Accelerating Digital Enterprise Collaboration with an Integrated Digital Environment

Karen Kontos, Director
Digital Manufacturing
Capgemini

September 25, 2024

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2024

Presenter's Bio

Karen Kontos

Director – Digital Manufacturing

Capgemini Engineering

US based – Phoenix, AZ

Qualifications

M.S. Engineering,
University of Cincinnati
B.S. Engineering,
University of Hartford
Six Sigma Black Belt
L1 Certified Architect

Specialist Skills

New Product Introduction
Program Management
Engineering/Mfg Leadership
Model Based Enterprise (MBE)
Product Lifecycle Management
APQP/DFMEA, PFMEA, SPC

DIGITAL CONTINUITY & MANUFACTURING TRANSFORMATION EXPERT

Biography

Karen Kontos is a Director with Capgemini, with over 30 years of experience in the Aerospace and Automotive industries. She has held a variety of leadership roles in Engineering, Manufacturing, Product Life Cycle Management, APQP, and Business Management. She is a Certified Six Sigma Black Belt and has driven large business transformations. Karen previously served as Vice-Chair of PDES Inc, leading industry efforts supporting model-based enterprise and standards-based data exchange. She is currently working as the Director of Digital Manufacturing for North America.

Experience (extract)

- **Director –Digital Continuity & Manufacturing:** Manage large global team of digital manufacturing engineers. Delivered model-based strategies and solutions for improved speed and quality for mechanical & electrical products, to a major Aerospace customer. Supporting delivery of MBE/digital thread solutions for client manufacturing and inspection processes. Delivered strategic long-range plan for Model-Based Digital Transformation clients. Driving application of Six Sigma and APQP tools to transform processes for major Automotive client.
- **Senior Product Manufacturing Engineering Manager:** Led manufacturing engineering team in factory support as well as strategic initiatives for increased efficiency and factory of the future. Led large team (up to 30 direct reports) of Manufacturing Engineers. Deployed APQP & SPC and analytics for proactive control of quality/zero escapes. Executed process transformations to improve producibility and reduce cycle time by 50%.
- **Senior Manager – Production Support Engineering Strategic Programs:** Led engineering and supply chain strategic initiatives that innovated engineering processes for producibility and highly successful new product launches. Led Advanced Quality Product Planning (APQP) global teams to innovate solutions to improve producibility across 19 manufacturing sites. 100% of programs launched on time in 2018 (over 80 programs) with over 96% Rolled Throughput Yield, on target unit part cost, and achieving "zero escapes". Innovated early supplier engagement process to ensure robust supplier feedback and design incorporation on all new product introductions.
- **Technical Manager – Product Lifecycle Management:** Managed a global team for engineering tools and process development. Led model-based enterprise strategies into deployment. Implemented technologies for improved data quality and bi-directional data exchange with external suppliers and partners. Deployed Model Based Enterprise (MBE) for Electrical Hardware, streamlined digital thread for suppliers. Developed and deployed automation of standards-based, closed-loop Technical Data Package for supplier feedback supporting Design for Manufacturing.

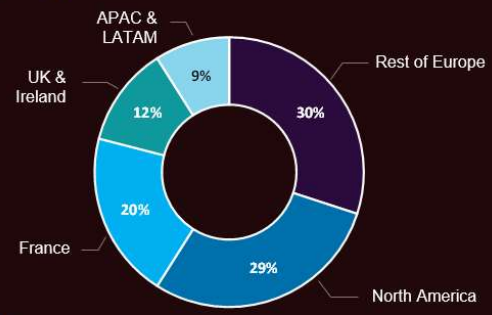
Capgemini at-a-glance

€22.5 BN
in revenues with an operating margin of +4%

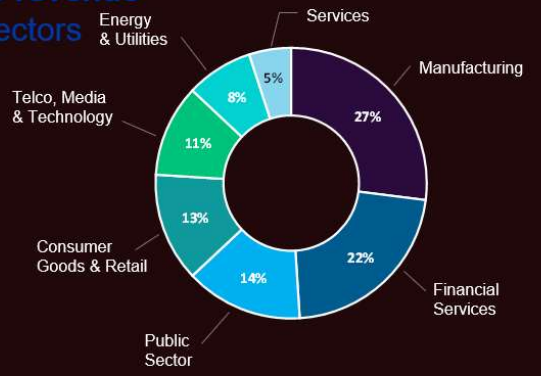
Nearly
340,000
people

More than
50
countries
with more than
160 nationalities

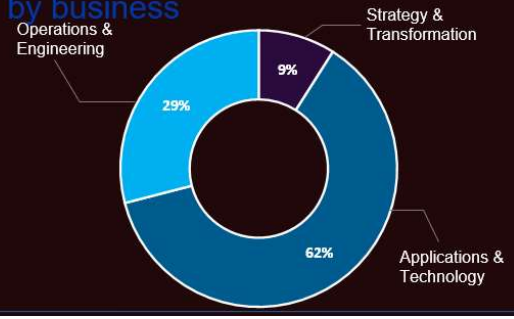
2023 revenue by region



2023 revenue by sectors



2023 revenue by business



Strong global footprint

North America **20,891**	Europe **123,611**
Latin America **11,577**	Asia-Pacific **197,205**
Middle East & Africa **6,283**	

