

# Artificial Intelligence technology, data spaces and platforms

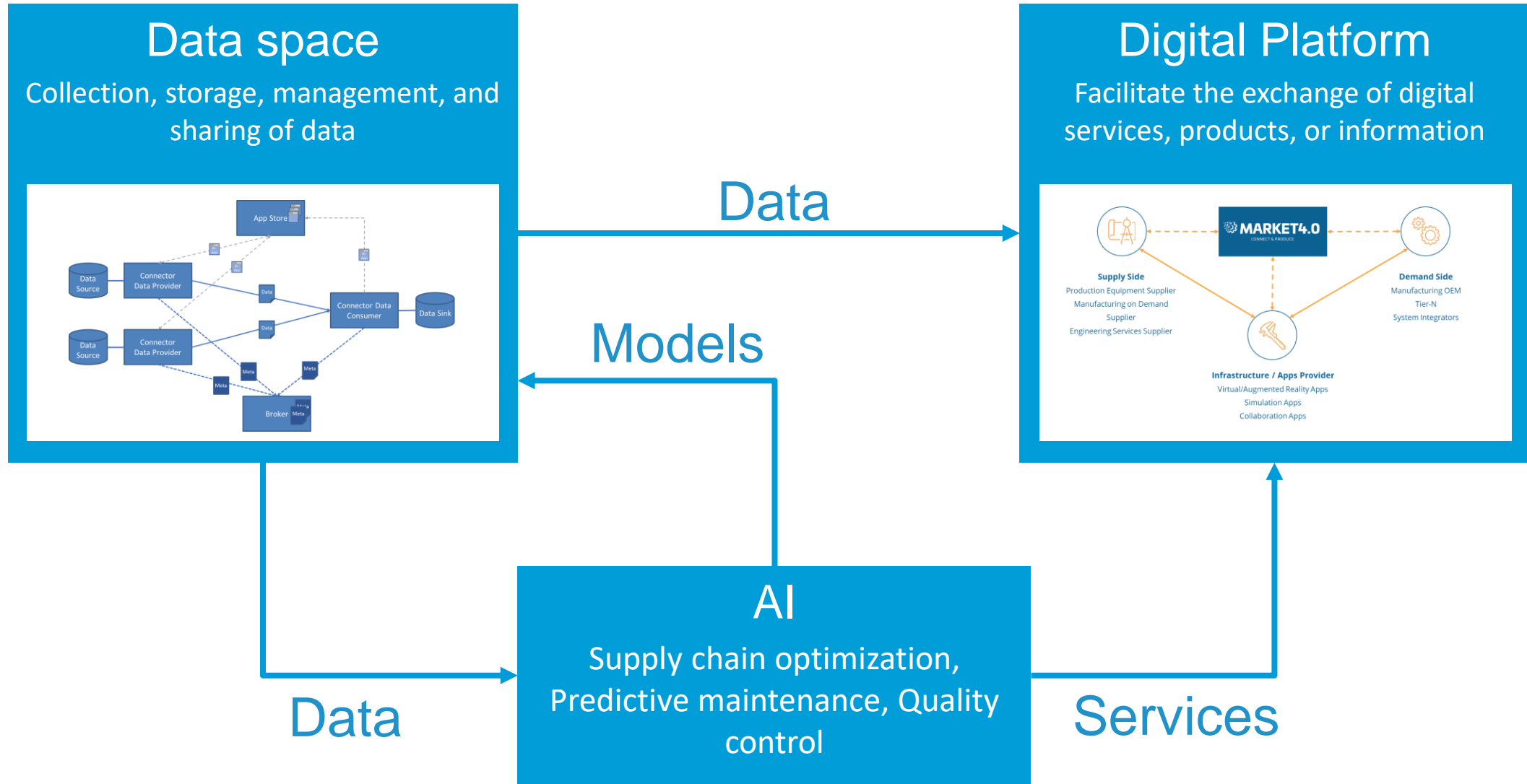
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- AI vs Data Spaces vs Data Platforms
- Data Spaces for Resilient Manufacturing
- Digital Platforms for AI development and deployment
- Conclusions



