The Digital Design Basis.

Building a framework to reduce costs and improve quality in early-phase design

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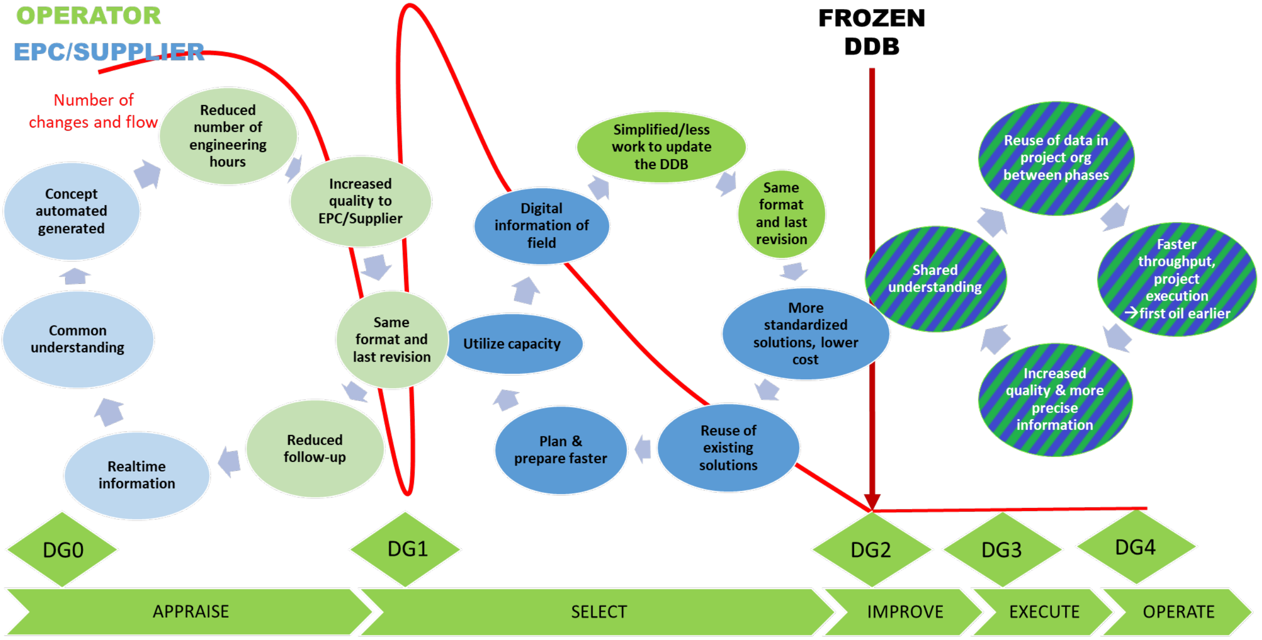
The Challenges and Potentials of Field Development



GATE PROCESS WITH SUPPLIER; FASTER INFORMATION FLOW TO PREPARE AND PLAN ORDERS

Benefits from a Digital Design Basis

Speed

- Less time spent on data transcription and transfer

Quality

- Fewer errors and support for automated validation

Effectiveness

- Support for streamlined workflows

Accuracy

- Unambiguous definition of data and assumptions

The Business Case

Value Potential:

- 50 % savings in work with use of a full Digital Design Basis.
- Order of £10m saving in a medium-size field development study.
- Increased Quality.
- Reduced risk of human error.

KonKraft
Konkurransekraft på norsk sokkel

Value Drivers:

1. Enable machine readable design basis and allow machine-to-machine communication.
2. Faster data processing and improved quality.
3. Allows operator and supplier to exchange technical requirements digitally and have clear version control on the requirements.

The Project

The Consortium

- Operators: Aker BP, Lundin Energy
- EPC: Aker Solutions, TechnipFMC, Aibel
- Engineering Software Company: Aize AS
- Academia: University of Oslo

Develop a Proof of Concept for a Digital Design Basis.

- A **data model** that holds data about both the **Design Basis** and **Functional Requirements** decided by an operator.
- A **model that can be implemented in any relevant software tools** in a concept study, to ensure that information that is sheared between Operator and EPC contractor and their different software tools have the same meaning and understanding.
- **A common digitalized language** between operators and main contractors.

