Topic 07: Digitalisation of Production Systems

DI4TEX

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INSTITUT INDUSTRIAL DE TERRASSA GREMI TÈXTIL

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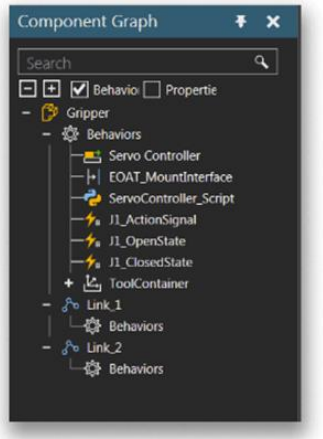
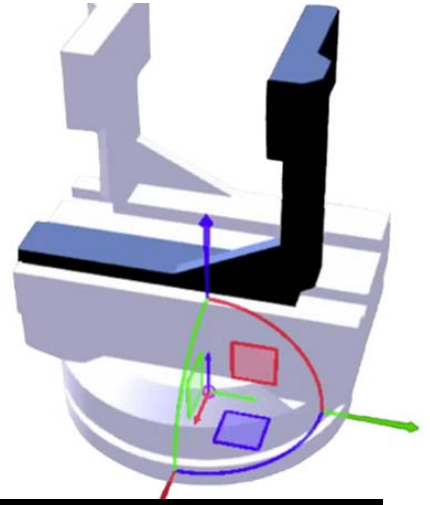
https://www.visualcomponents.com/

Digitalisation of Production

1 - Computer Aided Design, 3D Cad, Solidworks, CAX

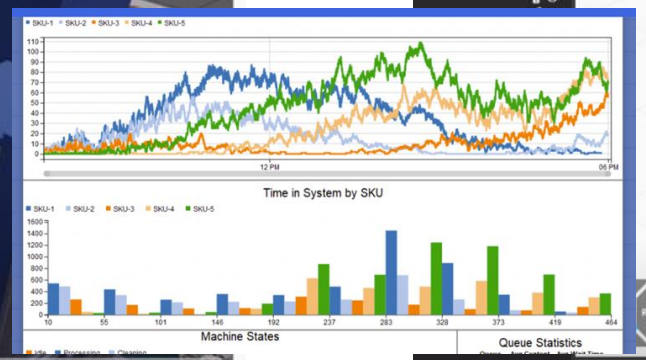
- Product Design, Kinematic structures and functional behaviours.

