Lecture 6.f
In Class Test 1 Review
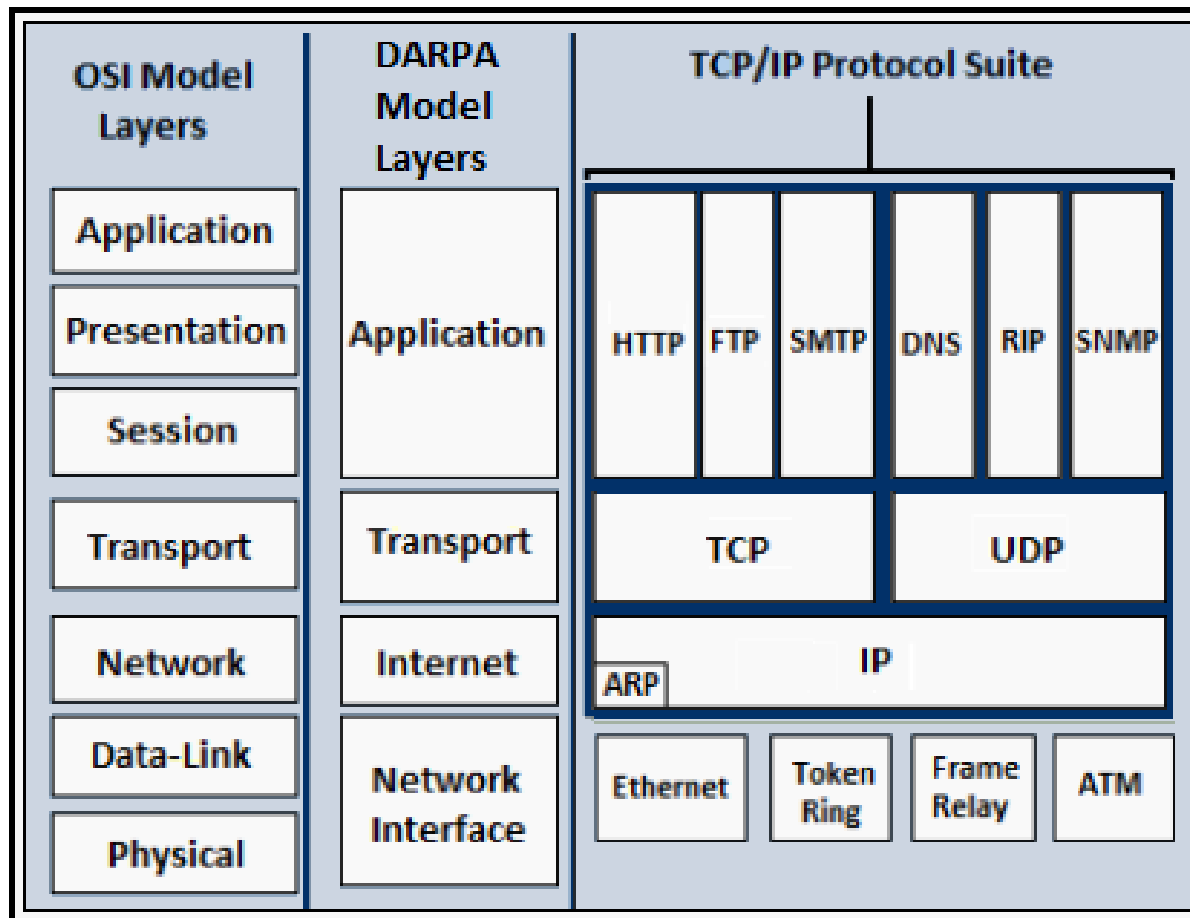## Application Layer
(DNS)

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Application Layer/DNS

- The APPLICATION Layer contains the protocol used by applications (http, ftp, etc) and DNS.

Networking Protocols

What does DNS do?

