



SANDVINE

Sandvine Solutions

Driving Network Economic Transformation

Cam Cullen

VP of Solutions Marketing

225+M

revenue

2.1B

network users

150+

major operators

500+

enterprises

100+

countries

45+

patents

Our Foundation

Data **visibility** and **accuracy** are our core building blocks for value delivery. Our **network intelligence** powers mission critical systems.

Our Philosophy

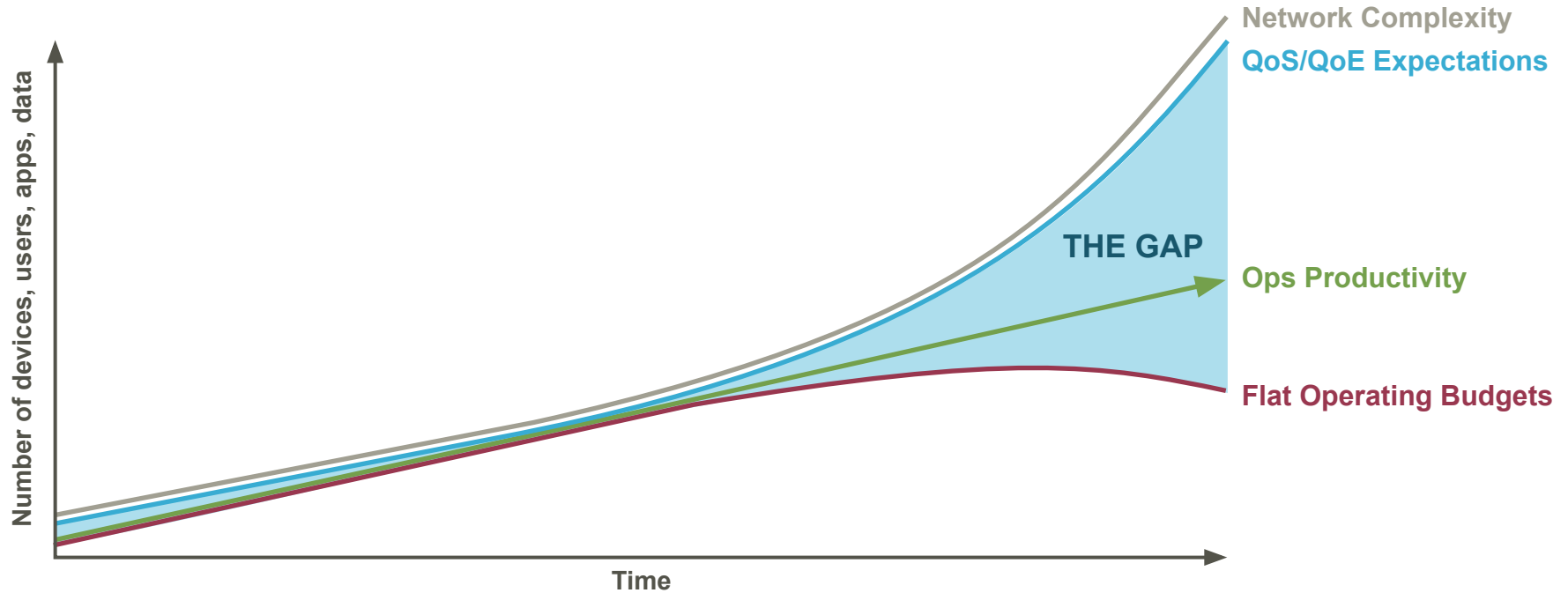
Operate to an aspirational goal of delivering “0%” unknown traffic by providing frequent signature updates and machine learning approaches to dealing with encrypted traffic.

Our Value

Provide the broadest **solution area breadth** and **use case depth** with DPI based middleware to help our customers maximize their OPEX savings opportunity within their infrastructure investments.

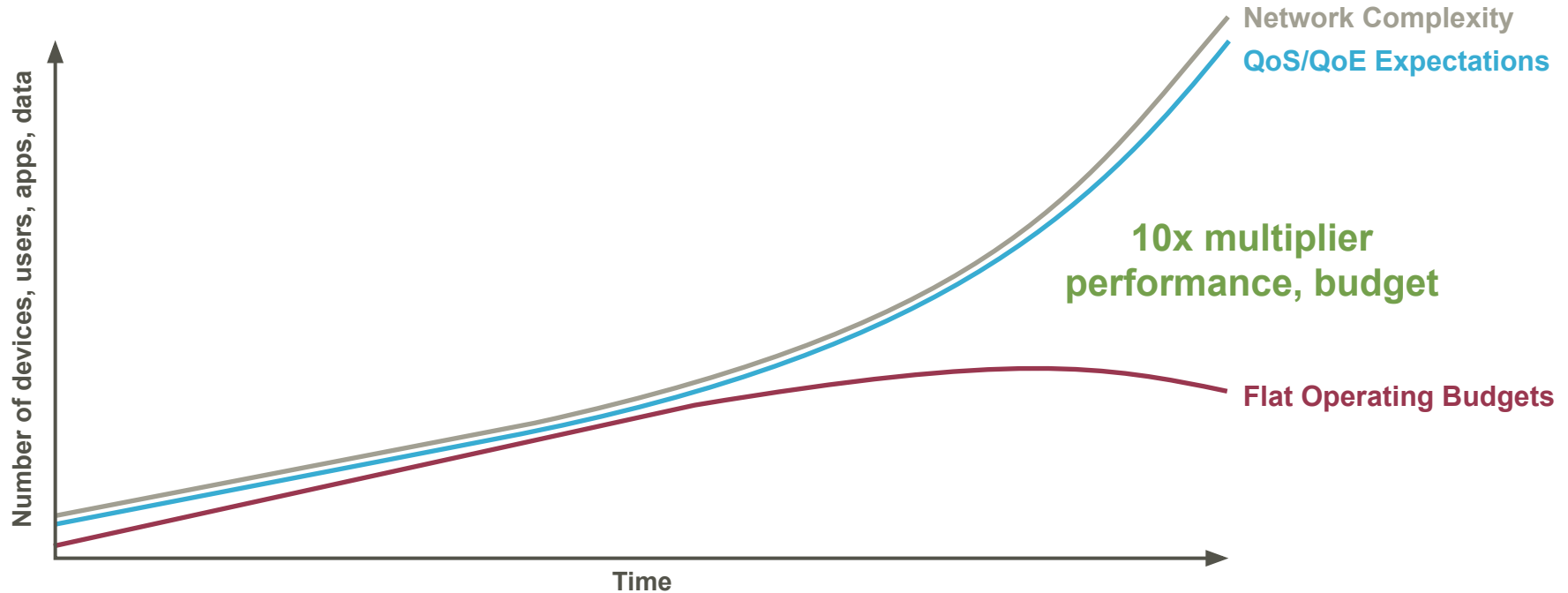
Realize 10x performance, same budget

Multiplier effect: close the gap



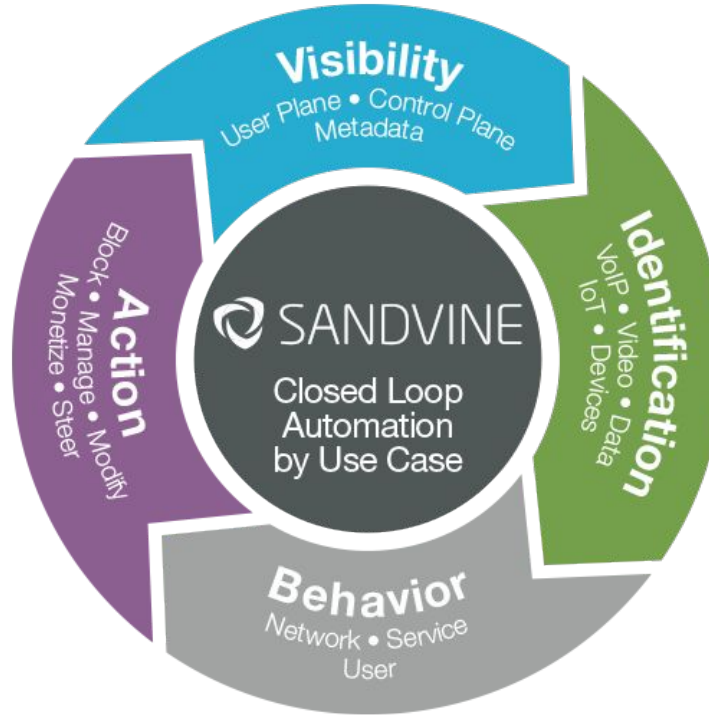
Realize 10x performance, same budget

Multiplier effect: close the gap



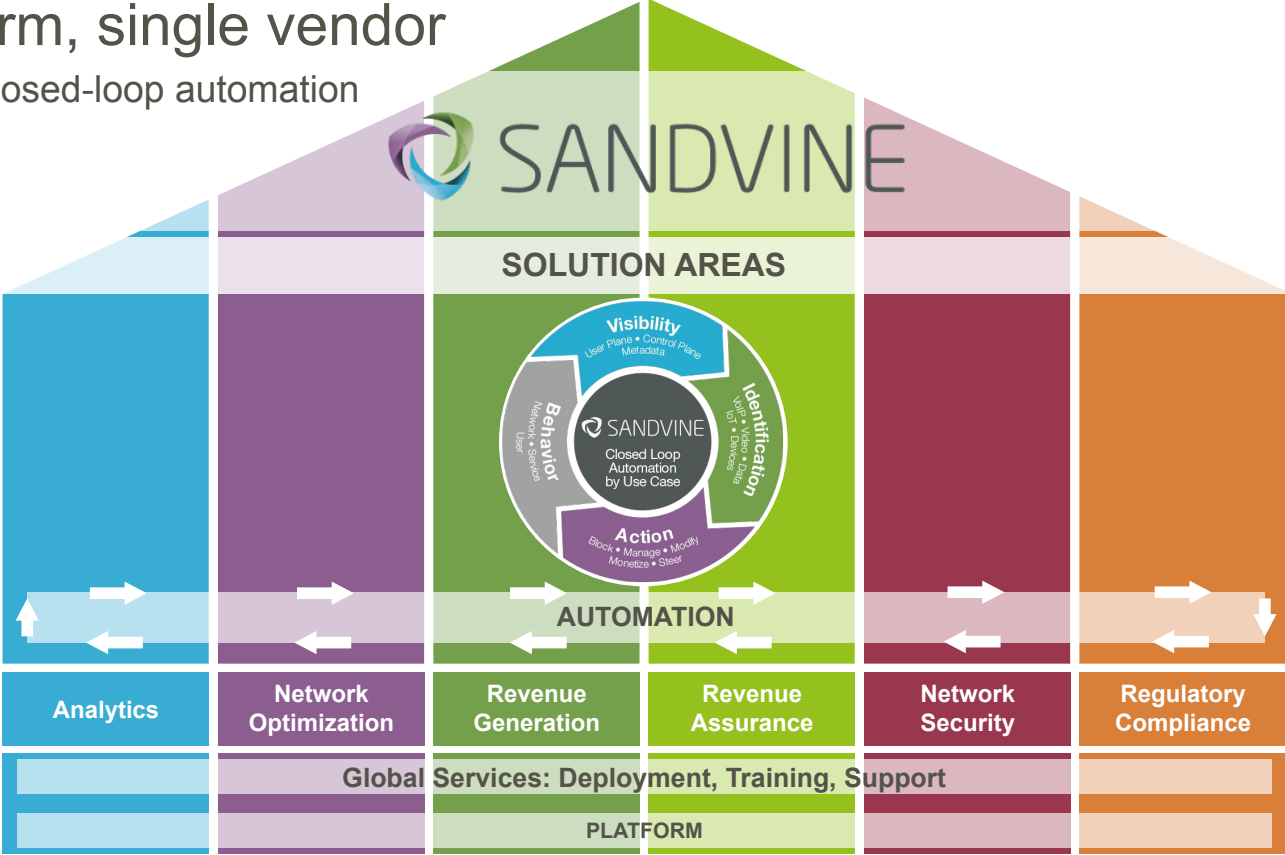
Only Sandvine delivers Active Network Intelligence

