
**ITU Workshop on Performance, QoS and QoE for
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**ITU-T Rec E.811
Quality Measurement in Major Events**

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AGENDA

Motivation

E.811 Scope

Traffic forecasting and network dimensioning

Strategies of QoS and QoE measurement

Relevant KPIs to be measured

Capabilities and levels to assure users satisfaction

Appendix: countries experiences

What are Major Events?



- 700k tourists
- 10 game venues
- Capacity for 500K fans



- 4 MM tourists
- 12 arenas
- Capacity for 620K fans



- 3 MM tourists
- 34 game venues
- Capacity for 750K fans



- 1,2 MM tourists
- 37 game venues
- Capacity for 720K fans

The challenge of QoS provision



11.5 MM calls at the arenas



195 MM data connections



400% in international roaming usage



300% SMS usage



70K pictures on each game



45% Wi-fi offload



26 TB+ of mobile data
(1.5 TB just in the final game)



6.9 Tbps
(peak backhaul traffic)



“Mobile traffic generated by 60,000 people in a soccer arena surpass the busy-hour traffic of Brazil's 94 million smartphone users” (CISCO, 2014)



The challenge of QoS provision



\$ 600 MM in 12 host cities



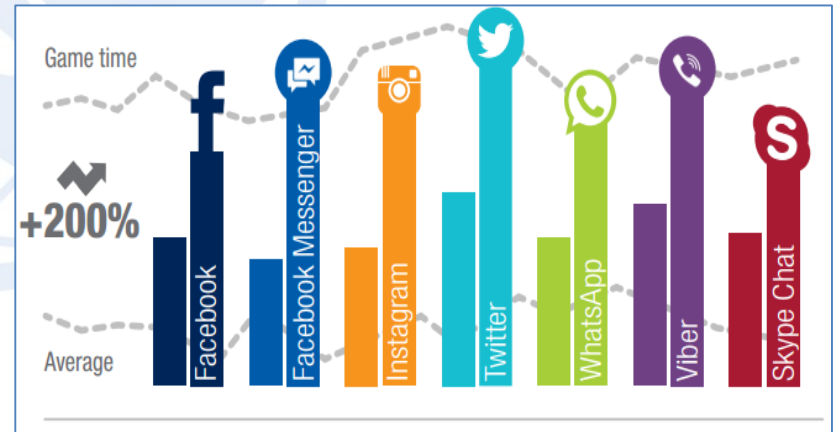
120K Wi-fi hotspots



15K new antennas



10K km of optical fiber



"Mobile traffic generated by 60,000 people in a soccer arena surpass the busy-hour traffic of Brazil's 94 million smartphone users" (CISCO, 2014)



E.811 Scope

This Recommendation addresses the quality assessment of services provided during major events, by creating a useful international reference to be considered by operators and regulators when preparing to host major events

Traffic forecasting and network dimensioning

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Appendix: countries experiences

Traffic forecasting

Mapping the events

- Understanding when, where and how long the crowds are supposed to be at the main venues and surrounding areas

Understanding users' expectations

- Defining an average user's usage profile based on customer surveys and Delphi questionnaires among experts

Predicting traffic demand

- Predicting the peak traffic demand that should be supported by the network in each venue

Network dimensioning

Site dimensioning

- Complementary deployment of macro-cells, small cells and cells on wheels (COWs)

Network contention

- Conservative choosing of the network contention ratio (e.g., less than 1:10)

Traffic off-loading

- Provisioning of Wi-Fi networks for data traffic offloading

Coverage and capacity optimization

- Dynamic changing in radio access network (RAN) parameters to guarantee coverage and capacity for moving crowds

Interference management

- Avoiding interference among the RAN elements and also the professional media equipment

Network quality audit prior the major events

Setting the audit objectives

- What parameter(s) to audit?
- Why audit it/them and what is the relevance of the measurement to network quality?
- How will the audit findings be presented?
- What possible conclusions can be drawn from the results?
- Based on observations and conclusions, what actions can be done for solving the issues identified?

Network quality audit prior the major events

Audit deployment principles

- Knowledging of operator's network planning
- Requesting action plans to upgrade network capacity if needed
- Deciding prior the network elements and KPIs to be monitored
- Deploying last-minute network audit before the kick-off to assure the readiness

Network quality monitoring during major events

Cause and effect analysis

- On-line identification of points of failure in the network, as well as their level of impact on subscriber experience.

Trend analysis

- In-depth breakdown to identify potential risks of failure

Providing recommendations

- Directives may be issued to enforce operator's network coverage/capacity expansion in response to potential risks identified

Results transparency

- Quality monitoring releases may be issued and published by regulators periodically (daily short reports are appropriate)

Network quality monitoring during major events

Reporting and verification procedures

- Required network statistics, traffic volumes in/out and RAN utilization and congestion
- Site's backhaul utilization and congestion
- Service interruption notifications

Real-time monitoring

- Regulators may deploy a network performance monitoring system that connects to the network operator's monitoring centre
- Alternatively, regulator's official may be placed at the network operator's monitoring centre

Relevant KPIs to be measured

Critical KPIs

- Users are very likely to notice the network quality degradation
- Regulator must demand immediate action from the network operator

Diagnostic KPIs

- Degradation is not necessarily perceived by the users
- Provide useful insights on whether the network is close to its limits and may fail to deliver the expected quality.

Relevant KPIs to be measured

Critical KPIs

- Voice block call rate
- Data session block rate
- Voice call drop rate
- Download/upload data rate
- Data PoI congestion
- Voice PoI congestion

Relevant KPIs to be measured

Diagnostic KPIs

- Data session drop rate
- Packet data traffic utilization
- RF traffic channel utilization
- Data service availability
- End-to-end delay (RTT)
- Delay variation (Jitter)

Capabilities and levels to assure users satisfaction

Critical and diagnostic KPIs	Threshold*	How to measure?
Voice call drop rate	Equal to or less than 2%	Network PM counters, walk test and drive test
Voice block call rate	Equal to or less than 2%	Network PM counters
Data session block rate	Equal to or less than 2%	Network PM counters
Data session drop rate	Equal to or less than 2%	Network PM counters
Download/Upload data rate	256 kbps or greater	Network PM counters

*The values presented may differ depending on the local regulations and the estimated average user profile.



Capabilities and levels to assure users satisfaction

Critical and diagnostic KPIs	Threshold*	How to measure?
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

*The values presented may differ depending on the local regulations and the estimated average user profile.



Capabilities and levels to assure users satisfaction

Critical and diagnostic KPIs	Threshold*	How to measure?
Delay variation (Jitter)	Less than 80 ms	Walk test and drive test
Voice Pol congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters
Data Pol congestion	Equal to or less than 2% (less than 4% in non-consecutive peak hours)	Network PM counters

*The values presented may differ depending on the local regulations and the estimated average user profile.



Appendix: countries experiences

FIFA World Cup (Brazil - 2014)

African Cup of Nations (Ghana - 2008)

Olympic and Paralympic Games
(Rio - 2016)

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Thank you!

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