

DNS

CS 241

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University of Illinois

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IP addresses

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- Fixed length, binary number
- Hierarchical, related to host location
- Examples: `64.236.16.20` and `212.58.224.131`

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Name could map to multiple IP addresses

- www.cnn.com to multiple (8) replicas of the Web site
- Enables
 - Load-balancing
 - Reducing latency by picking nearby servers
 - Tailoring content based on requester's location/identity

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Multiple names for the same address

- E.g., aliases like www.cnn.com and cnn.com

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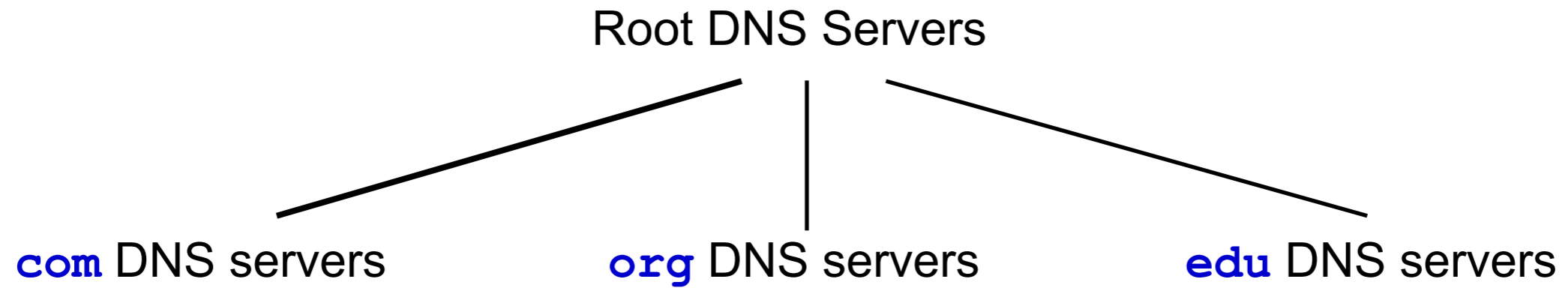
Performing the translations

- Local DNS servers
- Resolver software

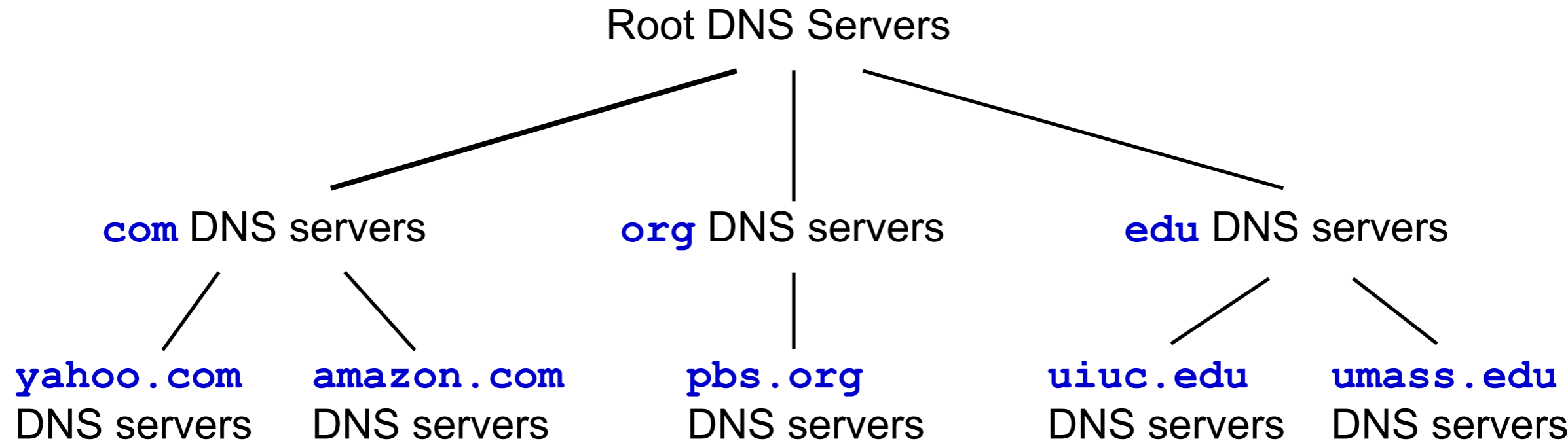
Distributed, Hierarchical Database

Root DNS Servers

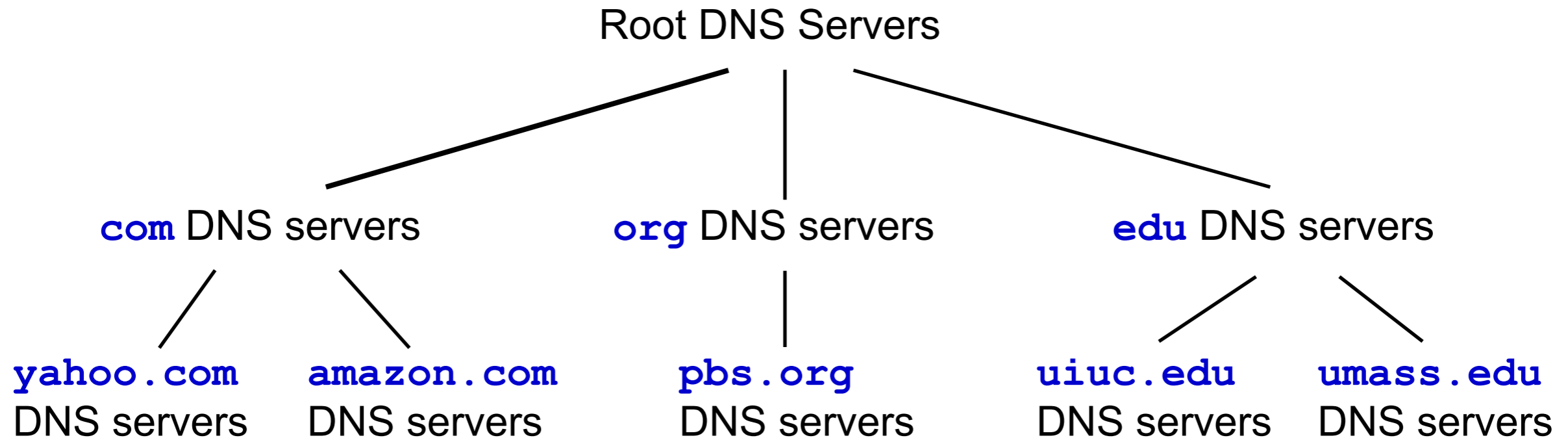
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Client wants IP for `www.amazon.com`

