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Holistic approach to project lifecycles

A software perspective

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It’s a world of software

- **Initial and Conceptual Design & Functional Simulation**
  - Process Simulation Software
  - Computational Fluid Dynamics (CFD) Software
  - Heat and Material Balance Tools
  - Process Flow Diagram (PFD) and Conceptual Design Tools
  - Cost Estimation Software
  - Feasibility Analysis and Optimization Tools
  - Geographic Information Systems (GIS)
  - Site Selection and Analysis Tools
- **FEED**
  - Piping and Instrumentation Diagram (P&ID) Tools
  - 3D Modeling and Plant Design Software
  - Structural Analysis and Design Software
  - Electrical Design Software
  - Instrumentation and Control Systems Design Tools
  - Process Safety Analysis Tools
  - Project Planning and Scheduling Software
  - Document Management Systems (DMS)
- **Detailed Engineering**
  - Computer-Aided Design (CAD) Software
  - Computer-Aided Engineering (CAE) Software
  - Piping Design and Stress Analysis Software
  - Electrical and Instrumentation Design Tools
  - Mechanical Design Software
  - Engineering Data Management Systems
  - Control Systems Configuration and Programming Tools
- **Procurement & Construction**
  - Material Requirements Planning (MRP) Software
  - Supply Chain Management Software
  - Procurement and Vendor Management Systems
  - Construction Management Software
  - 4D/5D Building Information Modeling (BIM) Software
  - Field Data Collection and Management Tools
  - Quality and Safety Management Systems
  - Construction Document Control Systems
- **Commissioning**
  - Commissioning Management Software
  - Pre-Startup Safety Review (PSSR) Tools
  - Checklist and Punch List Management Systems
  - Functional Acceptance Testing Tools
- **Operations and Maintenance**
  - Computerized Maintenance Management Systems (CMMS)
  - Enterprise Asset Management (EAM) Systems
  - Asset Performance Management (APM) Software
  - Supervisory Control and Data Acquisition (SCADA) Systems
  - Distributed Control Systems (DCS)
  - Data Historians
  - Process Data Analytics and Visualization Tools
  - Industrial Internet of Things (IIoT) Platforms
  - Condition Monitoring and Predictive Maintenance Tools
  - Alarm Management Software
  - Operator Training Simulators (OTS)
- **Brownfield Projects and Asset Modifications**
  - Laser Scanning and Point Cloud Processing Software
  - 3D Modeling from Point Clouds
  - Revamp and Retrofit Design Tools
  - Engineering Change Management Systems
  - Asset Integrity Management Software
  - Compliance and Regulatory Reporting Tools
- **Cross-Functional and Supporting Systems**
  - Project Collaboration Platforms
  - Risk Management Software
  - Health, Safety, Environment (HSE) Management Systems
  - Workflow and Business Process Automation Tools
  - Data Analytics and Business Intelligence Tools
  - Cybersecurity Solutions for Industrial Systems
  - Enterprise Resource Planning (ERP) Systems
  - Training and eLearning Platforms
  - Reporting and Documentation Tools

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Best of breed vs. best of suite

Best of breed

+ Specialized functionality
+ Flexibility
+ Adoption of technology

- Integration (data silos)
- User experience
- Total cost of ownership?

Best of suite

+ Integration (unified data platform)
+ User experience
+ Scalability

- Flexibility (function gaps)
- Vendor lock
- Upfront costs?

