

Transforming the Radio Access Network

Cloud RAN

The traditional, hardware-based approach to designing and deploying radio access networks (RAN) is no longer a viable solution for operators. Hardware is far too expensive with long development lifecycles that lead to vendor lock-in, making it nearly impossible for operators to keep pace with technology and demographic transitions, especially with 5G around the corner.

5G networks will support a much greater demand for data and massive amounts of new devices with reduced latency and increased reliability, all while operators face decreases in opex and capex with downward pressure on ARPU. While 5G standards are still in development, operators need a flexible RAN in place for today's 4G networks that is adaptive and responsive to evolving infrastructure needs. This evolved RAN architecture must incorporate cloud-centric virtualization techniques with the ability to flex and adapt based on usage and coverage while providing expanded choices in the locations for baseband/element processing and optimized fronthaul.

KEY BENEFITS

- **Dramatic Cost Reduction:**
Operators can save 49% in capex and 31% in opex
- **Front Haul Reduction:**
10x compared to CPRI
- **Expanded Distance Between RRU and vBBU:**
significantly expanding choices in network planning
- **Increased Business Agility:**
provides network elasticity, flexibility and dynamic RAN

Mavenir Cloud RAN: The Disruptive Game Changer

A 2017 Mavenir sponsored Cloud RAN study demonstrates that operators moving to a Mavenir Cloud RAN solution can save 37% in total cost of ownership (TCO) over a five-year period due to a 49% reduction in capex and a 31% annual reduction in opex (Figure 1). The Mavenir solution brings increased business agility, network elasticity, and dynamic RAN optimization and supports processing of the radio interface on COTS Intel processors—significantly reducing the TCO.

Mavenir Cloud RAN extends functional element virtualization to the edge of the network, and provides strategic differentiation by enabling remote radio units (RRUs) to interwork with the virtualized base band unit (vBBU) over ethernet fronthaul at a tenth of the bandwidth proprietary solutions require. The vBBU is designed to support multiple fronthaul architectures simultaneously and opens the door to previously excluded fronthaul transmission solutions.

Centralized baseband processing enables advanced capabilities such as coordinated multipoint (CoMP), centralized scheduling, and interference management without the need to exchange information among many access nodes. This enables resource pooling and coordination of radio resources.

With Mavenir Cloud RAN, service providers can future-proof their networks because the remote radio units (RRUs) designed with software defined radio (SDR) capabilities support simple software upgrades—no more truck rolls and expensive hardware upgrades.

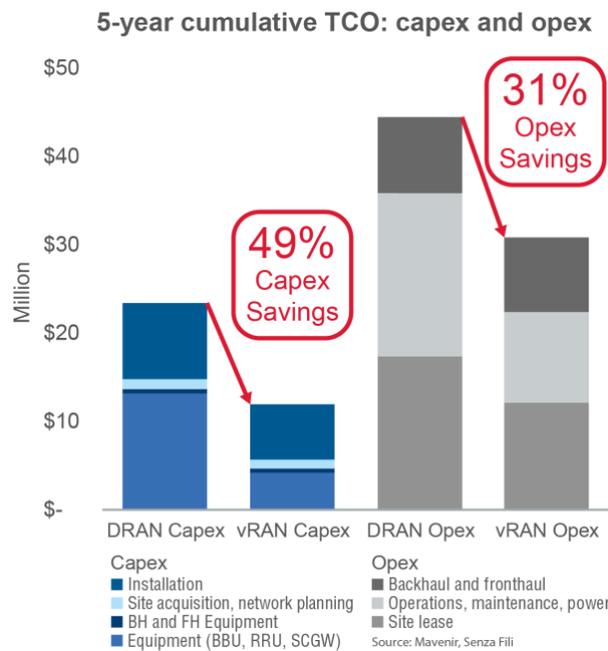


Figure 1- Cloud RAN Savings

Solution Description: Mavenir Cloud RAN

Mavenir’s Cloud RAN approach centralizes the baseband processing in a cloud native vBBU with optimized fronthaul transmission between the RRU and the vBBU over ethernet. The solution provides carrier aggregation (CA) to combine the fragmented spectrum of LTE (both FDD and TDD) in licensed and unlicensed bands (0.7 – 6 GHz), and supports the shared spectrum initiatives of CBRS and Wi-Fi LAA to address increased capacity demands at hotspots and areas with high smartphone data usage. The highly modular software platform brings the benefits of cloud-based virtualization to 4G networks and paves the way for 5G NSA and NR (non-standalone and new radio).

