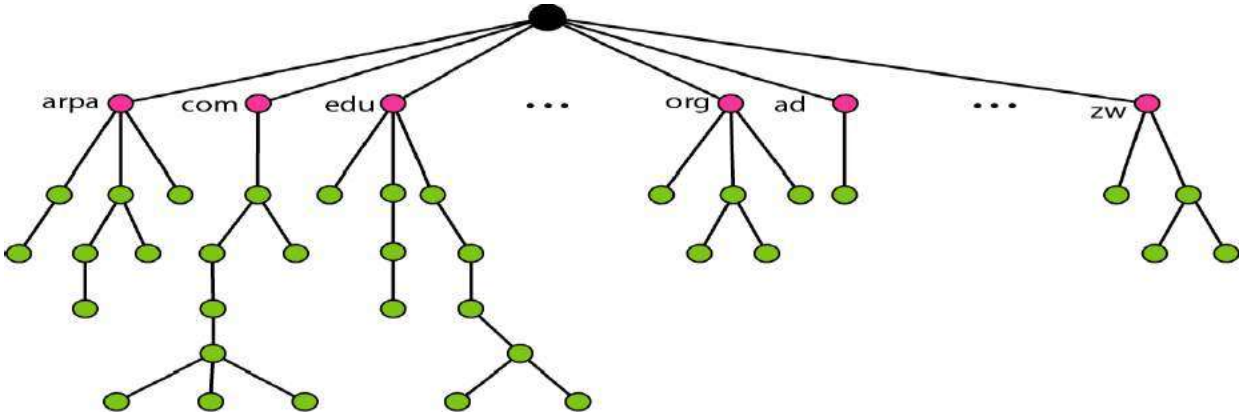
Application Layer

Domain Name System(DNS)

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..

Figure *Domain name space*



Label: Each node in the tree has a label, which is a string with a maximum of 63 characters. The root label is a null string (empty string). DNS requires that children of a node (nodes that branch from the same node) have different labels, which guarantees the uniqueness of the domain names

Figure *Domain names and labels*

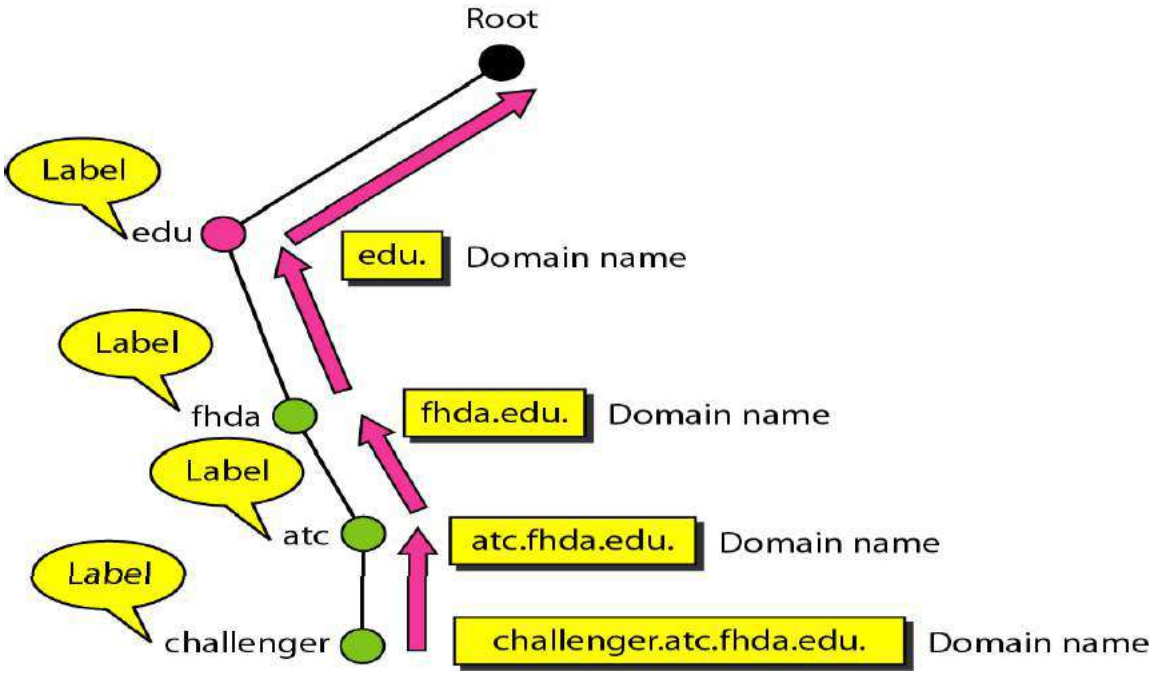
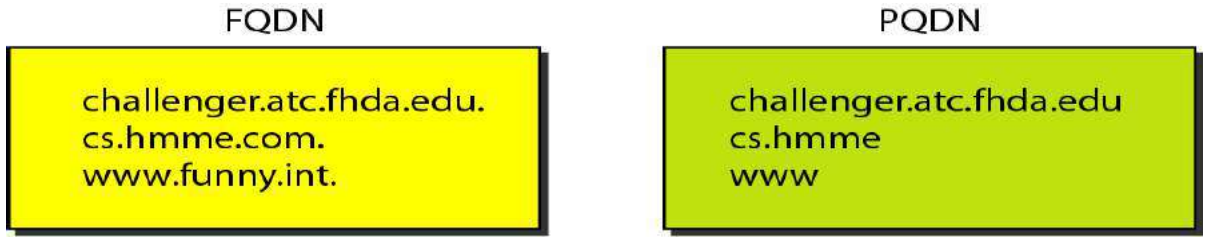


