



5G Service Intelligence Engine (NWDAF) for Core, Cloud, and Edge Networks

5G SERVICE INTELLIGENCE ENGINE (NWDAF)

Sandvine's enriched NWDAF implementation unlocks a number of valuable business benefits for 5G service providers, including:

- Providing access to the best real-time network and service data
- Leveraging this data to create and deliver innovative 5G services
- Assuring QoE and SLAs for 5G services by proactively adapting to network conditions
- Preventing performance issues by predicting network deterioration before it happens and taking corrective action
- Maximizing return on network capacity investments
- Preventing over-engineering by continuously tuning the network and balancing network loads

Sandvine's enriched, 3GPP-compliant and cloud native NWDAF provides the best real-time data, automation, and machine learning required for 5G success

SUMMARY

The promise of 5G is tremendous, but meeting the expected performance improvements, achieving the magnitude of scale required, and creating new services to leverage these capabilities will be difficult.

Service providers will need to evolve to deliver the demanding use cases that 5G can unlock. 5G networks will rely on a broad and deep set of analytics to derive actionable insights that may need to be predictive in nature. The 3GPP's Network Data Analytics Function (NWDAF) is the standardized function designed to meet these needs.

Although the NWDAF is often overlooked in 5G conversations, it is an absolutely essential component. To perform as needed, the NWDAF must include a number of technologies, most prominently artificial intelligence (and in particular machine learning), to process in real time the vast streams of key performance indicators (KPIs) the NWDAF receives from the network.

Moreover, the NWDAF's ability to enable complex use cases is greatly enhanced by leveraging advanced traffic classification techniques that use deep packet inspection. The inclusion of this technology in 5G networks creates a whole new level of value and accuracy for use cases as it leverages high-fidelity application and device metadata, application performance information, subscriber quality of experience (QoE) metrics, and other associated characteristics.

Equipped with such a solution, mobile service providers can introduce and monetize new services while accurately predicting network, slice, and user equipment (UE) performance across the entire network. This can be achieved while precisely understanding and managing each application flow and its network path for the purpose of meeting the performance or service level agreement (SLA) needs of every service in the most efficient manner.

To enable such a future, Sandvine has engineered an enriched 3GPP standards-compliant and cloud native NWDAF, called 5G Service Intelligence Engine, which incorporates proven machine learning capabilities and enrichment with the industry's most advanced traffic classification technology. The result is unmatched, automated service intelligence that unleashes the true potential of 5G networks.



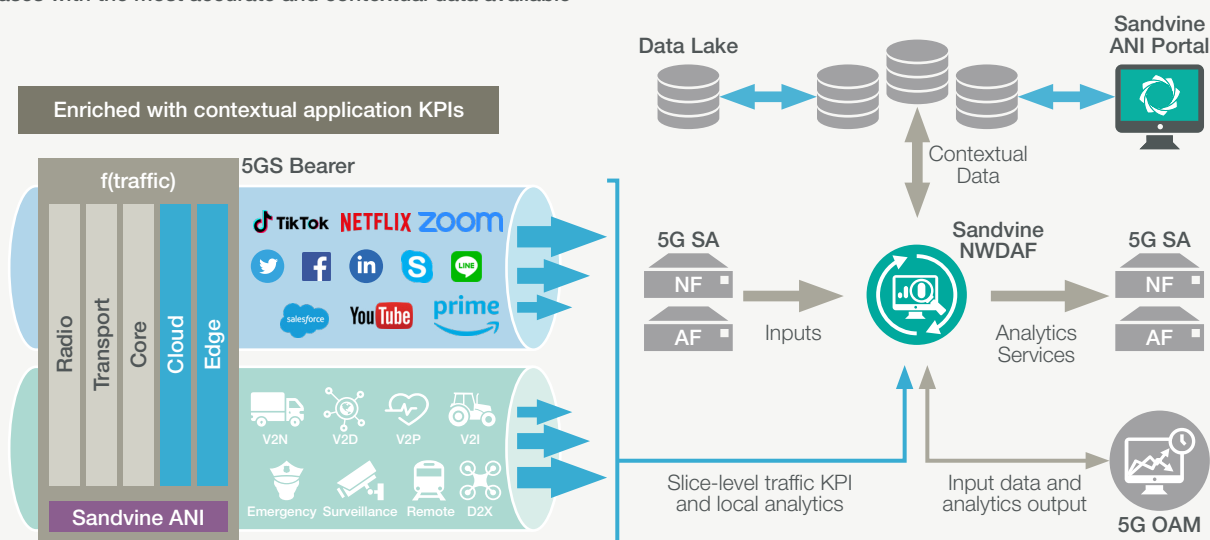
Sandvine’s 5G Service Intelligence Engine, an enriched version of the NWDAF

