Activating Quality of Experience KPIs in Your Network

By: Alexander Havang

Analytics, Artificial Intelligence (AI), and 5G were all the rage at Mobile World Congress this year. Each, in its own way, is a critical network enabler, with analytics and AI already having impact and 5G appearing to be the future endgame. With the transition to 5G just ahead, how do we evolve our current networks, operations, and investments to make this shift more seamless?

The answer is that we need to focus on the business "first principles" that will continue to be fundamental in both the 4G and 5G eras. Network quality of experience (QoE) is one of these fundamental areas that is poised for rapid advancement as industry, technology, and operational forces join to deliver better QoE analytics, actions, and outcomes.

Network QoE Today

Today's network QoE analytics are largely used to measure the impact that network resources and operational actions have had on the experience of operator-provided applications and services. These metrics help operators stay attuned to the impact that their tactical and strategic decisions have on customer QoE. The QoE metrics used by many operators are usually very basic and are centered on throughput and uptime, which are not always very actionable.

Existing QoE metrics are also used to take corrective actions when network conditions degrade and deliver subpar services. These actions are generally applied as use cases such as those that manage traffic in times of congestion, optimize traffic performance, and use current resources more efficiently and cost-effectively; generally, these actions are fairly static in nature, implementing a specific corrective action based on a small set of conditions without considering other, potentially more disruptive underlying problems.

Innovation is Coming

Advancements in QoE are underway as the industry prepares for high-quality 5G services and as operators have become more knowledgeable from their own in-house QoE initiatives. In due time, operators should have far more capabilities for delivering better quality—and for providing it on a more consistent basis.

Two leading industry bodies are taking significant steps on these fronts. The 3GPP 5G standards body has introduced a Network Data Analytics (NWDA) function for mobile network architectures and has defined a collection of initial use cases that specify the kind of data that can be provided to feed 5G network decisions.

ETSI has recognized the importance of customer experience and launched an Experiential Network Intelligence (ENI) Industry Specification Group (ISG) to define a context-aware system using AI. ETSI envisions that the control model should be "observe-orient-decide-act," in which the AI and network analytics are used to adjust services based on real-time changes in user needs, environmental conditions, and business goals.

In tandem, these two powerful initiatives will combine to identify and act in more powerful and specific ways than are currently available. Current QoE resources will provide the foundation for

near-term advancements and evolve to create a disruptive advantage for mobile operators today—and in the 5G future.

Embracing Change

Although change is afoot, it's best to reexamine your current network QoE activities in light of today's best practices. Yes, future networks will be faster, more automated, and much more agile, but many of today's greatest subscriber quality challenges will apply for years to come. Content and apps will be king, subscribers will want more personalization and self-service, higher-resolution videos will continue to drive up traffic volumes, and a burgeoning number of additional devices will demand an increasing number of network connections.

And, of course, the consumer will continue to demand more and want more applications to work—right now. If a YouTube video is low resolution and stalling, Skype Voice is skipping, or Facebook is loading images slowly, then the user is having a bad experience. The challenge today is that many network operators don't have a clear line of sight to determine what has occurred—and they often have even less when it comes to capabilities to fix the problem.

The Three Primary KPIs for Subscriber Experience

Bandwidth, latency, and packet loss are the greatest determinants of a subscriber's QoE. It is critical that operators continuously track subscriber traffic by each of these factors.

1. Bandwidth

Bandwidth is an important measure of a subscriber's broadband experience. High peak bandwidth capabilities may be a necessary condition but are not a sole determinant of the subscriber service experience. For instance, video streaming in particular is bandwidth-hungry, but it also needs long durations of high bandwidth access to deliver a quality service. In the case of video streaming, QoE metrics and remedial actions would need to consider both bandwidth and duration at a minimum.

2. Latency

Latency is another important metric, especially for interactive applications. Few consumer plans offer latency as a service level agreement (SLA), but it is sometimes included as part of a managed service offering for business connections. Anyone who has ever played an online first-person shooter game can tell you that latency "literally" kills! For instance, high latency voice connections can introduce timing issues that lead individuals to inadvertently speak over one another, resulting in a very frustrating conversation.

3. Packet Loss

Packet loss is another important determinant of QoE and can result in increased buffering and stalls in video streaming, slow web page load times and jittery voice applications. Packet loss wastes bandwidth on the network as packets are retransmitted. In addition, depending on the application types, packet loss can wreak havoc on subscriber experience. For a web shopping session in a browser, packet loss of even 1 percent can result in doubled page-loading times, significantly impacting QoE and potentially driving shoppers away from that site.

These three factors—throughput, latency, and packet loss—are commonly identified by telecom regulatory authorities (TRAs) as the key metrics for a broadband operator to either measure or use to self-evaluate. The TRAs themselves will increasingly deploy measurement solutions as an independent authority on network performance; however, the question that immediately follows the collection of these key performance indicators (KPIs) is "are these good numbers?" The answer is, "it depends on the application."

It's All About that App

Any subscriber experience effort must also factor in the characteristics and the needs of the application in question. The table on the next page highlights the different ways that various applications can respond to disparities in traffic throughput (bandwidth), latency, and loss:

Application Type	Throughput	Latency	Loss
Web	Needs short bursts of download performance	High latency leads to slow page load times	Packet Loss can lead to slow page load times
Video	Sustained throughput delivers good quality	Not usually a concern except for initial loading of video	Less sensitive to loss unless it affects throughput
Social Media	Needs short bursts of download/upload performance	High latency can slow interactive sharing experience	Packet Loss can slow interactive sharing experience
Gaming	Most games do not require high bandwidth	High latency leads to lag in real-time games	Packet Loss leads to lag in real-time games
Upload	Sustained bursts of upload performance	N/A	Less sensitive to loss unless it affects throughput
Download	Sustained bursts of download performance	N/A	Less sensitive to loss unless it affects throughput
Voice	Low throughput requirements	High latency leads to poor voice experience	Some loss can be tolerated, high loss leads to perceived latency

Table 1 - Traffic Impact on Apps
(Click to Enlarge)

As you can see from the table above, simply delivering a decent average throughput will not necessarily result in good subscriber experience. A good average score does not translate to a consistently good experience either, as conditions may vary throughout the day, week, or month. However, if operators collect these key metrics, they can create their own network experience scorecards and use them to improve customer experience.

The Future is Experiential

ETSI's Experiential Network Intelligence specification group aims to improve quality by adding closed-loop AI mechanisms based on context-aware, metadata-driven policies to more quickly recognize changing conditions so that the most suitable actions can be taken by the network.

Of course, bandwidth, latency, and packet loss must be considered, but so must factors such as application, location, time of day, device type, service plan, and end-to-end network conditions. AI should incorporate these factors and many more, providing far richer context and situational insight so that network modifications would be more specific, precise, and likely to deliver positive QoE outcomes.

The future of mobile data analytics and the automation that will invariably follow will need to combine the emerging Network Data Analytics function with robust, AI-based, Experiential Network Intelligence engines. The NWDA function will identify the changes needed, and the ENI engine will initiate the actions that resolve QoE issues in real-time.