

A View Through Happy Eyeballs

Client-Side IPv6 Metrics

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Background

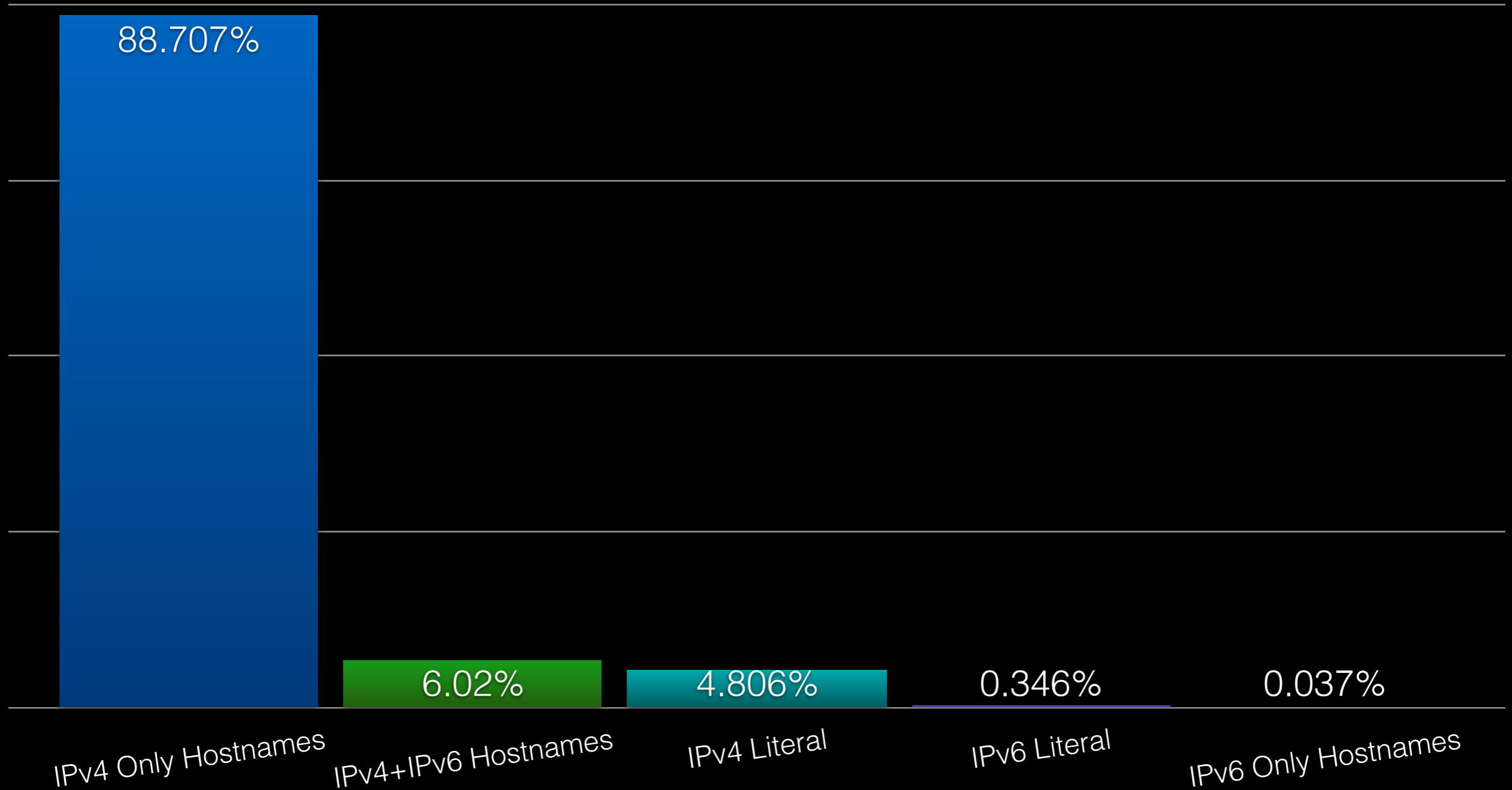
- On iOS and macOS, we use the following logic to create connections when we have multiple address options:
 - Sort addresses using RFC 6724
 - Inspired by RFC 6555 'Happy Eyeballs', prefer to try different address families as first two attempts
 - Try addresses in order, with a delay based on expected RTT and variation

Methodology

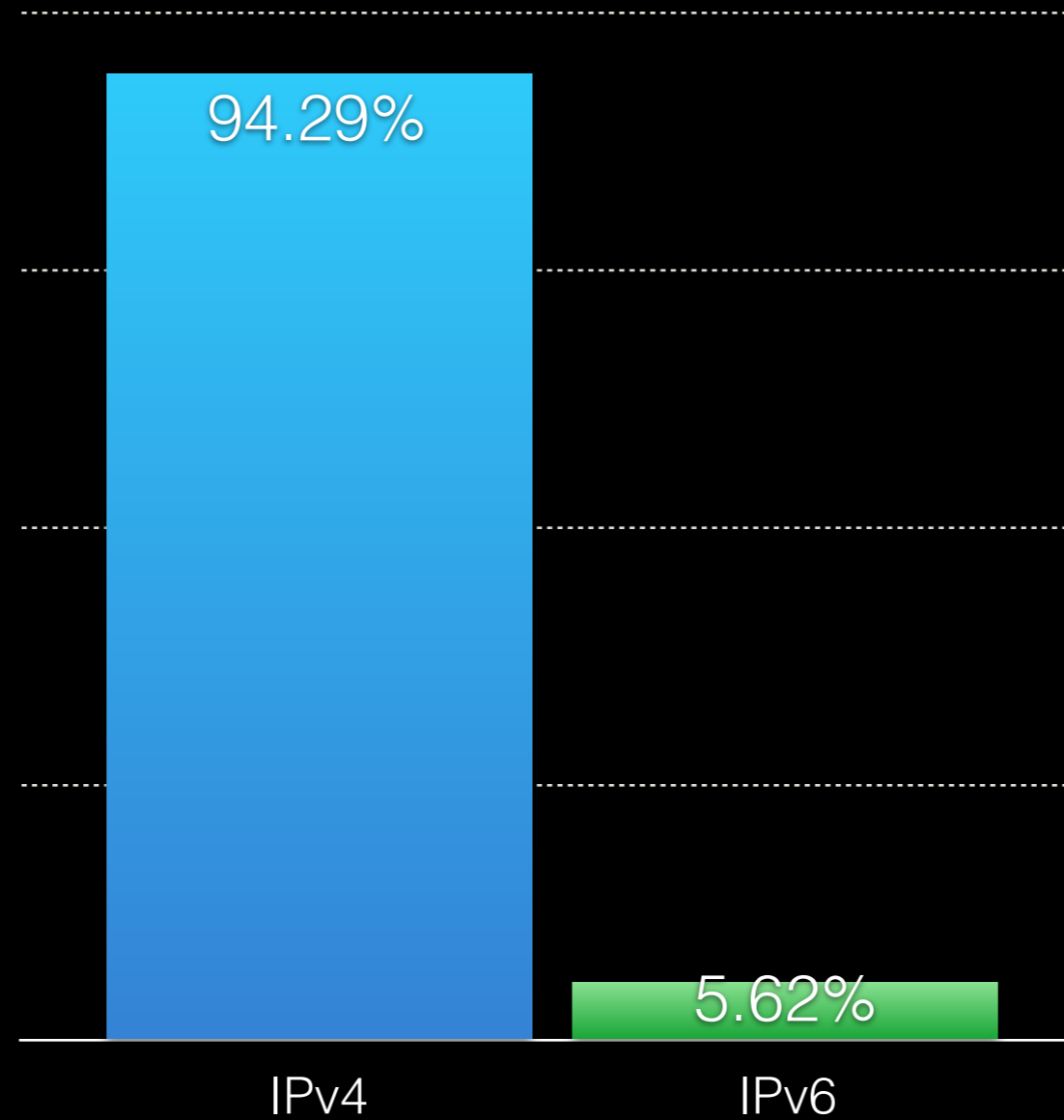
- Randomly sample 1% of connections made using Apple's networking library on the Public Beta of iOS 10 and macOS Sierra
 - Number of addresses resolved per family
 - First address family attempted
 - Connected address family
 - Connected address index
 - TCP handshake time
 - Interface Type (Wi-Fi, Cellular, Wired)

How often do we
connect over IPv6?

