RESEARCH TOWARDS DESIGN OF CPS FOR SMART FACTORIES

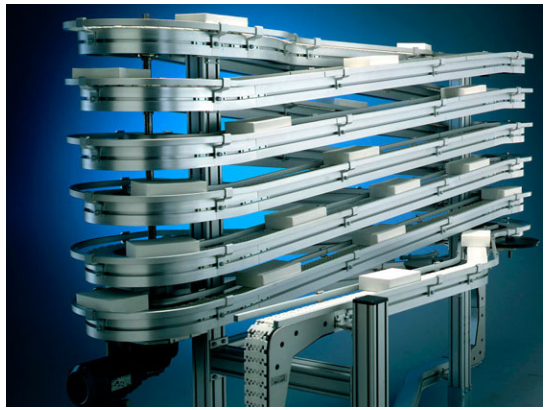
2018-09-25

FLEXLINK®

a coesia company

FlexLink

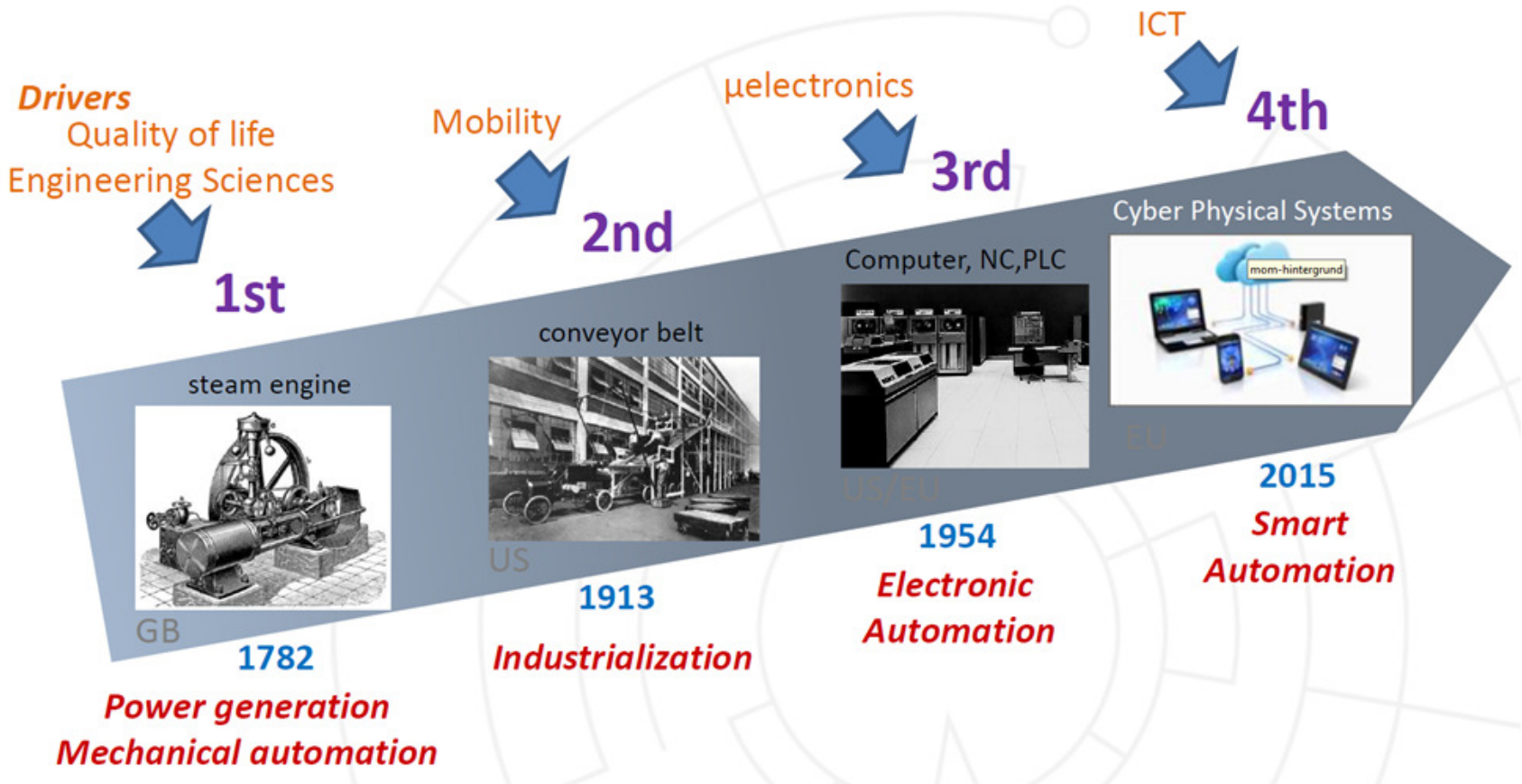
- 1100 employees
- Provider of high-end solutions to manufacturing industries such as: food, beverages, personal care, healthcare, automotive and electronics.
- Operating units in 30 countries



