FastRoute:
A Scalable Load-Aware Anycast Routing Architecture for Modern CDNs

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FastRoute Overview

• Microsoft’s online services exist inside small set of datacenters distributed throughout the world.

• “Edge” nodes distributed throughout the Internet reduce network latency of such services.

• FastRoute is the fully distributed mechanism used to direct users to nearby edge.
Why use an Edge?
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RTT = 180ms

Network Latency of first-byte = 2*RTT (360ms)
Why use an Edge?

Network Latency of first-byte
= 2*(short) RTT + 1*(long) RTT
= 210ms

Savings of 150ms by using edge
Which edge for which user?

- Which edge do I direct users to?
- How do I direct users to the right edge?
The “Map the Internet” Approach
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• Primary Benefit
  • Flexible Control: Can direct any DNS request to any node

• Trade off
  • High operational cost and complexity (Large scale central global co-ordinator required)
  • DNS can be inaccurate for client proximity routing.
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• There is an alternative...
The Anycast Approach
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• Benefits
  • Simple
  • Avoids DNS-based proximity routing

• Trade off
  • Relinquish routing control to “The Internet”
FastRoute

• Design Goals:
  • Simple (easy to operate)
  • Highly available (minimal downtime)
  • High Performance (better than existing solution)

• Desire:
  • A solution with the simplicity of Anycast, with *just enough* control to handle overloaded nodes.
FastRoute

Questions:
1. Does Anycast provide sufficient performance?
2. How can we manage the rare (but expected) individual overloaded node without sacrificing Anycast’s simplicity?
Performance of Anycast?

Note: Anything above 0% is good.
Not all Nodes are Equal!
Utilizing Anycast “Layers”
Load Management using Anycast Layers
Load Management using Anycast Layers

Note: Architecture choice not to send traffic to another edge in same layer. This prevents oscillatory behavior.
Anycast layer 0 is provisioned to absorb overflow. Further optimization can occur to improve absorption in this layer.
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Preserves the independence of each node (no real-time communication outside a node).
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  • DNS request for a user lands in the same location as HTTP request (i.e. self-correlated)
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• Is it good enough?
FastRoute Self-Correlation

Ideal 100% self-correlated
DNS Load Management In Practice
Basic Architecture Summary

• Statically configure edges in multiple Anycast layers
• Each edge *independently* monitors its own load and decides whether to “throw” traffic to the next layer.
• Final layer is dimensioned sufficiently to handle all load

• *Edge nodes act independently without any knowledge outside the edge.*
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Questions?