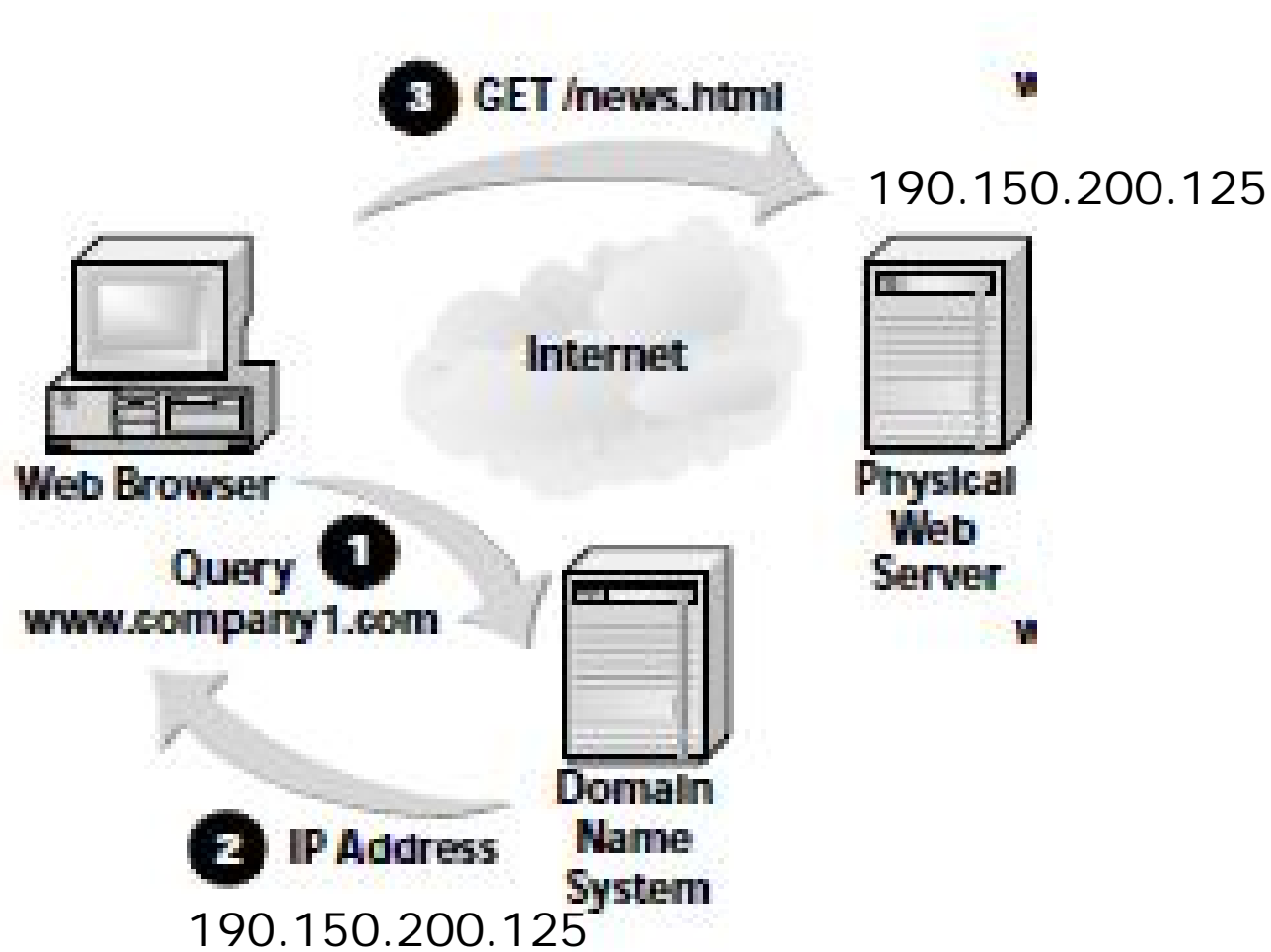# (DNS)
Domain Name System

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How it Works

History

▸ Late 1960s, the ARPA (later DARPA), began funding the ARPAnet, an experimental wide area computer network that connected important research organizations in the United States.

▸ The TCP/IP (1980s) quickly became the standard host-networking protocol on the ARPAnet. Its inclusion in Berkeley's (University of California) popular BSD Unix operating system was instrumental in democratizing internetworking. BSD Unix was virtually free to universities.
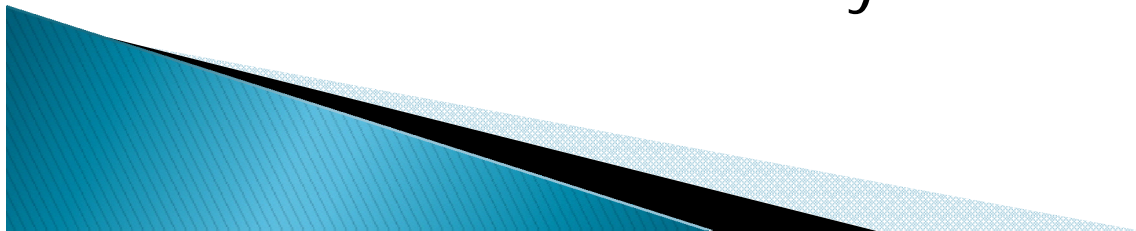
History

▸ The network grew from a handful of hosts to tens of thousands of hosts. The original ARPAnet became the backbone of a confederation of local and regional networks based on TCP/IP, called the **Internet**.

