KEYSIGHT

Y.Testbed: Framework showcase and Example evaluation

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UNIVERSIDAD
DE MÁLAGA

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QoS vs. QoE

Throughput comparison

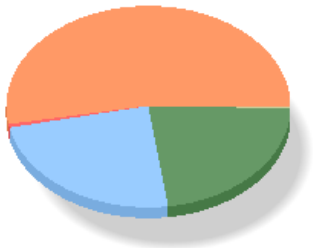
- Keysight Nemo Outdoor SW with Application Test Automation option
- Tests are run on a Samsung SM-S906B device (S22+ 5G)
- DL bulk data transfer + MS Teams audio quality (POLQA v3)
- 2 Finnish operators

	Operator 1	Operator 2	Comparison
Average DL Application Throughput	68.9 Mbps	109.4 Mbps	+59%
Max DL Application Throughput	221 Mbps	792 Mbps	+258%
Average MS Teams Start Delay	0.65 s	0.45 s	-31%

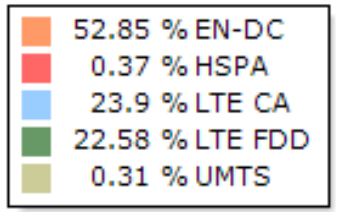
Operator 1

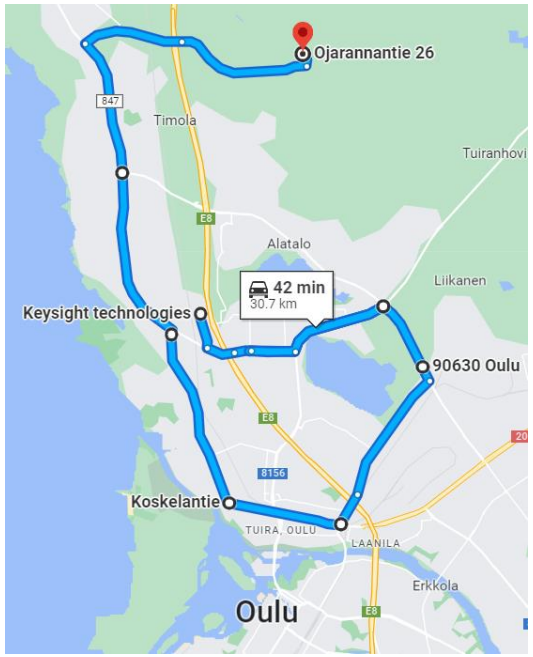
Total samples: 2346730

Operator 2



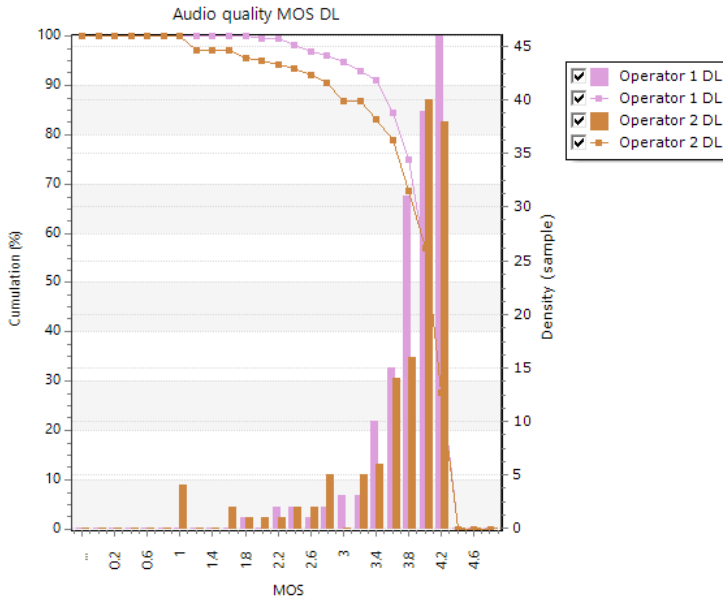
Total samples: 2239566





QoS vs. QoE

MS Teams Audio Quality



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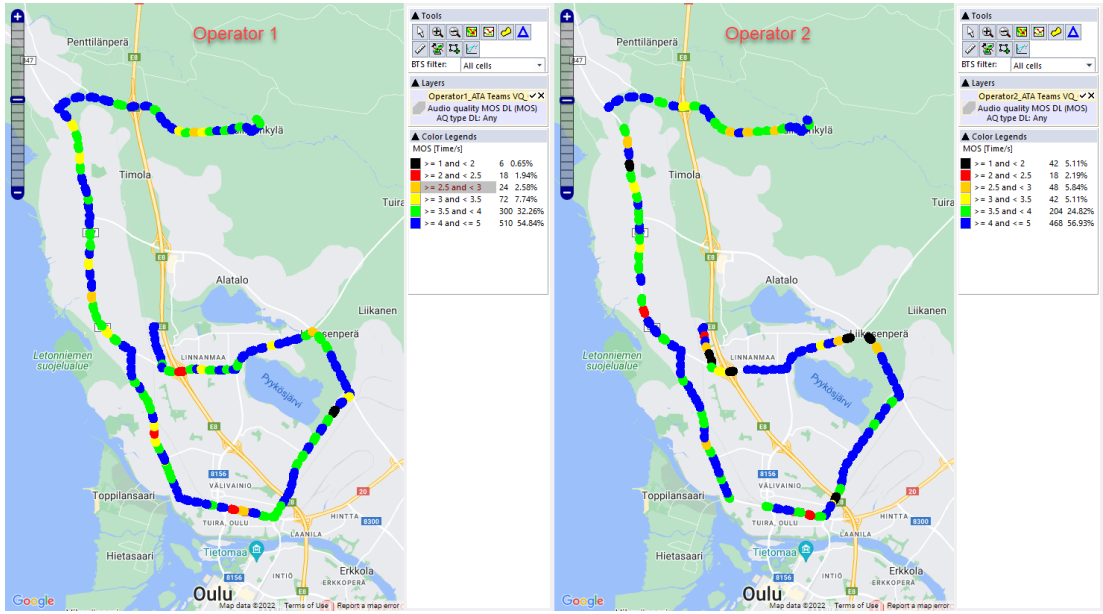
Average MS Teams Start Delay	0.65 s	0.45 s	-31%
Average DL MOS POLQA v3	3.9	3.7	-5%
Average UL MOS POLQA v3	4.1	3.8	-8%
Conference Start Success Rate	100%	100%	0%

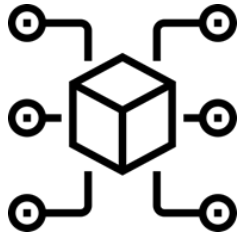
User Experience tells a different story!

- Operator 1: better audio quality (QoE)
- Operator 2: faster network (QoS)



QoS vs. QoE