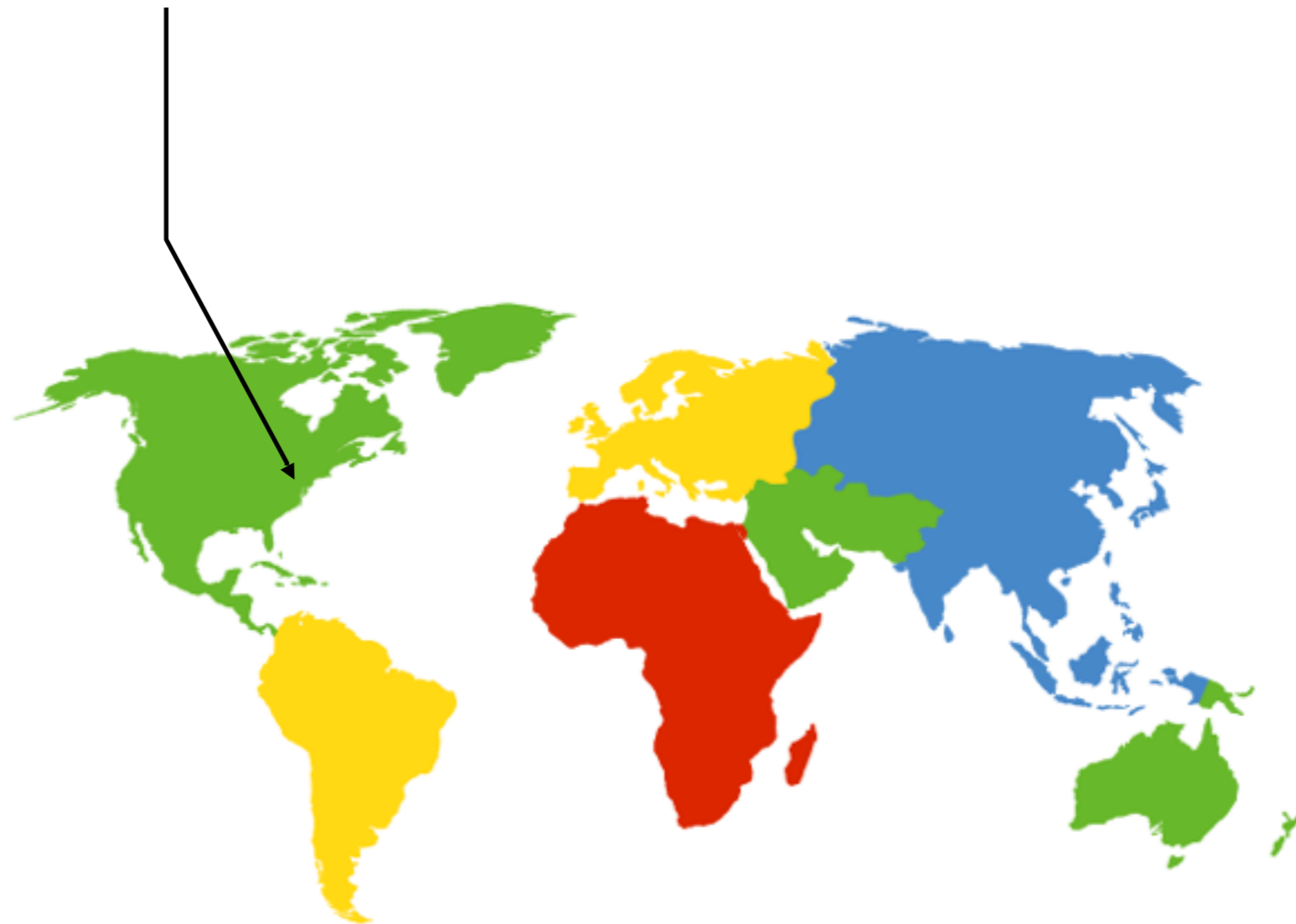
- Client queries a root server to find com DNS server
- Client queries com DNS server to get amazon.com DNS server
- Client queries amazon.com DNS server to get IP address for `www.amazon.com`

DNS Root

Located in Virginia, USA

How do we make the root scale?

Verisign, Dulles, VA

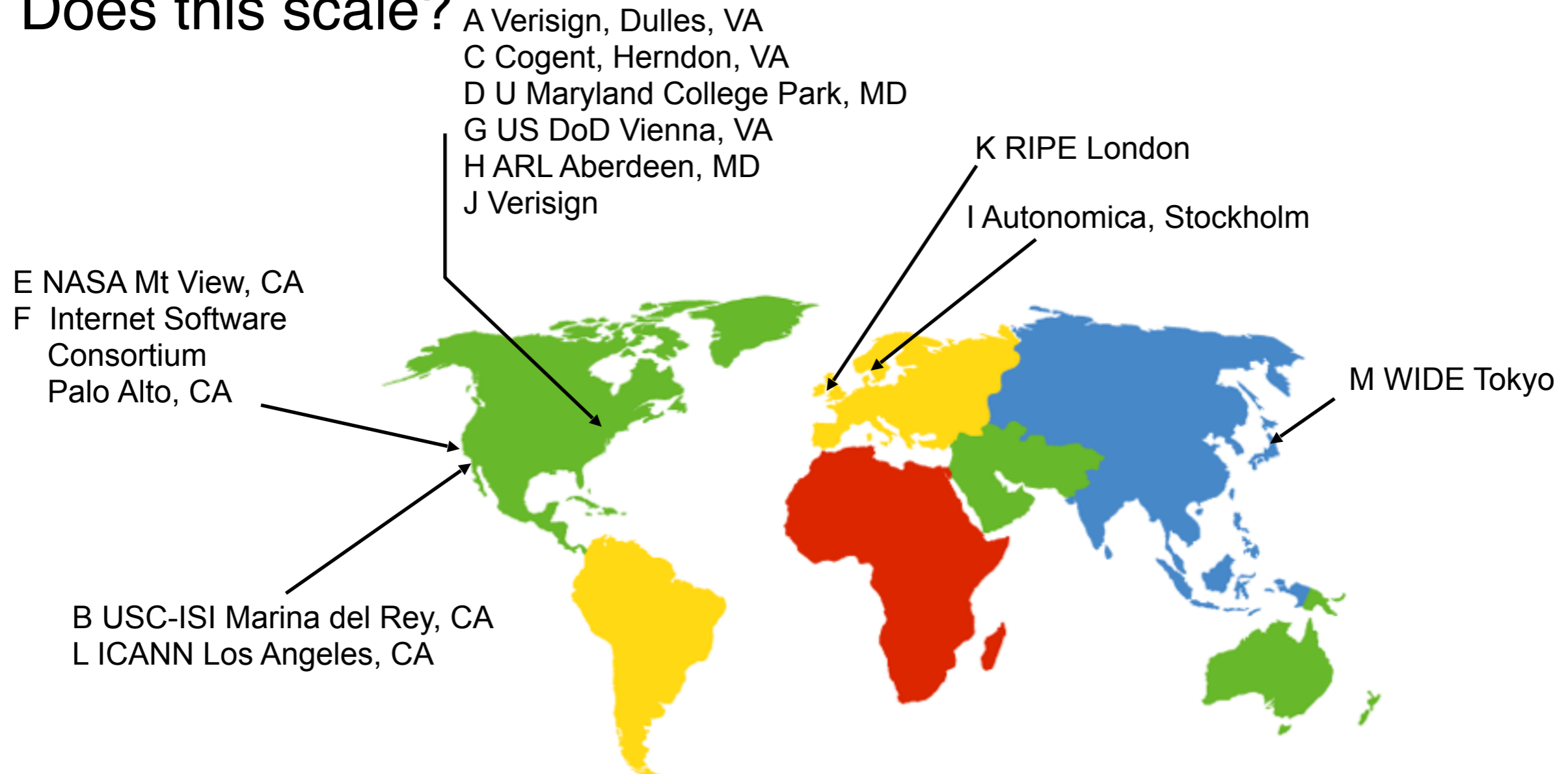


DNS Root Servers

13 root servers (see <http://www.root-servers.org/>)

