Network Latency

Why it matters, how to measure it, what to do about it

Stuart Cheshire, Apple

HotRFC

IETF 114, Philadelphia

Sunday 24th July 2022

Latency: Why It Matters

High Throughput

- Good for large uploads and downloads

Low Latency

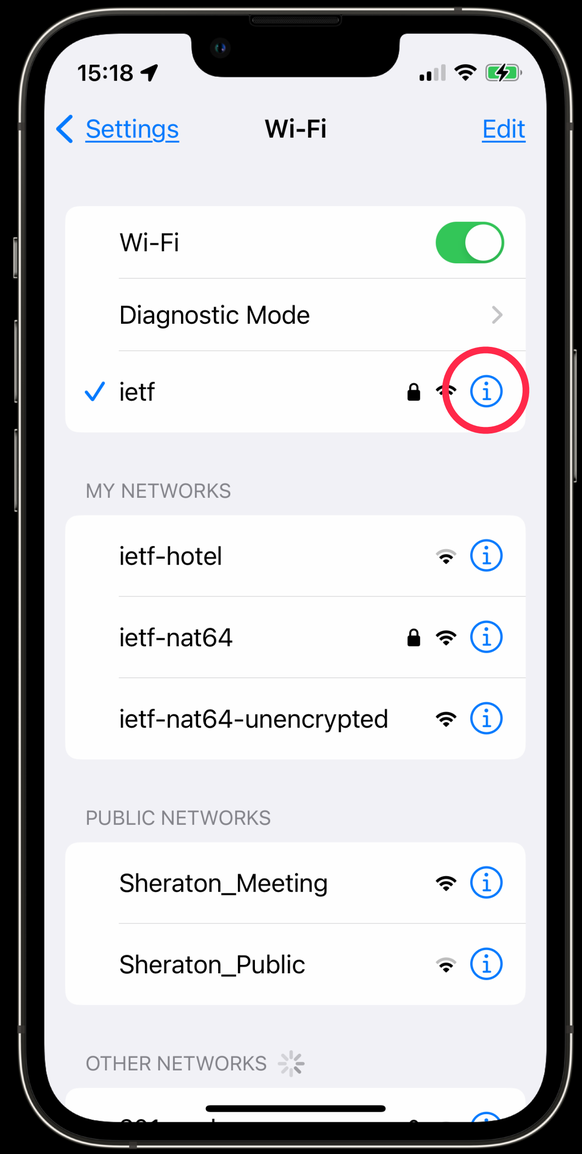
- Good for… everything else
- Maps, driving directions, weather forecasts, stock quotes
- Multi-player games, video conferencing
- Chapter switching and rate adaptation in streaming video

Latency: How to Measure It

Apple Network Responsiveness measurement tool

Measure *working* latency, not *idle* latency

- https://support.apple.com/en-us/HT212313



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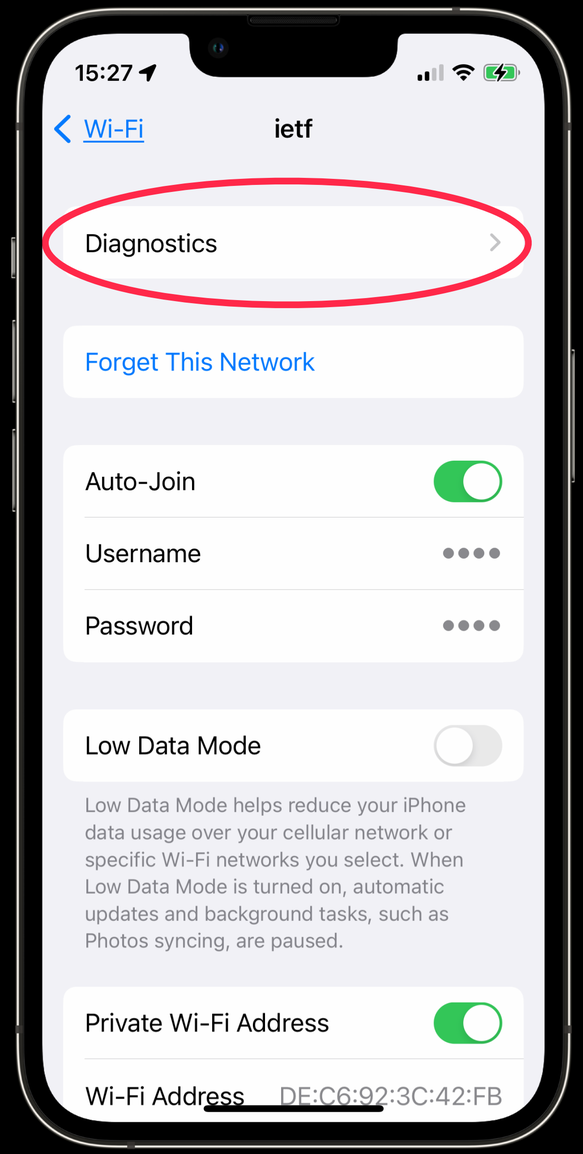

