글로벌 ICT 표준 컨퍼런스 2023
Global ICT Standards Conference 2023

**IoT and Digital Twin International Standardization
(JTC 1/SC 41) Workshop**

Digital Twin Standardization Activities
in ISO/IEC JTC 1/SC 41

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China Academy of Information and Communications Technology**

주최 과학기술정보통신부 Ministry of Science and ICT · 특허청 Korean Intellectual Property Office · 주관 국립전파연구원 National Radio Research Agency · TTA · IITP · KEA · kista · ETRI

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01. About presentation

Digital Twin Standardization Activities in ISO/IEC JTC 1/SC 41

In the ever-evolving realm of digital transformation, the concept of the 'Digital Twin' stands at the forefront. This presentation delves deep into the ongoing standardization activities related to Digital Twins within ISO/IEC JTC 1/SC 41. It will explore the intrinsic details of defining key concepts and terminologies, laying down a robust reference architecture, elucidating real-world use cases, and understanding the maturity models of Digital Twin implementation. Additionally, we'll shed light on several Preliminary Work Items (PWIs) that play a pivotal role in shaping the future standards of this digital paradigm.
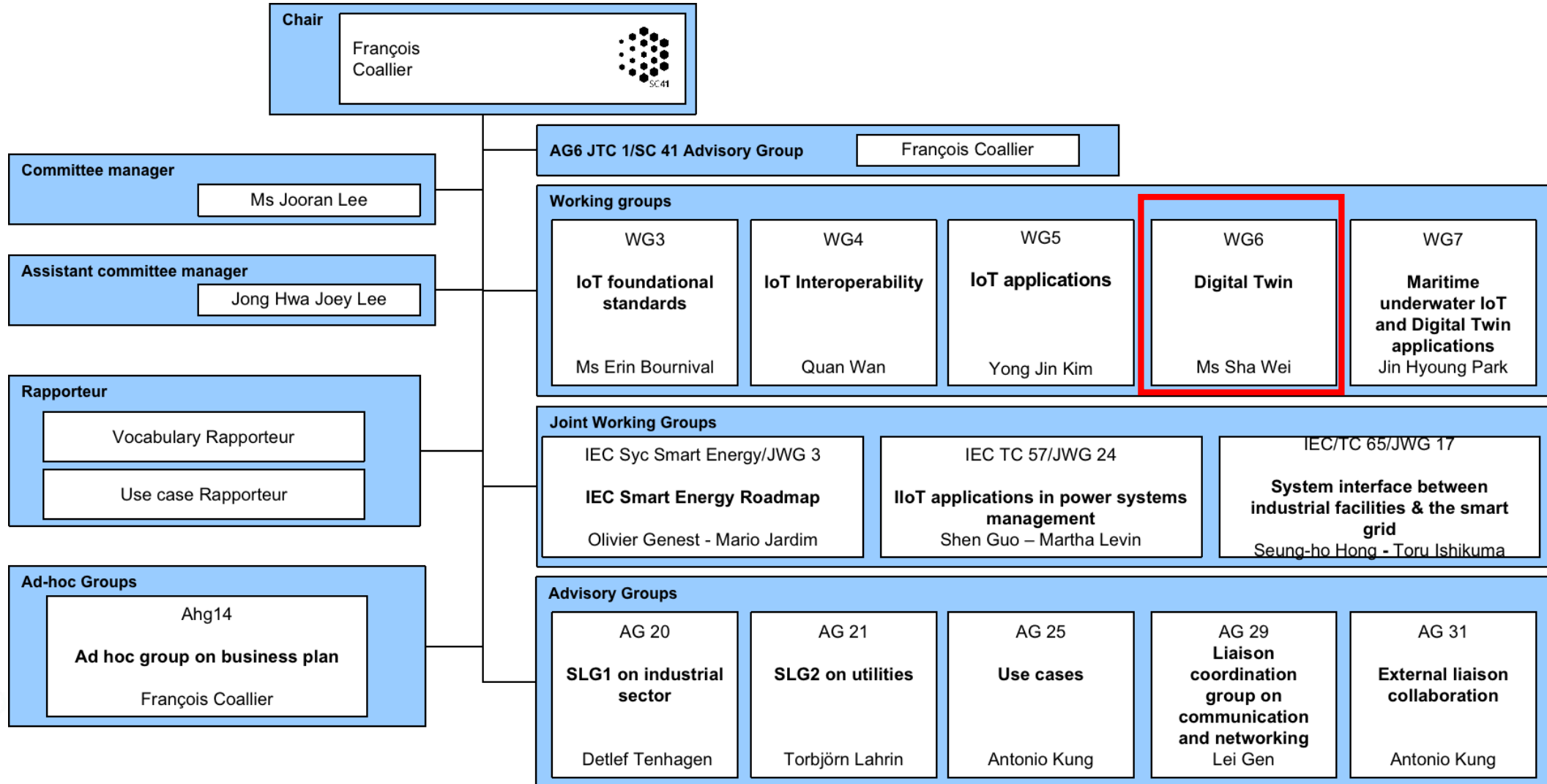
02. **About ISO/IEC JTC 1 SC 41**

History

- 2009: Creation of JTC 1/WG 7: Sensor networks
- 2014: Creation of JTC 1/WG 10: IoT
- 2016: Creation of SC41: IoT and related technologies
  - Merging of WG 7 and WG 10
- **2020: Adding Digital Twins in the scope**

Scope

Standardization in the area of Internet of Things and Digital Twin, including their related technologies.

