

# Testing Protocols in Simulated Network Conditions

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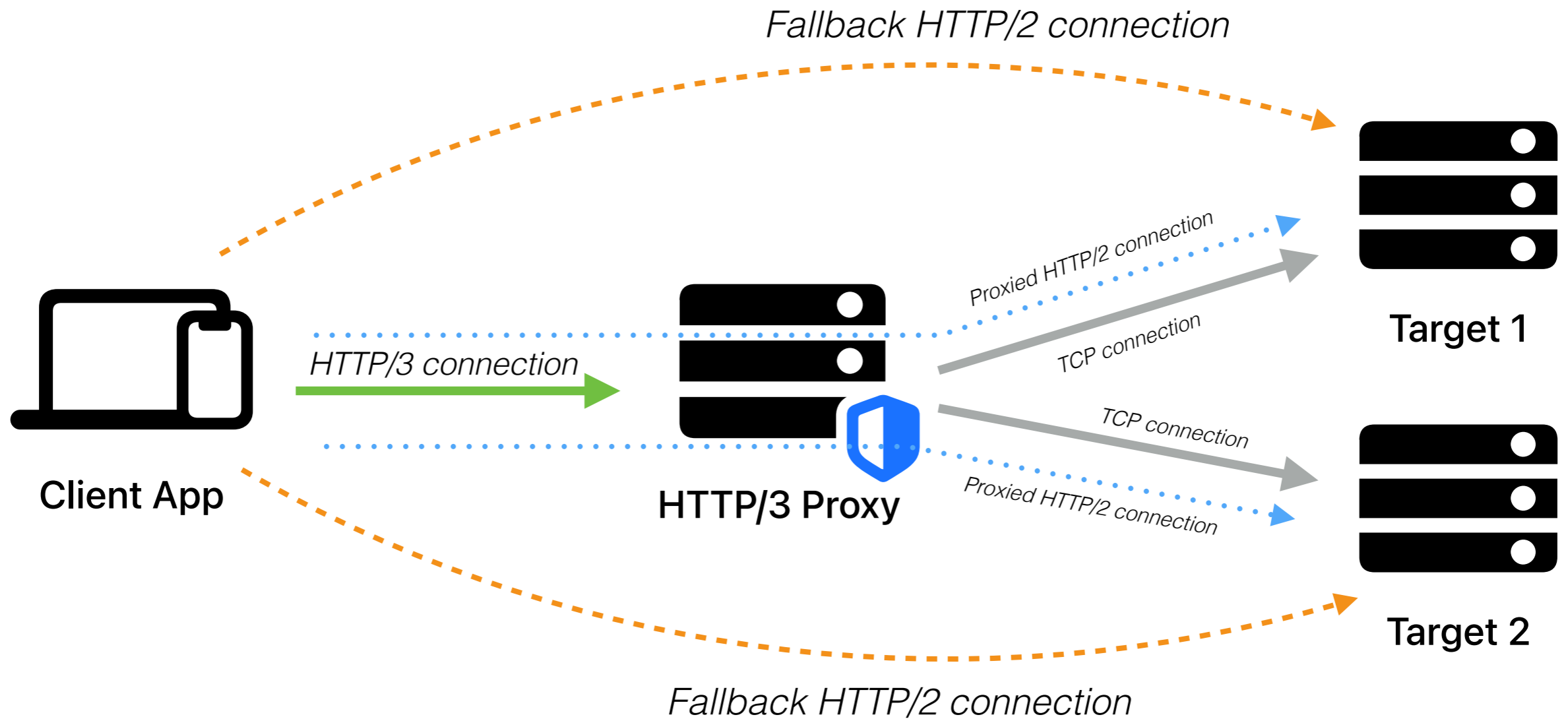
# Setup

NLC (Network Link Conditioner) is a tool available for macOS and iOS developers to test various network profiles

We used various profiles to test a setup where we used an HTTP/3 forward proxy to accelerate connection setup times

A single app that opened many HTTP/2 connections, now routing those connections through a single HTTP/3 proxy connection

# Connections



# Benefits of relaying



Cached DNS answers (save DNS round trip)

0-RTT to the relay (save TCP round trip)

Congestion control tuning to the relay (BBR, etc)

