# Partitioned Control Systems

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Real-time control activities are crucial in all critical systems such as avionics, space, railway, industrial and medical systems. A consolidated theory to analyse these systems from the control and real-time points of view has been developed during the past. From the real-time point of view, different theories have been developed to consider different circumstances that can add flexibility to the analysis. Some of them that can be cited are: control activities with optional and unbounded parts or allowing some deadline misses in specified intervals, combination of control activities with hard and soft time constraints, or architectural issues where distributed systems have played a fundamental role to isolate control activities according to their temporal constraints and the need of certification.

Now, new terminology has been consolidated and embedded or cyber-physical systems are the way to integrate the control systems in a more open execution environment. Also, mixed-criticality systems are the term that identifies systems with activities (mostly controllers) with different levels of criticality. Some theories dealing with mixed-criticality systems has been elaborated.

These trends have been driven by advances in computer architecture and specifically by the evolution of multi-core systems. The processing capability of multi-core embedded systems permits multiple applications on a single shared hardware platform, even if some of them are time-critical applications. Under these circumstances, the time-critical and non-critical application should be integrated into the same hardware. One of the most promising approaches to mixed-criticality systems is the use of multi-core execution platforms based on a hypervisor.

Additionally, it is necessary to consider the interconnection of the systems through Internet (Internet of Things) and the security issues that it is required.

In this talk, we will analyse the evolution of real-time control systems and present current software architectures that permit to consider all these issues: multi-core processors, mixed-criticality constraints, safety and security, certifiability, etc.