- Serve as the focus and proponent for JTC 1's standardization programme on the Internet of Things and Digital Twin, including their related technologies.
- Provide guidance to JTC 1, IEC, ISO and other entities developing Internet of Things and Digital Twin related applications.
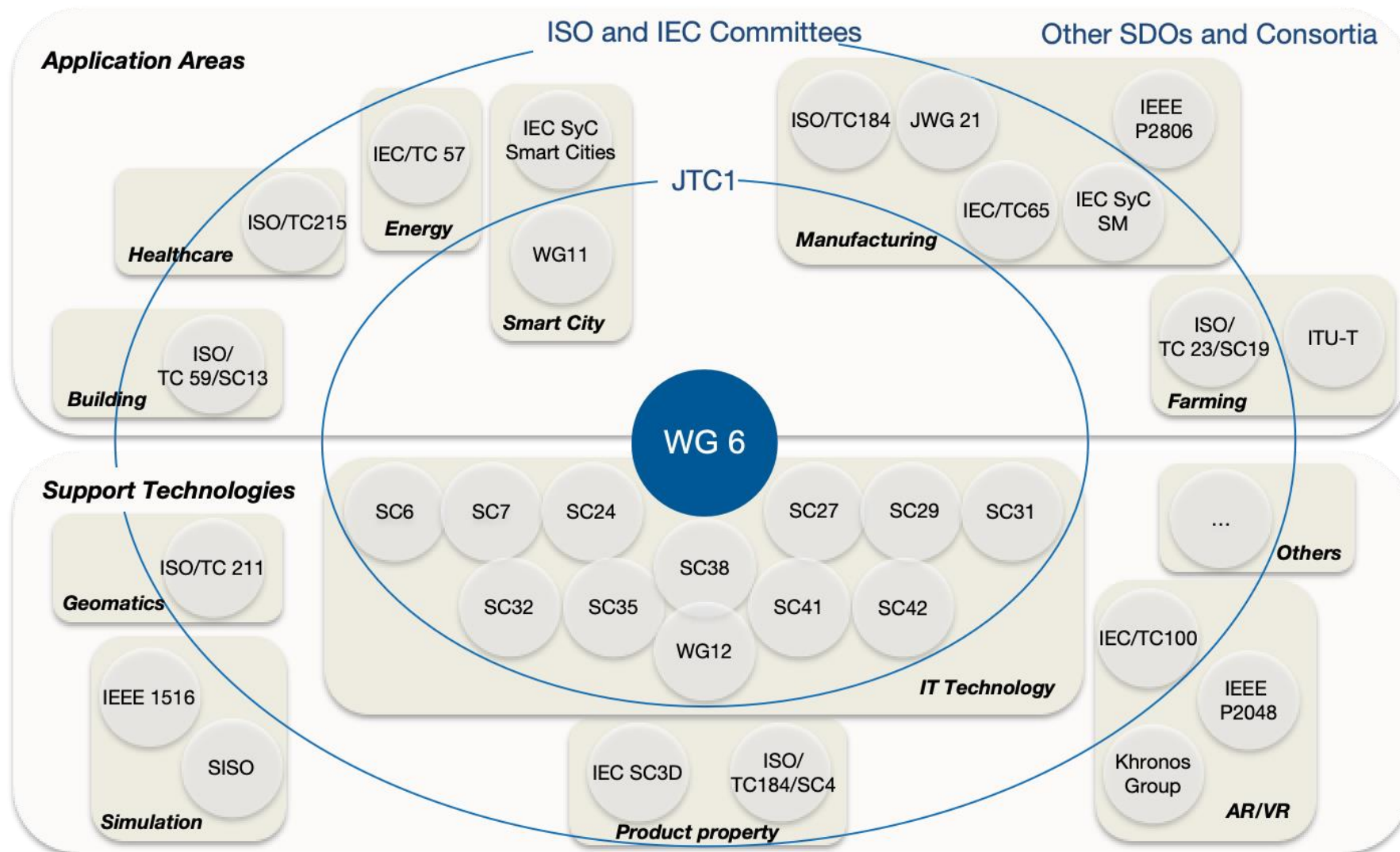
03. ISO/IEC JTC 1/SC 41 Structure

Chair

| François Coallier | SC41 |

AG6 JTC 1/SC 41 Advisory Group | François Coallier |

Committee manager

| Ms Jooran Lee |

Assistant committee manager

| Jong Hwa Joey Lee |

Rapporteur

| Vocabulary Rapporteur |

| Use case Rapporteur |

Ad-hoc Groups

Ahg14

Ad hoc group on business plan

François Coallier

Working groups

WG3	WG4	WG5	WG6	WG7
IoT foundational standards	**IoT Interoperability**	**IoT applications**	**Digital Twin**	**Maritime underwater IoT and Digital Twin applications**
Ms Erin Bournival	Quan Wan	Yong Jin Kim	Ms Sha Wei	Jin Hyoung Park

Joint Working Groups

IEC Syc Smart Energy/JWG 3	IEC TC 57/JWG 24	IEC/TC 65/JWG 17
IEC Smart Energy Roadmap	**IIoT applications in power systems management**	**System interface between industrial facilities & the smart grid**
Olivier Genest - Mario Jardim	Shen Guo – Martha Levin	Seung-ho Hong - Toru Ishikuma

Advisory Groups

AG 20	AG 21	AG 25	AG 29	AG 31
SLG1 on industrial sector	**SLG2 on utilities**	**Use cases**	**Liaison coordination group on communication and networking**	**External liaison collaboration**
Detlef Tenhagen	Torbjörn Lahrin	Antonio Kung	Lei Gen	Antonio Kung

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04. Digital Twins Standards under Development (Yellow Dots)

Foundational

20924:Ed2 IoT and digital twin - Vocabulary ①	**30173** Digital twin concepts and teminology ②
30141 Ed2 IoT reference architecure	**30168 TS** Generic Trust Anchor API for Industrial IoT Devices
30149 TS IoT trustworthiness principles	
30187 Evaluation indicator for IoT systems	**PWI** Digital Twin – Extraction and transactions of data components ⑤
30188 Digital twin Reference Architecture ④	**PWI** Guidance on IoT and digital twin integrations in data spaces ⑤
30186 Digital twin maturity model ③	

Interoperability

30178 IoT Data format, value and coding ⑦
30181 Functional architecture for resource ID interoperability
PWI 8 IoT and Digital twin Behavioral and policy interoperability ⑥
TR PWI 11 Digital twin correspondence measure of DTw twinning ⑦

Applications

TR Best practices for use case projects	**30172 TR** Digital twin use cases ①
30180 Status of self-quarantine through IoT data interfaces	**30184** Autonomous IoT object identification in connected home
30189-1 TR IoT-based cultural heritage management – Framework	
TR PWI 13 IoT Applications for Long-distance Oil and Gas Transmission Pipeline	**TR PWI 12** Environmental effect of underwater acoustic signalling
TR PWI IoT Applications for Natural Gas Distribution System	**TR PWI 10** IoT-based cultural heritage management – Use cases
PWI System requirements of IoT-based fixed asset seizure management	

Underwater

30177 Underwater network mgt system (U-NMS) interworking
30183 Interoperability of UWASNs based on underwater delay & U-DTN
30185 Interoperability of UWASNs & IPV6

# 05. Relevant SDOs and Consortia

06. Definition of Digital Twin

digital twin

digital representation(3.1.7) of a target entity(3.1.2) with data connections that enable convergence between the physical and digital states at an appropriate rate of synchronization

