Solution Brief

Networking and Communications

Symware™ Server Offers Scalable Platform for 4G/5G Cell Sites

As mobile networks adopt Open RAN, Symware distributed units (DU) have a capacity of nine 5G sectors and offer cell site routing in a single 3rd Gen Intel® Xeon® D Processor-powered server

Radio access networks (RANs) for mobile networks have been built using proprietary hardware-centric systems. But the growth in 5G networks is bringing with it a requirement for networks that cost less, are more agile and offer automated life cycle management.

This is leading many mobile network operators (MNOs) to adopt Open RAN as a more flexible alternative to the traditional RAN architecture.

This paper details how Rakuten Symphony* first generation Symware™ server provides a next-generation distributed unit (DU) device, supporting 4G and 5G radio cell site coverage for mass scale deployment thanks to the features and performance of 3rd Generation Intel Xeon D processors.

5G Growth and the Increase in Base Station Sites

5G growth is accelerating. According to 5G Americas, there were more than half a billion 5G connections made by the end of the 2021, with a forecast to reach 1.3 billion connections by the end of 2022, 2 billion connections in 2023, and 4.8 billion by the end of 2026.[1]

While 5G has a faster data rate than its 3G and 4G predecessors, the higher-frequency signals have a shorter transmission range. Because of these higher spectrum bands, 5G needs 300% more base stations for the same level of coverage provided by 3G and 4G LTE. By 2025, it is estimated that there will be 14 times more base stations deployed on poles and city furniture than in 2017.[2]

The increase in the number of base stations presents challenges for MNOs for total cost of ownership, operations and maintenance, and power consumption. If 5G is deployed in the same way as 3G and 4G LTE, MNOs will see multifold increases in costs and power use.

To effectively support the compounding number of 5G sites, the RAN is undergoing significant shifts in how it is deployed and managed.

Open RAN Deployment and Management Challenges for MNOs

The RAN is the most expensive part of a mobile network, with some analysts estimating it comprises up to 70% of the cost of the mobile infrastructure.[3] The move to Open RAN is helping to reduce these costs for MNOs.

Open RAN represents a major shift in mobile network architectures, allowing MNOs to use non-proprietary, commercial-off-the-shelf components from a variety of vendors. Once-proprietary components that had to be purchased as an appliance from a single vendor and installed at a base station are now disaggregated to centralized units (CU), distributed units (DU), and radio units (RU). These units can also be containerized or virtualized.

This disaggregation is where the costs can be reduced. Where a monolithic baseband unit was once installed at each base station, now only a DU is required at the base station – with the CU serving multiple base stations. Open RAN is envisioned as software running on commercial off the shelf (COTS) servers based on Intel® architecture CPUs. But unlike data center servers, space, power availability, and size are different in an Open RAN server. Remote sites have cabinets that are only 300 millimeters deep, but this is half of the depth of a typical data center server. Greenfield networks also want to minimize their thermal output and footprint, eliminating cabinets altogether and placing RAN components on utility / telephone poles.

Rakuten Symphony's Symware Next-Generation Appliance

Intel® Network Builders ecosystem member Rakuten Symphony's Symware next-generation DU supports 4G and 5G radio cell sites for mass scale deployment. A multipurpose edge appliance, Symware server combines Juniper* cloud native cell site routing functionality and containerized DU software on a single general purpose server platform. This significantly reduces capital and operating expenses for MNOs.

Symware Server Developed Using Intel Processors

The Symware first generation server is designed using the Intel Xeon D processor, a 20-core CPU with a base frequency of 2.0 GHz. The CPU is a member of the 3rd Gen Intel Xeon D CPU family and is a workload optimized system-on-chip built for space- and power-constrained environments. With built-in AI, security, advanced I/O, and Ethernet alongside dense compute, it delivers high data throughput for Symware Open RAN workloads.

With the Intel Xeon D processor, the Symware server is weather-hardened. It has an industrial-grade casing and board. Even as a compact and lightweight device, it can tolerate heat, cold, temperature swings, and corrosion.

The Symware platform features the Intel® vRAN Dedicated Accelerator ACC100, which accelerates layer 1 forward error correction (FEC) algorithms. By removing this compute-centric workload from the CPU, the ACC100 frees up CPU processing power for increased channel capacity on edge-based services and applications.

The accelerator is a dedicated device that works with Intel Xeon D processors to enable low-cost, power-efficient 4G and 5G Open RAN solutions.

