

# Introduction to Domain Name System (DNS)

## Objective:

- Define and explain domain name system (DNS) in distributed systems.

The domain name system is used for resolving IP addresses to user-defined names and vice versa. It is replaced with an original Internet naming scheme in which the hostname and addressees are stored in a single master file. It has limitations such as it cannot scale to a large number of computers, absence of generalized name services, lack of administration, etc. The Internet is a network of networks that interconnects many devices to exchange information. The process of DNS resolution involves converting a hostname (such as [www.yahoo.com](http://www.yahoo.com)) into an IP address and vice versa. [www.yahoo.com](http://www.yahoo.com) is called a fully qualified domain name (FQDN) where "com" is the First Level Domain or

Top-Level Domain (TLD), the "yahoo" is the Second Level Domain and "www" is the Third Level Domain. The Top Level Domains (TLDs) are divided into two types, namely generic Top Level Domains (gTLDs) (for example, .com and .org) and country code Top Level Domains (ccTLDs) (for example, .in for India, .uk for the United Kingdom and .us for the United States). The domain namespace specifies Top Level Domains (such as ".com"), second-level domains, (such as "[yahoo.com](http://yahoo.com)") and lower-level domains, also called subdomains (such as "[mail.yahoo.com](http://mail.yahoo.com)").

When you type "[www.yahoo.com](http://www.yahoo.com)" into your browser's address bar, the DNS server queries the "root servers" for the name resolution. The root zone only knows information about top-level domains. The root server refers to the DNS server to the ".com" nameserver then searches for the second level domains "yahoo" on TLD Name servers under their zones. The DNS servers then resolve the name [www.yahoo.com](http://www.yahoo.com) and return the IP address. The representation of different zones is shown in Figure 1.

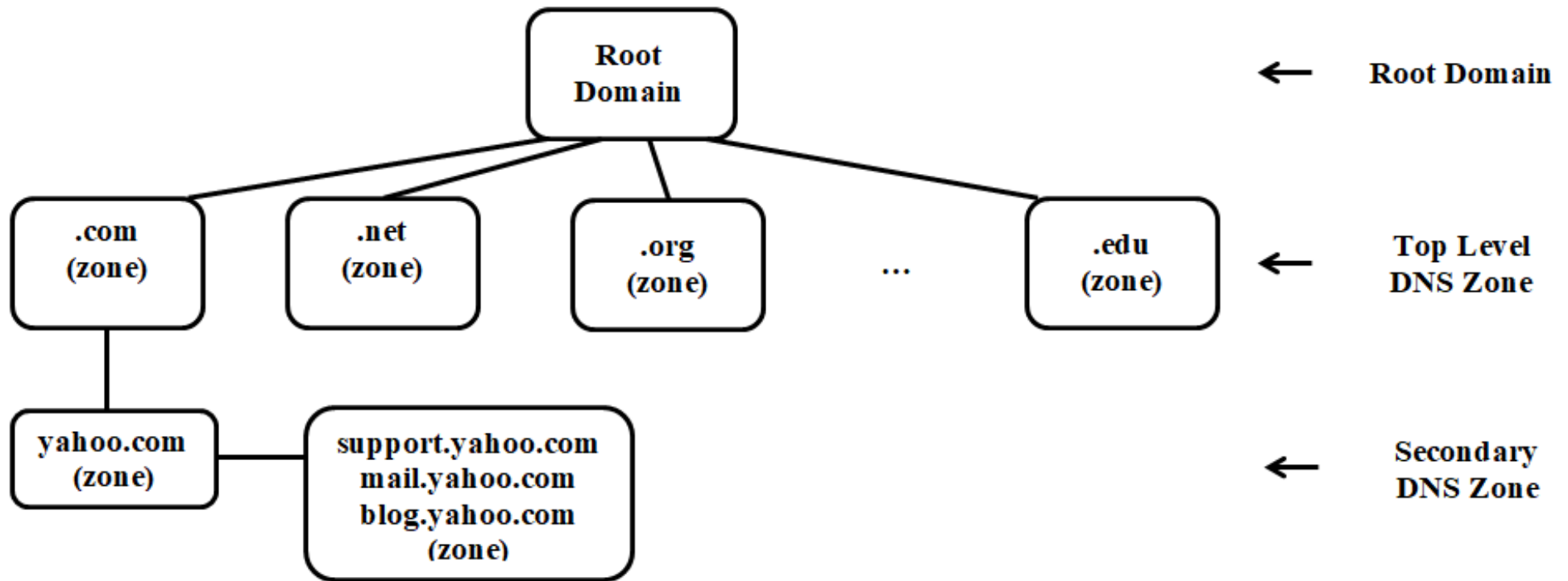


Figure 1. Representation of Zones in DNS

The popular top-level domains used across the Internet are shown in Table 1.