Aerospace & Defense …Partnering with clients across the globe

Capgemini engineering

#1

IN ER&D MARKET +30 YEARS

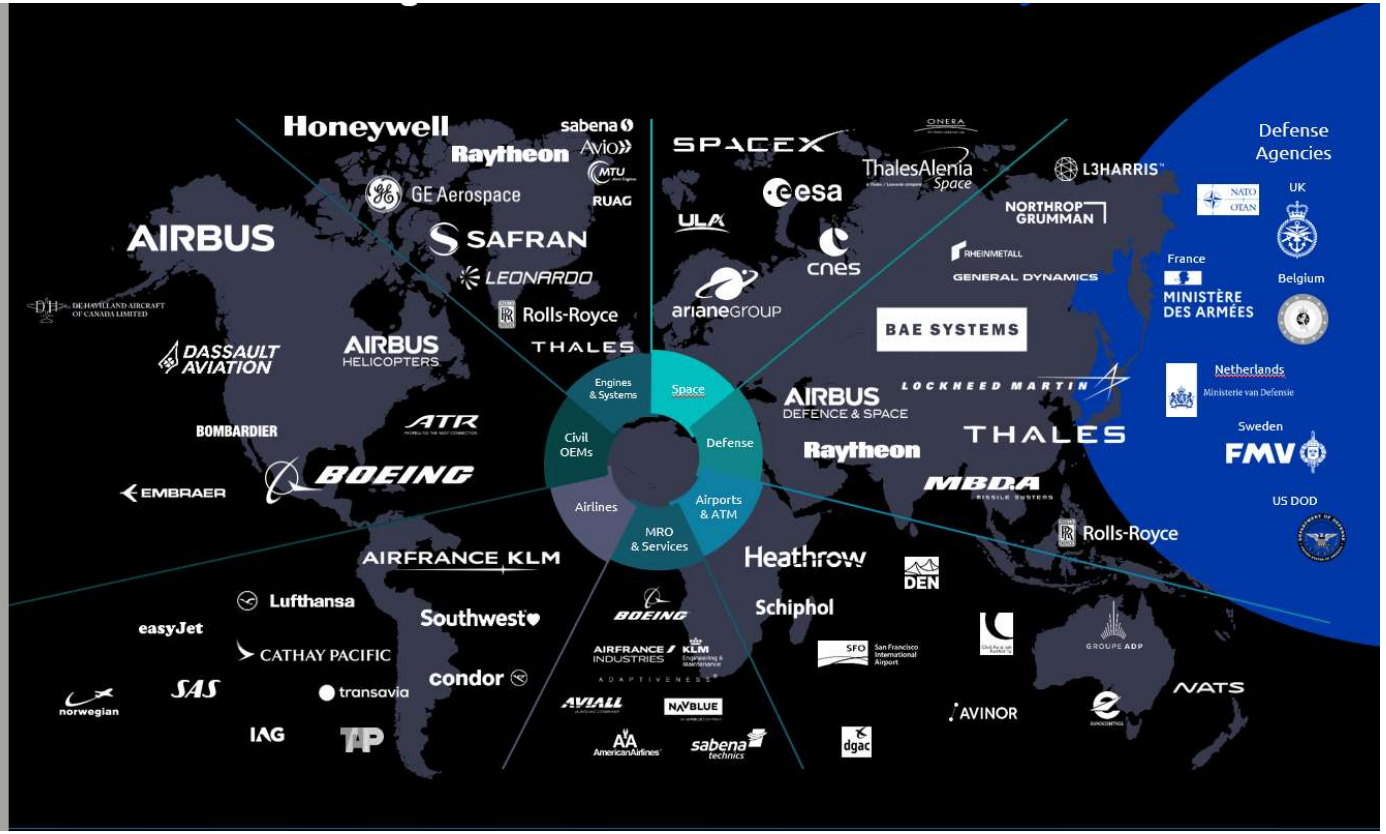
52,000

ENGINEERS & SCIENTISTS

30+

COUNTRIES

We are the **Global Digital Transformation Leader** for Industrial and Technology companies



Capgemini Vision for Digital Continuity

Vision

Digital mindset
Establish a common digital mindset to drive innovation

Lean & Agile culture
Realize a Digital-first culture

Easy integration
Integrate data to drive efficiencies and business decisions

Value creation
Create value and increase competitiveness from integration

Digital Continuity - requires solving a convoluted web of complexities

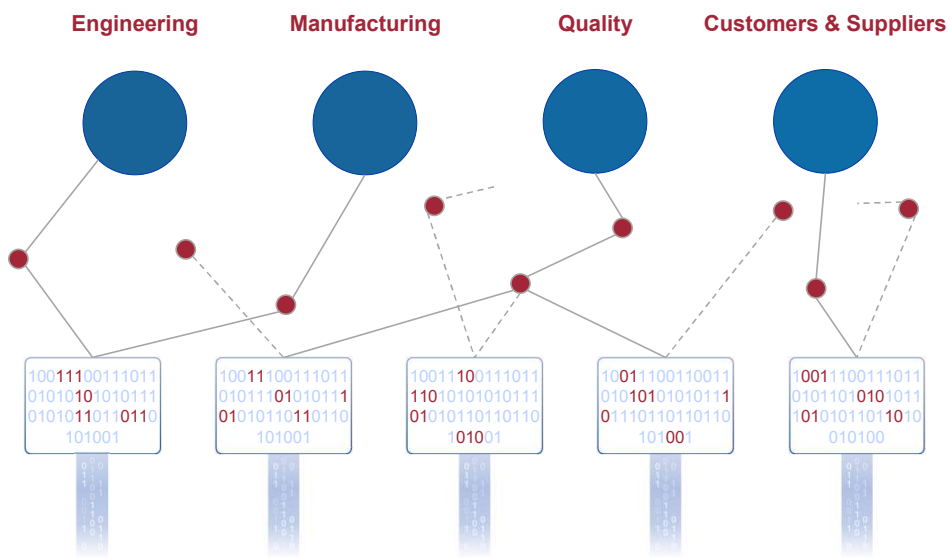
Increasing Product and Supply Chain Complexity
Collaboration is a significant challenge