- Labeled A through M

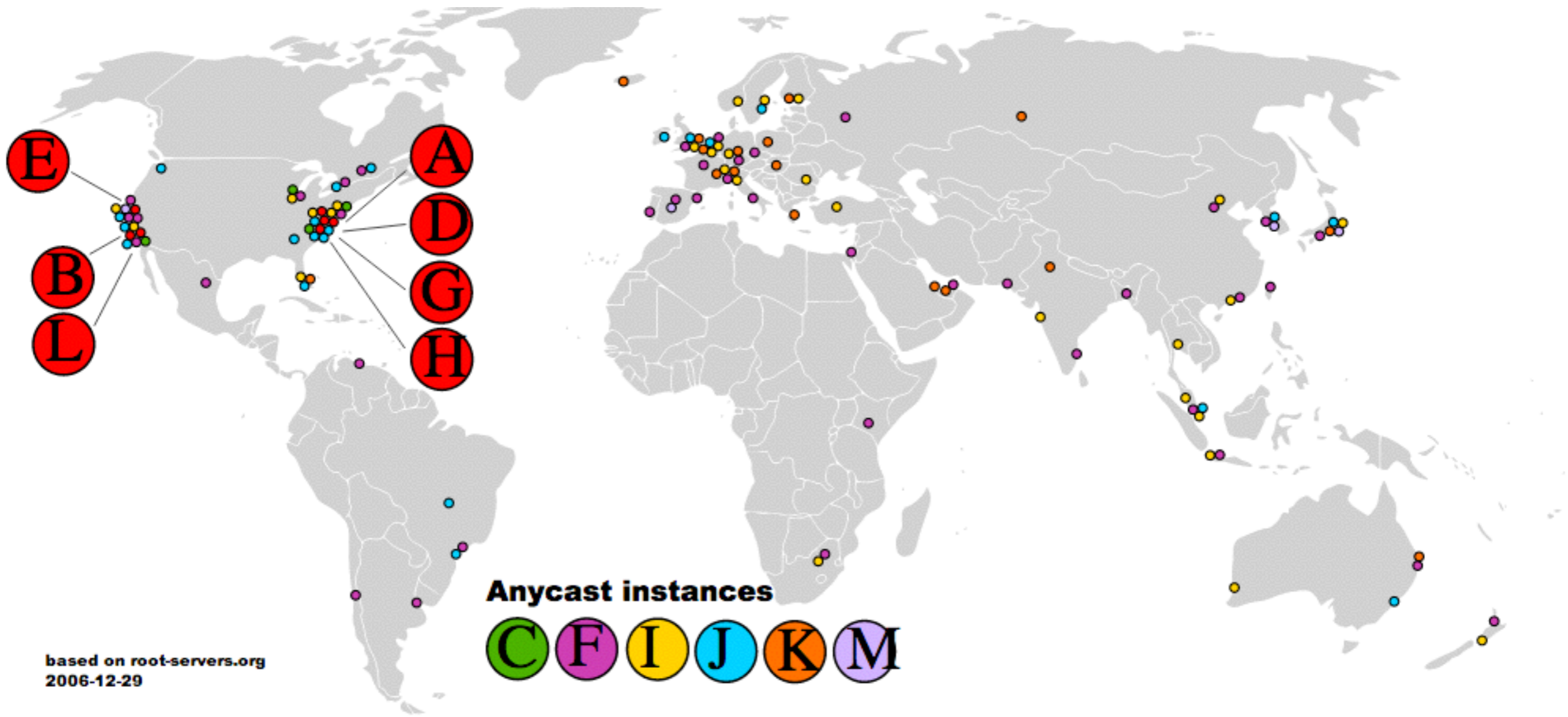
Does this scale?



DNS Root Servers

13 root servers each replicated via any-casting (localized routing for addresses)





Source: Wikipedia user Matthäus Wander

TLD and Authoritative Servers

Top-level domain (TLD) servers

- Responsible for com, org, net, edu, etc, and all top-level country domains uk, fr, ca, jp.
 - Network Solutions maintains servers for com TLD
 - Educause for edu TLD

Authoritative DNS servers

- Organization's DNS servers
- Provide authoritative hostname to IP mappings for organization's servers (e.g., Web, mail).
- Can be maintained by organization or service provider

Local Name Server

One per ISP (residential ISP, company, university)

- Also called “default name server”

When host makes DNS query, query is sent to its local DNS server

- Acts as proxy, forwards query into hierarchy
- Reduces lookup latency for commonly searched hostnames

Hosts learn local name server via...

- DHCP (same protocol that tells host its IP address)
- Static configuration (e.g., can use Google’s “local” name service at 8.8.8.8 or 8.8.4.4)

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Client application (e.g., web browser)

- Extract server name (e.g., from the URL)
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Server application (e.g. web server)

