



# Digital Twins at Industry Information integration

Valmet

Mika Karaila

Research Director

# Digital Twin some definitions

## What the definitions can agree on?

- It is a digital representation the elements and dynamics of a physical device.
- Collects real-time data using sensors.
- *Uses simulation and models to mimic the physical system.*

“A Digital Twin is an integrated Multiphysics, multiscale, probabilistic simulation of an as-built vehicle or system that uses the best available physical models, sensor updates, fleet history, etc., to mirror the life of its corresponding flying twin”  
*Glaessgen & Stargel, (2012)*

“a dynamic virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning”  
*Bolton, McColl-Kennedy, Cheung, Gallen, Orsingher, Witell & Zaki, (2018)*

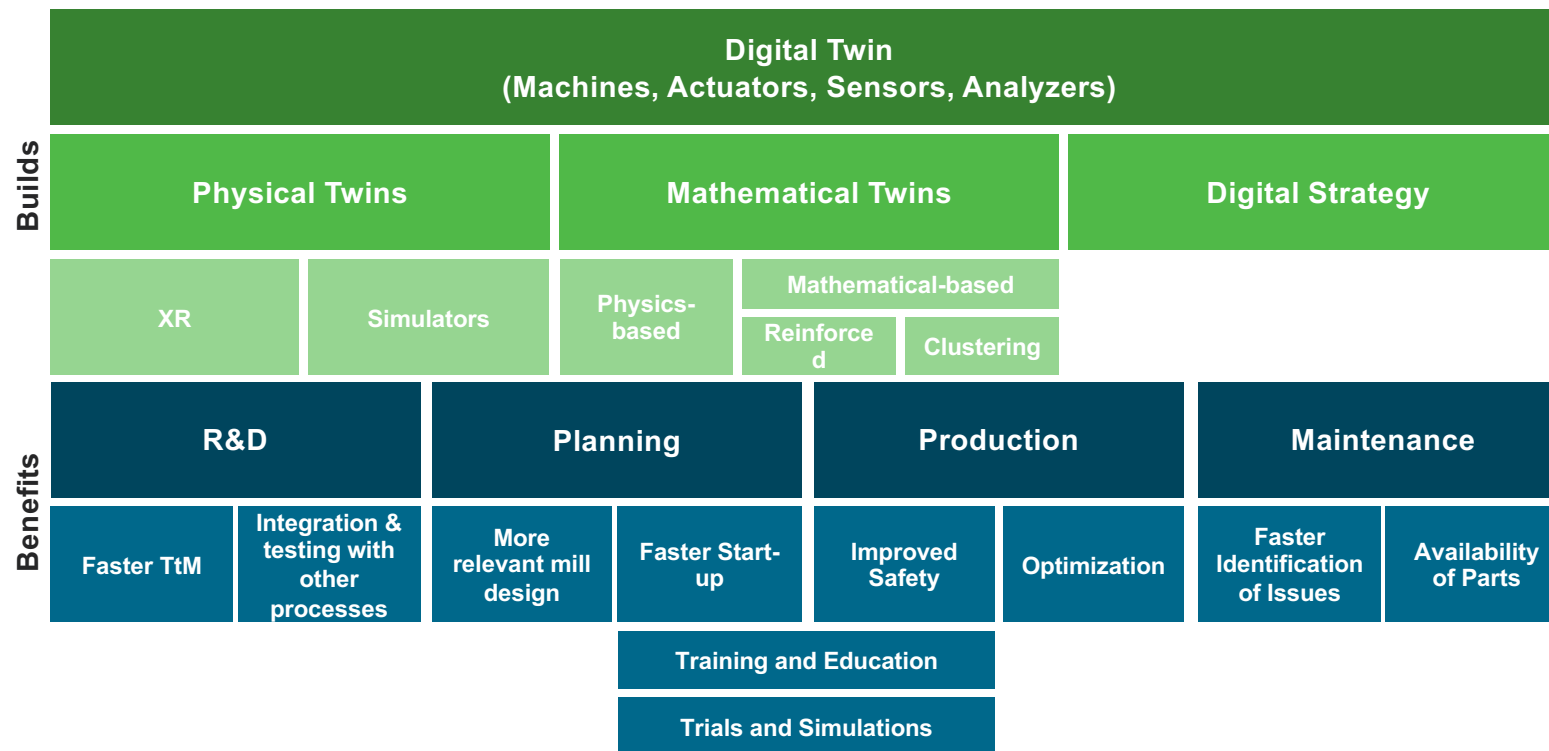
“Coupled model of the real machine that operates in the cloud platform and simulates the health condition with an integrated knowledge from both data driven analytical algorithms as well as other available physical knowledge”  
*Lee, Lapira, Bagheri, an Kao, (2013)*

