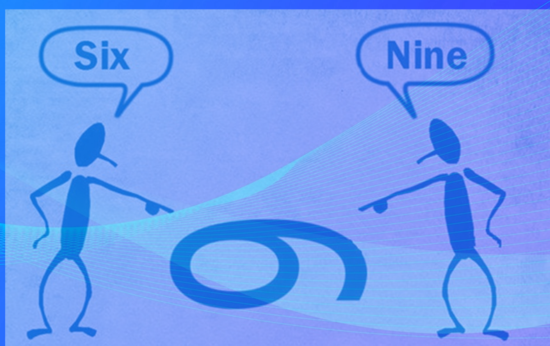
PLM Road Map™ & PDT Europe 2025

PLM's Integral Role in Digital Transformation From Strategy to Execution

Elevating PLM to an Enterprise Business Solution,
the PLM Professional's Road Map to Success

CIMdata 5 & 6 November eurostep

We are still facing the same lack of data** (meanings) **continuity



Paris - La Défense, November 5, 2025, France

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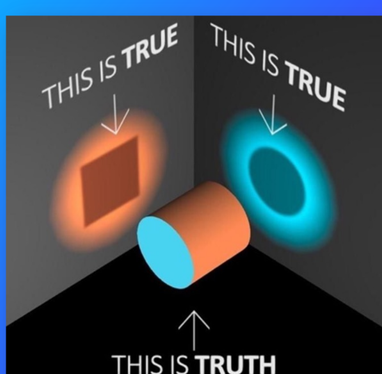
Bringing *Meaning* back to *Data*

Jean-Charles Leclerc

Innovation & Standards
OneTech | Digital Lines
D&DT | Data & Digital Technologies
Data Intelligence & Strategy Dpt.

W3C RDF
W3C OWL
W3C SPARQL
W3C SHACL

Agenda



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- **#1** Modelling challenges in our industry
- **#2** W3C Standards Implementation
- **#3** Semantic Governing Principles
- **#4** Standardized *(good)* practices
- **#5** Typical Usages & Cases
- **#6** Conclusions

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Modelling challenges in our industry

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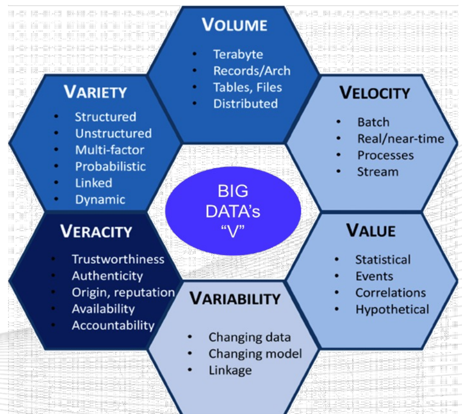
Data sharing ambition in our industry
(World Economic Forum WG - 2020)

"**Enable data exchange** between applications, among **different functions within organizations, between operators** as well as **across the supply chain** to support further **digitization & automation**"



"Variability" : ***VERSIONING*** *and* ***RE-USE are critical for dynamic modelling at scale***

Transverse Interoperability, internally and with our partners remains a strategic focus

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W3C Standards Implementation

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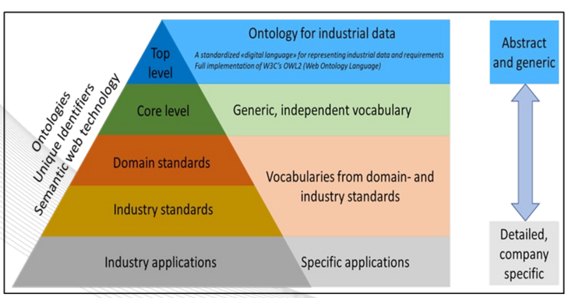
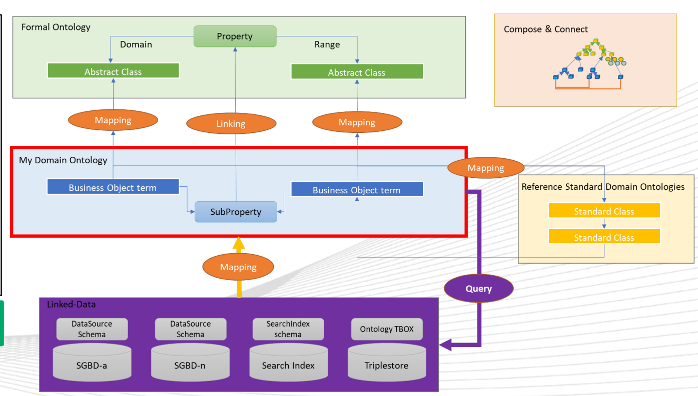
Ontologies: Define concepts and their relationships within a domain, structuring data and ensuring common understanding





