Domain Name Service (DNS)

Kameswari Chebrolu

Origins

- People have many identifiers: Full name, Pet name, Roll number, Passport number

- Internet hosts are no less

  – Hostnames and IP addresses

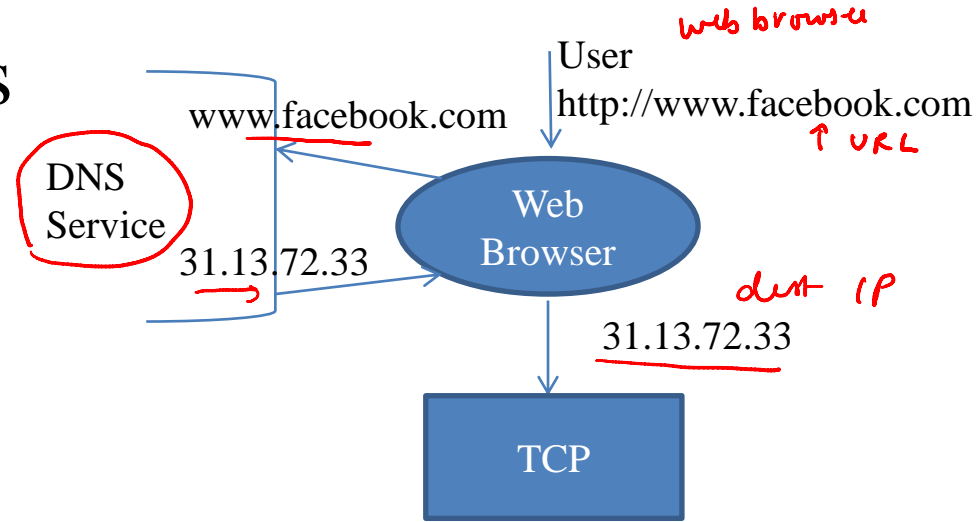*→ web sence*

E.g. www.facebook.com
- Variable Length
- Mnemonic *→ easy to remember*
- Carry no info to help route packets towards them

E.g.31.13.72.33
- Fixed Length ✓
- Numeric
- Routing information embed within them

Problem and Solution

- People prefer hostnames

- Routers prefer IP addresses

- Need a service (DNS) that converts hostnames/domains to Values → IP address

User
http://www.facebook.com
                    ↑ URL   web browser

www.facebook.com

DNS Service

31.13.72.33

Web Browser   dest IP

31.13.72.33

TCP

Domain Name: Label that defines a realm of administrative autonomy
E.g. facebook.com; iitb.ac.in; mit.edu

DNS Services

- Host name to IP address translation

- Host aliasing: "alias →other names"; many names may map finally to same IP address

  – www.facebook.com. (alias hostname) maps to star.c10r.facebook.com. (canonical hostname)

  – www.facbook.com, www.facebok.com map to www.facebook.com

  – Helps run multiple services from same server

(Handwritten annotations, in red:)

www.abc.com → owl.abc.com
            owls.abc.com
mx.abc.com ✓
↳ owl.abc.com

organization
⟨D
web server
email server

owr.abc.com
↓
owls.ab.com

www.xyz.com ⟩→ service.com
www.abc.com ⟩

DNS Services

- Mail server aliasing: Help specify mailserver of a given domain

  chebrolu@cse.iitb.ac.in

  - E.g. cse.iitb.ac.in maps to jeeves.cse.iitb.ac.in
    → IP

  - facebook.com maps to msgin.t.facebook.com

- Load distribution: Helps distribute load across replicated servers

  www.google.com → many IP

  - A single hostname associated with many IP addresses; order rotated on each request

