



Industry4.0 – All Inclusive
«IoT, CPS e le nuove frontiere della intelligenza artificiale»

Modulo 4
CPS: progettazione ed implementazione

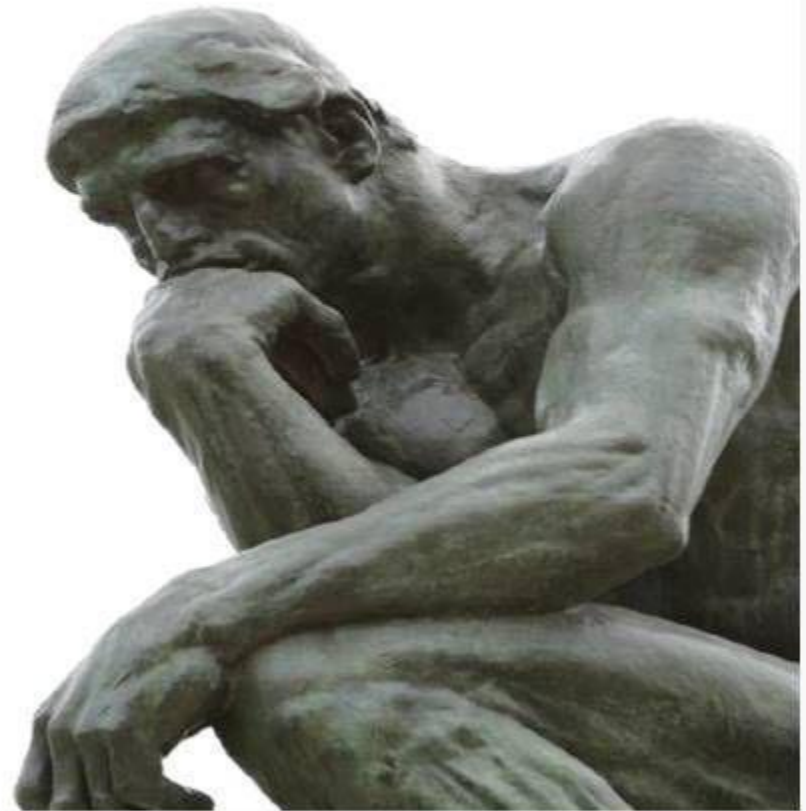
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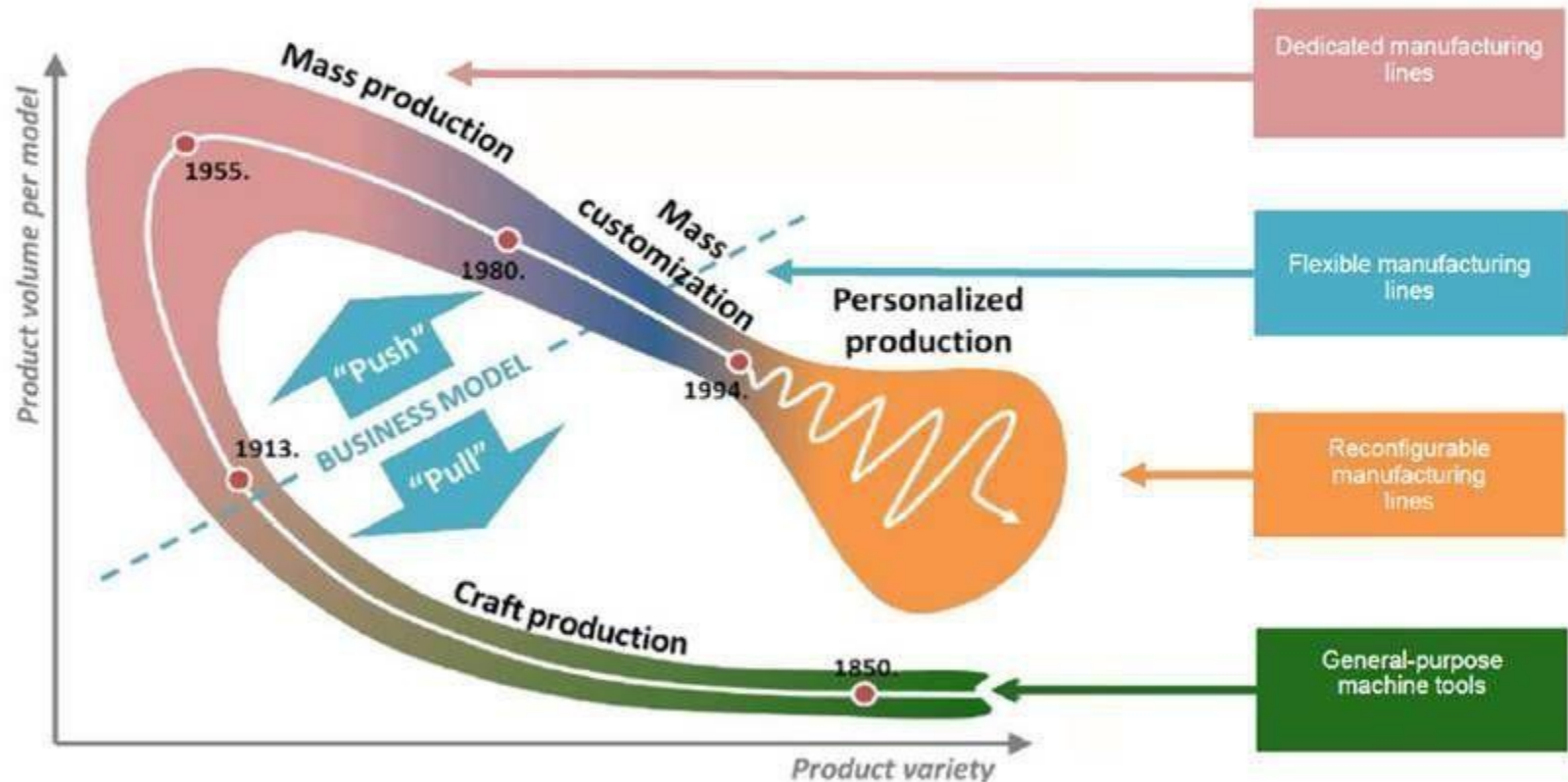
Re-Thinking