The Symware server also utilizes the 100GbE Intel® Ethernet Network Adapter E810. Its innovative and versatile capabilities optimize high-performance server workloads such as network functions virtualization, storage, high performance computing AI, and hybrid cloud. Its high throughput can carry intensive network traffic without impeding data speed.

The adapter also provides the enhanced packet timing capabilities needed to meet the demanding network timing and synchronization requirements of O-RAN deployments. The adapters support IEEE 1588 Precision Time Protocol (1588 PTP) and synchronous Ethernet (SyncE) for high-accuracy timing synchronization and feature an optional, integrated global navigation satellite system (GNSS) receiver with support for frequency, phase, and time-of-day synchronization.

Finally, the Symware server features the FlexRAN™ Reference Architecture for wireless access. This reference architecture can be used with the Open RAN ecosystem to build and deploy highly optimized, feature rich, 4G and 5G scalable cloud-native RAN solutions on Intel architecture.

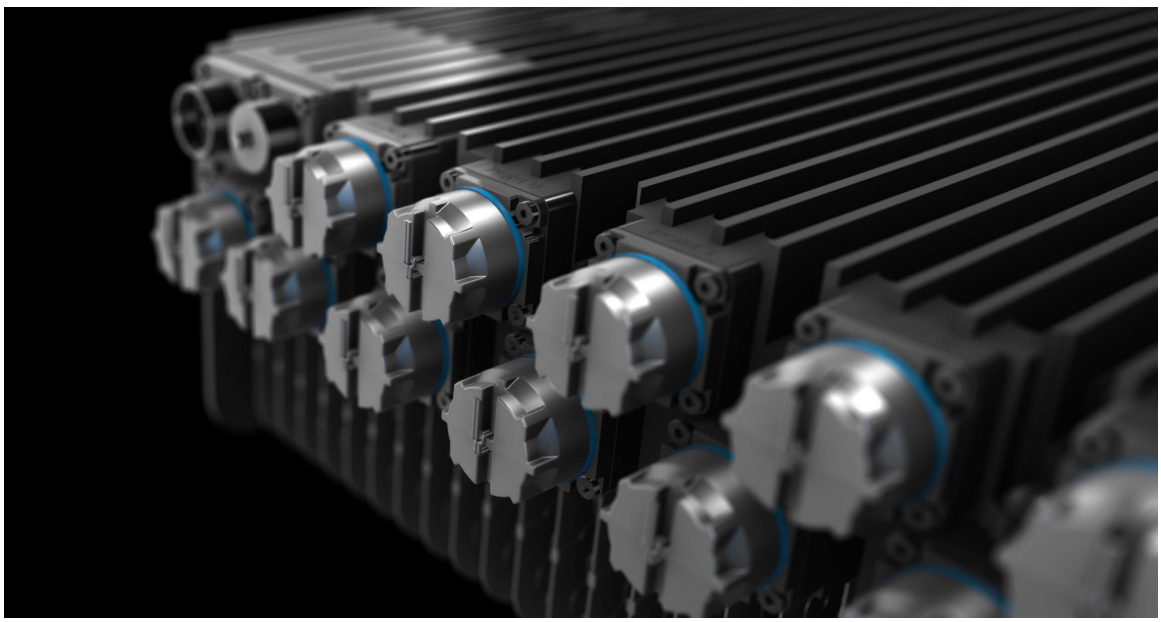

Figure 1. The Symware platform.