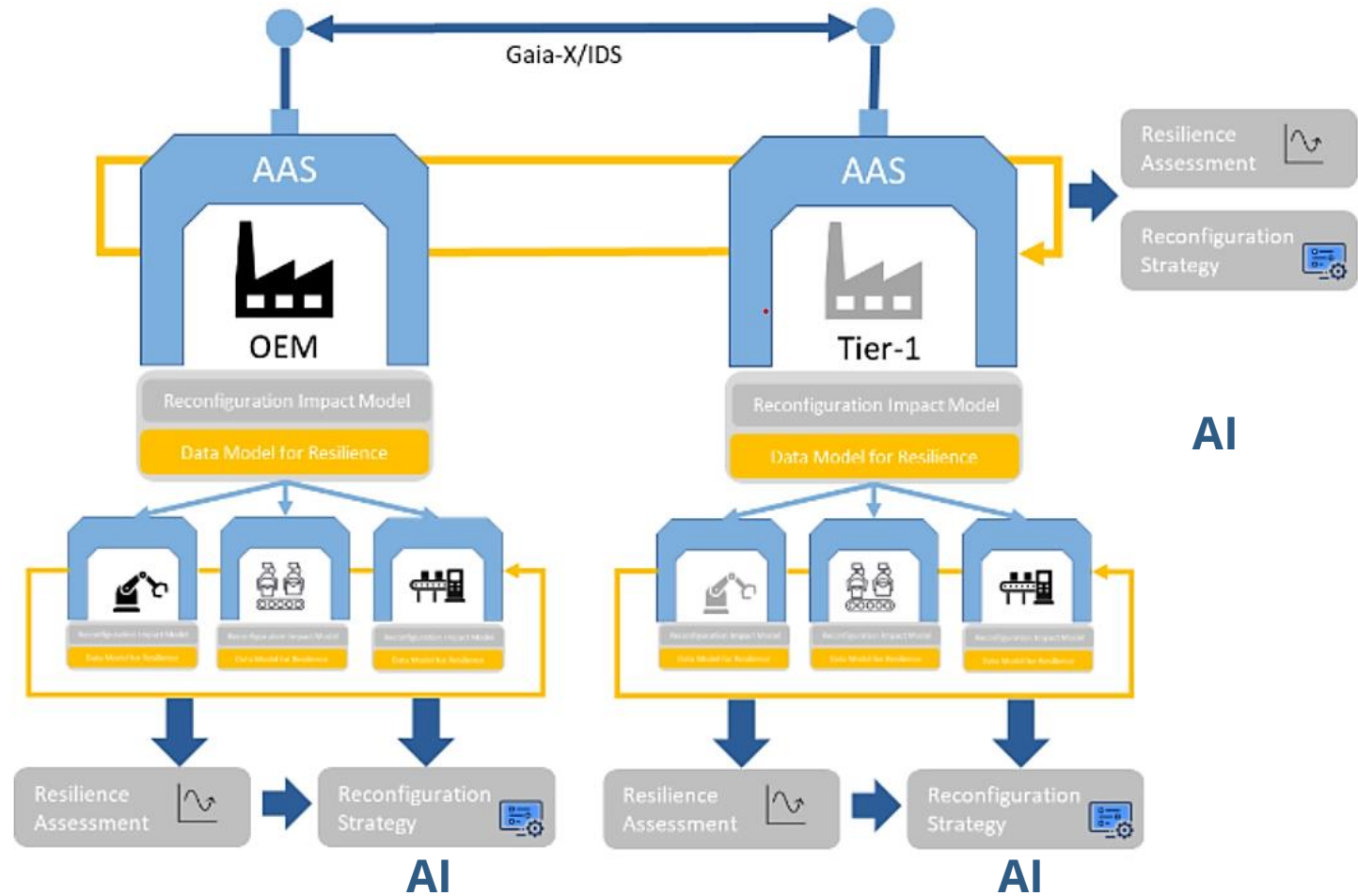
- Manufacturing industries continuously face the challenge of delivering high-quality products under high production rates while minimizing non-value adding activities.
- The recent COVID-19 pandemic has caused manufacturers to rethink and reassess their global supply chains and the resiliency of their production sites.
- ❑ The deficiencies can be attributed largely to the lack
  - of efficient ways of communication
    - › Or in other words
  - of trustworthy information exchange and data sharing among the value chain stakeholders

## Federated-based manufacturing

- **Gaia-X** and **IDS** technologies for data-sharing in the horizontal supply chain
  - › and
- the **AAS** for implementing intra-factory reconfiguration practices.