Speed-to-Market
Risk of losing market share

Complex & heterogenic IT
Costly and time-consuming IT integration

Fragmented Data
Product information that is not easy to find, wastes time and money

Reduced flexibility
Challenges in moving to data-driven products and becoming a data-driven organization



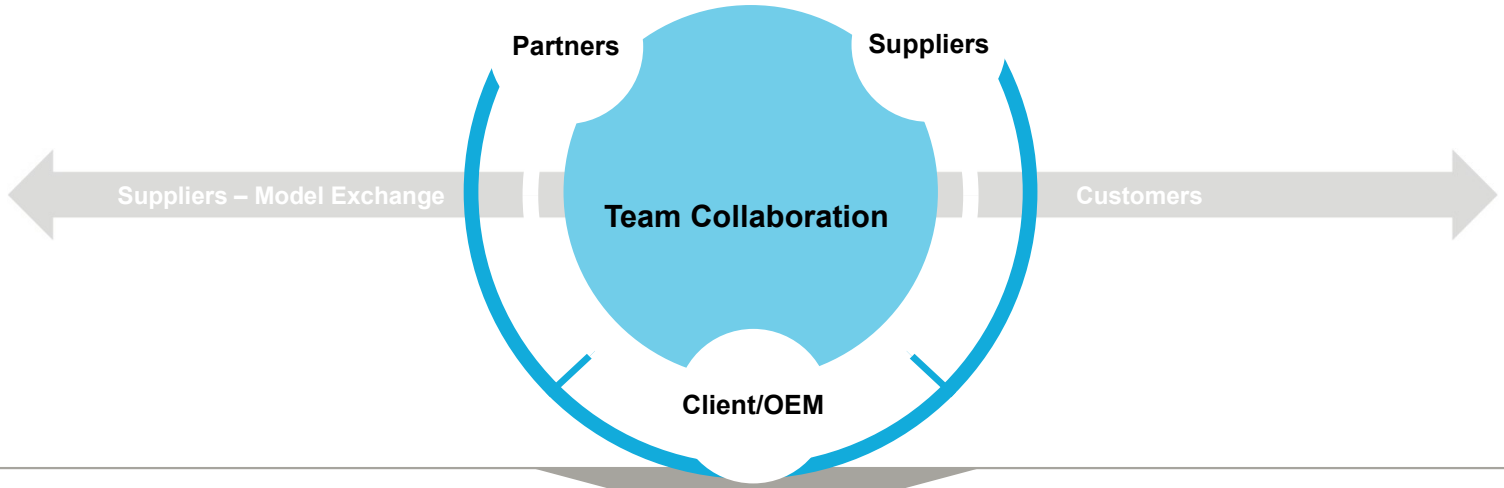
Intoducing the Integrated Digital Environment - a collaboration engine

MBx Capabilities Framework | Security Data Classification | Client Ontology | Industry Ontology | Vendor Solutions | DoD Requirements | Other Requirements | Model-Based Enterprise Architecture