To deliver the use cases envisioned for 5G, the NWDAF needs to be able to consume, analyze, and make predictions based upon an enormous stream of KPI data.

To ensure NWDAFs meet these needs, the 3GPP has provided prescriptive guidelines within the specification. Sandvine has embraced this standard and, in fact, is an active contributor in its development. Sandvine has not only built an NWDAF that meets this minimum standard, but has also enriched it with proven traffic classification capabilities and granular, contextual, and precise KPI measurements that can be used to revolutionize the way mobile service providers see and manage their networks (see **Figure 1**).

Figure 1

Sandvine’s 5G Service Intelligence Engine delivers unmatched predictive capabilities that enable NFs to deliver valuable use cases with the most accurate and contextual data available



Enriched with Active Network Intelligence

The NWDAF will be heavily reliant upon data plane visibility to make accurate predictions as most network KPIs will be throughput driven and will rely upon accurate modeling of application traffic characteristics. Recognizing this dependency, 3GPP Release 17 alludes to the need for “application awareness” in the context of automation and analytics—essentially acknowledging that application-level KPIs are required for the NWDAF to perform its function, or at least to fully reach its potential.

In this respect, Sandvine’s qualifications are unmatched. As the longtime industry leader in Active Network Intelligence, Sandvine’s NWDAF is enriched with feeds of accurate and contextual KPIs from Sandvine’s ActiveLogic data plane element and Maestro control plane element. This enrichment makes the NWDAF’s analytics services more accurate and valuable than the standard implementation, making it more equipped to address future 5G network slicing requirements (see **Figure 2** on following page).

Intent-based networking enabled by artificial intelligence and machine learning

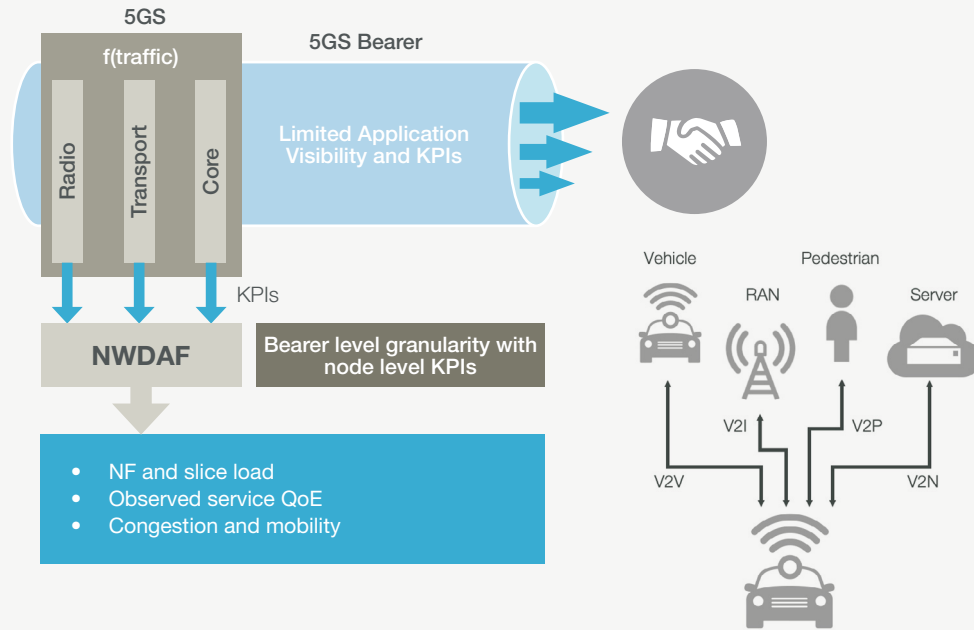
To keep pace with the stream of KPI data and DPI telemetry it consumes, and to deliver accurate analytics services to NFs, Sandvine’s 5G Service Intelligence Engine makes extensive use of machine learning capabilities.



