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

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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

The platform supports mixed criticality

includes a multicore space processor enhanced with the SPARROW AI short vector unit and a GPU is being developed and prototyped in an FPGA.

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.

hypervisor technologies

workloads and has a fully qualified software stack which makes it appropriate for institutional missions.



 High-Criticality Qualification Real-time requirements Partition Management 	 High-Criticality Qualification Real-time requirements XtratuM Partition for application 1 	 High-Criticality Qualification Real-time requirements XtratuM Partition for application 2 	 Low-Crit Best effor XtratuM Patrix 	ticality ort task artition tion N	
Software Partition	Applic	ation Layer			
Health Monitoring	Application Software	Application Software	Applic Softv	cation ware	
Update Management	Qualifiable FTQualifiable FTGPU SoftwareGPU Software		Linux So libra	oftware ories	taste
Satellite Management	stack/middleware GPU remoting API	stack/middlewarestack/middlewareGPU remoting APIGPU remoting API		driver	Embedded With RTEMS th
Other Functionalities	Ada/C/RTEMS (SMP)	LithOS APEX	Linux k	Kernel	www.rtems.org
	Middle	eware Layer			

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 Al 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



remoting API

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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Gaisler