

COMPUTER NETWORK (BCA301)

DEPARTMENT OF COMPUTER SCIENCE

PROGRAMME: BCA

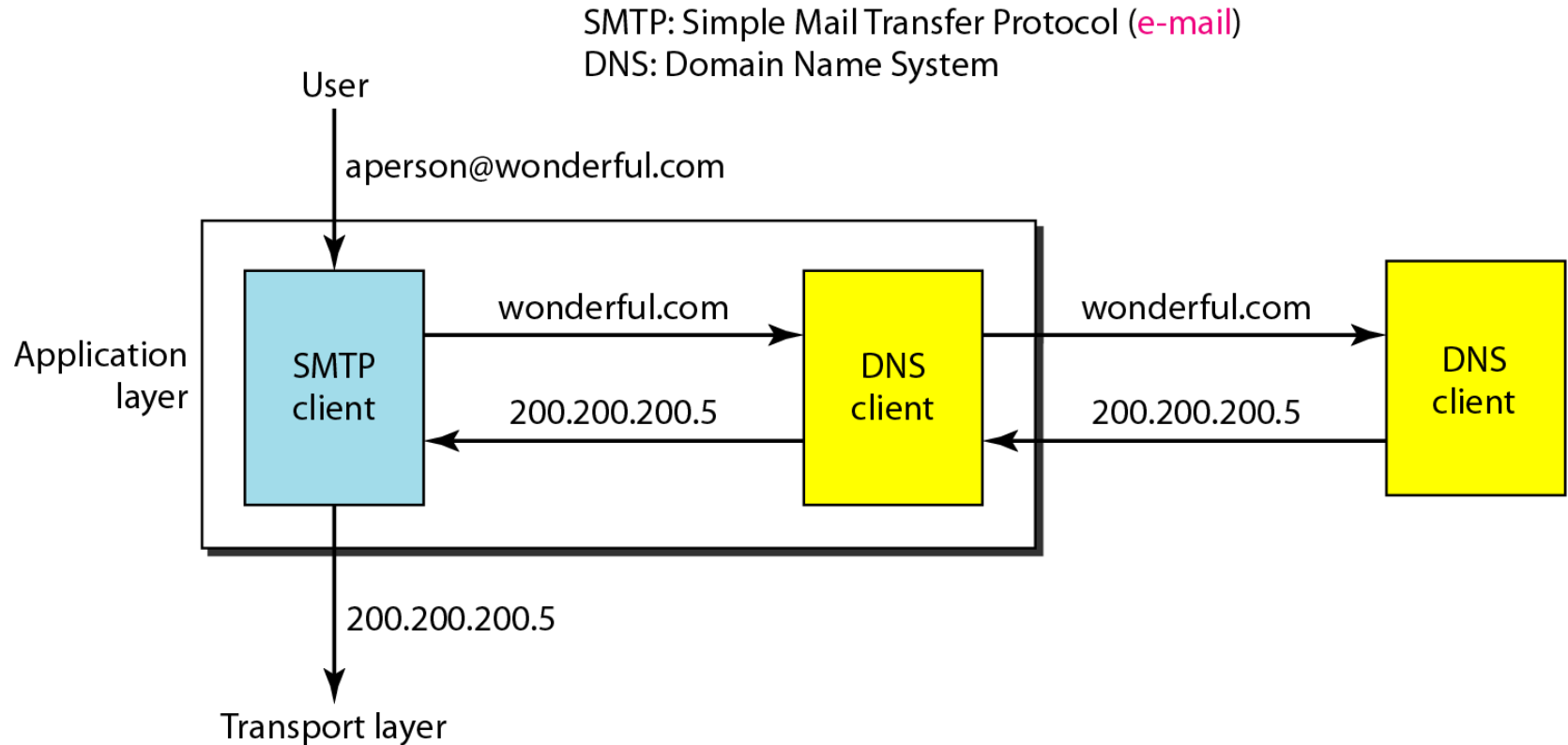


**CENTRAL UNIVERSITY OF ORISSA
KORAPUT**

Application Layer

- The application layer is responsible for providing services to the user.
- It provides user interfaces and support for services such as electronic mail, file access and transfer, access to system resources, surfing the world wide web, and network management.
- There are several applications in the application layer of the Internet model that follow the client/server paradigm. The client/server programs can be divided into two categories:
- Those that can be directly used by the user, such as e-mail, and those that support other application programs. The Domain Name System (DNS) is a supporting program that is used by other programs such as e-mail

Example of using the DNS service



NAMESPACE

- To identify an entity, TCP/IP protocols use the IP address, which uniquely identifies the connection of a host to the Internet.
- However, people prefer to use names instead of numeric addresses.
- Therefore, we need a system that can map a name to an address or an address to a name.
- The names must be unique because the addresses are unique.
- A name space that maps each address to a unique name can be organized in two ways:
 1. Flat or
 2. Hierarchical.

Flat Name Space

- In a flat name space, a name is assigned to an address.
- A name in this space is a sequence of characters without structure.
- The names may or may not have a common section; if they do, it has no meaning.
- The main disadvantage of a flat name space is that it cannot be used in a large system such as the Internet.