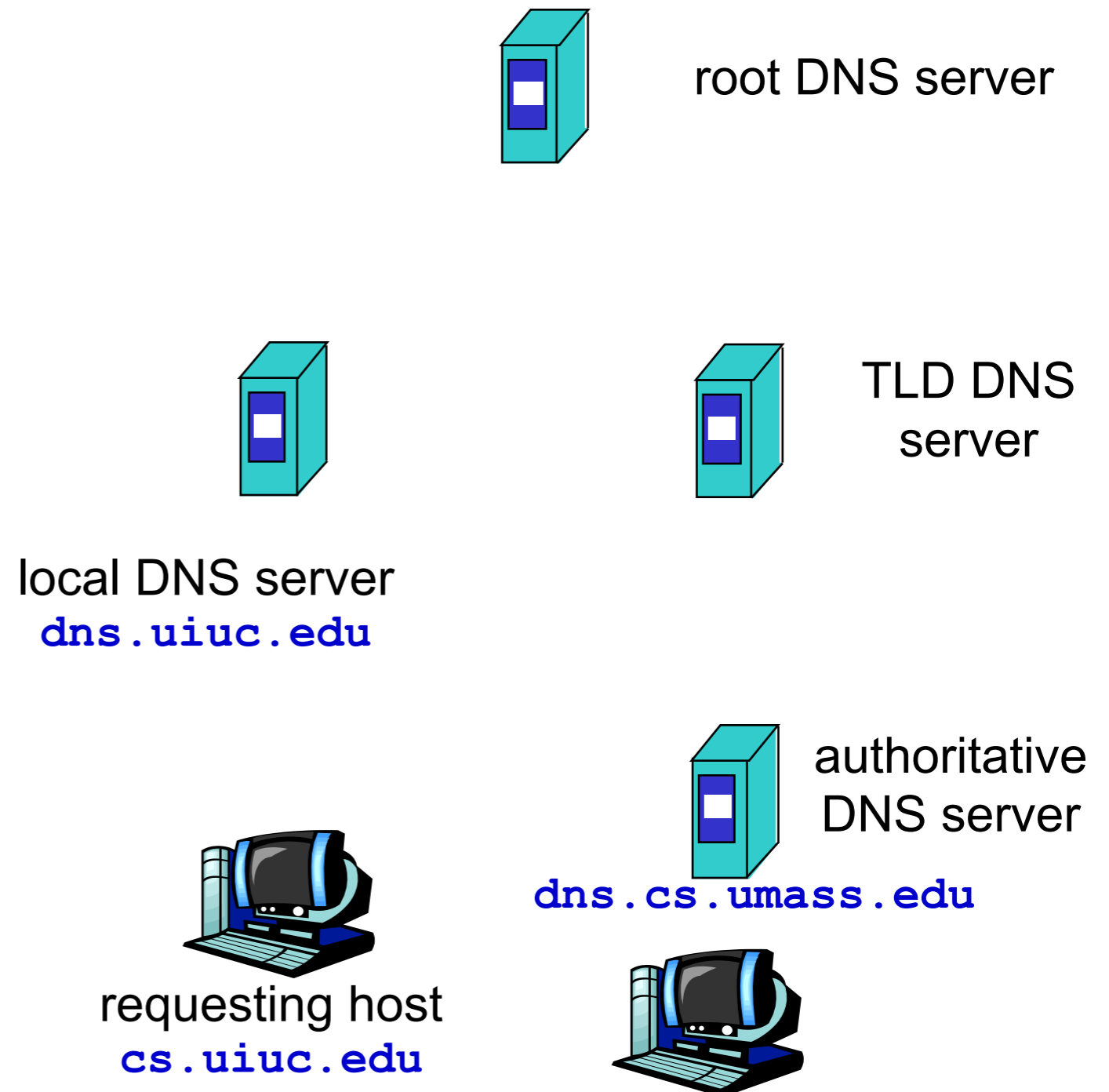
- Extract client IP address from socket
- Optional `gethostbyaddr()` to translate into name

DNS name resolution example

Host at `cs.uiuc.edu` wants IP address for `gaia.cs.umass.edu`

Iterated query

- Contacted server replies with name of server to contact
- “I don’t know this name, but ask this server”

