

Content Distribution

- ◆ How to distribute content without requiring centralized, heavy-duty servers?

- ◆ Examples:
 - » Bittorrent
 - ◆ Peer-to-peer content distribution
 - » Akamai
 - ◆ Content distribution service

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Content Distribution vs Caching

- ◆ Explicitly manage cache content
 - » Sell as service to web site owners for performance

- ◆ “Push” content to caches at major Internet providers
 - » Make content appear “nearby” (low latency) no matter where the requester is located

- ◆ Change cache content when necessary
 - » Operates as a proxy cache to refresh content

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Akamai Content Distribution Network

http://www.akamai.com/html/about/facts_figures.html

Representative Customers

1-800-4flowers	UCIral
Adobe	MMO Software
All Nippon Airways (ANA)	MTU Networks
Analog Devices Inc.	MySpace
Apple Computer	Nintendo
AT&T AZ	NPR
Best Buy	Pacific Sunwear
BMW Japan	The Princeton Review, Inc.
Calcelec	Quantar Airways
Canadian Broadcasting	QVC
Cathay Pacific Airline	Red Hat Inc.
Caterpillar	Rediff.com
Clear Channel Online Music	Reebok International Ltd.
Cognos	Reuters
Card Corp.	Ryan Simmons
Department of Defense	Saitchi & Saitchi
The Dow Chemical Co.	The Seattle Times
ehpge	Sony Ericsson Mobile Communications
Europages	Starz Entertainment Group
Federal Emergency Mgmt	Terra Lycos
FedEx Corp.	Thomson Financial
Food & Drug Administration	Ticketmaster Online-CitySearch
Fujitsu	Toyota Motor Sales
FUR TV	Travelocity.com
General Motors	TrendMicro
Harley-Davidson, Inc.	Turner Sports
Hiscock	Urban Outfitters
IBM Corp.	U.S. Geological Survey
BIS	Victoria's Secret
International Hotels Group	XM Satellite Radio
J.C. Penney Company, Inc.	Yahoo!
Jet Airways	The Yomam Shamban
Lands End Inc.	
Logitech	

- ◆ 56,000 servers in 70 countries within nearly 1000 networks
 - » 85% of the world's Internet users have a single "network hop" to an Akamai server

- ◆ Delivers 15 - 20% of all Web traffic

- » Web traffic at times reaching more than 2 Terabits/sec
- » Hundreds of billions of daily Internet interactions

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Akamai CDN Example



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Akamai Content Types

- ◆ Static (HTML, images, PDF, etc.)
 - » Expiration time (0 – infinity) assigned by customer
 - » On-demand cache invalidation available to customer
 - » Special features (authenticated access, transfer encodings, etc.)
- ◆ Dynamic
 - » Assembles cacheable and non-cacheable elements of page at cache (contacts origin only for non-cacheable)
- ◆ Streaming
 - » Uses redundant streams and jitter-control to ensure quality playback

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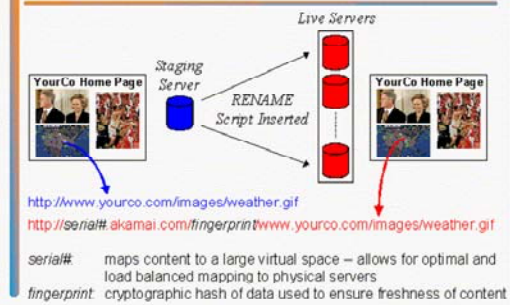
Web Site Redirection to Akamai

- ◆ DNS CNAME aliases
 - » e.g., images.pcworld.com CNAME=images.pcworld.com.edgesuite.net
- ◆ Modified URLs (“Akamized”)
 - » Prefix with domain name in Akamai
 - » e.g., <http://a1694.g.akamai.net/8675/images.pcworld.com..>

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“Akamaizing” Web Pages

An “Akamaized” URL



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Akamai URL Example (WRAL-TV)

Image: http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/menus/nav_curve.gif

