



# Computer Networks

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# The Domain Name System (DNS)

- Hostname
- IP addresses = 32-bit integers
  - 127.7.106.83
- We'd like
  - High-level names: human-readable identifiers
  - A mechanism to
    - Assign/manage names
    - Map between
      - Names and IP addresses
      - IP addresses and names

# DNS Syntax

- Domain names

- Example: “kutztown.edu” is a domain name

- Labels

- Example: “prime”, “cs”, “kutztown”, and “edu” are labels

- Delimiter

- Suffix

- Example: “cs.kutztown.edu”, “kutztown.edu”, and “edu” are domains

# DNS

- A distributed database implemented in a hierarchy of name servers
- An application-layer protocol that allows hosts and name servers to communicate in order to provide a translation service



# Other DNS Services

- Host Aliasing
- Mail server aliasing
- Local distribution

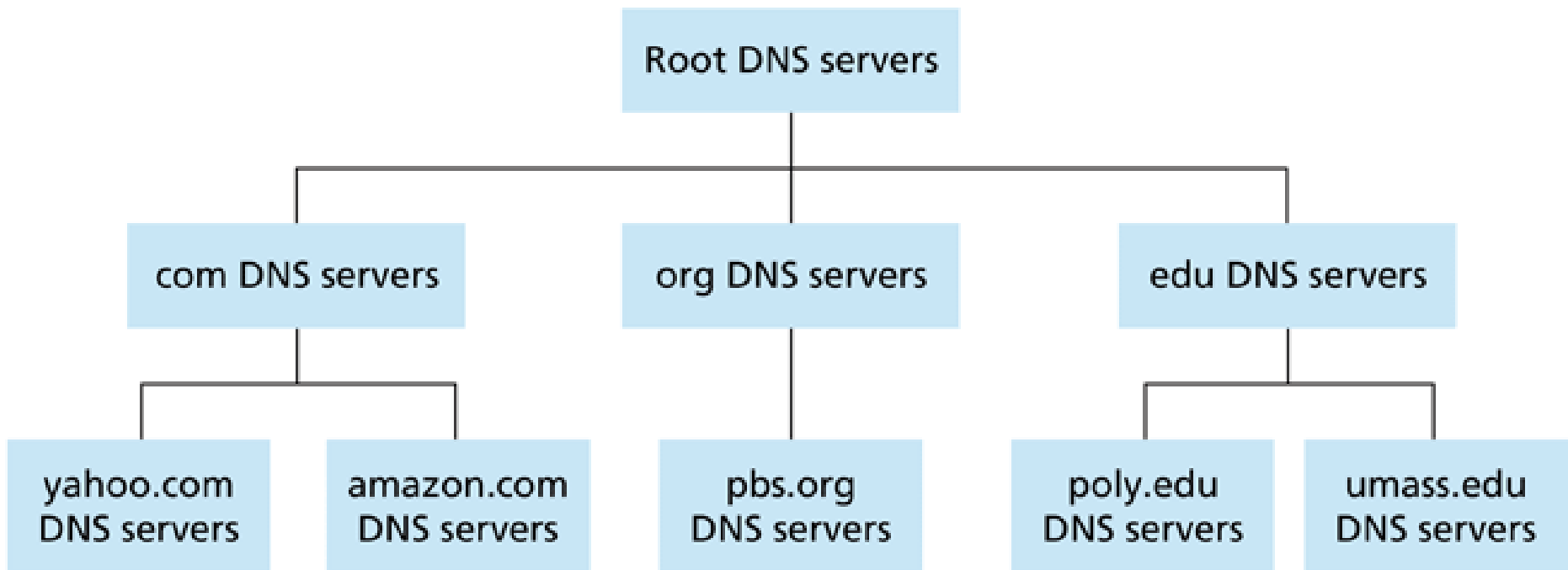
# Naming Options

- Flat Names
  - Simple, convenient
  - Does not scale well
- Hierarchical names
  - Distributed responsibility
  - Scalable

# Delegating Naming Authority

- Centralized vs. Distributed
- Network Solutions, Inc.
- Educause
- The federal government
- The U.S. military
- The state of Pennsylvania
- The RIPE Network Coordination Centre

