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# Deep Analytics: How Operators Can Avoid Being Data Rich, But Information Poor

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The rise of the Internet shows no signs of slowing down. It's been estimated by the GSMA that the number of new users being connected to the Internet will grow at an annual rate of 7.5 percent. Since 2015, traffic per user grew at a rate of 27 percent per year, with almost 80 percent of that being driven by video traffic.

These numbers come as no surprise to those of us on the network side. We know that our networks are being pushed to new limits. But what will bring water to our eyes is that pay-for-online services such as Disney+, gaming, or music streaming will soon exceed $1 trillion in revenues. But those charged with ensuring high-quality connectivity so that their customers enjoy these gaming and streaming services only see a return on investment in infrastructure of between six and 11 percent. So how can communications service providers (CSPs) bridge this gap and take a bigger share of the pie of this Internet boom?

It all comes down to utilizing the network and customer experience data that CSPs have access to every day. By connecting the dots with deep analytics, CSPs can make better network and customer experience decisions. This data enables them to build better networks to deliver superior customer experience, better engage with customers, and uncover new digital monetization opportunities.

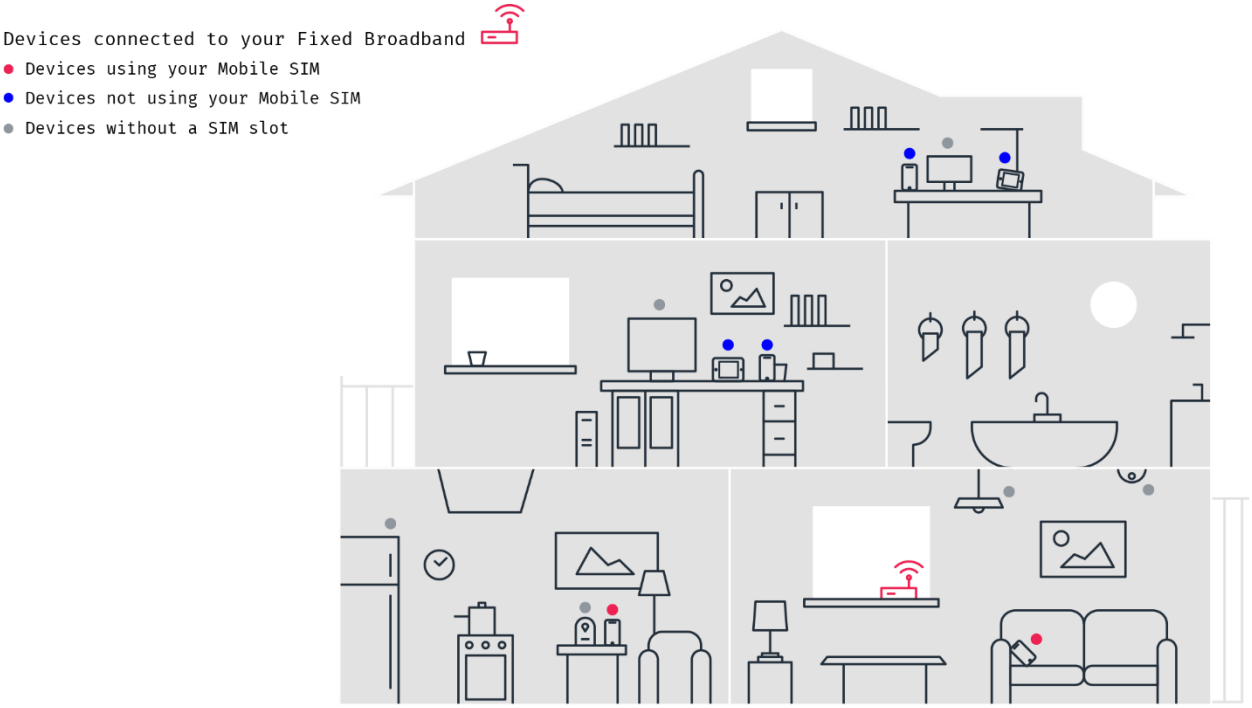


**Figure 1: Accurately counting devices**

# The edge challenge

Let's start at the edge. Managing performance at the network edge continues to challenge CSPs due to local traffic routing. Where traditional monitoring solutions built for a core network's centralized architecture fall short is they cannot provide the necessary visibility to support services, such as remote surgery, that require real-time analysis, processing, and communication at high speeds.

Instead, CSPs require 5G edge analytics that probe local traffic and interconnect with the core to provide visibility on edge user plane data and the corresponding control plane and back to the core. By doing so, CSPs can exploit traffic tracing, control plane logs, and KPIs functionality to provide a holistic and in-depth view of the entire network. This view enables CSPs to conduct connectivity monitoring with QoS metrics, identify network issues, and reduce maintenance interventions via remote validation of device status to identify non-authorized devices. With 5G edge analytics, CSPs have the necessary firepower to manage the increased demand for throughput, latency, and connected devices that 5G will encourage.