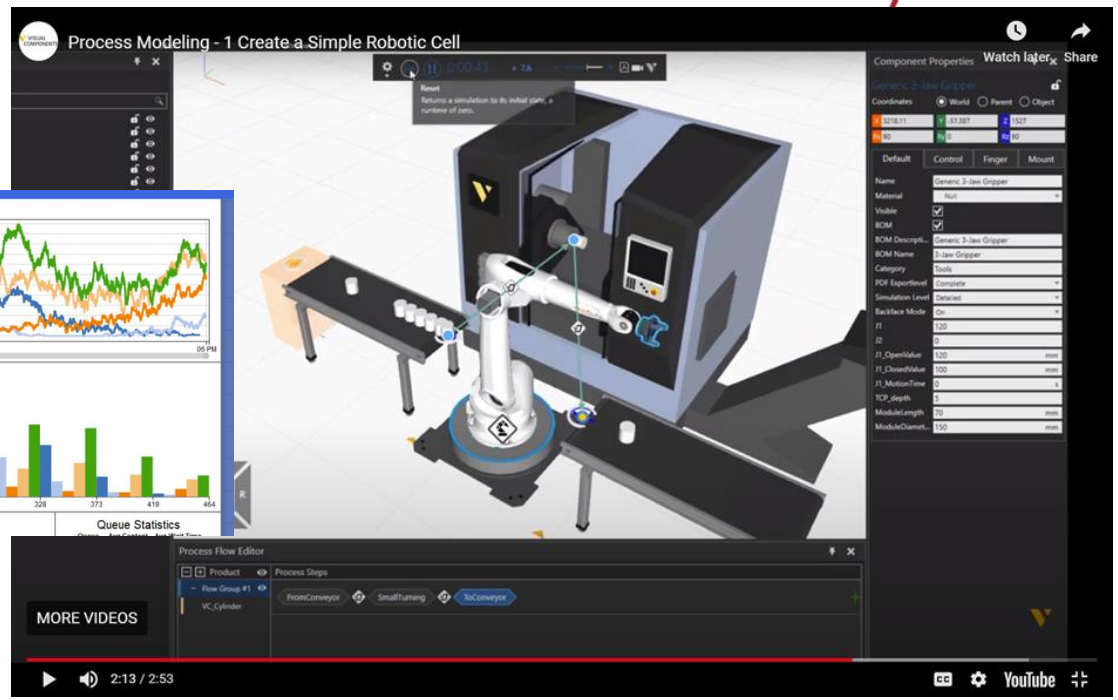




2 - Production Simulation Models

- Capacity planning, Performance measurement





https://www.youtube.com/watch?v=hE0uggebyaY

Digitalisation of Production

3 - Digital Twins

- Design and visualisation of production processes,
- Hardware in the loop.
- Operators in the Loop, Ergonomics.

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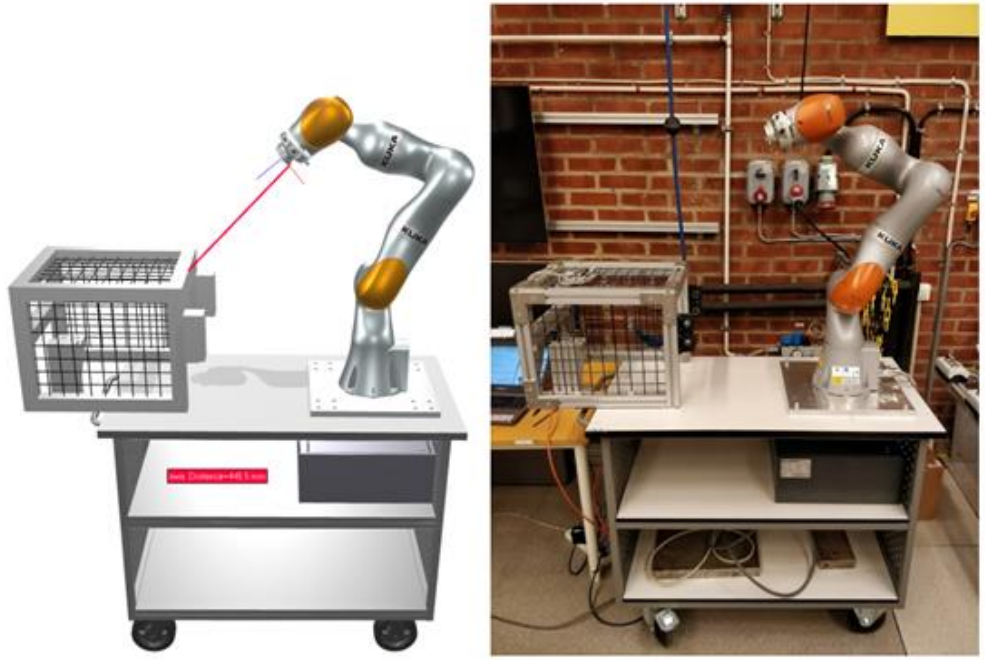


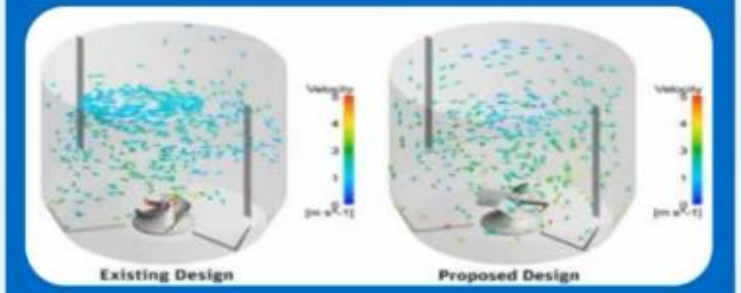
(a) Virtual representation rendered in IPS. (b) Real iiwa robot.

Figure 26: Digital twin example.

