Active Network Intelligence
Use Cases
for network operators

SANDVINE

SANDVINE

Active Network Intelligence

Sandvine helps organizations run world-class networks with Active Network Intelligence, leveraging machine learning analytics and closed-loop automation to identify and adapt to network behavior in real-time. With Sandvine, organizations have the power of an intelligent automated platform from a single vendor that delivers a deep understanding of their network data to drive faster, better decisions.

Our solutions make networks more efficient, enable service differentiation, rationalize disparate data sources, and increase profit margins. With 1.7 billion network users across more than 150 major operators and 500 enterprises benefiting from using Sandvine as their network intelligence innovator and partner, Active Network Intelligence from Sandvine is powering the next wave of network transformation.

Our customers

Telecom Operators
Sandvine's solutions can be deployed by network operators of any size, with any combination of access technologies (e.g., Cable/DOCSIS, DSL/FTTx, Satellite, 3G, 4G, 5G, WiFi, WiMAX), in any type of network (e.g., physical, virtualized, or hybrid).

Government Regulators
Sandvine enables government regulators to gain visibility into the quality that is being delivered to consumers and verify the truth in advertising for those services. They also ensure that network operators can easily comply with regulations that keep children safe and mitigate illegal applications on the network.

Enterprises
Sandvine provides actionable insight that can empower small and medium business, enterprises, and educational institutions to reduce their mobile and fixed data usage costs, protect users, and increase productivity, without the need for on-device software or extensive IT expertise.

Why Sandvine?

See with Clearer Eyes

Without high-quality data that you can trust, it's impossible to make informed decisions about your network. Sitting in-line on the network, the Sandvine platform provides deep data granularity so that customers see everything, in real-time. Full contextual awareness means that user, service, application, and device data are all correlated and made actionable. Sandvine truly understands network traffic by leveraging hueristics, behavioral correlation, and machine learning.

Act Smarter Every Day

At Sandvine, we understand that success hinges on the ability for organizations to run at the speed of their customers' businesses. Your team needs to be able to make faster, smarter decisions that continually get better over time. With the power of the Sandvine Policy Engine, organizations can link any condition to any action to make decisions in real-time. Intuitive visualization capabilities drive actionable business insights, while machine learning continually optimizes policies based on user behavior.

Handle the Unexpected

In today's constantly evolving technology environment, you need a highly versatile architecture that can identify and adapt immediately to changing market conditions and opportunities. Sandvine gives organizations the fine-grained control by more easily allocating each application, user, service, and device the resources it needs, on-demand. We work with the network you have – whether virtual, physical, cloud, elastic, in-line, network edge, or data center core – so you don't need to rearchitect to gain tangible value. Our solutions also scale up or down to match the size of your user base and network volume to maximize cost efficiency.

Drive New Economics

Running today's network is challenging. With network complexity growing and operating budgets flat, networks are not able to meet user expectations for quality of service and quality of experience. Sandvine closes this economic gap, delivering dramatically higher performance by leveraging machine learning, artificial intelligence analytics, automation, and cloud deployments. Our customers report new revenue streams, faster time to market with new plans and services, a better overall network user experience, and higher profitability.

Use Case Index

Solution Area: Analytics and Insights

Turn the power of Sandvine's deep data granularity into insights that take the guesswork out of managing your network, providing you with unmatched visibility into your network and service delivery.

Solution Area: Network Optimization

Get the very most out of your network, intelligently managing your traffic to deliver high-quality services and better customer experiences while containing costs, running more efficiently, and supporting best traffic management practices and network neutrality guidelines.

Solution Area: Revenue Generation

Grow revenue by rapidly deploying innovative services that meet customer demand and outpace the competition, with Sandvine's proven policy and charging expertise.

Solution Area: Revenue Assurance

Get paid fairly for the data and voice services you deliver by actively identifying and limiting the fraud that is impacting your revenue right now.

Solution Area: Network Security

Add a crucial layer of security for the network itself, reducing operational costs and increasing user quality of experience by protecting against online threats to the network and its users.

Solution Area: Regulatory Compliance

Changing regulatory environments demand flexible solutions that can quickly adapt to support new requirements and are proven to reliably meet the stringent needs of operators and regulators alike.

Analytics and Insights
Take the guesswork out of managing your network

With the right data and analysis, network operators are empowered to make decisions based on facts, rather than assumptions and guesses. Of course, insights are only actionable if the data foundation is trustworthy and crucial information can be accessed by those who need it, when they need it and in the right format.

Sandvine's Analytics and Insights solutions leverage unique traffic classification and measurement technologies to provide network operators with unmatched visibility into the network and its users.

Whether operators are monitoring key metrics in real-time, exploring data in interactive dashboards, using advanced machine learning and artificial intelligence algorithms to find hidden relationships and trends, or sending a targeted stream of data records into a big data engine, Sandvine takes the guesswork out of network management.

Network operators who choose Sandvine benefit from a range of real-world Analytics and Insights use cases that fall into two groups:

- **Real-Time Monitoring:** Ensure the network and its services are delivering to expectations by closely monitoring the metrics that matter
- **Trending Analysis:** Make the right strategic choices, informed by using advanced reporting and exploratory analytics to understand the network's past, present, and future

Network Optimization

Contain costs, preserve quality of experience, and improve efficiency

The story is well-known: traffic volumes are exploding, largely driven by over-the-top video services. At the same time, network budgets are flattening or even declining, and evolving standards are changing how the network itself is architected. To help network operators balance the need to deliver high-quality network services with budget realities, Sandvine offers a wide range of Network Optimization solutions.

These solutions leverage Sandvine's rich real-time and historical context (e.g., user identity, device characteristics, application, congestion awareness, network topology, etc.) and close the loop by using many different techniques to actively optimize network traffic. Importantly, Sandvine's Network Optimization solutions can be implemented to comply with the multitude of network neutrality guidelines around the world while improving network quality and performance.

There are a number of use case families that broadly fall under the Network Optimization solution:

- **Congestion Management:** Manage network congestion precisely, taking action only where and when needed, to extend infrastructure lifetime and protect user quality of experience
- **Traffic Management:** Precisely manage network traffic as an alternative to unbounded capacity investment, without sacrificing user quality of experience
- **Quality of Service (QoS) Assurance:** Meet QoS commitments by identifying traffic, marking it for downstream enforcement, and directly signalling to other network elements
- **Carrier-Grade Network Address Translation (CGNAT):** Alleviate IPv4 address exhaustion while maintaining network visibility
- **Traffic Steering/Diversion:** Intelligently redirect traffic through a specific network function (e.g., a DDoS scrubber, a cache, a content filter, etc.), and seamlessly reinsert into the normal network flow
- **Mobile-Specific Network Optimization:** Achieve significantly improved return on investment for the radio access network (RAN) and the mobile spectrum by optimizing network traffic at the transport level

Revenue Generation

Grow revenue by rapidly deploying innovative services

It's no secret that average revenue per user (ARPU) and average revenue per account (ARPA) are declining: increased competition and a lack of easy sources of growth mean that network operators need to create new revenue sources while maximizing existing ones.

Sandvine's policy and charging expertise and support for industry standards empower network operators to create innovative services built around real customer demand, so they can outpace the competition and reap the revenue rewards.

Importantly, Sandvine's complete Active Network Intelligence platform means that these services can be launched quickly while simplifying the overall network architecture, through functional consolidation and automated workflows.