▸ In 1988, DARPA experiment was over. Another network, funded by the National Science Foundation called the NSFNET, replaced the ARPAnet as the backbone of the Internet.
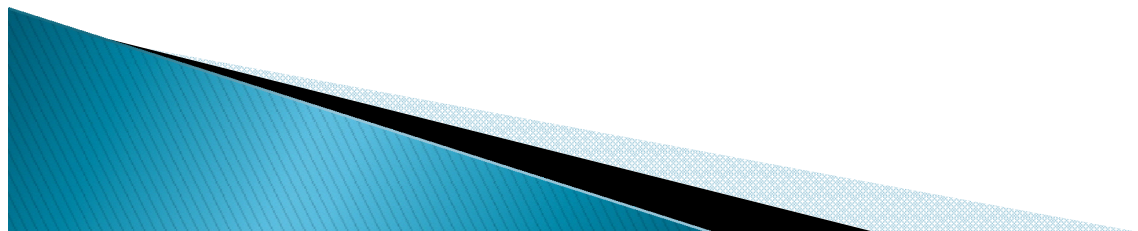
History

- In1995, the Internet made a transition from publicly funded NSFNET (as a backbone) to multiple commercial backbones, run by long-distance carriers like **MCI** and **Sprint**, and long-time commercial internetworking players like **PSINet** and **UUNET**.

- Through the 1970s, the ARPAnet was a small, friendly community of a few hundred hosts. A single file, *HOSTS.TXT*, contained all the information needed to know about those hosts: it held name-toaddress mappings for every host connected to the ARPAnet.

- *HOSTS.TXT* was maintained by SRI's *Network Information Center* (dubbed "the NIC") and distributed from a single host, SRI-NIC.

History

- ARPAnet administrators typically emailed their changes to the NIC, and periodically FTPed to SRI-NIC and grabbed the current *HOSTS.TXT*.
- Their changes were compiled into a new *HOSTS.TXT* once or twice a week. As the ARPAnet grew, however, this scheme became unworkable.
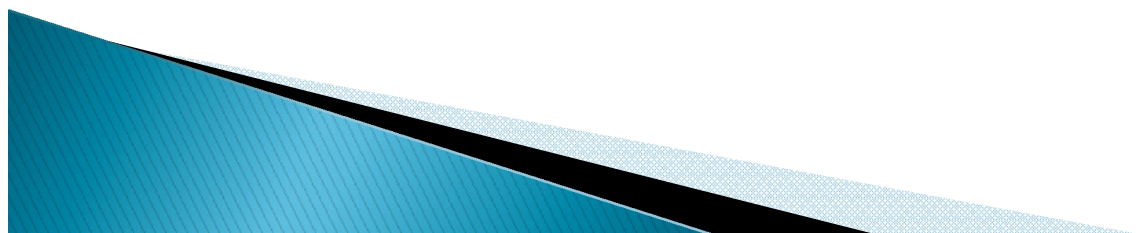
Challenges

▸ Moreover, the traffic generated by the update process increased even faster: every additional host meant not only another line in HOSTS.TXT, but potentially another host updating from SRI-NIC

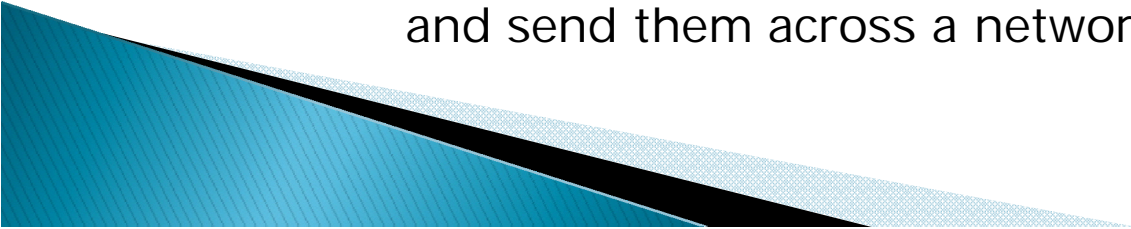▸ *Traffic and load*

▸ *Name collisions*

▸ *Consistency*
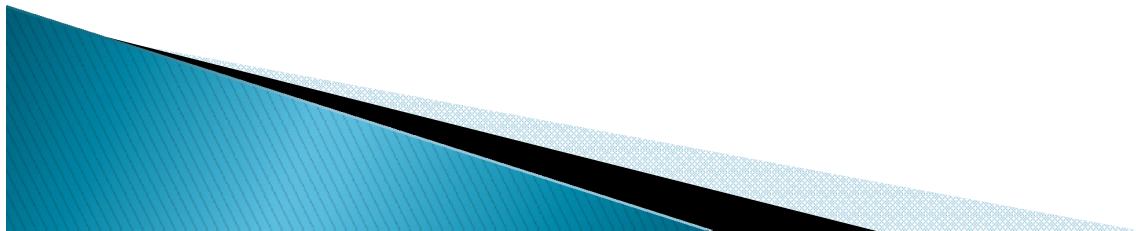
Challenges

- The essential problem was that the *HOSTS.TXT mechanism didn't scale well. Ironically, the success* of the ARPAnet as an experiment led to the failure and obsolescence of *HOSTS.TXT.*

- The ARPAnet's governing bodies chartered an investigation into a successor for *HOSTS.TXT.*

- Paul Mockapetris, was given responsibility for designing the architecture of the new system.