# Eliminating network blind spots

The ability to identify unauthorized devices is key. Have you ever wanted to know which customers present the best multi-play household revenue opportunity but have been unable to reconcile a subscriber's fixed and mobile views? Households, which typically subscribe to fixed services, and mobile subscribers belong to two distinct, hard-to-reconcile domains of identification. As soon as the mobile subscriber enters their front door and leaves the mobile network for the fixed one, the subscriber vanishes from the converged view. This is because CSPs cannot identify which mobile users latch, over Wi-Fi routers, onto fixed home broadband

connections because mobile devices send very limited unique identifiers when running on Wi-Fi. In addition, user-agents cannot be used to identify devices as two devices of the same model can have the same user-agent – which can also lead to unreliable data for marketing teams to work with. The end result is that as soon as a mobile user enters a home, he enters a blind spot, and gaining a single customer view becomes almost impossible. However, advances in analytics now make it possible to accurately identify and count unique devices connected to each household's broadband connection, from mobile devices and laptops to IoT devices.

Past technologies and approaches have failed because they considered subscribers as separate individuals per network and then inadvertently double- or triple-count the number of subscribers. Advanced analytics can now locate every device behind a household's broadband connection and identify if the devices are using a competitor's SIM or have an empty SIM. By gaining unprecedented visibility at the household level, CSPs' marketing and campaign teams have the data to identify the best upselling, cross-selling, and acquisition opportunities. As many mature markets experience mobile penetration rates that exceed 100 percent and high customer acquisition costs, the ability to upsell, cross-sell and capture a multi-play household can be extremely lucrative.

# Performance analytics for QoE

While acquiring new customers is great, keeping them is another challenge, particularly when it comes to video. A study from the University of Massachusetts found that the impact of a delay in video streaming will cause:

- Many users will abandon a video if it doesn't start streaming within two seconds
- Each additional second of delay will cost 6 percent of the audience
- A five-second delay will result in a quarter of the users being lost

This highlights how critical the need is for advanced analytics and AI to support effective testing methods that test, monitor, troubleshoot, and benchmark both live and on-demand video services. Supporting this requires at least three different levels of analysis. First, frame level analysis captures the video stream directly on the HDMI interface from any HDMI output, such as a set-top box or Apple TV, where the video source can be live or on-demand TV or OTT. The captured video stream is then processed, and each captured frame is analyzed, generating an extensive set of KPIs, which identifies the precise location in the video delivery chain that may be responsible for the quality degradation. QoE alarms are then triggered once this information has been reconciled against distortion KPIs.

IP-level analysis supports encrypted and unencrypted transmission and can be used to validate video quality across set-top boxes, video apps, and browsers. The KPIs measured at the IP layer are especially important for CSPs, who are typically responsible for the last mile part of a video transmission chain. In addition, IP-level analysis provides critical insights into audio and video packet loss, stream source and destination, audio, and video Mean Opinion Score (MOS).

Analysis can provide a proven quality assurance method at the application level, where active testing occurs directly on the smartphone or data-capable interfaces. By capturing and analyzing the Packet Capture (PCAP) associated, for instance, with a YouTube session, a Mean Opinion Score (MOS) for audio and video is generated, indicating the overall quality of experience. Analyzing Transmission Control Protocol/Internet Protocol (TCP/IP) can indicate packet loss, throughput, and bitrate. Conducting in-depth

performance testing and analysis of OTT video services (such as YouTube videos, Netflix streams, and video apps) directly on smartphones or data capable interfaces allows CSPs to get a granular view of performance KPIs, such as app launch duration, video start delay, content availability, to ensure the best quality of experience (QoE).

Network KPIs and QoE do not always mirror each other. Most subscriber experiences are negatively impacted when those metrics falter, but not all experiences are impacted equally. Different digital experiences demand different performance on the network. Without an understanding of subscribers' QoE, decontextualized calls for KPI improvement generally lead to misplaced and suboptimal effort allocations.

The impact of deep analytics can transform how a CSP prepares for and makes decisions that affect network performance and customer experience. True QoE established through network analytics makes it easier for network engineers to prioritize network KPIs strategically. By understanding that different applications respond in unique ways to different network KPIs, CSPs can better allocate time and resources to applying the right solution to the identified problem and improving their customers' experience. With these insights in hand, CSPs now have the actionable information to increase revenues, improve the customer experience, and capture future opportunities arising with growing digital adoption.