CS 725/825 & IT 725
Lecture 5
Networking Fundamentals

September 10, 2025

Domain Name Service

▸ Mapping between hostnames and IP addresses:

– one-to-one, one-to-many, many-to-one, or many-to-many?

– mapping in both directions

▸ Possible solutions:

– centralized database

– fully distributed database

Domain Name Service

▸ Distributed, redundant, hierarchical database

  – ownership

  – characteristics of the organization (.com, .org, ...)

  – geography (.uk, .cn, .nh.us)

▸ Query delegation:

  – recursive

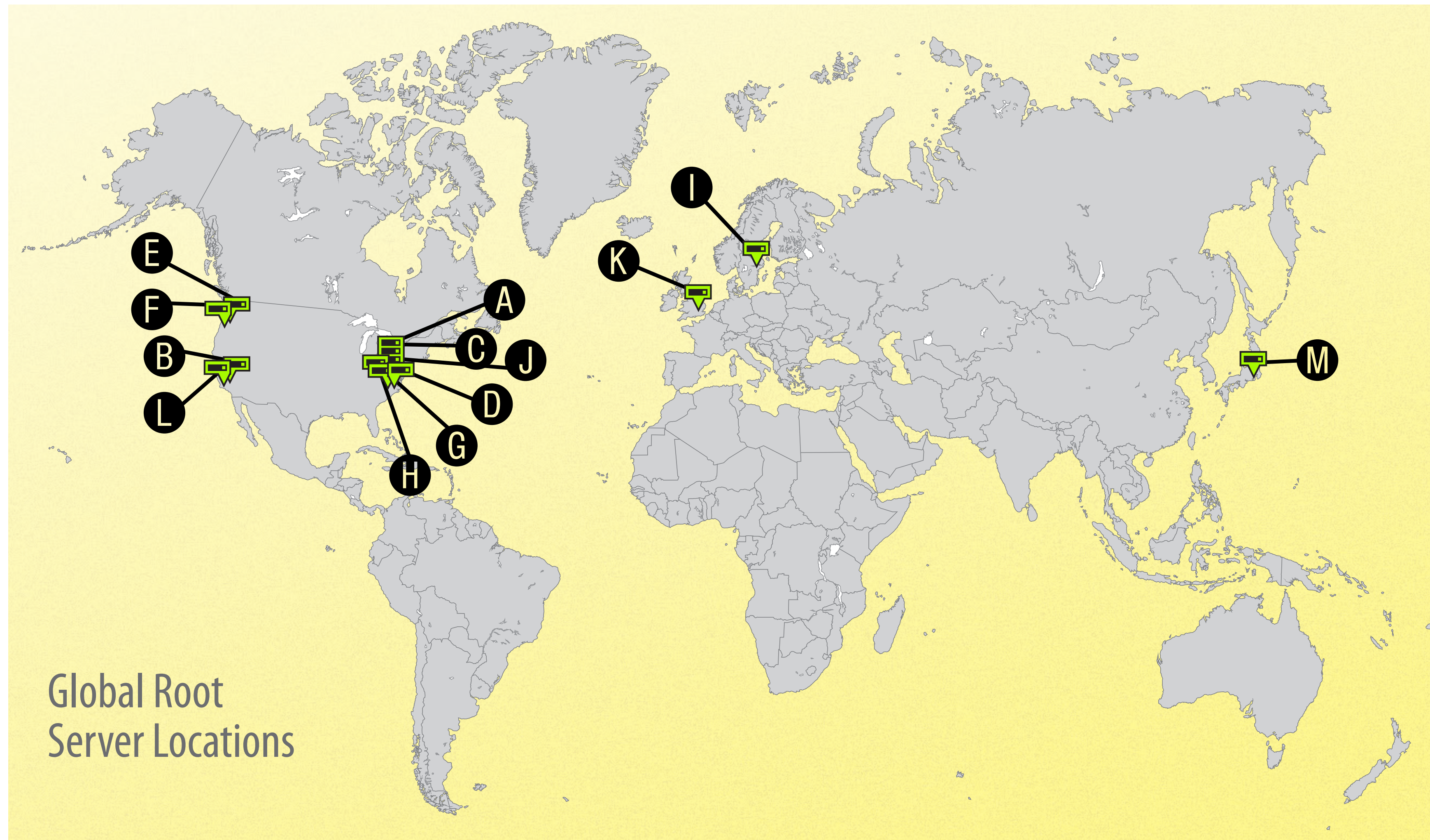 – iterative (non-recursive)