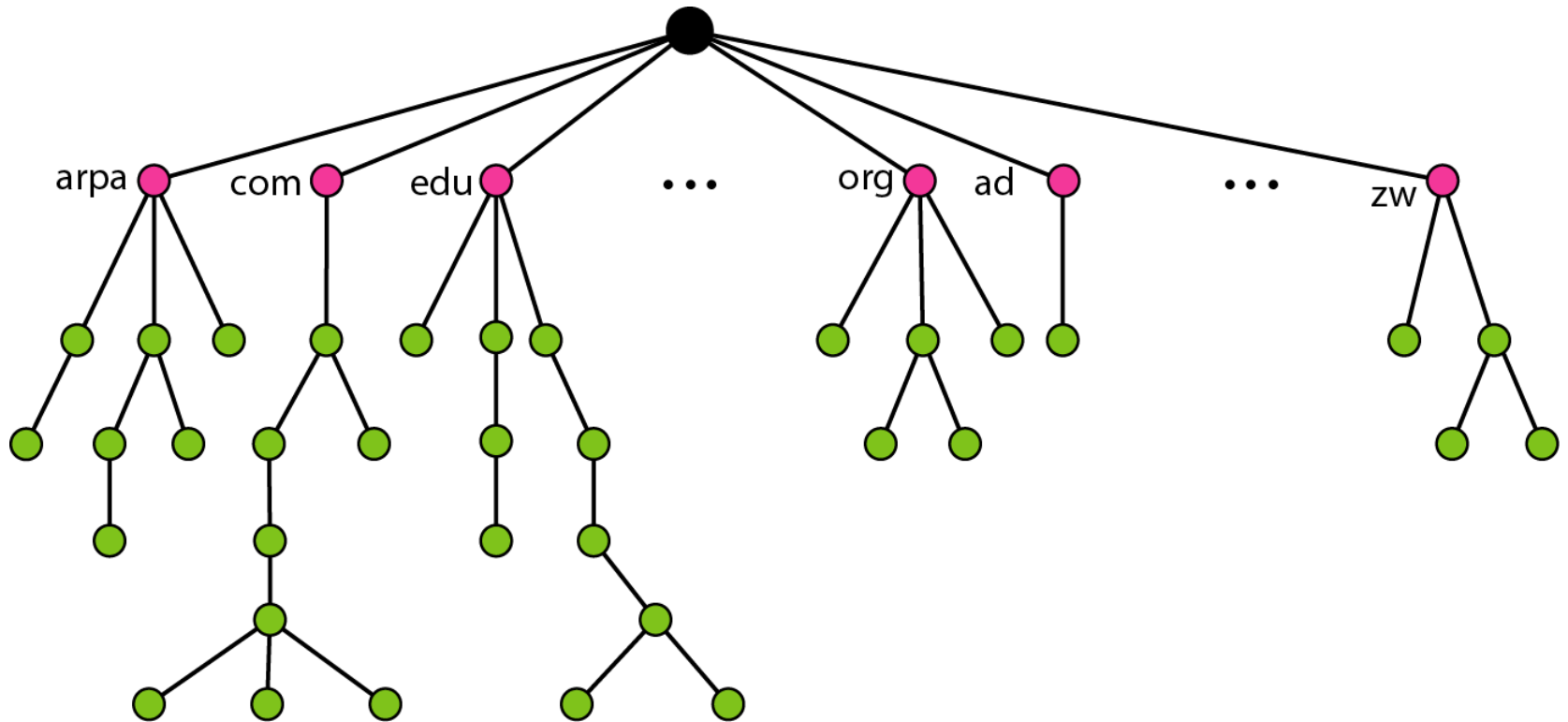
Hierarchical Name Space

- In a hierarchical name space, each name is made of several parts. The first part can define the nature of the organization, the second part can define the name of an organization, the third part can define departments in the organization, and so on.
- In this case, the authority to assign and control the name spaces can be decentralized.
- A central authority can assign the part of the name that defines the nature of the organization and the name of the organization.
- The responsibility of the rest of the name can be given to the organization itself. The organization can add suffixes (or prefixes) to the name to define its host or resources.
- The central authority controls only part of the name, not the whole.

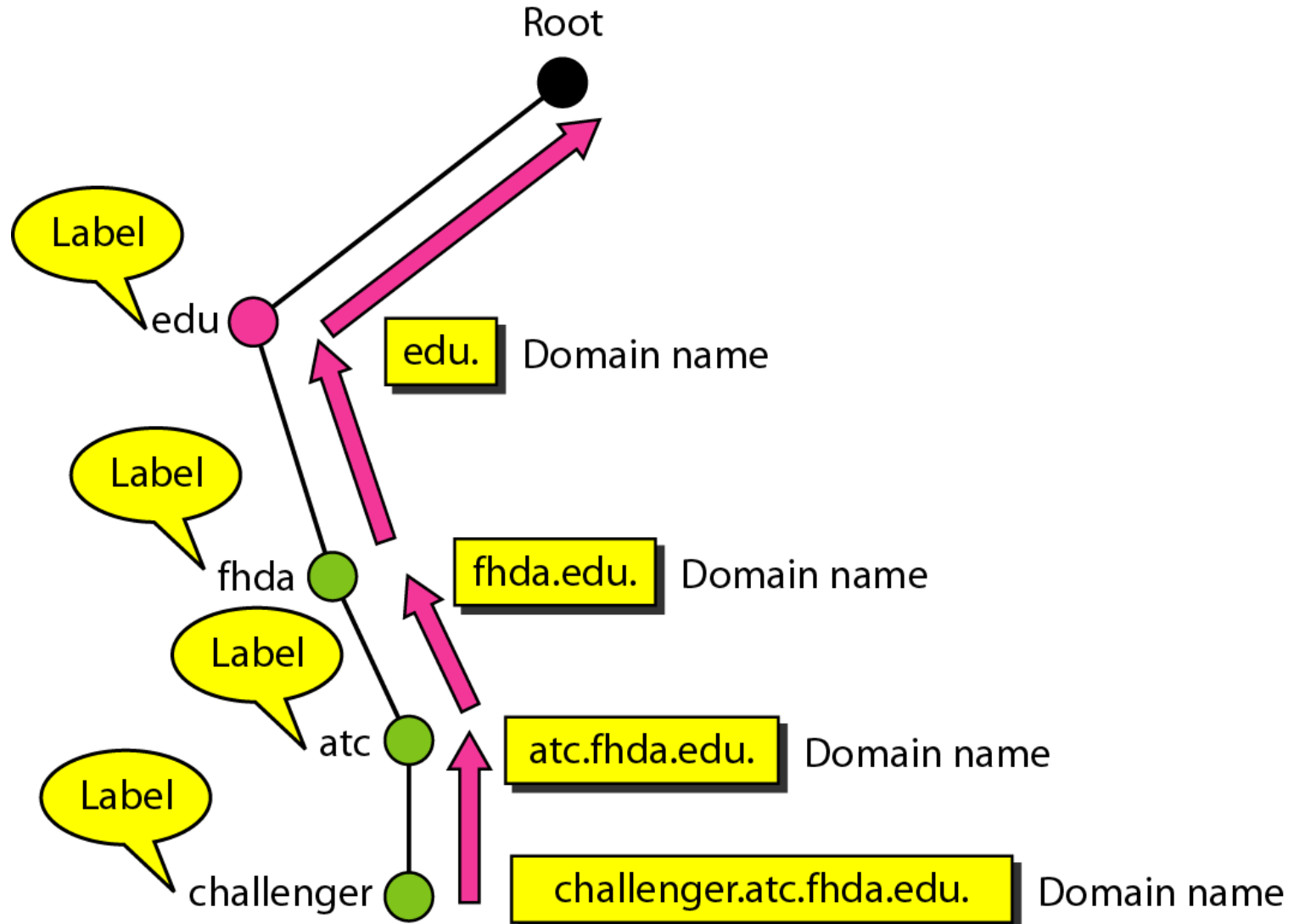
DOMAIN NAME SPACE(DNS)

- 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.
- 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).
- **Domain Name:** Each node in the tree has a domain name. A full domain name is a sequence of labels separated by dots (.). The domain names are always read from the node up to the root.
- This means that a full domain name always ends in a null label, which means the last character is a dot because the null string is nothing.