A digital twin is a virtual model designed to accurately reflect a physical object, both in its design and operation.

Digital Twins provide value in all phases of manufacturing

Design

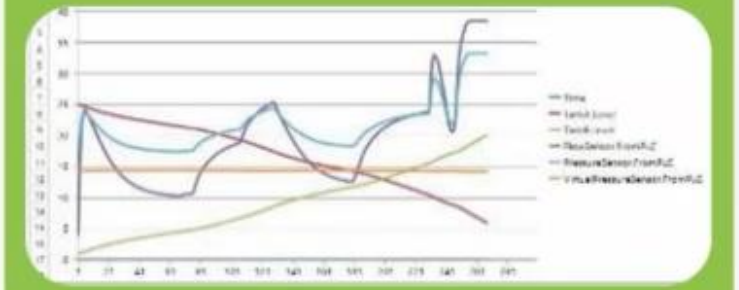


- Design optimization
- Optimum sizing of machines and control equipment
- Optimum equipment layout
- Sensor placement
- What if analysis

Controls Testing

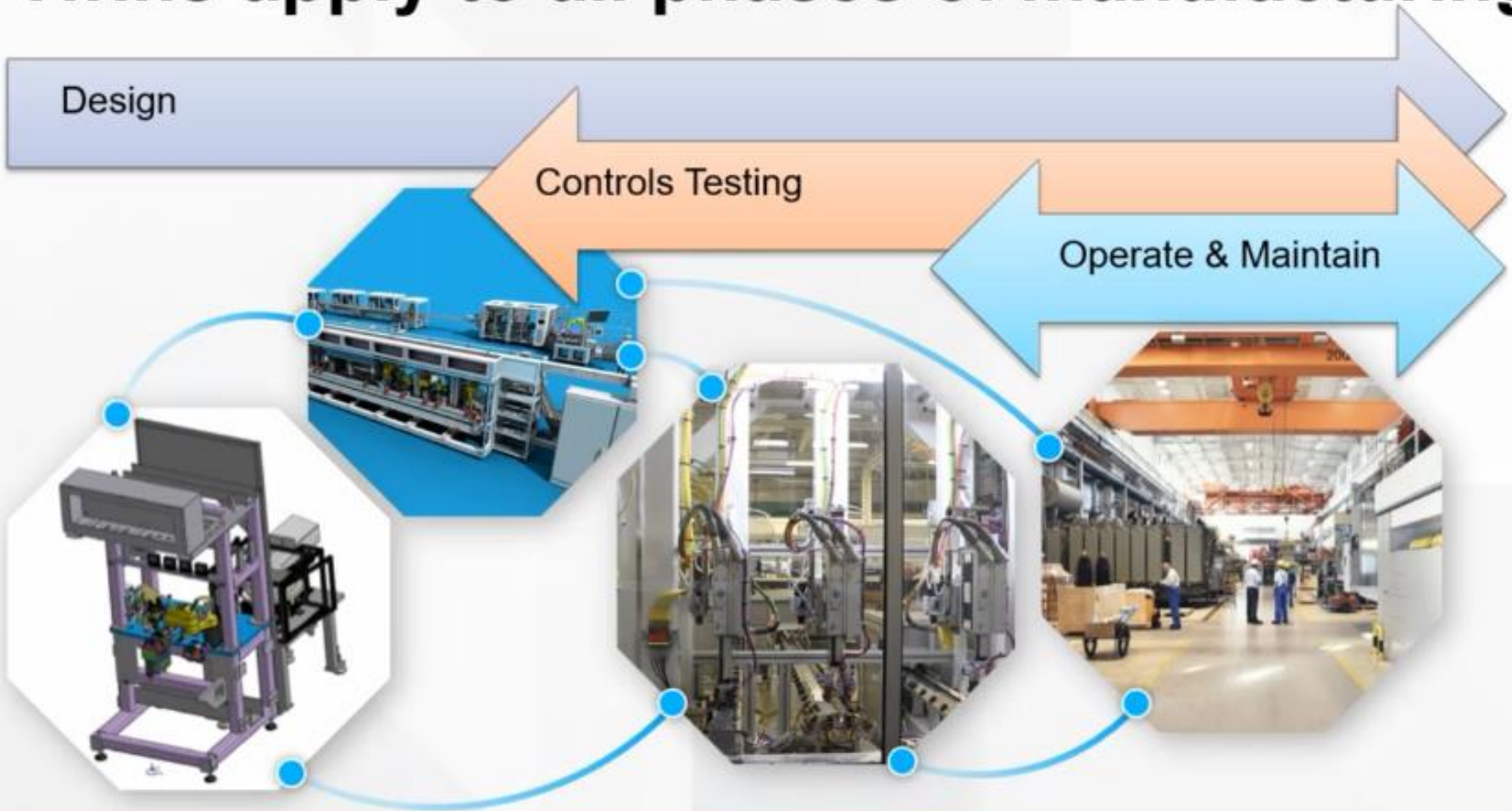
- Code development prior to installation
- Controls Testing
- Operator Training
- Anomaly detection and mitigation

