

The future of RAN services

Explore the evolved need on CSP
services partners in an increasingly
Open RAN ecosystem



The impact on services from cloudifying the RAN

The evolution towards Open RAN is one of the most important trends in the telecommunications industry today. For many CSPs, the first phase of this journey is to cloudify their RAN stack, e.g. disaggregate the hardware and the software in the baseband. This paper discusses the impact on services from this journey, the challenges and the ways forward.

The evolution towards Open RAN is one of the most important movements in the telecommunications industry today. Open RAN is a broad concept and consists of three main elements:

Cloudification

The disaggregation of hardware and software with RAN application software built as cloud-native functions running on a cloud architecture based on general-purpose hardware and cloud platforms.

Intelligent automation

Leveraging cloud-native principles, automation and model-driven management, and orchestration systems with capabilities for Artificial Intelligence

and Machine Learning for efficient Life-cycle management (LCM) of network functions.

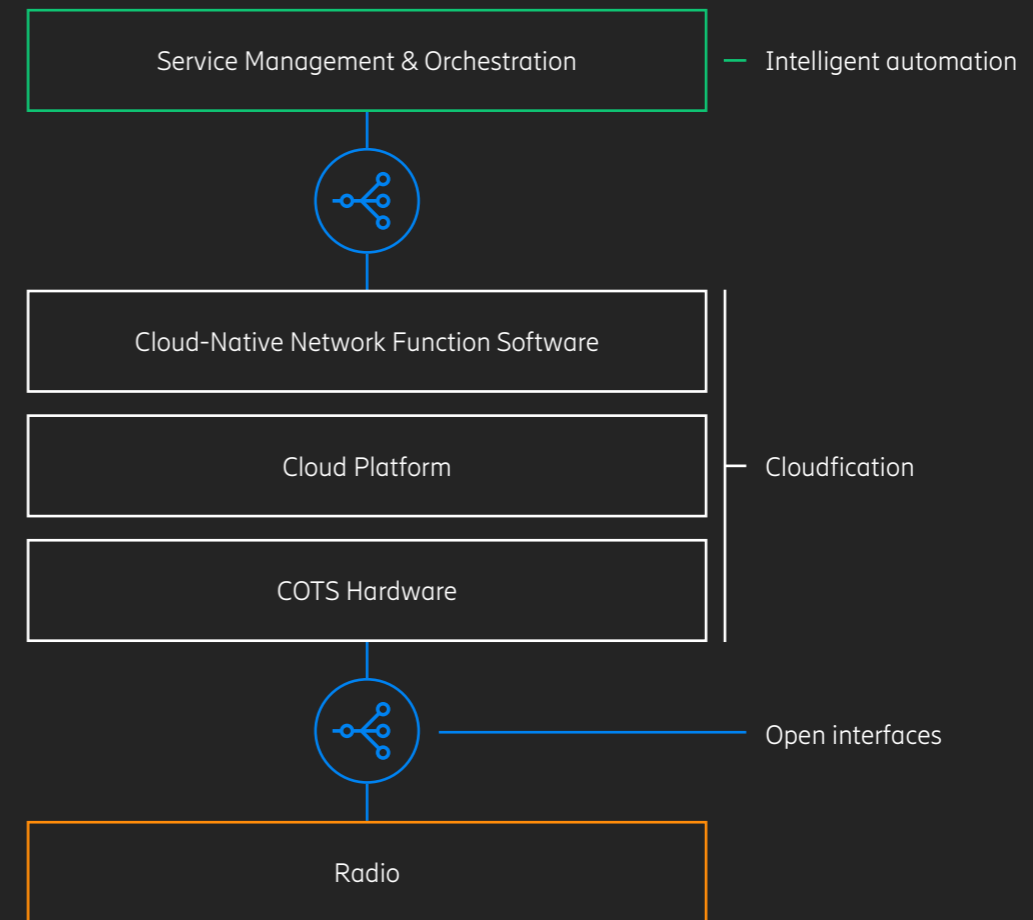
Open interfaces

Open internal interfaces, defined by O-RAN Alliance, between the different parts of the RAN stack, combined with 3GPP-defined interfaces.

For many CSPs, the first phase of their journey into Open RAN is to cloudify their RAN stack, e.g. disaggregate the hardware and the software in the baseband. This can be done in various ways and has major implications on design, deployment and operations and what kind of support CSPs would need from their services partners.

This paper discusses the challenges and the ways forward in this first phase, the cloudification of the RAN stack. Going forward, you can expect more papers from Ericsson, covering the impact on services from other perspectives in Open RAN.

