



Data Communications and Networking

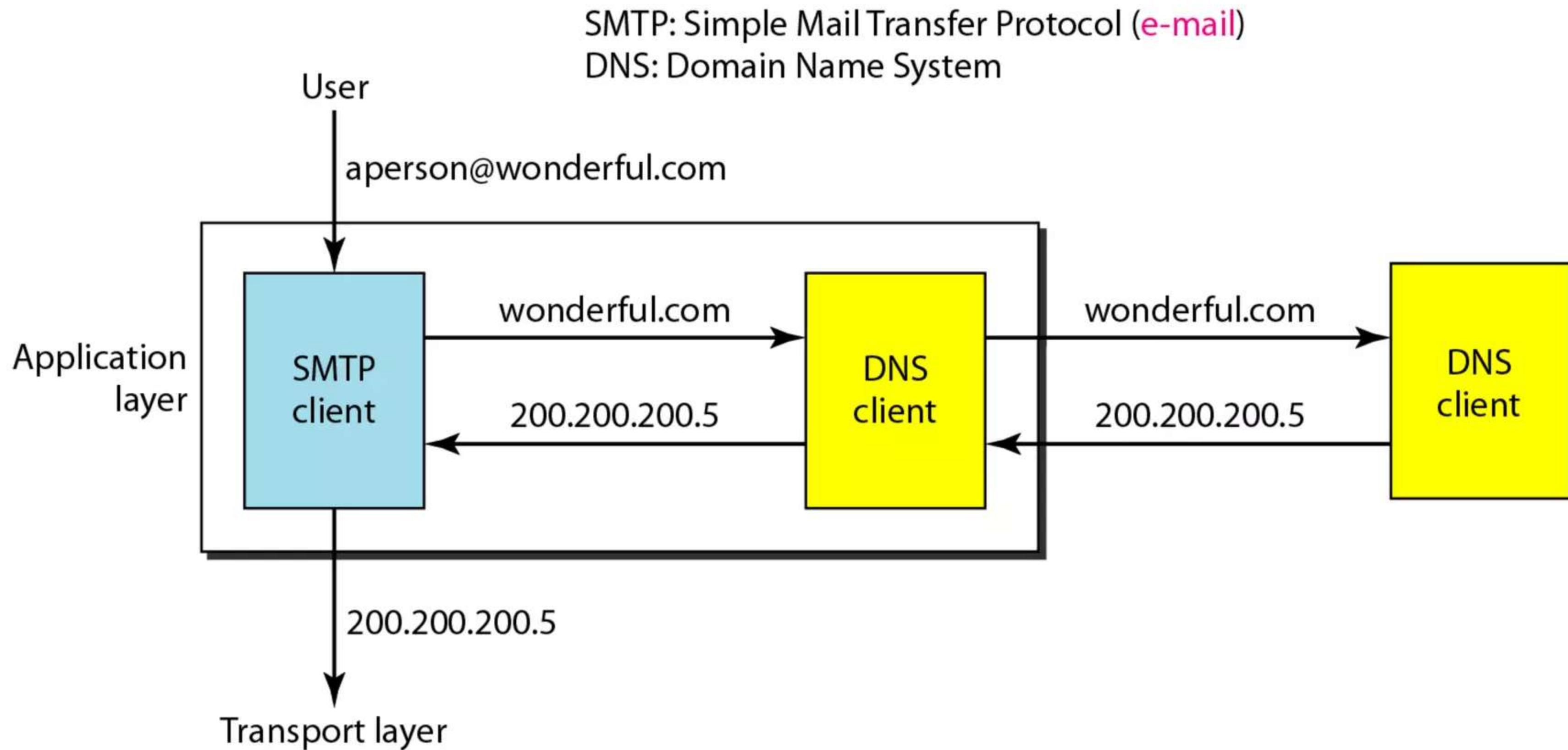
Fourth Edition

Forouzan

Chapter 25

Domain Name System

Figure 25.1 Example of using the DNS service



25-1 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.

Topics discussed in this section:

Flat Name Space

Hierarchical Name Space

25-2 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.

Topics discussed in this section:

Label

Domain Name

Domain

Figure 25.2 *Domain name space*

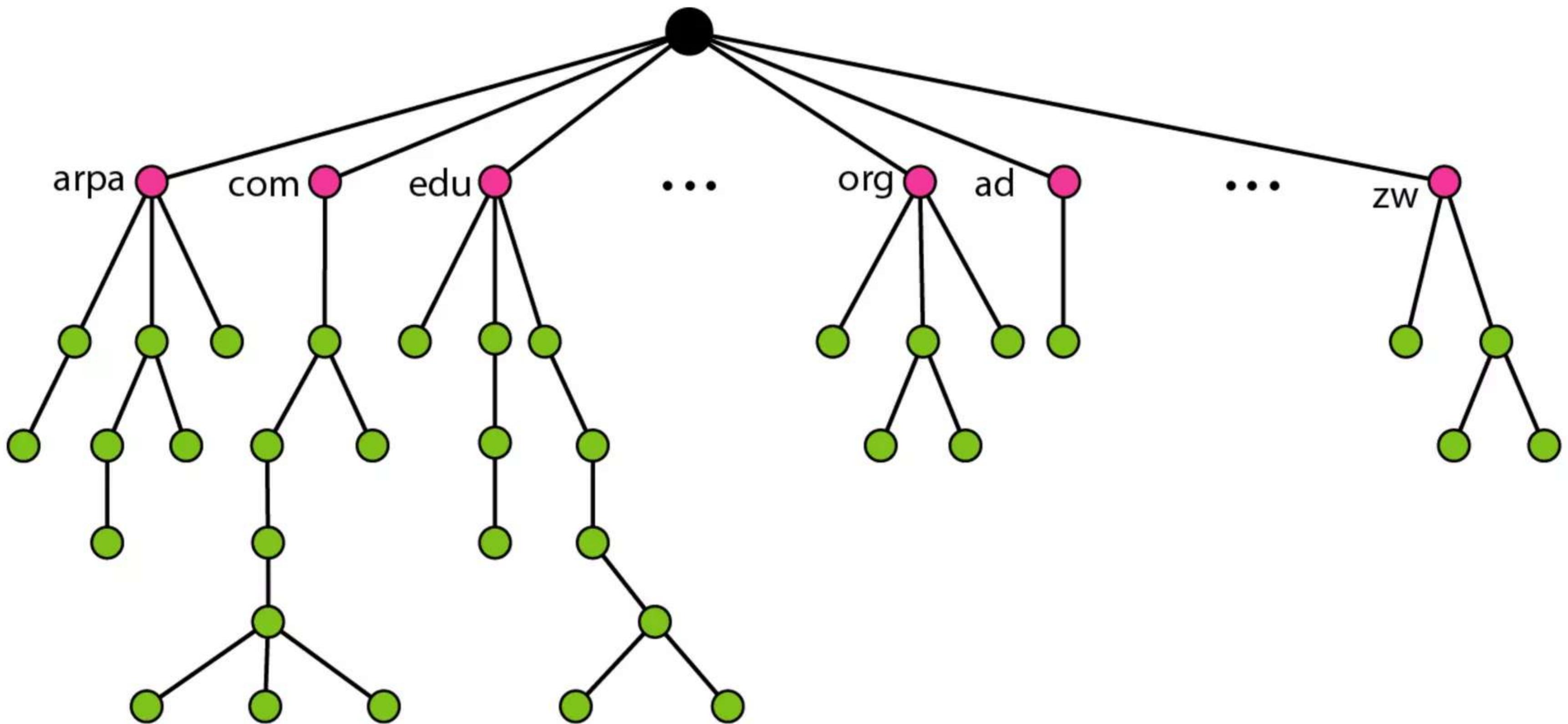


Figure 25.3 *Domain names and labels*

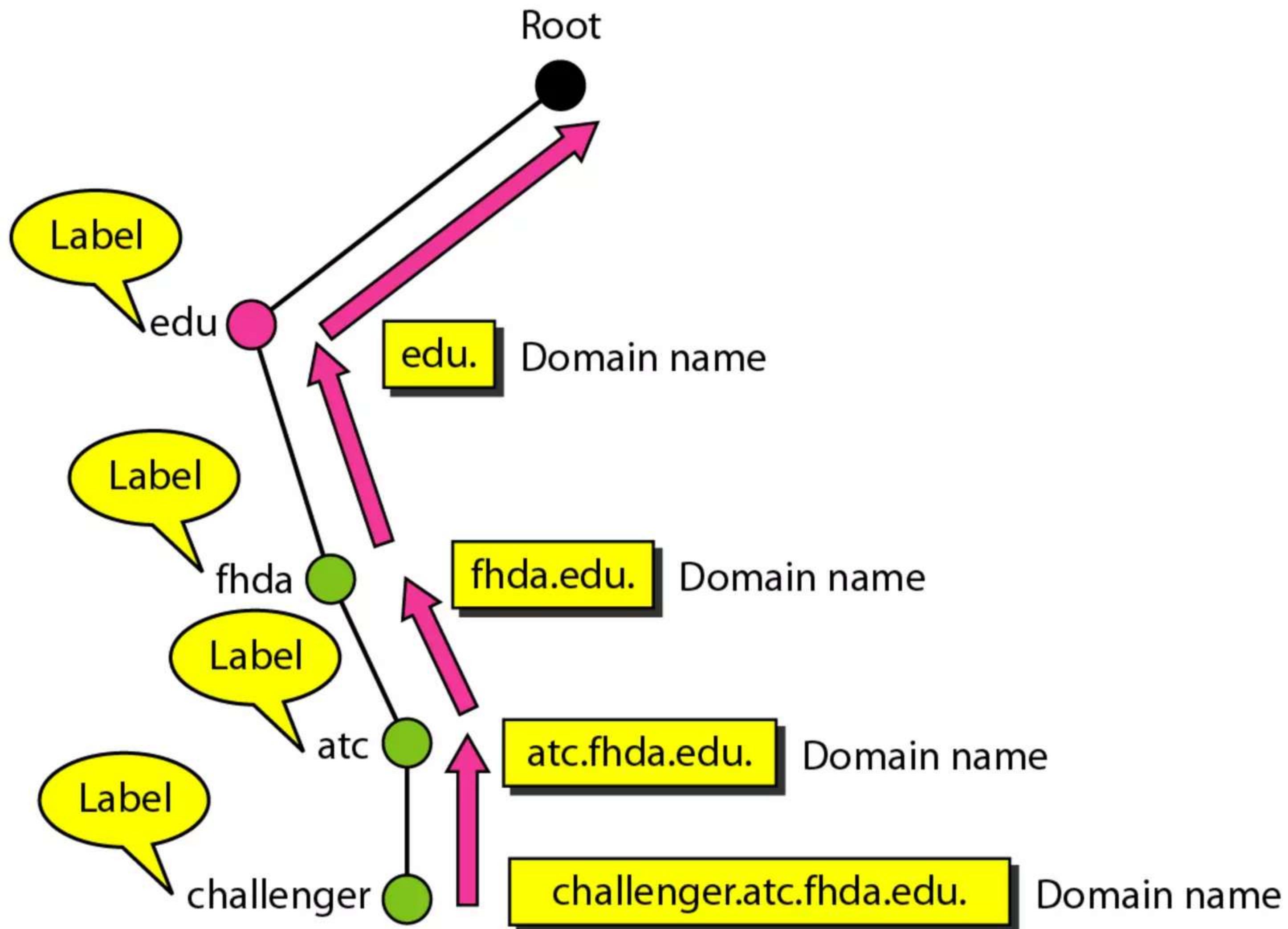


Figure 25.4 FQDN and PQDN

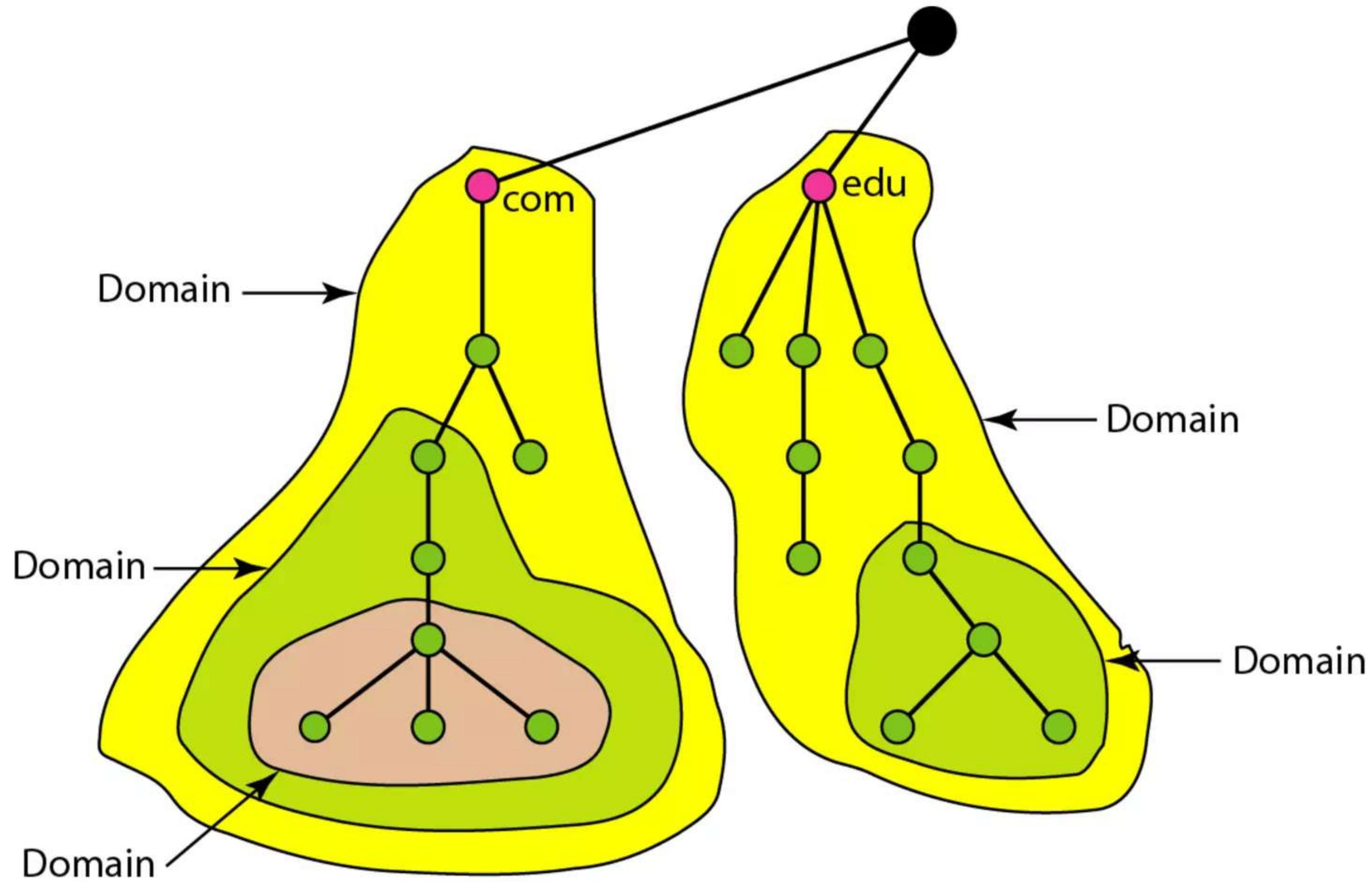