Client Integrated Digital Environment

Define

Suppliers – External Collaboration



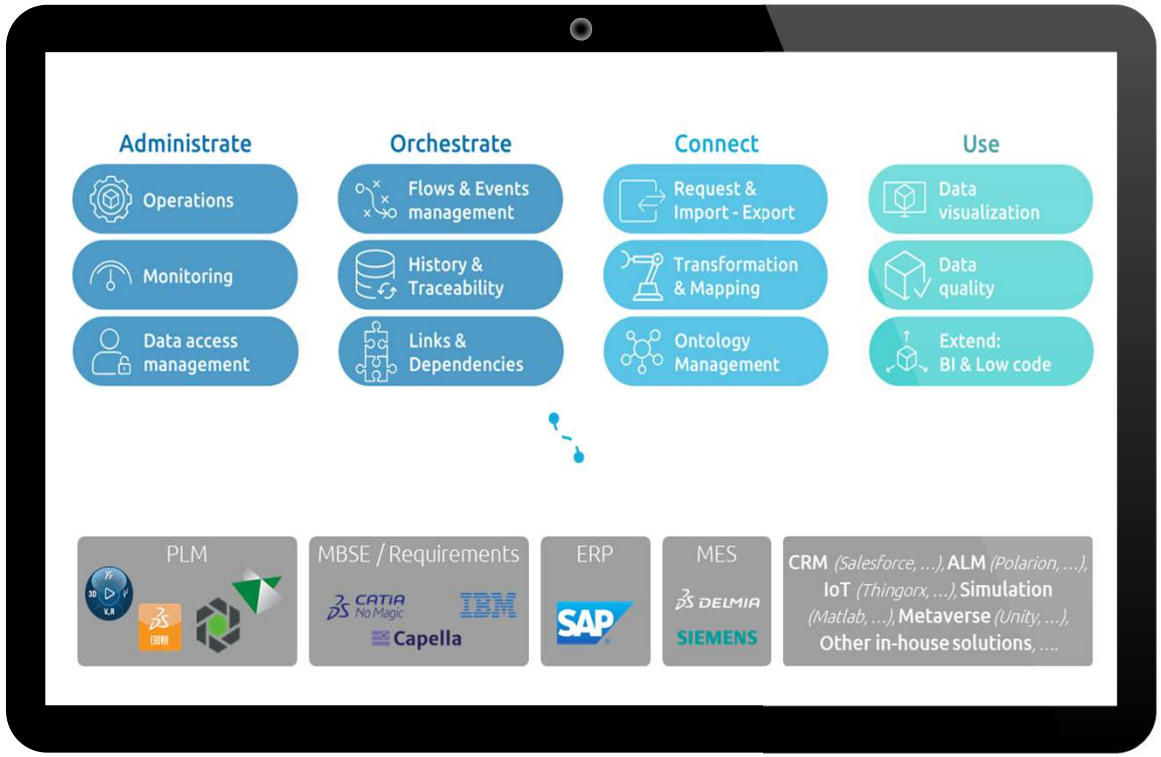
Enable

Model-based Acquisition | Digital Collaboration | Digital Review | Model-based Extended Enterprise | Digital Thread Model Federation | Enterprise CCM/Data Management | ASoT Exchange and Certification | Security Access Management

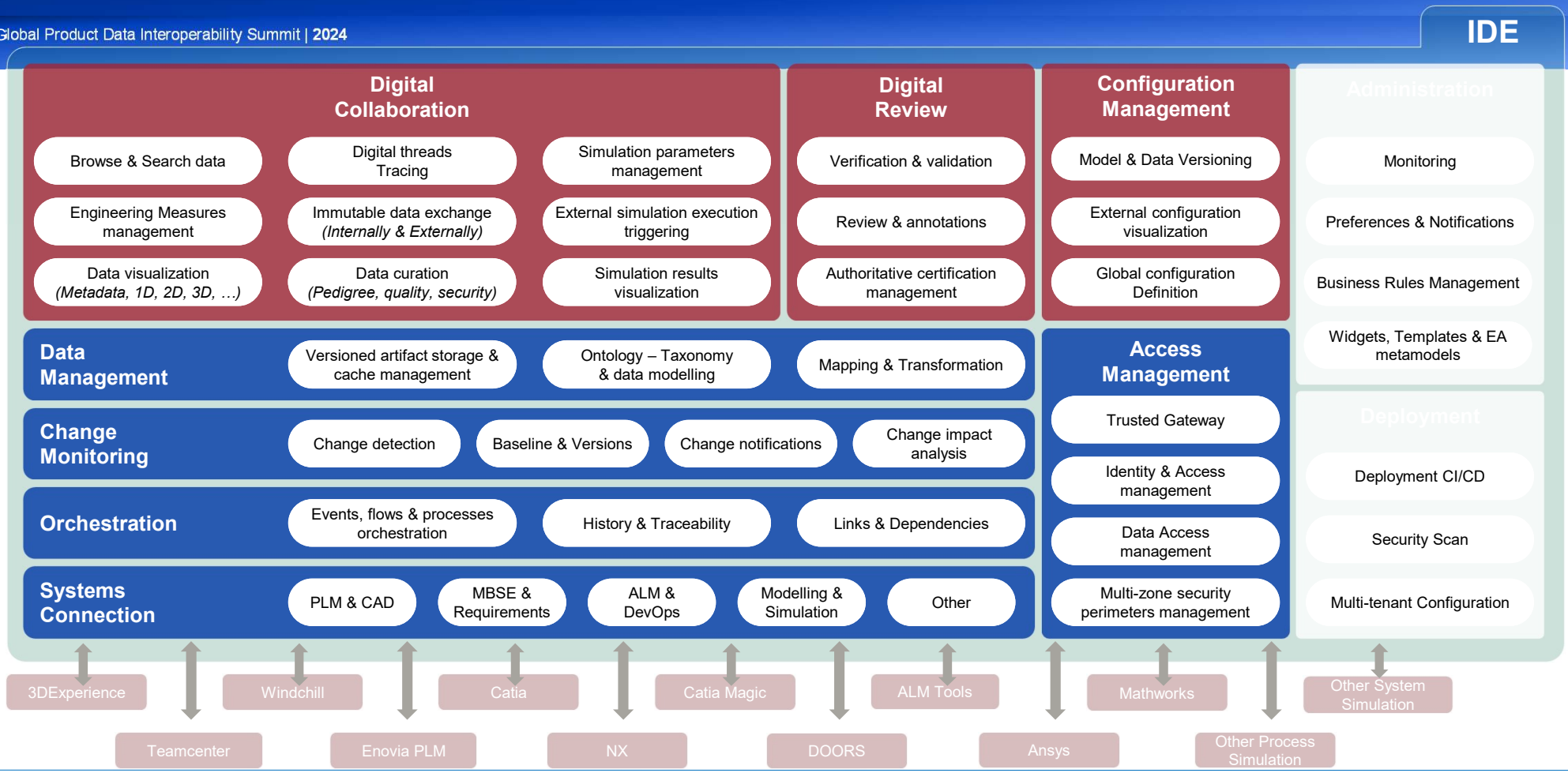
Integrated Digital Environment (IDE) - Example

