Operators Require All Layer Visibility to Assure QoE – Here’s How

In an app-centric era, user experience is key to communication service providers’ (CSPs) success. To deliver the user experience customers expect, operators must be able to analyze how well applications are performing, in addition to monitoring network quality of service (QoS)—they need visibility at all layers to effectively monitor, troubleshoot and optimize quality of experience (QoE).

Put another way, QoE assurance requires ‘illuminated troubleshooting,’ involving:

- All-layer visibility for rapid root cause isolation of issues affecting customers.
- Multi-layer, multi-metric correlation revealing the relationship between QoS and QoE.
- Focusing optimization efforts where subscribers are most likely to notice—and benefit.

Solutions to achieve this type of 20/20 vision with actionable insights must be cost and bandwidth efficient (measuring QoE shouldn’t impact it), and provide metrics from all layers, all locations, at all times and seasons.

Existing QoE Analysis Tools and Methods Fall Short

Until now, visibility into the application layer and user experience was restricted by analyzer cost, at locations governed by access to data. While deep packet inspection (DPI), protocol, and application-layer analyzers can deliver insights into the actual user experience, this technology is large, costly, and impractical to deploy remotely.

Ideally, central analyzers would have access to traffic from all locations in the network, but common remote capture methods—like Remote PCAP, (E)RSPAN and sFlow—provide only basic filtering and counting, don’t guarantee packet delivery, are insecure, and result in high network overhead. They also tax routers’ processors, potentially adding latency and loss to monitored traffic. Flow statistics methods—like NetFlow/IPFix—offer traffic distribution reporting from
routers in the network, but don't permit payload analysis when reported usage profiles indicate deeper investigation is required.

Other factors restricting QoE visibility include:

- Distributed packet brokering for use by centrally-located analyzers is impractical when there is no way to guarantee all the packets completed the transit, or to accurately time-stamp them for precise analysis.

- Sending captured traffic without efficient pre-processing over the network can potentially impact QoE, while offering no guarantees that the received captured data has enough fidelity to be useful—loss, packet resequencing, and inaccurate packet timing all result in non-representative samples to analyze.

- Software-based analyzers are limited by processing power of the hardware they run on—often, a general-purpose CPU chip not designed for the volume of data involved.

Analyzers benefit from tailored, pre-conditioned data, where filtering, slicing, flow assembly, and brokering offloads significant processing overhead to provide efficient all-layer visibility. This is one reason why packet brokers and intelligent taps are fundamental companions to most analyzers.

However, for brokered packets to have sufficient timing accuracy and integrity to afford accurate analysis, packet brokers and analyzers have to be collocated: packet brokers can offload traffic pre-processing from

Accedian's FlowBROKER™ solves these problems by combining lossless, precise, distributed remote capture with centralized, virtualized packet brokering. As it is impractical to bring analyzers to every data source, FlowBROKER brings this data to the analyzers. This separates data access from analysis, liberating analyzers from the myopia and confines of core locations, and dramatically increases their visibility to any flow in the network.

FlowBROKER: Complete QoE and All-Layer Visibility

FlowBROKER is the industry’s first network functions virtualization (NFV)-powered remote packet capture solution. It closes the QoE visibility gap by making distributed packet capture feasible and affordable. It also makes virtualized DPI and analyzers practical, by delivering precisely time-stamped packets to any location, physical or virtual, at cloud-scale.

This disruptive technology works by using either a miniature, NFV-based Module or smart SFP to tap any point in the network, then conditions and streams the captured data in real-time to Accedian’s virtualized VCX controller and the FlowBROKER virtual network function (VNF).
FlowBROKER provides exceptional coverage to assure QoS & QoE data center access (DCA) and hybrid cloud connectivity applications.

FlowBROKER = Total Visibility

Separates Traffic Access from Analysis
- Full line-rate capture
- Local time-stamping
- Local packet slicing
- Efficient, lossless delivery

Eliminates Blind Spots
- Tap the network anywhere
- Sectionalize the network
- Hop-by-hop visibility

Frees & Offloads Analyzers from:
- High-speed capture, filtering, processing OR The need for packet broker appliances

Offers Limitless Scale
- Distributed capture: scales site-by-site
- Centralized brokering: scales with NFVI
FlowBROKER allows centralized analyzers to gain access to network traffic flows to add location-based visibility into QoE of applications including VoLTE, IPTV, streaming video, software-as-a-service (SaaS), intrusion detection, policy enforcement, protocol, and payload analysis. This is a critical piece of missing information, to date, where analyzers could detect an error, but not localize and isolate it for root cause analysis and rapid service restoration and real-time optimization. In many applications, FlowBROKER makes the difference between identifying an issue and rapidly resolving it.