Key elements of Open RAN



Terminology and definitions

Open RAN: An industry term for open radio access network architecture. It is a RAN that includes open interoperable interfaces and virtualization and is big data and AI-enabled.

O-RAN: Refers to the O-RAN Alliance.

OpenRAN: Refers to initiatives driven by TIP's OpenRAN project group.

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01

Three dimensions of complexity

The cloudification of the RAN stack will impact CSPs in three primary dimensions: deployment diversity, multivendor systems integration and multivendor Life-cycle management. These dimensions will individually, and in combination, drive complexity that impacts the type of support they should be looking for from services partners.

Deployment diversity

Two different perspectives drive deployment diversity – site diversity and flexible deployment options.

Site diversity essentially means that the configuration and design will vary across different types of radio sites. Imagine three different types - a rural site, an industrial site and a radio site serving a high-density location, e.g. a stadium.

These three site types have different requirements on capacity and performance implicating different demands on the processing power of the site hardware. However, this is not the only source of diversity. Different sites could also have different generations of hardware building up over time due to upgrades of hardware, different requirements on frequency of site visits and potentially also different demands on what needs to be managed on site versus remotely.

Designing and managing a high-performing cloud-based RAN network with this kind of diversity requires a deep understanding of how to combine and integrate different components in different sites, while ensuring the performance of the total system.

The other perspective, flexible deployment options, comes from the fact that the RAN software can run on any capable cloud-native stack built on commercial-off-the-shelf (COTS) hardware. This means that the RAN software can be deployed at different locations in the network, such as data

centers, edge sites or far edge radio sites, as long as the specifications for the software are met in terms of processing capacity and time-criticality in relationship to the radio unit.

The combination of site diversity and flexible deployment options makes each network unique and means that CSPs and their services partners need to take a systems integration (SI) approach across the network lifecycle to create a RAN solution that is optimized for a specific context including the CSP's existing network and cloud hardware assets.

Multivendor systems integration

The second dimension of complexity comes from the multivendor nature of Open RAN. Consider a typical far edge radio site. It would consist of a COTS server with accelerators, a Container-as-a-Service (CaaS) platform and the RAN software at the top of the stack. Each layer in such a stack can come from different vendors and across the network, they could also come in different variants and versions. This is true for any site in the network that runs RAN software, not only for far edge radio sites.

For example, the virtual Centralized Unit (vCU) software could run in a centralized data center, an environment that is composed of the same layers and has the same multivendor nature. In such a context, the vCU may also share infrastructure with other types of workloads which increases the level of interdependencies

and puts additional demands on Life-cycle management coordination.

The multivendor dimension brings complexity to all phases of the customer journey, from planning and design to lifecycle management. Multiple vendors' systems must work together as a single solution at the same time as no single vendor, by default in Open RAN, will have full, E2E control. The CSP will need to find ways to encourage collaboration across their vendors to ensure that this critical accountability doesn't fall through the cracks.

One example of this is how to deploy hardware and software for far edge radio sites in a multivendor cloud-based RAN network. Using legacy ways of working, each vendor would deploy and install the layer they are responsible for – hardware, CaaS or RAN Software on every site and execute all associated deployment activities – software or hardware installation, configuration, testing, verification and security hardening. This would be complicated to plan and perform since each vendor would have their own organization and processes for the different activities. Applying legacy ways of working into an Open RAN context would drive cost and risk for misconfigurations and errors.

There are several solutions to solve these challenges. One is a fully automated zero-touch provisioning approach, in which the software can self-install within the maintenance window if all sufficient

Three dimensions of complexity



conditions are met, e.g. transmission bandwidth. Another way of doing it is using the concept of pre-staging. Most likely, these different approaches will be used in parallel and need to work in tandem.

This paper explores the concept of pre-staging in more detail. Pre-staging implies that one of the services partners takes a lead responsibility to integrate all components of the RAN stack before deploying it into the field. It is executed locally, close to the network, to meet the customer demands for an industrialized and automated process to achieve high levels of quality, cost-efficiency and visibility of assets being deployed into the network.

The services partner sets up a physical pre-staging lab in collaboration with the CSP where all activities take place; configuration of the hardware as well as installation and configuration of the CaaS and RAN software. The whole stack is then tested, validated and hardened from a security perspective and the appropriate software and hardware registration activities are performed.

At the end of the pre-staging process, the CSP has a server with the right software ready to be shipped to the field, installed and integrated into the network.

