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Disaggregation: The Foundation for Agile Networks

By: Prakash Siva

The demand for more broadband in our hyper-connected world is not slowing down, and service providers are increasingly turning to network disaggregation to leverage a multi-vendor ecosystem, drive down costs, and accelerate digital services innovation. This article will look at how disaggregation drives network agility with increased service velocity and automation. It will also dive into the importance of increased agile development and the role of systems integrators.

The challenge for today's communications service providers

For more than a decade, communications service providers (CSPs) have made huge capital investments in deploying 3G and 4G technology, and they are now in the middle of rolling out their 5G and broadband networks. However, in comparison to the spend, the overall revenues for CSPs have remained relatively flat, while over-the-top (OTT) services are seeing increasing revenue growth and shareholder return (Figure 1 on next page).

The growing performance gap between the CSPs and the big tech companies is stark. Figure 2 on next page from McKinsey & Company shows that while the market is growing exponentially, the overall share of revenue is rapidly shifting from the CSPs to the leading technology companies that provide services on top of this telco infrastructure.

Can open and disaggregated networks bridge the gap and help CSPs grow their share of revenues?

Figure 1: Total Shareholder Return for telcos and technology industry players

click to enlarge

The advantages of an open and disaggregated network

Communications service providers can gain significant advantages by disaggregating the hardware and software components of their networks and by turning to solutions that leverage open interfaces and standards. Disaggregation can result in more scalable, affordable, reliable and agile networks.

Openness and disaggregation are different but complementary concepts. Disaggregation is taking things apart; open indicates that the components are based on open-source technologies and APIs. A network can be disaggregated and still be closed (delivered by the same vendor).

Figure 2: Share of Revenue between telcos and technology industry players

click to enlarge

CSPs can leverage a multi-vendor ecosystem for white-box hardware and merchant silicon, while improving their time-to-market due to access to a larger supply chain. Through the use of open APIs integrated into the control and management systems, CSPs can also gain increased visibility

into their network infrastructure, allowing them to drive intelligent automation into the network. The advantages of a disaggregated and open network can be broken down into four major areas:

Faster time to revenue. Disaggregation allows CSPs to turn up their networks faster and deploy new services with increased velocity. If the unit costs of some components of the system are scaling faster than others over time, or they are required to support innovative services, it is possible to update just the impacted components without re-architecting the entire solution.

Reduced CapEx costs. With a multi-vendor ecosystem, CSPs have more choice in hardware and software, with vendors competing for business based on best-in-class components. Focus on merchant silicon and a range of network, compute, and storage platforms reduces single vendor dependency.

Reduced OpEx costs. By leveraging open, standards-based interfaces (programmatic and RESTtful), CSPs can lower their operating costs. Typically, disaggregated solutions are Linux based along with open, RESTful interfaces. Operating expenses are typically lower since they are not tied to proprietary management tools and interfaces.

Managed supply chain risk. CSPs can mix and match hardware such as optical line terminals (OLTs) and switches from multiple vendors, thereby gaining access to a much larger supply chain. Disaggregated networks should be seen as a key tool in the CSP toolbox to manage and potentially mitigate risk due to COVID-19 pandemic-induced supply chain disruptions.

The elements of disaggregation

There are different elements or forms of disaggregation—both technical and commercial.

On the technical side, a CSP can disaggregate based on separating the hardware from the software. A CSP can also disaggregate based on running functions on the cloud, both the public and the private cloud. Disaggregation can also be based on control and user plane separation, for example using a CUPS architecture. In a 5G network, the CSP can run the control plane in the public cloud, while bringing the user plane—and hence services—closer to the end users in a telco or hybrid cloud location.

A CSP could also disaggregate at the network function and workload level. An example of disaggregation in this scenario is the centralized unit (CU) that is separated from the distributed unit (DU) (see figure 3 on next page).

While disaggregation brings powerful advantages to the table, selecting the right form of disaggregation depends on the functionality and cost profile required to be satisfied by the CSP.

Pulling together highly available performant solutions based on merchant silicon, open-source technologies and vendors remains a challenging task. For these reasons, and to make disaggregation commercially viable, CSPs also need to have access to partners who bring systems integration skillsets, along with any supporting hardware and software development required to pull together the complete solution.

