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Perspectives on QoS Evaluation and Benchmarking
(QoS Audit and Benchmarking)

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QoS Questions

Typical questions that comes to heart when a Telecom regulator is faced with QoS challenges.

A. Why should a Regulator even evaluate the QoS of mobile operators?

B. What are the methodologies recommended by ITU/ETSI for QoS evaluation and which KPIs should be monitored?

C. What methodology takes the Quality of Experience of users into account?

D. What tools are necessary to carry out the evaluation and what comes next after QoS Evaluation?

E. What formula should a regulator use to benchmark mobile operators using an NMS given that vendors has different counters names and formulas?

F. What is the minimum recommended frequency of QoS Audit for Mobile Network Operators and Benchmarking?

G. What are examples of the QoS Monitoring/testing tools for Telecom Regulators?

QoS Anwsers

QoS Challenges have been addressed and solutions are given in recommendations as seen in **ITU-T E.800 sup 9**, **ITU-T E.811** and **ETSI EG 202 057-3**.

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

Supplement 9 (12/2013)

SERIES E: OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS

Supplement 9 to ITU-T E.800-series Recommendations (Guidelines on regulatory aspects of QoS)

Final draft **ETSI EG 202 057-3** V1.1.1 (2005-02)
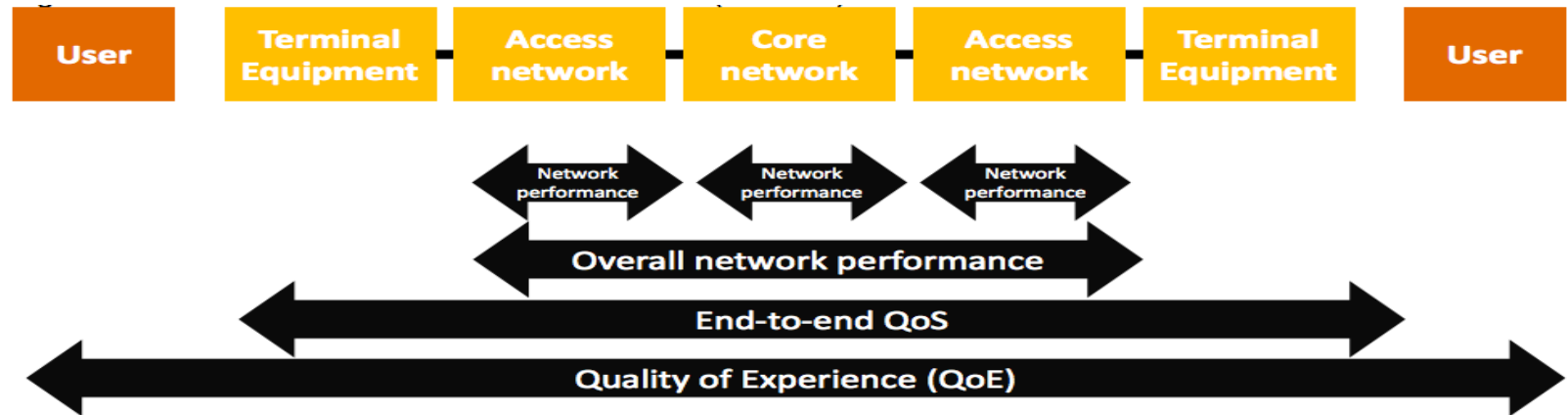
ETSI Guide

Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; **Part 3: QoS parameters specific to Public Land Mobile Networks (PLMN)**

SERIES E: OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS

Quality of telecommunication services: concepts, models, objectives and dependability planning – Models for telecommunication services

Quality measurement in major events

Relationship between NP,QoS and QoE

| User | Terminal Equipment | Access network | Core network | Access network | Terminal Equipment | User |

Network performance — Network performance — Network performance

Overall network performance

End-to-end QoS

Quality of Experience (QoE)

	Known	will get	Unknown
If	QoS	→	Estimated QoE
	QoE	→	Estimated QoS

- Access Network + Core Network ☰ Highway
- Terminal Equipment ☰ Vehicule/Truck
- QoE depends majorly on QoS which in turn depends on Network Performance(NP) thus NP parameters ultimately determine the QoS.