- Provides hostname – IP lookup services
- DNS defines
  - A hierarchical namespace for hosts and IP addresses
  - A distributed database of hostname and address info
  - A "resolver" – library routines that query this database
  - Improved routing for email
  - A mechanism for finding services on a network
  - A protocol for exchanging naming information
- DNS is essential for any org using the Internet

What uses DNS?

- Any application that operates over the Internet
  - email
    - Spam filters
  - WWW
  - FTP
 - IRC, IM
  - Windows update
  - telnet, ssh

The DNS namespace

- A tree of "domains"

- Root is "." (dot), followed by top-level (root-level) domains

- Two branches of tree
  - One maps hostnames to IP addresses
  - Other maps IP address back to hostnames

- Two types of top-level domain names used today
  - gTLDs: generic top-level domains
 - ccTLDs: country code top-level domains
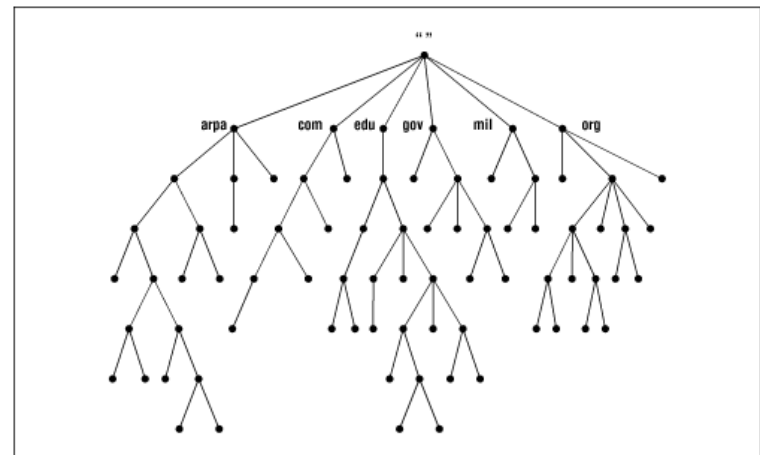
Resolving process

1. Name server **A** receives a query from the resolver.
2. **A** queries **B**.
3. **B** refers **A** to other name servers, including **C**.
4. **A** queries **C**.
5. **C** refers **A** to other name servers, including **D**.
6. **A** queries **D**.
7. **D** answers.
8. **A** returns answer to resolver.
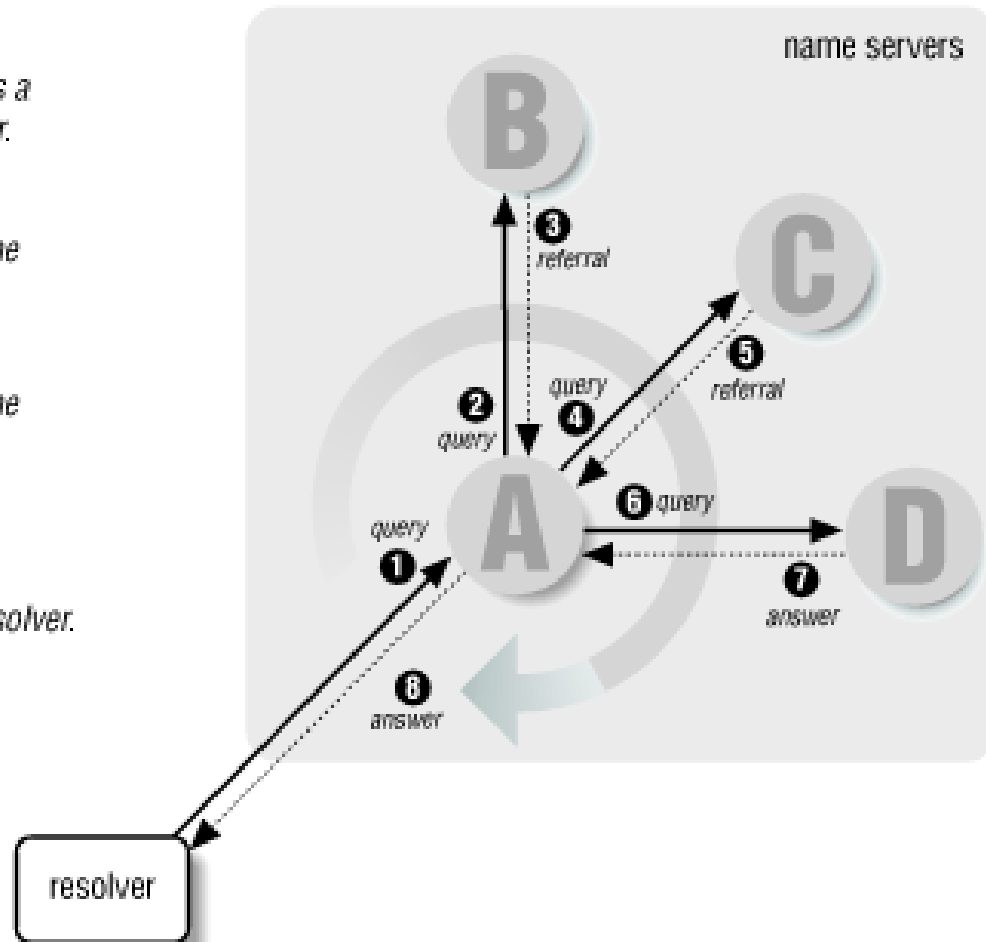
Delegation