## The Digital Twin (DT) of the value-adding network

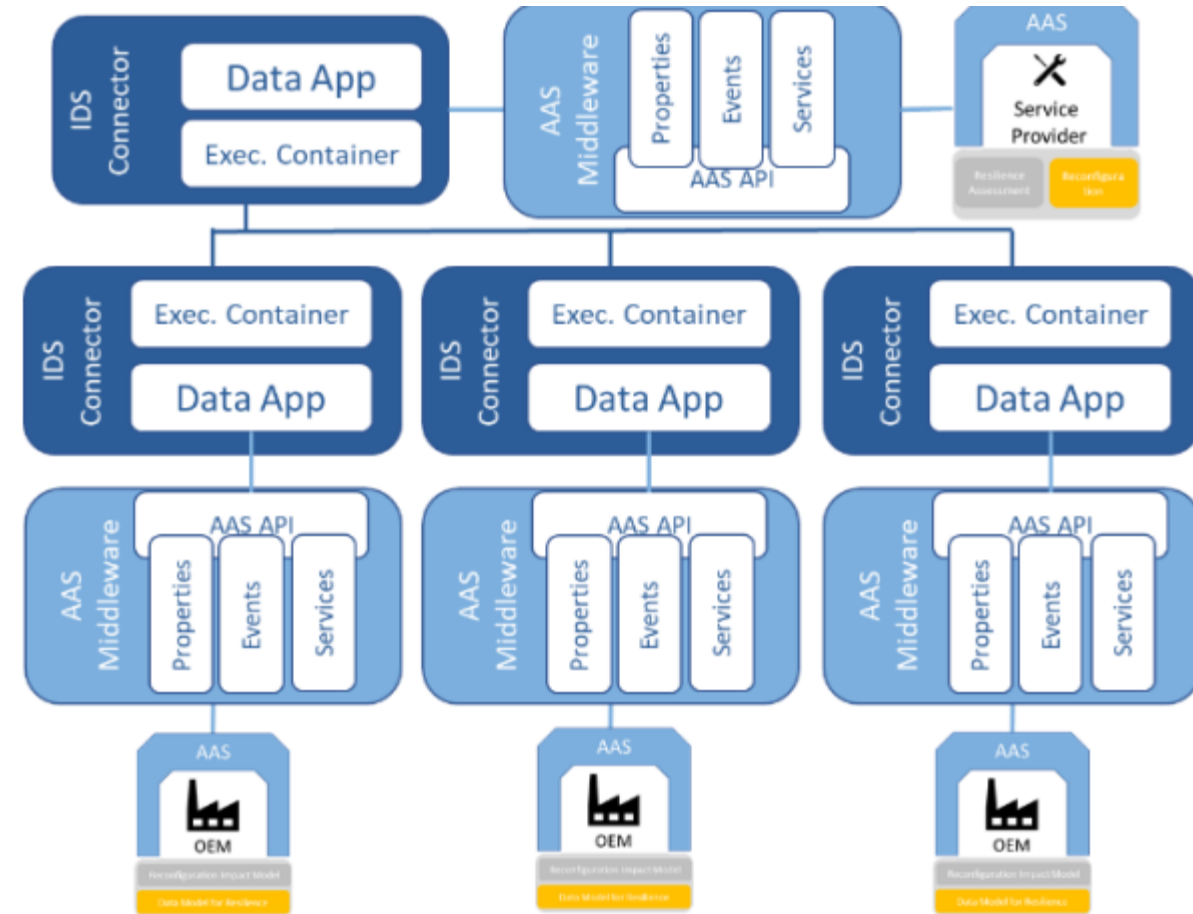
- The DT concept supports the **synchronization** of the virtual with the real world
  - › and
- provides a framework that enables **reconfiguration engineering** and **control**.



