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ITU-T Rec E.811
Quality Measurement in Major Events

Tiago Sousa Prado
ANATEL/Brazil
SG12 Vice-chairman
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

6.9 Tbps

(1.5 TB just in the final game)

(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
- Strategies of QoS/QoE measurement
- Capabilities and levels to assure users satisfaction
- Relevant KPIs to be measured
- 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

<table>
<thead>
<tr>
<th>Dimensioning Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site dimensioning</strong></td>
<td>• Complementary deployment of macro-cells, small cells and cells on wheels (COWs)</td>
</tr>
<tr>
<td><strong>Network contention</strong></td>
<td>• Conservative choosing of the network contention ratio (e.g., less than 1:10)</td>
</tr>
<tr>
<td><strong>Traffic off-loading</strong></td>
<td>• Provisioning of Wi-Fi networks for data traffic offloading</td>
</tr>
<tr>
<td><strong>Coverage and capacity optimization</strong></td>
<td>• Dynamic changing in radio access network (RAN) parameters to guarantee coverage and capacity for moving crowds</td>
</tr>
<tr>
<td><strong>Interference management</strong></td>
<td>• Avoiding interference among the RAN elements and also the professional media equipment</td>
</tr>
</tbody>
</table>
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

- Knowledge 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

<table>
<thead>
<tr>
<th>Cause and effect analysis</th>
<th>- On-line identification of points of failure in the network, as well as their level of impact on subscriber experience.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend analysis</td>
<td>- In-depth breakdown to identify potential risks of failure</td>
</tr>
<tr>
<td>Providing recommendations</td>
<td>- Directives may be issued to enforce operator's network coverage/capacity expansion in response to potential risks identified</td>
</tr>
<tr>
<td>Results transparency</td>
<td>- Quality monitoring releases may be issued and published by regulators periodically (daily short reports are appropriate)</td>
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</tbody>
</table>
Network quality monitoring during major events

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

**Reporting and verification procedures**

**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

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

*The values presented may differ depending on the local regulations and the estimated average user profile.*
## Capabilities and levels to assure users satisfaction

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<tr>
<td>Download/Upload data rate</td>
<td>2 Mbps or greater</td>
<td>Walk test and drive test</td>
</tr>
<tr>
<td>Data service availability</td>
<td>Equal to or higher than 99.9%</td>
<td>Network PM counters</td>
</tr>
<tr>
<td>Packet data traffic utilization</td>
<td>Equal to or less than 85%</td>
<td>Network PM counters</td>
</tr>
<tr>
<td>RF traffic channel utilization</td>
<td>Equal to or less than 85%</td>
<td>Network PM counters</td>
</tr>
<tr>
<td>End-to-end delay</td>
<td>Less than 200 ms (except 2G)</td>
<td>Walk test and drive test</td>
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## Capabilities and levels to assure users satisfaction

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<tr>
<td>Delay variation (Jitter)</td>
<td>Less than 80 ms</td>
<td>Walk test and drive test</td>
</tr>
<tr>
<td>Voice Pol congestion</td>
<td>Equal to or less than 2% (less than 4% in non-consecutive peak hours)</td>
<td>Network PM counters</td>
</tr>
<tr>
<td>Data Pol congestion</td>
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Appendix: countries experiences

- FIFA World Cup (Brazil - 2014)
- African Cup of Nations (Ghana - 2008)
- Olympic and Paralympic Games (Rio - 2016)
Thank you!

Tiago Sousa Prado
ANATEL/Brazil
SG12 Vice-chairman