Semantic Knowledge Graphs are Knowledge Graphs with* ***rich Semantics given by formal ontology* (structured with first order's logic axioms)

Web linked-standards- data offer:

1. **Each object must have a universal unique identifier (URI)**
2. **Each object can be described thru an assembly of other objects thru semantic relationships (triples)**

Modelling reality bites when our systems don't talk: *"governance isn't optional, it's survival"*

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Semantic Governing Principles

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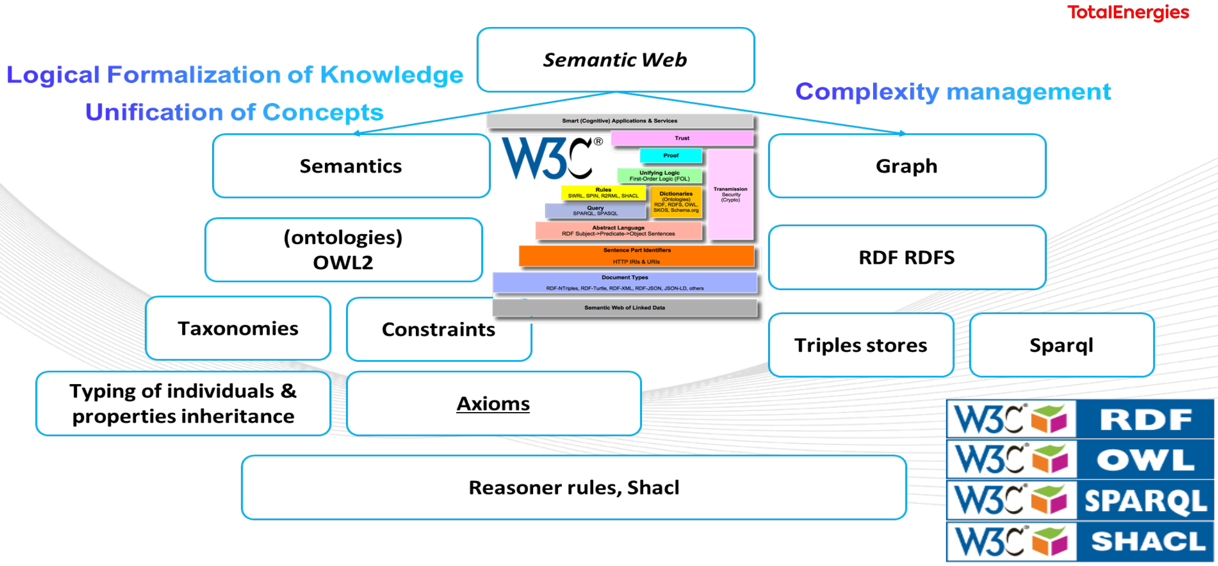

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Semantic Governing Principles

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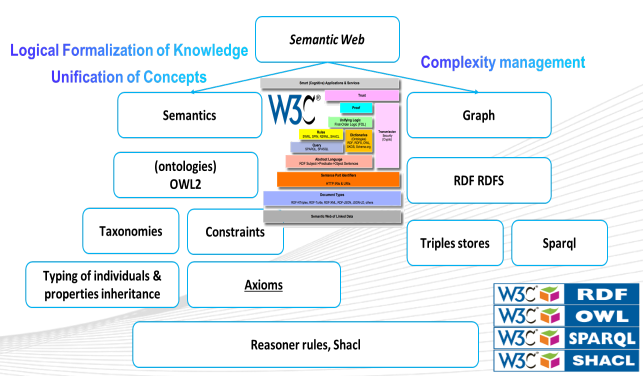
Main components of a "*standard*" Semantic Layer :

