Quality of Outcome

A Simulation study of Quality of Outcome scores in challenging network conditions

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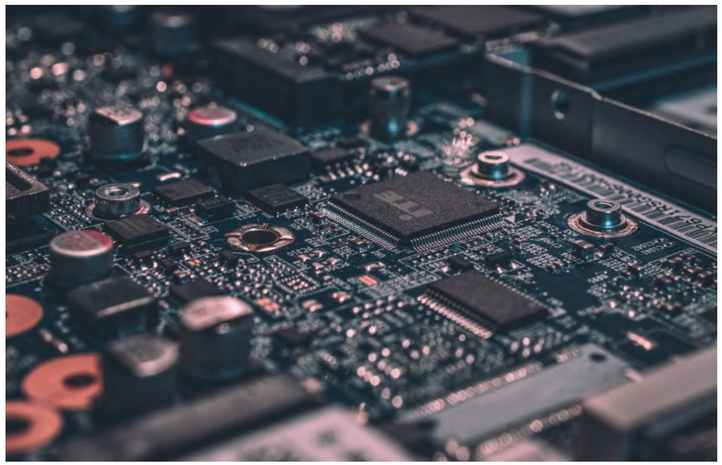
Agenda

- What is Quality of Outcome?
- Simulation study → understanding engineering best practices

Quality of Outcome:
One Network Quality framework - three audiences



Vendors and Operators

Precision

Repeatability

Composability

Applications

Want network to not cause problems

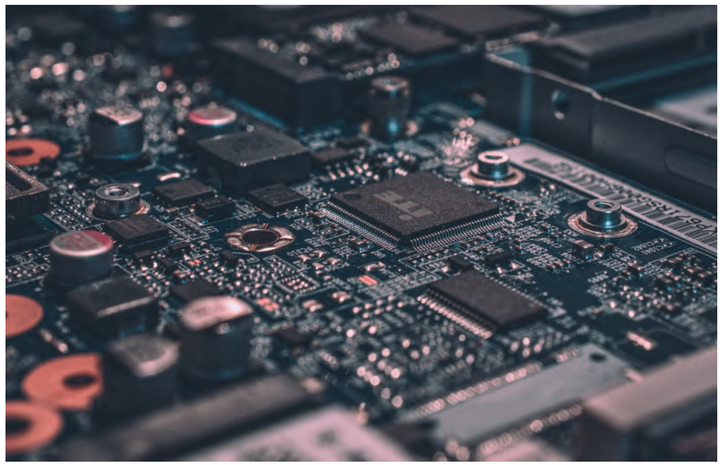
Want to help the end user succeed

The end user

Is the network causing problems?

If yes, how do I fix it ASAP

Quality of Outcome:
One Network Quality framework - three audiences



Vendors and Operators

Precision

Repeatability

Composability

Quality attenuation (TR-452.1)