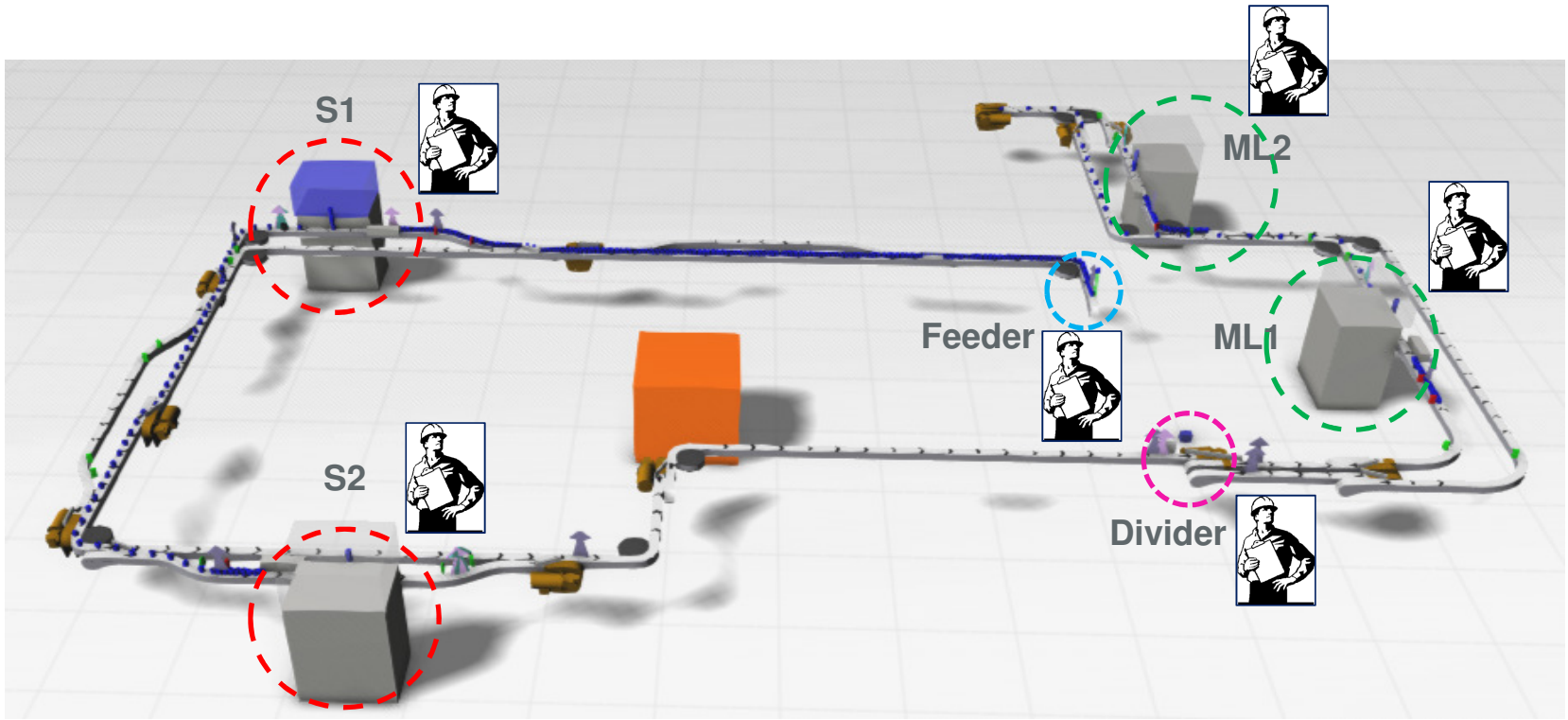
New business strategy for FlexLink

FlexLink has a new business strategy. Responding to the fast changes in industry as a whole, we aim to re-invent our entire company over the next five years (from 2016 to 2020). The commitment and engagement of each and everyone at FlexLink is crucial. It is a great challenge – with great rewards at the end of the rainbow.

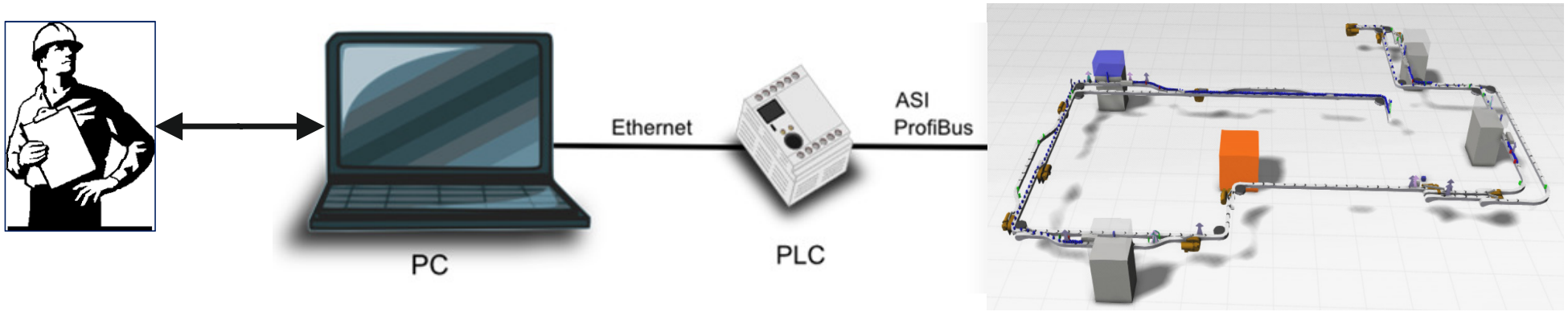
Industrial revolutions



Fast dynamic production line



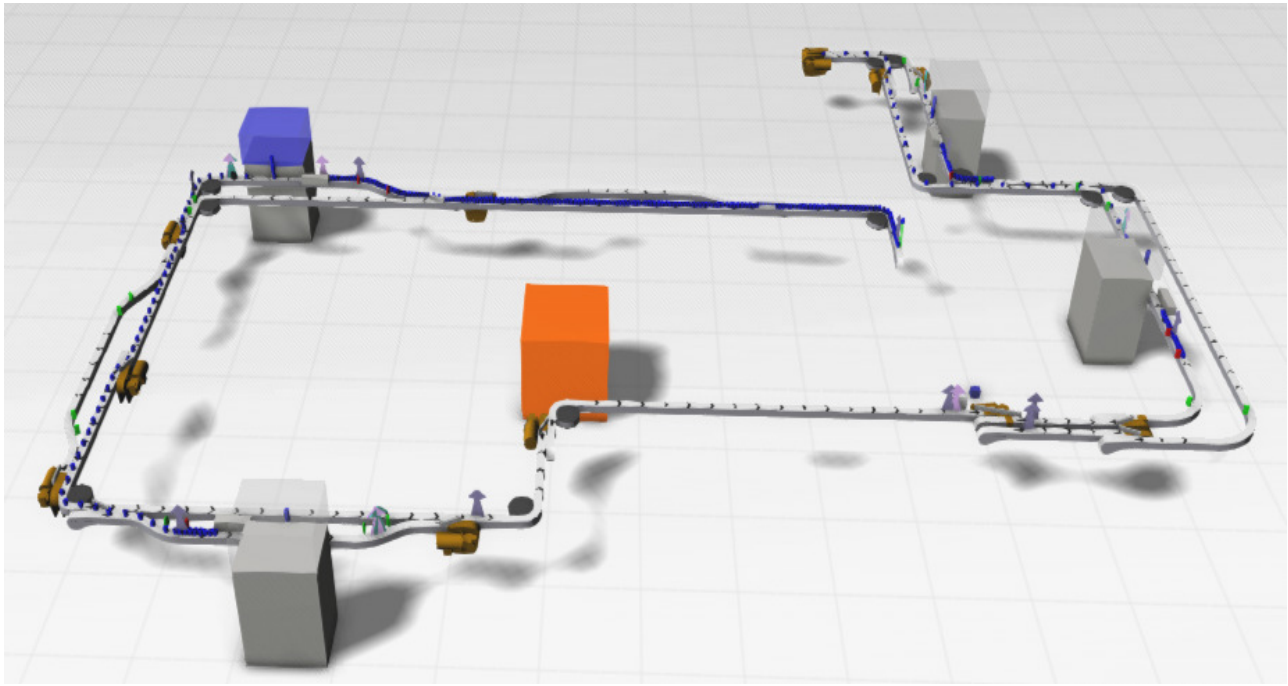
Conventional control of production lines



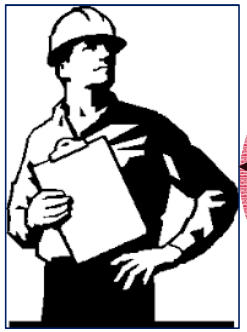
- Awareness: observe state of production
- Prediction: use knowledge, experience
- Adjustment: set low level control parameters
- Configuration: set high level control parameters
- Optimization: maximize production rate