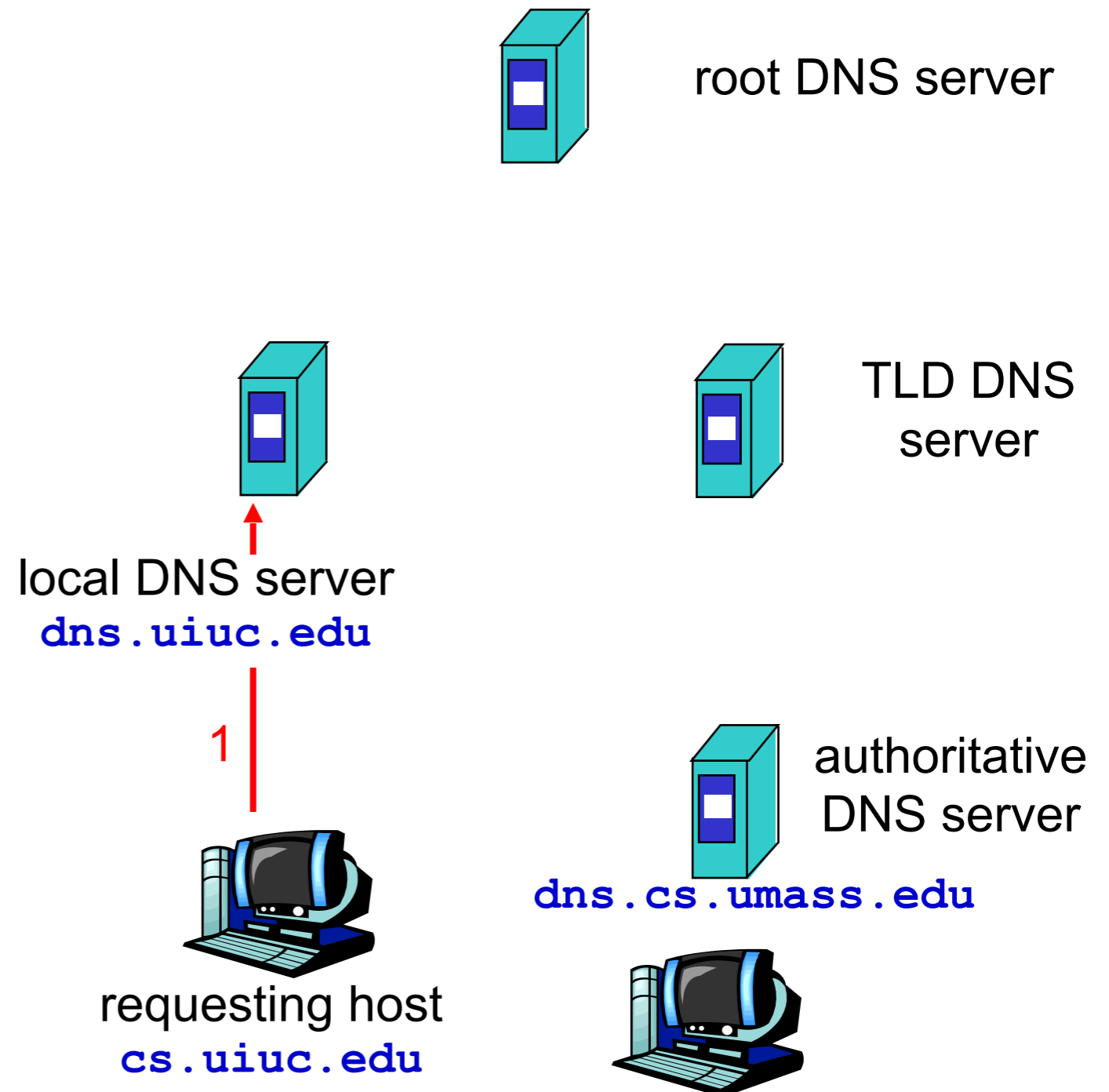


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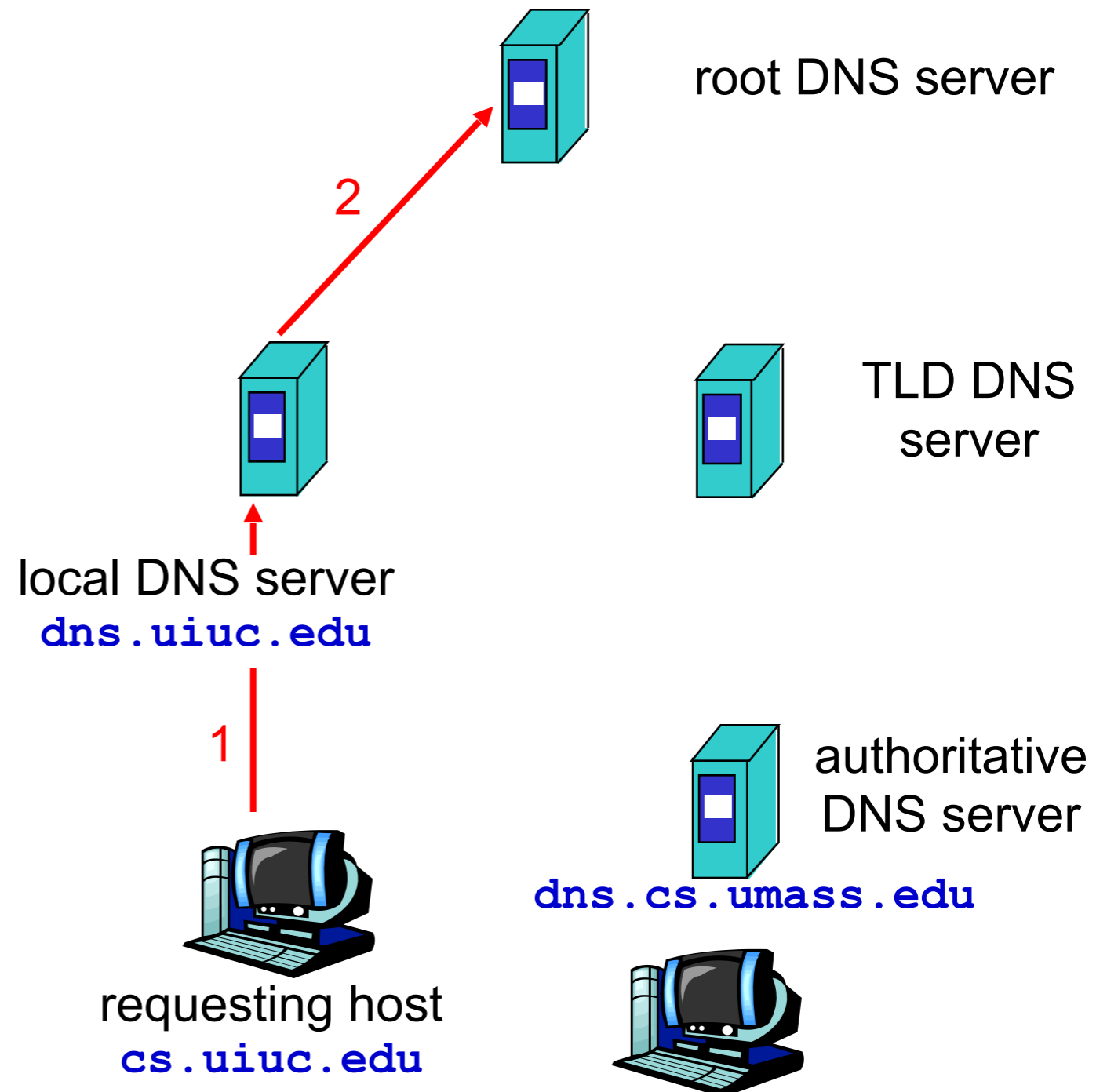


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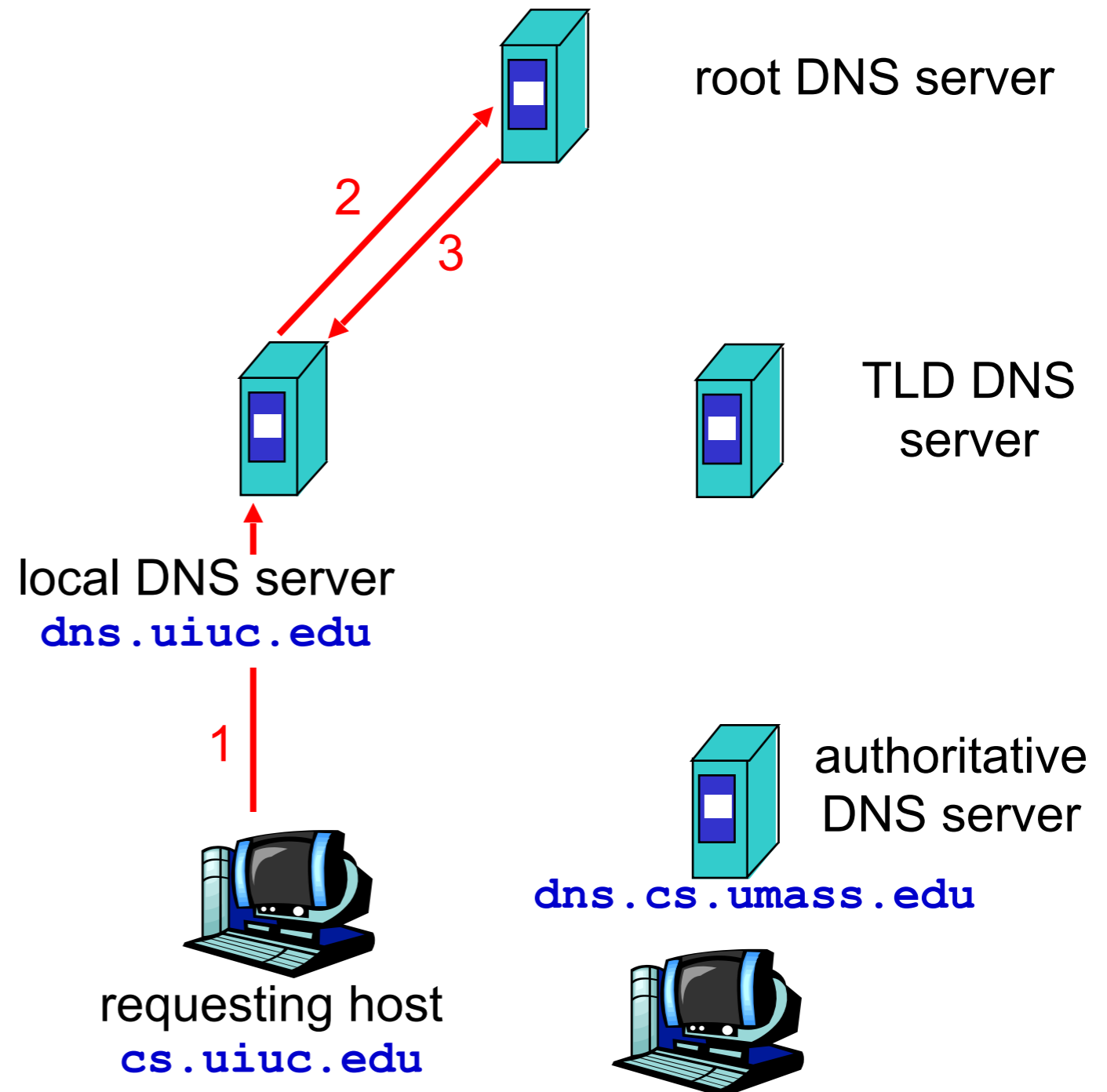