Across service providers and enterprises



Single platform, single vendor

With the power of closed-loop automation



A single platform delivers a wide portfolio of solutions

6 Solution areas & 33 use cases today



Analytics

Take the guesswork out of managing your network

- Performance and Operational Monitoring
- Service and Subscriber Monitoring
- Performance Analysis
- Capacity Planning Analysis
- User Behavior and Demographic Analysis

Network Optimization

Contain costs, preserve QoE, and improve efficiency

- Congestion Management
- Video Streaming Management
- Heavy User Management
- Fair Use Policy Management
- RAN Spectrum Optimization
- Mobile Backhaul Optimization
- QoS Assurance
- Peering and Transit Link Management
- Carrier-Grade NAT
- Traffic Steering/Diversion

Revenue Generation

Grow revenue by rapidly deploying innovative services

- Sponsored Data
- Advanced Data Services
- Advanced Roaming Services
- Internet as a Public Service
- HD Voice and VoLTE
- Mobile Data Management
- Office and Site Data Management

Revenue Assurance

Get paid fairly for the data and services you deliver

- Interconnect Bypass Fraud
- Video and Television Fraud Management
- Data Revenue Leakage Monitoring
- Data Fraud Management

Network Security

Protect your network and its users from online threats

- User Threat Management
- Network Threat Management
- Security Monitoring

Regulatory Compliance

Keep up with regulations, quickly and cost-effectively

- Regulatory Quality Monitoring
- Regulatory Voice-over-IP Management
- Regulatory Traffic Management
- Regulatory Data Retention

Business value built on a 'philosophy of zero unknown traffic' unmatched visibility of your network activity

Why innovators choose Sandvine

Key differentiators



See with
clearer eyes

Single version of truth,
deepest granularity



Act smarter
every day

Analytics,
Machine learning



Handle the
unexpected

Versatile architecture,
adapts dynamically



Drive new
economics

Closed-loop automation,
10x multiplier



First to market: Active Network Intelligence

Delivering benefits across the organization

Network Exec

- Gain full visibility and real-time policy-driven control
- Pinpoint and resolve network issues, immediately, with great precision

CTO/CIO

- Future proof the business
- Respond quickly to changing needs of the business
- Achieve 10x productivity with existing resources

CISO

- Reduce exposure to network-based risk to the business

Telco CMO

- Respond quickly to changing market dynamics
- Be first to market with new service offerings
- Make real-time offers based on subscriber behavior

Sample Customers By Use Cases

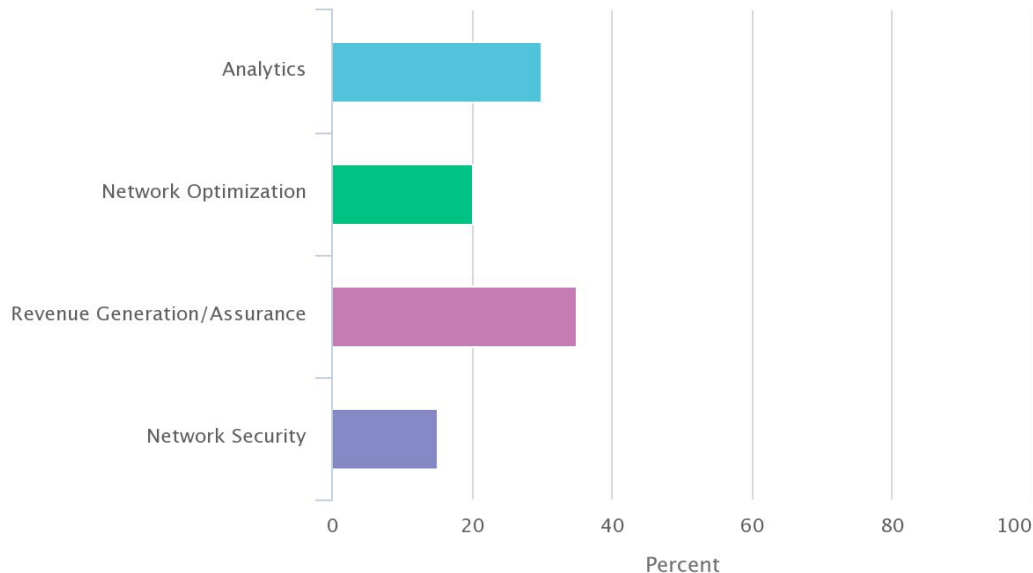
Deployed across the world with Network Operators

Analytics	Network Optimization	Revenue Generation	Revenue Assurance	Network Security	Regulatory Compliance
 SoftBank  Telecom Italia  NTT docomo  COMCAST  COX  LIBERTY GLOBAL	 vodafone  boingo  VIASAT  TELEKOM AUSTRIA GROUP  XPLOARNET  VimpelCom	 Telefonica  Globe  Virgin mobile  du  موبايلي mobily	 Digicel  bakcell  VIVAcell  MTS  movistar  du	 MEDIA  BT	 etisalat  zain  TELEKOM MALAYSIA  te  3  du

What Use Cases are driving Investments?

Sandvine's Voice of Customer

What use case area will you be focusing on in 2018?





SANDVINE

Sandvine Analytics

Unleash your network with granular network intelligence



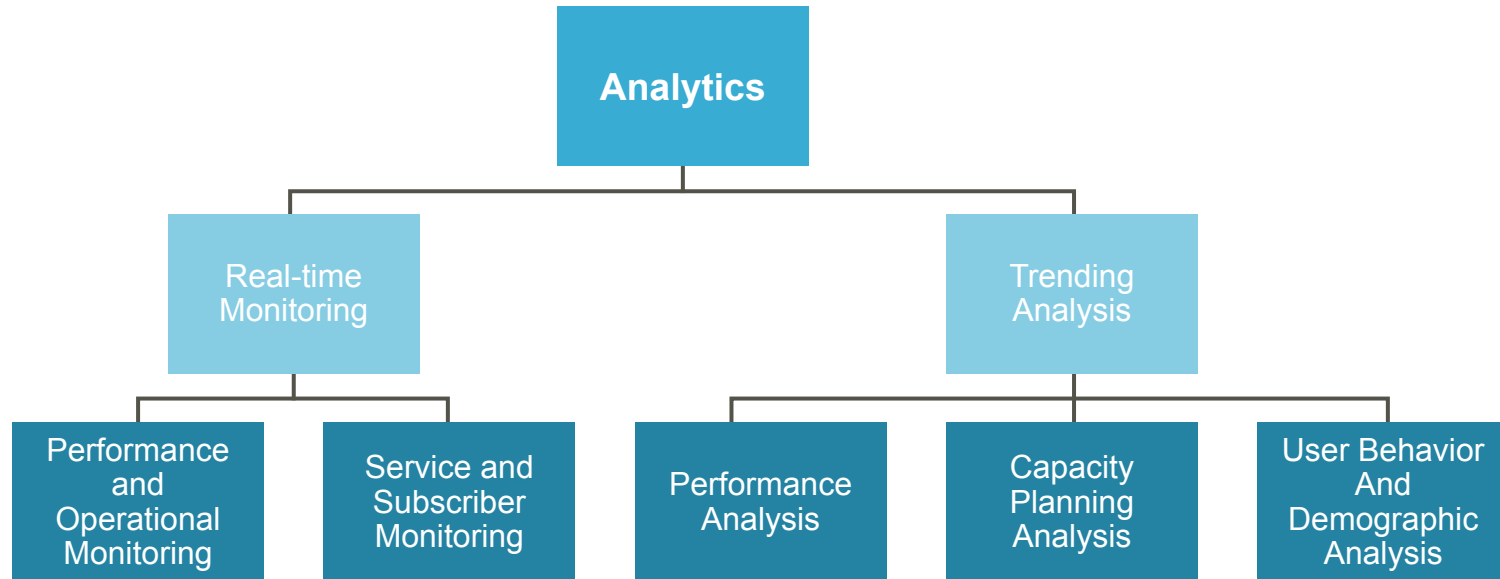
A person with long blonde hair is looking through binoculars. The lenses of the binoculars are replaced with blue money bag icons, each featuring a white dollar sign. The background is a soft-focus green field with a warm, golden light filter. The text 'OUR ANALYTICS GOAL' is overlaid in white, and 'SEE more of what MATTERS in your network' is overlaid in blue and white below it.

OUR ANALYTICS GOAL

SEE more of what **MATTERS** in
your network

Analytics Use Case Hierarchy

Industry-leading application identification and KPIs



Performance and Operational Monitoring

Granular network visibility in real-time

Use Case Need

Detect anomalies, monitor service availability, diagnose issues, and troubleshoot problems in real-time by carefully monitoring network performance and crucial quality indicators

Network Users

Network Operations

Customer Care

Business Value

Real-Time RCA

Interactive network analysis

CAPEX Reduction and/or Delay



Analytics

Key Technologies

Real-time high granular KQI data

High performance enabling full coverage monitoring in virtualized package.