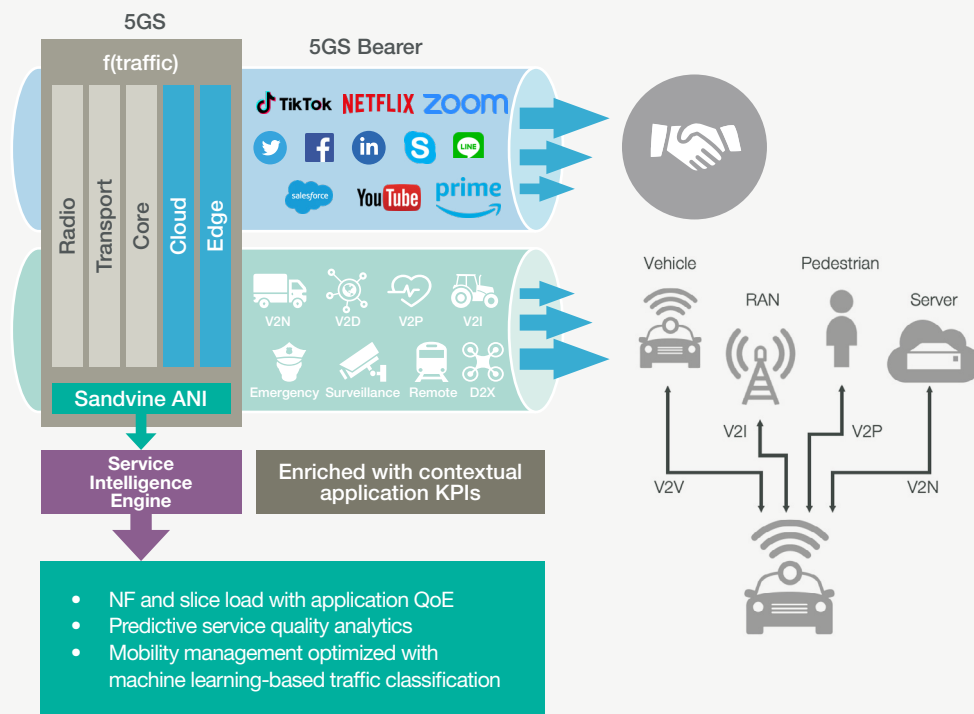
Figure 2

Sandvine's enriched NWDAF implementation provides network operators with the proven contextual application KPIs needed to enrich the analytics delivered to achieve the promise of many valuable 5G use cases

Standard NWDAF Implementation



Sandvine 5G Service Intelligence Engine (NWDAF) Implementation





This implementation is a natural extension of technologies already used within Sandvine's advanced traffic classification capabilities. It uses machine learning capabilities to enable intent-based networking while delivering the network-based predictions needed for many 5G-enabled use cases.

NWDAF leadership within 3GPP

Sandvine is an active member of 3GPP and has several approved 3GPP contributions related to 5G automation and 5G service awareness, particularly around quality of service (QoS) sustainability, observed service experience, distributed NWDAF for low latency use cases, and application enablers for network automation.

As part of Sandvine's participation in these standards, the company has been able to collaborate broadly across the service provider and vendor community.