Applications

Want network to not cause problems

Want to help the end user succeed

Expected stability + root cause analysis

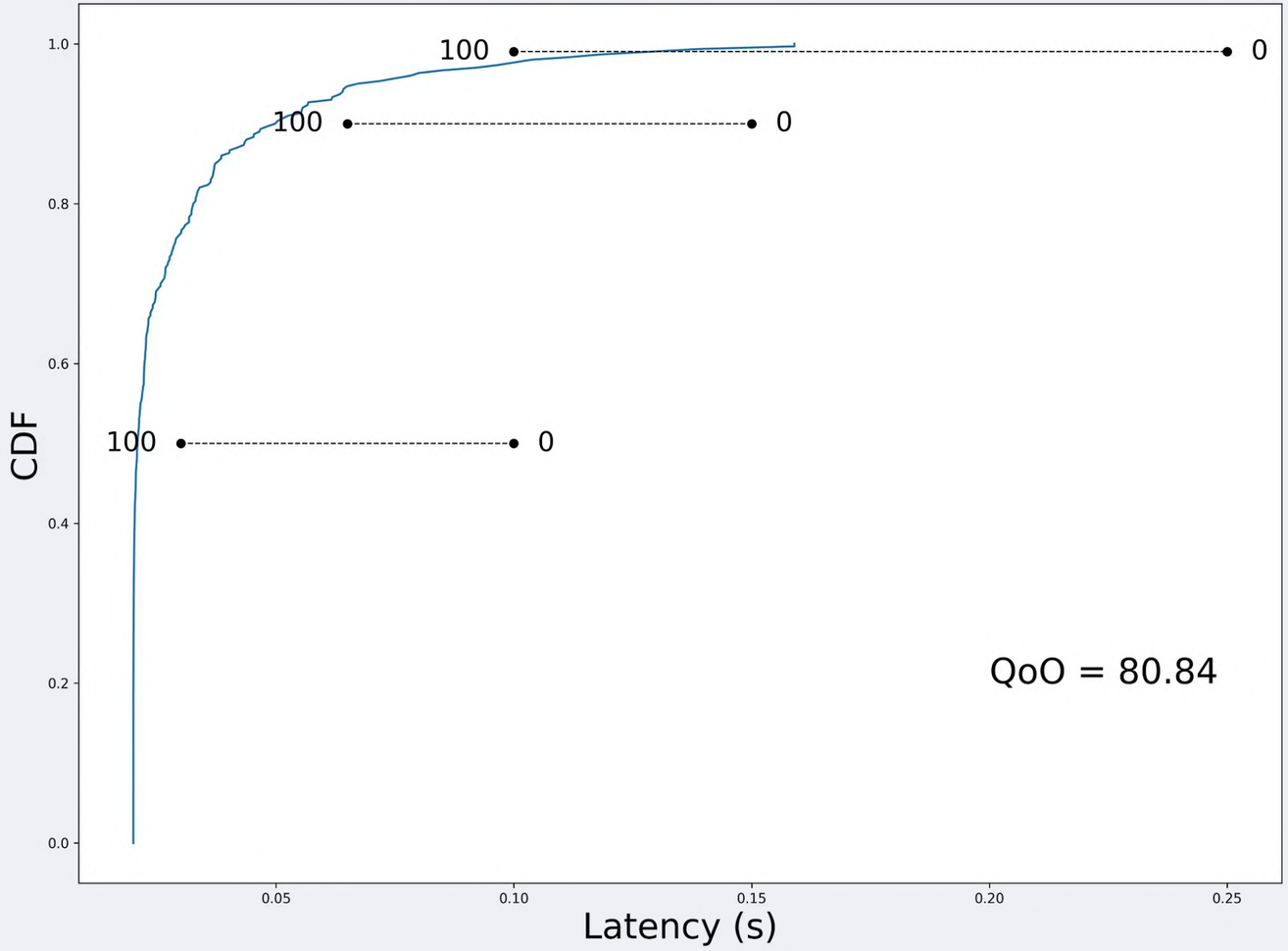
The end user

Is the network causing problems?

