



DEOS
DIGITAL

Digital strategies for a
smarter, more connected world

***Digital Engineering
as the foundation for building
Digital Twins and Smart Infrastructure***

Simon Vaux

CEO

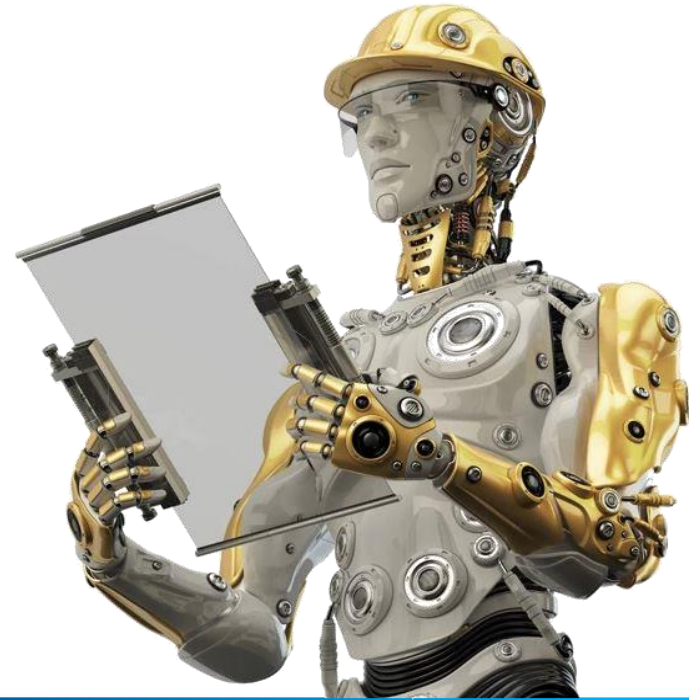
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Nov. 2022









Agenda

- What is Digital Engineering (DE)?
- Introducing the Common Data Model (CDM)
- Using DE to build the digital asset lifecycle
- Building digital twins and smart infrastructure
- Next steps



About DEOS Digital

- DEOS Digital commenced in 2021
- *We provide digital strategies for a smarter, more connected world*
- Former Director Digital Engineering at TfNSW
- Led the TfNSW Digital Engineering Framework Program for past 7 years
- For more details www.deosdigital.com

 <p>Digital Pioneer</p> <hr/> <p>We are a recognised 'digital visionary'</p>	 <p>Client know-how</p> <hr/> <p>We understand our clients' needs</p>	 <p>Change Maker</p> <hr/> <p>We know how to create long-lasting change</p>	 <p>Business Accelerator</p> <hr/> <p>We know how to accelerate your strategy</p>
 <p>Proven Track record</p> <hr/> <p>We have proven track record of delivery</p>	 <p>Thought Leader</p> <hr/> <p>We are a well-respected thought leader</p>	 <p>Well Connected</p> <hr/> <p>We are well connected with industry</p>	 <p>Professional Engineer</p> <hr/> <p>We are from the industry</p>

Some recent projects..



ACT Treasury
BIM Implementation Plan
Detailed Review



Main Roads WA
DE Strategy



Major Projects Canberra
Canberra Light Rail Stage 2
DE Framework



Victoria DELWP
Digital Twin Victoria
DE & Utilities Strategies



Canterbury Bankstown
DE Strategy



SAP
Digitising Public
Infrastructure Program



Waka Kotahi (NZTA)
Let's Get Wellington Moving
DE Framework



Auckland Transport
Auckland Light Rail
DE Strategy



Transgrid
Humelink Project
DE Strategy

RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

AS 7739:2022
DE Standard for Rail Infrastructure

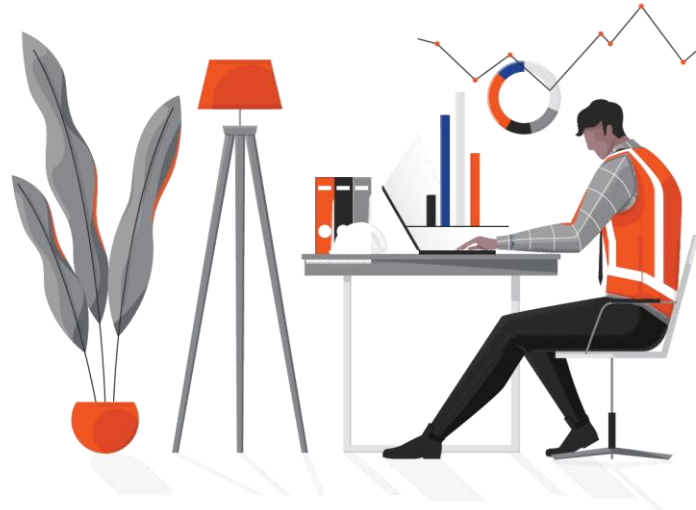
Standards Australia
Digital Engineering Sector-wide
Transformation Program

NSW WESTERN SYDNEY
PLANNING PARTNERSHIP

NSW Gov and Western Sydney
Smart Infrastructure Policy Acceleration
(SIPA) Project

▼ is a **data management** business

- Service planning
- Network planning
- Project planning
- Business-case assessment
- Asset design
- Project management**
- Project assurance
- Asset handover
- Asset management
- Network operations
- Customer service
- Asset renewal



Evolution of data management..