QoS Perspective for Regulators
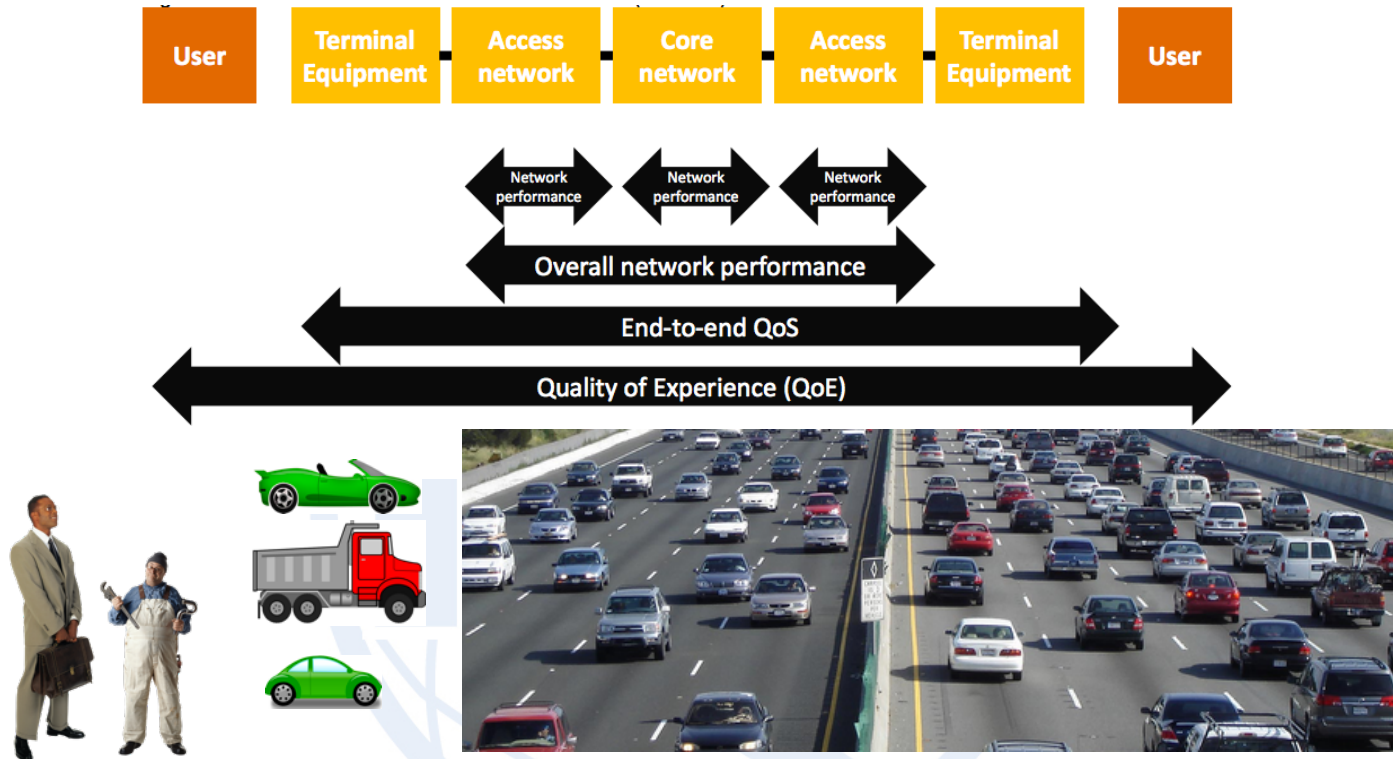
- Congestion ≡ Highway Traffic
- Given the rapid growth of Broadband, Regulators should monitor QoS from a network point in terms of capacity and resource availability.

A Objectives of QoS Evaluation(for Regulators)

- Ensure **Consumer satisfaction** by making known the quality of service, which the service provider is required to provide, and the user has a right to expect, enabling consumers make informed choices among several service providers.

- Assess **Operators Performance level** by benchmarking their performance against standards and criteria imposed by country's Regulatory Authority.

- Level the playing field for mobile operators to compete **on their own merits and not on alliances and sheer size.**

- Generally protect **the interests of consumers of telecommunication services** by putting a check on service degradations and outages through periodic QoS reports published on a corporate website.