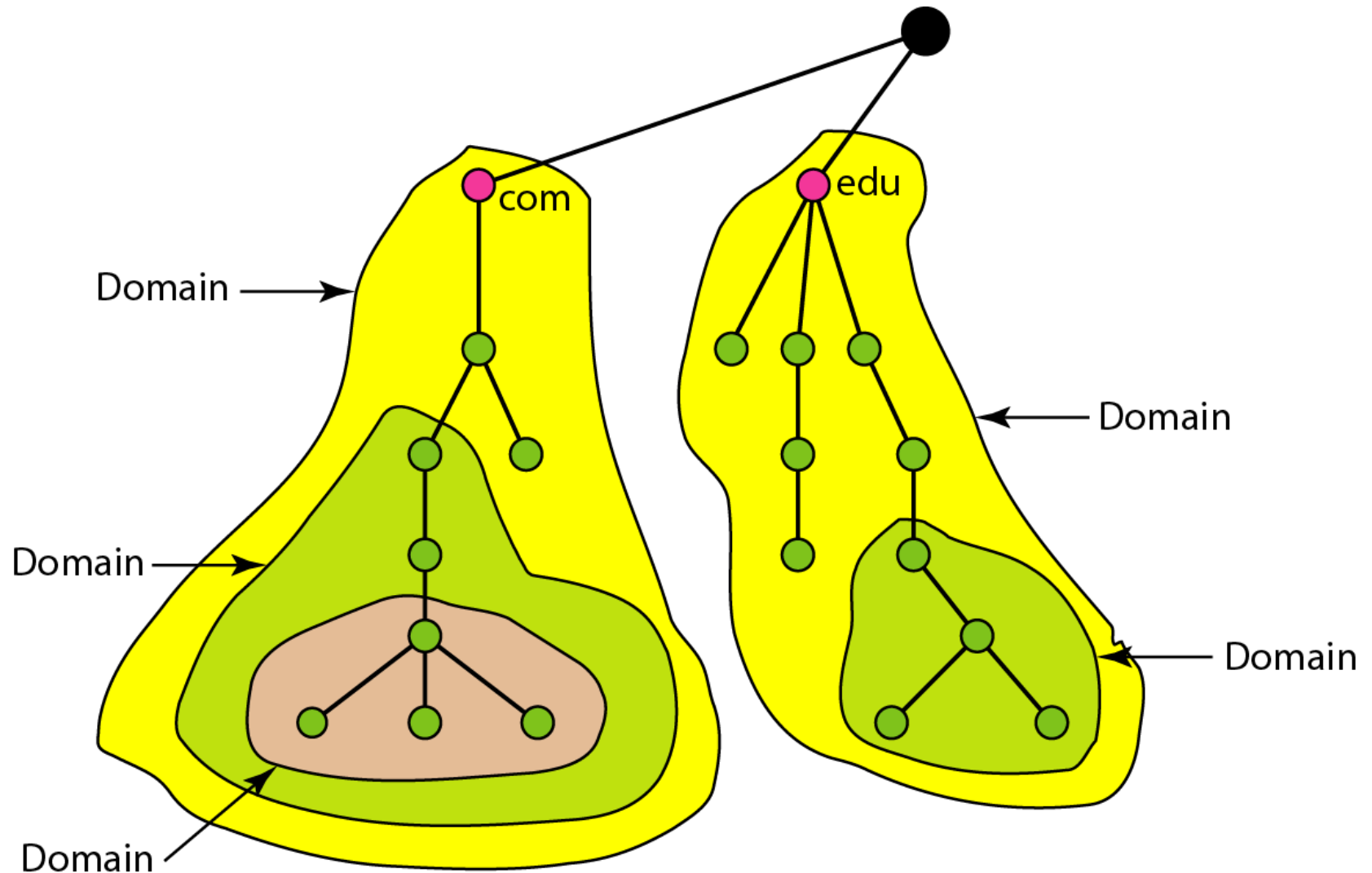
Domain name space



Domain names and labels



Domains: sub-tree of the domain name space

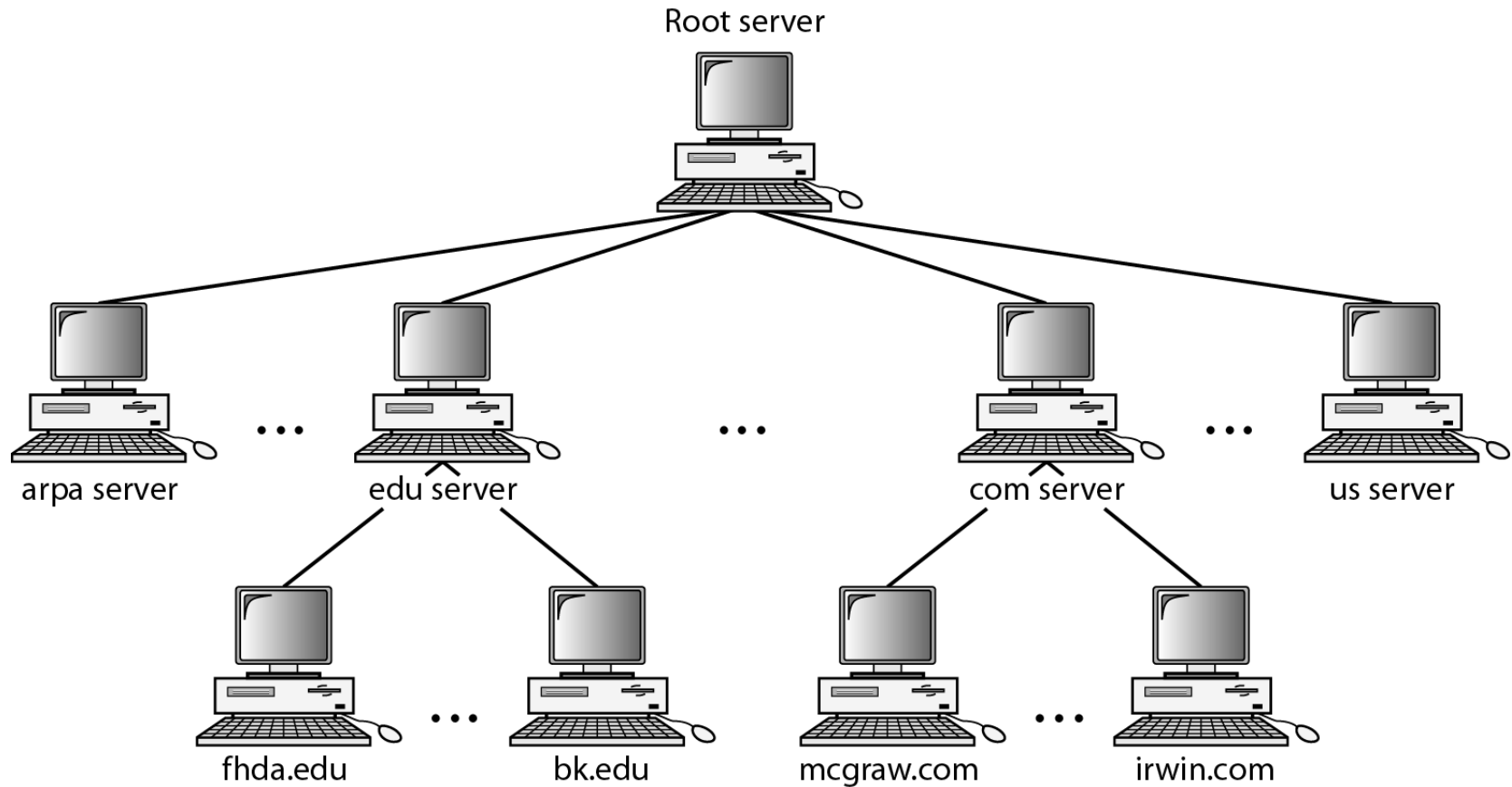


- **Fully Qualified Domain Name(FQDN):** If a label is terminated by a null string, it is called a fully qualified domain name(FQDN).
- An FQDN is a domain name that contains the full name of a host.
- It contains all labels, from the most specific to the most general, that uniquely define the name of the host.
- **Partially Qualified Domain Name (PQDN):** 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.
- **Domain:** A domain is a sub tree of the domain name space. The name of the domain is the domain name of the node at the top of the sub tree. A domain may itself be divided into domains (or sub domains as they are sometimes called).

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.
- **Disadvantage:** Heavy load on the system and Unreliable.
- **Hierarchy of Name Server:** It distribute the information among many computers called DNS servers.
