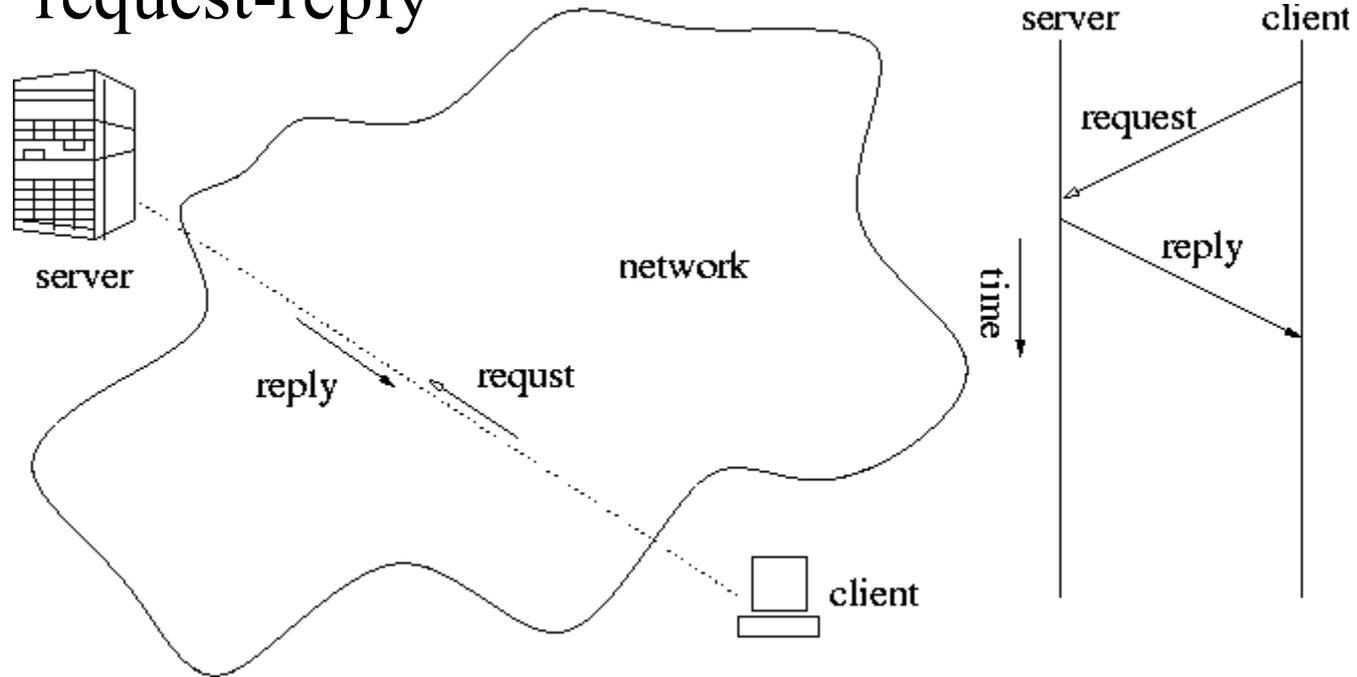


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Multimedia Systems
Content Distribution Networks

