

ENHANCING OVER-THE-TOP (OTTS) SERVICE QUALITY AND CONNECTIVITY ASSESSMENT IN MOBILE NETWORKS

ITU Workshop on "Telecommunication Service Quality"
Freetown, Sierra Leone, July 2025

ROHDE & SCHWARZ

Make ideas real



COMPANY RESTRICTED

USE CASES AND PLAYERS WITH 5G (AND 6G)



- ▶ **Not just more 'apps'**
- ▶ **Growth in all dimensions: services, users and networks**

- ▶ 5G use cases become interactive and real-time
 - ▶ Trend towards VR and real-time video in many applications
 - ▶ Remote meetings
 - ▶ Real-time remote control
e.g. smart home, smart factories, drone control etc.
- ▶ Non-human use cases arising
 - ▶ Machine communication
 - ▶ Surveillance, sensors
- ▶ New players / networks
 - ▶ Mission critical / First Responder networks
 - ▶ Tactical 3GPP networks
 - ▶ Large scale private network (harbors, mines, railway companies etc.)

EXPECTED MAJOR TRENDS IN 5G MOBILE NETWORKS

▶ Telephony / conferencing

- Stays a relevant service
- **OTT VoIP** to be replaced by native 5G telephony
- Telephony e

▶ **High reliability**

▶ **Short data latencies**

▶ **Secure communication**

▶ **Sufficient data rate**

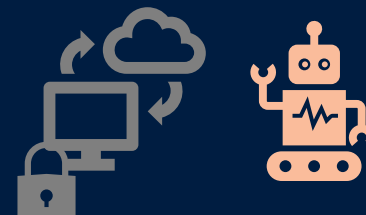
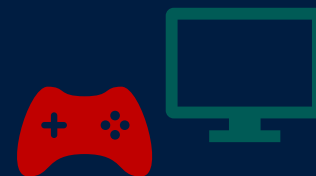
▶ **Resilient architecture and operation**

▶ Media / Web c

- Streaming s
- Online and

▶ Fast and reliable

- **Connected cars, smart home, smart factories**
- **Private 5G networks (reliability!)**
- **First responder and tactical radio move to 4G/5G (resilience!)**
- **Financial services (security!)**



EVALUATION OF NETWORK PERFORMANCE

HOW TO TEST AND MEASURE?

End-user service tests *'APP' testing*

Measures real user perception
Multiple KPIs with one test
Many apps for the same service (e.g. messaging)
Depends on 3rd party back-ends and software
Encrypted data ('black box')

Emulation of services *'Proxy' testing*

Emulates data streams as in real services (e.g. video stream)
Self-hosted and defined backend
Results considered as generic
Transparent data transfer ('glass box')
No exact one-to-one relation to '3rd party' apps

Technical performance *'pure data transfer'*

Measuring upper capacity limit (aka 'speed tests')
Pure functionality tests (e.g. PING)
Simple and widely available
Transparent data transfer
Very technical focus, limited relation to end-user applications

► All three test approaches are required for a full performance evaluation and enabling optimization potential

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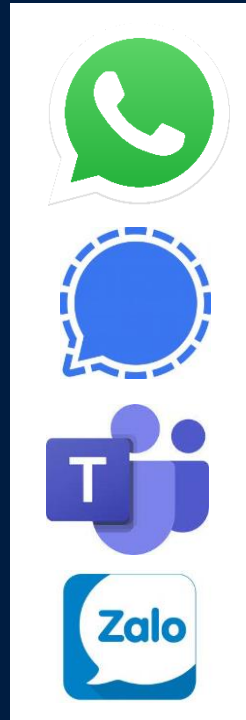
Encrypted data ('black box')

▶ How to minimize the drawbacks?