Issues regarding conventioal control

- Fixed control set points
- High level of noise
- High energy consumption
- Low resource utilization
- High losses
- Low OEE



Cyber physical system attributes for smart factories

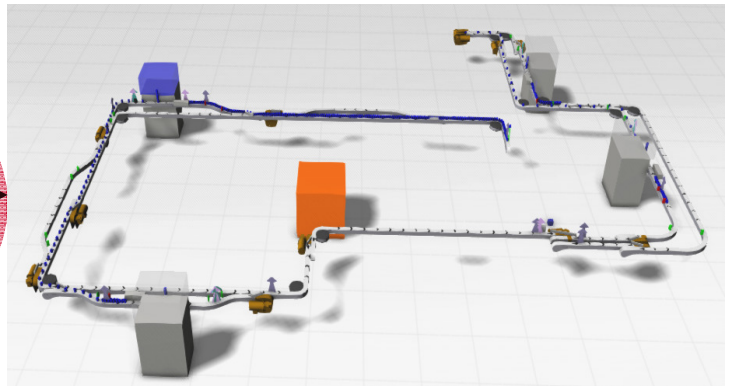


Supervision

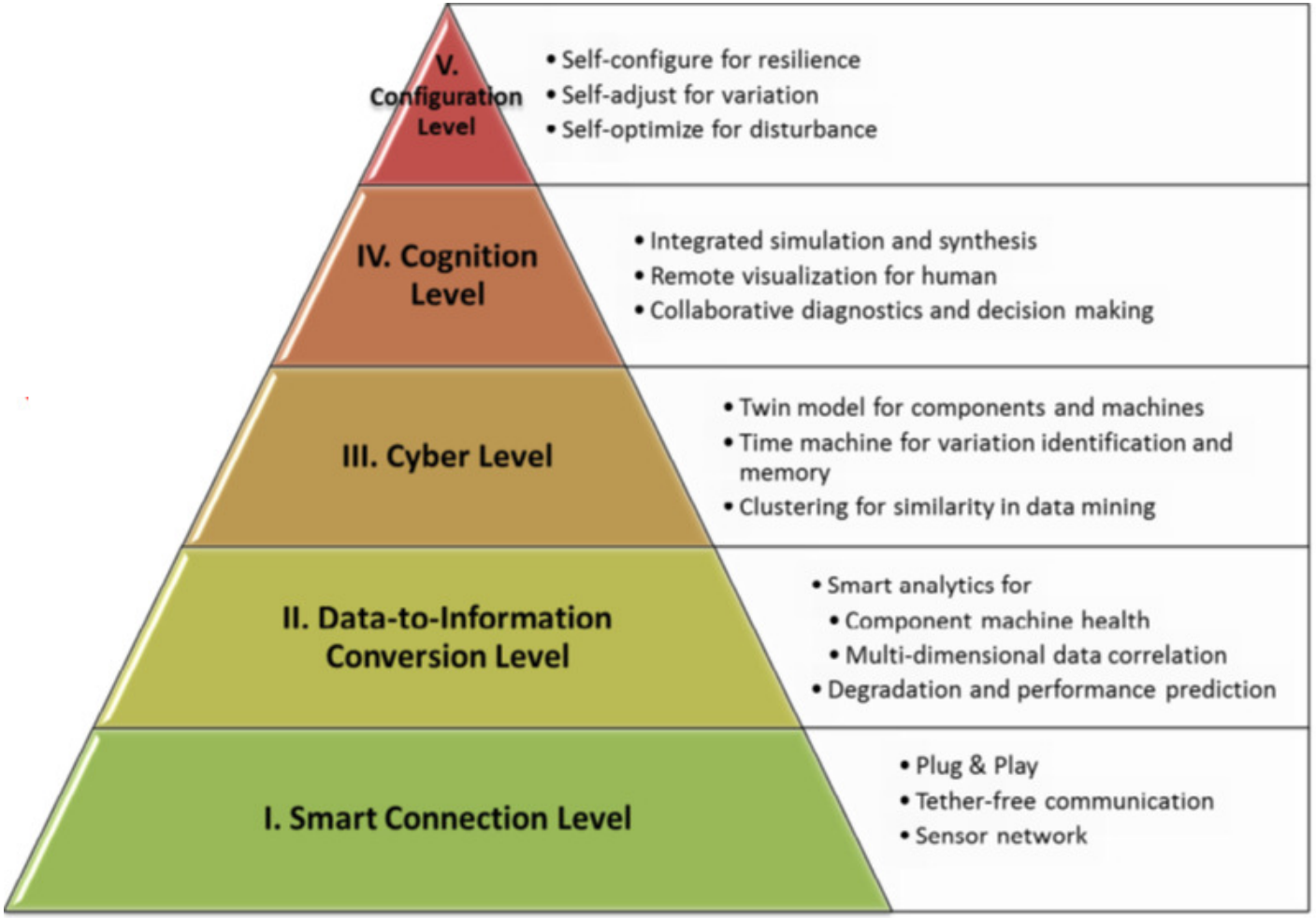
- Self-Awareness
- Self-Prediction
- Self-Adjustment
- Self-Configuration
- Self-Optimization

