



Swiss Alliance for
Data-Intensive Services

Lucerne University of
Applied Sciences and Arts

**HOCHSCHULE
LUZERN**

Technik & Architektur

Digital twins enabled services

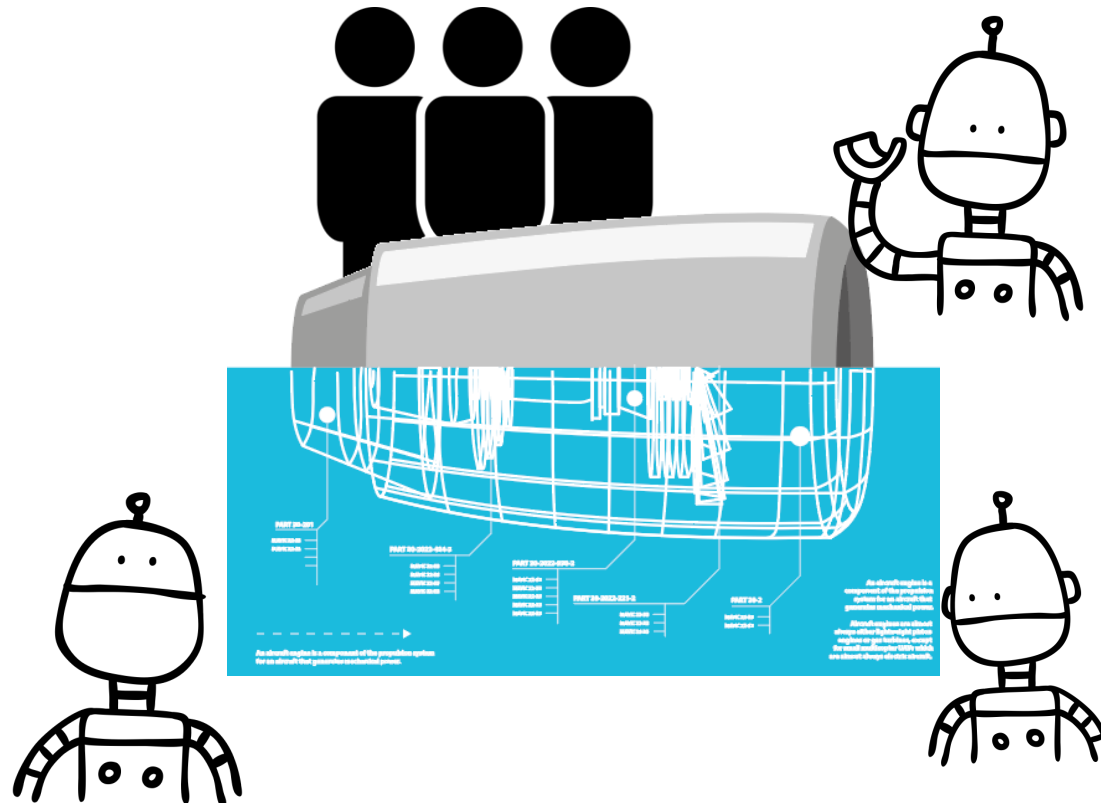
Zurich University
of Applied Sciences

zhaw School of
Engineering

WinLink Breakfast meeting

Wintertur, 7 November 2019

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Jürg Meierhofer (ZHAW)



FH Zentralschweiz



Introduction

Who are we and what do we do?



Shaun West

Expert in Product-Service System
Business Model Innovation



Jürg Meierhofer

Expert Smart Service Engineering



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Oliver Stoll

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Introduction

What am I going to talk about

Describe what a Digital Twin is and what it can do

Demonstrate that Digital Twins are a service enabler

Provide examples of Smart Twins develop in Switzerland

Provide you with a pathway for Smart Twin development

To described what a Digital Twin is and how it can be transformed to a Smart Service Twin that supports service delivery

What does the community think a digital twin is?

There is much marketing hype today

What is a Digital Twin?

"...a real-time data (dynamic) allowing simulation and forecasting to support decision making..."

"All sensor data, production data and process information over the entire life cycle..."

Who benefits?

"...the operations and maintenance team ...NPD team ... the service teams..."

"...many actors up-stream and down-stream of the product/equipment ..."

What are the benefits?

"...improve current practice and support optimization along the asset's life cycle..."

"...It allows the whole installed based to provide input for the next generation of machines..."

How would you model?

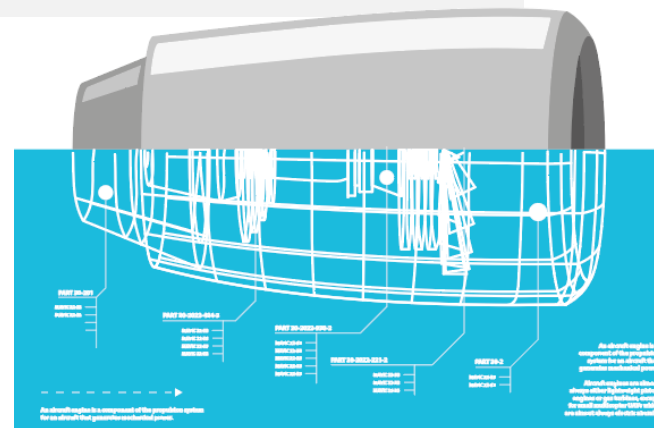
"... a simple Excel model to a complex real-time AI to machine learning (off process)..."

"... Rule based modeling, Agent-based, discrete event simulation..."

The digital twin support decision making processes

What is a Digital Twin? And what makes it smart?

... is a real mapping of [all?] components in the product life cycle using physical data, virtual data and interaction data between them.