FQDN

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

PQDN

challenger.atc.fhda.edu
cs.hmme
www

Figure 25.5 Domains



25-3 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.

Topics discussed in this section:

Hierarchy of Name Servers

Zone

Root Server

Primary and Secondary Servers

Figure 25.6 *Hierarchy of name servers*

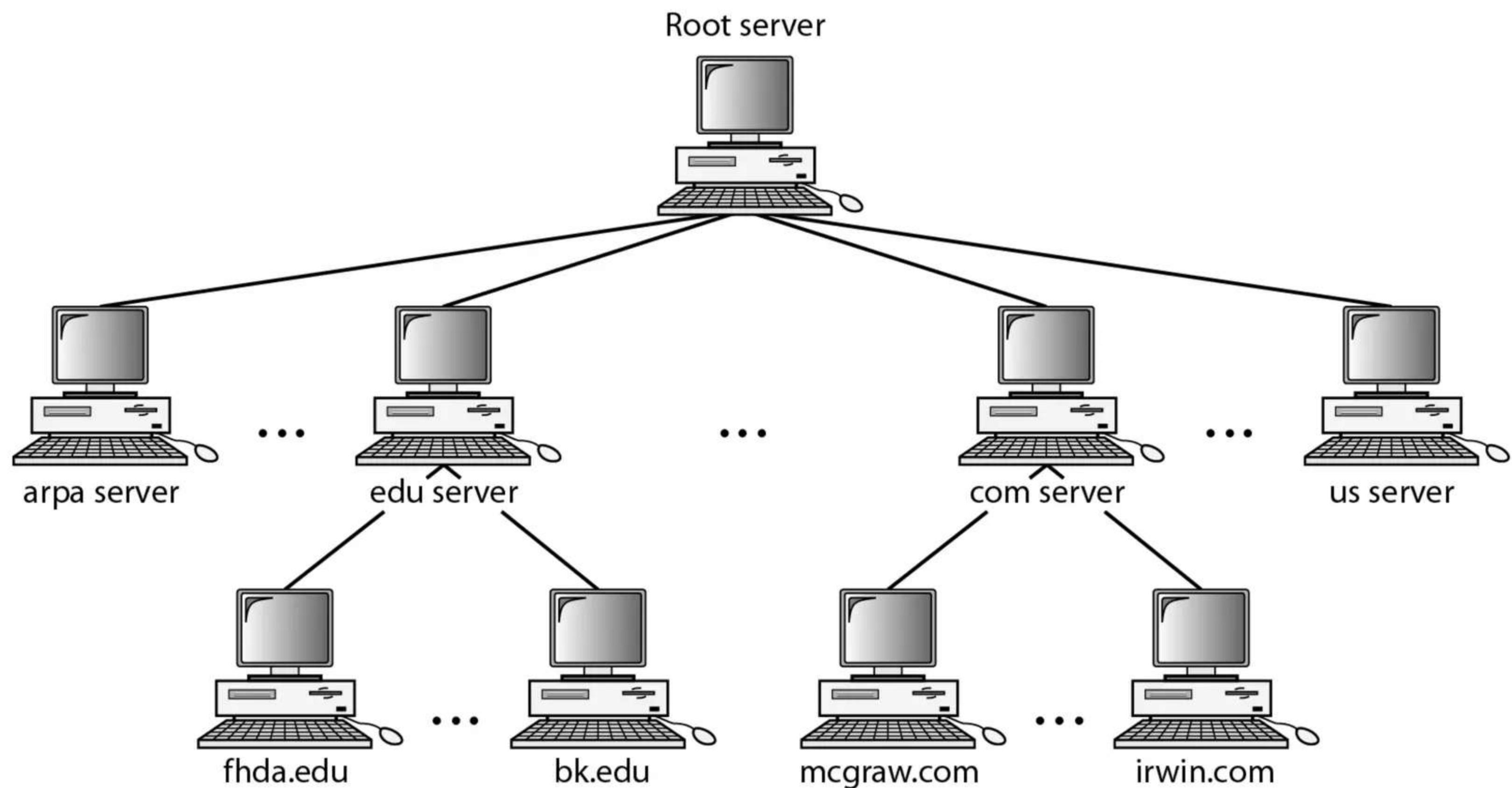
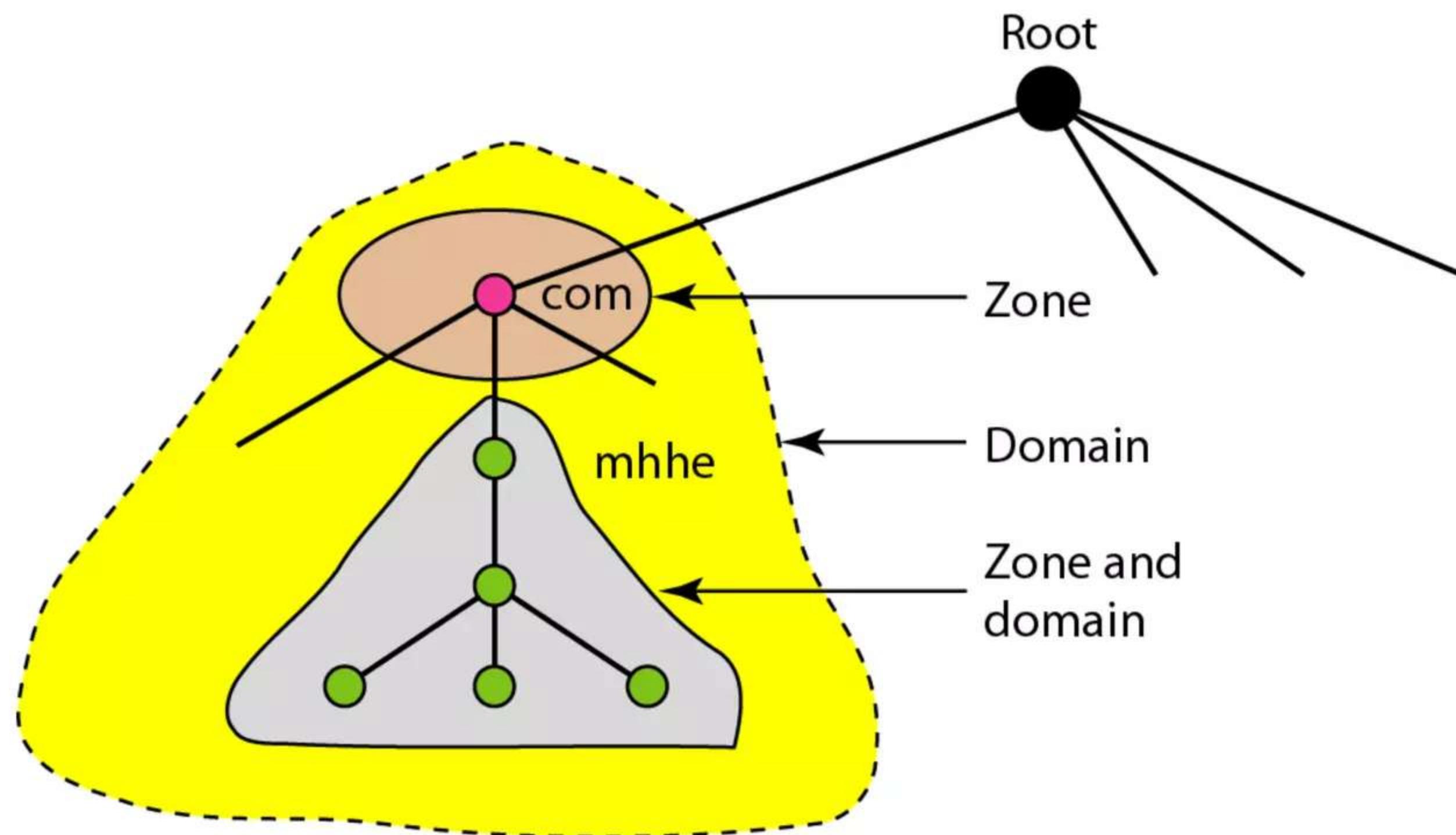
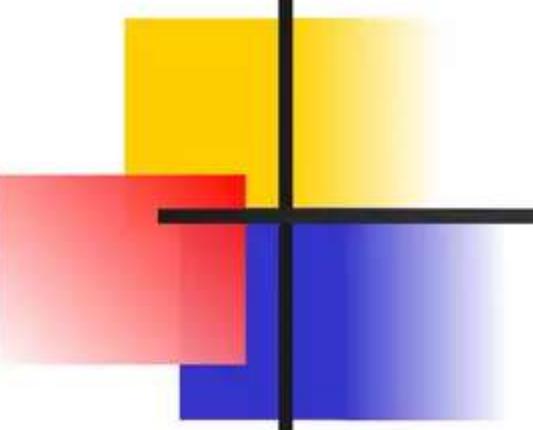