Multivendor Life-cycle management

The cloudification of the RAN and the multivendor situation also requires a different approach to Life-cycle management after initial deployment.

Since the software can come from multiple vendors, different software upgrade cycles need to be coordinated and synchronized to ensure high performance of the total system and to avoid errors or

misconfigurations that potentially could emerge when upgrading just one part of the stack.

Another LCM challenge is that there will be a faster software upgrade cadence, where individual pieces of software could be updated as frequently as weekly. This is an intrinsic characteristic of designing software using cloud-native principles, such as Continuous Integration/Continuous Development (CI/CD), DevOps and microservices. To extract maximum value in this context the LCM needs to be automated to a much larger extent, based on the power of Artificial Intelligence and fit-for-purpose processes.

One example of this is how to practically upgrade software. In a cloud-native context, software vendors would continuously develop software upgrades and ship them to the CSP in small increments. However, these small pieces of software should not be immediately integrated into the live network – this would impose a high operational risk.

Adopting ways of working will be necessary, but the CSP should start even earlier, in the design phase, to mitigate this risk. They should be working with product vendors that have a high degree of pre-integration of their solutions, i.e. software solutions from different vendors that have been developed in conjunction and tested for compatibility, even as the individual software evolves.

However, even with pre-integration, there is still a need for CSPs to set up location integration and testing labs to meet local needs and ensure compatibility across the whole software stack. This would involve regression testing new software with the whole E2E network

solution in the lab as a first step. This would be followed by testing the software in a limited part of the live network to ensure real-world performance. Only after successful testing in both a lab and the live network, the software is ready to be deployed into the network at scale.

Following cloud-native design principles, it is also important that the CSP continuously feeds real-world data back to vendors so that they can improve the software based on its actual performance. CSPs need to own this process and either execute it on their own or choose a partner to run it for them. Regardless of how CSPs choose to do, it is paramount that all software that is being deployed into the network follows the same process so that performance can be guaranteed.

Life-cycle management in Open RAN is clearly a different challenge and CSPs need to identify and collaborate with partners who work well together, creating a strong partner network to make it efficient and robust.

02

The role of services across the customer journey

The objective of cloudifying the RAN is to create a more flexible network architecture while bringing down TCO with new processes built on a high degree of automation. This chapter explores how services partners can support CSPs across all parts of the customer journey.

The objective of cloudifying the RAN is to create a more flexible network architecture while simultaneously bringing down TCO. The required new processes and standards to make this happen are currently being defined in various standardization bodies and forums. There is still a lot of work to be done to reach the same level of quality and industrialization as in the 3GPP standardization, and since there are no clearly agreed operational processes in this space, CSPs' services partners need to be

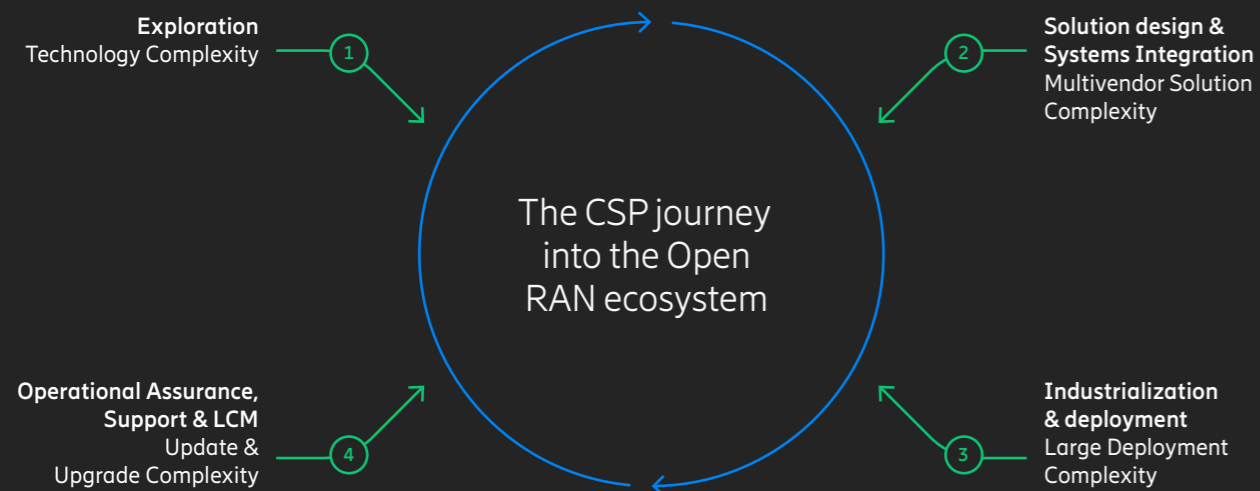
deeply embedded in this standardization work to bring emerging best practices to their customers. Services partners also need to contribute with strong telecom competence and have a broad range of partners in the ecosystem so they can help CSPs to navigate this partly uncharted territory.

