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The Edge Server Cookbook

Essential ingredients of an efficient eNodeB solution for private LTE network deployments

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Private LTE networks offer organizations broader coverage, and safer, stronger connections than public Wi-Fi. Signals are more robust and provide operators with more reliability, flexibility and resiliency. Organizations in public safety, defense, and transportation, to name a few, can choose who has access to it, and how the network will perform.

eNodeB hardware is a major architectural component of LTE network infrastructure and is responsible for managing the communication between mobile devices and the network's base station. Kontron's baseband unit (BBU) as a key element of an efficient eNodeB solution for next-generation mission critical networks, has been designed with the capability to respond to high peak workloads and evolve smoothly to 5G.

This "cookbook" is meant to break down all of the ingredients that make up an ideal eNodeB solution for LTE deployments, and explain the advantages of choosing Kontron's BBU recipe.

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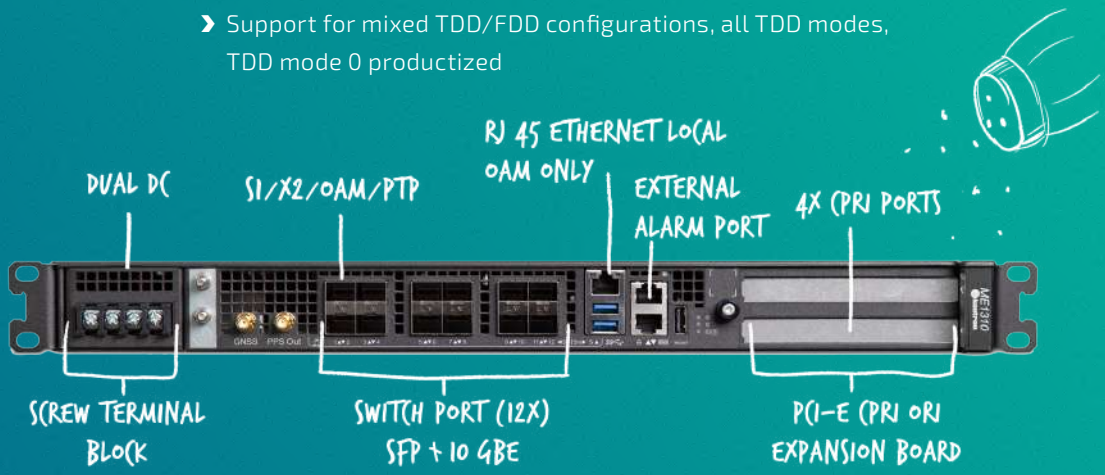
The main dish: ME1210 platform

The ideal LTE network deployment starts with a solid foundation as the BBU – the ME1210 edge computing platform, designed to solve restricted space and power challenges by enabling applications close to the network Edge.

The BBU mixture is composed of the following elements

- x86-based edge server as the BaseBand Unit (BBU)
- Indoor cabinet installations with an IP20 rating (outdoor variants also available with IP67 rating)
- S1, X2, PTPV2, and OAM interfaces through a single 10 GbE IP interface
- Up to four CPRI ORI TDM (Rate 6 | Split 8) interfaces through PCI-E CPRI board for fronthaul connections
- Front access only for all interfaces
- Up to 8 RRH connections and support via optical CPRI link (Fronthaul interface) with star and daisy chain
- Dual feed DC power supply (non-redundant) Single AC PSU (non-redundant AC version also available)
- PTPV2 (IEEE 1588v2) G8275.1 synchronization through integrated 12x10GbE switch with holdover
- Support for mixed TDD/FDD configurations, all TDD modes, TDD mode 0 productized



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Main ingredients

The combination of ingredients helps decrease network congestion and improve the performance of applications by getting task processing closer to the user.
The ME1210 edge computing platform contains 9 quality ingredients in one.

