

Tech Topic #1

January 20, 2010

Today's Objectives

- CDNs
- A bit on patents
- CDN traffic stats... by Bryce

First There Was the Web

- The web basically got started in about 1992
- It started to take off in late '94 and into 1995
 - “take off”: lots of servers and readily available clients
 - The first killer for the Internet was born
- Had dramatic impact on traffic amount and mix
 - Combined with size and complexity of files (multimedia)
 - Coming last-mile broadband revolution
 - Led to rapid capacity increases (contributed to dot-com bust)
 - To a certain extent, network research was born
- Frame of mind is critical

A Major Challenge: Delay

- Lots of traffic led to congestion
 - Net result was increase in delay or timeouts
- Even increase in capacity contributed to some additional delay
 - More hops, more propagation delay, more chances for queuing
- How to solve the delay problem
 - More servers only solves some of the problem
 - Push content closer to users

Some Solutions

- Use caching
 - Browser, local, institutional
 - Need protocols to locate and pull content
 - Good example: Squid
- Other techniques
 - Local pre-fetching (multicast) and possibly filtering
- Use replication
 - “Mirror” content: a kind of static replication
 - Challenge was still to find mirror
 - Evolution moved from static connections to caches/mirrors to dynamically locating best content

Solution Evolution

- The challenge with mirrors is loading ALL content at EACH mirror site
 - Could be wasteful and unnecessary
 - Neat research question
 - Azer Bestavros at Boston U. looked at question of which documents to locate at a mirror/cache site
- Also, the more mirror sites, the more backend content delivery (prefetching)
 - Especially problematic when content was dynamic
- Area was hot and multiple people were looking at the same time

Solution Evolution

- Prior to Akamai was Digital Island
 - Farber 6,185,598 patent
- First Akamai Patent was 6,108,703
- Aspects of the solutions:
 - Use page splitting so original content owner knew of hit
 - Using caching instead of mirroring
 - Use combination of factors to determine closest cache site
 - Use DNS as the mechanism to communicate cache location
 - Also has a mechanism to check object freshness

Patent Components

- Filing date is key
 - Date of patent not so much
 - The priority date can be earlier than the filing date
 - Based on provisional patent date
 - Based on continuation patent
 - Based on conception and diligence in reduction to practice
- References cited is also key
 - What the patent examiner was supposed to consider
 - Some provided by patentee, some found by examiner search
- “Person of Ordinary Skill in the Art”
- Specification
- Claims

The Original Akamai Solution

- “Akamaize” your web page
 - Replace all embedded URLs with special URLs
 - <http://<hash>.akamai.com/<stuff>/<original-hostname>/<original-path>/>
- <hash> is communicated to akamai.com as part of DNS lookup
 - Provides some information about information being requested
 - Note: rest of URL does not go along with the DNS request
 - Also helps with confirming doc freshness
- Returns info on “close” server cluster

The Original Akamai Solution

- Still need to find IP address of server within the cluster
 - Remember, can either be recursive or iterative
- Where are servers located?
 - Network Access Points (NAPs): places where network providers peer
 - Evolved from just providing inter-connectivity to great place to provide other services







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 - Network Access Points (NAPs): places where network providers peer
 - Evolved from just providing inter-connectivity to great place to provide other services
- Number of Akamai servers (not clusters)
 - 28000 as of November 2007
 - 48000 as of May 2009
 - 55000 as of November 2009

The Original Akamai Solution

- Still need to find IP address of server within the cluster
 - Remember, can either be recursive or iterative
- Local DNS server can choose a server from the cluster based any variety of factors
 - Disad is that mapping is stored in DNS cache
 - Could make “lifetime” short, but too short and DNS ignores timeout
 - Evolution of solution was to do TCP connection switching
- Still a challenge of how to do distribution within CDN
 - We’ll come back to this

Another Solution

- Another way of finding the local cluster: anycast
- Anycast is different than unicast, multicast, or broadcast
- Instead of <something>-to-<something>, it is more about finding the closest one of a set
 - The members of the set generally provide an identical “service”
 - “service” can be content or lookup (best example is DNS)
- Let’s talk about anycast routing

Challenges in Using Anycast

- Great for single “transactions”
 - Widely used in DNS today
 - Neat concept of, instead of using static DNS server mappings, use anycast routing
- Harder for TCP connections, but not impossible
 - If a TCP packet suddenly shows up at another server, the “other” server has none of the state (TCP control block or “TCB”) for the original TCP connection
 - See Al-Qudah article for one way of doing it
 - Are there others?

Some Other Thoughts

- CDNs: not just for web content
 - Can CDNs do live streaming?
 - Can CDNs distribute p2p content?
 - What can't CDNs do?
- Follow the bouncing dollar
 - What is the revenue model?
 - Who pays?
 - <http://seekingalpha.com/article/48808-akamai-limelight-understanding-content-delivery-overages>
- Moving content around the backend
 - Just caching? Push caching?
 - Use multicast?
 - Use P2P?

Some Other Thoughts

- How much traffic?
 - <http://www.akamai.com/html/technology/dataviz1.html>
- ...and now Bryce