At this stage of the Open RAN evolution, CSPs will look for services partners that can take on different roles and offer different levels of system integration services.

It ranges from collaborating as lead SI partner to delivering specific SI services on selected parts of the network solution.

Most importantly the services partners should support CSP to ensure the performance of the total RAN solution, not only the individual parts. This will require a combination of deep product knowledge, solid experience from large deployments and the skills to support and operate RAN networks.

There are four distinct parts of the customer journey where services partners play an important role:



Exploration

As CSPs start to cloudify the RAN, a phase of exploration is necessary to figure out how to leverage the new cloud technology in their specific network. The number of potential combinations of hardware, software, vendors and configurations is vast and it is important to narrow the options down to something that works in reality, provides the right level performance and fits into the existing networks, both technically and operationally.

In this phase services partners should bring skills in designing cloud-based RAN technologies and capabilities such as strategic and tactical planning, use-case exploration, creation of deployment scenarios and impact analysis on operations across the network life-cycle. This should be supported by proof-of-concepts and trials to assess gaps in interworking, technology maturity, operational processes, methods, tools and competences so that a solid transformation roadmap can be designed.

Solution design & system integration

In this phase the multivendor RAN solution comes together and components from all vendors are integrated into a full solution, designed for an existing context and network. It is important that services partners guide CSPs to make the right trade-offs between vendor flexibility and pre-integration in the design of the network.

If the CSP goes for a pre-integrated solution consisting of selected product vendors with verified configurations, it will limit flexibility in vendor choice but on a total solution level it will lower system integration costs, ensure predictable performance and lower TCO over the solution lifecycle. In contrast, a CSP could also drive a "best-of-breed" strategy for more vendor choice which implicitly would come at the expense of higher systems integration cost and TCO.

Industrialization & deployment

The industrialization and deployment phase is where the RAN solution is deployed into a live network with the aim of ensuring both maximum network performance and operational efficiency to optimize TCO.

Services partners should bring capabilities that ensure collaboration across the different vendors in the stack to practically deploy the network, efficiently and with high quality. Pre-staging, as outlined above, is one important component that needs to be introduced but it is also important that the partner contributes with deep knowledge of radio products and their functionality, the ability to coordinate different vendors' supply chains and ways of ensuring the performance of the total solution.

Operational assurance, Support & LCM

The Operational Assurance, Support & LCM phase is when the RAN solution is in commercial operation, a state characterized by high dependencies between hardware and software products and a high software update cadence.

Cloud-native practices for LCM with a high-degree of automation is at the center in this phase. Without automation and shared workflows across the ecosystem of different vendors and the CSP, it is not possible to efficiently evolve a cloudified RAN stack. Services partners should use cloud-native practices and support the CSP to change their ways of working, embedding more and more automation as they go along.

Even if automation takes central stage in this phase, human expertise will still be very important, especially in certain contexts. Consider a major update to the system, e.g. end-of-life replacement of hardware. In this situation, a careful analysis of the impact on the whole system needs to be performed to make sure that it performs as intended also after the replacement. Major changes like this can't be automated but need the expertise of seasoned engineers leveraging as much technology support as possible.

03

Characteristics to look for in a services partner

Choosing the right services partner can be the difference between success and failure. As shown in this paper, evolving ways of working is an important part to get the most value from cloud-based RAN and different types of CSPs will look for different types of support from their services partners.

CSP frontrunners, the cloud-native telcos, are ahead of the curve and will most probably want to leverage outsourcing services in all phases of the network lifecycle to accelerate the deployment of cloud-based RAN. The curious explorers will take a more stepwise approach and might instead look for more advisory type of services in the exploration and design phases.

Regardless of CSP maturity level there are some characteristics they should look for in a services partner to fulfill both current and future needs:

- Active participant in the Open RAN ecosystem.
- Strong and broad E2E RAN competence.
- Ability to co-pilot the journey and transform CSP operations.

Active participant in the Open RAN ecosystem

One of the most fundamental requirements is that partners are a contributing and powerful part of the Open RAN ecosystem. The number of potential combinations of components in Open RAN is massive and it is important that the services partner collaborates with the key vendors to create pre-defined solutions that are tested and

work in real life. Early in the process to create an Open RAN solution it is important to have agreements between partners in place that define clear responsibilities, ensure that there are plans of action for problem-resolution and enable testing of common solutions in shared labs.

