On the Schedulability of Real-Time Discrete-Event Systems

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Cyber-Physical Systems (CPS): Orchestrating networked computational resources with physical systems

Military systems:
- E-Corner, Siemens

Automotive
- Daimler-Chrysler

Power generation and distribution

Building Systems

Avionics

Telecommunications

Instrumentation (Soleil Synchrotron)

Transportation (Air traffic control at SFO)

Factory automation

Courtesy of Doug Schmidt

Courtesy of General Electric

Courtesy of Kuka Robotics Corp.
Ptides: Programming Temporally Integrated Embedded Systems

Platform 1
- Sensor 1
- Computation 1

Platform 2
- Sensor 2
- Computation 2

Platform 3
- Computation 3
- Computation 4
- Actuator 1

Network fabric

Physical plant

Local Event Source

Model time delay $d_1$

Model time delay $d_2$

Merge $e(t',v')$
Schedulability Problem

- WCET per actor
- Sensor & network input models
- Does the program always meet the deadlines?

Challenges:
- Difficult to identify worst-case scenario
- Expressiveness of programming model
Schedulability using Timed Automata

Input Automata
one per sensor

Task Automata
one per actor in the model

Scheduler Automaton
one per platform