Adapting to remote DNS for content delivery
namehelp

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CDNs direct web clients to nearby content replicas

Several motivations for using CDNs
- Performance, scalability, reliability

Most popular sites use them
- 75% of top 1000 sites
- 90% of pageviews to top 1000 sites
CDNs depend on DNS

- CDNs use DNS to map clients to servers
  - Assume proximity of client to DNS resolver
CDNs depend on DNS

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We see 27% annual increase in their usage.

Remote DNS services break this assumption.
Can we maximize user benefits from both remote DNS and CDNs?

- Today…
- Compare CDN redirections and end-to-end performance
- Evaluate adoption of industry’s response
- Present an end host solution
Remote DNS services yield radically different redirections
- Minimal overlap with those seen from the client

From the client, “perfect information”
Remote DNS services yield radically different redirections
  - Minimal overlap with those seen from the client

A good approximation
80% median overlap
Remote DNS services yield radically different redirections
  – Minimal overlap with those seen from the client

90% have no overlap
Different redirections mean different performance
Different redirections mean different performance

80% have <15% penalty
Impact of remote DNS on CDN performance

- Different redirections mean different performance

![Graph showing the impact of remote DNS on CDN performance. The graph displays the cumulative distribution function (CDF) of end-to-end latency percentage difference between ISP DNS and Google DNS. The graph indicates that in the median case, there is a 65% penalty, and the top 20% have a 200% penalty.]
An Industry response – DNS extension

- Resolver sends client’s subnet to CDN’s authoritative DNS
  - Redirections are based directly on client’s location
  - DNS extension requires participation of DNS and CDN services
- Limited adoption to date

![Diagram showing percentage of sites with extension support](chart)

*Conservative: Most from using Google services*
An end host solution – namehelp

- **Forget them! Go for the end host**
  - Colocate client and resolver
  - Act as transparent DNS proxy
  - Obviate need for DNS or CDN cooperation

- **Direct resolution**
  - Use recursive DNS to translate customer name to CDN
  - Directly query CDN for an improved redirection

- **Learning by doing**
  - Local caching of CDN’s DNS server – avoid extra lookup
  - Only do direct lookup when it improves performance
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- Focus on places where remote DNS affects performance
- Industry solution has significant *potential* benefit
- End host solution’s *actual* benefits are comparable

Relies on DNS and CDN adoption

Potential benefit

End-to-end latency % difference

CDF

Google DNS

Potential of Industry solution
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An end host solution – namehelp

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Within 16% of potential
Focus on places where remote DNS affects performance
Industry solution has significant potential benefit
End host solution’s actual benefits are comparable

Largest improvement where penalty is worst
An end host solution – namehelp

- Focus on places where remote DNS affects performance
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Improves performance in 76% of locations

And you can get this now!

End-to-end latency % difference

CDF

- Google DNS
- End host solution
- Potential of Industry solution
Conclusion

- Working on browser-based and standalone versions
- More to come
  - Selecting the best recursive DNS server
  - Deciding whether to use *direct resolution* technique
- Improve web performance for 76% of affected locations
- Provide insight on DNS’s role in web performance
- Questions?