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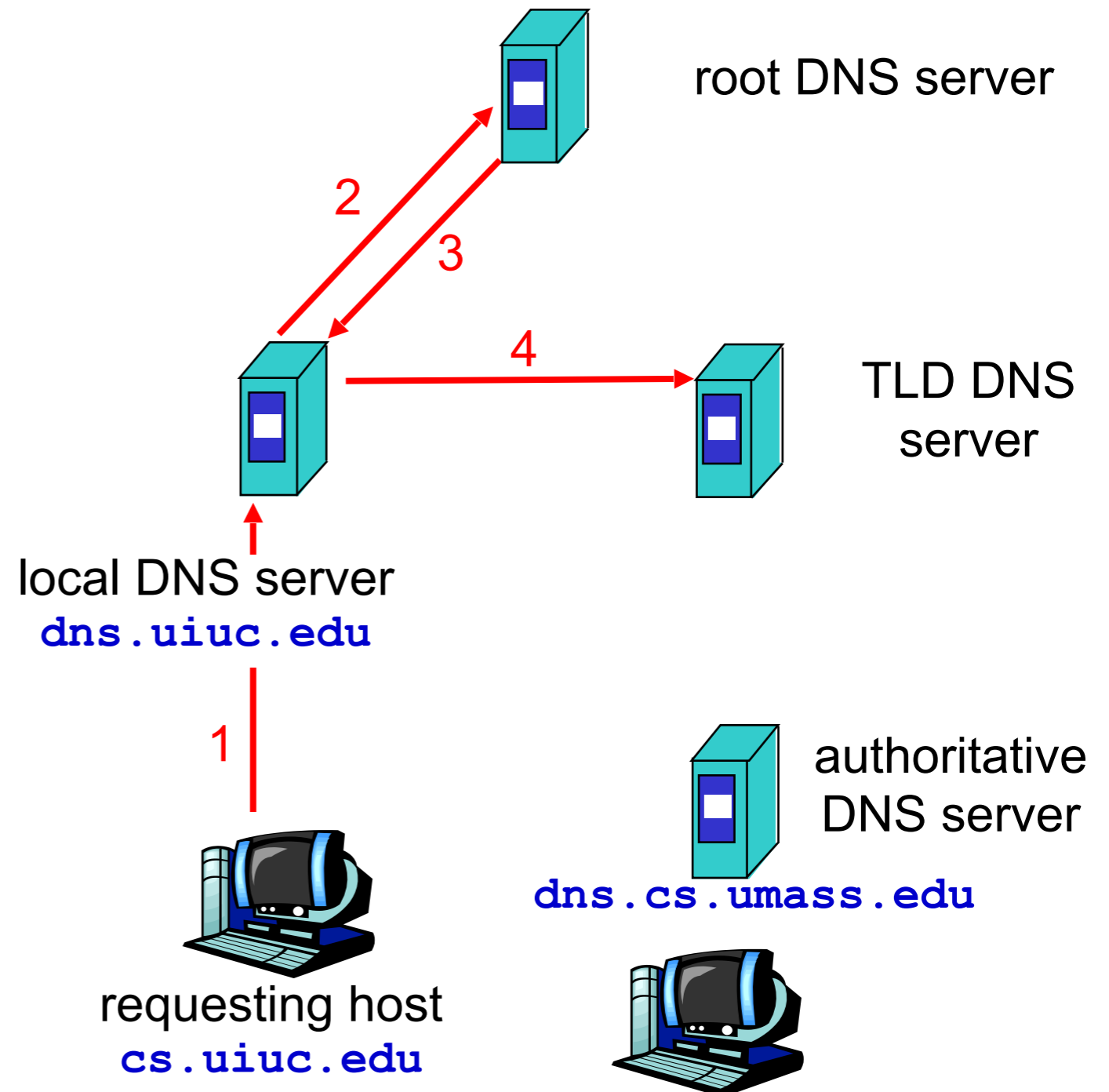


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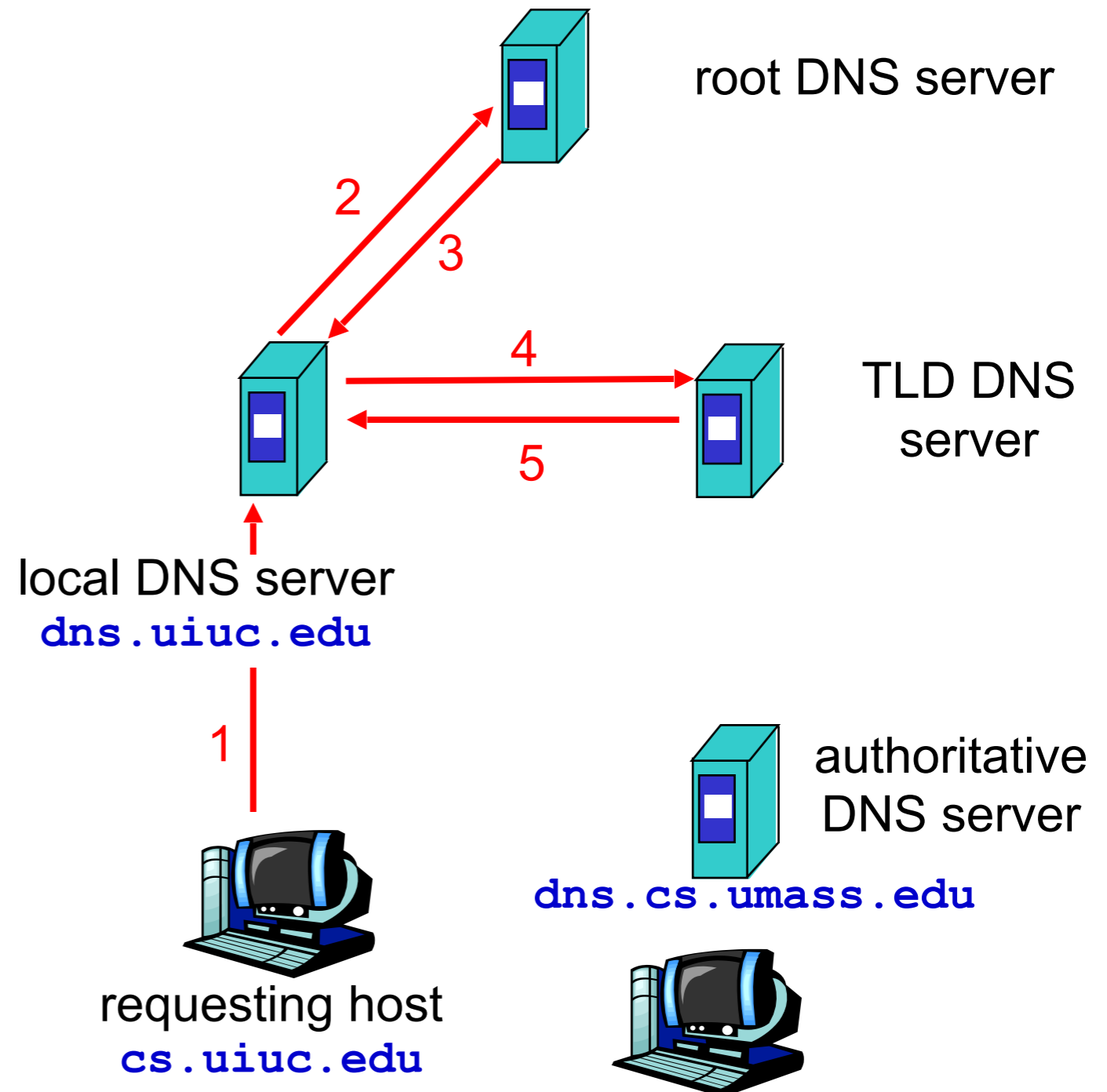