Flexible real-time and historical APIs for Big Data system integration

Unique Value Proposition

Sandvine's Performance and Operational monitoring delivers unique real-time data feeds for the critical KQIs required to accurately diagnose network performance and quality issues

Service and Subscriber Monitoring

Proactive subscriber quality monitoring

Use Case Need

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

Network Users

Customer Care
Network Operations
Sales and Marketing

Business Value

Churn Reduction
Differentiated customer experience
Improved subscriber Quality of Experience



Analytics

Key Technologies

ScoreCard QoE metrics

Outlier Analytics

High performance enabling full coverage monitoring in virtualized package.

Flexible real-time and historical APIs for Big Data system integration

Unique Value Proposition

Sandvine's Service and Subscriber monitoring solution delivers unique subscriber QoE metrics applied to the applications that subscriber measure their experience by - video, web, social, VOIP, gaming, upload, and download.

Performance Analysis

Performance management of critical services, network users, and applications

Use Case Need

Network operators face immense pressure to deliver high quality services; with a new generation of user with ever higher expectations, operators need to understand their customer experience on their network

Network Users

Customer Care
Network Operations
Network Engineering

Business Value

Churn Reduction
Differentiated customer experience
Improved subscriber Quality of Experience



Analytics

Key Technologies

Weekly signature updates for accurate and granular application identification
Real-time, high granular KQI data
High performance enabling full coverage monitoring in virtualized package.

Unique Value Proposition

Sandvine's Performance Analysis solution enables accurate detection of quality degradations for Over-The-Top broadband services and provides actionable intelligence with break down to root cause.

Capacity Planning

Understand your network assets for effective capacity expansion

Use Case Description

Capital expenditure burdens on operators remain significant, they need to make the right decisions about capacity planning and network engineering .

Network Users

Network Engineering
Network Operations
CTO

Business Value

Maximize return on CAPEX
CAPEX reduction
Network utilization maximization



Analytics

Key Technologies

Industry leading protocol recognition
Network level QoE metrics
Network topology/Hierarchy awareness
High performance enabling full coverage monitoring in virtualized package.

Unique Value Proposition

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 Demographics Analysis

Performance management of critical services, network users, and applications

Use Case Need

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.

Network Users

Customer Care

Network Operations

Marketing

Business Value

Churn Reduction

Service Innovation

Data Monetization



Analytics

Key Technologies

Weekly Signature Updates

Subscriber Enrichment

High performance enabling full coverage monitoring in virtualized package.

Persona-specific visualizations

Unique Value Proposition

Sandvine's User Behavior and Demographic Analysis solution can provide accurate and granular answers to the questions that drive the business model and service planning to drive CAPEX and OPEX spending and marketing

Forward thinkers choose Sandvine



35%

Reduction in
customer call time

Why Sandvine Analytics Solutions?

**Open Structured
Enriched Data**

**High accuracy with
KPI's that are relevant
and actionable**

**Action orientated data
– leading to
Automation**

**Flexible Data Export
and agile report
generation**

**Network Services
Domain Expertise**



SANDVINE

Network Optimization Solutions

Contain costs, preserve quality of experience,
and improve efficiency

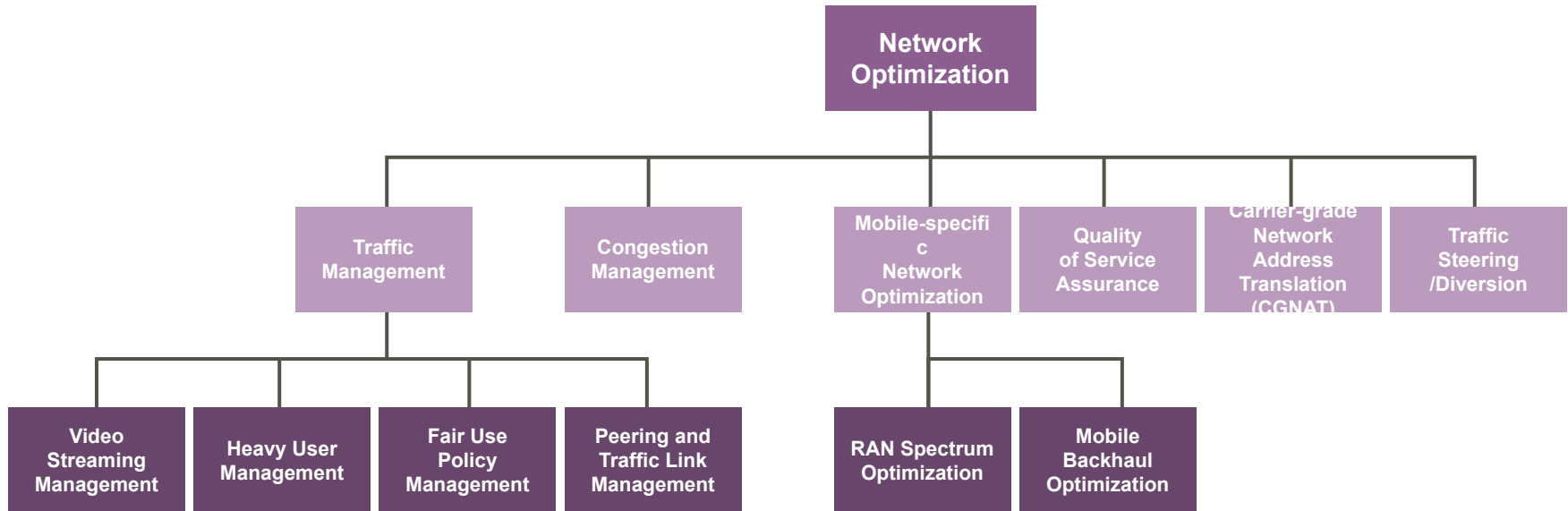
OUR OPTIMIZATION GOAL

DELIGHT your users while
MINIMIZING CAPEX



Network Optimization Use Case Hierarchy

Delivering high QoE to your network



Video Streaming Management

Managing the flood of video traffic for better QoE

Use Case Need

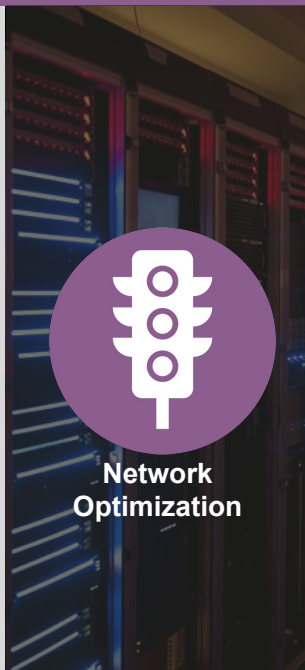
Optimize video streaming to ensure all users get the same, consistently good quality of experience, and the network isn't threatened by extreme load. Manage video traffic based on service plans, video type, or device capabilities.

Network Users

CTO
Network Engineering
Marketing

Business Value

Video Service Plans for differentiation
Differentiated customer experience for Video
Deferred CAPEX to increase bandwidth



Key Technologies

Weekly Signature Updates including OTT Video
Video traffic KPIs
Sophisticated queueing technology to optimize video streams for each OTT video provider based on their bandwidth need

Unique Value Proposition

Sandvine's Video Streaming Management solution enables accurate identification of Over-The-Top video streaming services and ensures a consistent, high quality video experience while accurately tracking the usage and quality delivered to each user

Heavy User Management

Don't let 10% of users degrade QoE for the other 90%

Use Case Need

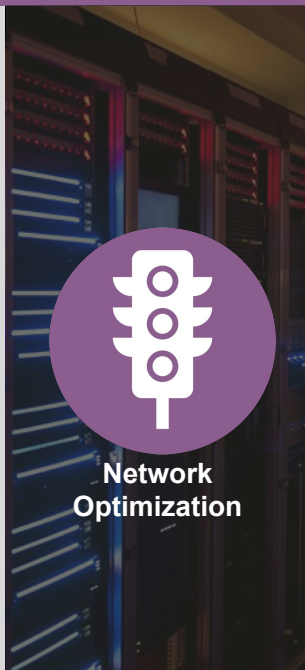
Reduce costs and improve overall user quality of experience by identifying, analyzing, and managing the network's heaviest users

Network Users

Network Operations
Network Engineering
Marketing

Business Value

Preserve QoE for the majority of users
Increase network efficiency and capacity during peak
Defer CAPEX to increase bandwidth



Key Technologies

Sophisticated queueing technology to optimize video streams for each OTT video provider based on their bandwidth need

QoE metrics to track effectiveness of management

Service plan-based heavy user profiles

Unique Value Proposition

Sandvine's Heavy User Management solution reduces network congestion during peak usage times which increases QoE. The closed loop nature of the analytics and QoE feedback ensures that the effect of the heavy user management is continually improved.

Fair Use Policy Management

Ensure fair access to bandwidth to all users

Use Case Need

Ensure shared network resources are available at all times by enforcing fair usage limits on users and applications

Network Users

Network Operations

Network Engineering

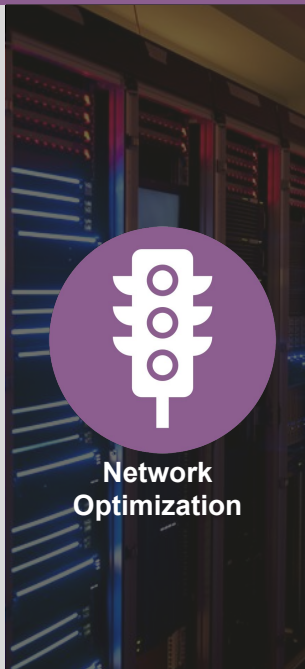
Marketing

Business Value

Preserve QoE for the majority of users

Increase network efficiency and capacity during peak

Delay CAPEX



Key Technologies

Sophisticated queueing technology to ensure each user access to a fair portion of the available bandwidth

QoE metrics to track effectiveness of management

Service plan-based fair usage for weighted fair usage

Unique Value Proposition

Sandvine's Fair Use Policy Management solution can implement hard, soft, or application-based fair usage to meet the business or regulatory requirements of the operator.

