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Kontron, Intel Power Integrated Solution for Open RAN, vRAN, and Private 5G

New Far Edge Server solution combines Kontron's unique product design and 3rd Gen Intel® Xeon® D processors for long life, wide operating temperature range, and support for harsh environments.

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6WIND
Virtualized Networking Software

Adoption of 5G continues to gain traction globally, with 5 billion 5G connections forecast by 2030[1] and worldwide economic impact expected to exceed $1.3 trillion.[2] The potential for 5G to enhance collaboration, improve experiences, increase productivity, and bolster security makes this transition inevitable for enterprises.

Private 5G appeals to many organizations because it offers better control over data, performance, and reliability. Moreover, private 5G is poised for growth, with a predicted compound annual growth rate exceeding 40 percent through 2030[3] and more than 1,000 business and government organizations expected to deploy private 5G networks in the same timeframe.[4]

From manufacturing to transportation, retail to hospitality, use cases for private 5G networks abound. However, some organizations may hesitate at the investment required for private 5G. The shift toward open virtualized radio access networks (Open vRANs) is helping communications service providers (CoSPs) reduce the cost of standing up private 5G networks, particularly in space-constrained or exposed environments.

These savings result from disaggregating components in the RAN. The total cost of ownership (TCO) of a traditional RAN—including equipment, site rental, support, maintenance, and energy—accounts for up to 70 percent of mobile network infrastructure costs.[5]

Decomposing RAN functions into a distributed unit (DU) that processes real-time data and a centralized unit (CU) that processes non-real-time data can eliminate the need for custom baseband unit (BBU) appliances. A BBU, typically placed at each base station, can be replaced with a lower-cost DU based on a general-purpose processor, and a single server-based CU can serve multiple base stations from a central location.

The potential cost savings from the disaggregation with Open vRAN is helping to drive the adoption of private 5G networks. And the lower TCO that disaggregated networks deliver is especially attractive for deployments in locations with space or power constraints, or those exposed to the elements.

As a result, DUs built for wide temperature ranges, constrained footprints, environmental exposure, and variable power sources are well suited for industrial and retail deployments, with applications ranging from remote maintenance to digital signage.

Designed from the Ground Up as a Far Edge Server

Kontron Far Edge servers—running on 3rd Gen Intel® Xeon® D processors—overcome several challenges CoSPs face. The servers are uniquely designed for DU applications in the field and are purpose-built to deliver a product lifespan of up to 10 years, operate within a wide temperature range, and support AC/DC power requirements. That makes them an excellent choice for deployment in exposed environments.

This fully integrated generation of Kontron servers—available in rack-mount, fan-cooled, and IP65 versions—is the only far-edge server on the market that includes embedded switching, time synchronization, and dry contacts for sensor control and alarm signaling.

The Kontron Mobile Edge 1310 (ME1310) server offers a short depth and can be installed in a telco closet or connected to an indoor or indoor/outdoor distributed antenna system.

Kontron RS1310 Far Edge server

The Kontron Rugged Server 1310 (RS1310) can be deployed on a pole or wall and connected directly to a radio unit (RU) or distributed antenna system (DAS) to cover large or small areas such as a campus, factory, public venue, or retail center.

These Kontron servers offer a modular platform to support varying I/O and switching options, and they include two PCIe Gen 3/4 slots for added flexibility. The servers' unique capabilities are the result of incorporating more than five years of O-RAN market and Open RAN/vRAN independent software vendor (ISV) partnerships.

Other key platform features include:

- Support for 6WIND's accelerated virtual cell site router (vCSR) with O-RAN-compliant precision timing
- 3rd Gen Intel Xeon D processors with up to 512 GB of DDR4
- Two FH3/4L PCIe slots with 16 lanes per slot (Gen 4, 32 GBps)
- Four M.2 SSD NVMe slots
- On-board switch with IEEE 1588v2 precision clock synchronization
- OCXO options that ensure precise timing accuracy and stability to support autonomous holdover requirements
- Independent out-of-band management network

Transformative Processor Performance for vRAN and Private 5G

Intel® Network Builders ecosystem partners Kontron and 6WIND have teamed up on this high-performance, integrated DU platform that combines full-featured vCSR from 6WIND with a server from Kontron powered by a 3rd Gen Intel Xeon D processor, a 12-port switch, and timing synchronization.