Automated actions

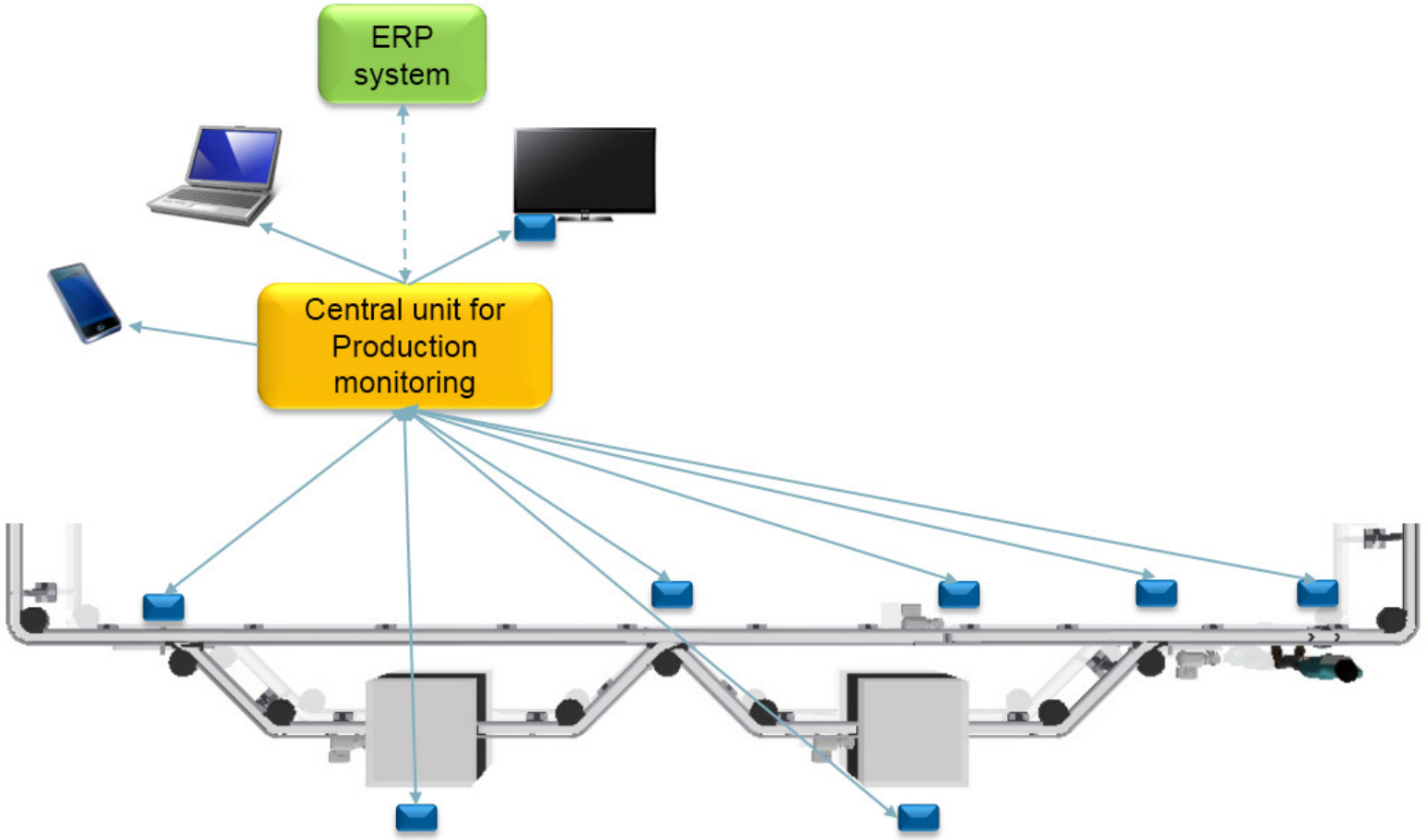
CPS



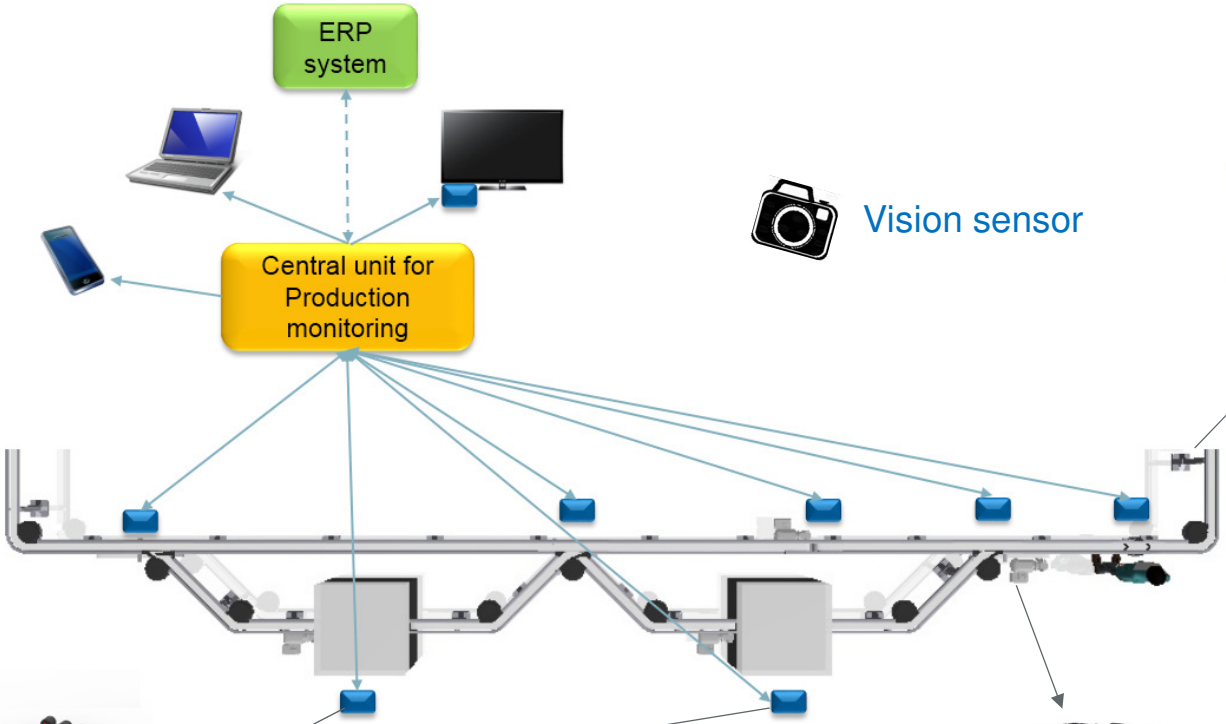
5C architecture for CPS: Jay Lee, Behrad Bagheri, Hung-An Kao