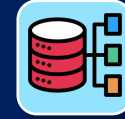
**Document
Management**

Project Records



**Information
Management**

Project Files



**Metadata
Management**

Business Databases

SQL Database

Relational



Fixed data storage in tables using rigid formats and pre-defined relationships

- Master data management
- Enterprise/business data e.g. ERP, CRM, finance, accounting
- Online transactions
- Business intelligence
- Analytics

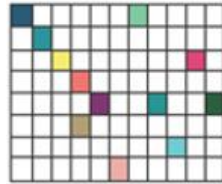
Data Storage

Use Cases

Not-only SQL (or NoSQL) Databases



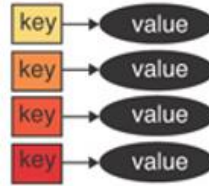
Wide Column



Flexible data storage/ grouping in columns instead of rows

- Financial services
- Retail
- Social analytics
- Messaging
- Real-time analytics
- IoT data management
- Time-series data

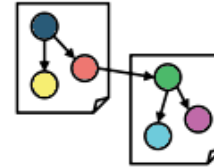
Key-Value



Flexible data storage as objects with unique keys, using a dictionary data structure

- Caching
- Queuing
- Filtering
- Statistics

Document



Flexible data storage as JSON documents which can be interlinked

- Customer service
- Inventory management
- IoT sensors
- Real-time analytics
- Apps development
- Personalisation
- Gaming
- Streaming media
- Advertising

Graph

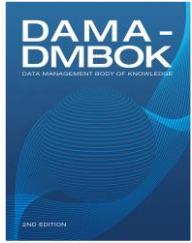
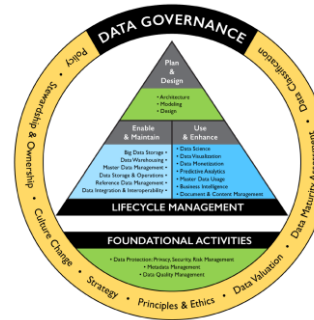


Flexible data storage as linked objects in complex graphs

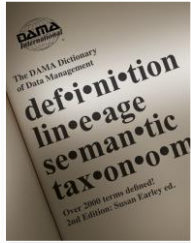
- AI
- Social media
- Recommendation engines
- Fraud protection