Kosmas Alexopoulos, Markus Weber, Thomas Trautner, Martin Manns, Nikolaos Nikolakis, Matthias Weigold, Bernd Engel, An industrial data-spaces framework for resilient manufacturing value chains, 30th CIRP Life Cycle Engineering Conference, 2023

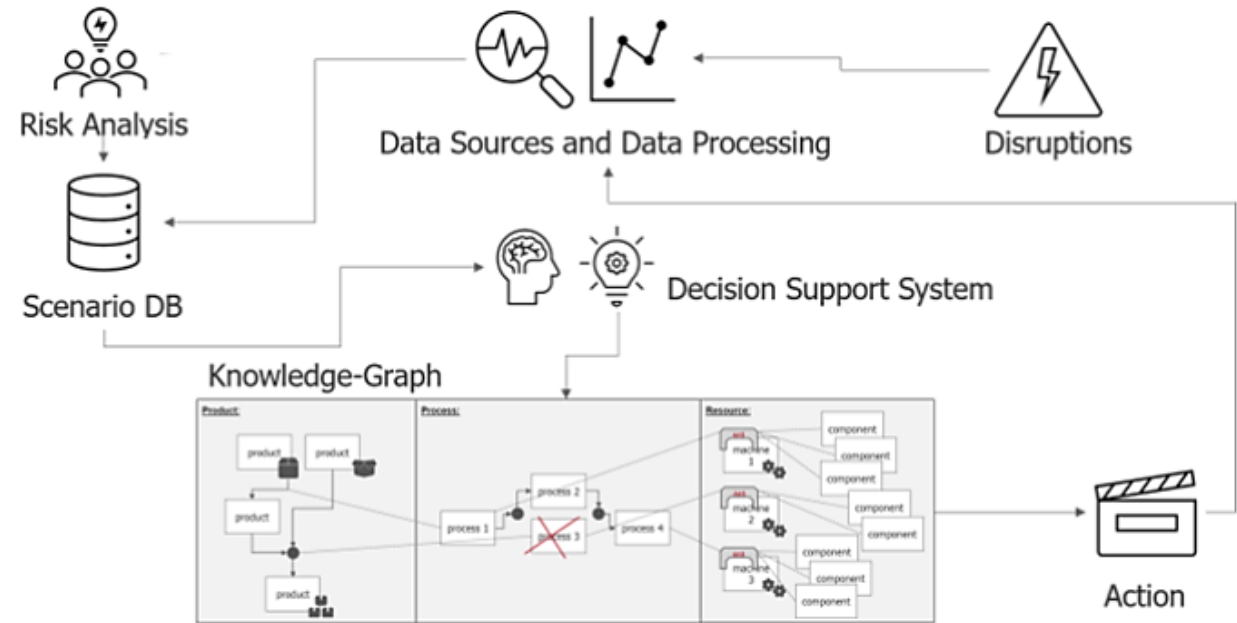
➤ Open framework based on data spaces and AAS

- AAS middleware
  - › manages the DT data using the AAS standard
  
- API
  - › for accessing the properties, services and events of AAS instances
  
- IDS/GAIA-X connector
  - › used as a proxy to access the DT data stored in the AAS middleware



