## **Network Latency** Why it matters, how to measure it, what to do about it

Stuart Cheshire, Apple HotRFC IETF 114, Philadelphia Sunday 24<sup>th</sup> 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

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#### 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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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

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	15:53 🕇	.ıll 穼 🛃
<	etf Diagnostics	
	BSSID	cc:db:93:f0:96:ce
	Channel	157 (40MHz)
	Signal Strength	-64 (Moderate)
	Channel utilization is moderate.	
	Security	WPA2 Enterprise
	Captive	No
	Deployment	Multi AP
	Motion	Moving
	CONNECTIVITY	
	Gateway	23ms
	Internet	63ms
(	Responsiveness	<u>Medium (229 RPM)</u>
	Responsiveness met	course the quality of your





# 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

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### 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

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## 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

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Sunday 24th July 2022



### ETF 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)

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![](_page_10_Picture_0.jpeg)

![](_page_11_Picture_0.jpeg)

![](_page_11_Picture_1.jpeg)

![](_page_12_Picture_0.jpeg)

# 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/

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![](_page_13_Picture_6.jpeg)

# Get nvo vec

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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![](_page_14_Picture_11.jpeg)

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