# Network Link Conditioner Profiles

Try to base profiles on **realistic** user scenarios

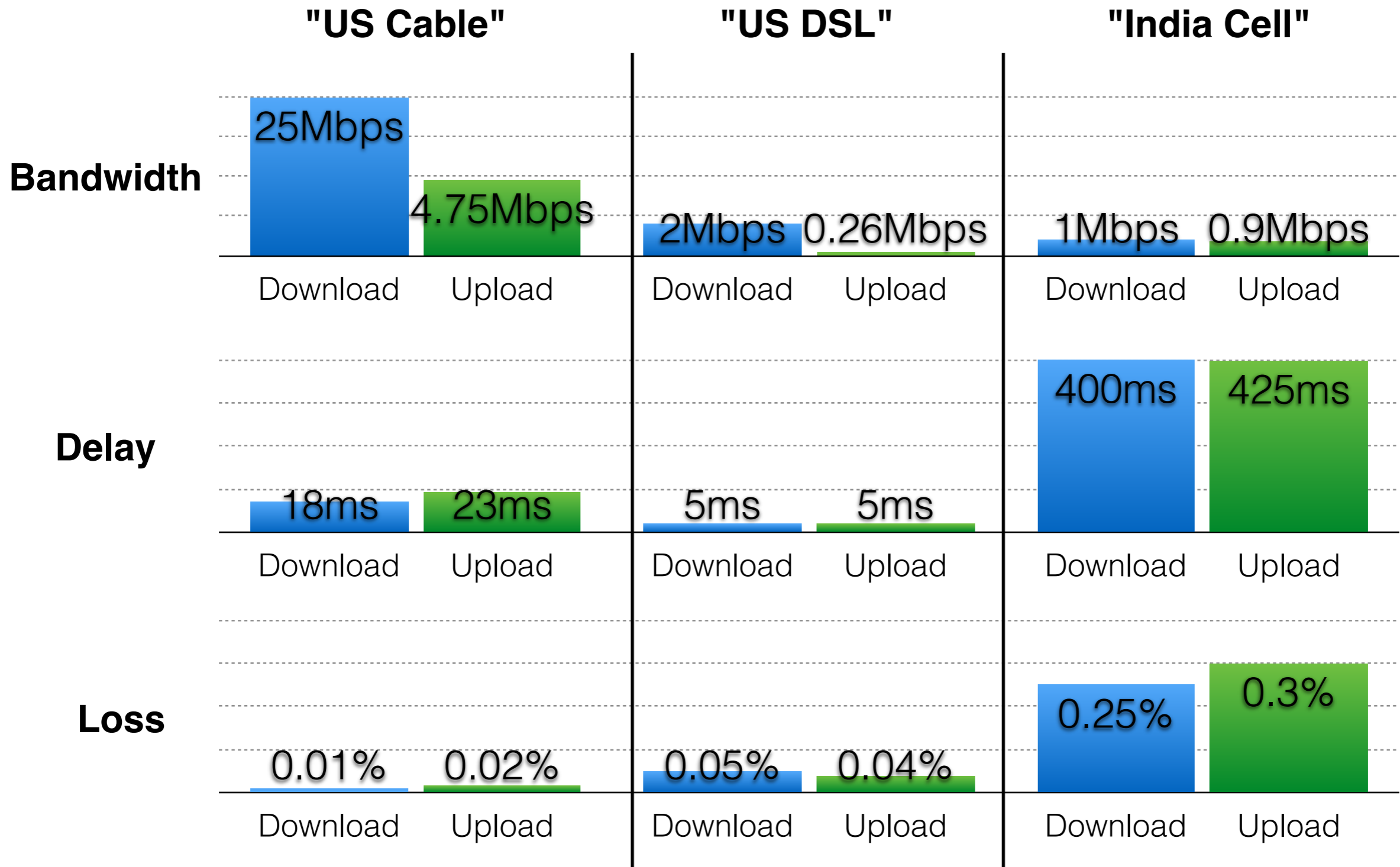
*Don't crank loss up too high*

*Delay is one of the most impactful variables*