Peering and Transit Link Management

Control costs and maximize QoE for peering

Use Case Need

Control costs and maximize user quality of experience by precisely managing traffic peaks and composition at vital links

Network Users

Network Operations

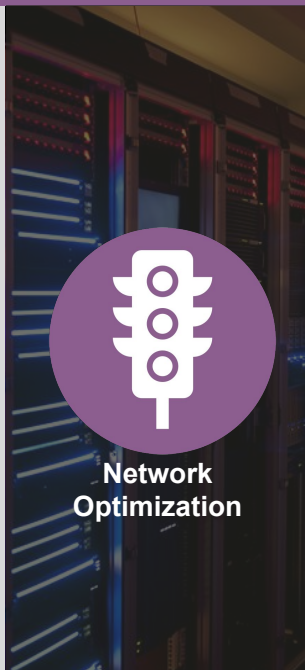
Network Engineering

Business Value

Monitor and manage QoE for peering links

Increase peering efficiency and capacity during peak

Delay Peering OPEX/CAPEX



Key Technologies

Performance and QoE metrics per AS Path in real time and historically

Sophisticated queueing and policing technology to prioritize and manage traffic on a per AS path and per application bases

Visualization for performance and QoE

Unique Value Proposition

Sandvine's Peering and Transit Management solution integrates with the operator's BGP infrastructure and can monitor and manage user and application traffic for each peering link on the network down to the AS Path level.

Congestion Management

Surgical management of network congestion

Use Case Need

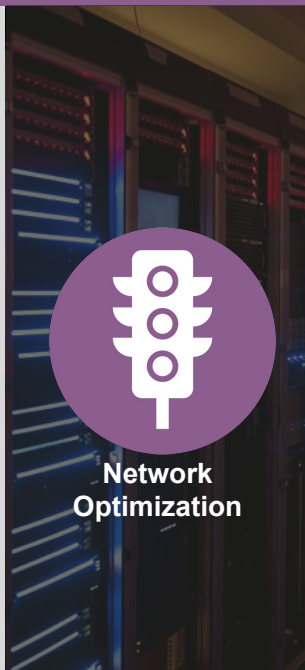
Manage network congestion precisely, taking action only where and when needed, to extend infrastructure lifetime and protect user quality of experience

Network Users

Network Operations
Network Engineering

Business Value

Reduced churn due to poor experiences; better QoE
Delay CAPEX and OPEX
Closed loop for analytics and network optimization



Key Technologies

Sophisticated queueing technology to maximize “goodput” on network

QoE metrics to track effectiveness of congestion management

ScoreCard to identify network hotspot and RCA

Unique Value Proposition

Sandvine's Congestion Management solution ensures that the network can operate in a closed loop manner with analytics and QoE constantly being optimized based on the network's behavior and responses.

RAN Spectrum Optimization

Control costs and maximize QoE for peering

Use Case Need

Achieve significantly improved return on investment for the radio access network (RAN) and the mobile spectrum by optimizing network traffic at the transport level

Network Users

Network Operations

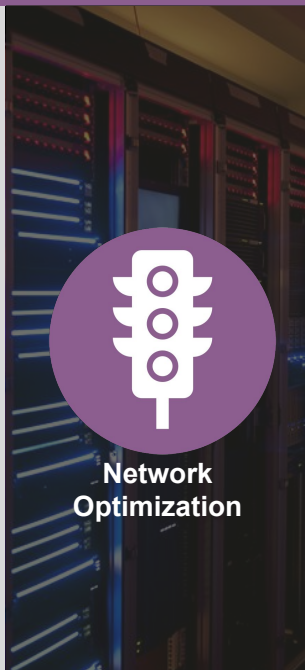
Network Engineering

Business Value

Users experience higher speeds and better QoE

RAN supports more concurrent users

RAN resources freed more quickly



Key Technologies

Sophisticated TCP optimization that is application and encryption agnostic

Performance monitoring to measure the impact of TCP acceleration on the network for performance and latency

Virtual deployment options

Unique Value Proposition

Sandvine's RAN Spectrum Optimization solution is powered by our TCP Accelerator, a carrier-grade transparent network element that manages TCP buffers to maximize "goodput" on the network.

Mobile Backhaul Optimization

Maximize usage of backhaul bandwidth for high QoE

Use Case Need

Improve network efficiency and user quality of experience by ensuring the mobile backhaul link performs at its best

Network Users

Network Operations

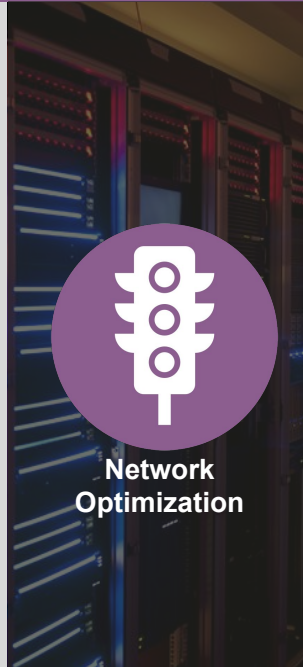
Network Engineering

Business Value

Users experience higher speeds and better QoE

Delay CAPEX to maximize ROI for backhaul

Closed loop for analytics and network optimization



Key Technologies

Sophisticated TCP optimization that is application and encryption agnostic

Performance monitoring to measure the impact of optimization and traffic management

VoLTE & emergency services QoS prioritization

Virtual deployment options

Unique Value Proposition

Sandvine's Mobile Backhaul Optimization solution ensures that the mobile network access links can operate in a closed loop manner with analytics and QoE constantly being optimized based on the network's behavior and responses.

Quality of Service (QoS) Assurance

SLA assurance for high priority traffic and 5G slicing

Use Case Need

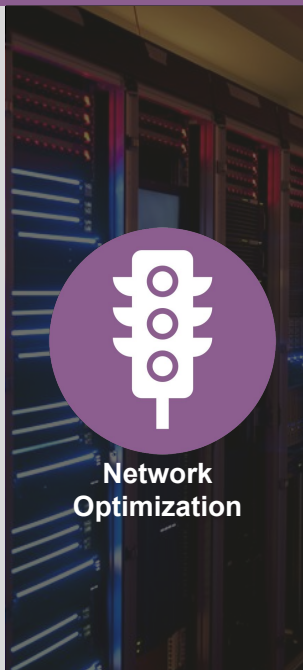
Meet quality of service (QoS) commitments by identifying traffic, marking it for downstream enforcement, and directly signaling to other network elements

Network Users

Network Operations
Network Engineering

Business Value

Critical applications get better performance and QoE
Delay CAPEX to maximize ROI for backhaul
Closed loop for analytics and network optimization



Key Technologies

Performance monitoring to measure the delivered QoS for critical applications and users

VoLTE & emergency services QoS prioritization

Scalable, sophisticated prioritization and queuing

Weekly Signature Updates to maintain accuracy and custom signatures for operator-defined services

Unique Value Proposition

Sandvine's QoS Assurance solution ensures that the mission critical applications and users achieve their service level agreements (SLAs) on your network through the industry's leading application identification and QoS engine.

Carrier Grade Network Address Translation (CGNAT)

IP Address conservation and migration to IPv6

Use Case Need

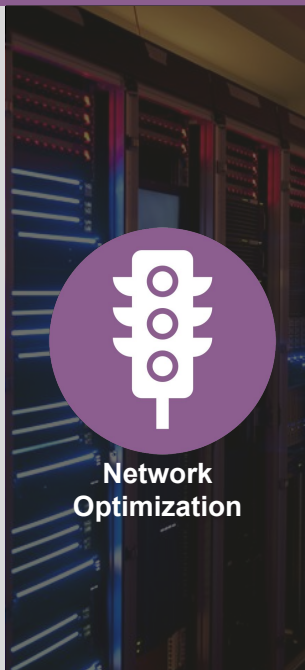
Conserve IPv4 public address space through the use of private addressing, while remaining subscriber aware, support asymmetric traffic, deliver scalable logging

Network Users

Network Operations
Network Engineering

Business Value

User growth not constrained by address limitations
Preserve user level analytics even with NAT
Simplify network design with asymmetry support



Key Technologies

Subscriber-aware CGNAT with service plan support
Subscriber level visibility and analytics
Scalable NAT logging
Support for network asymmetry with NATSync

Unique Value Proposition

Sandvine's CGNAT solution maximizes ROI on CGNAT by transforming it from a non-revenue generating network element to a single packet intelligence solution that can provide valuable analytics and closed loop actions.

Traffic Steering / Diversion

Surgical traffic mirroring and redirection

Use Case Need

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

Network Users

Network Operations

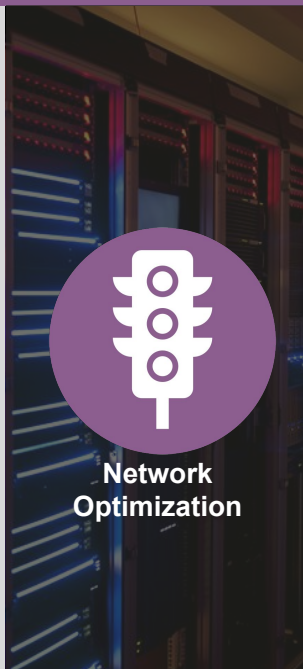
Network Engineering

Business Value

Conserve server bandwidth and save on CAPEX

Simplify service chain operations and troubleshooting

Monetize managed enterprise vCPE service chains



Key Technologies

Weekly Signature Updates for application-based accuracy in traffic identification

Subscriber enrichment to enhance the attributes beyond subscriber and application that can be used for diversion (location, time of day, service plan, etc.)

Traffic Steering Engine for large scale service chains

Unique Value Proposition

Sandvine's Traffic Steering solution surgically selects traffic for steering or diversion to minimize the cost and operational overhead for VAS or regulatory use cases, and opens up vCPE service chains before SDN is deployed in your network

Forward thinkers choose Sandvine

SoftBank

>40M

subscribers managed in real-time
with closed loop QoE

Forward thinkers choose Sandvine



51%

Faster pages loads on their
mobile network due to
Sandvine's TCP Accelerator

Why Sandvine Traffic Optimization Solutions?