Major dimensions	Key characteristics
Service Ecosystem	Flexibility & integrity
	Shared view
	Actor roles
Service Platform	Architecture
	Modular structure
Value Co-creation	Rules of exchange
	Value creation between actors
	Interactions between diverse actors
	Accommodation of roles
	Resource integration

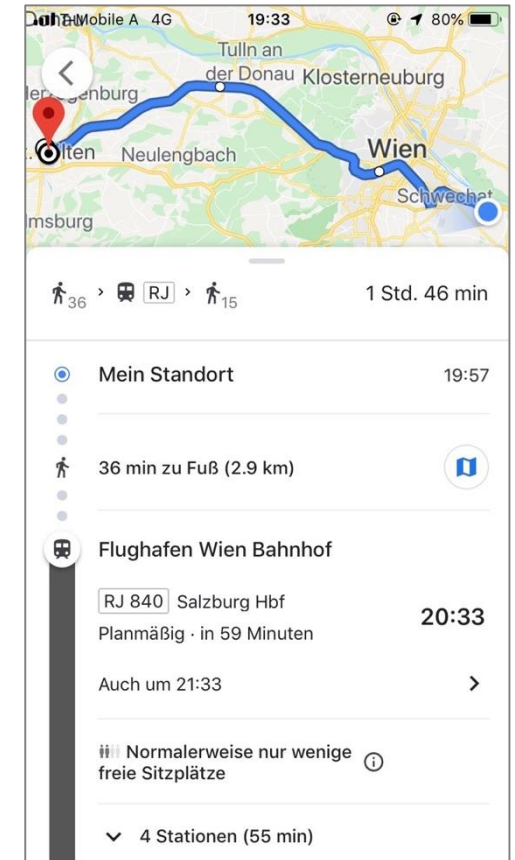
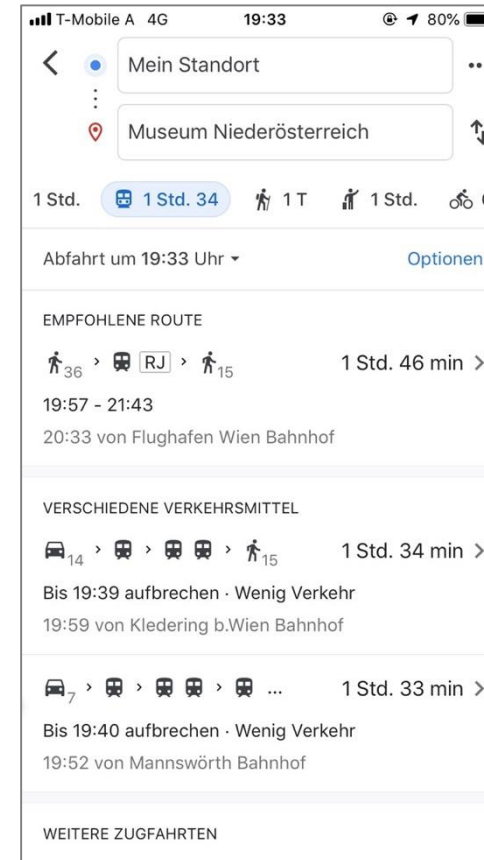
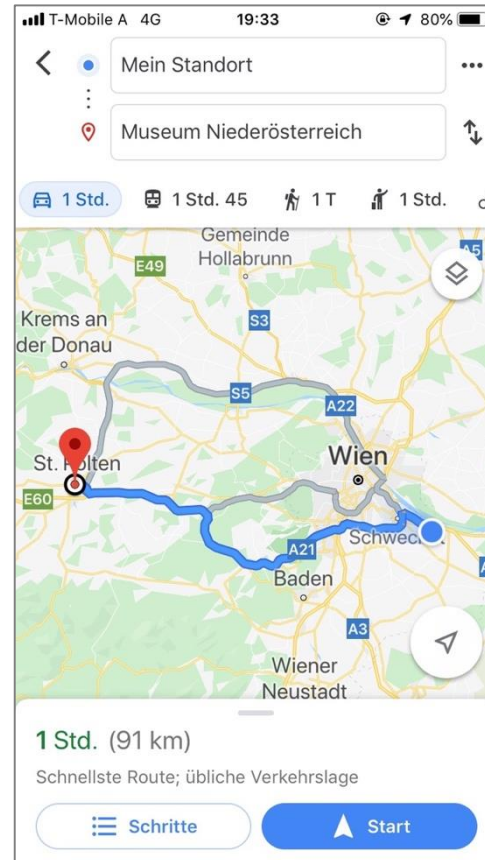
A Smart Twin supports co-creation of value by supporting many actors within an ecosystem