As network operators look to attract and retain customers, it's important they put their trust in a reliable solution. When it comes to powering innovative, revenue-generating services, Sandvine is the proven leader, with a compelling portfolio of real-world solutions:

- **Data and Voice Services:** Stand out from the crowd and grow new revenue by becoming the market leader for innovative, intelligent data and voice services, including sponsored data services, roaming services, Internet as a public service, HD Voice and VoLTE services, and other advanced data services
- **Enterprise Services:** Grow revenue by powering the connected business with unique value-added services (e.g., mobile data management, office and site data management) built into their Internet connections

Revenue Assurance

Get paid fairly for the data and voice services you deliver

Telecommunications fraud is an oft-talked about, but little-understood issue that costs network operators billions of dollars every year.

Sandvine's Active Network Intelligence capabilities empowers operators to identify and manage fraud that is impacting their revenue right now.

In addition to identifying fraud, the deep insights the Sandvine platform provides also let operators track down revenue leakage from misconfigurations and oversights in other systems, elements, and interfaces. Our solutions also enable you to identify video piracy services that may be running on your network that do not comply with government regulations.

Network operators are choosing Sandvine to address real-world use cases, including:

- **Interconnect Bypass Fraud:** Protect call termination service revenue by discovering, monitoring, and managing over-the-top voice bypass fraud
- **Video and Television Fraud Management:** Protect revenue and maximize value from exclusive media content by discovering, monitoring, and managing video and television piracy on the network
- **Data Fraud Management and Revenue Assurance:** Protect data revenue by uncovering fraud and discovering leakage

Network Security

Protect your network and its users from online threats

Security is strongest with a layered, defense-in-depth approach, and perhaps no layer is as important as the network itself.

Only a solution engineered specifically to secure the untrusted and unpredictably complex environment of the Internet can provide effective defense against today's ever-changing threats for network operators.

Whether the motivation is to protect users, the network infrastructure, or a hard-earned reputation, Sandvine's Network Security solutions combine real-time visibility, advanced network intelligence, and effective responses to create a crucial – and unique – security layer that delivers several valuable use cases:

- **User Protection:** Protect network users by blocking malware reconnaissance scanning, detecting when user devices are infected with malware, and detecting/disrupting communication with command-and-control channels
- **Network Protection:** Protect the network by detecting and mitigating DDoS attacks, DNS attacks and threats, malware propagation, and more
- **Security Monitoring:** Closely monitor a wide range of cyber threats in real-time for tactical intelligence, and explore longer-term trends to make informed strategic security decisions

Regulatory Compliance

Keep up with changing network operator regulations

Complying with changing regulatory environments requires flexible solutions that can quickly adapt to new needs and use cases.

Sandvine's Regulatory Compliance solution delivers industry-leading scalability and flexibility for telecom operators and regulators. Sandvine's ability to combine regulatory compliance with a broad set of operational use cases ensures that an operator can achieve a high ROI on even mandatory compliance deployments.

There are a growing number of use cases that are encompassed by Sandvine's Regulatory Compliance solution:

- **Quality of Experience (QoE) Monitoring:** Measure throughput, latency, and packet loss across all fixed and mobile operators in a country or a region to ensure consumer QoE standards are met
- **Regulatory Data Retention:** Surgical selection and storage of data required to be retained to comply with governmental regulations
- **Regulatory Traffic Management:** Compliance with governmental regulations for monitoring and blocking applications and content to comply with security, safety, and other mandated policies

Performance Analysis

Unique insights for better network and quality decisions


BACKGROUND

A new generation of network users has higher expectations from their service providers. Consequently, it is vital that network operators understand the network's performance through metrics including key performance indicators (KPIs) and key quality indicators (KQIs). These metrics provide insight into both the end user's experience and network-level performance of critical services and applications.

By providing clarity and insight, performance analysis enables operators to look more broadly at their business and to link network metrics with evolving customer needs and expectations.

Web Browsing Score Heat Map
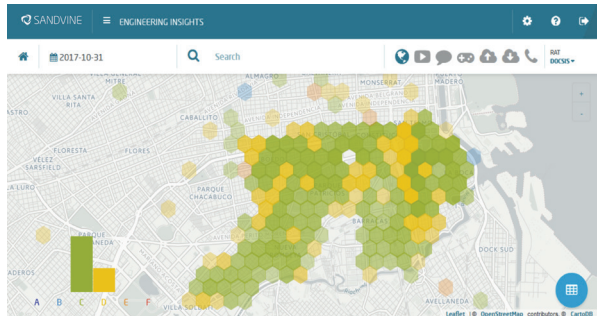
Video Streaming Score Heat Map
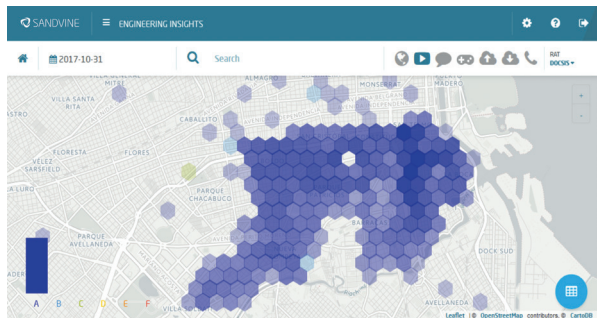
SOLUTION

Sandvine provides powerful metrics that combine detailed measurements into unique quality scores that quantify user experience for video and audio streaming, web browsing, VoIP, and even speed test utilities.

Using these metrics and other raw measurements enables network operators to understand network performance for:

- Crucial network services
- Applications used on the network
- Network elements
- Individual customers

Plus, by leveraging Sandvine's traffic classification technology, network operators can go even deeper into these metrics and other important subjects, to answer both strategic and operational questions.

IMPACT AND RESULTS

By monitoring performance and making data-driven decisions, network operators are able to create competitive differentiation, to gain market share, and to reduce churn, while increasing revenue and profits from new services and improving subscriber quality of experience.

Performance and Operational Monitoring

Monitor services and troubleshoot problems in real-time to ensure high-quality performance

Network Operators with the highest customer experience scores realize 5X the subscriber growth as do their lagging peers.

Dashboard showing a snapshot of a single subscriber's service experience – providing location, inbound and outbound throughput, traffic quality metrics, service categories, and more.

BACKGROUND

Modern networks are incredibly complex: they're made up of many elements, often spanning vast geographies, that work together to deliver crucial services to consumers, businesses, government organizations, connected cars, and an ever-growing list of Internet-capable devices. A lot can go wrong, and there's a lot to keep right. And seconds matter.

Keeping today's networks up-and-running requires rich, deep, and broad real-time insight that is used to diagnose problems, to prioritize operational activities, and to inform actions.

With the right performance and operational metrics, network operators are empowered to make quick and accurate decisions that can save the day; lacking these metrics, operators must play a high-stakes guessing game with everything on the line.
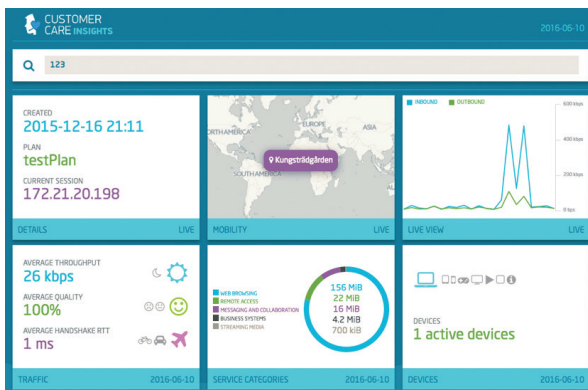
DNS response times for different locations within a city, color coded for easy recognition.