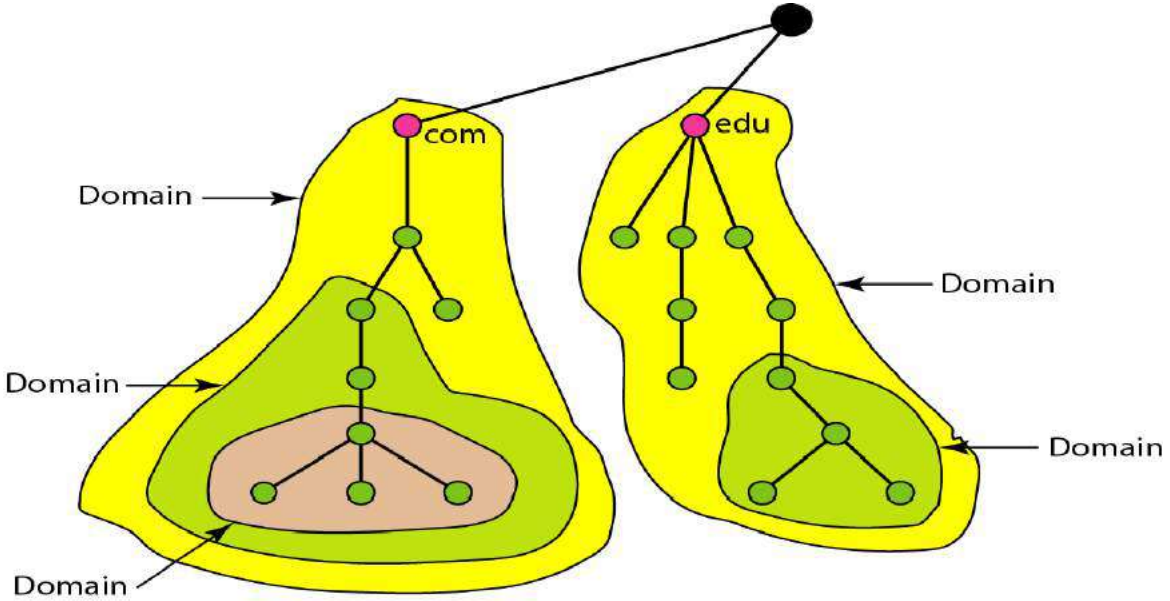
Figure *FQDN and PQDN*



Fully Qualified Domain Name If a label is terminated by a null string, it is called a fully qualified domain name (FQDN). An FQDN is a domain name that contains the full name of a host. It contains all labels, from the most specific to the most general, that uniquely define the name of the host. For example, the domain name challenger.atc.fhda.edu. is the FQDN of a computer named challenger installed at the Advanced Technology Center (ATC) at De Anza College.

Partially Qualified Domain Name If a label is not terminated by a null string, it is called a partially qualified domain name (PQDN). A PQDN starts from a node, but it does not reach the root. It is used when the name to be resolved belongs to the same site as the client. Here the resolver can supply the missing part, called the suffix, to create an FQDN. For example, if a user at the fhda.edu. site wants to get the IP address of the challenger computer, he or she can define the partial name challenger The DNS client adds the suffix atc.fhda.edu. before passing the address to the DNS server. The DNS client normally holds a list of suffixes.

