Cyber Physical Systems:
Opportunities and Challenges for Software, Services, Cloud and Data

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About NESSI

- Networked European Software and Service Initiative
- European Technology Platform dedicated to Software, Services, Cloud and Data
- Ca. 500 members
- 22 partners (full members)
CPS Recommendations

Software Engineering
- open world, adaptive systems

Cloud Computing
- distributed computing, multi-tenancy

Big Data
- edge, IoT, context analysis

Software-based Services
- value-add, instance-based architectures

Opportunities

Challenges

+++ Security (not in this talk), but, NESSI white paper available from http://bit.ly/2fpYmY3
Software Engineering for CPS

- **H-CPS**: Human-Operators-in-the-loop CPS ("Cockpits")
- **C-CPS**: Crowds-in-the-loop
- Software innovation (through advanced software engineering methodologies)

- Quality assurance of CPS in the presence of dynamic adaptation and discovery
- Middleware and platforms for dynamic evolution and composition of CPS
- **Powerful abstractions for understanding and modelling CPS** (e.g., context models)
Cloud for CPS

- Scalability, elasticity and availability (through cloud, fog and edge computing)
- Infrastructure cost reduction

- Real-time data collection, analysis, and actuation
- Multi-tenancy in CPS infrastructures
- Dependable and predictable cloud “SLAs” for CPS
- Cloud services and platforms for CPS construction and deployment
CPS and Big Data

- Leveraging Big Data analytics for CPS adaptation
- Greater customization and smartification in the products and services (customer segmentation, insight on each individual customer, ...)
- Assuring CPS assets stay online (predictive maintenance)

- Handling massive data production (volume, velocity, variety)
- Distributed (decentralized) data storage and processing
- Monetizing Big Data stemming from CPS
- Data visualization (in a decentralized setting of CPS)
Software-based Services creating Value with CPS

- Instance-based architecture for a “true” Business Network of Things
- Software-defined Industries (= Digitalization, Industry 4.0, ...)
- Service architecture for software-based services on top of CPS
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