Operation and Maintenance



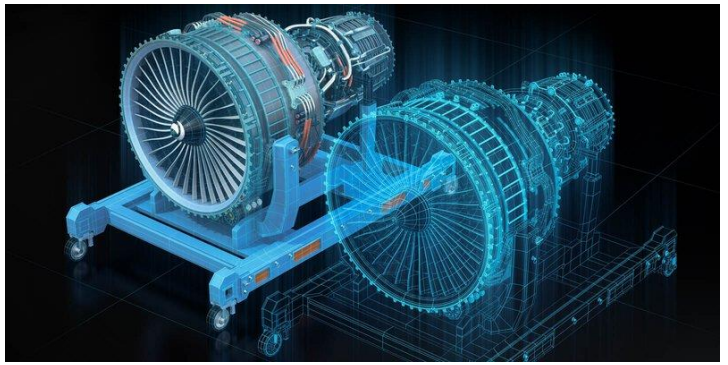
- Prediction of asset performance
- Flexible Operation
- Sustainable Operation
- Elimination of trial-and-error testing
- Reduction in process tuning time

Digital Twins apply to all phases of manufacturing

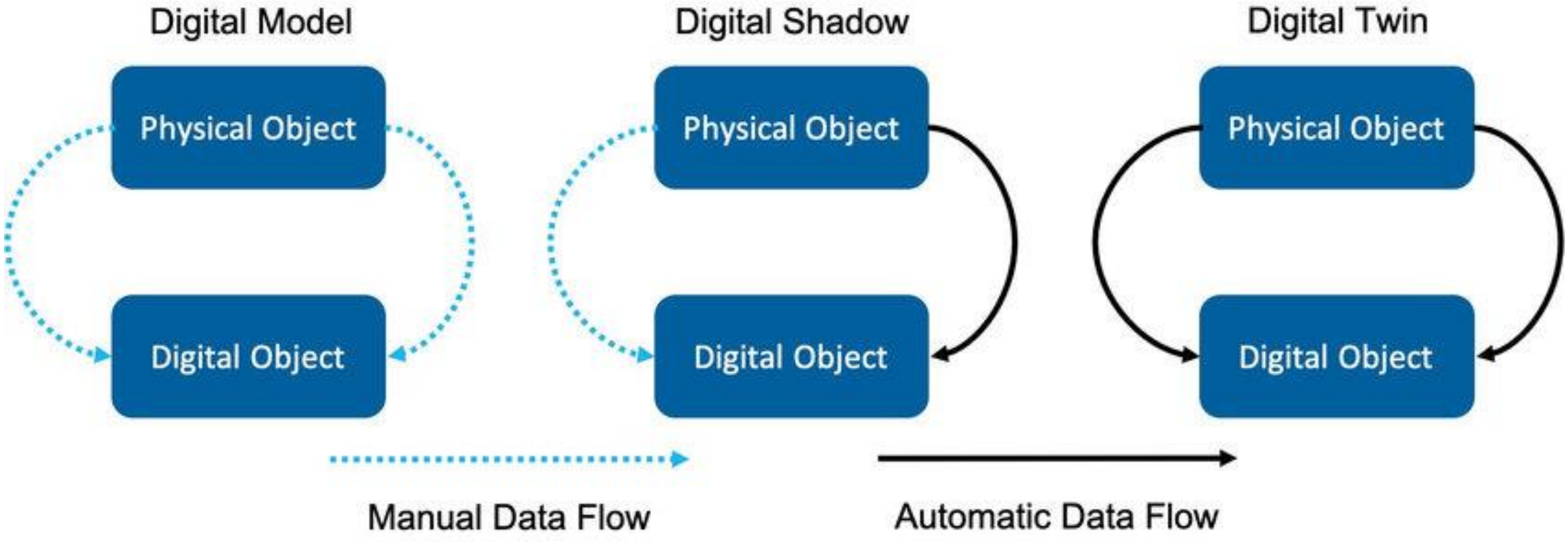


Greatest value is obtained by leveraging Digital Twins across all phases of manufacturing.

