Maestro Policy Engine

Next generation control plane for automated networks

KEY BENEFITS

- Complies with 3GPP CUPS architecture standards, improving scalability, cost, and ready for 5G
- Supports operators' cloud transition at the control plane layer with cloud-ready design
- Prevents service interruption with high availability nodes
- Unlocks key Sandvine use cases with contextual awareness and intelligence
- Reduces time-to-market for new policies and plans with flexible DevOps language – SandScript

For operators, the next era of networks represents a huge performance increase but also requires significant architectural changes. Specifically, for mobile networks, control and user plane separation (CUPS) architecture has been introduced to achieve ultra-low latency, higher speeds, and network availability promised by 5G.

CUPS compliance allows networks to be dynamically driven and adjusted to changing network demands. In 5G, control and user plane elements can independently scale to handle higher data loads. This allows for higher performance and quality of experience, as well as CAPEX and OPEX savings.

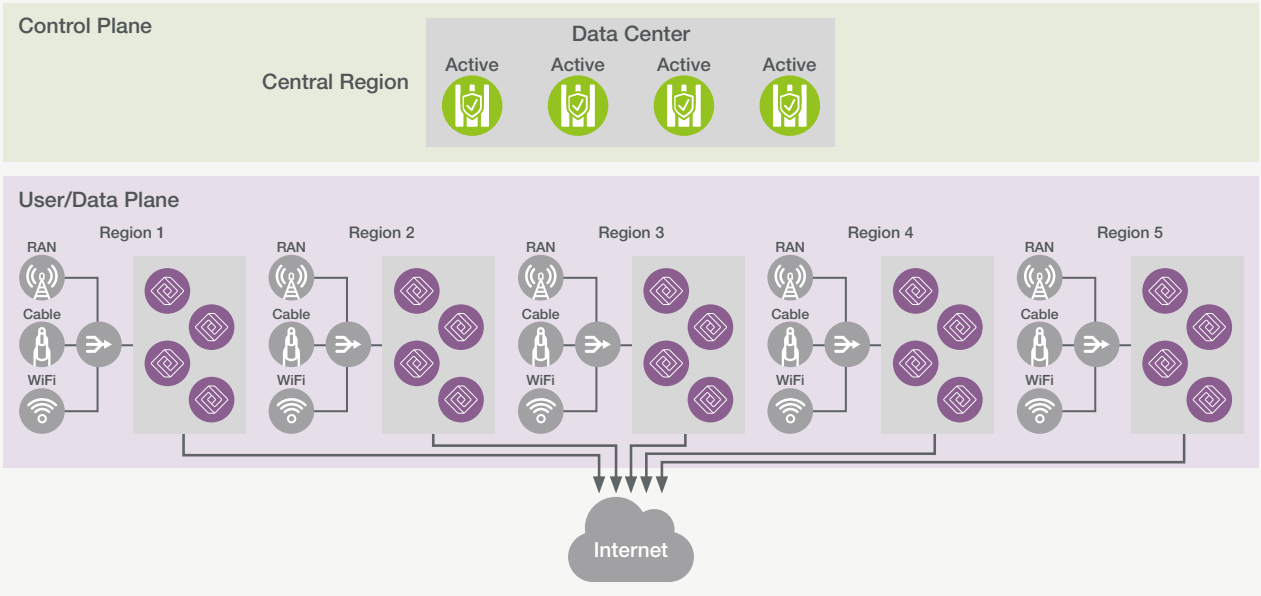
In the 5G architecture, more cells are required to improve coverage as radio penetration is decreased. Additionally, mobile and IoT devices and sessions are expected to dramatically increase, as are high-bandwidth applications. This will require higher performing, scalable control plane elements.

MAESTRO POLICY ENGINE

Maestro Policy Engine is high-performing, CUPS-compliant control plane. This evolution of Sandvine's existing control plane functions is designed to achieve granular policy control and innovative charging capabilities to suit the network needs of today, and the growing needs of tomorrow.