**Intelligent, Efficient Brokering**

After filtering/capture, microsecond precise time-stamping, slicing, and bundling performed directly by the Module at the tap location, FlowBROKER losslessly transfers packets to the virtualized VCX Controller for remaining aspects of the brokering function (unbundling, file storage, aggregation, and duplication if being sent to more than one analyzer). This results in efficient, guaranteed packet delivery from tap to analyzer — every packet is accounted for.

FlowBROKER’s patent-pending method of efficiently transporting data across the network allows remote capture to be used continuously as a monitoring tool, instead of only for intermittent troubleshooting. It can also be used alongside bandwidth utilization metering, and active test and performance monitoring methods.

**Granular, Shared Filters**

Detailed, 7-tuple+ capture and reporting filters—shared with other monitoring functions controlled by the VCX—results in highly granular analysis. FlowBROKER can classify and capture hundreds of concurrent flows at speeds up to full line rate, with microsecond precision and no loss.

FlowBROKER filters go beyond standard 5-tuples to include DSCP, interfaces, and all key Layer 2 header fields, for surgical classification—providing optimal input streams to analyze, while eliminating unnecessary data transmission.
Lossless, Assured Delivery
FlowBROKER makes it possible to locate analyzers remotely without sacrificing data capture quality. VCX Controller automatically verifies bandwidth availability for packet transfer, authenticates session setup for secure capture, and prioritizes drop with loss accounting if the session is disrupted.

Flexible and Performance Assured
FlowBROKER uses an NFV-based control and analysis engine, making it a scalable, programmable, future proof solution with open multi-platform integration.
FlowBROKER can be installed in-line or out, with physical or virtualized deployment options available.
As the SkyLIGHT™ VCX controller is a virtualized appliance, brokered flows can be easily steered to either physical or virtual appliances, VNFs and controllers, and can scale up and out to process vast amounts of data.
FlowBROKER Applications

FlowBROKER is a universal tool that enhances network visibility as well as the efficacy of a wide range of analysis tools in diverse applications. With access to data from any location in mobile, wireline, enterprise, or data center networks, centralized analyzers become “location-aware,” tapping all points of interest to form a complete picture of network behavior and the user experience.

Because the SkyLIGHT VCX is a virtualized appliance, its packet brokering capabilities can scale as required to process remote capture data from the entire network—analyzing data from thousands of capture points becomes practical, for the first time. This facilitates the use of virtualized analyzer appliances, as they can be “spun up” in close proximity to a VCX instance, and directly connect through a high-speed data center fabric.

Many applications benefit from this new level of insight, from traffic analysis to big data analytics. Some common ones include:

Troubleshooting Network & Service Performance

When QoS issues arise, operators need information to make a swift root-cause diagnosis, and tools to confirm that service has been restored as expected. FlowBROKER’s remote capture capabilities complement network layer monitoring and active test tools by affording protocol and QoE analyzers access to any point of interest, without the cost and delays of a technician dispatch.

By adding remote capture into Accedian Modules that also provide bandwidth utilization metering, continuous end-to-end performance monitoring, traffic loopbacks, and turn-up testing, service providers can rapidly detect, isolate, and analyze network and QoE impairments—then test and validate resolution—all from the SkyLIGHT performance platform.

Eliminating the manual configuration of many separate tools, commonly defined filters are shared by FlowMETER™, FlowBROKER, and L2-4 loopbacks. Problems can be quickly detected, flows of interest captured, and active tests conducted, knowing that results reflect consistent traffic classification across all functions.
VoLTE QoE

With complete visibility into call signaling and media, FlowBROKER permits per-session QoE analysis for both call control and user-perceived quality. As 80 percent of call drops originate in the radio access and backhaul network\(^1\), analyzers located in the core can detect quality issues, but lack information from the RAN/backhaul network to efficiently diagnose them.

With the ability to tap flows at any location in a mobile network—from packet or serving gateway to each eNodeB—call quality issues can be rapidly detected and resolved to their point of origin within the EPC or RAN, and at network, transport, control, and application layers. QoE degradation can be analyzed along the call path, to determine which segments or network elements introduce impairments.

Fully programmable flow brokering can be triggered by network events or QoS impairments (e.g. packet loss thresholds on voice bearer traffic), initiated on demand in the VCX interface or via XML northbound interface (NBI), or streamed continuously.

DPI-enabled QoE:

- Detect one-way issues
- Detect, isolate, and correlate local issues
- Bring full-path visibility to centralized analyzers
- Combine user context and meta data to correlate QoE and QoS with location, device type, signal strength, and more

Surgical VoLTE Traffic Capture:

- IGMP / SIP / IMS signaling
- RTP packets with time-stamp
- Real-time streaming and SCP host for PCAP storage

To learn in-depth how FlowBROKER helps mobile operators deliver and assure the best possible VoLTE experience, read Accedian’s “VoLTE QoE - Establish, Assure & Optimize.”

