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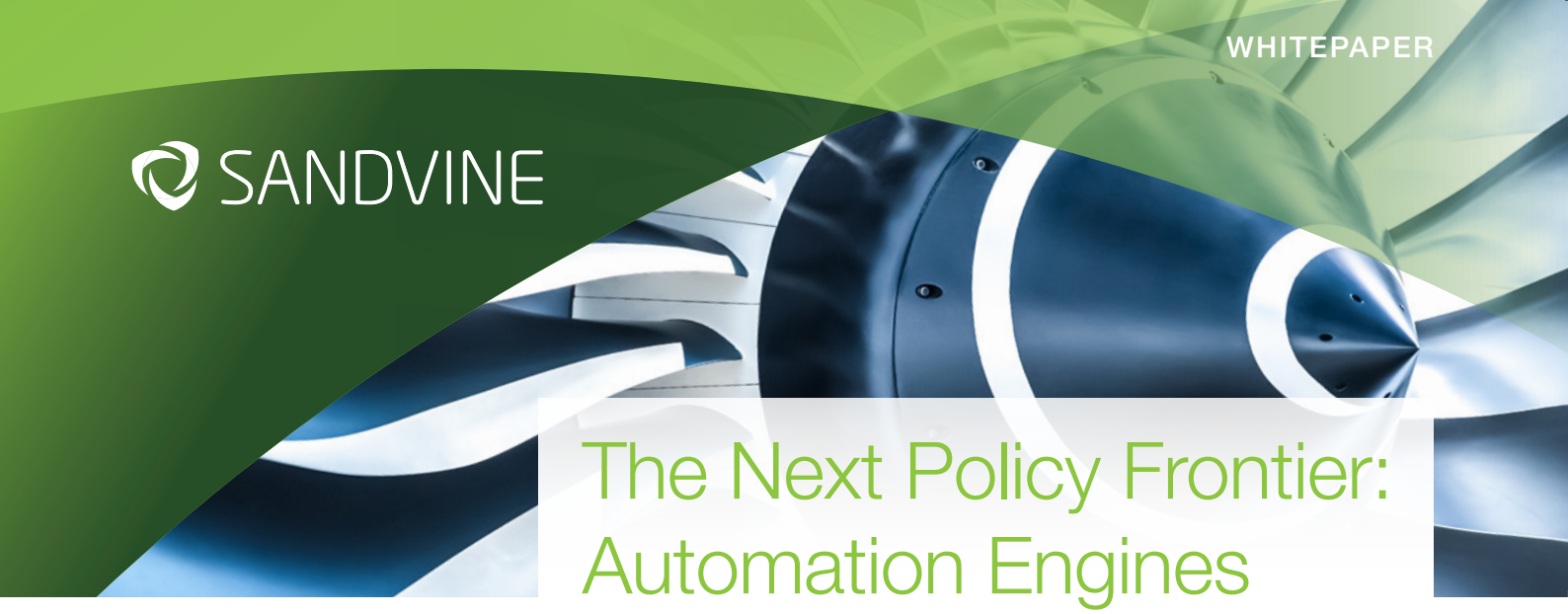


The Next Policy Frontier: Automation Engines

CONTENTS

EXECUTIVE SUMMARY

The pressures of running a network are increasing: operating costs must go down, while network traffic is exploding and customers are expecting a better experience. Historically, network operators have always addressed these issues manually with minimal success — now they need a long-term solution, and automation is the answer.

Sandvine's Active Network Intelligence delivers closed-loop automation across a full breadth of solutions by leveraging analytics and active enforcement. The Maestro Automation Engine plays a key role in delivering Active Network Intelligence: it acts as a bridge between analytics and user plane enforcement, while driving real-time policy decisioning and rapid service innovation. The Maestro Automation Engine is like a universal adapter in the network and therefore can be a single voice of policy across all access technologies.

Today, Maestro already drives value in a number of revenue-generating use cases and also achieves better OPEX. And for the networks of tomorrow, Maestro makes the transition easier and can deliver value from the outset of 5G.

This whitepaper explores the role Sandvine's Maestro Automation Engine plays in realizing automation within current and future networks.