Test with at least three different profiles

*Naive improvements often aren't consistent across profiles*

# Network Link Conditioner Profiles

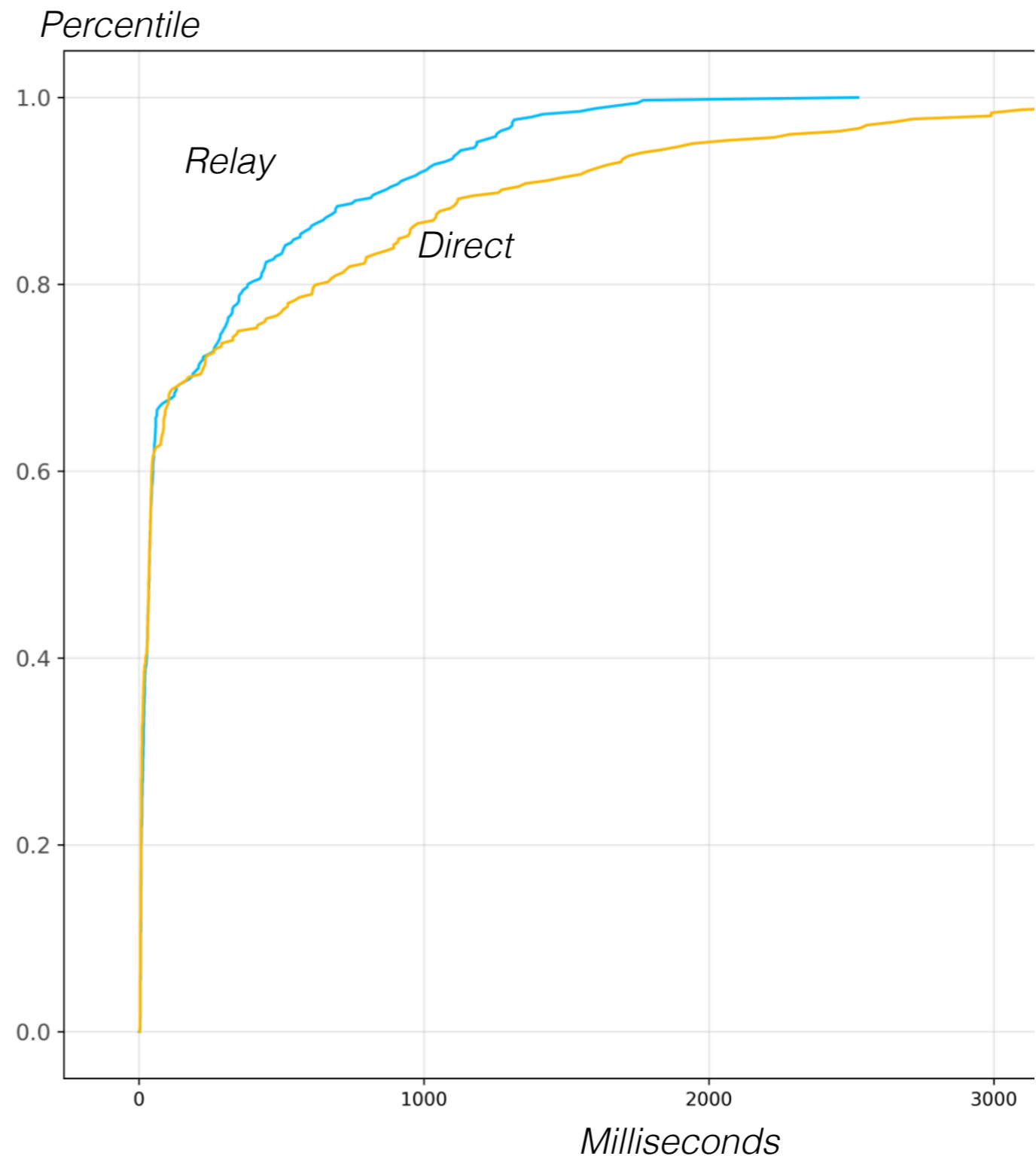


# Example results

Early test

"US DSL" profile

