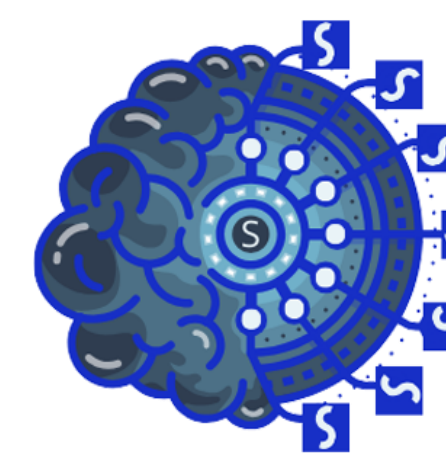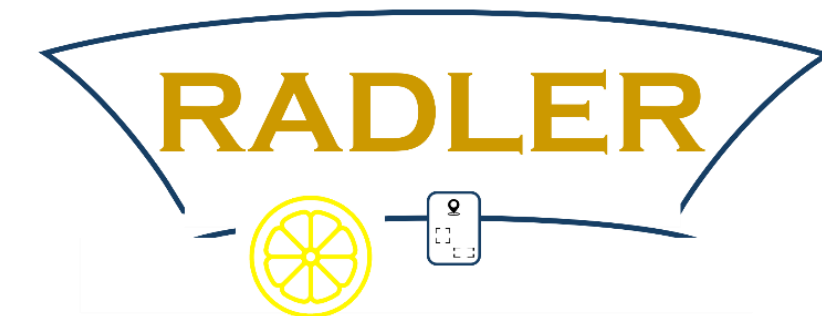# A Safe and Secure Platform for Autonomous Driving

Leonidas Kosmidis, Eric Rufart, Jannis Wolf, Guillermo Vidal, Marc Solé, Juan Carlos Rodriguez, Matina Maria Trompouki, Sergi Alcaide, Jeremy Giesen
Barcelona Supercomputing Center (BSC)