- **Different and Complementary Approaches to Mobile QoS**

There are two different and complementary approaches to mobile QoS:

- drive-round tests;

- measurements based on network element counters.

6 QoS parameters specific to PLMNs

6.1 General

It is important to understand the

- network coverage;

- network availability;

- service accessibility;

- service retainability; and

QoS Evaluation of any PLMN irrespective of the RAT -2G, 3G, 4G,or 5G should be based on these QoS Categories (NA, SA, SR and/or SI)

Continuous/Proactive Monitoring (Best approach)

- **Different and Complementary Approaches to Mobile QoS**

  – Stationary/Walk/ Drive Test
  – OMC-R counter measurement using Network Management System (NMS)

QoS Assesment Target	Best Suitable QoS Approach(es)	Player concerned
Network coverage	DT	OPERATOR/REGULATOR
Acceptance Procedure	DT or NMS	OPERATOR
Proactive Monitoring	NMS	OPERATOR/ REGULATOR
Optimisation Cycle	DT + NMS	OPERATOR

C Which Approach takes account of QoE

- **Answer : NMS because real traffic is used for evaluation.**

NMS

6.3   Considerations on measurements based on network element counters

The QoS experienced by users will be taken into account as the calls are made with the real terminals by the users, so the results from the measurements will reflect accurately the QoS.

Network statistics gives a far more accurate and comprehensive picture of network performance since it includes all geographical area covered. Network statistics are collected automatically by the system and hence no special costs are associated with the measurement.

DT

6.2   Considerations on drive-round tests

The air interface of a PLMN is to a large extent equivalent to the NTP of a fixed network. Measurements of some of the parameters defined in the present document can only be made using special test equipment and the results obtained may depend to some extent on the design of this test equipment.

The QoS experienced by users will also be influenced to some extent by the design of their terminals and therefore may differ somewhat from the results of formal tests.

Best Approach besides both being complimentary?

- We recommend the both, but if you should have only one tool, it should be an NMS, this is buttressed by the most recent recommendation on QoS of Major Events : ITU-T E.811**(03/2017)**

Table 9-1 – Relevant KPIs and thresholds1		
Critical and diagnostic KPIs	**Threshold[1]**	**How to measure?**
e call drop rate	Equal to or less than 2%	Network PM counters, walk test and drive test
e block call rate	Equal to or less than 2%	Network PM counters
session block rate	Equal to or less than 2%	Network PM counters
session drop rate	Equal to or less than 2%	Network PM counters
nload/Upload data rate	256 kbps or greater	Network PM counters
nload/Upload data rate	2 Mbps or greater	Walk test and drive test
service availability	Equal to or higher than 99.9%	Network PM counters
et data traffic utilization	Equal to or less than 85%	Network PM counters
raffic channel utilization	Equal to or less than 85%	Network PM counters
to-end delay	Less than 200 ms (except 2G)	Walk test and drive test
y variation (Jitter)	Less than 80 ms	Walk test and drive test
e PoI congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters
PoI congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters

  – 75% of the KPIs monitored during any major event in any country should be realised using an NMS

Next Course of Action after QoS Evaluation

– **Is COMPLIANCE** (ITU-T E.800 Supplement 9)

There are basically two alternative approaches:

- A regulation orientated approach where:
    - Reporting is to the regulator;
    - Performance targets are set in regulations;
    - Fines are payable to the regulator if targets are not achieved.
- A customer orientated approach where:
    - Reporting is to the customer;
    - Targets and minimum performance levels are given in contracts;
    - Compensation for poor performance is payable to the affected customer.

Regulators should as the name indicates adopt the regulation oriented approach where fines are paid to regulators per cell -faulty network element affecting the underserved area with unhappy end users.