“Using a digital copy of the physical system to perform real-time optimization”  
*Söderberg, R., Wärmeffjord, K., Carlson, J. S., & Lindkvist, L. (2017)*

“Digital twin is a real mapping of all components in the product life cycle using physical data, virtual data and interaction data between them”  
*Tao, Sui, Liu, Qi, Zhang, Song, Guo, Lu & Nee, (2018)*

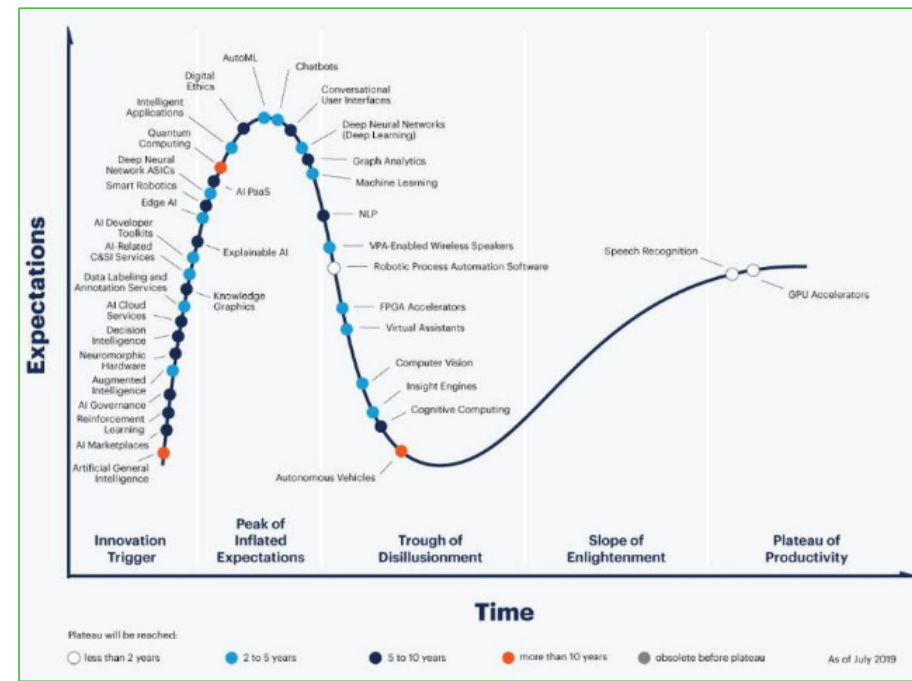
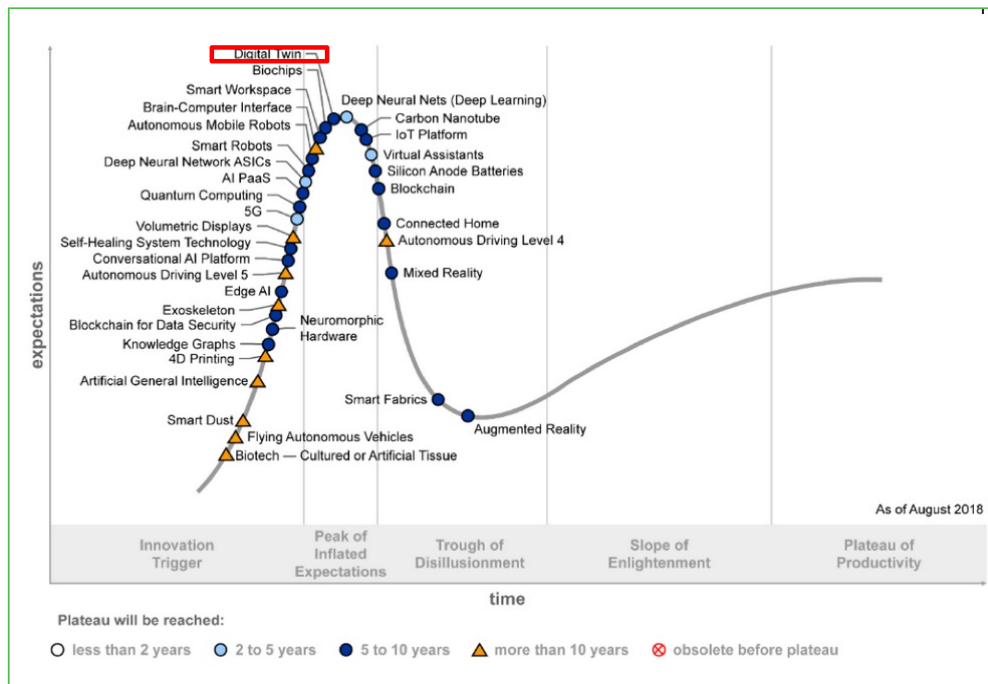
“A digital twin is a real time digital replica of a physical device”  
*Bacchiega (2017)*

# Digital Twin Builds & Benefits



# Digital Twin hype or reality?

- Digital Twin hype-curve, technologies making it possible and supporting emerging rapidly...



