

# Quality of Outcome

Towards a network quality framework useful for applications, users and network operators

**DOMOS**

# Proposed Solutions

<https://datatracker.ietf.org/doc/draft-teigen-ippm-app-quality-metric-reqs/>

<https://datatracker.ietf.org/doc/draft-olden-ippm-qoo/>

# Requirements for a Network Quality Framework Useful for Applications, Users, and Operators

## Objective

- To outline the essential features and attributes a network quality framework must have for various stakeholders.

## Stakeholders

- Application Developers
- End-Users
- Network Operators and Vendors

## Needs by Stakeholder

- **End-Users:** Require an understandable network metric
- **Application Developers:** Need a metric to evaluate application performance based on network conditions
- **Network Operators and Vendors:** Seek a metric for troubleshooting and network optimization

## Current Limitations

- Existing frameworks often cater to only one or two stakeholder groups
- A comprehensive solution that addresses all stakeholder needs is currently lacking

# Building on top of TR-452 (QED)

- Mathematical framework for network quality
- Network Quality is how latency distributes at different loads
- Captures jitter, peaks, packet loss..
- Composable
- Useful throughout the life cycle
- Can describe complex networks and requirements



## TR-452.1 Quality Attenuation Measurement Architecture and Requirements

Revision 1  
Date: September 2020

# Finding a middleground

## Quality of Experience

MOS, NPS, gMOS, ....



Subjective, unreliable

## Quality of Outcome

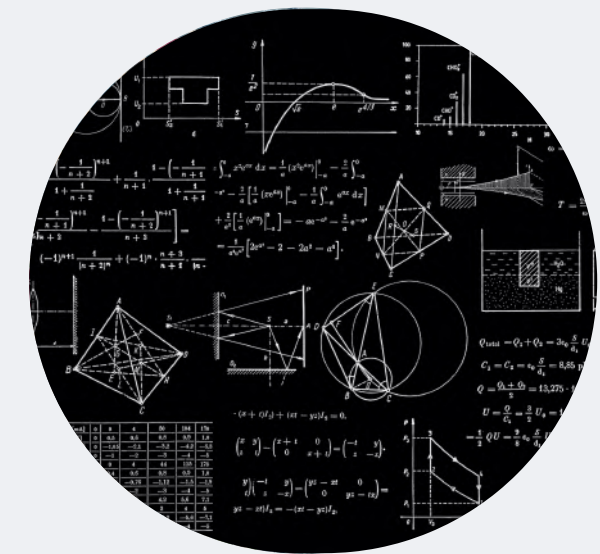
What is the likelihood of perfect video conference?