BSC Barcelona Supercomputing Center
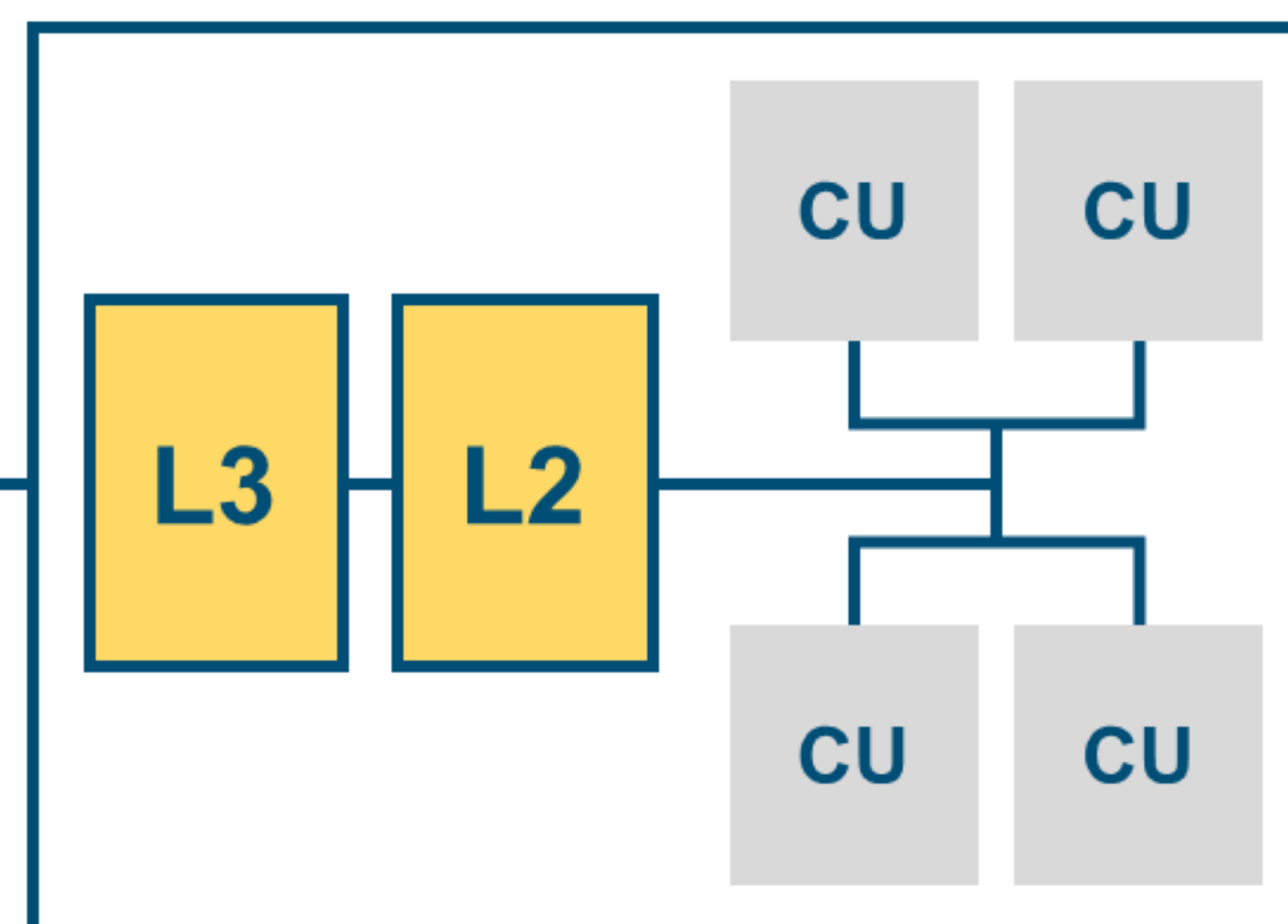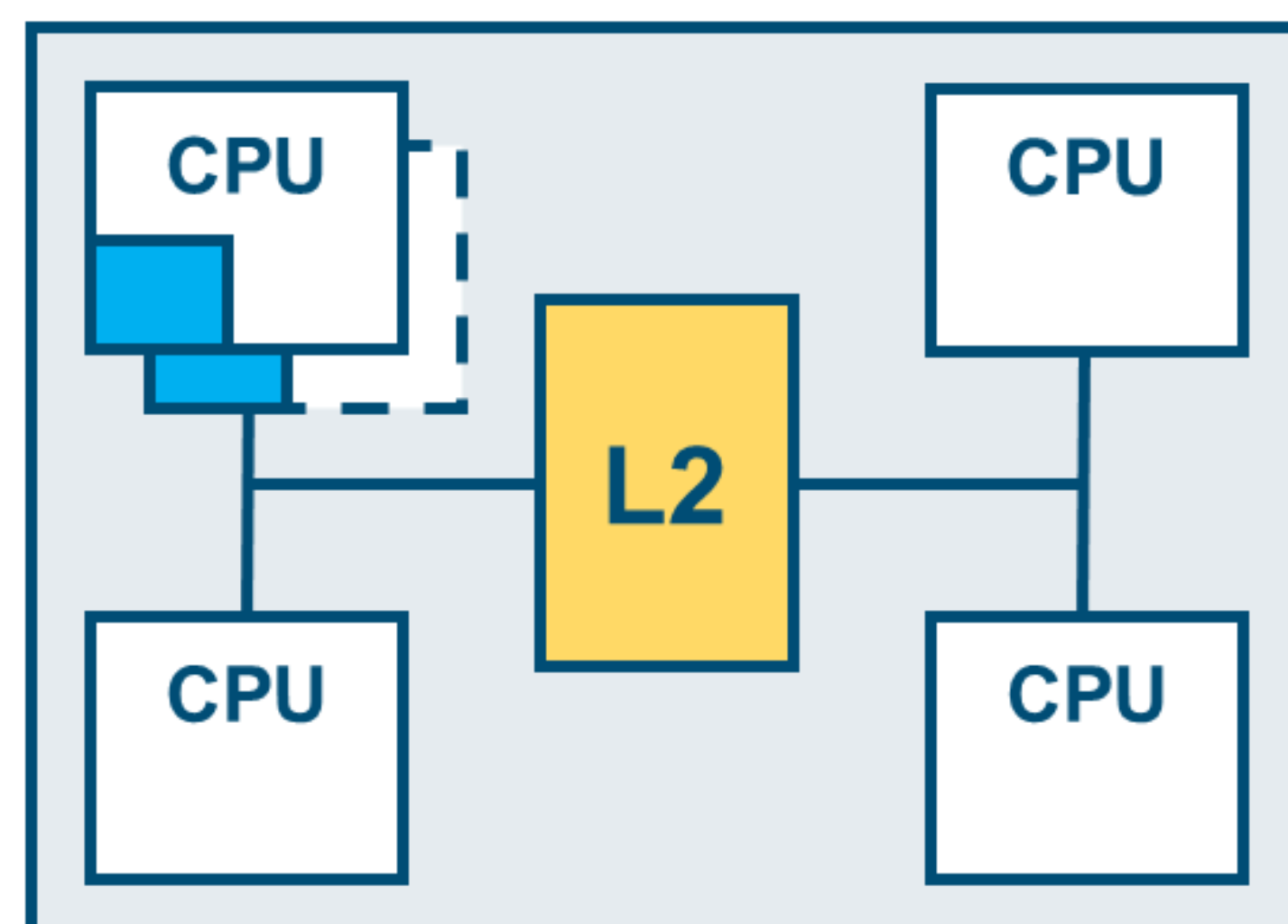Centro Nacional de Supercomputación