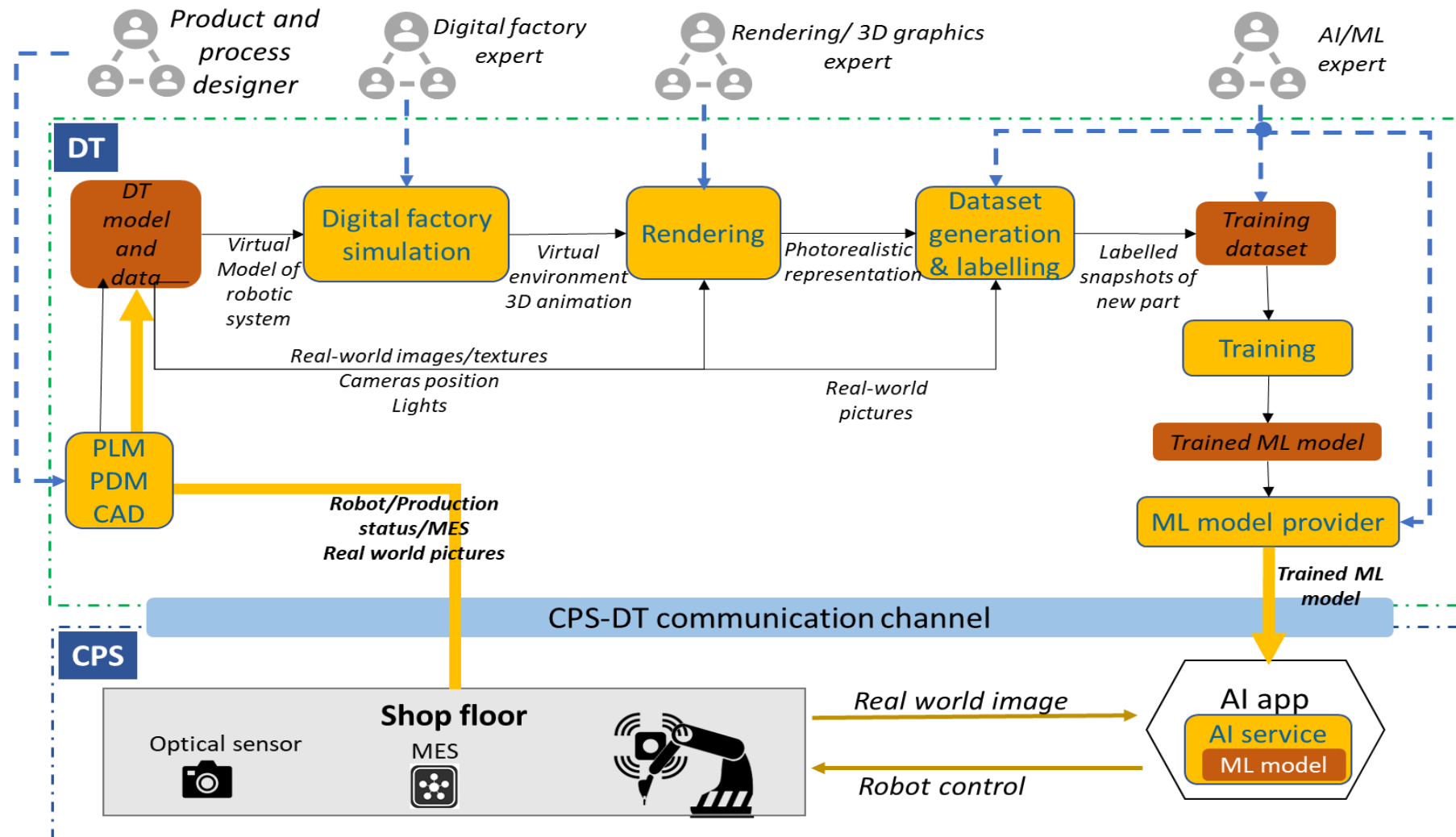
➤ Human centered enhanced decision-making process for reconfiguration strategies

- AI-based knowledge base
  - › detect a reconfiguration need,
  - › determine a reconfiguration strategy, and
  - › detect faults in the process
  
- Visualization
  - › VR/AR technologies to convey the necessary reconfiguration steps or problem-solving strategy intuitively and interactively to the user