- The root stand alone and create as many domains (sub trees) as there are first-level nodes. Because a domain created in this way could be very large, DNS allows domains to be divided further into smaller domains (sub domains).
- In other words, we have a hierarchy of servers in the same way that we have a hierarchy of names

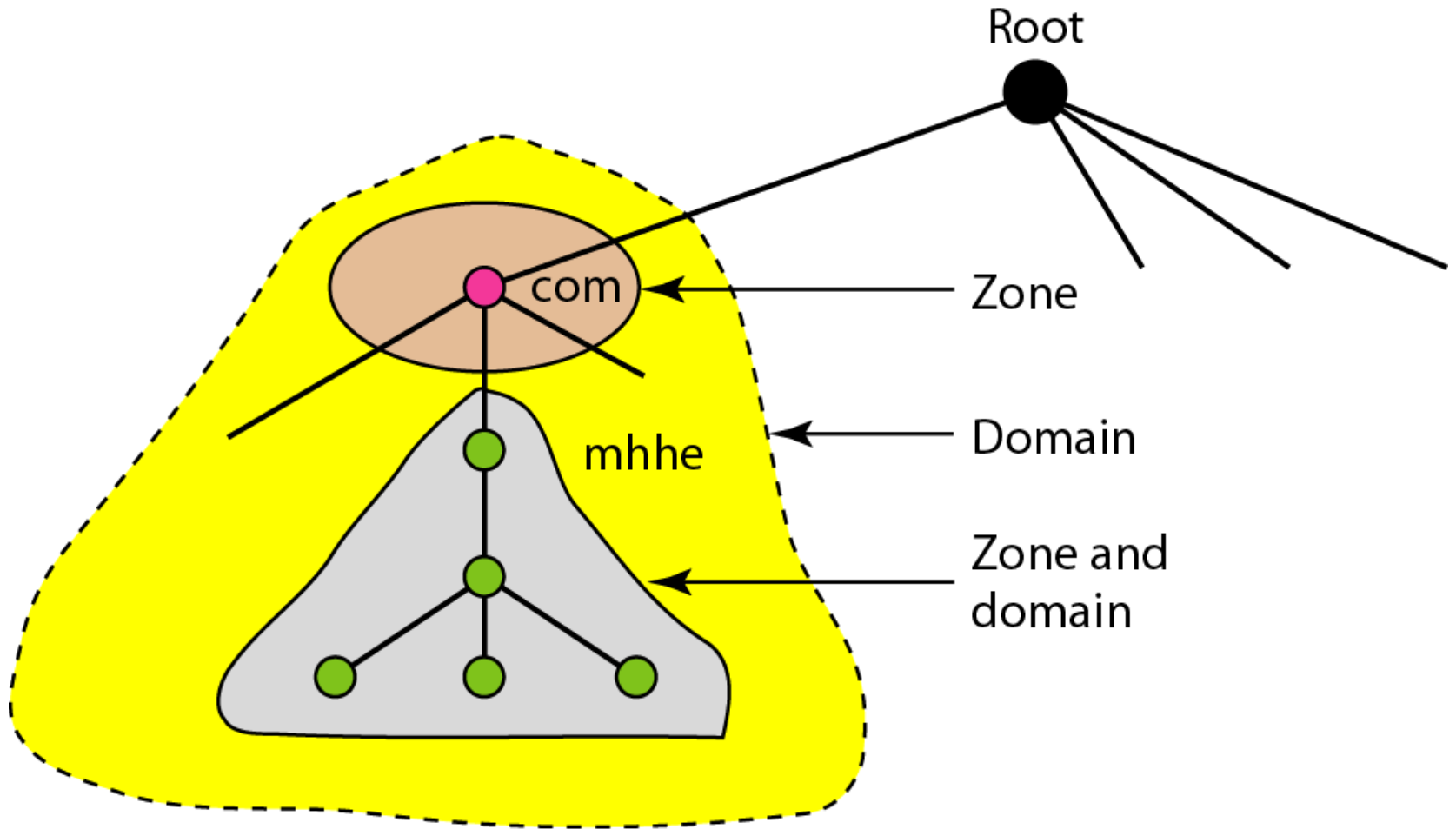
Hierarchy of name servers



Zone

- What a server is responsible for or has authority over is called a zone.
- If a server accepts responsibility for a domain and does not divide the domain into smaller domains, the domain and the zone refer to the same thing.
- 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 sub domains and delegates part of its authority to other servers, domain and zone refer to different things.
- **Root Server:** A root server is a server whose zone consists of the whole tree.
- A root server usually does not store any information about domains but delegates its authority to other servers, keeping references to those servers.