1. Processor

- Intel® Xeon® D-2100 Processor
- Skylake Architecture; Intel® Advanced Vector Extensions 512 (Intel® AVX-512); Built-In Intel® Virtualization Technology
- Selected CPU option for BBU: D-2183IT 16C/2.2Ghz 100W

2. Memory

- 8x DDR4 DIMM sockets, 4 channels @ 2667 MHz support up to 512GB
- BBU is equipped with 64 GB (4x16GB DDR4) memory

3. Storage

- 2x M.2-2230/2280/22110, up to 960GB (SATA or NVMe); Support RAID 1
- BBU is equipped with 1x128 GB SSD M.2

4. Networking

- Integrated Microchip switch (VSC7556)
- Total 12 SFP28/SFP+ Ports (2x 25G + 6x 10G or 12x 10G firmware configurations)
- 4 Internal 10GE connections to Xeon D-2100 integrated X722 controller
- Xeon D-2100 integrated X722 controller
- 4X Direct SFP+ port connection
- 1x 10 GbE connectivity for all backhauling interfaces

5. Timing and Synchronization

- SyncE & PTPV2 with Telecom profile performance
- Master and Boundary Clock modes
- Advanced OCXO to support Hold-Over
- Connector: 1x GNSS input and 1PPS output
- Hosted in integrated Microchip switch and telecom PLL
- Xeon D-2100 integrated X722 controller PTPV2 support
- Synchronization based on PTPV2 IEEE 1588-2008 G8275.1 with SyncE companion (for frequency support).

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Main ingredients

6. Local Diagnostic Ports

- 1xGE Copper Interface (shared Management port) (RJ-45)
- 1x Serial Console Port (RJ-45)
- 4x Dry contact alarm inputs (RJ-45)
- 2x USB 3.0 Interface to Xeon D-2100
- 1x USB 2.0 Interface to BMC

7. PCIe Expansion

- 2x Full Height, ¾ Length PCIe slots with x16 Gen3 lanes
- 75W power per PCIe slots
- Slot 1 is used by CPRI Expansion board

8. Management

- Independent management network support Redfish API and IPMI v2.0
- Secure Remote Management Capabilities (Encrypted firmware, boot, storage, Secure Boot, Failsafe Boot)
- Using TPM version 2.0
- Remote access using KVM & Virtual Media
- In-service Firmware Upgrade capability

9. Environmental

- Operating temperature: -40°C to 65°C
- 1U x 13.5in. (355mm) deep and designed to be mounted in a 19" standard rack
- Operating Input Voltage options:
  - -48V DC (-40VDC to -57VDC)
  - AC 115/230V 50/60Hz (-5°C to 65°C)
- DC supply is considered and therefore nominal Operating Temperature

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Main ingredients

The ideal eNodeB solution

At the root of every efficient eNodeB solution is the right mix of ingredients to enable cellular services for end customers and provide full network coverage. It functions as the LTE base station and allows user equipment to connect to mobile networks

eNodeB architecture coverage

Once the recipe is "cooked" the architecture can be used to provide coverage in the following areas:

- Linear or omnidirectional radio sites for outdoor cellular coverage
- Hot spots like public transportation stations
- Tunnel radio coverage
- Double radio coverage for redundancy purposes
- The BaseBand Unit (BBU) and remote radio head (RRH) are connected by optical fibers to support CPRI ORI links (Fronthaul interface). One can connect the RRH to the DM through:
  - Star topology
  - Chain topology

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Advantages of Kontron's BBU for eNodeB

Flexibility

In order to provide versatile installation options, the BBU and radio frequency (RF) are separated. The BBU is typically housed in cabinets, technical rooms, and co-located with applications, signaling and transmission equipment, while the RRH is installed outdoors.

The following features and functionality provide LTE operators with advanced flexibility:

- High capacity accommodating up to 8 cells per BBU, in a co-located or distributed mode
- High level of integration to adapt to stringent environmental constraints, significantly reducing the required floor space and equipment operating costs
- High resilience with redundancy based on dual layered radio architectures which guarantees service availability to end users even during a hardware failure
- TDD mode 0 which maximizes Uplink throughput (a rigid requirement for many vertical markets)
- Flows segregation and encryption with PKI (Public Key Infrastructure) interworking which addresses 3GPP compliancy needs
- PTPV2 G8275.1 Synchronization for both phase and frequency clocking accuracy with holdover
- Possibility to re-use existing site equipment such as shelters for simple eNodeB integration
- Extended lifecycle based on Kontron's x86 engineering and production capabilities
- 5G Hardware Readiness and scalability through a simple software upgrade
- Easily managed (Performance, Fault, and Configuration) by ad hoc Element Manager RAN EM, northbound interfaced with an NMS solution.

