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Proactive Device Problem Resolution

by Bruce Peterson

Mobile operators in today's saturated markets are introducing smartphone devices at an ever increasing rate to lure subscribers away from competitors. As a result, they're rushing new devices through the product development cycle.

''Spurred by the popularity of Apple's iPhone and its elegant user interface, global shipments of touch-screen display modules are expected to more than double from 2008 to 2012''
(source: iSuppli Corp)

Being first to market is not always a good foundation for success. In 1991, Geoffrey A. Moore wrote a book that became widely read and quoted in the business community, and was ultimately turned into a theory - Crossing the Chasm. Moore argued that there is a gap that exists between the early adopters of any technology and the mass market. He explained that many technologies initially get pulled into the market by enthusiasts, but later fail to get wider adoption because they do not have the foundation in place to move beyond early adopters and cross the chasm to reach the mass market.

Product managers spend a lot of time trying to figure out how to bridge the gap that stands between the early adopters and the mass market. In order to move beyond early adopters, who represent a very small percentage of the user population (and one that is prepared for technical glitches and idiosyncrasies), you need to have a reliable service offering that will appeal to the mass market that holds the key to financial success. In the case of smart devices, that means ensuring that the devices perform impeccably.

In fact, mass market subscribers avoid new smart devices until the device receives an endorsement from an early adopter they trust. Proactively resolving problems has been identified by JD Powers and Associates, a global marketing information services firm, as being the key factor to improve customer satisfaction that leads to greater market share.

A new device monitoring OSS is essential to create that consumer confidence, gain mass market acceptance, and sustain sufficient momentum to cross the chasm. Mobile operators need new real-time, per session, user plane-based key performance indicators (KPI) that provide insight into smartphone device data session integrity problems. Network-wide, cell site, device type, server and services key quality indicators (KQI) assist the mobile operator isolate and prioritize the problems before impacting these highly-valued, smartphone device early adopters.

By monitoring every data session for network-wide end-to-end service quality KPIs, mobile broadband operators are able to quickly determine session quality outliers that affect the customer experience of their mobile broadband device early adopters.

Some legacy probe solution providers realize the importance of end-to-end, network wide, user plane monitoring and recommend installing probes on every cell site interface. System wide cell link monitoring is expensive and extremely tedious to install and calibrate, as well as difficult to manage, requiring the collection of measurements from thousands of points in the network. Full end-to-end, network wide, user plane monitoring requires hardware based Deep Packet Inspection (DPI) to inspect every packet and extract the user plane KPIs.

Device Monitoring OSS utilizing DPI to ascertain the service quality of every session allows mobile operators to monitor new smartphone devices and services as they are being deployed. The components of a Device Monitoring OSS include:

- DPI deployed within the mobile network that extracts metadata about the quality of each session,
- Service Detailed Records (SDR) measurements inserted into a database,
- Per session KPIs and KQIs aggregated by service delivery component,
- Filtering based on preferences, dashboards and geographical map displays and
- KPI/KQI interface to the mobile operator's data warehouse.

Legacy KPIs have traditionally focused on voice dropped calls as the primary network/device quality indicator. Mobile broadband sessions are much more complex to monitor because a session drop may not affect customer experience if the user wasn't transmitting data, while other factors, like throughput, latency,

packet loss, and retransmissions, often times have a much greater effect. As a result, we need the measurements within the SDRs. These detail measurements are critical to understanding customer experience of smartphone device users and can fuel a successful device launch.

User plane monitoring focuses on measuring the customer experience of the actual user content service quality, not just on control plane signaling messages that detect network drops and server access problems. Mobile broadband customers have come to realize you can have a data session that doesn't necessarily drop but still have a bad customer experience because of lousy throughput, latency, and packet loss.

USER PLANE INDICATORS

Packet Loss

Packet loss is a basic indicator for broadband data service quality with new patent pending algorithms that improve applicability to mobile broadband networks. Simply stated, if you drop too many packets it will cause serious quality problems resulting in white screens and unusable content. Packet loss is also extremely difficult to isolate since it occurs at any point in the network from any of hundreds of servers or thousands of cell sites in the Radio Access Network (RAN) or the smartphone device itself.

Mobile service providers that proactively resolve statistically relevant packet loss problems increase user satisfaction. Furthermore, resolving packet loss problems on smartphone devices associated with revenue generating services eliminates revenue leakage.

Real-Time Throughput

Monitoring uplink and downlink throughput in near real-time (e.g. 5 min.) by subscriber and statistically aggregating by smartphone devices is a basic requirement for verifying service levels. Users view throughput as a critical performance indicator and expect promised throughput levels to be maintained for the session (e.g. 300 Kbps). Verifying the throughput for a certain user at a particular point in time is a basic requirement to perform up to the user expectations of valued smartphone device early adopter subscribers.

