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Management and Control of Cyber-physical Systems of Systems

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Abstract

Cyber-physical Systems of Systems (CPSoS) are large physical systems with many interacting elements that are managed, controlled and monitored by distributed interconnected computer systems. These systems, from railway systems to large production sites, are vital for the welfare of the European citizens. They are characterized by distributed control, supervision and management, partial autonomy of the subsystems, dynamic reconfiguration of the overall system on different time-scales, continuous evolution of the overall system during its operation and the possibility of emerging behaviours. The CPSoS Project (www.cpsos.eu) has performed extensive consultations with industrial and academic experts and has identified three core research and innovation areas for Cyber-physical Systems of Systems: Distributed, reliable and efficient management of CPSoS, Engineering support for the design-operation continuum of CPSoS, and Cognitive CPSoS.

In the presentation, we will focus on the distributed management of CPSoS and explain the challenges in this domain for the examples of electric vehicle charging and coordination of petrochemical production sites. Distributed management methods that do not employ a centralized optimization instance will be presented: population control and market-based coordination of systems that have to balance production/consumption networks.