

Whitepaper

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Application QoE in the Cloud Era

Data Driven Deep Insights

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EXECUTIVE SUMMARY

Application and network observability has become an important topic in the operations of modern networks. High fidelity data of application flows provides a deep understanding of subscriber experience across different services and applications. This is particularly important as the application-centric lifestyle takes hold.

The rise in streaming video, gaming, and application data is pushing CSPs to develop more capacity, which isn't recuperated by current business models and unlimited bandwidth pricing plans.

Encryption, QUIC, and other multiplexed transport protocols obscure service providers' visibility into the traffic on their networks. To obtain network visibility utilized in customer experience and to determine network upgrades and capacity expansion, CSPs need innovative approaches to test and ensure services.

With the development of digital platforms that provide increasingly sophisticated applications with enhanced capabilities and performance demands, there is a growing need for greater observability to extract insights from the vast amounts of data flowing through networks.

Network observability must include a contextual understanding of the subscriber, services, applications and usage types, devices, location, and access networks. Crucial to that understanding is high quality data capture that optimizes networks to provide the best user experience and to identify the monetization opportunities.

There must be a progression beyond traditional service assurance, or application performance monitoring, and toward deep performance monitoring and analysis that supports automation in the network. With high-quality data capture and analysis, service providers can make the longer-term leap toward network automation. Data acquisition and the ability to apply active application and network intelligence in real time will be a game changer for CSPs that want to improve user experience and offer superior service performance at scale.

Only best-in-class service assurance systems can offer multi-technology data acquisition and traffic classification at scale. These systems are location, experience, application, device, and subscriber aware (LEADS aware). To be LEADS aware, application and network observability requires a much more data-driven approach, the goal of which is to predict and prevent service impacts that lead to poor subscriber experience. Deep visibility is needed, and it requires high fidelity data in near real time, and it must be contextually aware.

DIGITAL TRENDS DRIVING NEED FOR APPLICATION QOE

Application behavior is changing. Cisco reported in its [Annual Internet Report](#) that average global fixed broadband speed is going to reach approximately 110 Mbps in 2023 (from 46 Mbps in 2022), with 5G Speeds about 13 times higher than what's been the average for mobile connections.

Video is taking off, with people streaming, downloading, uploading, and embedding video everywhere. For example, across a sample of 177 global networks representing 300 million subscribers worldwide, video accounted for 60% of total traffic volume over networks, according to Sandvine's 2023 [Global Internet Phenomena Report](#).

Further ratcheting up data volumes is an evolution of hardware that delivers better picture quality options. HD and UHD means more desire for 4K video, and soon 8K video. That could mean that what's currently a day's worth of data for a household might be eaten up in a matter of two or three hours.

Already, the biggest tech companies, such as Google, Apple, Microsoft, Meta, Netflix, and Amazon, account for nearly 60% of internet traffic volume. Big events like the FIFA World Cup have had profound consequences to networks and the subscribers whose applications and services rely on those networks.

For the world's telecom service providers, the combination of unlimited bandwidth pricing plans and insatiable growth in application bandwidth is putting enormous pressure on them to optimize network capacity builds. The practice of overprovisioning networks to ensure network performance and business continuity is not sustainable in the long term.

The pivot toward modern, more distributed networks at a time when there is more pressure to cut CapEx is pushing operators to look at capacity planning and network optimization through the prism of customer satisfaction.

THE PIVOT TO THE MODERN NETWORK: DATA-DRIVEN ACTIVE ASSURANCE

The telecommunication market continues to progress towards software-enabled networks that are programmable. Services may have lifetimes of seconds, not months or years. Workloads will move and scale based on service demand. End devices will no longer be simply a CPE or a smart phone, but rather a camera, robot, or sensor. Applications and content will be created and distributed by media and software development companies.

A modern network has fully distributed microservices that include network functions for routing, switching, access control, and authentication. Traditional networks were fixed hardware appliances performing routing, switching, and access control. Because traditional networks were static, this limited the agility to scale out services. The fixed characteristics of the traditional network meant that testing and monitoring points also remained static.

The complexity of modern decentralized networks means the NOC staff must understand the relationship between packet flows and time series of data in order to gain insight into network traffic anomalies, DDoS attacks, and the propagation of viruses. They need more visibility of data, voice, and video application flows to meet more sophisticated demands.