Note 1 to entry: Digital twin has some or all of the capabilities of connection, integration, analysis, simulation, visualization, optimization, collaboration, etc.
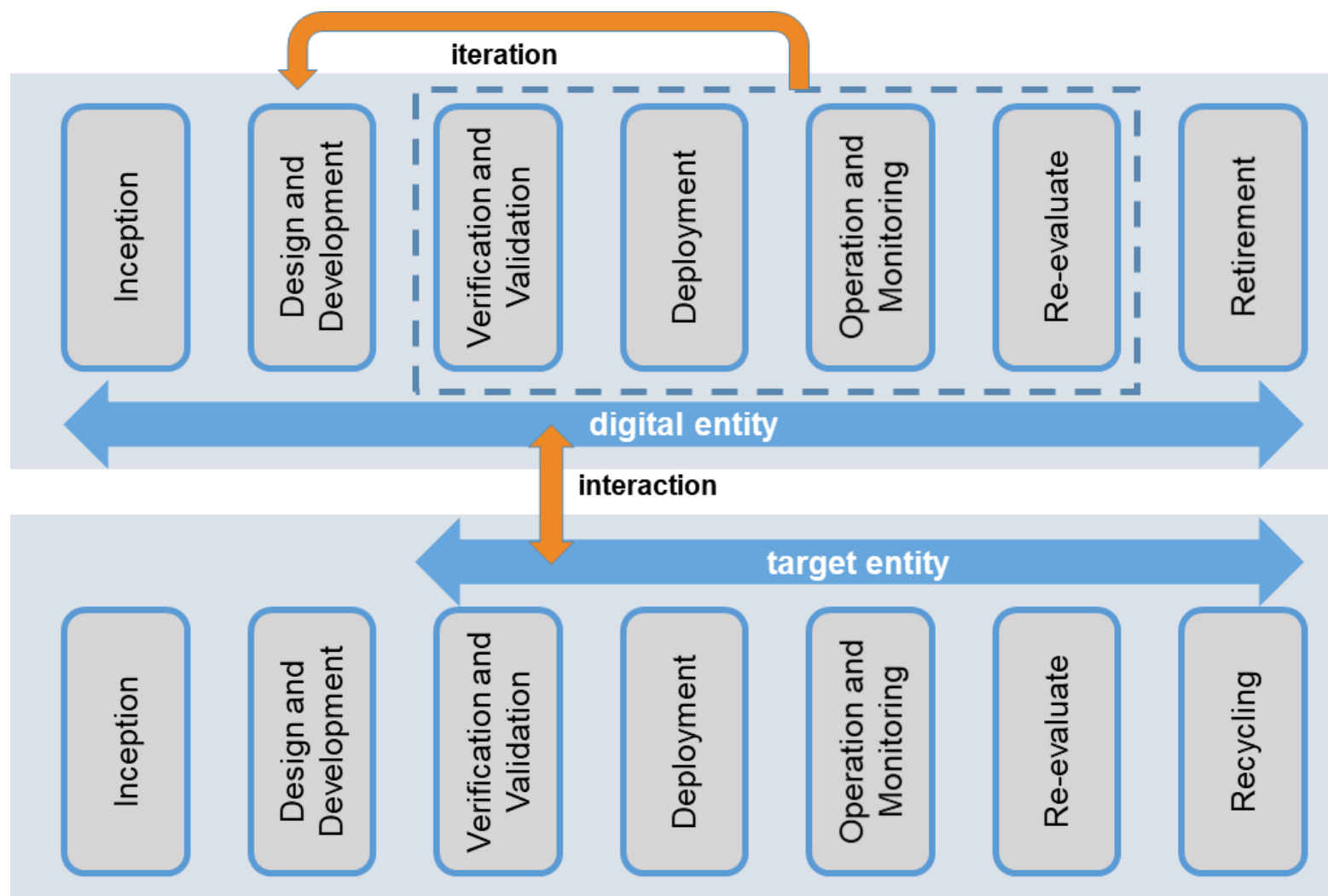
Note 2 to entry: Digital twin can provide an integrated view throughout the life cycle of the target entity.