Relay showed wins above P70, and had an overall faster time

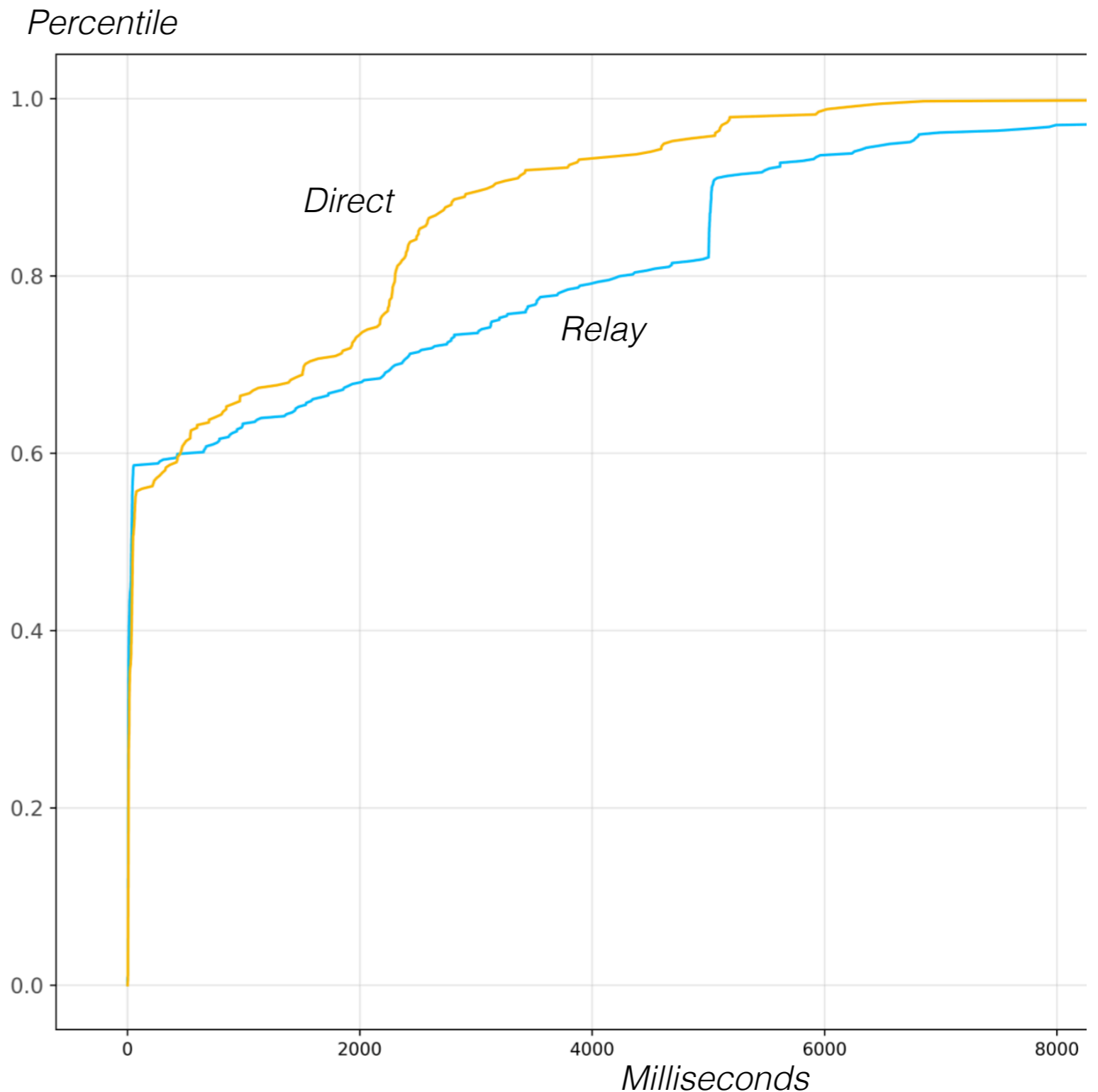


# Example results

Early test

"India Cell" profile

Relay performance was worse starting around P50-P60, failing to handle loss and delay well