Digital Twins provide decisions support

Google maps is an excellent example of a digital twin

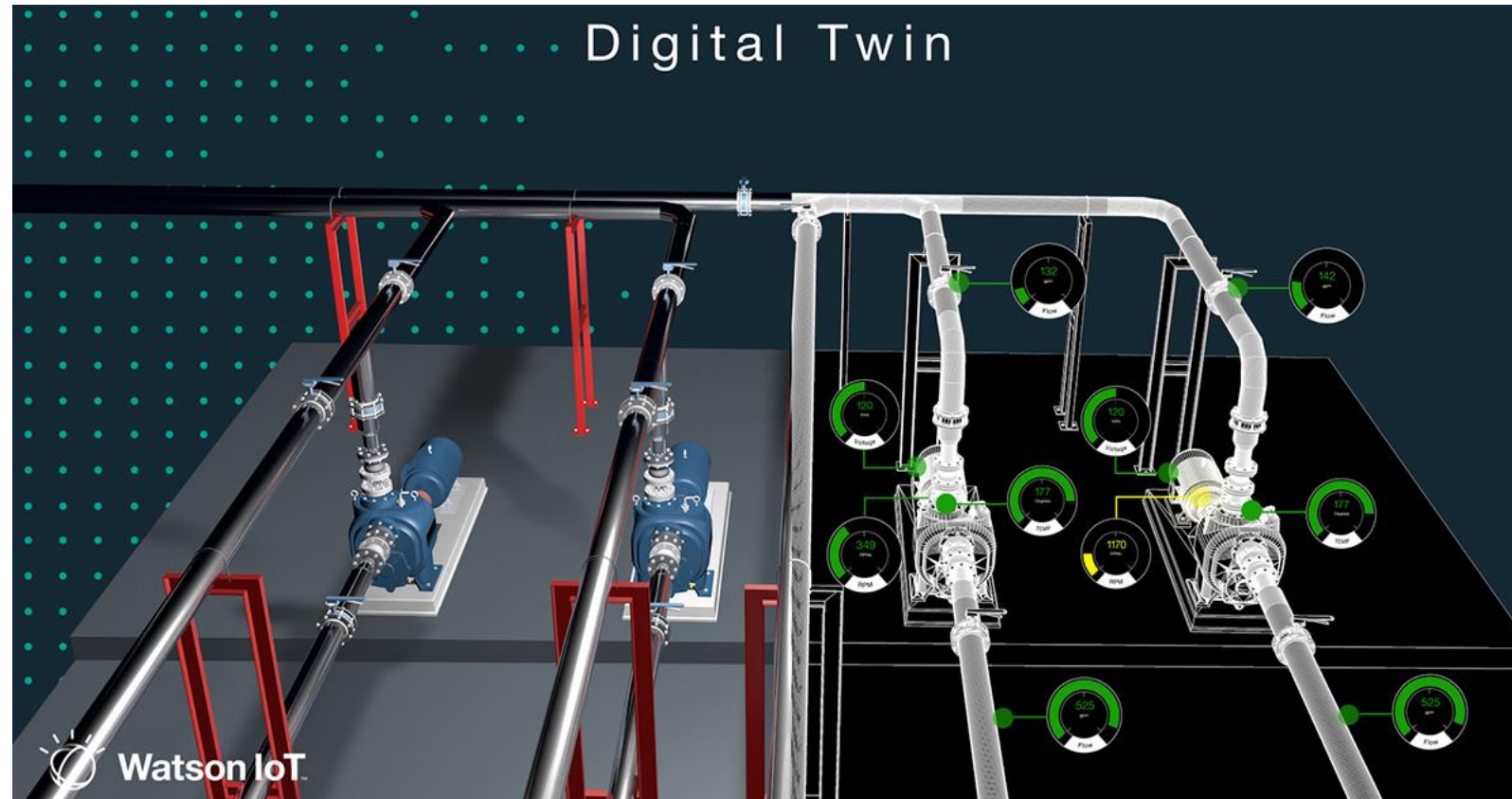


Google Maps



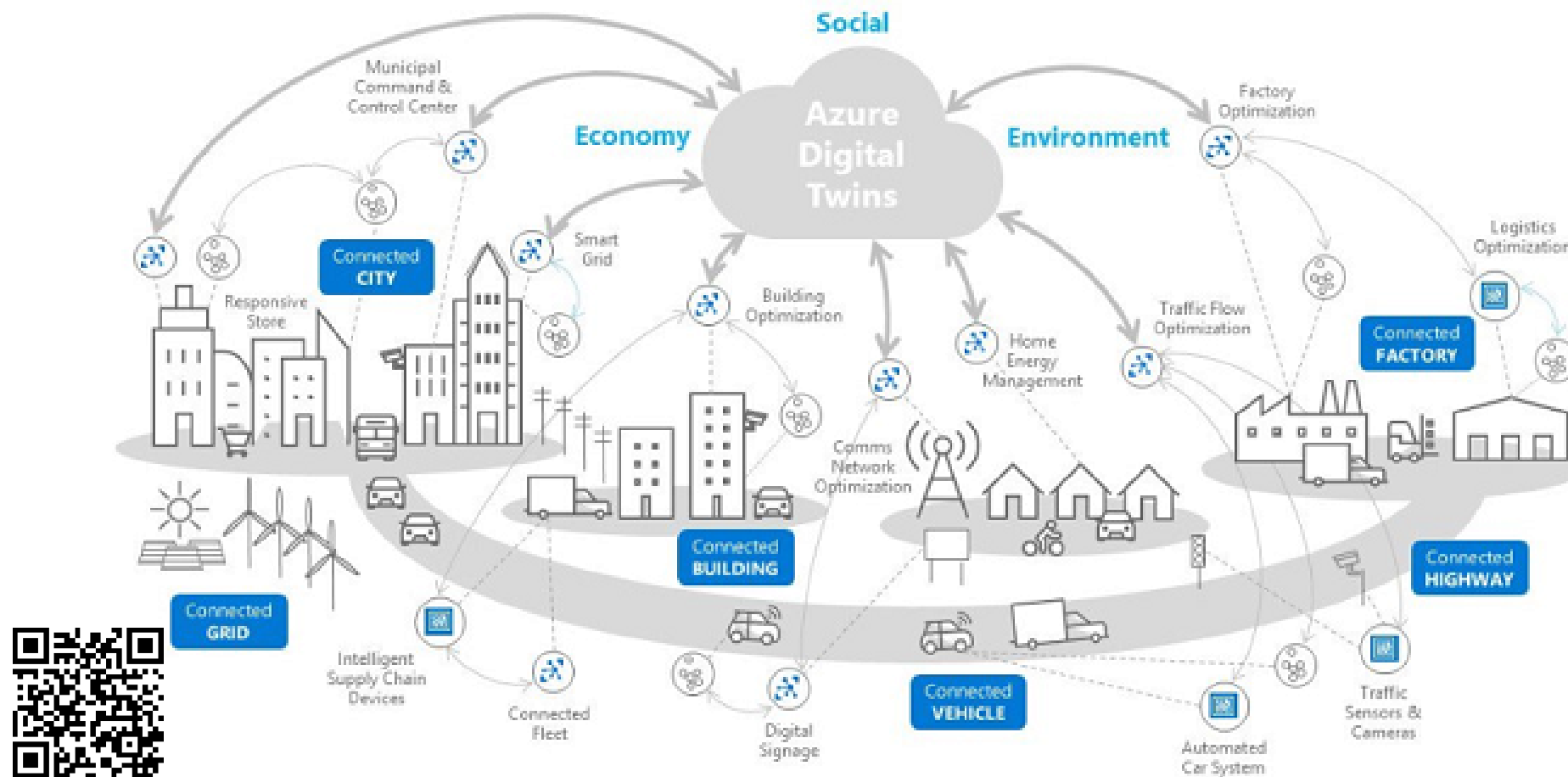
It helps me to take the appropriate action

