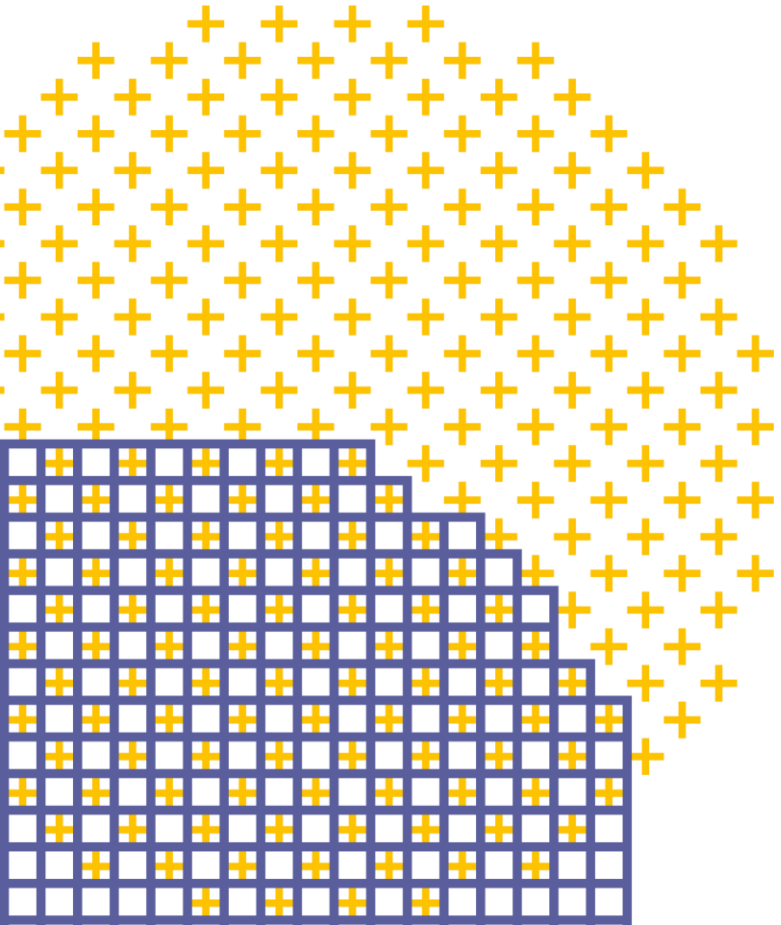

NATIONAL DIGITAL TWIN PROGRAMME

Connected Digital Twins in the built environment

Mark Enzer
Head of the National Digital Twin programme

UNIVERSITY OF CAMBRIDGE

UK Research and Innovation

Department for Business, Energy & Industrial Strategy

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Aim to cover…

1. The context

2. What we mean by connected digital twins

3. What the National Digital Twin programme is doing about it

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Our Vision for the built environment

Our

Vision

for the built environment

This Vision is not about predicting the future for the built environment.

It is about describing the future we want.

Making better decisions now will create a better future.

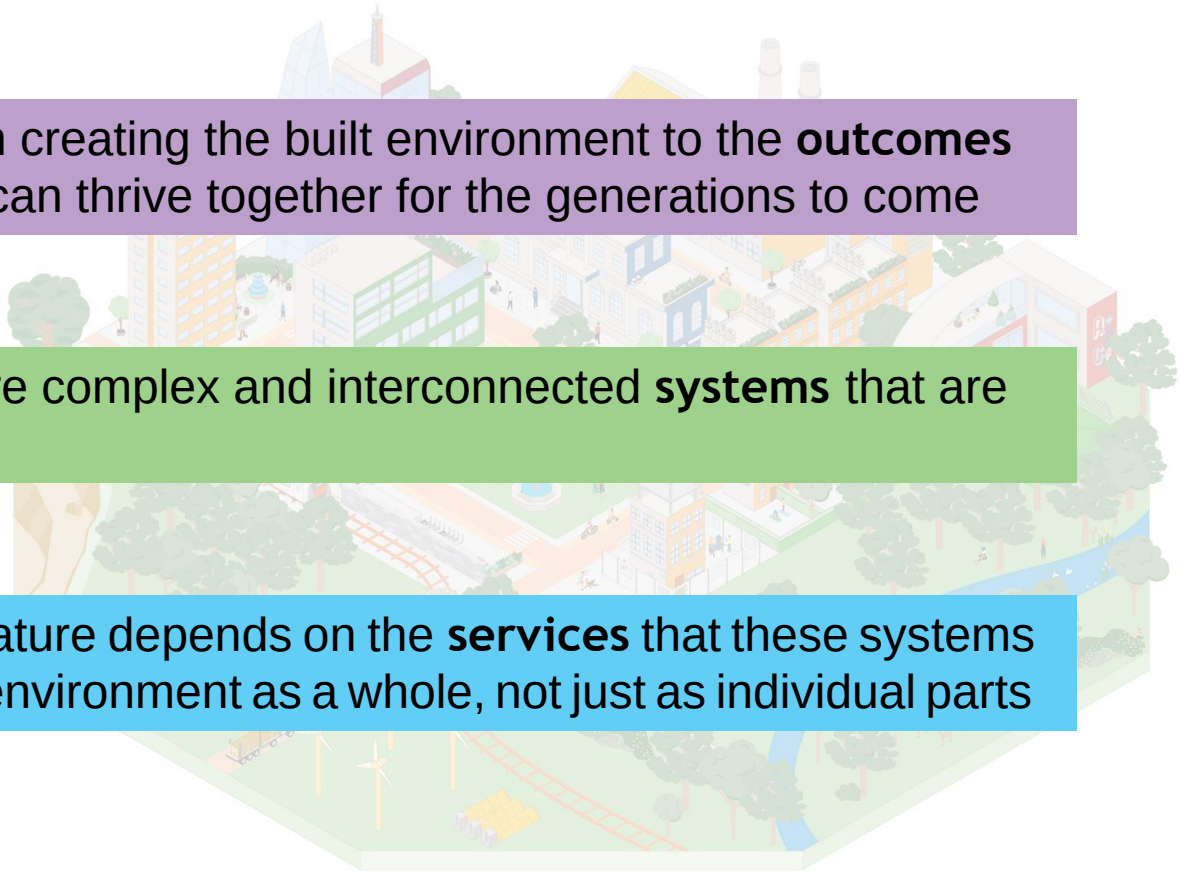
The Vision

Our Vision is for a built environment whose explicit purpose is to enable people and nature to flourish together for generations

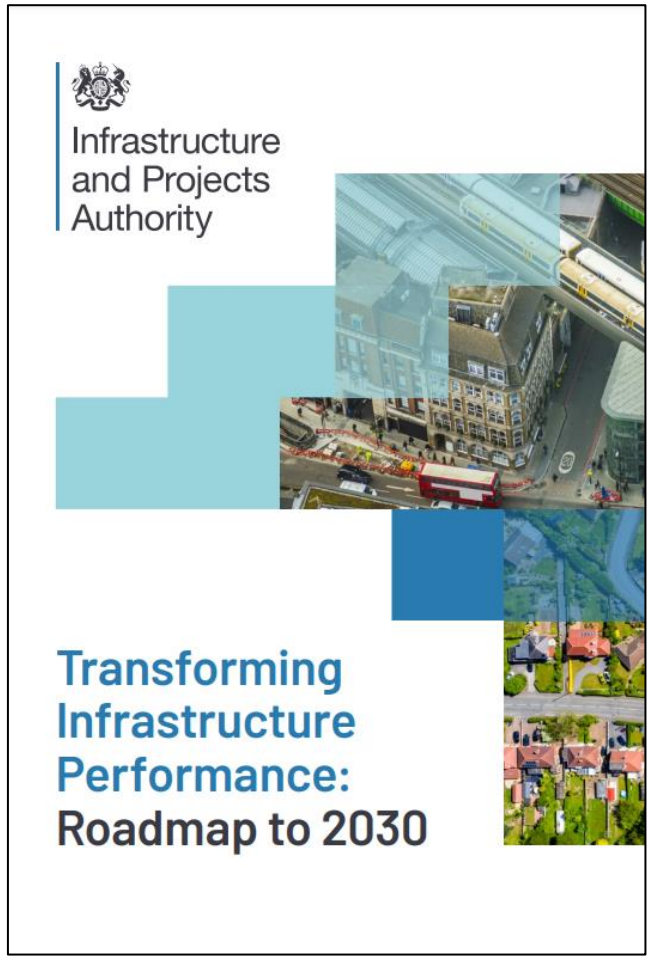
It is only when we shift our focus from creating the built environment to the **outcomes** enabled by it that people and nature can thrive together for the generations to come

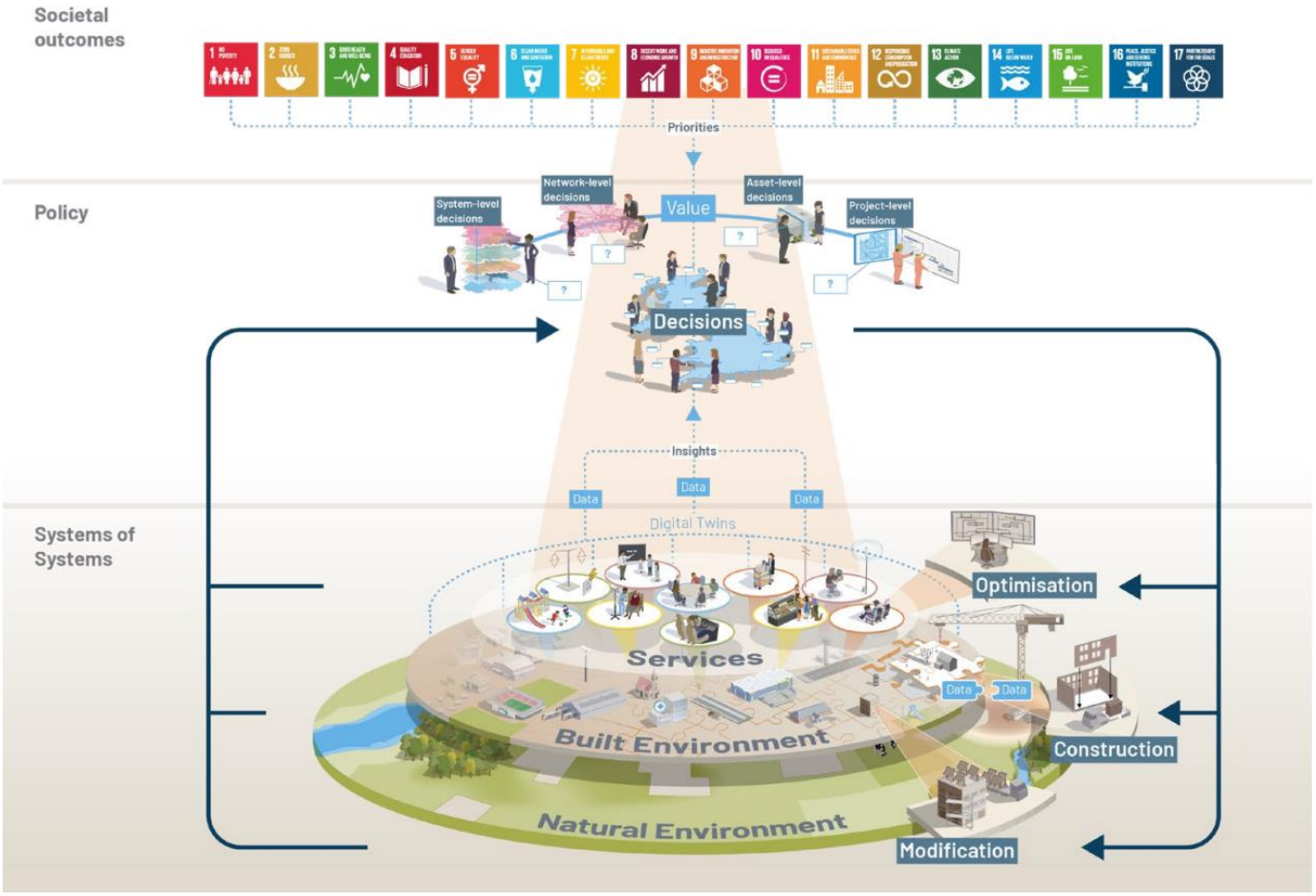
The built and natural environments are complex and interconnected **systems** that are essential for our wellbeing

