Digital Twins in Healthcare:

Security, Privacy, Trust and Safety Challenges

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Outline

- Introduction
- Digital Twins in healthcare
- Conflict analysis
- Final remarks

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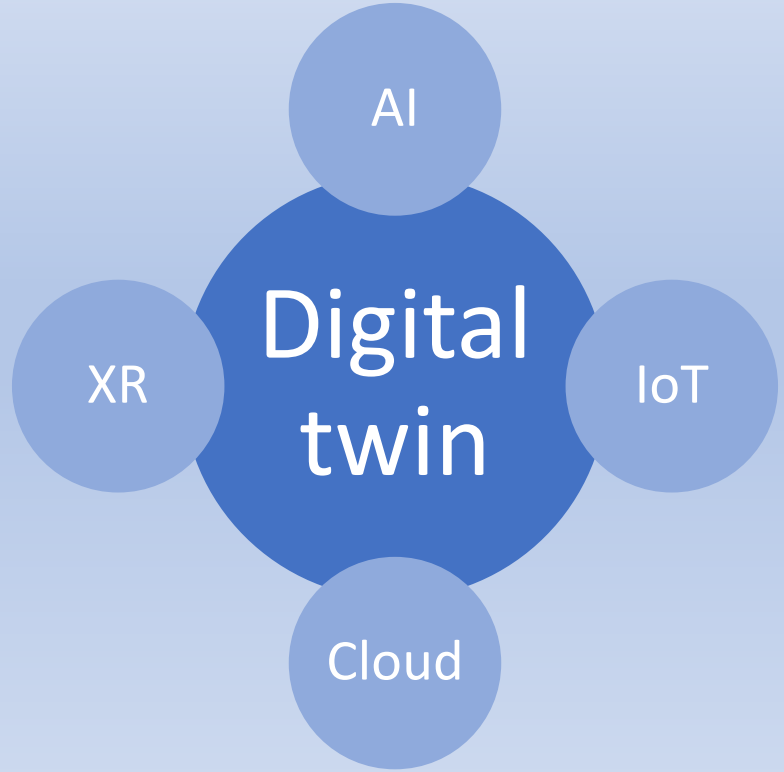
Methodology

Brief intro to digital twins

- NASA Apollo 13 spacecraft, 1960
- Industry 4.0
- Michael Grieves, 2002
- Rising industry interest




Digital twins – enabling technologies

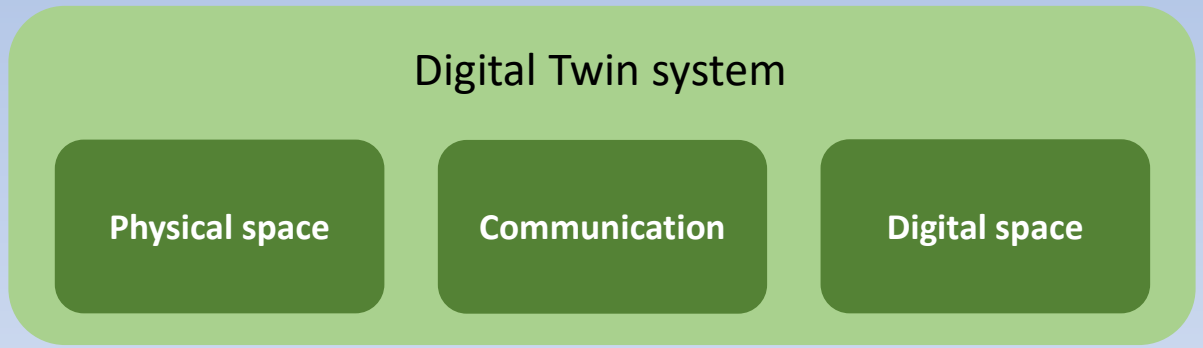


Defining the digital twin

- No commonly agreed definition
- No standardization

“Digital twins are virtual simulations of real-world entities, systems, or processes based on sensor data, and which is synchronized at a sufficient frequency.”

