



5G Slice Load Analysis

5G SLICE LOAD ANALYSIS DELIVERS:

- 3GPP-compliant analytics service in the form of statistics or prediction, enabling multiple use cases for network slices
- Real-time operational intelligence for network slices and constituent NFs provided to multiple users, including network functions like NSSF, AMF and application functions (AFs), and OAM
- A single source of truth in a multi-vendor environment
- A wide spectrum of use cases in central and edge locations
- Outputs critical Active Network Intelligence-enriched or application-aware information for understanding slice performance
- Innovation and monetization of net new enterprise and consumer services
- Zero-touch automated slice assurance
- Visualization of network slice performance trends and validates ROI with Intuitive dashboards

83% of the respondents are eyeing network slicing in their enterprise strategy

Network slice analysis for automated assurance

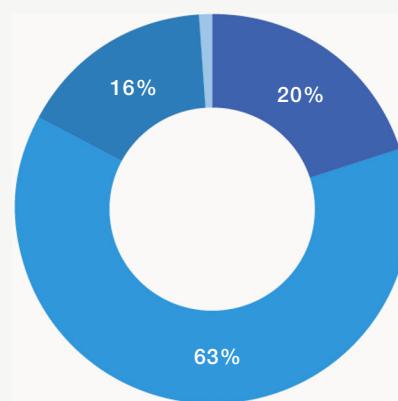
MARKET OVERVIEW

Network slicing is considered a game changer for mobile networks. This 5G-specific use case unlocks service innovation and the value chain for mobile service providers (especially for enterprise markets), giving them the opportunity to deliver complex services, with vastly different KPI requirements.

The expectation is for network slicing to not only address 5G consumers' higher expectations, but also enable new business models, revenue opportunities, and use cases across many verticals – enterprise, government, and industries (Figure 1).

Figure 1

Network slicing is key to 5G network adoption for enterprises



How critical is network slicing for your enterprise 5G strategy over the next three years?

- 20% Absolutely critical - enterprise strategy cannot succeed without slicing
- 63% Important - but other factors will play a bigger role in enterprise 5G success
- 16% Somewhat important - network slicing will play limited role in certain applications
- 1% Not important at all - slicing will play no role

Source: 5G Network & Service Strategy – Service provider Survey produced by LightReading and HeavyReading

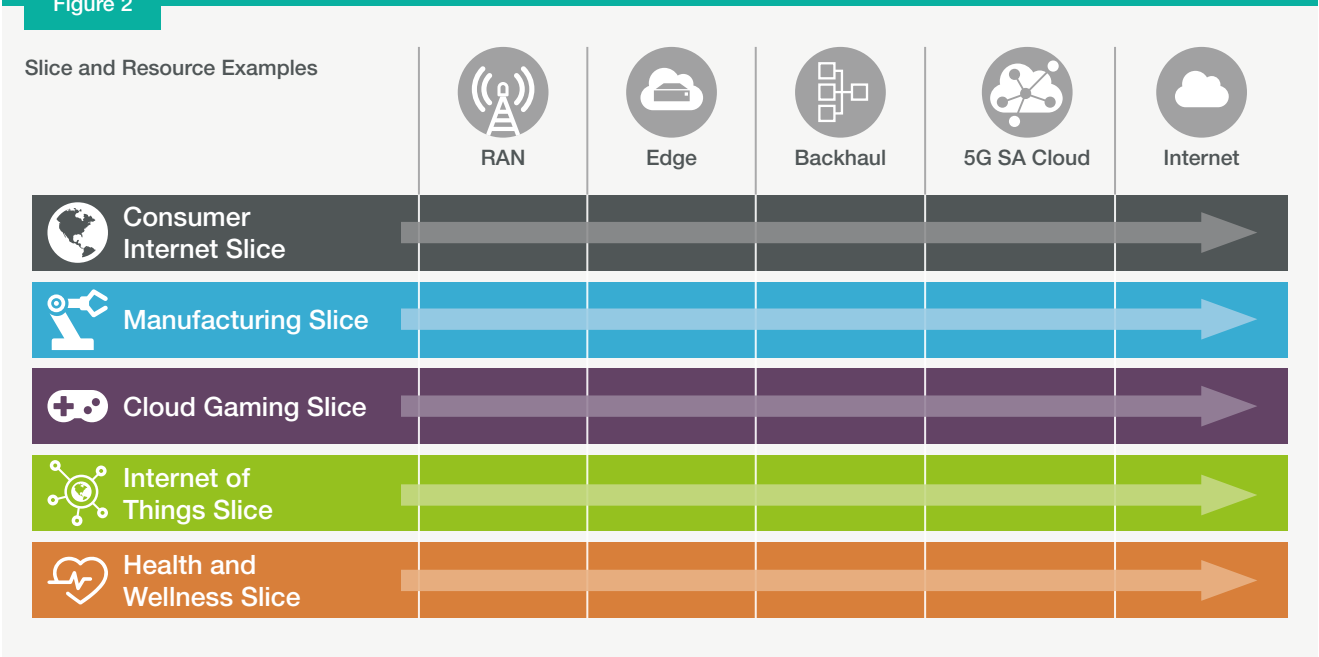
By definition, a network slice is an end-to-end virtual entity comprised of dedicated and shared resources. One of the key requirements for 5G networks delivering network slices, with unique and consistent service characteristics, is to provide continuous monitoring of slice load and assurance of slice key performance indicators.