Root Name Servers

Global Root
Server Locations

Image source: dyn.com

DNS Records (examples)

A	address record
AAAA	IPv6 address record
CNAME	canonical name record
MX	mail exchange record
NS	name server record
PTR	pointer record
SOA	start of authority record
TXT	text record

▸ DNS tools: nslookup, host, dig

DNS considerations

▸ Reliability and resilience

  – redundant servers, automatic consistency maintenance

▸ Performance

  – DNS lookup has to be completed before the next steps
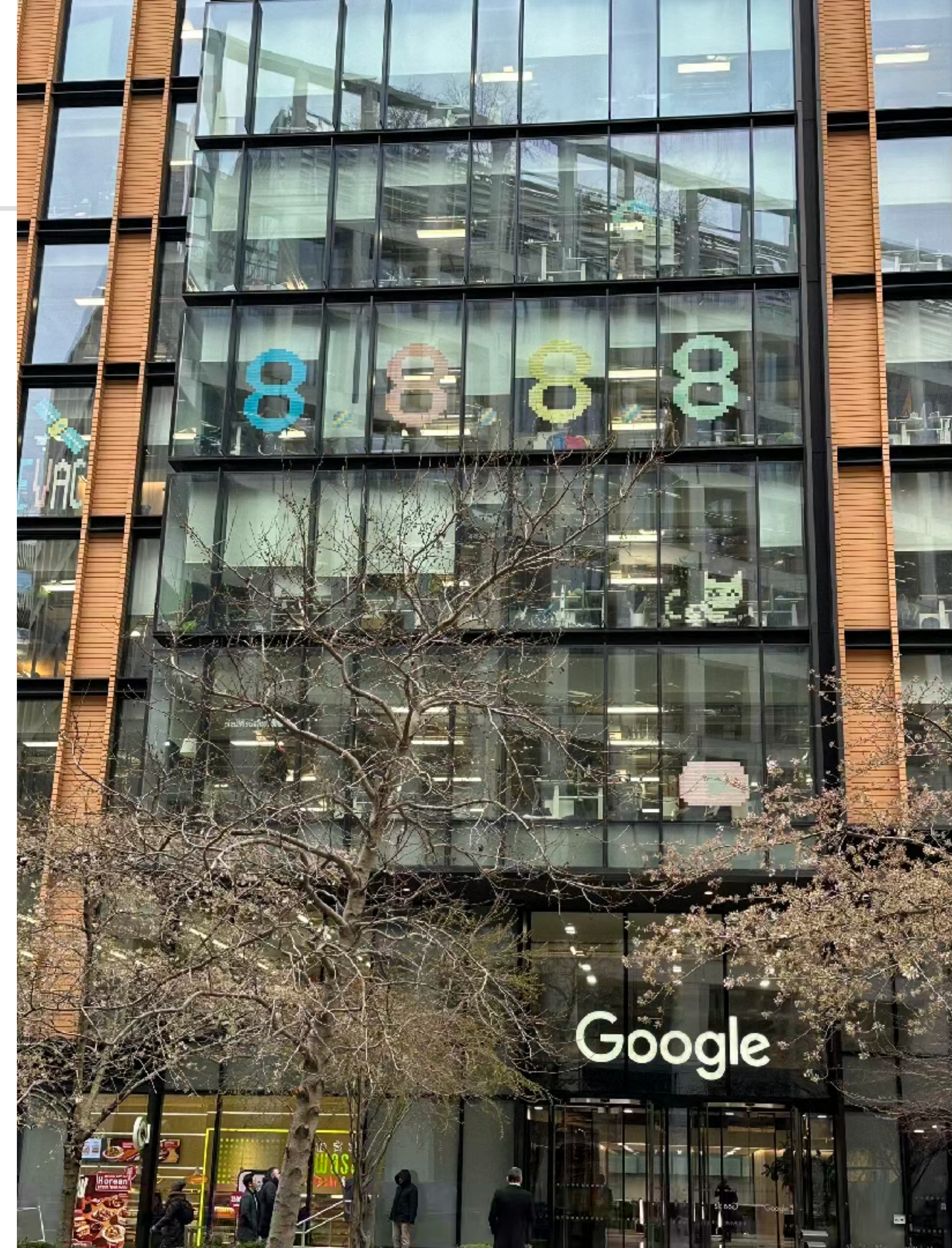
  – "in-house" or outsourced DNS servers