**Granular, frequently
updated application
signatures**

**Sophisticated traffic
management
technology**

**User awareness for
network optimization**

**Relevant QoE metrics
to measure impact of
traffic management**

**TCP Optimization to
reduce network
bandwidth**



SANDVINE

Revenue Generation Solutions

Power your service revenues by using network intelligence to deliver services signaled by customer intent

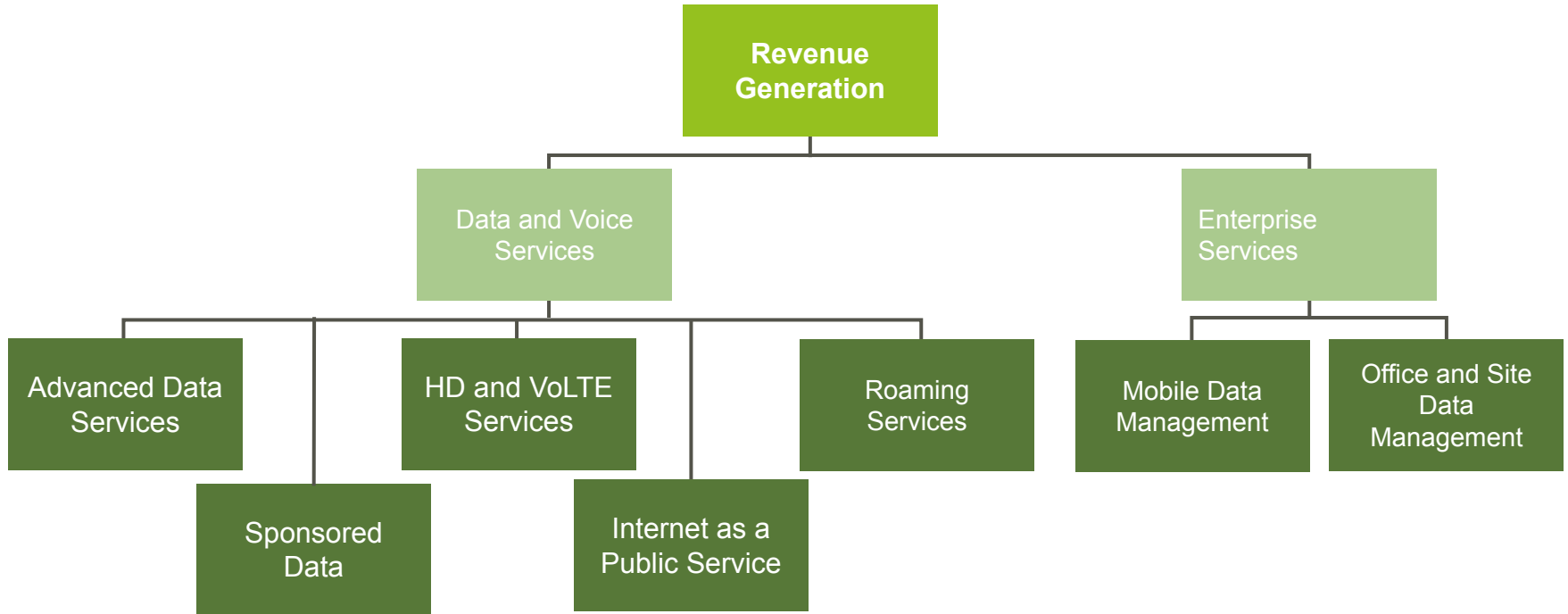




OUR REVENUE GENERATION GOAL

MAKE more **MONEY** by
offering what users want

Revenue Generation Use Case Hierarchy



Advanced Data Services

Service Innovation

Use Case Description

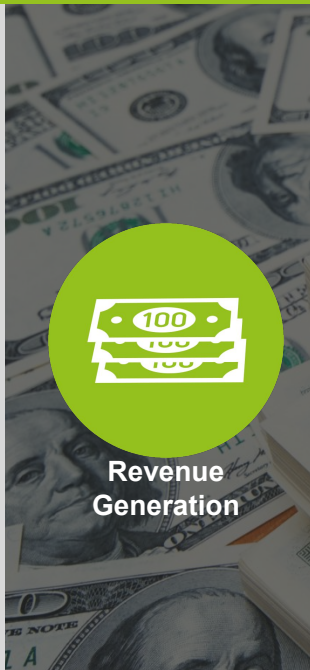
Stand out from the crowd and grow new revenue by becoming the market leader for innovative, intelligent, feature-rich data services

Network Users

CTO
Marketing
Network Engineering

Business Value

Attract new and retain existing customers
Micro-target users with perceived value
Increase revenue by selling more for more



Key Technologies

Active Network Intelligence-enabled PCEF
High performing, flexible PCRF
Weekly Signature Updates for application-based services including zero rating and charging

Unique Value Proposition

Sandvine's Advanced Data Services solution is a flexible combination of PCRF and PCEF products capable of quickly identifying monetization opportunities and turning them into new services. Our rich subscriber enrichment technology delivers the most flexible service enablement toolkit for innovative network operators.

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

Access-Independent quality voice services enablement

Use Case Description

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

Network Users

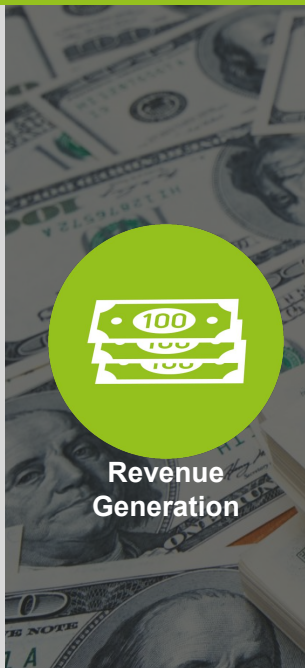
Marketing
Network Operations
Network Engineering

Business Value

Increased user satisfaction with exceptional call quality and faster call connection

Increased revenue with premium service plans

Compliance with emergency service regulations



Key Technologies

Active Network Intelligence-enabled PCEF

High performing, flexible PCRF

Weekly Signature Updates for application-based services including VOIP and custom voice services

Sophisticated network prioritization for real-time voice

Unique Value Proposition

Sandvine's HD Voice and VoLTE solution delivers 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.

Advanced Roaming Services

Monetization of content partnerships

Use Case Description

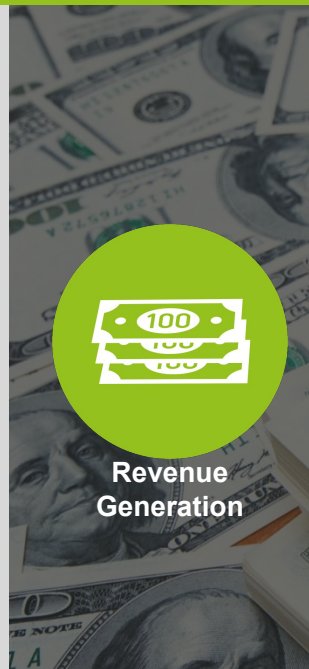
Provide affordable, unique, and enticing options for traveling data users and protect them from unexpected roaming fees

Network Users

CTO
Marketing
Network Engineering

Business Value

Increased roaming revenue
Competitive differentiation
Increased customer satisfaction and retention.



Key Technologies

Active Network Intelligence-enabled PCEF
High performing, flexible PCRF
Weekly Signature Updates for application-based services including zero rating and charging
Subscriber enrichment including location

Unique Value Proposition

Sandvine's Advanced Roaming Services solution enables immense configuration flexibility: time, volume, day pass, application-based charging, and zero-rating; plus, they can offer all these in self-service portals for users to manage their own roaming services. This flexibility maximizes take rate for roaming plans.

Sponsored Data Services

Monetization of content partnerships

Use Case Description

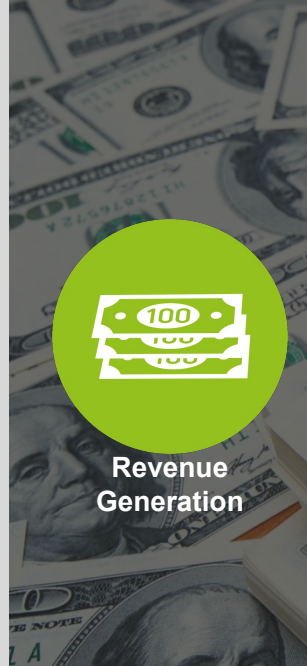
Unlock new revenue streams with sponsored data services, while also creating value for users and third-party sponsors

Network Users

CTO
Marketing
Network Engineering

Business Value

Grow and diversify revenue streams
Create differentiation in the marketplace
Increase users' perceived value



Key Technologies

Active Network Intelligence-enabled PCEF
High performing, flexible PCRF
Weekly Signature Updates for OTT applications and custom service definitions

Unique Value Proposition

Sandvine's Sponsored Data Services solution identifies traffic, associates usage with the right user, provides different flexible options (time or volume), while creating usage and billing records that the network operator can provide to the sponsor

Internet as a Public Service

Low cost internet access offers

Use Case Description

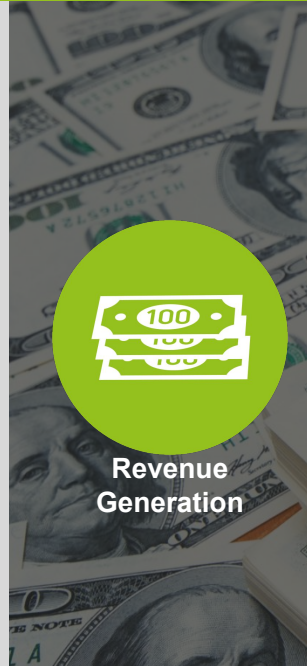
Increase loyalty and attract new users by providing free access to educational websites and other resources, whether through Free Basics by Facebook or a service of your own design

Network Users

CTO
Marketing
Network Engineering

Business Value

Positive brand recognition
Increased revenue from low-end users
Brand loyalty when users convert to paid services



Key Technologies

Active Network Intelligence-enabled PCEF
High performing, flexible PCRF
Weekly Signature Updates for application-based services including zero rating and charging
Access to Facebook Free Basics API

Unique Value Proposition

Sandvine's Internet as a Public Service solution allows network operators to design services that make sense for their market by using industry-leading traffic classification technologies and charging capabilities

Mobile Data Management

Enterprise managed mobile data offering

Use Case Description

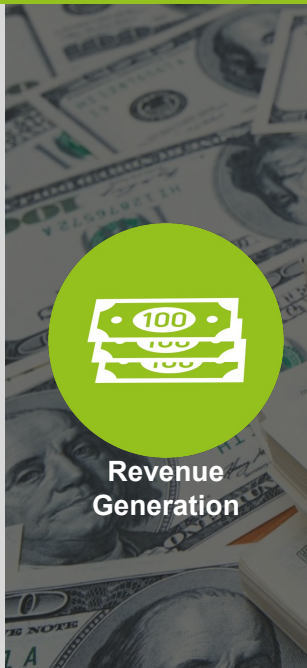
Provide businesses with actionable insight and empower them to manage application traffic and mobile data usage around the globe