Zones and domains



Primary And Secondary Server

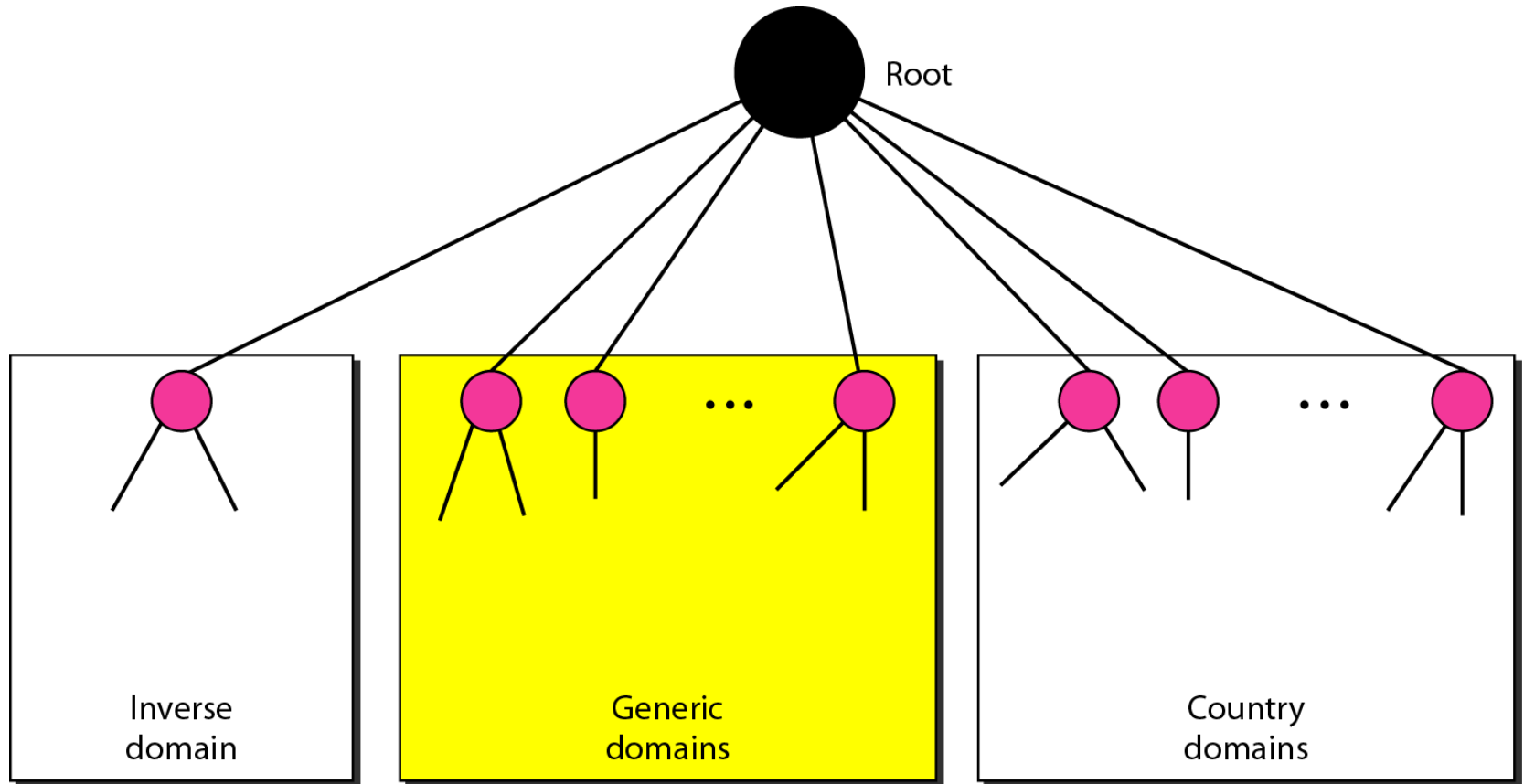
- DNS defines two types of servers: primary and secondary.
- **Primary Server:** A primary server is a server that stores a file about the zone for which it is an authority.
- It is responsible for creating, maintaining, and updating the zone file. It stores the zone file on a local disk.
- **Secondary Server:** A secondary server is a server that transfers the complete information about a zone from another server (primary or secondary) and stores the file on its local disk.
- The secondary server neither creates nor updates the zone files. If updating is required, it must be done by the primary server, which sends the updated version to the secondary.
- The idea is not to put the secondary server at a lower level of authority but to create redundancy for the data so that if one server fails, the other can continue serving clients.

DNS in The Internet

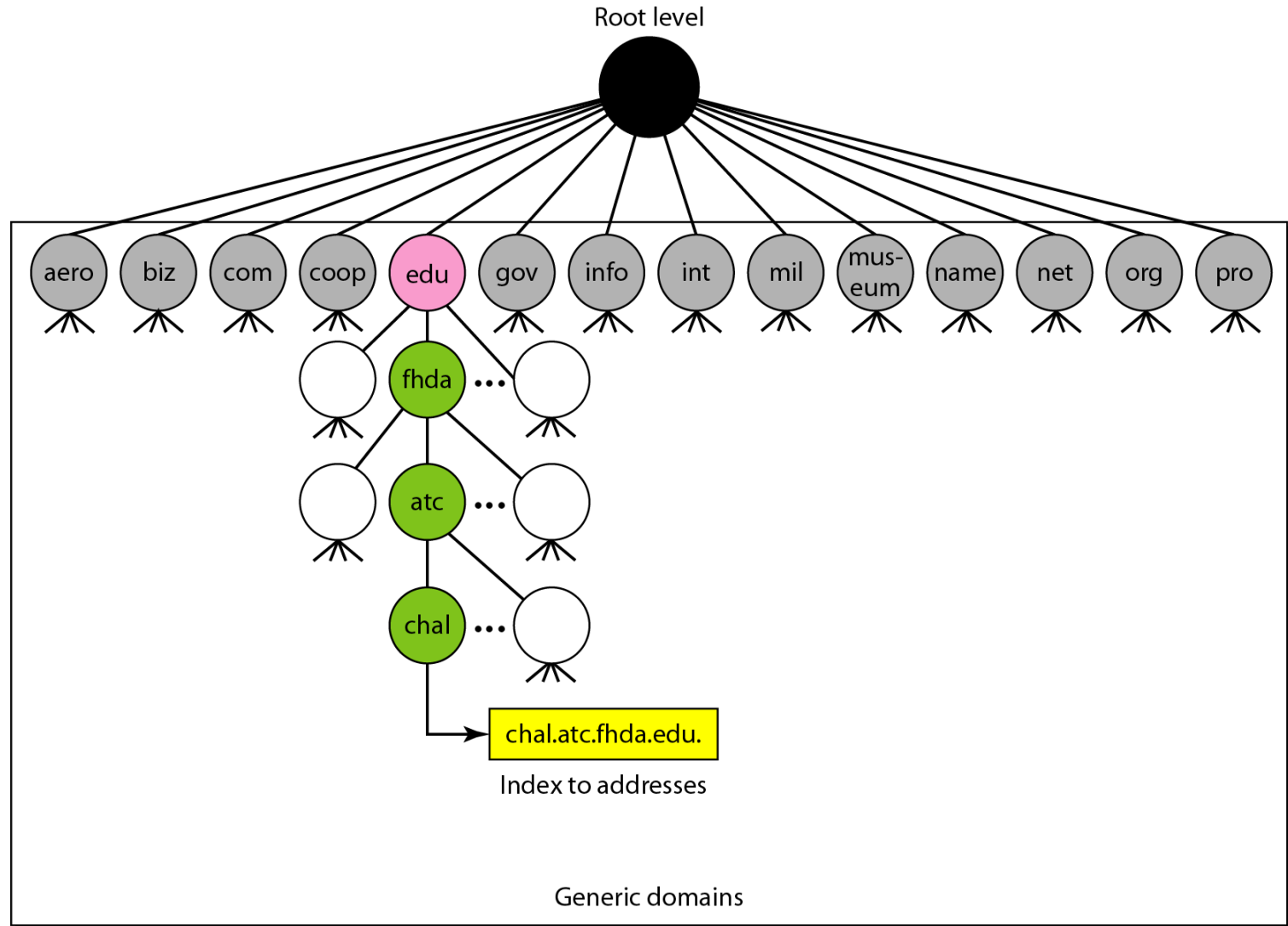
- DNS is a protocol that can be used in different platforms.
- In the Internet, the domain name space (tree) is divided into three different sections: generic domains, country domains, and the inverse domain.
- **Generic Domain:** The generic domains define registered hosts according to their generic behavior. Each node in the tree defines a domain, which is an index to the domain name space database.
- **Country Domains:** The country domains section uses two-character country abbreviations (e.g., us for United States). Second labels can be organizational, or they can be more specific, national designations.