METASAT

SMARTY

RADLER

The Hardware Platform

RISC-V

BSC Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Application Multicore Island

CPU

SPARROW SIMD Unit

CPU

L2

CPU

CPU

GPU

CU   CU

L3   L2

CU   CU

AXI

SPARROW SIMD Unit

CPU

CPU

Scratch pad

CPU

CPU
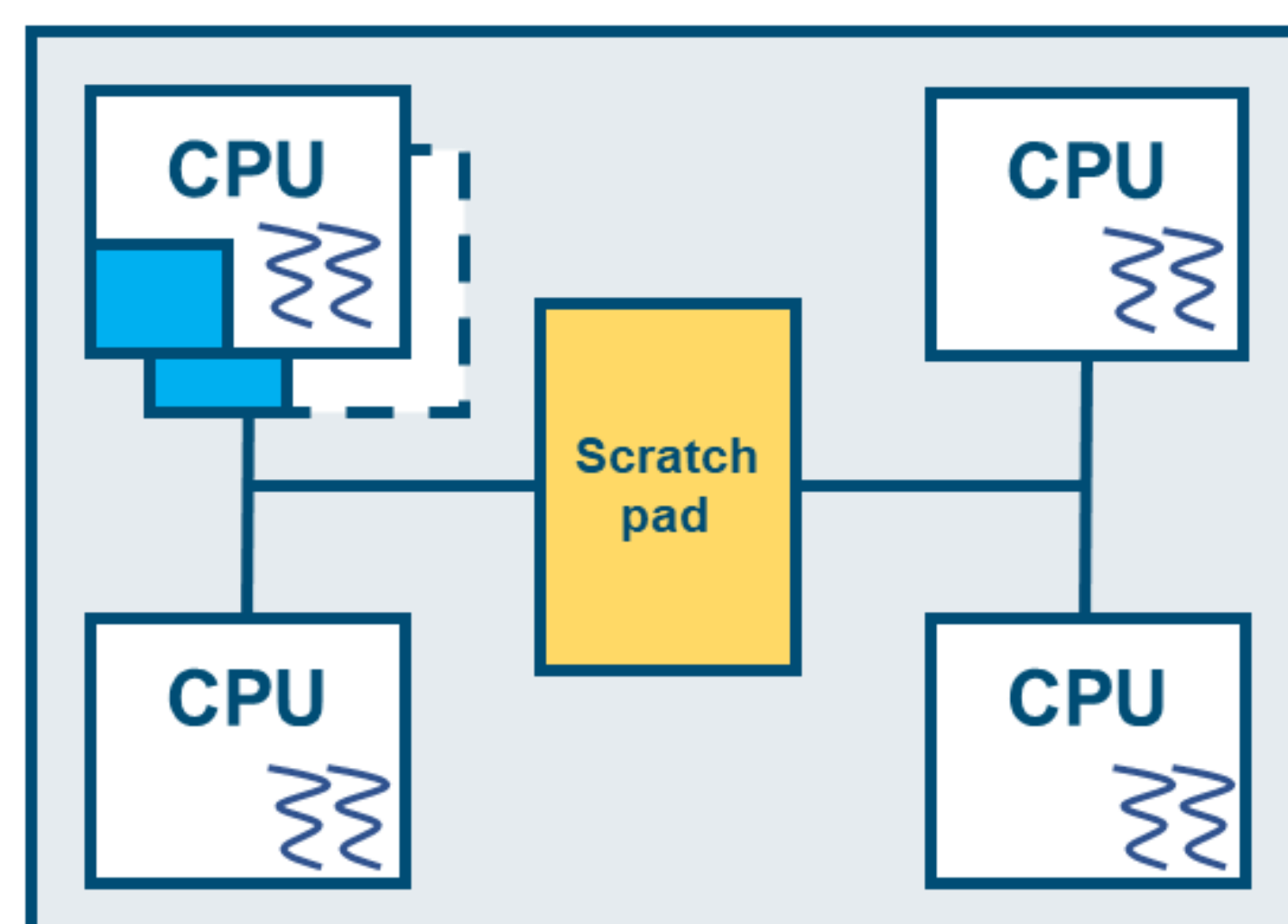
Implemented on a AMD Xilinx Virtex Ultrascale+ (VCU118)

VIRTEX UltraSCALE+
XILINX ALL PROGRAMMABLE.