To keep up with modern network demands, network tooling needs to evolve to handle the acquisition and decoding of all traffic, even encrypted sessions. To cope with the high volume of transactions, future systems should be able to optimize the data capture process and manage storage costs effectively over time. By analyzing data flow, active assurance systems can provide valuable information such as source/destination pairing, device type, and subscriber identity.

FOCUS ON CAPITAL EFFICIENCY

Return on invested capital is a critical business metric and in today's telecom market capital investments are under pressure. Most CSPs are looking to improve their cost structure. One lever being used is cutting CapEx budgets to reduce excessive debt on their balance sheet so there can be a focus on improved earnings. The problem is much of the current CapEx process is antiquated and deeply flawed. In fact, a recent study by PwC found that nearly two-thirds of executives say that Capex is driven by technology, with no clear business commercial objectives.

To defer CapEx, right-time capacity planning can be built around real-time customer consumption patterns. The ability to predict capacity demand in shorter cycles can drive a much more efficient capital allocation plan. It can also pave the path to proactive automation.

Accurate forecasting requires you predict how much growth there will be in a particular part of the network and why, so key questions would be:

- **What is driving utilization?** Is utilization increasing because of subscriber growth, or is more a movement of people to different places? Are certain devices like HD monitors or security cameras defaulting to 4K? Is there fraud like tethering or video in VPNs that needs to be evaluated for disproportionate usage?
- **What's the "application popularity"?** How many subscribers at peak are using hi-def video applications and what type of video is being used? Is it Netflix or YouTube and is it 4k or 1080p?
- **How much bandwidth does each application session use?** Is the session video, gaming, or social networking, and which applications within each category are consuming the most bandwidth. Is it TikTok, Netflix, Xbox, Video Conferencing, Enterprise apps, VPNs?

The demand for application and network intelligence in modern networks surpasses simply tracking router and switch counters. To achieve automated assurance deep performance monitoring and analysis are essential. Operators must strategically implement capacity upgrades and promote fair usage of network resources to prevent heavy or excessive users from negatively impacting the overall customer experience. Additionally, they must establish a foundation for usage-based monetization based on actual network and application patterns and the quality of experience being provided to customers.

SANDVINE INNOVATION: APPLICATION FOCUS ON DATA PLANE AND CONTROL PLANE

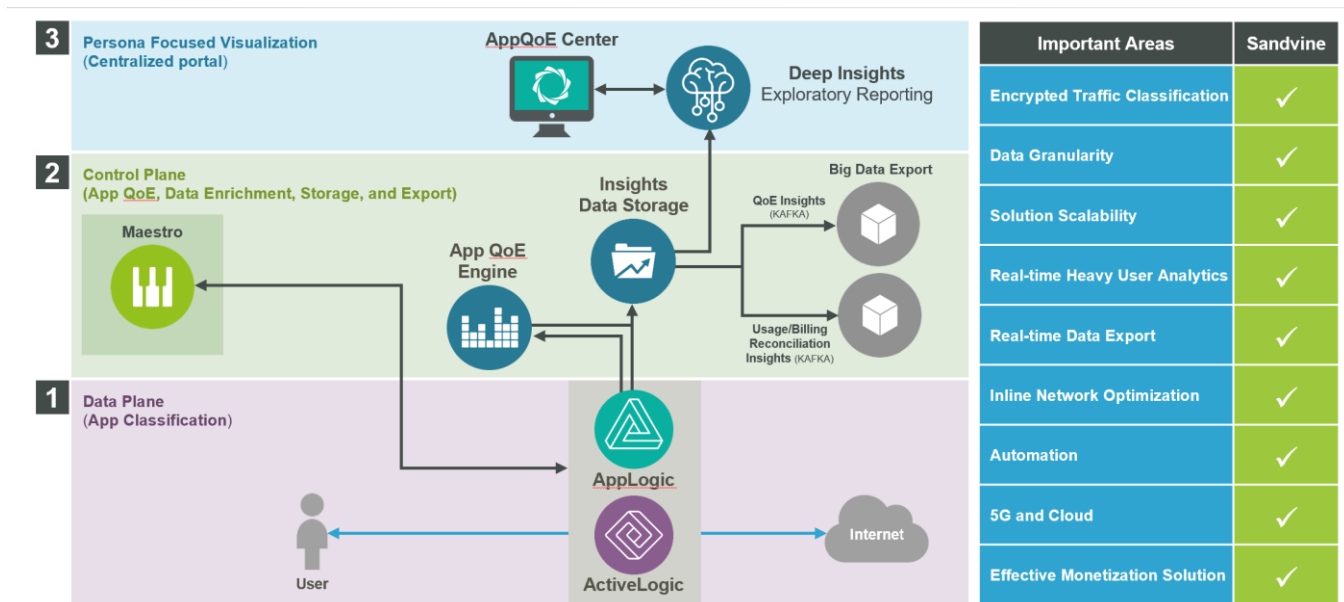
Sandvine has a very strong pedigree in telecom, enterprise, and government. For more than 20 years, it has pioneered the development of software solutions focused on accurate forecasting for capacity and network planning.