- ✓ **Ontologies:** Define concepts and their relationships within a domain, structuring data and ensuring common understanding.
- ✓ **RDF (Resource Description Framework):** Represents data as triples (subject, predicate, object), forming the basis of knowledge graphs.
- ✓ **RDFS (RDF Schema):** Complements RDF by allowing the definition of hierarchical classes and properties.
- ✓ **SPARQL:** A standardized language for querying RDF graphs, offering powerful data search and manipulation capabilities beyond traditional SQL languages.
- ✓ **SHACL (Shapes Constraint Language):** Defines constraints on RDF data to ensure compliance with defined ontologies.



The Semantic Layer based on W3C standards' stack to define, describe & query data semantically

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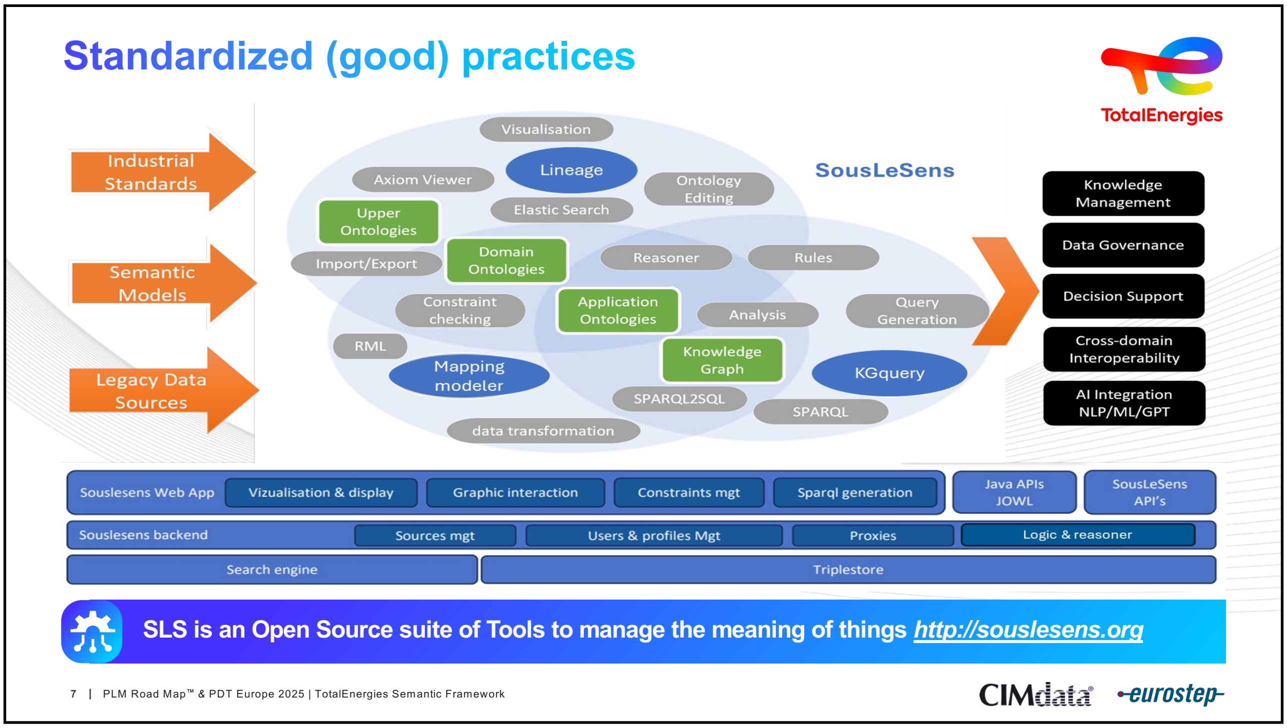
Standardized (good) practices
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Industrial Standards
Semantic Models
Legacy Data Sources
Visualisation
Axiom Viewer
Lineage
Ontology Editing
SousLeSens
Upper Ontologies
Elastic Search
Import/Export
Domain Ontologies
Reasoner
Rules
Constraint checking
Application Ontologies
Analysis
Query Generation
RML
Mapping modeler
Knowledge Graph
KGquery
SPARQL2SQL
SPARQL