- Impractical for high-level servers to know about all hosts (or even subdomains) below

- Servers delegate specific zones to other servers

- Names and addresses of authoritative servers for the relevant zone are returned in referrals
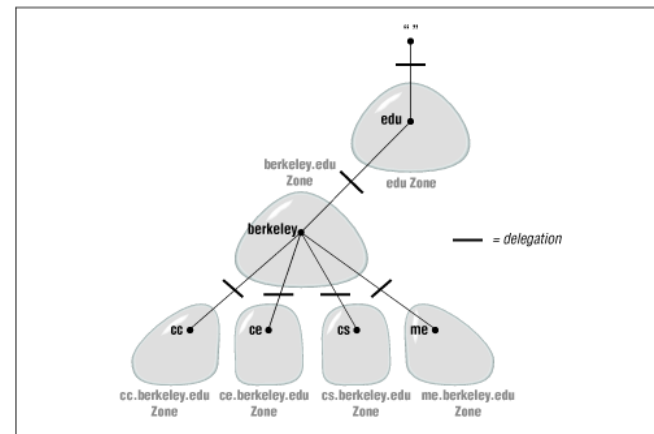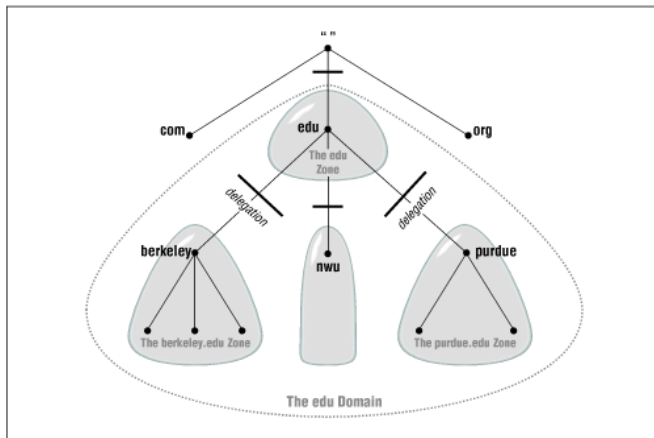
What servers know

- All servers know about the 13 root servers
  - hardcoded (rarely changes!), or in hint file
  - a.root-servers.net … m.root-servers.net
- Each root server knows about servers for every top-level domain (.com, .net, .uk, etc.)
- Each top-level domain knows the servers for each second-level domain within the toplevel domain
- Authoritative servers know about their hosts