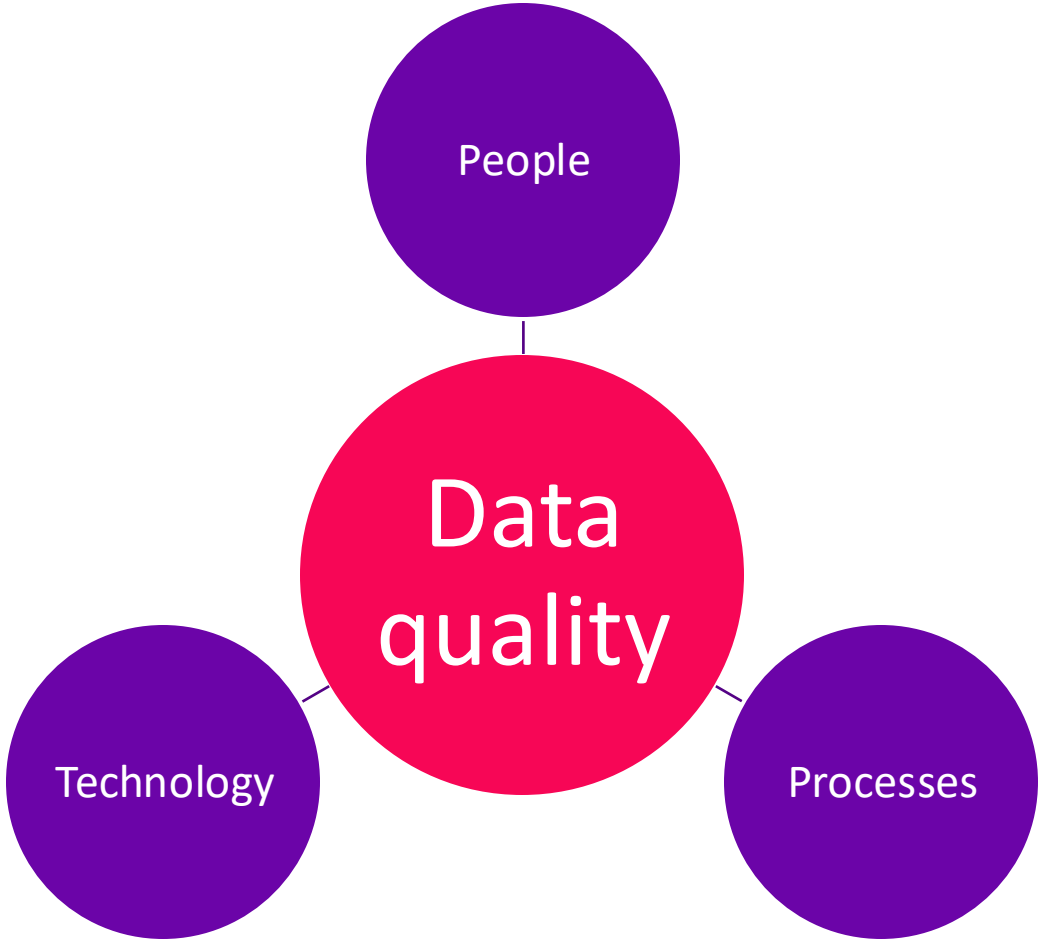
The importance of non-quality

"Cost of poor quality were as high as 15% of total install cost of a project. 20% were related to quality and accessibility of information."

