Solution Brief

Managing Dynamic QoS and QoE in On-demand Network Slices

Gain end-to-end network slice and per-service visibility from the 5G access network to the core

For mobile operators, 5G network slicing is a major new revenue opportunity, worth over $20 billion by 2026, ABI Research predicts.[1] End-to-end and segmented performance assurance is critical for capitalizing on that opportunity.

Network slicing is the ability to manage and optimize network resources to create and operate multiple virtual networks over a common architecture. Each slice is characterized by performance capabilities based on service definitions that dictate KPIs, service level agreements (SLA), or other metrics. This allows mobile operators to virtualize their compute resources and network infrastructure so they can meet individual customers' and per-service requirements for throughput, latency, jitter, and more.

Slicing goes far beyond the techniques and technologies, such as DiffServ, that operators historically used to ensure quality of service (QoS) for specific traffic types. For example, 5G slicing can ensure end-to-end QoS in the radio access network (RAN), as well as the transport and core networks. It also enables operators to isolate certain traffic for security or privacy by offloading it to dedicated infrastructure resources.

This highly granular control and customization enables operators to better support applications with unique performance requirements, such as factory automation/Industry 4.0, telehealth, automotive vehicle-to-everything (V2X), augmented reality, and video streaming. Beyond the initial non-standalone 5G deployments where, the main use case is enhanced broadband; in the near term, the majority of slicing customers and revenue are expected to come from industrial manufacturing, automotive (C-V2X), and logistics. ABI Research predicts these industries will collectively spend $12 billion by 2026.

By implementing slicing today, mobile operators can position themselves to lock in those early, lucrative adopters before their slower-moving competitors do. Network slicing would also allow a much more granular configuration of mobile virtual network operator (MVNO) wholesale services than is possible today.

[1]https://www.abiresearch.com/press/5g-network-slicing-will-generate-revenue-excess-us20-billion-2026/

But these new network slice capabilities and business opportunities also come with new complexity and performance challenges. A prime example is monitoring all of the hardware, software and services that comprise each slice to ensure that they're always meeting each application's KPIs and SLAs. Operators need to get service assurance right as both consumers and enterprises are extremely unforgiving after a poor initial experience.

Challenges

Before network slicing, mobile operators could tell customers: "Here's how my network behaves in terms of throughput, latency, and jitter. Determine how best to make your application work within those parameters."

Slicing and 5G's service-based architectures flip that relationship, giving customers the ability to say: "Here's what my application needs. Figure out how to make your network meet those requirements." If an operator can't do so — and consistently, 24x7x365 — it risks losing out on that customer's business.

End-to-end (E2E) service assurance

Hence the importance of end-to-end (E2E) service assurance, which ensures that the RAN, core, transport and other network components are individually and collectively meeting all of the customer's KPIs. E2E service assurance requires deep, real-time insights into how the physical underlay and the virtual overlay are behaving, as well as the ability to determine exactly which component is causing problems or underperforming. It also requires proactive alarming to identify emerging problems so they can be corrected before the application starts to suffer.

There may be hundreds of different slices to manage across a mobile network, each with its own SLAs and associated KPIs. Each slice may be used to connect thousands or even millions of devices. The KPIs of individual devices may need to be tracked by the operator. This being the case, the volume of data generated by 5G network slice monitoring could vastly exceed what is seen today in 4G networks. In this context, performance analytics is increasingly important and the solution must be able to scale to match the range of 5G slicing use cases it supports.
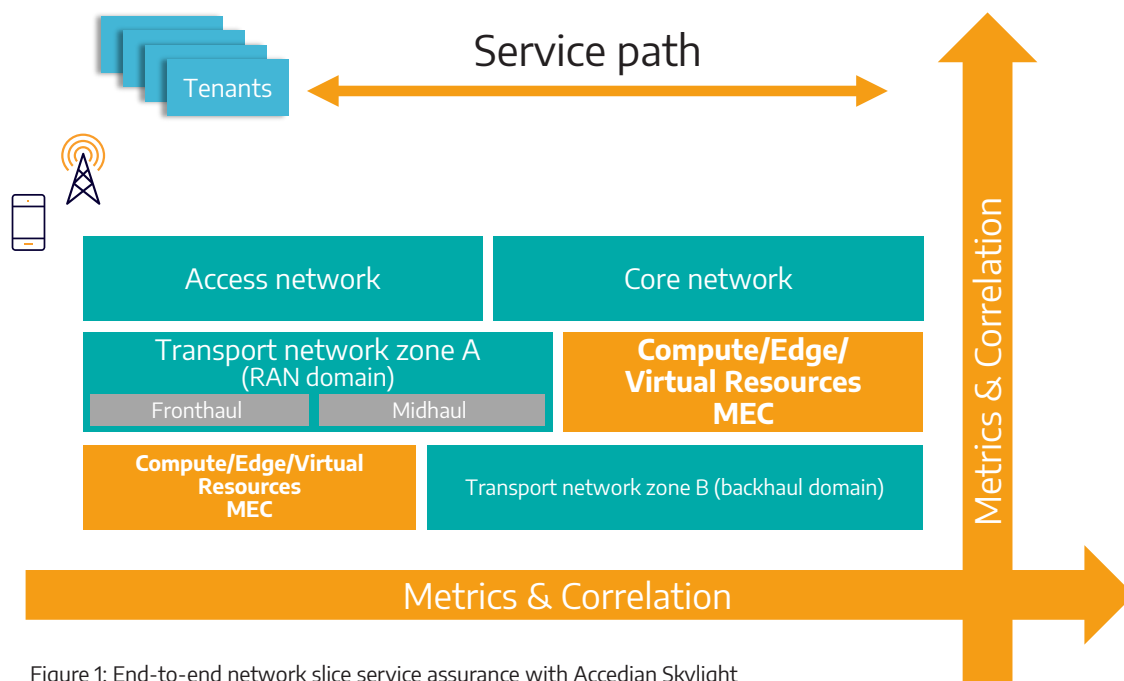