Connection Attempt Breakdown

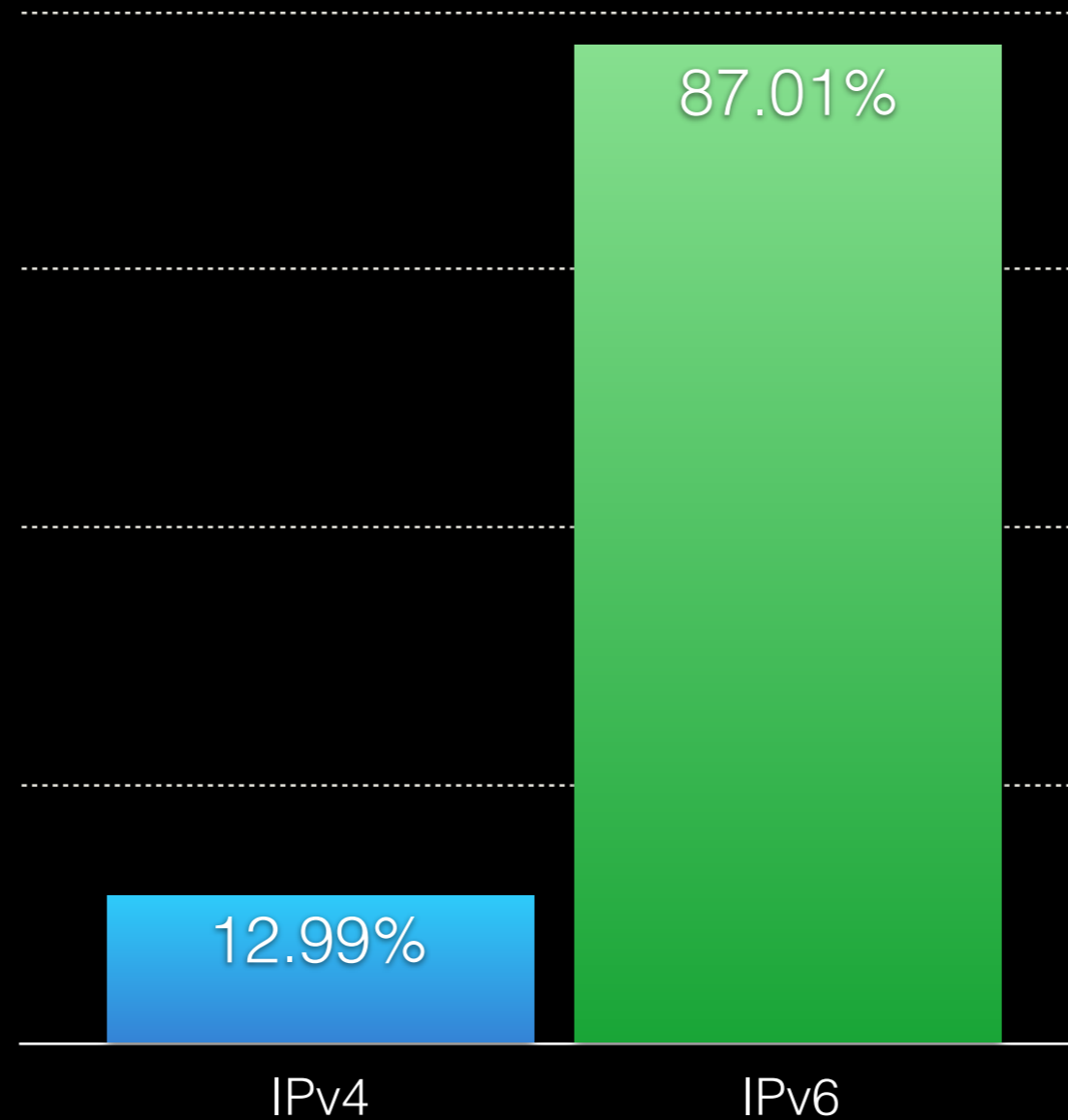


Connected Address Family Totals



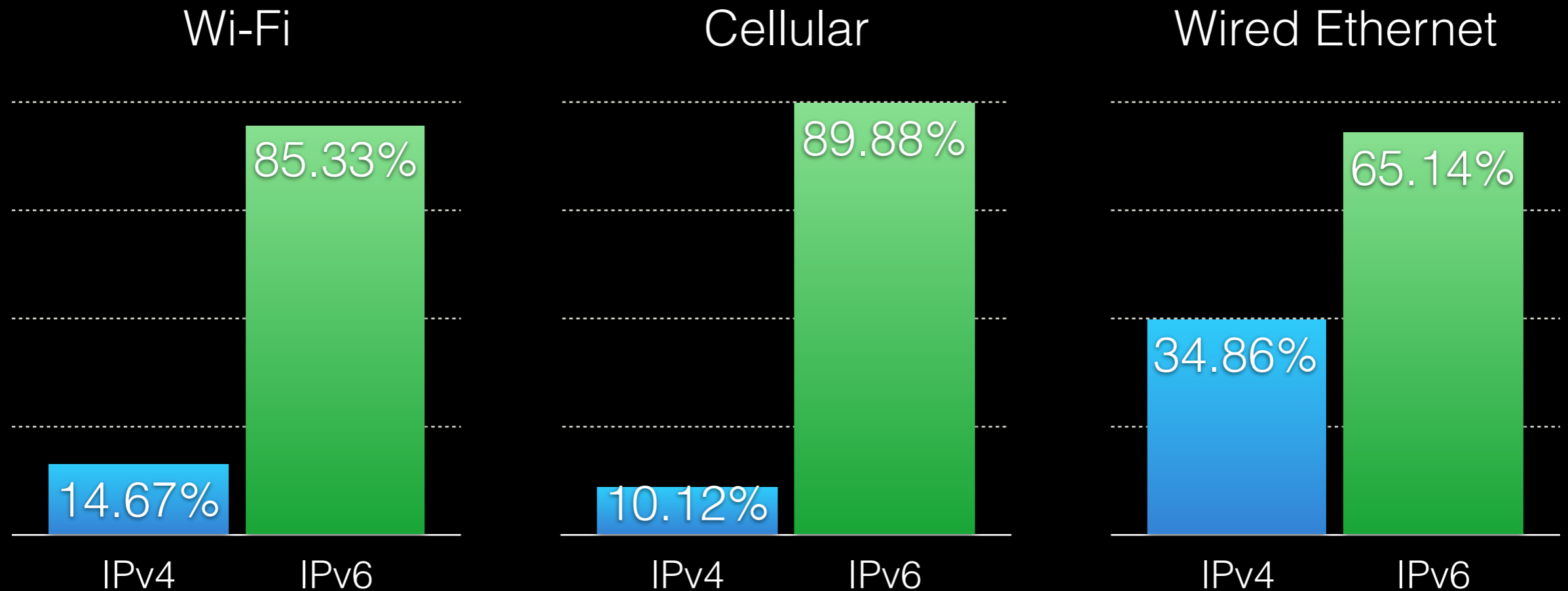
Connected Address Family

