

ITU Workshop on Performance, QoS and QoE for Multimedia Services



Planet Network
International

Perspectives on QoS Evaluation and Benchmarking

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QoS Questions

Frequently Asked Questions of a Telecom Regulator 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 (High-Level) should be monitored?**
- C. What methodology takes the Quality of Experience of users into account?**
- D. What comes next after QoS Evaluation?**
- E. What formula should a regulator with NMS, use for benchmarking purposes for MNOs given that vendors used by MNOs have different counters names and specific formulas?**
- F. What is the minimum recommended frequency of QoS Audit and Benchmarking Reports for Mobile Network Operators?**
- G. What are the examples of QoS Monitoring/testing tools for Telecom Regulators?**



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**.

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Series E
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)

ETSI EG 202 057-3 V1.1.1 (2005-04)

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)

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.811
(03/2017)

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



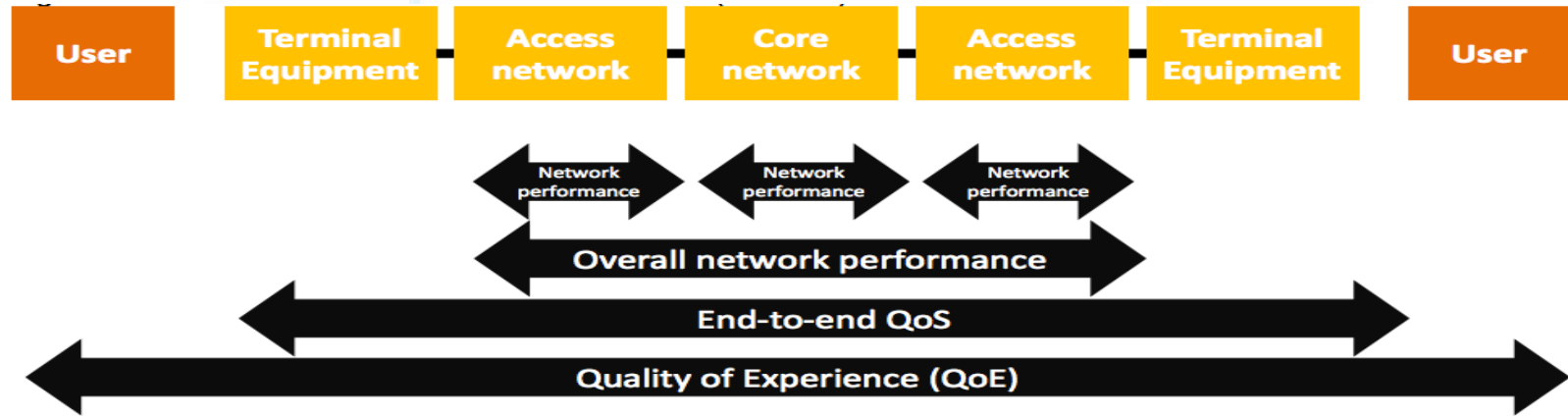
Gentle Reminder



Nothing is Possible **Without The Network**



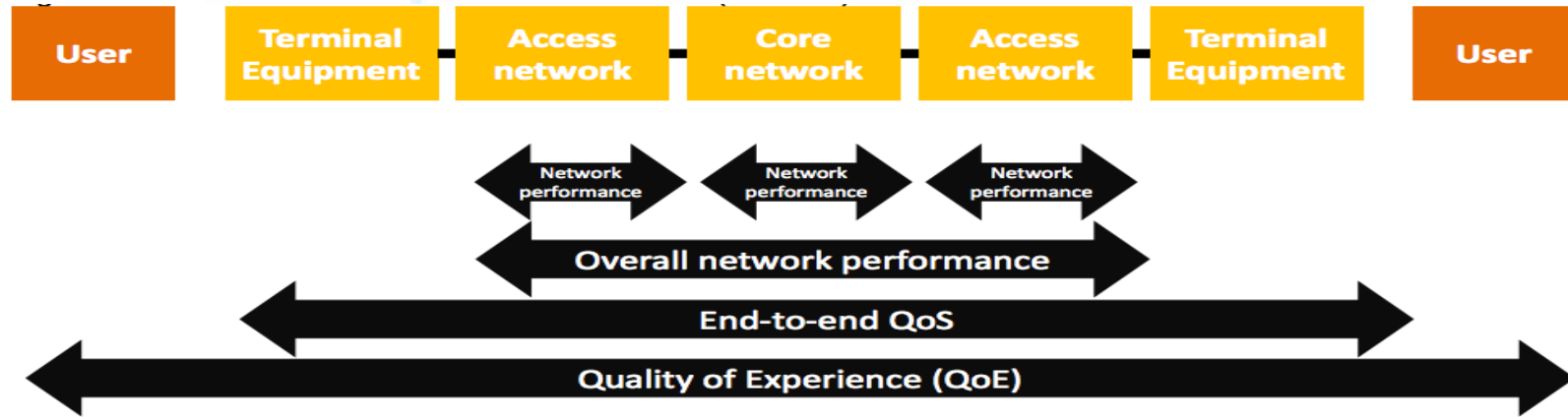
Relationship between NP, QoS and QoE



	Known		Unknown
If	QoS	will get →	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 \equiv Highway Traffic
- Given the rapid growth of mobile services, Regulators are advised to monitor QoS also from a network performance point in terms of **DELIVERY** and resource availability rather than service level alone.



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 interaction between:

- 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) using High level KPIs.



B. 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.



C. Why not Crowdsourcing and CDR Analysis for QoE

Analysis of Crowdsourcing :

- Crowdsourcing only looks at smart phones and feature phones leaving out the majority of the subscribers especially in Africa where the Smart phone penetration rate's all time high is less than 50% .
- KPIs such as Congestion and Cell_Unavailability cannot be measured using Crowdsourcing.
- There is a lot of Data Cleansing in crowdsourcing analysis which is yet to be standardised