data transformation
Knowledge Management
Data Governance
Decision Support
Cross-domain Interoperability
AI Integration NLP/ML/GPT
Souslesens Web App
Vizualisation & display
Graphic interaction
Constraints mgt
Sparql generation
Java APIs JOWL
SousLeSens API's
Souslesens backend
Sources mgt
Users & profiles Mgt
Proxies
Logic & reasoner
Search engine
Triplestore
SLS is an Open Source suite of Tools to manage the meaning of things http://souslesens.org
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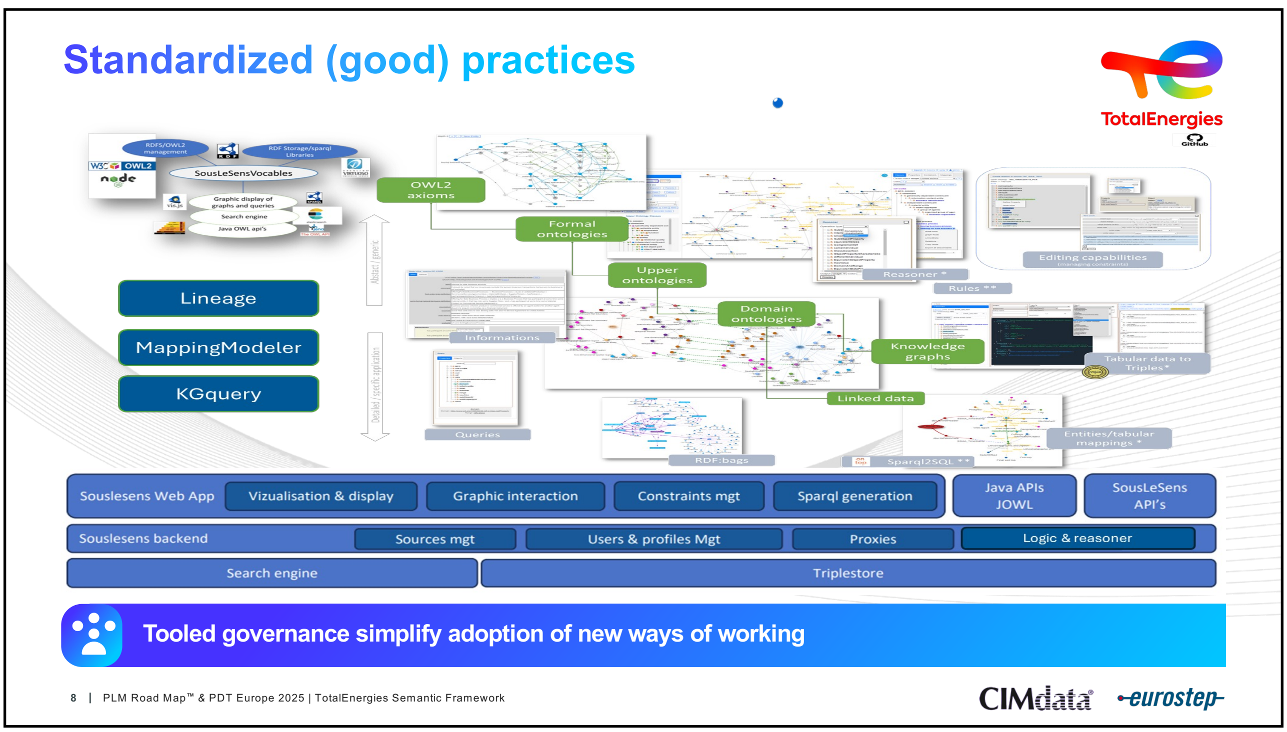
Standardized (good) practices
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SousLeSensVocables
Lineage
MappingModeler
KGquery
OWL2 axioms
Formal ontologies
Upper ontologies
Domain ontologies
Knowledge graphs
Linked data
Informations
Queries
Editing capabilities
Reasoner *
Rules **
Tabular data to Triples*
Entities/tabular mappings *
RDF:bags
Sparql2SQL **
Souslesens Web App
Vizualisation & display
Graphic interaction
Constraints mgt
Sparql generation
Java APIs JOWL
SousLeSens API's
Souslesens backend
Sources mgt
Users & profiles Mgt
Proxies
Logic & reasoner
Search engine
Triplestore
Tooled governance simplify adoption of new ways of working
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Standardized (good) practices