Jianping Pan
Spring 2015

Service model

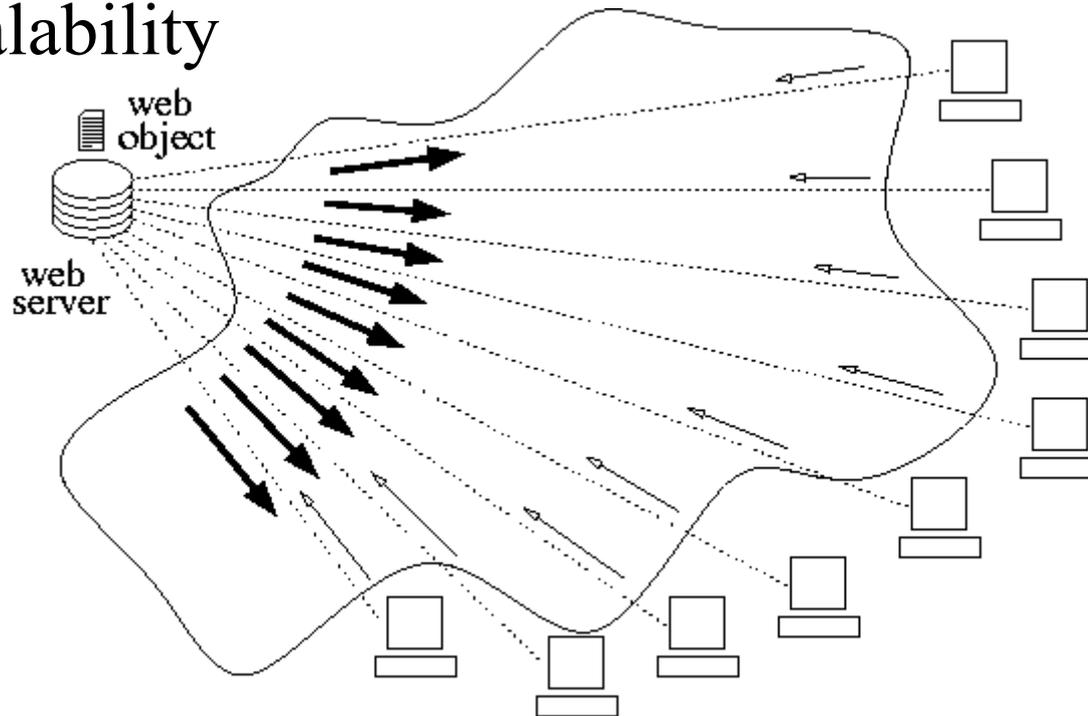
- Client-Server model
 - request-reply



Client-Server model

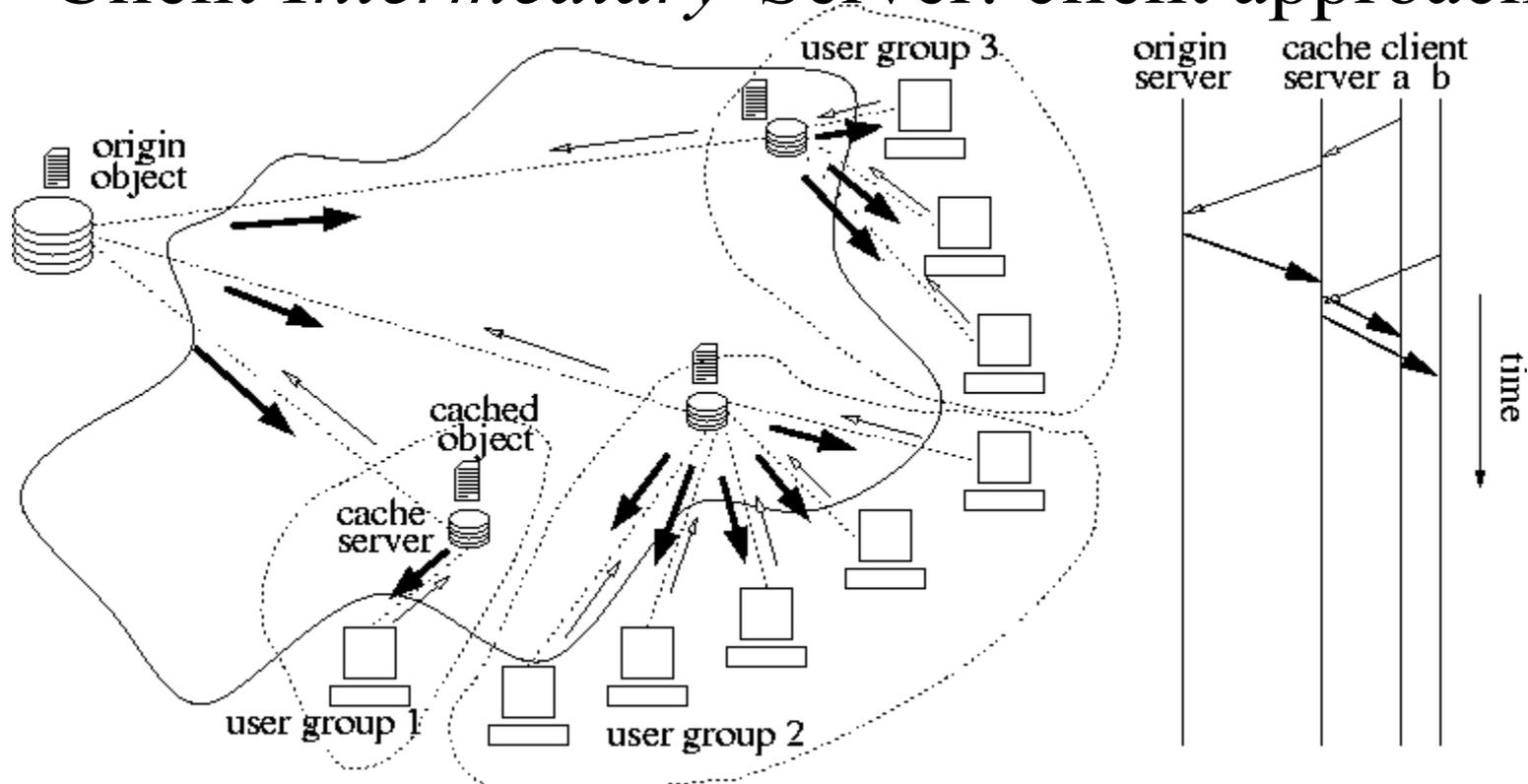
- Possible issues

- scalability



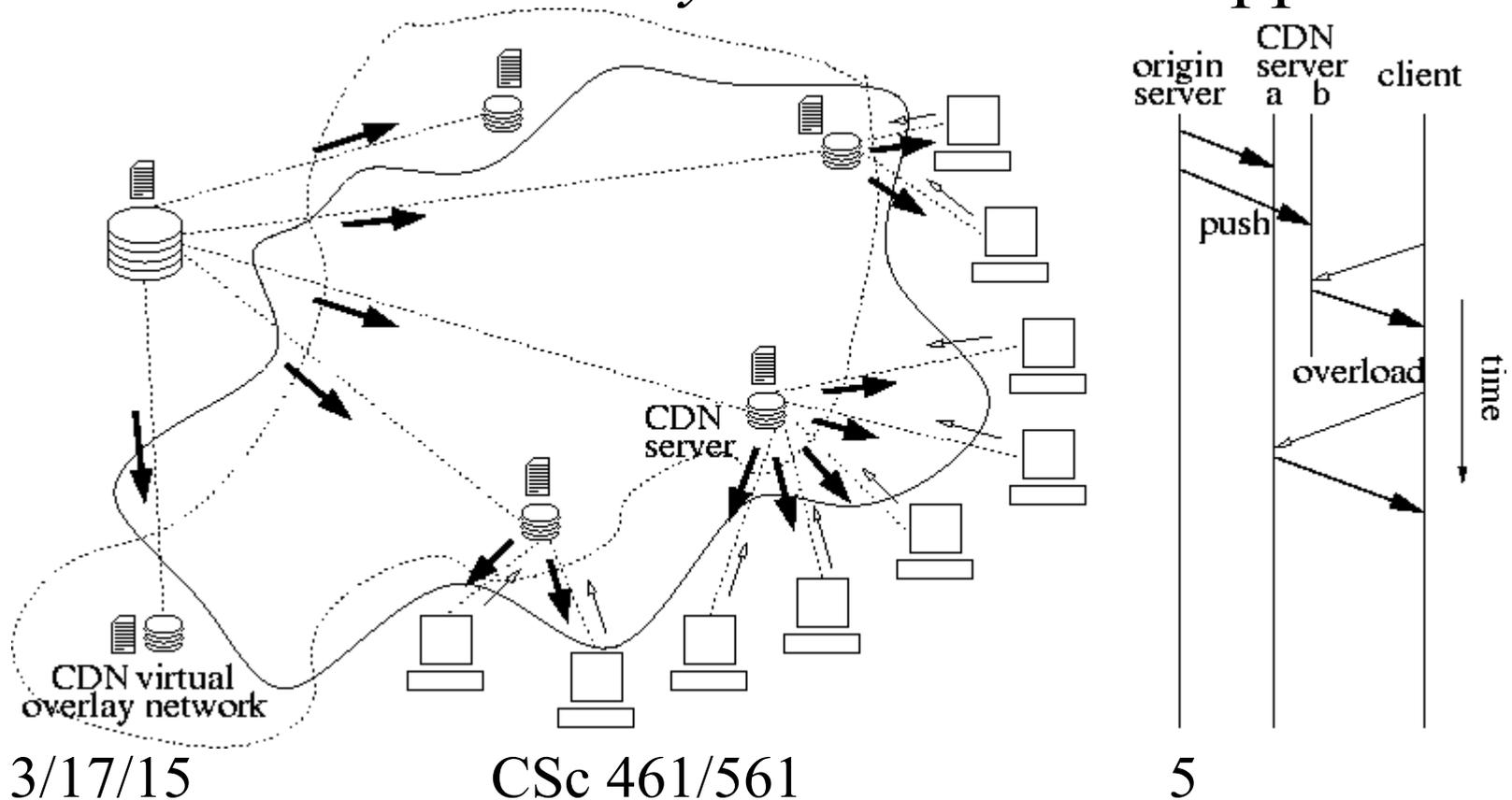
Service model: proxy

- Client-*Intermediary*-Server: client approach



Service model: content delivery

