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| Project | **Specification of Digital Synchronization Framework between Cyber and Physical World**  <<https://sagroups.ieee.org/2888/>3 **>** |
| Title | **Proposal on the Terminology of Digital Twins** |
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| Re: |  |
| Abstract |  |
| Purpose | To discuss and define the terminology for digital twin |
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# Introduction

In the last meeting there was a discussion of the terminology of virtual copies of physical objects in digital twins [1]. "Digital Thing", "Digital Entity" and "Virtual Entity" were in the table, but it was not determined which one was appropriate within the working scope of IEEE.2888.3. And in [2], the term "digital thing" is used as a counterpart of a physical thing.

We think it needs to be a consensus within the group on the terminology. Thus, in this contribution, we summarized typical definitions of digital twins suggested by researcher, industry and standard bodies. And we are going to propose a term and scope for virtual replication of physical objects.

# Proposal of Key Terms for Digital Twins

# 2.1 Overview

There is no official definition of digital twins until now but there are many suggestions. Following table shows typical definition of digital twins suggested by industries, consortium, standard body(consortium) and researcher. And we can see some commonly used terms in the table. In other word, things that exist in the real world are called physical objects, asset, entity and in virtual world it is called virtual representation(model), digital representation.

Table 1. Definitions of digital twins

|  |  |
| --- | --- |
| Wiki(https://en.wikipedia.org/wiki/Digital\_twin) | **A virtual representation** that serves as the real-time digital counterpart of a **physical object or process**. |
| IBM(https://www.ibm.com/topics/what-is-a-digital-twin) | **A virtual model** designed to accurately reflect a physical object. |
| GE(https://www.ge.com/digital/applications/digital-twin) | **A software representation** of a **physical asset**, **system or process** designed to detect, prevent, predict, and optimize through real time analytics to deliver business value. |
| Microsoft Azure(https://azure.microsoft. com/en-us/services/ digital-twins/) | An IoT platform that enables firms to create **a digital representation** of **real-world things, buildings and business processes.** |
| Gartner(https://www.gartner.com/en/information-technology/glossary/digital-twin) | **A digital representation** of a **real-world entity** **or system**. |
| Digital twin Consortium (https://www.digitaltwinconsortium.org) | **A virtual representation** of **real-world entities** **and processes,** synchronized at a specified frequency and fidelity. |
| ISO 23247(Automation systems and integration-Digital twin framework for manufacturing) | **A digital representation** of an **observable manufacturing element** with synchronization between the element and its digital representation. |
| ITU-T SG13/Q22(Requirements and Architecture of Digital Twin Network) [3] | **A real-time representation** of **physical assets** in a digital world. (Digital Twin Network is a virtual representation of the physical network, analyzing, diagnosing, simulating and controlling the physical network based on data, model and interface, so asto achieve the real-time interactive mapping between physical network.) |
| [Michael Grieves](file:///C:\Users\csyoon\Downloads\Michael%20Grieves) ([https://doi.org/10.5281/ zenodo.1493930](https://doi.org/10.5281/%20zenodo.1493930))[4] | **Virtual representation** of what has been **produced.** |

# 2.1 Proposal of key terms

As can be seen from Table 1, the term digital things is rarely used in the field of digital twins. Also, we think that expressing various physical objects/processes/systems existing in the physical world as one “digital thing” or “digital object” in the cyber world can cause confusion.

We propose to express an object/system/process existing in the physical world as a virtual object/virtual system/virtual process in the virtual world. In addition, we propose that virtual objects/systems/processes be collectively referred to as digital representations such as below table.

|  |  |  |
| --- | --- | --- |
| Virtual World | | Physical World (Real World) |
| Virtual (Digital) representation | Virtual (Digital) Object | (Physical) Object |
| Virtual (Digital) System | (Physical) System |
| Virtual (Digital) Process | (Physical) Process |