- ▶ Focus on the most popular and mature App's for one service type
 - ▶ e.g. WhatsApp, Signal and MS Teams for VoIP
 - ▶ e.g. YouTube, TikTok, and Facebook Reels for video
- ▶ Computing the 'same' KPIs for all App's of one type
- ▶ Focusing on main data flow (video, voice, signaling)
- ▶ Obtaining data flow details by means of statistics and AI-based intelligence

VOIP APP TESTS FOR BENCHMARKING MUCH MORE THAN WHATSAPP

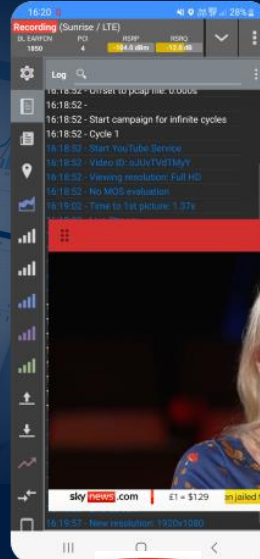
- ▶ RS MNT supports and measures with the real OTT VoIP app
 - ▶ RS MNT analyzes the real voice stream for OTT VoIP
-
- ▶ The classical one: **WhatsApp** (voice and messaging)
 - Always supporting the latest version
 - WhatsApp releases a new audio codec ('Mlow') → We do support it.
 - ▶ The 'good' one: **Signal** (voice and messaging)
 - More privacy than WhatsApp, available in regions where WhatsApp is banned
 - ▶ The 'business' one: **MS Teams** (voice and messaging, video sharing)
 - ▶ The 'local' one: **Zalo** (voice and messaging) → Vietnamese market



VIDEO APP TESTS FOR BENCHMARKING MUCH MORE THAN YOUTUBE

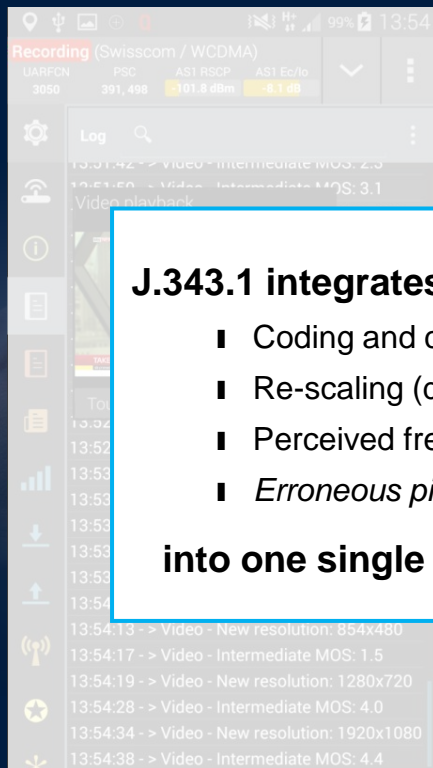
- ▶ RS MNT measures by analyzing the video frames in real-time
- ▶ The same measurement approach to all services → Results can be directly compared

- ▶ The classical one:
 - **YouTube Video**
 - *Successful for >10 years*
- ▶ ...more popular services
 - **Facebook Video**
 - **Facebook Reels**
 - **TikTok Video**
 - **Instagram Video**