Improving outcomes for people and nature depends on the **services** that these systems provide and on coordinating the built environment as a whole, not just as individual parts

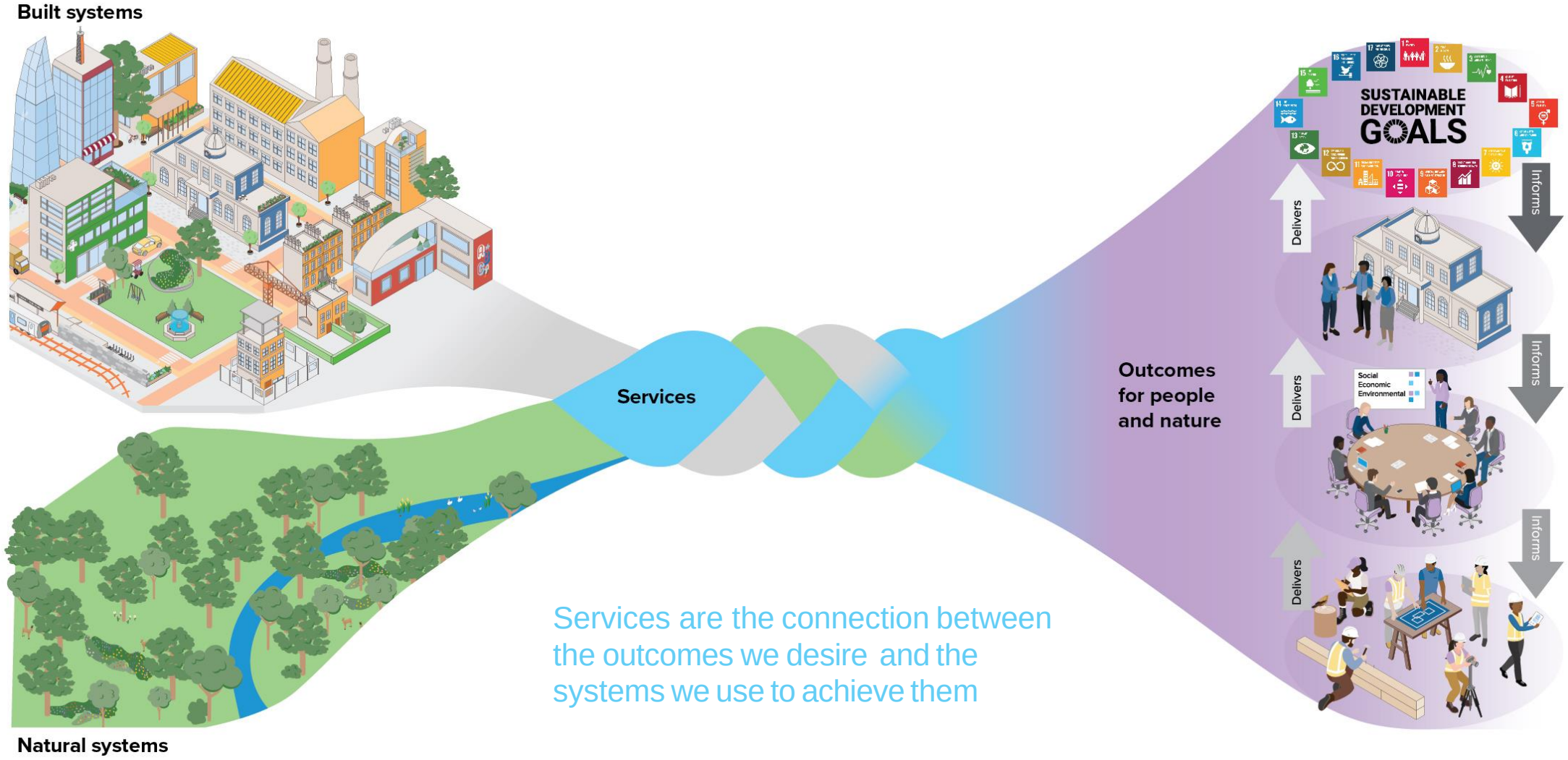


Policy – Transforming Infrastructure Performance





The whole model on a page



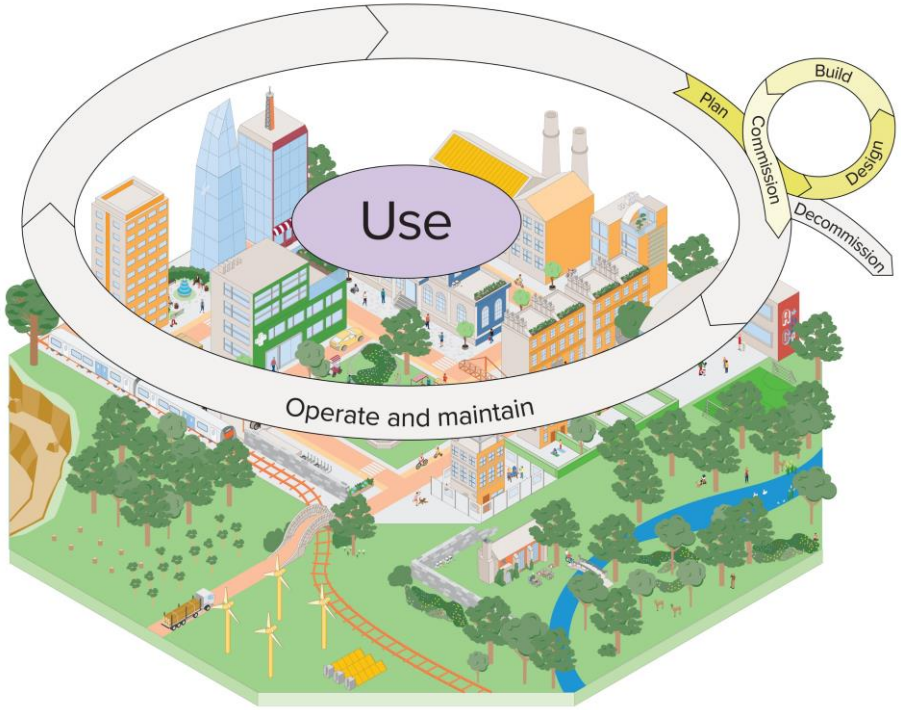
Services are the connection between the outcomes we desire and the systems we use to achieve them

Systems and processes

Built systems

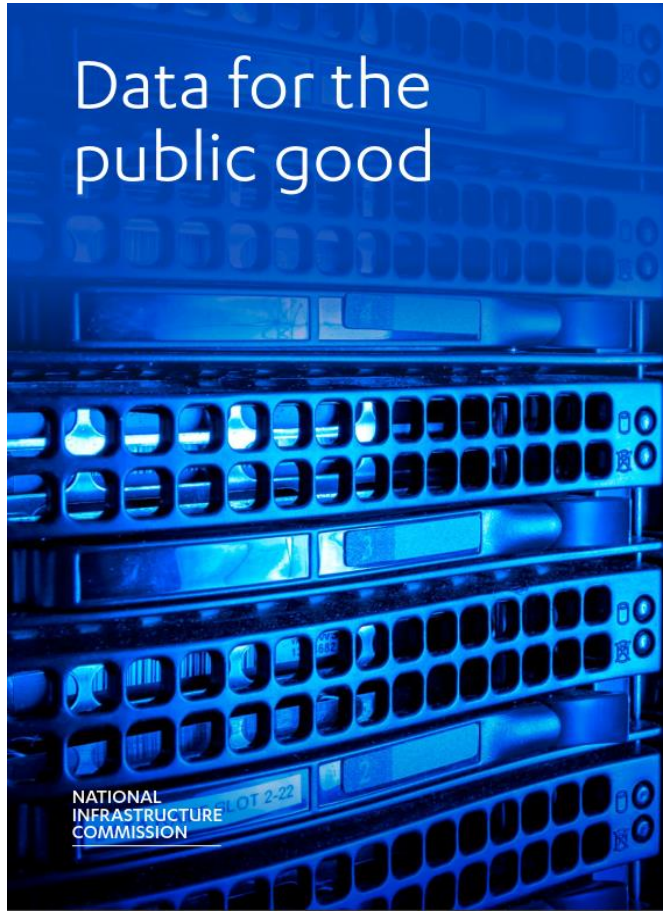
Natural systems

Cyber-physical



System of systems

Data for the public good



Recommendations:

1. **A National Digital Twin** – an ecosystem of connected digital twins to enable better outcomes from our built environment

2. **An Information Management Framework** – to enable secure resilient information flow across organisational and sector boundaries

3. **A Digital Framework Task Group** – to encourage coordination and alignment across government, academia and industry