Disaggregated broadband and RAN use cases

Disaggregated open broadband use case

For broadband networks, service providers are moving away from legacy chassis-based optical line terminal (OLT) equipment, and they are leveraging broadband access disaggregation to advance their telco cloud capabilities for greater efficiency and automation.

Service providers are swapping out the complex and costly “black boxes” to new “white-box” solutions with software defined networking control and web-based management portals. Disaggregating the network and deploying an open SDN controller increases networking programmability and innovation.

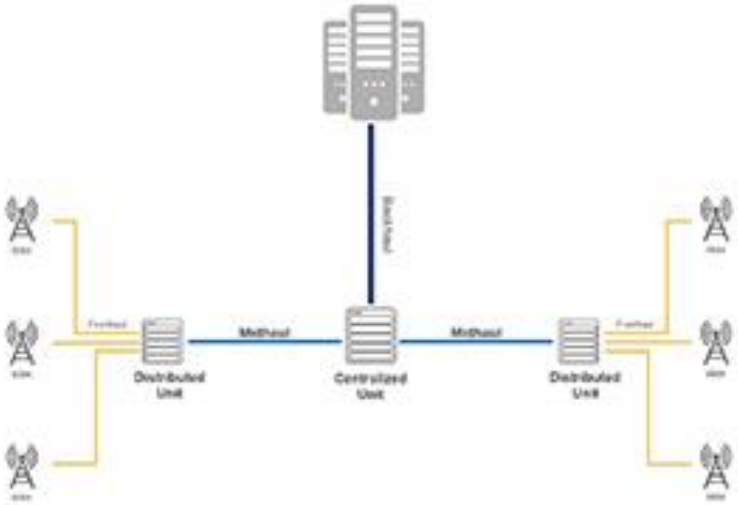

Figure 3: Example of a disaggregated CU and DU architecture
click to enlarge

These broadband access networks leverage open standards from the Broadband Forum (BBF) and the Open Networking Foundation (ONF). The open interface from the Broadband Forum enables the aggregation of service orchestration at the management level. ONF’s SEBA VOLTHA interface allows for the disaggregation of the control plane from the OLT, allowing scaling of the solution in both centralized and distributed architectures (seen in figure 4 on the next page).

Open and disaggregated broadband access allows service providers to realize faster service delivery by eliminating constraints based on single vendor components and reduced cost due to use of white-box OLTs, ONTs and switches. This enables faster broadband rollout and innovation on their own terms and time schedule.

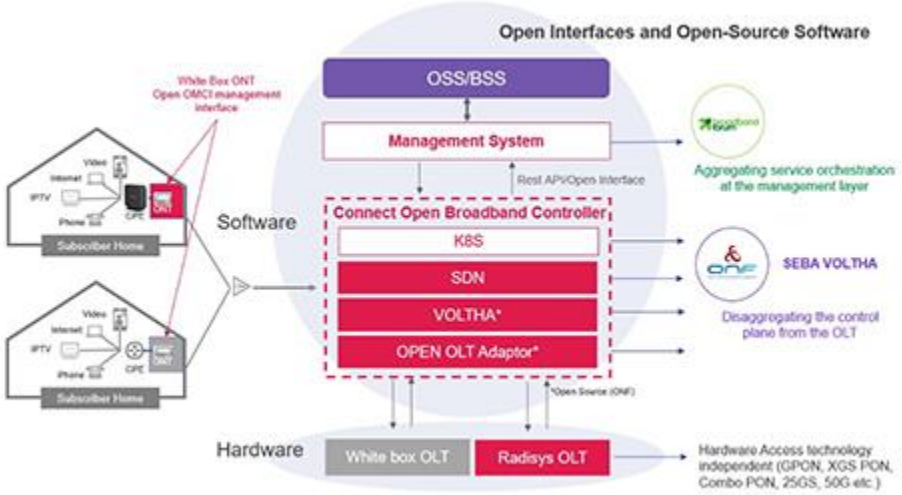

Figure 4: Open and disaggregated broadband architecture
click to enlarge

Disaggregated open RAN use case

Open RAN is one of the hottest topics in the telecom industry and service providers are seeking to build their 5G networks with open RAN-based components. In addition to broad industry support from tier-one CSPs, maturing standards work for open RAN is being driven in the O-RAN Alliance, the Telecom Infra Project (TIP), the Small Cell Forum, and the ONF. There is also a large vendor community delivering multiple COTS and SoC solutions for macro networks, small cells, and private wireless networks. These solutions offer high performance and efficient spectrum utilization along with the ability to run subscriber-specific or required workloads at an edge location.