E KPI Formula: standardization (CO-OP initiative)

DT TOOL **QoS Audit &Benchmark**

$$Call\ Drop\ Rate = \frac{\text{Number of TCH drops after assignment}}{\text{Total number of TCH assignments.}}$$

NMS **CO-OP**

QoS Benchmark

$$CallDropRate = \frac{\left(\begin{array}{l} nbrOfLostRadioLinksTCH + \\ unsuccInternalHDOsIntraCell + \\ unsuccHDOsWith\ Re\ connection + \\ unsuccHDOsWithLossOfConnection \end{array}\right)}{\left(\begin{array}{l} succTCHSeizures + succInternalHDOsIntraCell \\ + succIncomingInternalInterCellHDOs \end{array}\right)}$$

NMS **ALCATEL**

QoS AUDIT

$$CallDropRate = \frac{\left(\begin{array}{l} MC14c\text{-}Nbr\ of\ TCH\ (in\ HR\ or\ FR\ usage)\ drops\ in\ TCH\ established\ phase\ due\ to\ BSS\ problem + \\ MC739\text{-}Nbr\ of\ TCH\ (in\ HR\ or\ FR\ usage)\ drops\ in\ TCH\ established\ phase\ due\ to\ TRX\ failure + \\ MC736\text{-}Nbr\ of\ TCH\ (in\ HR\ or\ FR\ usage)\ drops\ in\ TCH\ established\ phase\ due\ to\ radio\ link\ failure + \\ MC621\text{-}\ Nbr\ of\ TCH\ drops\ during\ the\ execution\ of\ any\ TCH\ outgoing\ handover\ (Inter\ cell,\ Intra\ cell)\ + \\ MC921c\text{-}Number\ of\ pre\text{-}empted\ calls\ in\ the\ cell \end{array}\right)}{\left(\begin{array}{l} MC718\text{-}Nbr\ of\ TCH\ (in\ HR\ or\ FR\ usage)\ normal\ assignment\ successes + \\ MC717a\text{-}Nbr\ of\ incoming\ directed\ retry\ (towards\ a\ TCH\ channel\ in\ HR\ or\ FR\ usage)\ successes + \\ MC717b\text{-}Nbr\ of\ incoming\ internal\ and\ external\ TCH\ (in\ HR\ or\ FR\ usage)\ handover\ successes\ per\ TRX - \\ MC712\text{-}Nbr\ of\ outgoing\ TCH\ handover\ successes,\ per\ TRX.\ Intracell,\ internal\ intercell\ and\ external\ handovers \end{array}\right)}$$

- The non standardization of KPIs across equipment vendors makes it difficult for operators with multiple vendors to easily calculate network wide KPIs.
  Solution is the CO-OP initiative KPI formulas.(3GPP TR 32.814)

Frequency of QoS Audit and Benchmarking Reports

- QoS Audit reports should be monthly for countries whose users experience relatively poor QoS while quarterly for others.

- QoS Benchmarking reports should be quarterly for such countries with poor QoS delivered and six-monthly for others.

4.7 Data collection period

Where the measurements are to be used for long term comparisons, it is recommended that QoS data should be collected and calculated on a quarterly basis starting on 1 January, 1 April, 1 July and 1 October.

Stakeholders may also decide to use longer or shorter data collection periods. For most QoS parameters a data collection period on a quarterly basis is suitable, and will provide adequately up-to-date information. But there may also be cases were a longer period is more practicable, e.g. extensive customer surveys. Shorter periods are advisable for QoS aspects where frequent and fast changes in quality are likely to occur.

Timing of reports

The timing of reports is a significant issue. Where quality of service performance is sensitive and attracts a high level of public interest, there may be cause to issue monthly, quarterly or six-monthly reports
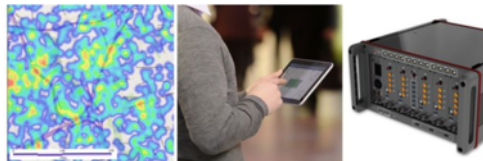
Tools for QoS Evaluation/Benchmarking