Median Response Time..

7.0   918.6
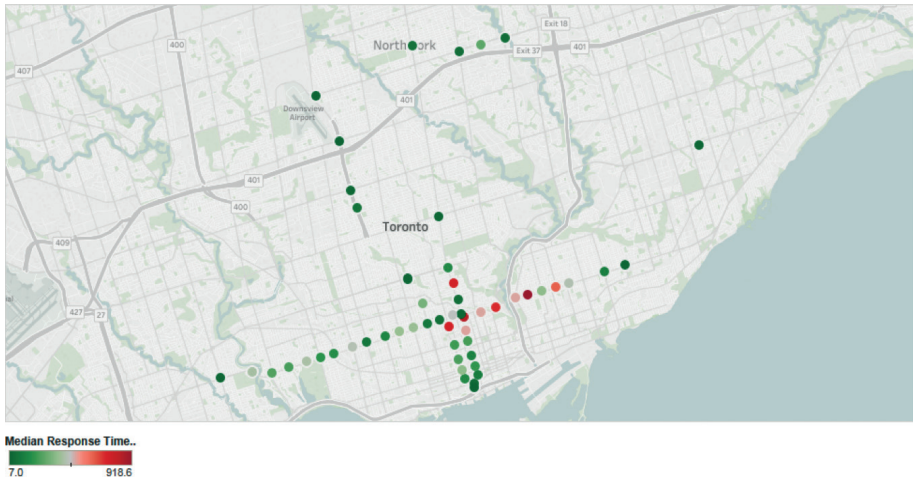
SOLUTION

Sandvine ensures the network and its services are delivering to expectations by closely monitoring the metrics that matter: from detailed transport measurements, to application-aware performance information, to quality of experience scores that can even take into account consumer speed test utilities.

This information is available to network operators in real-time, either through a stream of data records that can be connected to a big data system directly or via a telemetry message bus, or for examination in one of Sandvine's graphical user interfaces.

IMPACT AND RESULTS

Sandvine's customers have what they need to quickly diagnose issues before they grow into service-impacting problems, and to respond appropriately should problems arise.

Ultimately, end customers are more satisfied, and operational efficiency increases.

Capacity Planning Analysis

Fact-based planning for investment and growth

BACKGROUND

Capital expenditure burdens on operators remain significant, driven largely by ever-increasing customer demand for data and data-heavy services.

But building today's networks involves much more than simply rolling out 'fatter' pipes; today's networks are a complex mix of traditional network elements, caches, and content delivery networks. Plus, many network operators must also balance capacity expansion with coverage extension. Even routing decisions aren't simple, with many operators relying on a combination of peering and transit providers to provide connectivity to the Internet overall.

Furthermore, the data demands placed on the network can vary quickly and unpredictably: for instance, the Internet of Things receives a great deal of attention, but its impact on data consumption and generation still isn't well understood; additionally, data-intensive applications like 4K video, virtual reality, and augmented reality have the potential to drastically alter data patterns.

To make informed decisions about capacity planning and network engineering, today's network operators need more than basic volume projections – they need the deepest possible insight into usage trends.
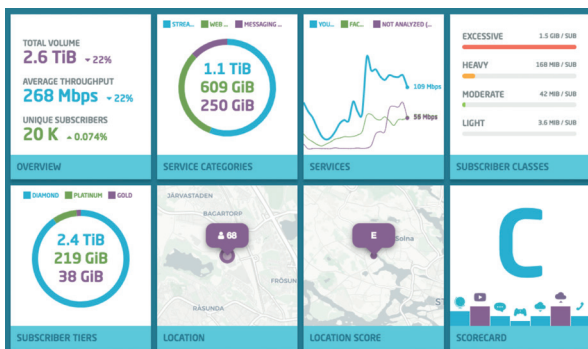
SOLUTION

Sandvine provides unmatched visibility into network traffic and trends, from comprehensive measurements to advanced quality of experience metrics, with granular application visibility, user visibility, and network topology/hierarchy awareness.

By aggregating and analyzing this information – whether in Sandvine's analytics interfaces or a big data system – operators can make truly informed network architecture and engineering decisions.
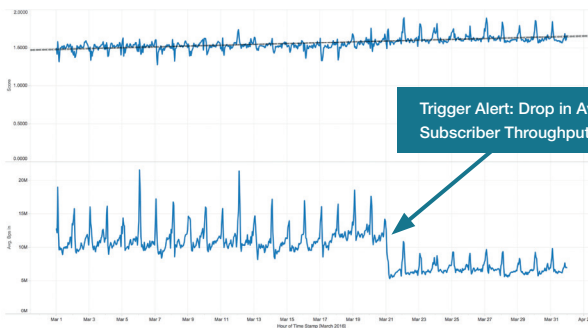
Analytics to justify more investment in WiFi capacity.

Dashboards to quantify throughput, quality of experience, and other metrics to inform strategic decisions such as capacity planning.

IMPACT AND RESULTS

With the insight provided by Sandvine's solutions, network operators design and benefit from an optimized network, and know exactly how to spend every unit of capital to deliver a maximum positive impact and return on investment.
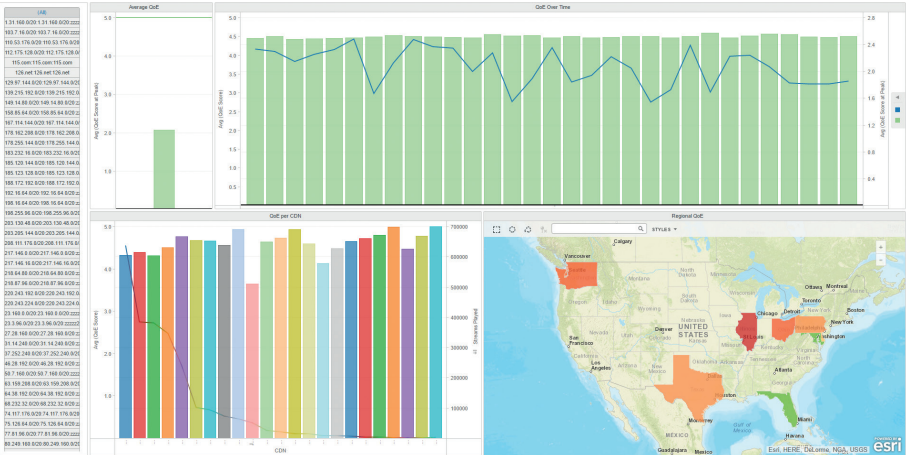
User Behavior and Demographic Analysis

Big data fuels new, subscriber-based revenue streams

BACKGROUND

Operators are competing with nimble disruptors for a share of the customer wallet; the upside is greatest for network operators who can play a leading role in creating new ecosystems. Efforts to personalize services and improve customer engagement are vital to all players, but keeping pace with changing customer attitudes requires a more sophisticated segmentation of users and a keen understanding of their needs. Analytics must measure user behavior (e.g., web browsing habits, video interests, application popularity, etc.) and link with demographic insights to develop a comprehensive understanding of customers and to unlock monetization opportunities.

Video QoE Analysis

Sandvine lets network operators examine how different video services are performing and identify any issues as they emerge.

