How to measure network performance and Quality of Experience in a 5G world

Providing operators with visibility of the quality of experience from a subscriber’s point of view is something R&S MNT has been at the forefront of since the early days of mobile networks. In this article, Hanspeter Dobert, Vice-President, Mobile Networks Testing at Rohde & Schwarz considers the emergence of 5G, the necessity to rethink the approach to measuring network performance, and the quality of experience delivered over 5G networks.

5G QUALITY OF EXPERIENCE

The challenges of 5G use cases, network performance, and services

It is important to remember that 4G services will continue to evolve but also to recognise that the implementation of 5G will be very different from previous generations of cellular technology, particularly in the RAN. It starts with a consideration of the 5G use cases of eMBB, mMTC and URLLC which bring new dimensions in terms of real-time, higher-bandwidth, scalability etc and require a revised methodology and set of parameters to measure the Quality of Experience. This in turn drives the performance of the network needed to support these uses cases. Finally, an expanded test methodology is needed to measure new parameters more accurately at higher frequencies and wider bandwidths and meet the challenge of how to quantify QoE, particularly where the end user will not be using a smartphone. We therefore need to re-think our approach to what constitutes QoE and how to measure it.

Smartphone-based test cases to measure the quality of eMBB will remain but for mMTC and URLLC, the end user will be a machine and the service will bring a new set of demanding parameters to measure. For machine-type communications, the traditional concept of quality of experience (QoE) will no longer be using a smartphone. We therefore need a new interpretation and understanding of what constitutes QoE and how to measure it.

Implications for operators

The services and applications for these 5G use cases such as automotive, industry 4.0, AR, remote surgery etc are often more critical in nature and the consequences of degradation or loss of service become more serious, potentially life threatening. Therefore, operators must monitor networks with greater accuracy and in finer detail to pre-empt QoS issues. The challenge facing operators moves from ensuring subscriber satisfaction and compliance with SLAs to being able to guarantee the delivery of often critical services and legally prove that they meet this obligation to address questions of liability.

With each individual application potentially supported by a dedicated network slice, each with its own QoS definition, metrics and thresholds, operators’ network monitoring requirements expand from a single one for their entire network to multiple, simultaneous performance and quality measurements.

Measuring 5G network slice performance

A much more diversified range of use cases, serviced by logical network slices, expands performance measurement requirements for operators.
The role of standardisation organisations

International standards organisations such as ITU and ETSI are actively evolving their test models to cover these changes and this is something R&S is very actively engaging in. However, building 5G methodologies and standards is going to be complex when we consider all of these use cases and remember that operators already have 200-400 core KPIs to monitor, often making it very difficult in understanding QoE in a granular way. Therefore, this is another change in the QoS environment driven by 5G, where there will be many more parameters to monitor.

To evaluate and benchmark networks, KPIs are required that truly reflect the network’s performance so that based on such KPIs it is possible to define a fair and transparent performance scoring method. ETSI has taken the driver’s seat to discuss and define best practices for network benchmarking and scoring that enables the network to be characterised in a single, unified metric. The method provides the operator with visibility of the status of their network and identifies the factors that influence quality. The factors and weights that influence the scoring method will be adapted for each 5G use case and application, but the fundamental methodology is robust and will provide the industry with an independent reference against which 5G QoE can be measured.

Approach of R&S

The approach of R&S has two parts. Firstly to release test solutions that enable the technical aspects of 5G networks such as coverage, performance and operation and secondly to evolve the 4G QoE methodologies to encompass 5G use cases. The solutions for testing technical aspects of the 5G RAN are already being used by operators as they move from from trials to the commercial deployment of 5G, while the QoE solutions from lower layers up to signalling are being developed in partnership with the operators and standardisation bodies.

Conclusion

In conclusion, we need to push first to an understanding of what the requirements of each 5G use case are. Then we can build out key parameters and KPIs required to meet those requirements. Once we understand why we are testing certain parameters, we will then have the test methodology to quantify QoS according to those KPIs. Although we have seen that the requirement to test becomes more critical and it demands more accurate tools and complex methodology, R&S has the capability to test the network performance today to test the technical aspects of 5G networks and QoE/QoE of eMBB. And we are working towards the QoE for mMTC and uRLLC to ensure 5G applications function in accordance with their requirements. This ultimately enables mobile network operators to benefit from new 5G business models.