(*) Alstom – SAIC

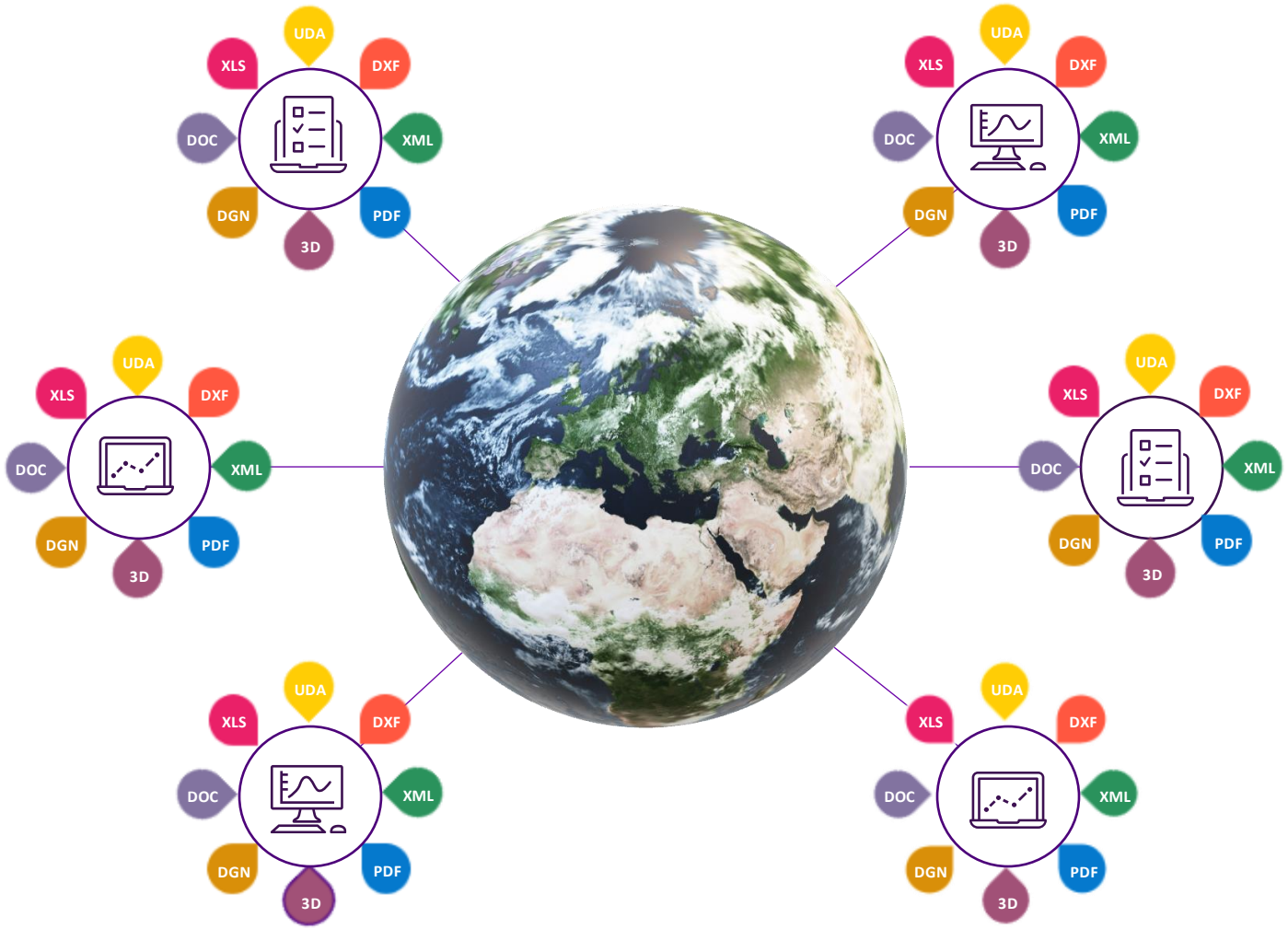
"Only 1% lower data accuracy vs. plan will require 10% more resources to complete a project"

