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Definition for Digital Twin

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FUTURE 6G NETWORK SERVICES

Universiteit van Amsterdam

Progress

1. Paper Submitted to 6G-PDN2 link
2. Digital Twins in Networks: A Systematic Survey link
3. Future Network Services with Next-Generation Network Digital Twins: Architectural Framework & Tool Evaluation link
4. Extensive Survey paper [Working in Progress]

Future 6G Network Services

To understand and give a definition of Digital Twin, we can start with the existing definitions.

Thus:

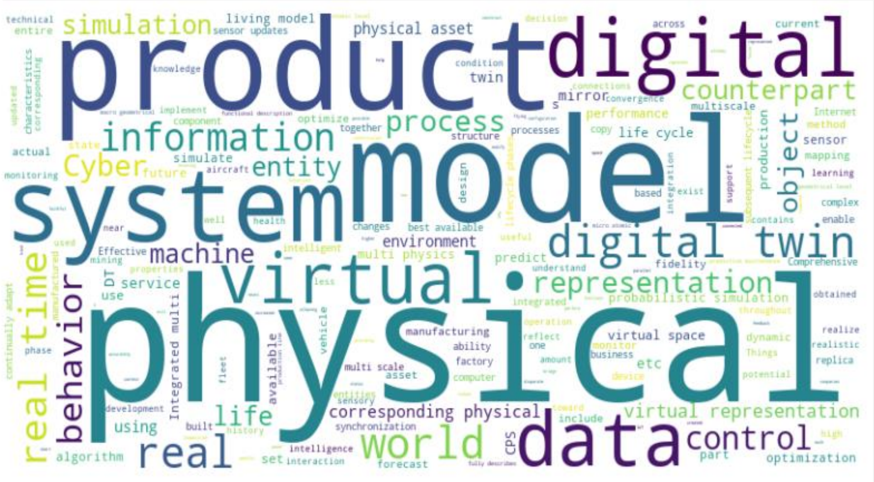

Fig 1: Wordcloud for all definitions we found

Existing Digital Twin Definitions

1. We investigated around 100 definitions of Digital Twin;

2. We manually selected the most common aspects and areas of emphasis;

3. We conducted NLP techniques to identify and match the key aspects across different definitions (with random manual sampling inspection), shown in Fig 2;

4. Then, we categorized them into the following bigger aspects / focuses in Fig 3.

Due to space limitations, the definitions will not be listed in this slide we categorised them into the following categories in Fig 3

Key Aspects and Composition of Digital Twin

We find the small key aspects across different definitions:

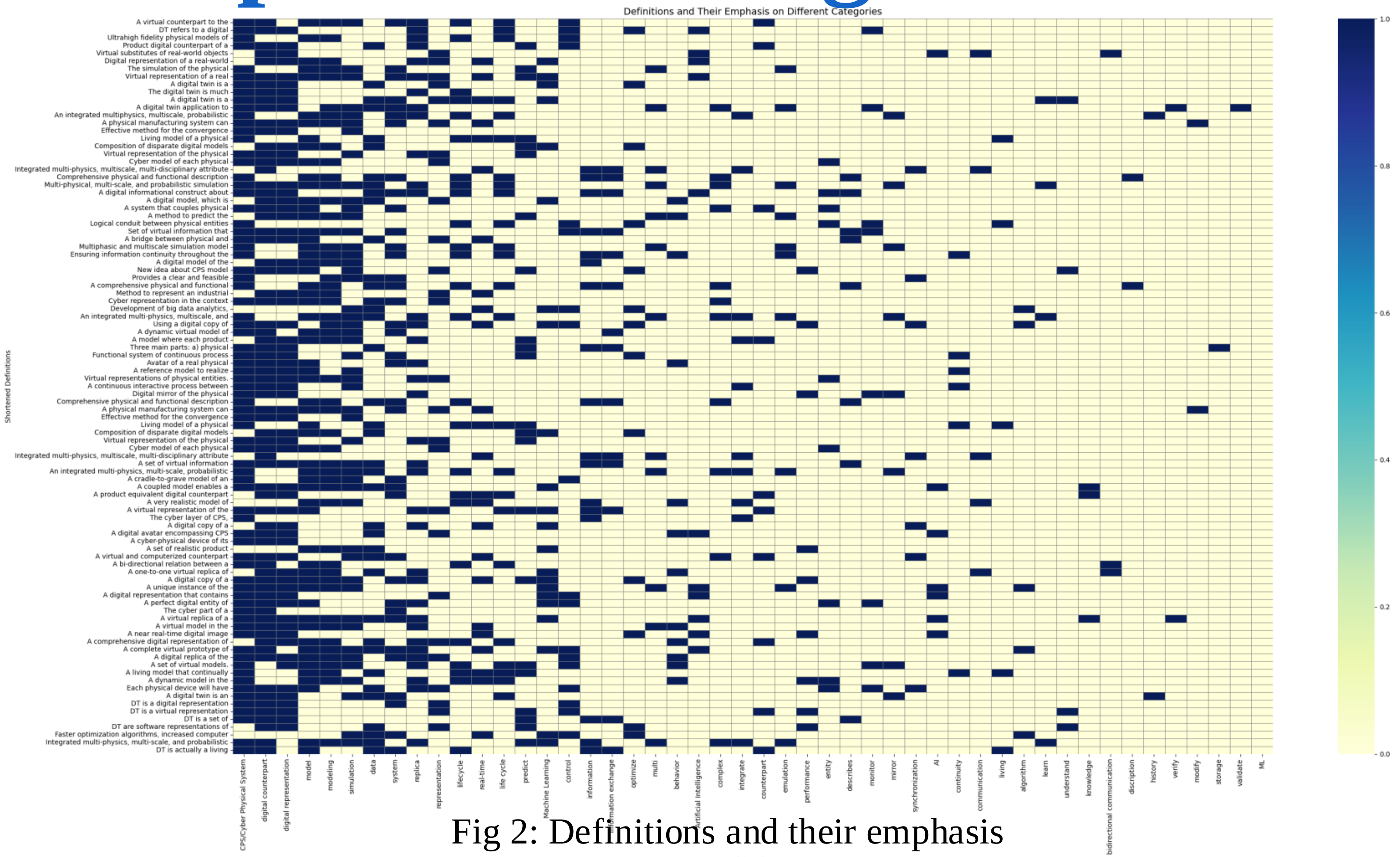

Fig 2: Definitions and their emphasis on different categories

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Key Aspects and Composition of Digital Twin

We summarize and abstract the main focused topics:

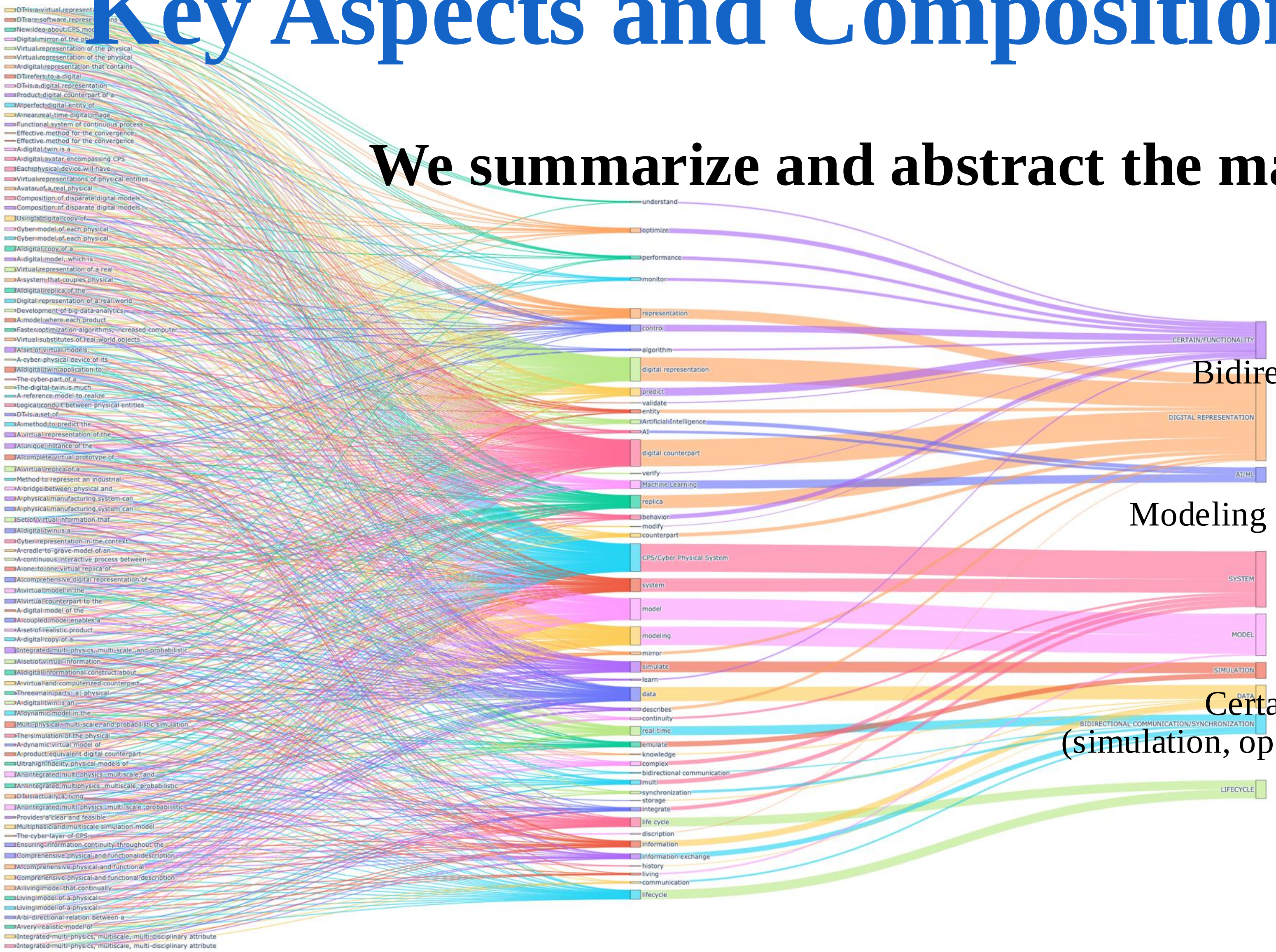

Fig 3: Sankey Diagram Combining Definitions, Small Topics, and Large Categories

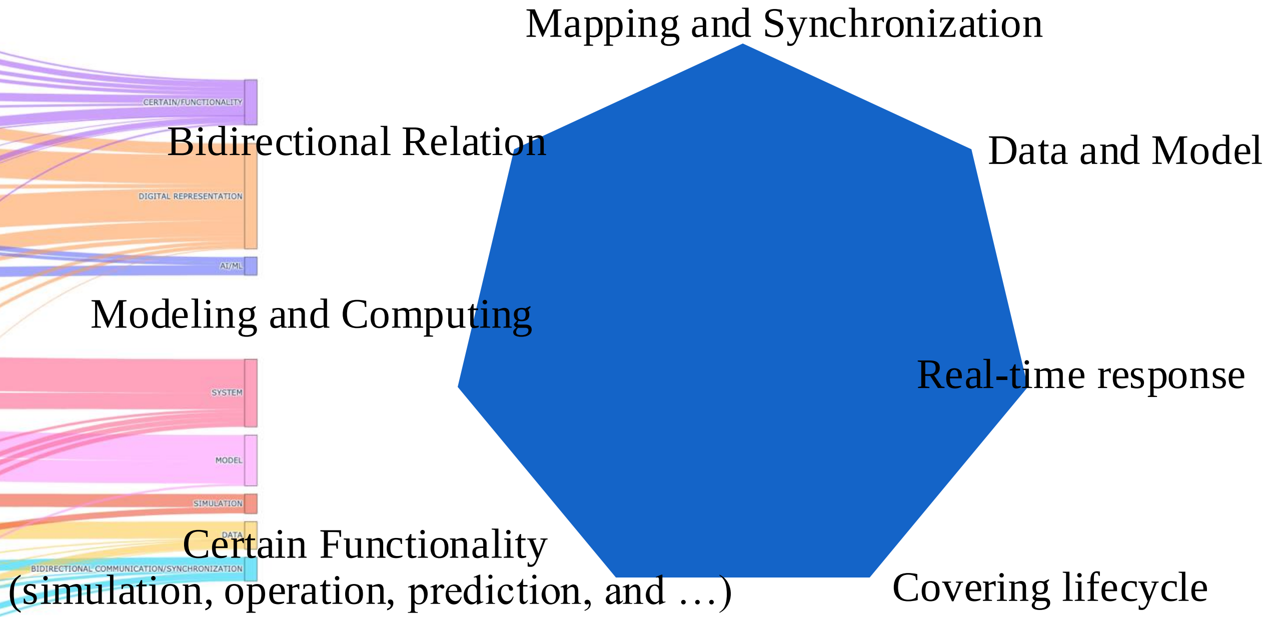

Fig 4: The key concepts of Digital Twin

[Link for Fig 3]

What should our definition be?

When we propose our definitions, there are some requirements, the definition should:

- Focus on the big picture, not the details
- Be aligned with our proposed architecture and existing applications
- Be practical and capable of guiding real-world development
- Prioritize and align our efforts towards areas of our research (networks)

Thus, we proposed our candidate definition for Digital Twin.

Digital Twin Definition

Based on the literature review and investigation of existing definitions,

We define *Digital Twin* as follows:

*A **Digital Twin (DT)** is a virtual representation that maps a physical object, system, process, or an intricate combination of these elements at certain levels.*
It enables bidirectional synchronization between the physical and digital realms, allowing for seamless information exchange and simulation of physical behaviors.
It is developed to achieve further objectives by utilizing its functionalities (such as simulation, prediction, optimization, control, etc.).

Ongoing work

- Taxonomy Based on the Definition
- Use case ZERO
- Reference Architecture
- Standards