Nokia AirScale Cloud RAN

Executive Summary
Nokia AirScale Cloud Radio Access Network (RAN) enables cloud-based radio access networks that are highly scalable, flexible and efficient.

Processing capacity can be allocated from almost anywhere in the network, such as an adjacent cell, a centralized data center or a data center at the network edge, to where it is needed most. This unique multi-layer approach supports distributed and centralized deployments, or a combination of both, using multiple fronthaul types, including Ethernet. A Communications Service Provider’s (CSP’s) existing radio access and transport assets are used more efficiently, enabling smooth evolution to a cloud optimized RAN, ready for 5G and Internet of Things (IoT).

**Nokia AirScale Cloud RAN: scalable, agile and 5G-ready**

- **Business agility**: enables new services and creates business opportunities through shorter software and innovation cycles
- **High scalability**: allows resources to be scaled in and out efficiently, for IoT and next generation heterogeneous access
- **Evolutionary**: combines licensed and unlicensed spectrum for maximum use of radio assets
- **5G readiness**: a foundation for a leap in spectral efficiency, high peak rates and low latency

AirScale Cloud RAN is part of Nokia’s radio access generation, Nokia AirScale Radio Access, to which it provides scalability and flexibility. This agile solution can be continually upgraded through software, while virtualized RAN functions can be defined and deployed quickly in response to changing network requirements.

Nokia AirScale cloud base station and Nokia AirScale RNC (cloud-based controller) run on Nokia’s powerful AirFrame data center platform, that meets stringent radio access capacity, performance and latency requirements. Furthermore, Nokia’s proven management solution, Nokia NetAct and Nokia CloudBand™, can manage legacy radio networks and Cloud RAN with the same view, offering easy transformation to virtualization.

**Nokia AirScale Cloud RAN pieces together business and network agility**
Benefits to CSPs

Business agility

Nokia AirScale Cloud RAN enables new services and opens business opportunities through its ability to run shorter software and innovation cycles. Nokia Multi-access Edge Computing (MEC) solution runs on the same servers as Cloud RAN and opens Application Programming Interfaces (APIs) to a world of new business opportunities, applications, services and plug-ins, seamlessly integrated into the RAN and using information from real radio conditions.

The solution enables a joint CSP/supplier “DevOps” model for the entire service lifecycle with continuous R&D delivery process from design to supply, implementation support and operation. Continuous development and software delivery models shorten the time to market of new features, allowing new revenue opportunities to be captured quickly and to continuously improve the Quality of Experience.

High scalability

Cloud RAN enables resources to be scaled efficiently to meet traffic and service growth and eliminate the need to over-dimension a local, distributed RAN site. The solution can enhance peak data rates and improve spectral efficiency because the key features are delivered and coordinated from the cloud. The deployment of radio Virtualized Network Functions (VNFs) on the scalable AirFrame IT platform enables large-scale resource pooling gains.

Dynamic pooling/provisioning of cell and device capacity brings savings in both CAPEX and OPEX. This is made possible by RAN dimensioning being based on need rather than on peak capacity.

By moving the radio network controller to the cloud, CSPs can protect their investments and benefit sooner from unrivalled scalability across technologies, greater automation and inherent flexibility to meet customer demand more efficiently.

Evolutionary

Combining licensed and unlicensed spectrum enables CSPs to maximize the use of their radio assets through multi-connectivity technologies, such as inter-site carrier aggregation, LTE Dual Connectivity, LTE and Wi-Fi Link Aggregation (LWA), Licensed Assisted Access (LAA) and forthcoming 5G-LTE-Wi-Fi from the cloud.

Applying these radio technologies to meet different needs enables CSPs to always deliver the best customer experience.

Nokia AirScale Cloud RAN offers smooth migration from legacy RAN towards a multi-layer scalable RAN, with optimized Total Cost of Ownership (TCO). With the AirScale cloud base station running in the cloud, the solution can be extended cost-effectively throughout its lifetime.

5G readiness

Nokia AirScale Cloud RAN is the foundation for vastly improved spectral efficiency, peak data rates and latency optimization. Quick deployment of new 5G access can be achieved by re-using existing LTE-A, transport and telco cloud infrastructure. CSPs can save on individual RAN deployments by using a multi-connectivity layer in the cloud to host 5G, LTE and Wi-Fi aggregation. At the same time, a cloud-based and multi-layer access network is an enabler for new 5G services, such as ultra-reliable and low-latency Internet of Things (IoT) services.
A flexible architecture

Nokia AirScale Cloud RAN provides a multi-layered one-cloud technology and supports Ethernet fronthaul with innovative radio architectures. It also ensures an evolutionary approach by working with today’s distributed and centralized radio architectures, offering high flexibility, scalability and efficiency.

What does multi-layered mean in practice? Nokia cloud-based radio enables distributed and centralized cloud solutions or a combination of both. However, all components are managed as a single cloud with common orchestration.

