Information-Centric Networks

Section # 3.2: DNS Issues

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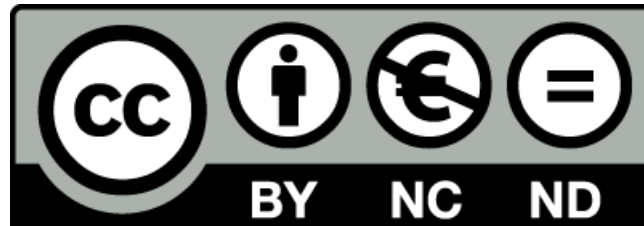
Week 3 / Paper 2

- Comparing DNS Resolvers in the Wild
  - Bernhard Ager, Wolfgang Mühlbauer, Georgios Smaragdakis, Steve Uhlig
  - ACM IMC 2010.

- Main point
  - How does ISP DNS compare with Google DNS and OpenDNS?
    - Latency and caching are the main performance factors
  - How do the answers work with CDNs?
    - CDNs use locality info which may be hidden

Introduction

- DNS is a critical part of the Internet and the web
  - Scalability is heavily influence by caching
- DNS is widely (mis)used to map users to content
  - How well does this work?
- Third-party DNS operators have emerged
  - ISP DNS does not always work that well
  - However, it works better for CDNs for location info
- Extensive performance study
  - 50 ISPs in 5 continents and 28 countries
  - Using ISP DNS, Google DNS and OpenDNS

Domain name system

- DNS is a hierarchical distributed database
  - End hosts query caching resolvers
  - If there is no cached result, root servers are queried
  - Root servers redirect to more specific servers
  - Caching is heavily used to avoid starting from the root
  - All responses are cached according to their TTL parameter
- DNS today is more than it was designed to be
  - CDN load balancing: custom responses that cannot be cached
  - NXDOMAIN catcher: return an ad page instead of an error
- Third-party DNS providers have emerged
  - OpenDNS offers phising protection and claims better server
  - Google DNS does prefetching and load balancing

Measurements

- DNS performance as seen by end users
  - DNS queries for more than 10000 hosts
    - Measuring response time and TTL
    - Also measuring time to DNS server
  - ISP DNS, OpenDNS and Google DNS servers
  - 60 vantage points in 50 ISPs
  - Two queries per host to examine caching and load balancing
  - Different sets of hosts to query
    - Top5000: most popular from Alexa
    - Tail2000: least popular from Alexa
    - Embedded: hosts with content from Alexa top1000 (3500 total)
  - Two special sets of hosts depending on response
    - Redirected and akamaized

Responsiveness

- What is the latency of DNS replies?
  - It really depends on the ISP
- A good ISP
  - The ISP's DNS servers are the closest to the client
  - Consistently better than OpenDNS and Google DNS
  - The second query is quicker due to caching
- A bad ISP
  - The ISP's DNS server are comparable to third-parties
  - The second query does not improve the local ISP
  - OpenDNS and Google DNS work better with caching
- Results are mixed
  - There are many good, bad and intermediate ISPs

DNS deployment

- How well does caching work in each case?

- A good ISP
  - The second response is nearly constant time
  - In all cases, caching works well

- A bad ISP
  - The second response depends
    - It may work well (nearly constant time)
    - It may not work at all (same time as first query)
    - It may work strange (second query slower than the first)
  - The problem is DNS load balancing!
    - The second response may come from a different server
  - This occurs with both ISP and third-party DNS
    - It implies centralized server infrastructure

DNS answers

- How good is the response of the DNS server?
  - Server load balancing and CDNs may lead to different responses
  - CDNs try to locate a nearby server

- Responses show a lot of diversity
  - 10000 host lookups lead to 36000 different answers!
    - Each query occurs 2x3=6 times
  - How often do you get a server in your ISP?
  - The local DNS usually returns local servers
    - This commonly occurs in ISP hosting CDN servers
    - Especially for the akamaized host set
  - OpenDNS and Google DNS do not return local servers
    - The answer is based on the DNS server address
    - They may even return servers in different continents

Conclusions

- Two things must be considered

- How well does the ISP manage its DNS?
  - Centralized DNS with load balancing is not good
  - It does not allow caching to work well
  - It is better to use hierarchical DNS servers
  - A good ISP generally outperforms third-party DNS

- How well do CDNs work with DNS?
  - Quite well with the ISP's DNS servers
  - Quite bad with third-party servers
  - DNS needs to be extended with client IP to handle this
    - This simplifies misusing it of course!

End of Section # 3.2

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