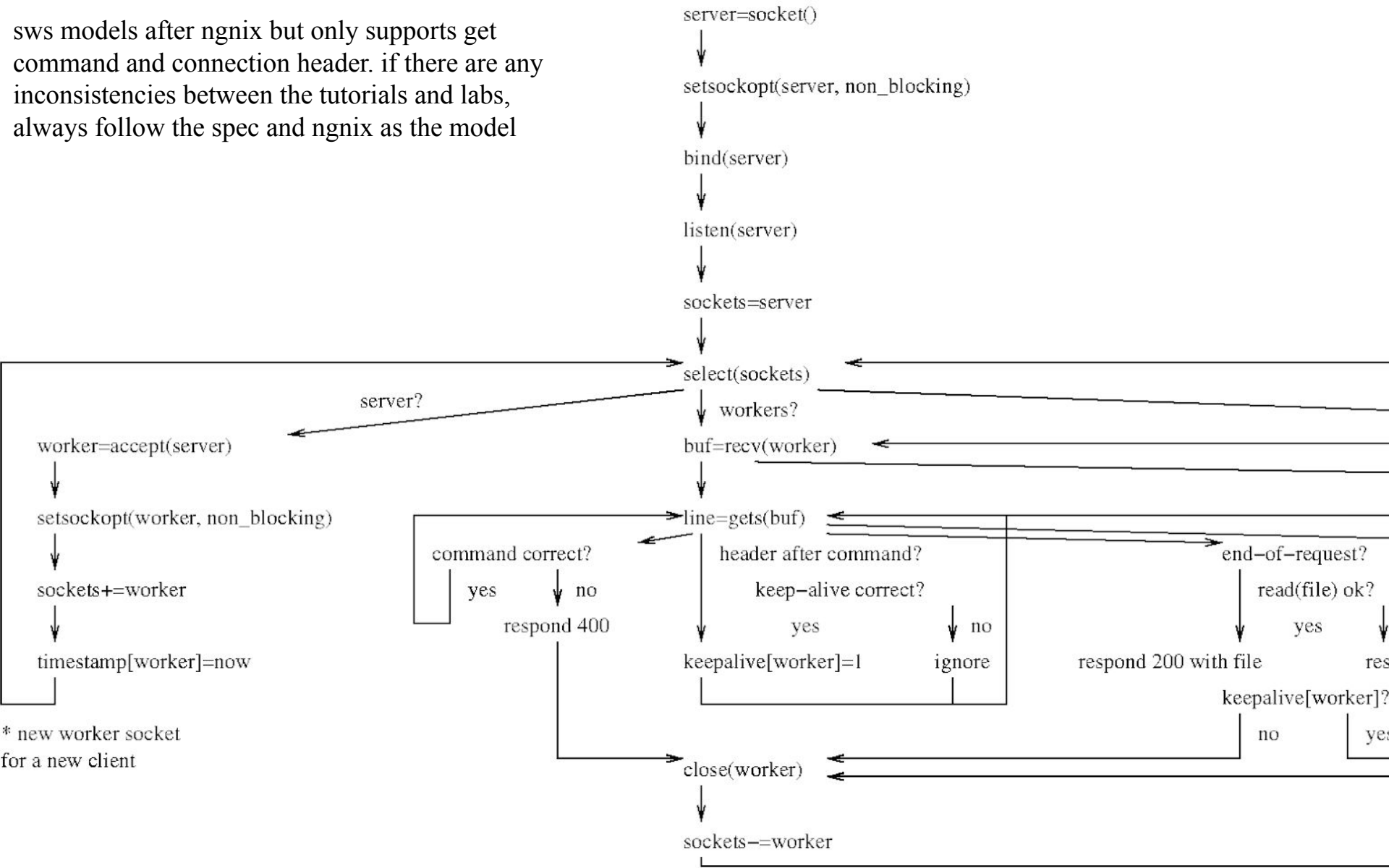
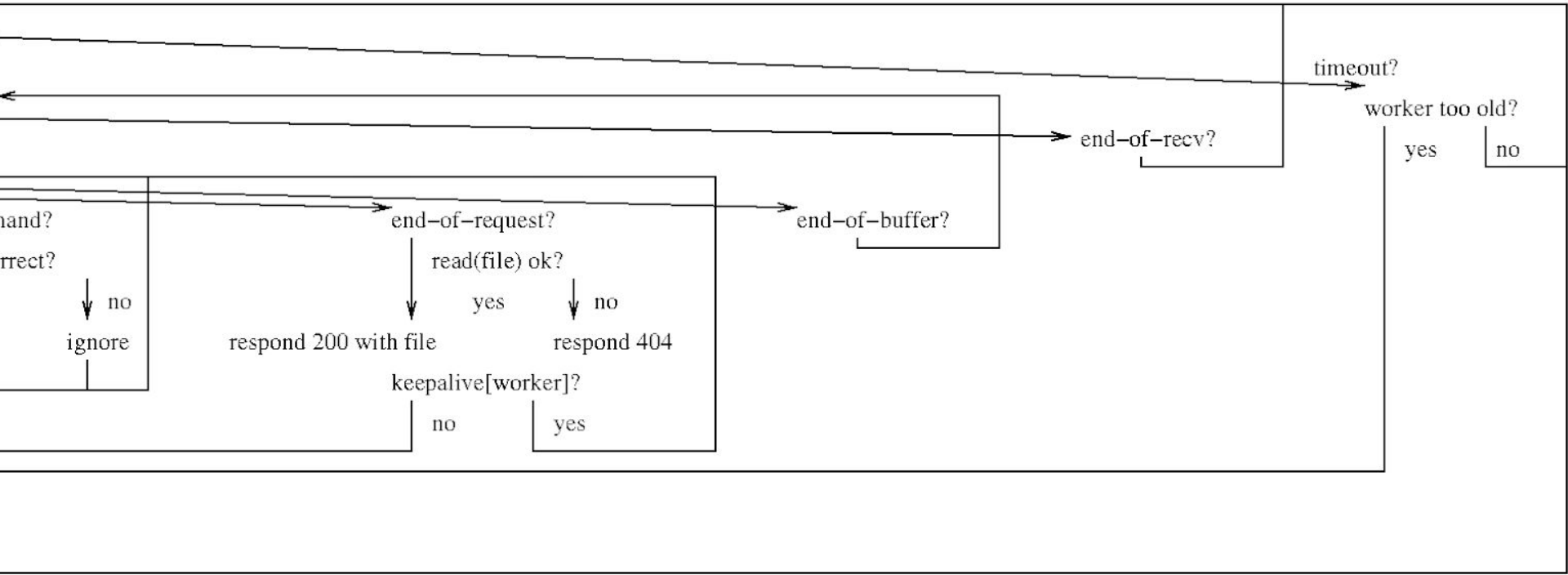
sws models after ngnix but only supports get command and connection header. if there are any inconsistencies between the tutorials and labs, always follow the spec and ngnix as the model