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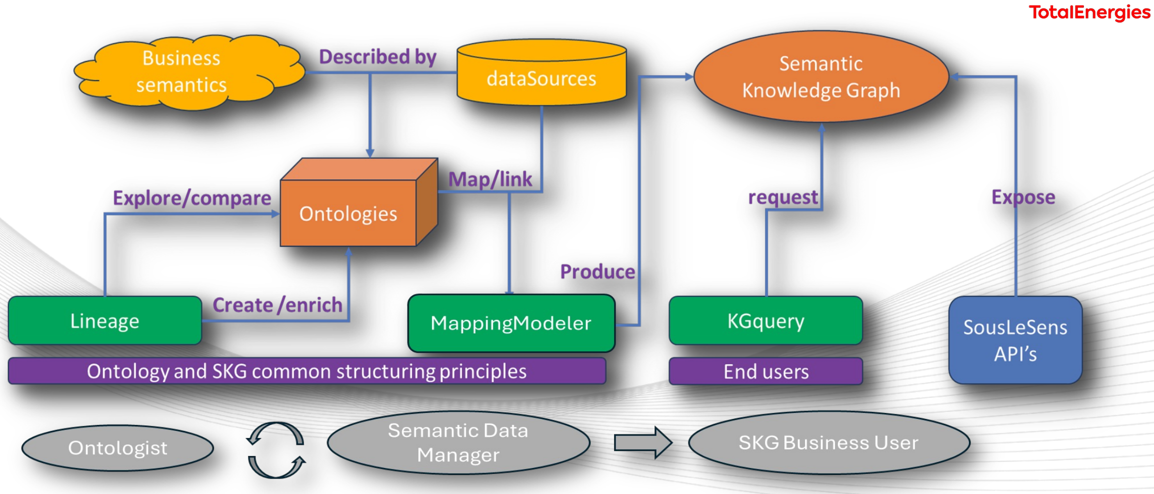

SousLeSens & TotalEnergies Semantic Framework workflow in a nutshell

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Standardized (good) practices

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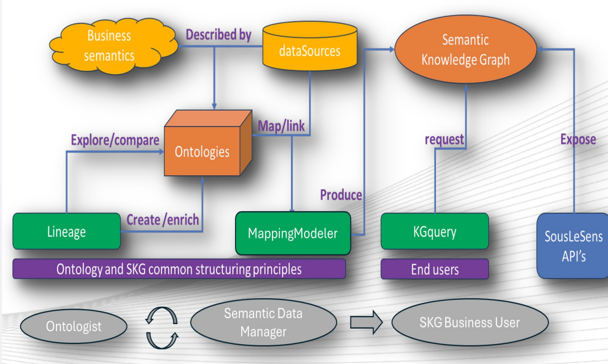
From Silos to Scalable Semantic Knowledge Graphs …
… a (W3C) digital transformation Sequence …

1. Start from siloed data: We begin with fragmented datasets stored across disconnected systems.
2. Build a generic model: A foundational model is created, aligned with domain ontologies driven by Top Level Ontologies (TLO), to enable semantic mapping of the data.
3. Extend the model as needed: This generic model is tailored and enriched based on our specific source requirements and business challenges.
4. Generate a Semantic Knowledge Graph (SKG): The extended model is instantiated into a SKG that integrates the semantically mapped data.
5. Add a collaborative semantic layer: An editable layer is added to support semantic collaboration, enabling shared understanding and co-construction.
6. Integrate plugins: Functional plugins are embedded to enhance usability, interoperability, and automation.
7. Query and evolve flexibly: The SKG is queried and incrementally enriched in a flexible manner, allowing scalable extension based on evolving needs.