- Three main parts



Usage of digital twins

- Almost any sector
- Aircrafts
- Oil and gas
- Healthcare

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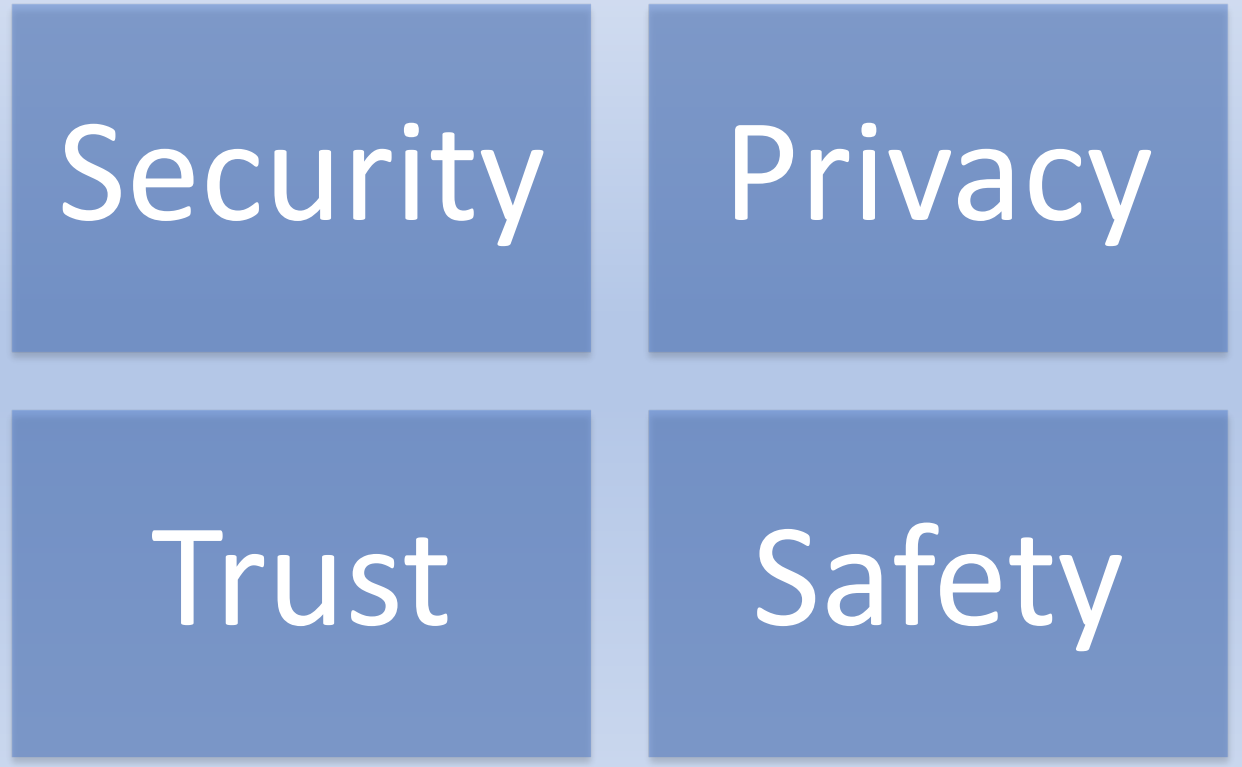
Digital twins in healthcare

- Several potential use-cases
- Ethical challenges
- Sensitive input
- The role of IoT

Benefits of digital twins

- Predictions, testing and optimization
- Decision support
- Efficiency and cost reduction
- Predictive maintenance
- Anomaly detection
- Better security and resilience

Challenges of digital twins



Challenges of digital twins: security

- Increased attack surface
- IT/ OT integration
- Increased connectivity
- Tampering
- Compromised model or loss of confidentiality
- Real-time insights




Challenges of digital twins: safety

- Crucial in healthcare
- Ethics
- Imperfect models
- Deprivation from environment
- Loss of control
- Increased influence on physical world

Challenges of digital twins: privacy

- Location of assets
- Private information
- Patterns and states
- Use of AI
- Comply to regulations




Challenges of digital twins: trust

- Operational functionality and performance
- Level of quality of data
- Accuracy
- Errors, incomplete data
- Lack of transparency of AI decisions
- Introducing errors humans that cannot recognize

“Level of confidence in the probability that the intended and actual behavior are equivalent given a fixed context, fixed environment, and fixed point in time”

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Security vs. safety

- Patient safety
- Loss of control
- Access and encryption




Security vs. privacy

- Beyond confidentiality
- Huge amounts of sensitive personal data
- Location of data
- Monitoring
- Processing of privacy data in security mechanisms




Security vs. trust

- Fidelity
- Accuracy
- Overhead
- Time sensitive tasks
- Identify incorrect decisions




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Final remarks

- Risk vs. gain
- Acceptance in healthcare
- Paradoxes




THANK YOU!

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