Digital Twins can provide technical feedback IBM using digital twins in pumping solutions



We can have many different Digital Twins

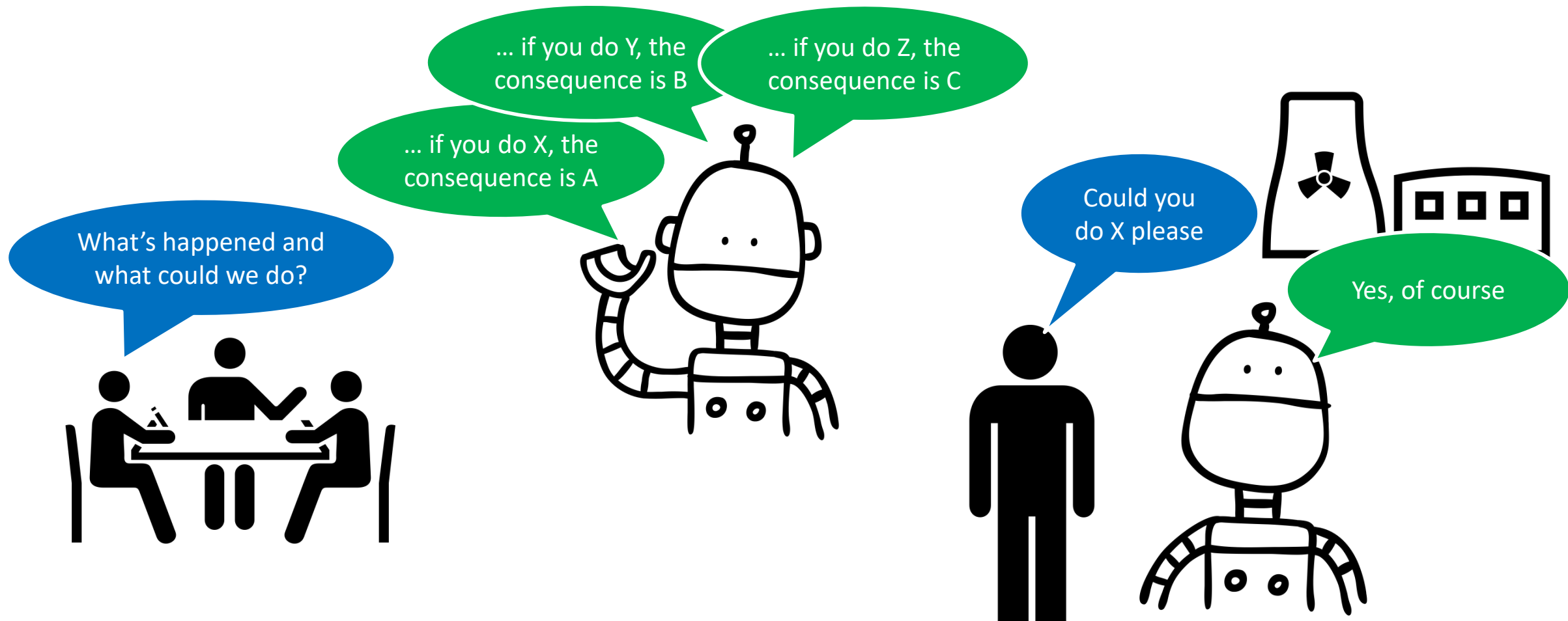
Microsoft Azure using digital twins in cities



The digital twin can be integrated with other technologies
The values it offers can then be multiplied



Service Dominant Logic places value in the action (not the product)
Value is only created when an action is taken (or not) based on an active decision



It helps me to take the appropriate action – in general a Smart (Digital) Twin provides advisory services

Types of industrial services

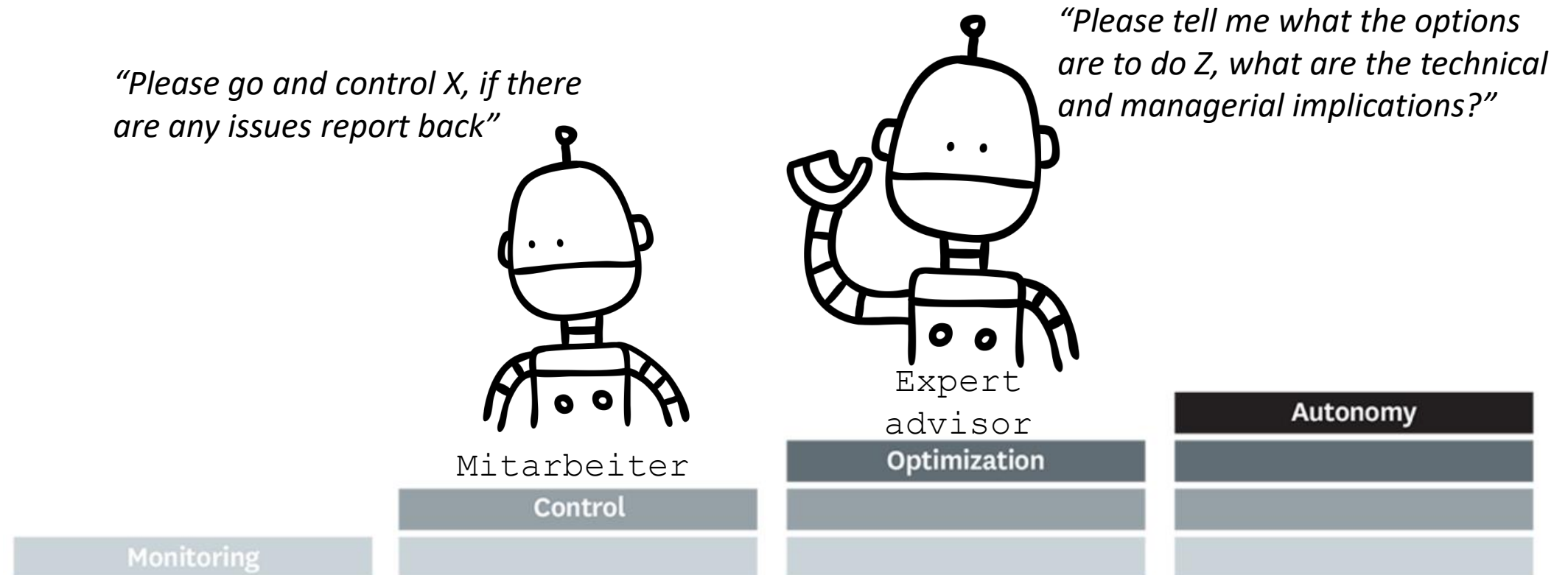
The Smart Twin can provide a range of advisory services