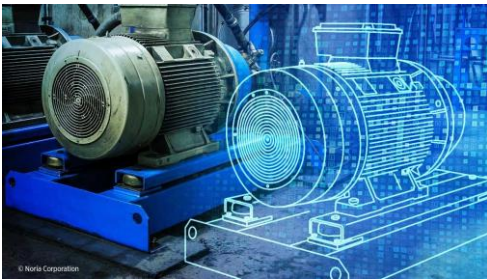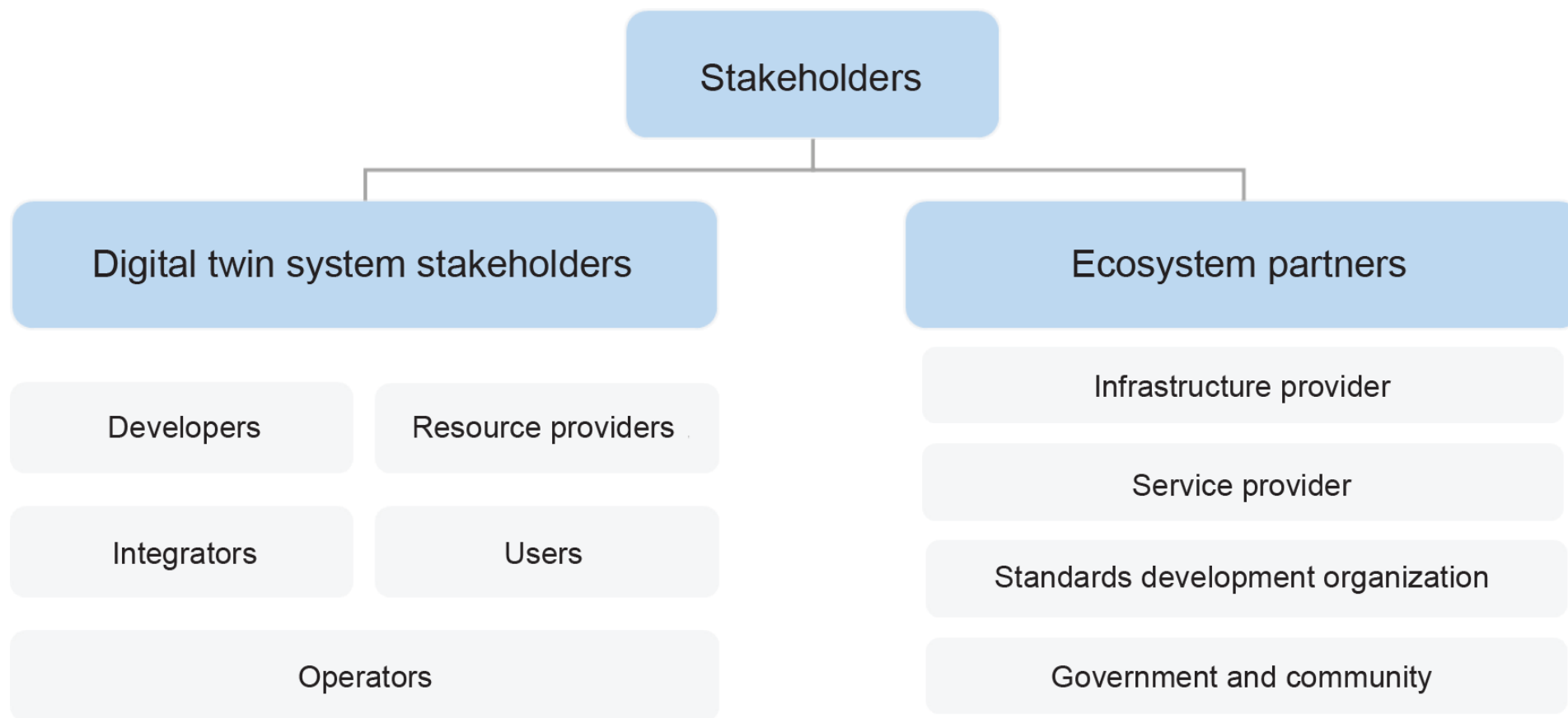
07. **Digital Twin System Context Diagram**
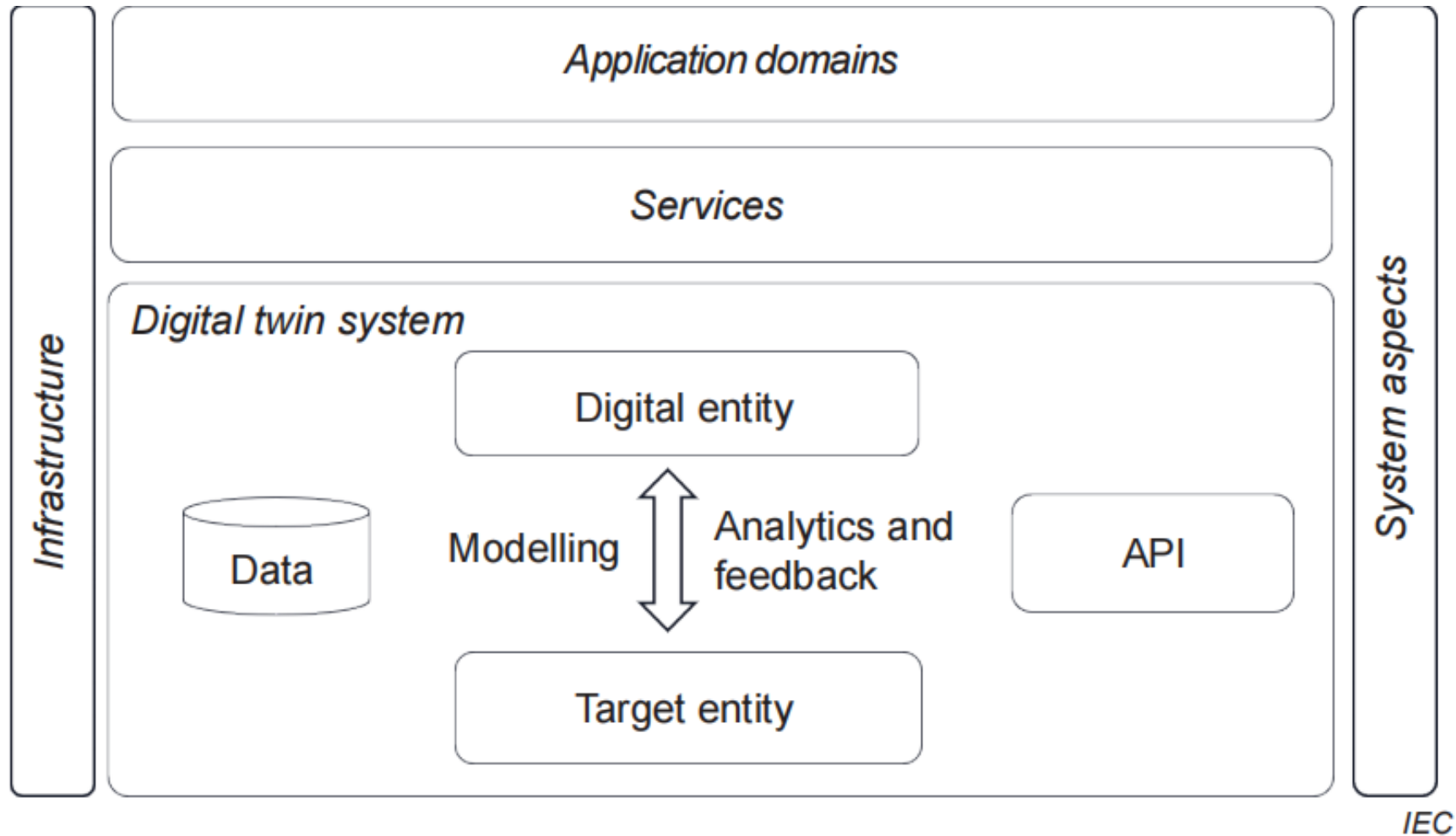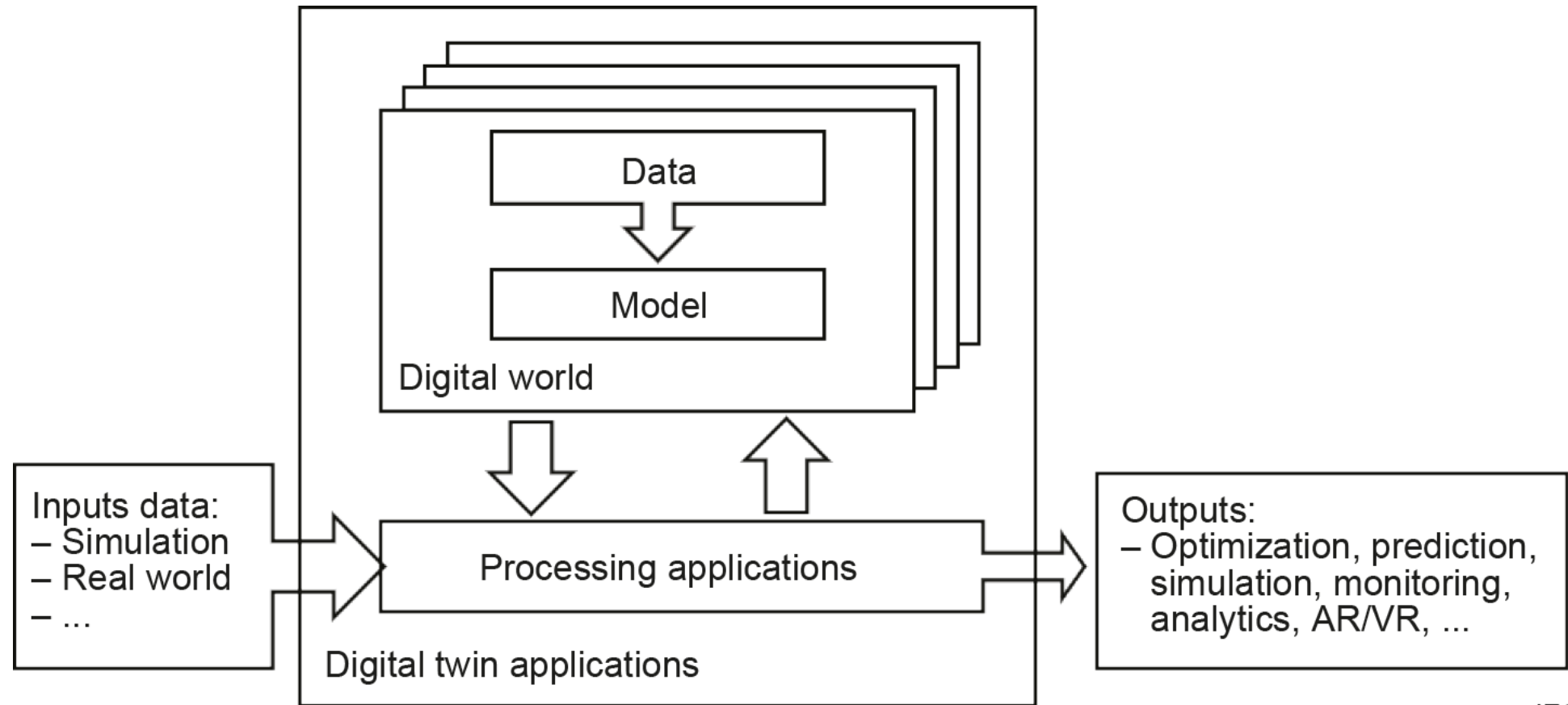
08. Digital Twin Lifecycle Process