A disaggregated RAN solution includes three main elements: the centralized unit (CU), the distributed unit (DU), and the radio unit (RU).

Figure 5 below highlights the use cases supported by Open RAN, as well as options for the DU and CU to either be both on premise, or to be separated with a centralized cloud-based CU.

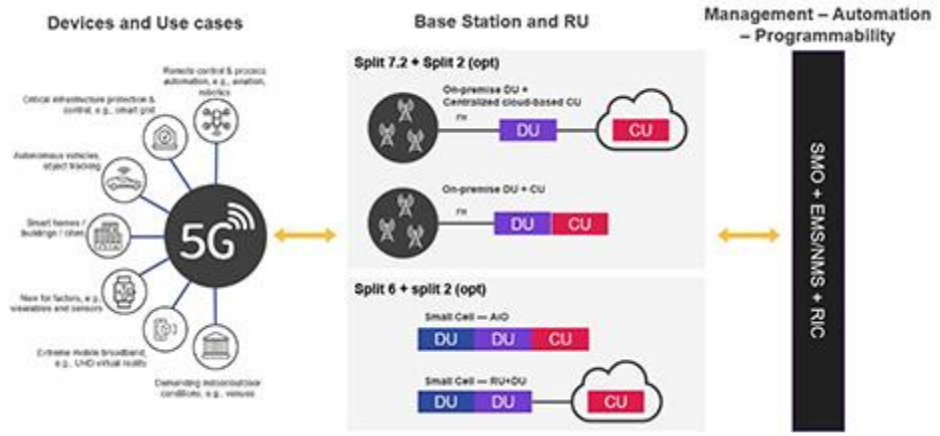

Figure 5: Open RAN supports many use cases
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Increased agility and automation are achieved via the O-RAN Alliance's Service Management and Orchestration (SMO) platform, which supports automation at scale. The introduction to the network of the O-RAN Alliance's real-time RAN Intelligent Controller (RIC) also enables increased automation and changes how the RAN is managed and optimized. An open and disaggregated RAN supports edge computing and IoT by enabling the colocation of the RAN and core user plane closer to the end subscribers to support low latency use cases.

Disaggregated private network use case

With the arrival of Industry 4.0 and the digital transformation of industries, there is an increased push towards private network deployments, which can enable increased automation, efficiency, and security.

Many of these private 4G/LTE and 5G networks are increasingly based on open and disaggregated architectures. These private networks rely on available spectrum—such as locally licensed, shared (CBRS) or unlicensed spectrum—and can be deployed via small cell technology, micro or macro networks, or in-building DAS solutions. Figure 6 below a complete private network that supports moving the user plane function closer to the end users.

The role of systems integrators

Once a network is disaggregated, the components need to be integrated back together for seamless end-to-end functionality and performance. Disaggregated systems require even more validation than traditional monolithic systems as the components are selected from a multi-vendor ecosystem. Systems integrators can play a key role to optimize this complex process while ensuring timely and on-budget delivery of the complete solution.

The use of open, standardized interfaces helps streamline the process, making it easier to aggregate the various components. At the same time, they enable easier development of automated systems for solution validation. A systems integrator such as Radisys that also builds open standards-based broadband and RAN products can deliver additional value to CSPs by bringing to the table deep knowledge of industrystandards, a systems architecture viewpoint with tradeoffs, and hands-on experience in integrating hardware and software.

