

A System-level Digital Twin for Smart Manufacturing Systems Using Software Defined Control [SDC]



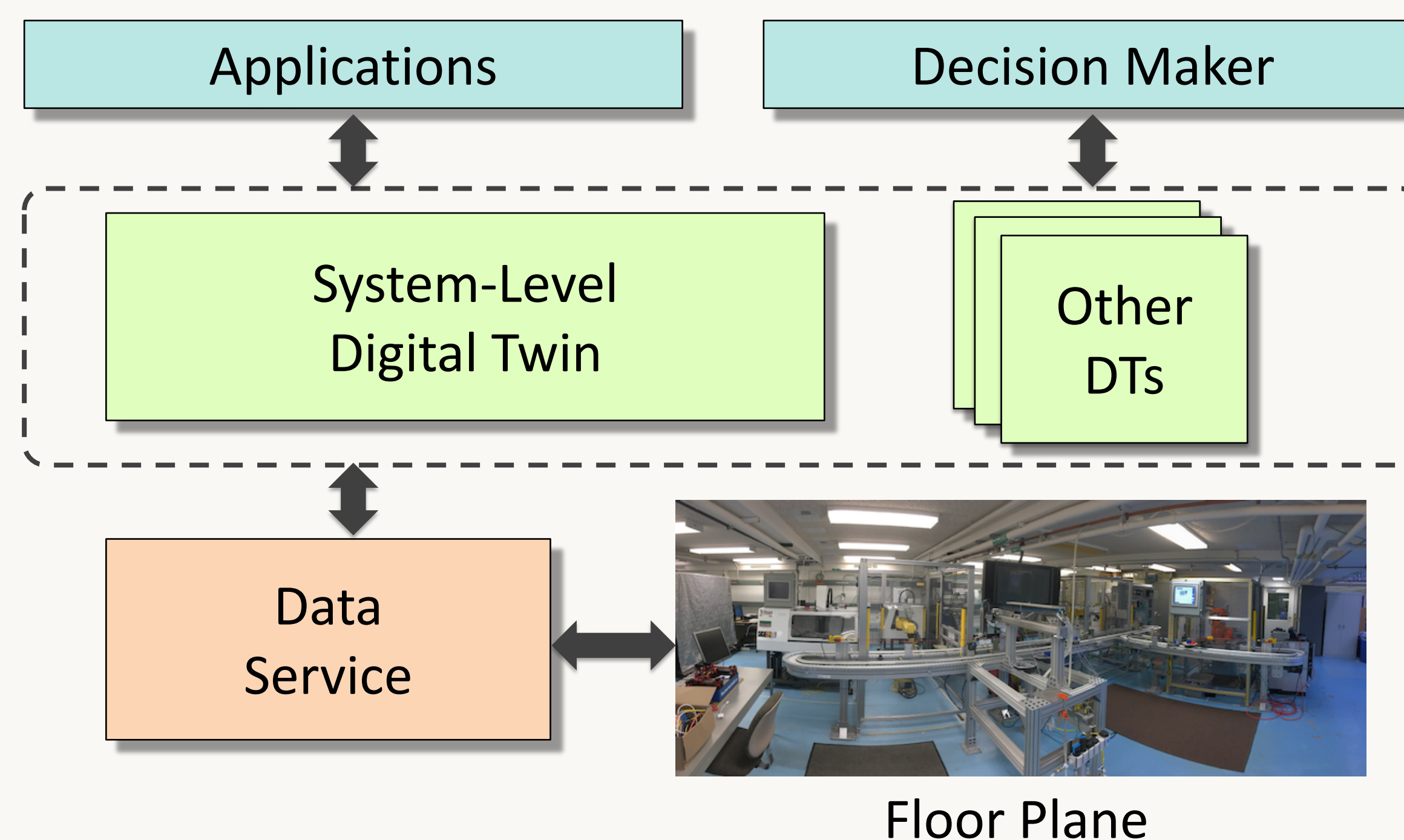
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Challenges

- Discrete manufacturing systems are complex cyber-physical systems (CPS)
- Centralized control & monitoring
→ **Software Defined Control**
- Need for bridging physical world (production plane) and virtual world (a formal model) in real-time
- Need for predicting future manufacturing states (for deployment verification or production projection)