08. **Digital Twin Stakeholders**

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                          Stakeholders

     Digital twin system stakeholders          Ecosystem partners

      Developers    Resource providers          Infrastructure provider

      Integrators        Users                     Service provider

              Operators                    Standards development organization

                                              Government and community
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IEC

09. **Functional View of Digital Twin**

10. ISO/IEC TR 30172 Digital twin - Use cases
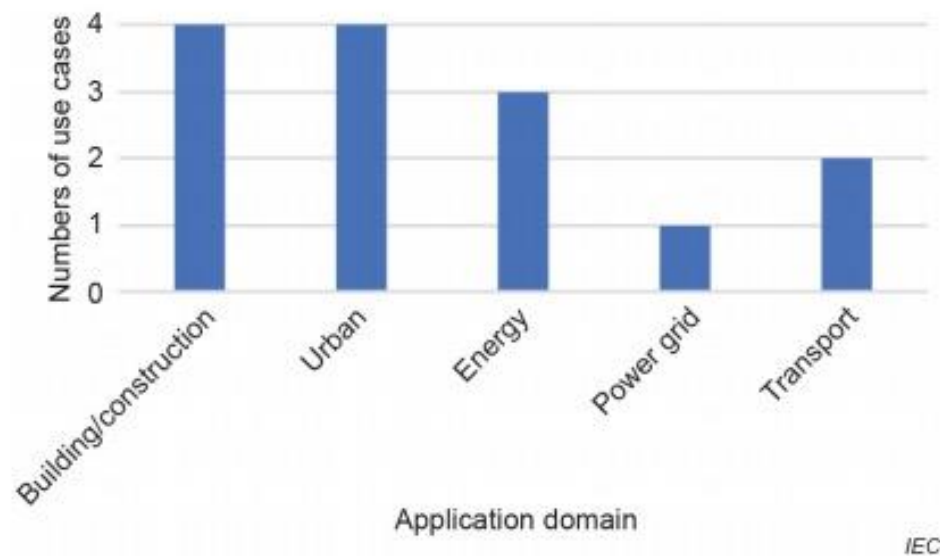
Table 2 – List of use cases by status of lifecycle

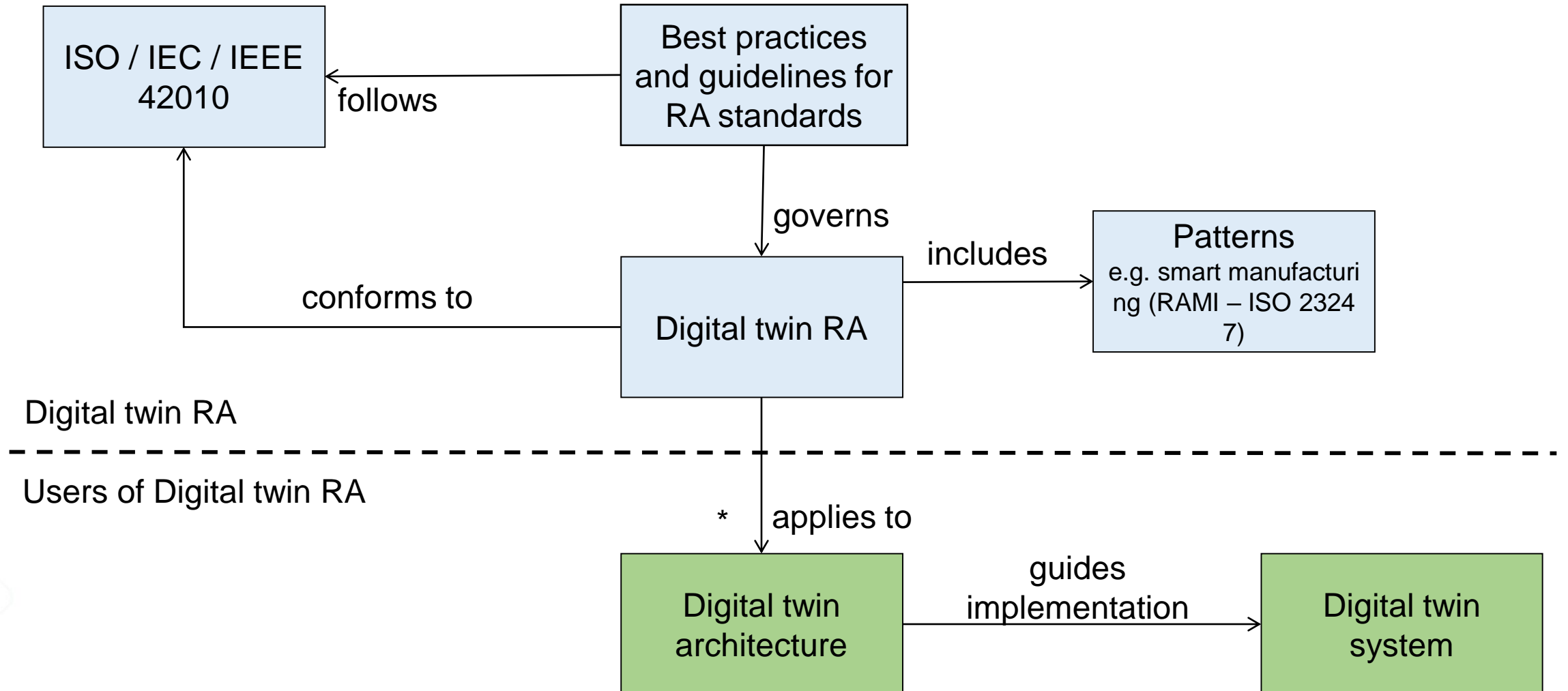| Status of lifecycle	Numbers of use cases
Inception phase	4
Design and development phase	6
Installation phase	4
Deployment phase	11
Operation and monitoring phase	4
Re-evaluate phase	3
Retirement phase	2