Example resolution
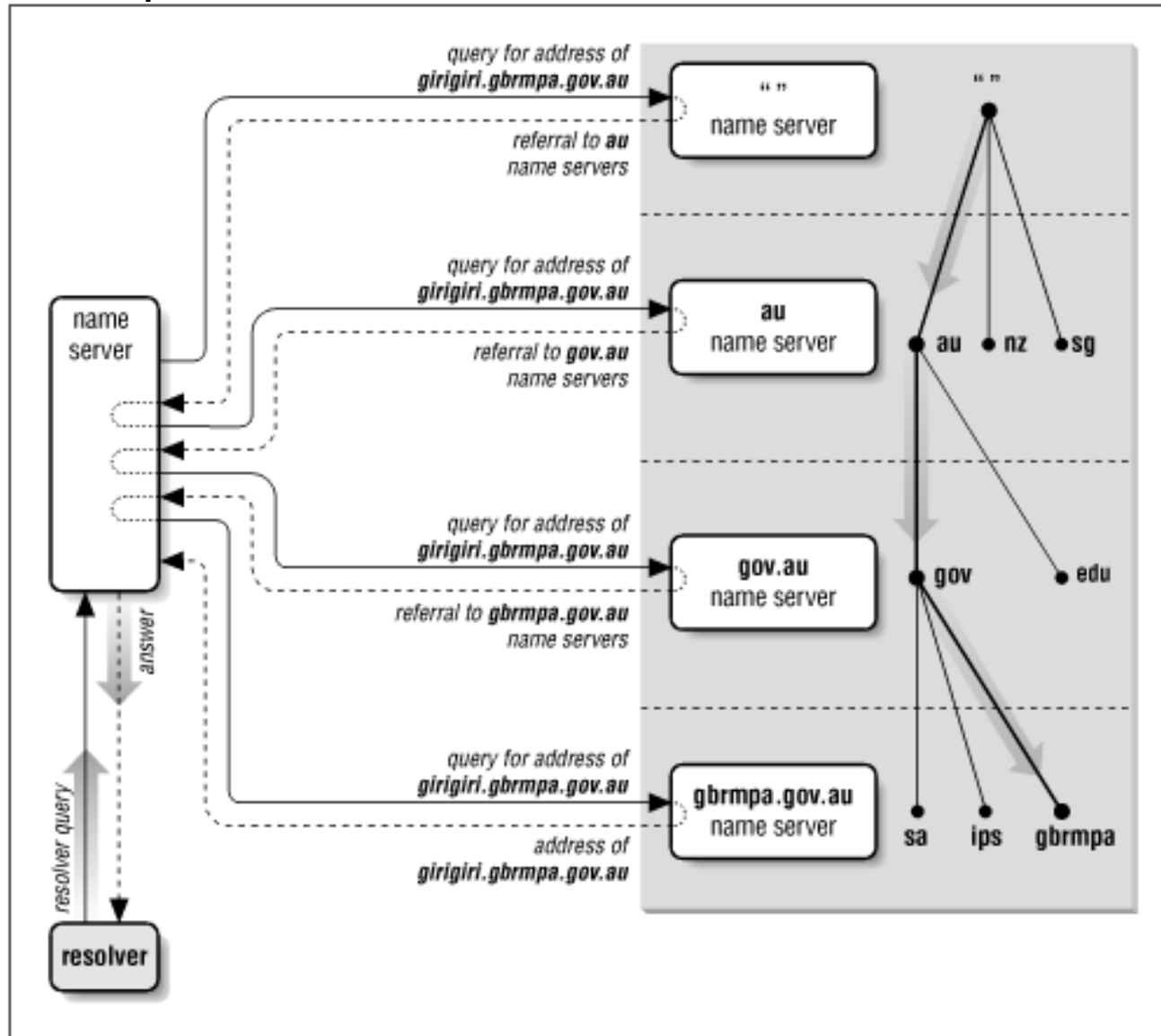
IP-to-hostname resolution

- IP resolution works essentially the same as hostname resolution
- Query for 15.16.192.152
    - Rendered as query for 152.192.16.15.in-addr.arpa
- Each layer can delegate to the next