		Service recipient	
		Service orientated towards the supplier's goods	Service orientated towards the customers processes
Nature of the value proposition	Supplier's promise to perform (input-based)	Product life-cycle services	Process support services
	Supplier's promise to achieve performance (output-based)	Asset efficiency services	Process delegation services

The Smart Twin can enable the delivery of new value propositions

Types of jobs

The Smart Twins need to support us with controlling and optimising

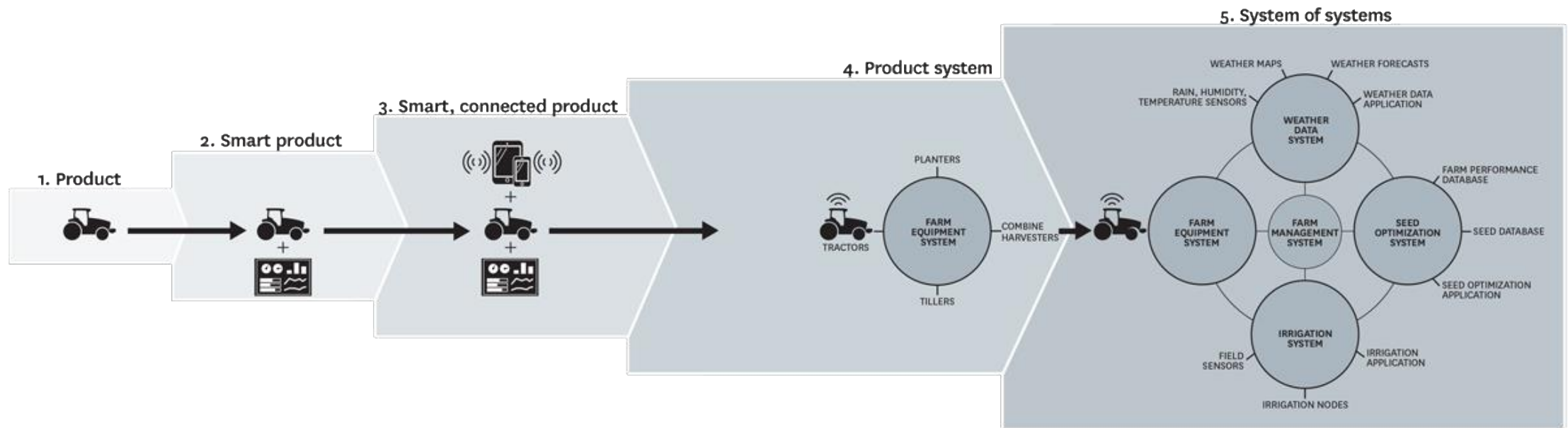


Michael E. Porter and James E. Heppelmann: "How Smart, Connected Products Are Transforming Competition", November 2014, Harvard Business Review

Smart Twins generally help us with controlling and optimizing advisory services (can also be a teacher)

But we live in a complicated connected world

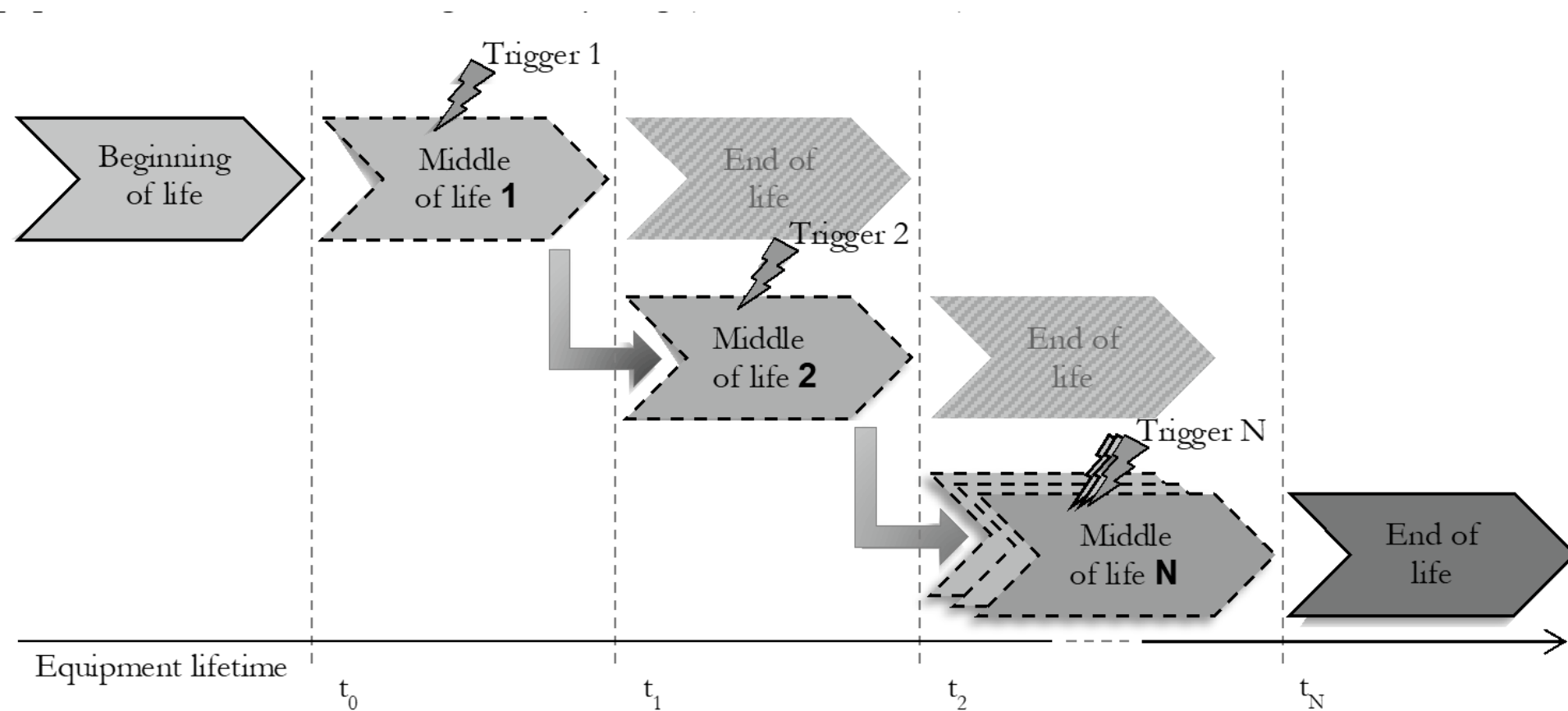
The Smart Twin need to operate seamlessly from product to system of systems