# The DNS Name Hierarchy



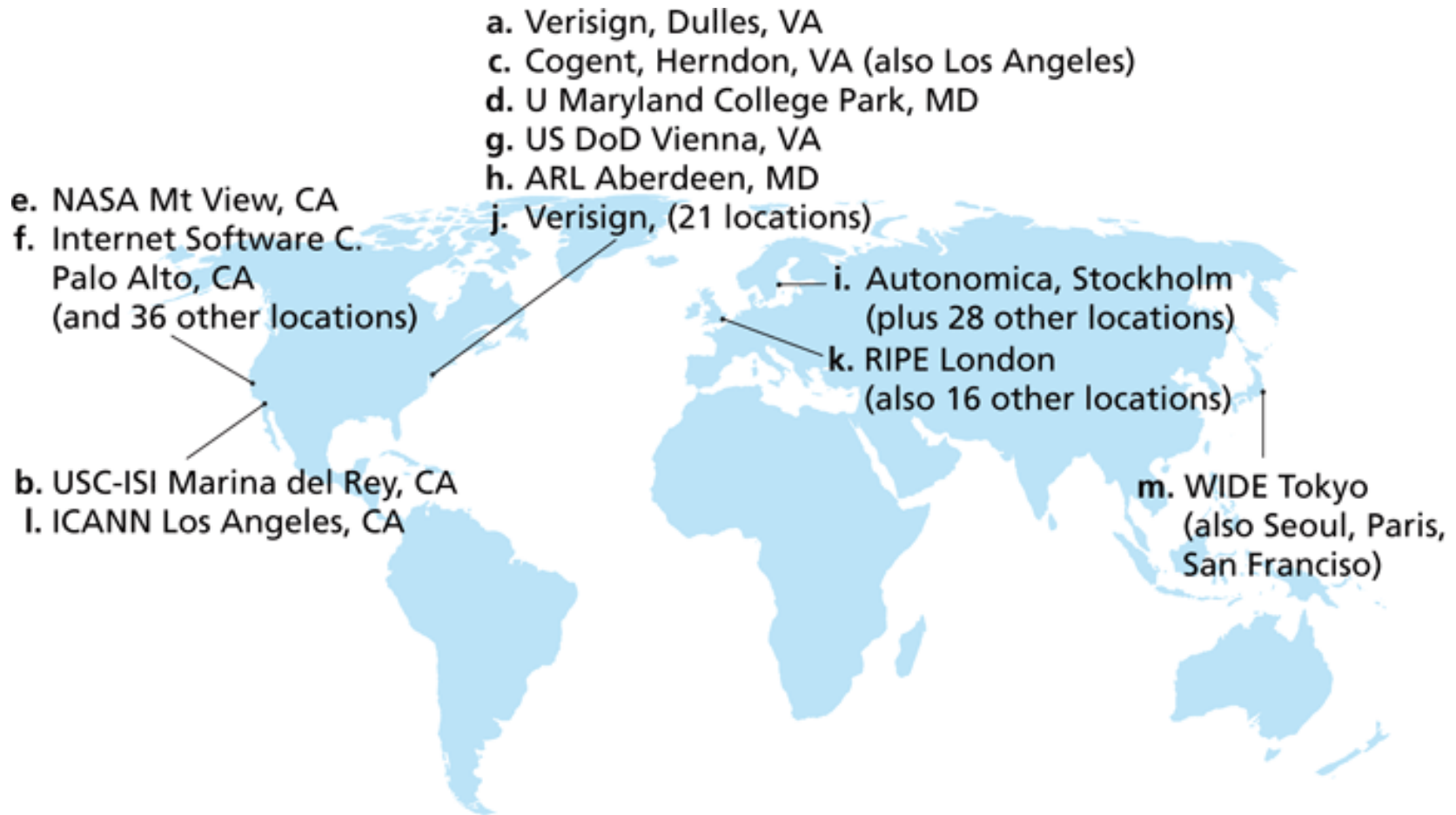
**Figure 2.19** ♦ Portion of the hierarchy of DNS servers



# DNS Name Servers

- Root Name Servers
- Top-Level Domain (TLD) Name Servers
- Authoritative Name Servers
  
- Local Name Servers

# Root Name Servers



**Figure 2.20** ♦ DNS root servers in 2007 (name, organization, location)



# DNS Name Servers

- Multiple domains
- Multiple simultaneous connections
- Distribute information

# Mapping Names to Addresses

- The DNS algorithm for mapping between IP addresses and names
  - Distributed
  - Efficient
  - General-purpose
  - Reliable