Figure 1

Maestro Policy Engine Deployment



With a CUPS-compliant network, operators can reduce costs by deploying data plane nodes closer to the edge, and therefore not having to transmit all data back to the core. This deployment change also translates into reduced data center costs by hosting the data plane and the control plane in different geographic locations **(See Figure 1 on previous page)**.

CONTEXTUAL AWARENESS

For intelligence-based policy enforcement, contextual awareness plays a key role for ensuring subscriber identification, implementing policies, and real-time policy application and updates. Maestro Policy Engine gathers key information from a number of sources throughout the network, ensuring data accuracy and relevancy, for precise policy enforcement.

By supporting one of the widest ranges of protocols **(Figure 2)** for session activation, session updates, and information reporting and receiving (simultaneously from multiple network elements), Maestro Policy Engine performs the following:

- Delivers accurate subscriber entities and policies
- Updates and reports contextual information and actions to other network platforms and elements
- Shares factual subscriber information, including network, with other network devices

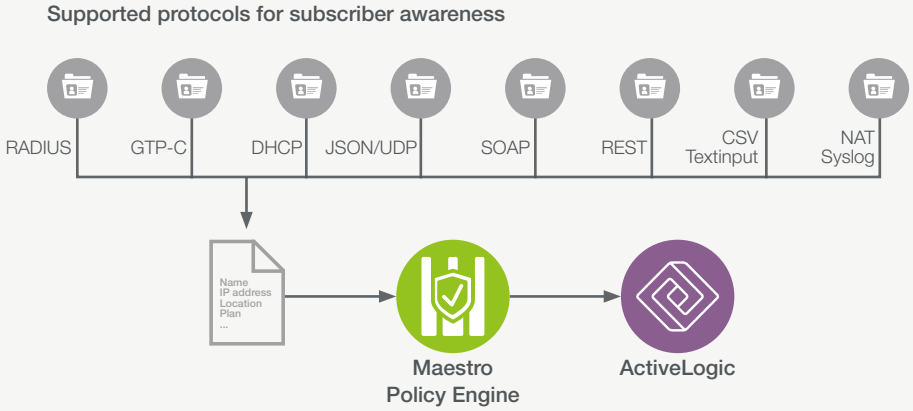
This contextual awareness also provides ActiveLogic, Sandvine's data plane, with subscriber identity to enhance reporting and policies, allowing for intelligence-based policy and analysis.

Sandvine's Maestro Policy Engine sets subscriber-centric contextual information gleaned from mapping systems and/or assigned by BSS/OSS via REST such as:

- Subscriber tier/plan
- Subscriber location
- Subscriber entitlement (e.g., free zone, tethering, etc.)
- Subscriber account/family plan
- Device type
- Specific opt in/out of long-term reporting
- Subscriber public and private IP address

Figure 2

Maestro Policy Engine's Support Protocols for Contextual Awareness



Note: All subscriber identifying information can be obscured and/or encrypted to protect sensitive information and comply with privacy-related regulations or policies.

Overlapping IP Addresses

For network elements dependent on subscriber awareness, applying the correct policies can be challenging as IP address reuse impacts the ability to uniquely identify the subscriber information associated to data traffic flows. Maestro Policy Engine properly map these overlapping IP addresses on a single system by using site identifiers, making the overlapping IP addresses unique throughout the network.

Network Address Translation (NAT)

Maestro Policy Engine enables mapping of post-NAT deployments as well and pre-NAT deployments. When in a post-NAT deployment, Maestro Policy Engine can map the public IP and port to the private IP, allowing operators to deploy ActiveLogic post-NAT without losing the subscriber awareness.