IPv4 + IPv6 Hostnames Only



Connected Address Family

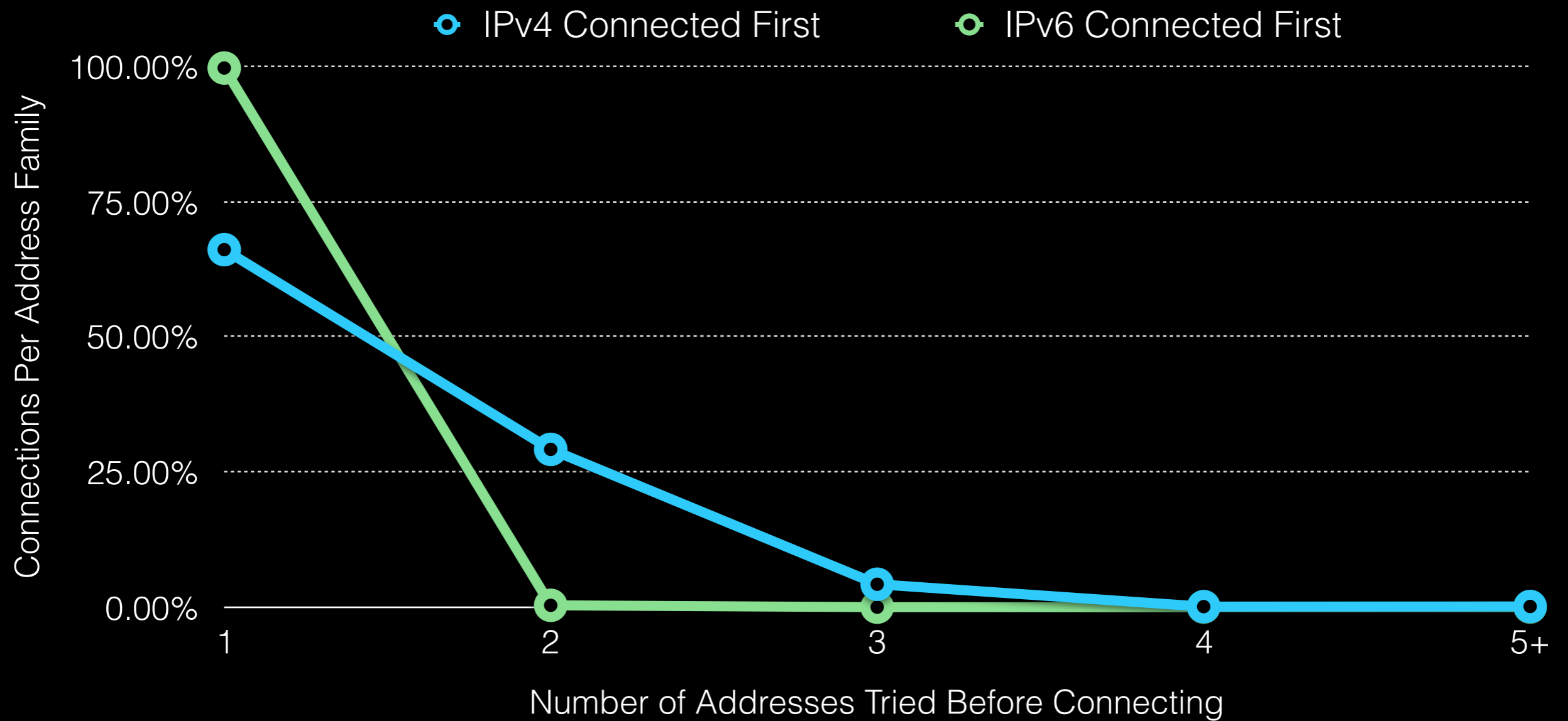
IPv4 + IPv6 Hostnames, Per Network Type



How often do we need
'Happy Eyeballs'?