**The Global
Data Management Community
(since 1980)**



**DAMA
Data Management
Body of Knowledge**
(2nd Edition - 2017)

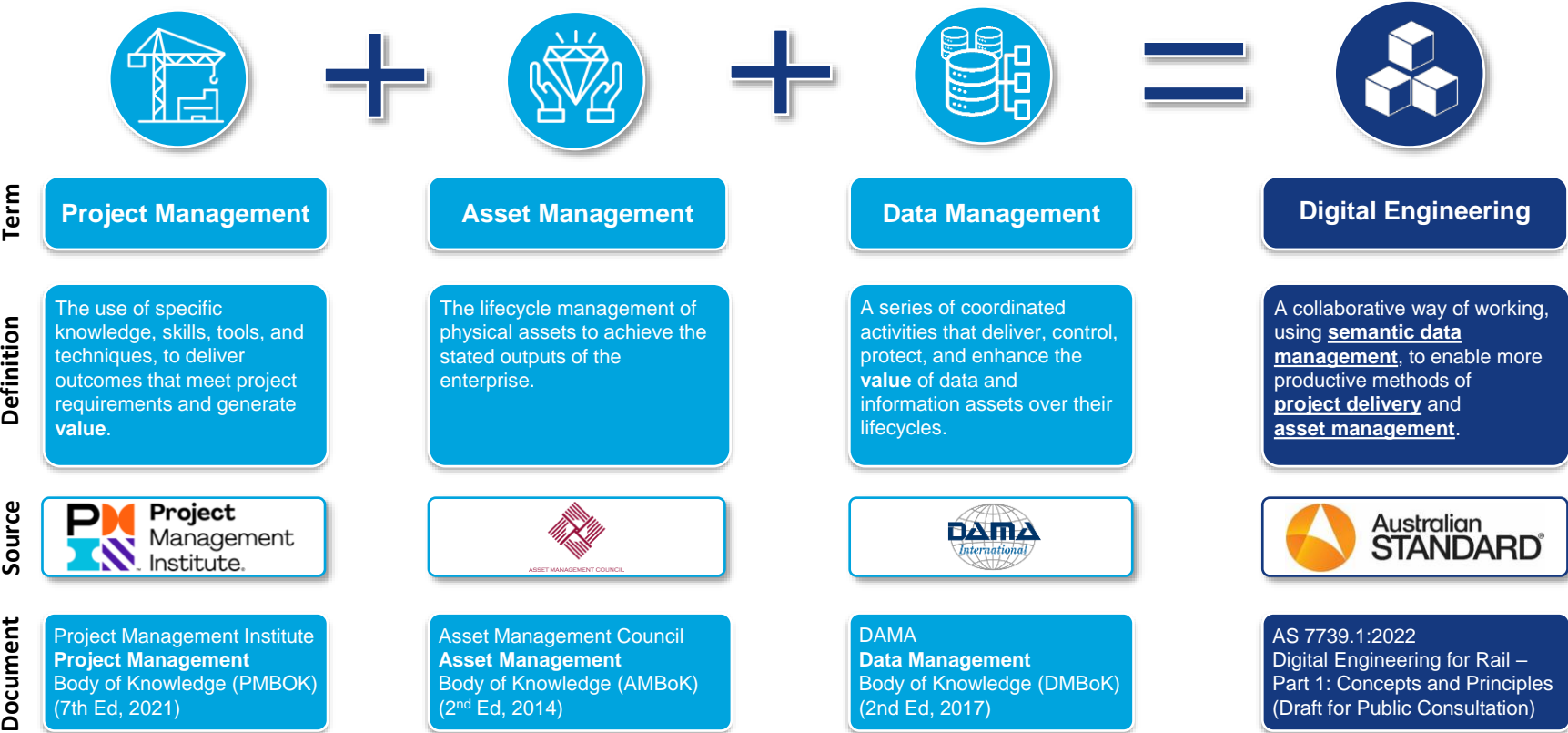


**DAMA
Dictionary of
Data Management**
(2nd Edition - 2011)

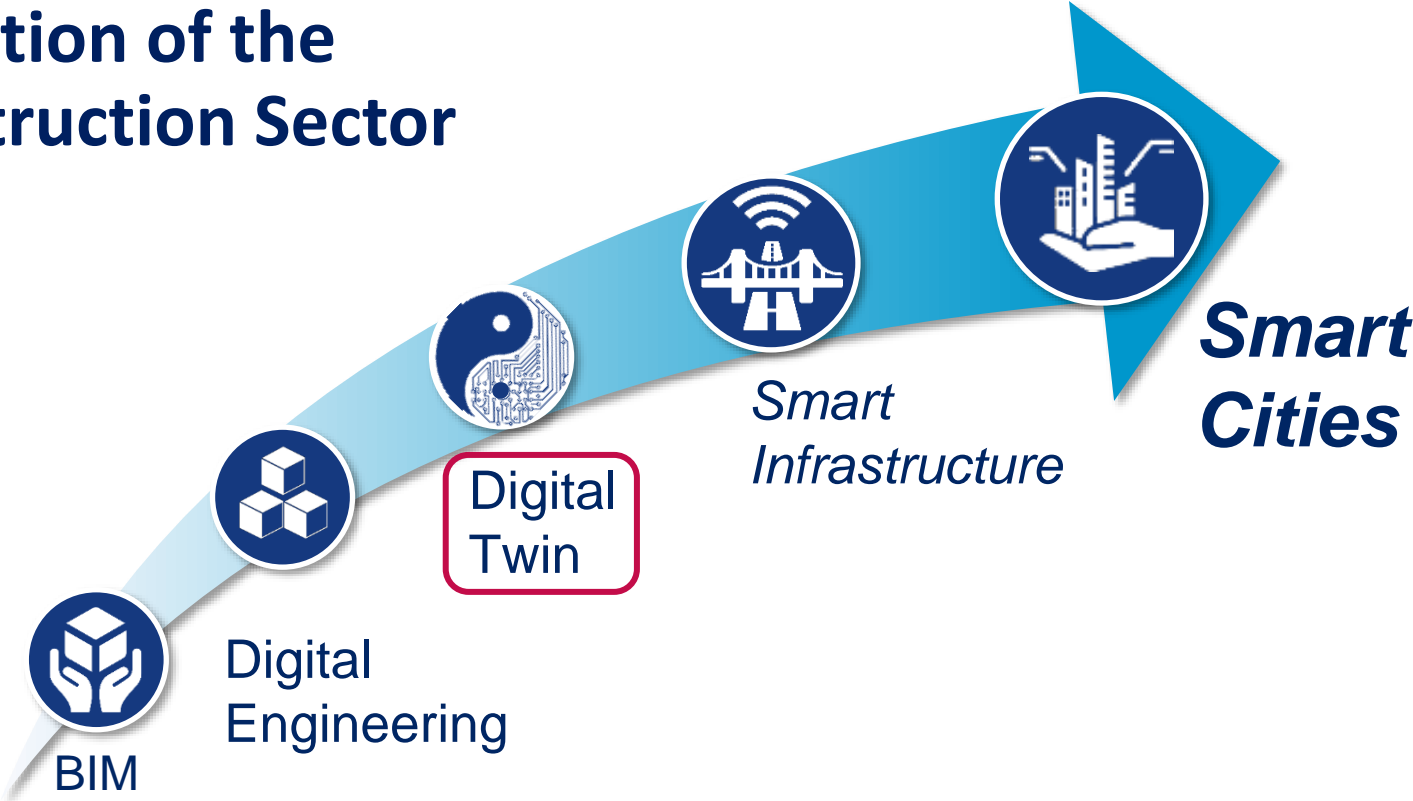
<https://www.dama.org>

DATA GOVERNANCE	FOUNDATIONAL ACTIVITIES	LIFECYCLE MANAGEMENT		
		Plan and Design	Enable and Maintain	Use & Enhance
Policy	Data Protection	Architecture	Big Data Storage	Data Science
Stewardship & Governance	Privacy	Modelling	Data Warehousing	Data Valuation
Culture Change	Security	Design	Master Data Management	Data Monetization
Strategy	Risk Management		Data Storage & Operations	Predictive Analysis
Principles & Ethics	Metadata Management		Reference Data Management	Master Data Usage
Data Valuation	Data Quality Management		Data Integration & Interoperability	Business Intelligence
Data Maturity Assessment				Document & Content Management
Data Classification				

What is Digital Engineering?

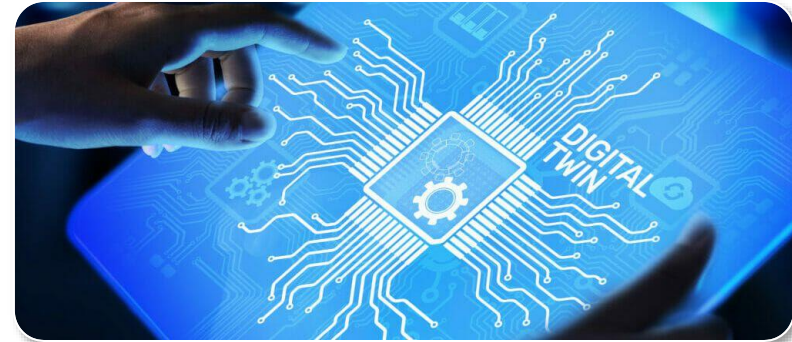


Evolution of the Construction Sector



Thinking beyond the meme..