- Client-*Intermediary*-Server:server approach



Content distribution networks

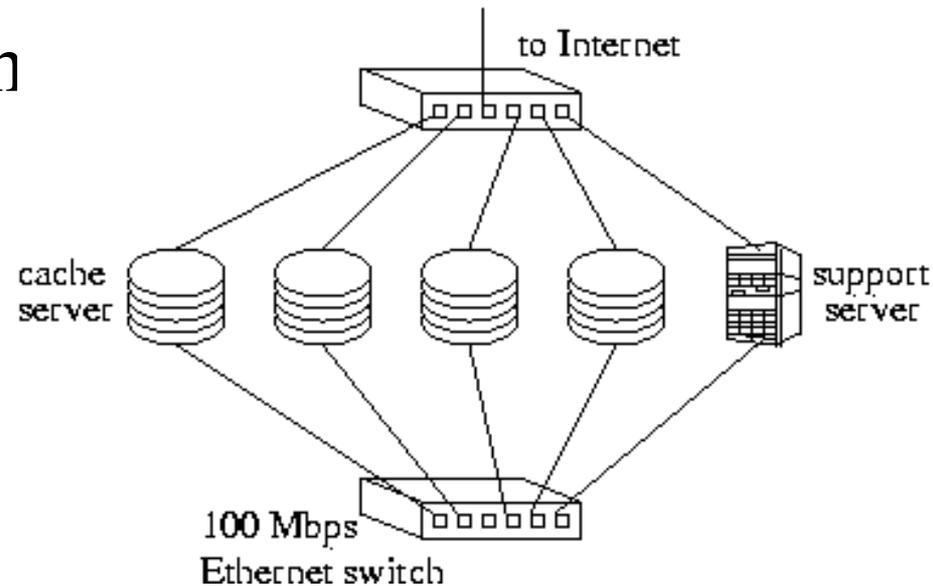
- Client-Intermediary-Server model
 - intermediary: content distribution servers
- Origin server and CDN server
 - how to distribute content properly
 - CDN server placement
 - content consistency control
- CDN server and ordinary client
 - how to choose the *right* CDN server

Server selection

- An art of *redirection*
 - HTML refresh
 - HTTP redirect
 - moved temporarily or permanently
 - DNS: name => IP mapping
 - IP-in-IP tunnel
 - ARP: IP => MAC mapping
- Goal: transparent to end-users

Akamai content delivery

- Akamai EdgePlatform
 - 147,000+ servers
 - 1,200+ networks
 - 90+ countries
 - 15~30% web traffic
- Server selection
 - DNS-based
 - for site or object delivery