REAL TIME TESTING OF VIDEO STREAMING

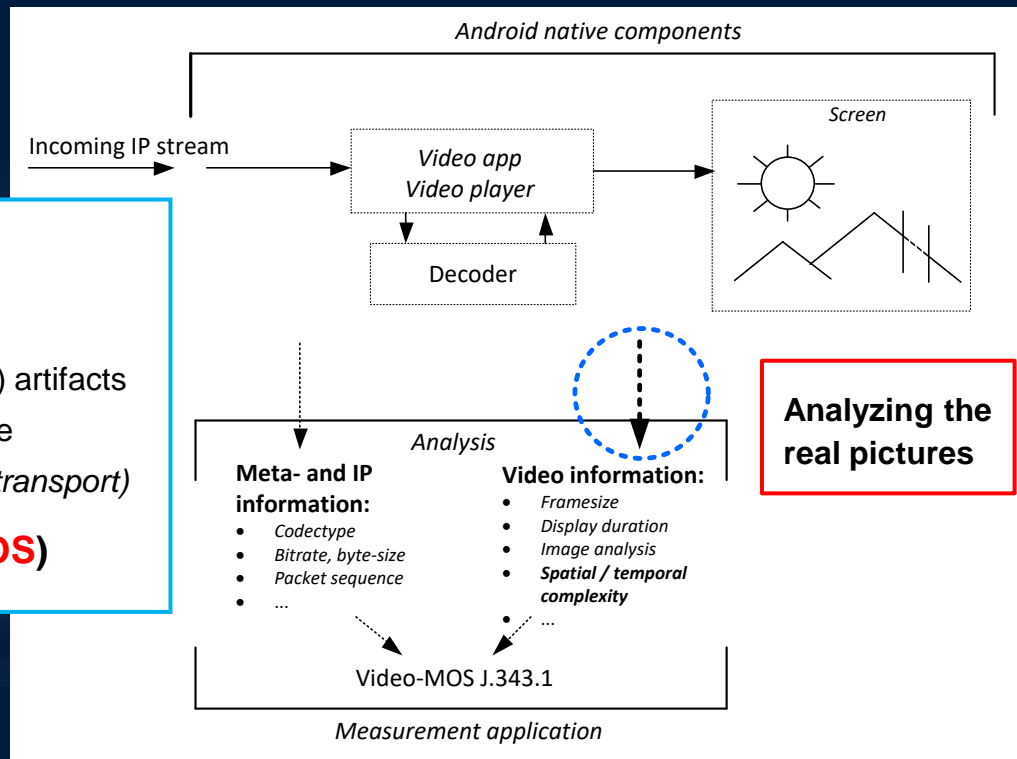
MEASURING VISUAL QUALITY WITH J.343.1 ON A SMARTPHONE



J.343.1 integrates

- Coding and compression effects
- Re-scaling (down- and upscaling) artifacts
- Perceived freezing and frame rate
- *Erroneous pictures (if unreliable transport)*

into one single score (**Video-MOS**)



R&S TEST CASES REFLECT USE OF NETWORKS

P2P direct real-time connection

Telephony

- 2G/3G Call
- VoLTE Call
- VoNR Call
- WhatsApp (VoIP)
- Signal (VoIP)
- MS Teams (VoIP)

Video telephony

Video sharing

- WhatsApp video call
- MS Teams video sharing
- WhatsApp Video availability

Focus on mobile-to-mobile

Receiving / sending media w/ motion, real-time

Streaming media

- YouTube Full HD
- YouTube 4K
- Facebook Video
- Facebook Reels
- TikTok video
- Video uplink simulation

Up- or download files

Messaging

- SMS/RCS messaging
- WhatsApp messaging
- Signal messaging
- MS Teams Chat

Social media

- Browsing
- Facebook Posting
- Instagram Posting
- Twitter Posting
- Dropbox Up- / Download

File transfer

- HTTP file transfer
- FTP file transfer

Content delivery Transport performance

Data speed

- HTTP/TCP Capacity
- FTP Capacity
- UDP Capacity

Transport latency

- UDP Stream (latency)
- Interactivity (latency) (ITU-T G.1051)