Safety Multicore Island

RISC-V platform for high performance in critical systems

- Veer as the Safety Multicore Island for safety critical workloads.
- Sargantana as the Application Multi-core Island for high performance CPU workloads.
- Each CPU has been extended with SPARROW, a SIMD acceleration unit tailored for AI.
- Vortex GPU for dedicated accelera-tion using a GPGPU.
- Implementation on an FPGA and simulation using QEMU.
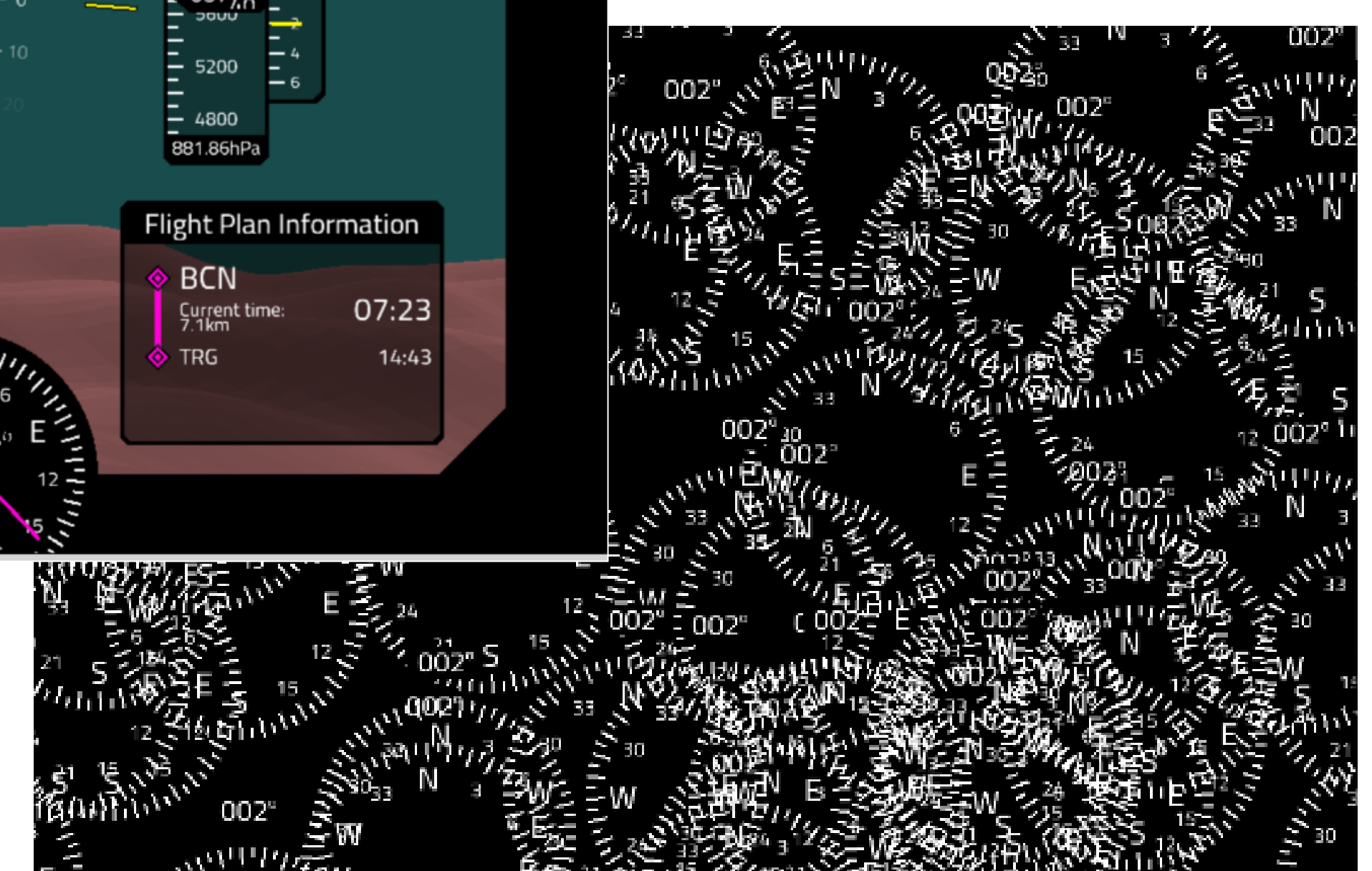
The Software Stack

Automotive AI use case

- Traffic sign detection application
- Support for non-Linux environment as RTEMS and baremetal.
- Support for TensorFlow Lite Micro.
  - CPU, SPARROW acceleration and GPU acceleration.
- 3x performance speedup
- Additionally ESA's OBPMark-ML suite are supported.
  - Cloud screening: 2x
  - Ship detection: 2.55x

Avionics use case

- OpenGL SC 2.0 driver support for Vortex
- Primary flight display demonstrator
- Configurable library of widgets for safety critical GUIs.
- Can be used also for safety critical GPU benchmarking
  - Allow to emulate stressful conditions for the GPU

ChipsJU