Connected Address Index

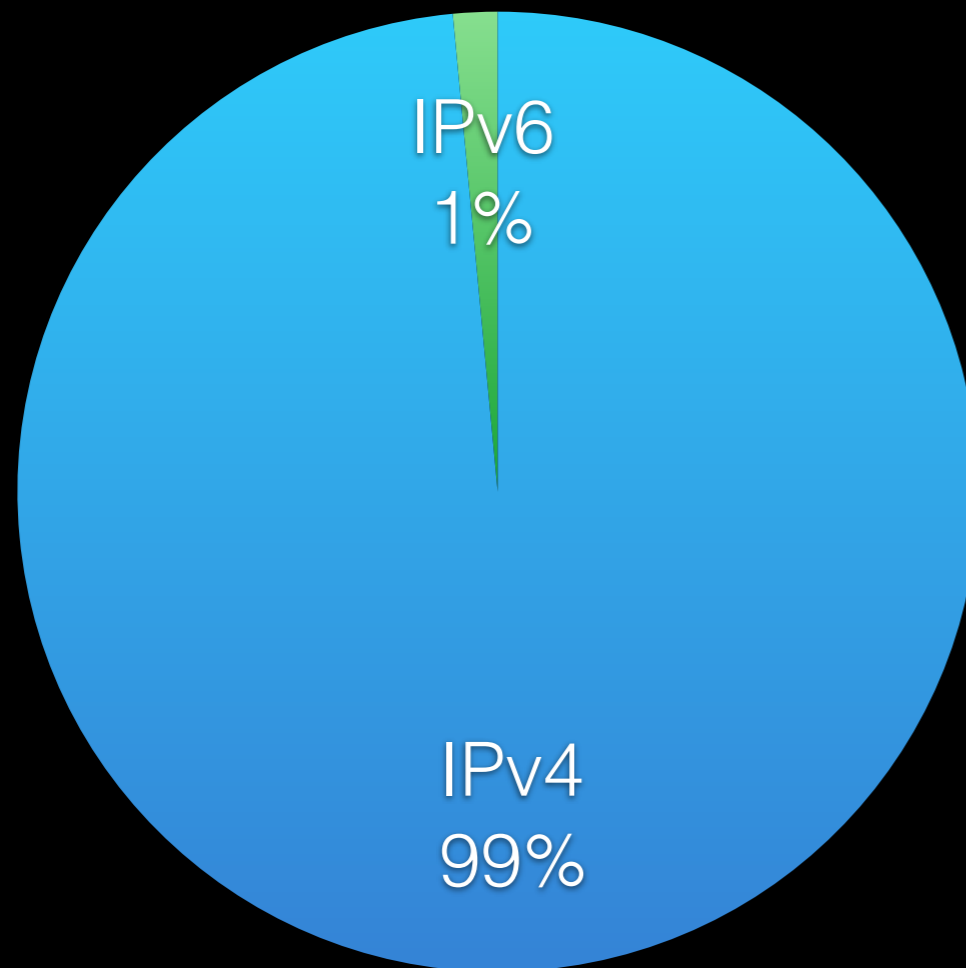
Happy Eyeballs Fallback



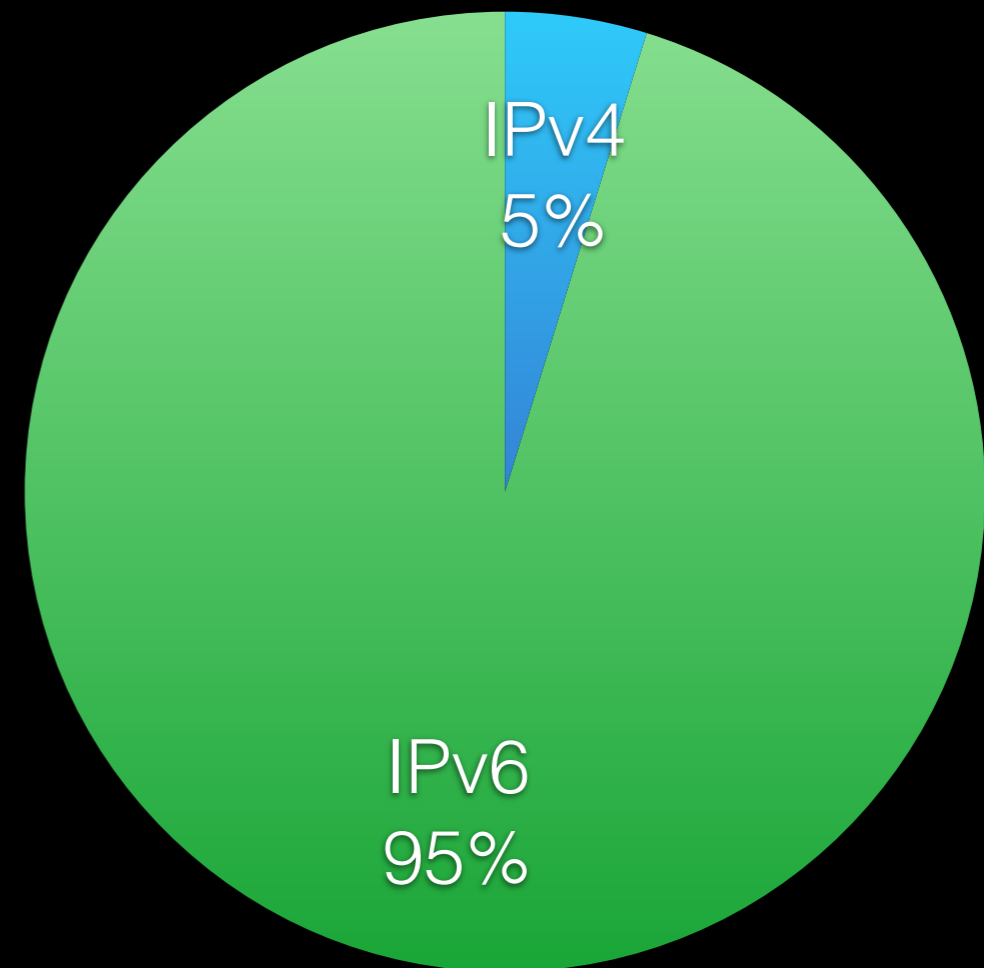
Connected Address Family

Happy Eyeballs Fallback

IPv4 Attempted First



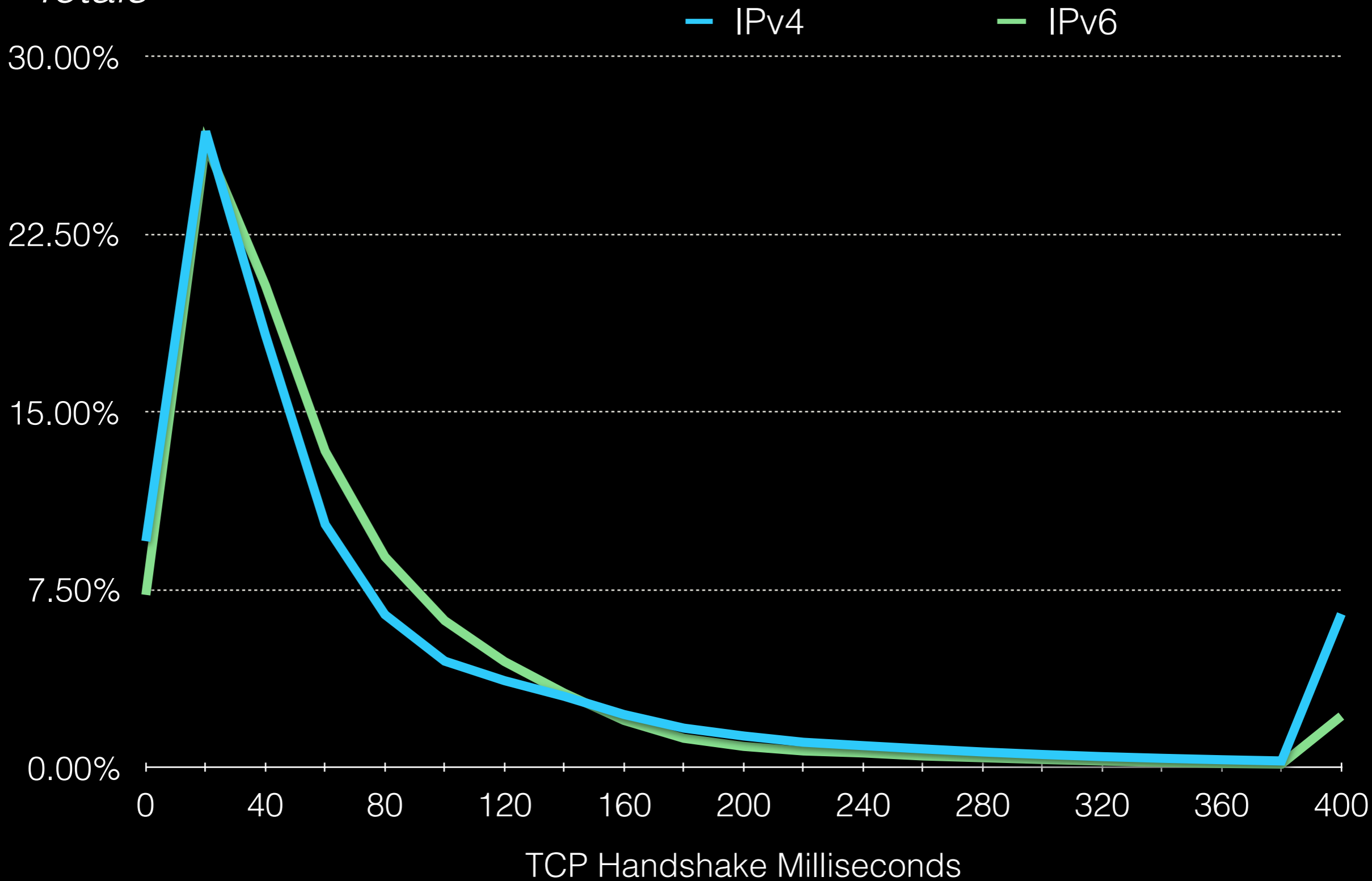
IPv6 Attempted First



How fast is IPv6?