Analysis of CDR:

- Benefits of CDR analysis include the following but not for QoS/QoE
- Disaster Response, Health, Socio Economics, Transportation, SimBox Fraud Detection, Telephone Use Patterns, Customer Profiling and Sales Forecasting.



C. Why not Crowdsourcing and CDR Analysis for QoE

Analysis of CDR:

- KPIs such as Congestion and Cell_Unavailability cannot be measured using CDR analysis.
- QoS DELIVERED cannot be evaluated using this methodology, also There are Privacy Concerns, Data Discontinuity, Accuracy, and the File structure (Meta Data) and contents tailored in such that it is best suited for Billing Verification and Traffic Management.

Information (Meta data) (CDRs)

- the phone number of the subscriber originating the call (calling party, A-party)
- the phone number receiving the call (called party, B-party) etc.

Information (Meta data) 2G (PM files)

- the serving cell
- the TCH attempts, the Cell unavailability period etc

Best Approach besides both being complimentary

We recommend 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

High Level KPIs (-/+)	Critical and diagnostic KPIs	Threshold ¹	How to measure?
QoS Voice SR-	Voice call drop rate	Equal to or less than 2%	Network PM counters, walk test and drive test
QoS Voice SA-	Voice block call rate	Equal to or less than 2%	Network PM counters
QoS Data SA -	Data session block rate	Equal to or less than 2%	Network PM counters
QoS Data SR -	Data session drop rate	Equal to or less than 2%	Network PM counters
QoS Data SI +	Download/Upload data rate	256 kbps or greater	Network PM counters
QoS Data NA +	Download/Upload data rate	2 Mbps or greater	Walk test and drive test
	Data service availability	Equal to or higher than 99.9%	Network PM counters
	Packet data traffic utilization	Equal to or less than 85%	Network PM counters
	RF traffic channel utilization	Equal to or less than 85%	Network PM counters
	End-to-end delay	Less than 200 ms (except 2G)	Walk test and drive test
	Delay variation (Jitter)	Less than 80 ms	Walk test and drive test
QoS Voice SA-	Voice PoI congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters
QoS Data SA-	Data PoI congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters

QoS Evaluation Categories (NA, SA, SR and SI)

77% of the KPIs monitored during any major event in any country should be realised using an NMS
 High Level KPIs refer to 3GPP TS 32.410 (2G & 3G) and 3GPP TS 32.450 (4G).



