An Update to Happy Eyeballs

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Agenda

• Hostname Resolution
• Measurements
• Underlying DNS Transport
• Sorting Addresses
• Connection Attempts
• DNS Updates
• Next Steps
Hostname Resolution

- RFC 6555 does not describe how to query DNS
  - example mentions `getaddrinfo()`
Hostname Resolution

`getaddrinfo()`
Hostname Resolution

call getaddrinfo()
Hostname Resolution
Asynchronous
Hostname Resolution
Asynchronous

Start DNS

Start TCP

AAAA

IPv6 SYN

Done

A

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Hostname Resolution

• AAAA received first → start IPv6 SYN
  • A records added to list when received
• A received first → start 50ms timer
  • AAAA received before then → start IPv6 SYN
• timer fires → start IPv4 SYN
Hostname Resolution

• Why is this important?

  • DNS timeouts / retransmissions are common

  • Synchronous networking calls on a single thread are not compatible with Happy Eyeballs
Measurements

Number of Queries Sent per DNS Question

- Cellular | A
- Cellular | AAAA
- NonCellular | A
- NonCellular | AAAA

Percentage (PDF)

Number of Queries Sent per DNS Question

- 0
- 1
- 2
- 3

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Measurements

DNS Response Latency (ms)
Underlying DNS Transport

- Prefer IPv6 when sending DNS queries
- Both A and AAAA
- Some networks will have IPv6 DNS closer to user
Sorting Addresses

- Destination Address Selection — RFC 6724
- Rule 8.5 — leverage historical data
  - RTT
- Used addresses
Sorting Addresses

RFC 6724

Updated Happy Eyeballs

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Connection Attempts

• Walk entire list of addresses

• Start next attempt after $\mu_{RTT} + 4\sigma_{RTT}$
Connection Attempts

Connected Address Index

Percentage (PDF)

- 92.2%
- 7.2%
- 0.6%
DNS Updates

• DNS results are dynamic
  • Asynchronous DNS
  • Long-lived queries / DNS push
  • TTL expiry
• React accordingly
  • Insert new addresses into sorted list
  • Remove deleted addresses only if not started yet
Next Steps

• Several possible approaches:
  • Update RFC 6555 (Standards Track)
  • New standard with different name
  • Informational