The Capgemini Data Continuity Platform for the Client's IDE automates **data flows and supports live integration**

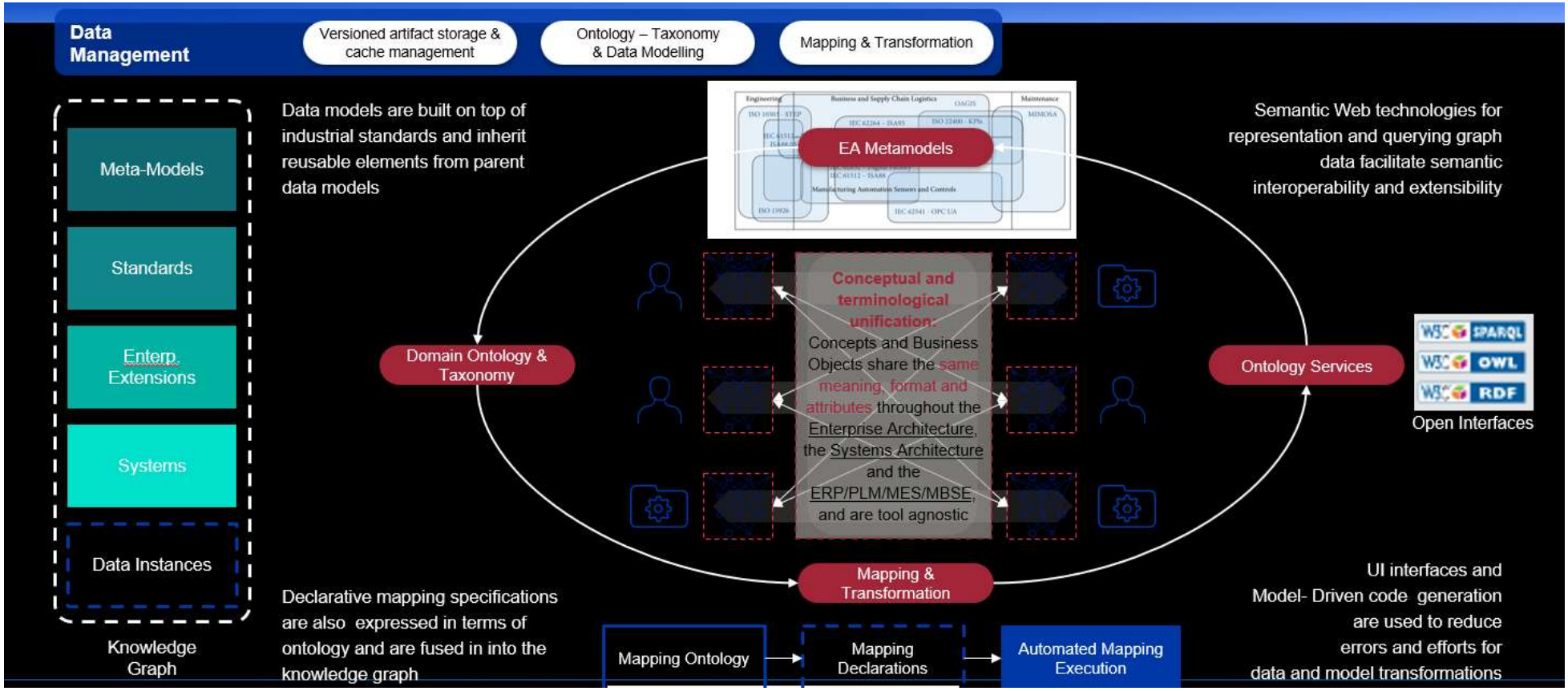
- Flows & Events Orchestration
- Platforms Connection & Synchronization
- Data Exchange & Data Federation
- Ontology based Data Mapping
- Data Visualization
- Real-Time Monitoring
- High-Availability and High-Scalability



