Future Trend Forum – Key Technology Template

1 Description

The objective of this template is to provide a common structure to document the key technologies identified by the Future Trend Forum group. The idea is that this content will be published on a common website served by the PTA.

Each webpage should provide sufficient information to gain a basic understanding on the technology for a layman, and to provide additional resources and key pointers for specialized companies to further their knowledge.

The contact person for each key technology is responsible for keeping the content up to date.

2 Template Fields

2.1 Technology Name

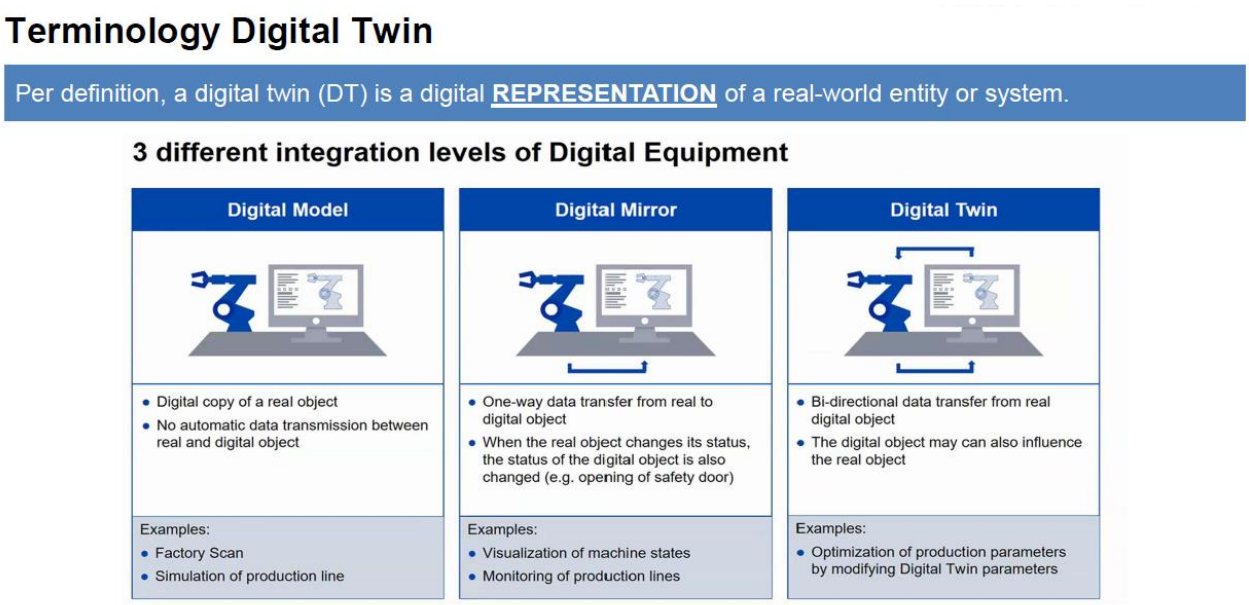
Digital Twins / Process Flow and Machine Digital Twins

2.2 Contact company/person

TDK Electronics Components, S.A.U. / Francisco Lavado Rodríguez

2.3 Technology Overview

Brief description and benefits of the technology:



Source: TDK Electronics Components, S.A.U.

Process Flow DT

Benefits

- Support for investment decision.
- Avoiding unnecessary CAPEX.
- Define
  - No. cells / equipment
  - cycle time
  - buffers (number, size, …)
  - operators (number, occupation, …)
  - number of needed tools
  - …
- Relevant KPI calculations.
- VSM analysis.
- Visualize production lines.
- Virtual tour.

Machine DT

Benefits for new machines:

- Improved transparency with supplier:
  - Support for conceptual design. Optimization and cost saving opportunities at the initial stage of the projects.
  - Design Testing, early problems detection at design phase.
- Costs savings by shortening real commissioning:
  - Off line functional test (mechanical; PLC/Robot programs).
  - Optimization of processes before commissioning.
- Virtual reality for maintenance and training.

Benefits for existing machines:

- Minimize impact of changes in production capacity by Offline function test of improvements (mech., PLC/Robot programs).
- Visualization of machine activity in the past based on stored data (project with PIC).
- Virtual reality for maintenance and training.

Source: TDK Electronics Components, S.A.U.

2.4 History and major achievements

History:

The digital twin concept gained recognition in 2002 after Challenge Advisory has hosted a presentation for Michael Grieves in the University of Michigan on technology. The presentation involved the development of a product lifecycle management center. It contained all the elements familiar with the digital twin including; real space, virtual space and the spreading of data and information flow between real and virtual space. While the terminology may have changed over the years the concept of creating a digital and physical twin as one entity has remained the same since its emergence. While its commonly thought to be developed in 2002, digital twin technology itself has actually been a concept practiced since the 1960s. NASA would use basic twinning ideas during this period for space programming. They did this by creating physically duplicated systems at ground level to match the systems in space. An example is when NASA developed a digital twin to assess and simulate conditions on board Apollo 13.