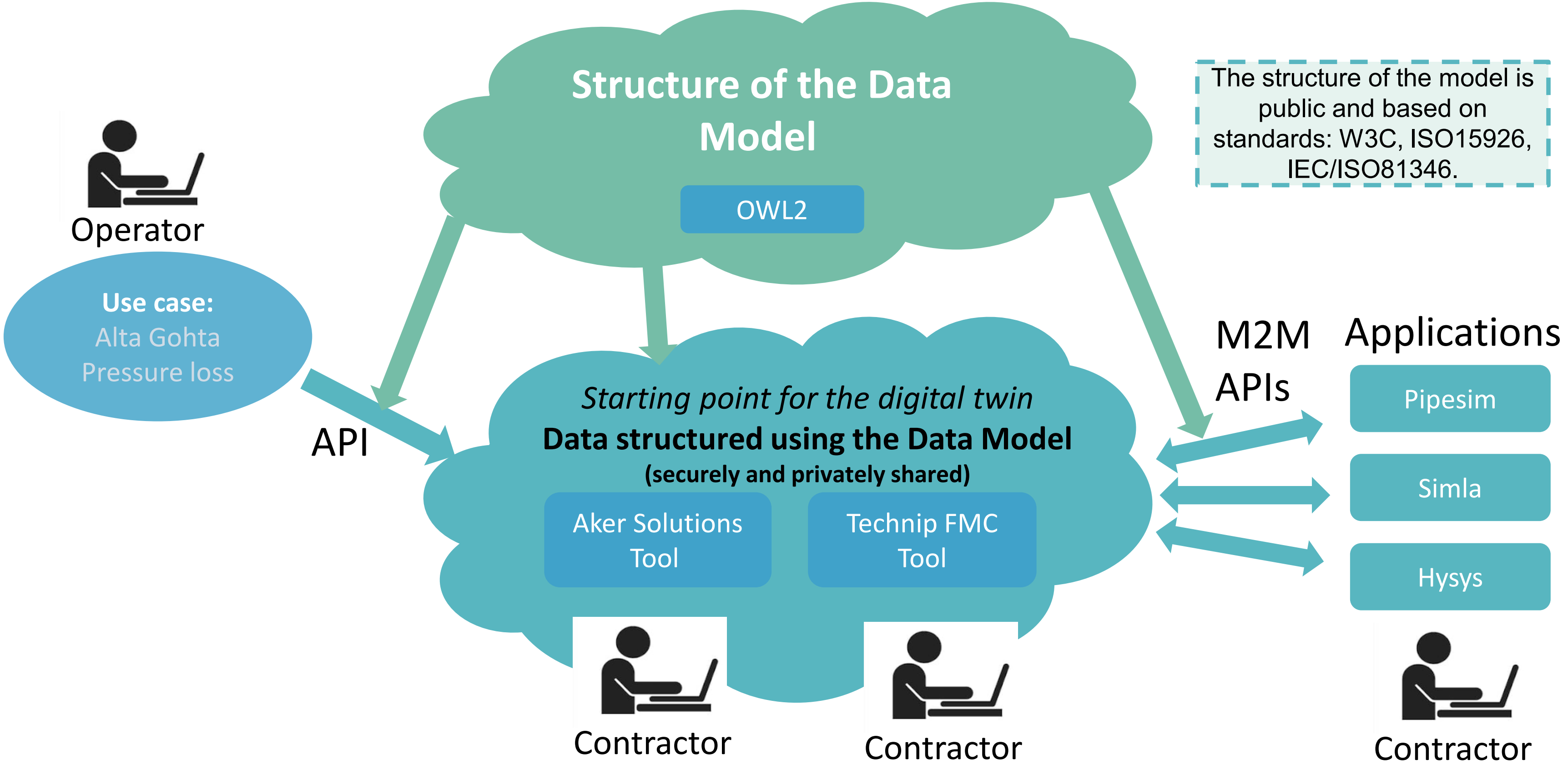
The Project's Ambitions

Now

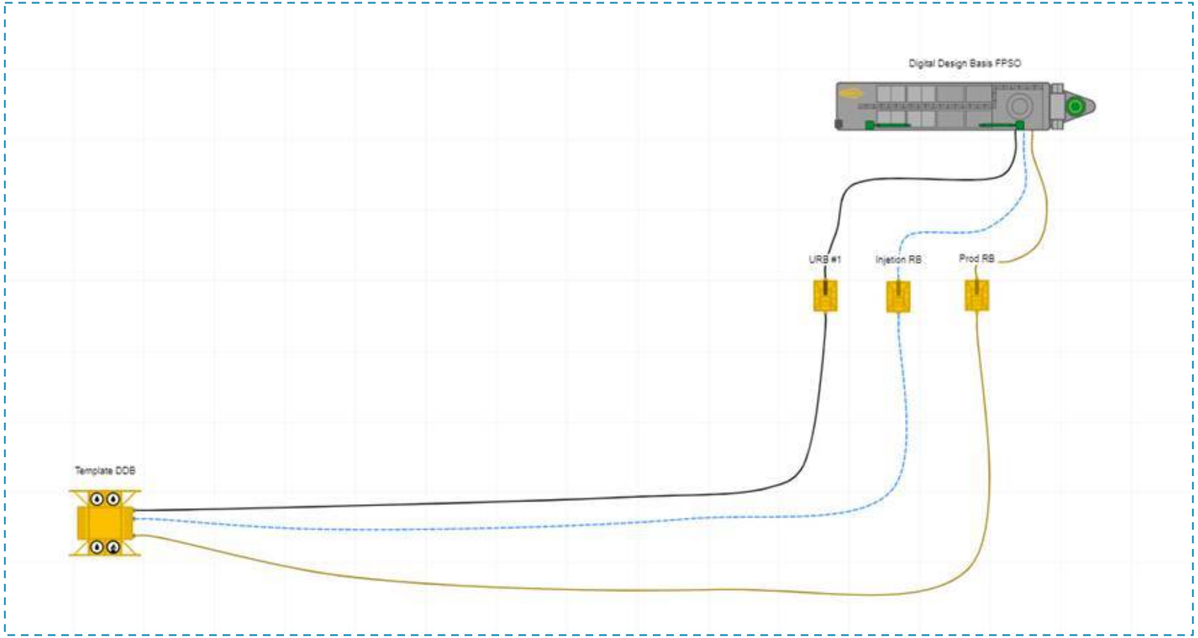
- Design Basis is a **set of documents.** These are not available as structured data to be consumed by machines.
- Changes are reported in documents that need human interpretation.
- Challenging and time consuming for engineers to identify and apply updates.

With the DDB