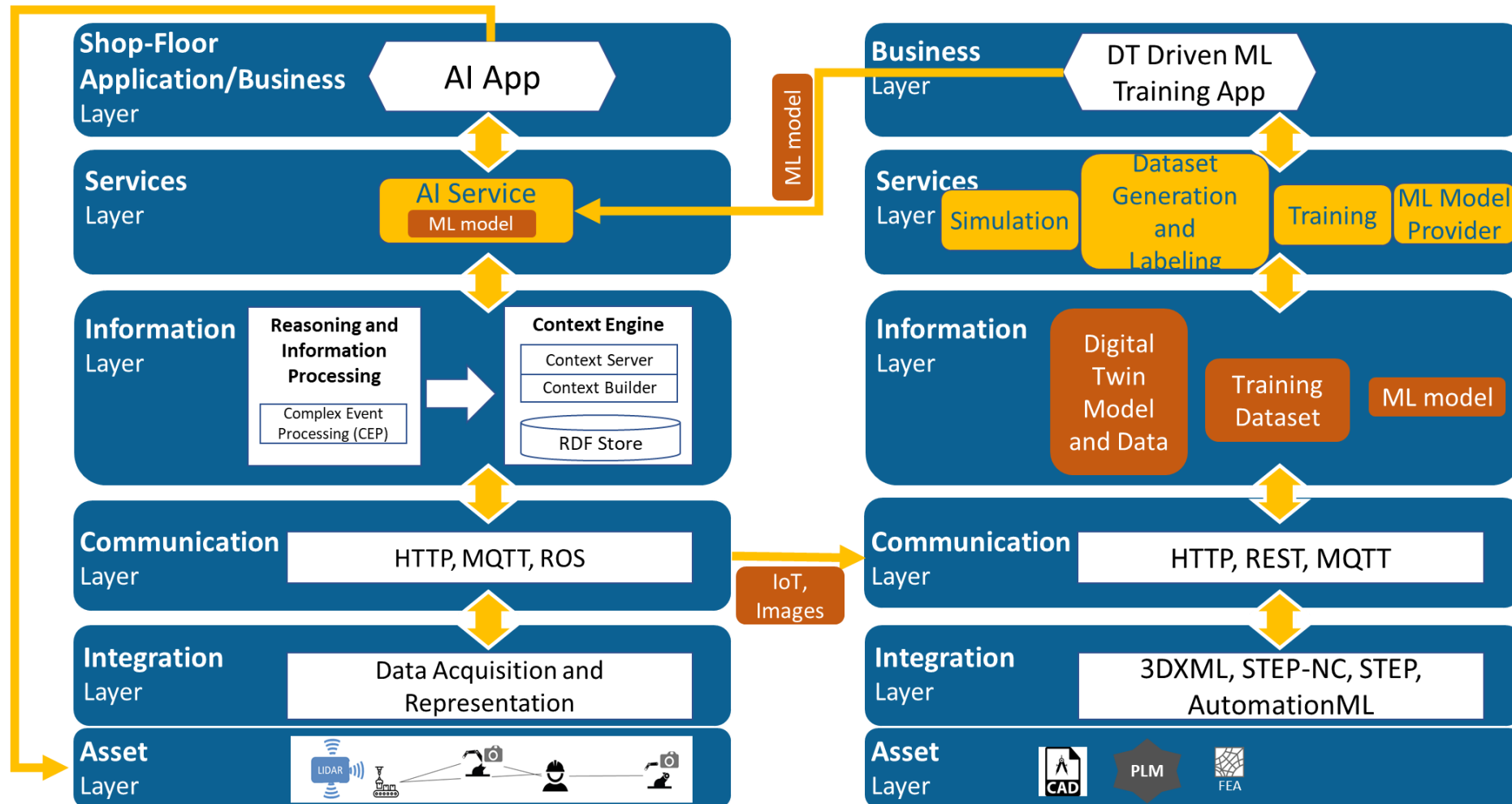


- Artificial Intelligence (AI) applications based on Machine Learning (ML) methods are widely accepted as promising technologies in manufacturing.
- However, ML techniques require large volumes of quality training datasets and in the case of supervised ML manual input is usually required for labelling those datasets.
- Such an approach is expensive, prone to errors and labour as well as time intensive, especially in a highly complex and dynamic environment as those of a production system.
- Digital Twin models can be utilized for accelerating the training phase in ML by creating suitable training datasets as well as by automatic labelling via the simulation tools chain and thus alleviating user's involvement during the training phase.