_blocking)


timeout?
worker too old?
yes
no
end–of–recv?
nand?
end–of–request?
end–of–buffer?
rrect?
read(file) ok?
no
yes
no
ignore
respond 200 with file
respond 404
keepalive[worker]?
no
yes

SOA, NS

- dig soa cs.uvic.ca
  - cs.uvic.ca. 43200 IN SOA active.uvic.ca. gduncan.dns.engr.uvic.ca. 705181509 3600 300 604800 1800
    - origin = active.uvic.ca; mail addr = gduncan.dns.engr.uvic.ca; serial = 705181509; refresh = 3600 (60 minutes); retry = 300 (5 minutes); expire = 604800 (7 days); minimum = 1800 (0.5 hour)
    - replication consistency control
- dig ns cs.uvic.ca
  - cs.uvic.ca. 40800 IN NS dns1.uvic.ca.
  - cs.uvic.ca. 40800 IN NS active.uvic.ca.

@?

Q: TTL?

- dig **mx** cs.uvic.ca
  - cs.uvic.ca. 43200 IN MX 0 mta.cs.uvic.ca.
    - priority = 0 (highest)
    - often at least 2 for each domain for email resilience
- dig **a** cs.uvic.ca
  - cs.uvic.ca. 43200 IN A 142.104.100.110
- dig **cname** www.cs.uvic.ca
  - www.cs.uvic.ca. 42383 IN CNAME thing2.cs.uvic.ca.
- dig **a** thing2.cs.uvic.ca
  - thing2.cs.uvic.ca. 43200 IN A 142.104.100.111
- dig **ptr** 111.100.104.142.in-addr.arpa
  - 111.100.104.142.in-addr.arpa. 43200 IN PTR thing2.cs.UVic.CA.

Q: why CNAME?

DNS queries

- Local DNS resolver-server

#nslookup

>set debug

>www.cs.uvic.ca

QUESTIONS

www.cs.uvic.ca, type = A, class = IN

ANSWERS

-> www.cs.uvic.ca

canonical name = thing2.cs.uvic.ca.

-> thing2.cs.uvic.ca

internet address = 142.104.100.111

AUTHORITY RECORDS

-> cs.uvic.ca

nameserver = active.uvic.ca.

-> cs.uvic.ca

nameserver = dns1.uvic.ca.