DNS

- It is a *distributed database.*
  - *Allows local control of the segments of the* overall database, yet the data in each segment is available across the entire network through a client/server scheme.
- Robustness and adequate performance
  - are achieved through replication and caching.
- *Nameservers*
  - It's a program that contains information about some segments of the database and make it available to clients, called *resolvers.*
- *Resolvers*
  - *Resolvers are often just library routines that* create queries and send them across a network to a nameserver.
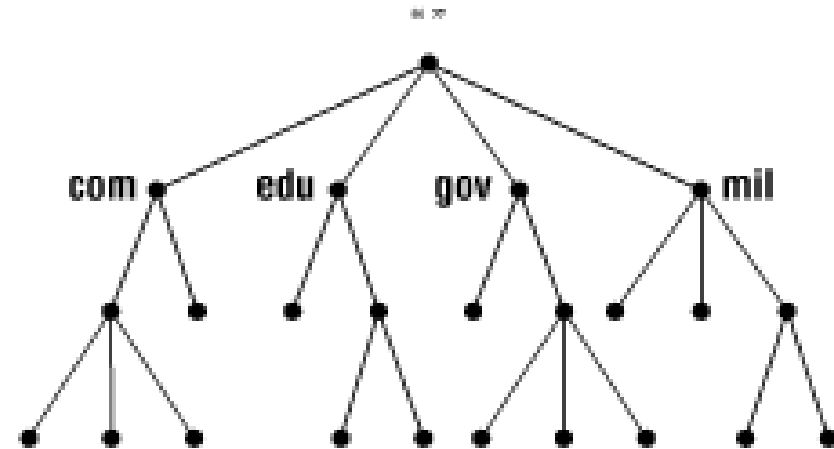
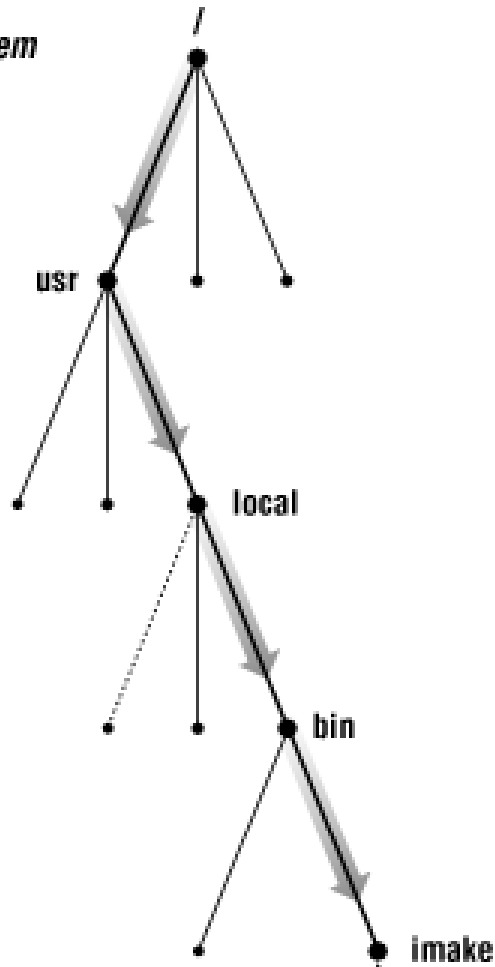# DNS Database structure
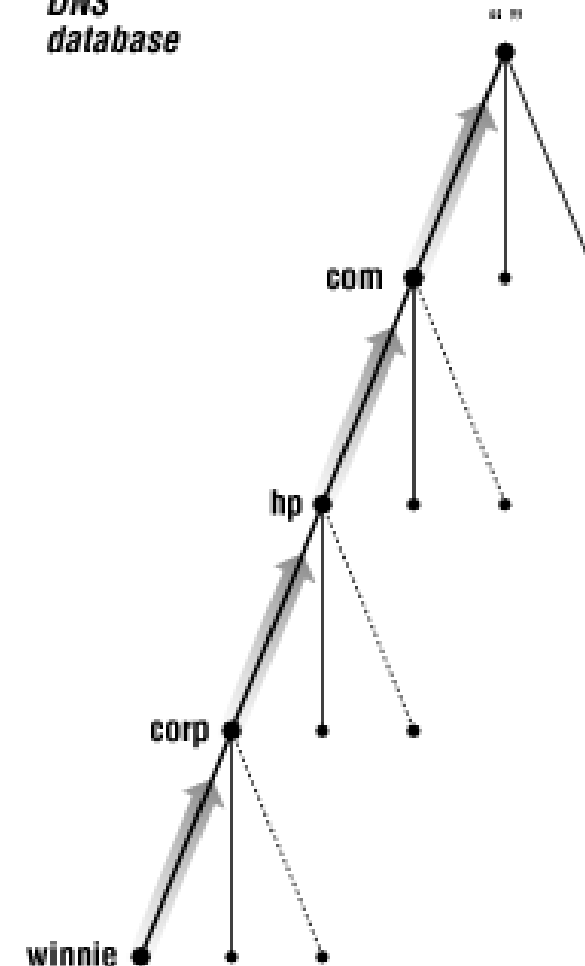
•Similar to Unix Filesystem

