First Experimentations with iOS Multipath TCP in the Wild

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• Initially for Apple Siri
• Now available for any application since iOS 11
Performance of Multipath TCP?

Typical multipath use cases

- (Bandwidth aggregation)
- Network handover

How does the iOS implementation behaves

- with different network traffics?
  - Bulk transfer, light latency-sensitive traffic,...
- under user mobility situation?
  - i.e., does it perform network handover "efficiently"?
An iOS 11 Measurement Application

MultipathTester

- WiFi reachability tester
  - Under bidirectional light fixed-rate streaming traffic
  - Can Multipath TCP quickly react to network handover?

- Multipath benchmark
  - Bulk transfer, goodput probing, latency with light traffic,…
  - With optional aggregation behavior

- Result visualization
  - e.g., how does the congestion window evolve during iperf?

- Compare with (Multipath) QUIC protocol
Since its Deployment (March 8th - March 20th)

- 205 tests run
  - Including 22 mobile ones (10 with actual network handover)
- 50 different users
  - Mostly from Europe
  - With 1/3 from America
Mobile Tests

How far can you reach your WiFi?

The record is 24.5 m.

Wifi is ready.

Cellular is ready.

You can estimate how far your WiFi is reachable.

Everything is set up. Are you ready?

I'm ready to move!
First Mobile Results: Methodology

- Run 20 KB/s streaming traffic in both direction
  - i.e., 10 chunks of 2000 bytes per second
  - For both Multipath TCP and Multipath QUIC
  - Use interactive mode
- Collect application latency between data chunk and applicative ack
- Test stops when system declares WiFi as lost
Maximum Delay Observed (Upload)

Max stream upload delays (with correction)

CDF
Max delay (ms)
Max stream upload delays (with correction)
MPTCP
MPQUIC
0.2
0.4
0.6
0.8
1
100
1k
10k
100k

CDF
Max delay (ms)

MPTCP
MPQUIC
Maximum Delay Observed (Download)

Max stream download delays (with correction)

CDF
Max delay (ms)
Max stream download delays (with correction)
MPTCP
MPQUIC
0.2
0.4
0.6
0.8
1
400
1k
2k
4k
10k
20k
40k
What’s Next?

- The iOS Multipath TCP interactive mode seems quite good in upload
  - Compared to a naive Multipath QUIC scheduling scheme
- Only preliminary results
  - Only 10 points so far...
- Looking for kind volunteers 😊
  - Interesting results will be posted on https://multipath-quic.org
Want to Give it a Shot?

Multipath Tester


Feedback welcomed at quentin.deconinck@uclouvain.be 😊