5th HVM New Materials Conference Summit 2019
Cambridge, UK 6-7 November 2019
www.cir-strategy.com/events

Digital Twins

What are they and why should we care?

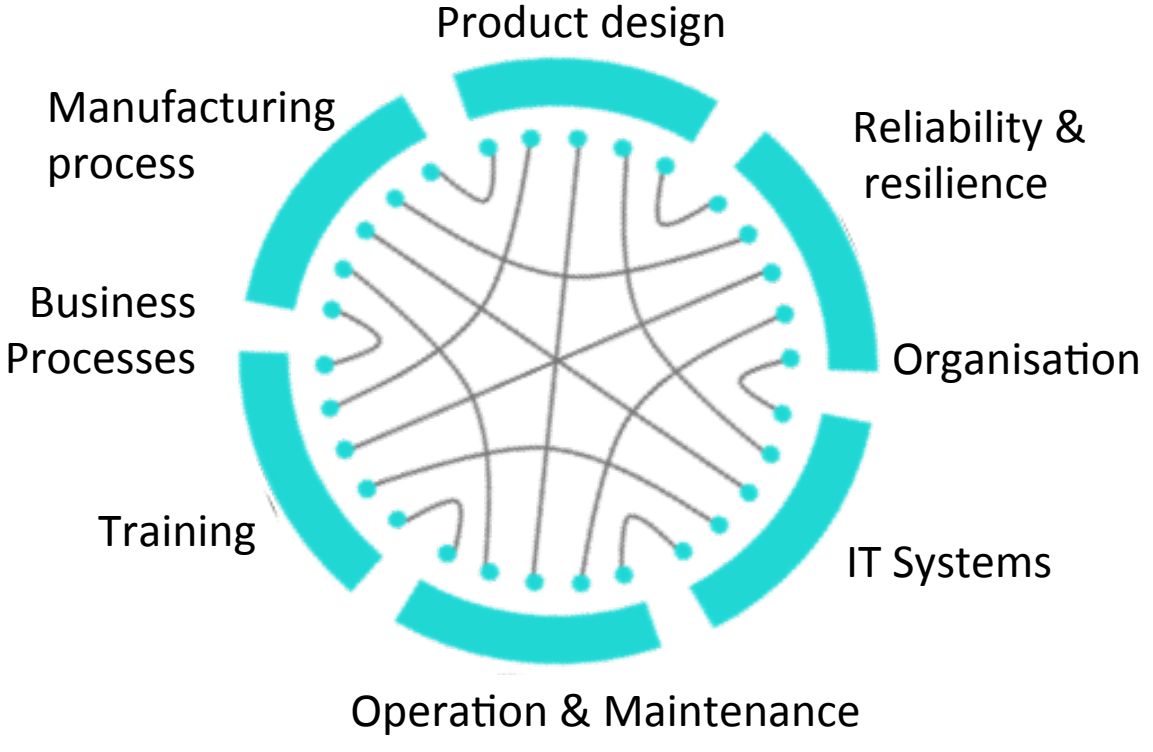
Our (working) definition

A digital twin is a dynamic virtual representation of a physical object or system, usually across multiple stages of its lifecycle. It uses real-world data, simulation and / or machine learning models, combined with data analysis to enable understanding, learning and reasoning. Digital twins can be used to answer what-if questions and should be able to present the insights in an intuitive way.

It is likely that you will end up with multiple, federated, digital twins – that will need to share data and possibly be integrated in real time.