Additional slice-specific attributes and requirements that need to be taken into consideration, include:

- No single 5G network slice fits all purposes
- Delivering diverse services tailored to meet specific requirements must have end-to-end support, e.g., a cloud gaming service requires high throughput and low latency (Figure 2)
- Slices are a combination of dedicated and/or shared radio/core resources
- Resources must be allocated to a slice dynamically, depending on when and where they are required, to meet specific application QoS or SLAs
- 5G core must be enhanced with the ability to collect and analyze KPI data per slice, including application performance, to assist dynamic slice assignment and management

Figure 2



Given the significant role slicing is predicted to play in the success of 5G networks, it is critical for service providers to ensure they understand how well they are performing and feed the associated analytics to NSSF or AMF systems for slice selection or OAM systems for automated slice management. Ultimately, success is dependent on a service provider's ability to analyze, optimize, and then monetize the slices and the services running across them (Figure 3).

Figure 3

Three critical actions requiring sophisticated application and network intelligence





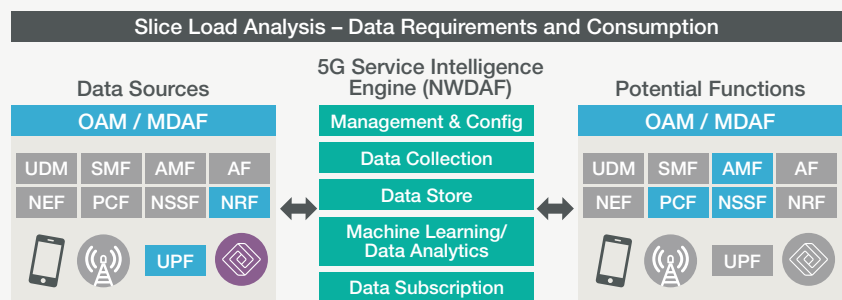
USE CASE OVERVIEW

Sandvine’s 5G Slice Load Analysis empowers service providers with the necessary real-time and machine learning-based analytics required for operational intelligence.

These load-level analytics are provided in the form of statistics, predictions, and threshold-crossing notifications to various systems (Figure 4), including PCF, NSSF, AMF and standardized OAM functions – Network Slice Management Function (NSMF).

Figure 4

Data sources and data consumers for 5G Slice Load Analysis



Sandvine’s 5G Service Intelligence Engine, an enriched NWDAF, is the critical product at the core of the use case, and is uniquely designed to enhance this analytics service (Table 1). It augments the standard load information available from the NRF (i.e., CPU, Memory, and Disk) for the individual NFs from which the slice is comprised. Specifically, Sandvine takes the actual network conditions into consideration by incorporating an average score (a composite KPI calculated using more fundamental network KPIs like bandwidth, latency, packet loss, etc.) of user plane data associated with the slice.