QoS



- Network-centric perspective
- Objective, reasonably well defined
- Defined on specific application settings
- Typically, not computationally demanding
- Can be measured with synthetic traffic

QoE

- User-centric perspective
- Subjective and hard to define and model
- Defined on classes of applications
- Can be computationally demanding
- Measured with real application

Y.Testbed

The Reason To Exist

Virtual Reality

Content Distribution

Augmented Reality

Live casting

Patient Monitoring

E-gaming

Telemeeting

Smart Metering

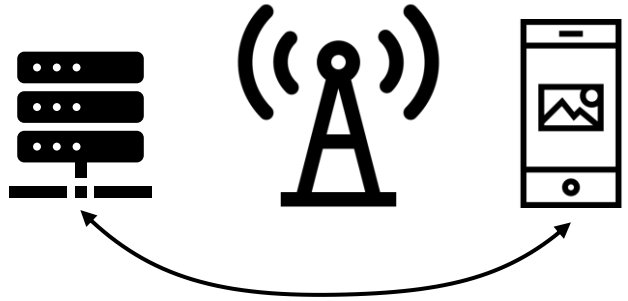
Connected Vehicles

Look coherently at all the 5G&B use cases

Supported by Nemo Outdoor

New release!

Focus on commercial applications

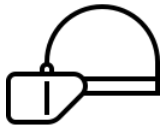


Look at real end-to-end performance

Test use cases in multiple NGMN scenarios

The Process Illustrated

Test Cases → Measurements → KQIs → KQI Score → KQI Score Aggregation



Virtual Reality

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...

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Measurement Process

Test Case: Content Streaming

Execute user flow in the App, while collecting Network and App KQIs

Measurement points
Application starts
Application closed
Video requested
Video starts
Video stops
Freeze start
Freeze end
Resolution/encoding change
…

