RAN slice controller

Deploy powerful capabilities to monetize your 5G investments

Executive Summary
Streamline network slicing with automation

Network slicing enables Communications Service Providers (CSPs) to generate new revenue from their 5G infrastructure with valuable, highly tailored services for specific customer segments.

Different customers have different communications needs. A utility company might want to communicate securely and reliably throughout a national smart meter network over the next decade. In contrast, an events company might want to provide extra capacity for the duration of a weekend music festival. CSPs can meet all these needs and more by creating multiple logical networks, or slices, that can deliver differentiated services in line with various Service Level Agreements (SLAs).

Creating and managing network slices on complex 5G-era networks running on virtualized and containerized infrastructure is a challenging task for any CSP. Especially when you consider there may be hundreds of slices, many of which need to be created and taken down over short periods of time. In practice, advanced network automation of the processes involved in creating a slice and then assuring its end-to-end performance is essential.

**Manage radio network slices to assure the customer experience**

Automated slice controllers can be used in all three 5G network domains – core, transport and Radio Access Network (RAN). However, it’s the RAN slice controller that largely determines whether the user experience matches the agreed Quality of Service (QoS) in terms of throughput, latency, mobility and reliability.

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**Figure 1:** The RAN slice controller plays a critical role in the end-to-end orchestration of network slicing
The 3GPP standard function that automates radio network slice lifecycle is called the RAN Network Slice Subnet Management Function (NSSMF). For simplicity, Nokia names its solution the RAN slice controller.

An essential part of Nokia’s end-to-end 5G slicing solution, the RAN slice controller automates slice lifecycle management from the creation and activation of network slices to their re-configuration and deactivation according to triggers from the end-to-end network slice orchestrator.

**Automation simplifies RAN slice lifecycle management**

To create and configure a RAN slice, the CSP uses the Nokia Orchestration Center to set the communications requirements for a slice. These inputs are converted to slice profiles with set values for coverage, performance, mobility, traffic resources, resource sharing and more. Slice profiles can cater for any need, which will commonly include working from home, 5G corporate LAN, dedicated private network or public safety. The CSP can pre-set any combination of performance parameters to meet specific customer demands.

The Network Slice Management Function (NSMF), which controls the end-to-end slice across the RAN, transport and core domains passes the slice communications requirements to the RAN slice controller. RAN slice controller then configures the slice in the RAN by using these instructions to set the gNB (the 5G base station) parameters for the required cells.

**Figure 2:** The RAN slice controller converts slice requirements from the Orchestration Center into slice profiles that govern the appropriate performance parameters in the 5G base station

Set up slices in minutes, not hours
CSPs can cater to a wide set of services that require different network characteristics. They need a mechanism to configure the network slice so that it can cater to each use case.

The Nokia RAN slice controller allows the CSP to associate specific 5G QoS Identifier (5QI) values to a slice profile. This allows the data packets pertaining to different applications to be treated differently and hence achieve different performance levels. Done in minutes, this level of automation enables a CSP to manage hundreds of slices with ease.

Figure 3: Slice profiles are associated with (5QI) values that are standardized for common services in 5G networks.

For example, while high-definition video streaming and video gaming both need high bandwidth, video gaming requires lower latency. The treatment of the data packets is different. The CSP can either create different slices to serve the two applications or associate multiple 5QIs to the same slice to treat the data of the two applications differently. The CSP can also specify scheduling weights to prioritize traffic according to use case. In this case, video game data can enjoy a higher priority compared to HD video data.

**Segregate traffic flows for maximum security**

With the Nokia RAN slice controller, CSPs can logically separate each use case’s traffic through the network by assigning IP addresses to the gNB for specific slices. The transport slice controller then uses the IP addresses to segregate the traffic in the transport network slice.

The automated setting up of separate data pipes for slice-specific traffic flowing across the CSP network provides a high level of security to meet the needs of customers, for instance public...
safety organizations or private network users. IP configuration also assures the highest slice performance for demanding use cases such as cloud-based gaming.

**Monitor and maintain slice performance from start to finish**

Should performance requirements change while a network slice is live, the CSP simply updates the communications parameters in the orchestration center and the RAN slice controller automatically reconfigures the gNBs. When the need for the slice ends, the RAN slice controller deactivates it.

The RAN slice controller monitors the slice performance within the RAN domain. It also reports slice specific KPIs to the Nokia Orchestration Center. The Orchestration Center provides a bird’s eye view of the end-to-end network and provides feedback to the RAN slice controller based on the inputs it receives from Core and Transport domains for closed loop assurance. This is important because if a network slice falls short of its SLAs, the promised revenue for the CSP is put at risk.

**Assure and optimize RAN slices**

Once a CSP has deployed and is using the first two capabilities of Nokia RAN slice controller, it will be possible to add two further features - lifecycle management and monitoring.

With slicing assurance, the Nokia RAN slice controller works to maintain the SLA set by the CSP for the slice. It takes proactive action based on set thresholds and ensures that the guaranteed SLA (throughput, latency, etc) is not affected by unexpected conditions.

In addition, the RAN slice controller can optimize radio network resources across the slices according to network demand to maintain the best possible performance. Slice controller actions are triggered according to network KPIs to ensure that computing resources are allocated based on the network load. The RAN slice controller can dynamically scale up or scale down network resources depending on the user traffic to maintain the slice KPIs that have been assured to the customer.

**Nokia RAN slice controller: scalable, flexible, adaptable**

Nokia’s 3GPP-compliant RAN slice controller is a cloud-native microservice. It’s easily scalable and can run on any cloud platform. It’s also vendor agnostic and interfaces with third party software both on the northbound and southbound interfaces. The Nokia RAN slice controller supports physical networks and will support virtual radio networks including O-RAN.

Network slicing will be one of the biggest game-changers brought by 5G. But it’s the RAN slice controller function that ultimately turns slicing from a theoretical benefit into a practical reality.
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