Cost efficient services testing, monitoring and benchmarking

ITU-T QSDG Workshop

Brazil, 27th-29th November
Agenda

• Popular OTT services landscape

• Requirements for cost efficient testing, monitoring and benchmarking solutions

• Smart testing techniques

• Take aways
Popular OTT services landscape

- DIRECTV
- YouTube
- vudu
- Hulu
- Amazon
- Netflix
- Facebook
- Instagram
- Twitter

**VIDEO**

The New TV: HD to 4K and 3D (5G for VR/AR)

The New Video LTE Broadcast

The New Conversational

**SOCIAL MEDIA**
OTTs – Few sample QoE/QoS/KPIs

Facebook Logon and Logoff Success Ratio (%) and Duration
Facebook Operation Success Ratio (%) and Duration: (Load Feeds, Upload Photo, Upload Status, Load Friends List)

Instagram Logon and Logoff Success Ratio (%) and Duration
Instagram Operation Success Ratio (%) and Duration: (Load Feeds, Search b Hashtags)

Twitter Logon and Logoff Success Ratio (%) and Duration
Twitter Operation Success Ratio (%): (Load Feeds, Twitter Posts)

YouTube
Streaming Completion Rate, Streaming Setup Success Rate, Streaming Video Play Start Success Ratio, Streaming Video Session Success Ratio, Streaming Service Access Time, Streaming Session Video Interruption Duration, Streaming Video Play Start Time, Streaming Video Session Time
MOS-QoE: number of resolution switches and distribution, resolutions, Interruption/buffering, throughput …

Skype
Session set up time, session accessibility
Average audio MOS for VoIP

- All KPIs have same importance?
- Which one affects end user more than the rest?
- How to qualify and quantify performance differences from a user perspective?
- How to react and/or preempt problems?
- How to optimize bandwidth for sustaining happy customers at with optimal CAPEX/OPEX?
- Align with technology evolution
- Embed intelligence
- Simplify and automate
Requirements for cost efficient testing, monitoring and benchmarking solutions
Testing strategy aligned with technology evolution

Virtualization, distributed cloudification, slicing, edge computing

3GPP Rel13, Rel14

LTE Pro
Addressing some of 5G objectives

3GPP Rel15 (2018)

LTE - Pro
5G Phase 1
Use Cases:
- Enhanced Mobile Broadband
- Some Low Latency and High Reliability capabilities
- Frequency ranges below 6GHz and above 6GHz
- Context aware service delivery

3GPP Rel16 (2020)

LTE Pro
5G Phase 2: new RAN & core
IoT: mMTC, URLLC,

Step One
Continuously Secure LTE Pro

On device measurements / QoE centric, Cloud & Automation

Step Two
Evolve while transform (4.5G-4.9G)

+ Real time data flows, automated symptoms and causes pattern detection, real time statistically significant priorities ranking

Step Three
Be ready for The 5G revolution

+ Predict & React nearly in real time

Assist and enable AI (Artificial Intelligence) and cognitive networks

Minimize operational / deployment costs of network and vertical services delivery towards optimized QoE and satisfied customers

..2016...

2018...

2020...
Minimum requirements to follow the strategy

- Big data support
- Remote access for real-time view of network and test environment
- Cloud based testing solutions

- Big data support
- Real time analytics and root cause analysis
- Centralize and embed Subject Matter Experts into machine learning / artificial intelligence algorithms
- Develop cost efficient benchmarking solutions, new machine learning based QoS/QoE evaluation / monitoring techniques suited for OTT services on the path to 5G

- Common KPIs
- Same script leveraged across stages
- Reduce post processing cost and conflicting information

- Common Management platform of data collection for all stages (monitoring, testing, benchmarking, etc)
- License management and sharing across users

- Lower cost solutions enable larger footprint
- Smart innovative testing techniques
- Benefits of common testing methodology (scripting, log files, etc) across monitoring, testing, optimization and benchmarking
- Centralized functionality to help reduce Total Cost Ownership (TCO)
TEMS testing approach – performance orchestration

Aligned with draft recommendation E.FINAD “Framework for Intelligent Network Analytics and Diagnostics”, TD 307 (TEMS contributors)

- Operations (FM, resources, licensing etc.)
- Storage of raw data,
- Real-time dashboards,
- Real-time analytics
- Monitoring statistics reports/views
- Alarms
- RCA on Real-time data

TEMS Discovery
Insightful Post Processing & Analysis of TEMS & 3rd party results

TEMS Post Processing Product
- Powerful off-line analytics
- Multi data format
- Desktop and Enterprise versions
TEMPS testing approach – smart testing

Aligned with draft recommendation E.FINAD “Framework for Intelligent Network Analytics and Diagnostics”, TD 307 (TEMPS contributors)
Smart testing techniques
Benchmarking needs and TEMS solution

Remote configuration
- System and Software configuration
- TAG information- Company/ Team/ Project/ etc
- Workorder configuration, incl DoD/ DoF
- SIM configuration
- Trigger conditions (Time/ Area/ Route/ Position)
- Pre-validation of Work orders*