Implementation

- Original Implementation: hosts.txt file
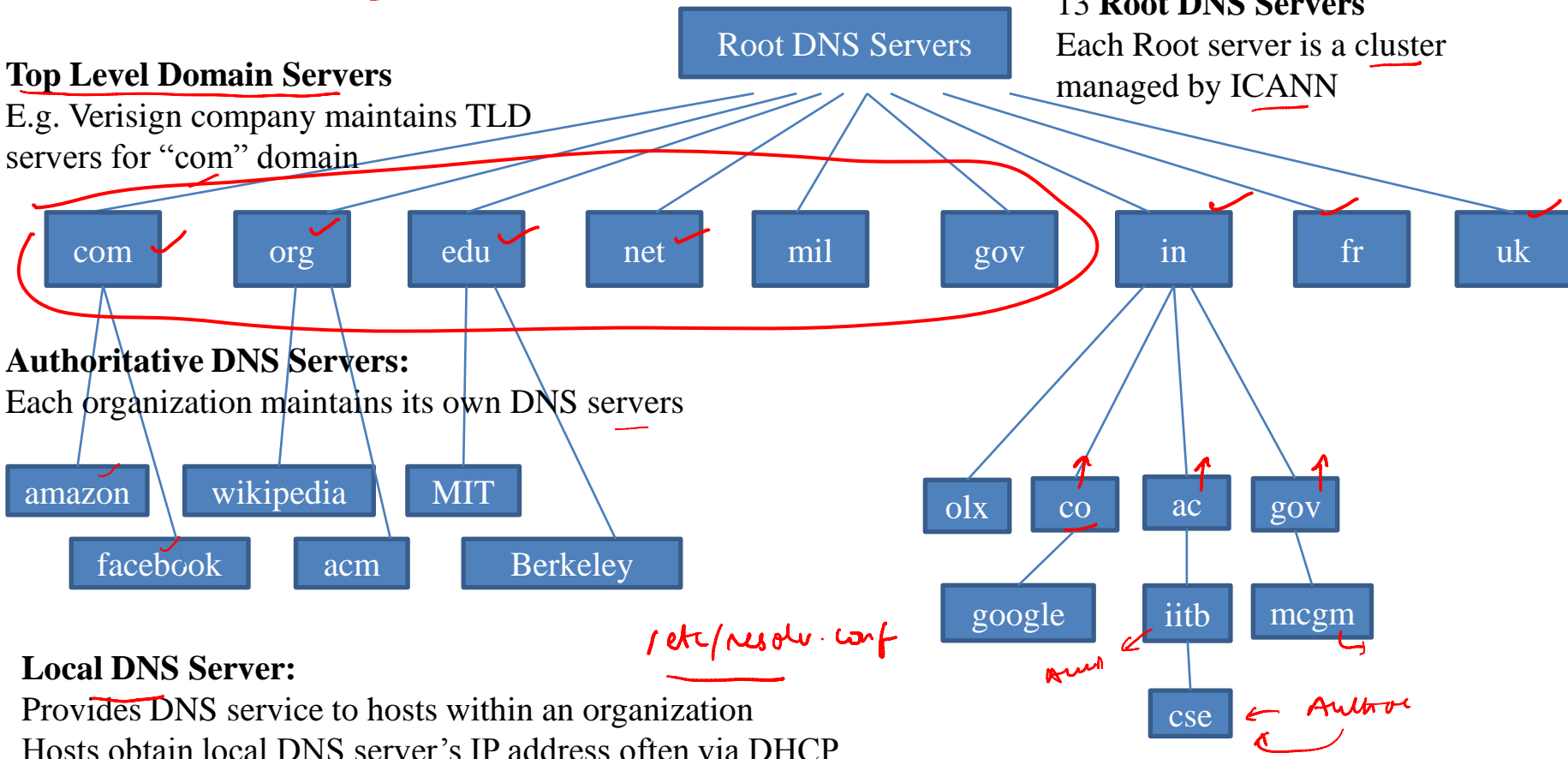
- Centralized Architecture:

  – Single point of failure

  – Has to cope with high traffic volume

  – Location: where should it be placed?

  – Huge database maintenance

  – Overall its not scalable
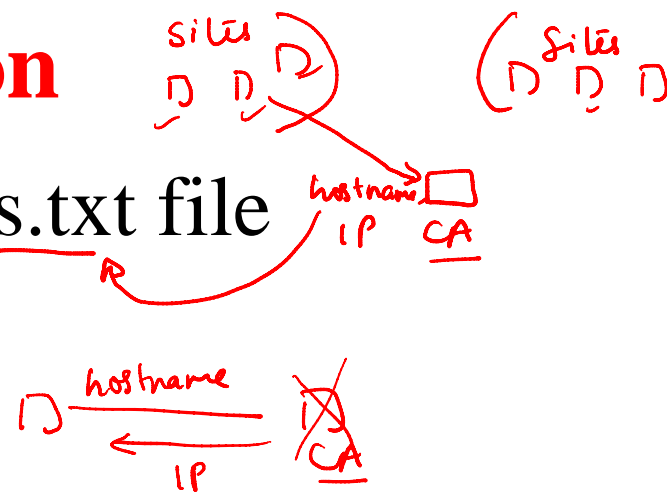
Hierarchical and Distributed Implementation

Root DNS Servers

13 Root DNS Servers
Each Root server is a cluster managed by ICANN

Top Level Domain Servers
E.g. Verisign company maintains TLD servers for "com" domain

| com | org | edu | net | mil | gov | in | fr | uk |

Authoritative DNS Servers:
Each organization maintains its own DNS servers

amazon

wikipedia

MIT

facebook

acm

Berkeley

olx   co   ac   gov

google   iitb   mcgm

/etc/resolv.conf

cse   ← Author

Local DNS Server:
Provides DNS service to hosts within an organization
Hosts obtain local DNS server's IP address often via DHCP