Unix Filesystem
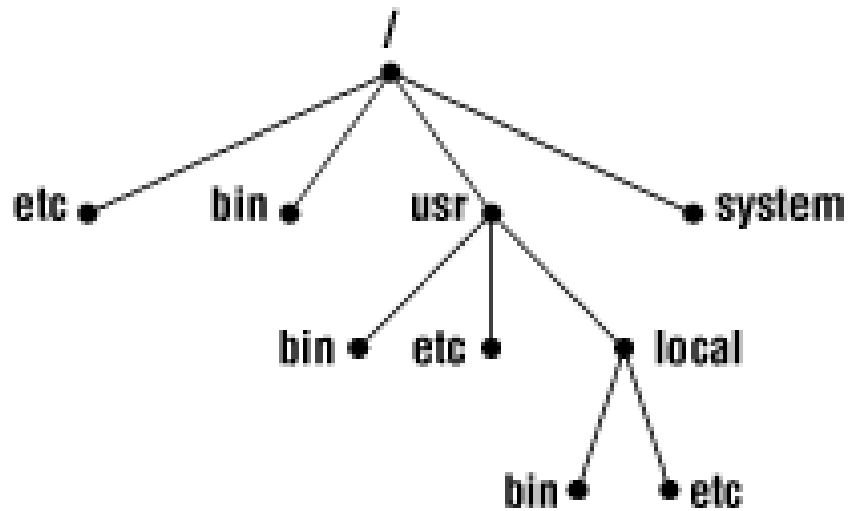
DNS Database
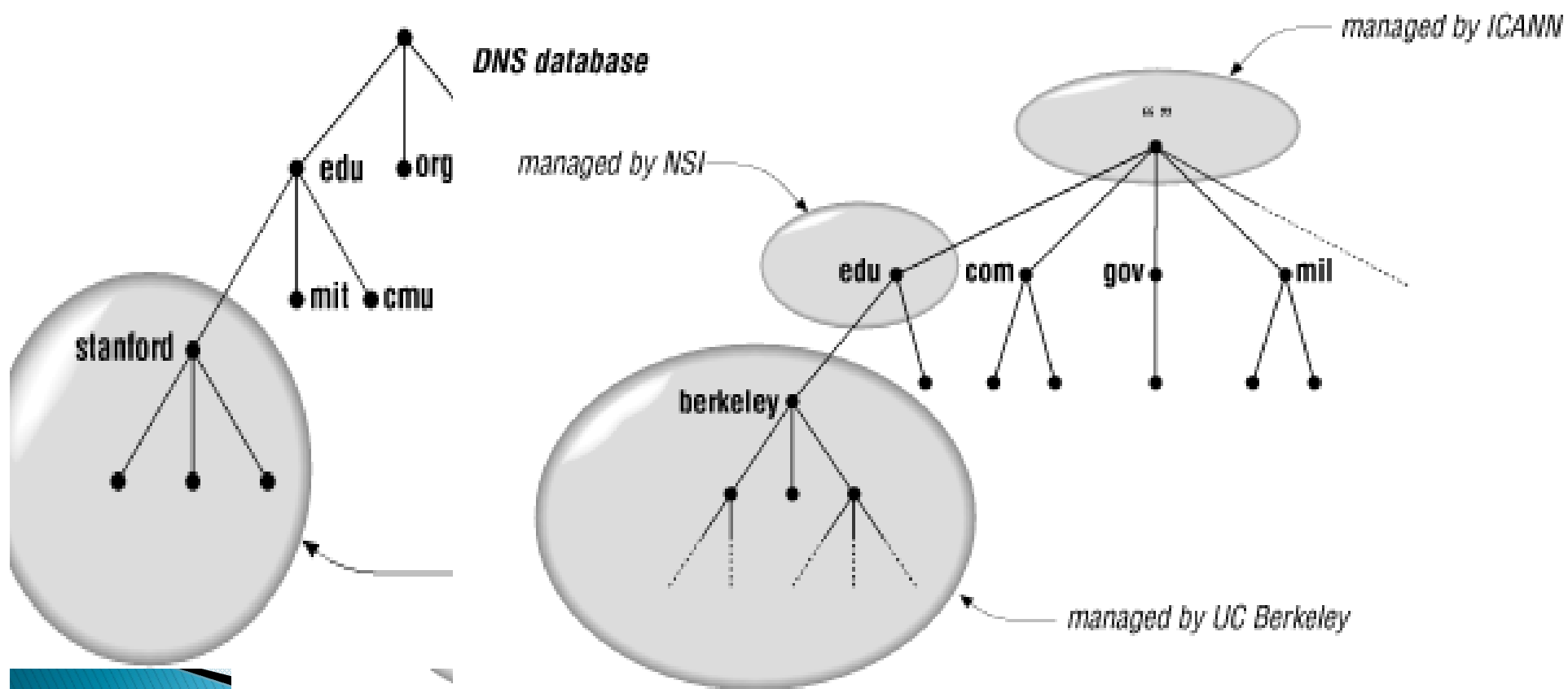
Reading Name

Unix filesystem

/usr/local/bin/imake

DNS database

winnie.corp.hp.com

DNS Delegation

Delegating like remotely mounting a filesystem

Domain Name

▸ Domains are often referred to by *level* ; These terms simply refer to a domain's position in the domain name space:

- *top-level domain or second-level domain*
- A top-level domain is a child of the root.
- A first-level domain is a child of the root (i.e., a top-level domain).
- A second-level domain is a child of a first-level domain, and so on.
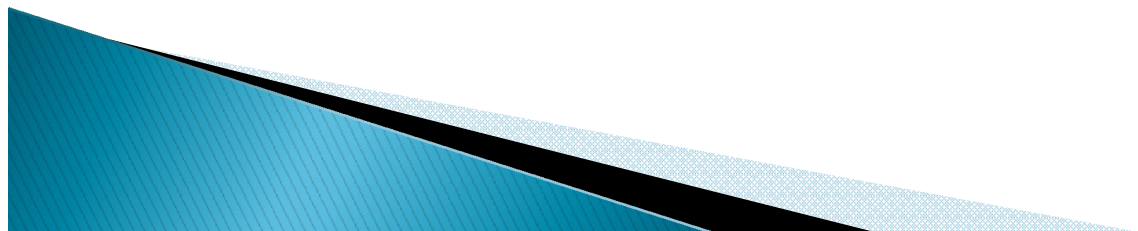
Top-Level Domains (TLDs)

▸ divides the Internet domain name space organizationally into seven domains:
  com, edu, gov, mil, net, org, int

➢ These original domains are called *generic top-level domains, or gTLDs.* maintained by the IANA

▸ IANA distinguishes the following groups of top-level domains:
  - infrastructure top-level domain(arpa)
  - country top-level domains (ccTLD)
  - internationalized top-level domains (IDNs)
  - generic top-level domains (gTLD)
    - com, info, net, org, and biz*, name*, pro*