Network Users

Marketing and Sales
Network Operations
Network Engineering

Business Value

Monetize the rapidly growing enterprise mobility services market
Reduced CAPEX/OPEX costs with cloud deployment



Key Technologies

Sandvine Cloud

Flexible menu of enterprise services – security, bill shock prevention, roaming control, application control, and mobile analytics

Self-Management GUI for end users

Unique Value Proposition

Sandvine's Mobile Data Management solutions manage access from within the network, rather than on individual devices. This dramatically simplifies IT management on BYOD devices, which can often be challenging to implement across operating systems, especially from a security perspective

Office and Site Data Management

Enterprise vCPE for multi-site enterprises

Use Case Description

Help business customers increase productivity and manage their data usage through an intelligent network service

Network Users

Marketing and Sales

Network Operations

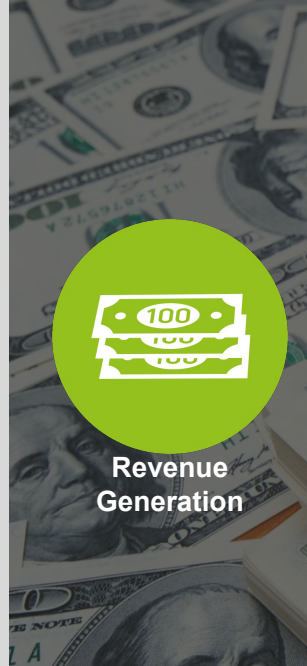
Network Engineering

Business Value

Reduced CAPEX/OPEX costs with cloud deployment

Capitalize on the enterprise IT migration to the cloud

Upsell advanced services beyond bandwidth



Key Technologies

Sandvine Cloud

Flexible menu of enterprise services – security, application control, content filtering, and analytics

Self-Management GUI for end users

Unique Value Proposition

Sandvine's Office and Site Data Management solutions are differentiated from traditional solutions that require on-premises equipment or proprietary hardware, these capabilities are built right into the network connection and 'delivered' to business customers via a self-service web interface that can be branded by the network operator.

Forward thinkers choose Sandvine

3 weeks to launch application-based data plans in multiple markets for millions of subscribers

Forward thinkers choose Sandvine



10M

New data users added deploying
innovative services plans using
Sandvine's Policy and Charging Solutions

Why Sandvine Revenue Generation Solutions?

**Network
Intelligence-powered
PCRF-PCEF
combination**

**Granular application
identification to enable
service innovation**

**API-driven subscriber
enrichment for
real-time services**

**Industry leading zero
rating and sponsored
data solutions**

**Sandvine Cloud for
enterprises**



Revenue Assurance Solutions

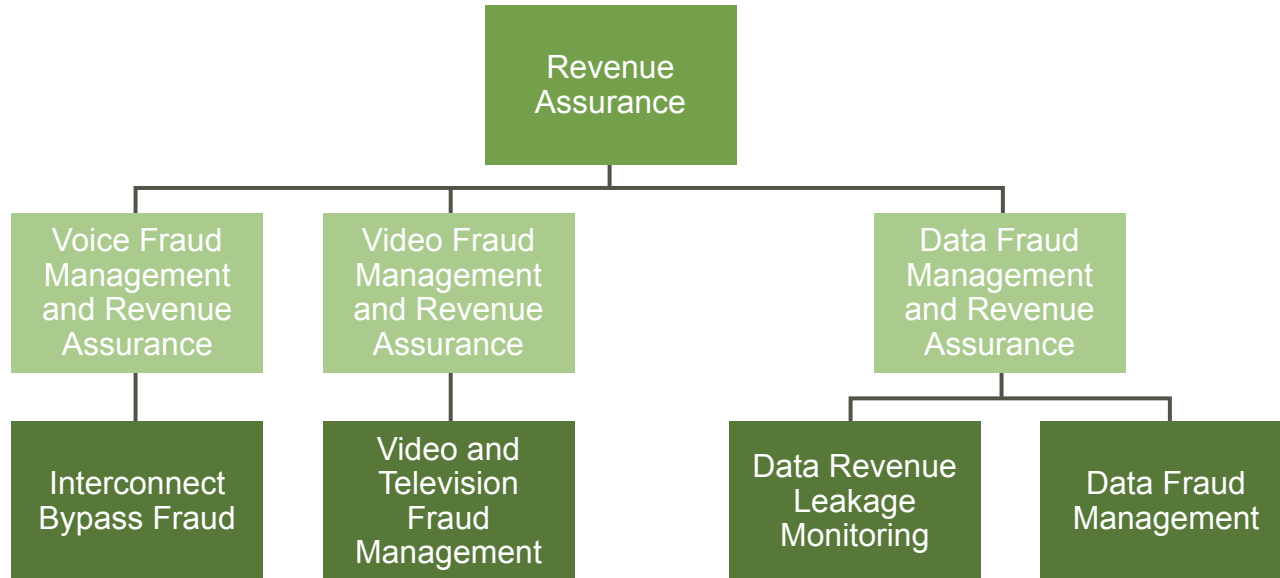
Protect your revenue streams
from fraud with granular
network intelligence



OUR REVENUE ASSURANCE GOAL

KEEP the **MONEY** you
are already making

Revenue Assurance Use Case Hierarchy



Interconnect Bypass Fraud

Prevent fraud from exploitation of VOIP revenue leakage

Use Case Description

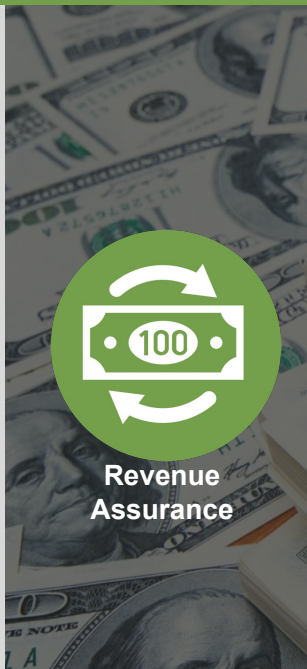
Measure the extent of the exploitation of the security flaws in the voice network to enable data-driven decisions about where to invest to secure it, report to the regulator, and build a mitigation plan to reduce the OTT voice bypass fraud impacts.

Network Users

Network Engineering
Network Operations
CTO

Business Value

Quantify business revenue impact for VOIP Fraud
Support law enforcement efforts
Close the loop by mitigating fraud loopholes



Key Technologies

Voice Application classification
Sophisticated encryption evasion techniques detection, fed by machine learning algorithms
Off-line eVolution solution for flexible deployment
Data exported APIs for further analysis and auditing.

Unique Value Proposition

Sandvine's Interconnect Bypass Fraud solution uses the advanced heuristics and machine learning capabilities of the Sandvine platform and vast OTT signature library to differentiate between authorized OTT VoIP apps from fraudulent OTT VoIP apps calls. These apps can be blocked, logged, or trigger a notification sent to user of the fraudulent application.

Video and Television Fraud Management

Protect revenue and maximize value from exclusive media content

Use Case Description

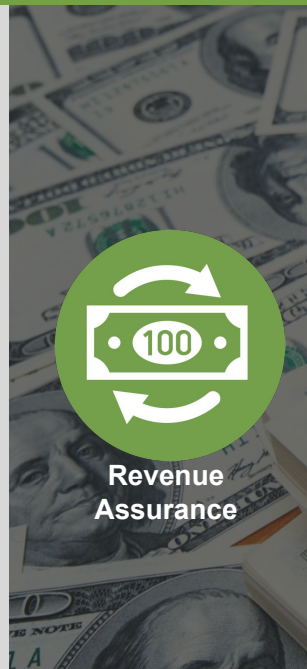
Protect revenue and maximize value from exclusive media content by discovering, monitoring, and managing video and television piracy on the network

Network Users

Marketing
Network Operations
CTO

Business Value

Quantify business revenue impact
Support law enforcement efforts
Marketing and segmentation for churn reduction



Key Technologies

Video and IPTV classification
Sophisticated piracy techniques detection, fed by machine learning algorithms
Pre-configured dashboards provide a bird's-eye view of piracy trends on the network
Data exported APIs for further analysis and auditing.

Unique Value Proposition

Sandvine's Video and Television Fraud Management solutions enable network operators to 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 educate other industry stakeholders.

Data Revenue Leakage Monitoring

Retain the revenue that you are entitled to

Use Case Description

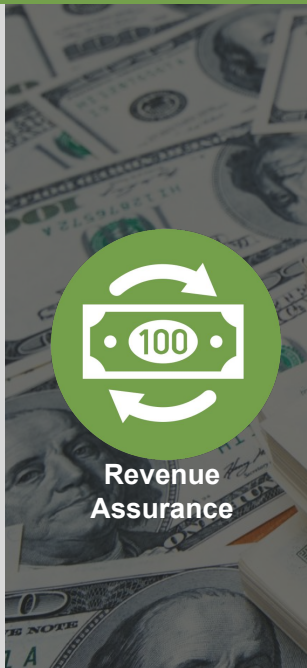
Get paid for the data the network delivers by identifying the misconfigurations, fraud techniques, and oversights that cause revenue leakage, especially for premium service offerings

Network Users

Marketing
Network Operations
Network Engineering

Business Value

Quantify business revenue impact of fraud techniques
Build an ROI for fraud enforcement solutions to close leakage holes
Modify ToS to explicitly prevent fraud techniques



Key Technologies

Weekly Signature Updates for application-based services including zero rating and charging
Sophisticated fraud techniques detection, fed by machine learning algorithms
Data exported APIs for further analysis and auditing in revenue assurance teams
Off-line eVolution option to compliment existing solutions and flexible deployment

Unique Value Proposition

Sandvine's Data Revenue Leakage Monitoring solutions provide operators an additional set of eyes in the network that accurately measures usage and also detects problems in the control and charging planes. This insight provides a point of comparison for other systems, and also serves as a fall-back redundancy measure that preserves charging capabilities in the event that other systems fail.