Connection: Data collection

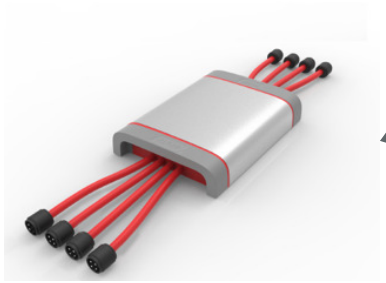


Smart sensors and drivers

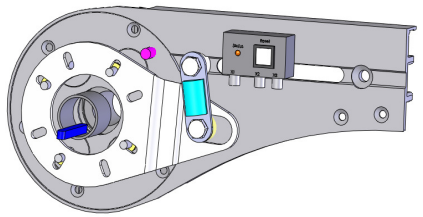


Vision sensor

Smart sensor

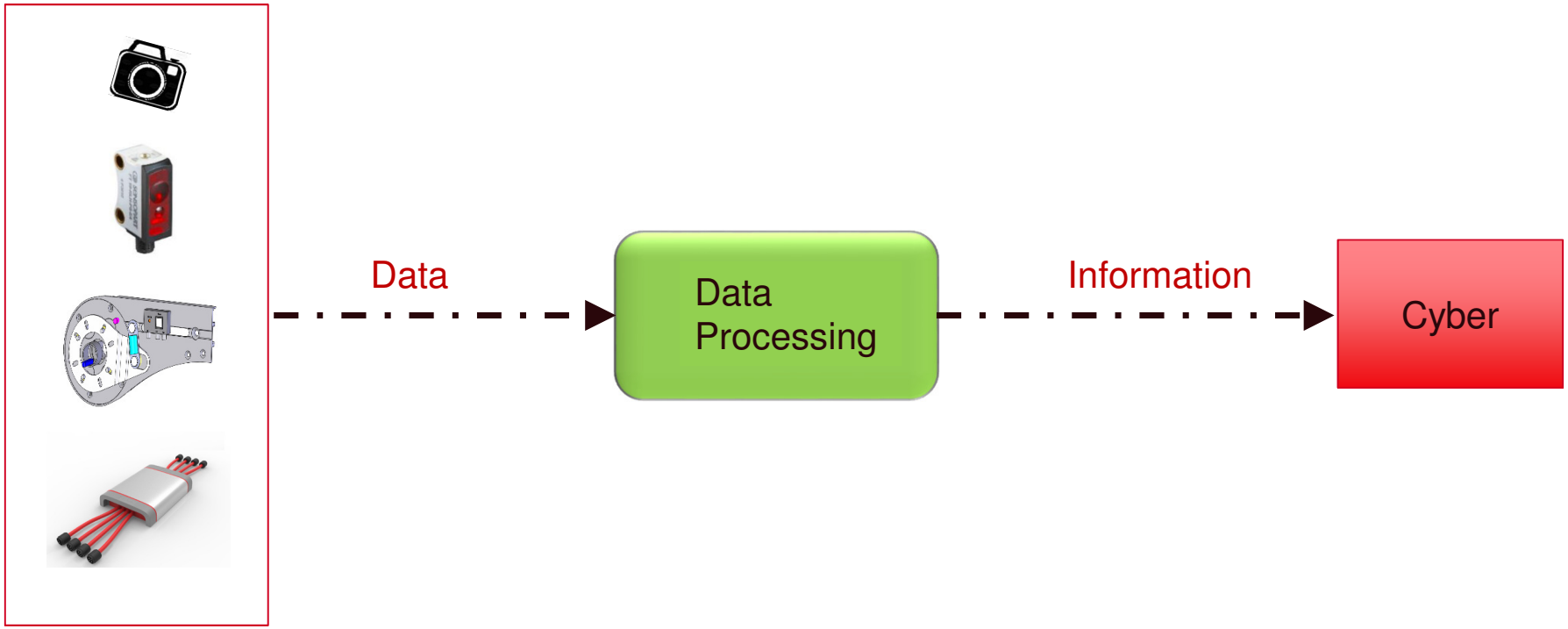


Smart collector data box

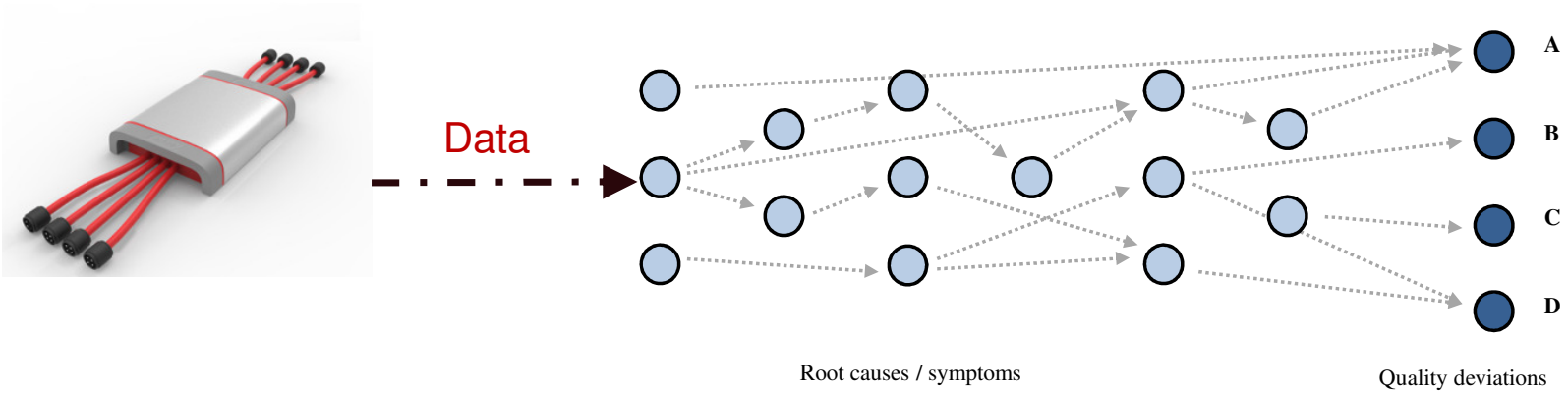


Smart driver

Conversion: Data to information



Root cause analysis of quality deviations in manufacturing using machine learning