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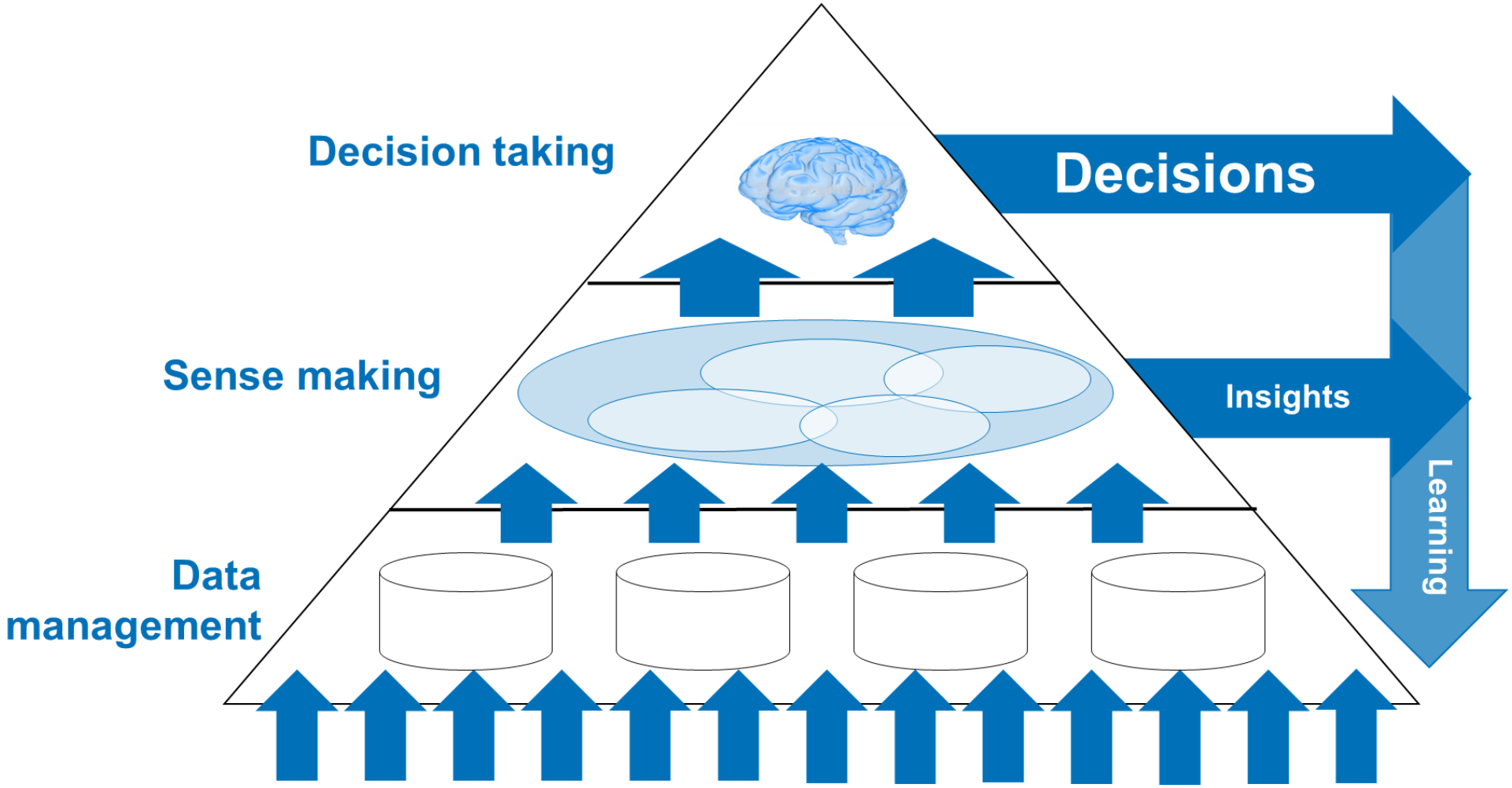
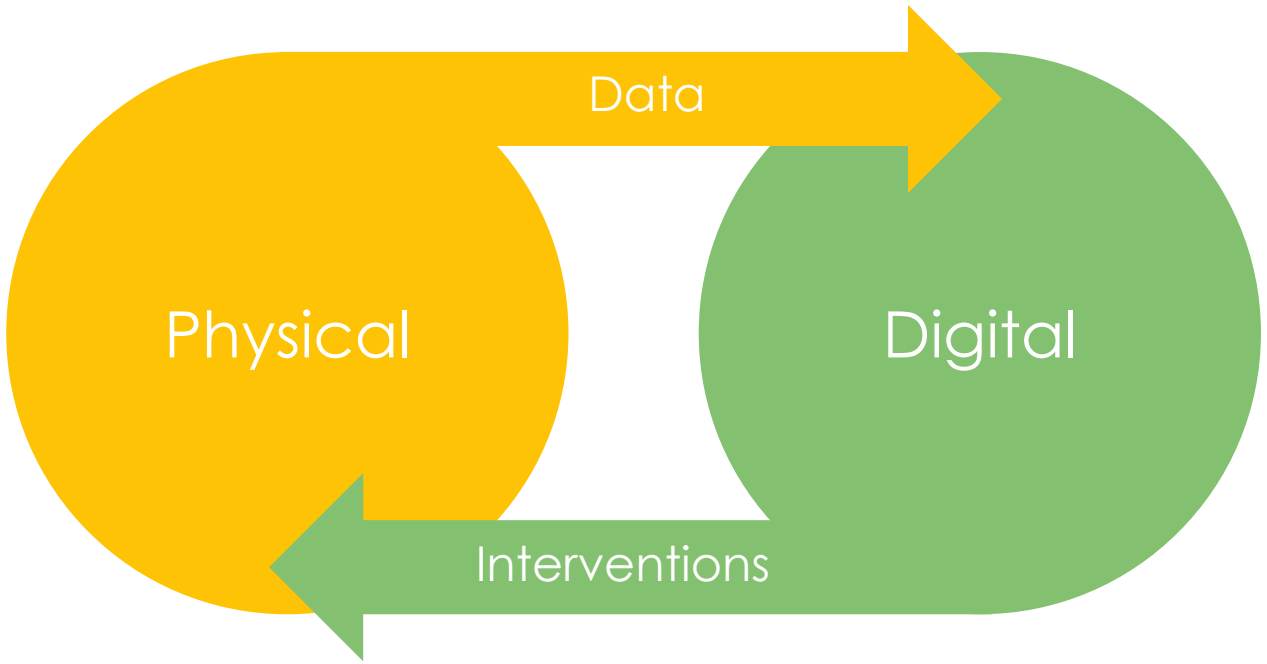
The information value chain



Digital twins

Outcomes



Insights

Decisions

NATIONAL DIGITAL TWIN PROGRAMME

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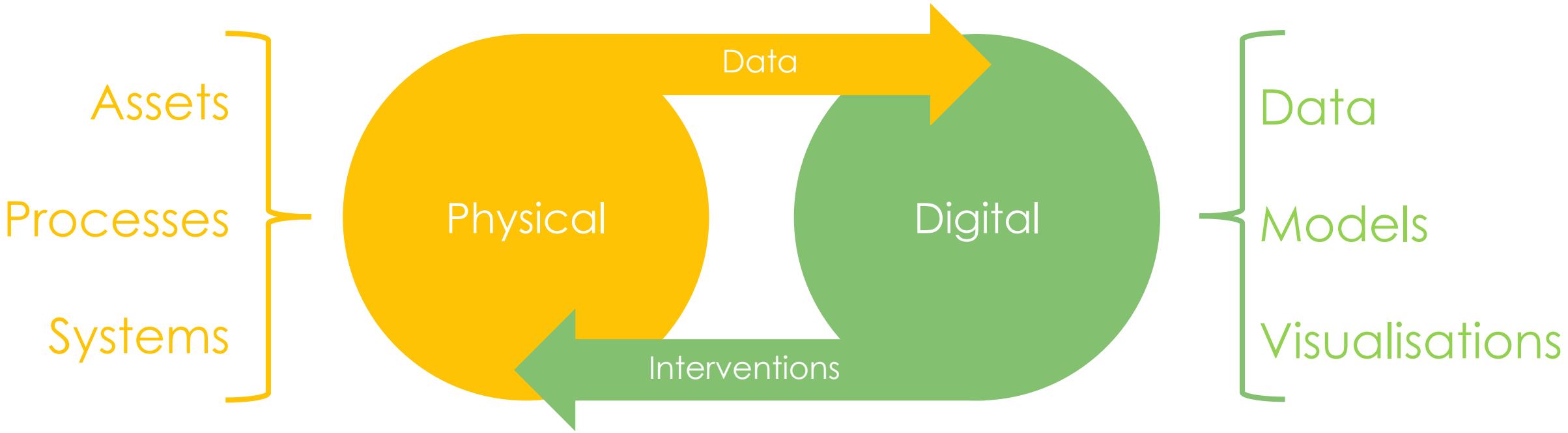
Digital twins – many twins for many purposes

Delivering value: “better decisions faster”



Driven by purpose

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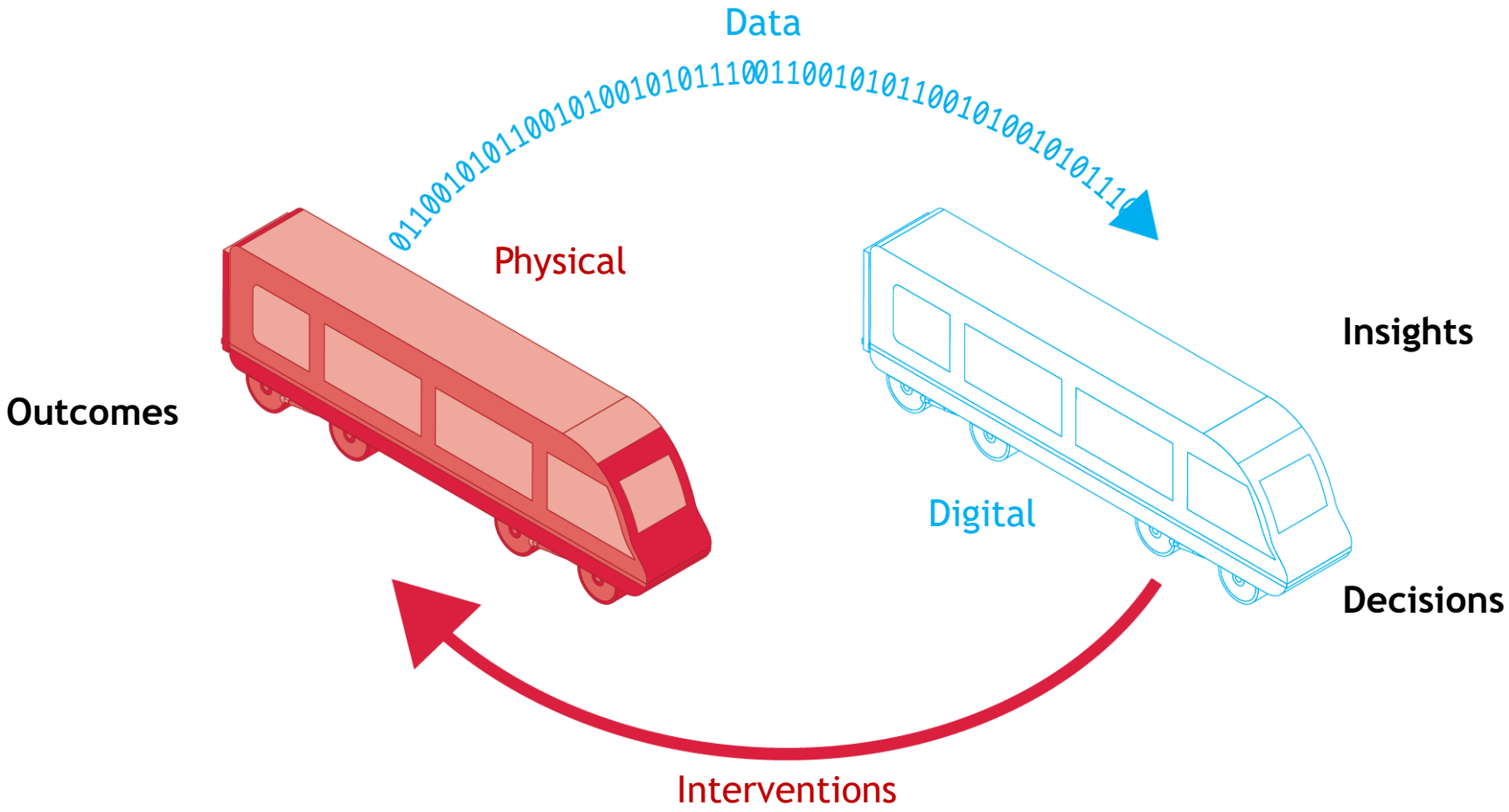
Individual digital twins