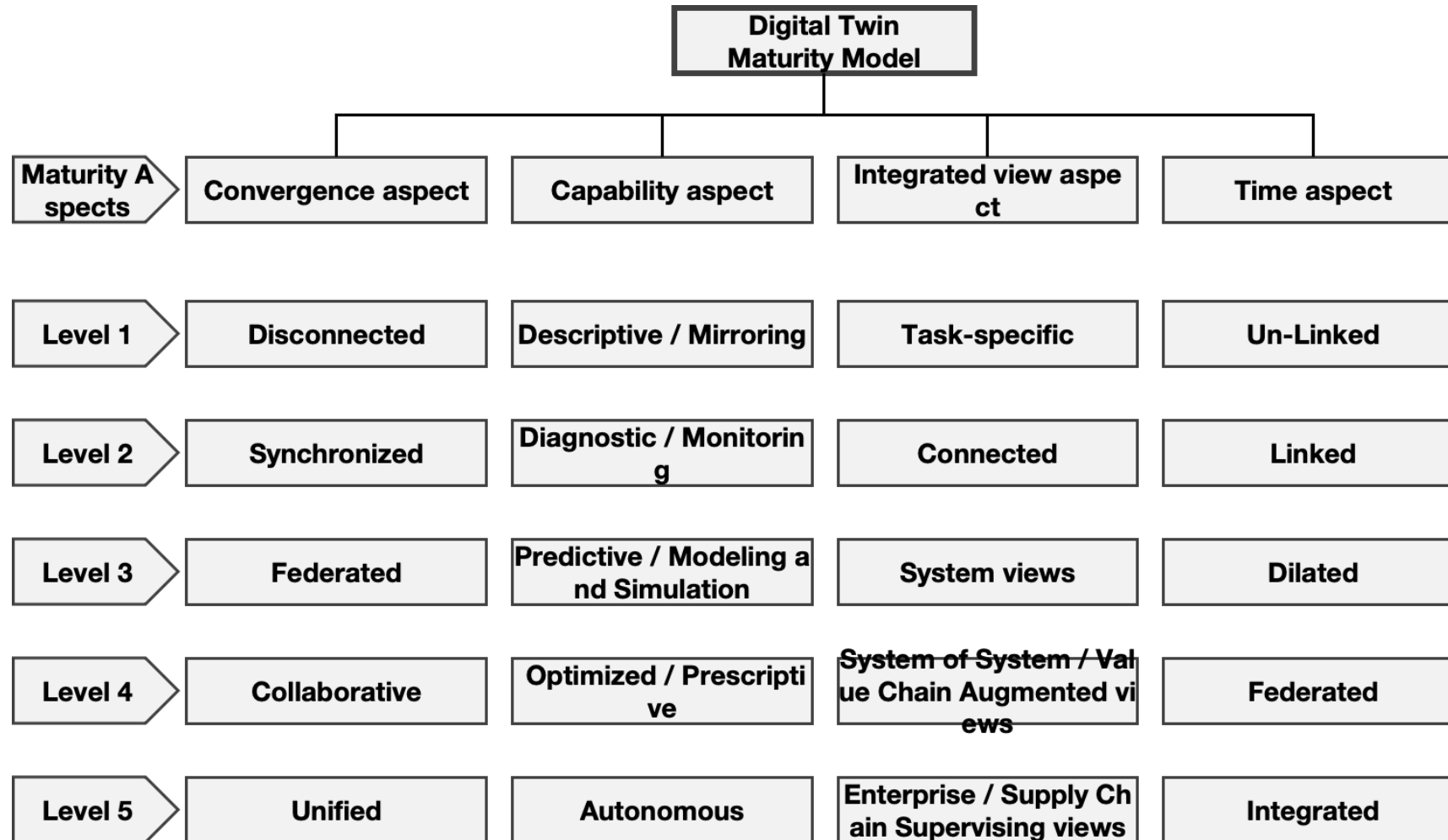# 11. Statistics on adopted key technologies from use cases

12. ISO/IEC 30188 Digital Twin Reference Architecture

ISO/IEC/IEEE 42010:2011 Systems and software engineering — Architecture description
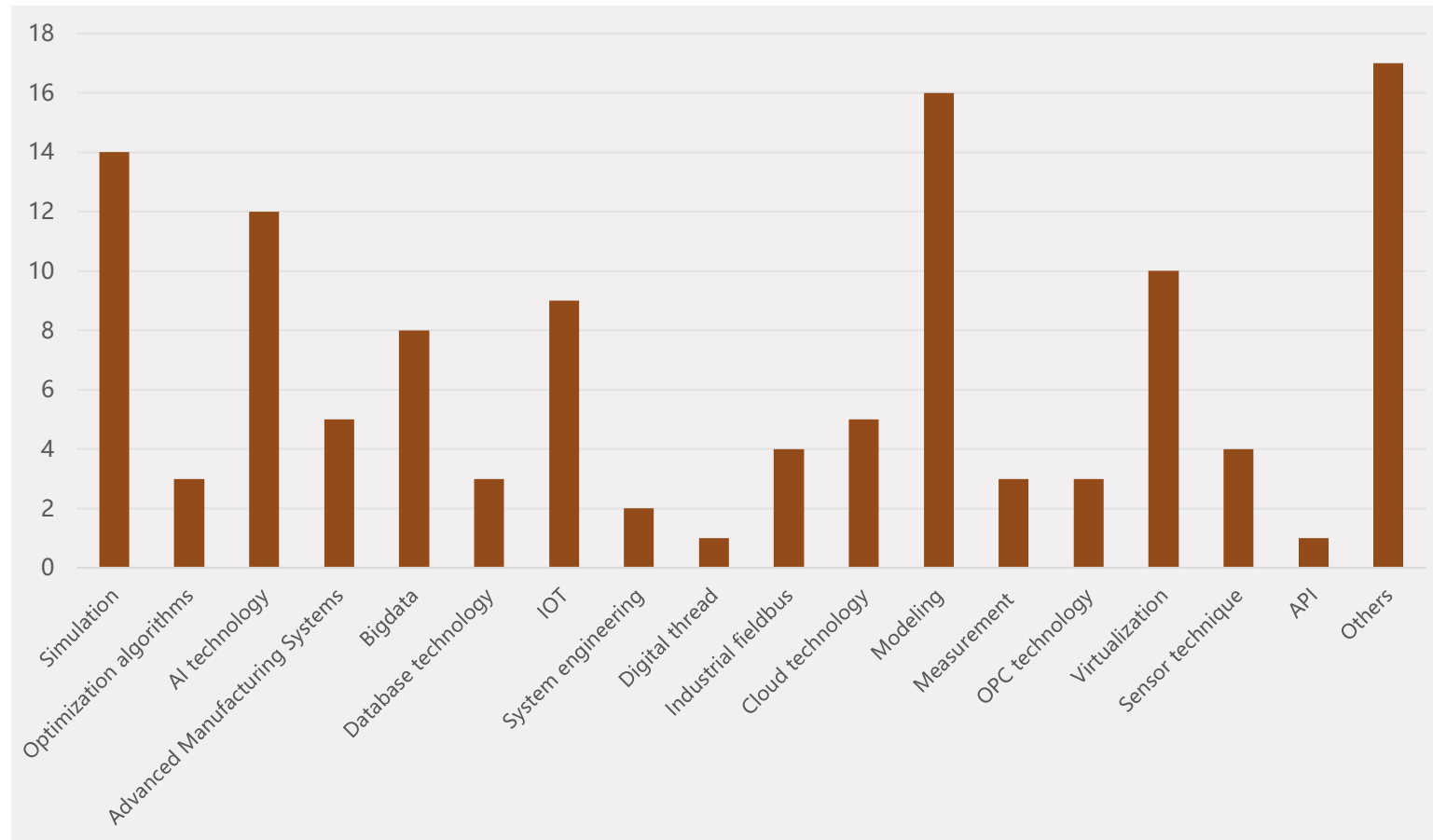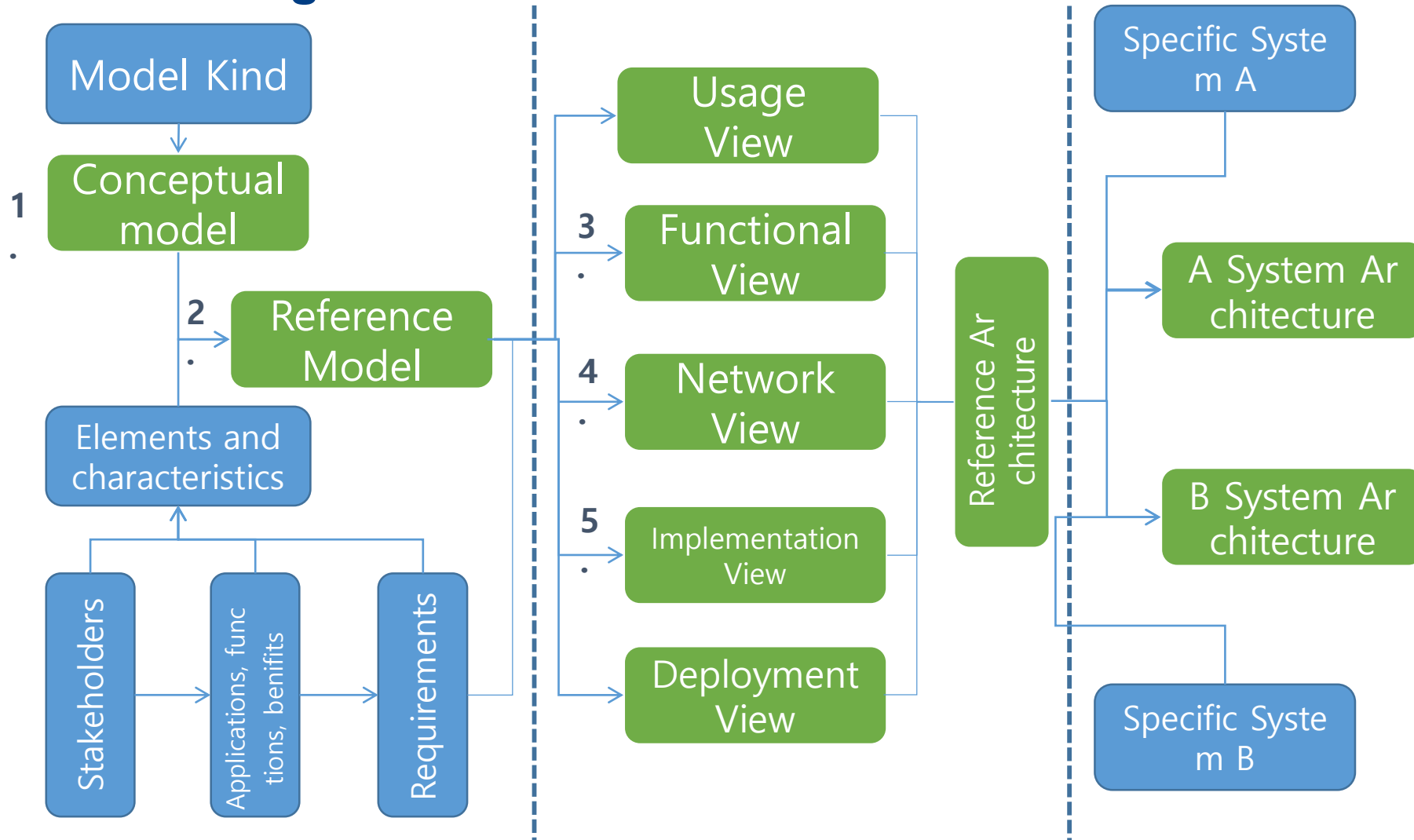
13. ISO/IEC 30188 Digital Twin Reference Architecture