Table 1: Comparison between standard NWDAF versus Sandvine’s Intelligence Engine for 5G Slice Load Analysis

Standard NWDAF	Enriched 5G Service Intelligence Engine
<ul style="list-style-type: none"> • 3GPP R15/R16 does not specify how to calculate slice load • In the absence of a specified method, only control plane loading is measured for the slice which is some composite sum of all the NFs loads • NWDAF knowledge of slice load allows UEs to be placed appropriately on slices with lower load, which will improve the user QoE across applications running on the slice, e.g., gaming, video, enterprise, etc. 	<ul style="list-style-type: none"> • Using time stamped throughput and RTT, user plane load on the slice is calculated on the scale of 0-100 that is used by NWDAF as input • Slice load is comprised of both control plane load and user plane load as slices are more sensitive to application performance • Enriched slice selection will result in better user QoE for that application • Efficient data collection as Sandvine ANI can be the alternate source for several KPIs • Lower TCO as slices are optimally utilized



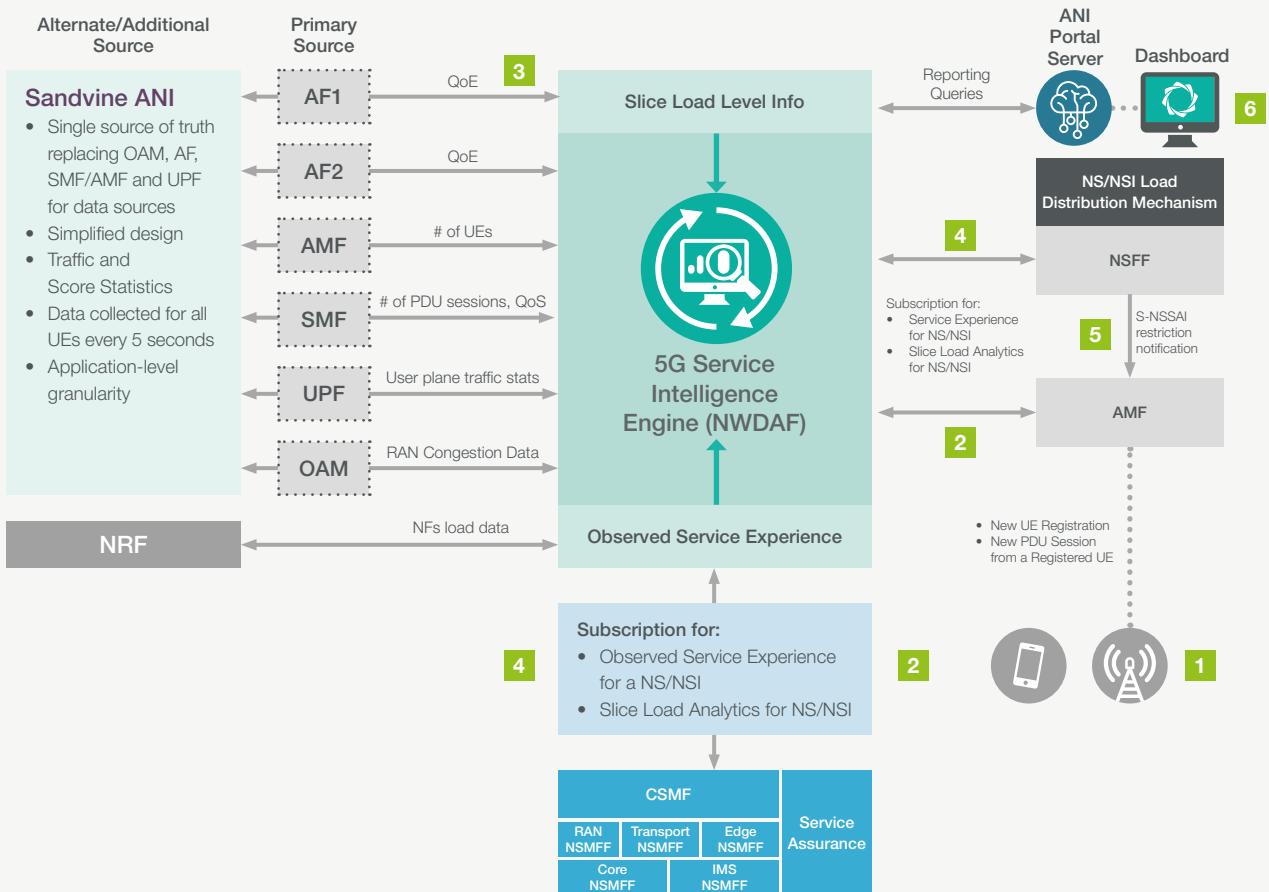
As stated, the analytics (enriched or otherwise) enables two critical slice functions – selection and SLA assurance/advanced slide load management (Figure 5). In both instances, analytics consumers (NF and/or OAM) can react in real time, adjusting to the requirements imposed by the service through optimizing the slice resources and/or gating new UE entry, avoiding slice QoE issues. Network automation enabled by this approach will not only protect the SLAs associated with the slices but will also accelerate the deployment and monetization of new services.