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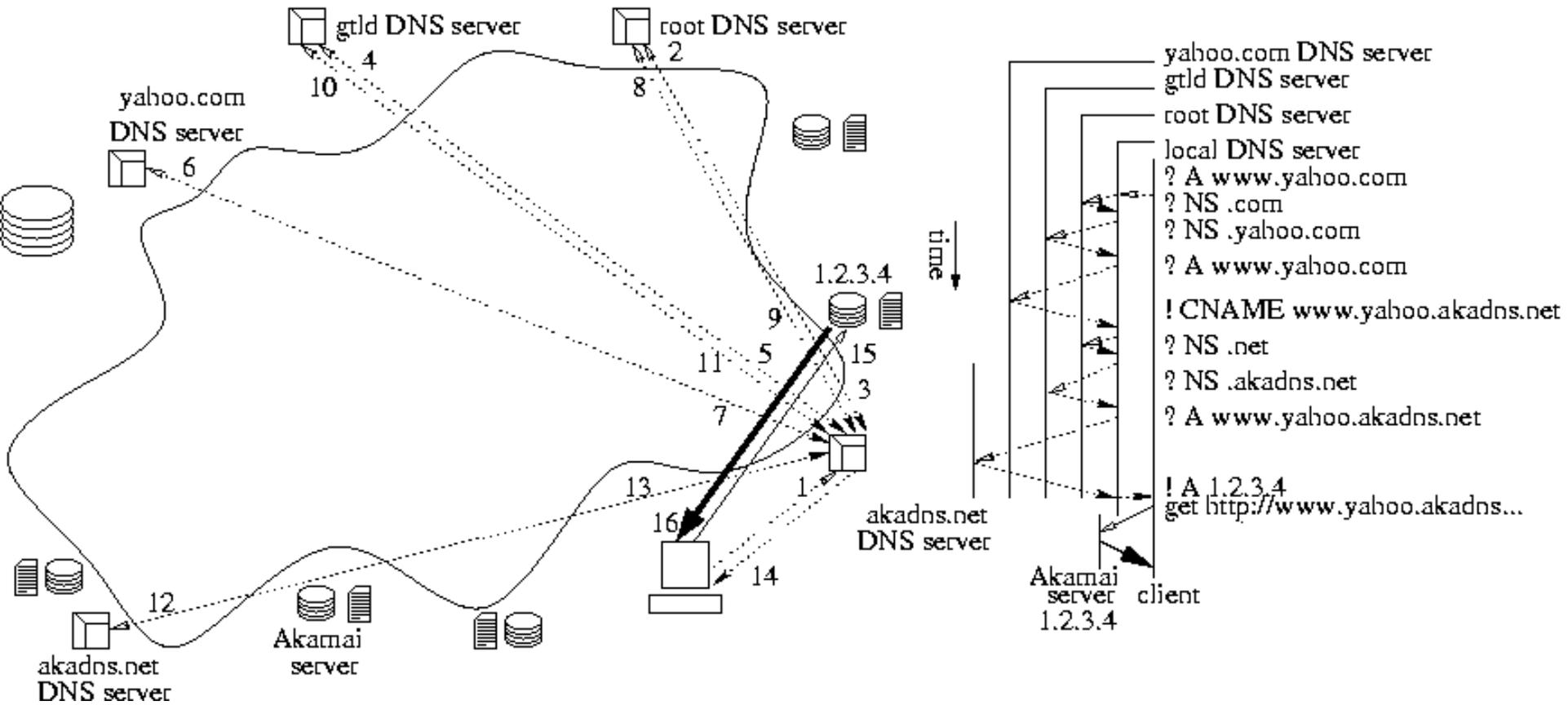
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* check akamai.com for the latest server/network/traffic stats

Domain Name System

- DNS: largest distributed database
 - name and address mapping and more
- Database maintenance
- Name resolution
 - local resolver
 - local DNS server
 - cache DNS server
 - authoritative DNS server