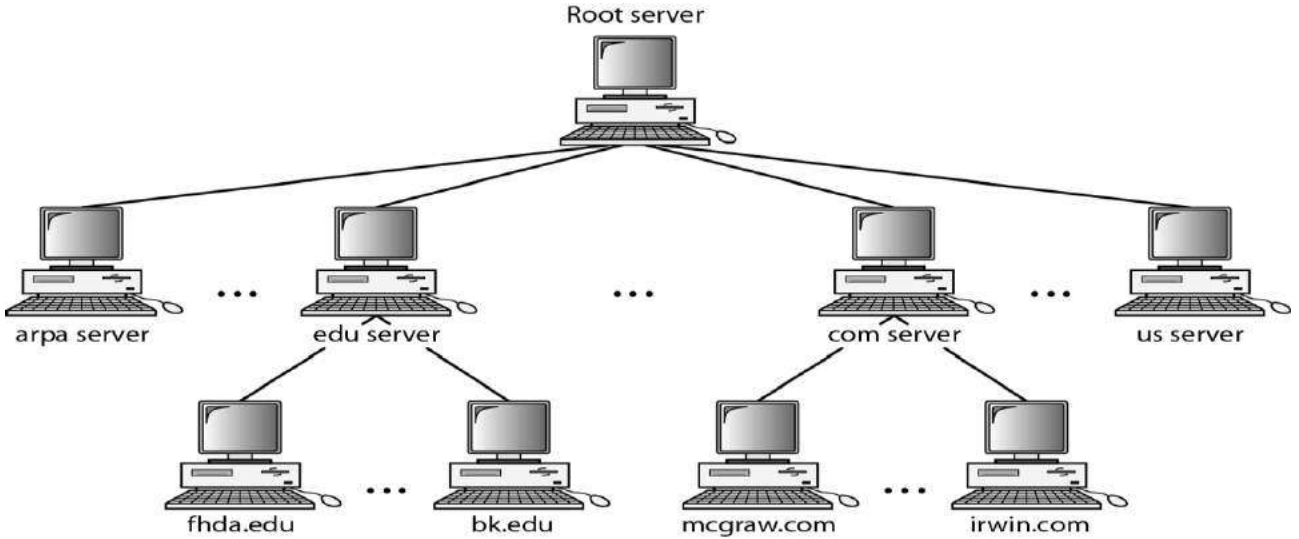
Figure *Domains*



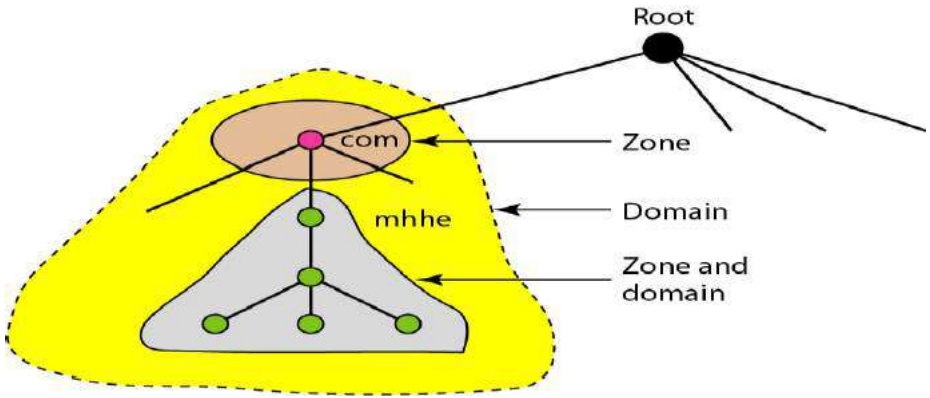
DISTRIBUTION OF NAME SPACE

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



Zone: Since the complete domain name hierarchy cannot be stored on a single server, it is divided among many servers. What a server is responsible for or has authority over is called a zone. The server makes a database called a zone file and keeps all the information for every node under that domain. However, if a server divides its domain into subdomains and delegates part of its authority to other servers, domain and zone refer to different things. The information about the nodes in the subdomains is stored in the servers at the lower levels, with the original server keeping some sort of reference to these lower-level servers. Of course the original server does not free itself from responsibility totally: It still has a zone, but the detailed information is kept by the lower-level servers (see Figure 25.7)