ADDITIONAL RECORDS

-> dns1.uvic.ca

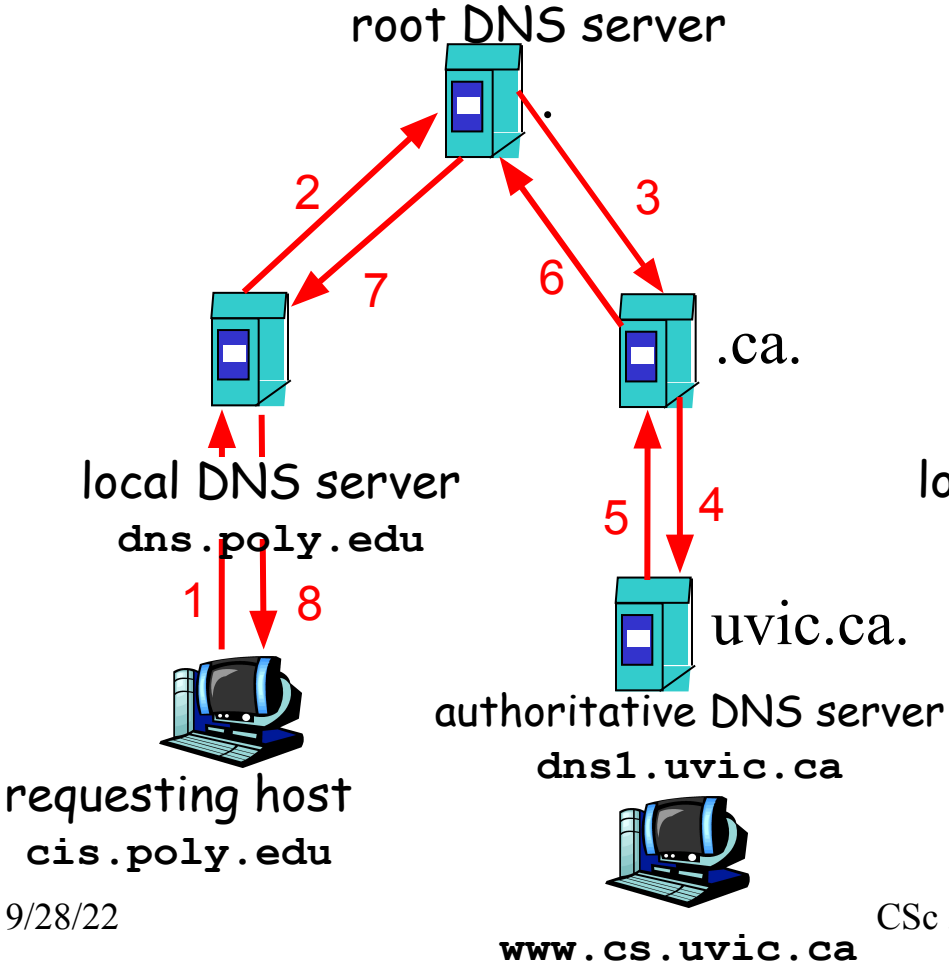
internet address = 142.104.6.1

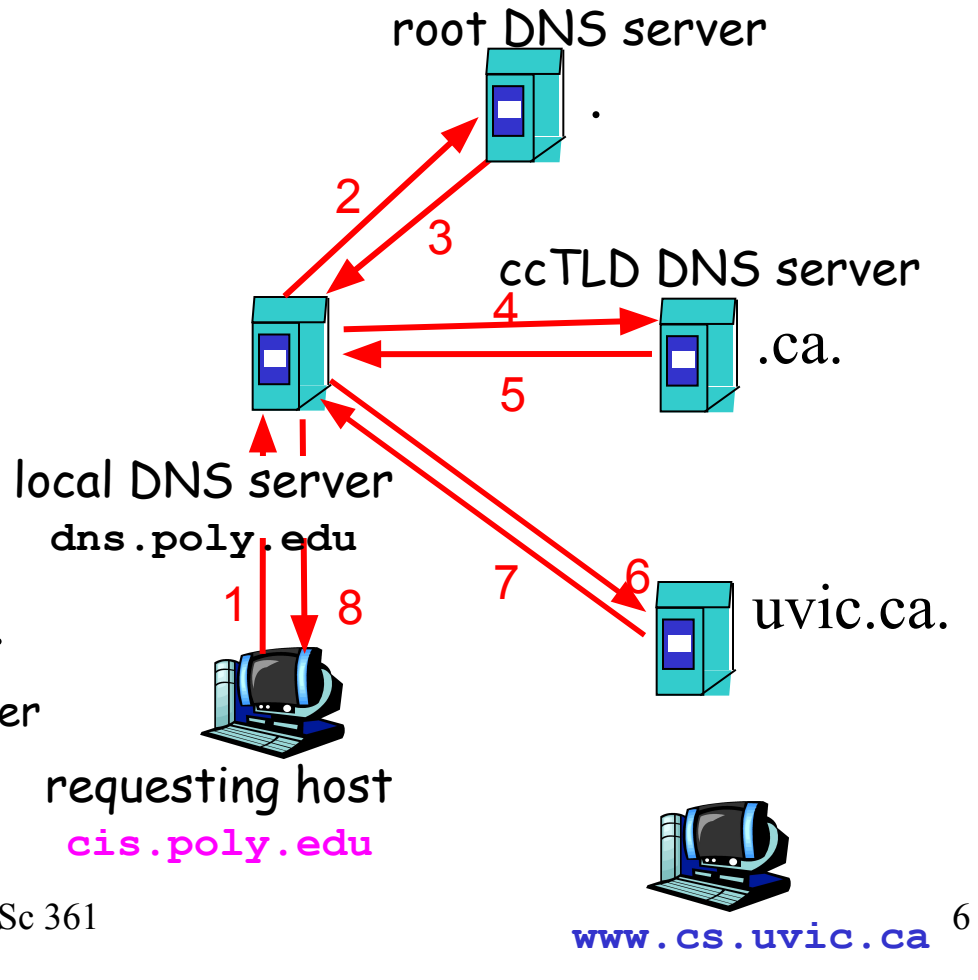
-> active.uvic.ca

internet address = 142.104.96.2