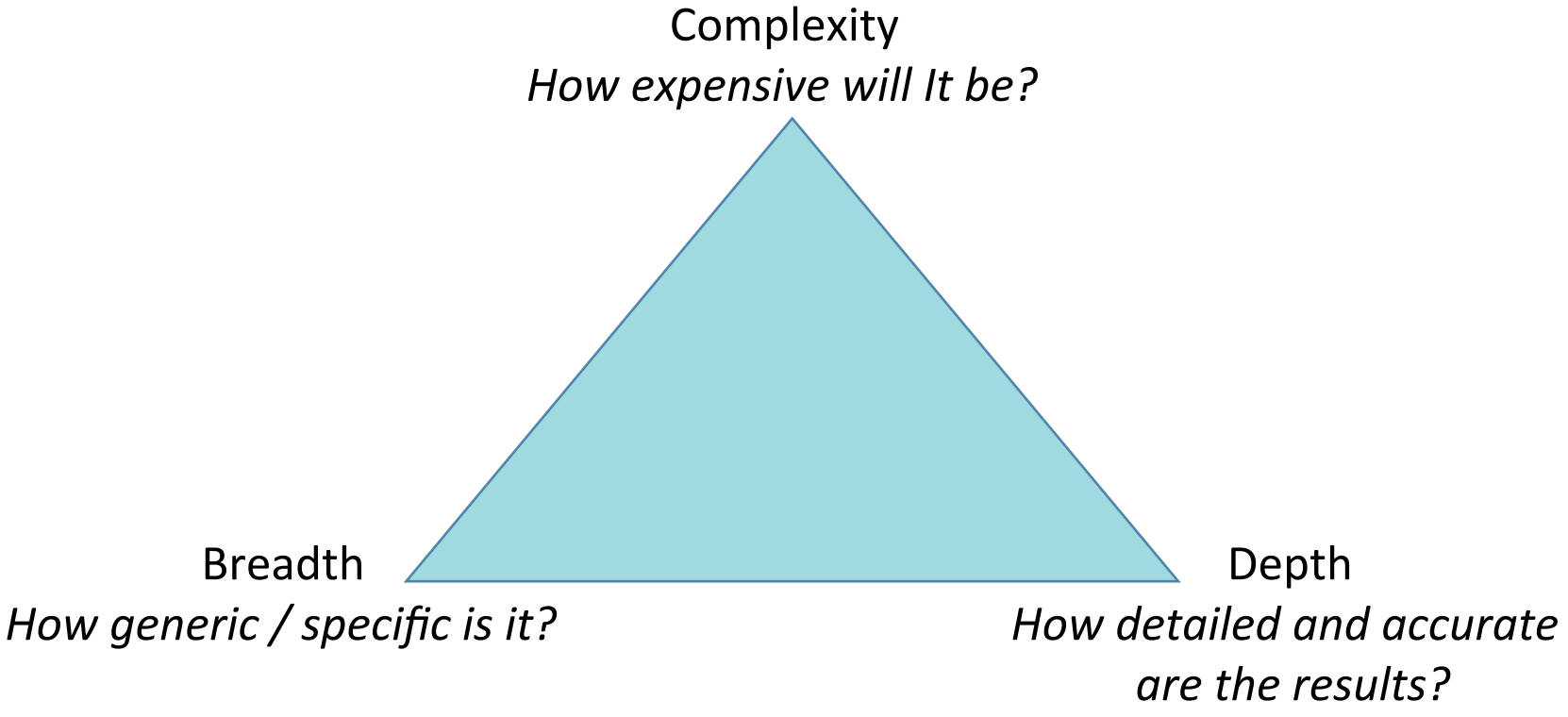
Classes of problems that DTs can address

- Design
  - Evaluating alternatives
  - Testing designs
  - Visualising
- Planning
  - Comparing different plans / heuristics used for planning
  - Contingency, resiliency planning
- Reliability engineering
- Operating policy evaluation
- Training
- Real time decision making
- Decommissioning

