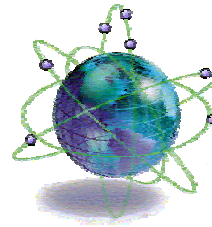


CDN Brokering

Alex Biliris, Chuck Cranor, Fred Douglass,
Michael Rabinovich, Sandeep Sibal,
Oliver Spatscheck, and Walter Sturm
AT&T Labs--Research



March 12, 2001



Content Distribution Internetworking

- Definition: Interoperation between CDNs
- Benefits
 - Cost
 - Deploying caches in all POPs of all ISPs is expensive
 - Capacity
 - Additional protection from bursts or expected high-volume events
 - Network connectivity
 - Bypass congested peering links
 - Expanded footprint
- Challenges
 - Added management complexity
 - Requires some level of interoperability of CDNs
 - CDI IETF working group is being formed

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Possible Mechanisms

- Most mechanisms apply to both **intra-CDN** and **inter-CDN** redirection
- Generally classified into Application level and DNS level
- Layer 5-7 based systems
 - HTTP redirect
 - URL rewriting
 - Interception proxies
- DNS-based systems
 - Anycast
 - DNS extension
 - **Pure DNS redirection**

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Intelligent-DNS (IDNS)

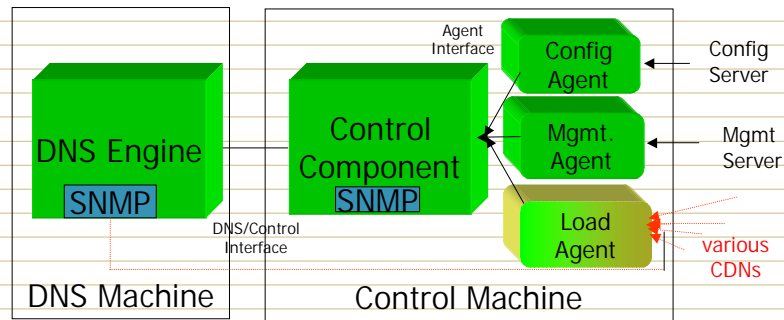
- Brokers between multiple CDNs using DNS-based redirection
- Uses live load feedback and static proximity for load balancing
- Longer time scale than CDNs (5min feedback loop)
 - CDNs can recover individual faults and performance bottlenecks
- Consists of three components
 - DNS engine
 - Brokering policy module
 - Measurement, provisioning and configuration agents

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IDNS Architecture



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Issues/Mechanisms

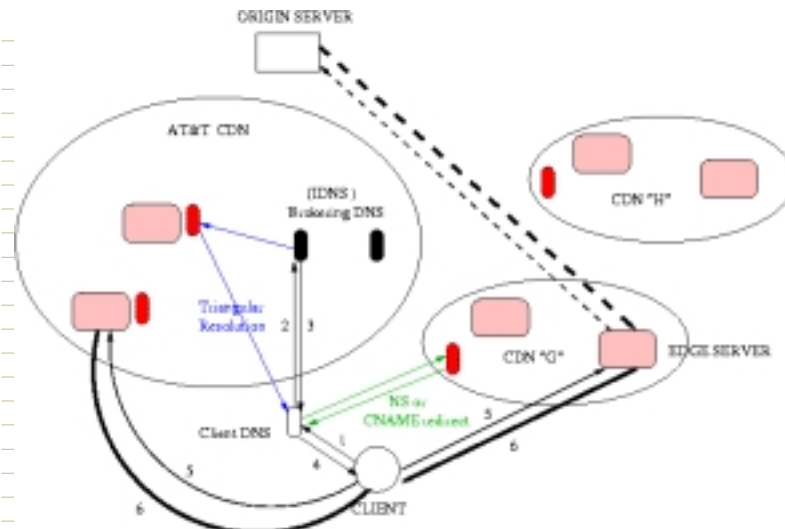
- Capacity reservation
 - Currently manual off-line reservation process
 - IDNS has to be aware of capacity reservations on CDNs
- Load Feedback
 - Simple HTTP-based protocol providing
 - Total available capacity
 - Load generated by brokered sites
- Selection
 - Do not overload CDNs
 - Optimize proximity
 - Reduce cost
 - React to failures
- Redirection
 - DNS-based
- Accounting
 - Off-line by aggregating CDN-provided accounting information

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Redirection



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Performance

- DNS request rate
 - How fast can we resolve DNS requests using our tables
- Redirection overhead
 - How much time does the additional DNS round-trip add
- Overall performance
 - Simple case study in which CDN brokering increases performance