Figure 1: End-to-end network slice service assurance with Accedian Skylight

It's important to note that some slices have service chains that don't span the entire network, from access to core. For example, some slices may have core components closer to the edge, such as in the base stations or in an aggregation router in order to improve latency and other KPIs. A slice's exit point also could be a cloud service provider. All of these variables add to the complexity of E2E service assurance and require the ability to monitor and manage a wide variety of connectivity points.
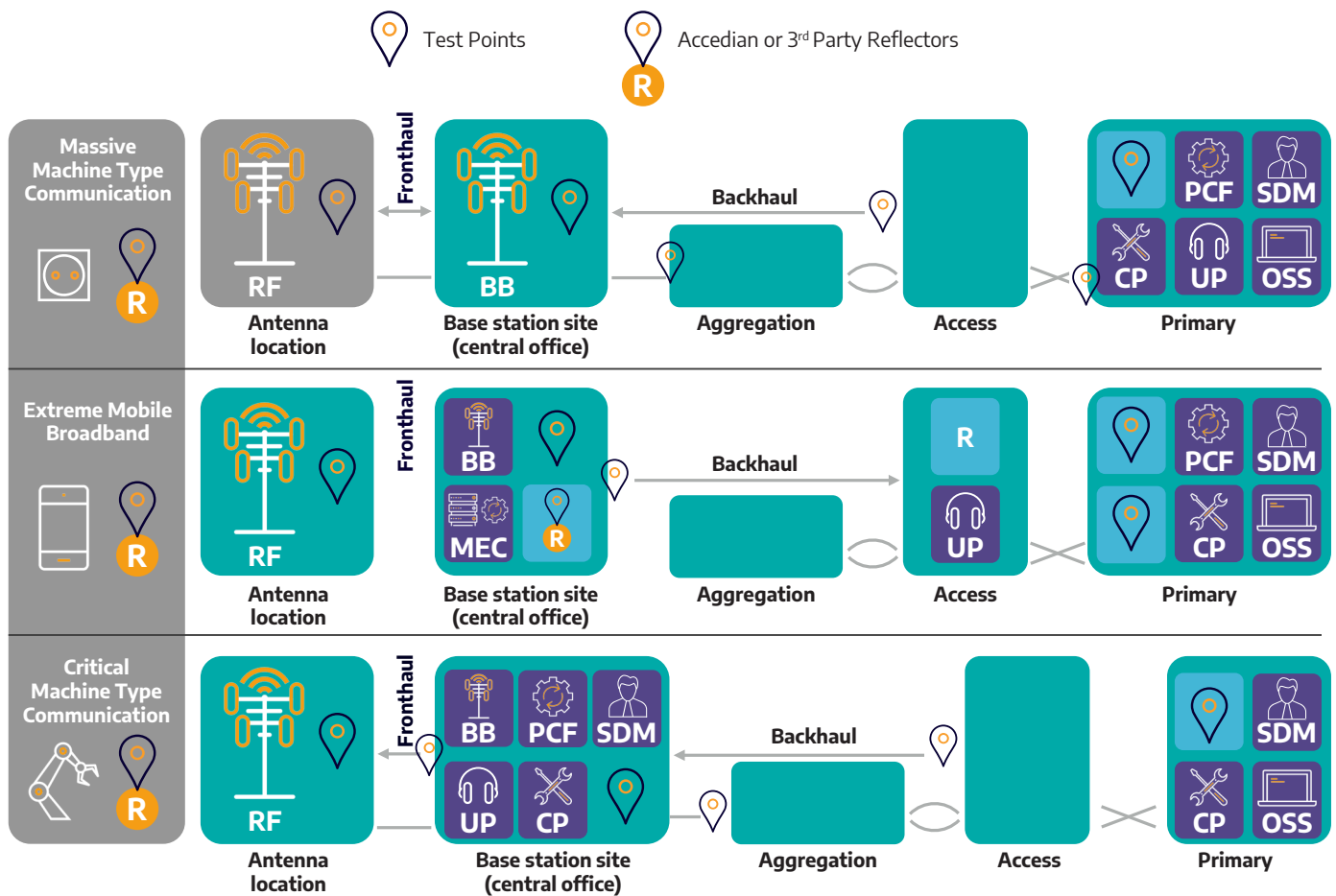