Commitment to the cloud

Sandvine is committed to meet the demands of emerging 5G services, and as such has designed the 5G Service Intelligence Engine with next generation cloud native principles, implementing software on Cloud Native Network Functions (CNFs). Cloud native design offers tremendous scale and performance benefits while accelerating the creation and delivery of new services.

In addition to support for CNFs, Sandvine offers private cloud support for Virtual Network Functions (VNFs) in a Red Hat OpenStack and VMware environments across all key architectural components.

Sandvine's enriched NWDAF is designed to support deployment in a distributed public cloud-based architecture providing required analytics both at the edge and in the core at a more aggregated location. Importantly, Sandvine has proven integration with leading public cloud vendors such as AWS.

In summary, Sandvine recognizes the need to support a varied multi-cloud environment, spanning public, private, or hybrid cloud environments within both Virtual Machine (VM) and containerized clouds.

USE CASES

Think of all the different users and devices on 5G network slices and their potential needs—from enabling remote surgery, to providing real-time navigation for drones in an emergency response, to enabling smart IoT networks, to sustaining cloud gaming connections in a fixed wireless network, to providing ultra-high-definition (UHD) video streaming. This section showcases some use cases that will be enabled by the 5G Service Intelligence Engine.

To help convey the breadth and depth of potential use cases, Sandvine has created a logical set of use case categories that represent common themes across analytics requirements. These categories are: Quality of Service (QoS) and Policy, Service Delivery, Mobility, Service Assurance, and Security.

Figure 3 (on following page) describes each of these buckets and also lists some of the 3GPP-defined representative use cases (as defined by 3GPP TS 23.288 V16) that would fall under each category.



Figure 3

Service intelligence is essential to unlocking entire families of valuable use cases

Sandvine's 5G Service Intelligence Engine (NWDAF) 3GPP R16 Use Cases				
Load Analysis		Network Performance		Service Assurance
Slice Load Level	NF Load Analytics	Network Performance	User Data Congestion	QoS Sustainability
Slice load level information to an NF when the load level cross a specific threshold	NF load analytics in the form of stats/predictions or both for one or multiple NFs	Stats or predictions on the gNB resources and performance in an Area of Interest	Congestion level experienced by a specific user or a specific area in the form of stats/predictions	QoS change stats in a specific area during specific time in the past or the predictions in future
UE Behavior Analysis				Observed Service experience
UE Communication	Expected UE Behavioral Parameters	Abnormal UE Behavior	UE Mobility	Observed service experience in the form of stats/predictions for applications in a slice
Application-specific data analytics performed on UE communication pattern and user plane traffic	How a service consumer learns the expected UE behavior parameters	Stats related to a group of UEs or a specific UE showing abnormal behavior	UE mobility analytics in the form of stats/predictions by collecting UE mobility info from NFs and OAM	

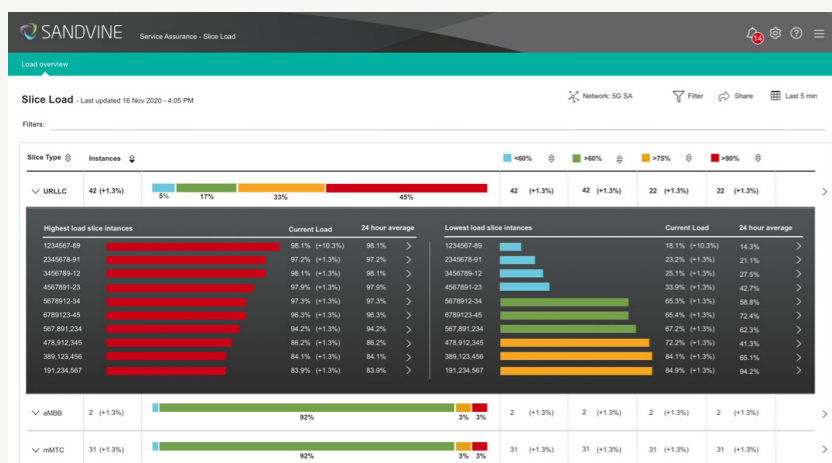
ANI PORTAL – VISUALIZED VALUE FROM A SINGLE PANE OF GLASS