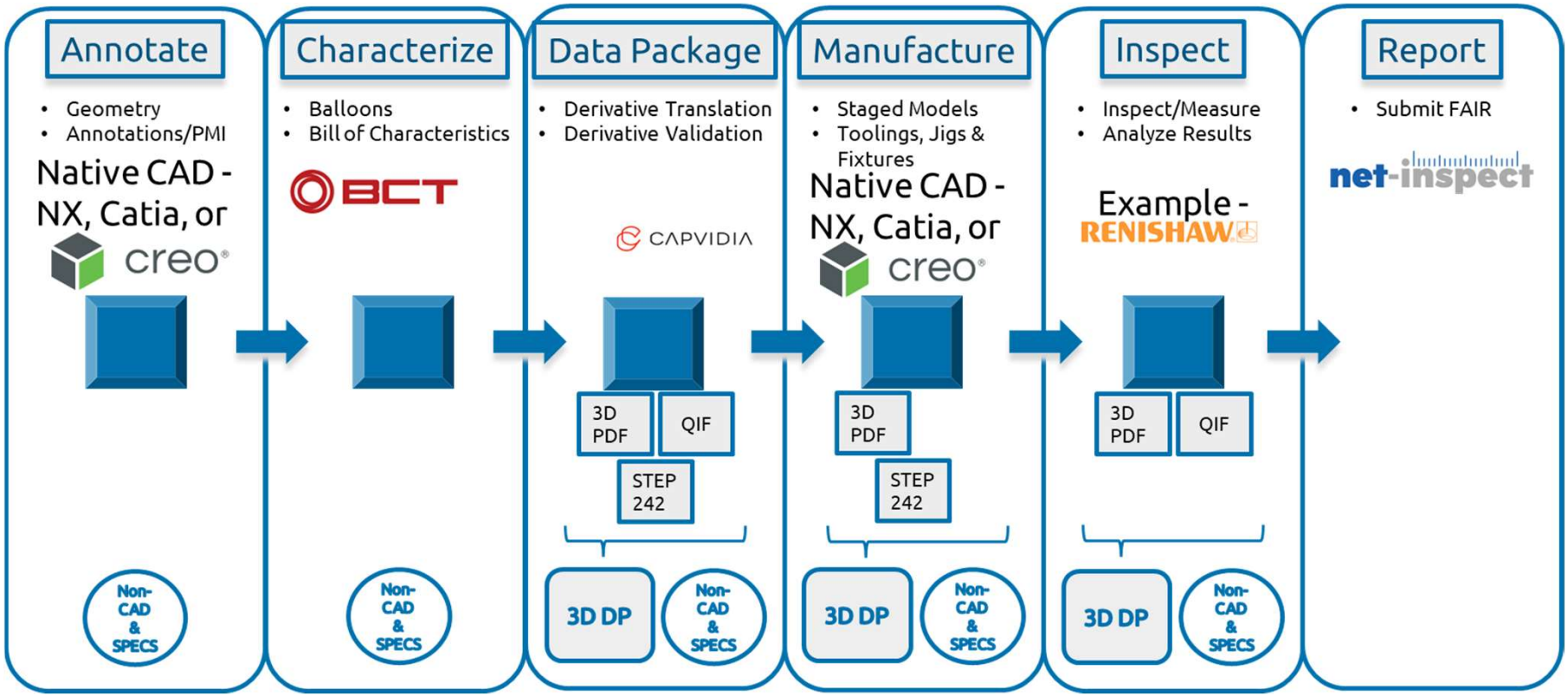
Capgemini Data Continuity Platform for Client IDE



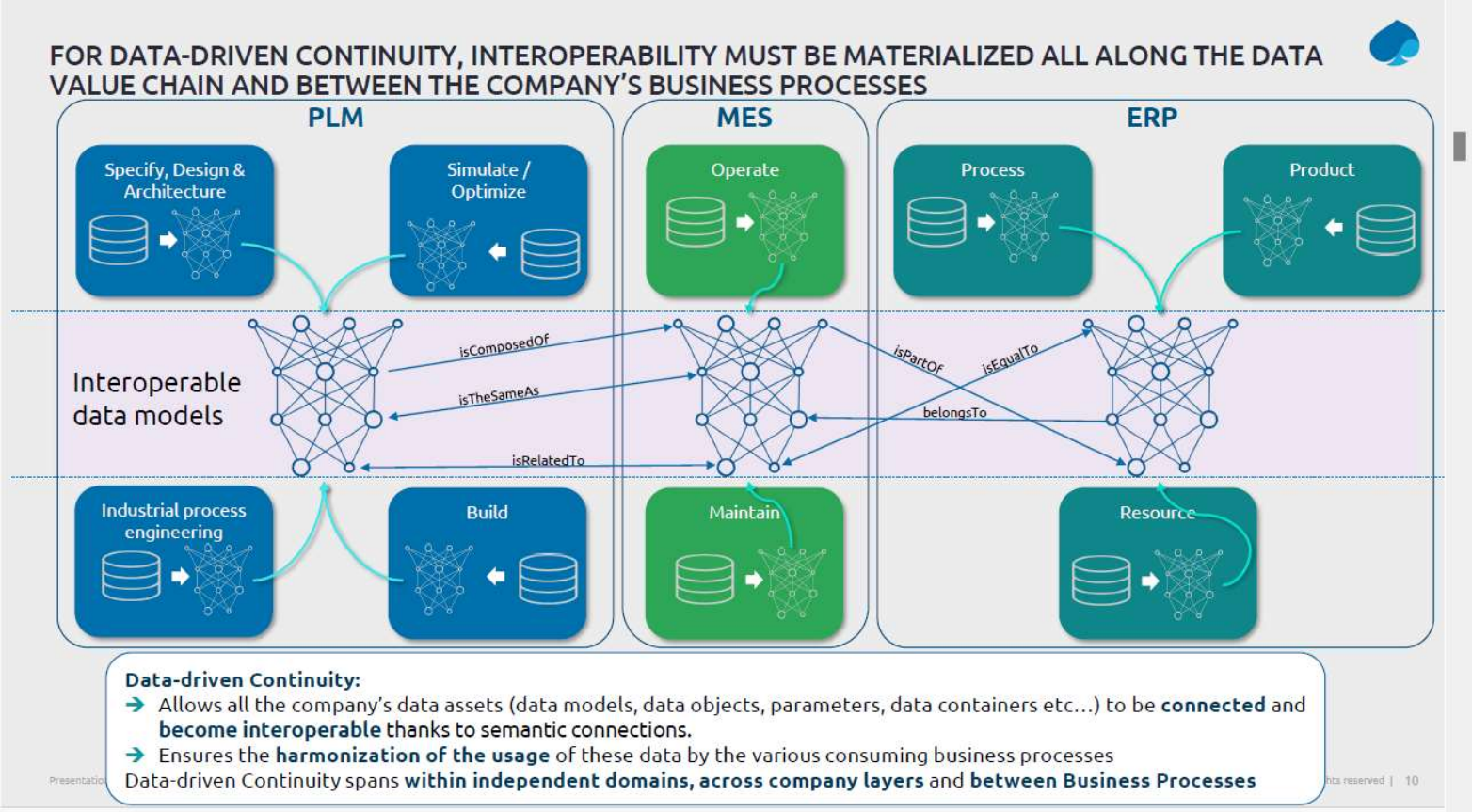
Ontology-based Data Management: General Principles