Site delivery

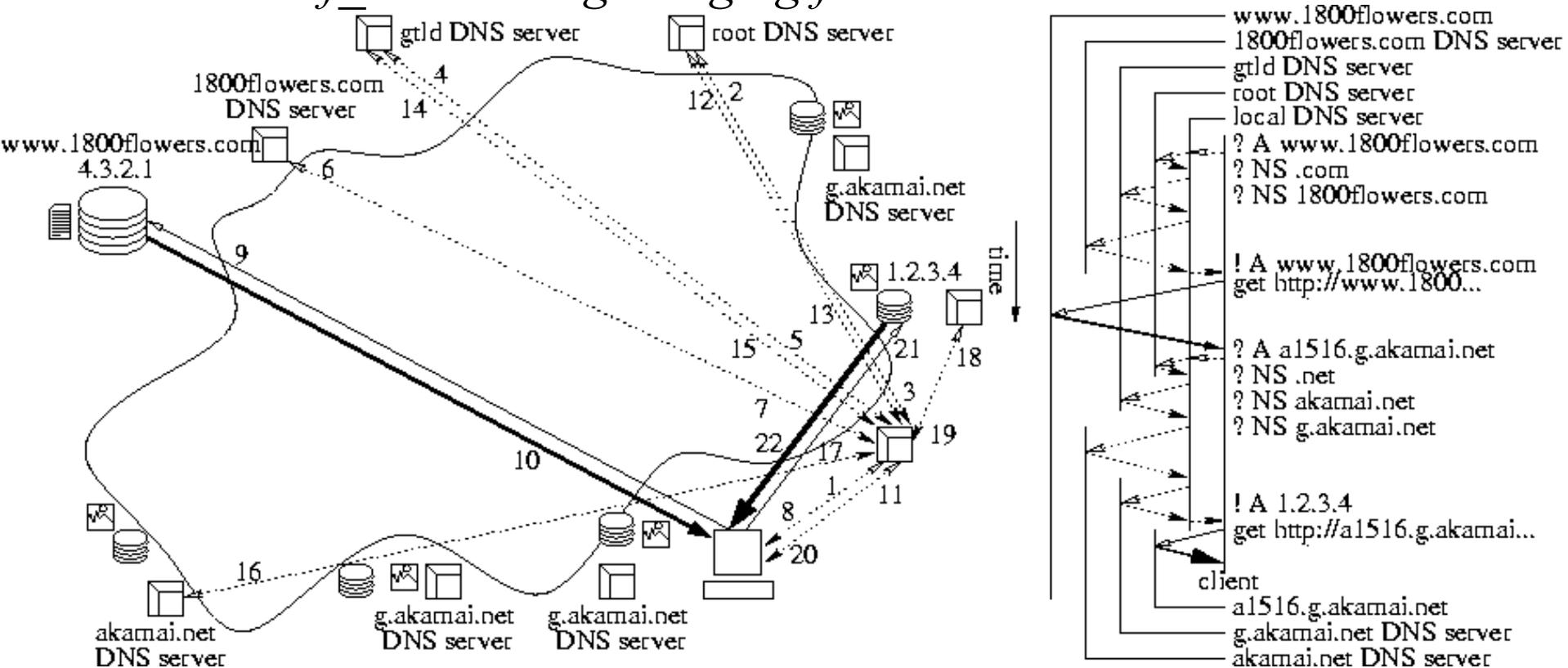


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* as of 2003; now for illustration purposes

Object delivery

- http://a1516.g.akamai.net/f/1516/1052/2h/1800flowers.com/800f_assets/images/logo.gif



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* as of 2003; now for illustration purposes

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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
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
www...	z{a..g}.akadns.net	-	-	300

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* as of 2003; now for illustration purposes

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Akamai.net

akamai.net DNS servers

Server	IP address	Access network	Location
ZA	209.67.231.142	cw.net	Boston, MA
ZB	12.47.217.18	fast.net	Bethlehem, PA
ZC	213.161.66.159	mfn.net	London, UK
ZD	216.32.65.14	cw.net	Sterling, VA
ZE	210.81.97.184	alter.net	Tokyo, Japan
ZF	63.240.15.245	attens.net	New York, NY
ZG	213.61.5.28	colt.net	Frankfurt, Germany
ZH	63.215.198.78	level3.net	San Jose, CA
ZI	63.240.144.98	attens.net	Chicago, IL
ZJ	63.210.142.26	level3.net	Dallas, TX
ZK	64.215.170.28	gblx.net	Dallas, TX
ZL	209.185.188.14	cw.net	Jersey City, NY
ZM	12.129.72.181	att.net	Atlanta, GA
ZN	193.45.1.100	telia.net	London, UK
ZO	193.108.153.36	colt.net	UK
ZP	209.67.231.204		

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g.Akamai.net

g.akamai.net DNS servers

Server	From local DNS server		
	133.164.59.8	129.97.34.2	192.63.105.17
n0g	129.250.134.66	130.185.5.11	194.82.174.220
n1g	129.250.134.67	130.185.5.12	194.82.174.221
n2g	129.250.134.75	130.185.5.14	194.82.174.227
n3g	129.250.134.77	130.185.5.11	62.129.135.36
n4g	129.250.134.82	130.185.5.11	64.241.221.237
n5g	129.250.134.66	130.185.5.11	194.82.174.220
n6g	208.187.212.167	63.76.54.131	213.161.66.179
n7g	216.32.119.56	130.185.5.11	62.129.135.36
n8g	129.250.134.66	130.185.5.11	64.241.221.237

akamai.net and *g.akamai.net* DNS NS and A TTL

Ask	Answer			
	Server	Refer	NS-TTL (s)	A-TTL (s)
net.	{a..m}.root-servers.net	{a..m}.gtld-servers.net	172,800	172,800
akamai.	{a..m}.gtld-servers.net	z{a..p}.akamaitech.net	172,800	172,800
g. . .	z{a..p}.akamaitech.net	n{0..8}.g.akamai.net	1800–3600	1800–3600
a1516. . .	n{0..8}.g.akamai.net	–	–	20

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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

- Content distribution networks
 - why service models other than “client-server”
 - web caching vs. content delivery
 - DNS-based server selection
- Explore further
 - <http://www.akamai.com/stateoftheinternet/>
 - [PHL03] 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.