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SKF
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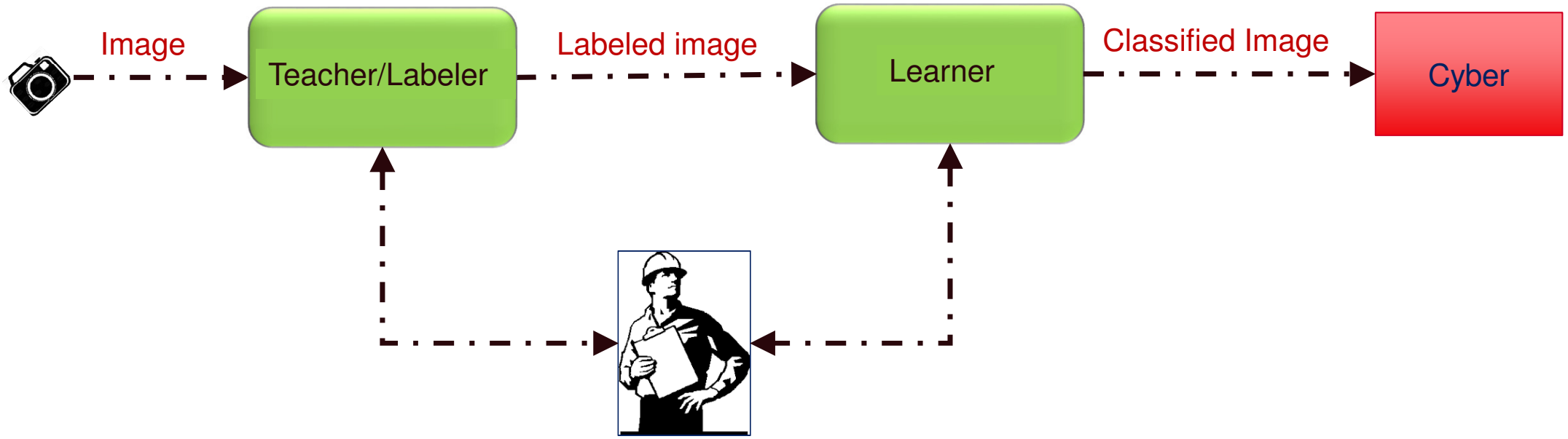
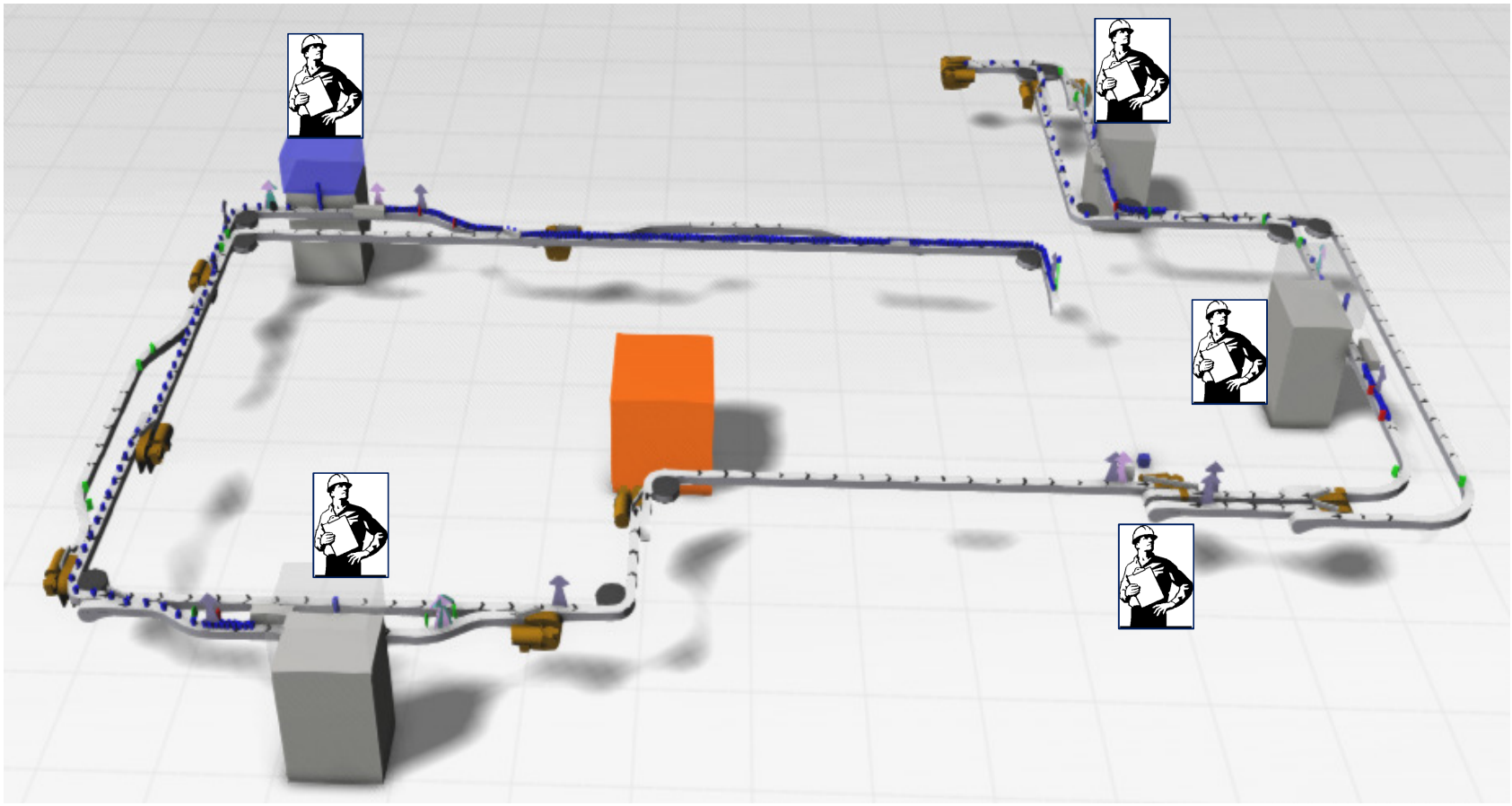
Image to information conversion under controlled conditions



Robust image classifier

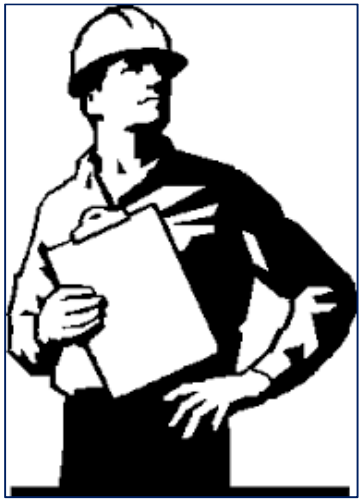
Cyber level: Agent-based control of production line



Agent

- is persistent and goal-oriented.
- gathers information and reacts to its environment.
- runs without continuous direct supervision.
- performs complex analysis for an end-user.
- learns the environment and gets experience.
- has a character: cooperative, competitive, selfish.