High Level KPIs (+/-) for QoS Audit using NMS, Per RAT et QoS Evaluation Category

2G (Voice Service only)

ITU-T QoS Category	TRA KPI NAME	
NETWORK AVAILABILITY	CELL DOWNTIME (H)	-
	CELL AVAILABILITY (%)	+
	CELL UPTIME (H)	+
SERVICE ACCESSIBILITY	TCH CONGESTION RATE (%)	-
	SDCCH CONGESTION RATE (%)	-
	CALL SUCCESS RATE (%)	+
	CALL SETUP SUCCESS RATE (%)	+
SERVICE RETAINABILITY	CALL DROP RATE (%)	-
	CALL COMPLETION RATE (%)	+

3G (Voice and Data Services only)

ITU-T QoS Category	TRA KPI NAME	
NETWORK AVAILABILITY	CELL DOWNTIME (H)	-
	CELL AVAILABILITY (%)	+
	CELL UPTIME (H)	+
SERVICE ACCESSIBILITY	VOICE BLOCK CALL RATE (%)	-
	VOICE CALL SETUP SUCCESS RATE (%)	+
	VOICE CALL SUCCESS RATE (%)	+
	DATA ACCESS SUCCESS RATE (%)	+
SERVICE RETAINABILITY	VOICE CALL DROP RATE (%)	-
	VOICE CALL COMPLETION RATE (%)	+
	DATA DROP RATE (%)	-
SERVICE INTEGRITY	DATA DL HS THROUGHPUT (Kbps)	+

4G (Data Service only)

ITU-T QoS Category	LICENSE KPI NAME	TRA KPI NAME	
NETWORK AVAILABILITY	Downtime for Radio Access	CELL DOWNTIME (H)	-
		CELL AVAILABILITY (%)	+
	Uptime for Radio Access	CELL UPTIME (H)	+
		DATA SERVICE AVAILABILITY (%)	+
SERVICE ACCESSIBILITY	DATA SERVICE ACCESS FAILURE RATE	DATA SERVICE ACCESS FAILURE (%)	-
	DATA SERVICE ACCESS SUCCESS RATE	DATA SERVICE ACCESS SUCCESS RATE (%)	+
SERVICE RETAINABILITY	DATA SERVICE DROP RATE	DATA SERVICE DROP RATE (%)	-
SERVICE INTEGRITY	DOWNLOAD DATA SPEED	DATA DL THROUGHPUT (Mbps)	+
	UPLOAD DATA SPEED	DATA UL THROUGHPUT (Mbps)	+

For QoS Audit and compliance, TRAs are advised to choose at least one KPI (+ or -) per QoS Evaluation Category.

- + The higher the value of the KPI the better
- The lower the value of the KPI the better

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

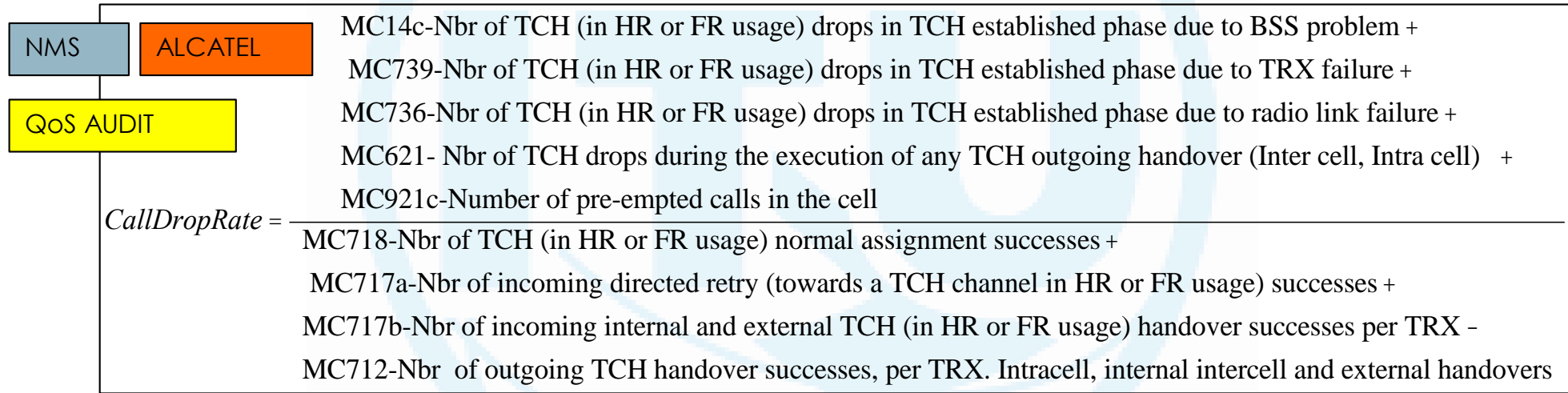
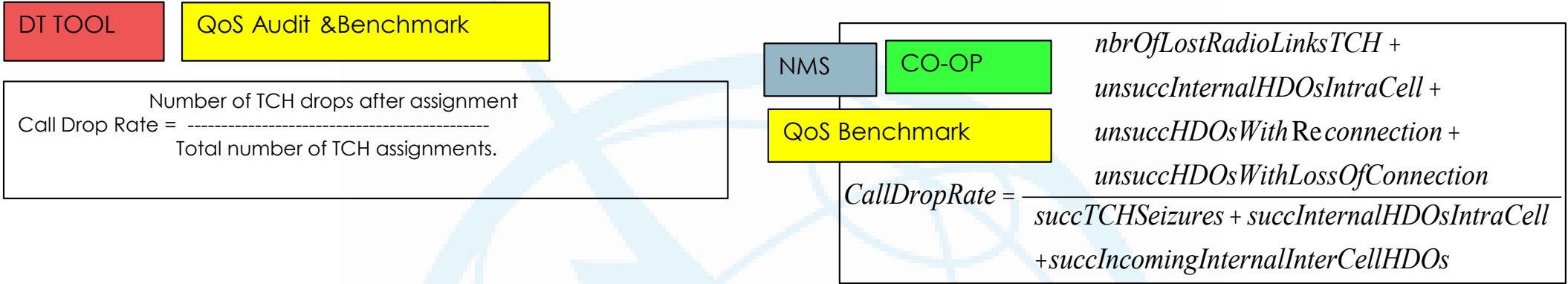
There are basically two alternative approaches:

- 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 (i.e. faulty network element affecting the underserved area with unhappy end users.)**



E. KPI Formula: standardization (CO-OP initiative)



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 formula for High Level KPI.(3GPP TR 32.814)

- 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 where 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.

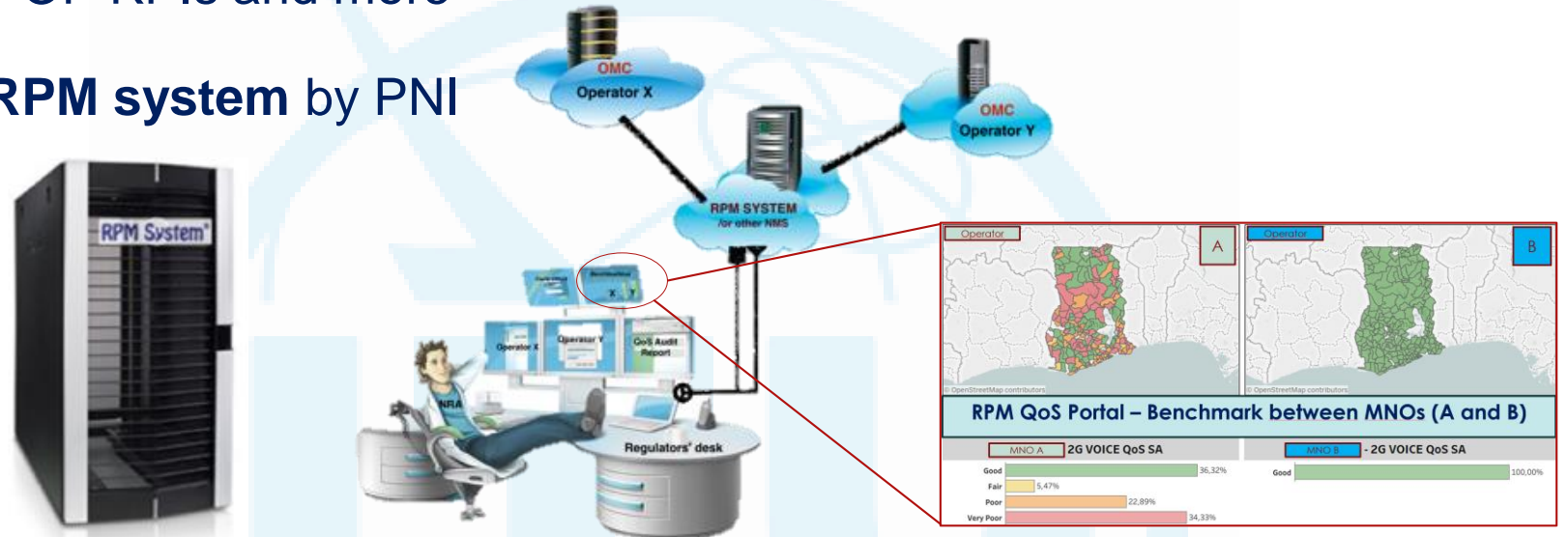
Timing of reports

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

G. Tools for QoS Evaluation/Benchmarking

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

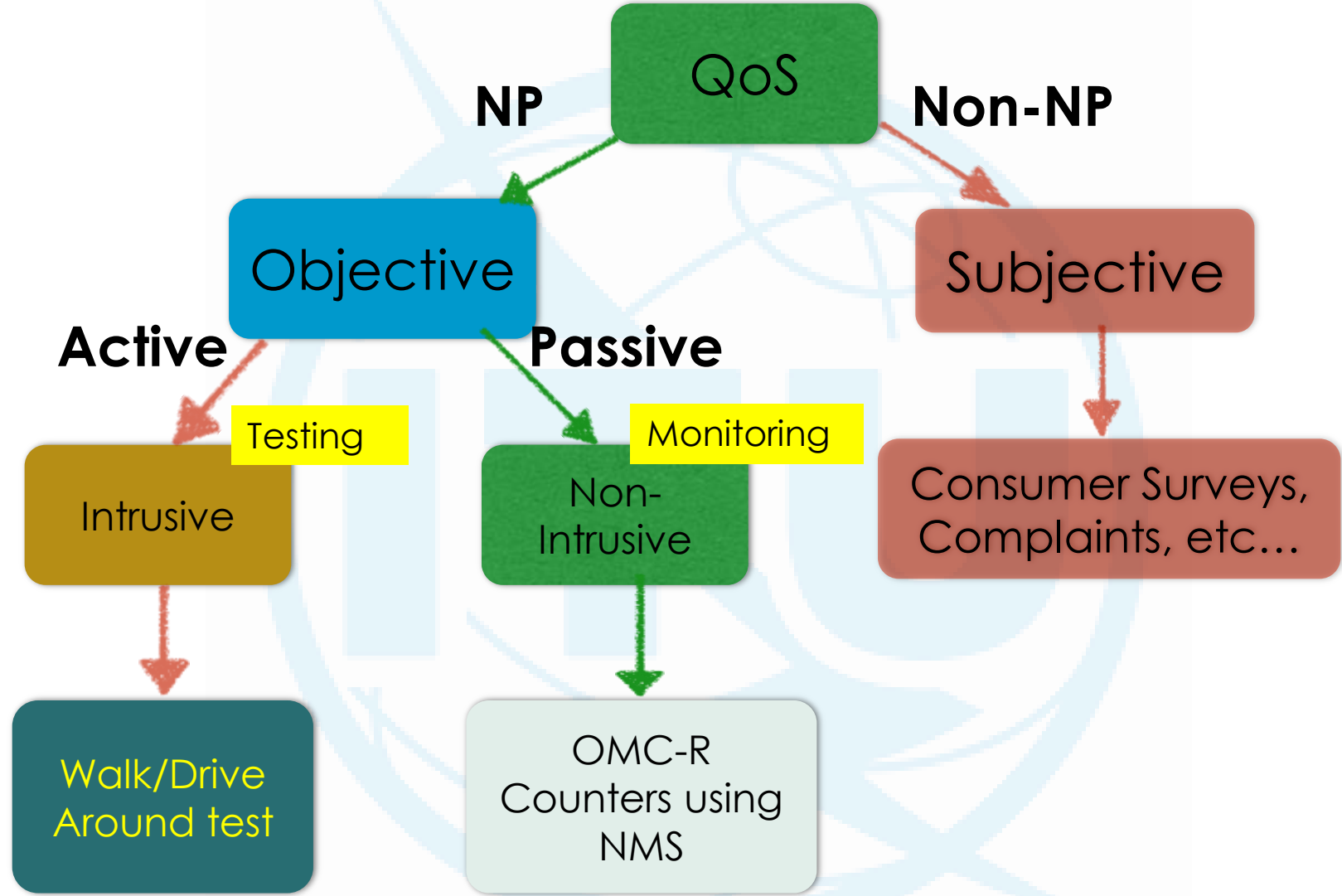
– **RPM system by PNI**



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

– **Nemo Wireless Network Solutions by MidWex**







Conclusion / Recommendations

- Today, QoS Evaluation and Benchmarking on a Network level using DT Tool alone is just incomplete and DT 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 MNOs 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 adopted 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 objectives.



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**THANK YOU
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For more information or guidance on
QoS Monitoring Solutions & QoS Strategies
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