Sandvine adopts a full-stack approach that focuses on application data in both the data plane and control plane. The company's ActiveLogic hyperscale data plane and policy enforcer support an application classification engine, AppLogic, which provides extensive coverage of app classification with over 5,000 signatures covering 2,500 applications.

Sandvine regularly tests and updates apps daily, reevaluates and reclassifies content within application flows, and accurately categorizes various content types, including voice, video, file delivery, web browsing, and messaging. The company maps 11 content categories across 14 application categories, enabling it to provide comprehensive and granular views tailored to different personas within service provider organizations, including CTO, Operations, Planning, and Engineering.

AppLogic feeds Insights Data Storage and the Maestro Policy Engine in the control plane. The combination of these technologies feeds the App QoE Engine, an abstraction layer that enables operators to determine the type of performance delivered over the network for various applications and content across different devices and access types. Figure 1 provides a high-level architecture of the Sandvine portfolio.

Figure 1: Sandvine Data and Control Plane View



Source: Sandvine

Sandvine's User Persona Use Case Architecture aims to enhance the accuracy and precision of forecasting by correlating exported data and KPIs with guided workflows for various roles such as CTO, Operations/Customer Care, Big Data, Network Planning and Engineering. This is achieved using the Sandvine Application and Network Intelligence Portal, which offers Deep Insights business analytics products to visualize use cases. By contextualizing data and providing actionable insights, different personas can drive automation use cases and streamline operational processes that extract value from Layer-1 and Layer-2 data.

INTELLIGENT AUTOMATION AND THE ROLE OF SANDVINE

The Sandvine data foundation combined with its application and network intelligence enables CSPs to transition towards closed loop automation. The signature library provided by Sandvine allows CSPs to build a model of subscriber activity and network behavior which can then accurately predict network performance, service quality, and NPS scoring.

The LEADS aware contextual data enabled by Sandvine reduces both the cost and accuracy of applying AI compared to conventional hard coded methods. In the telecom market it is being applied to improving subscriber experience, optimizing network traffic, isolating faults, and identifying network threats, among other things.

The unique value of Sandvine application and network intelligence is that it captures traffic in the data plane to discover patterns, and then predict outcomes more reliably than current methods. Sandvine measures all content, applications, and subscribers all the time. Table 1 provides a list of application categories supported by Sandvine today.