This architecture provides highly scalable, flexible and efficient cloud-based radio access networks that optimize network performance and TCO. Additionally, CSPs will be able to increase the utilization of their physical server hardware. Peak hour capacity can be allocated where and when needed, reducing the need to dimension the network for peak hours and making more efficient use of capacity.

Telco cloud architecture in the radio access domain needs to provide real-time services as well as meet the specific requirements of RAN functions. This means that some functions need to be moved closer to cell sites and the network edge. A unique part of AirScale Cloud RAN architecture is that it supports radio functions in large, centralized data centers, as well as in smaller, distributed data centers, for example, in aggregation points or at the far edge of the network to deliver real-time services to end users.

With this solution, all multi-layer cloud components become an effective single, orchestrated cloud that enables CSPs to flexibly deploy virtualized RAN functions. Deployment can be based on functional requirements (such as bandwidth or latency towards cell sites), the CSP’s available assets (such as suitable aggregation sites and transport infrastructure), and deployment strategy (such as considerations of resiliency, chosen approach, etc.).

Thus, the solution is fully scalable, allowing it to support the widest range of RAN virtualized network functions. It further allows optimal integration for cloud application servers such as Multi-access Edge Computing (MEC).

Real-time and non-real-time split supports any transport

Bringing the cloud into the radio domain affects the fronthaul between the baseband processing running on centralized servers and remote radio heads. Cloud RAN enables centralization benefits while supporting relaxed transport requirements, enabling CSPs to re-use existing transport assets in their LTE networks.

Introducing a functional split between real-time (RT) and non-real-time (NRT) traffic enables much longer backhaul latency to be tolerated and permits the use of Ethernet-based backhaul transport. This is key for many CSPs as they seek to achieve real Cloud RAN savings.

The functional split addresses the use of multiple fronthaul types, including innovative Ethernet fronthaul. Time-critical functions can be processed at the cell site, connected via Ethernet fronthaul, while the centralized data center performs non-real-time functions cost-effectively. This NRT/RT split architecture enables cost-effective scaling of HetNet and IoT capacity without the need for macro site visits. Transport costs are optimized, and control plane capacity scaling is achieved efficiently in the cloud.
Flexible and cost-effective fronthaul and mid-haul solutions to meet any requirement are available from Nokia's fixed broadband and IP and Optical Networks portfolio.

**New, all-in-cloud RAN architecture**

Nokia is introducing a new cloud RAN architecture with AirScale all-in-cloud base station which puts RAN real-time functions into the cloud, to run alongside the non-real-time functions already there. This produces a software focused and hardware agnostic solution, which keeps the key benefits of cloud centralized RAN and edge cloud distributed RAN deployment models. In this case, real-time and non-real-time functions can be co-deployed deeper in the network.

The new AirScale Cloud RAN solution for 4G and 5G with AirScale all-in-cloud base station supports extremely low latency use cases by introducing a lower layer split option. Real-time baseband is virtualized and placed in the cloud, allowing real-time processing to be hosted at the far edge.

Introducing processing closer to the radio site ensures that tighter latency requirements can be handled. The recently launched AirFrame open edge server provides the smaller data centers needed to support this far edge processing. Low latency and high bit rates are drivers for the distribution of functionalities. With the flexible architecture options, CSPs can locate functions to meet requirements in each area, depending on application needs and latency targets, as well as available and planned transport capacity.

**Evolutionary approach**

Nokia cloud-based radio architecture works with existing telco interface standards and technologies already widely deployed in the field. It builds on Nokia Single RAN and centralized radio solutions, which act as stepping stones to the cloud-based radio solution.

It also offers an evolutionary deployment for CSPs and is built to work with Nokia equipment already deployed. Migration to new processing platforms can take place as and when network functions are modernized, new network layers are built, or as new services are deployed. Supporting standard interfaces and bringing in 2G, 3G – such as the 2G and 3G cloud-based controllers AirScale RNC and AirScale BSC - and 4G virtual functions allows the architecture to integrate with today's networks, as well as serving as the platform for continued evolution to 5G.

**Proven capability**

Nokia AirScale Cloud RAN has been developed in close cooperation with CSPs globally that have helped shape the solution via trials and proofs-of-concept. This ensures the platform is scalable to meet very different market conditions, that it is ready for future network requirements and that it has synergies with the continuing telco cloud modernization conducted by CSPs.

**AirScale cloud base station**

The commercially available Nokia AirScale cloud base station functional NRT/RT architecture split is field proven with several major CSPs. Field experience in live networks with commercial traffic shows the solution is ready for diverse market needs, ready for future network requirements and ready to support CSP business strategies.
AirScale RNC and AirScale BSC

Nokia AirScale RNC and AirScale BSC, cloud-based radio network controllers running on AirFrame data center infrastructure, complement Nokia AirScale Cloud RAN for 3G and 2G. They introduce the telco cloud operating model and its benefits to 3G and 2G CSPs and offer unrivalled scalability, as well as greater automation and flexibility for managing radio resources. They are both commercially available and deployed.

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