Yum!

Cost savings

The following features contribute to major cost savings for LTE operators:

- Easy transition to 5G based on software updates only
- Architecture flexibility (x86 EDGE computing based) for various topologies and tailor made solutions.
- Reduces site preparation, installation times and OPEX costs

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The complimentary dish: RRH

Another key component of an eNodeB solution is the RRH, which typically sits at the top of a cell tower and transmits and receives signals.

The RRH mixture is composed of the following elements:

Versatile Platform for various bands, productized here in B28 FDD PPDR (3 Mhz BW) and B38 TDD

MiMo 2x2 support (TM3), 20W output power per port

Compact and light weight (less than 12 kgs, 295x200x148 mm)

Designed for outdoor application – Ingress Protection IP67 when installed, limit joint to 2

Designed for optimized operational use:

- Full frontal accessibility for ease of maintenance
- Fully equipped cabinet for easy transportation and fast installation
- Easy handling, no lifting bar mechanism required
- Power source backup via an external battery cabinet
- Extended operating temperature range (-40/+55°C with sun cover)

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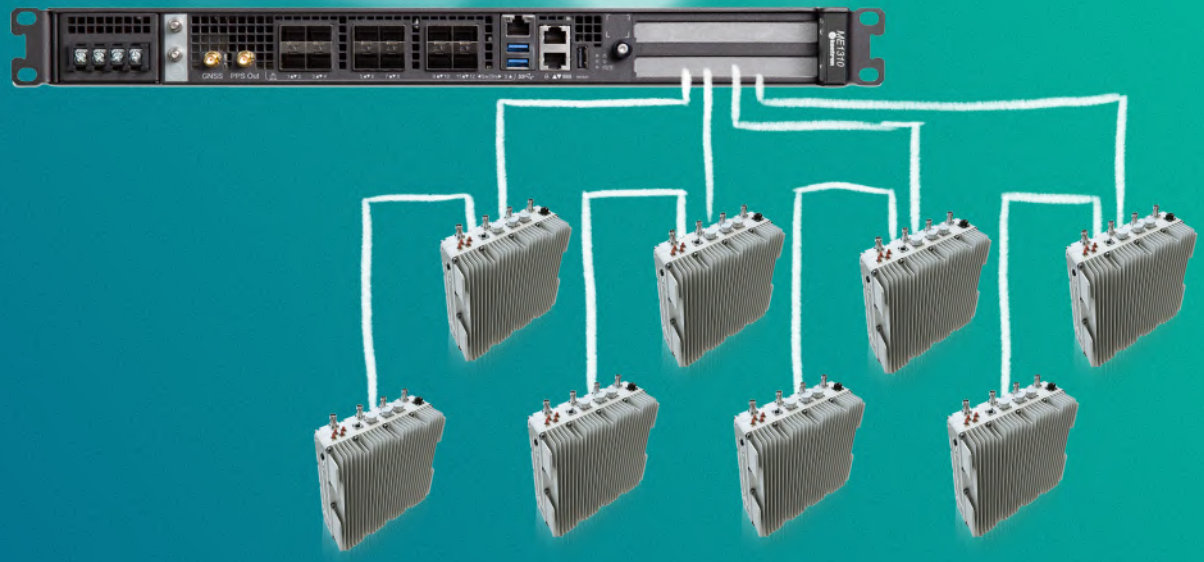
Highest attainable density: 4 CPRI fronthaul links = 8 RRHs / BBU

The ME1210 offers 4 CPRI links that support both star and daisy chain configurations, to interconnect up to 8 RRHs to one BBU.



Software for that extra flavor

For the tastiest results, the eNodeB requires centralized software architecture. The BBU is designed for seamless software integration that helps manage external interfaces and various RRH modules.

The eNodeB is remotely upgradeable, encompassing not only application layers but also assorted BBU and RRH firmware.

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Advanced Kontron BBU for the best results

The BBU acts as a hub for controlling RRU functionality and communicating to the core network, playing a critical role in the processing of baseband signals.

Kontron provides the most advanced BBU as the main dish, for the best possible eNodeB solution. It offers LTE operators in public safety, transportation and defense quality ingredients and a solid foundation that combines flexibility, density and performance in a single box, to streamline and accelerate network deployments.

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