– Example of NMS tool for Regulators with in built **Compliance Mechanism**, default **High level** CO-OP KPIs and more
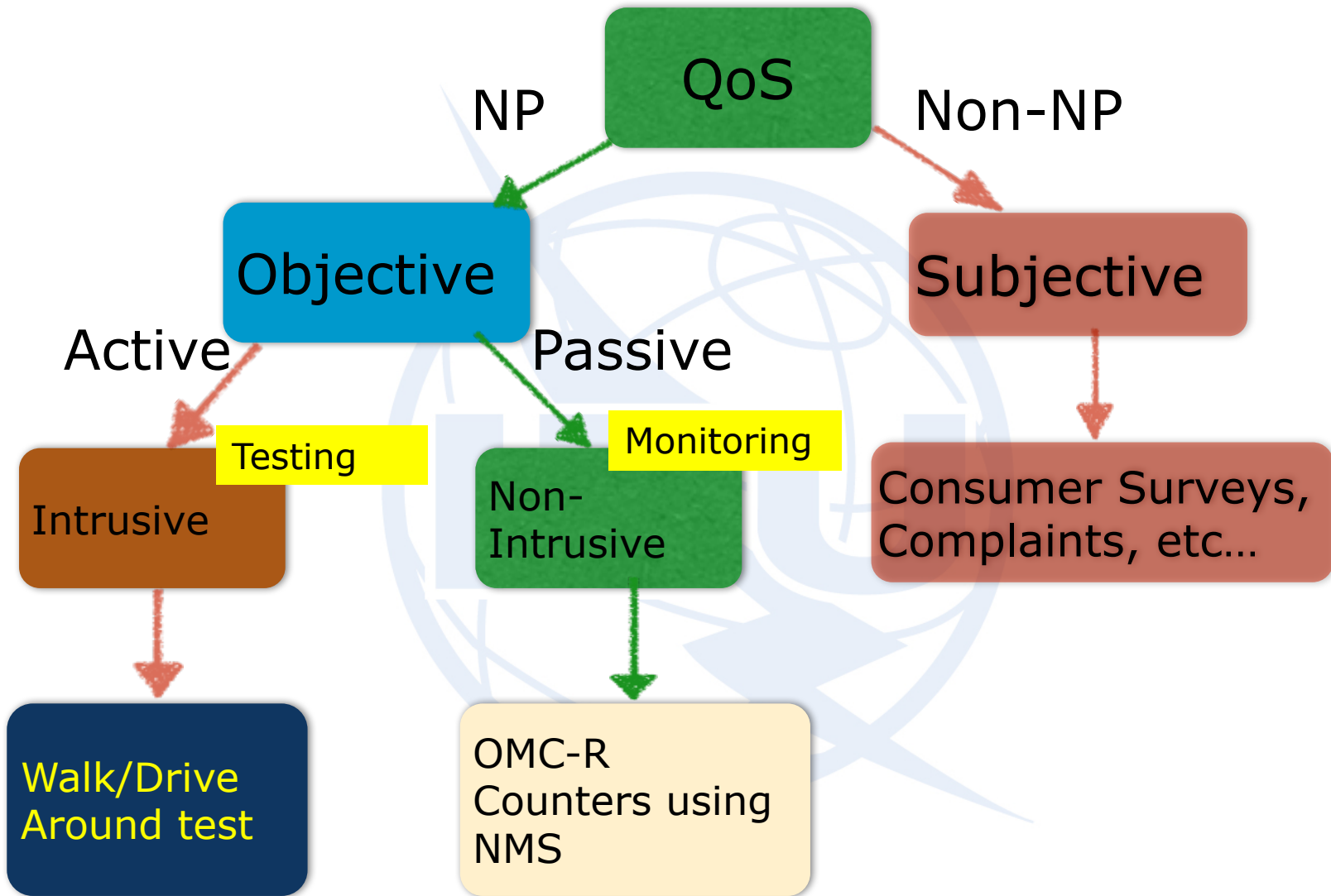
   – **RPM system** by PNI

– Example of DT tool for Regulators with Customer experience application based monitoring capability and more

   – **Nemo Wireless Network Solutions** by MidWex

QoS Evaluation Overview

Conclusion/Recommendations

- Today, QoS Evaluation and Benchmarking **on a Network level using DT Tool alone is just incomplete** and results **on a network level** are not representative at all owing to sampling size and timing of acquisition.

- Regulators need to **add an NMS to the QoS portfolio** suite in order to assess the most accurate and complete vision of the value offered by the provider to end-users.

  > Network statistics gives a far more accurate and comprehensive picture of network performance since it includes all geographical area covered. Network statistics are collected automatically by the system and hence no special costs are associated with the measurement.

- The Trend and widely used methodology is the use of NMS to process Performance management(PM) files for monthly QoS Audit and leveraging CO-OP KPI formula for quarterly QoS Benchmark reports.

- Regulators should put to practice these contribution-driven recommendations of ITU-T to achieve desired Country QoS goals.

THANK YOU FOR YOUR ATTENTION

**for more information or guidance on QoS Monitoring Solutions
email:info@planetworkint.com**