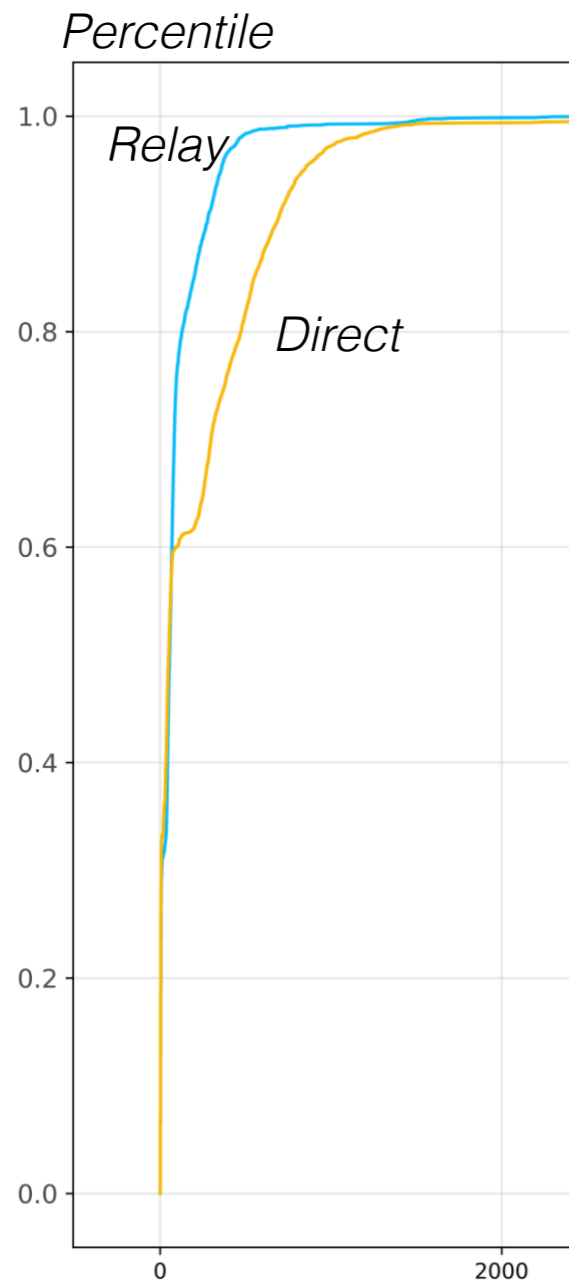




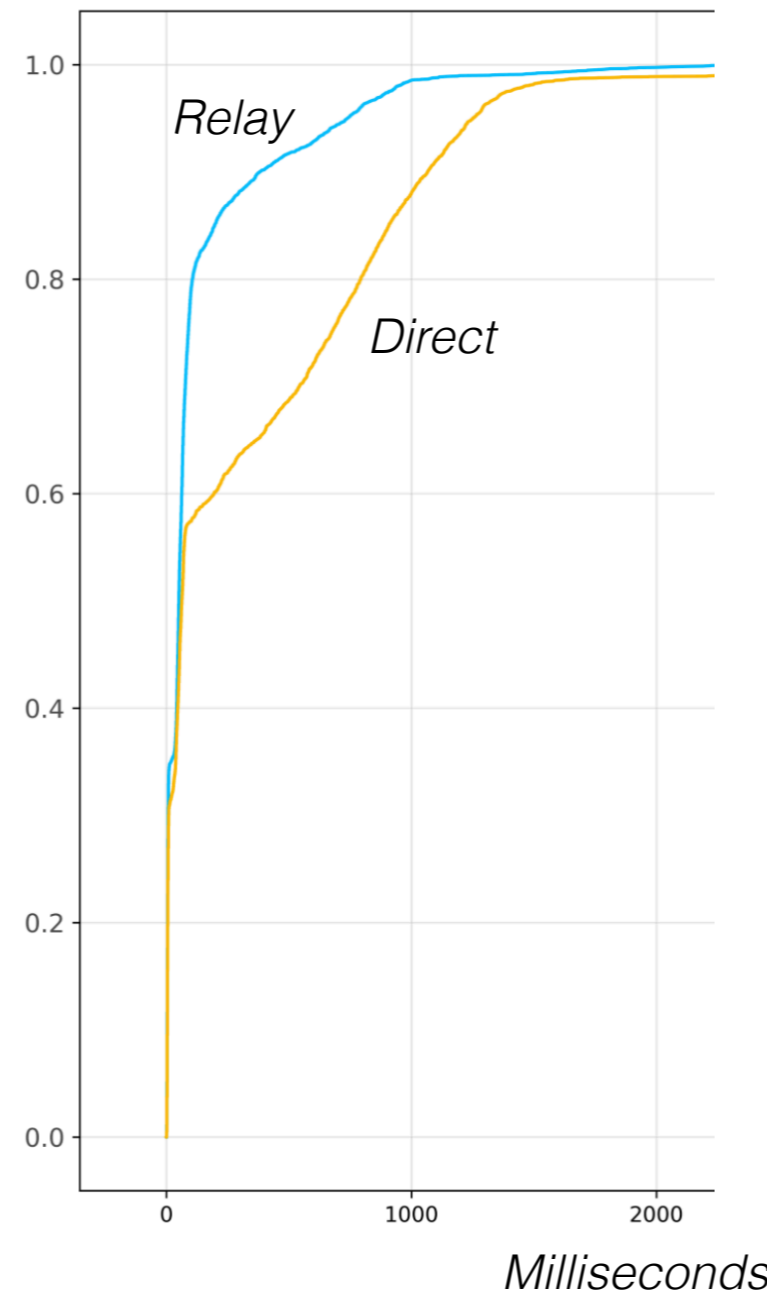
# Example results

Later