Transport continuity

- UDP Stream
- iPerf3

EVALUATION OF NETWORK PERFORMANCE

TYPICAL USE CLASSES IN PUBLIC NETWORKS

*P2P direct
real-time connection*

Telephony

*Continuous transfer
of media, real-time*

**Streaming media
Online gaming**

Up- or download files

**Messaging
Browsing
Social media
File transfer**

*Content delivery
Transport performance*

Data speed

Different technical focusses on transport

► *Evaluation of performance must cover all aspects of network use*

PERFORMANCE SCORE



NPS v3 COVERS ALL USE CASE CLASSES

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SCORING NETWORK PERFORMANCE

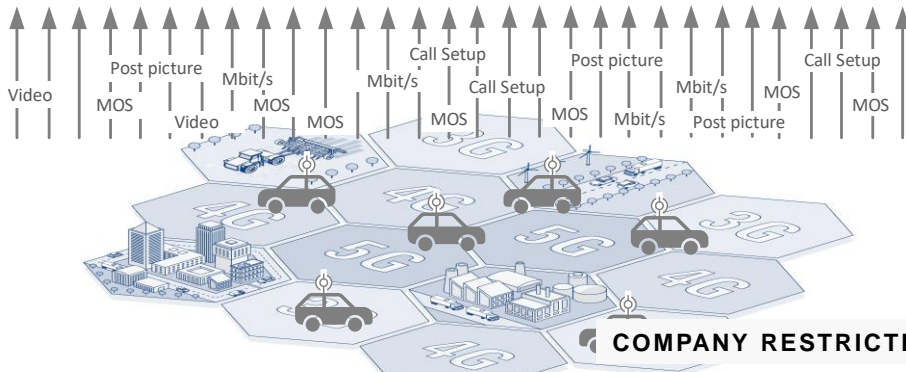
Integrated score 'overall'

Integrated score per 'region'

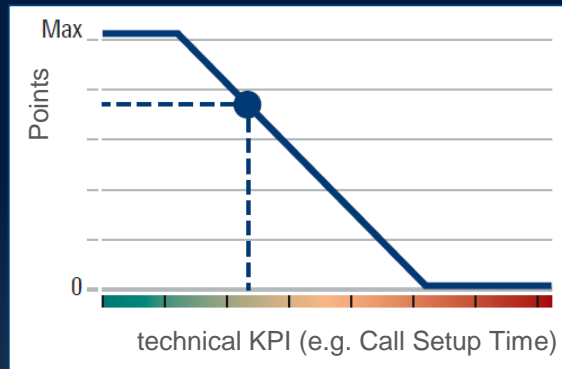
Integrated score per 'service'

All technical KPIs 'as usual' are measured, accessible and reported

You will not loose any detail!