If yes, how do I fix it ASAP

QoO score + root cause analysis

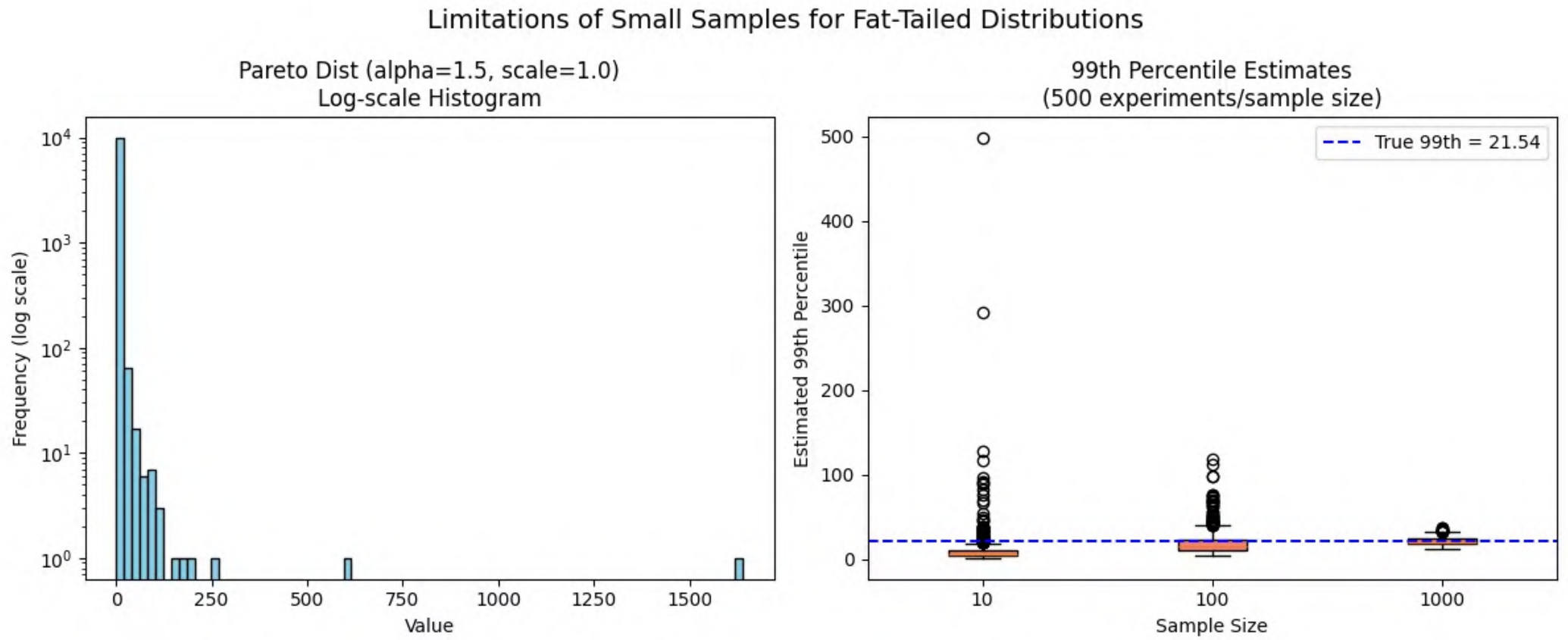
Example

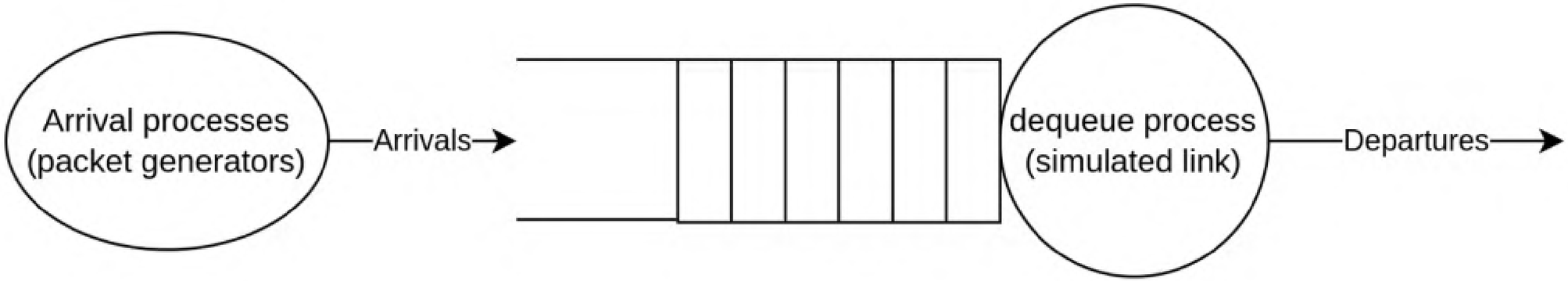

100
0
100
0
100
0
CDF
Latency (s)
QoO = 80.84
1.0
0.8
0.6
0.4
0.2
0.0
0.05
0.10
0.15
0.20
0.25