▸ Security

  – basic protocol is not authenticated

 – recursive servers return cached responses

Public Servers

▸ Public Recursive Name Servers

– faster

– resistant to filtering

– privacy (?)

▸ Examples

– Google 8.8.8.8 and 8.8.4.4

– Cloudflare 1.1.1.1 and 1.0.0.1

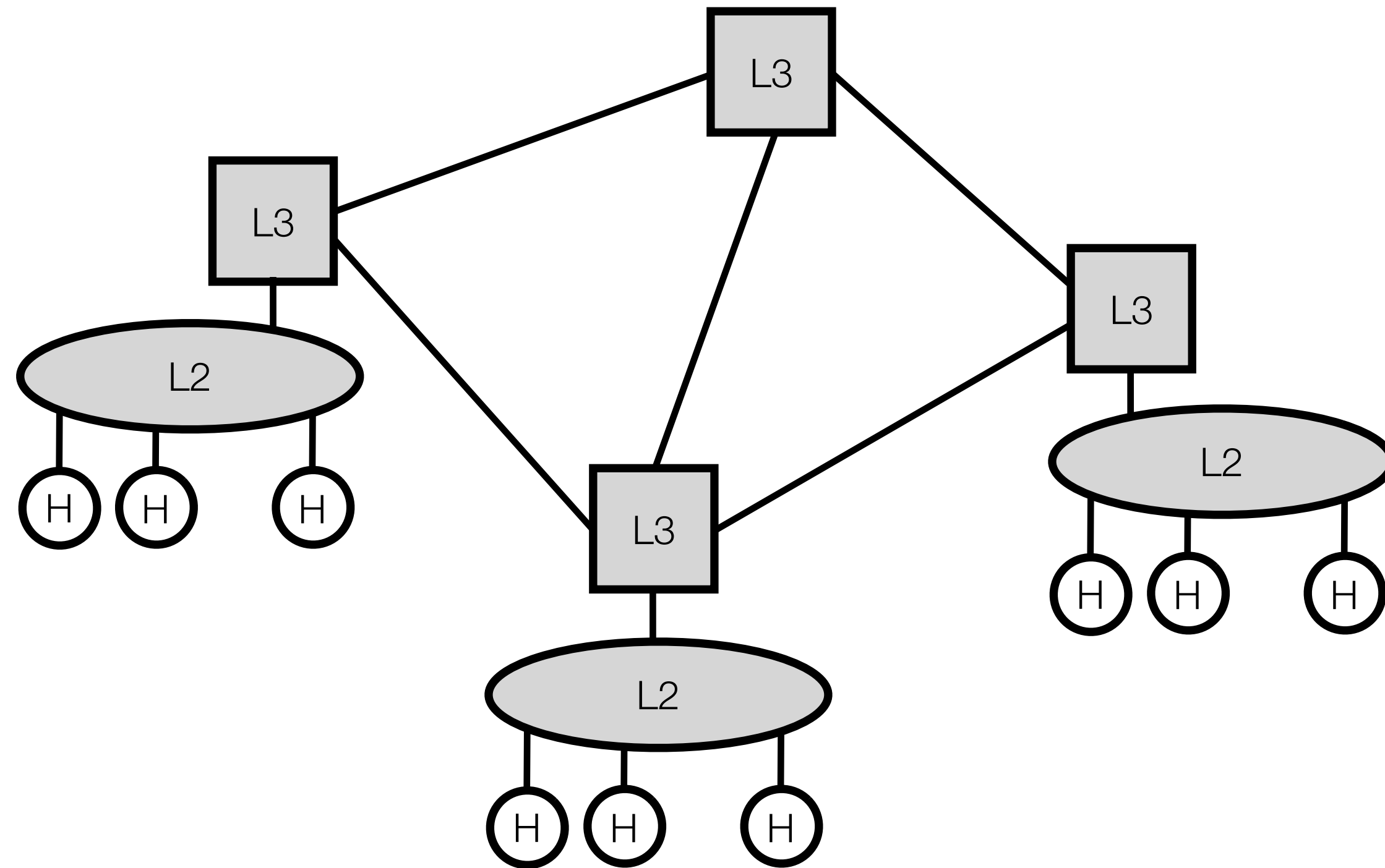Google offices near St Pancras railway station in London