Virtualized Baseband Unit (vBBU)

Coupled with the RRU for radio access, the solution is exclusively based on network virtualization (NFV/SDN) for centralized baseband processing in the cloud (vBBU). Network-wide centralization, coordination and scalability are just some of the benefits. The vBBU is fully integrated with Mavenir’s vEPC and CloudRange™ NFV management and organization (MANO) framework operating on standard open-hardware platforms (COTS). It empowers CSPs with highly efficient orchestration and control of VNF (virtualized network function)

assets, and helps deliver cost savings by including NFV infrastructure elements for traffic aggregation, load balancing and end-to-end service assurance with analytics, monitoring, and orchestration.

The vBBU also incorporates self-organizing network (SON) capabilities for improved RAN performance, capacity, adaptive interference management, and efficient network load management functions. The vBBU supports live migration and dynamic management of RAN infrastructure—alleviating the challenges of a live network.

Mavenir Fronthaul Split Technology: Innovation at the Edge

Mavenir's flexible fronthaul (FH) split is designed to overcome the inherent limitations of the common public radio interface (CPRI) in terms of latency adaptation/tolerance, overhead compression, optimization and proprietary IPR—while addressing the technical challenges of non-ideal FH. The FH solution is ethernet-based and supports transport over wireless or wired elements—actively handling delays up to 16ms round-trip time (RTT).

The FH supports multiple split options at the MAC/PHY interface as well as at the upper PHY. The nFAPI (networked functional API) is supported, to allow connection from other RRU vendors to the Mavenir vBBU. Configurable asymmetric splits on the FH enable unique adaption to U/DL traffic. These capabilities provide flexibility and reduce FH requirements tenfold in comparison with CPRI. QoS sensitive splits are supported through the separation of control and data planes, with the ability to support Multi-Access Edge Computing (MEC) for applications that require low-latency, local HARQ decisions.

Mavenir Cloud RAN: Deployment Scenarios

There is no need to wait for 5G to realize substantial capital and operating expense reductions, along with increased Gbps speed and enhanced QoS compared to the current 4G LTE environment. Mavenir products are designed for today's networks, deployment scenarios, and use cases, with a clear and simple evolution path to 5G.

Network Densification

Mavenir Cloud RAN solutions feature a flexible radio infrastructure that adapts to usage patterns for improved coverage and enhanced user experiences. Wireless service providers can deliver extra capacity and coverage in high data traffic areas, for an enhanced user experience and increased ARPU.

Enterprise Customers

Cloud RAN solutions are neutral host ready and support multi-operator/multi-frequency use cases. The solution enables seamless wireless connectivity in small, medium and large business buildings, campuses, shopping malls, sports arenas, industrial complexes and major retail locations. Cloud RAN enterprise RRUs can be clustered using industry-standard 10GbE interfaces to provide discrete and wide area coverage operating on LTE licensed and unlicensed bands, and feature a Wi-Fi option, all combined to provide a high-value, high-performance enterprise user experience.

Installation, Maintenance and Environmental

Mavenir RRUs are compact, light and unobtrusive. Each version can be mounted on utility poles, building facades, walls, ceilings or street furniture. They can be powered by standard AC and feature craft access through secure remote connectivity for installation and troubleshooting.

Mavenir RRUs can be integrated and configured by zero-touch and auto-script downloading from the EMS (element management system), leading to faster, cost-optimized rollouts of clusters. The RRUs can be managed remotely through the Cloud EMS. Mavenir's RRU design dramatically reduces power consumption by selectively turning off unused carriers on CA, MIMO (multiple input, multiple output) or Tx (transmission) power, reducing energy costs.

Summary

Conventional RAN platforms are based on proprietary hardware and rely on long life cycles in development, deployment, and operation. Cloud RAN enables the separation of some or all baseband functions from the remote radio unit that run as VNFs on commodity hardware, enabling centralized capabilities, such as CoMP, scheduling and interference management, without the need to exchange information among many access nodes.

Mavenir's comprehensive portfolio of fully virtualized VNFs extend the cloud scale to the edge of the network, bringing business agility with network elasticity, dynamic RAN optimization, and lower capex and opex. Mavenir's vBBU supports multiple fronthaul splits simultaneously—making Cloud RAN the ideal choice for a vendor-agnostic, future-proof strategy for CSPs.