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DNS Request Rate

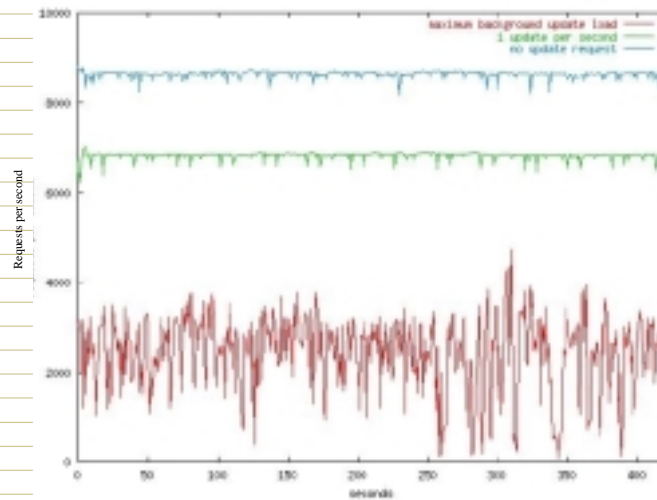
- In the experiment we configured randomly:
 - 1-10 CDNs
 - 1-100 customers
 - 1-500 regions
- The control component generated table updates based on agent input :
 - Never
 - Every second
 - As fast as possible
- Multiple client site DNS servers generated DNS requests as fast as possible

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DNS request rate



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Redirection overhead

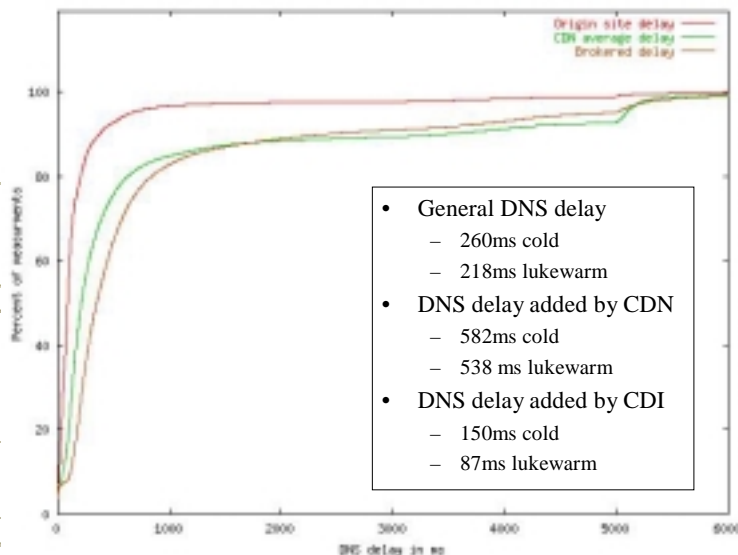
- Methodology
 - Use 25000 client site DNS servers as “relay”
 - Determine latency from measurement machine to “relay”
 - Ask “relay” for recursive resolution of DNS name in question and measure the latency
- Setups tested
 - Regular Web Site
 - Average of 4 Web sites accelerated by 4 different CDNs
 - Site brokered between 4 CDNs
- Experiments
 - Cold client site DNS server (3 days experiment interval)
 - “Lukewarm” client site DNS server (70 min. experiment interval)

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Redirection overhead - Results



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Geographic Distribution



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Overall performance

- Depends on CDN setup
- Completely overlapping CDNs
 - No performance gain
- CDNs from example before (partly overlapping)
 - Throughput increases from 50KByte/sec and 52KByte/sec average for each CDN individually to 82KByte/sec
 - Pays for overhead within a few Kbytes
- Even better performance gains expected if ISPs enter the CDI business

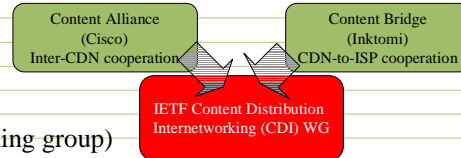
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Related Work

- **CDN brokering**
 - Content Bridge
 - Content Alliance
 - IETF CDI BOF (working group)
- **DNS-based redirection**
 - Many vendors and CDNs
 - Used within CDNs, not across them until now
- **DNS performance**
 - Cache validation & prefetching (Cohen and Kaplan)
 - Proximity (Shaikh and Tewari)



Conclusions

- **IDNS provides a first step in making CDI real**
 - Successful brokering of live site among 4 CDNs
- **Long way to go until CDI is as widespread as L3 peering**
- **Substantial industry-wide interest in CDI**