Workshop on High-performance Computing Platforms for Dependable Autonomous Systems

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A number of high-performance computing (HPC) commercial off-the-shelf (COTS) platforms offer the computation capabilities needed by autonomous systems in domains such as automotive, space, avionics, robotics and factory automation by means of multicores, GPUs and specialized accelerators. Unfortunately, the utilization of HPC platforms has been traditionally considered out of the reach for the safety-critical systems industry due to the difficulties or roadblocks these platforms bring to the certification process. This workshop focuses on the research towards the adoption of HPC hardware and software platforms in the context of safety- and security-critical applications. In particular, the scope of the workshop includes functional-safety and security requirements for HPC systems, including but not limited to non-functional aspects such as time-predictability and energy consumption.

The goal of this workshop is to bring together practitioners and academics working in the area of high-performance safety-critical applications and to allow them exchange ideas on how to address the main challenges of this important topic. In particular, the workshop features three different sessions covering: (1) hardware, (2) software, and (3) certification. For each of these sessions we have invited two speakers. Four speakers are affiliated to the industry and two are from the academia. Three of the talks target specifically automotive, space, and avionics domains. The other three talks present challenges that are common across domains

The first session starts with a talk about "Open Source Hardware: an opportunity for critical systems" by Jimmy Le Rhun from Thales Research and Technology. This talk analyzes the new opportunities that the development of open-source computing platforms using the open RISC-V instruction set architecture will bring to the safety-critical systems industry. The second talk of the hardware session will be given by Jan Andersson from Cobham Gaisler and will present the "Development of a NOEL-V RISC-V SoC targeting Space Applications". As Jan explains in this talk high-performance computing platforms bring new opportunities to the space market and will also allow traditional space companies to reach new opportunities in other safety-critical application domains.

The second session focuses on software platforms for autonomous systems. The integration of complex software functionalities challenges the validation and verification steps required to assess the conformance of the system to domain specific safety standards. To make complex autonomous systems economically viable new innovative approaches are required. The first talk of this session is given by Evin Arnautovic from TTTech and focuses on the requirements of safety-compliant software platforms for automated driving systems. In the second talk, Irune Agirre from Ikerlan will talk about "Safe and secure software updates on high-performance embedded computing systems". In a context in which safety critical applications will be mostly driven by software, frequent software updates are unavoidable. This talk focuses on how to efficiently deal with software updates in safety-related applications.

The third session will feature two talks covering some of the challenges high-performance autonomous applications face in the context of functional safety certification. Nicholas McGuire, technical leader of the OSADL Safety Critical Linux Working Group analyses how to tackle the certification of complex systems with a talk titled "Approaching certification of complex systems". This talk analyses the best approaches to certify complex systems in the context of the IEC 61508 standard and how this can be applied to complex software systems like the Linux kernel. Finally, Jose Hernández-Orallo from Universitat Politècnica de València presents "AI Safety Landscape: from short-term specific system engineering to long-term artificial general intelligence" an ongoing global initiative to create a worldwide, consensus-based and generally-accepted knowledge base of structured subareas in artificial intelligence Safety.

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