(*) CMII Research Institute – White Paper CMII-810C

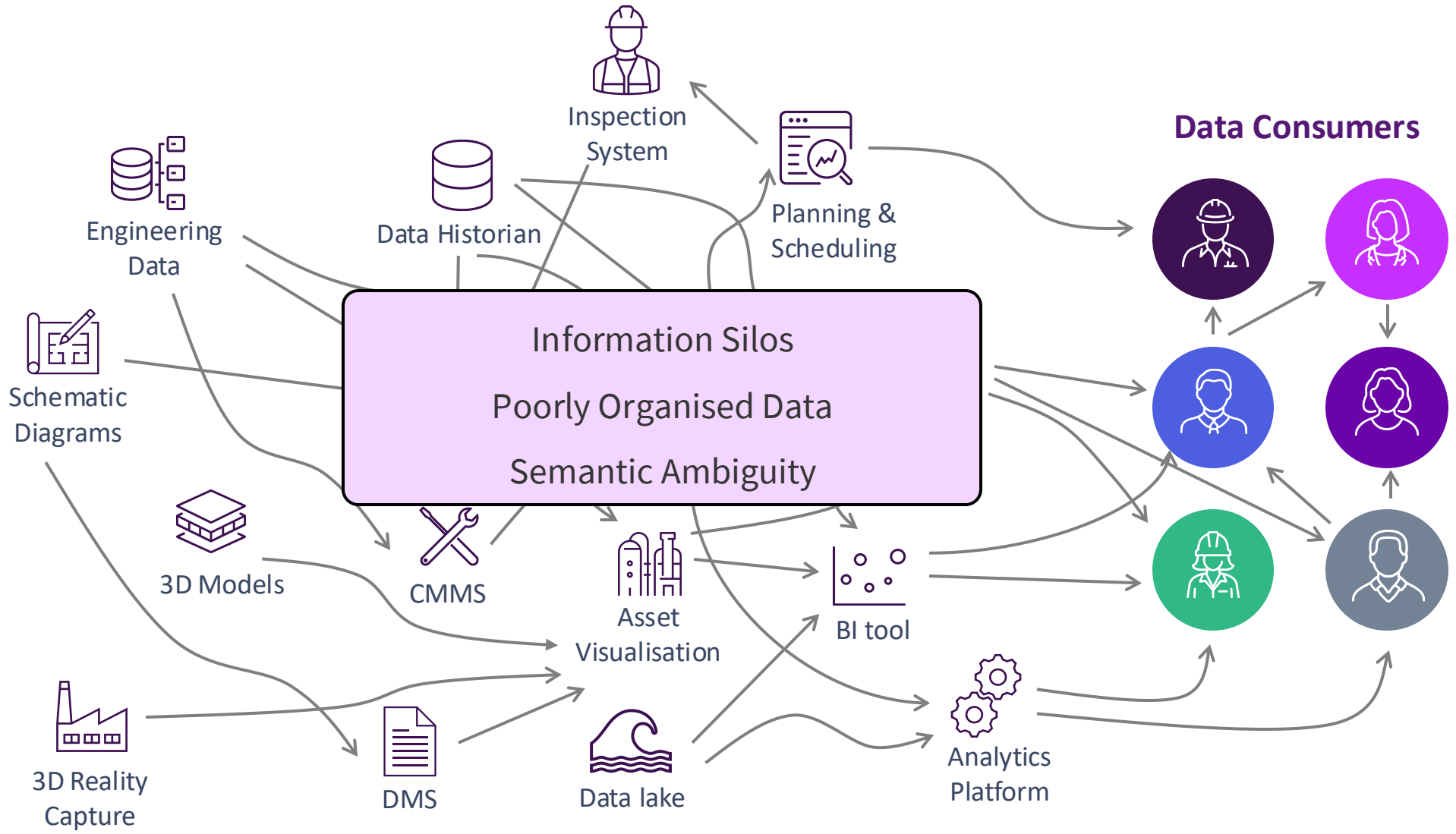


Data distribution challenge

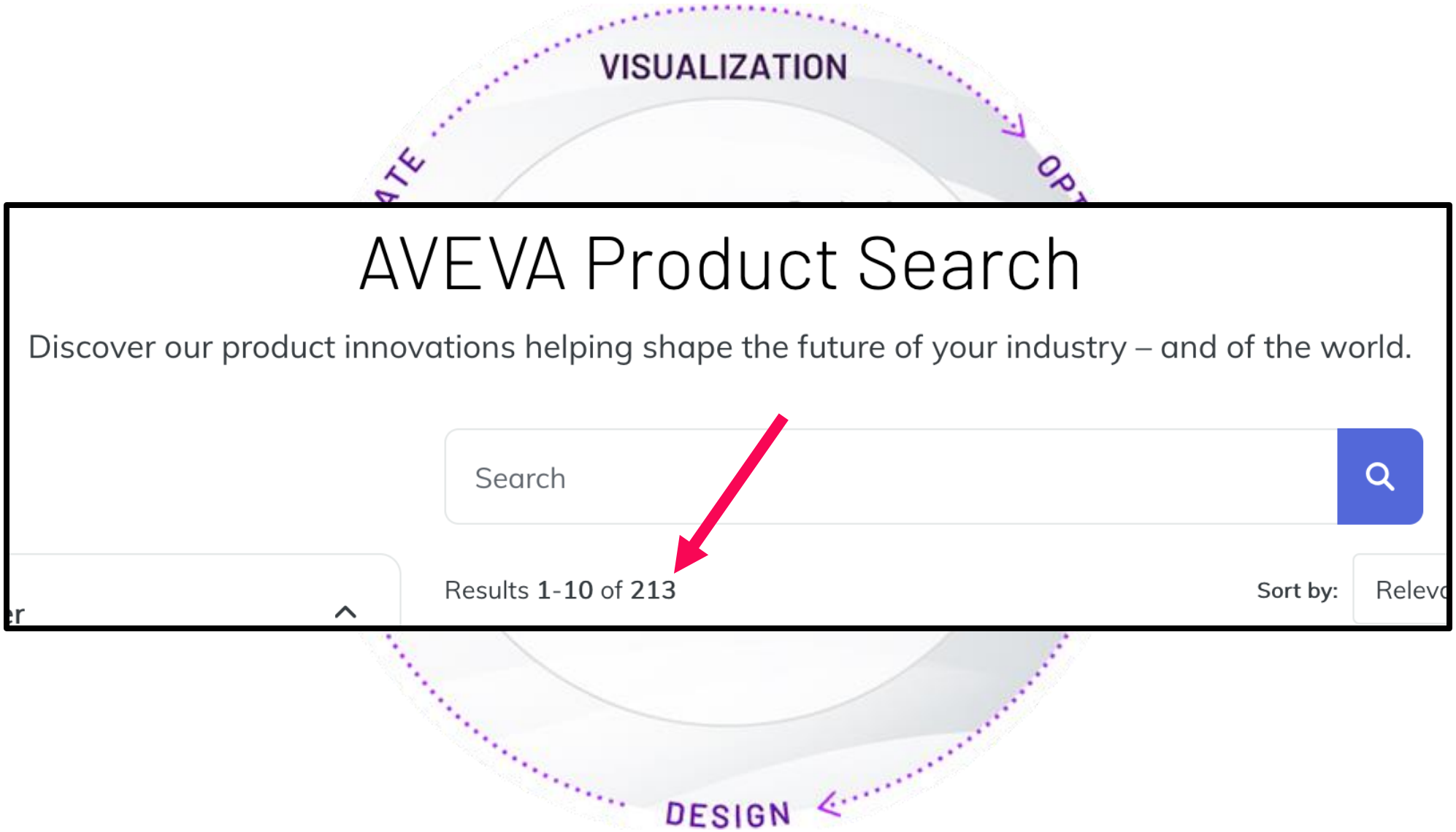
- Inaccurate information has a major impact on business processes.
- Data is distributed across multiple systems…
- …in multiple formats
- …across multiple teams and locations
- …dependent on availability.



Data quality challenge



One digital twin with a side of fries, please!



The Digital Twin

The Digital Twin is a digital representation, which brings together data from a variety of systems/sources, in context to form a digital representation of a system, plant or piece of equipment.

