Congestion Management And Service Experience Optimization for Mobile Service Providers

The exponential increase in data consumption and a growing share of time-sensitive streaming content in network traffic is making mobile networks increasingly congested. Signaling storms caused by always-on smart mobile devices frequently cause service disruption and degradation, which impact customer experience. Subscribers that frequently experience diminished service quality not only abandon the service but also share their experiences, creating an avalanche effect that disproportionately increases subscriber churn and impacts the service provider’s top-line.

While over-provisioning network infrastructure for peak traffic conditions can help lower congestion, it is often a prohibitively expensive and impractical option to pursue. As mobile traffic tends to be “bursty,” overprovisioned capacity may remain frequently underutilized. Many network performance monitoring solutions operate in silos and don’t have an end-to-end view of the network. Moreover, they tend to analyze historical network data and don’t help mitigate problems as they occur.

To adequately address these challenges, service providers need a dynamic, end-to-end service monitoring and congestion remediation solution that helps them maximize the return on their existing infrastructure investments. The solution must operate in real time to address issues before they significantly impact subscriber experience.

THE BROCADE SOLUTION
The Brocade Congestion Management and Service Experience Optimization solution offers mobile service providers the ability to know when, where, and why congestion occurs. Further, it enables them to mitigate network congestion and optimize service experience in real time.

ADVANCED CONGESTION DETECTION
Congestion in a mobile network may occur in the Radio Access Network (RAN), backhaul, or in the packet core. Service degradation may even occur outside the mobile network, when for instance, Over The Top (OTT) application servers introduce latency.
DETECTING SIGNALING STORMS
Signaling volumes in the LTE packet core are significantly higher than in 2G and 3G networks. The LTE Mobility Management Entity (MME) serves every eNodeB and microcell in its tracking area. When a large number of subscribers simultaneously access a mobile network with always-on mobile apps, the volume of signaling traffic they generate results in signaling storms.

The Brocade solution actively monitors all packet core signaling traffic, including S1-MME, S6a, S11, and Diameter interfaces, for signaling storms. It measures current traffic volume against historical trends to detect surges and drops in traffic volume.

When signaling storms are detected, the Brocade solution notifies the service provider’s operations staff, providing detailed, actionable reports and suggested remediation. The Brocade solution can also trigger Self Optimizing Network (SON) control functions, policy servers, and other controllers through SDN, REST or other interface types to initiate remedial policy action.

TCP CONGESTION
The completely flat, all-IP architecture of LTE necessitates active monitoring of the TCP KPIs at both bearer and signaling interfaces. Some key TCP metrics monitored by the Brocade solution include latency, throughput, retransmissions, session setup time, and DNS round-trip delay. Latency measurements across the network are aggregated and correlated to compute RAN, backhaul, core, and external latency, which enables operations staff to plan network capacity and troubleshoot errors and anomalies.

CONGESTION MANAGEMENT AND SERVICE EXPERIENCE OPTIMIZATION ANALYTICS
The Brocade Congestion Management and Service Experience Optimization solution performs deep analysis of current and historical data to determine trends and root causes for service degradation, using the following criteria:

- **Subscriber:** Who are top users of the network and how are they impacting the service experience of other users? What are some behavioral trends associated with congestion (for example, traffic surges after lunch on weekdays)? How are roaming subscribers experiencing the visited network?
- **Application:** Which applications and OTT services are the top offenders impacting the performance of operator services? What trends can be observed in the patterns of traffic that specific applications generate? Which applications or services are subscribers most attached to (correlating with customer care call data)?
- **Network:** Are specific regions, zones or silos within the mobile network more prone to congestion and service degradation? Where does capacity or coverage need to be expanded and where are they underutilized?
- **Device:** Which devices generate the largest volume of traffic (helps structure device-specific data plans)? Does the correlation between device and subscriber demographics help predict congestion in specific areas or regions?

The Brocade Congestion Management and Service Experience Optimization solution provides proactive insight to launch remediation policies in access networks, including planner actions and network controller actions, reducing network wide and subscriber specific congestion.