Michael E. Porter and James E. Heppelmann: "How Smart, Connected Products Are Transforming Competition", November 2014, Harvard Business Review

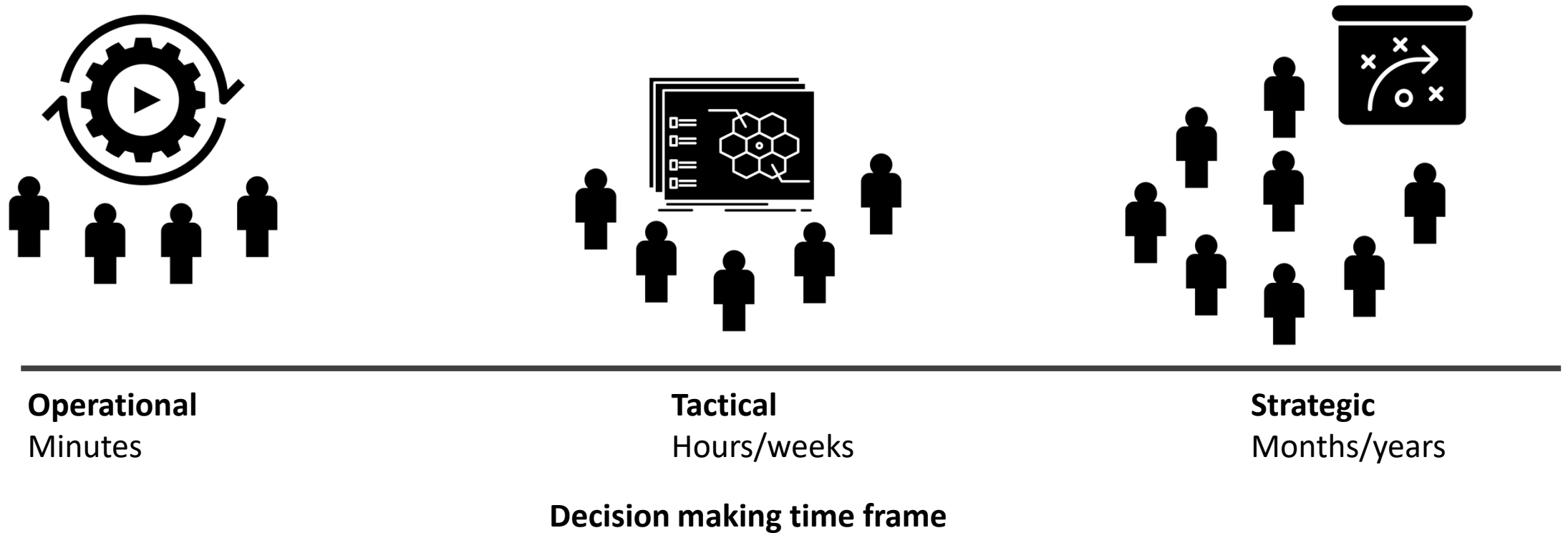
Data is generated in many different places – information is consumed by many actors

The digital twins need to support over the whole asset life cycle
As bid, as built, as commissioned, as operated, as maintained, as upgraded...

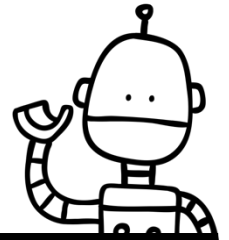


The digital twins need to be synced with the assets, people and processes

The digital twins need to support us with different outlooks
We need support making operational, tactical and strategic decisions



It helps me to take the appropriate action in complex systems



Questions we might ask a Smart Twin

Examples where the digital twins can provide advice

Question	Actors (primary)	Layer	Phase	Level	Time frame
How did the component actually function compared with the design?	Operations, Maintenance, Design	Component (aggregated)	BOL/MOL	Strategic	Annually
What could I do to improve factory output	Asset mgr, operations	Equipment, line	MOL	Tactical, strategic	Annually
What happens if I delay the next planned maintenance on the machine?	Asset mgr, operations, maintenance	Assembly, equipment, line	MOL	Tactical, strategic	Monthly, annually
How can I improve my spares holding?	Asset mgr	Line/Lines	MOL		
What options do I have now that machine is broken?	Operations, maintenance	Line/Lines	MOL	Operational	Live/daily
A competitor is opening a new factory what are the implications?	CEO, CFO	Business ecosystem	MOL	Strategic	Annually
I have a new mix of products, what is the optimal production plan?	Production, sales	Lines	MOL	Tactical	Daily, weekly, monthly
I need to replace a machine in a line, what is the best option for me?	Asset mgr, production, maintenance, component	Equipment/ lines	MOL	Strategic	Annually
		Component	MOL/BOL	Strategic	Annually