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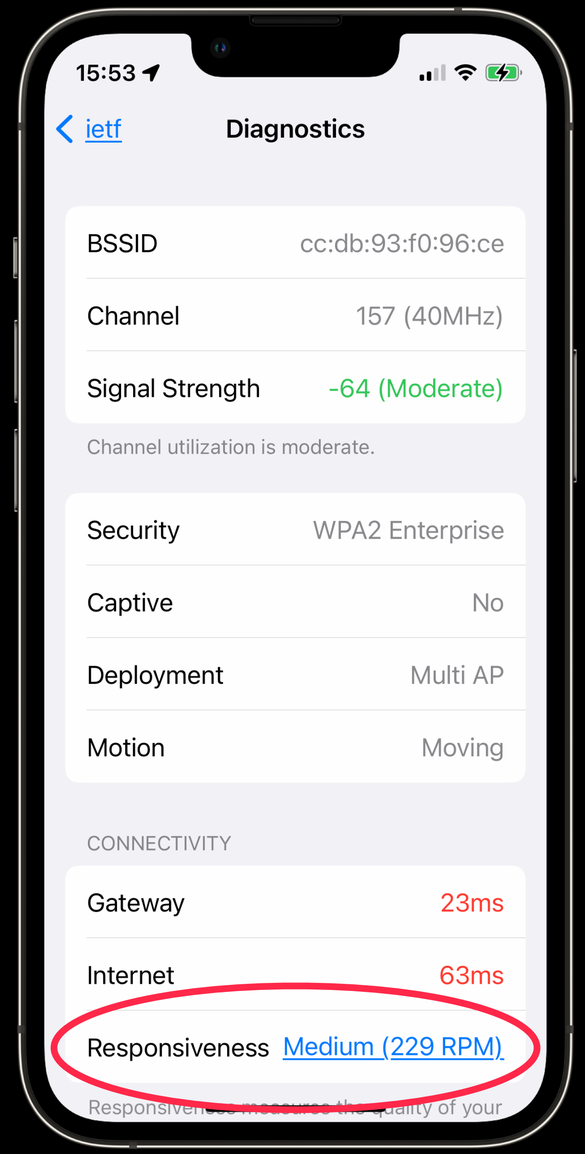
Responsiveness in RPM (Round-trips Per Minute)

To calculate RPM,
divide one minute (60,000 milliseconds)
by round-trip time (in milliseconds)

More is better:

- 60 RPM means one-second round-trip time
- 6000 RPM means 10 ms round-trip time



Latency: How to Measure It

Waveform Bufferbloat test

- https://www.waveform.com/tools/bufferbloat

goresponsiveness, Professor William Hawkins, University of Cincinnati

- https://github.com/network-quality/goresponsiveness

Latency: How to Measure It

Ookla

Speedtest app and web site

- https://www.speedtest.net/
- https://www.ookla.com/articles/introducing-loaded-latency

Try this for yourself!

- In your hotel at the IETF meeting
- Using LTE or 5G
- At your home
- At your work, school, or university

Latency: What to Do About It

https://www.l4s.net/

L4S: Low Latency Low Loss Scalable throughput

Keeps network queues short,
to keep working latency similar to idle latency

When queue starts to form at bottleneck link,
bottleneck router sends immediate ECN feedback
to tell sender to slow down

IETF 114 Hackathon

Lots of companies, lots of people, lots of equipment!