Digital Twin



ISO 23247 Digital Twin Framework – digitalisation of observable manufacturing elements

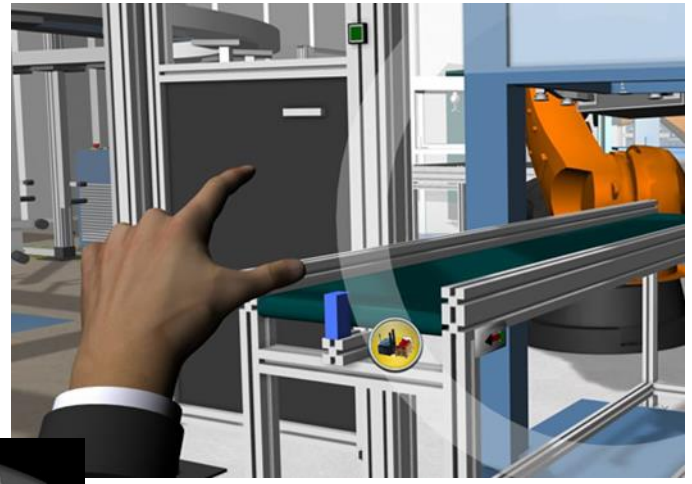


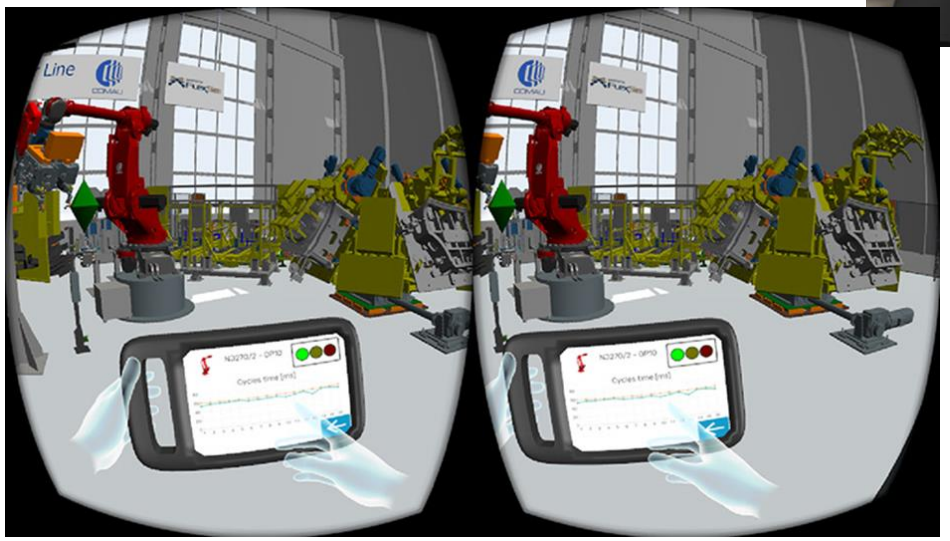
Fuller, Aidan & Fan, Zhong & Day, Charles & Barlow, Chris. (2020). Digital Twin: Enabling Technologies, Challenges and Open Research. IEEE Access. PP. 1-1. 10.1109/ACCESS.2020.2998358.