Semantic Layer in practice, our typical processes & worflows

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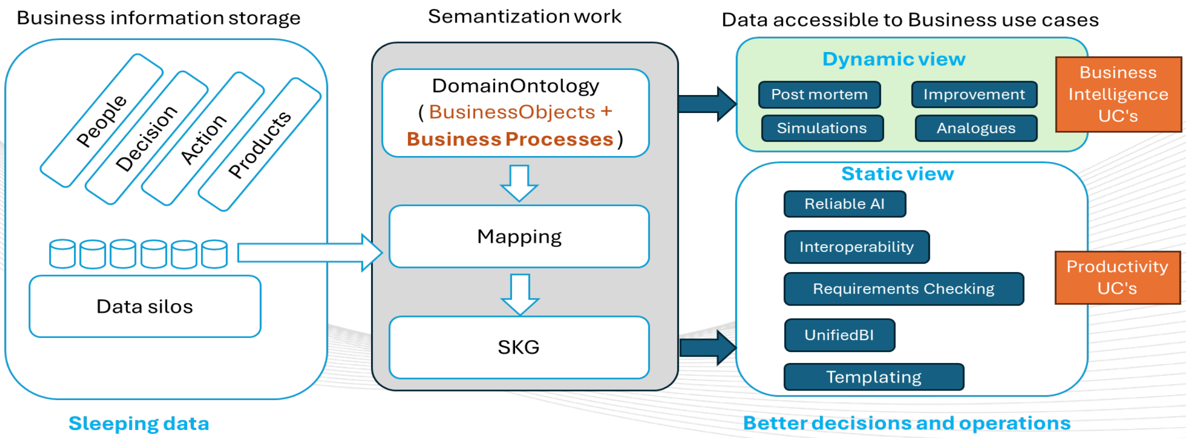
Typical Usages & Cases

Ontologies: Define concepts and their relationships within a domain, structuring data and ensuring common understanding



Knowledge capitalization & ontology developments imply collaboration

Typical Usages & Cases

#1 | Information Sharing & Integration

Information Sharing

Facilitates collaboration through consistent information within and outside organizations.

Reduces ambiguity and simplifies data interchange through ontologies.

Integration

Standardizes terminology and provides consistent information. The flexibility enables dynamic adaptation and learnings. Acts as data hubs for transformation purposes and manages variables and terms effectively. This allows automated workflows & tasks allocations.

Interoperability

Adheres to W3C standards, ensuring compatibility with third-party systems.

Enables efficient semantic mapping during solution migrations.

#2 | Data Management & Quality

Master Data Management

Excels in key management, maintaining data integrity and consistency across multiple platforms. This allows business synthesis and interactions crossing organization's data domains as structured knowledge representation

Data Quality

Validates the quality and consistency of data through ontologies and SHACL constraints, allowing semantic reasoning and inference.

Provenance Tracking

Manages complex metadata and tracks linked-data provenance (semantic data lakes, semantic ETLs ...)

#3 | Advanced Applications & Insights

Artificial Intelligence
Enhances AI's ability to provide structured information using formal ontologies like BFO. Supporting explainable AI, audit & Decision

360 Systems
Offers a comprehensive view of a business or organization, enabling cross-domain understanding.

Networked Systems
Provides robust solutions for complex networks involving interconnected elements.

Publishing and Authoring
Manages the complexity of interrelated sections and characters across different media.

Healthcare, IoT, and Supply Chains
Supports resource management, IoT device tracking, and inventory control. Ideal for modeling supply chains and event state changes.

Annotations and Commentary
Enables annotation and commentary of events, similar to social media platforms.

Narrative Structured Content
Transforms and analyzes narrative structures, providing powerful semantic and content store combinations.

Generative AI Use Cases Support
Enriches data semantically, making it more suitable for ML models. Enabling multi-agents AI coordination & context awareness for IA.