MAESTRO

SANDVINE'S ACTIVE NETWORK INTELLIGENCE

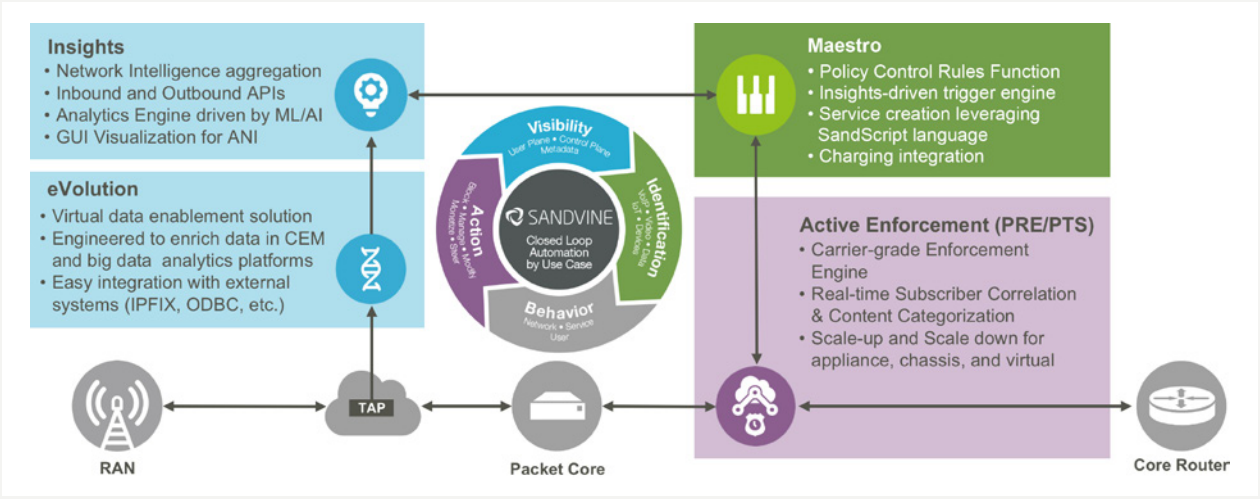
For network operators, the ever-increasing challenge of running a world-class network is prompting a change within the industry as manual methods of network management are not scaling to meet user expectations. Some of the challenges impacting long-standing business models include the exploding volume of network traffic, an experience-savvy customer base, and the upside-down economics rampant in the industry.

To be successful in the long-term, operators need to begin automating their networks, and some have already made the leap – planning for the network of today and tomorrow by selectively deploying automation for specific use cases.

Sandvine's Active Network Intelligence delivers closed-loop automation, powered by analytics and delivered via active enforcement (see **Figure 1**). It is built upon Sandvine's industry-leading expertise in network intelligence and combines application and content awareness with tight policy enrichment. This contextual integration brings actionable intelligence to the network, which enables significant automation-driven cost and operational benefits for the operator.

Figure 1

Closed-loop architecture powered by analytics and driven by policy



From the perspective of use cases, Sandvine's Active Network Intelligence covers the full breadth of solutions, from the foundation of Analytics to the enforcement in Network Optimization, Revenue Generation, Revenue Assurance, and Regulatory Compliance.

ACTIVE NETWORK INTELLIGENCE AND SERVICE CREATION

Active Network Intelligence isn't just limited to driving operational efficiency, but also plays a key role in the future of policy and charging control (PCC) and service creation, which translates to increased revenue generation opportunities for operators.

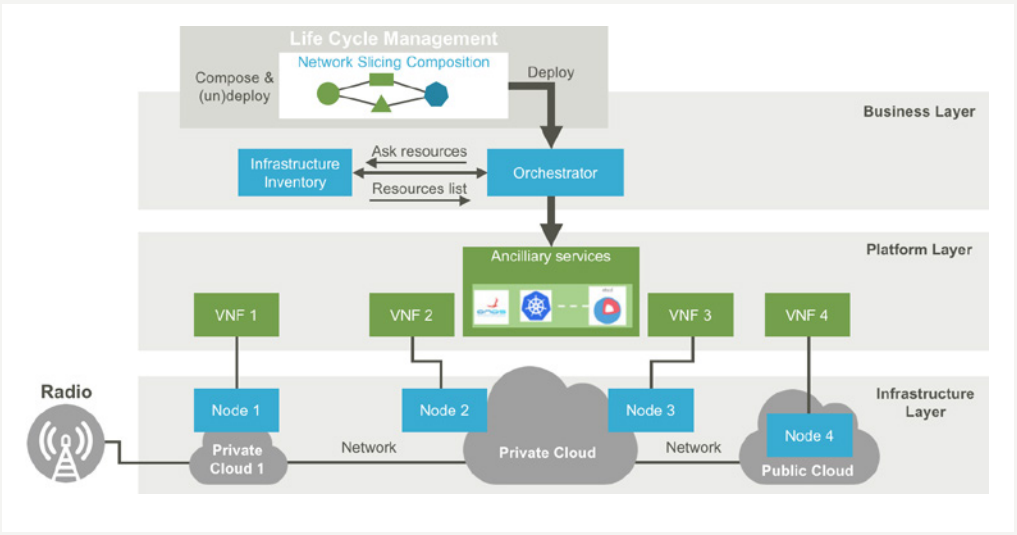
At the network level, Active Network Intelligence creates opportunities to automate actions that lead to improved user experience and improved profitability, which ultimately solves the major critical business problems facing network operators.