DHCP

▸ Dynamic Host Configuration Protocol

- to obtain IP address and other configuration params

- one or more servers on the same subnet

- utilizes IP broadcast (255.255.255.255) and UDP
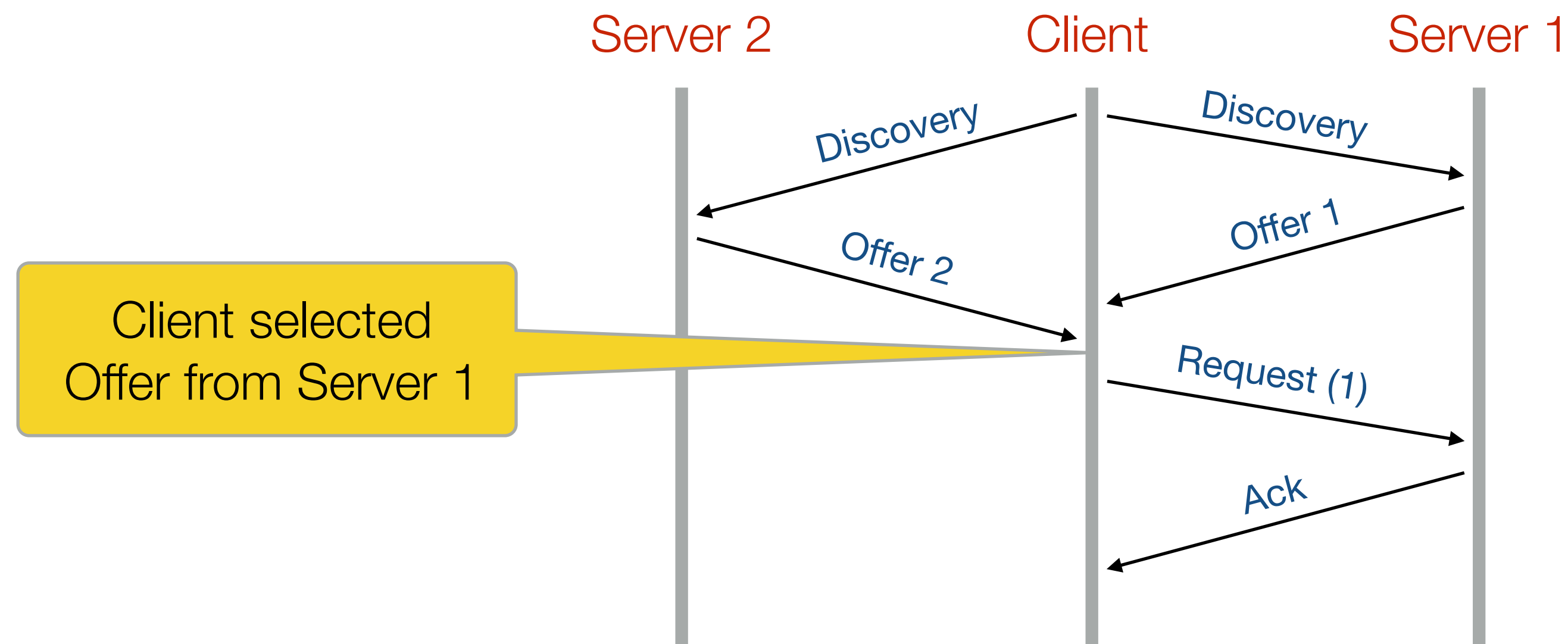
Network Layer Routing

Hop-by-hop routing: "your next hop is X, go there and ask for further directions"