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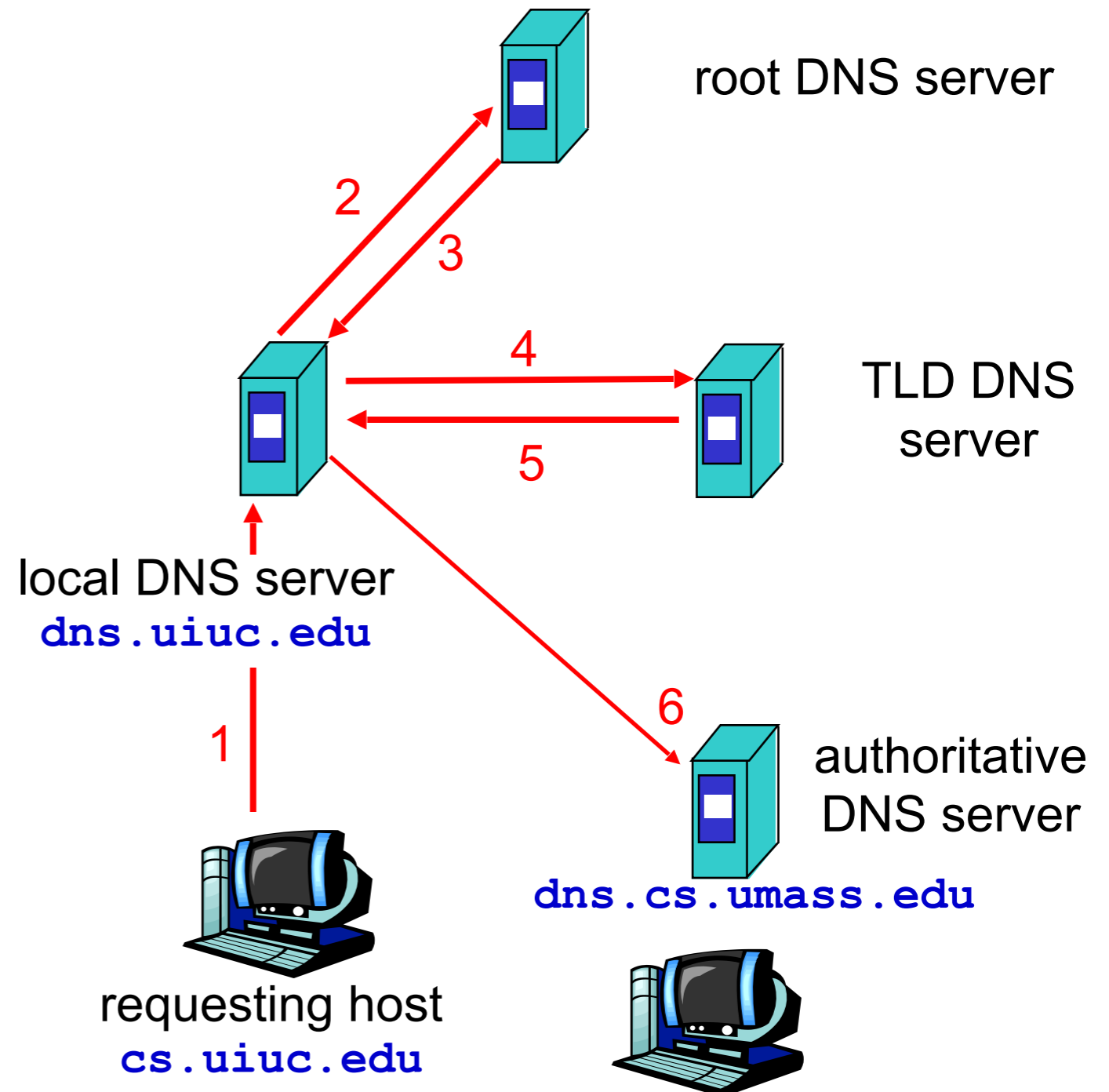