SOLUTION

Sandvine enables you to understand user behavior and demographics by providing unmatched insight into network usage and related characteristics. This information lets network operators answer questions including:

- What applications are most popular at different times of day?
- What new network services are growing in popularity?
- How does behavior change by day of the week?
- How do preferences change by device?
- How many devices are in today's connected home?
- What websites are customers accessing?
- What are the warning signs of pending customer churn?
  …and much, much more

Verizon generated $7 billion in digital advertising in 2016 - roughly 6% of overall revenues.

IMPACT AND RESULTS

Network operators who use Sandvine to gain a deeper understanding of their customers put that information to use in many beneficial ways:

- Identifying customers with a high propensity to churn, and taking preventative action
- Increasing subscriber loyalty by introducing relevant services in response to – or in anticipation of – emerging demands
- Growing revenue from incremental activations by recognizing underserved markets
- Pursuing more relevant content deals and partnerships based upon demographics analysis

With the right data, the possibilities are endless.

Service and Subscriber Monitoring

Prevent user issues and diagnose problems by measuring and monitoring individual user and service quality metrics in real-time

BACKGROUND

A fast, reliable connection is now a fundamental expectation for most Internet users. Long-gone are the days when people tolerated occasional outages or service degradations; instead, even the slightest decline in service quality – whether real or perceived – is enough to trigger a customer to churn to another network operator or, at the very least, to phone the support line and perhaps argue for a reimbursement.

For network operators, maintaining high customer renewal rates demands an intense and relentless focus on operational quality. This approach requires complementing traditional operational and performance monitoring with an approach that shines a spotlight on the real-time performance of individual services and monitors the experience of individual network users – whether just a subset of high-value users, or the entire customer base.

SOLUTION

Sandvine provides network operators with unique insight into real-time service performance and user quality of experience.

Based on leading traffic identification and measurement capabilities, and linked to customer identity, this information delivers deep insight into the performance of individual applications and application categories, cloud-based services, speed test utilities, individual protocols, and more.

With Netflix traffic representing 40% or more of total bandwidth on some networks, network operators need dashboards that allow them to easily – but comprehensively – monitor subscriber QoE for Netflix by location, CDN, and any other relevant factor.
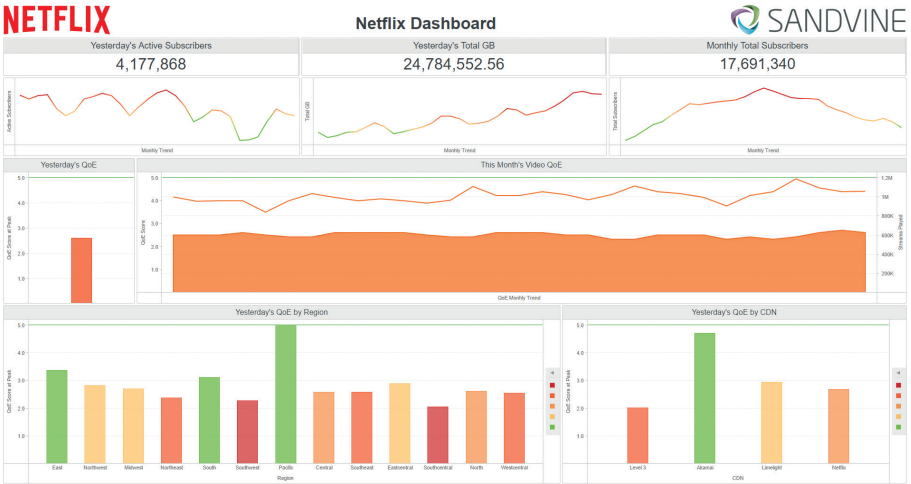

IMPACT AND RESULTS

By monitoring service performance and user quality of experience in real-time, Sandvine's customers are able to take informed corrective action before quality issues pose a threat to customer satisfaction.

Additionally, logging this performance information creates a valuable case history in the event that a customer calls to dispute the quality of service delivered.

Congestion Management

Manage congestion precisely, extending infrastructure
and protecting quality of experience
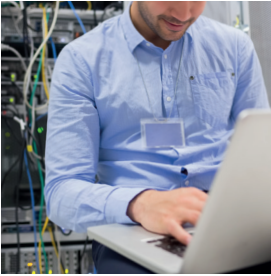
BACKGROUND

In the short term, network congestion leads to frustrated users; in the long term, frequent congestion leads to churn. The underlying congestion problem is that all access network resources have a finite capacity, and demand can exceed that capacity.

Congestion management achieves cost-savings by pulling more utility from the existing network, while preserving service quality. These dual objectives are often contradictory, and a careful balance must be struck.

A complete congestion management solution must have two functional components: a mechanism to recognize congestion and a mechanism to trigger and manage that congestion most suitably.

Network operators should consider many factors when evaluating solutions, including the regulatory environment, which often requires compatibility with network neutrality guidelines.

Sandvine congestion management is flexible, offering multiple ways to optimize traffic delivery.
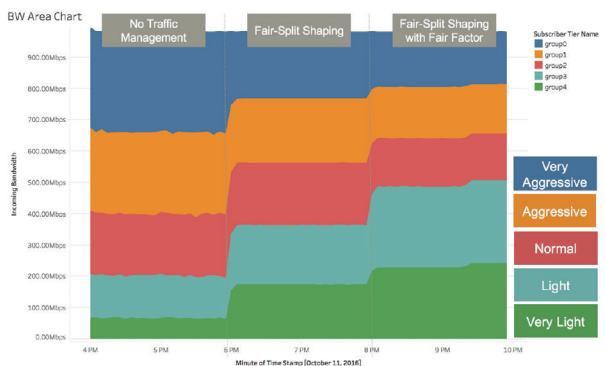
SOLUTION

Sandvine offers the industry's most precise congestion management solution, enabling network operators to define the applications or application types to be prioritized during times of congestion and if policies should be applied on a per-subscriber level (e.g., type of service plan or recent usage).

A real-time feedback loop measures the quality of experience (QoE) at each location in the network; if resource congestion threatens QoE, then precise management policies take action. And Sandvine's congestion management is optimized for each type of network access technology, and operates in conjunction with network neutrality traffic management principles.

IMPACT AND RESULTS

Network operators who implement Sandvine's congestion management solution benefit from:

- Deferred capital investments, providing near-term relief that buys time before adding capacity
- Extended lifetime and utility of legacy network equipment that will not be expanded upon but will continue to be in use
- Reduced or capped transit costs: to be applied to cap peaks on expensive links or to get the most utility out of a saturated link
- Enhanced or protected user quality of experience
- Fair use or fair access policy, provisioning traffic to protect the network and to deliver the greatest utility to the most subscribers

RAN Spectrum Optimization

Achieve superior return on mobile infrastructure and spectrum by optimizing network traffic

BACKGROUND

Two of a mobile network operator's largest capital investments are the radio access network (RAN) and the license to use mobile spectrum.

However, many mobile operators take for granted that their network is making efficient use of these resources when, in fact, there are significant opportunities for improvement.