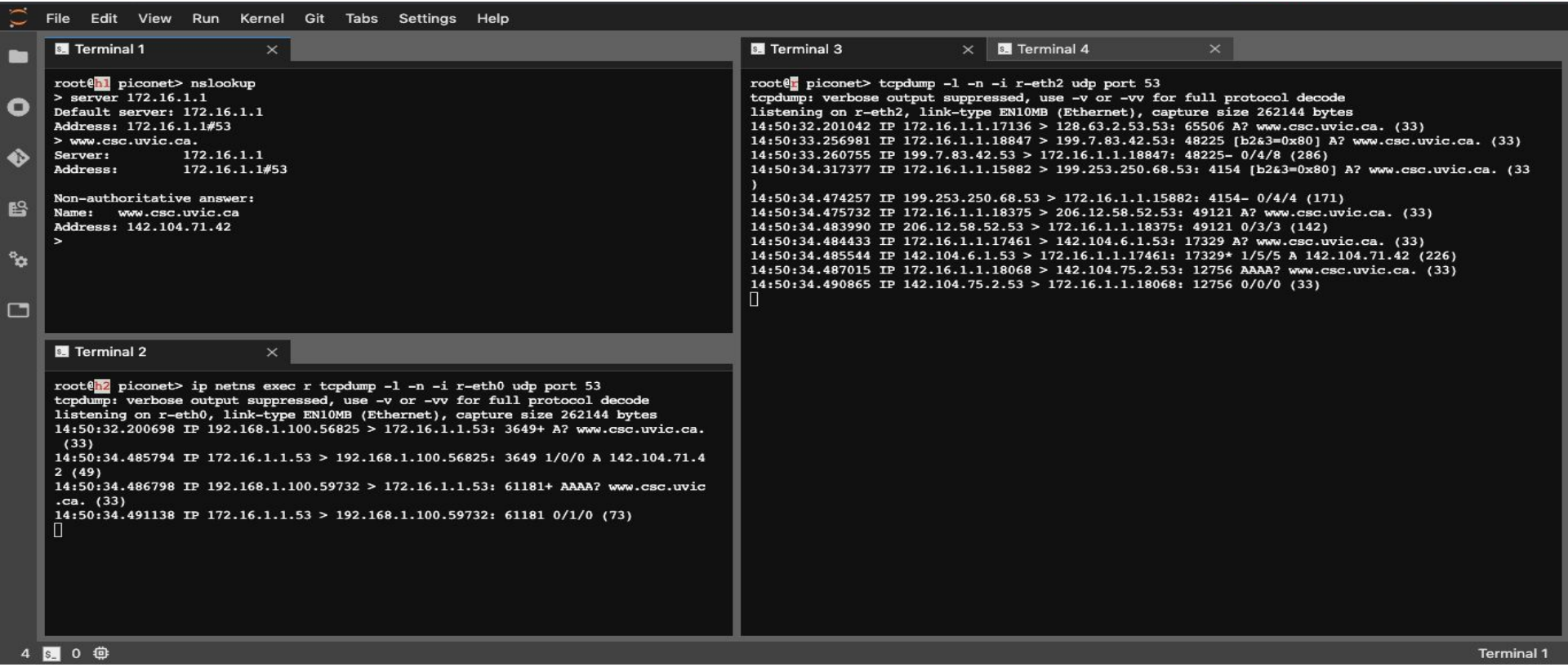
Q: recursive or not recursive

Recursive vs iterative



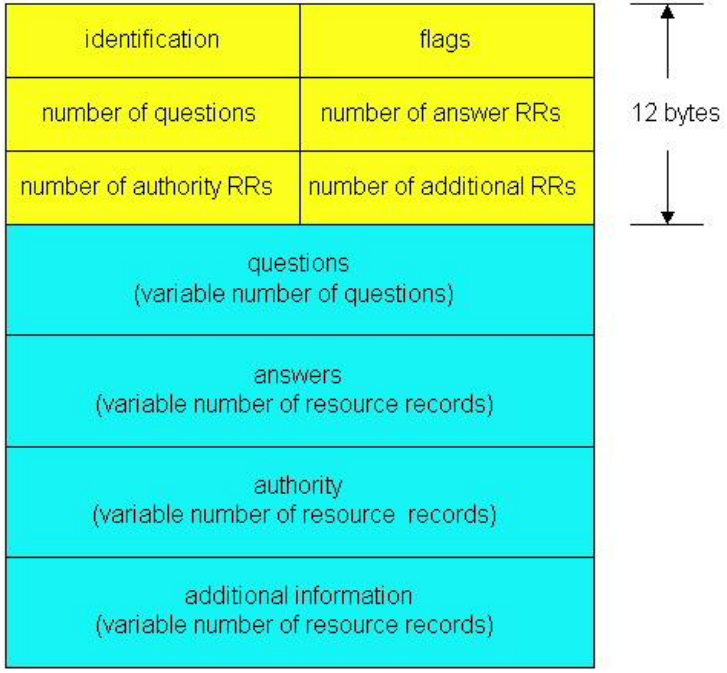


In the lab *next* week: recursive vs iterative DNS



DNS queries: more

- Local DNS server and higher hierarchy
  - recursive vs iterative
- Reply cache
  - time-to-live (TTL)
- Services required
  - commonly by UDP
- Attacks on DNS
  - cache poisoning