Common Data repository- history aspect
- Workspaces
- Workorders (DoD/ DoF)
- Logfiles *.trp
- Reports
- Settings/ configurations
- Profiles
- NO-SQL

Remote access-*
- Trouble shooting
- Add-hoc testing

Map with way-points
- Turn-By-Turn instructions

KPI reports
- Data Upload (OTA)
  - Service information
  - Event information
  - CDF information*
  - Log file *.trp
  - Part of payload

Trigger handling
- Manual scheduling
- Synchronization
- M2M
- Device detection

Alerts (DoF)

Hard case (x4NUCs)
- Inbuilt Router with WiFi/ hot-spot
- Power control logic
- Local display- sys. administration
- Ext. GPS, shared

Device mounting kit (up to 24 UEs)
- Inbuilt USB HUB
- Inbuilt charging

Real Time monitoring
- Service information
- Event information
- CDF information
- Progress information (DoD)

Architecture
- Web
- Workflow
- User Profiles (Use-cases)
- Cloud

System administration
- User configuration
- System configuration

Project administration
- Project configuration
- Resource scheduling

Reporting- profiles
- KPI reports
- RCA reports
- Completion report
- etc

Alarm handling profiles
- Operational alarms-Event
- KPI threshold- CDF

Real Time monitoring profiles
- Map positioning- CDF

Real Time monitoring profiles
- Performance counter monitor (KPIs/ Radio)
- Service monitor CDF
- Event monitor CDF
- Project monitoring- DoD/ DoF
- Post-validation of results

System administration
- User configuration
- System configuration

Orchestrating network performance
### Statistical scoring and ranking

Aligned with draft recommendation E.NetPerfRank “Statistical Framework for QoE Centric Benchmarking Scoring and Ranking”, TD283 (TEMS authors)

Define set of KPIs/QoS contributing to QoE (per service)

Calculate KPIs statistics (e.g. avg, std, N) for each operator

Calculate KPIs statistics (e.g. avg, std, N) for each operator

Weight the statistical difference corresponding to each KPIs contributing to service’s QoE

Calculate for each operator the service’s Statistical Score as sum of weighted statistically difference

Rank: the lower the Statistical Score the better performance (closer to the best performing)

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<th>Network 1</th>
<th>Network 2</th>
<th>Weight</th>
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<td>StatKPI</td>
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Aligned with draft recommendation E.NetPerfRank “Statistical Framework for QoE Centric Benchmarking Scoring and Ranking”, TD283 (TEMS authors)
New QoE models: machine learning based

Aligned with draft recommendation P.VSQMTF “Voice service quality monitoring and troubleshooting framework for intrusive parametric voice QoE prediction”, TD 312 (TEMS authors)

- A hybrid solution which aims to provide a QoE predictor (MOS) for EVS based VoLTE test scenarios
  - A feasible solution for VoLTE case because the knowledge of codec/client, jitter, delay and loss are sufficient to estimate voice quality
  - EVS codec profiles (bit rates, voice bandwidths, error concealment scheme) are standardized and they also replace the traditional device based VoLTE clients used with AMR codec
  - Hybrid: parameters and reference voice sample

Parameters set

Codec Rate, Voice Bandwidth, Jitter, Delay, Loss, DTX distribution

Reference voice sample (time analysis)

- Advantages:
  - No need for MOS calibration based on subjective scores (expensive and time consuming)
  - No need of speech signal recording and therefore simplified test set up
  - No need to perform tuning per device (expensive and time consuming)
TEMS approach for service and technology centric root cause analysis

Aligned with draft recommendation E.FINAD “Framework for Intelligent Network Analytics and Diagnostics”, TD 307 (TEMS contributors)
Add on video QoE centric view to MOS scoring
Aligned with ETSI Work Item STQM 00215m (TEMS authors)

MOS (whenever available)

- Service information (e.g. session id, contributing Content Delivery Networks id)
- QoE centric video/audio (e.g. resolution, bit rate switches, bit rate, etc)
- Transport / delivery (throughput, delay)

Inferences due to encryption

Layer 3
MOS
Player information

Layer 2
Bitstream (GOP)
Metadata (Codec)
Player information

Layer 1
Packet Loss (UDP)
No Data (TCP)
Jitter
Throughput

DASH
MP2-TS
HTTP
RTP
TCP
UDP
IP

Screen
Player
Player
H.264/AAC/etc..

Raw input
Take Away
Take away

1. Variety and complexity of OTT services (e.g. social media, video) require testing solutions which offer real time, remote cloud based big data collection, handling and processing; automated intelligent root cause analysis – TEMS ITU-T aligned solution

2. TEMS offers solutions for cost efficient statistical scoring and ranking of networks/services performance aligned with ITU-T recommendations

3. TEMS drives standardization efforts
   - For the introduction of machine learning techniques as a new technique for QoE prediction for OTT service
   - Evolving Video streaming quality evaluation beyond MOS
Thank you!

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