By optimizing network traffic at the transport (e.g., TCP) level, mobile providers achieve significantly improved return on investment by improving the efficiency of their RAN and the spectrum it uses.
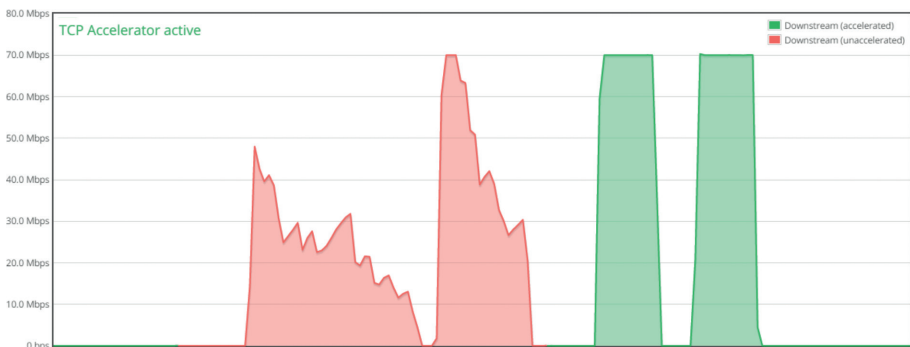
With acceleration: radio glitches don't cause slow-downs, so transfers complete much faster and RAN resources are freed.

SOLUTION

Most network optimization efforts focus on congestion management in general, or specific use cases like managing video streams, heavy users, and network links. However, it is possible to complement these solutions by optimizing the transport layer (i.e., Layer-4 in the OSI model); doing so introduces an entirely new and independent class of network optimization.

By improving the transport layer via TCP optimization, mobile operators can go one step further. TCP was designed initially for fixed access networks where packet drops were a reliable indicator of congestion; as a consequence, when left on its own, TCP behaves very poorly on mobile networks.

Sandvine's solution makes TCP 'access-aware', optimizing it for the unique characteristics of a mobile operator's network, and by doing so dramatically improving efficiency.

IMPACT AND RESULTS

When the Sandvine solution is deployed, users experience higher speeds and quality of experience; perhaps more importantly, radio resources are freed up much faster, so the RAN can carry more concurrent users and the spectrum is put to more effective use.

Video Streaming Management

## Ensure consistent quality and protect from extreme loads

BACKGROUND

Led by global powerhouses including Netflix, YouTube, Amazon, and HBO, and joined by local services like BBC iPlayer, CraveTV, and Hulu, video is the driving force behind Internet usage worldwide.

Most of this video is adaptive in nature, with bitrates changing in response to factors including device capabilities and network capacity. The range of bitrates is immense: a 320p video can play smoothly at 850 Kbps, while a 1080p video needs 7.5 Mbps, and a 4K video needs around 15 Mbps.

Making matters more difficult for network operators, video traffic peaks during the network's busiest periods – posing a threat to the quality of other types of network traffic as well.

In Australia, traffic volumes remained 25% higher than normal six weeks after the market introduction of Netflix.
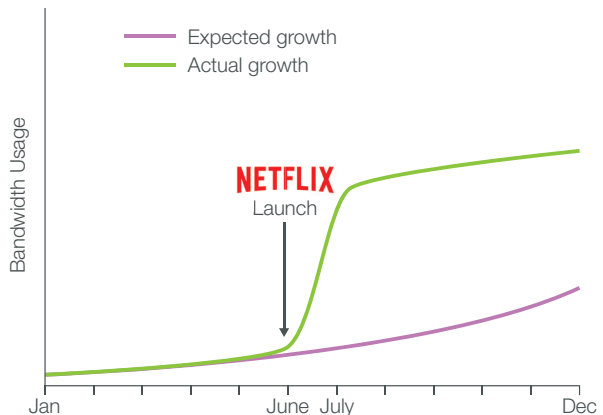
SOLUTION

Sandvine enforces intelligent rate limits on a per-stream basis, ensuring fairness and reducing the average bitrate-per-stream without compromising quality. More advanced approaches are possible too, incorporating real-time congestion awareness, service plans, device types, and other factors for extremely precise optimization.

O2 UK protects their network from the impact of popular streaming services. The video stream on the left played smoothly and clearly with a 75% reduction in bandwidth compared to the stream below.

IMPACT AND RESULTS

By consciously managing video streaming traffic, network operators can ensure the consistent delivery of high-quality video – as well as protecting other services from disruptive video traffic spikes. In addition, intelligent video management can extend the useful life of network infrastructure, deferring investment and positively impacting ROI.

Good quality of experience is maintained for critical and sensitive services like gaming and VoIP.

Heavy User Management

Manage the network's heaviest users and improve the overall quality of experience

BACKGROUND

While networks are shared resources available to all users, network usage is not evenly distributed. In practice, a very small segment of users – the heavy users – impose a disproportionate amount of strain on network resources. For instance:

- The top 1% of users account for 15% of monthly bandwidth utilization
- The top 2% of users account for more than 20%
- The top 5% of users account for more than 35%

These uneven usage distributions create complications and complexity for network planning, service business models, and profitability. In addition, heavy users have the potential to negatively impact the quality of experience for all network users.

Due to the different behaviors of applications, network capacity is unable to be allocated fairly, causing service degradation.

BitTorrent connections · Video streaming

User 1 · User 2
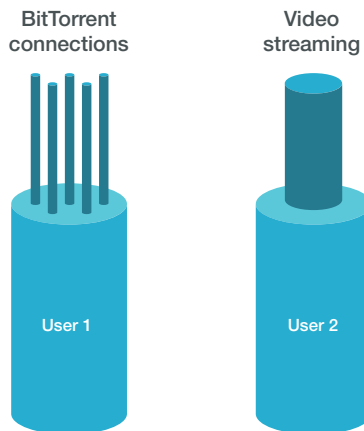
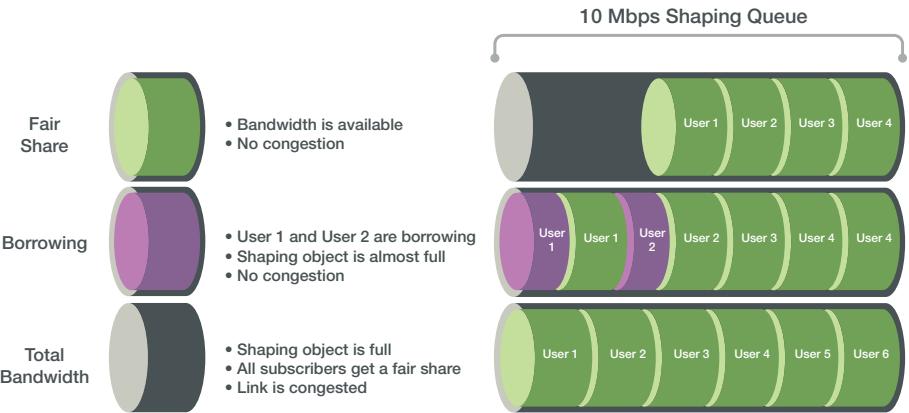**Differences in bandwidth usage caused by application behavior**

SOLUTION

The solution is to carefully manage heavy user traffic so that their impact on the network and on other users is controlled, reasonable, and fair.

By measuring usage over a defined period (e.g., by day, by week, by month, by rolling window, etc.) and linking management policies to different factors (e.g., time of day, risk of congestion, number of users on a resource, etc.), network operators can ensure shared network resources remain available for all users.

IMPACT AND RESULTS

Through precise management of heavy users, network operators can preserve QoE for the majority of users; plus, the same approach increases the carrying-capacity of the network overall, letting network operators serve more customers without additional infrastructure investment, and driving higher profitability as a result.

