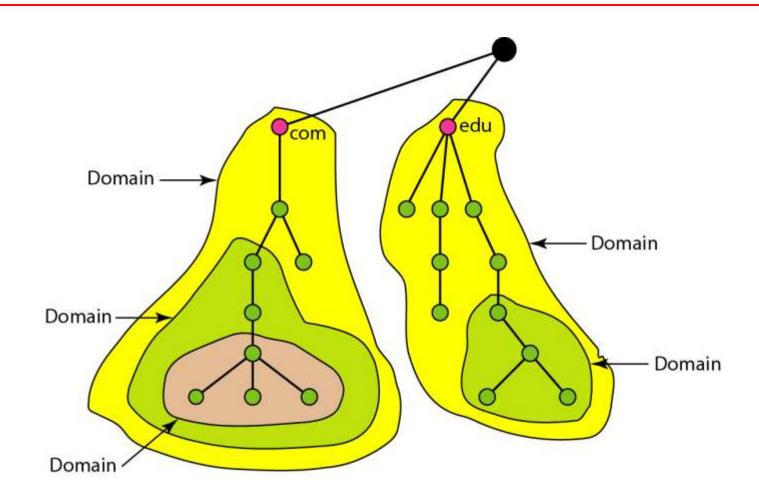
Figure 25.4 *FQDN and PQDN*

FQDN

challenger.atc.fhda.edu.
cs.hmme.com.
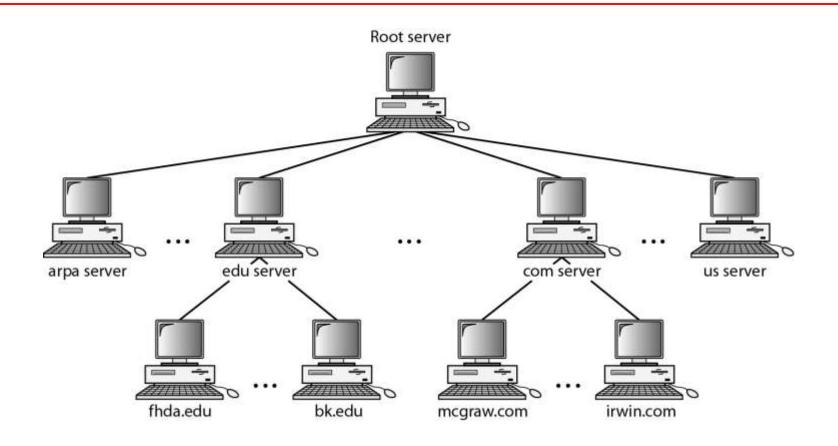www.funny.int.

PQDN

challenger.atc.fhda.edu
cs.hmme
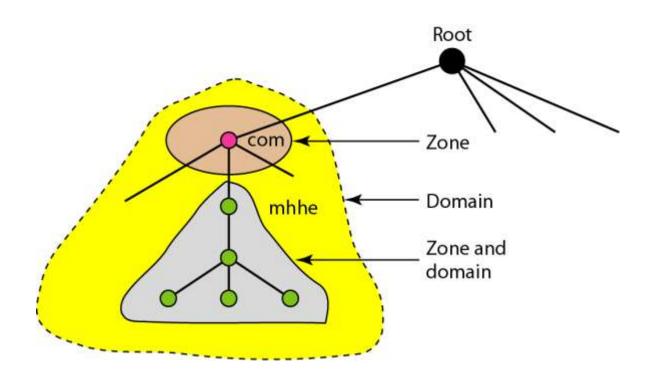www

Figure 25.5 *Domains*

DISTRIBUTION OF NAME SPACE

The information contained in the domain name space must be stored. However, it is very inefficient and also unreliable to have just one computer store such a huge amount of information. In this section, we discuss the distribution of the domain name space.

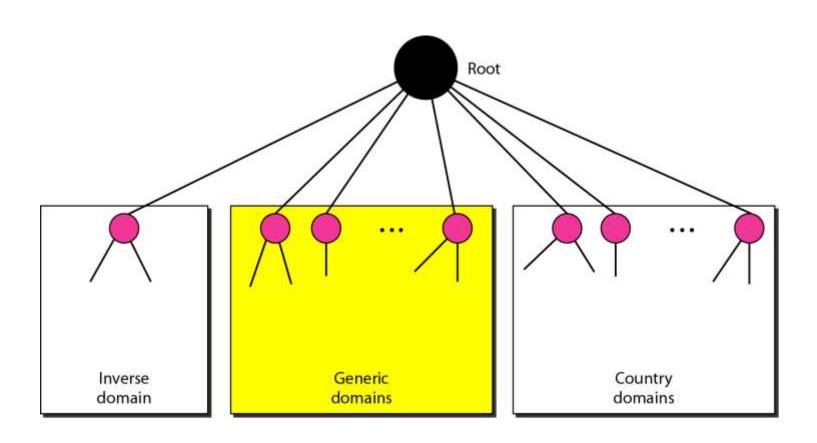# Hierarchy of name servers

Zones and domains

A primary server loads all information from the disk file; the secondary server loads all information from the primary server.

