Why SIRIUS is interested in CAPE-OPEN

David Cameron

CO-LAN Annual Meeting

28th October 2021

SIRIUS: A Centre for Research-Driven Innovation

- 8 Years
- 20 Partners
- 3 Universities
- 20+ PhD
- 50+ Workers

Academia

UiO : University of Oslo
University of Oxford – Department of Computer Science
simula
NTNU – Norwegian University of Science and Technology
SINTEF

Industrial end-users

Schlumberger
equinor
TechnipFMC
aibel
AkerSolutions
BOSCH
DNV

Vendors

ENVESTER
ONTOPIC
KADME – Knowledge and data management expertise
OSIsoft.
metaphacts
prediktor
Dolphin
SAP
IBM
tieto EVRY
NUMASCALE – BIGGER DATA ANALYTICS
Oxford Semantic Technologies
BPT – Billington Process Technology
computas

Scalable Data Access in the Oil & Gas Domain

We have lots of data

We have unprecedented processing capability

Why is it so hard to get access to the data we need?

Industrial Digital Transformation		Empirical studies of industrial data projects: Best practices
Analysis of Complex Systems		Simulation and optimization of complex systems: ABS simulator
Data Science		Domain-adapted data science and language processing
Ontology Engineering		Making ontology usable by non-specialists: OTTR templates
Semantic Integration		Robust semantic databases and data access: RDFox & OBDA
Scalable Computing		Cloud, architecture and HPC interconnects: Melodic + hardware

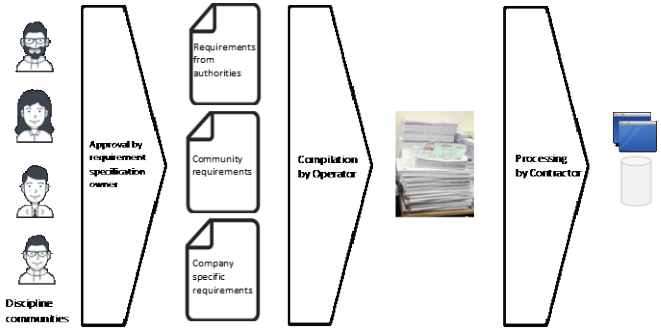
Applied to beacons that address industry needs

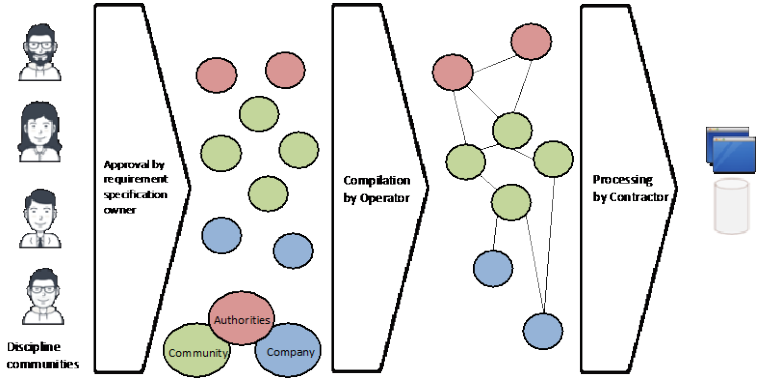
Geological Assistant		Integrated Digital Planning	
Subsurface Data Access & Analytics		Digital Twins	
Digital Field & Reservoir Management		Digital Field Development	
Personalized Medicine		Environmental Applications	

Answering the challenges of KONKRAFT

- Digital collaboration
  - Simplification and standardisation.
  - Remove duplication and paper
  - Digitalization of NORSOK
- Upgrading of DISKOS
  - Easier to use – interoperable – a platform for the sector (the oil and gas crowd).
- Modifications and Maintenance
  - Planning
  - Equipment reuse

Digitalizing of Requirements





Industry pain:

- Processing of requirement specifications by manual interpretation of text
- Asset information locked in hundreds of proprietary applications
- Huge information loss in handover from one project phase to another

Requirements as Digital Artefacts

- From documents to structured data
- Objects for all life cycle phases (e.g., design, fabrication, maintenance)
- Requirements become rules over the asset model
- Compliance checking is automated
- Handover is information sharing

Digital Twins

Industry Pains:

- "Everybody" is offering a digital twin.
- Fragmented systems, siloed perspectives and overload of data.
- Systems are difficult to configure, maintain and scale.
- Challenges in work practices, security and alignment to business.

