



Runtime Solutions for 5G Access Networks

Key Benefits

- ▶ **High performance** - Runtime performance that supports increased data rates and shorter latency
- ▶ **Scalable** - Scales over many cores with maintained performance and determinism
- ▶ **Flexible** - Flexible solutions allows adaptability to different deployment scenarios and evolving standards.

Enea provides runtime solutions to the world's largest 5G equipment vendors for current and next generation radio access network and baseband solutions. Runtime solutions that are massively scalable, flexible, and meet the stringent requirements for performance and determinism in 5G RAN.

The 5G use cases drive the need for higher data rates, reduced latency, and massive connectivity. As the requirements to process more data faster in the RAN is pushed to new limits, combined with the evolution of the C-RAN architecture, both hardware and software performance must scale far beyond previous generations, not the least in the lower layers of the protocol stack. This poses increasing requirements on the runtime environment for determinism, low jitter, low latency, and low overhead.

Enea offers runtime solutions covering all nodes in the gNB, including RRH, CU and DU. The solutions range from DSP optimized compact real-time kernels to carrier-grade Linux. They provide flexibility to support a step-wise approach to implementing coming NR standards and an evolving C-RAN architecture with minimized need for platform redesign. They allow using homogenous multi-core processors for heterogeneous real-time requirements, promoting reuse of hardware designs for shifting needs.

5G characteristic	Requirement on runtime	Enea advantage
5G will bring significantly higher data rates and lower end-to-end latency.	A high performance and deterministic runtime must provide <math><5\mu\text{s}</math> response time also on many-core devices to support TTI down to 0.2ms.	Enea runtimes solutions provide <math><2\mu\text{s}</math> response time with maintained performance and determinism also when scaled out on many-core devices.
Increased amount of data sent through the mobile network and to and from many more end points.	The runtime must be able to scale over multi- and many-core processors with maintained characteristics to be able to handle the increase in traffic through the RAN.	Enea runtimes scale performance linearly over many cores with maintained determinism. Most other operating systems does not scale well beyond 4 cores.
Macro cells, small cells, hot spots and shifting network topologies increase deployment complexity.	A cost-efficient solution needs to scale and offer flexibility to support different deployment scenarios.	Enea runtimes scale from small to large deployments with maintained performance per core. A higher order of flexibility is achieved since the runtimes easily can be adapted to different scenarios without redesign or changing hardware.
The evolution of the C-RAN is gradual with the "functional split" moving down in the software stack as latency in the fronthaul becomes lower and lower, eventually allowing real-time critical functions to reside in the CU.	Flexibility to support a gradual migration of functions from DU to CU, and a capability to host both real-time critical and non-critical functions.	Enea runtime platforms are scalable to support different sized deployments. Accelerated Linux enables functionality with different real-time characteristics to be consolidated on a single multi-core SoC. It allows a dynamic and flexible hardware utilization that can be adapted to various setups.
The evolution of standards specifications is a continuous process.	Flexibility to support new standards with existing runtime platform keeps cost low and time-to-market short.	Enea runtime platforms run on standard hardware with support for hardware accelerators, which promotes flexibility and scalability.

Flexible and Scalable High-performance Runtime Solutions for 5G

Real-time Accelerated Linux

The Real-time Accelerated Linux framework provides a unified Linux and real-time environment for homogenous multicore processors. It combines an unmodified SMP Linux kernel with a high-performance real-time executive that scales performance over many cores. The framework offers a highly flexible runtime suitable for consolidating real-time critical L1/L2 functions with more relaxed L2/L3 functions running on Linux.

Being able to reallocate processor cores between the real-time and Linux domains without redesigning the whole system provides flexibility to reuse designs for shifting and evolving needs. A single design reduces costs and accelerates development time.

Enea OSE - High-Performance Real-time

Enea OSE is a high performance POSIX compliant real-time operating system. It scales performance linearly over many cores with maintained determinism, offering excellent characteristics for real-time critical applications in the 5G baseband stack and radio components.