Video QoE

Video quality can degrade at any point along the transmission path. FlowBROKER gives centralized analyzers segmented and local access to video flows, allowing them to isolate where individual sessions deteriorate or disconnect. From IPTV delivered over residential access networks to VILTE over mobile, FlowBROKER allows analyzers to capture all key control and media KPIs from any point in the network.

Operators offering differentiated access to partner content providers (CDN), zero-rated bundles, or multi-screen broadcast and streaming services can ensure that the user experience meets customer expectations, while ensuring that premium content excels against over the top (OTT) applications.

\(^1\) Amdocs mobile network survey, January 2016

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\(\text{FlowBROKER} \bullet \text{February 2016} \)
By performing targeted capture on real-time protocol (RTP) streams, operators can quickly isolate video quality issues stemming from sequence gaps, out-of-order, and lost packets. FlowBROKER’s microsecond-precise time stamping allows analyzers to identify excessive jitter for any particular flow. This allows the provider visualize how jitter develops along the transport path, to isolate packet drop locations, and to optimize jitter buffers where the most loss occurs.

FlowBROKER can help identify changes in RTP transport configuration that can impair video QoE, including loss of packet prioritization (DSCP / CoS marking / Bearer QCI), and routing changes. It also offers insight into common causes of video degradation: transcoding issues, insufficient streaming rate, and IGMP signaling latency. Programmable capture can be automatically triggered by analyzers detecting repeated failures in IGMP / SIP / IMS messaging, excessive latency, packet loss or jitter, or degrading video MOS user experience scores.

Financial Compliance & Trade-Flow Analysis

Accedian’s FlowBROKER remote, distributed packet brokering solution allows institutions to accurately time-stamp and capture every trade flow packet, at all critical locations to record the exact time of each trading event—guaranteeing optimal performance, transparency and regulatory conformance of their trading infrastructure. With a unique ability to synchronize time-stamping clocks at each capture point, no new timing distribution infrastructure is required.

FlowBROKER simplifies compliance with regulations such as MiFID II and Dodd Frank, while opening up a real-time feed for detailed trade flow analysis. Since time-stamping takes place at the network level—rather than the application level—there is no need to re-instrument potentially hundreds of technology stacks across all the locations an institution operates in.

FlowBROKER’s cost-efficient licensing model allows providers to fully instrument their full trading flow, from ingress into the bank/brokers’ buy side FIX Hub all the way down to the executing venues’ infrastructure, and back again. It does this without impacting underlying trade flows latency or content.

Learn all about Accedian’s solutions for financial services, and how FlowBROKER brings a whole new level of precision and resolution to compliance solutions, extranet monitoring, and trade flow visualization in our web library.
Security & Policy Applications
In addition to QoE and protocol analysis, FlowBROKER’s unique access to any packets, anywhere, dramatically increases the coverage surface area of detection and intercept systems, in addition to providing granular insight to policy enforcement systems.

Accedian Performance Elements and Modules can also filter and regulate flows at wire-speed, providing distributed enforcement applied directly at network entry points.

Intrusion Detection
FlowBROKER increases the coverage of intrusion detection systems (IDS) to every network access point—and to all points within the network itself—to combine the fastest-possible security threat vector detection with per-location awareness and isolation.

Lawful Intercept
FlowBROKER permits lawful intercept systems to capture sessions that may bypass traditional tapping locations. With programmable capture control, calls of interest can be quickly identified and logged from bandwidth-efficient signaling traces, only capturing media from targeted sessions when recording is required.

Policy Enforcement
FlowBROKER allows traffic from any location or interface in the network to be delivered to DPI appliances, and policy and charging rules function (PCRF) systems for traffic analysis, and policy enforcement.

Conclusion: FlowBROKER Opens a New Era of Visibility
FlowBROKER is part of Accedian’s virtualized SkyLIGHT Performance Platform that also integrates exceptionally granular, scalable active QoS testing and real-time monitoring. This brings together application-layer performance assurance, QoS, QoE, and analytics to give operators a complete, actionable view into network performance and resulting user experience.

FlowBROKER provides—for the first time—pervasive, all-encompassing visibility into all flows, applications, layers, and locations in any network, for direct insight into application performance, network behavior and user experience.

FlowBROKER extends the reach, utility and scale of established DPI, security, policy and QoE analyzers by separating traffic access from analysis, much the way SDN separates control and data planes, making holistic, efficient network-wide awareness possible. An exceptional and unique tool, it allows centralized tools to analyze traffic at any location, without compromising data integrity, granularity or timing precision.

Visit Accedian.com to learn more about FlowBROKER, or to contact one of our solution engineers