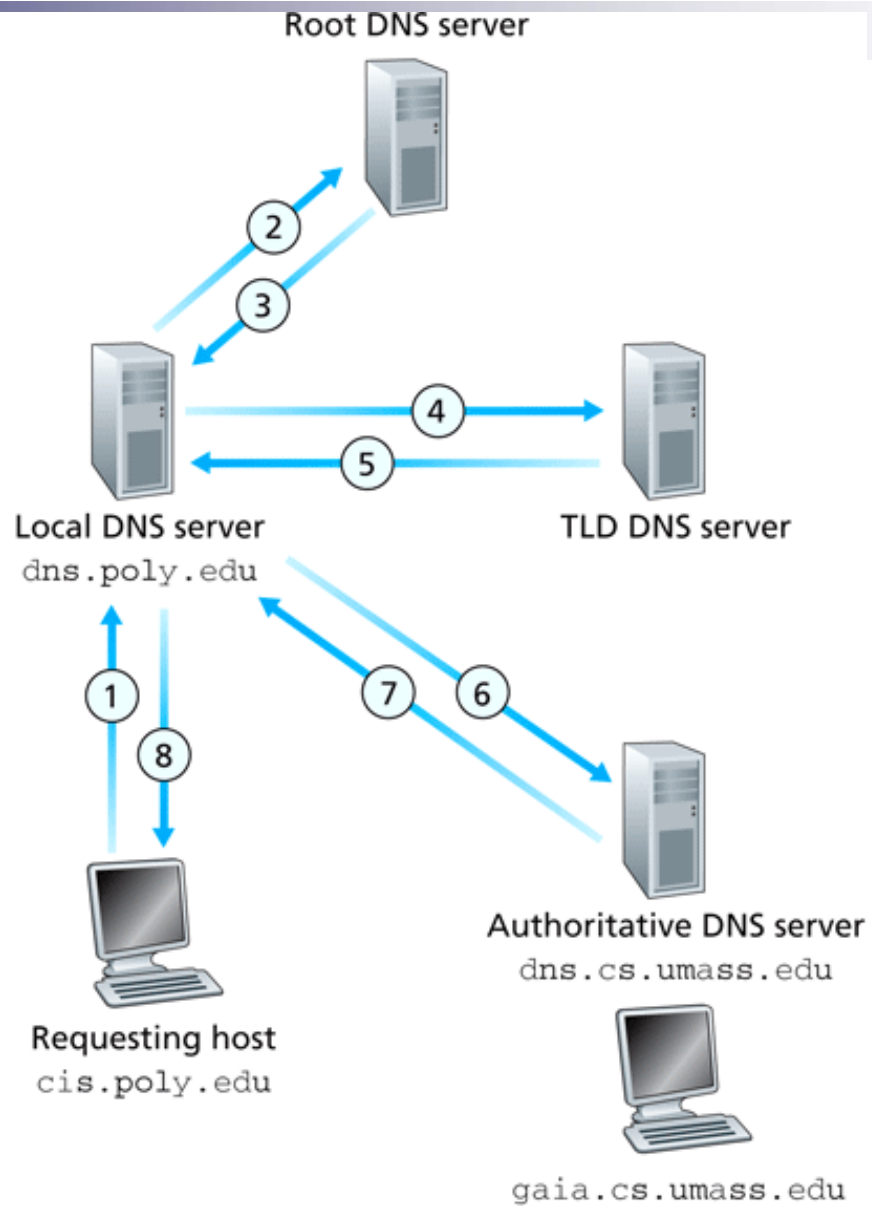
# DNS Parts

- Resolver
- Nslookup
- Server
  - BIND



# DNS Name Resolution

- Recursive
- Iterative



**Figure 2.21** ♦ Interaction of the various DNS servers

# DNS Name Resolution

- Client creates a domain name query
- Name server receives a query:
  - Is the server an authority for the name?
  - Is the response in the cache?
  - Did the client request recursive resolution?
  - Did the client request iterative resolution?
- For name resolution to work:
  - Name server
  - Root server





# DNS - Efficient Name Resolution

- Top-down name resolution is inefficient
- DNS uses bottom-up name resolution

# DNS Name Caching

- **Servers maintain a caches**
  - Recently used names
  - Server that provided resolution for each name
- **Cache entries are flushed**
  - TTL

# DNS Name Caching Sequence

- Name server receives a query:
  - Is the server an authority for the name?
  - Is the name in the cache?
- Client receives answer quickly but it may be out of date

# Resource Records

- Name
- Value
- Type
  - A
  - NS
  - CNAME
  - MX
- TTL

# DNS Messages

Identification	Flags
Number of Questions	Number of answer RRs
Number of authority RRs	Number of additional RRs
Questions	
Answers	
Authority	
Additional information	

# Inverse Mappings

- Inverse Queries
- in-addr.arpa
- Pointer Query
- 156.12.23.5 → 5.23.12.156.in-addr.arpa

# Dynamic DNS

- RFC 2136
- UPDATE option
  
- Windows 2000
- Newer versions of BIND



# DNS in Action

- nslookup
- KU files