Note

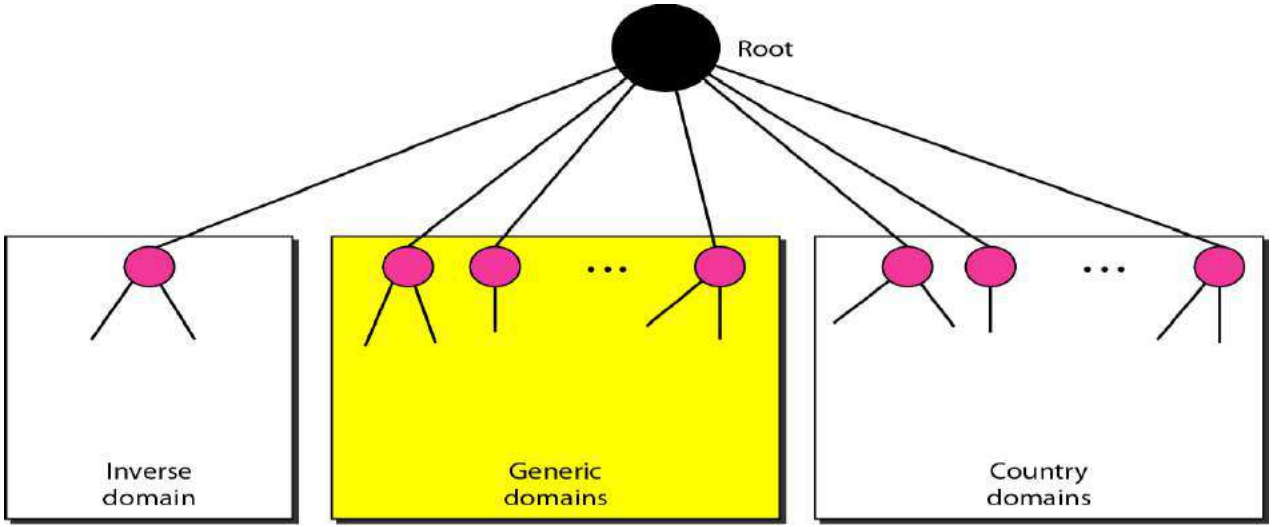
A primary server loads all information from the disk file; the secondary server loads all information from the primary server.