Digitalisation of Production

4 - Visualisation of Production

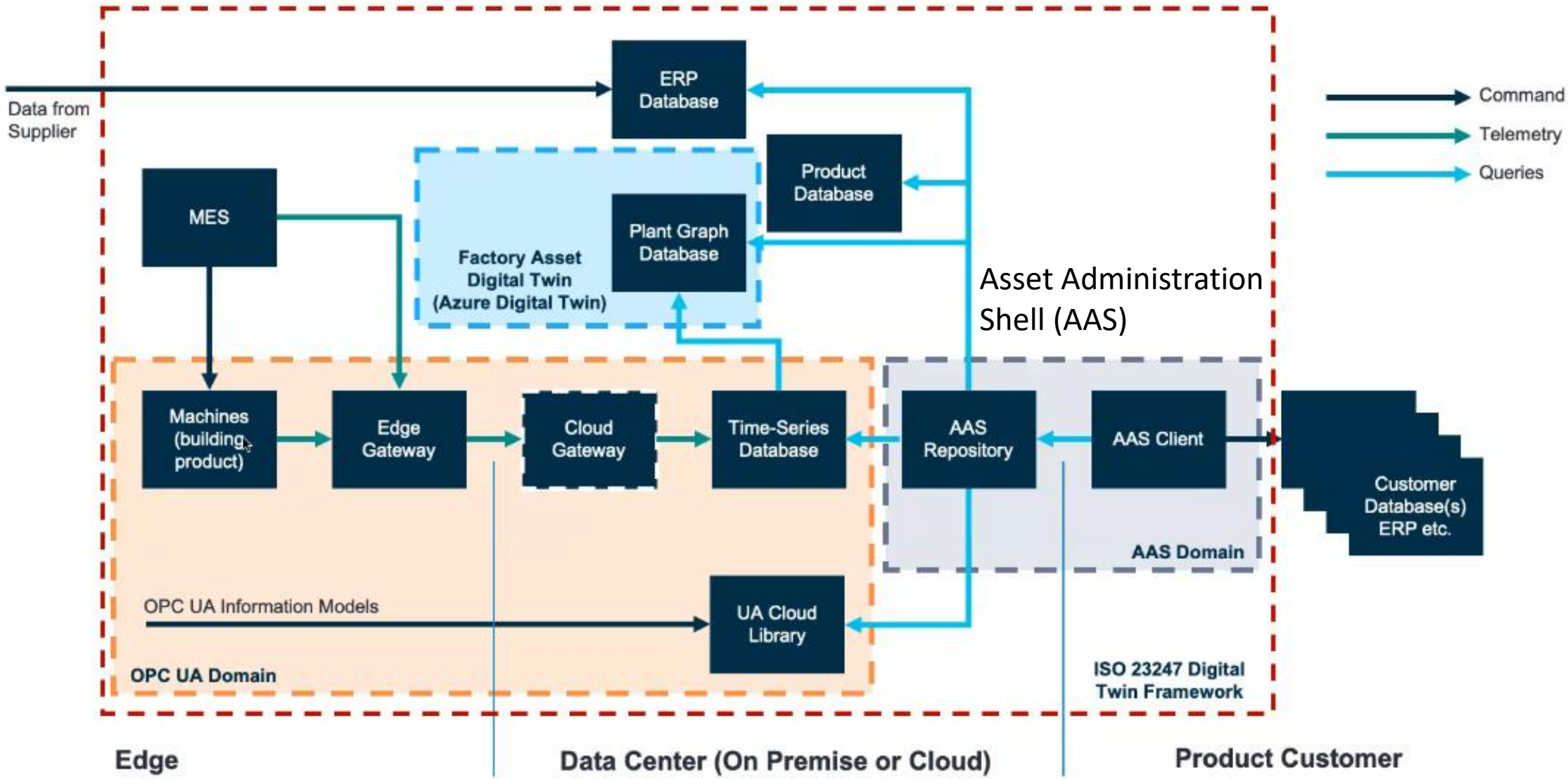
- XR, Virtual Reality, Augmented Reality.
- Applications in Manufacturing
- Gamification.