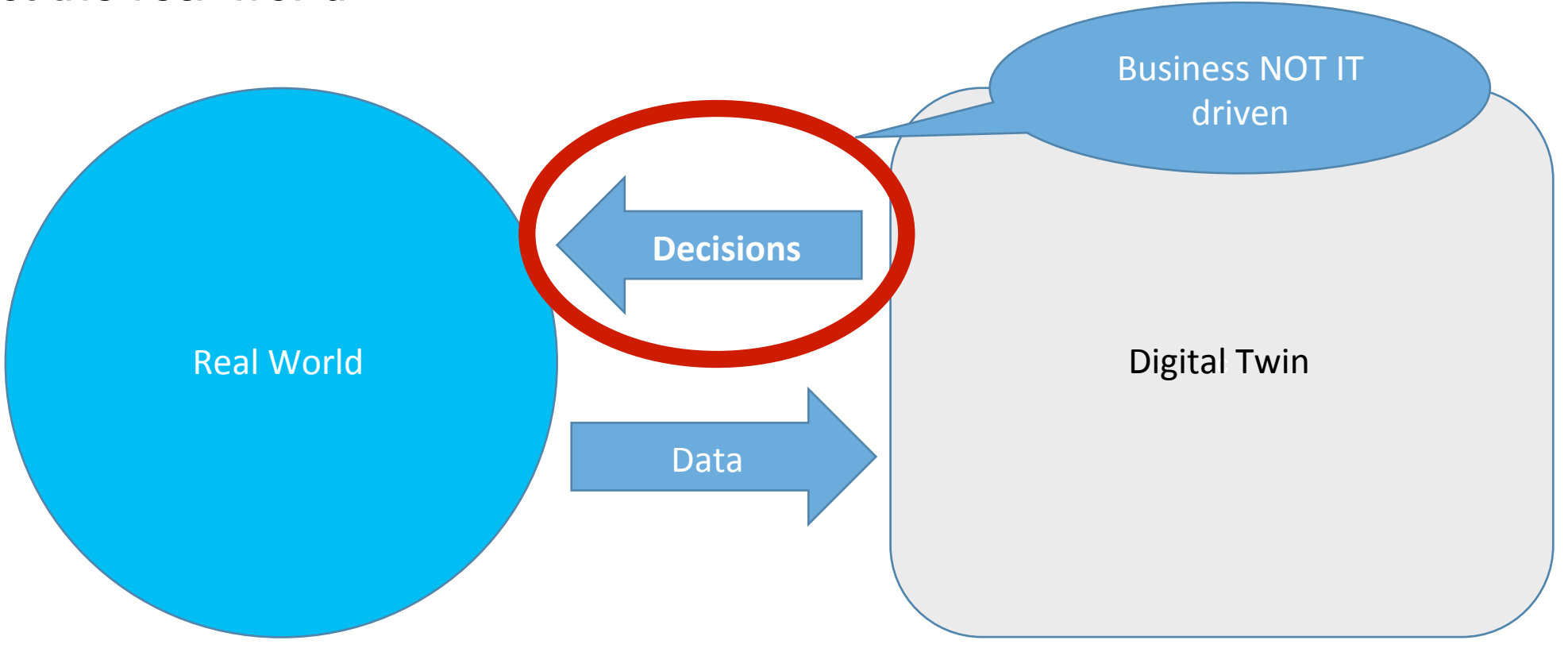


Simulations are, by necessity, bounded and an approximation

Digital Twins need to make a number of trade-offs…



Digital Twins model data from the real world to enable us to take better decisions that impact the real world



High level component view of a Digital Twin



Visualisation and Interaction

Actionable insights / Alerts

Real World

People

Places

System Component

Sensors

Digital Twin

Situational Awareness

Visualisation

Digital Model (now-cast)

Predictive Engine (forecast)

