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Virtualized RAN Challenges Debunked

Overview

Mobile network operators (MNOs) are now considering ways to take advantage of the benefits that Virtualized RAN (vRAN) can deliver. vRAN gives MNOs greater network availability and better deployment flexibility using pooled, centralized resources that are operating on standardized commercially available hardware. The virtualized functions that provide the network's baseband processing in vRANs also lower CAPEX and OPEX by reducing cell site real-estate space and the power needs of the equipment that no longer resides on-site.

The vRAN architecture centralizes baseband processing resources, which introduces requirements and mandates additional network operation competencies. Virtualization in wireless networks, in itself, is relatively unfamiliar, and questions about its ability to support low latency and new highly available services are front of mind to many. With the distributed nature of the virtualized network, high capacity connectivity between the radio and the processing network is paramount, and many believe there is only one acceptable solution - to increase the number of fiber connections in the system. Another challenge posed is the perception of an overwhelming set of management and operational tasks an operator must track with a virtualized RAN.

While these challenges have merit, there are answers that refute each point. This short paper discusses the technology-enabled solutions and responses that will allow network operators to deploy and confidently manage these virtualized elements in the RAN.

Virtualization Is Not Ready for the RAN – False!

With the new focus on virtualizing the RAN, is the technology that virtualization uses ready to support latency-sensitive applications in the network like voice and video? It is, and here is why.

As networks evolved from 2G to 4G, the RAN functions became increasingly complex. First- and second-generation systems housed the radio and baseband equipment in a shelter at the cell site. To mitigate signal loss between the antenna and the shelter, the cell site separated the baseband functions from the radio by moving the radio onto the tower near the antenna to improve signal strength. Further evolution of the existing baseband functions continued by separating real-time critical baseband functions from non-real-time critical functions. The separation activities created a centralized architecture, moving the non-real-time functions to the service provider's central office or data center, while the real-time functions remained at the cell site. This centralized architecture created the foundation for virtualizing the RAN by proving that baseband processing functions did not have to be in the same location, much less the processor.

In virtualizing the RAN, the RAN performs radio processing intelligence at higher levels of the network without requiring purpose-built hardware required initially to deliver high-quality real-time communications of voice, video, and other latency-sensitive applications. This approach reduces the footprint of the radio equipment at the cell site, resulting in more flexible deployment options that can accommodate a variety of cell site configurations.

Virtualization does not come without challenges. The primary problem comes from disaggregating what had been hardware-optimized functions and placing these functions in reliable software running on high-powered

servers. While challenging, the good news is that the deployment of virtualized technologies in other networks and network functions exposed many of the concerns that the vRAN would encounter. The teams are using their broader virtualization experience to develop optimized solutions for baseband processing. A careful study of the virtualized implementation led to a design that enables processes for time-critical functions at the cell site and non-real-time critical tasks in a centralized location.

The distributed unit (DU) function resides near or as part of the remote radio unit to support real-time critical baseband processing. These essential functions at the radio site provide the sending and receiving of radio's communication with the user. The centralized unit (CU) function resides on commercial off the shelf servers in a central office or data center, providing the coordination and scheduling of activities and resources for use by the radio.

In the centralized locations, the virtualized applications provide high flexibility and increased service availability, as the responsibilities of scheduling and coordination can shift between the virtualized instances with nearly no network disruption. This new architecture not only reduces site costs, but it also simplifies BBU maintenance responsibilities in the centralized location – pooled BBU services minimize service impact during maintenance activities – resulting in an overall reduction in operational costs.

vRAN Requires Lots of Fiber – False!

With the new virtualized architecture, connectivity is critical to the success of virtualizing the RAN, and many believe that fiber is the only option. While the baseband processing functions reside in different physical locations, reliable high-speed connectivity, like that provided by fiber, is a necessity to provide the required processing. Unfortunately, not all sites will have access to fiber resources. Since the real-time critical functions are at or near the remote radio unit, the latency between the distributed unit and the centralized unit can use high-speed connectivity options like microwave to supply necessary connectivity.

Each cell site connects over high-speed connectivity to the baseband processing center using Common Public Radio Interface (CPRI) or Enhanced CPRI (eCPRI) signaling to transport control and user data between the centralized processing and the remote radios at the cell site. With the processor flexibility at the centralized unit and the use of Ethernet over fiber or microwave resources, the vRAN provides the ability to share, optimize, and scale radio resources up and down in real-time without deployment or movement of network hardware to accommodate the necessary capacity.

vRAN Requires Extensive Manual Management – False!

With the software-focused implementation used in the vRAN, some challengers point to visibility, monitoring, and management of the processes as a problem. Centralizing and sharing the management and allocation of baseband resources points to a new way of managing the baseband functions across the network. The virtualized Central Unit (vCU) that is performing scheduling and coordination functions for the cell sites under its control is itself under the direction of automated network management capabilities.

As field-proven with other networks, maintenance and management operations of virtualized components rely on the management and network orchestration capabilities of the virtualized platform. The system continuously designs, fulfills, and assures network services by allocating resources automatically to the network function, resulting in high service availability of the vCU service. When baseband processing reaches defined limits - based on performance metrics or service level agreements, the orchestrator automatically scales up processing resources to handle the increased capacity. Alternatively, when processing on a site is low, the orchestrator can consolidate resources to fewer servers and power down those not being used to save energy and reduce operating costs.

Samsung's vRAN Answers the Challenges

Samsung is providing operators with solutions that use virtualization for many parts of their network, including the RAN, enabling cost reductions for operators. With 5G networks operating in millimeter-wave and sub-6GHz spectrum bands, network operators will require a new level of cell site density for which virtualized RAN components deliver IT scalability using software-driven functions. Samsung's products will play a critical role in evolving carrier networks by offering the flexibility network operators need to develop new innovative services that enable modern cost economies.

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