Digital twin is a complex black box, with unknown components, inputs and outputs



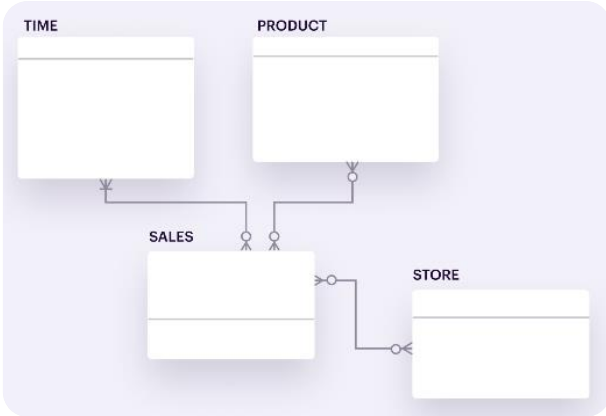
In reality: Data Modelling is the foundation for building Digital Twins

Digital twin is a structured ecosystem of data entities, attributes, relationships and values - designed intentionally to ensure standardised semantic interoperability

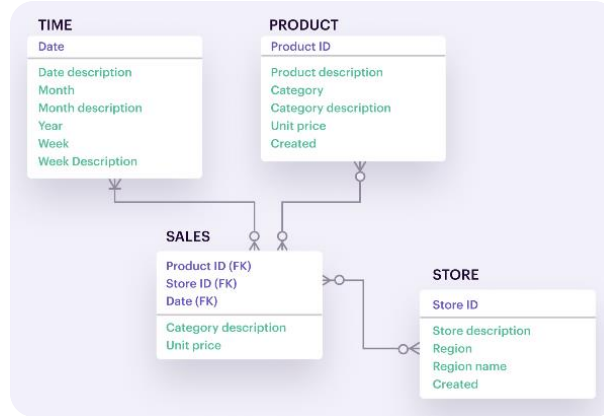


Data modelling process

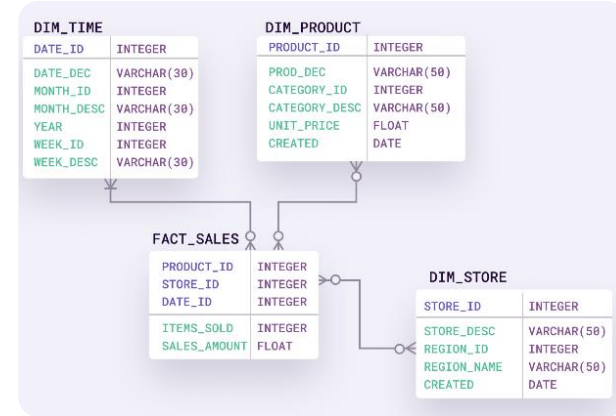
Conceptual Data Model



Logical Data Model