Data Analysis

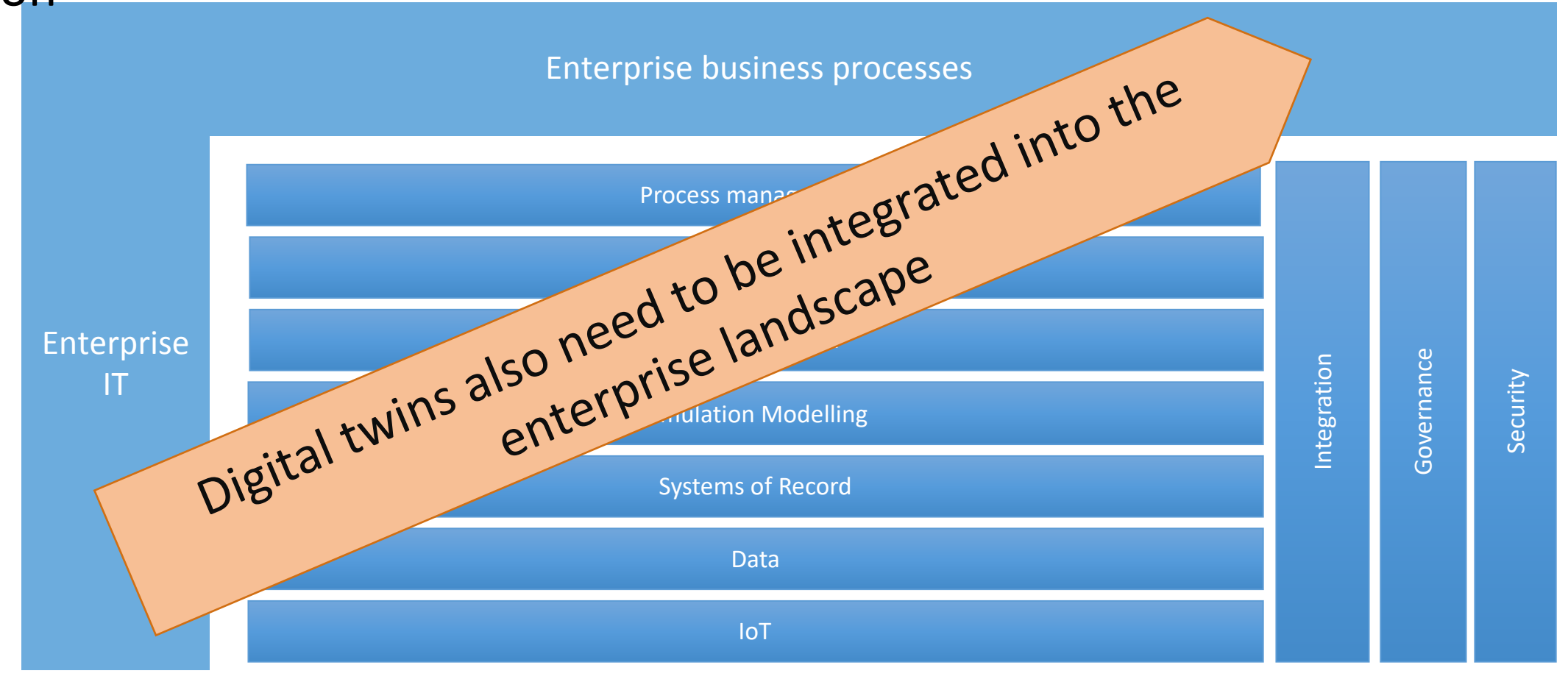
Real-world sensor data

Physical Model data

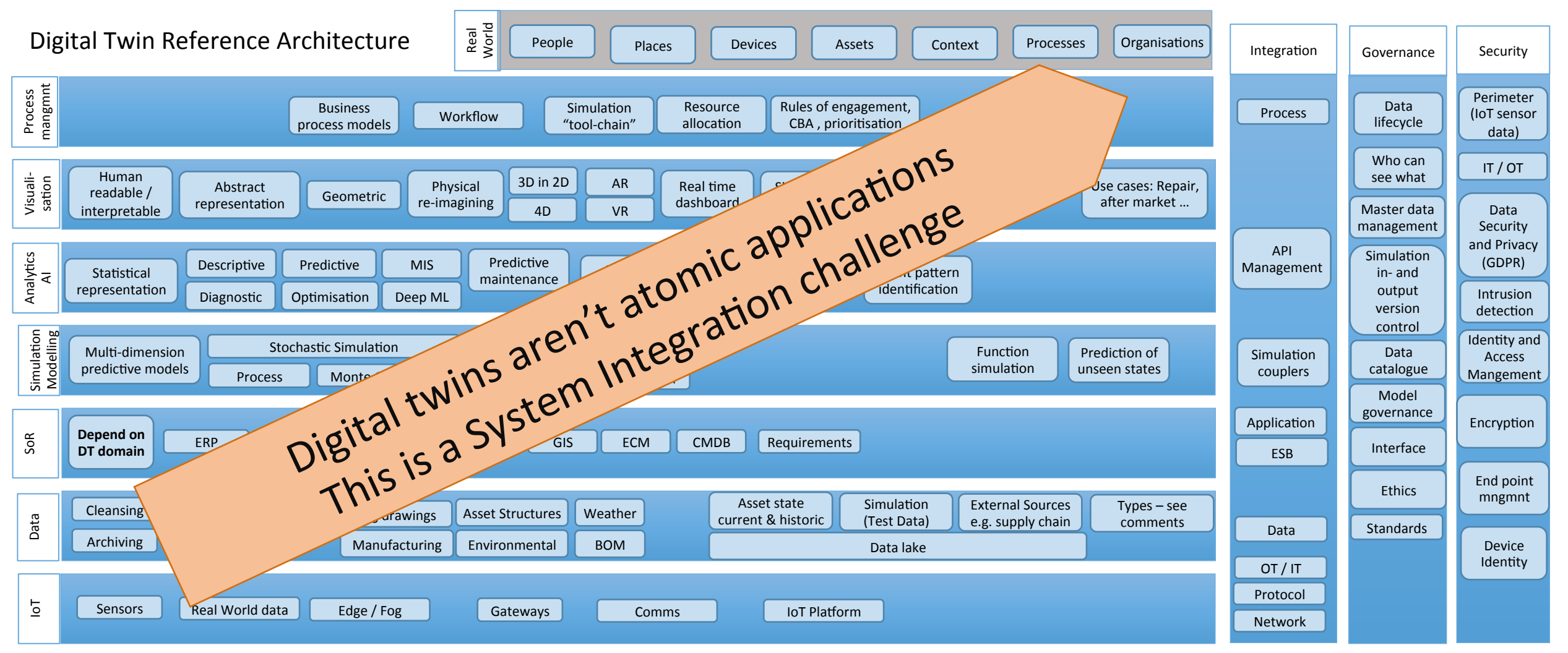
Modelling output Estimated states

Data Security and Privacy, Governance and Management etc.

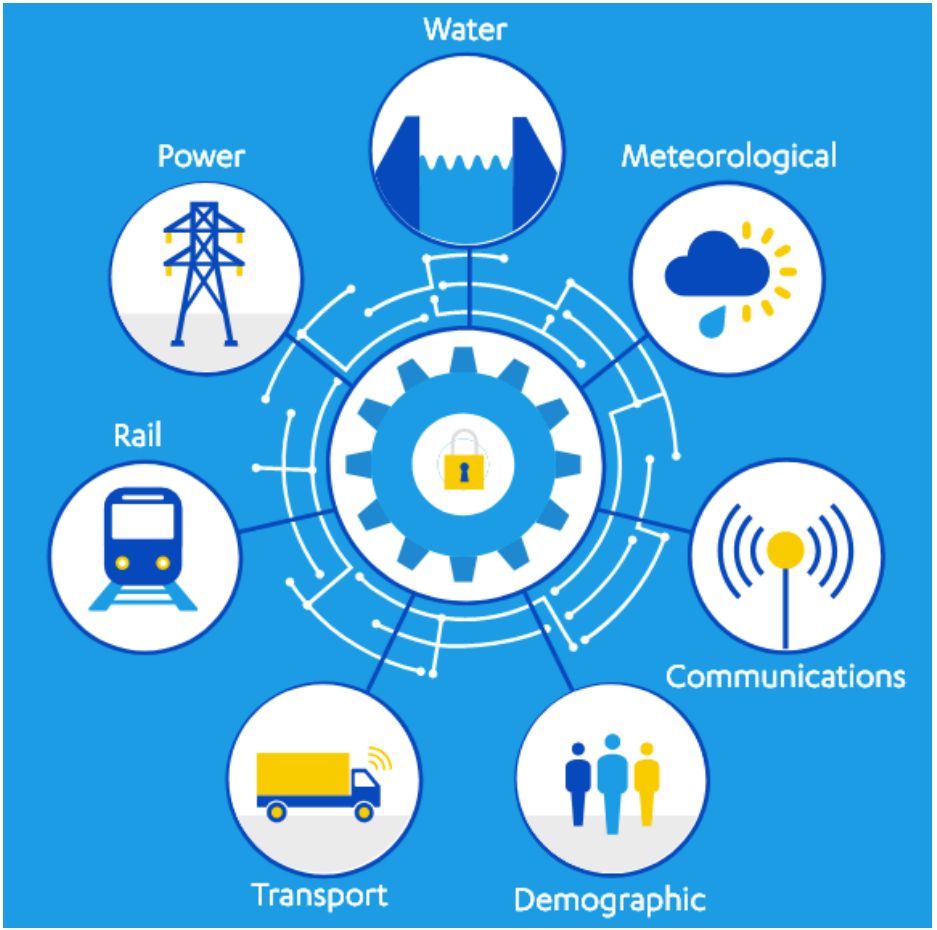
Digital Twin Enterprise Integration



Digital Twin Reference Architecture



National Infrastructure Commission: National Digital Twin or *Brit-Twin*



WHY DOES THE UK NEED A DIGITAL TWIN?

A national digital twin would enable the UK to develop a richer understanding of the way our infrastructure works and optimise it, so government and industry can make more informed decisions about the future.