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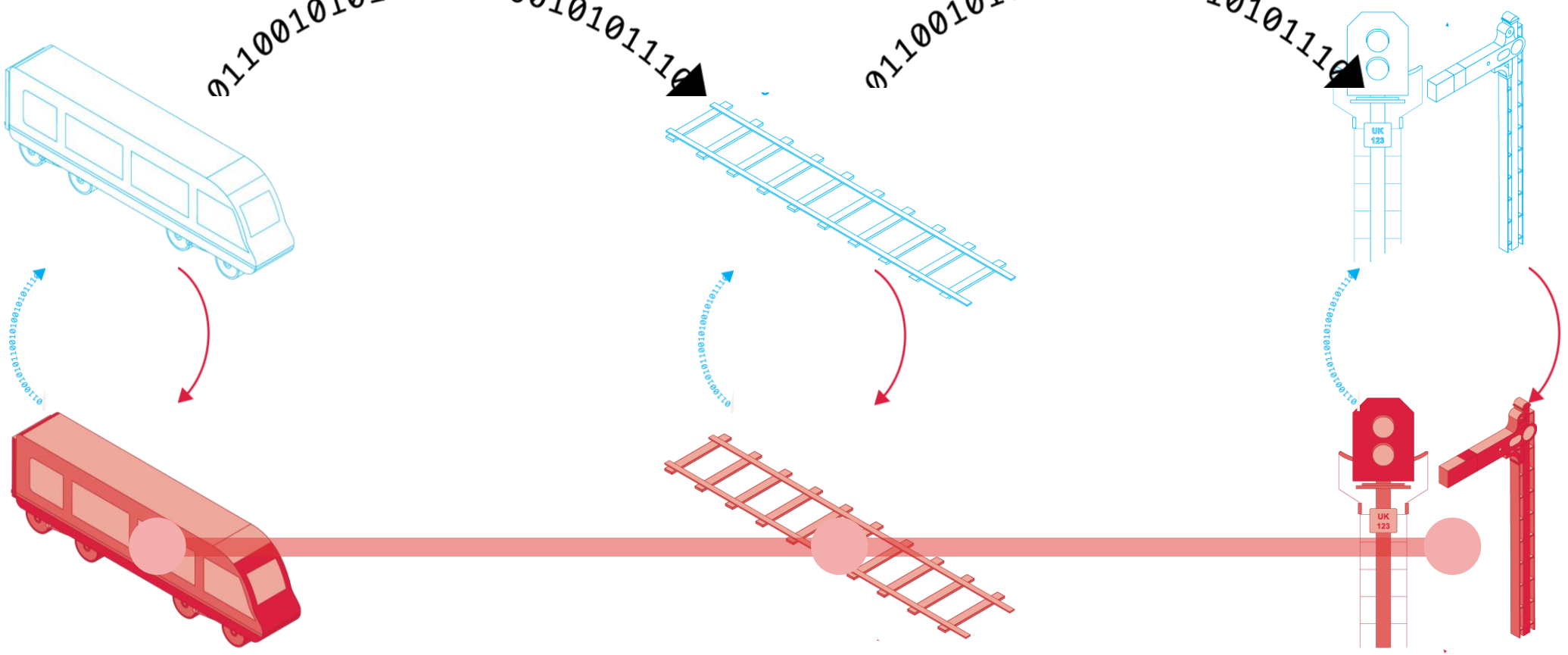
Connected digital twins



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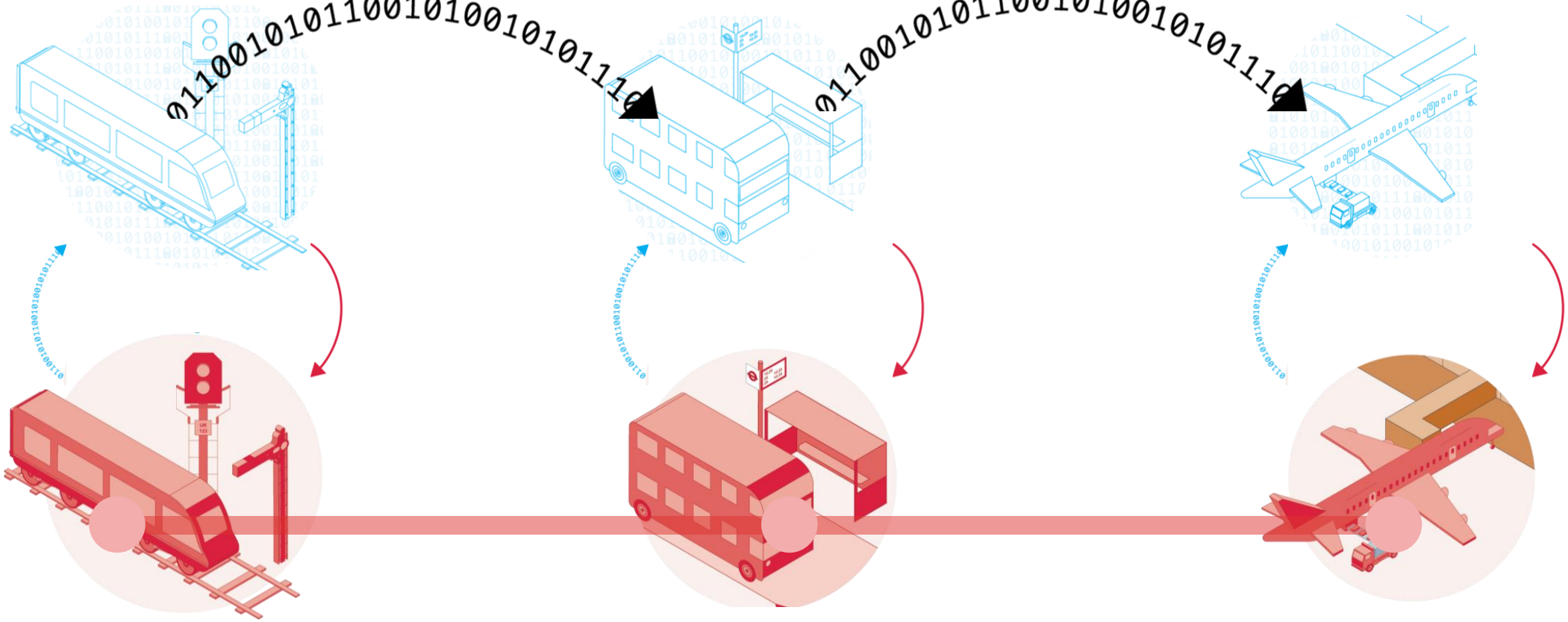
Ecosystem of connected digital twins



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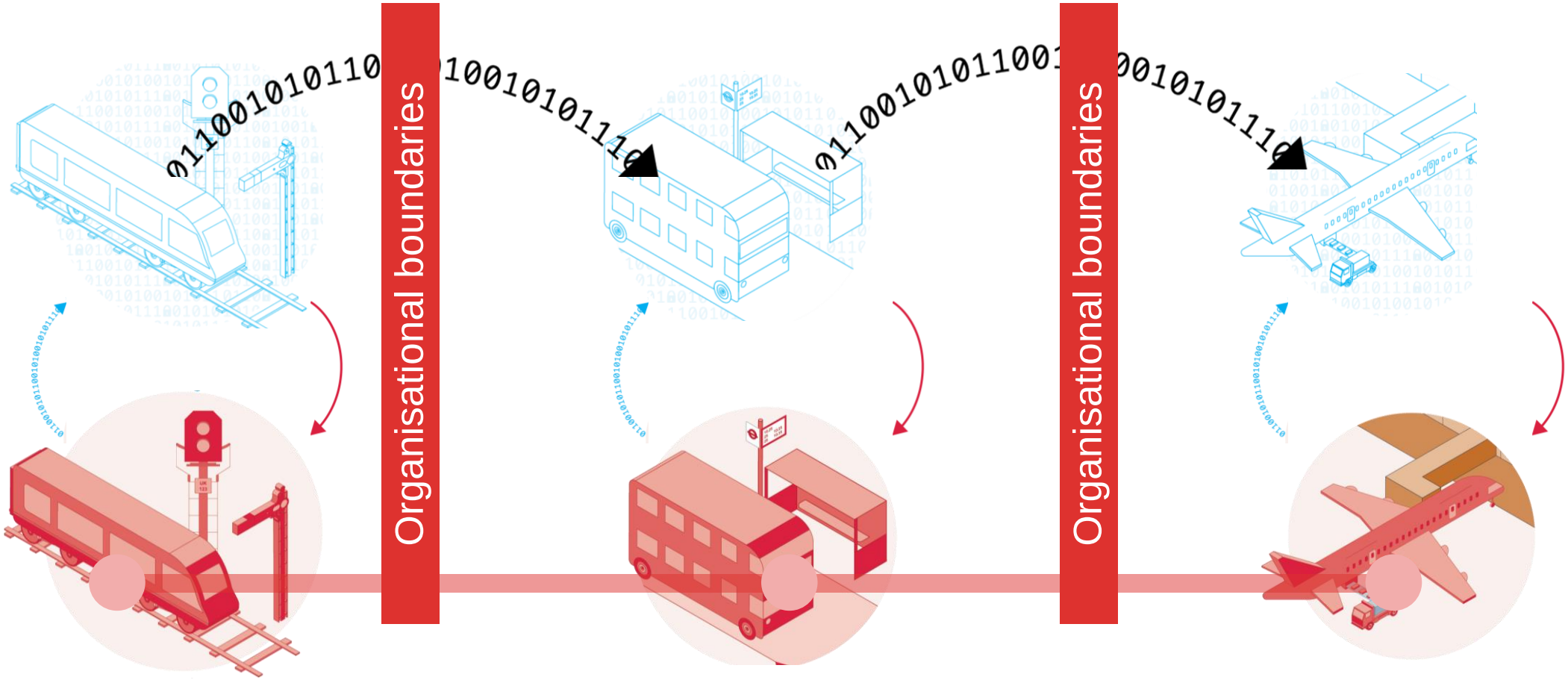
Ecosystem of connected digital twins



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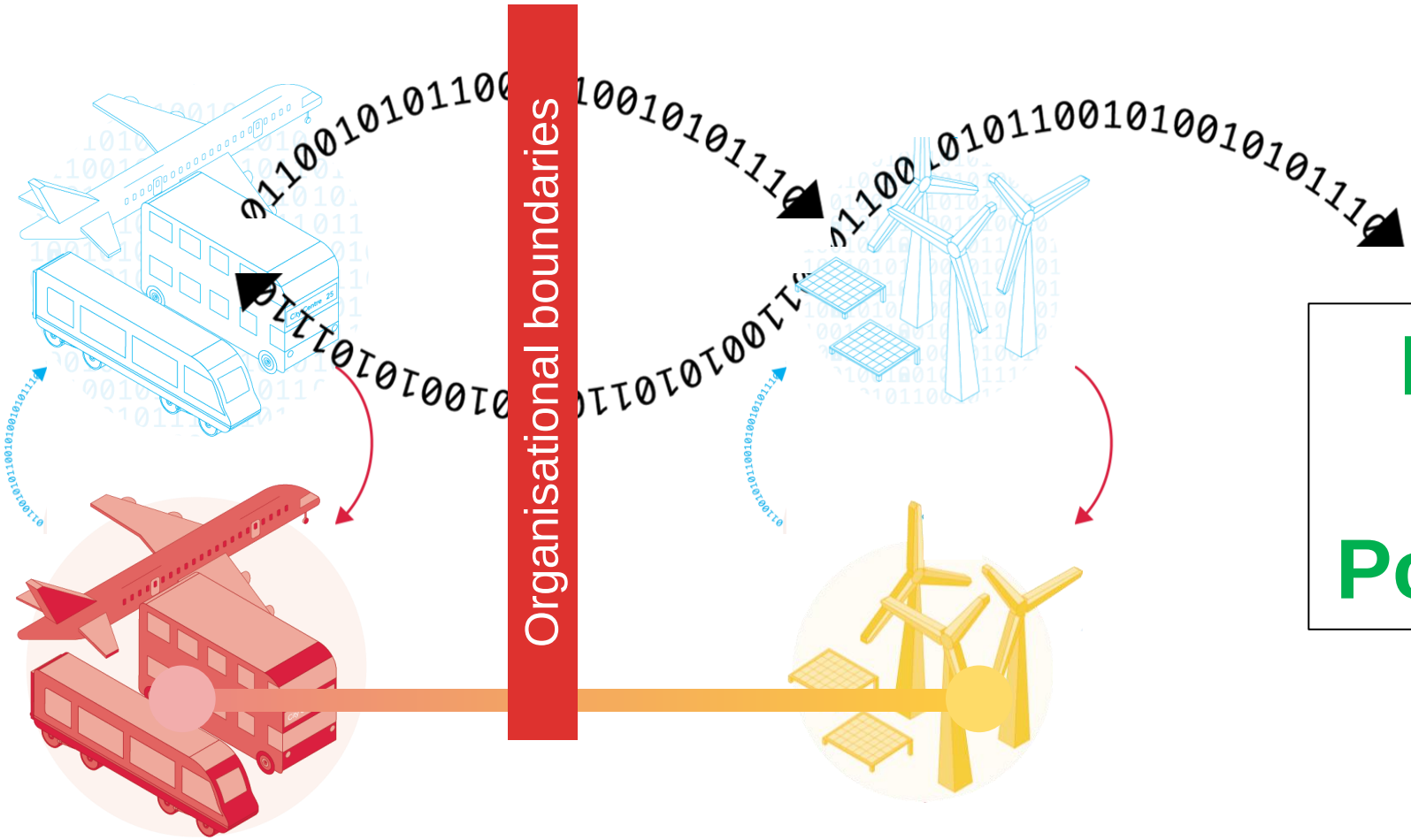
Ecosystem of connected digital twins