Objective, reliable

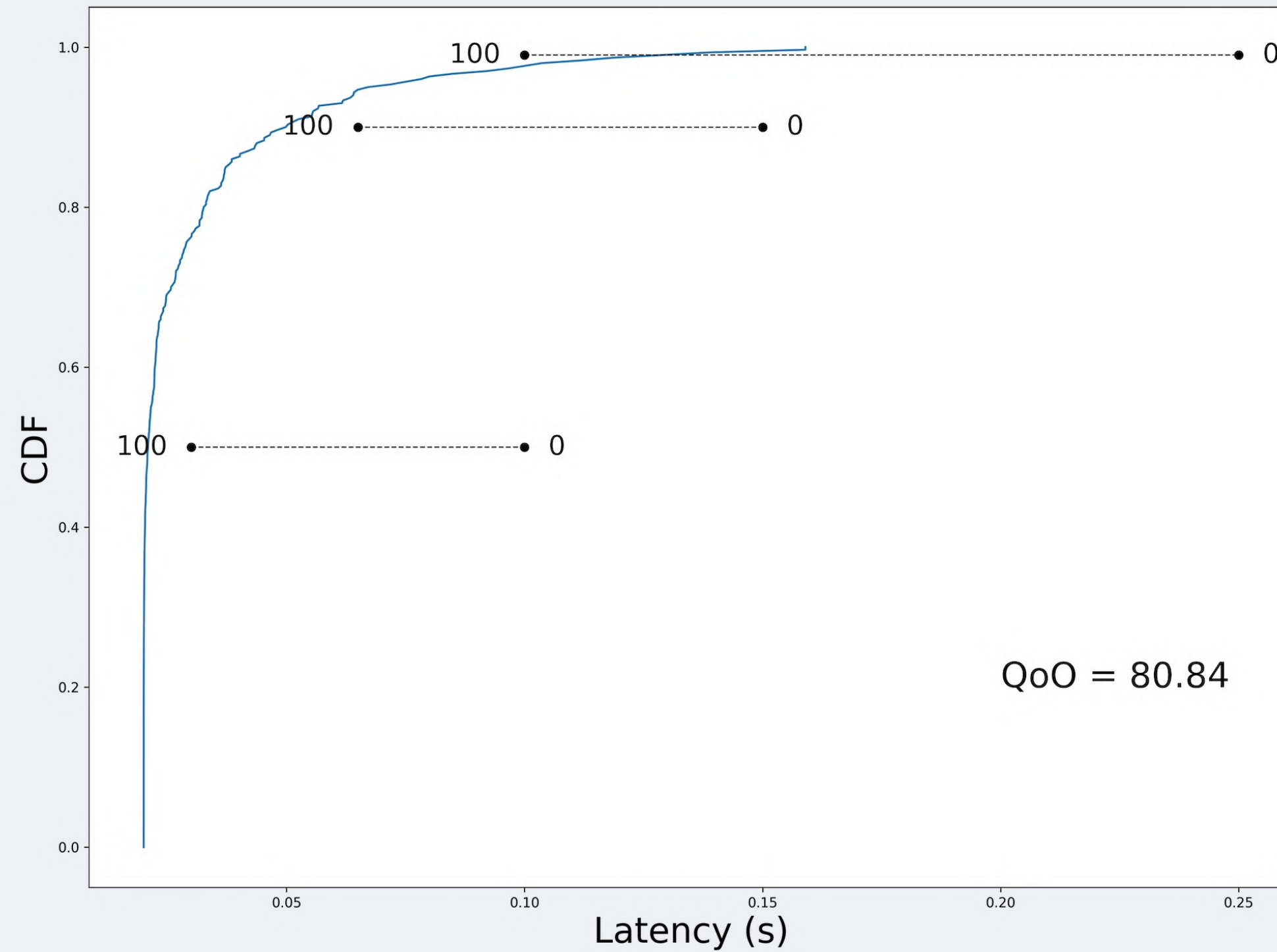
## Quality of Service

Bandwidth, latency (in many forms), packet loss



Complicated, unrelatable

# Example



# Implementation status

## qoo-c

Quality of Outcome is a network performance metric. QoO scores are calculated by comparing network measurements to application requirements. The network measurements are Quality Attenuation measurements as specified in [TR-452.1](#) from the Broadband Forum, but excluding the computation of G, S, and V.

TR-452.1 can be found here: <https://www.broadband-forum.org/technical/download/TR-452.1.pdf>

This tool can:

- Compute Quality Attenuation summaries from latency and packet loss measurements
- Compute [Quality of Outcome](#) scores, and several other performance metrics such as [RPM](#)

How to use:

1. Create a `sqa_stats` data structure and add latency and packet loss samples.
2. Calculate RPM, QoO, or any of the other quality metrics.

```
Starting: /home/bjorn/go/bin/dlv dap --listen=127.0.0.1:37751 --log-dest=3 from /home/bjorn/DonosLabs/goresponsiveness
DAP server listening at: 127.0.0.1:37751
Type 'dlv help' for list of commands.
07-20-2023 09:17:13 UTC Go Responsiveness to mensura.cdn-apple.com:443...
Download: 136.105 Mbps ( 17.013 MBps), using 8 parallel connections.
Quality Attenuation Statistics:
Number of losses: 0
Number of samples: 1669
Loss: 0.000000 %
Min: 0.033647 s
Max: 1.280975 s
Mean: 0.294922 s
Variance: 0.031772 s
Standard Deviation: 0.178248 s
PDV(90): 0.506033 s
PDV(99): 0.865317 s
P(90): 0.539680 s
P(99): 0.898964 s
RPM: 203
Gaming QoO: 0
Download RPM: 167 (P90)
Download RPM: 960 (Single-Sided 5% Trimmed Mean)
```