POLICY CONTROL AND REPORTING

Sandvine's Maestro Policy Engine (in combination with ActiveLogic) is a fully 3GPP compliant PCEF platform, adding intelligence to fixed, mobile, and converged communications networks for service creation. Powered by SandScript, Sandvine's policy language, Maestro Policy Engine performs end-to-end policy control functions, policy decisioning and policy enforcement across the data, control, and business planes. By leveraging SandScript, Maestro Policy Engine enables advanced policy enforcement in a fraction of the time and complexity required by traditional PCC-solutions.

Diameter-Based 3GPP Interface Support

- Gx for policy control and monitoring (real-time policy enforcement)
- Sd for application signaling
- Gy for usage counting (i.e., online charging)
- CDR for OFCS, OSS, BSS, data lakes, and other external and big data systems

Online Charging

With true layer-7 application metering, the Maestro Policy Engine enables application-based charging and monitoring through 3GPP Diameter Gy, for richer, more complex, and real-time charging use cases (e.g., Zero-Rating and Application-Based Plans).

Real-Time Policy Enforcement

Sandvine's Maestro Policy Engine interacts with PCRFs via 3GPP standard Gx and Sd interfaces. The PCRF can send PCC rules to Maestro and depending on the use case, logic can be built based on subscriber profile information in order to send the corresponding enforcement rule to the ActiveLogic (user plane in CUPS architecture) handling that subscriber-specific traffic.

Audit Subscriber Usage with Records

Aside from reporting usage to PCRFs and the OCS, the Maestro Policy Engine can also generate usage records (CDRs). It also allows existing mediation devices for retrieving these usage records directly from Maestro using supported file transfer protocols. Additionally, data records can be streamed towards agents in existing big data infrastructure.

HIGH PERFORMANCE

Maestro Policy Engine uses elasticity to achieve cost-effective deployments for better utilization of network resources and dynamically scales in/out with demand.

Key features for optimized performance:

- Active-active versus active-passive
- Information distribution (Maestro node sync protocol)
- Horizontal scale load balancing – stateless
- Vertically scalable

Performance

Subscriber Awareness:

GTP-C	100,000 messages per sec
RADIUS	67,000 messages per sec
DHCP	60,000 messages per sec
JSON/UDP	42,000 messages per sec

Policy Control and Charging:

Gx	11,000 messages per sec
Gy	24,000 messages per sec

AUTOMATION

The challenges of automated networks bring further complexity into the control plane function. Automation increases the scalability requirements, because the control plane is required to process additional messages, more frequently, as well as having dedicated processing power for decision-making.

With Maestro Policy Engine, operators can monetize the same control plane entity when automating their network to gain the benefits of this highly scalable product with processing power allocated to process messages and determine the right response and then take the right action – all within a limited time window when that action is appropriate. Automation also requires a highly flexible framework for policy actions where SandScript is an excellent fit for this problem.

5G

Typically, operators are deploying services for 5G-capable devices in two different phases.