PROACTIVE SUBSCRIBER NOTIFICATION
Many subscribers accessing the Internet from their mobile devices aren’t aware of where latency occurs in the traffic route. They may therefore hold the mobile operator responsible for issues that occur outside the mobile network.

Using the Brocade solution, mobile operators can detect the exact point of congestion or degradation in real time and notify the subscriber (via SMS or other mechanisms) that the problem lies outside the mobile network. Such proactive communication builds subscriber goodwill and reduces instances of negative brand perception.

INTELLIGENT TRAFFIC ENGINEERING
The Brocade solution can perform the following mobile traffic engineering functions:

- **WiFi Offload:** Detect VoLTE and data service degradation to trigger seamless session offload from radio access to service provider or partner WiFi access networks
- **SON Triggering:** The Brocade solution can function as a real-time policy decision engine for triggering SON load-balancing functions in access networks

DIFFERENTIAL USAGE METERING BASED ON REAL-TIME TRAFFIC CONDITIONS
Many operators have implemented differential usage metering policies for peak or high-volume traffic conditions. These policies are based on static time windows (for example, from 4 p.m. to 7 p.m. on weekdays) when the network is expected to get congested. With static metering policies, however, subscribers pay a higher price for their usage during these hours even if the network is not congested.

The Brocade solution enables operators to implement dynamic metering policies based on the actual state of the network. For example, subscribers may be billed at
peak usage rates only when the network is actually congested. This lowers instances of bill shock and reduces subscriber churn.

**VIDEO ANALYTICS AND OPTIMIZATION**

With the growth of mobile video, service providers have begun to regard video as a service in its own right, like data and voice. The video analytics and optimization capabilities of the Brocade solution transform mobile operators into video service providers.

**VIDEO DELIVERY AND PRESENTATION QoE**

The Brocade solution uses industry-leading algorithms to compute video Quality of Experience (QoE) and creates a scorecard for each video transaction. It can further determine the impact of the network (Video Delivery QoE) versus the impact of the device, application, or environment (Presentation QoE) through the quality of the video.

The Video Quality Score can be rolled up by cell tower, region, video service, device, plan, and subscriber. This allows service providers to refrain from charging for data usage when the quality of the subscriber’s video viewing experience is lower than a minimum video QoE threshold value.

**ADVANCED DIAGNOSIS FOR VIDEO SERVICE DEGRADATION**

In addition to measuring video QoE, the Brocade solution provides drill-down analysis capabilities to accurately pinpoint the cause of diminished QoE and the points of congestion in the network.

**VIDEO OPTIMIZATION**

When video congestion is detected, the Brocade solution can optimize video quality by modifying the video’s codec or bitrate in real time through an inline video optimization gateway. This improves buffering speed while marginally reducing the presentation quality (which is often unnoticeable to subscribers).

**SOLUTION ARCHITECTURE**

The Brocade solution is built using the Brocade mobile visibility and analytics product suite, comprising of:

- **virtual Intelligent Protocol Engines (vIPE):** vIPEs are high-speed packet processing engines that intercept and decode traffic on specific mobile bearer and signaling interfaces. They extract relevant information, reducing high-volume traffic data into lower volume metadata which is securely transmitted to vACE for further processing.

- **virtual Analysis and Correlation Engine (vACE):** vACE aggregates traffic metadata received from numerous vIPEs deployed in the mobile network. It correlates the metadata to compute metrics and Key Performance Indicators (KPIs) which are reported by the vVID reporting engine. vACE also acts as a policy decision engine, triggering external controllers (for example, PCRF, SON controller etc.) through the vISE module for policy enforcement.

- **virtual Intelligent SDN Engine (vISE):** vISE is the third-party notification and policy action engine that can trigger policy enforcement across the network via SDN, REST and other types of interfaces.

- **virtual Visualization and Insights Dashboard (vVID):** vVID is a highly intuitive, browser-based reporting engine that displays recent and historical metrics as well as QoE and performance KPIs in graphical and tabular formats.

**THE NFV ADVANTAGE**

The Brocade solution is a fully software-based, NFV compliant solution deployed on commodity x86-based servers. It is an agile, scalable, and cost-effective solution orchestrated by open frameworks like OpenStack and OpenDaylight.

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