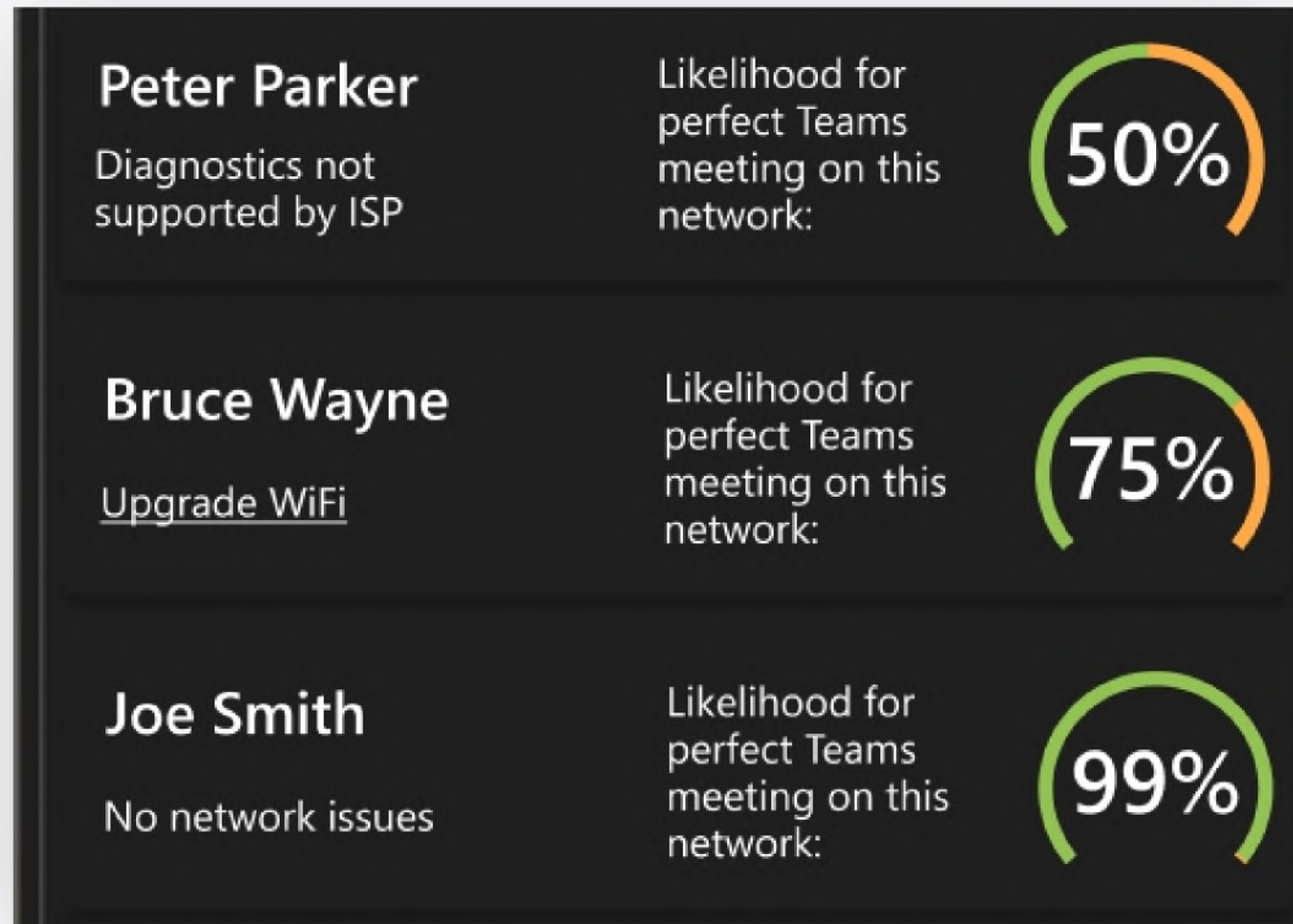
## qoo-c

C library for calculating QoO scores based on latency measurements and requirements