test, after adding 0-RTT, loss recovery tuning, etc.

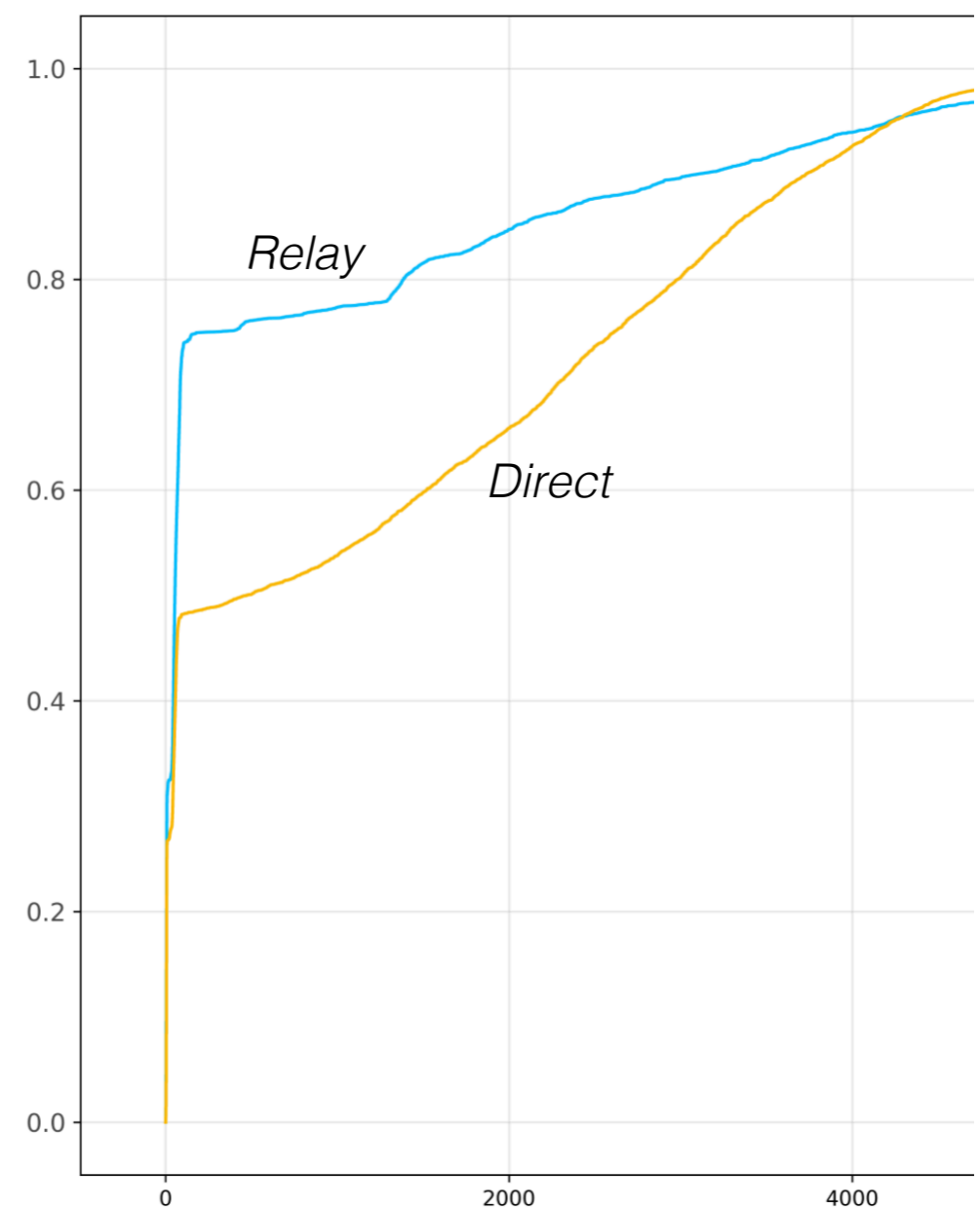
"US Cable"