AVEVA Digital Twin =

Data + Models + Visualization

Physical Asset

Digital Twin

Native Formats
Spreadsheet
3D Model
Laser Scan
Documents
Drawings
Images
Realtime Process Data
MES, BES
Maintenance Data
Inspections Data
Simulation Data
Other Data

Plant Structured and Unstructured Data

Realtime data

Transactional data

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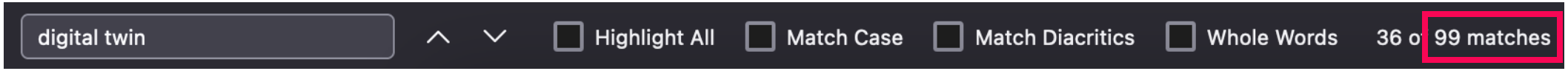
Digital Twin for X

Case: COMPIT 2023 (22nd Conference on Computer and IT Applications in the Maritime Industries)

- Improving Vessel Safety with a Digital Twin for Ice Accretion
- Digital Twin for Evaluation of Emission Reduction by Novel Technologies
- Designing Engineering Services Based on Digital Twins – An Arctic Navigation Case
- Towards a Digital Twin to Inform Propulsion Safety Margins in Ice



“In simple terms, the vision was some IT model with the look and feel of the real deal. Not only would it look like its physical twin (this would be mere Computer-Generated Imagery or Virtual Reality), but it would behave like its physical twin, and evolve in time like it. The Digital Twin of a ship would lose strength in time as it rusts, slow down as the hull gets fouled, etc.”

V. Bertram, "CAVE Matrix Reloaded," DNV Germany, 2023. [Online].
Available: http://data.hiper-conf.info/compit2023_drubeck.pdf. [Accessed: May 9, 2024].

Digital Twin Journey

System of Engagement


Touch Devices


Portal


Mobile Devices


Human Machine Devices

Use the Digital Twin

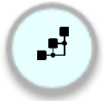
System of Reference


Report


Classify


Object Centric


Associate


Map

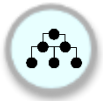

Translate

Collect, Interpret

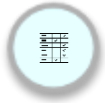
System of Record

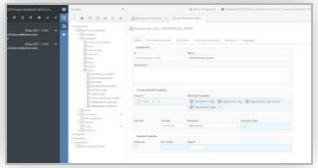
Create, Modify

System of Standards


Asset Hierarchies

Class Library


Data Requirements




Numbering Systems


Business Validation Rules


Data Governance Modal

Define the Digital Twin

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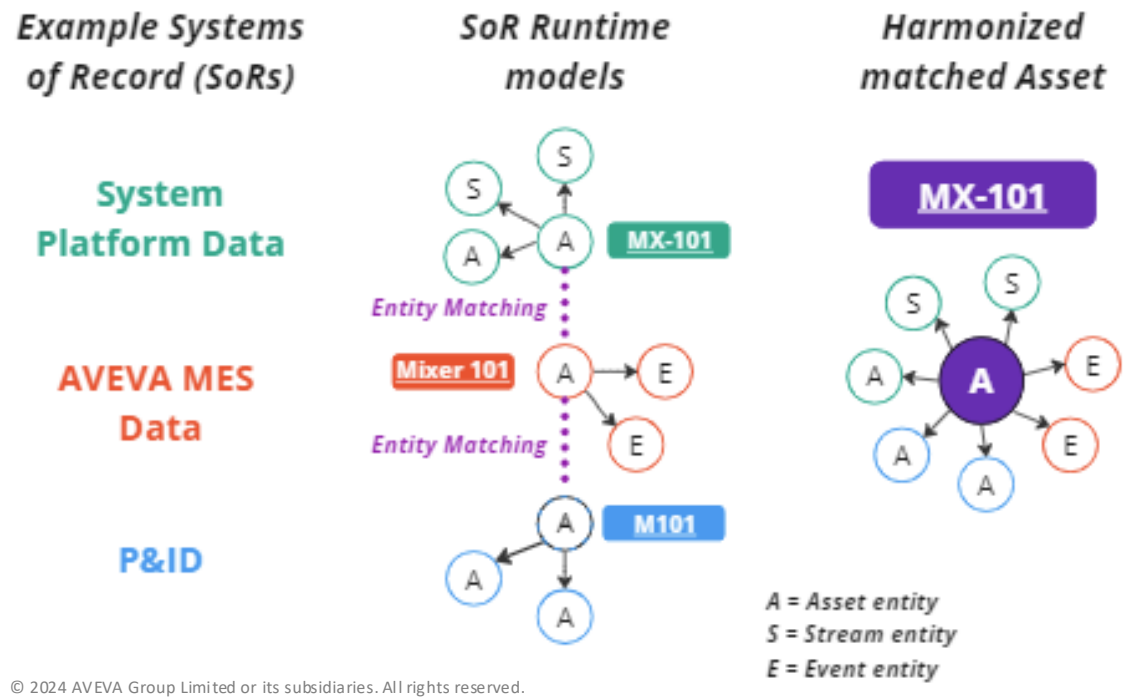
AI-assisted data harmonization and normalization