Strong and broad E2E RAN competence

The aim of building cloud-based RAN solutions is to build high-performing networks at an optimal TCO level. This requires a deep understanding not only about cloud infrastructure and cloud-native ways of working, but even more importantly, about the inner workings of radio networks.

It is not possible to copy cloud-native processes straight from the IT-industry and expect them to work in a telecom context. Telecom expertise is necessary to handle the multivendor aspect, the various scenarios of deployment and the fact that the software development processes will involve all software vendors and the CSP when moving towards DevOps. The services partner needs to understand how to leverage existing cloud-native practices but adapt them and turn into very practical processes and activities in a RAN context. Robust capabilities in network function virtualization and service orchestration

are also important, as well as how to integrate cloud-based RAN with the existing network.

Ability to co-pilot the journey and transform CSP operations

The Open RAN technology is still young, and work remains to be done in standards and interface specifications. As a result, de-facto ways of working and collaborating have not yet emerged, and it will be hard for niched and specialized players to see the full picture. The ability to understand the impact on the network as a whole is important to serve CSPs across the whole lifecycle.

Services partners should also support the CSP to transform and transition knowledge and skills to the CSP. This would include process and organizational redesign and introduction of automation as fast and as much as possible to make the CSP fit for new ways of working.

In conclusion, a CSP's selection of services providers should be holistic, considering technical prowess, reliability, support and commercial perspectives.



04

The value of the right services partner

The path towards a cloudified RAN is fraught with challenges. The right services partner should collaborate with their CSP customers to reduce hurdles and minimize complexity. The below values are what CSP should expect from their services partners.

Bridging the skill gap

Cloud-based RAN is a novel technology and CSPs in general do not have the full set of skills needed to deploy and manage it. Services partners should provide access to domain expertise, bridging the skill gap across all domains. In early stages it might be design and integration skills and as the CPS grows their cloud-based RAN footprint, capabilities in operations and optimization become more relevant.

Minimizing operational risk

Cloud-based RAN promises benefits but creates new levels of complexity. New technologies combined with new vendors creates a risky landscape to navigate. Services partners should be experienced and help CSPs to minimize the operational risks that inherently come with a transition of this magnitude.

Securing high network performance

The purpose-built RAN is built around high performance in all dimensions – spectral, energy, footprint and performance. Multivendor cloud-based RAN is still a bit of uncharted territory for CSPs and the right services partner should ensure that the transition can be done with performance and feature parity to purpose-built RAN. This requires an approach that puts the network and what it should achieve front and center rather than the cloud technology itself.

Reducing time-to-market

One of the benefits of cloud-native ways of deploying and managing the RAN software is that it can reduce time-to-market. It enables CSPs to be much more agile in terms of both constantly improving and updating the network itself, but also to launch new end-user services. The services partner should be capable of setting up and operating cloud-native processes that make it possible for the CSP to launch such services faster and more efficiently.

Controlling Opex

One of the objectives of Open RAN is to create vendor diversity to increase competition and reduce CSP Capex. However, since it also brings additional system integration complexities there is a risk that the potential Capex benefits are offset by an ever-growing Opex. The right services partner should have the processes and capabilities in place to reduce complexity through best-practice processes, automation and an extensive use of AI and machine learning to minimize manual labor.

Unlock cloud-native values

At the end of the day, CSPs want to unlock the key values from cloudification. Three core values from cloud-based RAN can be identified. The first is cloud economics which is allowing for flexibility in deployment options and scalability

of compute resources. As a result, CSPs have the option to choose the hardware and cloud infrastructure that fits them the best and move from high upfront costs to only paying for used resources and at the same time free up IT staff from hardware maintenance work.

The second value is that they can build a common operational model for both Core and RAN based on cloud-native principles. This increases overall efficiency in the management and operations of the whole network.

The third value is to simplify expansion into the enterprise space. Since cloud-based RAN can run on enterprise hardware and use the operational processes that enterprises already use, it becomes a good fit for new offerings such as private networks.

The cloud-based RAN holds a lot of promise for service providers who want to transform their networks. However, its true value can only be realized when CSPs prepare for the comprehensive changes it brings, not just technically, but operationally and organizationally. With the right mindset, tools, and support from their services partners, CSPs can navigate this transformation, harnessing the full power of cloud-native technologies.