10 Mbps Shaping Queue

Fair Share	• Bandwidth is available • No congestion
Borrowing	• User 1 and User 2 are borrowing • Shaping object is almost full • No congestion
Total Bandwidth	• Shaping object is full • All subscribers get a fair share • Link is congested

Fair Share: User 1, User 2, User 3, User 4

Borrowing: User 1, User 1, User 2, User 2, User 3, User 4, User 4

Total Bandwidth: User 1, User 2, User 3, User 4, User 5, User 6

Advanced Data Services

Lead with innovative, intelligent, and feature-rich data services

BACKGROUND

User acquisition is a primary problem facing network operators today. Those operating in developed markets, which are predominately postpaid, also have to increase retention, and those in the developing markets must emphasize purchase continuity to retain prepaid revenue.

Offering compelling services is the best way for network operators, regardless of market and access technology, to tackle these major problems. But service differentiation is only the first step; to truly dominate the market, service providers need the agility to quickly launch those services in response to – or in anticipation of – competitive threats and market opportunities.

Selling select social and VoIP application access is a creative value-added offering.

SOLUTION

Sandvine provides a standards-compliant, complete platform, with integrated PCRF and PCEF functions, that allows network operators to launch market-leading services. Sandvine's platform is used by service providers around the world to power services that offer prepaid or postpaid plans, shared data plans, a variety of quota types, data rollover, zero-rated applications, and more.

IMPACT AND RESULTS

Network operators who rely on Sandvine to deliver their advanced data services enjoy significant market benefits:

- They attract new customers, with services that stand out in the market, and they retain the customers they attract
- They are able to act quickly, to take advantage of short-term opportunities and to respond to competitive threats
- By enjoying increased agility and a lower cost to deploy new services, they are able to micro-target specific user demographics

All of these benefits ultimately contribute to revenue growth and market leadership.

End users also benefit, with increased personalization from plans that suit their needs, and with greater satisfaction.

Mobile Data Management

Provide businesses with actionable insight and empower them to manage application traffic and mobile data usage around the globe

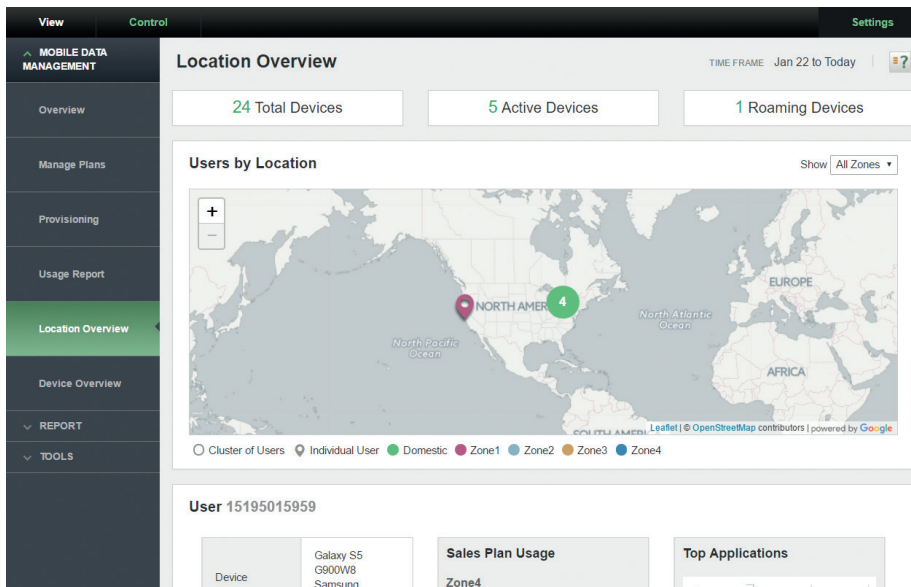Enable businesses to manage and secure their employees' domestic and international mobile data usage.

BACKGROUND

Globalization has changed the way enterprises conduct business; plus, with adoption of bring your own device (BYOD) policies and the ever-increasing reliance on connectivity, managing data and system applications has become an even more complex job for IT managers.

To offset the flattening residential consumer business, many network operators are turning to enterprises and similar clients as a growth engine. However, in order to land the deal with enterprises and maintain high and valuable renewal rates, operators need to differentiate their business services.

View	Control		Settings

MOBILE DATA MANAGEMENT

- Overview
- Manage Plans
- Provisioning
- Usage Report
- Location Overview
- Device Overview
- REPORT
- TOOLS

Location Overview

TIME FRAME Jan 22 to Today

24 Total Devices	5 Active Devices	1 Roaming Devices

Users by Location　　Show All Zones ▼

4

NORTH AMER

North Atlantic Ocean

EUROPE

North Pacific Ocean

AFRICA

SOUTH AMER

Leaflet | © OpenStreetMap contributors | powered by Google

○ Cluster of Users　♀ Individual User　● Domestic　● Zone1　● Zone2　● Zone3　● Zone4

User 15195015959

Device	Galaxy S5 G900W8 Samsung,	**Sales Plan Usage** Zone4	**Top Applications**

SOLUTION

Sandvine provides network operators a solution that takes mobile enterprise data plans to a whole new level.

With this solution, the end user has the flexibility and control to manage their mobile data: from tiered plans and roaming packages, to application-based policy actions and individualized solutions to fit every need. IT administrators are able to gain a deep understanding of the organization's mobile data needs, and can quickly and easily apply time-of-day restrictions, traffic category policies, threshold management, and other enforcement actions.

Unlike mobile device management solutions, data is managed within the network, rather than on individual devices; therefore, there is no need for device software, which can often be challenging to implement across operating systems and which requires frequent updates and management.

IMPACT AND RESULTS

By offering this service, network operators can offer a truly unique mobile data service to the valuable – and rapidly growing – enterprise services market.

High Definition (HD) Voice and Voice-over-LTE (VoLTE) Services

Deliver crystal-clear voice services that stand out from the noise of over-the-top alternatives

BACKGROUND

To compete and stand out in the market, network operators are focusing on quality as a point of differentiation for customer acquisition and retention. At the same time, the network continues to evolve from 3G to LTE, which sees calling technology shift from circuit switched to IP-based packet architectures.

Adding another level of complexity is the increasing user preference for over-the-top alternatives, taking away potential revenue from the network operators.

With all these factors at play, many network operators are introducing High Definition (HD) Voice and Voice-over-LTE (VoLTE) Services:

- HD Voice delivers noise cancellation and crystal clear sound via a wider band audio spectrum
- VoLTE relies on the network to deliver end-to-end quality of service (QoS), which means a predictable, superior call quality for users

SOLUTION

Sandvine's solution enables HD Voice and VoLTE services:

- Sandvine's PCRF signals to network elements via the 3GPP Rx interface so that the whole network applies the correct QoS
- Sandvine's PCEF elements can enforce QoS directly and also provide quality measurements as a vital form of feedback to network operators, both for real-time operational insight and for long-term trending

IMPACT AND RESULTS

VoLTE users receive exceptional call quality and a significantly faster call connection time over analog systems. Network operators can increase revenue by leveraging this call quality in premium service plans.

"Sandvine's PCRF will play a key role in ensuring our customers enjoy a superior experience when making VoLTE calls."

Matthew MacLellan, President, Eastlink

Video and Television Fraud Management

Protect revenue and maximize value from exclusive media content by discovering, monitoring, and managing video and television piracy on the network

BACKGROUND

With the rise in popularity and prevalence of video and television piracy, network operators who license or produce video content stand to lose enormous amounts of revenue; in North America alone, Sandvine's Global Internet Phenomena Spotlight report revealed that a significant portion of households are accessing known subscription television piracy services, with a potential revenue impact of billions of dollars per year.

