

Real-Time Linux Acceleration: Addressing Performance-Feature Trade-offs on Multicore Devices

Overview

- ▶ AMP solution for real-time Linux acceleration on homogenous multicore devices
- ▶ Standard SMP Linux accelerated with a real-time executive
- ▶ Type 1 hypervisor provides clean and strong isolation
- ▶ Standard Linux/POSIX API
- ▶ Portable and future-proof through hardware abstraction and standard APIs
- ▶ Hardware platform independent
- ▶ Independent of number of cores, scales easily to different devices
- ▶ Flexible deployment, core assignment at boot time
- ▶ High determinism (low latency and low jitter)
- ▶ High availability through domain isolation

Standard Linux is not well suited for real-time applications. So when the ecosystem and rich feature set of Linux is desired in combination with strict real-time requirements, an accelerated Linux solution provides a runtime without trade-offs between features and performance.

Real-Time Accelerated Linux Solutions

Our optimized real-time accelerated Linux solutions are based on a framework including Enea Linux and an SMP micro-kernel executive. Using the framework we offer customized solutions for multicore devices.

A type 1 hypervisor vertically partitions homogenous multicore devices providing strong and clean isolation between the Linux domain and the real-time domain. It also enables direct hardware access from applications running in the real-time domain, providing uncompromised real-time characteristics.

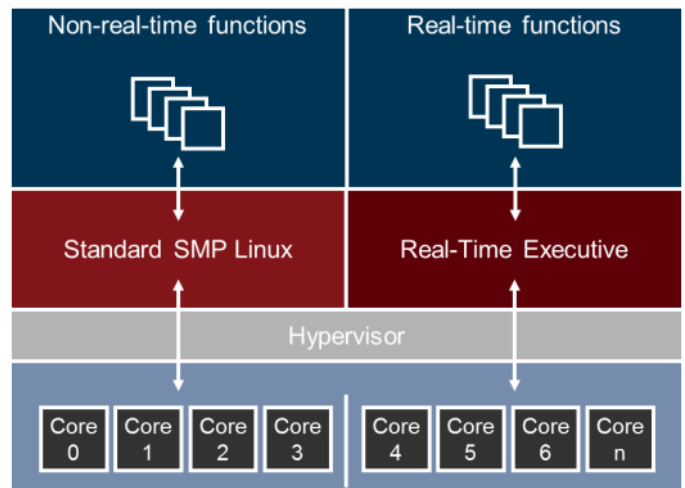
Deployment Flexibility

Solutions built on our framework are independent of the number of available cores in the SoC. Deployed on homogenous multicore processors, it allows full flexibility for how to partition the cores between real-time and Linux domains. Cores can be assigned to either domain (Linux or real-time executive) based on the needs for the application. This makes it possible to easily change the configuration to match new requirements or new hardware platforms.

No Black Boxes

Unlike some other approaches to enable Linux with real-time (i.e. core isolation) with "black boxes" that cannot be debugged in the runtime environment, our framework supports full debug and profiling capabilities of the real-time domain.

Overview of the dual OS partitioning approach to enable real-time in Linux in multicore devices



Shared Resources

Enabled by fast zero-copy IPC between the Linux domain and the real-time domain, both partitions can share a number of services such as file system and debug channels as well as hardware resources. The ability to share resources allows better resource utilization.

Hardware Support

The framework targets real-time accelerated Linux solutions on ARMv8 and x86 homogenous multicore processors. A reference implementation is available for Xilinx Zynq Ultrascale+.

Other targeted processors include:

- Xilinx Zynq Ultrascale
- Xilinx Zynq 70xx
- Altera Stratix 10
- Intel Denverton
- NXP i.MX
- NXP LayerScape LS20XX
- TI Sitara
- NXP B4860
- Nvidia Tegra

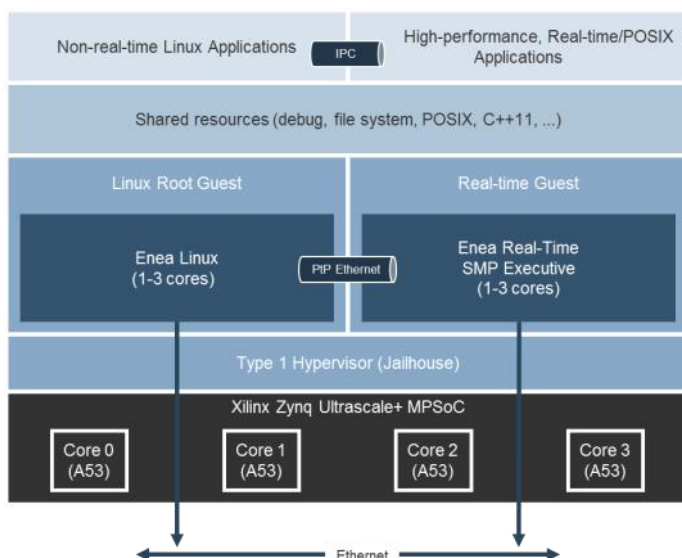
Commercially Supported Multicore OS Solutions

We provide long-term commercial support for all the real-time accelerated Linux solutions we build. We do not just support and maintain the components but the entire solution as such.

All solutions we build are extensively tested and validated to ensure full production quality, also for mission critical designs. A fully integrated and optimized solution delivery reduces risks in development projects and shortens time-to-market. Fully supported and with maintenance and security updates provided by us, not just for the components but also for the integrated solution as such, it also reduces product lifecycle risks and the total-cost-of-ownership.

Reference Implementation on Xilinx Zynq Ultrascale+

Enea has made a reference implementation of the AMP framework on Xilinx Ultrascale+. It sets up the framework on the ARM quad-core Cortex-A53 platform. The division of how many cores are used to run Linux and how many cores that are used to run Enea Real-Time Executive as real-time guest is flexible.



Services on Linux side:

- Startup of Jailhouse hypervisor
- Boot Enea Real-Time Executive
- Establish communication links to real-time domain: Enea IPC, Virtual FS and Ethernet (enable debug Tools suite)
- Debug console to real-time executive on real-time side (terminal window)
- Dump viewer - Visualizes startup & error logging to ram on real-time side

The Real-Time Domain:

- Enea Real-Time Executive in SMP mode
- BSD TCP/IP stack (for fast path user plane data transport)
- Shared File system (mounted Linux FS remotely via IPC)
- Boot & supervision of Cortex R5 cores
- Direct access to FPGA via Xilinx SDK (from both Enea Real-Time Executive and R5)

Evaluation Request

Contact Enea to request an evaluation or a demo of the framework for accelerated Linux on Xilinx Ultrascale+ or any other hardware platform.

- www.enea.com/accelerated-linux
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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