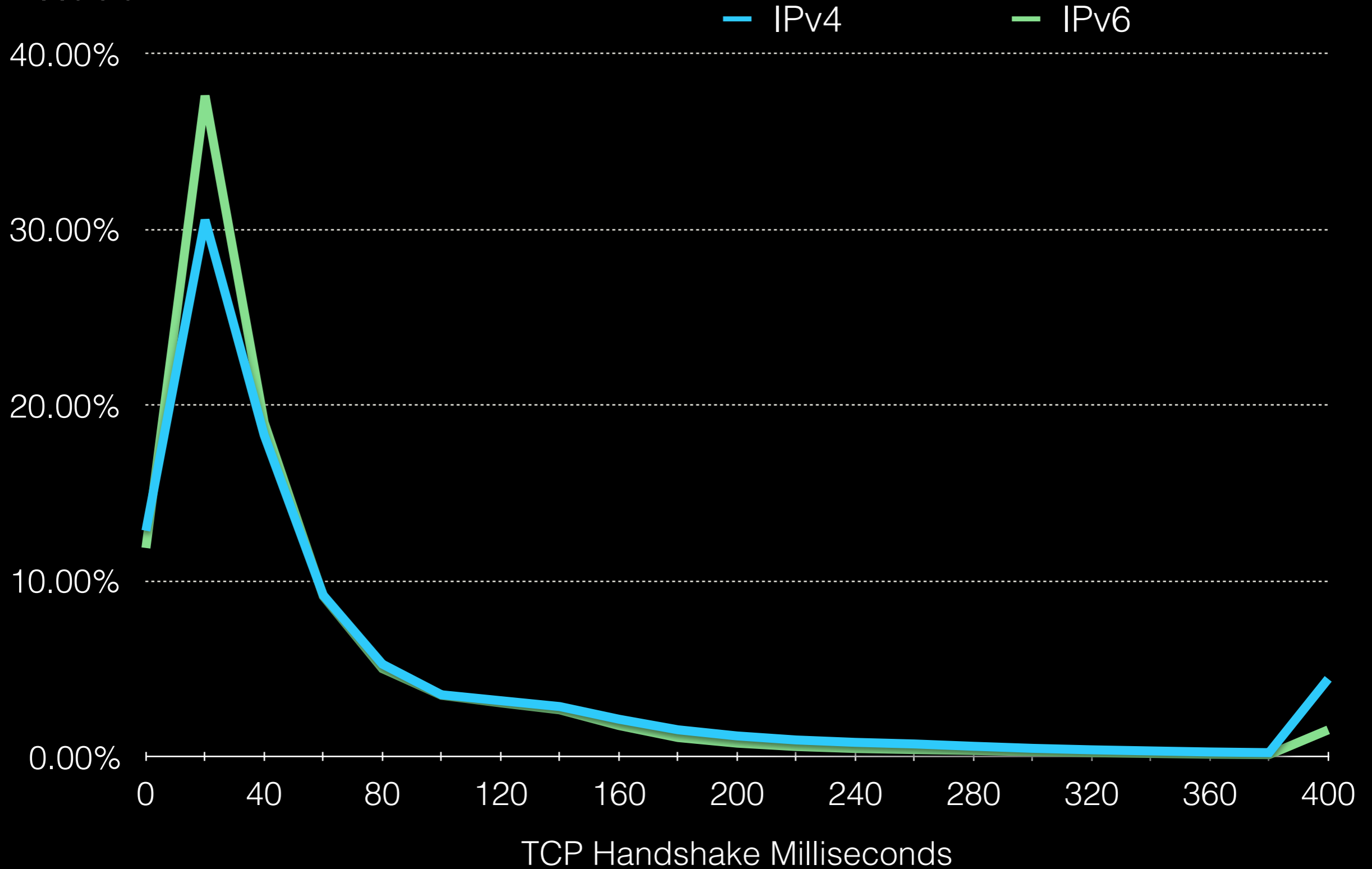
TCP Handshake Latency

Totals



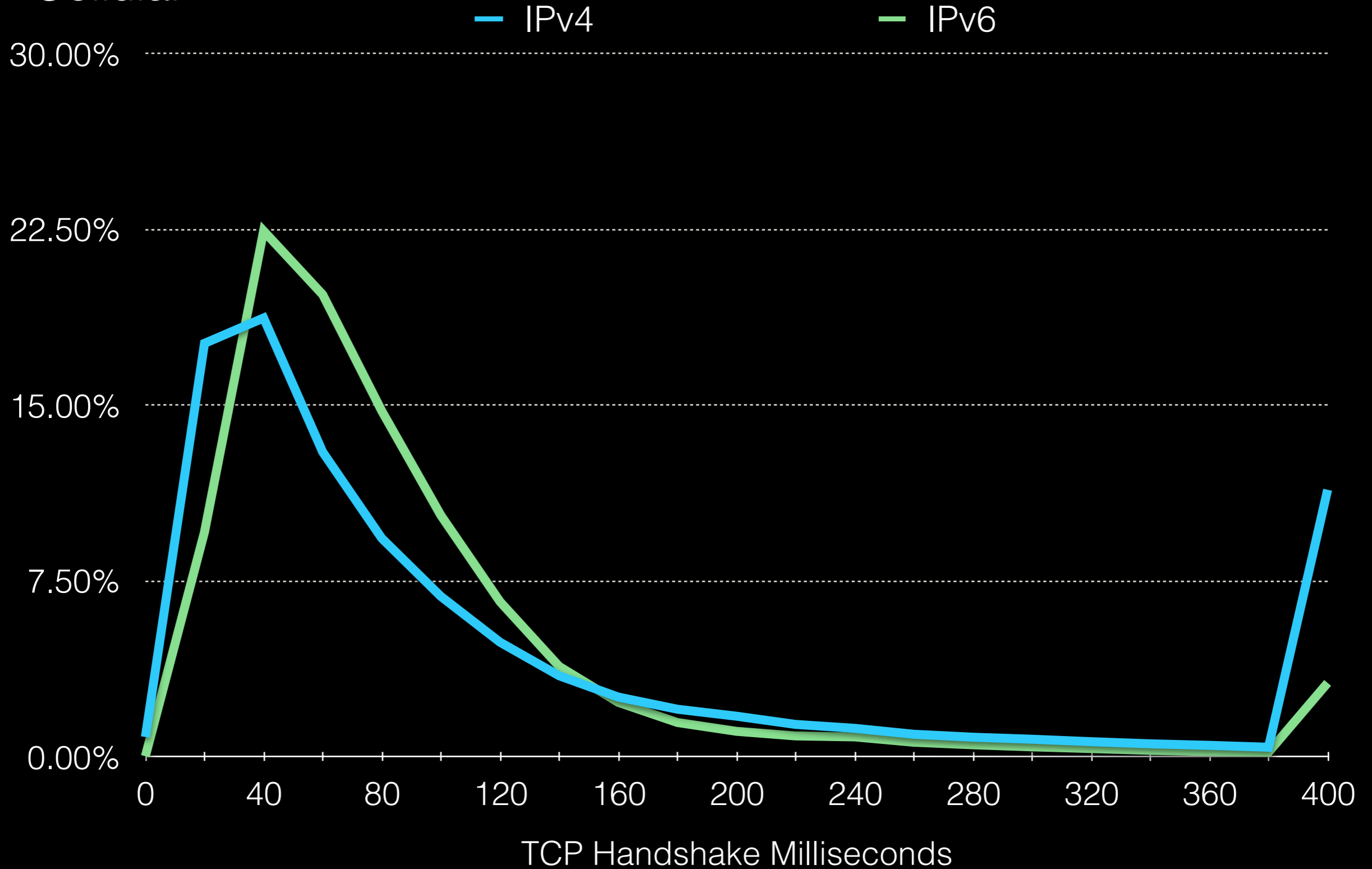
TCP Handshake Latency

Wi-Fi



TCP Handshake Latency

