METASAT Platform: High Performance Space Processing for Institutional Missions Using Multicore, GPU and AI Accelerators

Leonidas Kosmidis[1,2], Marc Sole[1,2], Jannis Wolf[1], Matina Maria Trompouki[1], Aridane Alvarez[3]

[1]Barcelona Supercomputing Center (BSC), [2]Universitat Politècnica de Catalunya (UPC), [3]Fent Innovative Software Solutions (fentISS)

METASAT is focused on enabling the high-performance processing capabilities of next generation European Space Missions, including advanced robotics and Artificial Intelligence (AI).

An open source, high performance RISC-V platform which includes a multicore space processor enhanced with the SPARROW AI short vector unit and a GPU is being developed and prototyped in an FPGA.

The platform supports mixed criticality workloads and has a fully qualified software stack which makes it appropriate for institutional missions.

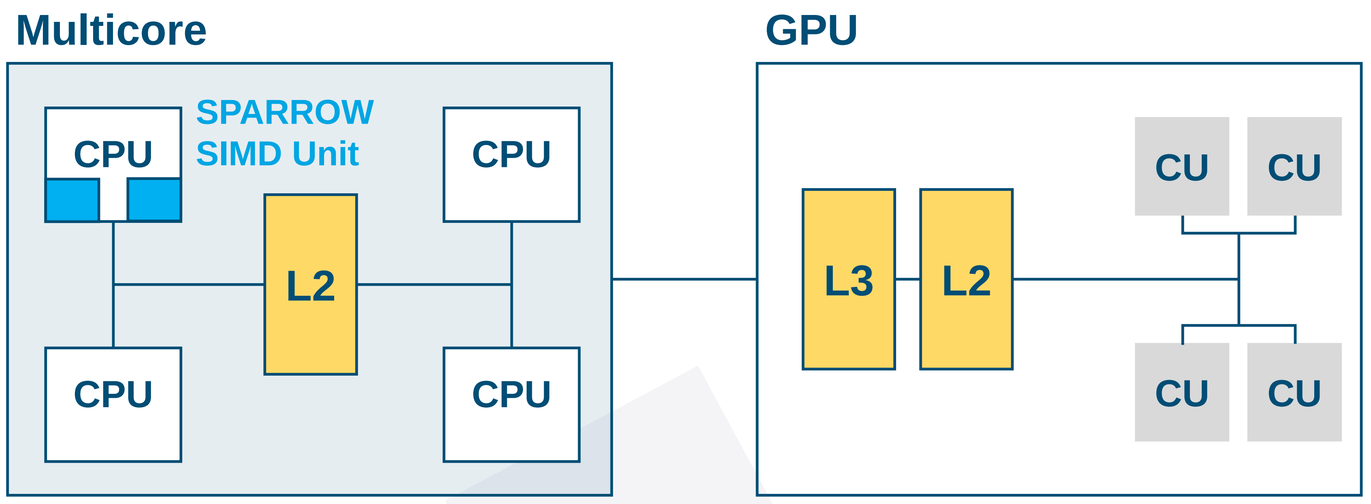
Hardware and Software Overview

The METASAT platform is prototyped on **Xilinx VCU118 FPGA**.