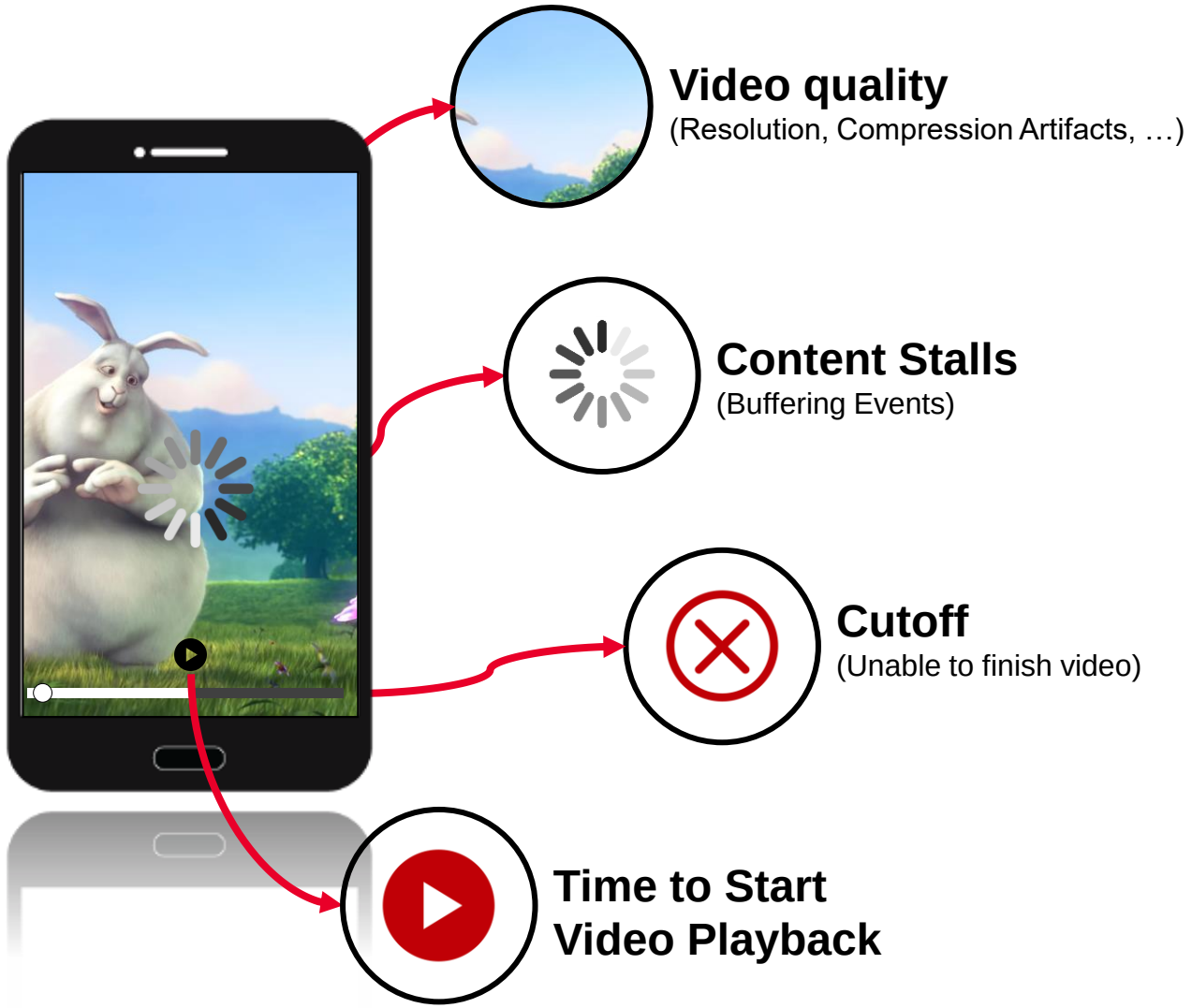
Measurements can be passive (external tools) or active (made by the application itself)

Key Quality Indicators

Test Case: Content Streaming

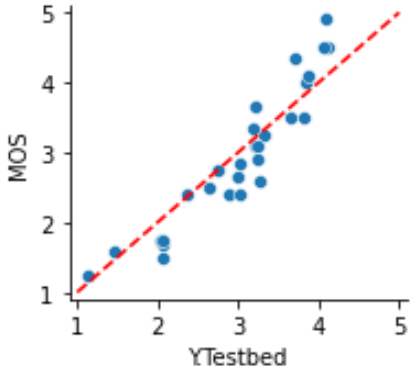
- Estimate the QoE based on the real application events.
- The KQIs are normalized and weighted according to human panel data

KQI	MOS: 1	MOS: 5
Time to load first frame (s)	10	0
Playback cutoff (bool)	1	0
Content stall ratio (%)	60%	0
Video vertical resolution (px)	144	1440

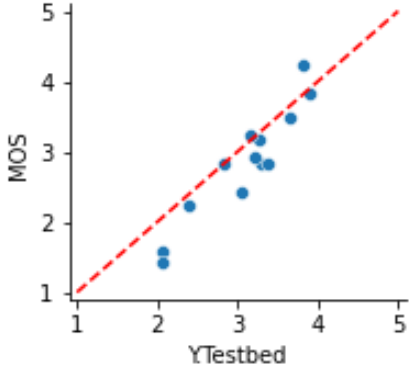


Performance

Train set



Test set



Y.Testbed

- ⚠ KQIs are not always straightforward to obtain
- ✓ The model operates directly on user-level features
- ✓ Good performance
- ✓ Good generalization performance

	Metric range	Train set	Test set
RMSE	[0, 4]	0.373	0.381
Pearson R	[-1, 1]	0.938	0.942
Spearman R	[-1, 1]	0.934	0.860

Conclusions

Y.Testbed Framework

QoS vs. QoE:

- Network metrics can be misleading
- Modern applications dynamically adapt to the network: hard to model
- User-level KQIs hardly change among applications of the same type

Y.Testbed:

- Single framework for 5G/6G services
- Solid academic and industrial background
- Adopted by NGMN
- Preliminary results are promising

Next steps:

- Contribute to Y.Testbed work item
- Extend content streaming use case
  - More comprehensive dataset
  - Larger human panel
- Include more use cases
  - Telemeeting
  - Gaming
  - VR/AR
  - …