SDC Framework

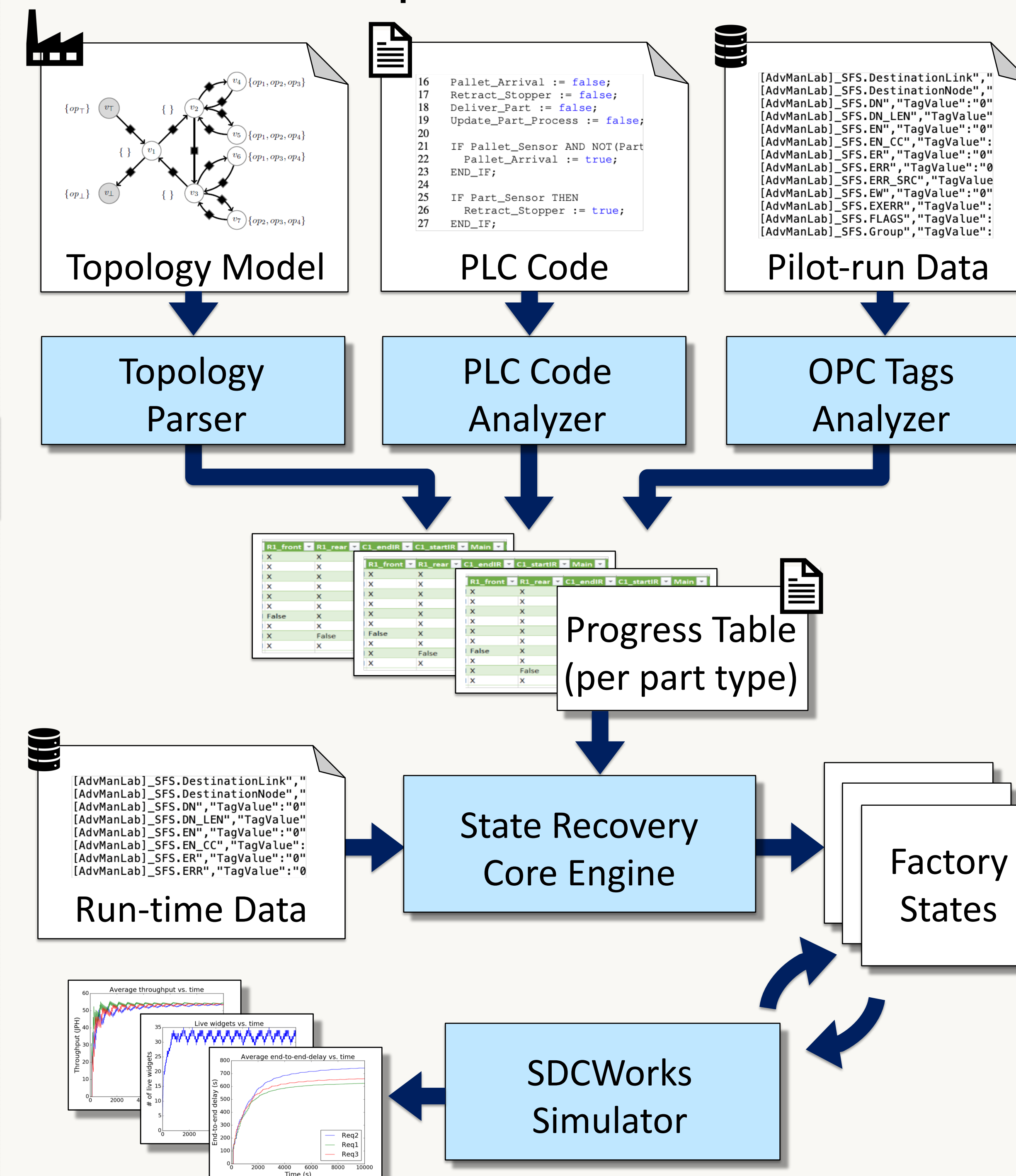
- SDC-powered digital twin architecture:



Solution

SDC-based System-level Digital Twin

- Manufacturing system progress interface (MSPI)
- System states reconstruction and future states prediction



Scientific Impact

- A system level digital twin for smart manufacturing system based on SDC
- Capturing real-time behavior of manufacturing systems backed by formally verified modeling framework (SDCWorks**)
- A bridge between physical world (production plane) and virtual world (a formal model)
- **Predict future manufacturing states** for various applications (e.g., anomaly detection, performance projection)
- An open source tool set

Broader Impact

- Improved quality, efficiency and productivity in manufacturing
- **Educational outreach:** SPLASH program (a programming language class) at the Urbana Middle School