Gartner Hype Cycles for Emerging Technologies and for Digital Workplace 2018.





# Next generation Digital Twin: ValmetXR & Valmet Expert

## Mixed Reality application with integrated AI assistant

- Use cases:
  - Virtual training, integrated eLearning
  - Maintenance:
    - Field worker can get immediate help
    - Documents like manual, photos, videos available
    - Knowledge base from cloud (Valmet ticketing system based solutions reused abstracted)
- Extended, CMMS connected:
  - Maintenance / repair needed -> Teleport user to device (POI is marker for instrument/system)
  - Give short message to user
  - Animate device with color / movement
- Some technical background:
  - Services
  - REST APIs
  - OPC UA communication interface to simulator / real system

# Valmet Digital Twin – Use cases

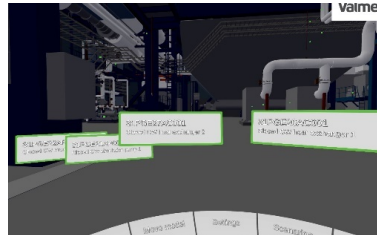
- All live values to POI from OPC UA Server
  - Live value can use animated symbol like 3D Tank
- Connect condition monitoring system to Digital Twin
  - Enable system / machinery service need like warning or maintenance needed
- Connect VII Cloud solution data to Digital Twin
  - Show machine / process part if there is notification
- Other external system can be connected with adapter (micro service / server principle)
  - State and variable values can be changed with REST API
- Digital Twin will execute and update animations to ValmetXR
  - Animations can be written as text to file
  - Each animation file can be loaded
  - Animation will use 3D model part names
  - Actions are color change, move part, hide part, show part, rotate part
  - Teleport user to POI coordinates