For a TTI down to 0.2 ms the preferred OS response time for L1/L2 is <math><5\mu\text{s}</math>, and the determinism must be preserved also when the system is scaled out over many CPU cores. Enea

Proven in use

Every day over 3 billion people use mobile network solutions built with runtime solutions from Enea.

Reliable

One major telecom equipment manufacturer reported they achieved at least “seven nines” (99,99999%) availability for equipment running Enea’s runtime solutions.

OSE provides a response time of <math><2\mu\text{s}</math> on typical hardware and maintains its characteristics and determinism also when deployed on a many-core processor. This means that for the 5G stack the same software solution can be used on systems of shifting sizes, from smaller 4- or 8-core deployments and up to much larger systems, including central units with pooled resources on massive multi-core devices.

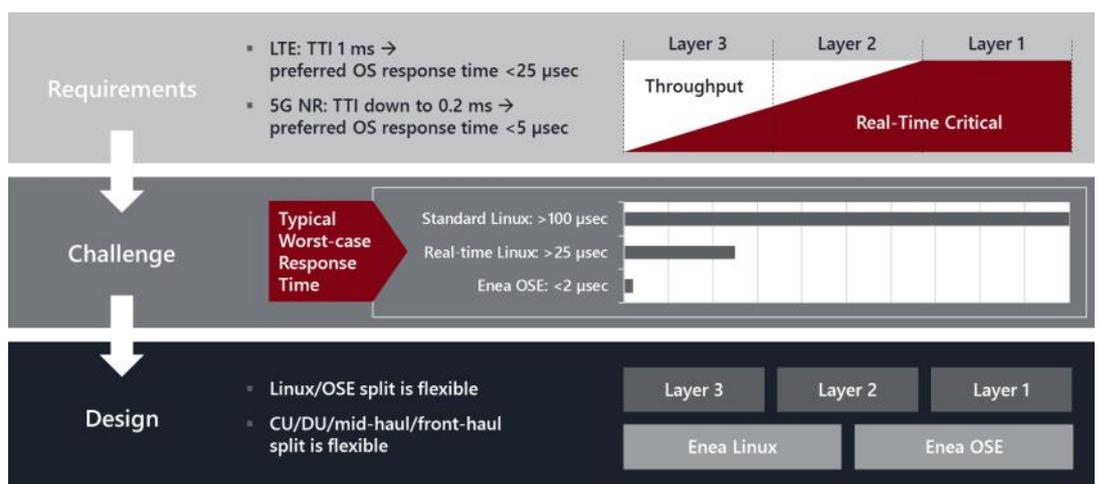
Enea OSEck – Optimized for DSP

Enea OSEck is designed and optimized for use in DSPs. Built on a compact kernel with small memory footprint, Enea OSEck brings rich functionality and true real-time behavior for single and multicore DSP devices, leveraging the processing speed of DSPs in various telecom applications.

Enea Linux – Carrier-Grade Linux

Enea Linux is a Carrier Grade Linux (CGL) certifiable distribution optimized for telecom and networking applications. It provides a robust and secure Yocto-compliant Linux platform which can be custom-tailored and optimized with production-ready board-support packages for standard and custom hardware.

Enea Linux is supported and maintained by Linux experts, reducing technical and financial risks for its users.



Enea OSE can provide real-time characteristics that allows also time critical functions in L1/L2 to be modeled in software.



Enea develops the software foundation for the connected society with a special emphasis on reducing cost and complexity at the network edge. We supply open-source based NFVI software platforms, embedded DPI software, Linux and Real-Time Operating Systems, and professional services. Solution vendors, Systems Integrators, and Service Providers use Enea to create new networking products and services faster, better and at a lower cost. More than 3 billion people around the globe already rely on Enea technologies in their daily lives. For more information: www.enea.com