Figure 2: Performance requirements for end-to-end slice assurance

AI and machine learning to manage anomalies at scale

As more customers take advantage of slicing, the more challenging it becomes to rely on human staff to stay on top of everything. This highlights the value of artificial intelligence (AI), including machine learning (ML), to automate monitoring and drive smart decision making at the slice orchestration layer.

AI can look across all of the network layers to quickly understand the interdependencies and correlations, enabling the operator to focus its response to a problem rather than trying to fix everything. AI also can respond faster than humans, thus enabling quicker responses to detect and resolve problems.

Multiple slices

Another challenge is that a single device may have multiple slices. Take the example of a consumer's smartphone. The OTT subscription video application might use one slice that provides consistently high throughput and low jitter to avoid freezing, pixelization, buffering, and other artifacts that undermine the viewing experience. The smartphone also might get service from an MVNO, which has its own separate slice provided by a facilities-based operator. Each of these slices must be individually monitored and managed to meet their respective KPIs and SLAs.

Maximizing 4G investment

Although operators need E2E service assurance for 5G slicing, these tools also can be used to transform their 4G network into a service-based architecture. This strategy enables operators to wring additional revenue and competitive benefits from their LTE network and determine the business case and services to run on 5G infrastructure. There may be IoT services that do not require high-performance KPIs and can still run on 4G connectivity. 5G investment can then be directed towards low-latency or critical enterprise services that require high-performance service assurance.

End-to-end network slice service assurance with Accedian Skylight

Accedian Skylight provides fully automated discovery and deployment, initial service activation testing, and highly granular in-life performance monitoring of new 5G services — including services delivered over network slices. The solution is designed to fit seamlessly into existing operations for ease of management, rapid implementation, and operational cost savings. Accedian Skylight also enables multi-dimensional service assurance. One example is that by supporting 4G assurance as well, the solution lets operators extend their 5G service-based architecture to LTE.

Accedian Skylight offers the following multi-layered architecture featuring three key elements: sensors, orchestration, and performance analytics:

- A flexible combination of software agents, hardware-assisted components, virtualized functions, and smart SFP hardware that comprise its lightweight sensor layer. Unique and truly industry-first, 10Gbps compact SFP devices can be installed at cell sites to enable turn-up testing, bandwidth monitoring, and 24/7 SLA performance monitoring, all on a per-service basis.
- A virtualized orchestration layer centralizes the management and orchestration of the sensors, leveraging local controls and REST API automation. It can also feed data into third-party platforms for planning and troubleshooting. Skylight orchestrator automates the configuration and service provisioning and testing for fast service turn-up.
- Skylight performance analytics combines data from all Skylight sensors and third-party sources into a single pane of glass. It offers machine learning-powered alerts and rapid troubleshooting for network and application performance issues. Real-time intelligent monitoring also helps to predict and automate fixes. This layer can also feed near real-time performance KPIs and threshold crossing alerts to the slice orchestration platform.

Key capabilities and benefits

With Accedian Skylight, operators gain complete visibility into the end-to-end infrastructure that comprises a slice, with the tools necessary to proactively monitor and quickly identify and take action to prevent and resolve issues. Accedian Skylight provides the ability to:

- Collect performance and resource metrics from architecture to support network slice instantiation.
- Simultaneously monitor both the QoS (from a physical underlay perspective) and the QoE (from the application and service perspective).
- Monitor network slice domains inter edge-compute, cloud, service connectivity between MEC.
- Gather and correlate metrics from hardware or software components to build an end-to-end network slice view.
- Correlate passive, active, and third-party data to eliminate false positives.
- Use metadata to help pinpoint problems, such as a specific router.
- Provide data that orchestration systems can use to make decisions, such as which slice to use.
- Leverage machine learning for alerts about out-of-ordinary metrics.

Business benefits

- Deploy new 5G services based on network slices faster and with confidence
- Drive slice orchestration and closed-loop automation with near real-time KPIs
- Reduce the risk of new on-demand network slices failing and potential brand impact
- Differentiate on service quality with granular monitoring of network slice KPIs
- Meet strict network slice SLAs for business customers and partners
- Detect service degradations before customers are impacted
- Optimize capacity, deployment planning, and mobile backhaul

About Accedian

Accedian is the leader in performance analytics, cybersecurity threat detection and end user experience solutions, dedicated to providing our customers with the ability to assure and secure their digital infrastructure, while helping them to unlock the full productivity of their users.

Learn more at accedian.com