Questions provide a good way to define the use cases where we need advice

Smart Twins can help us to do our jobs better

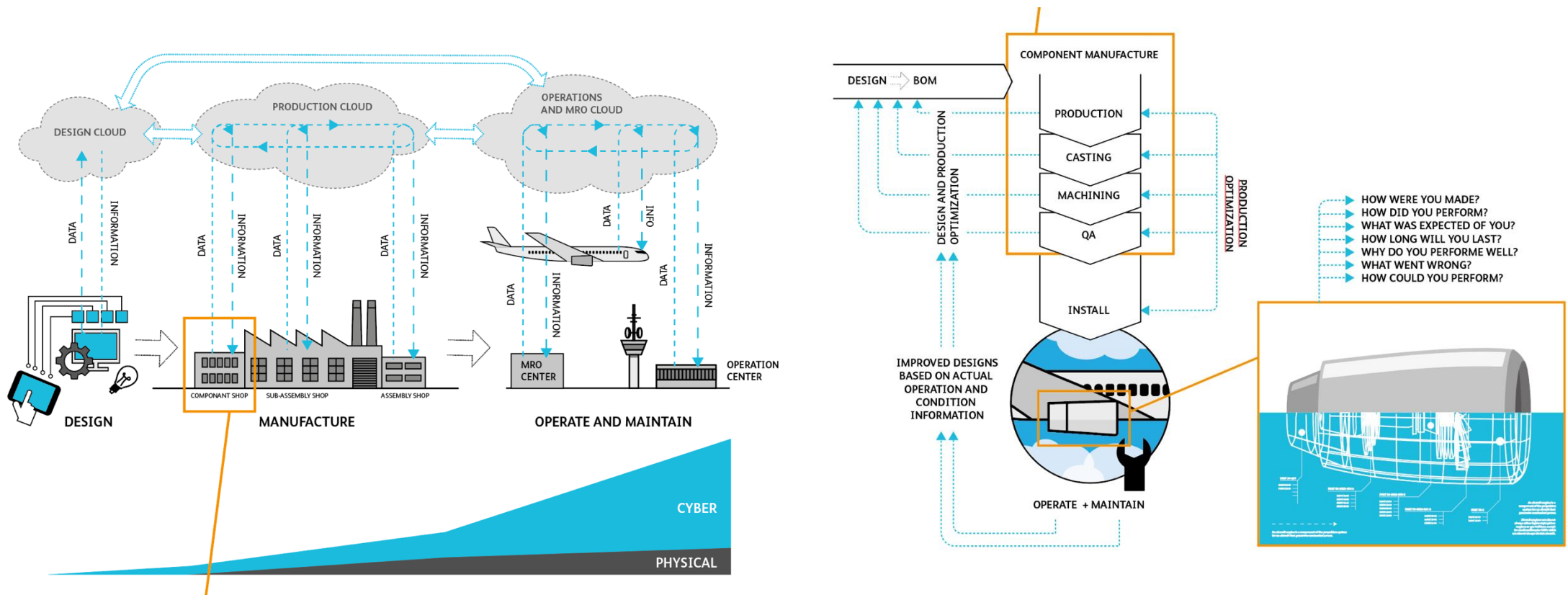
With our Innosuisse “Smart Twins” project we have six firms creating twins

Many factories / businesses					
Production line / Factory		3 Smart Operations	4 Smart Planning		
Products / machines		2 Smart control	4 Smart transport	2 Smart transport	
Components					
	Monitoring Condition and use	Control Tasks	Prediction Events and downtime	Optimization Performance and efficiency	Autonomy operation and service

Number of use cases in the bubbles

We have a range of control, prediction and optimization support

Smart Twins need to be aware of the whole asset life cycle and the system Advice is demanded by many actors in different situations



