Contribution and challenges of multiagent simulation for factory digital twin

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SOLYSTIC
a NORTHROP GRUMMAN company

LABORATOIRE HUBERT CURIEN

CONNECTED INTELLIGENCE

Coactis
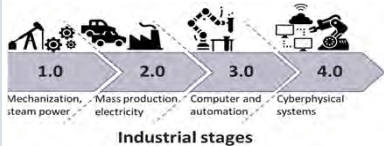
Digital twin
A key technology for the Industry of the Future

Industrial stages
1.0 Mechanization, steam power
2.0 Mass production electricity
3.0 Computer and automation
4.0 Cyberphysical systems

➢ One of top 10 **strategic technology** trends for 2019 (cf. Gartner)

➢ A factory digital twin serves as a **virtual replica** of what is actually happening on the factory floor in near-real time

SOLYSTIC
SOSi™


SOSi™

➢ **SOLYSTIC** is a provider of solutions for mail and parcel industry

➢ **SOSi™** is an inhouse developped factory/supply chain digital twin; simulates **1 production year in 10 minutes**

➢ Enables **digital VSM** and **optimization of processes**
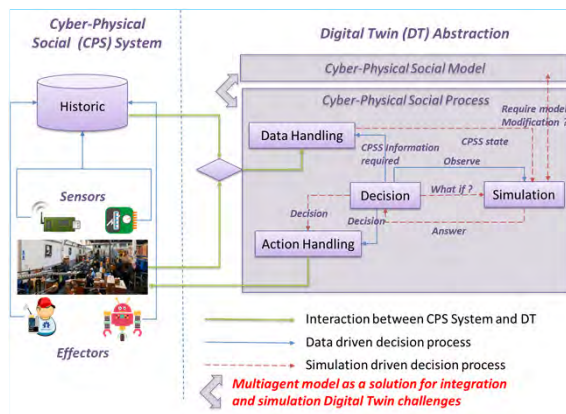
Multiagent approach
A bottom-up modeling approach for modeling a CPS System

➢ **Agents** for modeling goal-driven decision processes

➢ **Environment** for modeling information perception and actions

➢ **Interaction** for modeling influences between components

➢ **Organization** for modeling formalized and\or implicit rules

Multiagent model of a CPS System
A solution for making easier the transition

➢ **FROM Simulation as a tool for Observation**: to understand the behavior of the reference system thanks to a model that is considered as a miniature reproduction of the reference system

➢ **TO Simulation as a tool for Validation**: to test an hypothesis of the reference system, to validate or to certify the underlying theory.

Why?
A CPS System is often

➢ **Complex:** the global behavior of the system is hard to model and any modifications is difficult

 ➢ **Multiagent solution**: The global system is not explicitly designed

 ➢ **Multiagent solution:** The multiagent concepts can be understood by non-experts

➢ **Open**: new component may be added to the system leading to a modification of the initial model

 ➢ **Multiagent solution:** only the new components and its interaction with other components must be designed

➢ **Heterogeneous:** different decision models, data models, …

 ➢ **Multiagent solution:** the resulting model is independent of the domain and can integrate several point of views.

➢ Decentralized: many local decisions without a centralized control

 ➢ **Multiagent solution**: decentralization management is the core of a multiagent system.

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