## goresponsiveness

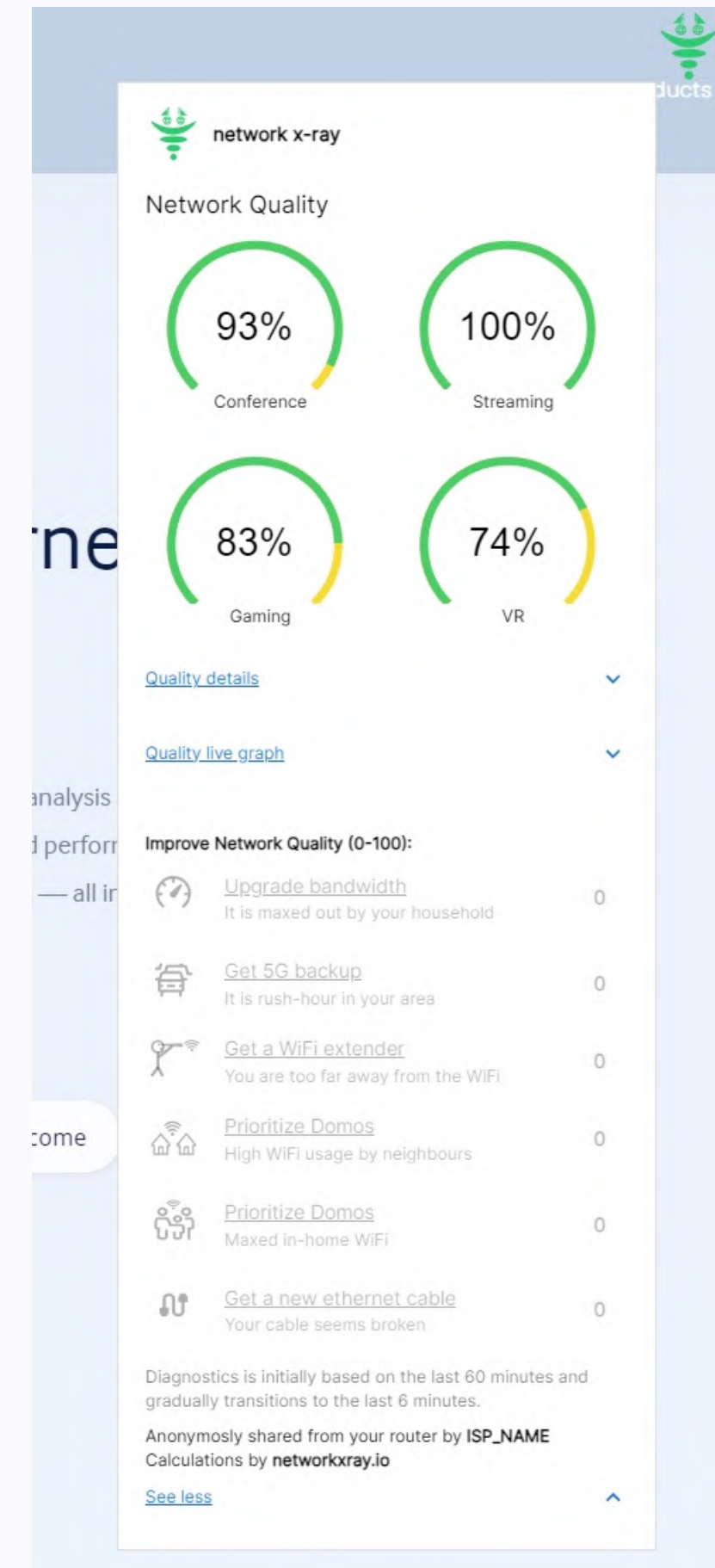
Network Quality test in Go.

## Teams:



- Clear indication of network quality across the call for ALL participants
- Easily relatable: Probability of perfect experience
- Team and IT no longer in the dark where on the call the productivity issue lies

## Chrome:





**We propose a working group adoption call**

Contributions and criticism welcome!

**Thank you!**

**Call to Action: Get in touch and contribute!**

**bjorn@domos.ai**  
**magnus@domos.ai**