The entire industry is looking to automation and intelligent service creation, but operators can make the leap today instead of waiting for the necessary multi-vendor interoperability required to achieve closed-loop actions. Sandvine's solution lays the foundation for the future to properly handle demands, and achieve personalization through service differentiation based on user behavior and perceptions.

Across multiple standards groups (e.g., 3GPP 5G standards), the movement is for deployments to focus on a service-based architecture (SBA). In a SBA, a user can be present on a number of different access networks — often simultaneously with multiple devices — and the service delivered to users is more than just simple connectivity. In this model, the network operator is no longer an internet service provider or even a communications service provider – they become a Universal Service Provider (see **Figure 2**).

Figure 2

Service-Based Architecture designed to deliver service level aware quality of experience



To deliver on this promise of providing a seamless end-to-end experience for users, universal policy control capable of delivering consistent service is required across all networks. Services could be based on application (voice or video), goal (i.e., low latency), or even sector (transportation network, utility network), with each network defining the characteristics for successful service delivery.

The foundation for delivering a successful SBA deployment is being able to determine if the network is meeting the expected service-level agreement (SLA) for users — not just at the connectivity layer, but at the user experience layer. In a 5G architecture, the NWDA function is responsible for collecting network and user data and feeding it into the operator's data analytics systems. ETSI has taken this a step further with its Experiential Network Intelligence (ENI) working group, which is mapping out use cases to help operators determine how to take the NWDA intelligence and apply machine learning to turn network intelligence into recommendations for action.

Ultimately, automation will underpin this necessary network transformation by taking ENI policies and initiating actions on the data plane to create closed-loop automation.

SANDVINE'S MAESTRO AUTOMATION ENGINE

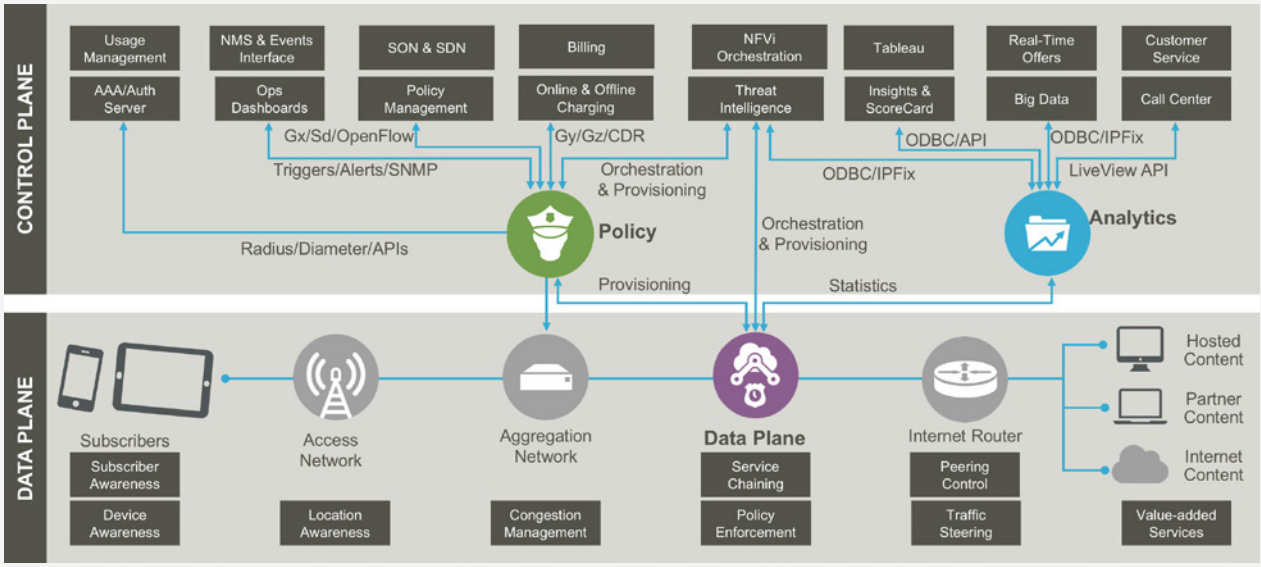
A key component of Sandvine's Active Network Intelligence solution is Sandvine's Maestro, which contains an automation engine. This automation engine turns analytics-influenced intelligence and recommendations into policy actions that get pushed into the enforcement elements via policy rules using standards-based interfaces.