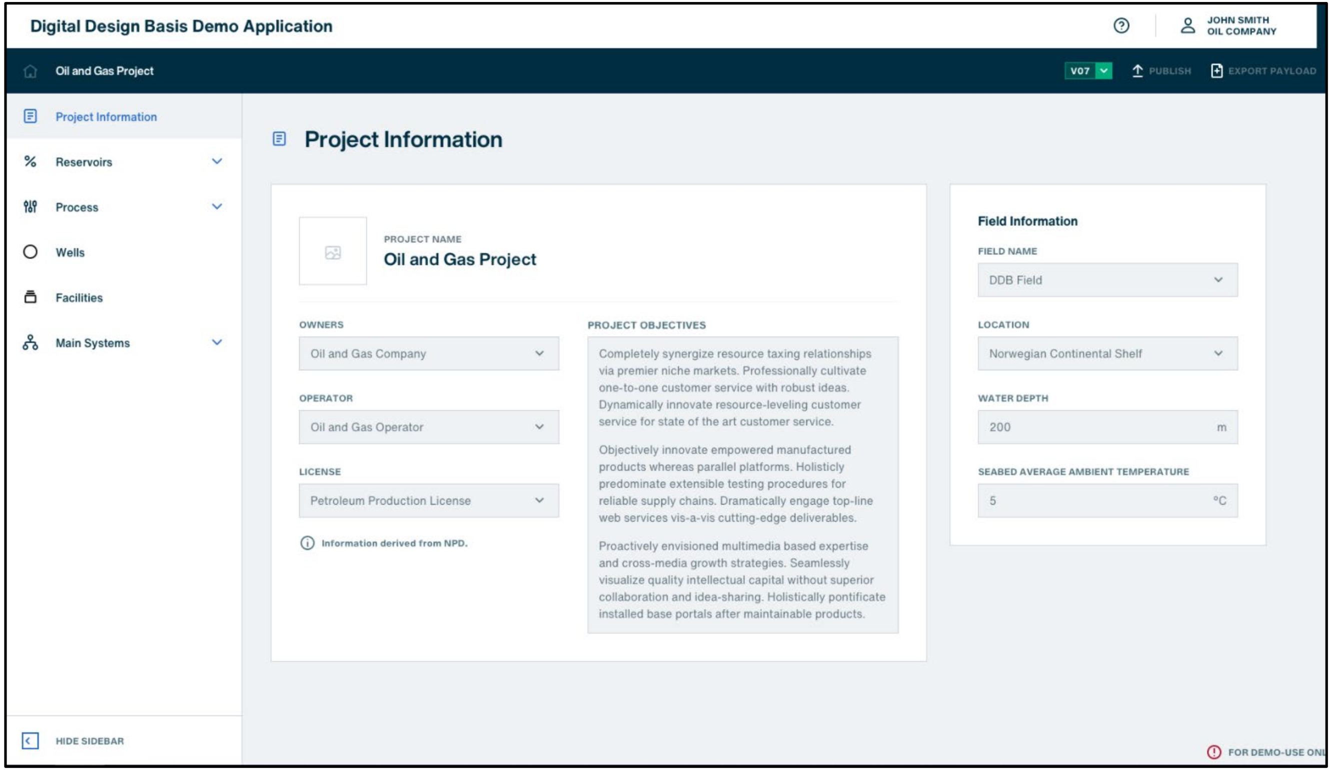
- Automatic processes replace manual work:
  - A **common data model** holds structured data for Basis of Design and Functional Requirements.
  - This data can be consumed by all relevant software applications in a study through API's based on the **data model.**
  - Data can be shared between applications 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