Root Servers

a Verisign, Dulles, VA
c Cogent, Herndon, VA (also Los Angeles)
d U Maryland College Park, MD
g US DoD Vienna, VA
h ARL Aberdeen, MD
j Verisign, (11 locations)

k RIPE London (also Amsterdam, Frankfurt)

i Autonomica, Stockholm (plus 3 other locations)

m WIDE Tokyo

e NASA Mt View, CA
f Internet Software C. Palo Alto, CA (and 17 other locations)

b USC-ISI Marina del Rey, CA
l ICANN Los Angeles, CA

Example

Root DNS Server
202.12.27.33
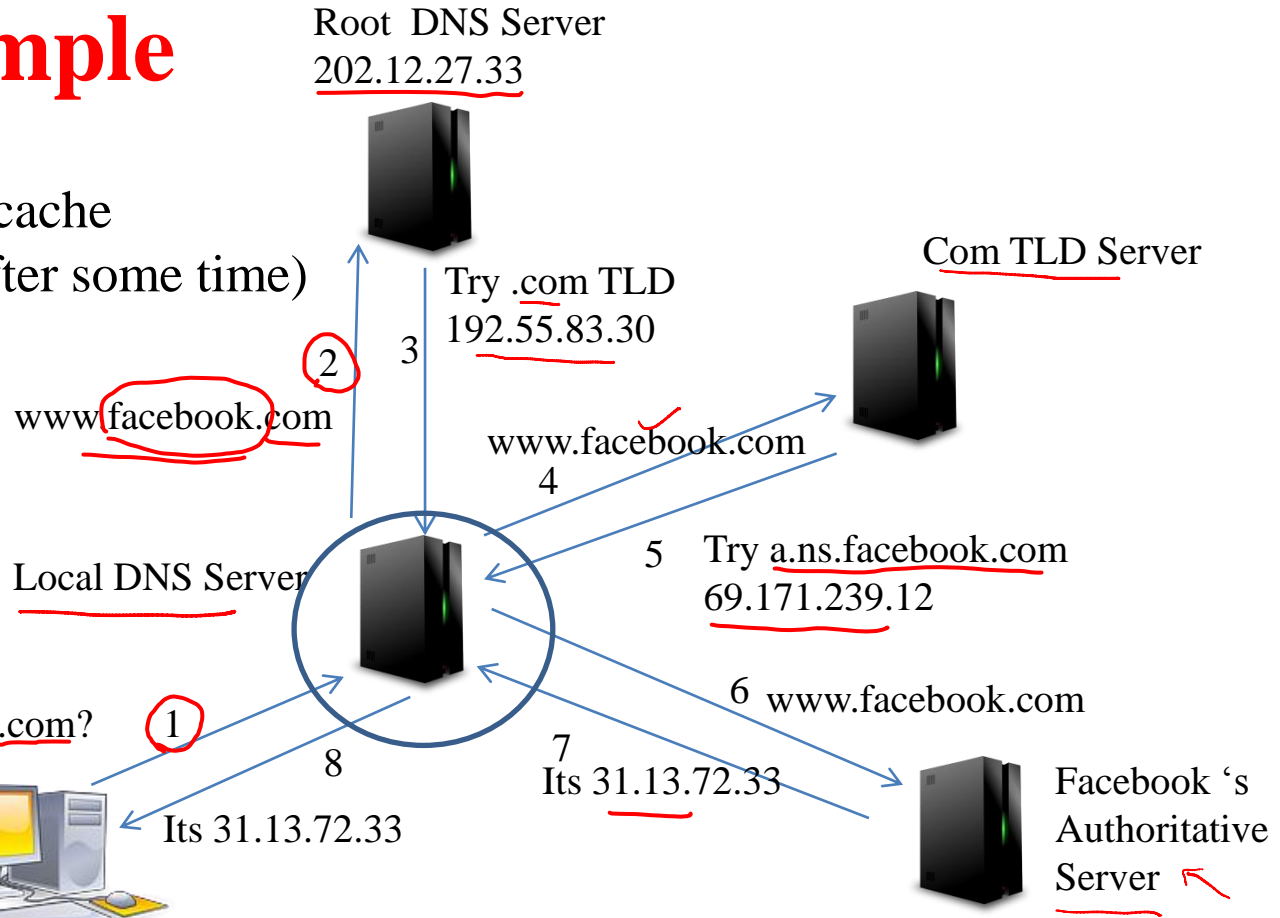
Local DNS server can cache
mappings (discarded after some time)

Cache
.com TLD, IP
.org TLD, IP

TTL
Cache
www.facebook.com
31.13.72.33

Com TLD Server

Try .com TLD
192.55.83.30

② 3

www.facebook.com

www.facebook.com
4

Local DNS Server

5   Try a.ns.facebook.com
    69.171.239.12

6   www.facebook.com

Whats IP of www.facebook.com?   ①

8   7   Facebook 's
Its 31.13.72.33   Its 31.13.72.33   Authoritative
                                       Server

Break