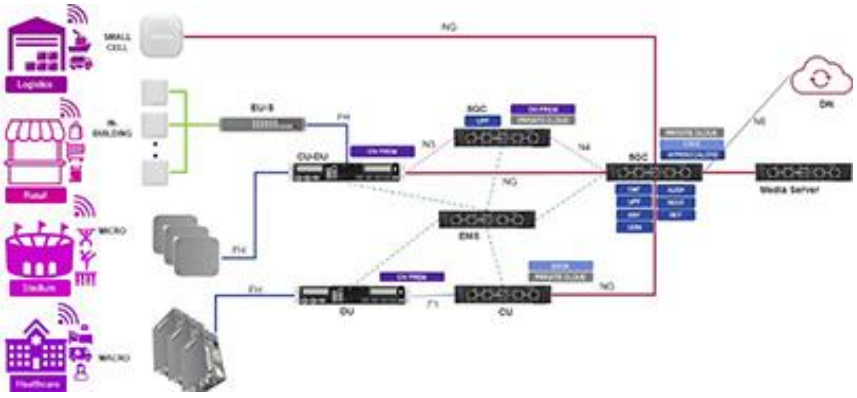

Figure 6: Radisys example of an end-to-end solution offering for private network

click to enlarge

The CI/CD (Continuous Improvement / Continuous Delivery and Deployment) figure 7 below highlights the steps needed for integration as well as continuous multi-year improvements. CI/CD methodologies are used to efficiently develop, integrate and up-level the performance of open source-based systems. While open-source technologies are the foundation for disaggregated systems, significant additional development needs to be completed to ensure scalable, highly-available and performant solutions required by CSPs. System integrators with a product background can apply their product development learnings along with CI/CD processes toward optimized integration activities.

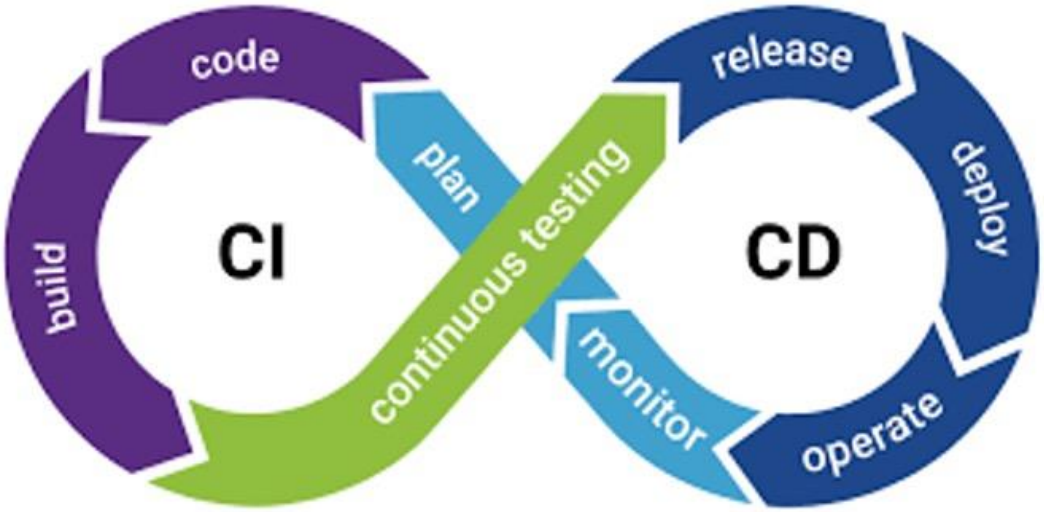

Figure 7: Continuous Improvement / Continuous Delivery and Deployment

Summary

Open and disaggregated networks are the way forward for fixed broadband, mobile and private networks. Through disaggregation, CSPs can:

- Continue to support massive growth in mobility and fixed fiber connections, data usage, and multimedia services
- Reduce long development cycles and eliminate complex integration efforts to create more agility and flexibility
- Address falling margins and ARPU
- Reduce overall CapEx and OpEx
- Accelerate new service introduction and time-to-revenue

There is a mature standards ecosystem, a growing multi-vendor ecosystem of both hardware and software components, along with experienced systems integrators that can aggregate the components back together into agile networks that can keep up with subscriber demand. The time is right for open disaggregated networks and solutions.