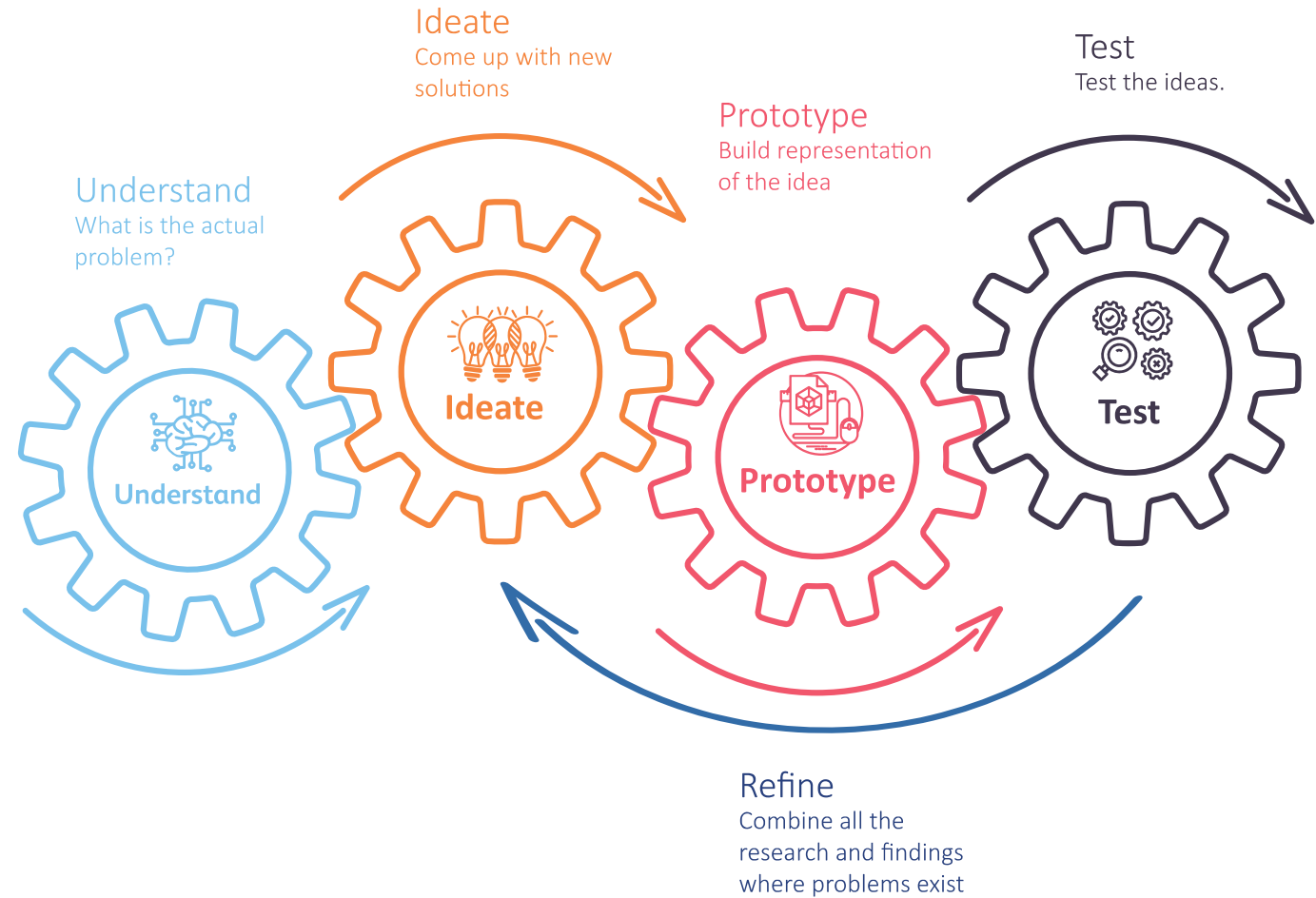
The Smart Twins support the building of knowledge

Developing new services and micro-services

So what do we need to develop our out digital twin based services?

Problem understanding leads to problem solving services

Technology enables advance service delivery



Using this model we have worked with Ricoh to improve customer experience and cut costs

Closing Summary

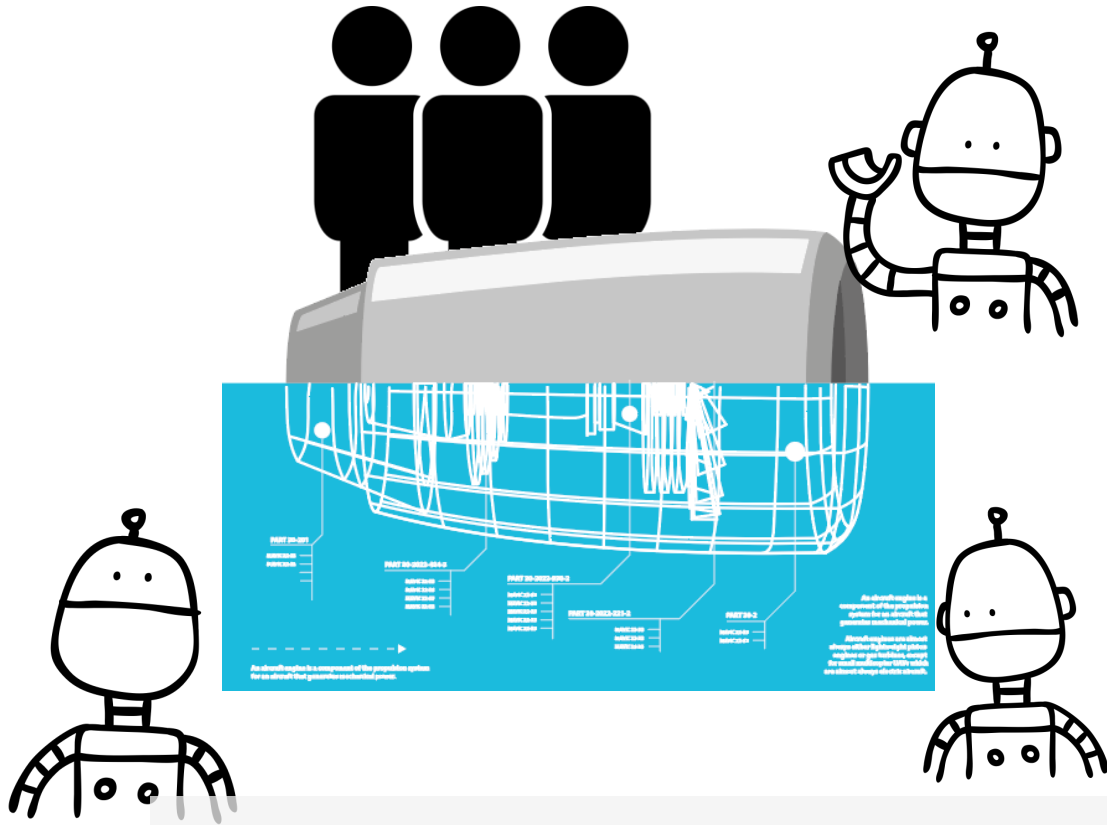
We have shown what Digital Twins can do

Smart Twins provide control and advisory services

The examples demonstrate that the Smart Twins supports services

Proposed a pathway for services enabled by Smart Twins

This presentation has described the Digital Twin and show that it can support service delivery by providing control and advisory services.



THANKS FOR YOUR TIME!

**VISIT WWW.SLIDESHARE.NET/SHAUNWEST
OR MAIL ME AT SHAUN.WEST@HSLU.CH**