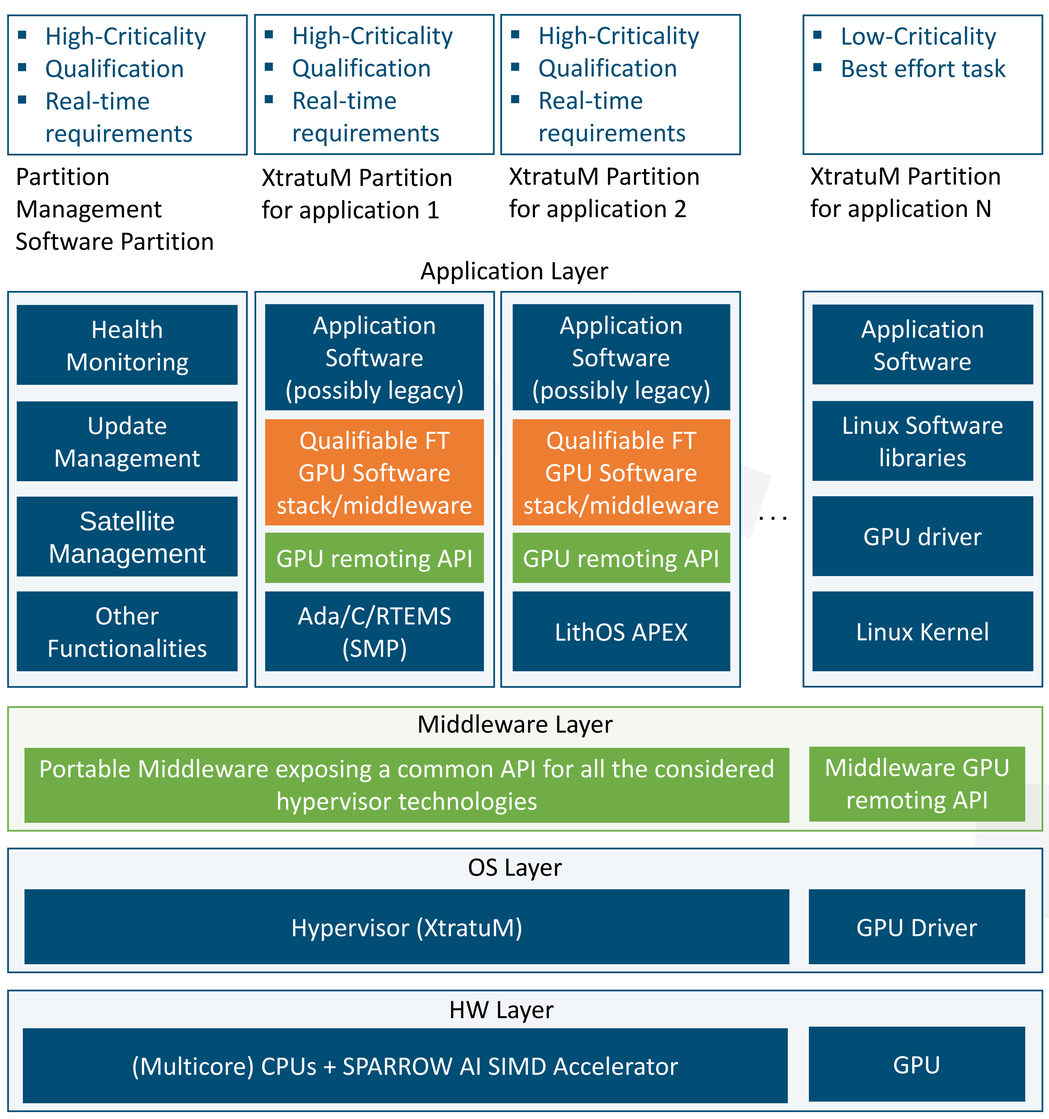
The basis of the METASAT system-on-chip is the GPL versions of NOEL-V and GRLIB from FrontGrade Gaisler, which provides the baseline multicore processor and its peripherals.

The CPU cluster is connected through AXI to a Vortex GPU.

The multicore cluster contains a shared Level 2 cache.



The entire platform is configurable in terms or processing units and cache sizes.



The highest performance configuration of the processor is used, including a dual-issue pipeline, memory management unit (MMU), and support for the RISC-V hypervisor extension.

Each NOEL-V core is integrated with two SPARROW AI accelerator units.
The platform includes a UART and an ethernet device.

The Vortex GPU is also based on RISC-V and can be used either bare metal or under RTEMS.

The **XtratuM NG hypervisor** has been ported to the platform offering time and space partitioning, allowing:

- complete separation of different partitions
- each partition to share the SPARROW AI accelerator and the GPU

Under the RTEMS SMP real-time operating system, multiple cores can be used for homogeneous parallel processing using OpenMP.

Parallel CPU and GPU processing allows to meet performance requirements which are not possible with a single core.

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