Simulation study

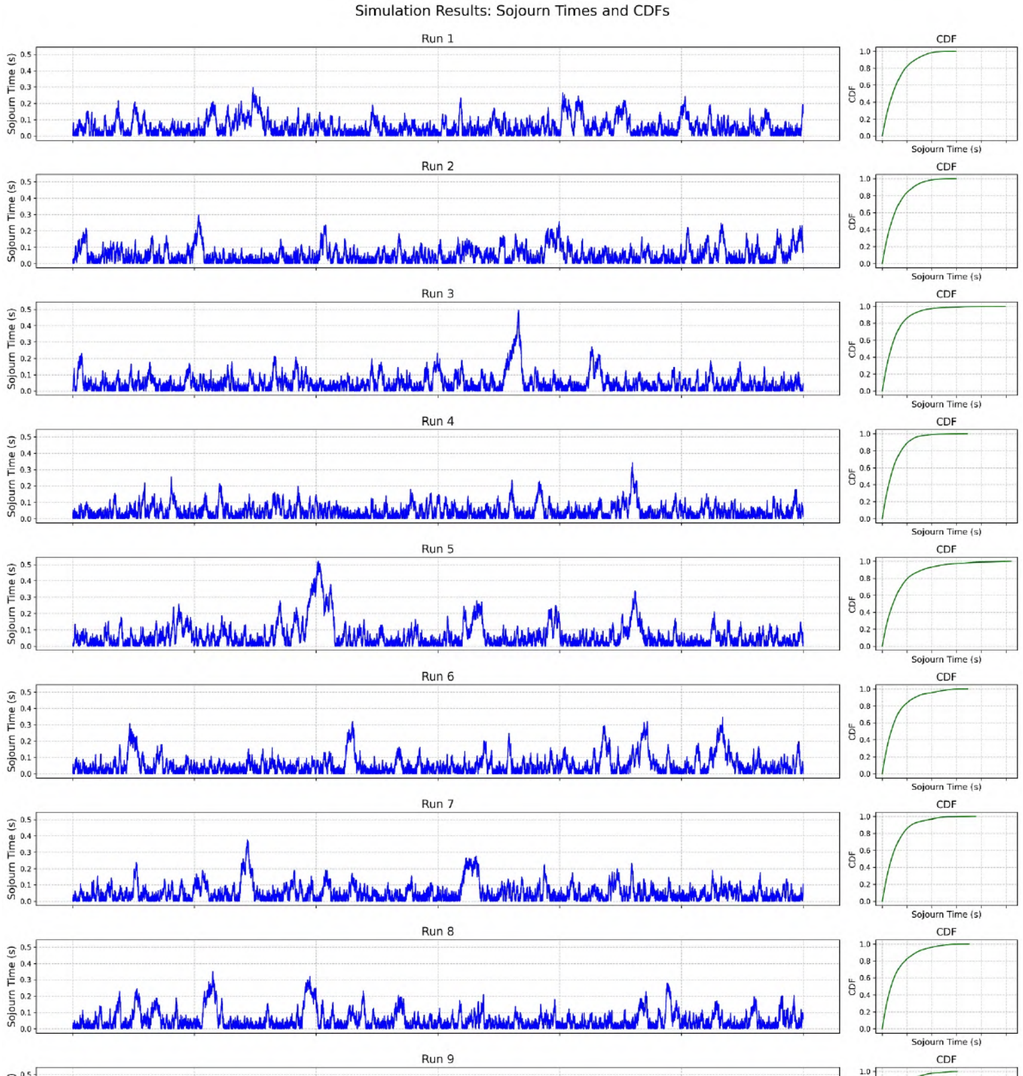
- Simulation study of QoO in specific challenging network scenarios
  - Open source implementation, here: https://github.com/domoslabs/qoosim
- Goal: Document how QoO is affected by engineering decisions, such as:
  - Sampling rate
  - Sampling accuracy
  - Application requirement details
  - Number of samples (measurement duration)