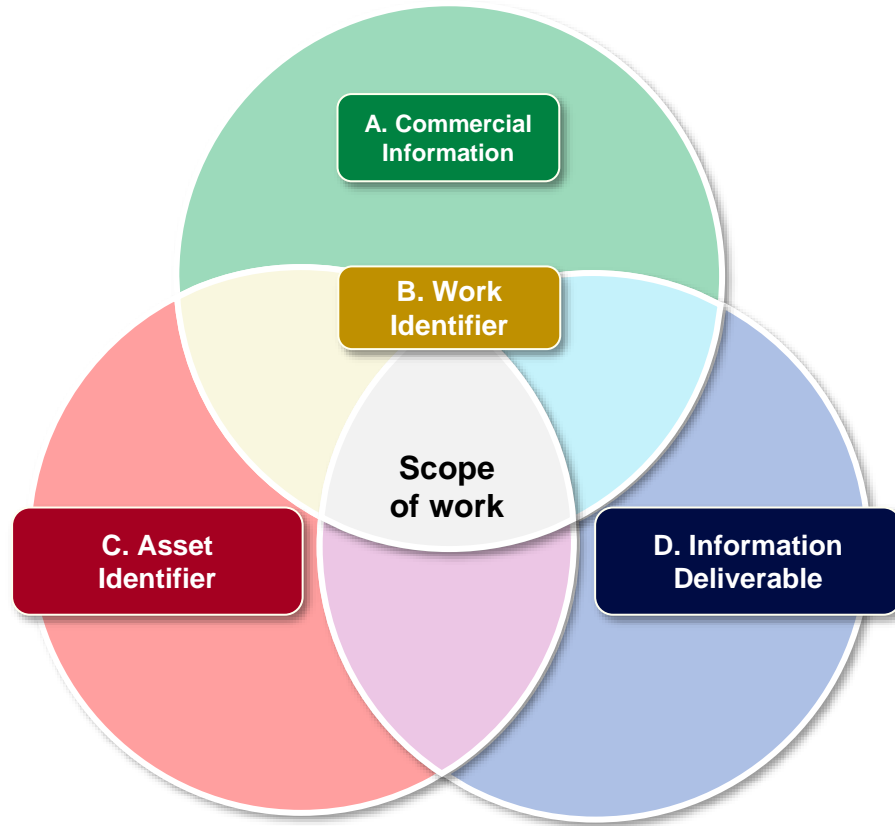
Physical Data Model



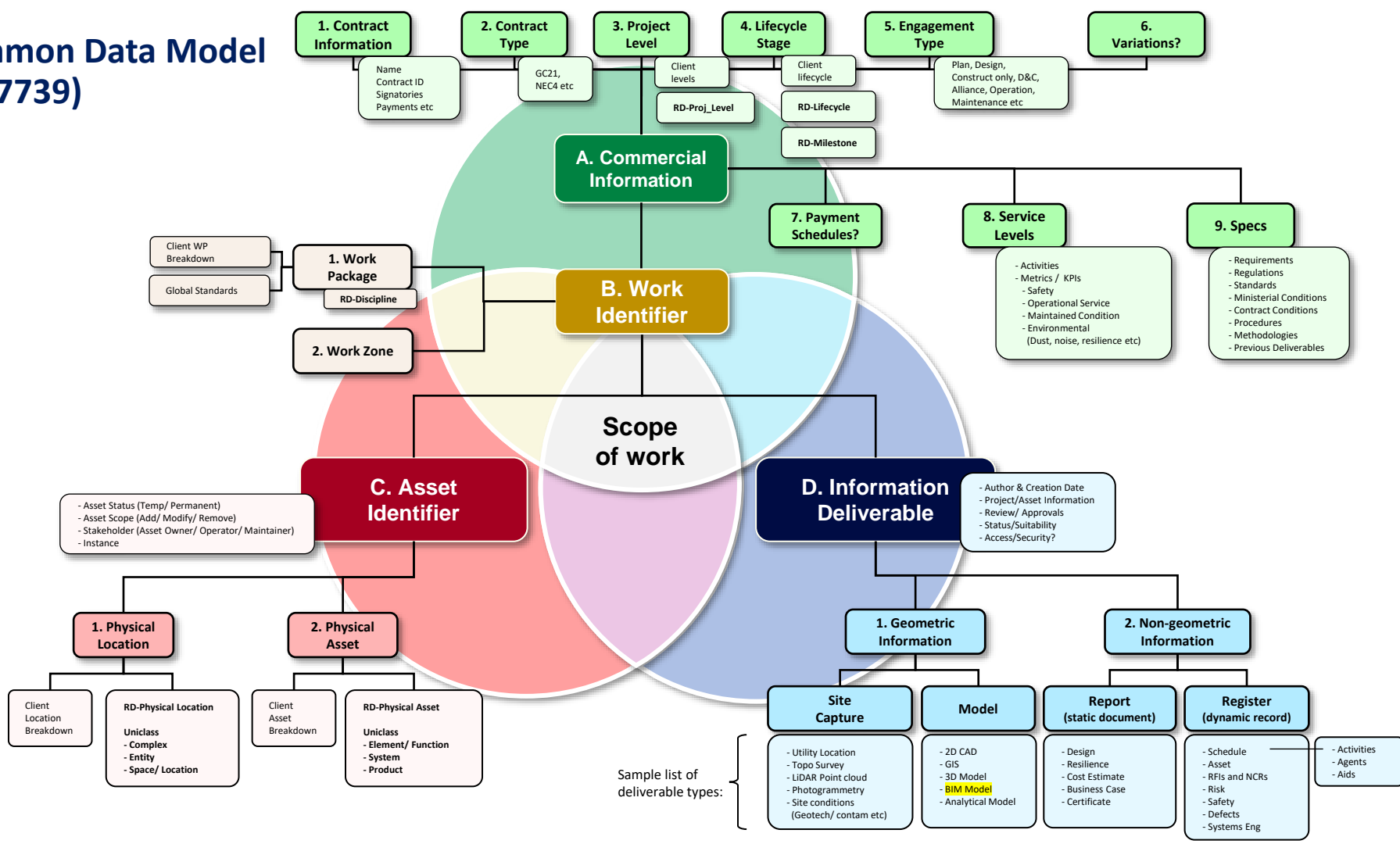
Source: [Data Model Relationships 101: Simplified Guide for Beginners \(HEVO, May 2022\)](#)

Common Data Model (AS 7739)

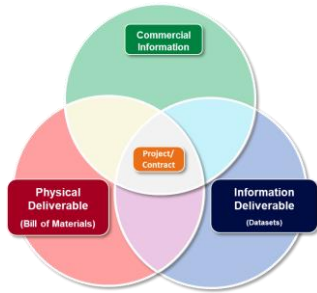
*Represents the contract
and its scope of work
for any lifecycle stage*



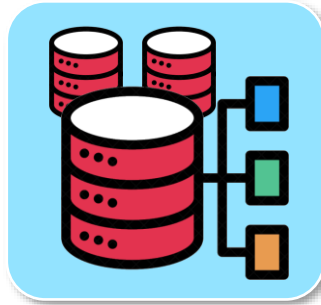
Common Data Model (AS 7739)



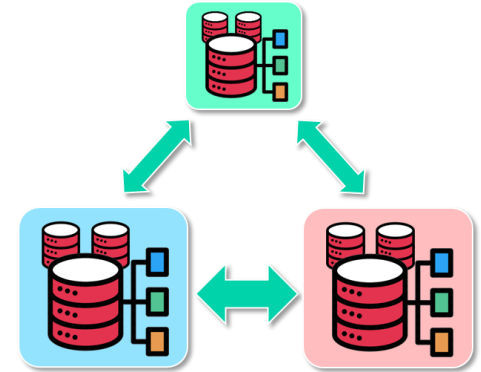
Building the “Connected Digital Ecosystem”



Common Data Model
(CDM)