Collaboration Use Case Example – Model Based Enterprise



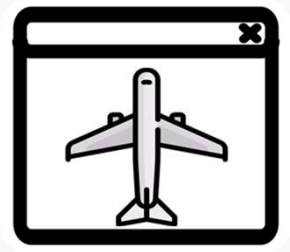
The Role of An Ontology Layer



Use Case: aircraft Configurators data exchange – AS-IS

Simplified Representation

Fuselage Application

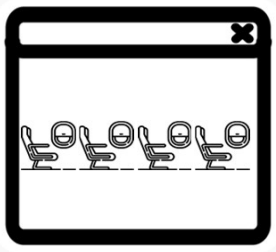


- **Description:** Fuselage Configuration
- **Number of Parameters**: 6000
- **Input File Format (s):** xml
- **Output File Format (s):** xml

Fuselage parameters, door geometry position & zones, cabin wall…

Cabin layout (Galley, Cabin attendant seat, PAX seats, Lavatory, Stowage, PSU…)

Cabin Application



- **Description:** Cabin Layout Configuration
- **Number of Parameters:** 4000
- **Input File Format (s):** json
- **Output File Format (s):** json

AS-IS Description and Need Expression

Aircraft Configurator applications have their own data formats and have different ways of defining and naming their configuration parameters. This cause inconsistencies and loss of information when exchanging data between these applications. Furthermore, this no common database to store shared parameters (with their meanings), making it difficult to integrate smoothly with other tools needed for aircraft design configuration.

Need Expression: A standardized parameter dictionary is needed to facilitate the sharing of configuration parameters between these applications, ensuring consistency and enabling easy integration with other tools used in Aircraft design configuration.

Key Issues in the current process

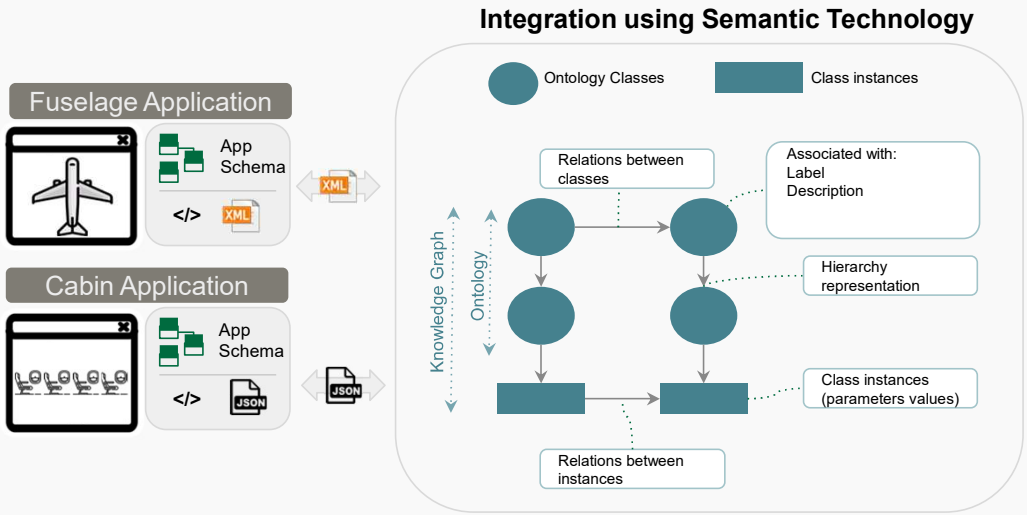
1	**Data Format**	• Each application use a specific data format and structure
2	**Data Meaning**	• Applications do not share the same definitions and naming of the shared parameters
3	**Data Mapping and Transformation**	• No standard way to reconcile differences data structures leading to data loss and inconsistencies during the exchange process
4	**Point to Point Connection**	• Absence of a common database for exchanged parameters makes it challenging to establish seamless integration with other tools in future.