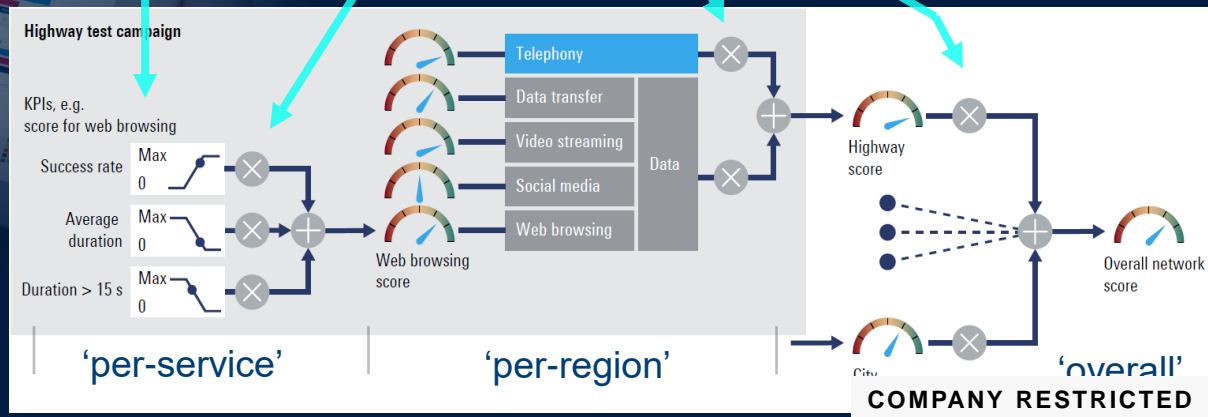


NETWORK PERFORMANCE SCORE IN PRINCIPLE: AN AGGREGATION MODEL



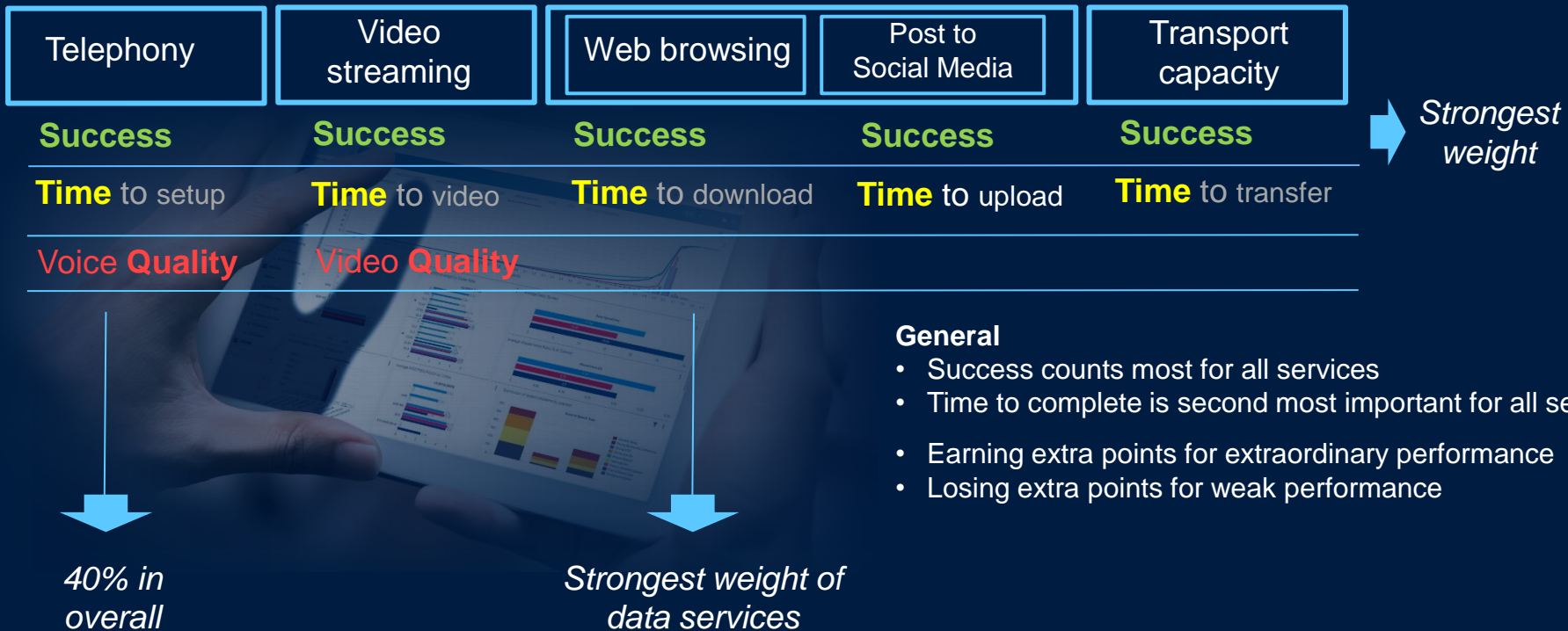
Each technical KPI is transformed to a perceptual point scale. This makes the KPIs directly comparable (same scale).

Each KPI is weighted according to its importance and further combined and aggregated with other KPIs.



NETWORK PERFORMANCE SCORE

SIMPLE CONSTRUCTION PRINCIPLE



ETSI TR 103 559

ROBUST SCORING NETWORK PERFO

- ▶ TR 103 559 describes the methodology and provides guidance for scoring network's end-to-end performance
- ▶ TR 103 559 methodology is technology agnostic
- ▶ Referenced in ITU-T E.804.1 and ECC Recommendation 2019/1
- ▶ Scoring is based on standardized and established test methods:
 - ▶ Telephony: ETSI TS 102 250-2
 - ▶ **Speech Quality:** ITU-T P.863 'POLQA'
 - ▶ Video/YouTube: ETSI TR 101 578
 - ▶ Video Quality: ITU-T J.343.1
 - ▶ Data Transfer: ETSI TS 102 250-2
 - ▶ Browsing: ETSI TS 102 250-2, ETSI TR 103 559
 - ▶ Latency / Interactivity: ITU-T G.1051
 - ▶ UDP speed test: ITU-T Y.1540



THANK YOU!

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