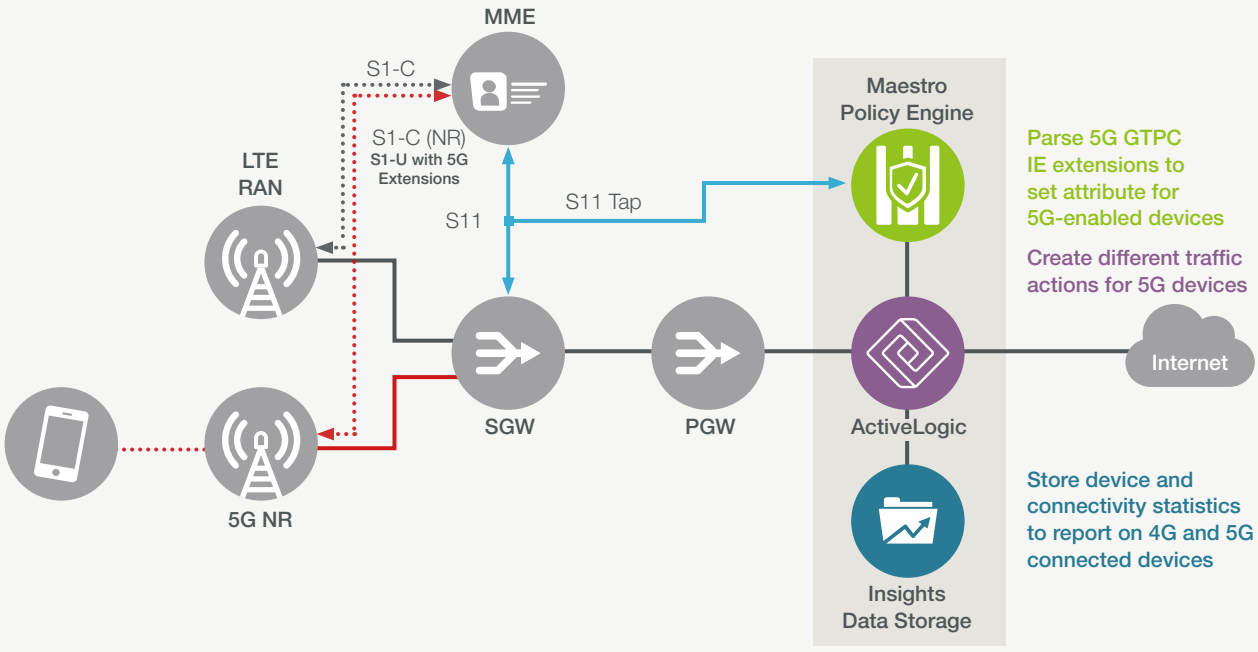
Those that are primarily aiming to provide high-speed connectivity to consumers are starting with non-standalone (NSA) deployments using existing 4G infrastructure and, once 5G coverage is established, there is a move to standalone (SA) 5G. Maestro Policy Engine can be inserted in today's 5G NSA deployments to help operators with the same capabilities and more.

5G NSA Mapping

In early 5G deployment stages, the 5G radio (NR) infrastructure will be deployed before the 5G packet core. Specifically, 5G non-standalone (NSA) deployments allow 5G connectivity across existing 4G packet cores (**Figure 3**).

Figure 3

Support for 5G Non-Standalone (NSA) Architecture on Maestro Policy Engine for GTPv2-C Mapping



As part of this feature, the Maestro Policy Engine detects:

- 5G-capable devices/users
- Whether the 5G-capable devices are hosted only on eNB or both gNB and eNB in dual mode
- Conditions and conveys to ActiveLogic after receiving feeds on the s11 or s11_s2a interface

New attributes for 5G NSA are added in the package subscriber mapping. These attributes are subsequently encoded as Session Context Columns, and the 5G capability/connectivity is communicated to ActiveLogic as a result.