General property of fat-tailed distributions: Small samples tend to under-estimate the tail

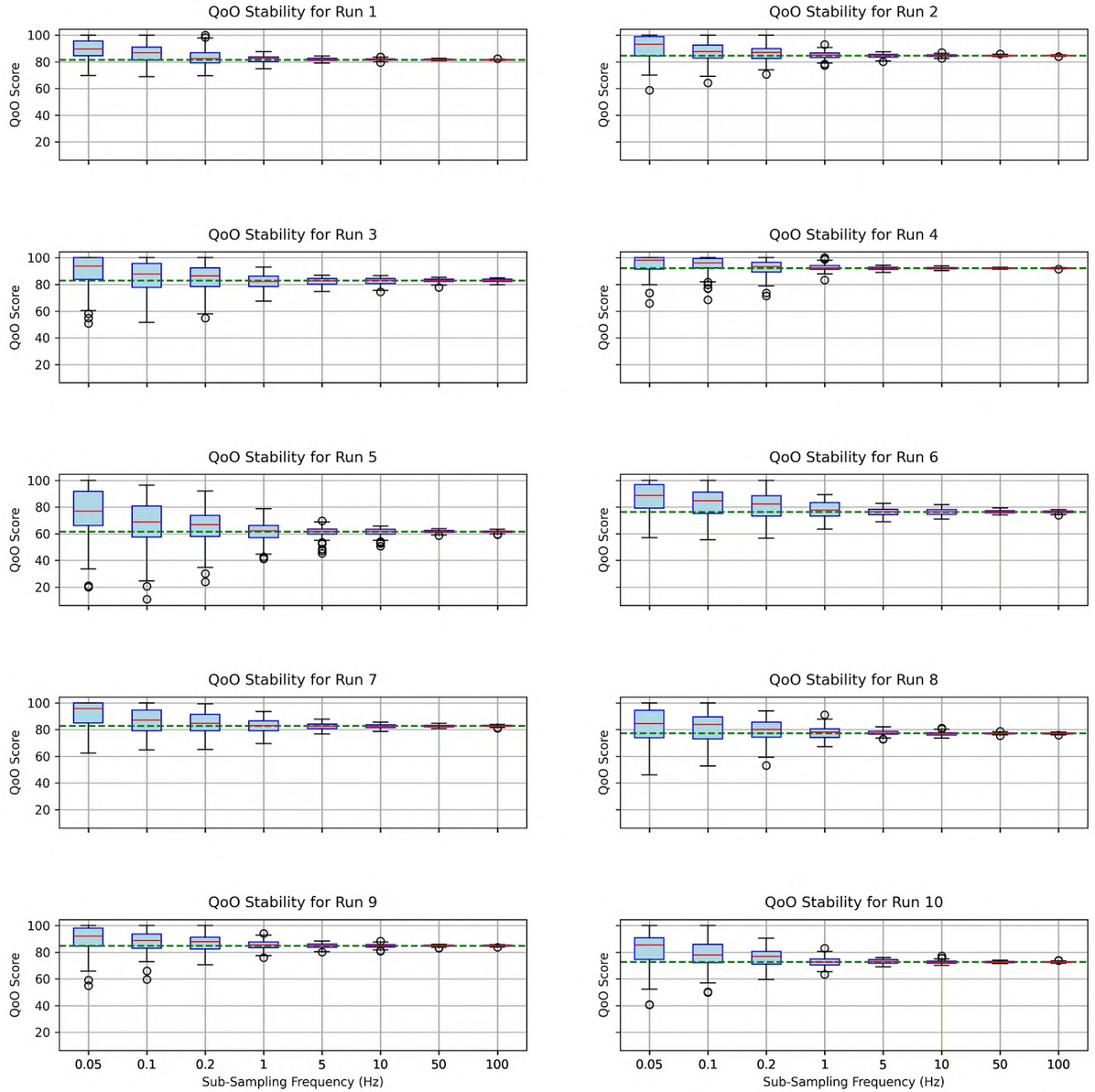



Arrival processes
(packet generators)
Arrivals
dequeue process
(simulated link)
Departures