- Optimise use of resources such as energy and water
- Reduce disruption and delay for transport and ease traffic flow
- Increase resilience in the face of terrorist attacks
- Boost quality of life for UK citizens
- Improve responsiveness in natural disasters

A digital twin that unifies these separate systems can answer questions such as:

Is it possible to:

Avoid building a new hospital carpark by managing appointment times and traffic flows?

Reduce energy consumption by 10% per person over six months?

Assess the impact of closing a road in the event of a water leak?

https://www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf

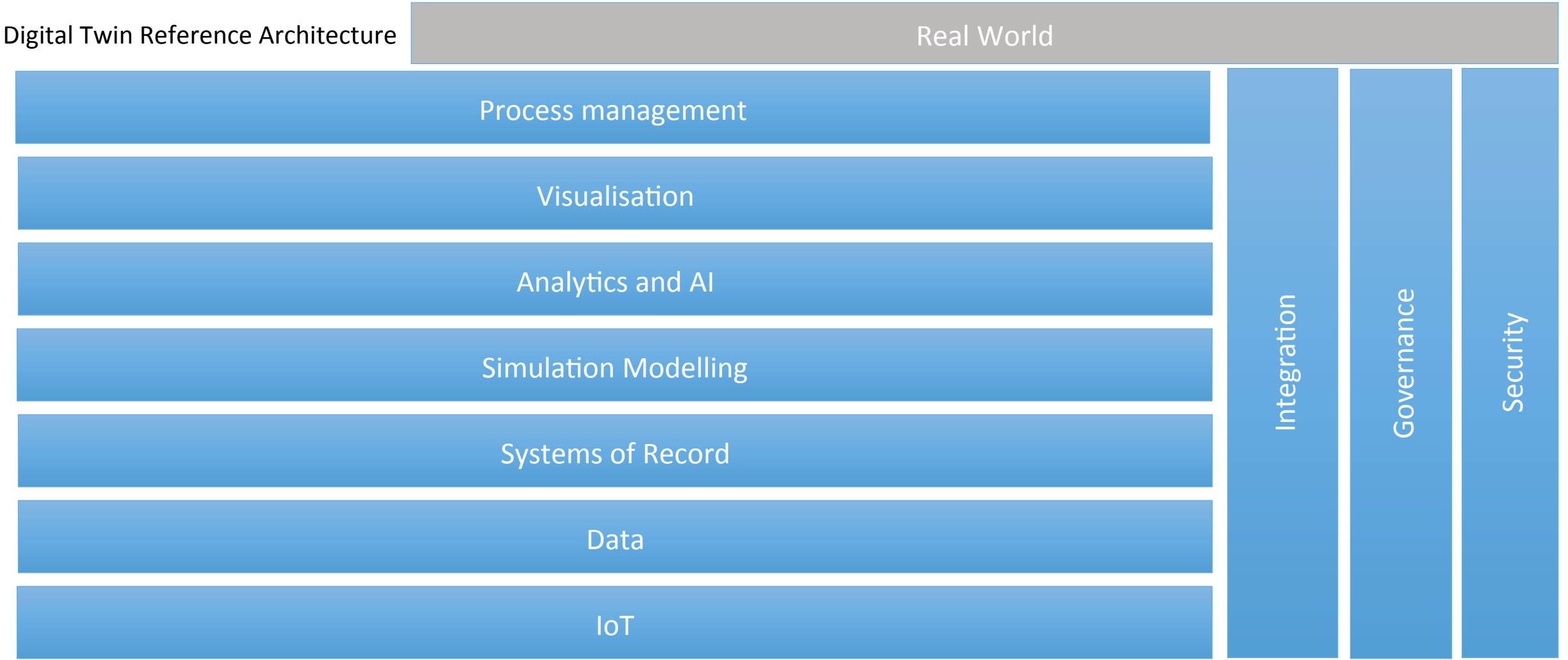
https://www.cdbb.cam.ac.uk/Resources/ResoucePublications/TheGeminiPrinciples.pdf

Examples


The Weather Company
IBM


ASTON MARTIN
Aston Martin
Red Bull Racing


N-1 Resilience
modelling


Digital Twin Reference Architecture
Real World
Process management
Visualisation
Analytics and AI
Simulation Modelling
Systems of Record
Data
IoT
Integration
Governance
Security