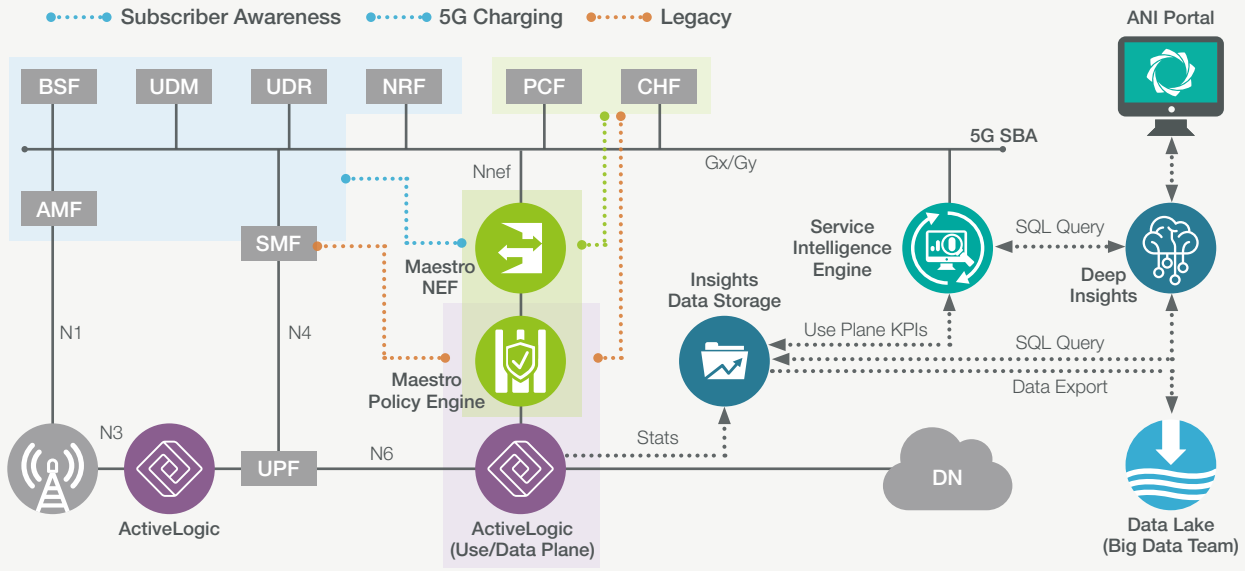
5G SA Enablement

Maestro Network Exposure Function

Sandvine's overall solution is enhanced to enable communication with the other network functions (NFs) in the 5G Service-Based Architecture (SBA). Maestro is enriched with the Maestro Network Exposure Function (NEF) component, which registers with the 5GC and acts as a consumer of the relevant 5GC services to obtain the information necessary to map subscriber session information to the data plane (ActiveLogic) – including slice awareness (**Figure 4**). Sandvine's Maestro Policy Engine will continue to support Radius interface for those operators who will provide RADIUS feed from their Session Management Function (SMF) according to 3GPP.

Figure 4

5G Service-Based Architecture and Maestro Policy Engine



5G SA Subscriber Awareness

Subscriber awareness is a critical factor in enabling Sandvine use cases in 5G standalone deployments; it associates the subscriber IP address with the Subscription Permanent Identifier (SUPI) and/or Generic Public Subscription Identifier (GPSI), as well as session-related fields in the Protocol Data Unit (PDU).

5G Standalone (SA) subscriber awareness is enhanced with:

- **Slice Awareness** – Details such as slice service type and slice differentiator are sent to ActiveLogic for enforcement and/or analytics.
- **TLS Support** – The Maestro NEF Load Balancer sends and receives encrypted data. To provision client TLS and CA certificates using the SFTP protocol a new user (nefcertloader) has been introduced.
- **NF Set Binding** – When the Network Exposure Function (NEF) or Session Management Function (SMF) is unavailable for requests on a resource, the Maestro NEF uses the NF set binding to re-select a Network Function Service Producer (NRF and SMF) from the NF set to route new requests.

ABOUT SANDVINE

Sandvine's market-leading, cloudified Service Innovation and Intelligence portfolio helps customers deliver exceptional digital experiences and grow revenues. Our ability to classify over 95% of network traffic across mobile and fixed networks by user, application, device, location and other parameters creates uniquely rich, real-time network and service data. We then apply machine learning-based contextual insights to improve performance and enhance digital services. For more information, visit **http://www.sandvine.com** or follow Sandvine on Twitter **@Sandvine**.

SANDVINE

USA
5800 Granite Parkway
Suite 170
Plano, TX 75024
USA

EUROPE
Svärdfiskgatan 4
432 40 Varberg,
Halland
Sweden
T. +46 340.48 38 00

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

ASIA
RMZ Ecoworld,
Building-1, Ground Floor,
East Wing Devarabeesanahalli,
Bellandur, Outer Ring Road,
Bangalore 560103, India
T. +91 80677.43333