Figure 25.7 Zones and domains





Note

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.

25-4 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.

Topics discussed in this section:

Generic Domains

Country Domains

Inverse Domain

Figure 25.8 DNS IN THE INTERNET

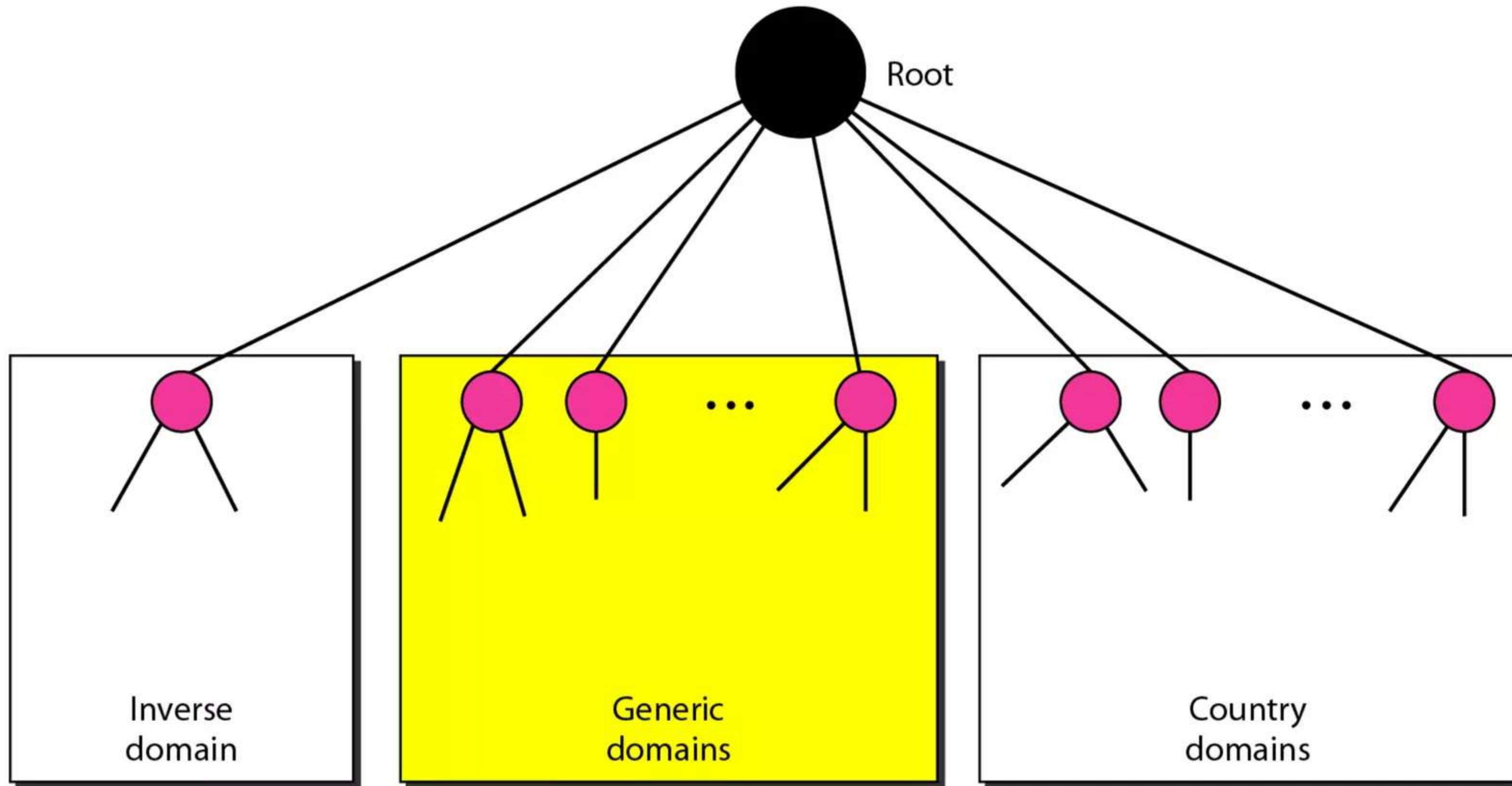


Figure 25.9 Generic domains

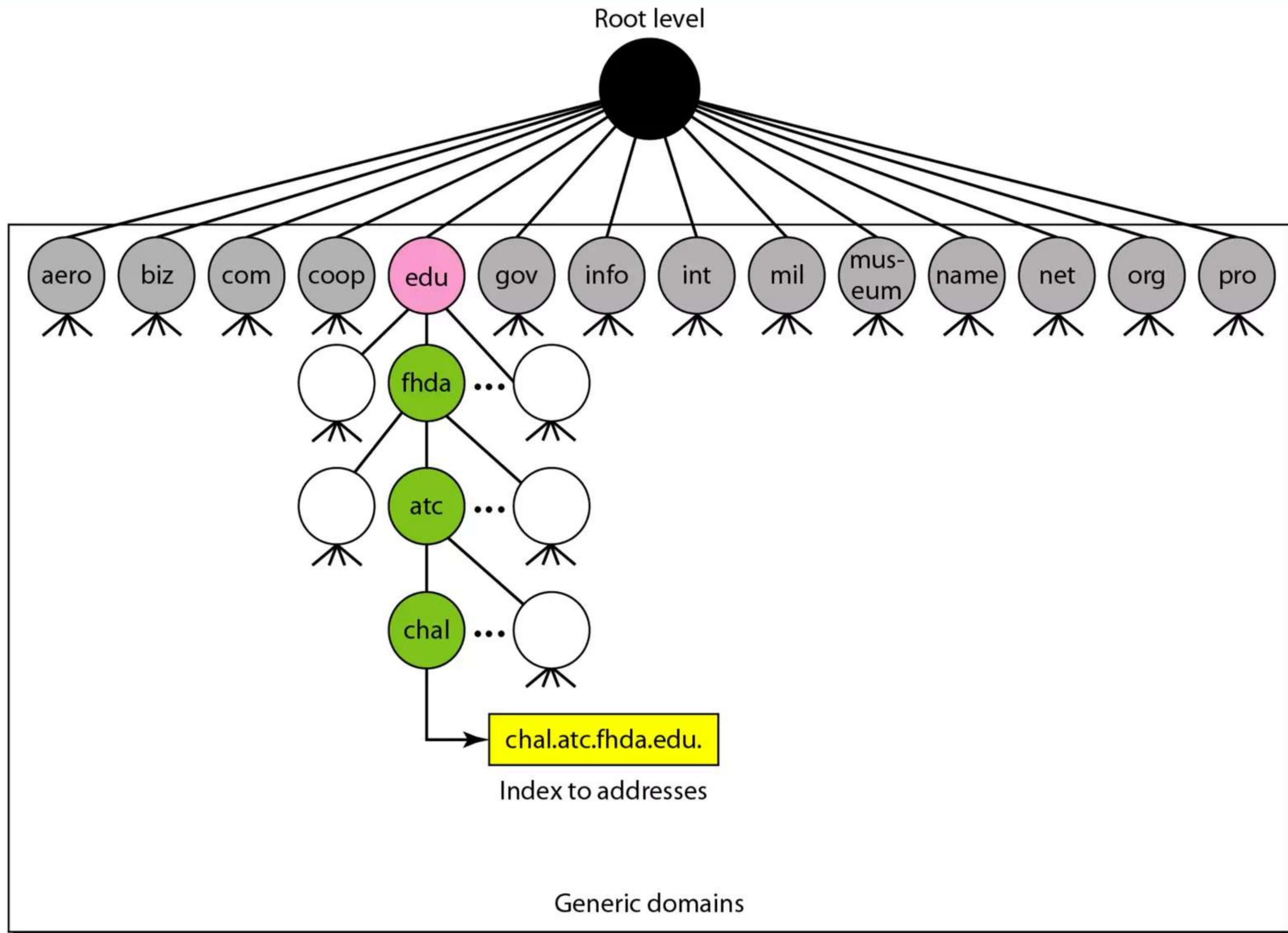


Table 25.1 *Generic domain labels*

| <i>Label</i> | <i>Description</i> |
|---------------|---|
| 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*