14. ISO/IEC 30186 Digital Twin Maturity Model

Maturity Aspects	Convergence aspect	Capability aspect	Integrated view aspect	Time aspect
Level 1	Disconnected	Descriptive / Mirroring	Task-specific	Un-Linked
Level 2	Synchronized	Diagnostic / Monitoring	Connected	Linked
Level 3	Federated	Predictive / Modeling and Simulation	System views	Dilated
Level 4	Collaborative	Optimized / Prescriptive	System of System / Value Chain Augmented views	Federated
Level 5	Unified	Autonomous	Enterprise / Supply Chain Supervising views	Integrated

15. PWI Digital twin correspondence measure of DTw twinning

◢ Correspondance measure of DTw twinning
- Needs fo DTw twinning measures
  - Characteristics of digital twin system against Metaverse, AR, CPS
  - DTw twinning cycle: mutual augmentation
  - How to differentiate human twins
- Analysis of related international standars
  - Quality information framework (ISO 23952)
  - Product data quality (ISO/PAS 26183)
  - Equivalence validation (ISO 10303-62)
  - Hybrid B-rep modeling
  - Measuring the fidelity of digital twin
- Similarity measures
  - How to measure similarity
  - Static similarity measure
  - Temporal similarity measure
  - Similarity measure for 3D CAD models
- Correspondence measure
  - What is twinning correspondence?
  - Hybrid of spatial measure and temporal measures
  - Relation with other DTw projects including maturity level
  - Elements of the correspondence measure