Domains

- Domains <u>edu</u>, <u>gov</u>, <u>int</u>, and <u>mil</u> are now considered sponsored top-level domains, much like the many newly created *themed* domain names (e.g., <u>jobs</u>).
- *GeoTLD* invokes an association with a geographical, geopolitical, ethnic, linguistic or cultural community. .cat, .asia, .kiwi, .paris, .gal
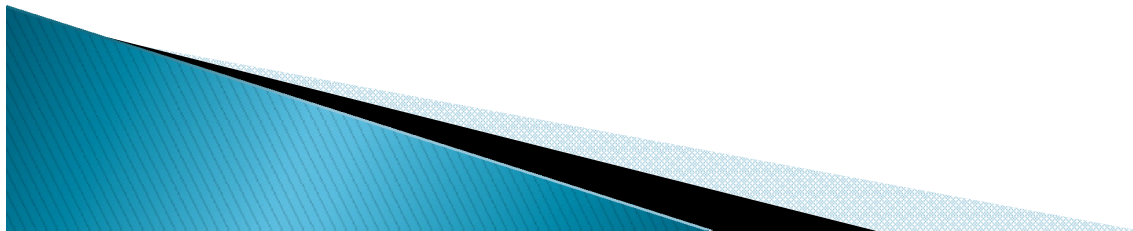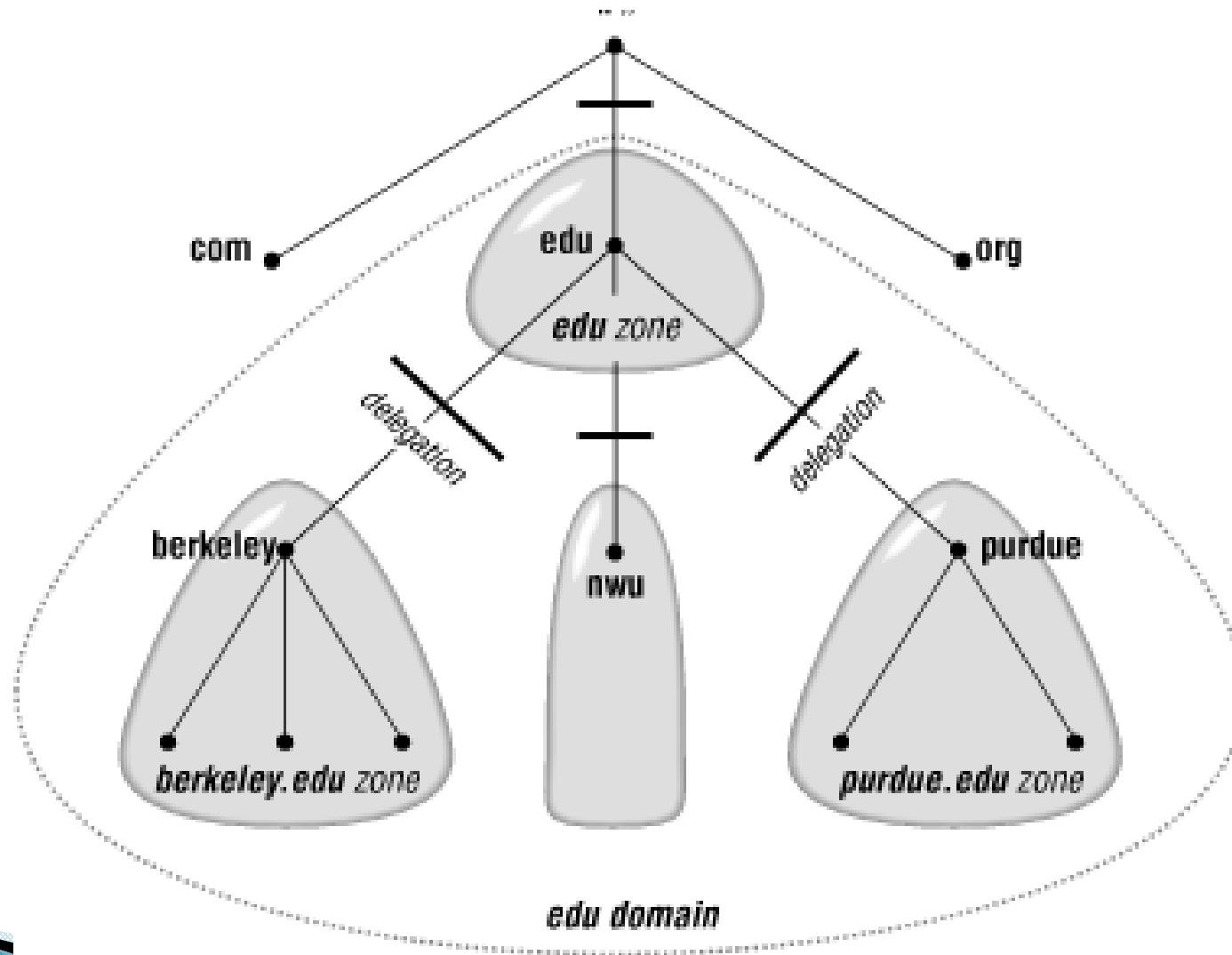
Name Servers and Zones

▸ NSs have complete information about some part of the domain name space (a *zone)*, which they load from a file / name server.