Regulators

+

Policy makers

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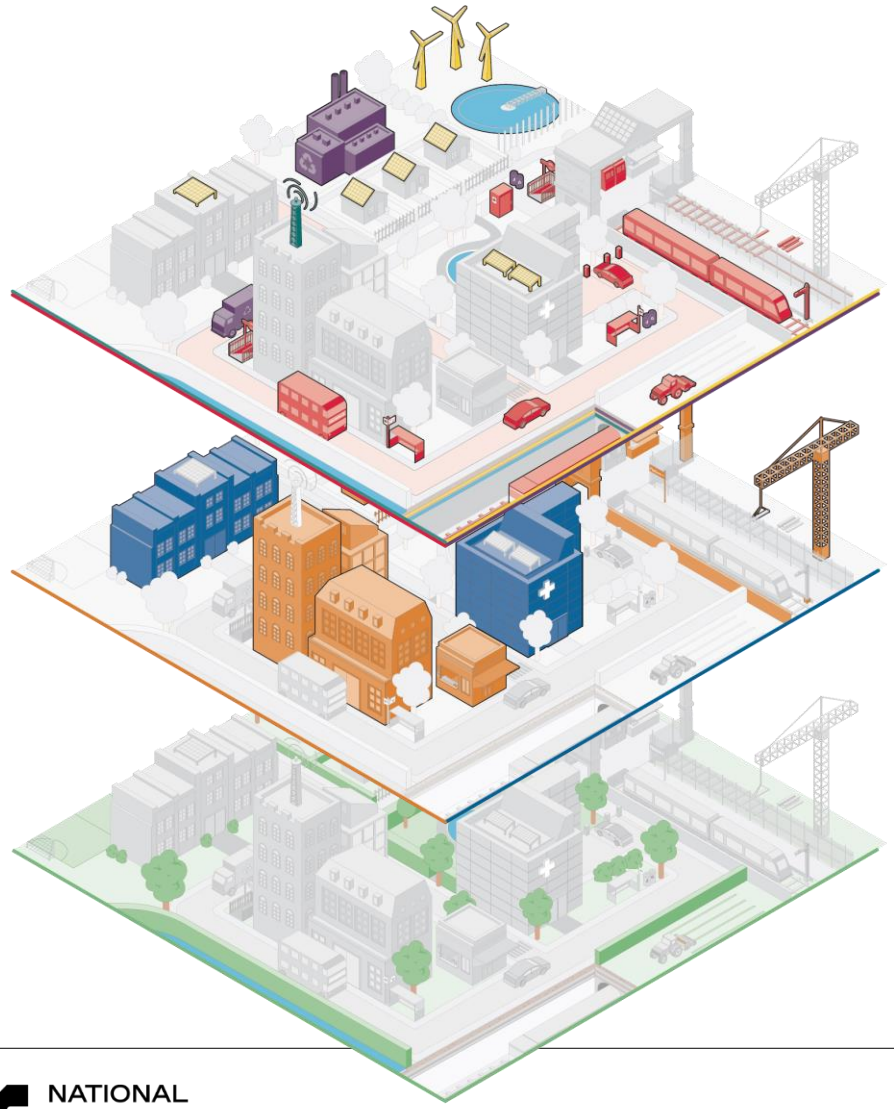
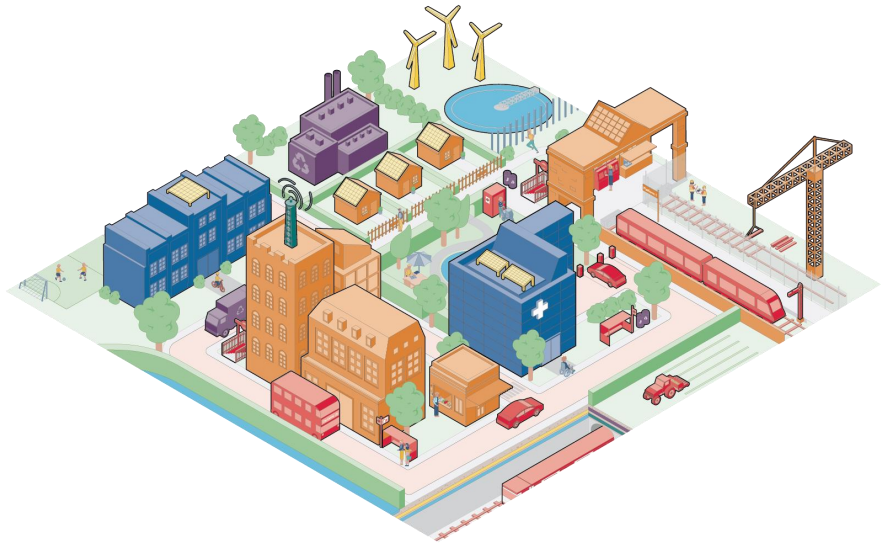
The built environment is a system of systems



Economic infrastructure

Social infrastructure

Natural environment



Built environment

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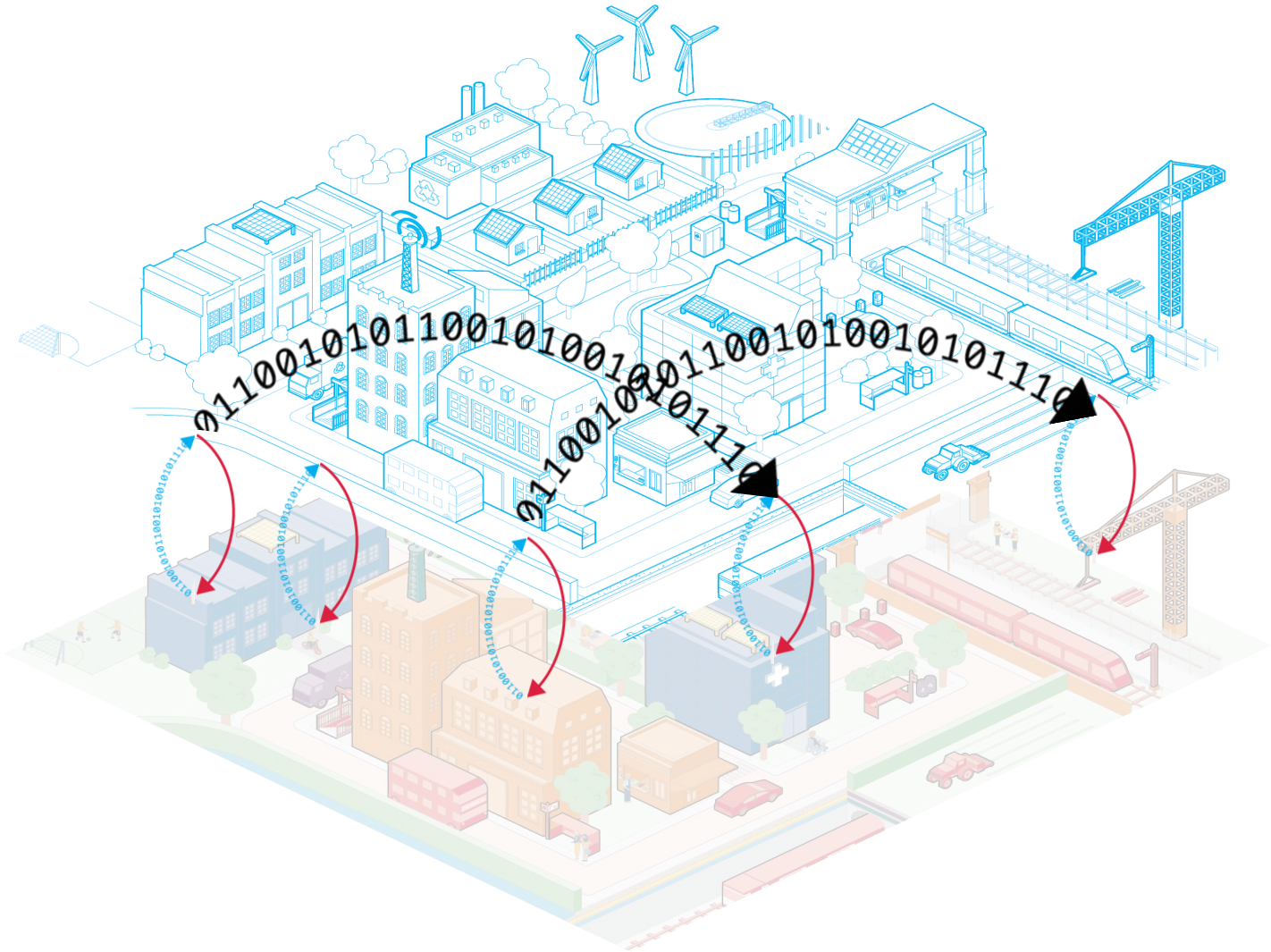
Cyber-physical Infrastructure



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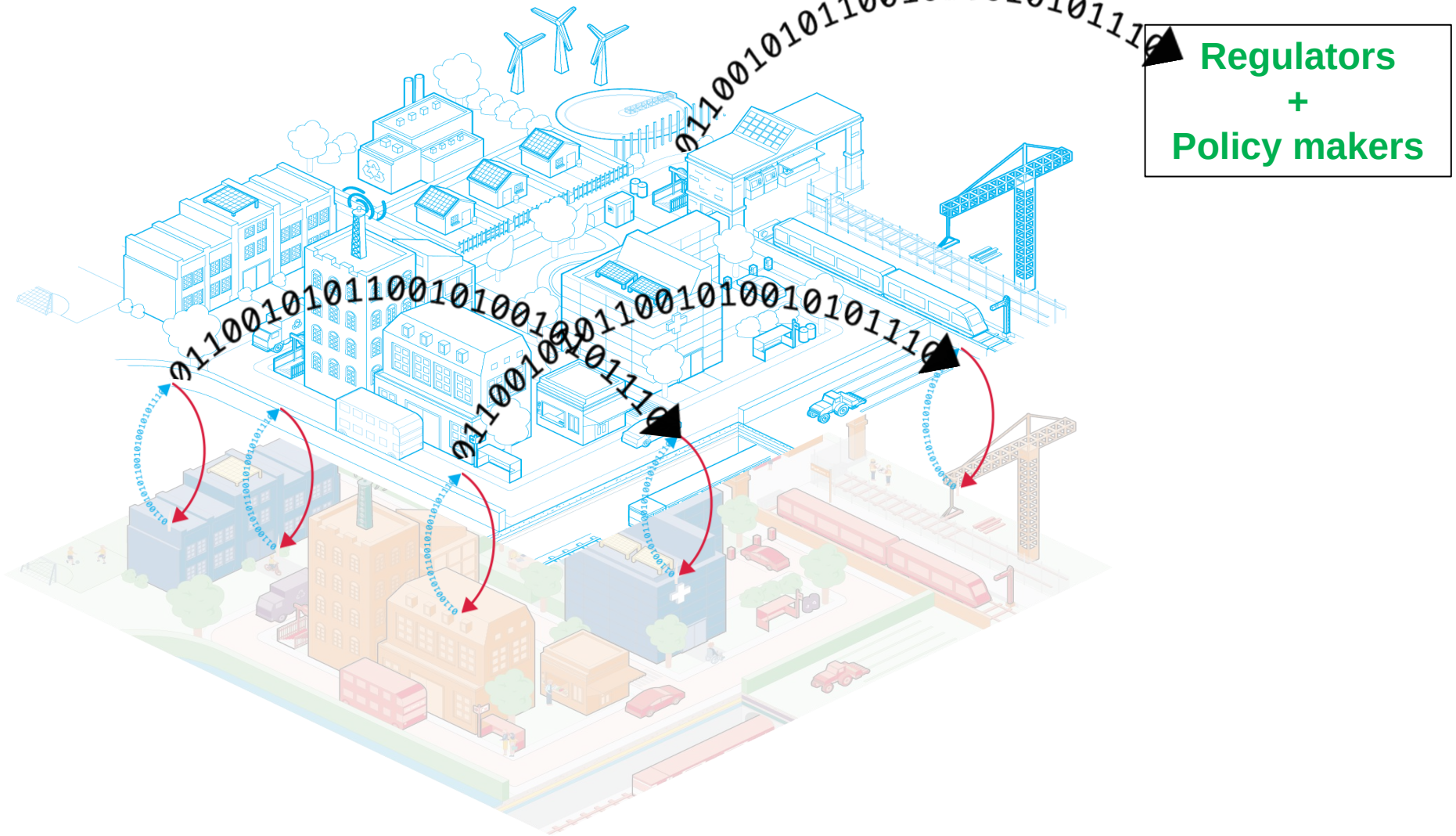
Cyber-physical Infrastructure