This general-purpose, open-system approach based on Intel® architecture offers a cost-effective, flexible foundation for the next generation of networks compared to fixed-function devices. By supporting the disaggregation of RAN software and hardware, the Intel® FlexRAN™ reference software has helped transform how RAN functions are designed and implemented.

Because Intel FlexRAN reference software is designed for 4G/5G DU workloads, an increasing number of companies have licensed it for their RAN developments as they migrate from fixed-function devices to commercial off-the-shelf computing platforms that rely on general-purpose processors (GPPs).

Though Intel Xeon processors are GPPs, they offer capabilities tailored to cloud, edge, and 5G network deployments. In space- and power-constrained environments, 3rd Gen Intel Xeon D processors deliver density-optimized workload performance—up to a 2.4x performance improvement over previous generations[6]—and can scale up to 20 execution cores with up to 2x 100 GbE networking connectivity.

The Intel Xeon D processors are designed for provisioning compute density at the edge, balancing high computation throughput with low thermal design power and high per-core performance. The processors also deliver advanced security features and built-in hardware acceleration.

Intel Xeon D processors also feature a host of valuable capabilities:

Workload Acceleration

Intel® Deep Learning Boost (Intel® DL Boost) increases deep learning performance by lowering numerical precision, while Intel® AES New Instructions (Intel® AES-NI) accelerates resource-intensive elements of the AES encryption algorithm in hardware.

Intel® Advanced Vector Extensions 512 (Intel® AVX-512) enhances performance for demanding workloads like AI and 5G with ultra-wide 512-bit vector operations. And Intel® QuickAssist Technology (Intel® QAT)—with inline IPsec support—accelerates encryption and compression, freeing up compute cores for other applications.

Security

By creating private execution enclaves, Intel® Software Guard Extensions (Intel® SGX) helps protect data while it is in use. At the same time, memory encryption supports existing software and cryptographically protects memory against hardware attacks using NIST XTS-AES encryption.

Connectivity

Intel Xeon D processors feature integrated Ethernet with up to 100 Gbps of throughput and include a network acceleration complex enhanced packet processor component.

A flexible packet processor and switch accelerate inline packet processing, while up to eight ports at 25, 10, or 1 Gbps offer flexible connectivity options.

Proven Performance, Tested by Intel

With its proven performance and compelling features, dozens of companies have licensed Intel FlexRAN reference software for the RAN developments—with more planning to make the move soon.

The Kontron ME/RS1310 servers were tested by Intel Labs for vRAN performance cases using Intel FlexRAN reference software version 22.11 and Intel's 4G/5G software built for vDU processing on GPPs (Figure 1). The ME/RS1310 servers include the 3rd Gen Intel Xeon D-2700 processor and Intel® ACC100 accelerator card.

The ME/RS1310 servers are perfect for deployment in virtualized Cloud RAN or Open RAN networks, including:

Private 5G networks
Examples: Industrial, retail, campus, smart cities

Indoor networks
Examples: Public venues, conference centers, malls

Macro outdoor coverage
Examples: Hot spots, hole filling, rural coverage

Configuration	Carrier Bandwidth	Antenna Configuration (Transmit x Receive)	Cells Tested (9# Sectors x # Carriers)	Use Cases – 5G
• Kontron ME/RS1310 • 3rd Gen Intel® Xeon® D (20 core) processor • Intel® ACC100 accelerator card • Intel® FlexRAN™ using 22.11 Ubuntu OS **All test cases passed**[7]	10 MHZ - FDD[8]	4x4	18	Private 5G networks, indoor networks, macro outdoor coverage
	20 MHZ - FDD	4x4	12	
	40 MHZ - FDD	4x4	8	
	60 MHZ - FDD	4x4	6	
	80 & 100 MHZ - FDD	4x4	4	
	100 MHZ - TDD[9]	32 x 32 mMIMO[10]	3	Macro outdoor coverage
	100 MHZ - TDD	64 x 64 mMIMO	3	
	100 MHZ - TDD	64 x 64 mMIMO	6	