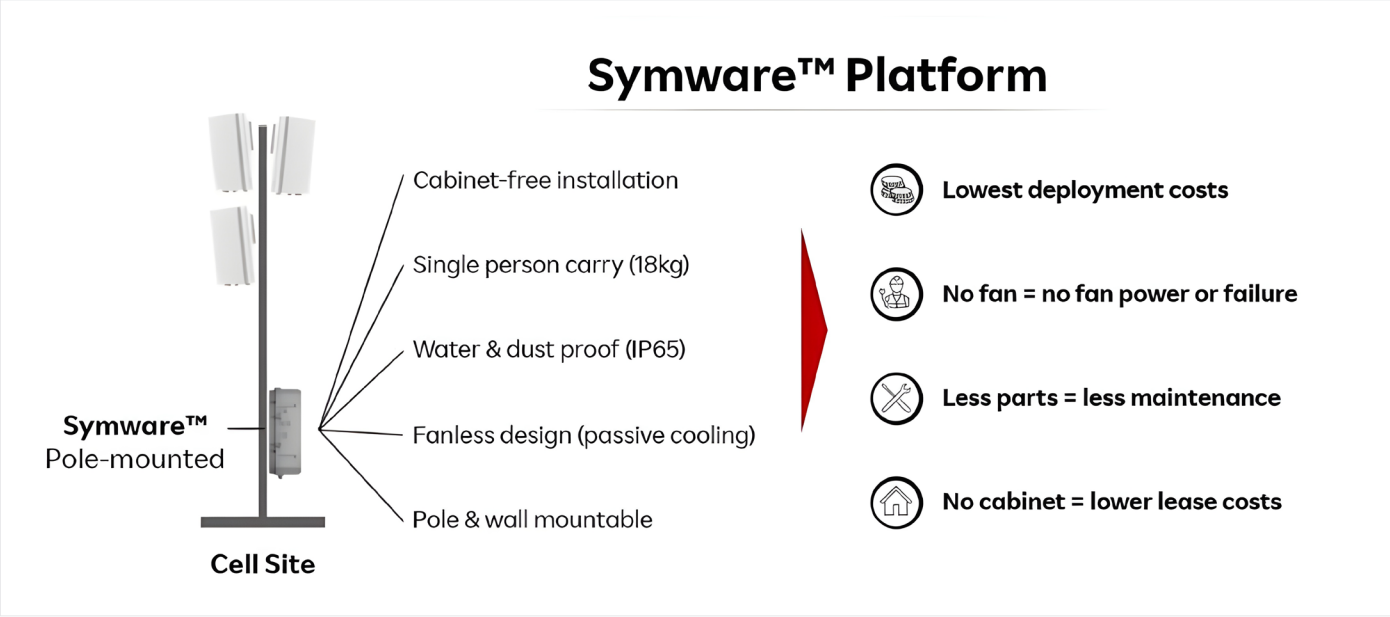

Figure 2. The Symware platform technology architecture.

Built-in Massive MIMO Support

To add more antennas to base stations to improve throughput and efficiency, Symware server supports configuration for massive MIMO. This includes support for 5G Open RAN radio or Common Public Radio Interface (CPRI) radio. Leveraging the latest cloud-native architectures, it supports the RT-kernel, RT-OS, and Lite Kubernetes platforms.

The Symware platform is naturally cooled, waterproof, and with an IP65 enclosure, it is ready for pole site deployment with zero footprint.

A future-proof cell site solution, the Symware server is designed to reduce total cost of ownership for MNOs. With no capital expenditure requirements and turnkey deployment at the site or in an edge data center, it is highly scalable. It features a durable and sustainable design and is multi-purpose and adjustable to the unique needs of a range of cell sites.

Other benefits of the Symware platform include single-person carry design with zero touch provisioning and plug-and-play cabinet-free installation. It is fan-less, does not require fiber connectivity, and is ideal for both greenfield and brownfield deployments. The Symware server improves thermal output and lowers power consumption when compared with traditional DU at a data center.

Conclusion

5G growth is rapidly accelerating. 5G RAN offers the latest wireless communication architecture but requires significantly more base stations to support its faster throughput. Open RAN allows MNOs to use non-proprietary, commercial-off-the-shelf components from a variety of vendors. Rakuten Symphony's Symware server supports 4G and 5G radio cell site coverage for mass scale deployment. The Symware platform combines cell site routing functionality and a containerized DU on a single general purpose server platform, reducing footprint and total cost of ownership for MNOs. Developed in collaboration with Intel, the Symware server is designed using the Intel Xeon D processor, a workload optimized system-on-chip built for space and power constrained environments

Learn More

Rakuten Mobile Open Innovation Lab

Rakuten Symphony Symware

Rakuten Symphony Symware Phase Two Begins with Plans to Commercially Deploy 30,000 Units in Japan

Juniper Networks' RAN Intelligent Controller

Intel® Xeon® D-2796TE processor

Intel® Xeon® D-1559 processor

Intel® vRAN Dedicated Accelerator ACC100

100GbE Intel® Ethernet Network Adapter E810

Intel® FlexRAN™ Reference Architecture

Intel® Network Builders

[1] https://www.businesswire.com/news/home/20220323005107/en/5G-Forecast-1.3-Billion-by-Year-End-2022
[2] https://www.analysysmason.com/research/content/perspectives/5g-key-considerations-rma18/
[3] https://www2.deloitte.com/xe/en/insights/industry/technology/technology-media-and-telecom-predictions/2021/radio-access-networks.html

0523/DC/H09/PDF ♻Please Recycle 355207-001US