- **Products**
- **Value Add**
- **Business Model**
- **Business Processes**



Progettazione di sistemi CPS

A New Manufacturing Approach Personalized Production Demands



Progettazione di sistemi CPS

Key Automation Trends

INVESTMENT OPTIMIZATION



- Maximize Overall Equipment Effectiveness
- Enhanced Virtual Commissioning
- Minimize Production Cost

AUTOMATION HIGH DENSITY



- Minimize Floor Space per Vehicle
- Maximize Machine Modules Reuse
- Minimize Plant Facility Construction Costs

MATERIAL MANAGEMENT



- Transportation Cost
- Minimize Path per Kitting
- Minimize man hours/kitting
- Minimize Implementation Time and Cost
- Minimize Non-Value Added Activities

INTEGRATED PRODUCT-PROCESS



- Product-Process standard template
- Non-Model Specific Architecture
- Minimize Startup Time
- Advanced Joining Technologies for Dissimilar Materials

ZERO DEFECTS



- Minimize Scrap and Rework Costs
- Minimize Defect Rates

Progettazione di sistemi CPS

Digital Factory Elements



Virtual Industrialization

Virtual plants and products to prepare physical production via simulation, verification and physical mapping

Smart Robots & Machines

Multipurpose «intelligent» robots able to adapt, communicate, and interact with each other and with humans based on remote control

New quality of connectivity

Connection of digital and real worlds with constant exchange of information between machines, work pieces, systems and human beings

Big data and analytics

New methods to handle huge amounts of data and tap into the potential of cloud computing

Cyber-physical systems and marketplace

IT systems built around machines, storage systems and supplies linked up as CPS

Factory efficiency

Preventive and predictive maintenance; energy efficiency; decentralization and remolization; process reengineering

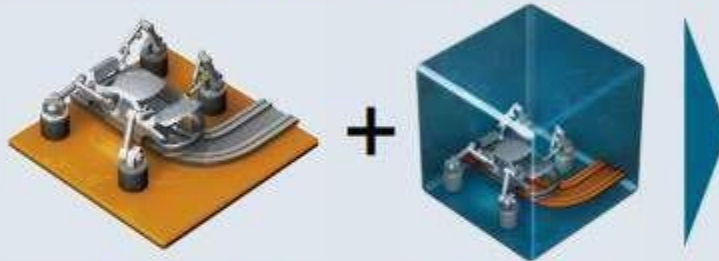
Progettazione di sistemi CPS



Cyber-physical systems

have all the information as a digital model

Cyber-physical system (CPS)



Physical production facility

Digital model

Contains all the information on ...

- Software / Informatics
- Mechanics,
- Electrics, Electronics
- Automation, HMI
- Safety, security
- Maintenance
- Location, identity...
- Status
- SW version
- Interfaces
- ...