Agent design



Operation knowledge

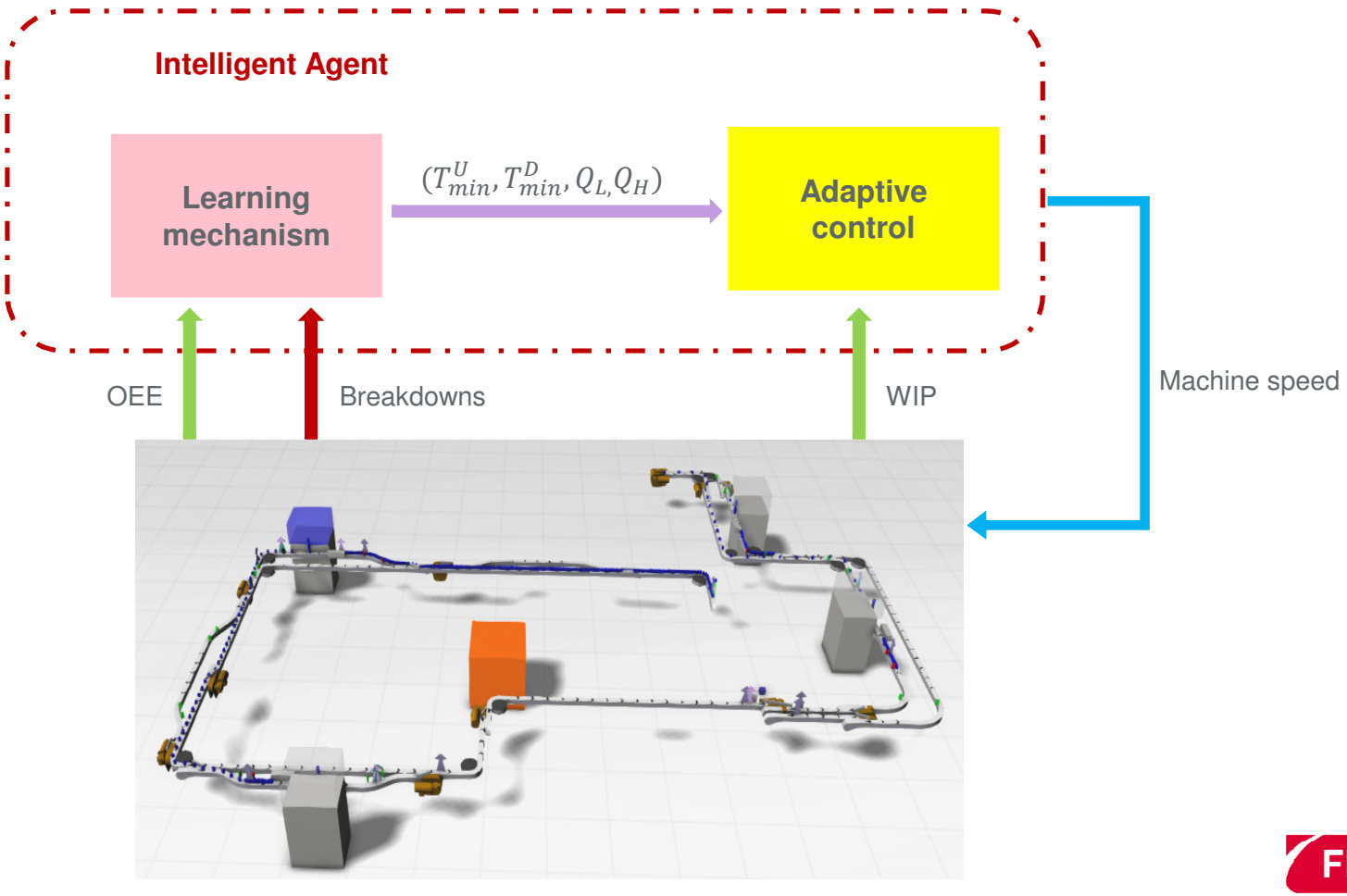
Production rules

Operator experience

Production goals

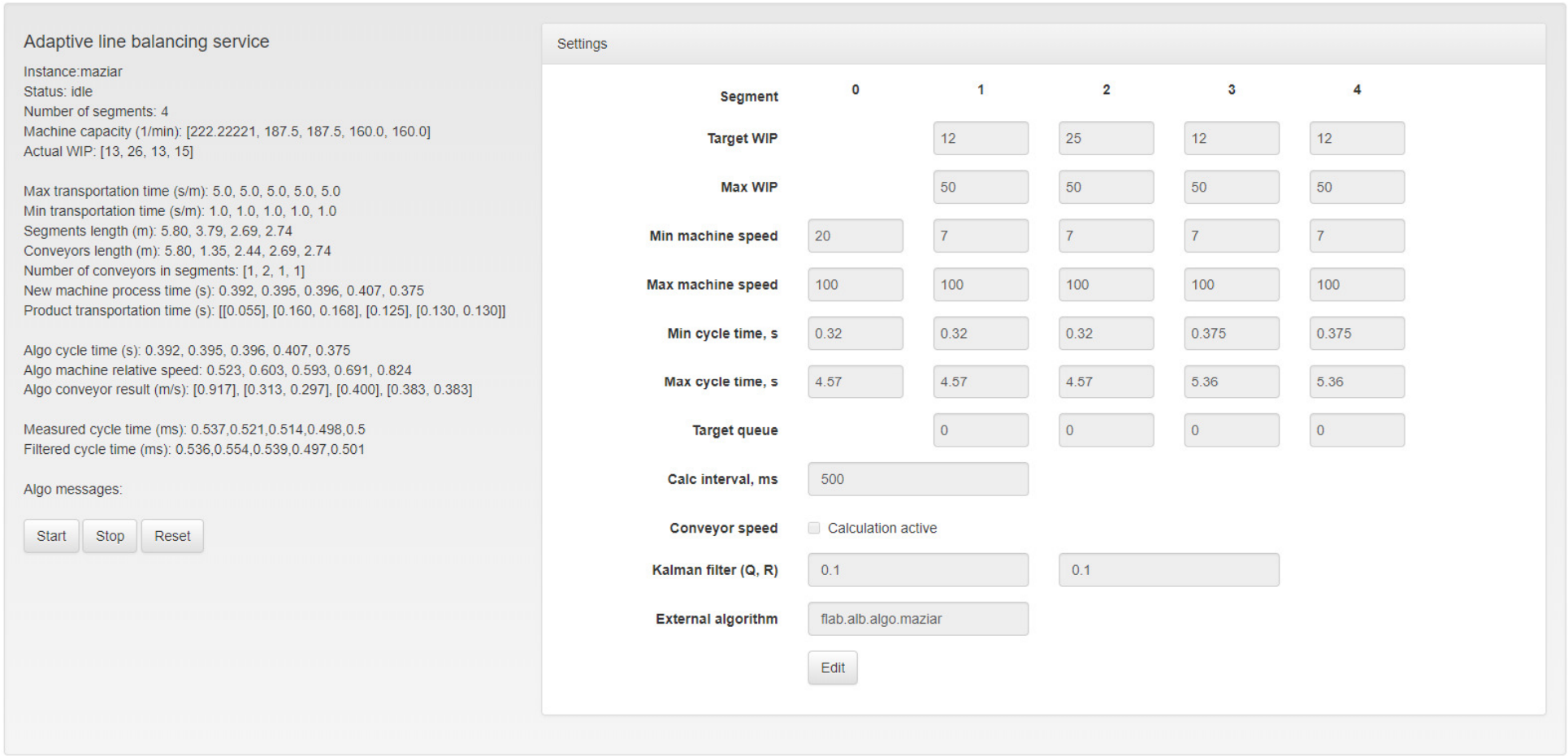
Formal Translation

Agent design diagram

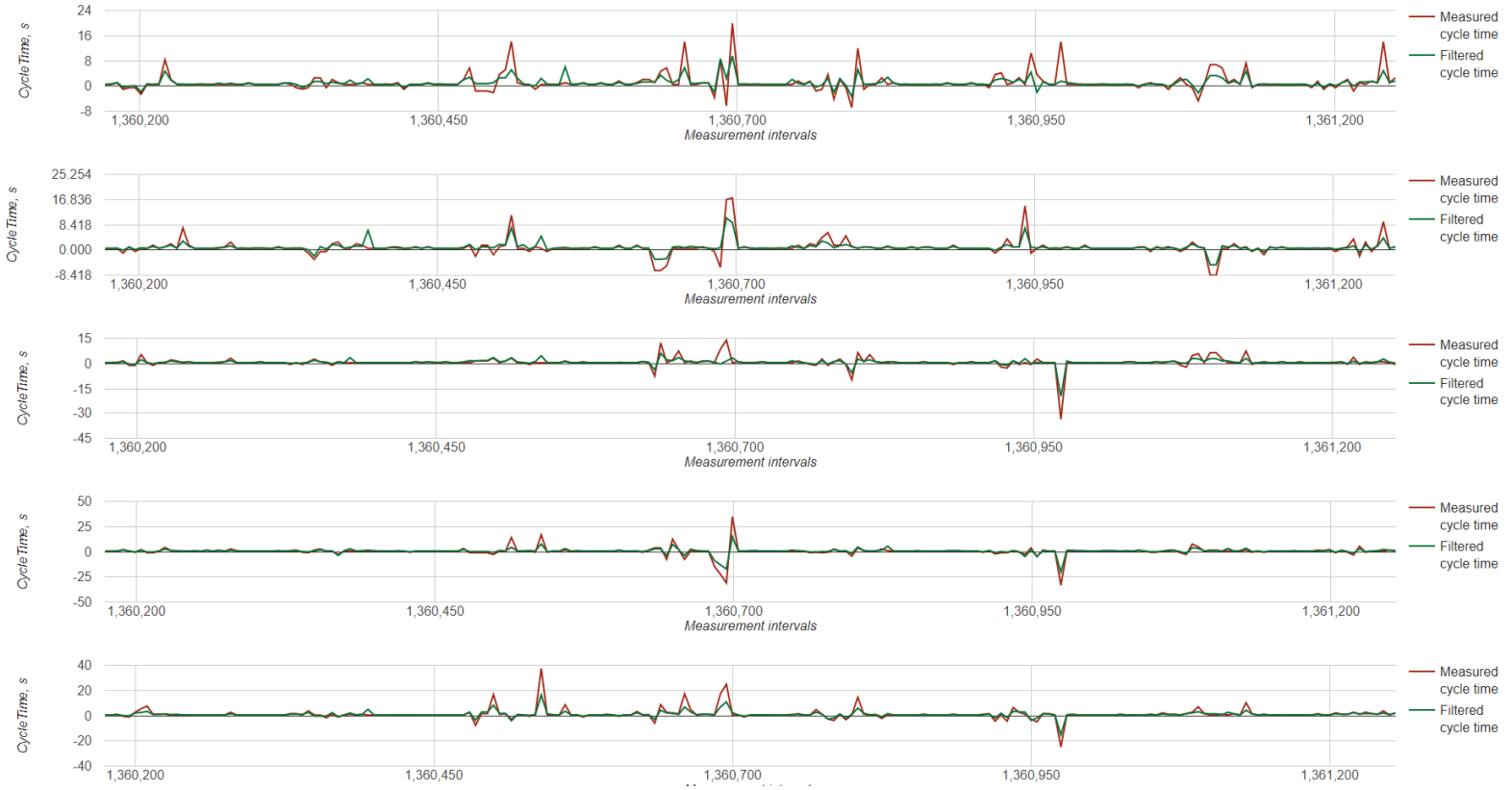