Figure 1. Intel Labs 5G test cases for the Kontron ME/RS1310

Cost-Effective Integrated Solution for DU Applications

Kontron Far Edge servers' integration of several components, such as Ethernet, routing, and GPS/timing, greatly reduces operators' TCO. Consolidating these functions results in reduced power consumption, improved heat dissipation, a smaller overall footprint, and a higher overall mean time between failures (MTBF). And thanks to the Kontron solution's simplified, accelerated implementation and streamlined operations and maintenance, operating costs can also be reduced.

Reduced TCO is also realized by the Kontron converged edge platform's full remote management capabilities—resulting in fewer truck rolls—and a fully reconfigurable design that can adapt as standards and applications evolve.

Other key features of the integrated solution include:

- Three-in-one integration of O-RAN 3rd Gen Intel Xeon D-2700 processor baseband processing, ITU-T G.8273-compliant timing/sync (PTP/SyncE; GPS/ grand master clock with four-hour holdover), and switching/routing/port aggregation

- True harsh environment support, with an operating temperature range extending from -40°C to 65°C, available in rack-mount and IP65 outdoor versions

- Optimized for remote deployments, with secure remote access for monitoring and upgrades, deployment support that doesn't require tools, 10-plus-year availability, and a high MTBF

- Fully validated 6WIND vCSR

- Layered application support, including content delivery network (CDN), firewall, AI, IPsec, and others

- In full production and directly scalable to next-generation Intel Xeon D processors

The Kontron platform features 3rd Gen Intel Xeon D processors that can scale up to 20 execution cores, with 12 native 10 GbE /25 GbE FH/BH ports. It has been validated with leading O-RAN ISV protocol stacks and supports up to six sector 64T/32R 5G mMIMO. Proof of concept units are available for immediate shipment.
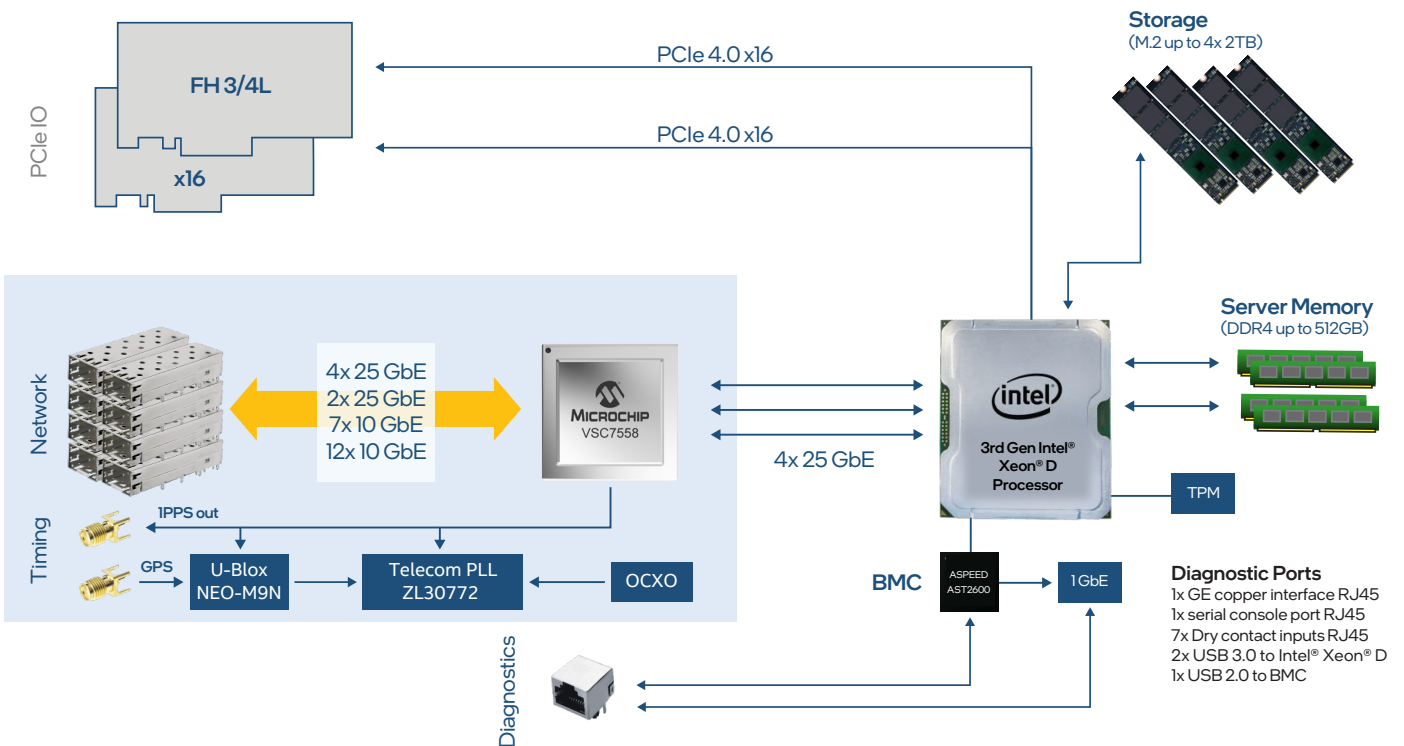