▸ The name server is then said to have *authority for that zone.*

▸ *Name servers can be authoritative for multiple zones, too.*

▸ Domains (*berkeley.edu, hp.com) are broken into smaller, more manageable units by delegation. These units are* called zones.
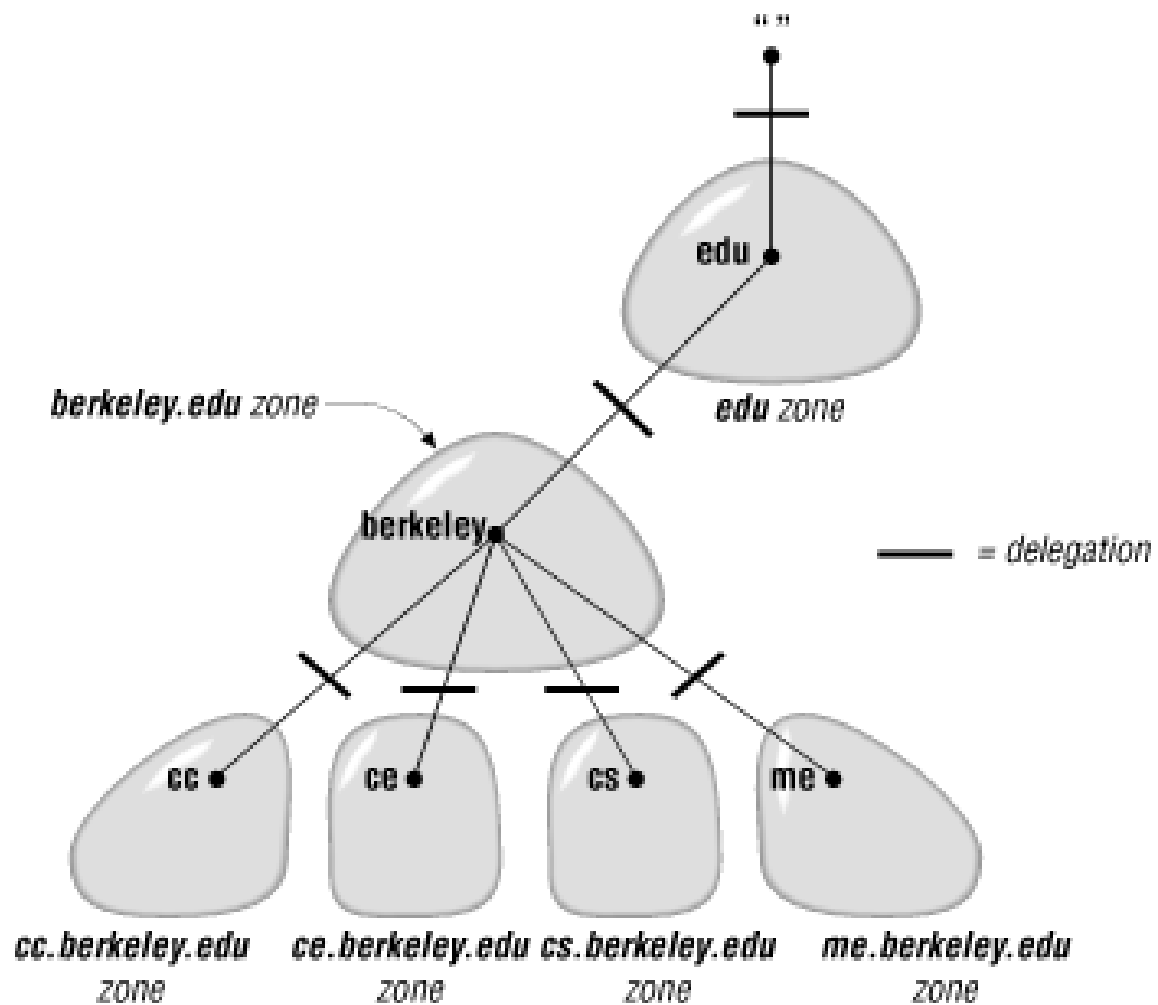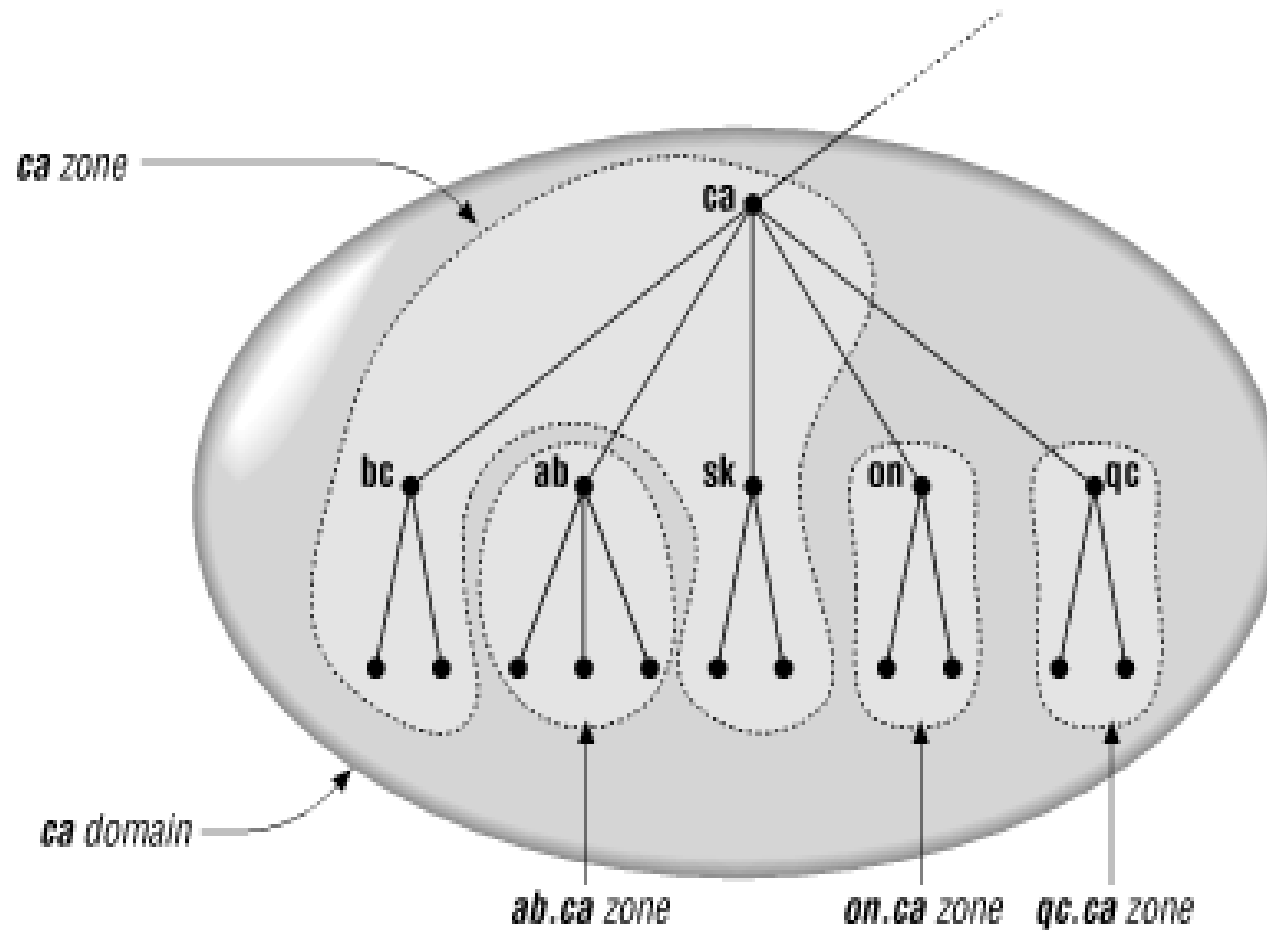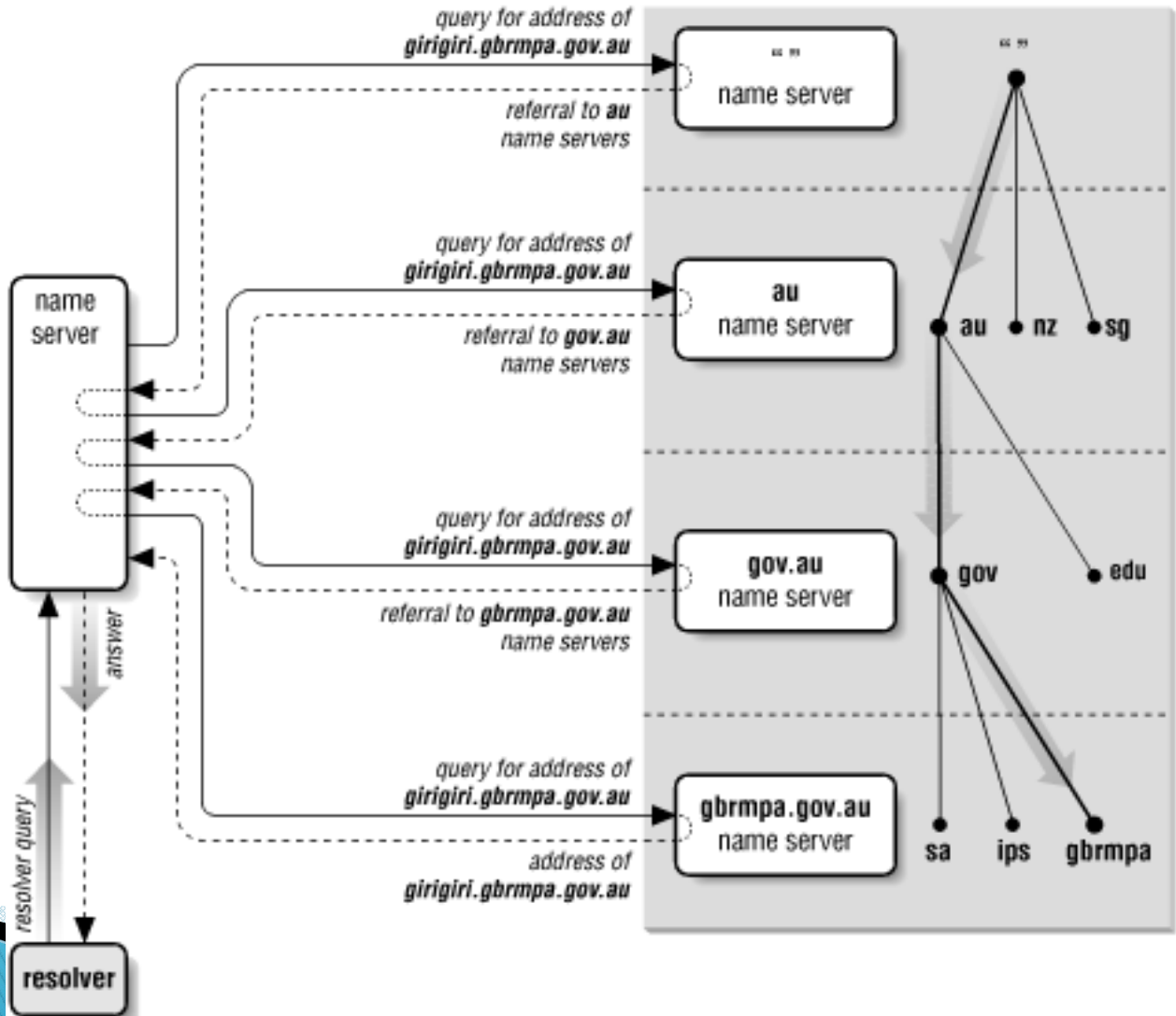
Zones