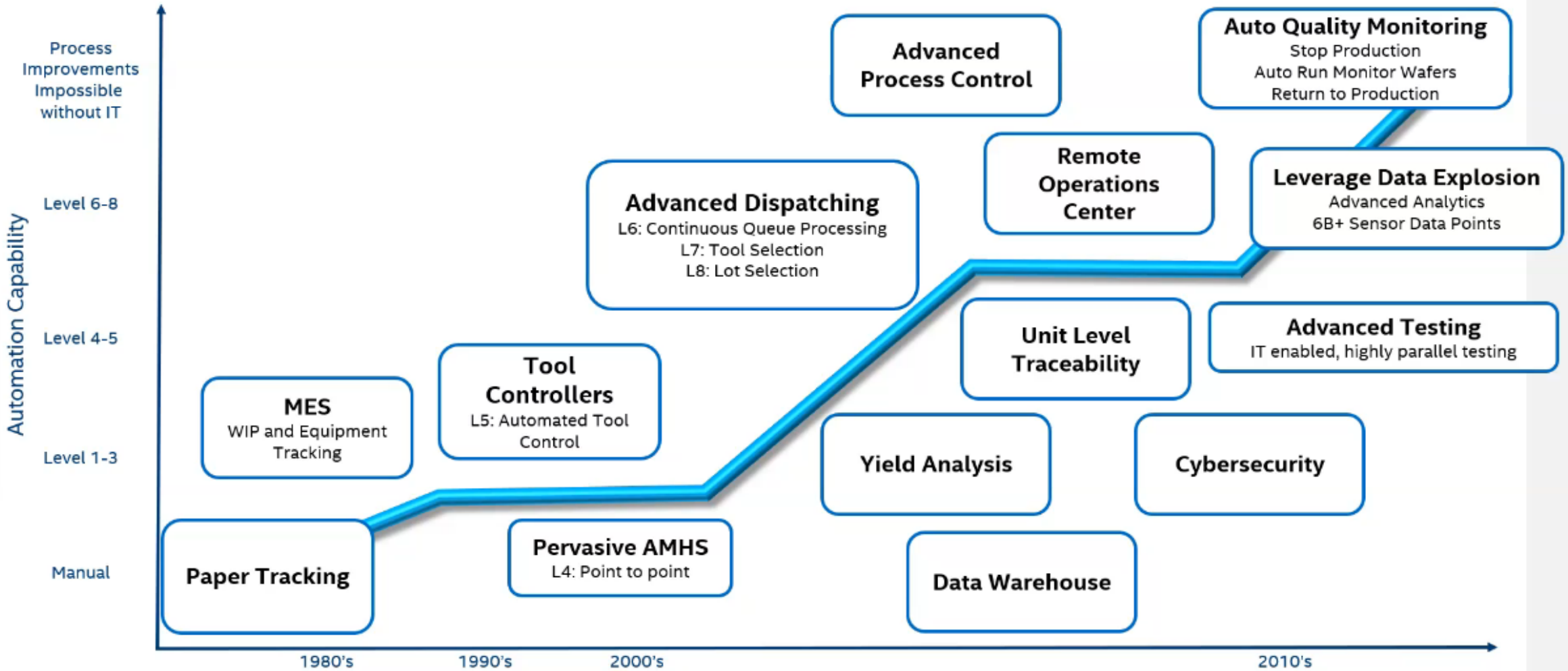
https://youtu.be/p-S_9aBV_k0

Industry 4.0 Typical Smart Factory Architecture

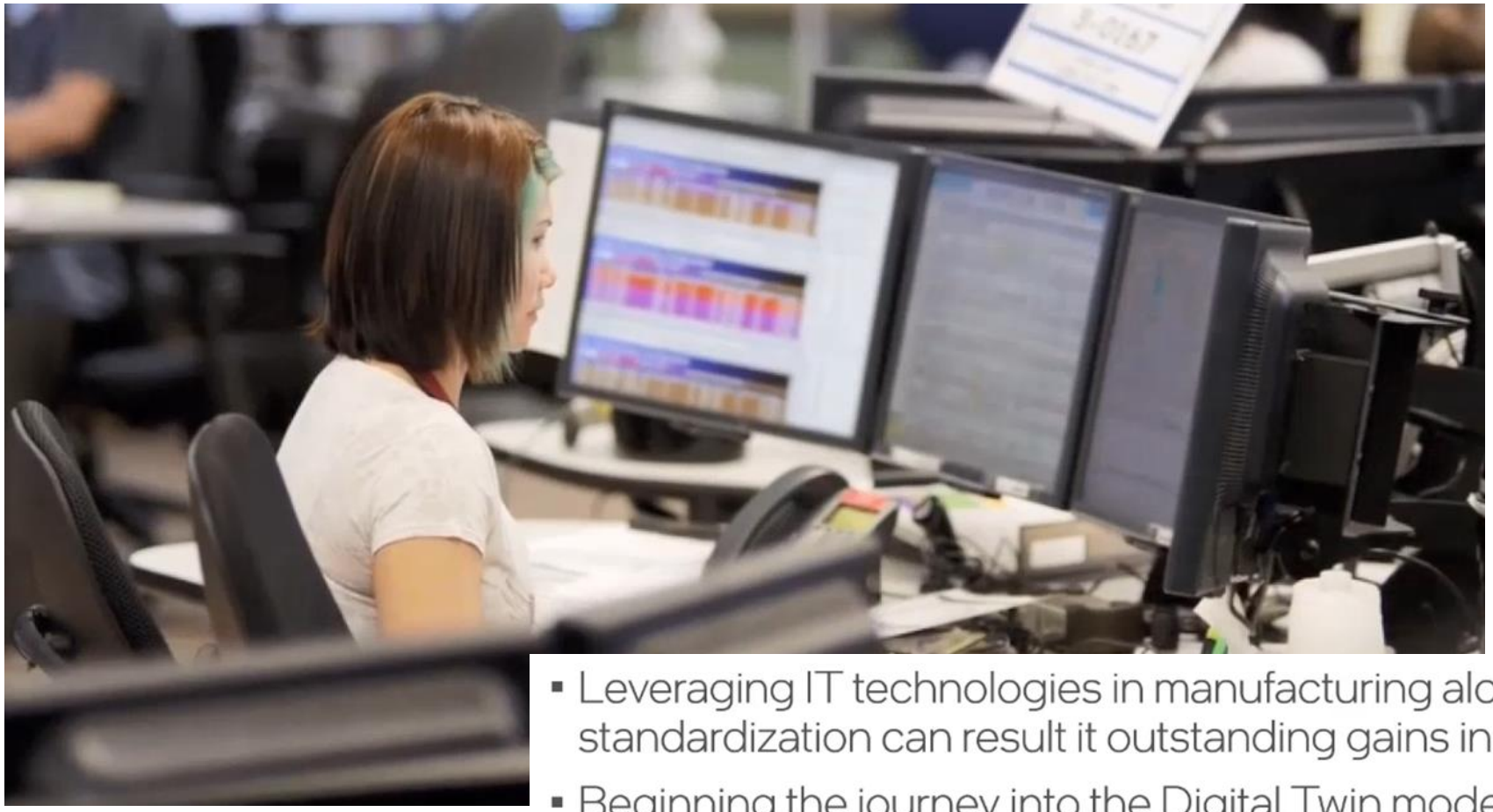


Adapted from reference architecture by Erich Barnstedt - Microsoft

Intel Manufacturing's Digital Transformation



Intel – Production Operator



- Remote Operation Control (ROC)
- Management by Exception
- Responsible for up to 140 tools

- Leveraging IT technologies in manufacturing along with strong standardization can result it outstanding gains in efficiency
- Beginning the journey into the Digital Twin model has proven to solve many business and process problems

Key Takeaways

1) Digitalisation is a change management process – it needs to be customised to the needs of your business.
2) Measure what level of digitalisation you are currently deploying – e.g. Digital Maturity Index, Digitalisation Assessment.
3) Have an overall strategy of why and how you want to digitalise – with management buy-in.
4) Capture user inputs and engage employees with new technologies.
5) Pilot in less critical areas (logistics, facilities) to develop capabilities, but then deploy in mission critical areas to measure impact.
6) Engage in collaboration with other businesses, networks, service providers, and built-up your in-house expertise.

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