Impacts

For Our Businesses	• Non efficient and synchronous access to knowledge and data Inconsistencies during the data exchange process • Point to Point Connection
For Our Customers	• Increase cost and time of Aircraft Design Architecture (increase Aircraft Lead time)

Use Case: aircraft Configurators data exchange – “To-Be”

Simplified Representation



Target Description

Connect Applications: establish connection between Aircraft configurator applications using a common data model for shared parameters with the possibility to connect to other applications.
Thanks to the integration platform, the parameters can be exchanged automatically without inconsistencies (in values, formats, structure and meaning)

What Changes

1. **Common Meaning for shared Parameters**
   - Meaning of shared parameters are modelled in an ontology (understood by both machines and humans)
2. **Data Mapping and Transformation**
   - The mapping rules between exchanged data are modelled explicitly in an ontology - easy to understand and reuse.
3. **Automatic Data Exchange**
   - Semantic Integration of parameters (possibility to add quality checks in the process)
4. **Extensible Integration**
   - The proposed semantic integration can be extended to other tools in the future (intrinsic property of semantic technology)

Impacts - Value

For Our Businesses

- Smooth and Automatic data exchange process for Aircraft design configuration
- Extensible process to integrate other tools if needed
- Explicit knowledge on transformations and mappings needed for data exchange

For Our Customers

- Rapid Aircraft Design Configuration and Customisation
- Reduction of Aircraft Lead time

Digital Continuity – Aerospace Example - MBE & MBSE enabled with Ontology Layer

AEROSPACE TIER 1

MODEL BASED DIGITAL THREAD

BUSINESS STAKES

CONTEXT

- The client is developing methods and their demonstrators on key projects initiatives to **test and validate model-based practices** to deploy in their businesses.
- The activities focus on: E2E engineering process definition, MBD/MBE maturity assessment and roadmap definition, support to MBSE, MBD and ontology development, domain exchange and interoperability analysis
- The program is run with the SAFe framework

OBJECTIVES

- **Define digital model exchange practices** to enable collaboration between business units and with customers and suppliers
- Deploy industry standards and best practices for co-design and co-manufacturing to **digitize and automate engineering to factory transition and quality**
- **Consolidate ontology** for each discipline **to harmonize communication and product definition** company wide
- **Establish digital thread across different engineering discipline** (e.g. MBSE to MDAO)
- Put in place methods and governance to **support off-ramp of newly define features** to the business units

MAIN RESULTS

Model exchange practices defined for MBSE and MBD models. Practice are tested, documented and being off ramp to the business unit.
Off ramp process and governance

Prioritizing of CDM use cases for 2023
Implementation of MBE industry standards for Semantic PMI.
Automation of processes for manufacturing and quality

Definition of ontology and its governance at corporate level

Integration of MBSE with physical simulation

OUR APPROACH

Deploy SMEs on key projects to support definition and deployment of the model based digital thread

	Extended Enterprise	MBDMI/Semantic PMI	Ontology	Design
MBSE MBDMI Ontology Simulation	Methods to share models in the supply chain with diversified access depending on the stakeholder	Methods for model-based definition to support co-design and co-manufacturing. Expertise on QIF and STEP format	Researching and mapping ontology for Maintenance, Repair and Overhaul Defining ontology governance with stakeholders	Overall process definition around the MBE activities connecting MBSE to MBD and Simulation

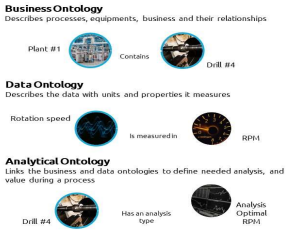
Off ramp

Benefits of the Ontology Layer – Demonstrated Solutions

4 main benefits

Use Case Driven Platform

Design domain-oriented ontologies to create the foundational ontologies based on standards and specific use cases ontologies

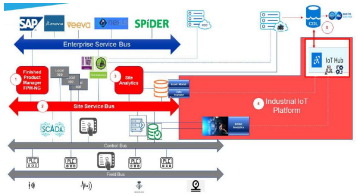


*Define a use case development methodology to re-use **core objects** (Product/Process/Resources structures…) to avoid duplication of work and ensure data consistency in & out the enterprise*

Drive Scale and Replicability on use cases with a foundational layer with ontology classification

Semantic Integration Layer

Integrate a Semantic Integration Layer at the IT level to standardize and contextualize data

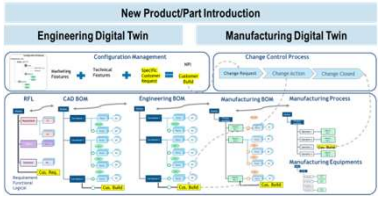


*Upgrade the Site Service Bus and Enterprise Service Bus with an Ontology layer to reach level 3 of interoperability (Foundational – Structural – **Semantic**)*

Drive Scale and Efficiency Gains with Data Transformation and Integration

Digital Thread

Implement a Data Hub (Digital Thread) across domains to connect cross-domain objects

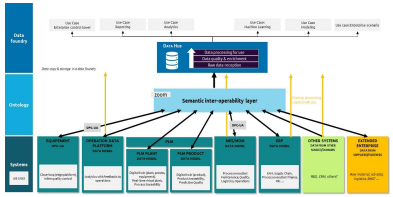


*Define an **ontology** model to connect domains and objects to ensure better data quality across systems*

Enhance Data Quality Between Data Domains & Systems

Data Architecture

Define a data architecture to support data exposition to other systems



*Set-up a **data platform** to standardize – contextualize and expose data to multiple systems, based on a data-driven architecture patterns for real-time performance*

Enable New Digital Capabilities with a Data Support Platform

Thank You!

Questions, comments, and all feedback welcome!

Karen Kontos
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