When the secondary downloads information from the primary, it is called zone transfer.

DNS IN THE INTERNET

DNS is a protocol that can be used in different platforms. In the Internet, the domain name space (tree) is divided into three different sections: generic domains, country domains, and the inverse domain.
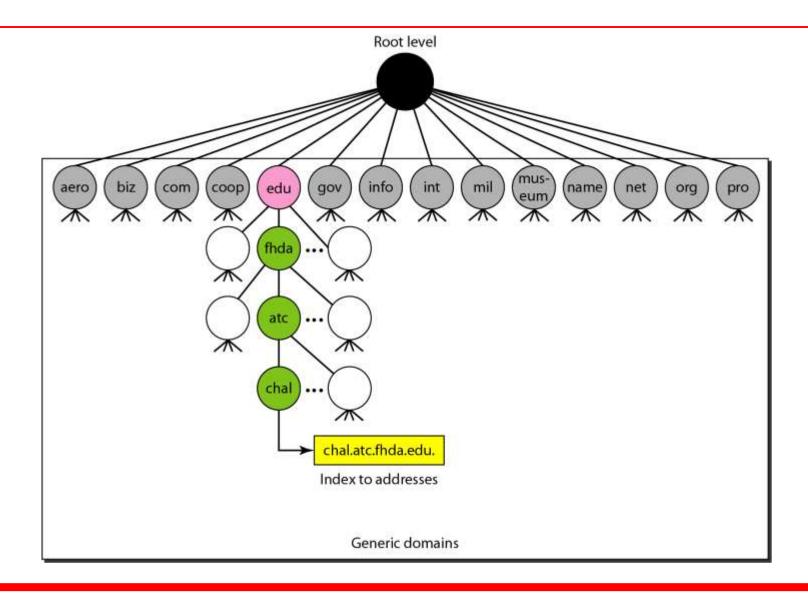
DNS IN THE INTERNET

Generic domains

Generic domains

Table 25.1 *Generic domain labels*

Label	Description
aero	Airlines and aerospace companies
biz	Businesses or firms (similar to "com")
com	Commercial organizations
coop	Cooperative business organizations
edu	Educational institutions
gov	Government institutions
info	Information service providers
int	International organizations
mil	Military groups
museum	Museums and other nonprofit organizations
name	Personal names (individuals)
net	Network support centers
org	Nonprofit organizations
pro	Professional individual organizations

Figure 25.10 *Country domains*

Figure 25.11 *Inverse domain*

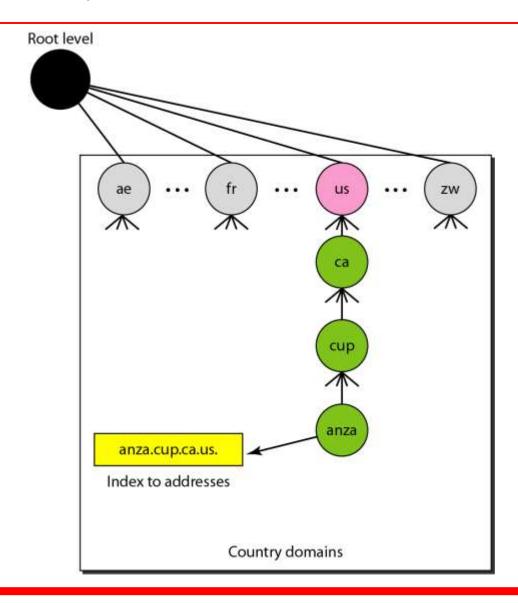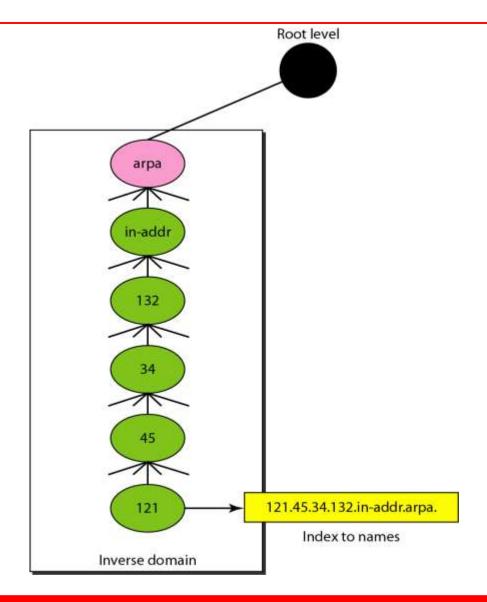# RESOLUTION

Mapping a name to an address or an address to a name is called name-address resolution.