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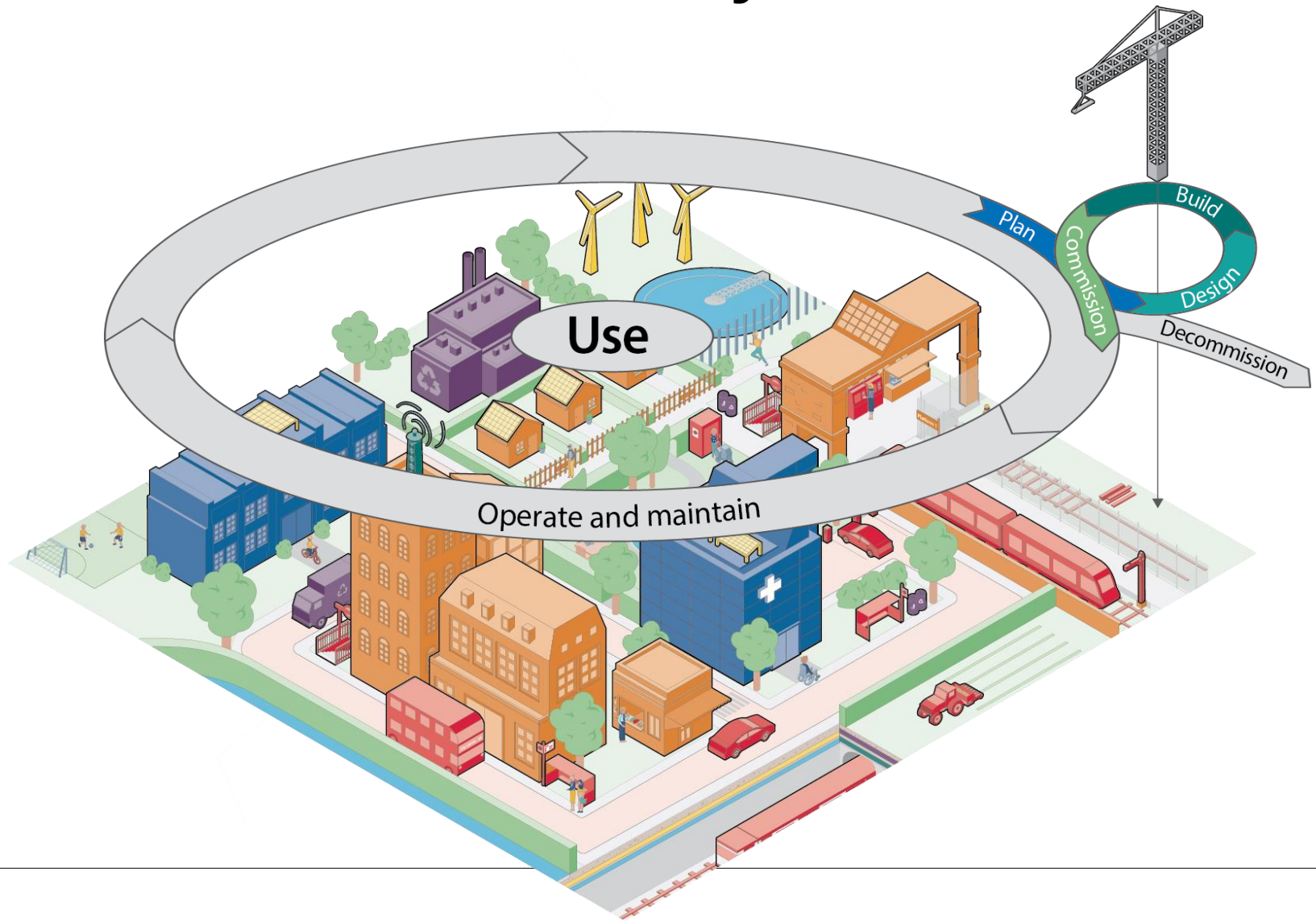
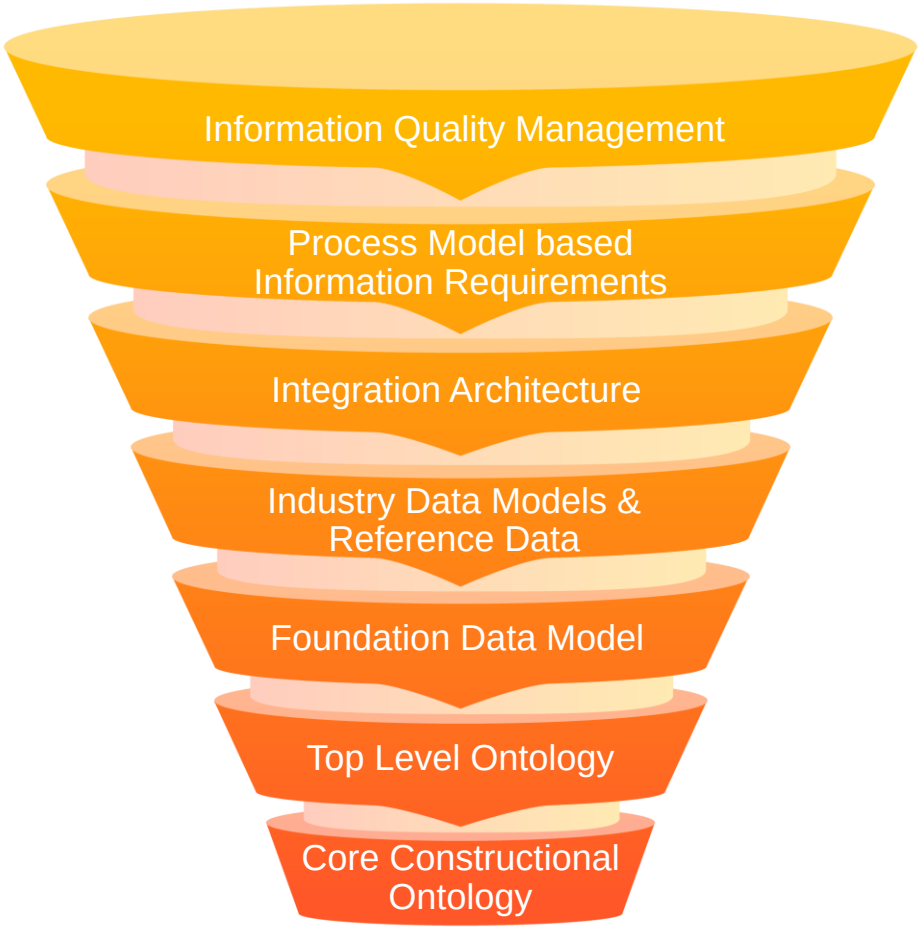
System processes and asset lifecycles