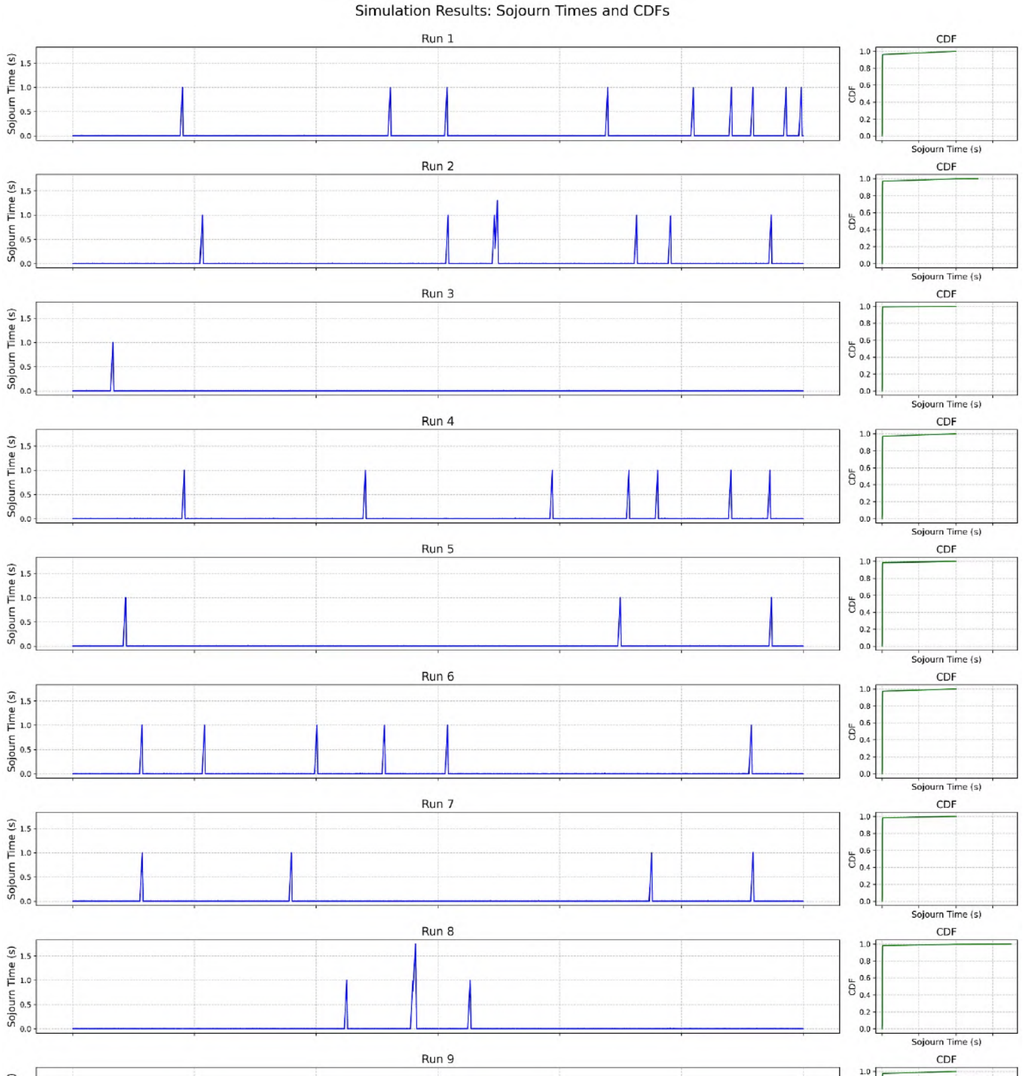
Sampling rate implications for QoO: WiFi