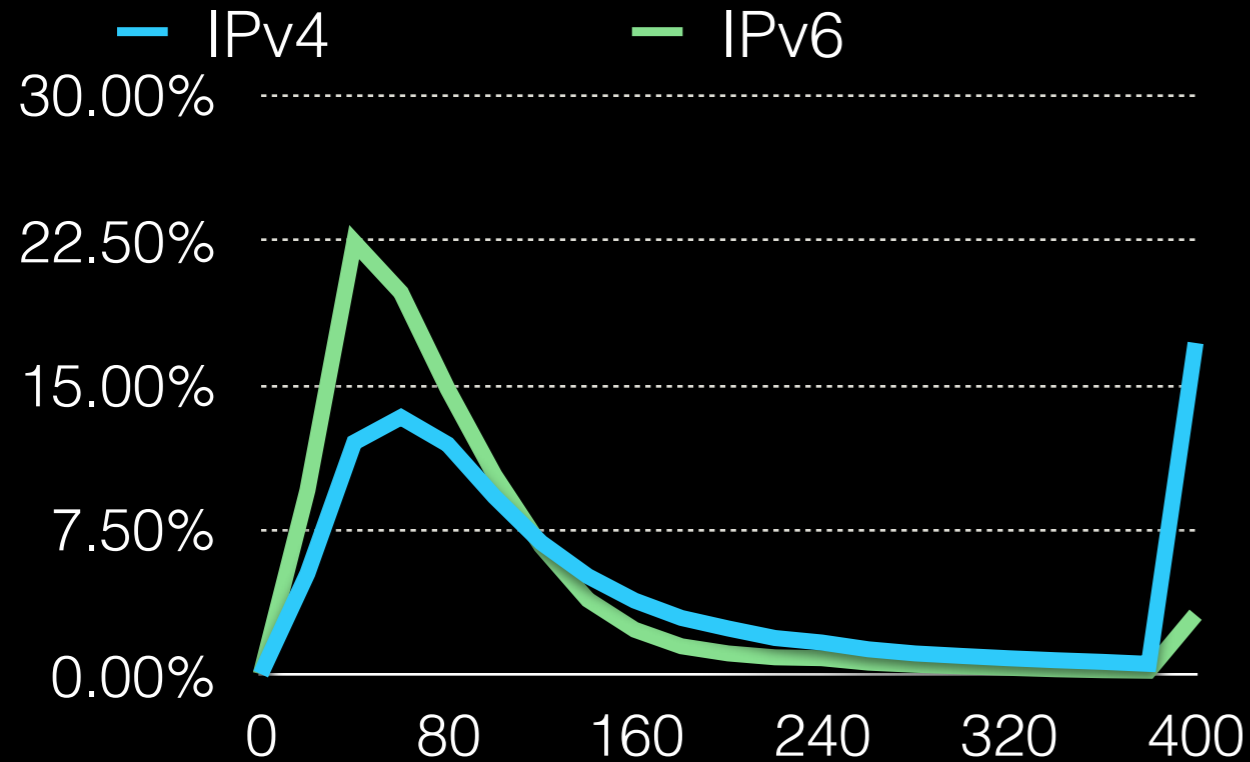
Cellular



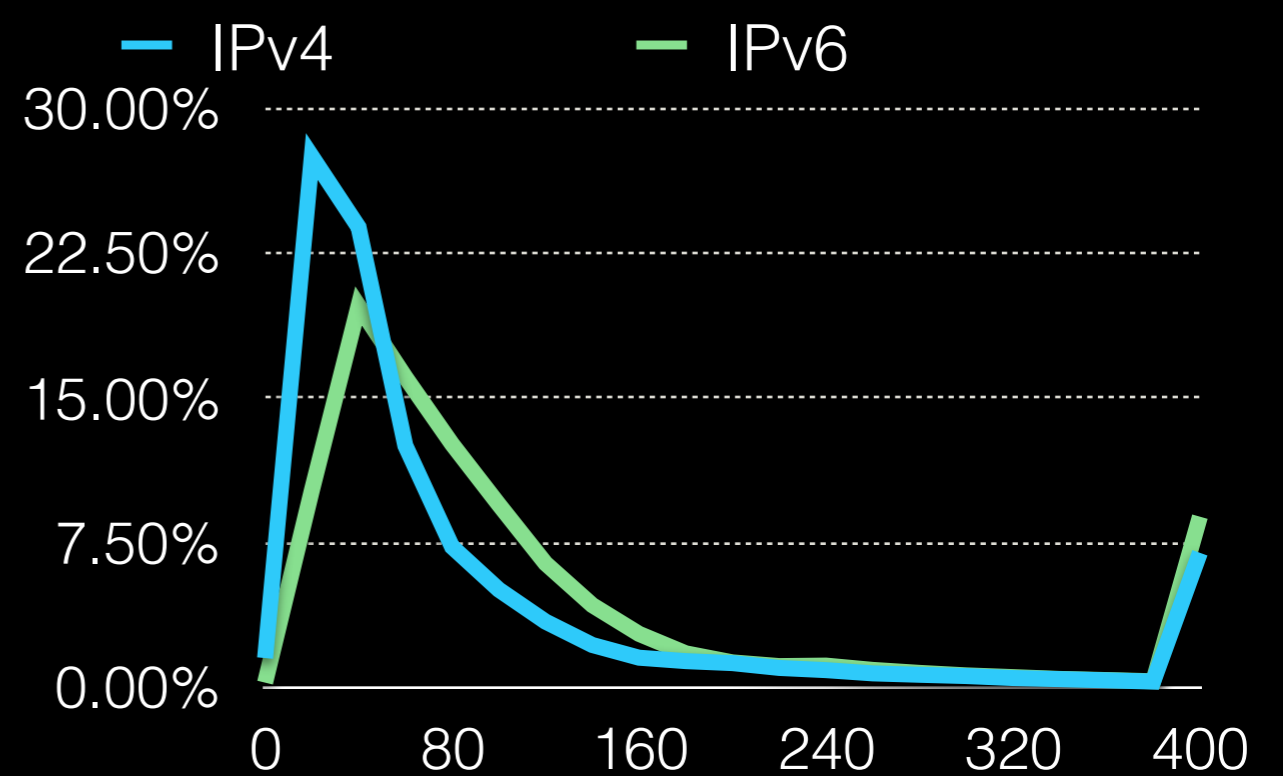
TCP Handshake Latency

Cellular

IPv6-Promoting Carriers

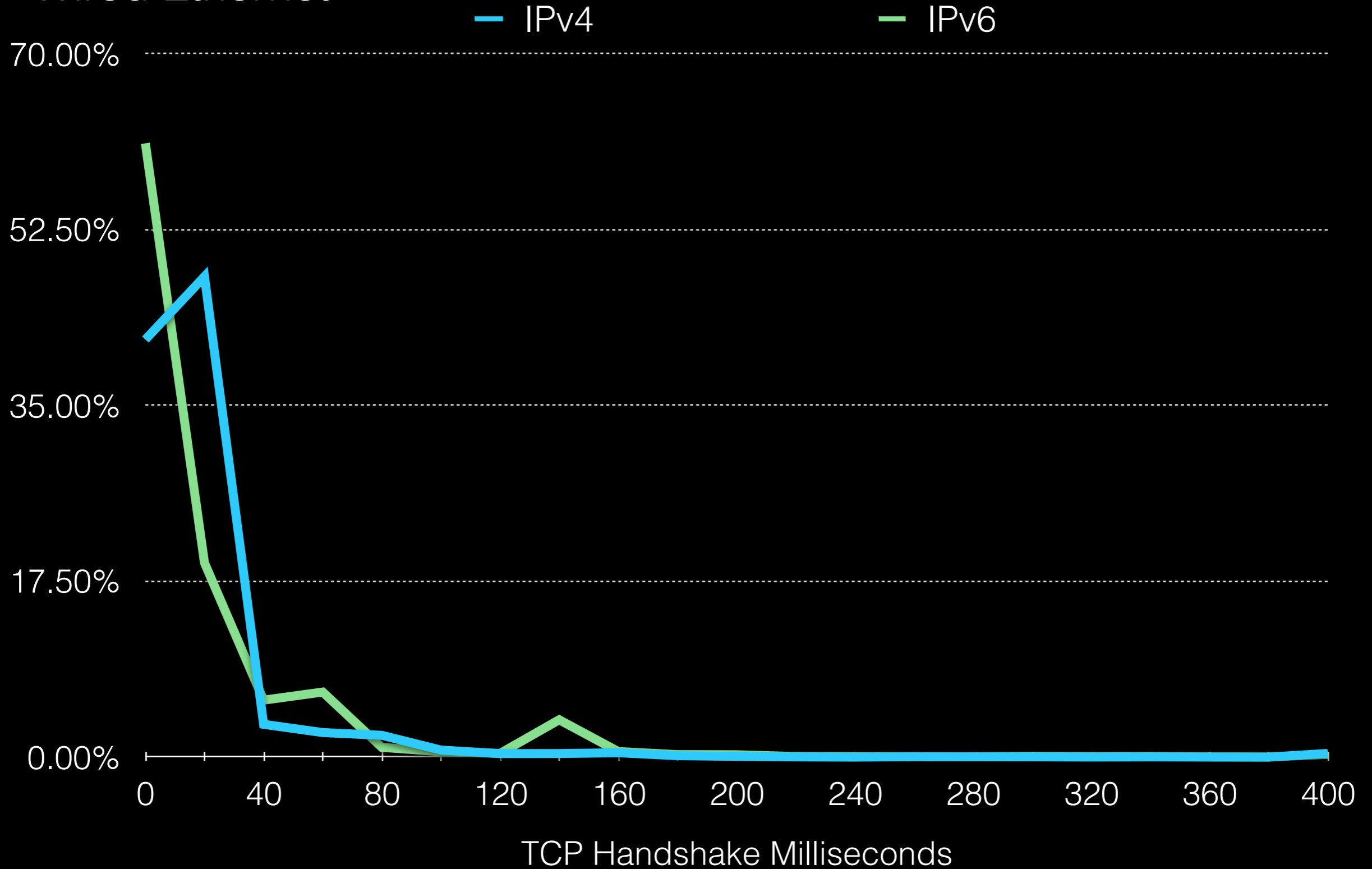