- **Inverse Domain:** The inverse domain is used to map an address to a name. The server asks its resolver to send a query to the DNS server to map an address to a name to determine if the client is on the authorized list. The servers that handle the inverse domain are also hierarchical. This means the netid part of the address should be at a higher level than the sub netid part, and the sub netid part higher than the hostid part.

DNS IN THE INTERNET



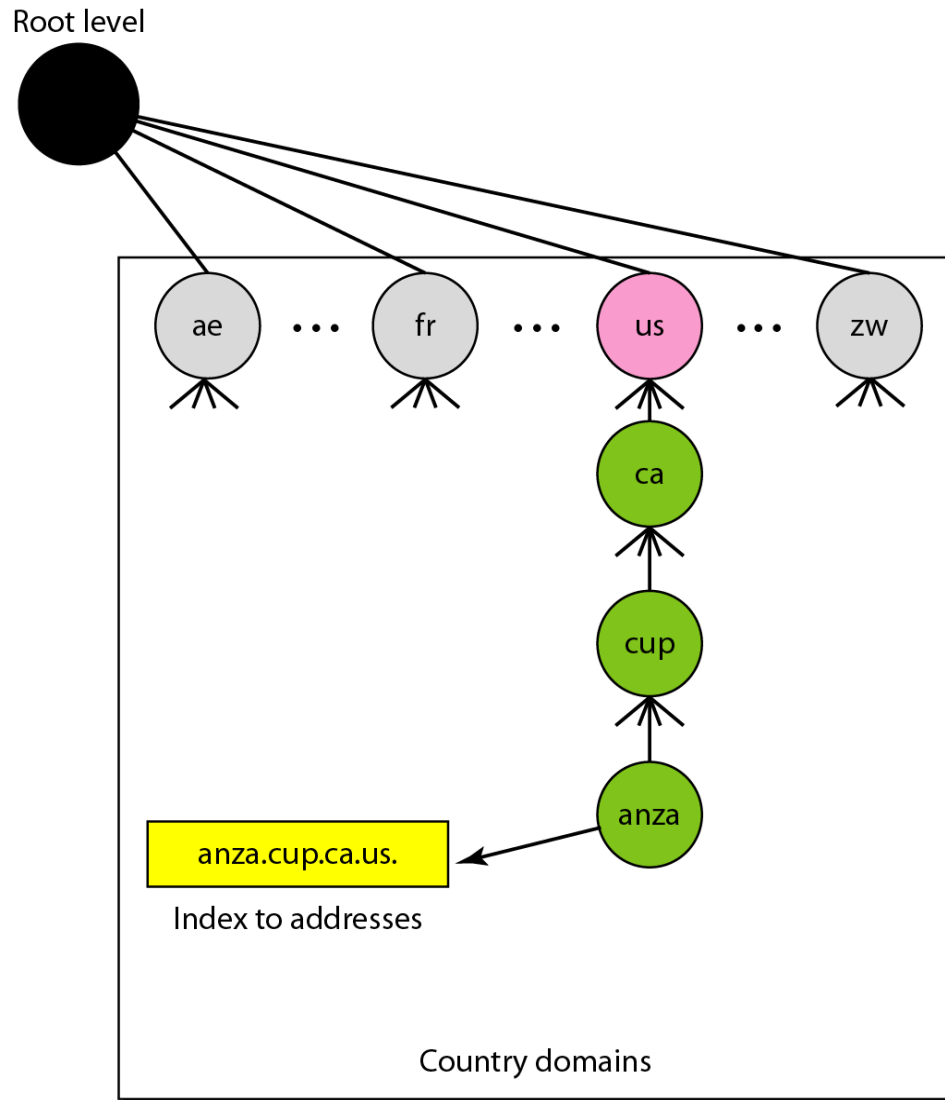
Generic domains



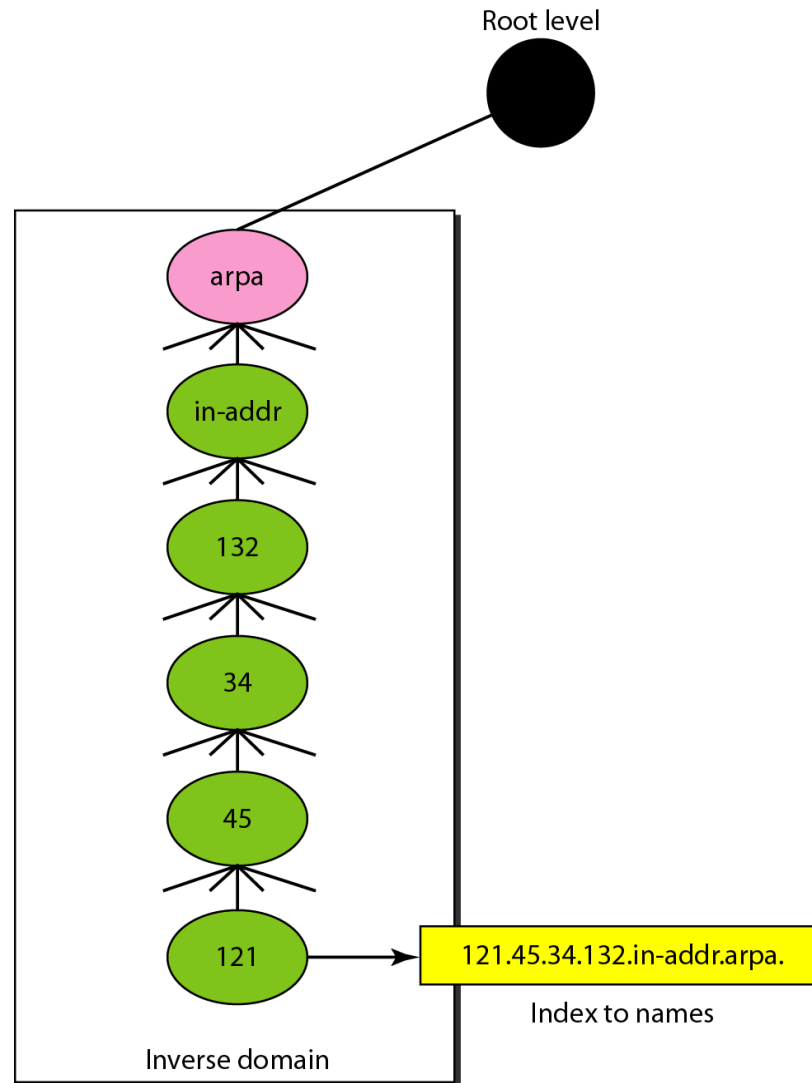
Generic domain labels

<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

Country domains



Inverse domain

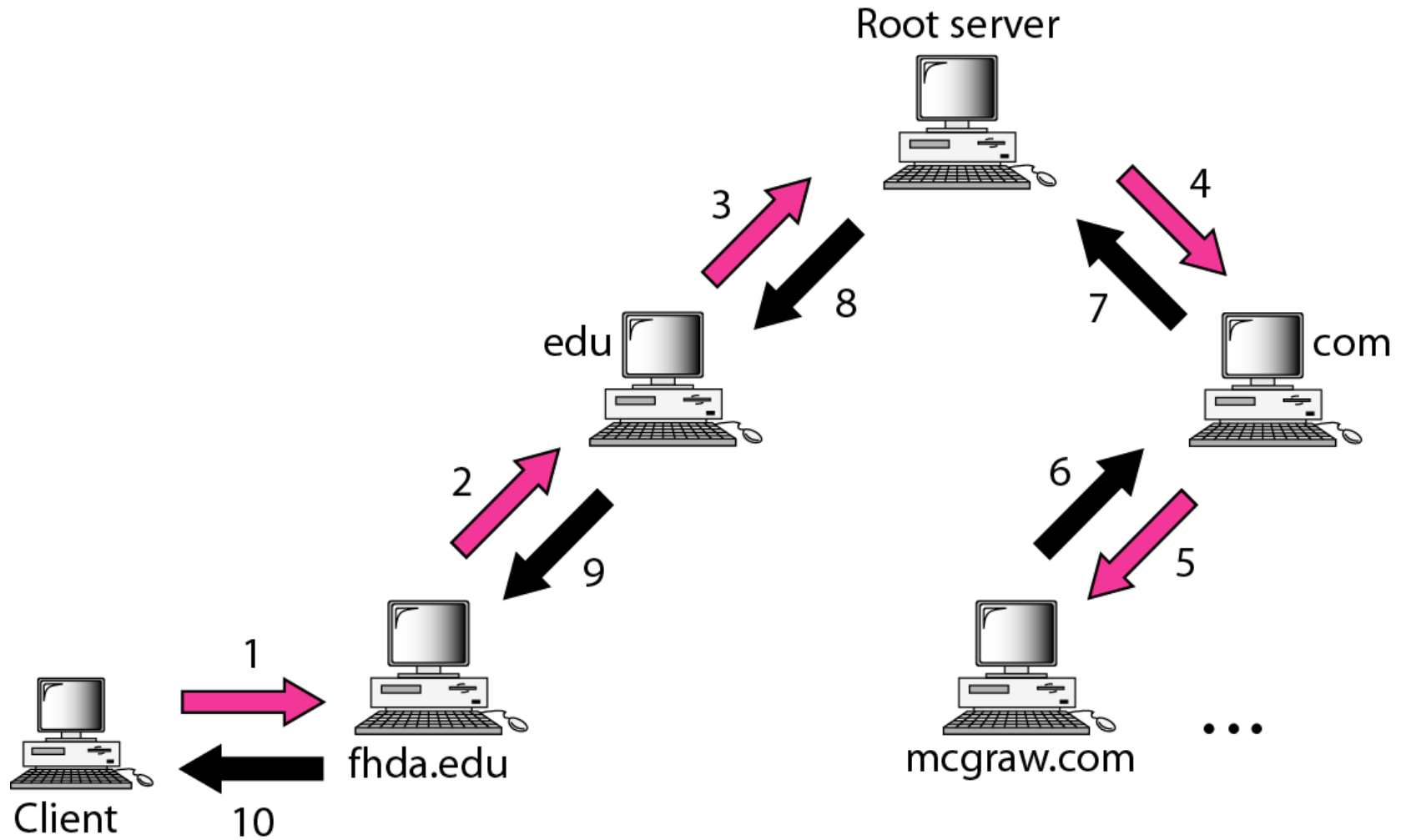


Name Address Resolution

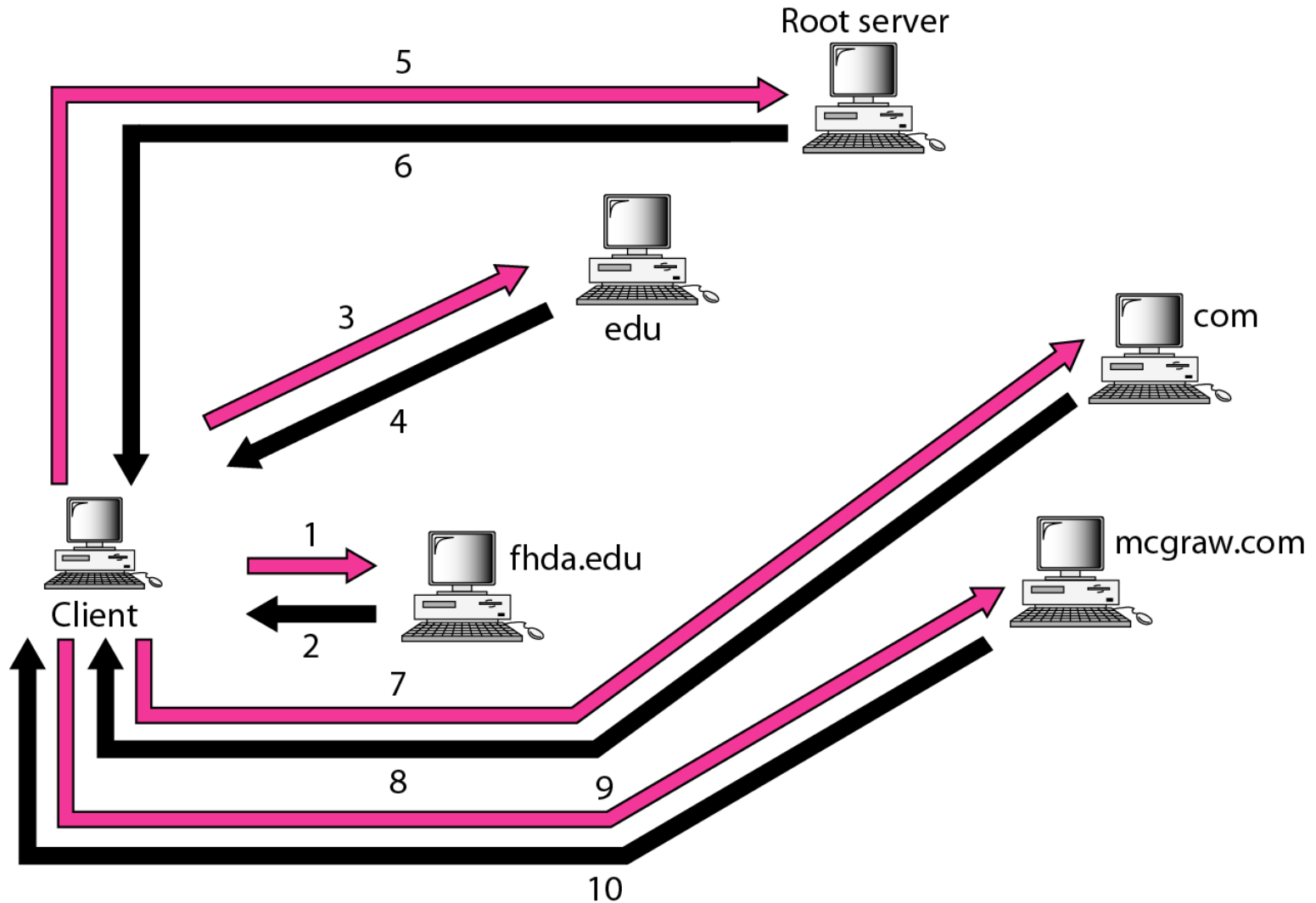