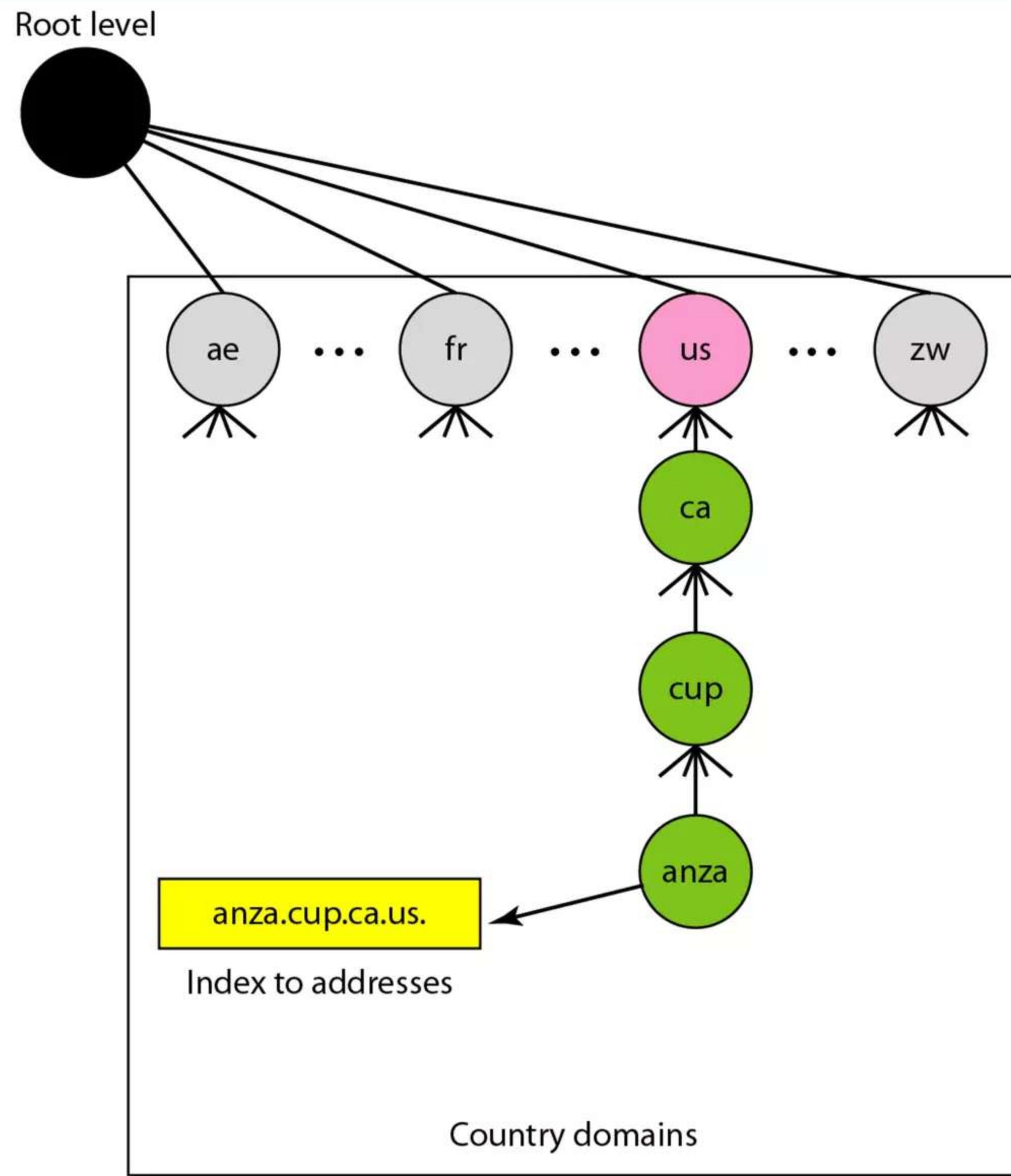
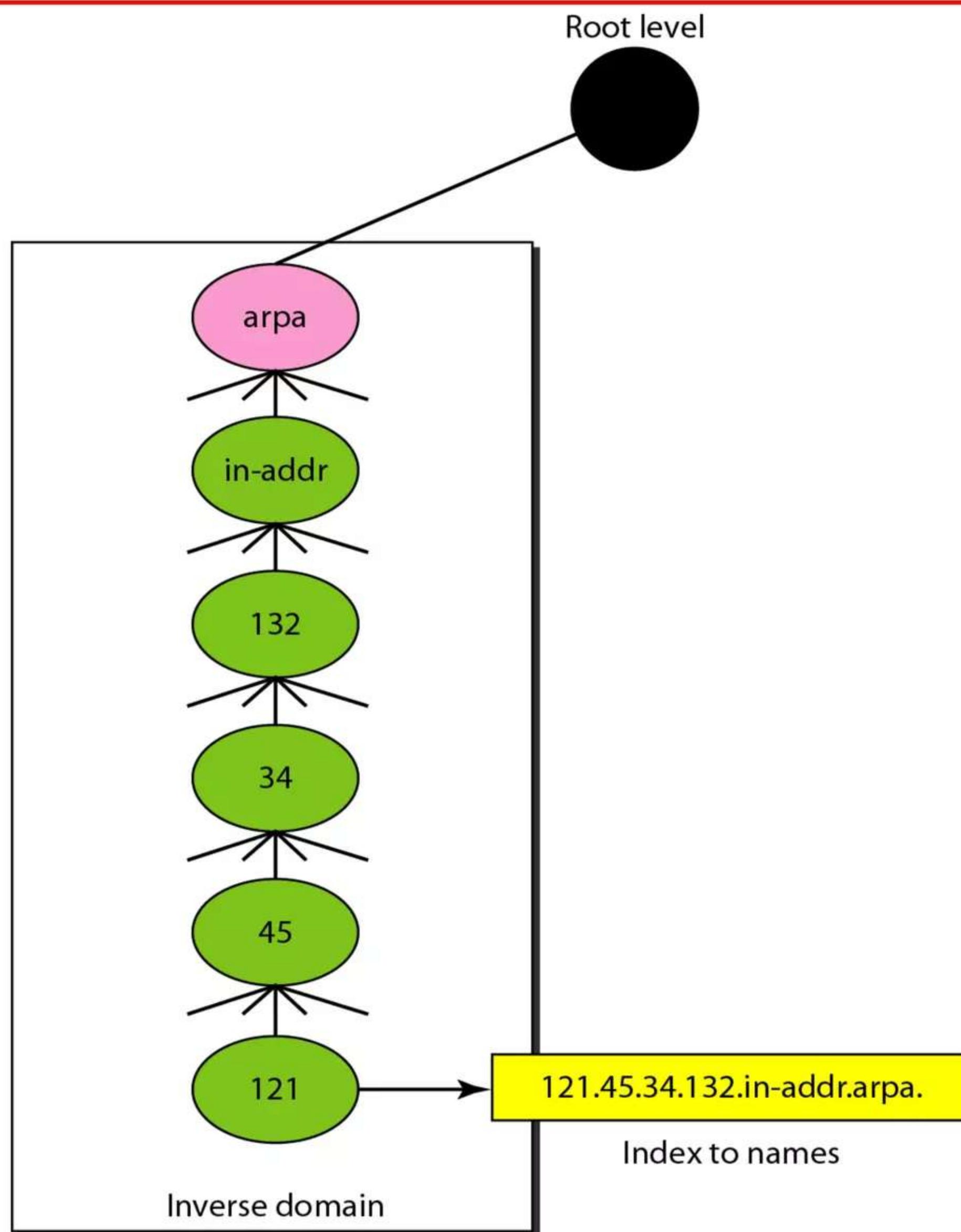


Figure 25.11 *Inverse domain*



25-5 RESOLUTION

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

Topics discussed in this section:

Resolver

Mapping Names to Addresses

Mapping Addresses to Names

Recursive Resolution

Caching

Figure 25.12 Recursive resolution

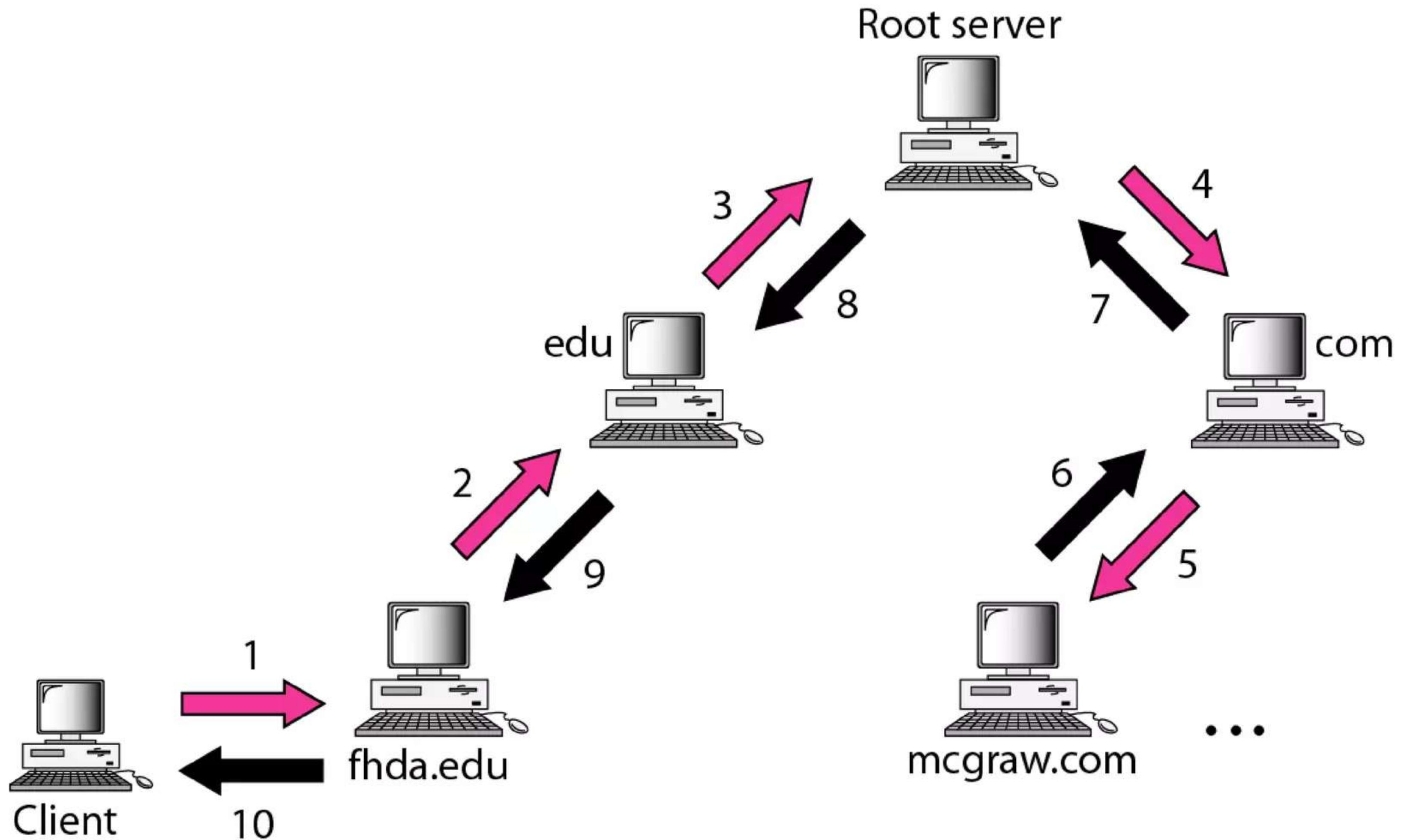
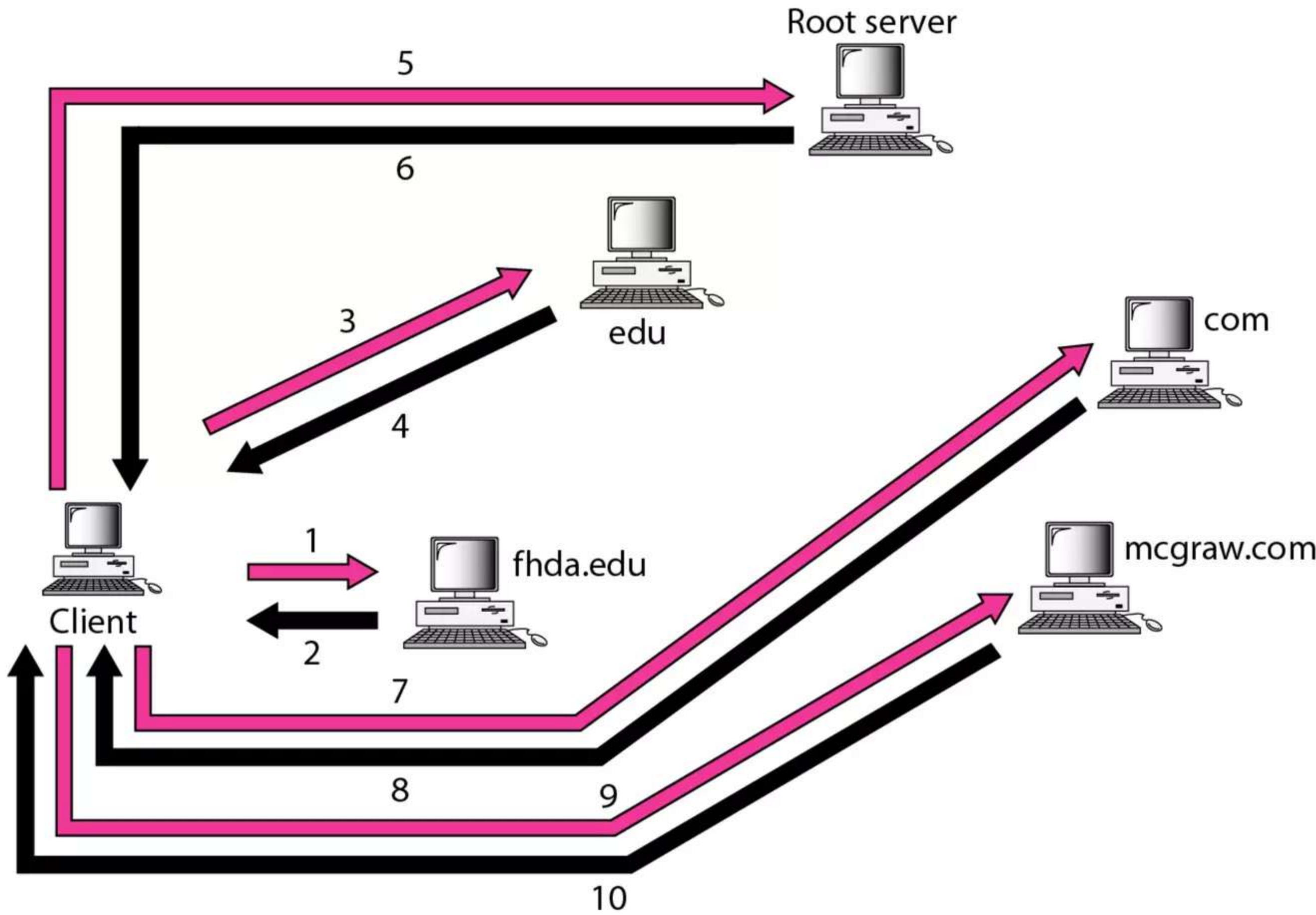