Sandvine's Maestro Automation Engine can be thought of as a "universal adapter" of integration points, which leverages standards-based service interfaces for a variety of access networks. It is a 3GPP standards-compliant PCRF, a WiFi/DSL/Satellite policy server, and a DOCSIS PCMM Server all at the same time, connecting the management and OSS layer of the access network to the enforcement points. Maestro is an access agnostic, policy controller that plays more than "just a PCRF" role in the network.

An automation engine functions as the bridge between decision and action. The northbound interfaces from the operator's analytics and decisioning systems need to translate the business requirements for a service into detailed policy; the policy then needs to be configured on the individual network elements responsible for delivering that service (see **Figure 3**). In its Active Network Intelligence role, Maestro interacts with the Insights analytics solution and the Elements management system; in doing so, it determines which systems need to be configured to enforce a specific network or user- level policy, and then pushes the policy to optimize delivery of the service.

Figure 3

5G architecture emphasizes Control and User Plane Separation (CUPS), but enrichment ensures awareness for actionability



As part the Automation Engine, operators have access to a quota counting capabilities that can deliver innovative plans through the combination of real-time usage metering and measurement, rich configuration options, and policy control.

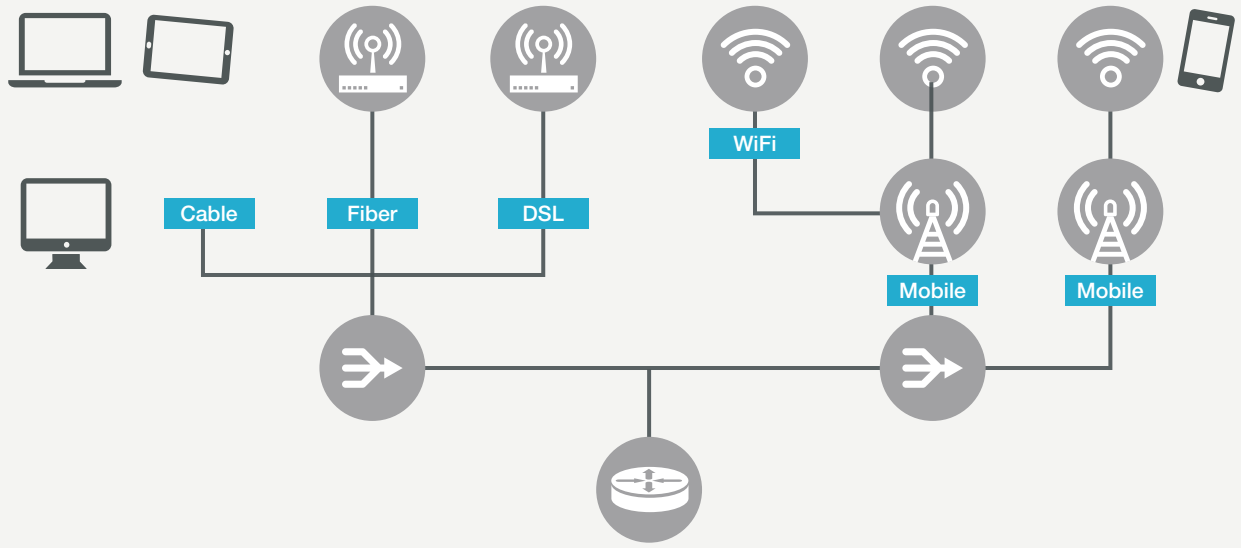
Since the Sandvine Automation Engine is access agnostic, these quota counting capabilities can count usage from a variety of endpoints using 3GPP Gx, Radius, IPDR and any CSV streaming format. This allows to easily count usage across multiple access technologies under a single plan, and can offer consistent policy enforcement by utilizing the multitude of policy enforcement interfaces to install redirects, shaping and/or blocking traffic based on quota usage across the technologies.