"US DSL"

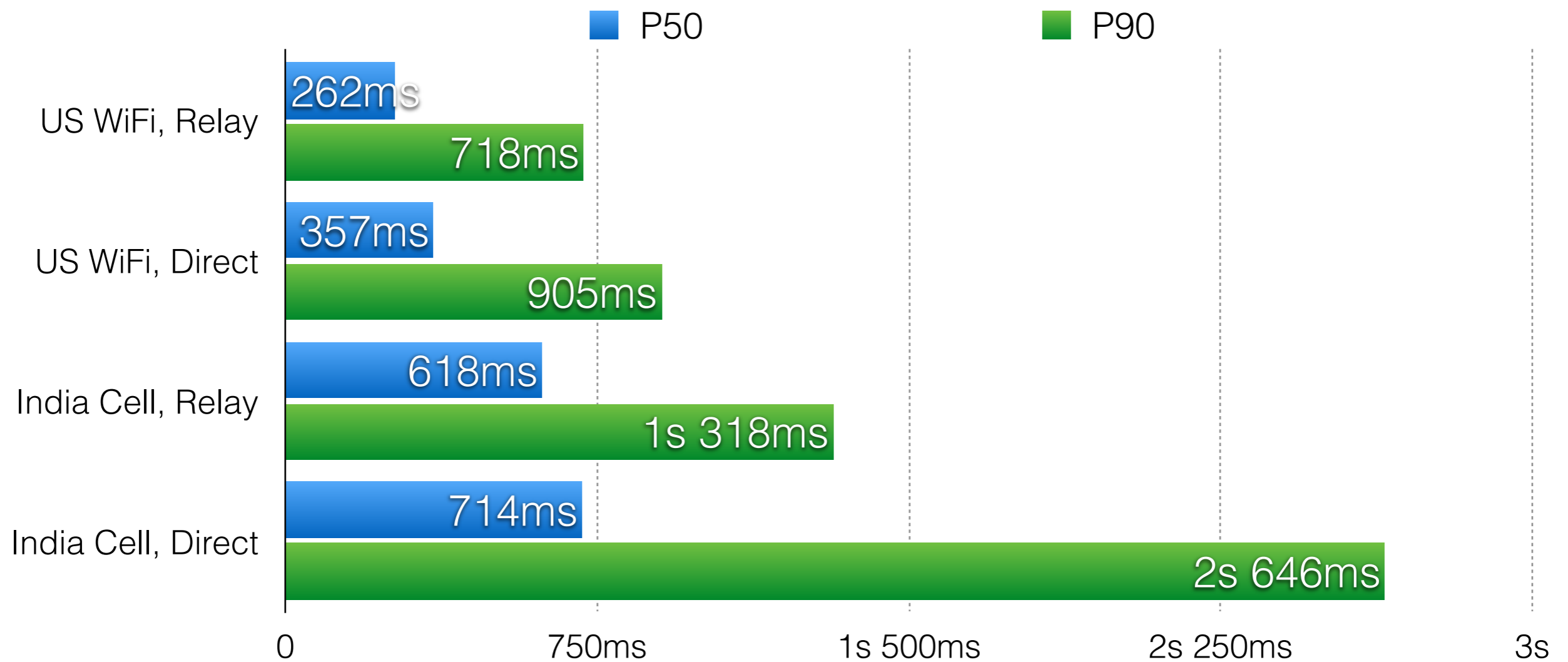


"India Cell"



# Real-world results

Results from aggregated traffic data of real app users shows the same rough patterns seen in simulated data



# Takeaways

Testing with simulated conditions is a great way to anticipate real-world performance problems

It would be useful to have collaborative efforts to share settings that represent real network conditions around the world