* DNSSEC, DNSCurve, HTTPS, etc (CSC490 Summer 2014; JCURA'14)

DNS: reality check

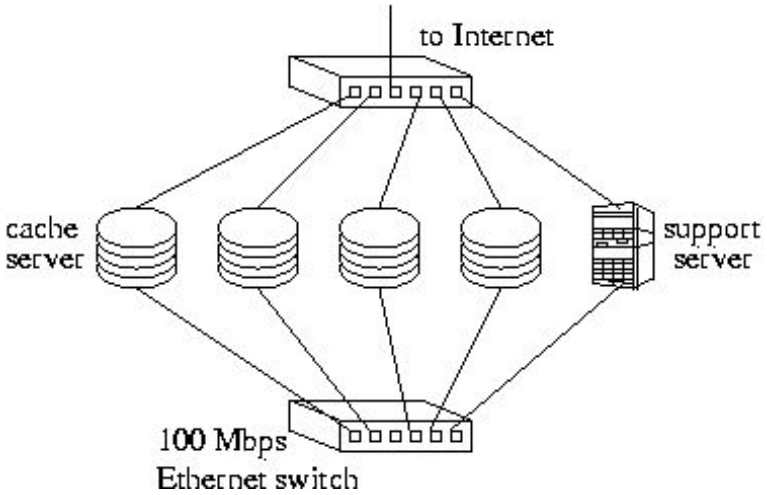
- Design goals
  - distributed, hierarchical, low overhead, robust
- Protocol mechanisms
  - cache, weak consistency, redundancy
    - e.g., at least two NS servers per domain in different subnets for redundancy; reality: many are on the same subnet due to poor provisioning
    - e.g., stable name-address mapping for caching efficiency; reality: very short TTL in CDN
- Secure DNS

What's the other DNS: ***D***e facto ***N***etwork ***S***earch engine? SIGCOMM'04 OOS