MAESTRO AND UNIVERSAL POLICY CONTROL

Maestro brings universal policy control and the power of automation to the control plane of any fixed, mobile, or converged network; the management is of user sessions is automated and ensures a high-quality user experience. This ability to act as a single voice of policy in the network uniquely enables a wide range of valuable use cases to be deployed in a similar and consistent manner across all access technologies, and parts of the network (See Figure 4).

Figure 4

A universal policy controller needs to be able to see across all access types to deliver consistent services



With Maestro, network operators can consolidate their control plane architecture into a single point of unified policy control. Simply stated, the automation engine is a universal policy controller that simplifies end-to-end quality of service (QoS) control in converged networks, while enabling a range of cost-saving and revenue-generating use cases. Sandvine's Automation Engine can not only make decisions based on network events and policies, but can also monitor and monetize users' data into network policies.

For multi-access operators, Maestro eliminates an overlapping stovepipe of multiple policy systems that require constant maintenance; this ensures consistency in policy and service delivery within a multi-vendor network. A single "source of truth" is crucial in a service-based architecture: it guarantees a consistent view of the quality of experience delivered by the network, and adapts policies based on real-time network issues to overcome network degradation, outages, or congestion.

Single-access operators can also reap the same benefits of having the Maestro Automation Engine conduct policy within their network, because Maestro is vendor-independent; meaning that multi-vendor networks can support consistent SLA measurements and enforcement of QoE that leverages industry standards and is not tied to a specific vendor's technology.

Since Maestro is based on a common policy framework, it ensures the delivery and creation of policy control across multiple policy enforcement points, regardless of the operator's access network. More importantly, the true benefit comes from its intelligent capability to apply policy it has learned from one access technology to another, achieving consistent service delivery to users, increasing satisfaction and loyalty.

UNIVERSAL POLICY CONTROL USE CASES TODAY

The primary benefit of a universal policy controller is that it gives network operators a single point of coordination of policy control for the entire network, for any policy control use case.

The following are some of the use cases that can be driven by Sandvine's Active Network Intelligence through a single point as a universal policy controller. This list is by no means exhaustive, but is meant to highlight some use cases that would be difficult or impossible with the traditional, fractured approach.

IMS and VoLTE Services

With networks migrating to LTE, operators are using IMS and VoLTE to deliver a seamless voice service offering for their users, and are often deploying a separate policy solution just to handle Voice-over-IP (VoIP). However, the rigors of VoLTE can be quite challenging, and legacy PCRFs aren't equipped to deliver it in a reliable and cost-effective manner, as they aren't able to scale as the needs of the network evolve.

Sandvine's Maestro Automation Engine can manage the QoS of voice and multimedia calls in compliance with regulations (e.g., emergency call prioritization, or comparable voice quality to legacy voice calls). When it comes to integration, Maestro has the ability to play a lead role in connecting existing third-party network elements, because it can adapt to any specific interoperability configurations.

The Automation Engine maintains state, service, and policy delivery through handoffs between 3G and LTE, and also handles Wi-Fi offload QoS to the Access Point Controller. It can report on and audit all QoS values it installs on the network. With Sandvine's Analytics solutions, operators can also measure and report on the QoE being delivered to their users, even when users are using a third-party network to gain access to their VoIP services, which is critical in markets where regulatory requirements for reporting on voice availability exist. This standards-based approach to universal voice services leverages Sandvine's network awareness and flexible integration with both access networks and B/OSS systems.

Ultimately, the Automation Engine delivers a single point of voice control across all networks, including future 5G voice deployments.

Advanced Data Services

Sandvine's Automation Engine is a critical component in delivering innovative services. Primarily, its role is to manage quota and set and enforce rules. In order to remain competitive and handle the pressure of the market, operators need to look to personalization and go beyond basic quota-based plans.