Figure 2. Block diagram of Kontron ME/RS1310 Far Edge servers

Private 5G in the Real World: Use Cases

Private 5G deployments have typically been slowed by environmental and economic factors ranging from exposed physical locations to high operational costs. Now, with Kontron Far Edge servers delivering a long product lifespan, wide operating temperature range, and support for AC/DC power, private 5G deployments are a cost-effective, compelling option.

Potential private 5G industry use cases include:

Industrial

Realize the potential of Industry 4.0 with connected workers, factory controls, and asset tracking.

- Voice/video collaboration, training, and safety management
- Robotics, machine-to-machine, workflows, predictive maintenance, and remote inspections
- Logistics, tracking, digital twins, mapping and navigation, and security

Retail

Deliver enhanced customer experiences while streamlining operations.

- Personalized shopping with interactive mirrors and augmented reality
- Enhanced point-of-sale (POS) with self-checkout and traditional POS capabilities
- Video analytics, including threat and theft detection; digital signage; shopper insights and analytics; and video, holographic wall, and magic mirror applications
- Robotic fulfillment

The Advanced Private 5G Platform

With Open vRAN changing how private 5G networks are deployed, the Kontron ME1310 and RS1310 Far Edge servers—with 6WIND vCSR software—minimize hardware footprints and deliver optimized performance across a wide range of deployment environments and use cases. Powered by 3rd Gen Intel Xeon D processors, the Kontron solution offers an advanced integrated platform for private 5G network deployments, whether indoors or exposed to the elements.

Learn More

To learn more about Kontron Far Edge servers, visit:

- Kontron ME1310
- Kontron RS1310
- Intel® Network Builders
- 3rd Gen Intel® Xeon® D processors
- Intel® Advanced Vector Extensions 512 (Intel® AVX-512)
- Intel® FlexRAN™ Reference Architecture
- Intel® QuickAssist Technology (Intel® QAT)
- 6WIND Virtual Service Router

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2. The global economic impact of 5G, PWC
3. Private 5G Network Market, Straits Research
4. 5 predictions about 5G adoption in 2023 and beyond, TechTarget
5. The next-generation radio access network: Open and virtualized RANs are the future of mobile networks, Deloitte Insights
6. See [9] at www.intel.com/processorclaims: Intel Xeon D. Results may vary.
7. Results may vary by use, configuration, and other factors.
8. FDD = Frequency Division Duplex
9. TDD = Time Division Duplex
10. mMIMO = massive MIMO