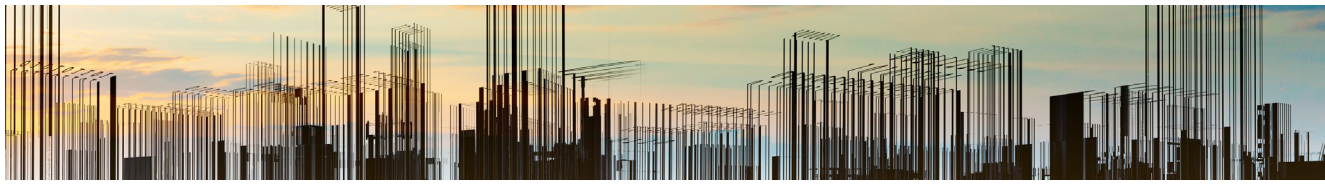
Each use case comes with a set of dashboards that can be visualized through Sandvine's Active Network Intelligence (ANI) Portal. With the portal, service providers have access to contextual use case information by network types, network slices, user, device, service, and technology, all aligned with standard, service provider-defined workflows.

For example, with the Slice Load Analysis dashboards, mobile service providers have the ability to track and visualize slice types and instances and understand the range of loads across each slice type as shown in the figure below. Service providers can dive deeper within each slice type to understand more about individual slice instances such as individual loads and slice instances with highest and lowest loads. Other key characteristics can include visualizing the KPIs of slice types and within slice instances. These are just a few important visuals that will be helpful for service providers to manage their 5G slices.

Figure 4

Visualizing and analyzing slice loads allows service providers to make informed decisions that maximize the efficiency of 5G network design and operations





KEY HIGHLIGHTS

- Leverages 'the best network data' and machine learning capabilities to provide predictive insights
- Provides highly granular data from the data plane along with contextual enrichment from the control plane to enable service innovation
- Includes a unique set of pre-packaged return on investment (ROI)-driven use cases to assure QoE and SLAs for 5G services
- Out-of-the-box use case dashboards to visualize the intelligence collected, solve critical network problems, and evolve services
- Fully cloud native platform for core, cloud, and edge deployments built on top of a highly scalable data management and data export framework
- One of the first vendors to offer a 3GPP standards-compliant NWDAF

CONCLUSION

5G promises to enable an array of valuable use cases that are reliant on a new breed of analytics powered by automation and machine learning. The 3GPP has recognized this requirement and developed the NWDAF standard function as a critical component in 5G networks to provide the predictive analytics needed to deliver 5G smart ecosystem services.

NWDAF consumes KPIs from NFs, processes this stream of information in real time, and provides predictions to NFs and other systems via subscription and pull interfaces.

Sandvine is one of the first vendors to offer a 3GPP release 16-compliant NWDAF, which represents the natural evolution of the company's unmatched track record of enabling innovative and valuable real-world use cases through service intelligence and closed-loop automation.

Sandvine's 5G Service Intelligence Engine further enhances the standard NWDAF by leveraging industry-leading application classification and advanced machine learning capabilities to provide 'best real-time data' that unlocks the true potential of 5G services.

ABOUT SANDVINE

Sandvine's cloud-based Application and Network Intelligence portfolio helps customers deliver high quality, optimized experiences to consumers and enterprises. Customers use our solutions to analyze, optimize, and monetize application experiences using contextual machine learning-based insights and real-time actions. Market-leading classification of more than 95% of traffic across mobile and fixed networks by user, application, device, and location creates uniquely rich, real-time data that significantly enhances interactions between users and applications and drives revenues. For more information visit <http://www.sandvine.com> or follow Sandvine on Twitter @Sandvine.



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