Maestro's flexibility facilitates the creation and management of personalized and differentiated plans by augmenting existing offerings with building blocks such as: shared data plans, tiered plans, data rollover, location-based services, and time-of-day charging.

Zero-Rating and Application-Based Plans

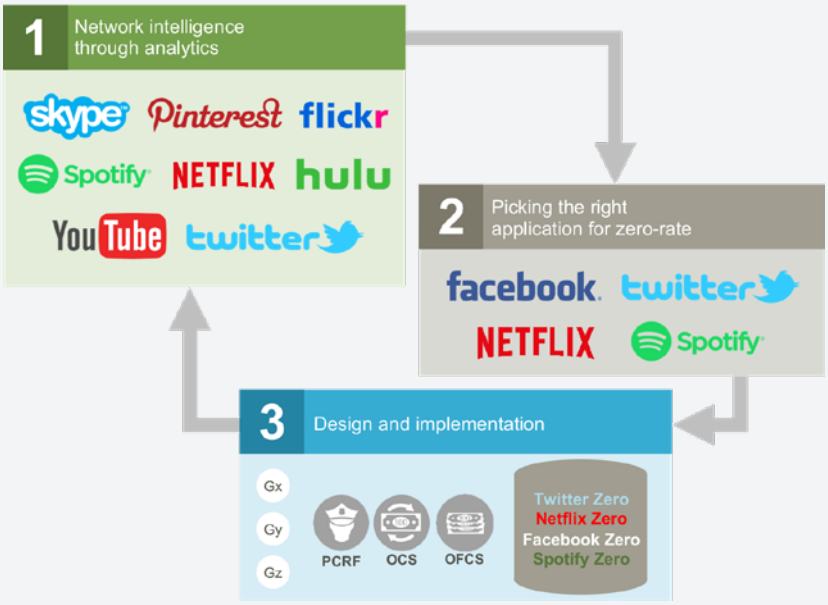
Zero-rating has proven to be a big advantage for the operators that have been able to successfully implement this specialized application-based service. However, operators struggle with the total time to launch and often miss out on the market opportunities that prompted the initial plan creation (i.e., Pokémon Go).

To combat the inflexibility of existing network elements that slow down time to market, operators look to the Automation Engine to take on the quota capabilities of zero-rated plans alongside their existing online charging system (OCS), which handles regular billing requirements.

When combined with Sandvine's enforcement element, operators benefit from Sandvine's industry-leading application identification capability, which achieves a more reliable and accurate delivery of this use case (See **Figure 5**). Specifically, the Automation Engine connects the enforcement of the zero-rating plan to the charging (or lack of charging) systems for the operator. A closed-loop application signature process is ultimately required to ensure that accuracy is maintained as applications evolve, and the ability to consistently enforce zero-rating across multiple access networks is a unique Sandvine differentiator in the market.

Figure 5

Sandvine closes the loop with a zero-rating solution that covers every step of the process



Advanced Roaming Services

Sandvine's Advanced Roaming Services enables the creation and management of unique and enticing roaming options. When it comes to successfully delivering roaming services, users need timely usage information and the ability to manage their accounts whilst roaming.

Maestro's quota counting capabilities measures and reports usage in real-time, and Sandvine's built-in API allows users to directly provision and retrieve account information. Specifically, threshold and event information can be signaled to the user over a multitude of communication channels.

Sandvine offers an add-on to the Sandvine Automation Engine — Sandvine Notification Manager — which can offer direct http redirects, in-browser overlays, html5 notifications, SMS, email, in-app notification, and an array of other communication methods, please contact us to find out more.

In addition to notifying a subscriber on roaming overages, or advice of charge when roaming, this same system can be utilized for other use cases, such as Advanced Data Services or Zero-Rating and Application-Based Plans.

The S9 interface support enables the Automation Engine to provide Advanced Roaming Services by transferring policy control and quota counting to the visited network (i.e., local breakout). If local breakout is not an option, Sandvine's Automation Engine can still help the operator implement roaming use cases, including VoLTE, with the support of roaming over the S8 interface in the home network (S8HR) so that the QoS control is still done within the home network.

