



# Computer Communication Networks

## **Application Layer**

Dr. Raja Vara Prasad

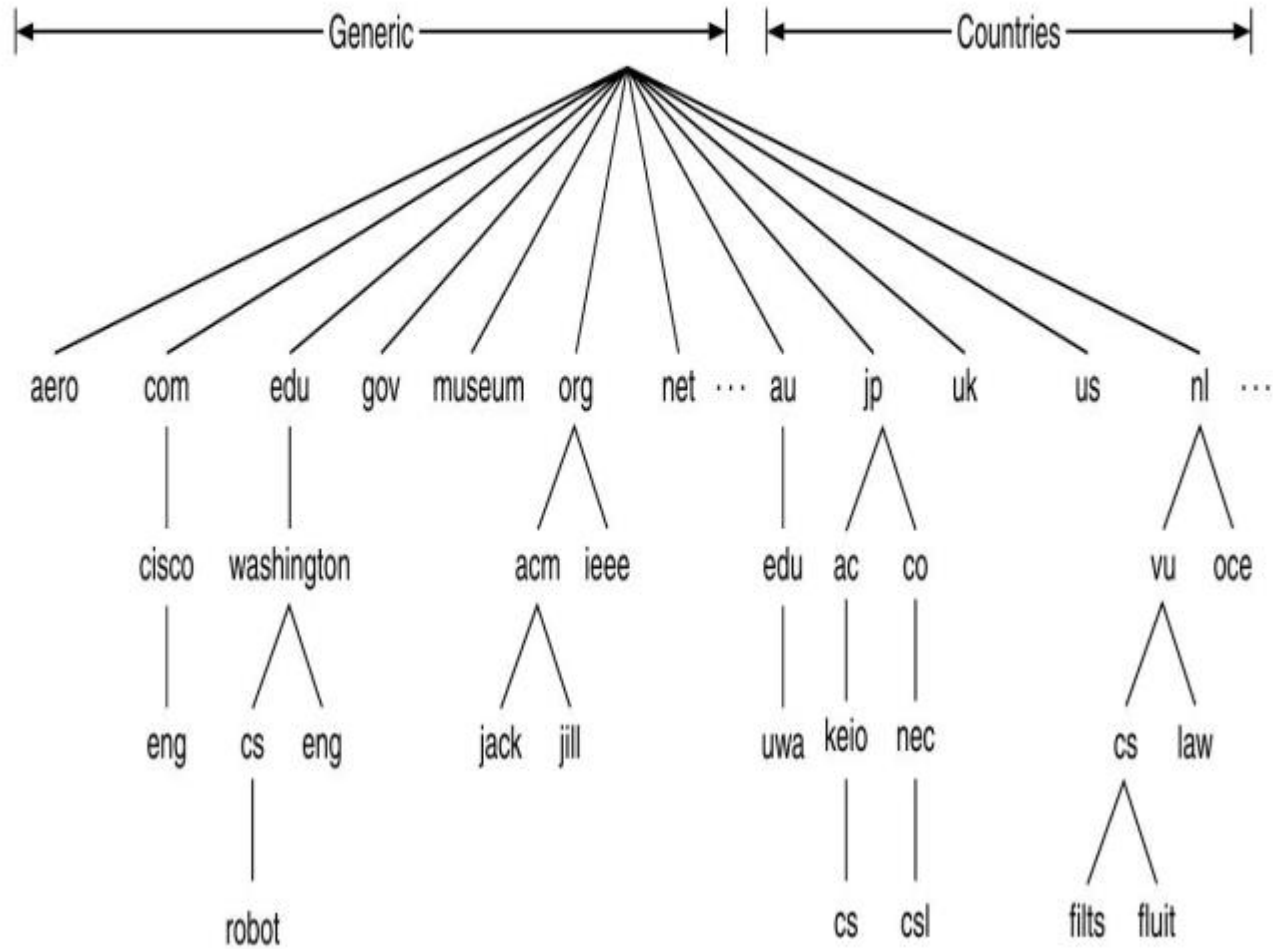
Assistant Professor

IIIT Sri City

# What is a Domain Name

- Consider `www.iiits.in`
- Domain: `in`
- What is the domain name of `www.iitm.ac.in`
- Domain: `in`, subdomain: `ac`
- **250** top-level domains; examples: `com`, `org`, `edu`.