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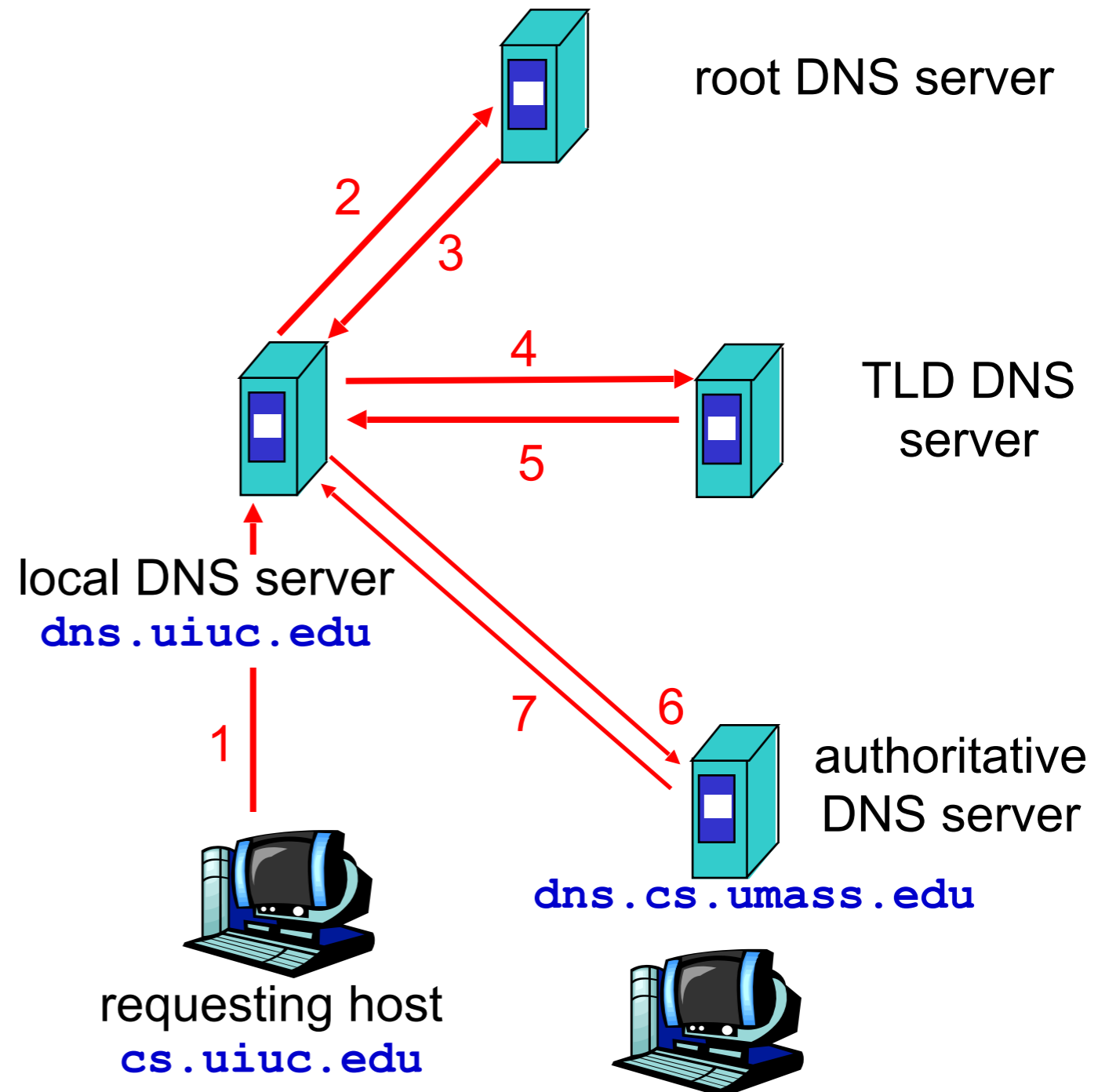


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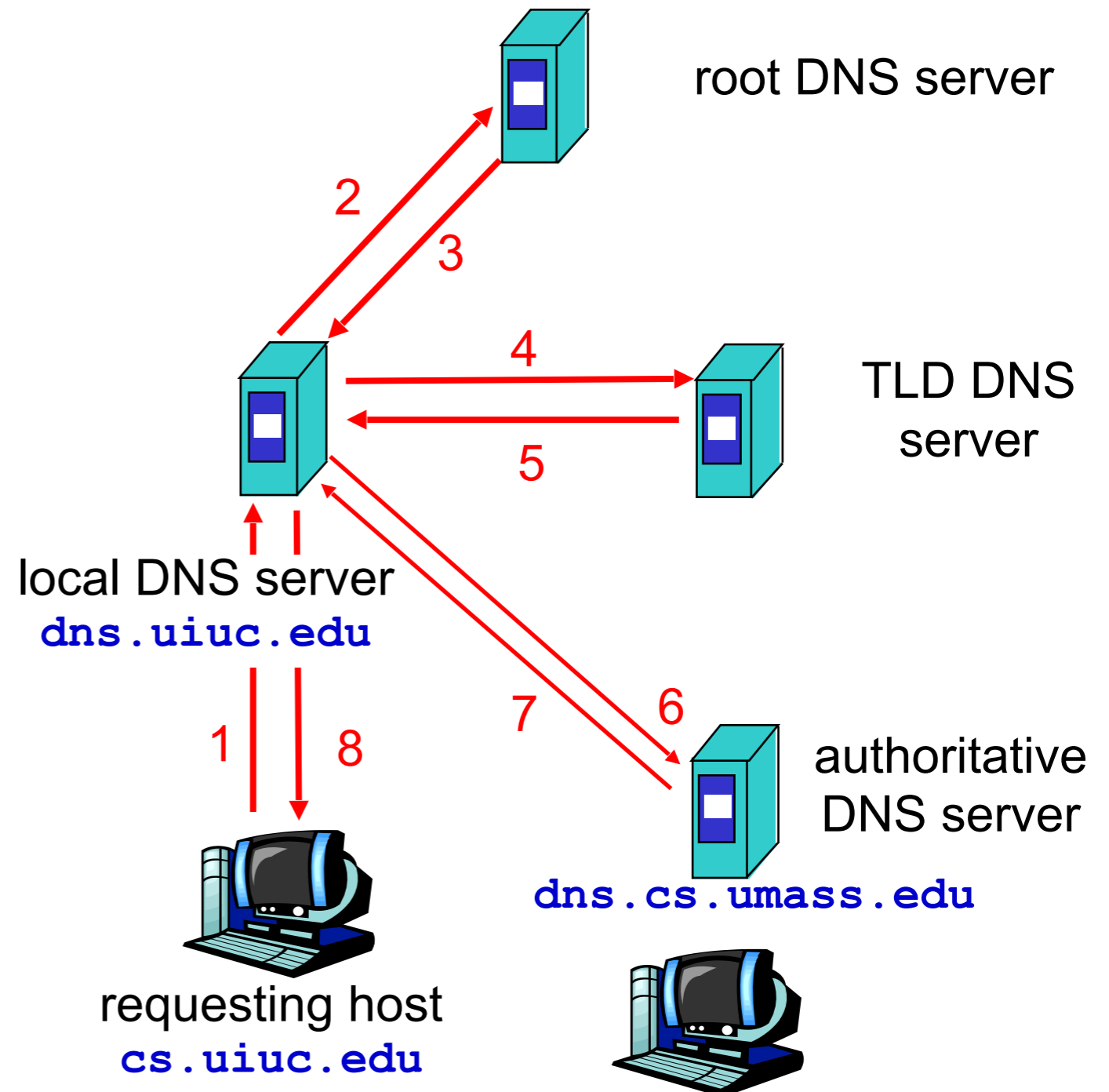


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An example demo.
Say your prayers!!

DNS: Caching

Once (any) name server learns mapping, it caches mapping

- Cache entries timeout (disappear) after some time
- TLD servers typically cached in local name servers
 - Thus root name servers not often visited