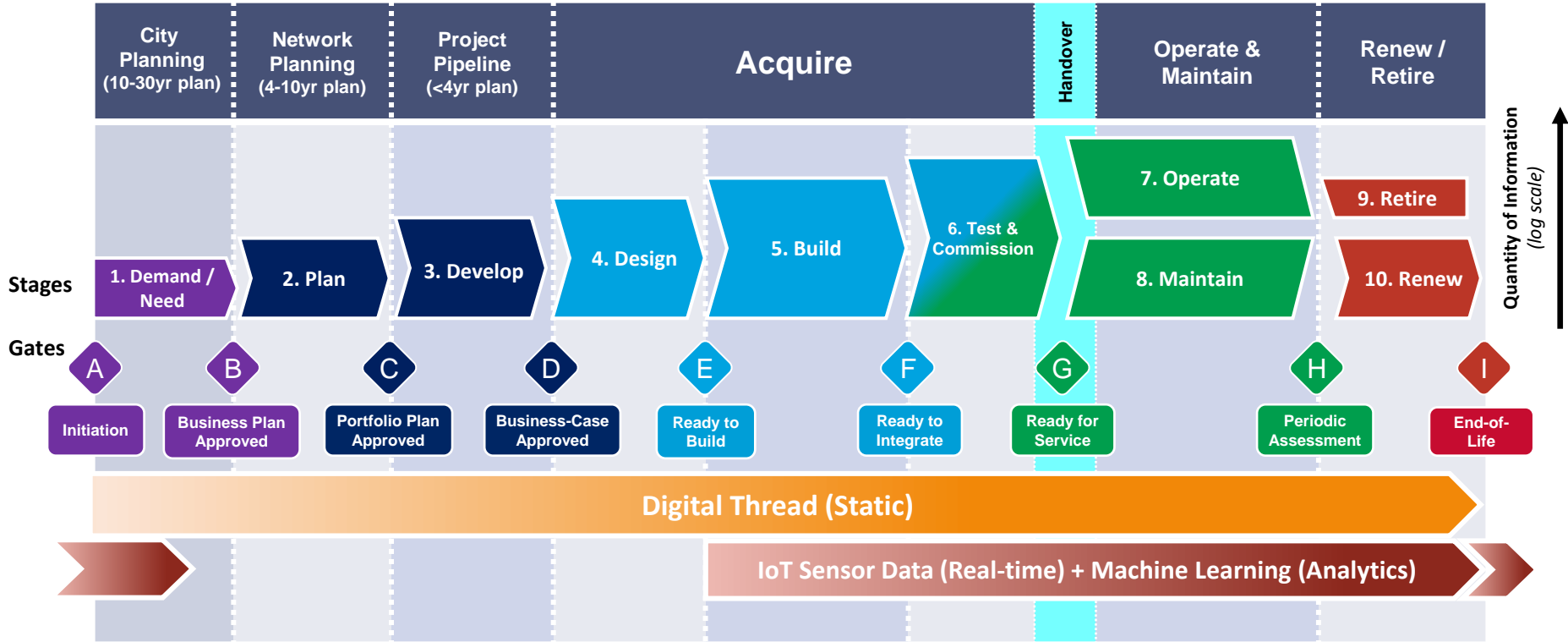


Connected Digital Ecosystem
(CDE 2.0)