Although the digital twins have been highly familiar since 2002, only as recently as 2017 has it become one of the top strategic technology trends.

Source: challenge.org

Major achievements:

Over the course of the last decade, deployment of digital twin capabilities has accelerated due to a number of factors:

• Simulation. The tools for building digital twins are growing in power and sophistication. It is now possible to design complex what-if simulations, backtrack from detected real-world conditions, and perform millions of simulation processes without overwhelming systems.

Further, with the number of vendors increasing, the range of options continues to grow and expand. Finally, machine learning functionality is enhancing the depth and usefulness of insights.

• New sources of data. Data from real-time asset monitoring technologies such as LIDAR (light detection and ranging) and FLIR (forward-looking infrared) can now be incorporated into digital twin simulations. Likewise, IoT sensors embedded in machinery or throughout supply chains can feed operational data directly into simulations, enabling continuous real-time monitoring.

• Interoperability. Over the past decade, the ability to integrate digital technology with the real world has improved dramatically. Much of this improvement can be attributed to enhanced industry standards for communications between IoT sensors, operational technology hardware, and vendor efforts to integrate with diverse platforms.

• Visualization. The sheer volume of data required to create digital twin simulations can complicate analysis and make efforts to gain meaningful insights challenging. Advanced data visualization can help meet this challenge by filtering and distilling information in real time. The latest data visualization tools go far beyond basic dashboards and standard visualization capabilities to include interactive 3D, VR and AR-based visualizations, AI-enabled visualizations, and real-time streaming.

• Instrumentation. IoT sensors, both embedded and external, are becoming smaller, more accurate, cheaper, and more powerful. With improvements in networking technology and security, traditional control systems can be leveraged to have more granular, timely, and accurate information on real-world conditions to integrate with the virtual models.

• Platform. Increased availability of and access to powerful and inexpensive computing power, network, and storage are key enablers of digital twins. Some software companies are making significant investments in cloud-based platforms, IoT, and analytics capabilities that will enable them to capitalize on the digital twins trend. Some of these investments are part of an ongoing effort to streamline the development of industry-specific digital twin use cases.

Source: Deloitte Insights_TechTrends 2020

2.5 Hot Topics & Key challenges

Challenges associated with the technology. Current hurdles the community is trying to overcome [3 pages max]

2.6 Market

Global market opportunity and trends [2 pages max]

2.7 TechPark companies involved in this research line

So far, there are no companies working on developing either the Process Flow Digital Twin or the Machine Digital Twin softwares within the TechPark.

The company that is making use of this technology as adopter within the TechPark is TDK Electronics Components, S.A.U.
Additional companies that could be interested on adopting this technology are those related to Manufacturing (Process Flow Digital Twin), Logistics (Process Flow Digital Twin) and Machine Manufacturers (Machine Digital Twin).

2.8 University departments actively involved in this research line

University of Malaga (UMA): Sistem Engineering and Automation department (Departamento de Ingeniería de Sistemas y Automática). Professor: Victor Fernando Muñoz Martínez.

During the last 2 years TDK Electronics Components, S.A.U. and professor Víctor Fernando Muñoz Martínez have been exchanging information about their automation activities, and as a result a formative project called "Design and construction of Digital Twins in the context of Industry 4.0" (Diseño y elaboración de Gemelos digitales en el contexto de la industria 4.0) has been selected in the last edition of the "Key-Project" Program. This formative project, is targeted for students of Official Grades and Masters of the University of Málaga and will take place from February´21 to December´21.
This project is now under preparation: acquisition of material and software for a Digital Twin laboratory, definition of program of the course and eventually training of teachers. The course should take place during the last quarter of 2021.

2.9 Relevant discussion forums

Include a list of the most relevant discussion forums (conferences, events, local meetups, …) where the community is sharing progress around this technology

- Worldwide
- National
- Local

2.10 Key reference companies & people

Include a list of the top companies that are a reference in terms of pushing this technology forward

- Worldwide
- National (if any)
- Local (if any)

2.11 Strategic Initiatives linked to the technology

Current European, Spanish or Andalusian strategic projects and guidelines

2.12 List of Current Projects

Active projects from TechPark companies related to this technology

2.13 Additional resources

Links to gain deeper knowledge on the technology:

Webinar videos:

https://www.youtube.com/watch?app=desktop&v=W0nmq0fwyYU&feature=youtu.be

https://academy.visualcomponents.com/webinars/visual-components-3d-factory-simulation-webinar-plan-for-whats-next/

Webpages of Simulation Software suppliers:

https://www.visualcomponents.com/

https://www.plm.automation.siemens.com/global/es/products/tecnomatix/

https://www.demo3d.com/

https://www.flexsim.com/es/