- Mapping a name to an address or an address to a name is called **name-address resolution**.
- **Resolver:** DNS is designed as a client/server application. A host that needs to map an address to a name or a name to an address calls a DNS client called a resolver.
- The resolver accesses the closest DNS server with a mapping request. If the server has the information, it satisfies the resolver; otherwise, it either refers the resolver to other servers or asks other servers to provide the information.
- **Mapping Names to Addresses:** 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.
- 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.

- **Mapping Addresses to Names** :A client can send an **IP** address to a server to be mapped to a domain name. 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.

Recursive resolution



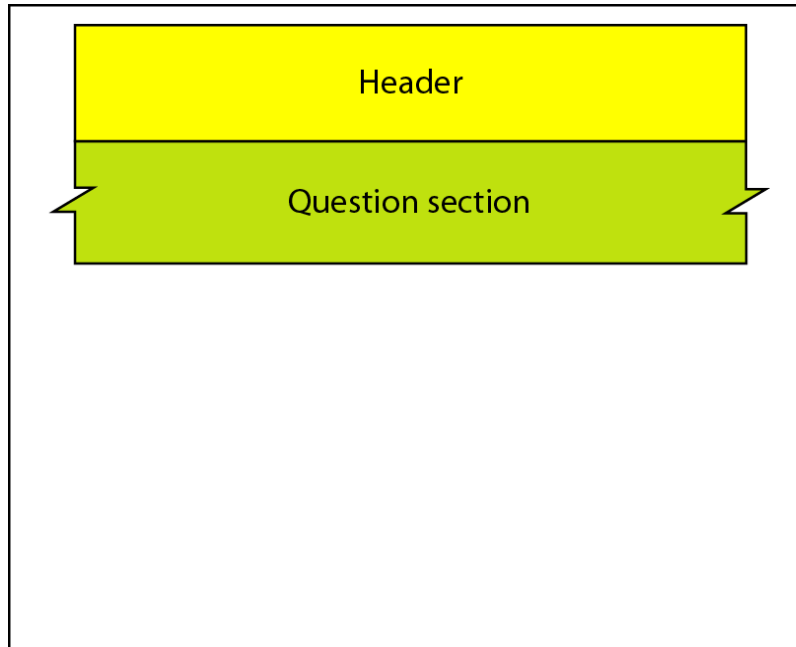
Iterative resolution



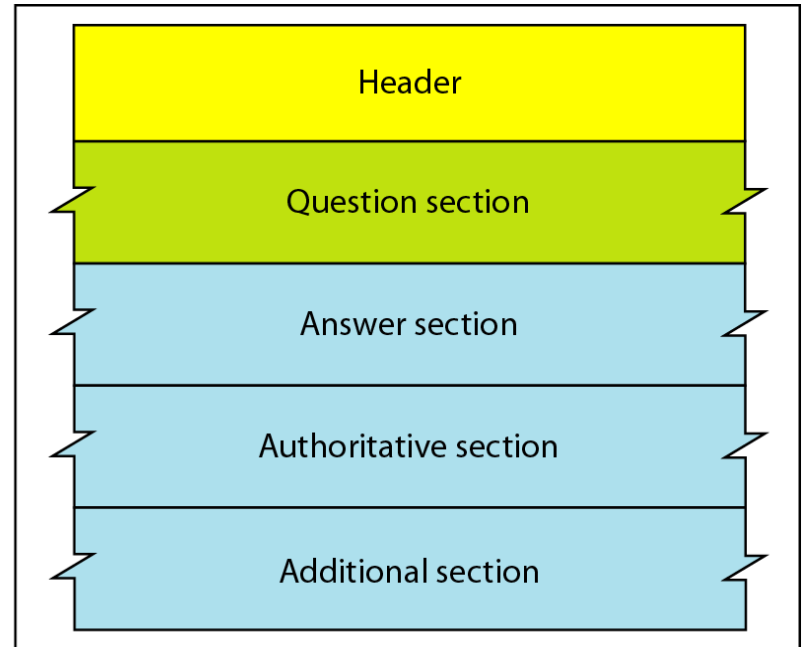
DNS MESSAGES

- 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

Query and response messages



a. Query



b. Response

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)

REGISTRARS

- New domains are added to DNS 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.
- Today, there are many registrars; their names and addresses can be found at <http://www.intenic.net>
- To register, the organization needs to give the name of its server and the IP address of the server.

REFERENCES

- “ DATA COMMUNICATIONS AND NETWORKING ”,
Behrouz A. Forouzan And Sophia Chung Fegan , Fourth
Edition , McGraw-Hill