# Valmet Virtual Plant Features – Interactive & Live Digital Twin



Teleports

Jumping to the pinned locations



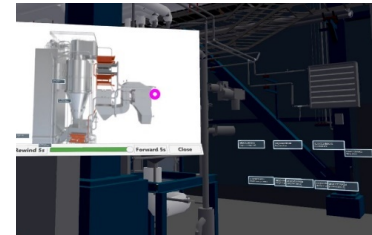
Tags Descriptions

Automatic pop-up description



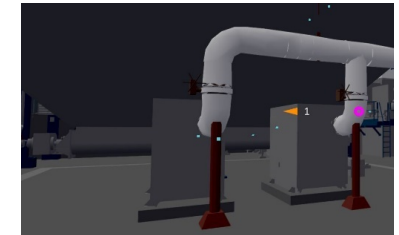
Live Values

Automatic pop-up live data panel



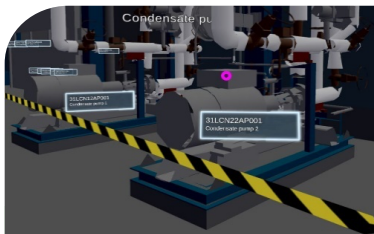
Training Videos

Instructional 360/2D videos



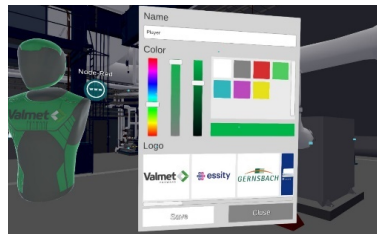
Alerts

List of active alarms



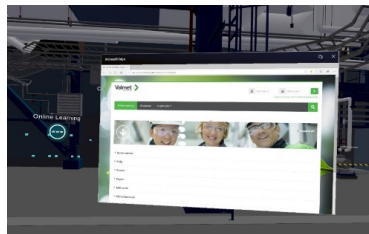
Danger Zones

Virtual tapes indicating hazardous areas



Collaboration Avatar

To communicate with other user as an avatar



Online Learning

Checking Online courses virtually



Virtual Trainer

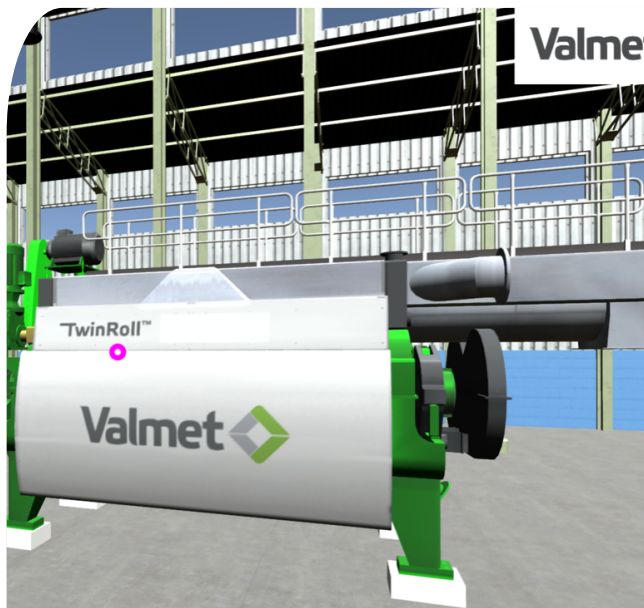
Predefined route for daily check



Remote Support

Video streaming via augmented application

# Digital Twin Features



Dynamic Digital Twin

- 3D model, part names
- REST engine for animations



AI ChatBot

- Valmet Expert (AI Assistant chatbot)

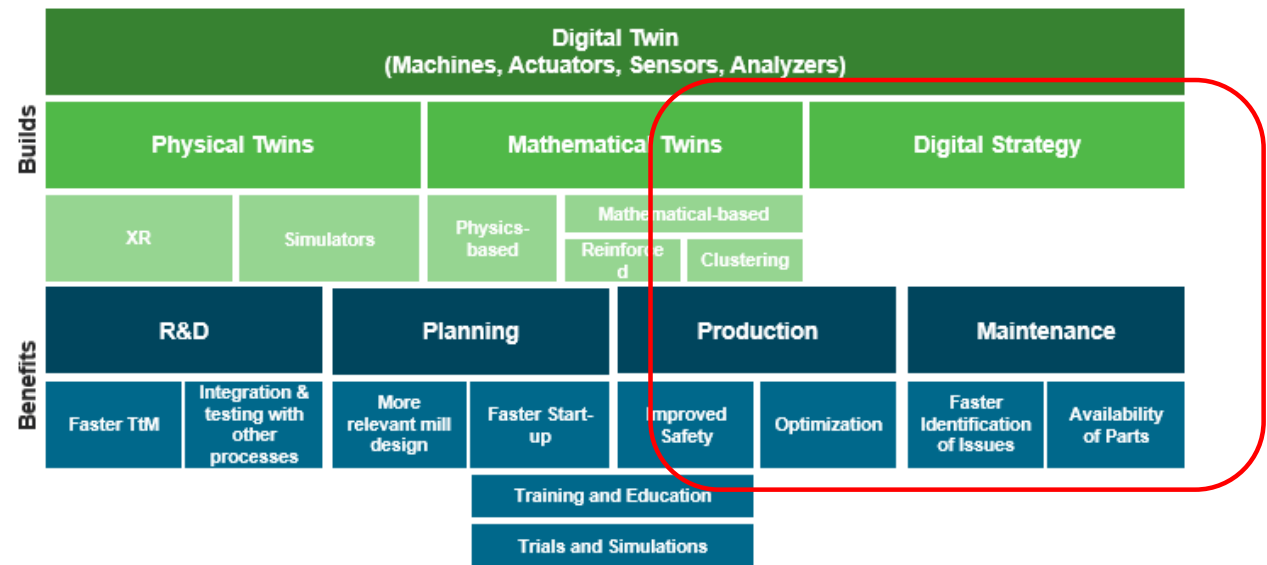


Live Values

- OPC UA Server:  
Real-time values & alarms

# Digital Twin with AI assistant

- Context aware chatbot
- API interface to local data == tacit knowledge (user / site specific)
- API interface to knowledge base == product knowledge (validated)
- Faster problem solving





# ValmetXR & Valmet Expert Activate



# ValmetXR & Valmet Expert

Instance ready: connects to backend chatbot service



# ValmetXR & Valmet Expert

Commands: pre-configured in settings





# ValmetXR & Valmet Expert

## POI specific context menu



## Future visions

- From consumer applications to industrial
- NLP is “ready”, practical use cases coming out
- AI needs knowledge base & training => this will take some time

## Comments & questions ?