Table 1: Sandvine AppLogic Application Categories

Application Category	Description	Example Apps
General Web Apps	Generic Web Browsing of Search Engines, News Sites, and general content sites that provide mostly textual and graphic information to the Subscriber	Search Engines, CNN, Craig's List, Amazon, AT&T
Video	Video Services that offer VoD like Services	YouTube, Netflix, Amazon Prime, Disney+, Hulu
Television	Any Service Offering Television Streams	YouTube TV, Sling TV, Peacock TV, Tubi TV
Social Media	Any Type of Social Media browsing or Social media video services or live streams, from the most popular Social networks. Voice, Video and Messaging Services tied to the Social Media app will be Content Classified in this group	Facebook, Instagram, TikTok, Snapchat, Twitter
Communication	The Application Services that allow messaging, Voice, Video and live services as a specific Application we can identify and traditional VoIP and Video Calling Services	Whatsapp, Facetime, Telegram, VoIP
Conferencing	The Work From Home conferencing apps enabling companies to communicate with companies across the globe	WebEx, Google Meet, Zoom, Slack, Teams
Cloud Gaming	Any Gaming Service that resides in the cloud and has a major video steam along with gaming functions the subscriber	Google Stadia, GeForce Now, Amazon Luna, PlayStation Now
Device Gaming	Any Gaming Service where all of the video rendering and major game play is performed on the device, such as mobile and consoles	PUBG, Call of Duty, Minecraft, Fortnite, Candy Crush, Xbox, PlayStation
Audio	Any Service That streams audio music to the subscriber for the purpose of entertainment. This should also include live Audio Concert events on these streaming audio services	Apple Music, Spotify, Pandora, YouTube Music, iHeart Radio, Shazam
Content	This is the traditional Content Up/Content Down services we previously classified. Office Collaboration Applications, and Cloud Storage Services	iCloud, Office 365, Bittorrent, Google Drive, One drive, Dropbox, FTP
VPN	Any VPN or masking service, as many Businesses use VPNs but the sub classification in these VPNs will be important to providers to ensure Conferencing, VoIP and Video inside these VPNs are delivered Appropriately verses VPNs to hide illegal or large downloads.	iCloud Private Relay, Nord VPN, Cisco VPN, OpenVPN, ExpressVPN, PPTP
IoT	Contains IOT devices in homes and any machine to machine communication, such as Vehicle to Vehicle, infrastructure, Video Cameras and smart devices	Tesla, Alexa, Google Home, Nest, Ring, Phillips Hue, Security Cameras, CoAP
Application Unknown	Generic Application Transport Protocols	HTTP, SSL, QUIC,
General Network Protocols Unknown	Traffic carried by general transport and control protocols in the network Traffic Flows we cannot match to a known protocol	BGP, OSPF, etc
Custom	A Custom Category that Service Providers can put a max of 10 Apps into and provide their own Matrix for QoE. Therefore no Sub Classification	

Source: Sandvine

FINAL THOUGHTS

One of the most important business metrics in the telco industry, which is reported every quarter, is customer churn. Acquiring customers is expensive and the ability to predict customer churn is critical. The first step in reducing churn is the ability to identify customers most likely to leave. Today, customers expect great experiences, no matter how complex the application and no matter what their location.

Regression methods to predict churn have been the backbone of the industry up until now. Regression attempts to predict churn based on what has happened in the past. Regression can be improved for churn by considering multiple conditions. For a mobile user, conditions might be handset in use, coverage area, technology deployed in the RAN, pricing plans, usage patterns, bill shock, payment patterns, and so forth.

Today real time data capture and application and network intelligence are outperforming regression models. The reason for this is more variables are available on a larger data set of subscribers. Instead of hundreds of variables and thousands of customers, CSPs can now utilize technology from companies like Sandvine to analyze thousands of variables and millions of subscribers, in near real time.

To observe the networks behavior, CSPs must have access to high quality data that provide contextual awareness as to who, where, and what is being consumed. The data stream and collection of performance metrics and service impacting events become critical inputs of user activity to fully realize network observability.

Active and continuous data capture and analysis provides a solid baseline for understanding subscriber experience. It allows CSPs to support the existing services and prepare for new services that will be more distributed in the network. The Sandvine technology provides the data flow of real user activity across the entire service chain. It is more precise and very effective at isolating problems sooner.

Observability is necessary in the telecom cloud network to realize the automation of labor-intensive activities which cost the telecommunication industry half a trillion dollars every year. Automation is being deployed today in the 5G radio access (RIC), SON, and SD-WAN network domains. CSPs should be preparing now to implement network observability to realize the benefits of closed loop automation for orchestration driven processes. Logic follows that you can only control by observing the complete state of the network.

Application QoE is one arrow in the quiver of network automation. But it is a necessary component! The old adage “You can’t manage what you can’t measure” still holds. Real time data capture and analysis is the trigger to input action into the control system. This can take the form of adding network capacity, dispatching a truck roll, or notifying a care agent.

Intelligent network automation will proliferate as labor shortages persist and managing the network complexity increases with advanced technologies such as 5G, Edge, and private networks. Many developed countries will face an increasing skilled labor shortage in the latter years of this decade.

The promise of the modern network is to provide highly valuable dynamic services which must become autonomous. Network observability provides the high-value data inputs to gain insights and actions for telco operations. Applying AI in operations enables CSPs to reduce noisy events as data explodes. In many NOCs billions of network events can overload technicians with an avalanche of tickets. Sandvine analytics driven automation can process and suppress non-severe events and elevate only the most critical high impacting events.

Insight and analysis for telecom transformation.

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