Data Enrichment
Links internal data to public knowledge graphs, enhancing analyses and providing additional context.

Advanced Exploration
Enables intuitive data navigation, revealing hidden relationships and correlations.

Typical Usages & Cases

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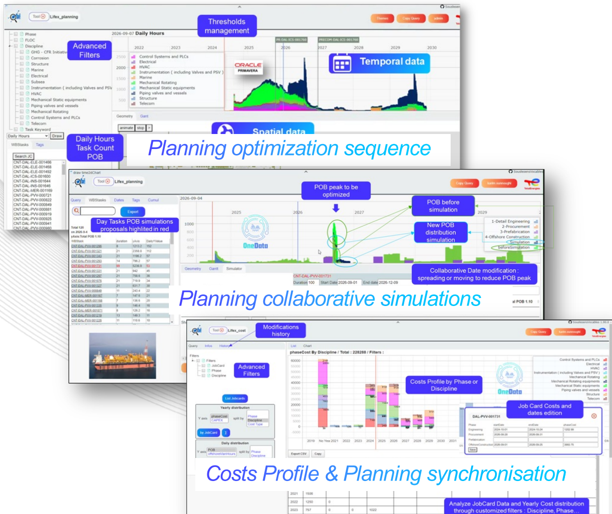

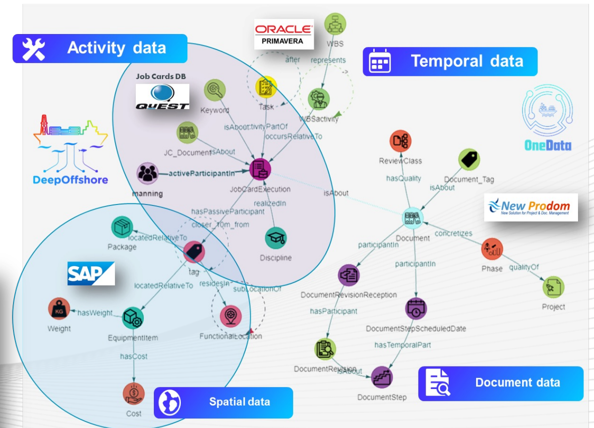

KGquery module showcase relationships between data objects from multiples sources

Projects & Operation's advanced plugins supporting efficiency in decision making

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Conclusions

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By implementing a **rigorous semantic layer** during the development of knowledges graphs & mappings, aligned with **W3C standards**, we enable **structured data, interoperability, and AI-ready models.**

This approach addresses **metadata consistency, scalability, and cultural transformation**, while fostering **collaboration** on **technical commons to ensure sovereign knowledge capitalization and drive cross-industry innovation.**

Don't do semantic web & ontologies just for the thrill of changing format !