Other Carriers



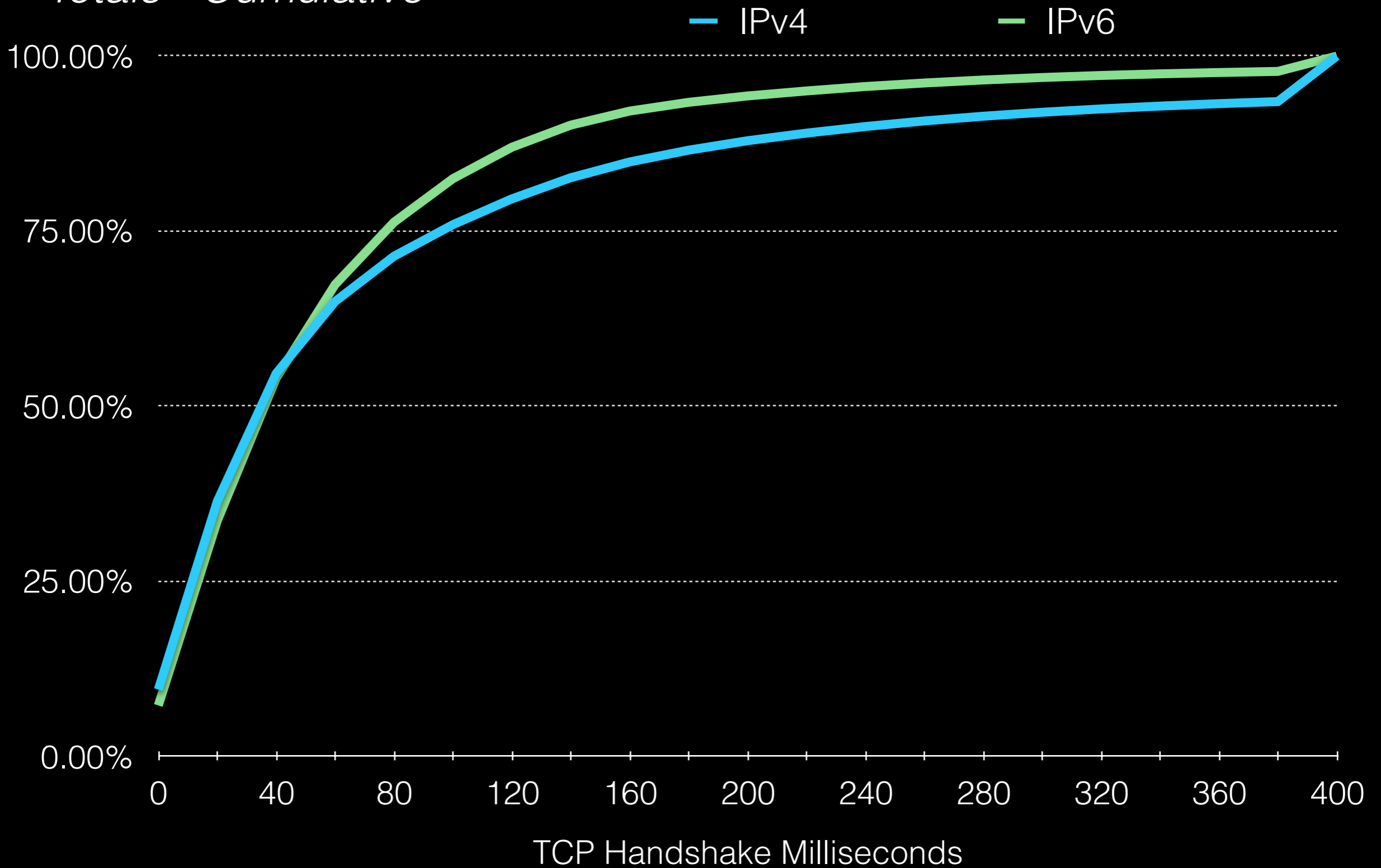
TCP Handshake Latency

Wired Ethernet



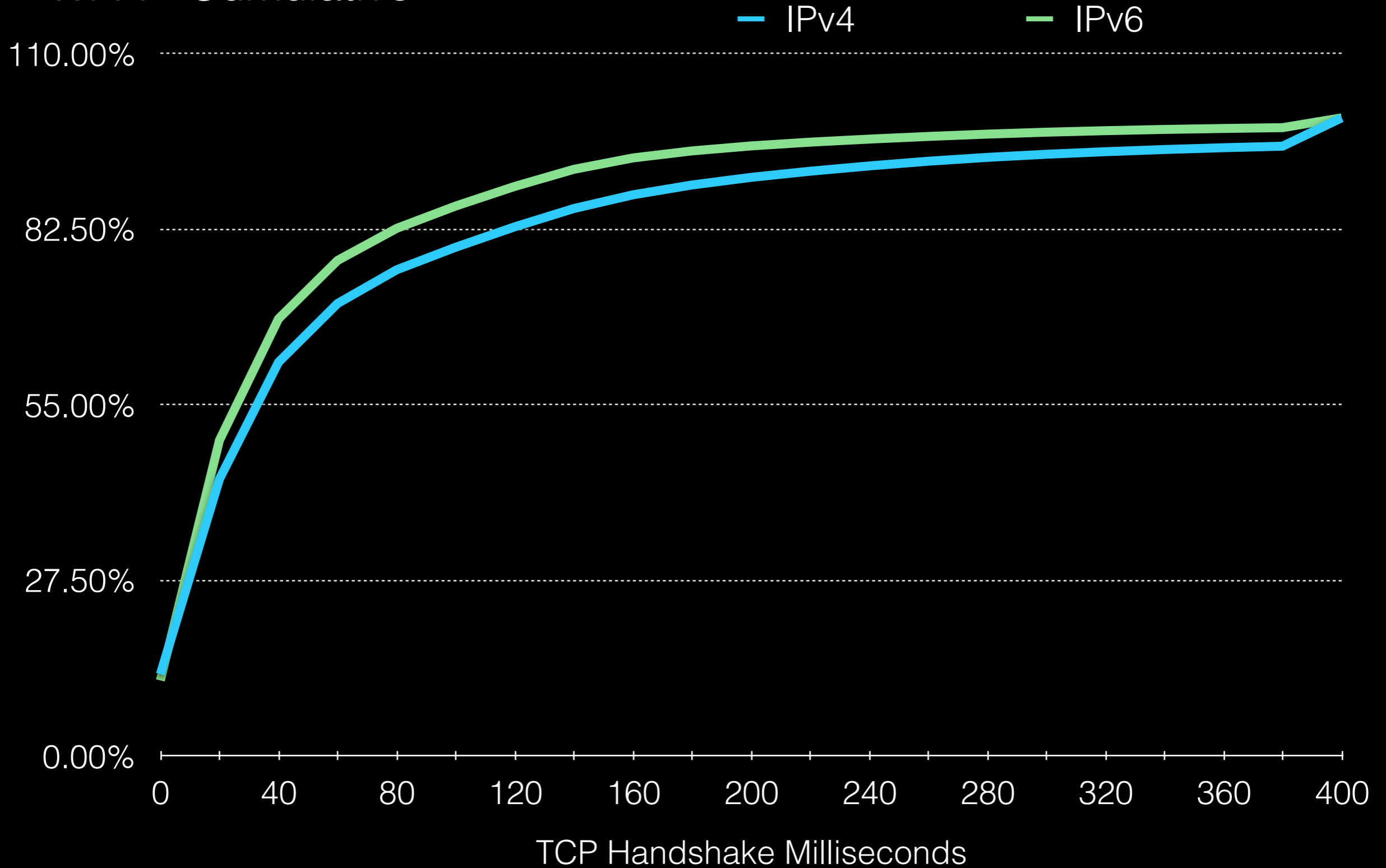
TCP Handshake Latency

Totals - Cumulative