Real-time end-to-end throughput monitoring is also required in monitoring streaming and other advanced smartphone device data services to verify service levels. For example, monitoring real-time throughput levels of a particular server or service and correlating them with statistically aggregated smartphone device indicators assists in problem resolution.

By providing the ability to isolate, prioritize and proactively resolve service affecting problems, mobile operator engineers can significantly enhance user satisfaction and resolve early adopter subscriber issues. Furthermore, proactively resolving problems associated with smartphone device early adopter subscribers is a proven method to increase user satisfaction of early adopters and increases adoption take rates and

revenue ramp up rates.

Latency

Considered the key to providing user satisfaction in fixed-line broadband networks, latency is crucial to understanding user satisfaction in a mobile broadband network. While some mobile operators manually ping a smartphone device to perform basic latency reports, this method is flawed, error prone, and may not provide the level of granularity needed as data volume and service complexity increase.

Isolating the root cause component within the mobile network with latency over threshold provides actionable results to improve the customer experience of smartphone device early adopters. Measuring latency at the edge of the mobile network before packets enter the internet acts as a demarcation point to assist in root cause problem determination.

These KPIs indicate TCP connection creation latency (TCP Access RTT) or TCP packet delivery latency (TCP Data RTT). Both are indicators that are useful in indicating potential smartphone device and transmission path performance problems. The separation of the uplink and downlink KPIs allows identification of the problem areas either in transmission path of the Mobile Data Network or the smartphone device.

By aggregating the per-session TCP latency for a smartphone device to various service delivery components (Devices, Cell Sites, NEs, APNs, Application servers …), the mobile operator can determine which service delivery components require immediate attention.

Measuring latency on every session is critical to verifying session quality. Proactively isolating quality problems for high value smartphone device early adopter subscribers differentiates high value service providers providing significant added value and revenues.

Service Drop Detection

Service providers that perform up to the user expectations of their valued smartphone device early adopter customers monitor services to ensure they are not impacted by service drops. Existing solution providers trying to re-use legacy solutions built for voice applications utilize old architected solutions to monitor smartphone devices. The problem is these legacy systems only monitor the transport layer for network drops, which was very effective for fixed timeslot voice calls. With new always-on advanced data services, the transport layer could drop but have no effect on user satisfaction of the subscriber if the user wasn't actively transmitting data. Engineers utilizing these old voice dropped call troubleshooting solutions for data service monitoring end up "chasing their tails" and looking to resolve problems that are not customer experience impacting.

A new patent pending indicator allows the detection of the TCP connection drops during the active packet transfer. This type of drop impacts the user's perception of the smartphone device performance. This indicator does not detect TCP connection drops during TCP idle time, i.e. no packet transfer. The TCP Connection Drops KPI

allows the detection of the session drops that are user impacting.

Customer experience impacting session drop indicators can be aggregated from per-session to various service delivery components (mobiles, Cells, NEs, APNs, Application servers…), and operators can detect the root cause of problematic smartphone devices.

New service assurance drop detection architecture is required for advanced data services utilizing DPI. Smartphone device monitoring requires not only the transport layer (L2) but also the data services transport layer (L4) and the application layer (L7). Having complete visibility to service affecting session drops is critical to assist in proactive problem resolution to enhance customer satisfaction and increase smartphone device adoption rates.

Service Type Classification

Service type classification with visibility down to the cell site and smartphone device level is critical to intelligently manage the bandwidth burden problem. By over subscribing bursty data traffic (SMS, email, web browsing) and understanding the amount of real-time sustained streaming sessions, service type classification allows mobile service providers to intelligently manage and plan transport build out.

These unique indicators allow the detection of the sustained TCP or UDP traffic based on TCP/UDP port utilization over time. These KPIs indicate which users and which cells have the most sustained traffic, thus the most potential impact on network performance.
Furthermore, the end-user customer experience satisfaction levels need to be monitored end-to-end, not just individual device testing, since end-users rate end-to-end the complete user experience when evaluating the performance of a new device.

Customer experience of a smartphone device early adopter is significantly affected by delays in retransmissions, not freeing IP addresses properly, window size buffer problems, and on and on. Monitoring device KPIs coupled with end-to-end performance monitoring provides numerous views to assist the mobile operator proactively resolve problems. And with the total customer experience as the final verdict of customer satisfaction and crossing the chasm, network-wide end-to-end monitoring is required.

The Bottom Line: Profitable Revenues from Achieving Mass Market Approval

More often than not, the root cause of a problem that affects the customer experience of a valued early adopter may not be the device but a server they are accessing, network problems, or application issues, but without the ability to isolate the root cause component, the new smartphone device gets the blame. Therefore, without the proper OSS monitoring system, many new mobile broadband devices and services are destined to fall into the chasm.

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