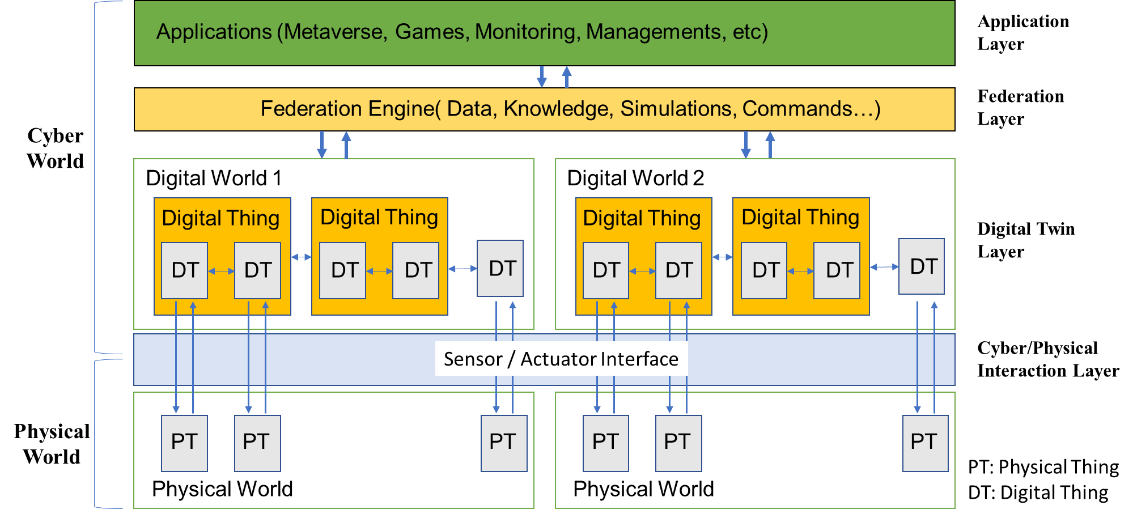
And According to our proposed terms for digital twin, we also propose to change the figure (Fig. 1) of the “interaction between the physical world and the cyber world” in [1] to Fig. 2.

Fig. 1. Physical and Cyber World Interaction [1]

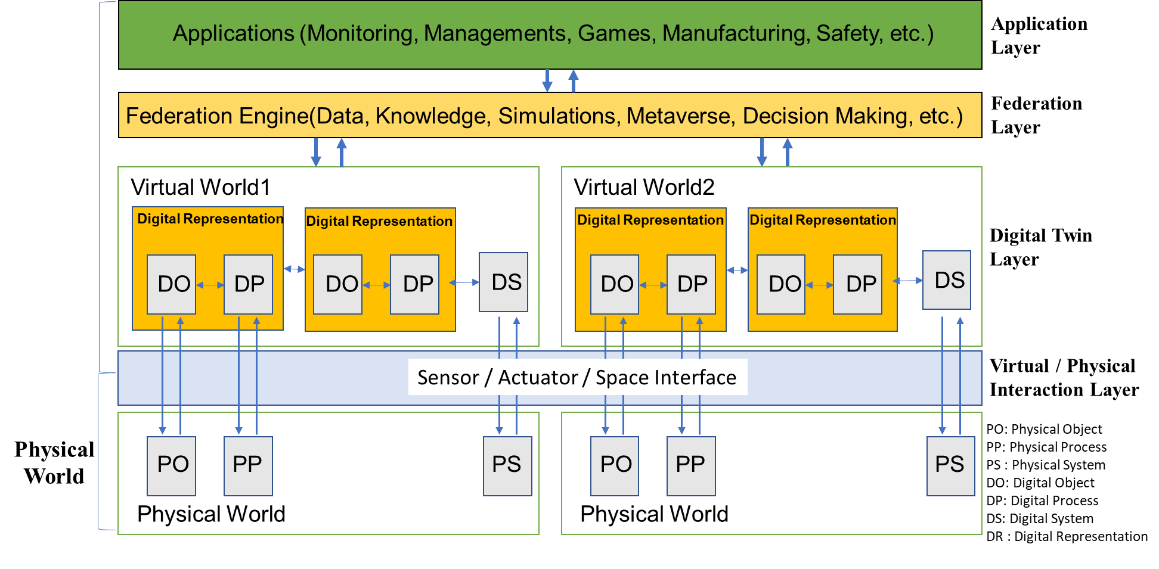


Fig. 2. Virtual and Cyber World Interaction (Our proposal)

# Conclusion

There was some discussion on the terminology in digital twins in the last meeting. In this contribution In this contribution, we summarized some definition of digital twins suggested by others and comment for the terminology for further discussion.

# Reference

[1] IEEE P2888.3 “Draft Standard on Orchestration of Digital Synchronization between Cyber and Physical Worlds”, July 2021

[2] IEEE2888, “Session 7 2888.3 TG Meeting Summary”, 2021.07.01

[3] ITU-T SG13/Q22 Draft new Recommendation ITU-T Y.DTN-ReqArch: "Requirements and Architecture of Digital Twin Network", 2021.07.13

[4] Grieves, M. (2014). Digital Twin: Manufacturing Excellence Through Virtual Factory Replication. Whitepaper. <https://doi.org/10.5281/zenodo.1493930>