Data Fraud Management

Eliminate zero rating fraud

Use Case Description

Get paid fairly for the data the network delivers by detecting and mitigating a range of zero-rating fraud techniques

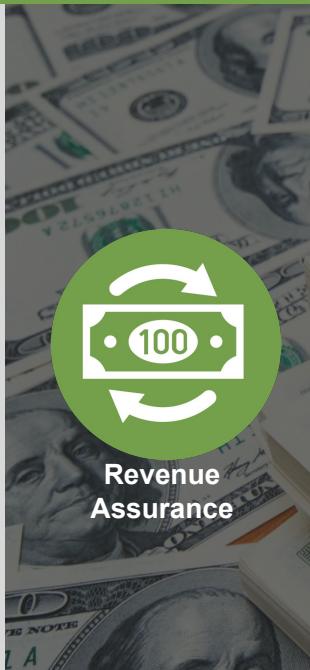
Network Users

Marketing
Network Operations
Network Engineering

Business Value

Maximize revenue for zero rated and sponsored data services by closing fraud holes for chargeable traffic

Prevent bill shock with incorrect zero rating charges through false positives or negatives



Key Technologies

Weekly Signature Updates for application-based services including zero rating and charging

Sophisticated fraud techniques detection and mitigation, fed by machine learning algorithms

Policy enforcement options to close leakage gaps

Reporting and Analytics to analyze types of fraud

Unique Value Proposition

Sandvine's Data Fraud Management solutions provide operators an active fraud management solution inline that is updated regularly to minimize revenue leakage from popular services that are prone to fraud.

Forward thinkers choose Sandvine

Digicel

18 countries experiencing the life-changing power of the Internet at no cost thanks to Sandvine and Free Basics by Facebook

Why Sandvine Revenue Assurance Solutions?

**Detection for
encrypted traffic and
fraud techniques**

**Granular application
identification to enable
revenue assurance**

**API-driven subscriber
enrichment to ensure
subscriber accuracy**

**Industry leading zero
rating and sponsored
data fraud prevention**

**Unique IPTV Fraud
solution**



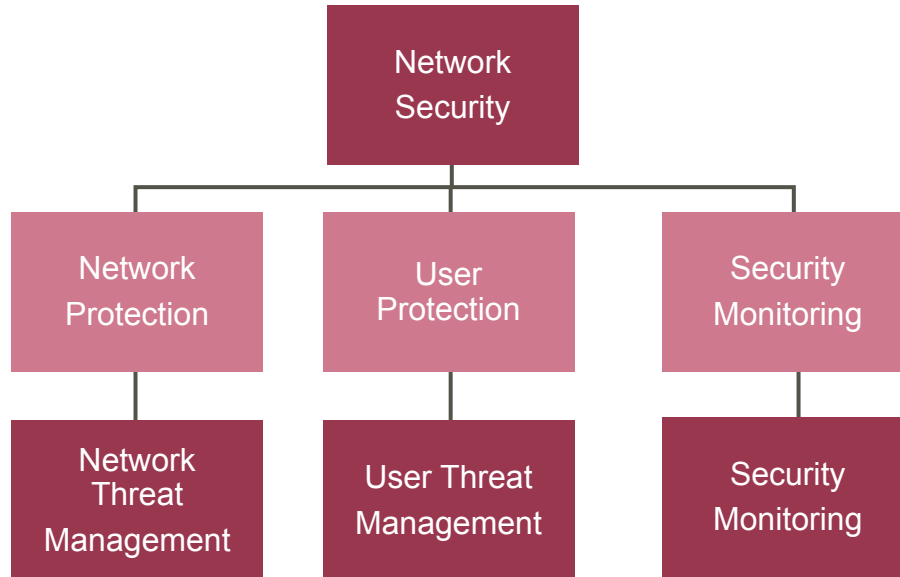
Network Security Solutions

Defend your network and users from cyber threats with network intelligence to reduce costs and preserve quality

OUR NETWORK SECURITY GOAL

PROTECT your **NETWORK AND USERS**
from QoE impacting attacks

Network Security Use Case Hierarchy



Network Threat Management

Minimize network downtime

Use Case Description

Protect the network by detecting and mitigating DDoS attacks, DNS attacks and threats, malware propagation, and other network level threats

Network Users

CTO/CISO

Network Operations

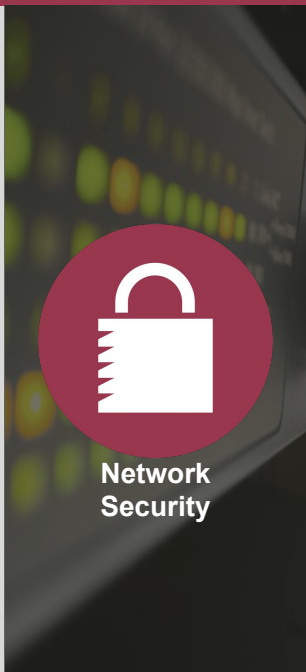
Network Engineering

Business Value

Reduced operational costs from network attacks and associated downtime

Enhanced QoE for network

Reputational protection from negative PR for network downtime and attack impacts on user base



Key Technologies

Weekly Signature Updates including malware and known attack vectors

ContentLogic solutions for URL filtering of known malware and phishing sites at scale

DNS monitoring and protection to prevent core network service interruptions

Unique Value Proposition

Sandvine's Network Threat Management solutions deliver carrier scale network threat mitigation at the user and application layer that traditional firewall and DDOS solutions cannot deliver as an in-line network element for network operators that require Tbps of network performance.

User Threat Management

Enhance user security

Use Case Description

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 Users

CTO/CISO

Network Operations

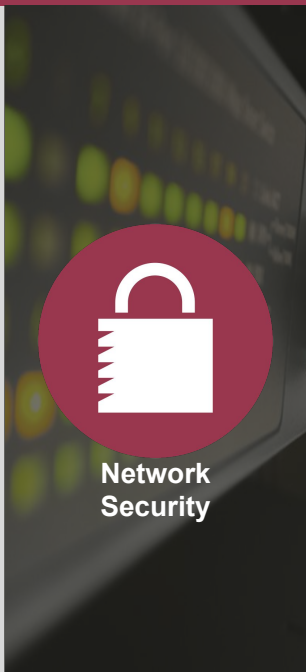
Customer Care

Business Value

Reduced operational costs from network attacks and associated downtime

Enhanced QoE perception by users

Security services for revenue or increased user stickiness and customer care visibility into services



Key Technologies

Weekly Signature Updates including malware and known attack vectors

ContentLogic solutions for URL filtering of known malware and phishing sites at scale

Subscriber enrichment for subscriber-level security services

Unique Value Proposition

Sandvine's User Threat Management solutions deliver carrier scale user threat mitigation by integrating subscriber enrichment for user-level security services delivered in the network at multi-Tbps rates.

Security Monitoring

Rich network and user security data source for SIEM systems

Use Case Description

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

Network Users

CTO/CISO

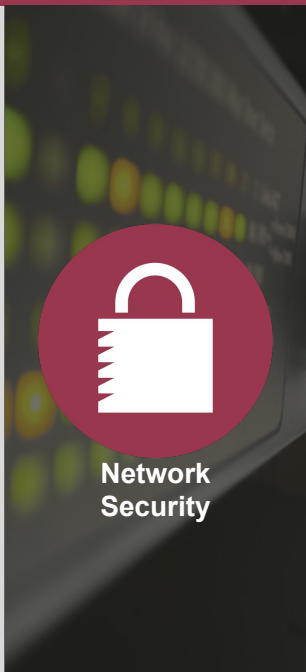
Network Operations

Customer Care

Business Value

Fine-grained network and user intelligence to feed security decisioning systems

Security visualization for network operations and customer care for real-time attacks



Key Technologies

Weekly Signature Updates including malware and known attack vectors

ContentLogic solutions for URL categorization of known malware and phishing sites at scale

Subscriber enrichment for subscriber-level security visibility and awareness

Flexible real-time and historical APIs for SIEM integration

Unique Value Proposition

Sandvine's Security Monitoring solutions 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 with a highly granular intelligence fed into a SIEM system.



Forward thinkers choose Sandvine

100s

of IoT devices and traffic types identified with Sandvine's signatures for security services and threat protection

Why Sandvine Network Security Solutions?

**Encrypted traffic
detection and
classification**

**Granular application
identification**

**Network-based
defense**

**API-based integration
with SIEMs in real-time**

**Contextual Awareness
for users**



Regulatory Compliance Solutions

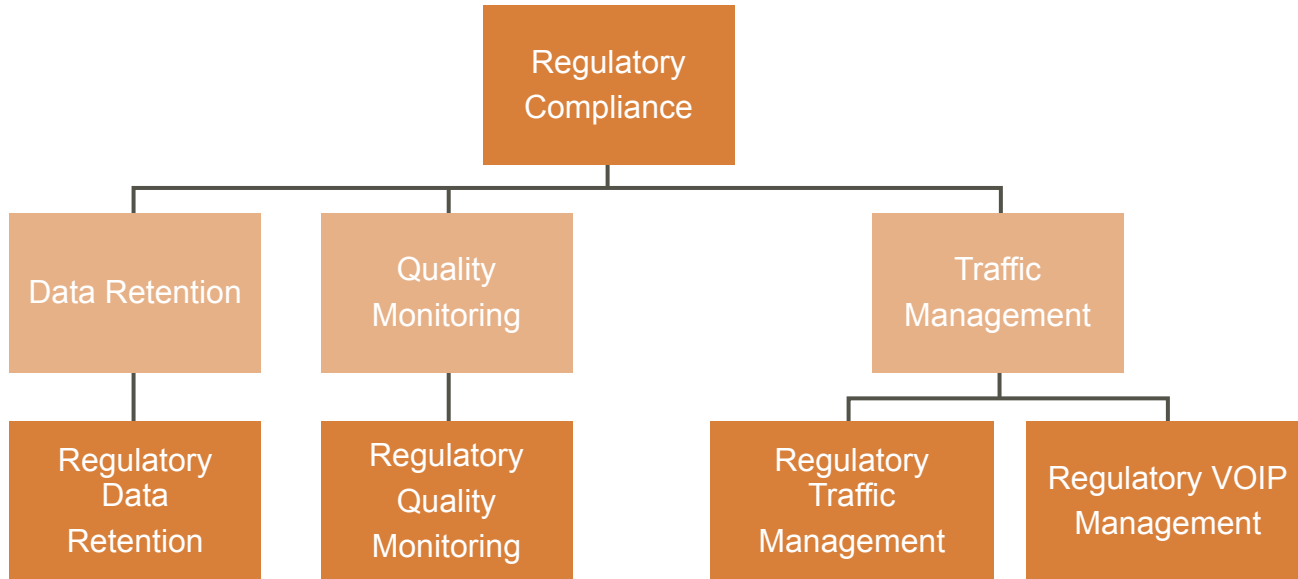
Comply with changing network operator regulations
with network intelligence-based solutions