Fair Use and Congestion Management

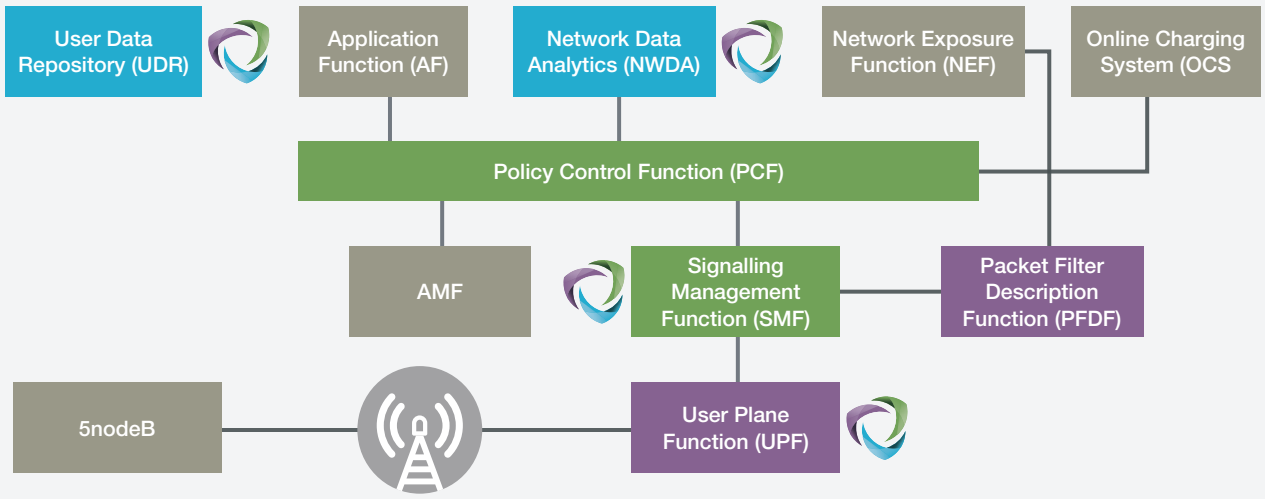
For network operators that manage multiple types of access, Sandvine can manage the fair use policy or policies for each user from a single policy control point. Sandvine also ensures that location-specific congestion management policies are applied from a single policy control point for multiple network access types.

Integrating 5G Policy Management with an Automation Engine

The evolution from 4G to 5G is the next big architecture shift for mobile operators: in 4G, the PCRF was the policy control point, while 5G architecture centers policy control on the Policy Control Function (PCF). The PCF's unified policy framework provides policy rules to control plane functions and accesses subscription information for policy decisions in the user plane (see **Figure 6**).

Figure 6

Sandvine offers 5G solutions across analytics, policy, and enforcement to deliver closed-loop automation



There are two key challenges that mobile operators face with 5G and the PCF that are directly applicable to automation and universal policy control. First, the PCF needs to apply policy across all of the active network slices, so it requires a superior intelligence feed from the NWDA function, which ensures that it can manage the QoE delivery and SLA compliance consistently across slices. Second, multi-access or converged network operators will need to integrate 5G into their existing networks – whether they are just 3G/4G mobile or if they also include Cable, DSL, FTTx, WiFi, or Satellite. If a unique policy controller is needed to bring 5G into the larger policy framework, it will disrupt and complicate the network, increasing OPEX and CAPEX, perpetuating the upside-down economics.

Sandvine's Maestro Automation Engine solves both of these challenges as part of our Active Network Intelligence architecture. When integrated with 5G NWDA capabilities and Experiential Network Intelligence (ENI) decisioning solutions, Sandvine can deliver closed-loop automated use cases for 5G operators from the outset.

CONCLUSION

Network operators need to leverage automation in order to continue to be successful. Specifically, closed-loop automation can manage network growth which shows no sign of slowing down, deliver a better and seamless customer experience, and achieve better economics with revenue-generating and cost-saving use cases.

However, operators don't have to wait for the standards, but can start reaping the benefits of Sandvine's Active Network Intelligence with the Maestro Automation Engine. Regardless of network, the Automation Engine will solve the problems of today and enable an easy transition to the next generation network.

Sandvine will explore further Maestro Automation Engine-centric use cases in future papers.

FURTHER RESOURCES

Read more about Maestro Automation Engine-driven use cases from the following resources:

IMS and VoLTE Services Click here

Advanced Data Services Click here

Zero-Rating and Application-Based Plans Click here

Advanced Roaming Services Click here

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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 **sandvine.com** or follow Sandvine on Twitter at **@Sandvine.**

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