for update: http://www.akamai.com/stateoftheinternet/

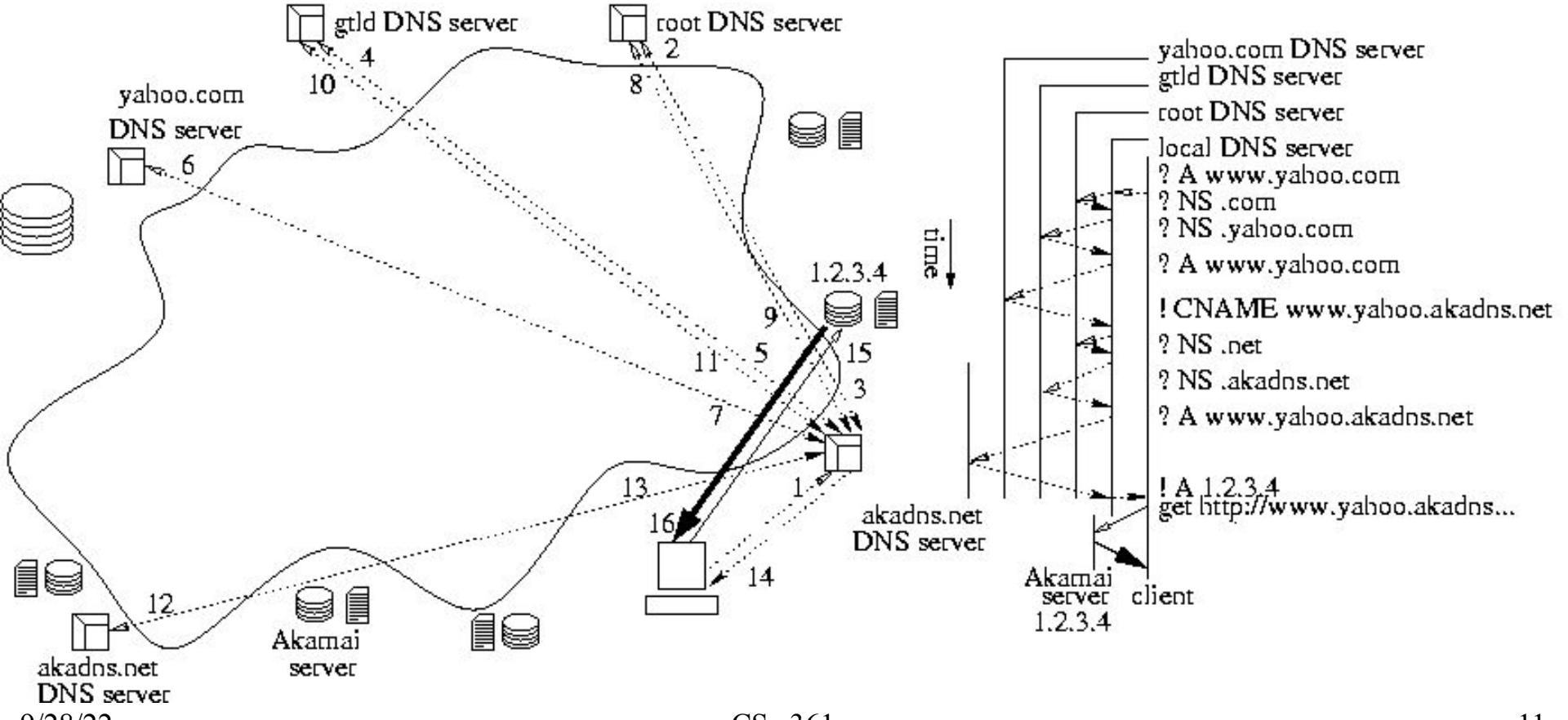
Akamai content delivery

- Akamai EdgePlatform
  - 15,000+ servers
  - 1,100+ networks
  - 69 countries
  - up to 15% web traffic!
- Server selection
  - DNS-based
  - for site or object delivery



J. Pan, Y. Hou, and B. Li, ``An overview of DNS-based server selections in content distribution networks,'' Elsevier Journal of Computer Networks, 43(6):695-711, 2003.

Site delivery



AkaDNS.net

akadns.net DNS servers

Server	IP address	Access network	Location
ZA	216.32.65.105	exodus.net	Washington, DC
ZB	216.52.46.145	bbnplanet.net	Denver, CO
ZC	63.241.199.50	att.net	Dallas, TX
ZD	206.132.160.36	glbx.net	Santa Clara, CA
ZE	12.47.217.11	att.net	Parsippany, NJ
ZF	63.215.198.79	level3.net	San Jose, CA
ZG	204.248.36.131	sprintlink.net	
ZH	63.208.48.42	level3.net	St. Louis, MO

akadns.net *NS* and *A* TTL

Ask		Answer			
Name	Server	Refer	*NS*-TTL (s)	*A*-TTL (s)	
net.	{a..m}.root-servers.net	{a..m}.gtld-servers.net	172,800	172,800	2 days
akaDNS.net.	{a..m}.gtld-servers.net	z{a..g}.akadns.net	172,800	172,800	
yahoo...	z{a..g}.akadns.net	–	90,000	90,000	~1 day
www...	z{a..g}.akadns.net	–	–	300	5 mins

DNS-based server selection

- Transparent to end-users
- Issues
  - effectiveness (who's making the decision)
  - overhead (low TTL)
  - granularity (hostname vs. service name)
  - proximity (client, local DNS, CDN server)
  - accuracy (*network positioning*)
- Bottom-line: avoid the worst, hope for the best

This lecture

- DNS
  - DNS names and hierarchies
  - DNS resource records
  - DNS resolution queries
- DNS-based server selection
  - “site delivery”: mechanisms, pros and cons
- Explore further
  - CDN: “object delivery”

Next lectures

- This Friday
  - *No lecture*
  - *No tutorial*
- Next week/month: Transport layer
  - read KR4Ch4: Computer Networking
  - Transport layer services
  - User Datagram Protocol (UDP)
  - Transmission Control Protocol (TCP)