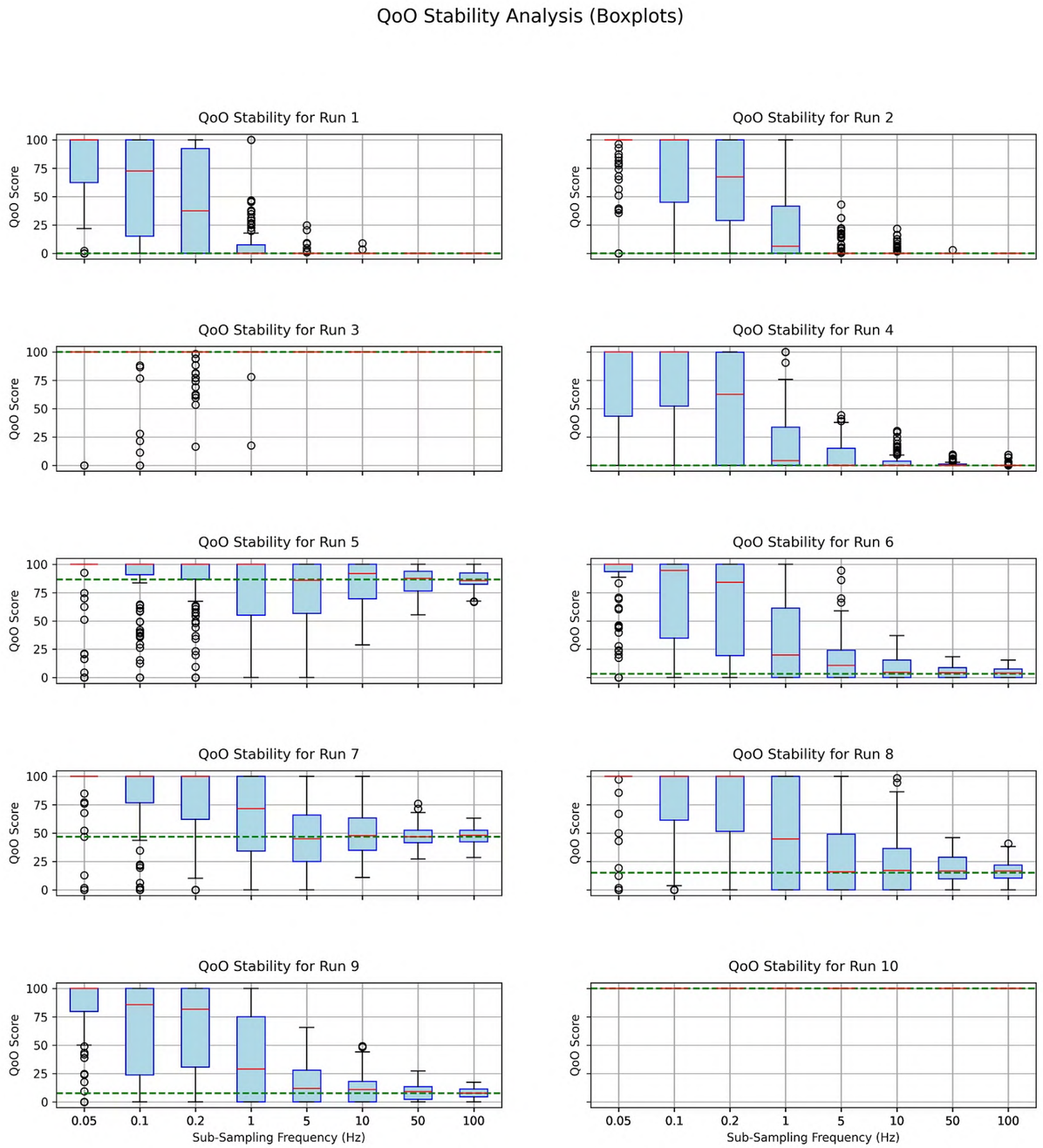


QoO Stability Analysis (Boxplots)