Figure 25.13 Iterative resolution



25-6 DNS MESSAGES

DNS has two types of messages: query and response. Both types have the same format. The query message consists of a header and question records; the response message consists of a header, question records, answer records, authoritative records, and additional records.

Topics discussed in this section:

Header

Figure 25.14 *Query and response messages*

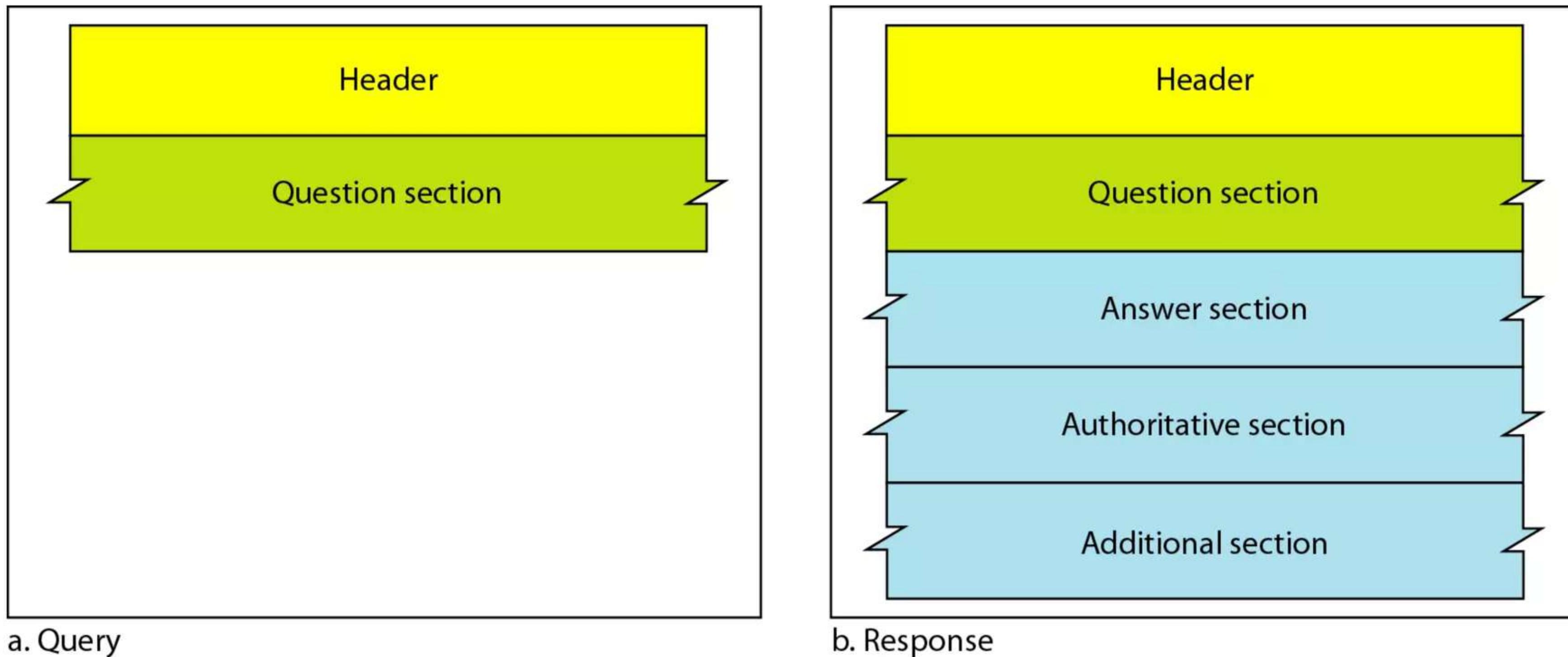


Figure 25.15 Header format

| Identification | Flags |
|--|---|
| Number of question records | Number of answer records (all 0s in query message) |
| Number of authoritative records (all 0s in query message) | Number of additional records (all 0s in query message) |

25-7 TYPES OF RECORDS

As we saw in Section 25.6, two types of records are used in DNS. The question records are used in the question section of the query and response messages. The resource records are used in the answer, authoritative, and additional information sections of the response message.

Topics discussed in this section:

Question Record
Resource Record

25-8 REGISTRARS

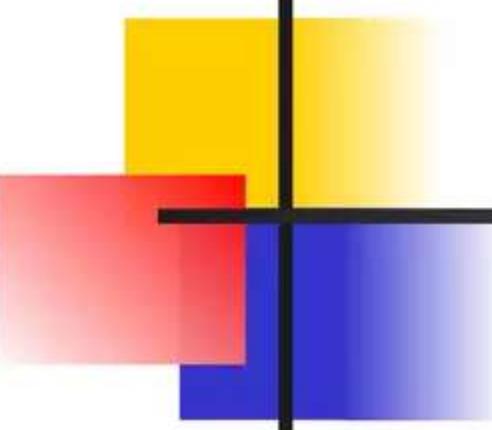
How are new domains added to DNS? This is done through a registrar, a commercial entity accredited by ICANN. A registrar first verifies that the requested domain name is unique and then enters it into the DNS database. A fee is charged.

25-9 DYNAMIC DOMAIN NAME SYSTEM (DDNS)

*The DNS master file must be updated dynamically. The **Dynamic Domain Name System (DDNS)** therefore was devised to respond to this need. In DDNS, when a binding between a name and an address is determined, the information is sent, usually by DHCP to a primary DNS server. The primary server updates the zone. The secondary servers are notified either actively or passively.*

25-10 ENCAPSULATION

DNS can use either UDP or TCP. In both cases the well-known port used by the server is port 53. UDP is used when the size of the response message is less than 512 bytes because most UDP packages have a 512-byte packet size limit. If the size of the response message is more than 512 bytes, a TCP connection is used.



Note

**DNS can use the services of UDP or TCP
using the well-known port 53.**