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

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

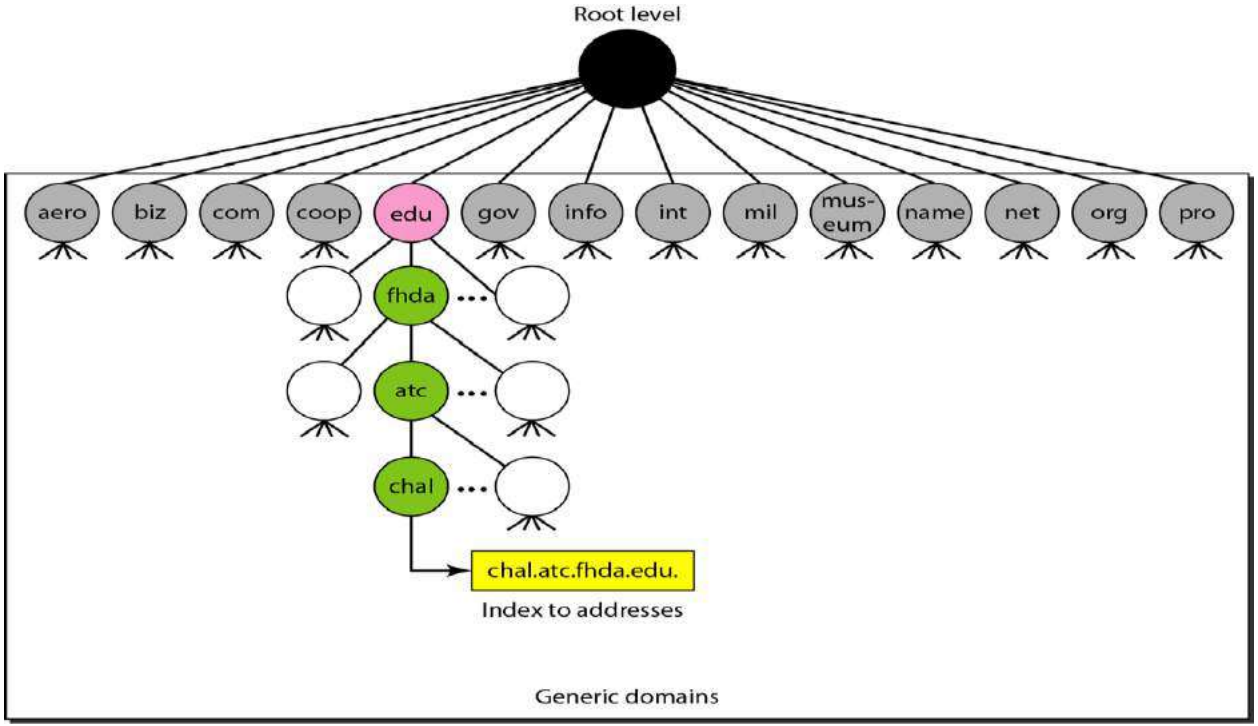


Table *Generic domain labels*

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 *Country domains*

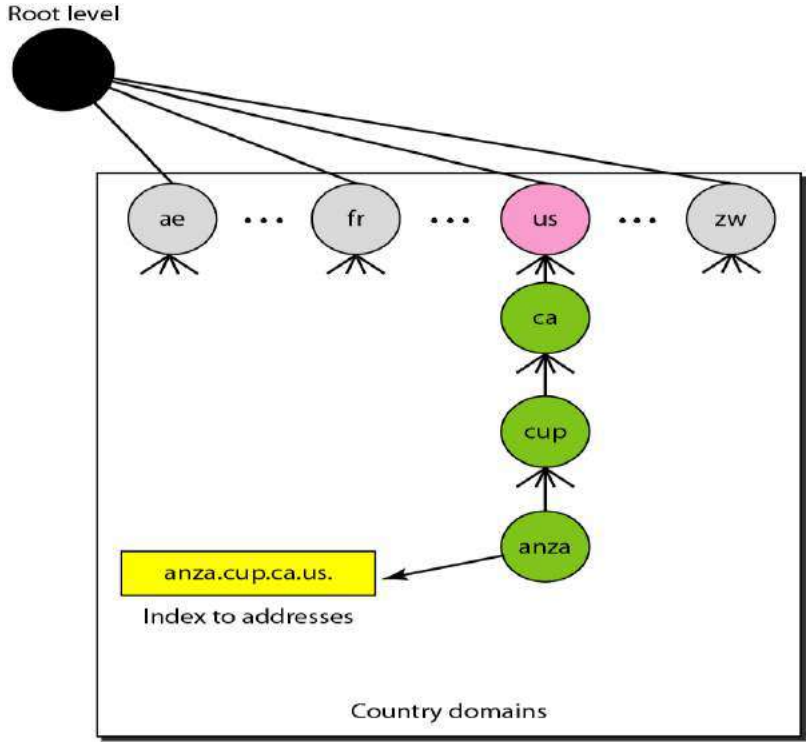
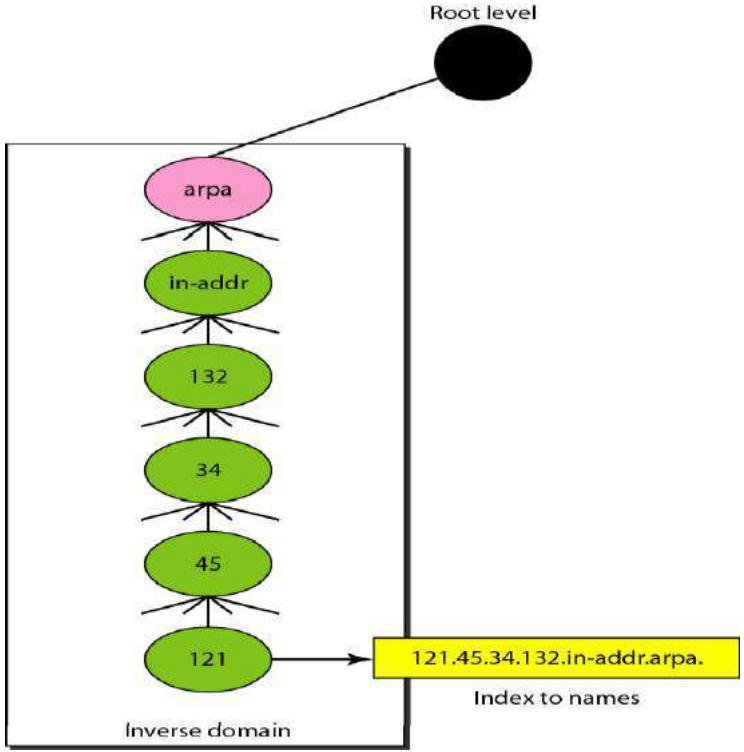