Zones

Domain Vs Zone

Root servers (Root Nameservers)

▸ 13 Root Nameservers

Resolution

Resolution Process
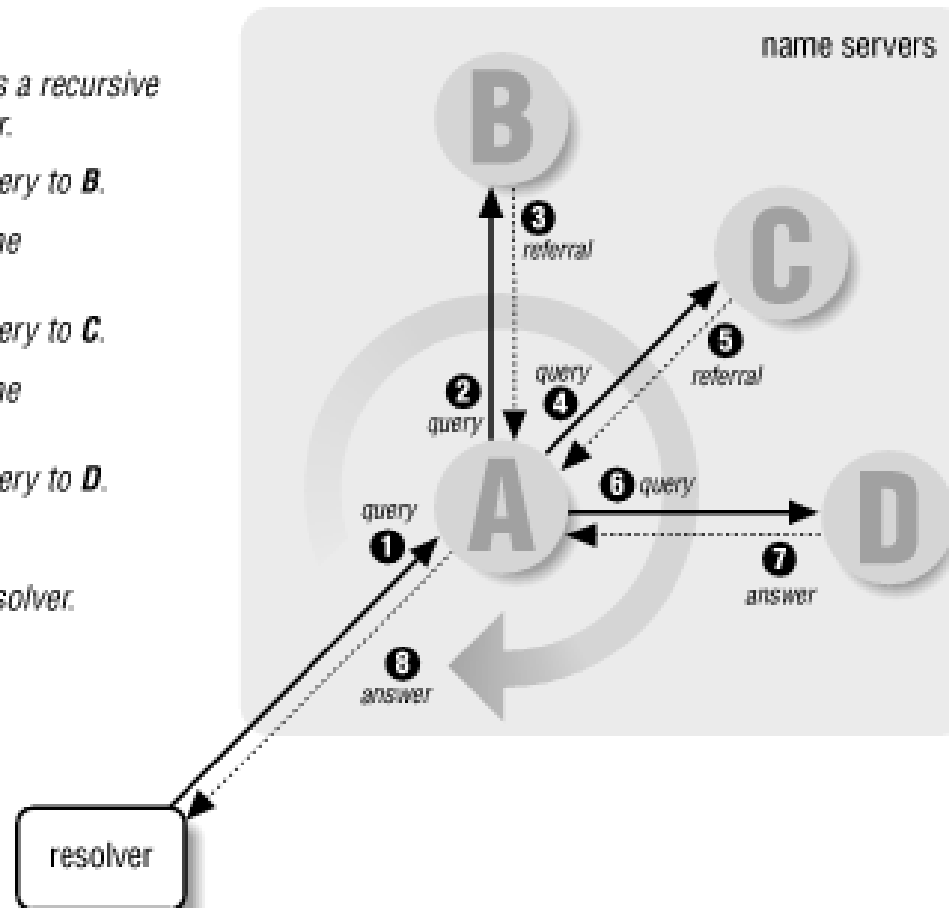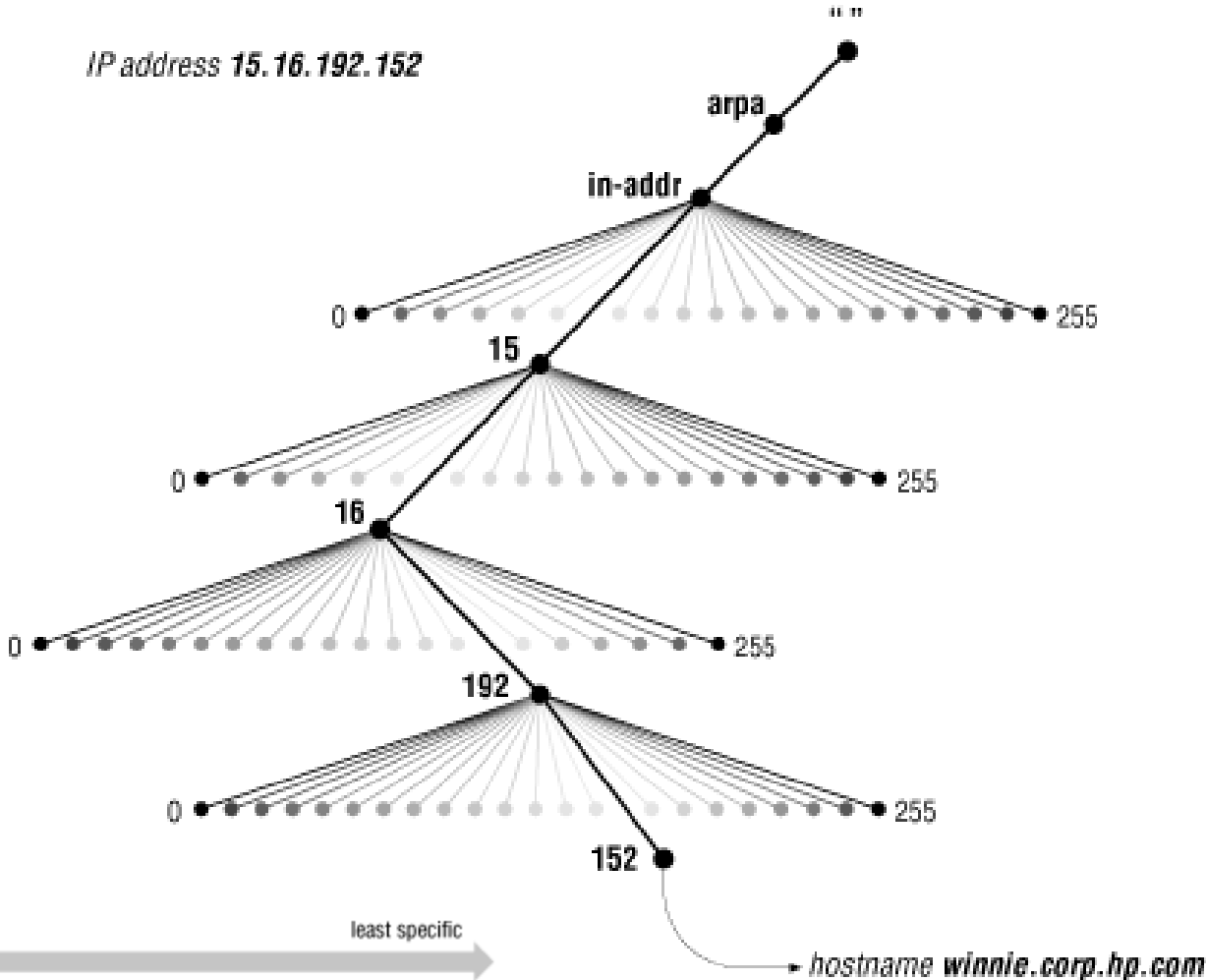

1. Name server **A** receives a recursive query from the resolver.

2. **A** sends an iterative query to **B**.

3. **B** refers **A** to other name servers, including **C**.

4. **A** sends an iterative query to **C**.

5. **C** refers **A** to other name servers, including **D**.

6. **A** sends an iterative query to **D**.

7. **D** answers.

8. **A** returns answer to resolver.

Address to Name Mapping

IP address *15.16.192.152*

"."

arpa

in-addr

0 — 255

15

0 — 255

16

0 — 255

192

0 — 255

152

→ hostname *winnie.corp.hp.com*

most specific ◄—————————————————► least specific

winnie . corp . hp . com
152 . 192 . 16 . 15

Caching

root name servers

A   B   C

berkeley.edu name servers

D

E

query
❶

referral
❷

name server

❸ query

❶ query for *baobab.cs.berkeley.edu*'s address
❷ referral to **F & G**
❸ query for *baobab.cs.berkeley.edu*'s address
❹ address of *baobab.cs.berkeley.edu*

❹ answer

F

G

cs.berkeley.edu name servers