The availability of set-top boxes and streaming services, coupled with their ease-of-use and the reality that money changes hands might be creating an air of legitimacy around the piracy ecosystem; where an average (i.e., not tech-savvy) consumer could conclude that the actions are legitimate, rather than contributing to an ecosystem of fraud and piracy.

The risk to network operators is enormous: continued adoption of unlicensed video and TV streaming services could lead to increased cord-cutting, significantly impacting top-line revenue and overall profitability, and – by extension – undermining the very business models that keep networks operating.

| Video on Demand	Catch Up	Live Video
An extensive content library of select television shows and movies available for playback at any time. Example: all Game of Thrones episodes	A sliding window of on-demand content acting like a DVR in the cloud. Example: all programs that aired on a channel in the last 7 days	Video streams that are available as something is aired/broadcast/transmitted. Example: Sunday night's new episode of Game of Thrones; professional sports

SOLUTION

Sandvine's leading traffic classification technology – backed by domain experts conducting active research – provides network operators with the insight needed to make informed strategic decisions relating to video and television piracy, including its impact to both the network and the overall business. Sandvine arms network operators with historical reports and customizable dashboards that both present insights and give operators the opportunity to really explore the data to increase understanding.

Additionally, data can be easily exported to other systems (e.g., big data, fraud management, etc.) for further analysis and auditing.

Users	Identify (including in a privacy-sensitive manner) and count users who are consuming pirated video and television content
Usage	Measure how much of your network traffic consists of pirated video and television streaming, and identify trends over time
Device and Software	Learn which hardware devices and software applications your subscribers are using to access pirated video and television content
Services and Hosts	Monitor the video provider services and video hosts behind the pirated content being consumed on your network
Channels	Gain a more complete perspective on how your subscribers are viewing pirated content
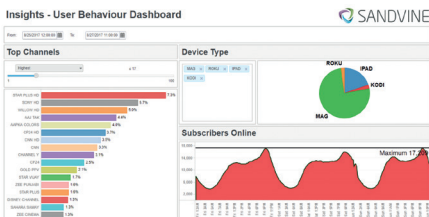
Quickly understand the number of subscribers engaged in the ecosystem, what devices are being used, and the content that is being delivered across the pirated services.
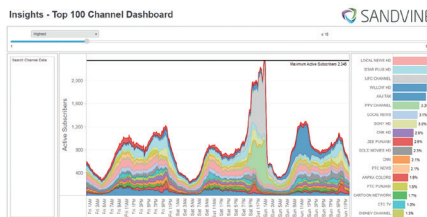
Understand the content that is being delivered across the video and television piracy ecosystem and measure the business impact.

IMPACT AND RESULTS

Aided by an accurate understanding, network operators can monitor the threat, support law enforcement and regulatory efforts aimed at preventing the proliferation of these services, incorporate insight into churn prediction models, and help to educate other stakeholders.

Data Fraud Management
Get paid fairly for the data that the network delivers

BACKGROUND

From a services perspective, zero-rating is a popular addition to the line-up of mechanisms network operators employ to attract and retain users.

However, the introduction of zero-rating unfortunately creates a potential avenue for unscrupulous users to exploit, which directly impacts operators' revenue. To benefit without worry from the promise of zero-rating, network operators need to detect and mitigate various methods of zero-rated fraud, primarily HTTP header injection, domain fronting, and DNS spoofing.

A real-world example in which 6 TB of daily fraud traffic was detected and shut down by applying the appropriate policy.

SOLUTION

Sandvine's solution uses its superior traffic classification, policy enforcement, and reporting capabilities to detect and manage zero-rated fraud:

- Traffic classification that goes far beyond what traditional and embedded deep packet inspection (DPI) systems can deliver, including advanced application fingerprinting
- A range of policy enforcement options to empower network operators to respond appropriately when fraud is detected
- Advanced reporting and analytics that provide insight into the prevalence of data fraud and the impact of management policies

IMPACT AND RESULTS

Network operators who implement Sandvine's data fraud solutions can confidently introduce the zero-rating features that their customers want and know that zero-rated fraud can be managed.

User Protection
Protect your network users

BACKGROUND

For much of the Internet's mainstream history, the only malware protection available to network users was from traditional anti-virus software installed on each and every device. Enterprises and other organizations could go a step further, with specialized equipment.

All of these solutions are designed to detect and block threats as they arrive at the boundary between the public Internet and a private network, or well after they've installed themselves and begun to do damage.

It's time for a new approach – one that gives network users an extra layer of protection and additional peace of mind.

DDoS attacks for hire, as openly offered on public sites.

SOLUTION

Sandvine's network-based malware defenses add a rich and powerful layer to any network security strategy, by:

- Intercepting malware before it even reaches the private network to prevent propagation
- Detecting when users are infected with malware, based upon the symptoms that manifest on the network
- Detecting and disrupting malware communication with command-and-control infrastructures
- Spotting phishing attempts and enabling filtering of dangerous websites

Because the Sandvine solution is network-based, users don't need to install or configure software, and device compatibility is never an issue. Plus, the intelligent defense algorithms are based on observed network behavior, not on specific byte signatures, so zero-day defense is built-in.

IMPACT AND RESULTS

Network operators who implement Sandvine's user protection solution primarily benefit from reduced operational costs associated with user security issues. By reducing infection rates, operators experience fewer support calls and the network is impacted less by malware.

By identifying infections earlier, operators are able to intervene before major problems appear, for instance by contacting users with infected devices and assisting them with a remediation process.
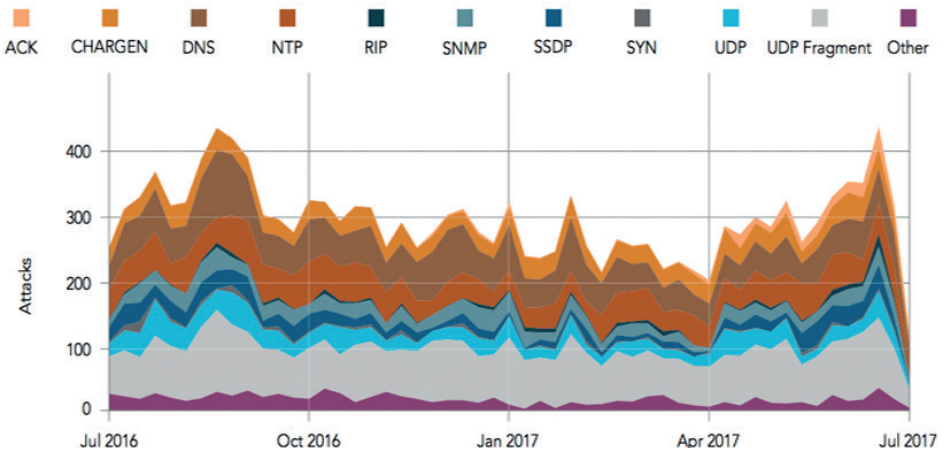
Security Monitoring
Closely monitor DDoS, malware, and other cyber threats

BACKGROUND

Effective network defense requires both tactical intelligence and long-term strategies: real-time information empowers network operators to respond immediately to threats and to choose the appropriate course of action in the moment; trending and analytics provides crucial insights that enable network operators and security specialists to choose the best strategic approach for the future.

10 Most Frequent Attack Vectors by Week

DDoS attacks continue to threaten data network reliability and pose threats to operator reputations.