Figure *Inverse domain*



RESOLUTION

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

- **Mapping Names to Addresses**
  Most of the time, the resolver gives a domain name to the server and asks for the corresponding address. In this case, the server checks the generic domains or the country domains to find the mapping. If the domain name is from the generic domains section, the resolver receives a domain name such as "chal.atc.jhda.edu.". The query is sent by the resolver to the local DNS server for resolution. If the local server cannot resolve the query, it either refers the resolver to other servers or asks other servers directly. If the domain name is from the country domains section, the resolver receives a domain name such as "ch.jhda.cu.ca.us.". The procedure is the same
- **Mapping Addresses to Names**
  A client can send an IP address to a server to be mapped to a domain name. As mentioned before, this is called a PTR query. To answer queries of this kind, DNS uses the inverse domain. However, in the request, the IP address is reversed and the two labels in-addr and arpa are appended to create a domain acceptable by the inverse domain section. For example, if the resolver receives the IF address 132.34.45.121, the resolver first inverts the address and then adds the two labels before sending. The domain name sent is "121.45.34.132.in-addr.arpa." which is received by the local DNS and resolved

Figure ***Recursive resolution***

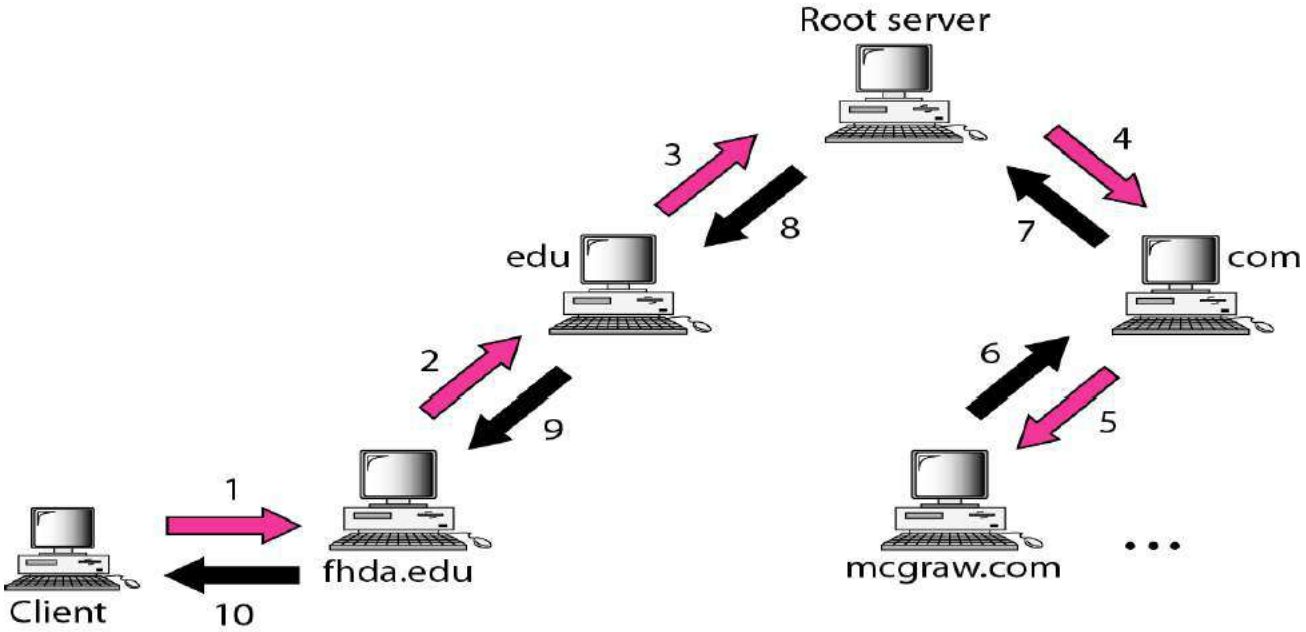
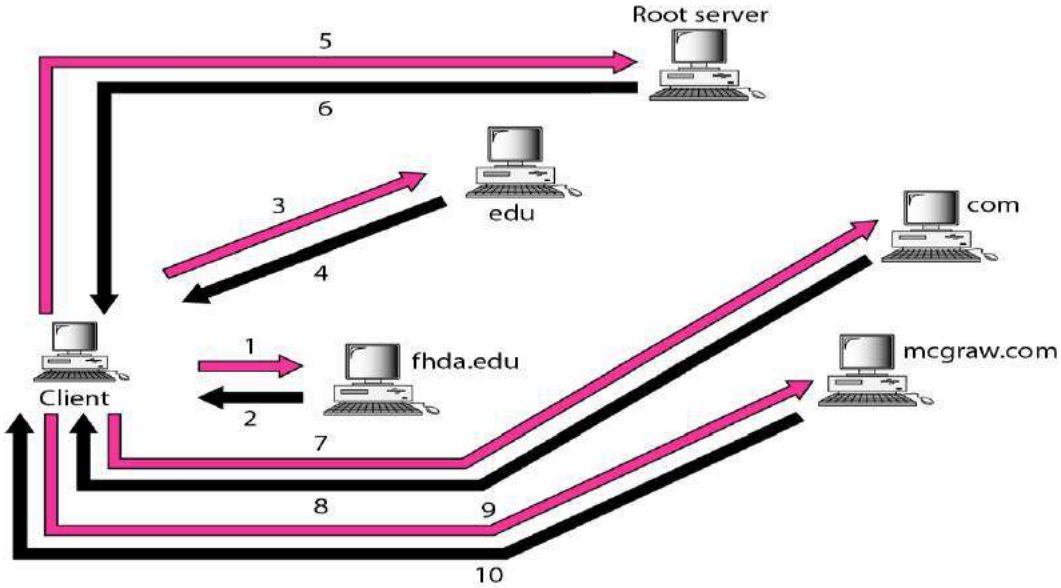