OUR REGULATORY GOAL

ACT on **COMPLIANCE** laws
and still get an ROI

Regulatory Compliance Use Case Hierarchy



Regulatory Data Retention

Mandatory data retention for operators and regulators

Use Case Description

Retain data from network users mandated by governmental agencies to comply with safety and security laws while minimizing cost and storage space required

Network Users

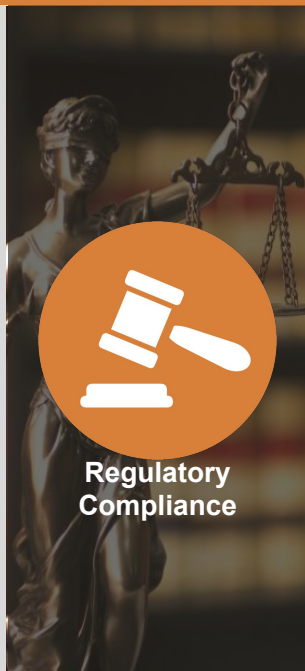
CTO/CISO

Network Operations

Business Value

Minimize data storage required with surgical data selection and streaming to data storage

Operational requirements satisfied with same system required to meet regulatory needs



Key Technologies

Weekly Signature Updates to maintain currency on applications and minimize data selected for retention

Subscriber enrichment for subscriber-level data selection

Flexible real-time and historical APIs for data retention & integration

Role-based data browsing dashboard

Unique Value Proposition

Sandvine's Regulatory Data Retention solutions provide a rich data source that can easily integrate with regulatory monitoring solutions while providing value to the operational teams within a network operator. These solutions scale to multi-Tbps for carrier-scale deployments.

Regulatory Quality Monitoring

Quality KPI collection for operators and regulators

Use Case Description

Comply with regulatory requirements for quality monitoring and enable comprehensive network quality data collection for user SLAs

Network Users

CTO/CISO

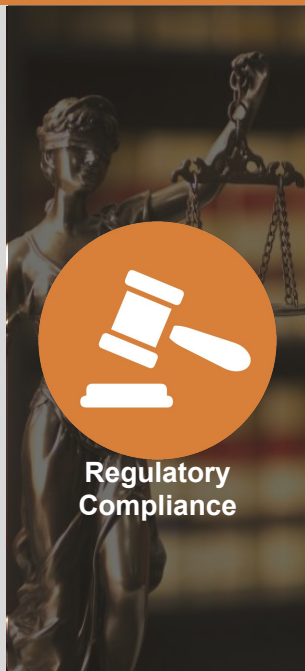
Network Operations

Business Value

Measure actual QoE delivered to network users

Validation of SLAs promised to users and proactive RCA for degraded QoE on network

High QoE operators can market and promote their QoE scores as measured by TRA



Key Technologies

ScoreCard for QoE KPI collection

Subscriber enrichment for subscriber-level data selection

High performance enabling full coverage monitoring in virtualized package.

GUI and data export for KPIs into big data systems

Unique Value Proposition

Sandvine's Regulatory Quality Monitoring solutions provide actual QoE metrics from the subscriber's experience in a virtualized deployment package. The QoE KPIs match the guidance offered by most TRAs for the key broadband KPIs – throughput, latency, and packet loss.

Regulatory Traffic Management

Traffic management for safety and security

Use Case Description

Manage applications and content allowed on a network based upon local regulatory requirements

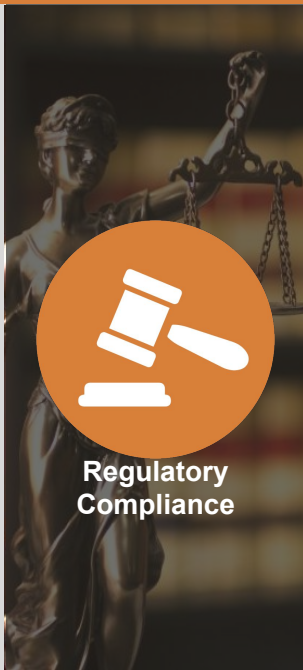
Network Users

CTO/CISO
Network Operations
Network Engineering

Business Value

Fine-grained control of traffic on network to minimize the number of systems required to comply

Operational requirements satisfied with same system required to meet regulatory needs



Key Technologies

Weekly Signature Updates to maintain currency on applications and URLs

Subscriber enrichment for subscriber-level traffic management based on service plans

Packets can be filtered, redirected, rejected, shaped, or logged based upon requirements

Unique Value Proposition

Sandvine's Regulatory Traffic Management solution delivers the most granular traffic management options for operators that need flexibility to adapt to new regulatory requests in real-time. Our solutions also enable operational use cases, delivering a superior ROI for regulatory deployments.

Regulatory VOIP Management

VOIP management for safety and security

Use Case Description

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

Network Users

CTO/CISO

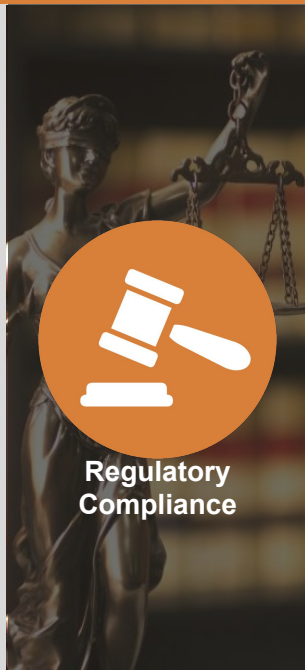
Network Operations

Network Engineering

Business Value

Fine-grained control of VOIP traffic on network

Operational requirements satisfied with same system required to meet regulatory needs



Key Technologies

Weekly Signature Updates to maintain currency on VOIP applications and evasion techniques

Sophisticated encryption evasion techniques detection, fed by machine learning algorithms

Subscriber enrichment for subscriber-level traffic management based on service plans

Packets can be filtered, redirected, rejected, shaped, or logged based upon requirements

Unique Value Proposition

Sandvine's Regulatory VOIP Management solution delivers the accurate VOIP management options for operators that need flexibility to adapt to new regulatory requests in real-time. Our solutions also enable operational use cases, delivering a superior ROI for regulatory deployments.

Why Sandvine Regulatory Compliance Solutions?

**Detection for
encrypted traffic**

**Granular application
identification for
traffic management**

**Frequent signature
updates**

**Comprehensive VOIP
application
identification**

**QoE metrics for actual
user experience
monitoring**

In summary

Active Network Intelligence delivers a multiplier effect



Deepest Data Granularity

See everything “on-the-wire” with detailed clarity, in real-time



Single Version of Truth

Robust analytical understanding organizations can trust



Full Contextual Awareness

Understand users, services, networks, technology



Any Condition, Any Action

Policy-driven automation, machine learning, closed-loop



Versatility

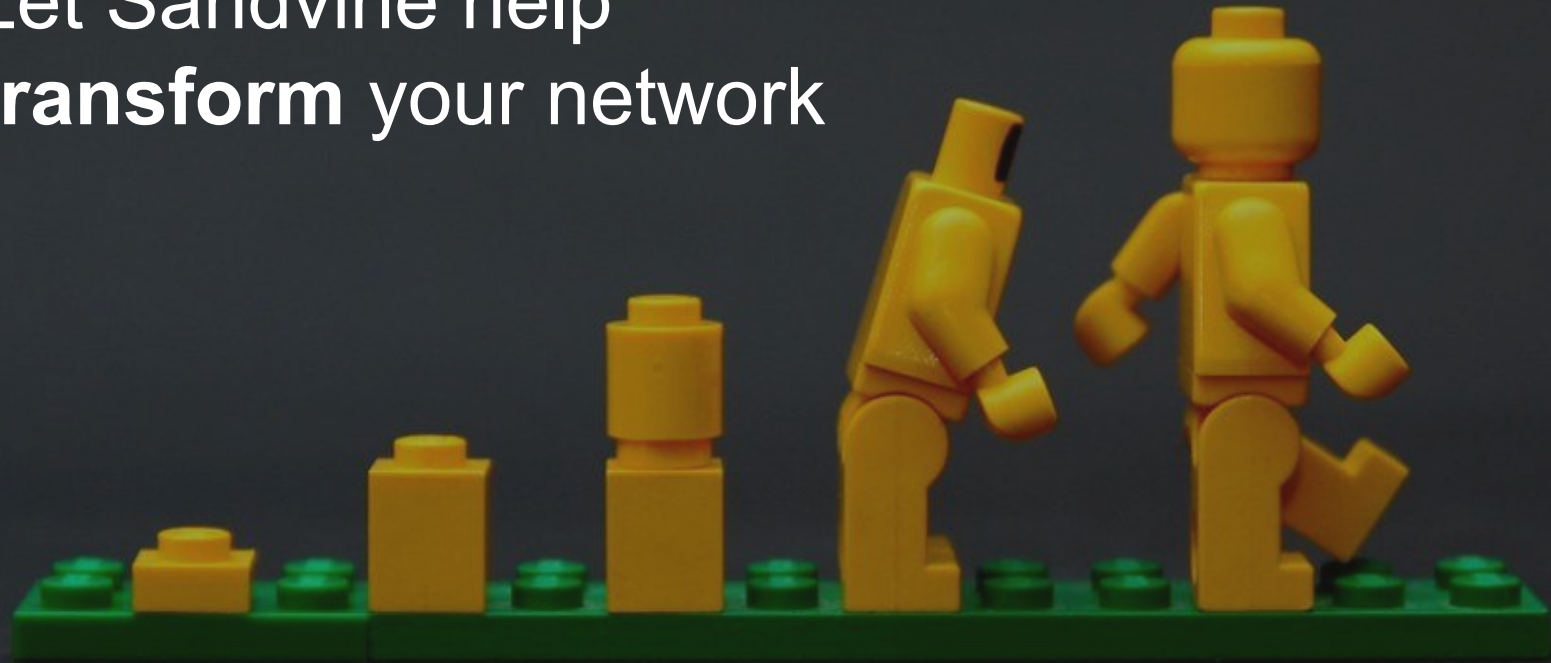
Works with what you have, enable any business, handle the unexpected



Embedded in the Business

Feeds other systems and processes: put the data to work

Let Sandvine help
transform your network



Visibility

Actions

Flexibility

Economics

Questions?



Thank You!