Cognition: Human agent interface (HAI)

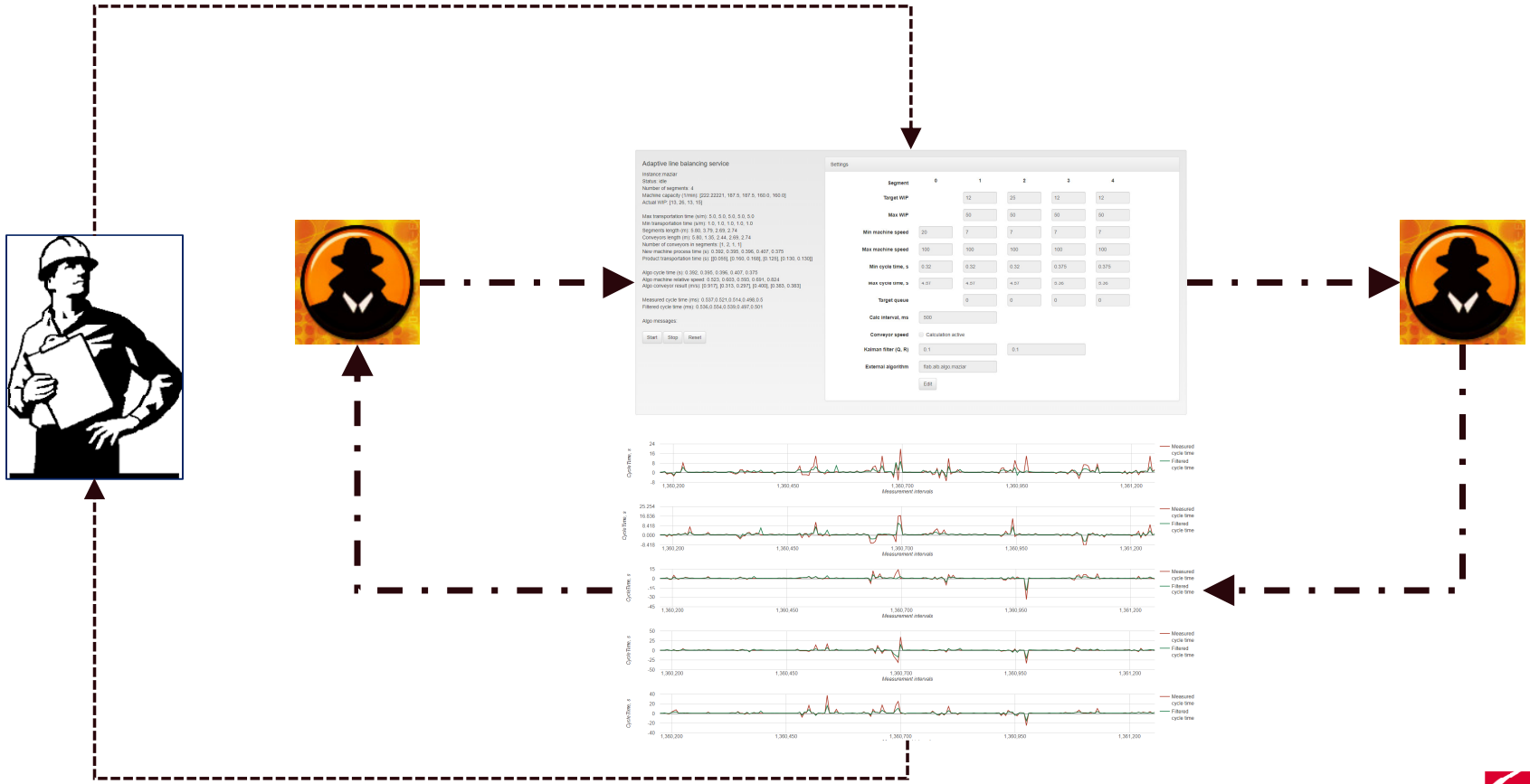
HAI: Interface to setup production goals



HAI: Interface for monitoring of production states



Configuration: Self-adaptive and self-configure



Questions?