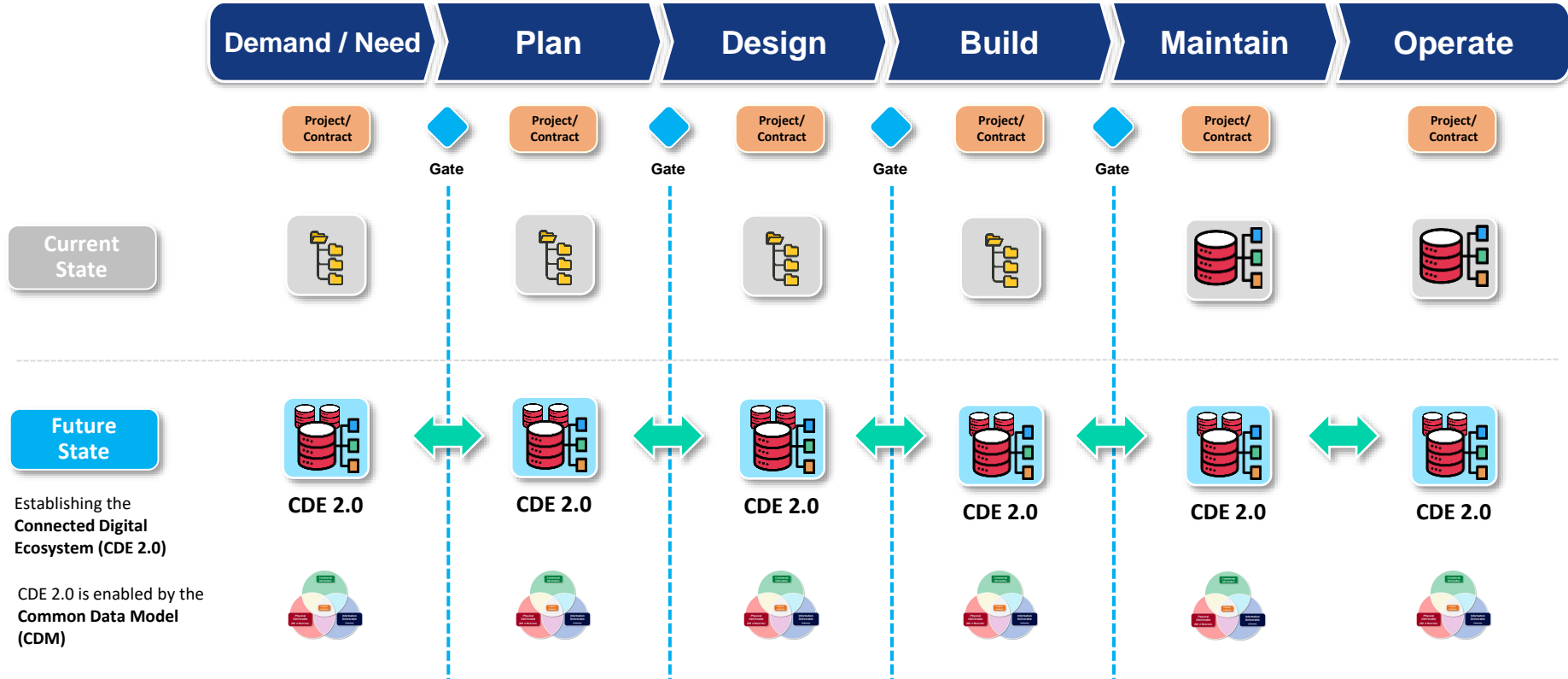


Ecosystem of CDE 2.0

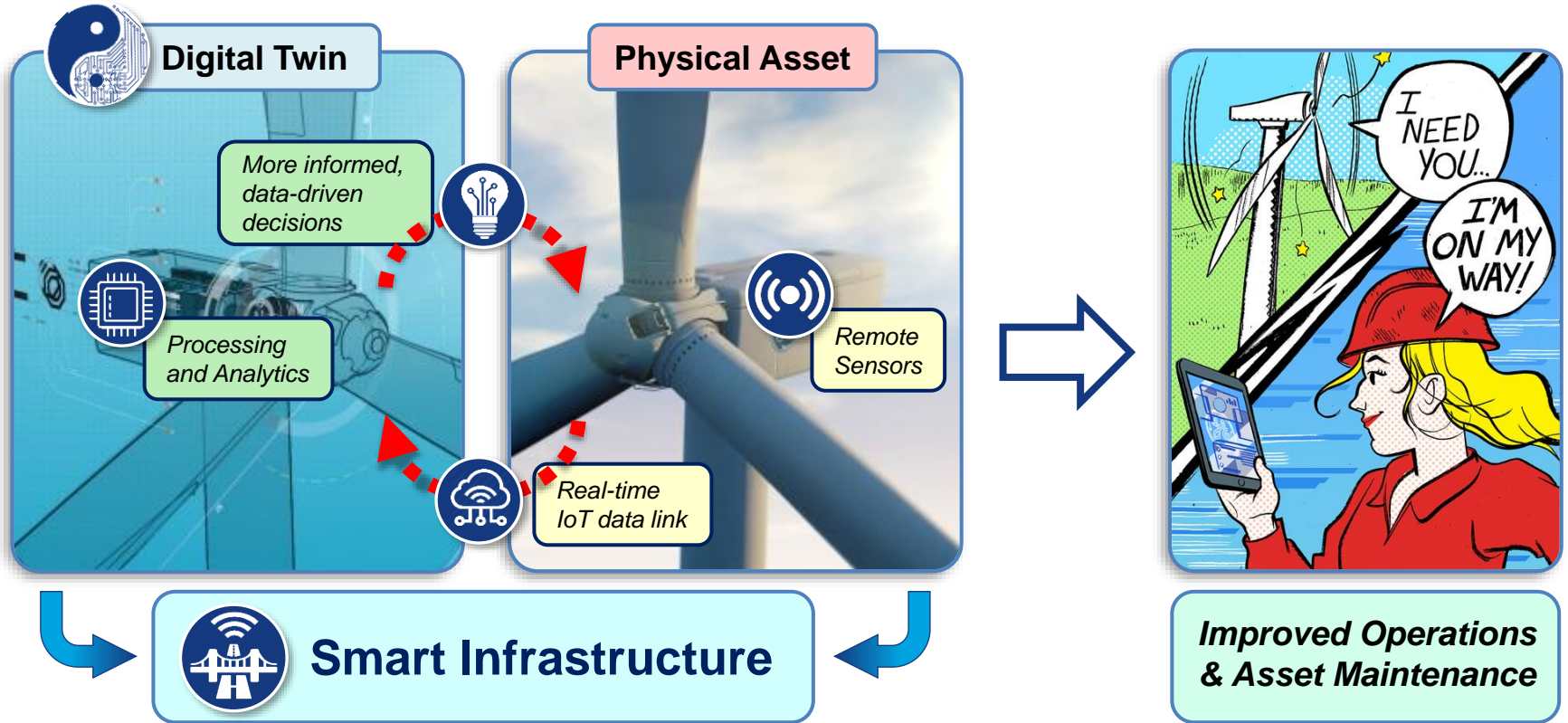
Infrastructure Asset Lifecycle



Building the Digital Asset Lifecycle..



Smart Infrastructure – Key Concepts



Infrastructure projects require highly complex roles & teams



Project Management



Site Capture



Environmental Management



Spatial Management



Planning Approvals



Systems Engineering



Stakeholder Engagement



Property Acquisition



Benefits Modelling



Business Case Management



Contract Management



Procurement Management



Commercial Management



Value Engineering



Design Management



Project Info Management



Schedule Management



Cost Management



Risk Management



Safety Management



Construction Management



Quality Management



Sustainability Management



Variation & Change Management



Transition Readiness



Commissioning Management



Handover Management



Defects Management



Asset Management



Asset Maintenance



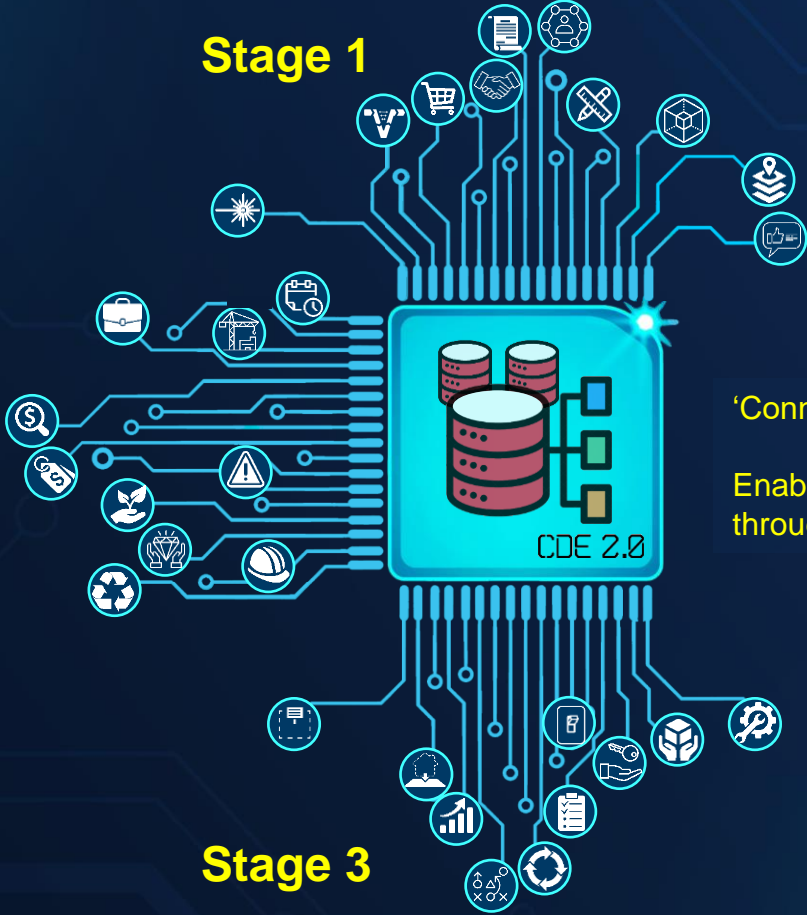
Project roles & teams are typically siloed with:

- low levels of data sharing and re-use
- low maturity digital collaboration

Stage 2

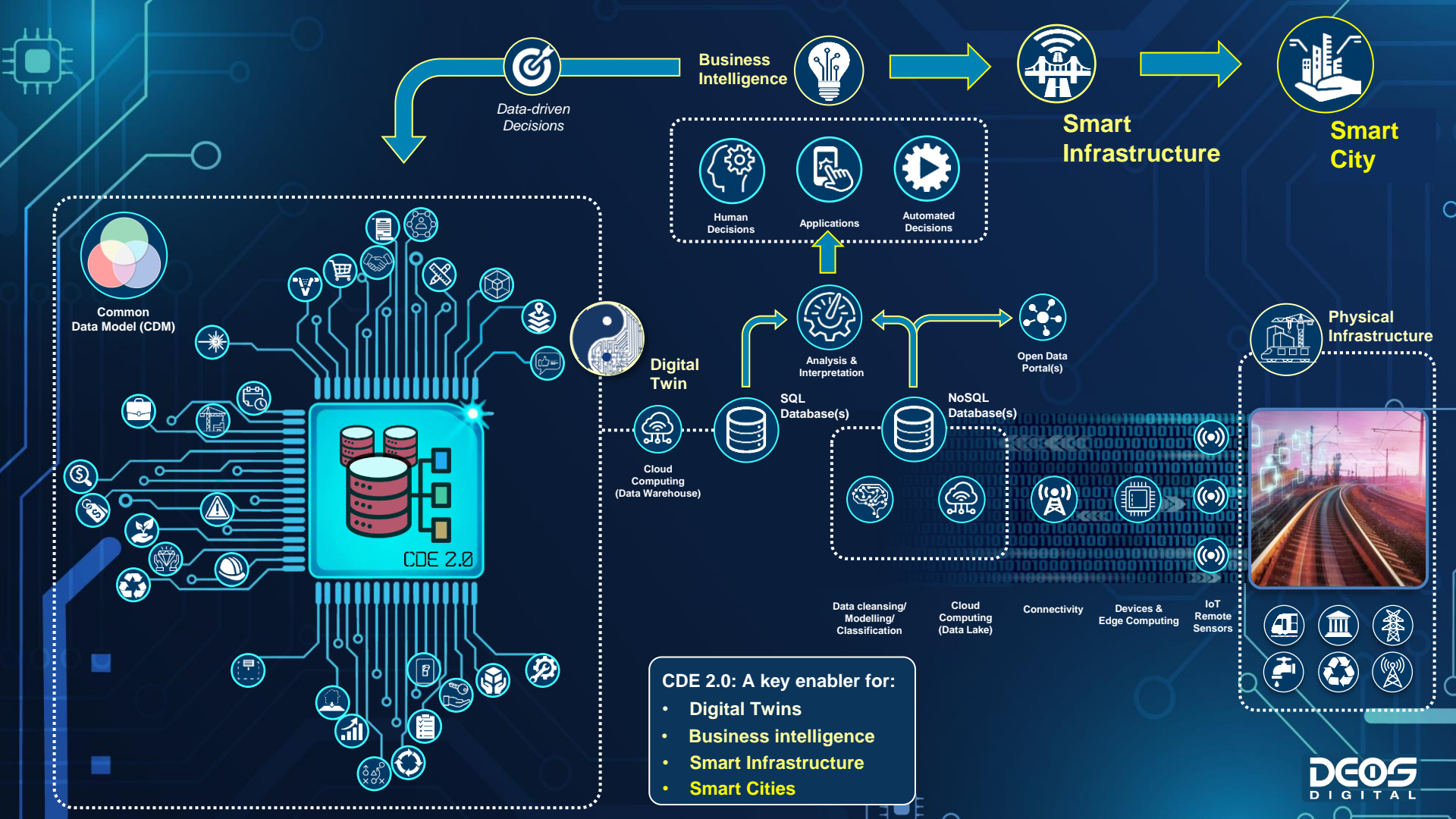
Stage 1

Stage 3



'Connected Digital Ecosystem' (CDE 2.0)

Enables data sharing, exchange and re-use,
through incremental business integration



Data-driven Decisions

Business Intelligence

Smart Infrastructure

Smart City

Common Data Model (CDM)

Digital Twin

Analysis & Interpretation

Physical Infrastructure

CDE 2.0

Cloud Computing (Data Warehouse)

SQL Database(s)

NoSQL Database(s)

Open Data Portal(s)

Data cleansing/Modelling/Classification

Cloud Computing (Data Lake)

Connectivity

Devices & Edge Computing

IoT Remote Sensors

- CDE 2.0: A key enabler for:**
- Digital Twins
 - Business intelligence
 - Smart Infrastructure
 - Smart Cities

Next Steps

- **AS 7739:2022 Digital Engineering for Fixed Rail Infrastructure**
(to be published by RISSB Australia)
 - Part 1: Concepts and Principles (release imminent)
 - Part 2: Technical Requirements (inc. CDM and Data Dictionary) (to be released in 2023)
- **Digital Engineering – Shifting the Paradigm of the Construction Sector**
(to be led by Standards Australia)
 - Launch event held Mon 7th Nov.
 - Thought leadership papers and **new standard** to be published in 2023
- **Promote uptake with infrastructure agencies throughout ANZ**
- **Build data management capability (*and attract data architects*) across the infrastructure sector**

« Thank you »



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