Figure 5

SLA assurance/advanced slide load management

- 1 UE tries to register
- 2 NSSF/Slice manager subscribes slice load and observed service experience
- 3 SIE collects data either from primary sources and/or from Sandvine ANI

- 4 SIE provides analytics to the two consumers
- 5 NSSF/AMF performs load distribution
- 6 Customer can see the trends



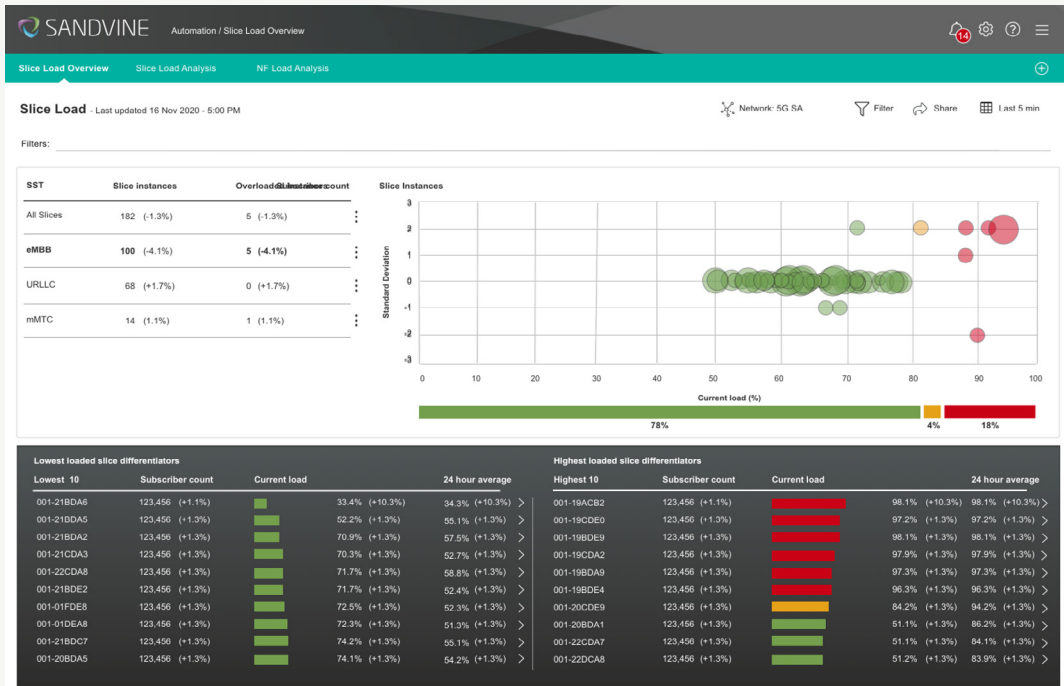
Network automation is essential for delivering various QoS-differentiated offerings that include applications like AR/VR, cloud gaming, V2X, D2X, self-driving vehicles, remote surgery, and smart factories. As with any optimization, the more accurate and timely the intelligence, the more precise and effective the action, which ultimately equates to better QoE.

Like other 5G use cases, slice operational intelligence is gathered predominately for the other analytics consumers (machines); however, Sandvine provides service providers with a real-time visualization as part of the ANI portal (Figure 6). This information can be leveraged by operations and planning teams as an intuitive way to look at slice load statistics and predictions. The same slice-level data can be used by marketing teams to offer innovative services on a per-network slice basis, which is necessary for an overall slice monetization strategy.



Figure 6

5G Slice Load Analysis



For service providers, having analytics output based on actual service experience on slice instances will enable more informed decisions on the selection, operation, and management of network slices.

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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