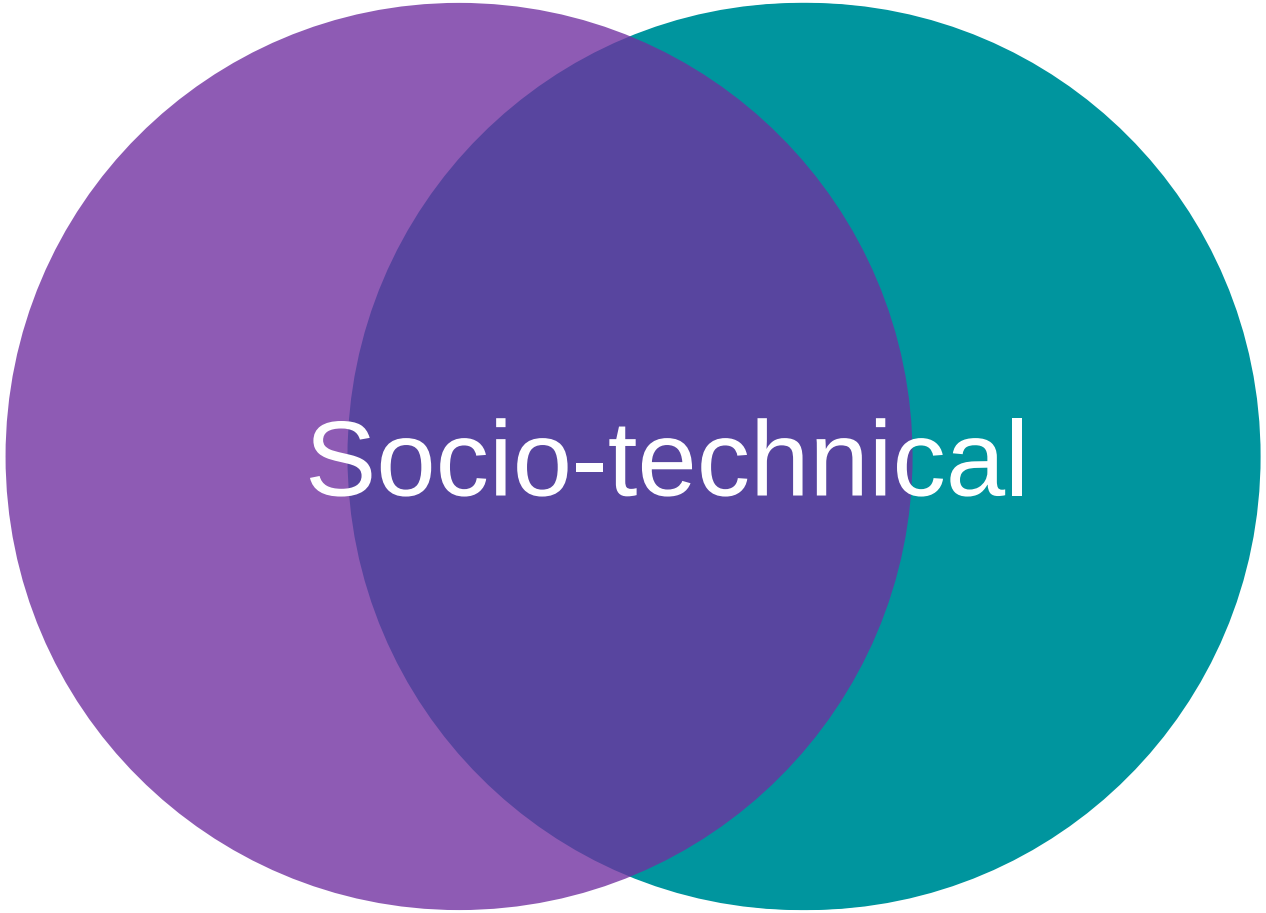
The Information Management Framework



The semantic solution at the core of the NDT

1. A consistent approach to data modelling
2. Shared reference data
3. Common security and access protocols

The NDTp is a socio-technical change programme



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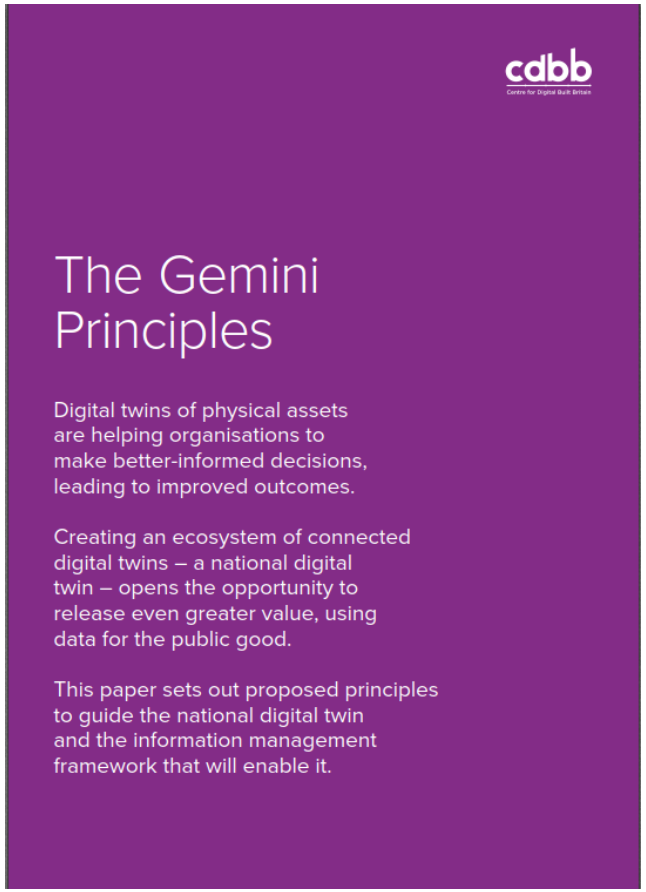
Driven by values – The Gemini Principles



Purpose: Must have clear purpose	**Public good** Must be used to deliver genuine public benefit in perpetuity	**Value creation** Must enable value creation and performance improvement	**Insight** Must provide determinable insight into the built environment
Trust: Must be trustworthy	**Security** Must enable security and be secure itself	**Openness** Must be as open as possible	**Quality** Must be built on data of an appropriate quality
Function: Must function effectively	**Federation** Must be based on a standard connective environment	**Curation** Must have clear ownership, governance and regulation	**Evolution** Must be able to adapt as technology and society evolve

https://www.cdbb.cam.ac.uk/system/files/documents/TheGeminiPrinciples.pdf

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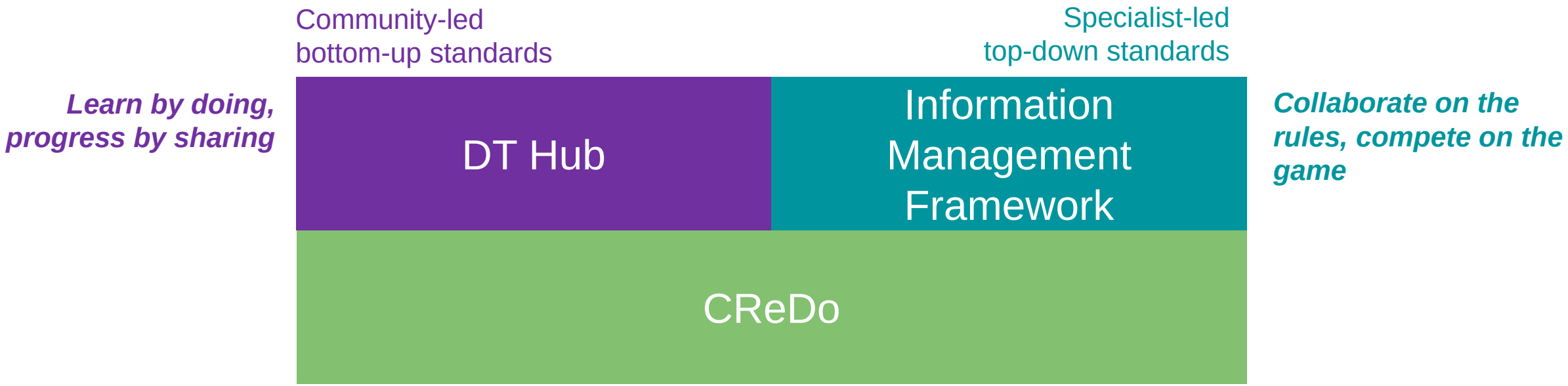
The NDTp key projects for FY21/22



Climate **Re**silience **D**em**o**nstrator project
Tangible working example of the National Digital Twin working with CPC

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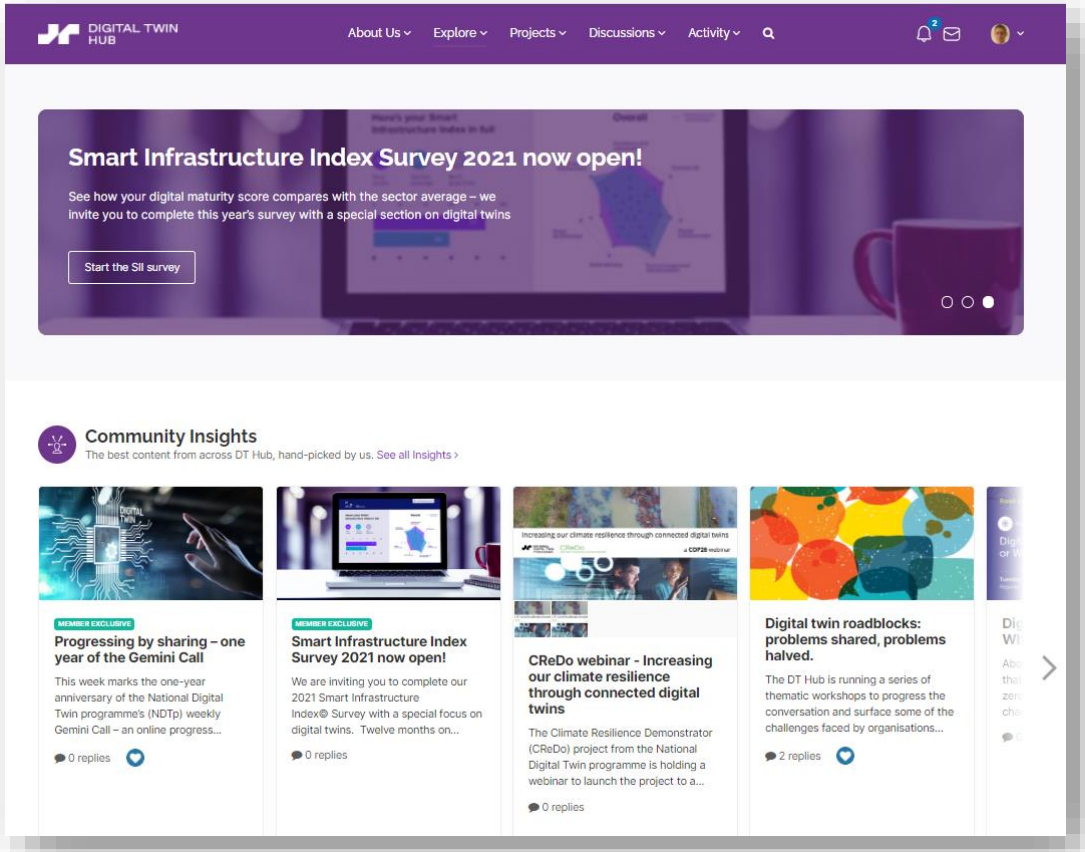
Digital Twin Hub

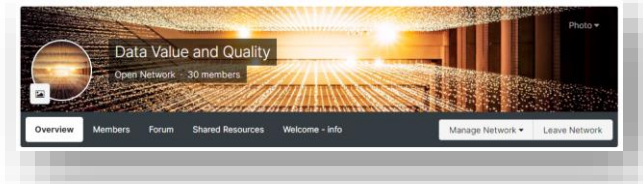
Learn by doing, progress by sharing



Established community
3000+ members
1500+ organisations
60+ Countries

Examples of existing content

- Digital twin case studies
- Digital twin toolkit
- Media and events recordings
- Digital twin register
- Digital twin research register
- Groups and networks
- Articles and publications
- Forums and networks
- Glossary



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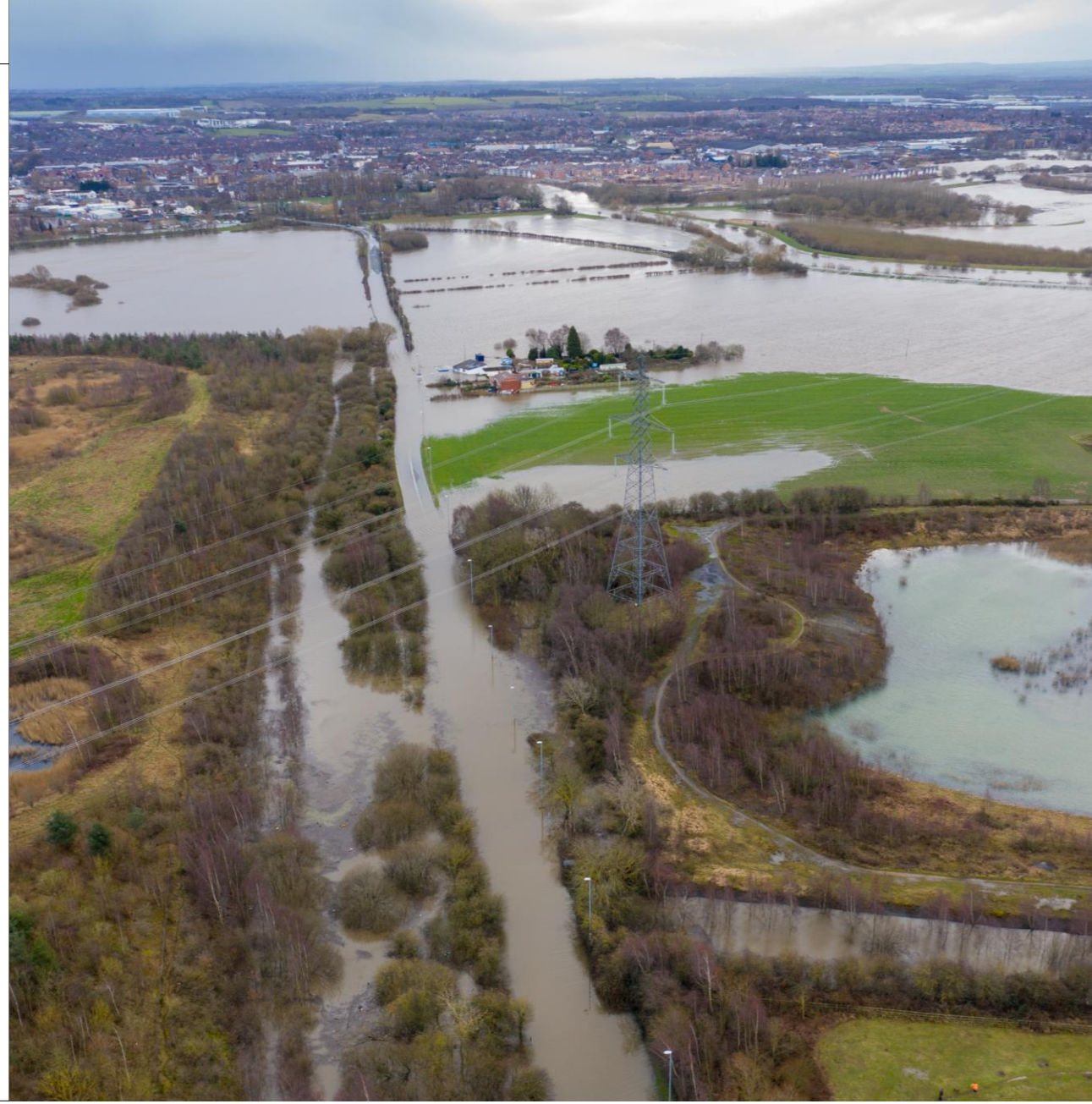
CReDo

1. Climate change

- Climate change is a systemic challenge that demands systems-based solutions.
- Cross-sector data sharing is an essential enabler of climate resilience.