Table 1. Popular Top-level Domains

.com	Commercial organizations
.edu	Universities and other educational institutions

.gov	US governmental agencies
.mil	US military organizations
.net	Major network support centers
.org	Organizations not mentioned above
.int	International organizations

The domain name system is mainly used for a host name, mail hosts resolutions. Some system uses DNS to resolve an IP address to the domain name as well. The DNS name server is responsible for executing the DNS queries for resolving domain names into IP addresses and vice versa. The DNS naming system is divided into zones that contain attribute data for names in a domain, names and addresses of name servers, authoritative data for zones and zone-management parameters.

The DNS server stores authoritative data for different zones. There are minimum two DNS servers in each zone, namely primary or the master server that reads zone data directly from a local master file and secondary servers that download

zone data from a primary server. Generally, the root domain information is replicated by a primary server to a collection of secondary servers. The representation of the DNS server is shown in Figure 2.

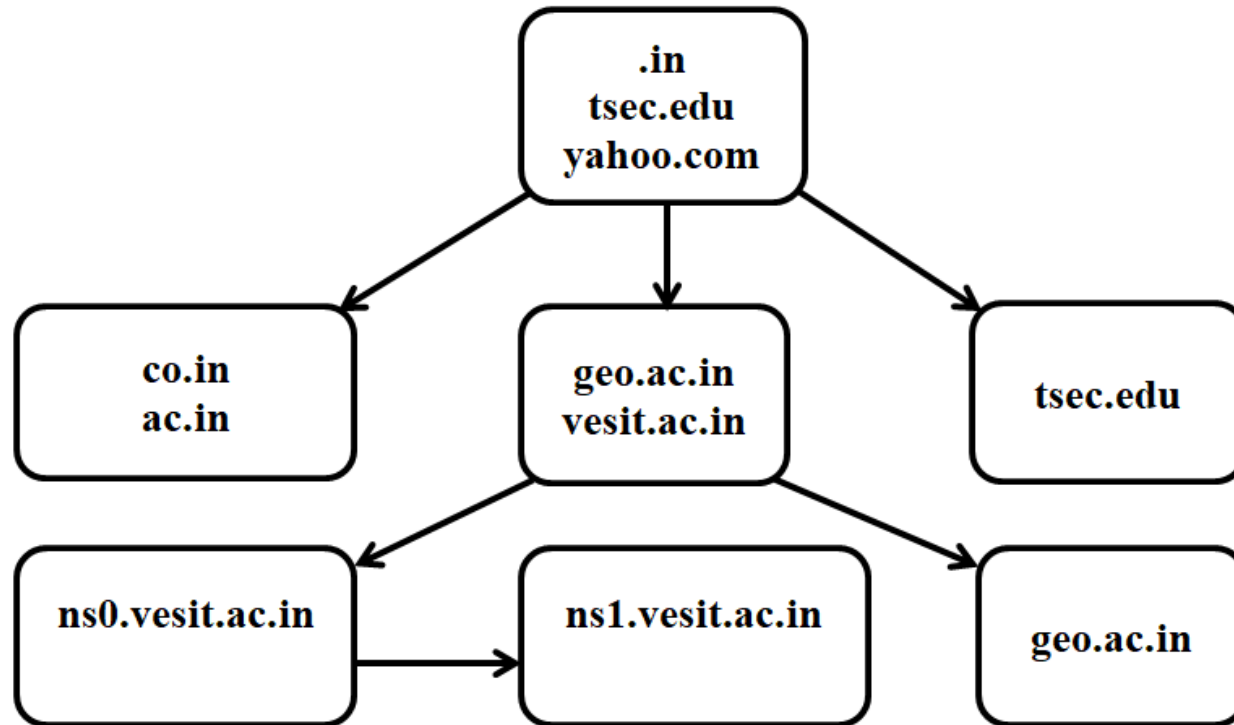


Figure 2. Representation of DNS Server

The name servers store zone data in files with one of the fixed types of resource

records. The different resource records managed by the name server are shown in Table 2.

Table 2. Types of Resource Records

Record Type	Meaning
A	A computer address (IPv4 address)
AAAA	A computer address (IPv6 address)
NS	An authoritative name server
CNAME	The canonical name for an alias
SOA	Marks the start of data for a zone
HINFO	Host information
PTR	Domain name pointer
MX	Mail exchange

## **References:**

1. George Coulouris, Jean Dollimore, Tim Kindberg,, "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.
2. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.