# Domain Name Space



# Examples of Domains

Domain	Intended use	Start date	Restricted?
com	Commercial	1985	No
edu	Educational institutions	1985	Yes
gov	Government	1985	Yes
int	International organizations	1988	Yes
mil	Military	1985	Yes
net	Network providers	1985	No
org	Non-profit organizations	1985	No

# Who Manages Domains

- **ICANN**: Internet Corporation for Assigned Names and Numbers
- **Registrars** of ICANN check for uniqueness
- Domain names can be **absolute** or **relative**
- Absolute domain names end with .
- Relative domain names have to be interpreted based on the context

# Domain Name Server: The Directory

- We identify hosts by hostnames. For example, www.amazon.in
- For a network, there is a very little information about the host. Network needs IP address for processing
- Domain name servers (DNS) provides the necessary mapping from hostname to IP address
- DNS is an application layer protocol used by other applications
- Client-Server architecture; uses UDP at its transport layer

# DNS Example:

1. The same user machine runs the client side of the DNS application.
2. The browser extracts the hostname, `www.someschool.edu`, from the URL and passes the hostname to the client side of the DNS application.
3. The DNS client sends a query containing the hostname to a DNS server.
4. The DNS client eventually receives a reply, which includes the IP address for the hostname.
5. Once the browser receives the IP address from DNS, it can initiate a TCP connection to the HTTP server process located at port 80 at that IP address.

**DNS adds an additional delay—sometimes substantial—to the Internet applications that use it**

# Aliases

- We typically memorize **alias** hostnames but the actual hostnames are very complicated
- The **canonical** hostnames are not mnemonic. Canonical: *according to the rules*
- Example: *www.timesofindia.com* is the alias but the actual host name or canonical name is *timesofindia.indiatimes.com*
- Different canonical names might have the same alias
- Many hosts can be installed within a domain or subdomain. Example: *www.ee.iitm.ac.in*, *www.cse.iitm.ac.in*, *smail.iitm.ac.in*



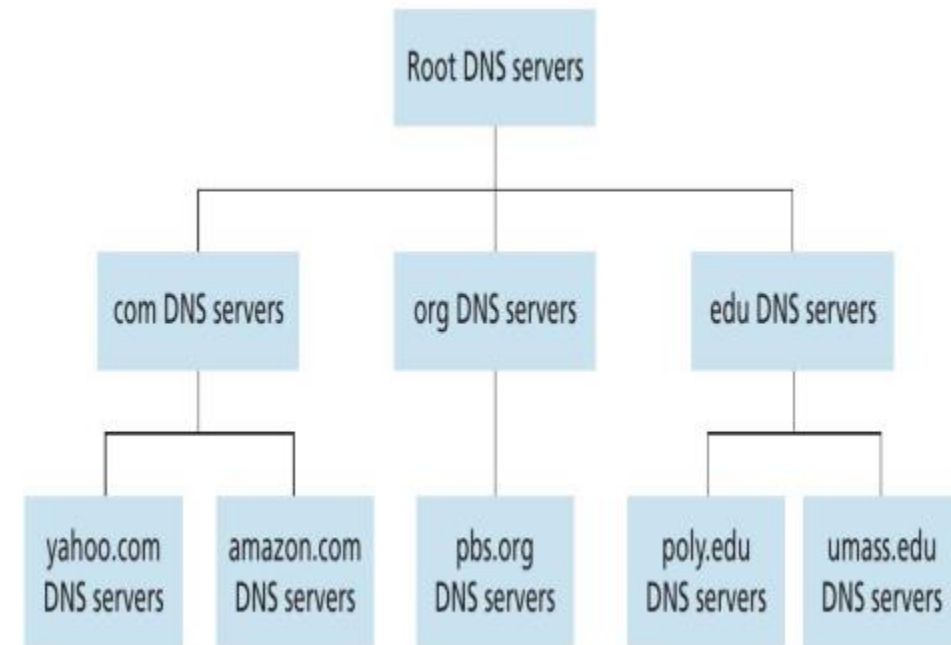
# Services of DNS

- The Internet's directory service
- Host aliasing
- Mail Server aliasing
- Load distribution, example: *IRCTC*