2. Information Management Framework (IMF)

- Demonstrate a tangible working example of the National Digital Twin - a 'thin slice' of the envisaged ecosystem of connected digital twins.
- Apply the Information Management Framework approach to achieve cross-sector interoperability.
- Connect datasets in a principled and scalable way.



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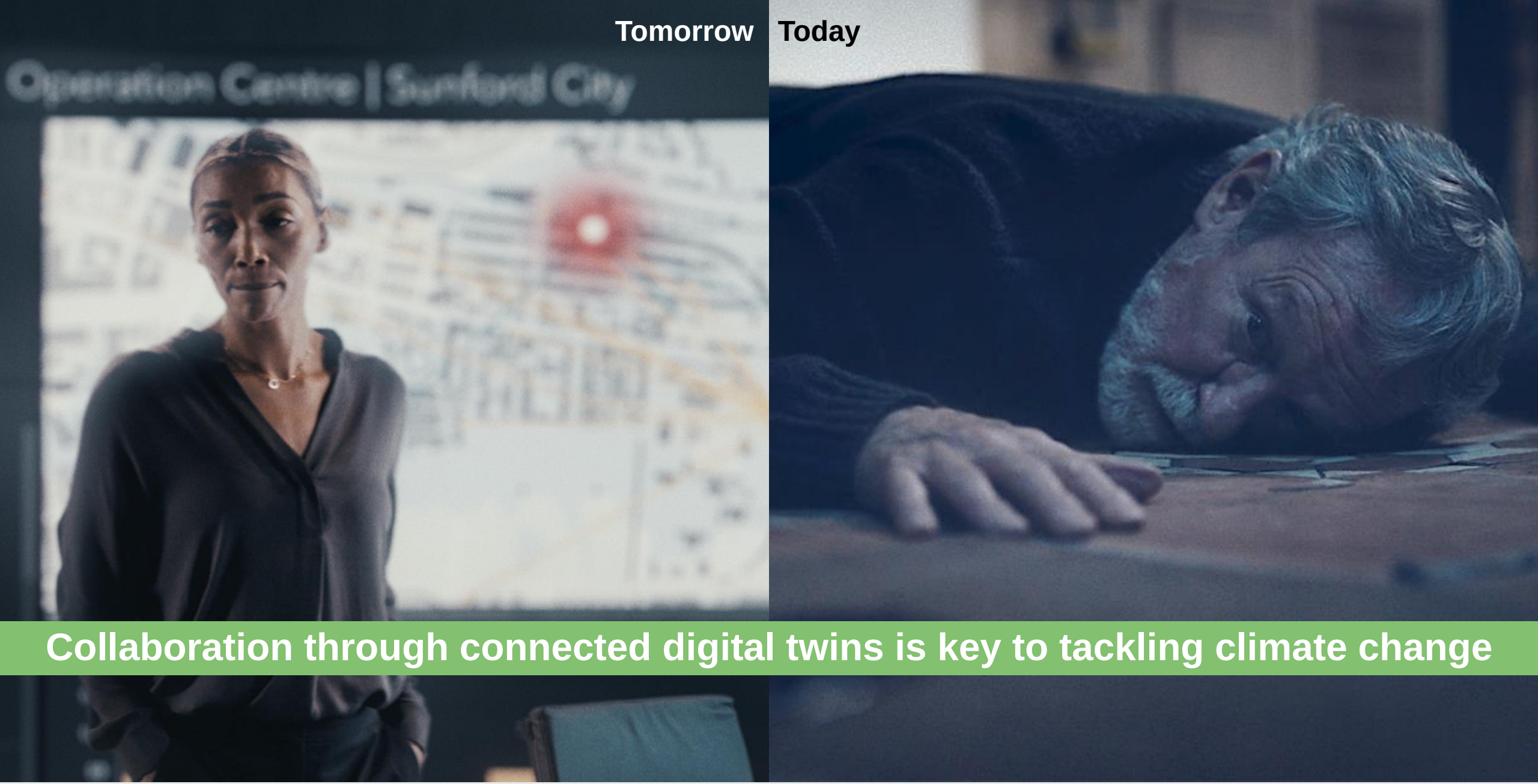
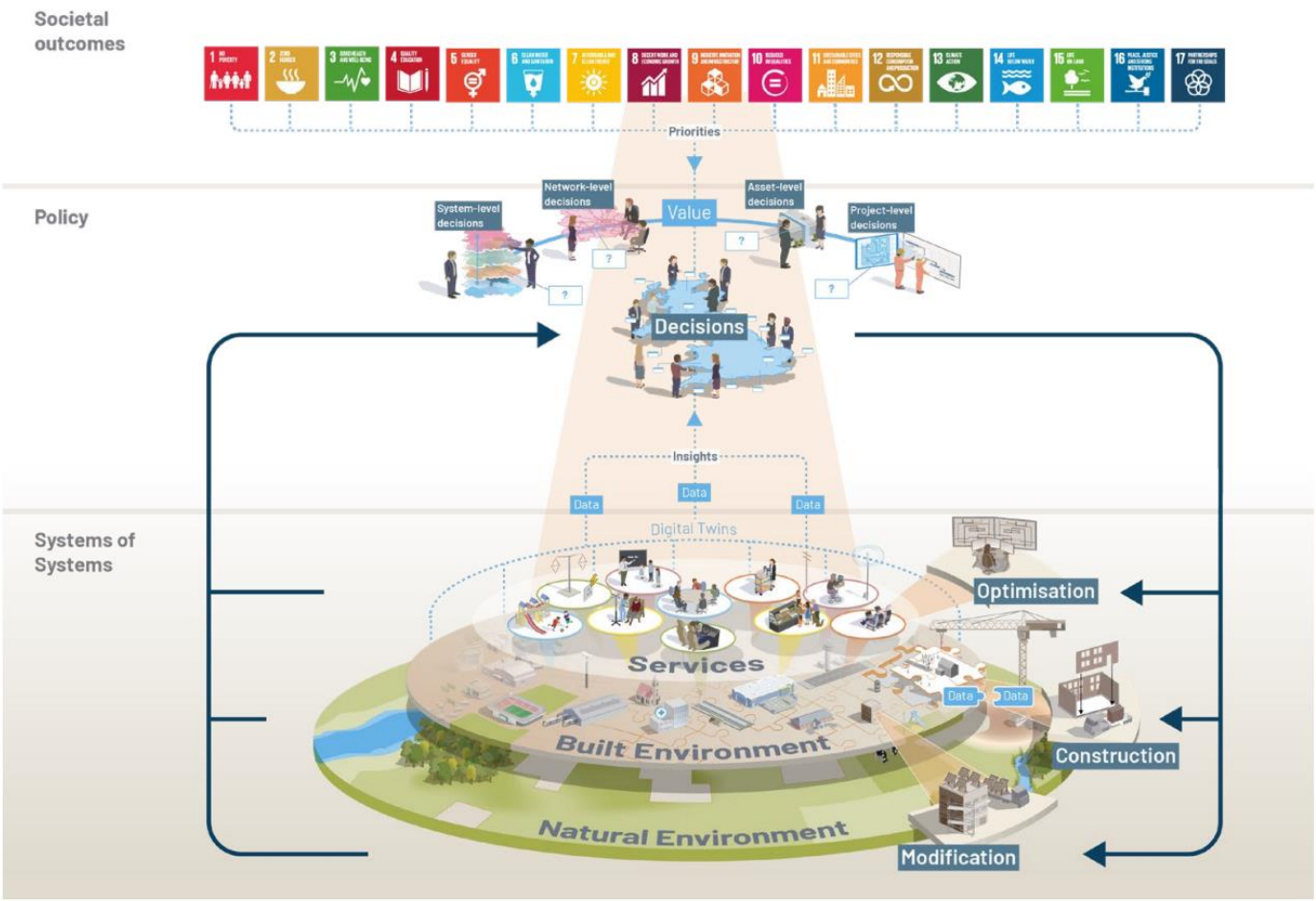


Collaboration through connected digital twins is key to tackling climate change

National digital twin programmes must be

- Outcome-focused
- Purpose-driven
- Systems-based
- Values-guided
- Socio-technical



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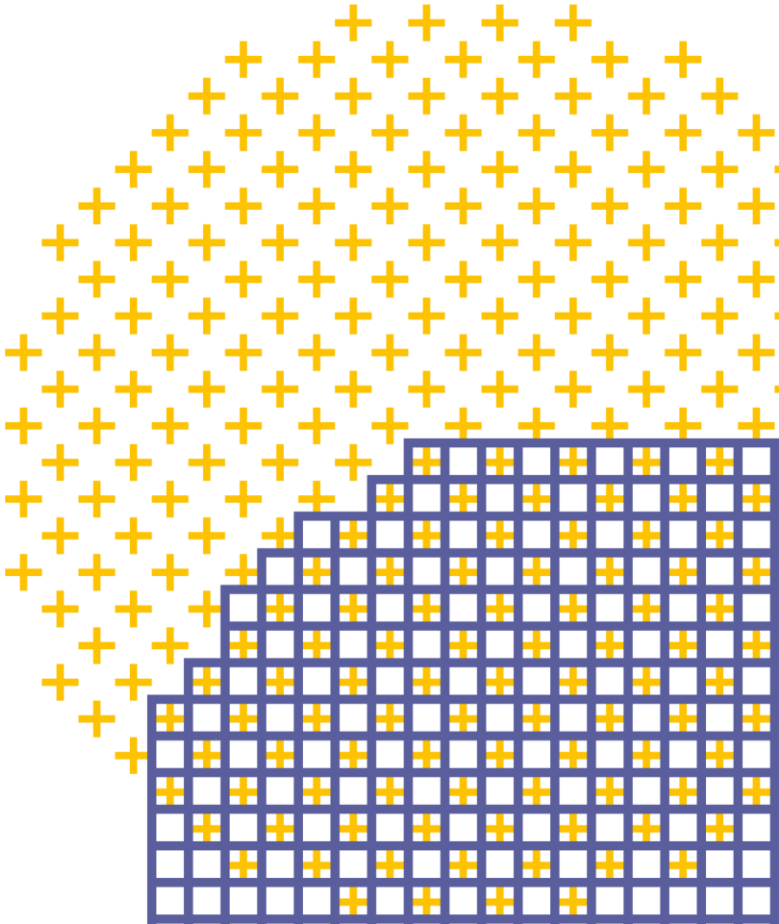
Thank you

Build better connections:
digitaltwinhub.co.uk



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Benefits of the National Digital Twin

Better decisions >>> better outcomes for people and planet

- **Benefits to society:** Improved stakeholder engagement. Better outcomes for the ultimate customers (the public – taxpayers/bill payers/fare payers/voters). Improved customer satisfaction and experience through higher-performing infrastructure and the services it provides.
- **Benefits to the economy:** Improved national productivity from higher-performing and resilient infrastructure operating as a system. Improved measurement of outcomes. Better outcomes per whole-life pound. Improved information security and thereby personnel, physical and cyber security.
- **Benefits to business:** New markets, new services, new business models, new entrants. Improved business efficiency from higher-performing infrastructure. Improved delivery efficiency, benefiting the whole construction value chain – investors, owners, asset managers, contractors, consultants, suppliers. Reduced uncertainty and better risk management.
- **Benefits to the environment:** Less disruption and waste. More reuse and greater resource efficiency – a key enabler of net zero and the circular economy in the built environment.