Apple, Cablelabs, Casa, Charter,
Comcast, CommScope, Google,
Kyrio, Meta, Netflix, Nokia, Nvidia

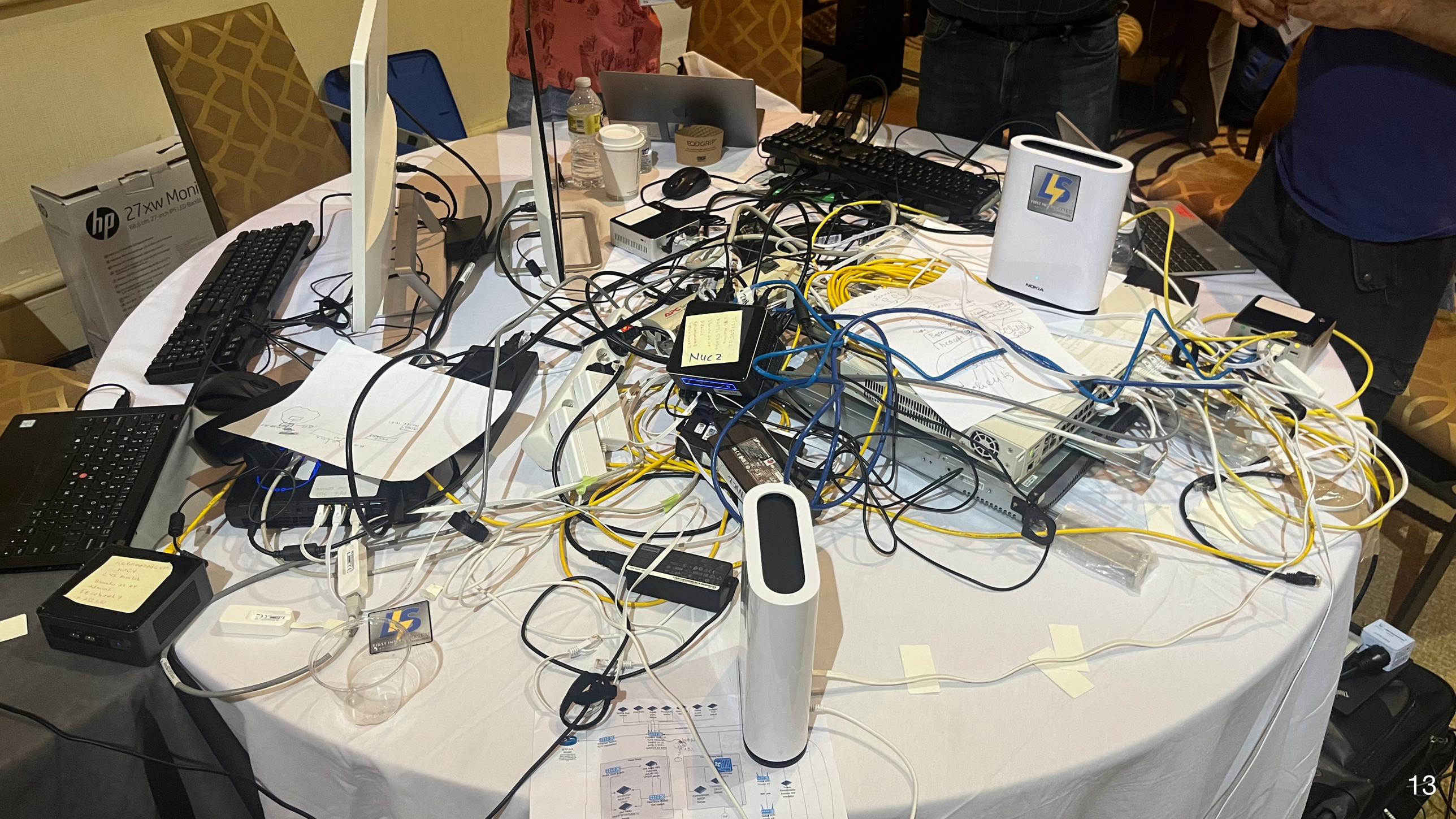
Bob Briscoe, Nick Feamster, Richard Scheffenegger

Thanks to:
Charles Eckel, Cisco & Barry Leiba, Futurewei
China Internet Network Information Center (CNNIC)


E6000


L4S

L4S
CM-5 PORT9
AC ADAPTER
intel
STAPLES


27xw Moni
Nuc2
NOKIA

Learn More

BITAG Report: Latency Explained

- https://www.bitag.org/latency-explained.php

Apple WWDC 2022: Reduce networking delays for a more responsive app

- https://developer.apple.com/videos/play/wwdc2022/10078/

Get Involved

L4S: Low Latency Low Loss Scalable throughput

- Monday 17:30-18:30 Hackdemo Happy Hour

Measurement

- Responsiveness under Working Conditions
  - draft-ietf-ippm-responsiveness
- Friday 12:30-14:30 IP Performance Measurement (IPPM)

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