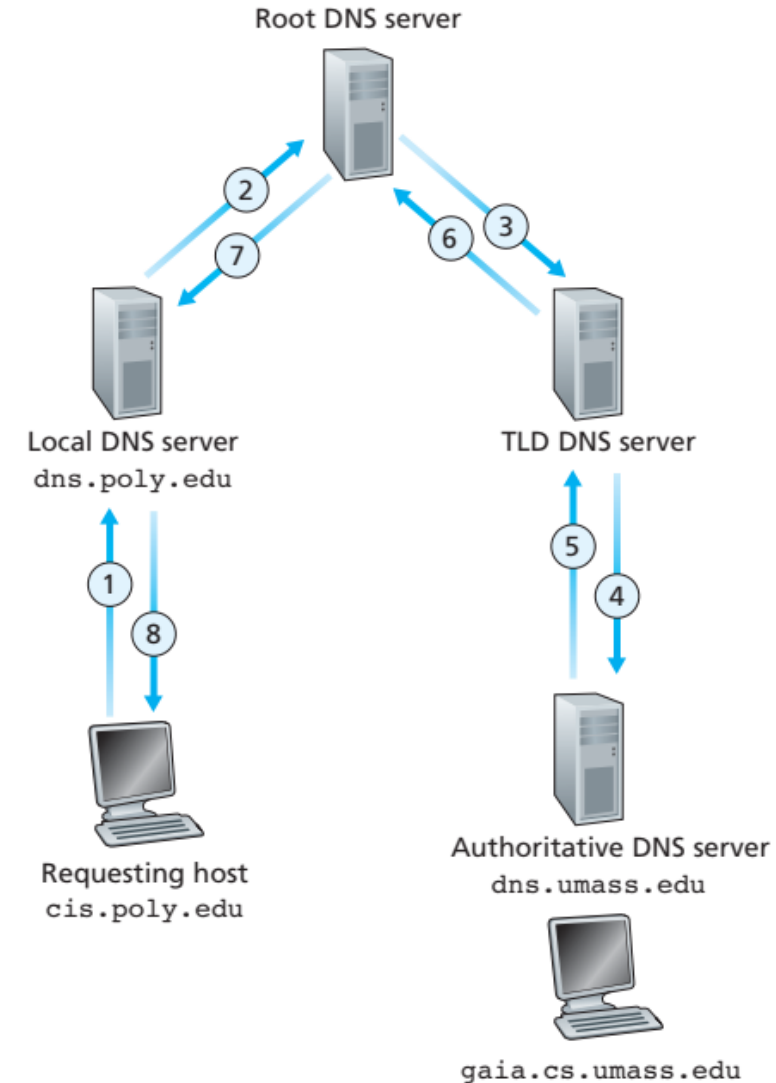
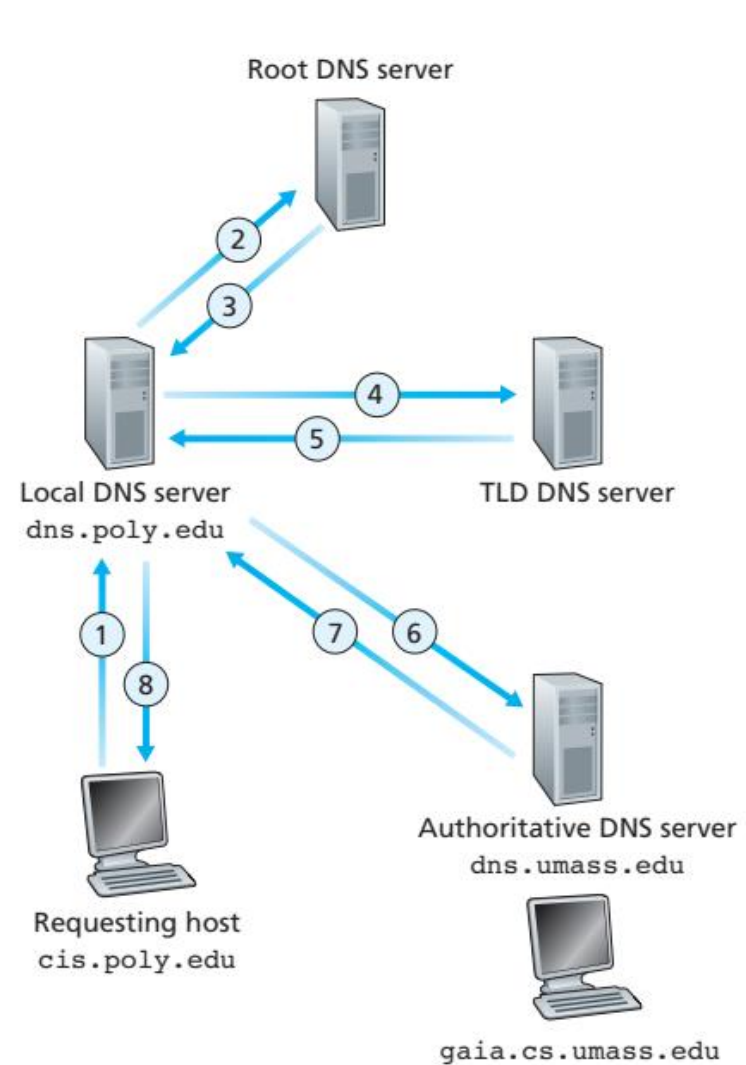
## Problems of Single DNS:

- A single point of failure
- Traffic volume
- Distant centralized database
- Maintenance

## Hierarchy of DNS



# How does DNS Work: Recursive and Iterative Query



- An ISP can provide local DNS
- Host will query the local DNS and that takes it forward to the root DNS
- Cache DNS replies

## DNS Resource Records:

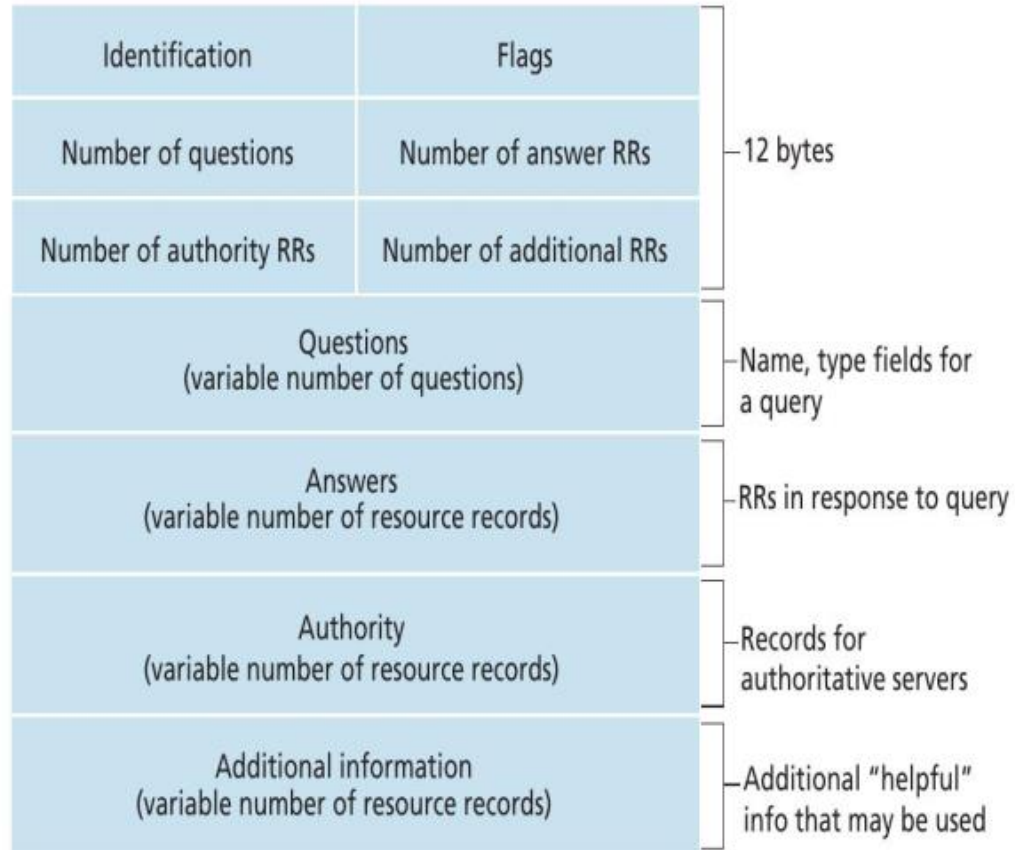
- DNS distributed database store resource records
- Resource Record is four tuple: (Name, Value, Type, TTL )
- TTL: Time-to-Live
- The interpretation of Name and Value files change based on Type

# Types in RR

- **Type = A**: *Name* is a **hostname** and *Value* is the **IP address** of the host
- **Type = NS**: *Name* is a **domain** and *Value* is the **hostname** of the authoritative DNS server
- **Type = CNAME**: *Name* is an **alias** and *Value* is the **canonical hostname** of the alias.
- **Type = MX**: *Name* is an **alias hostname** and *Value* is the **canonical hostname of a mail server** of the alias.

Type	Meaning	Value
SOA	Start of authority	Parameters for this zone
A	IPv4 address of a host	32-Bit integer
AAAA	IPv6 address of a host	128-Bit integer
MX	Mail exchange	Priority, domain willing to accept email
NS	Name server	Name of a server for this domain
CNAME	Canonical name	Domain name
PTR	Pointer	Alias for an IP address
SPF	Sender policy framework	Text encoding of mail sending policy
SRV	Service	Host that provides it
TXT	Text	Descriptive ASCII text

# DNS Message Format



## Flags:

- 1-bit flag to indicate its a query/reply
- 1-bit recursion flag is set if the DNS supports recursion