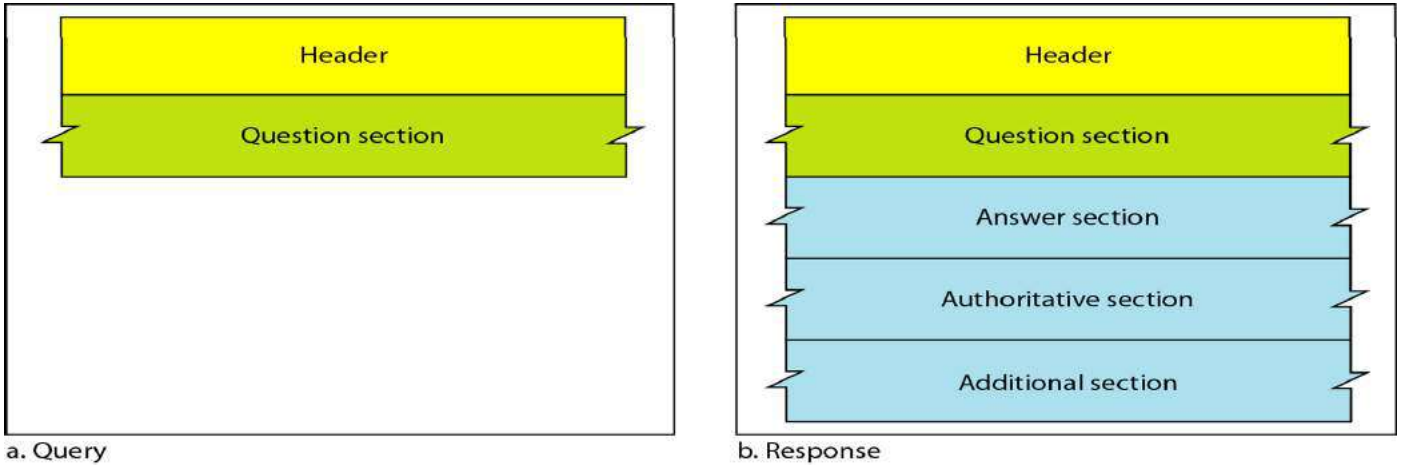
Figure *Iterative resolution*



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.

Figure *Query and response messages*



a. Query

b. Response

Figure *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)

TYPES OF RECORDS

- ***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.***
- **Question Record** A question record is used by the client to get information from a server. This contains the domain name
- **Resource Record** Each domain name (each node on the tree) is associated with a record called the resource record. The server database consists of resource records. Resource records are also what is returned by the server to the client

Note

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