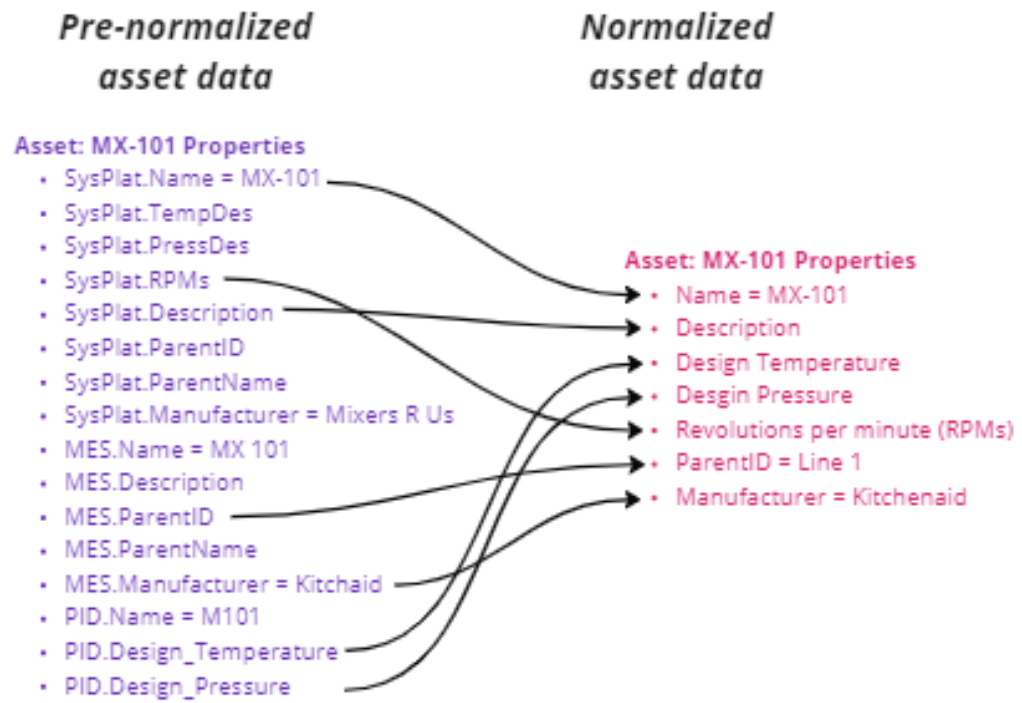
1. Data Harmonization

Match entity IDs and provide a view of all entity properties and relationships from all Systems of Record (SoRs), with minimum manual effort.



2. Data Normalization

Provide a standardized view of data from all SoRs consistent with the digital twin information model, with minimum manual effort.



Moral of the story

Please understand your…

1. Processes — Know your use cases.
2. People — Involve, organize, commit.
3. Technology — Understand limitations & possibilities.

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