SOLUTION

Using Sandvine's real-time data and reporting interfaces, security operations teams can monitor malicious traffic threatening network users and resources, such as address scan activity, distributed denial of service (DDoS) attacks, botnet traffic, and active connections related to phishing scams and malware infections.

In Sandvine's GUIs, network operators can instantly zero-in on the source and target of each network threat with the flexibility of navigating directly to an individual user or network element.

To inform longer-term strategies, network operators can explore Sandvine's security insights in powerful analytics dashboards. These dashboards let personnel conduct trend analysis, apply advanced clustering algorithms, and automatically or manually analyze all the security data gathered by Sandvine's solutions.

IMPACT AND RESULTS

Network operators with Sandvine's real-time security visibility are able to immediately detect and respond to network threats as they materialize, preventing further damage and acting before threats turn into emergencies that impact many users.

By understanding longer-term security trends, these same operators can make informed decisions about threat defenses and general security strategies. Tomorrow's threats will not be the same as today's, and network operators that prepare more effectively will benefit significantly by having the right tools in place when the inevitable attacks arrive.

Regulatory Quality Monitoring

Comply with regulatory requirements for quality monitoring


BACKGROUND

Telecommunications regulators are struggling to define metrics for broadband performance that can be measured consistently across multiple access types (e.g., DSL, Cable, Mobile, Satellite, WiFi, etc.) and that captures the actual performance experienced by subscribers during peak usage times. Customers of network operators are seeking to ensure that they receive the service quality that they are promised. Finally, network operators themselves want a "single version of the truth" that can be broadly deployed to monitor user experience.

A key challenge is that today's user experience is driven primarily by data performance, but different application types have widely varying needs. Therefore, a truly comprehensive solution requires both application-aware quality measurements and application-agnostic metrics.

SOLUTION

Sandvine's traffic measurement technology measures the actual performance delivered to the network's users, regardless of access technology. Measurements take place for all data traffic, all the time – incorporating subscriber experience KPIs that are recognized by the FCC in the United States and the European Union's BEREC. The solution is subscriber-, service-, location-, and device-aware, to facilitate root cause analysis for quality of experience (QoE) issues.

ScoreCard metrics with location awareness for video streaming.
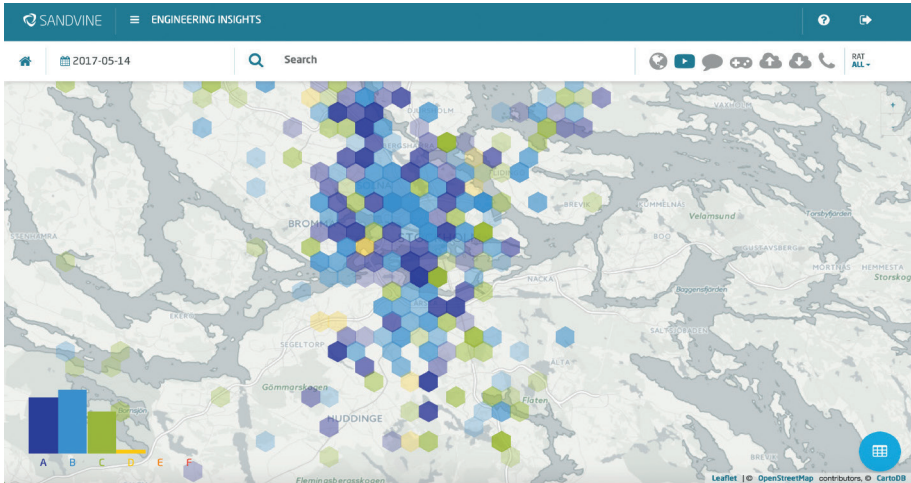
IMPACT AND RESULTS

The Regulatory Quality Monitoring solution is used by regulators and operators to verify compliance and to measure and improve upon key quality metrics.

Regulators can measure QoE across a regional footprint with multiple operators and network types. Operators can validate for themselves that they are in regulatory compliance and allocating resources appropriately in their efforts to improve user experience. And users can be provided service scores that quantify the quality of service received.

Regulatory VoIP Management

Comply with regulatory requirements to monitor and manage unlicensed/illegal Voice-over-IP services

BACKGROUND

Government regulators are concerned with the security risks posed by the use of encrypted VoIP for unlawful communications. This is especially true in developing regions where many regulators originally chose to block over-the-top VoIP altogether. Now more jurisdictions permit regulated VoIP providers to operate, creating a more level playing field between VoIP providers, addressing security concerns, and preserving crucial revenue streams for network operators.

The challenge facing network operators today – who are obligated to uphold a jurisdiction's regulations – is to permit only lawful voice services.

Old style HTTP – less than 50%
Majority of traffic
May happen with TLS1.3 in future
May happen in future

Impacts
- Metadata is no longer visible
- Specific URLs can't be blocked (e.g., YouTube)
- Domain visibility only for Content
- Application ID requires heuristics and DPI

SOLUTION

Sandvine is the leader in regulatory VoIP management. The Regulatory VoIP Management solution provides the broad functionality and flexibility needed to deliver reliable compliance while also preserving the ability to adapt to changing regulations, traffic makeup, and patterns of usage.

The solution is provided with an extensive application signature library that is continually upgraded to identify new and changing applications, and that even identifies encrypted application traffic.

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Operators also have the option to design their own custom signatures if so desired.

Once traffic is identified, multiple actions can be applied to comply with regulations. For instance, unlicensed traffic can be blocked or rejected, which will halt the traffic streams; alternatively, traffic can be rate-limited or session-limited, which delivers better results for some types of applications (e.g., polymorphic applications that change behavior when blocked).

If logging or analytics is part of the regulatory requirement, then statistics can be gathered on traffic passed, blocked, limited, or dropped; these statistics include volume, number of call attempts, quality of experience, and many other metrics that provide a closed-loop analysis of the effectiveness of the regulatory compliance.
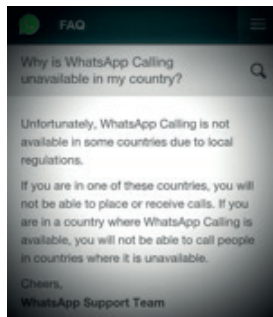
IMPACT AND RESULTS
The Regulatory Voice-over-IP (VoIP) Management solution has been deployed by leading providers around the world. These providers can rest assured that they are complying with current regulations, and that they have the flexibility to change the way that they manage these applications should regulations change.

ABOUT SANDVINE

Sandvine helps organizations run world-class networks
with Active Network Intelligence, leveraging machine
learning analytics and closed-loop automation to identify
and adapt to network behavior in real-time. With Sandvine,
organizations have the power of a highly automated
platform from a single vendor that delivers a deep
understanding of their network data to drive faster, better
decisions.

For more information, visit **www.sandvine.com**
or follow Sandvine on Twitter at **@Sandvine**

SANDVINE

ASIA
Ardash Palm Retreat,
Bellandur, Bangalore,
Karnataka 560103
India
T: +91.80677.43333

CANADA
408 Albert Street,
Waterloo,
Ontario N2L 3V3,
Canada
T: +1 519.880.2600

EUROPE
Birger Svenssons Väg 28D
432 40 Varberg,
Sweden

T: +46 (0)340.48 38 00

USA
47448 Fremont Blvd
Fremont,
CA 94538
USA
T: +1 510.230.2777