- A standards-based semantic backbone for digital twins
- Faceted data access and semantic user interfaces for usable twins
- Domain-adapted interpretation of unstructured information in twins
- Formal simulation of complex twin deployments and architectures

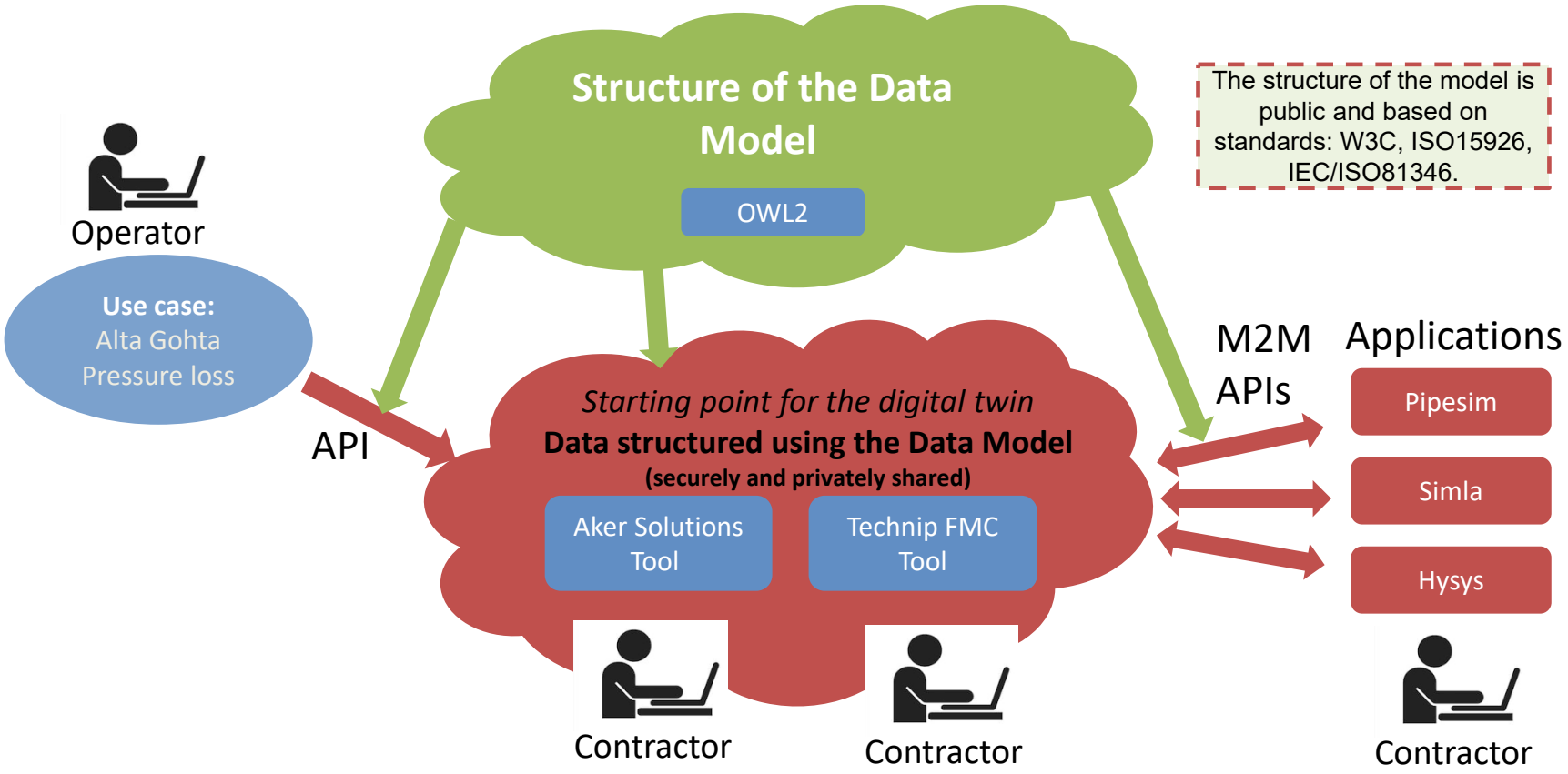
Digitalizing the Design Basis

Now

- Design Basis is a **set of documents**. These are not available as structured data to be consumed by machines.
- Changes are reported in documents that need human interpretation.
- Challenging and time consuming for engineers to identify and apply updates.

With the DDB

- Automatic processes replace manual work:
  - A **common data model** holds structured data for Basis of Design and Functional Requirements.
  - This data can be consumed by all relevant software applications in a study through API's based on the **data model**.
  - Data can be shared between applications without human intervention.


Structure of the Data Model
OWL2
The structure of the model is public and based on standards: W3C, ISO15926, IEC/ISO81346.
Operator
Use case:
Alta Gohta
Pressure loss
API
Starting point for the digital twin
Data structured using the Data Model
(securely and privately shared)
Aker Solutions Tool
Technip FMC Tool
M2M APIs
Applications
Pipesim
Simla
Hysys
Contractor
Contractor
Contractor

Why CAPE-OPEN?

- The process simulator is a vital application in development of the design basis.
  - Frequent and comprehensive exchange of heat- and mass balance data.
- The Material Object in Ports approach to modelling and data representation is effective.
- We are working with a **functional system** breakdown of engineering data – that maps well onto simulation control and results handling.
- Our semantic reasoning is helped by considering and adopting the semantic pre-suppositions of CAPE-OPEN.
  - Also directly through use of classes from OntoCAPE.

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