● Correpondence: the agreement of things with each other
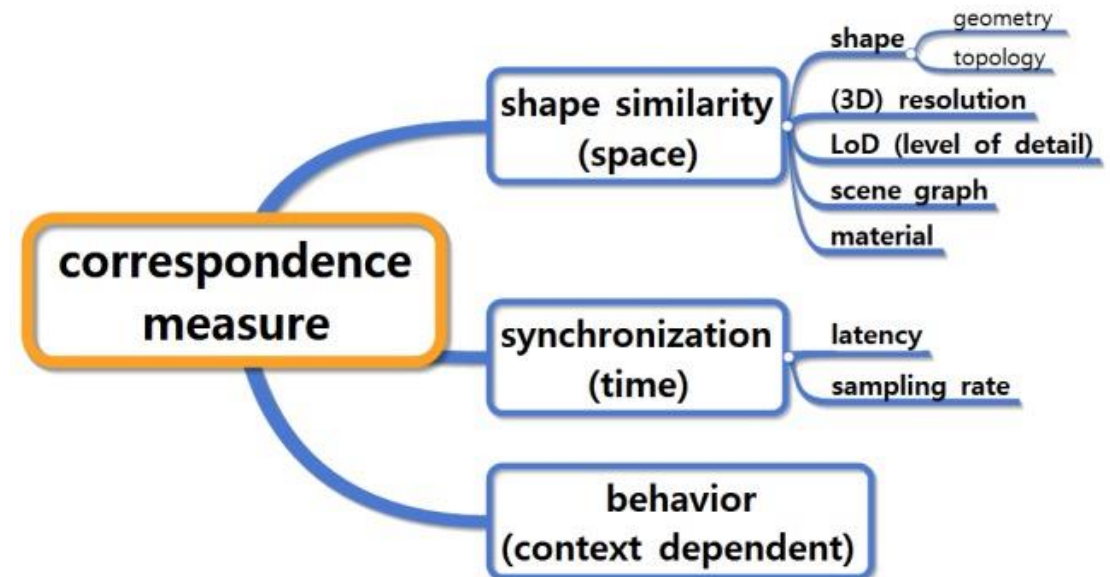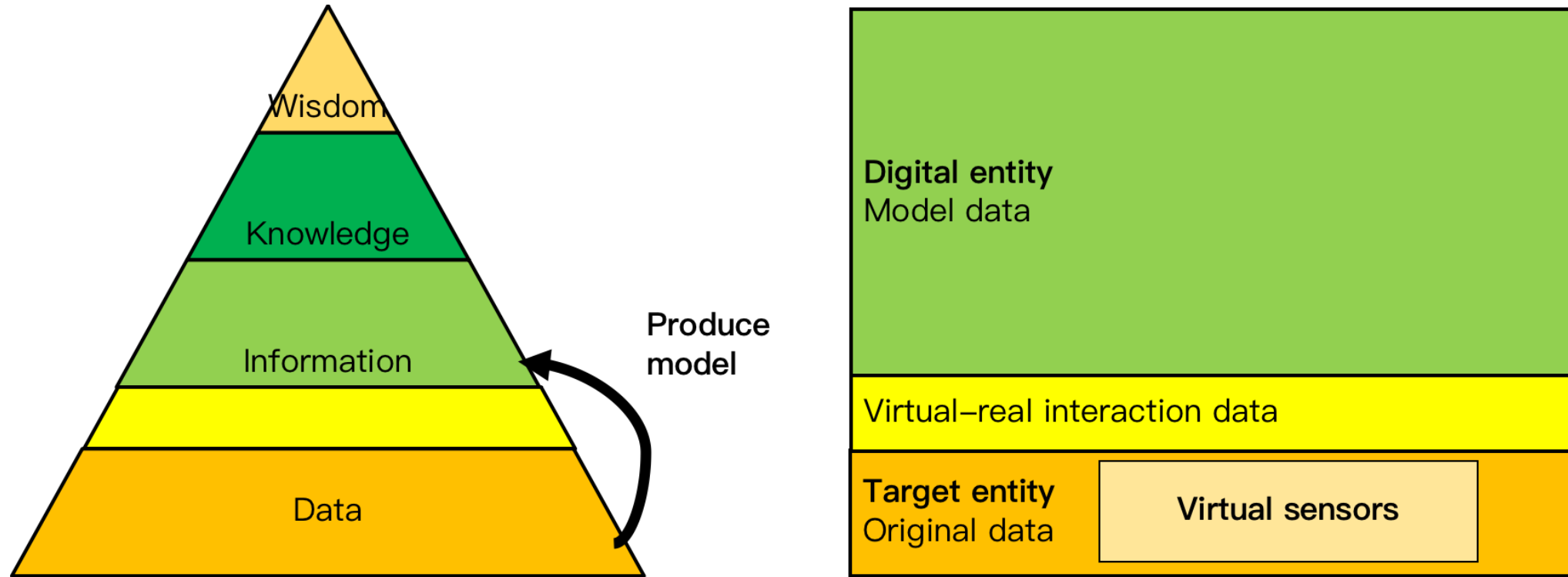● Twinning: pairing or union of two similar or identical objects

Figure 15 Elements of correspondence measure

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16. PWI Guidance on integration of IoT and Digital twins in Data Spaces

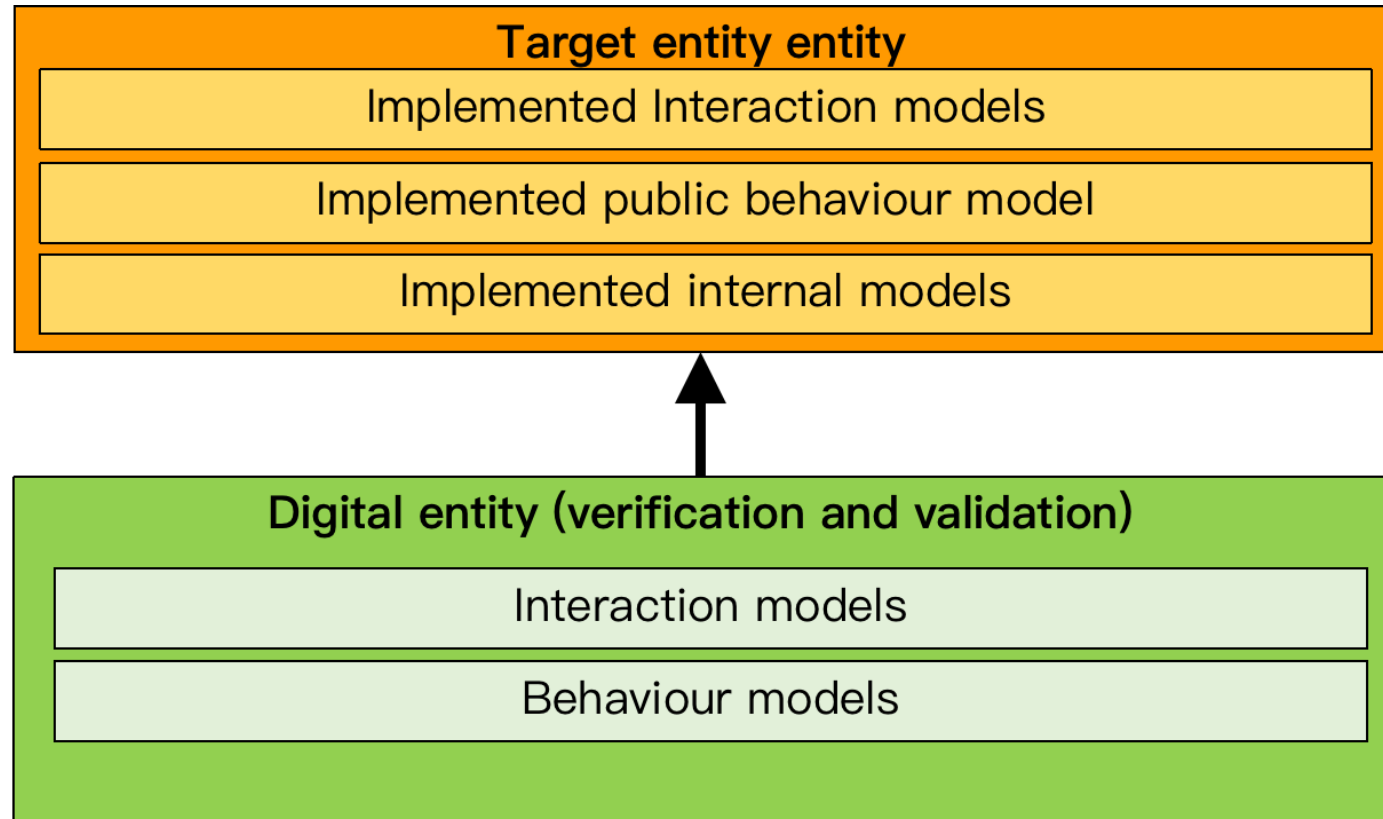- Mapping DIKW pyramid to digital twins
- Integrating virtual sensors

17. **PWI Policy and Behavioral Interoperability**

◢ Target entity

◢ Implements Interaction and public behaviour models

◢ Digital entity verifies and validates behavior of target entity

◢ E.g. compliance of data usage

Target entity entity

Implemented Interaction models
Implemented public behaviour model
Implemented internal models

↑

Digital entity (verification and validation)

Interaction models
Behaviour models

Thank you

Name, Department / Position, Affiliation
E-mail@email.kr