The digital model is always up-to-date and is extended over the entire lifecycle

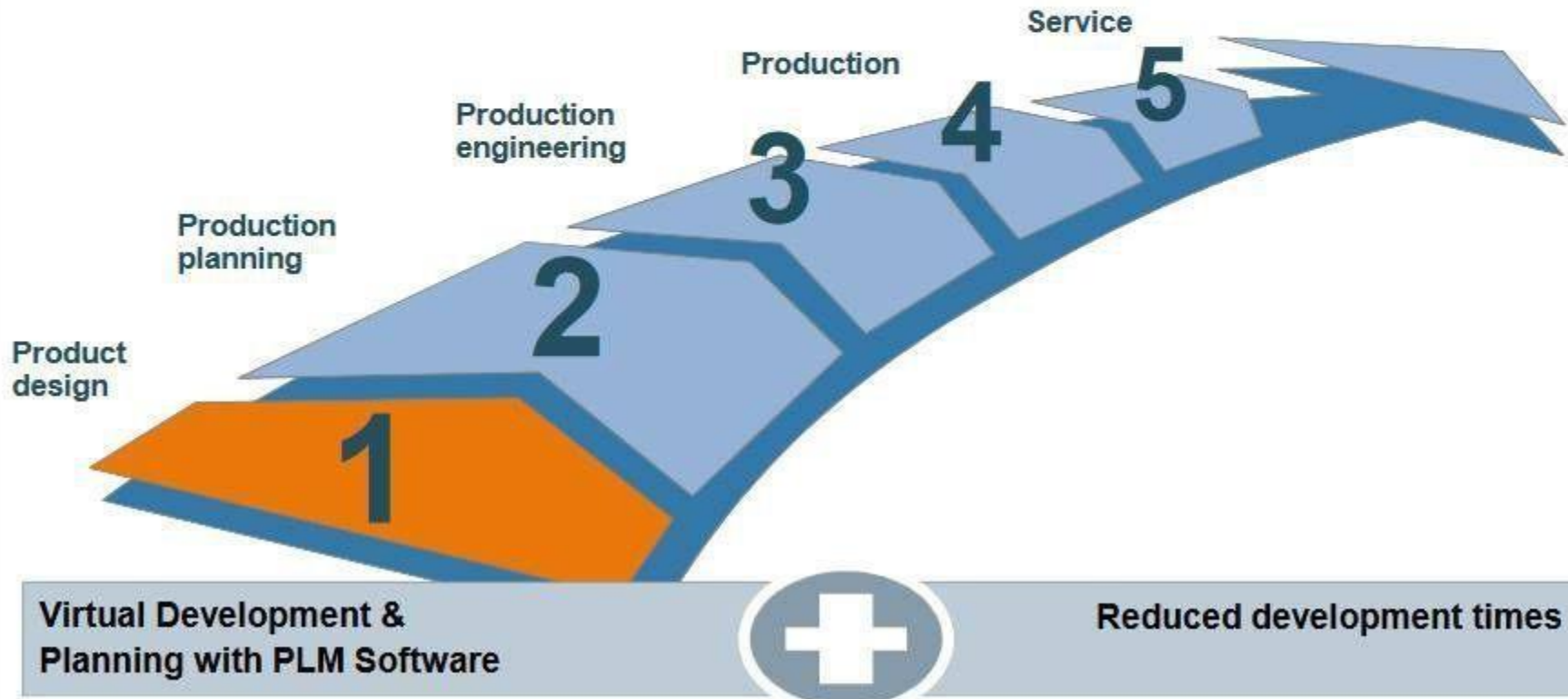


Progettazione di sistemi CPS

SIEMENS

The Future of Manufacturing

1. Faster development of product design through PLM software



Progettazione di sistemi CPS

SIEMENS

Digitalization is Transforming the Manufacturing Industry

Smart Model

The product model sets the objectives needed to produce itself



Digital Twin

Full digital product definition that simulates reality



Optimized, Distributed Production

Autonomous production with embedded intelligence.



CPS & Sicurezza

- Gli attackers possono essere in grado di lanciare singoli attacchi per controllare i sistemi CPS
- Esempio: **resonance attacks**. L'Attacker impone una nuova frequenza di oscillazione ai sensori/attuatori per poterli controllare
- Fino ad oggi la sicurezza ha riguardato:
 - i sistemi IT aziendali (con aggiornamenti software e patch)
 - i sistemi di controllo SCADA (focus sulla reliability: protezione del sistema da attacchi casuali)
- Perciò emerge che:
 - Aggiornamenti software e patch previsti per i sistemi IT non sono sufficienti
 - Soluzioni specifiche del prodotto (es. SCADA) non sono più sufficienti
- Occorre:
 - Maturare una **visione complessiva della cyber-security**
 - Adottare un approccio basato su **Prevention → Detection&recovery → Resilience**
 - Esempi: ridondanza e/o diversità a livello di sistema o applicazione, ridondanza fisica e/o analitica, predizione, adattatività, rischedulazione,