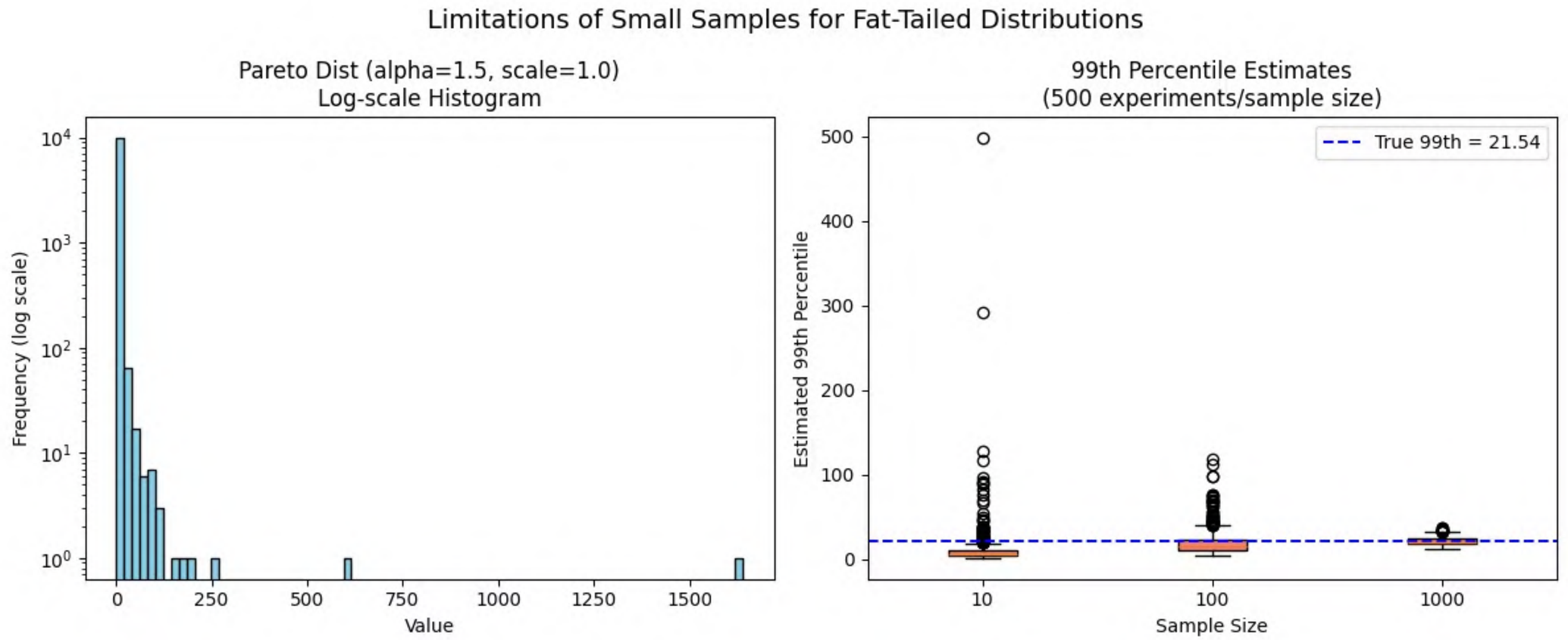


Sampling rate implications for QoO: Service outage





General property of fat-tailed distributions: Small samples tend to under-estimate the tail



Conclusion

- It is important to choose the correct sampling parameters for QoO
- What "correct" means in this case depends on your use-case.
  - What kind of network problems are you looking to detect?
  - What is the time-horizon of your measurements?
  - How accurate do the QoO scores need to be?
- We have presented simulated data, and open-sourced the simulation tool..
  - .. and hope to help implementers make the right decisions

Thank you!

Bjørn Ivar Teigen Monclair

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