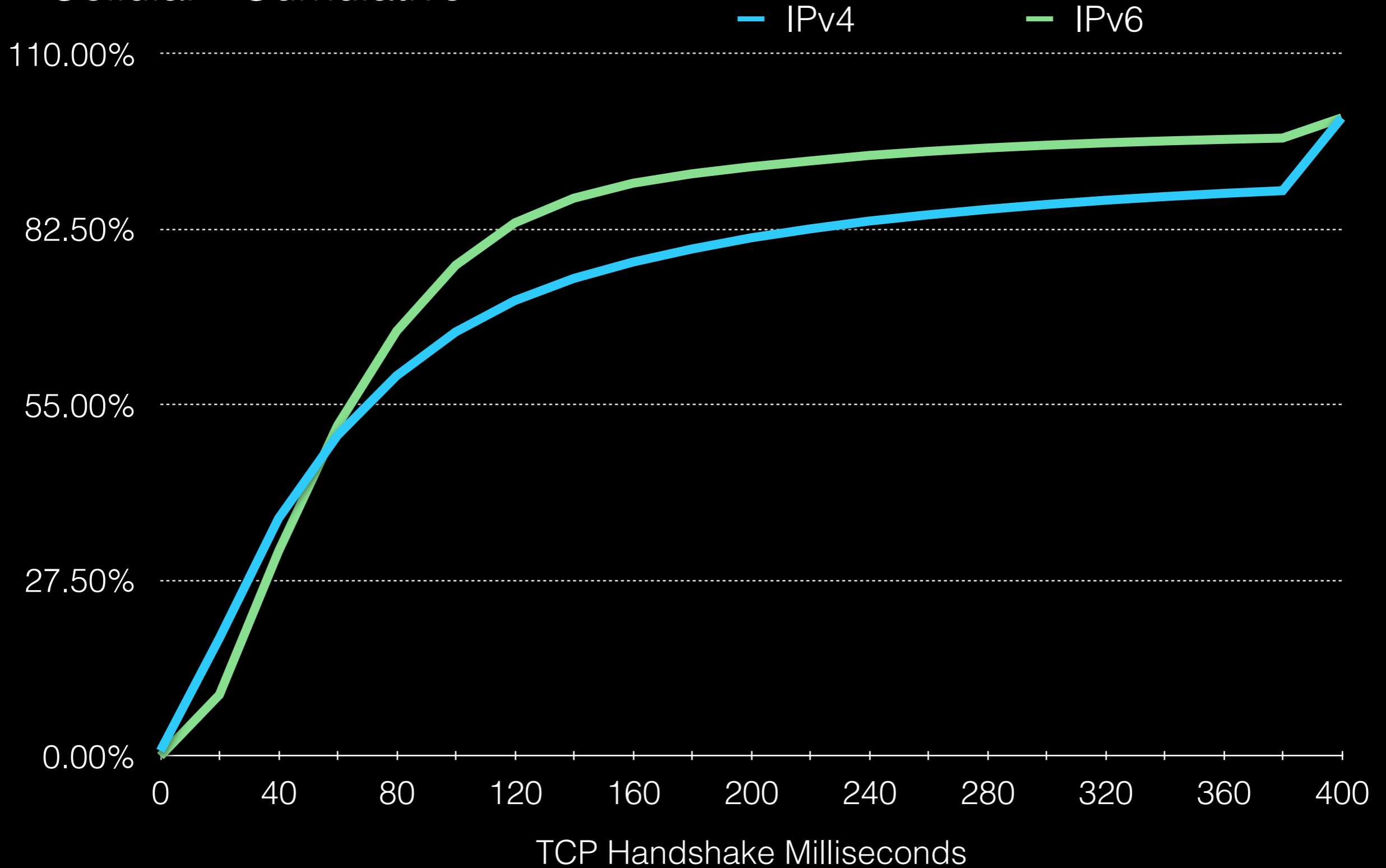
TCP Handshake Latency

Wi-Fi - Cumulative



TCP Handshake Latency

Cellular - Cumulative



TCP Handshake Latency

Wired Ethernet - Cumulative