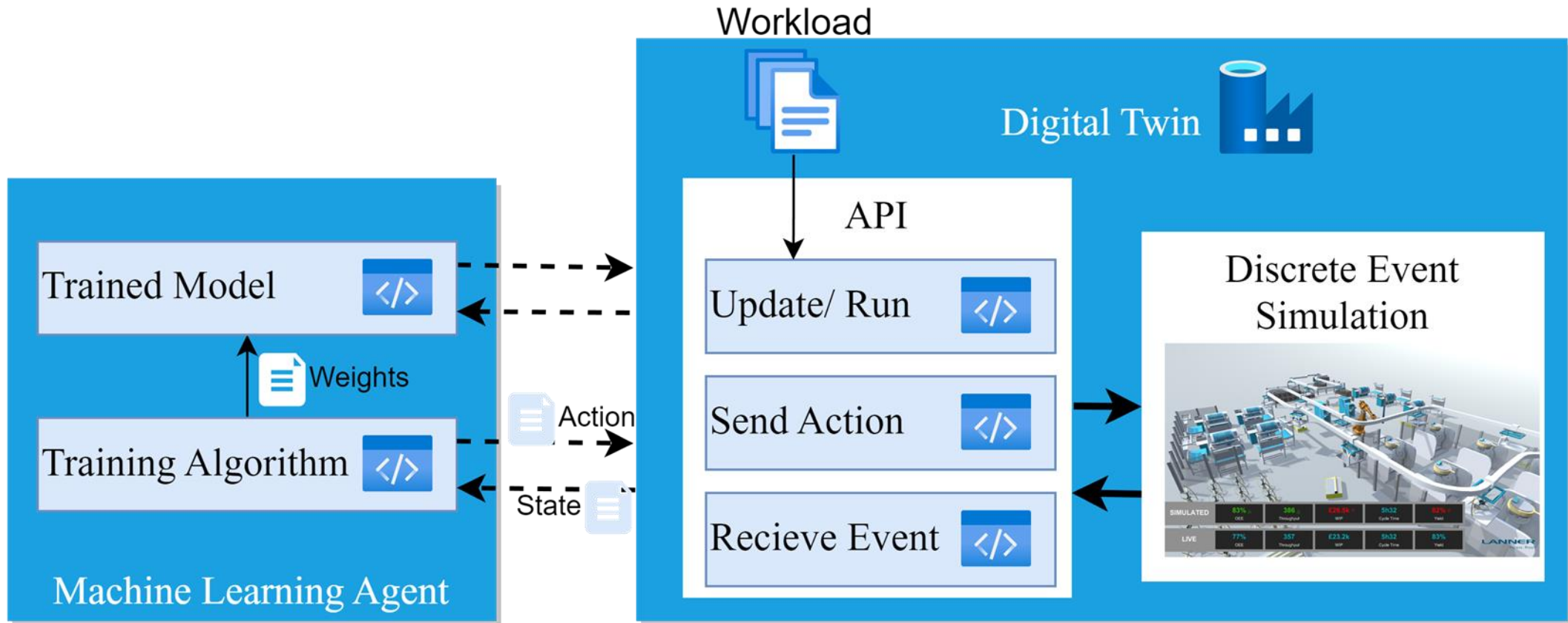




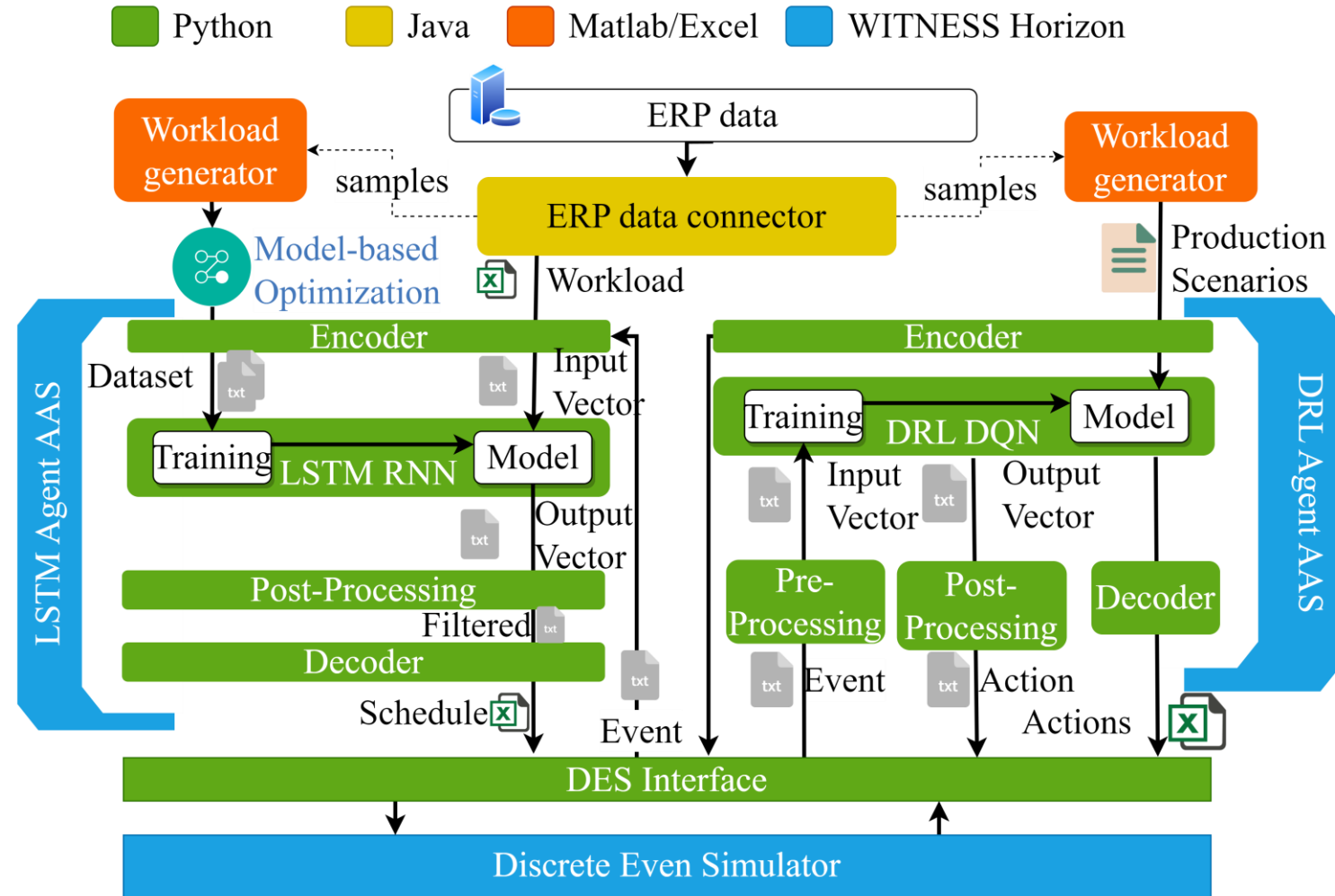
K. Alexopoulos, N. Nikolakis, G. Chryssolouris, "Digital twin-driven supervised machine learning for the development of artificial intelligence applications in manufacturing", International Journal of Computer Integrated Manufacturing, Volume 33, Issue 5, pg. 429-439, (2020).



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Kosmas Alexopoulos, Nikolaos Nikolakis, Emmanouil Bakopoulos, Vasilis Siatras, Panagiotis Mavrothalassitis, Machine Learning Agents Augmented by Digital Twinning for Smart Production Scheduling, IFAC World Congress 2023



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- Artificial Intelligence, data spaces, and digital platforms are interconnected and mutually beneficial.
- Data spaces provide the necessary infrastructure for AI algorithms to access and utilize data effectively,
- AI technology enhances the functionality and capabilities of digital platforms by providing services to optimize the performance of value chains.
- Together, they form a powerful ecosystem that drives innovation

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# Thank You

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