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Value (Log scale)
Level 0
Paper
Level 1
Open digital Format
Read and search on screen
Level 2
Machine readable document
Structured content of standard documents
Content can be processed by software
RDF
OWL
SPARQL
SHACL
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Machine Ready means "processable"
Concepts axiomatized in Domain's Ontologies
Common Logic
Interoperability
Inference
RDL aligned with Upper Ontologies
SousLeSens
GAP
Level 4
Machine interpretable content
Information modeling that expresses content and relation between elements
Interruption-free data flow within the value chain
Automatic question answering or predictive content supply
CWA
Rigid & Specific
OWA
Flexibility
Graphs & Linked-Data based interoperability
Semantization
Standardization
Contextualization
Change management
Relationships between concepts
Taxonomies aligned with Top Level Ontologies (TLOs)
Catalog of concepts
Siloed Databases
GO FAIR
Time (Log scale)
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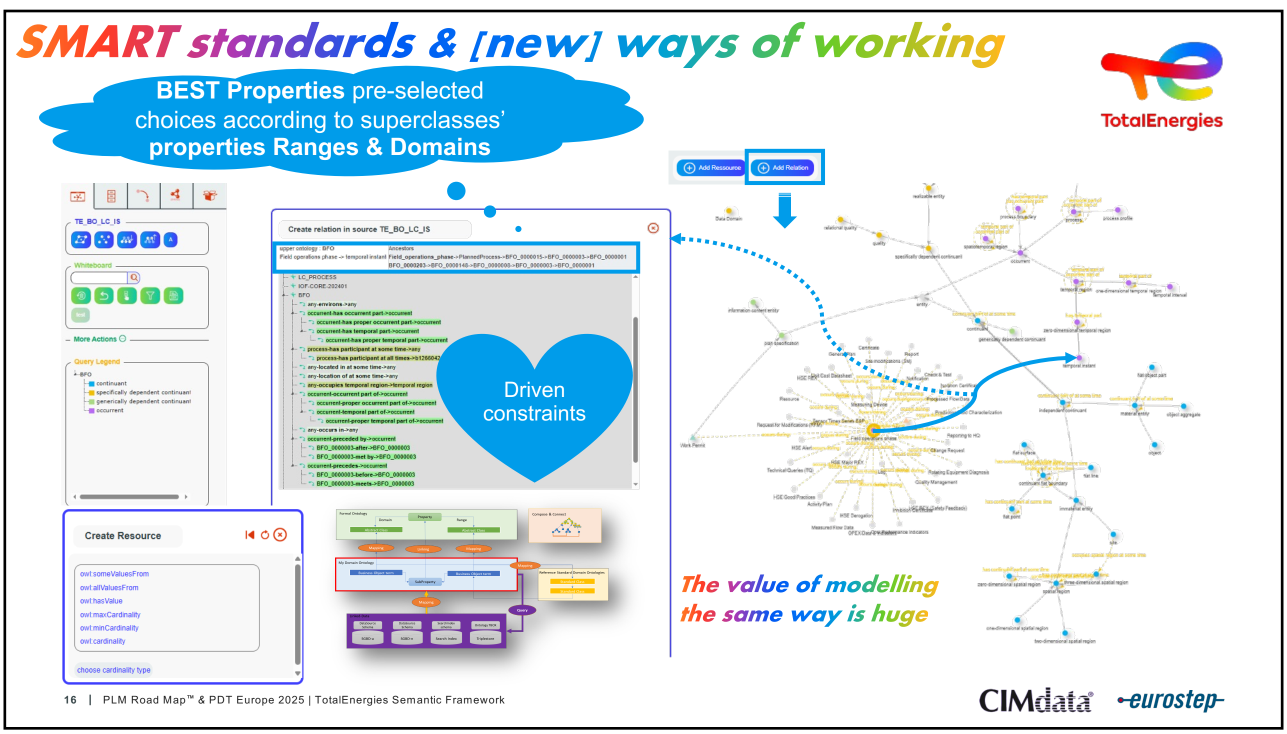
SMART standards & [new] ways of working
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BEST Properties pre-selected choices according to superclasses' properties Ranges & Domains
Create relation in source TE_BO_LC_IS
Driven constraints
Create Resource
The value of modelling the same way is huge
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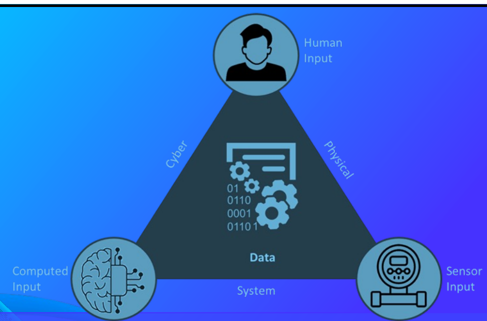

Takeaways

The implementation of a semantic layer represents a significant advancement for our organization's *data platform*.

By adopting W3C standards full stack and fully leveraging the capabilities of Semantic Knowledge Graphs (SKGs), we can enhance the quality, interoperability, and value of our contextualized data, all along their lifecycle.

This will address current data governance challenges while preparing for future advanced use cases in AI & analytics.

SCAN THE QR CODE!
PLEASE GIVE ME FEEDBACK
ON MY PRESENTATION

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W3C RDF
W3C OWL
W3C SPARQL
W3C SHACL

Thank You !

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