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/misc/personalize_left.gif

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/misc/personalize_right.gif

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: <http://scrooge.ibsys.com/s/ral.gif?rnd=999208094182&version=2>

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: <http://images.ibsys.com/2001/0126/435612.gif>

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Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/misc/morestories.gif>

Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

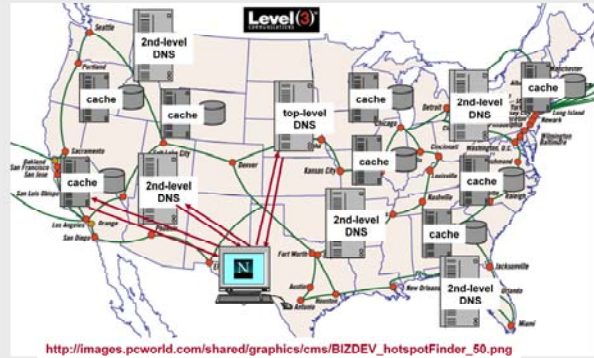
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Image: <http://a1844.g.akamai.net/7/1844/95/22/html.wrnl.com/images/structures/spacer.gif>

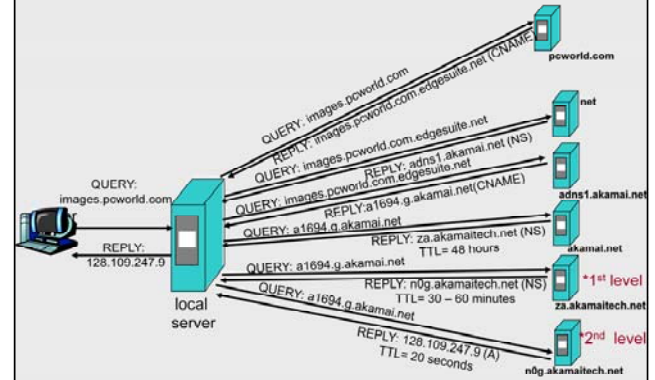
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Akamai -- DNS "Request Routing" (finding the "closest" cache)



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Akamai DNS Processing



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Akamai Network Operations Center

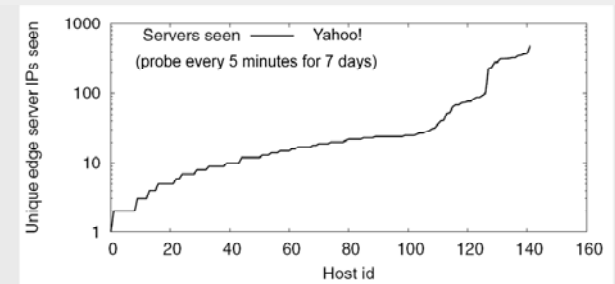


- ◆ Monitors all proxy servers and end-to-end conditions on paths from 1000s of network locations to servers
- ◆ DNS servers updated with new loads and maps every few seconds
- ◆ Monitored conditions
 - Server load and operational status
 - Routing topology
 - Latency and packet losses per route
 - Available bandwidth per route

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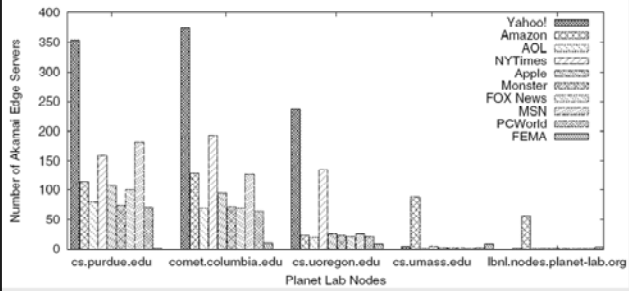
How Much Server Diversity Exists?

A. Su, D. Choffnes, A. Kuzmanovic, F. Bustamante, "Drafting Behind Akamai (Travelocity-Based Detouring)", Proceedings of SIGCOMM 2006



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Server Diversity per Akamai Customer and User Location



Redirection Dynamics