The Digital Design Basis starts with a field layout from the operator. The model allows us to structure the rest of the DDB data and requirements around the technical systems in the layout.

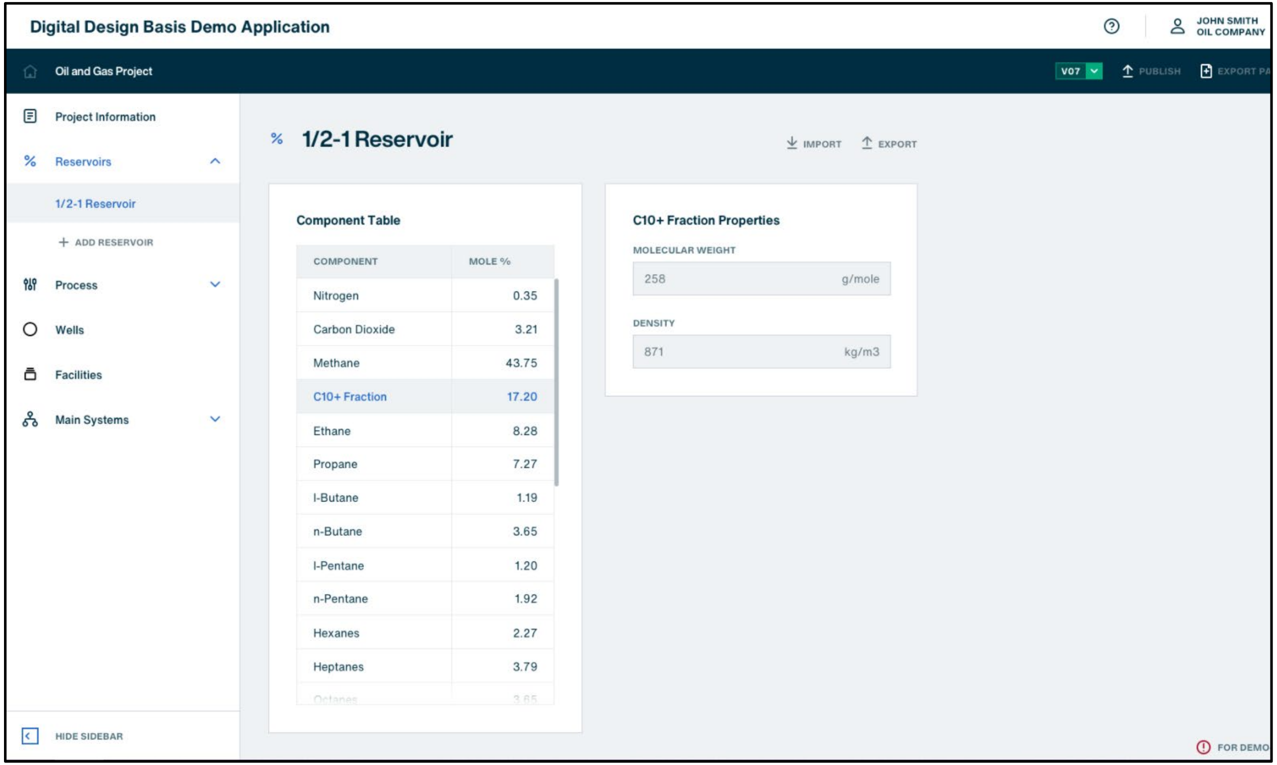


The DDB starts with a definition of the field development, including descriptive text.

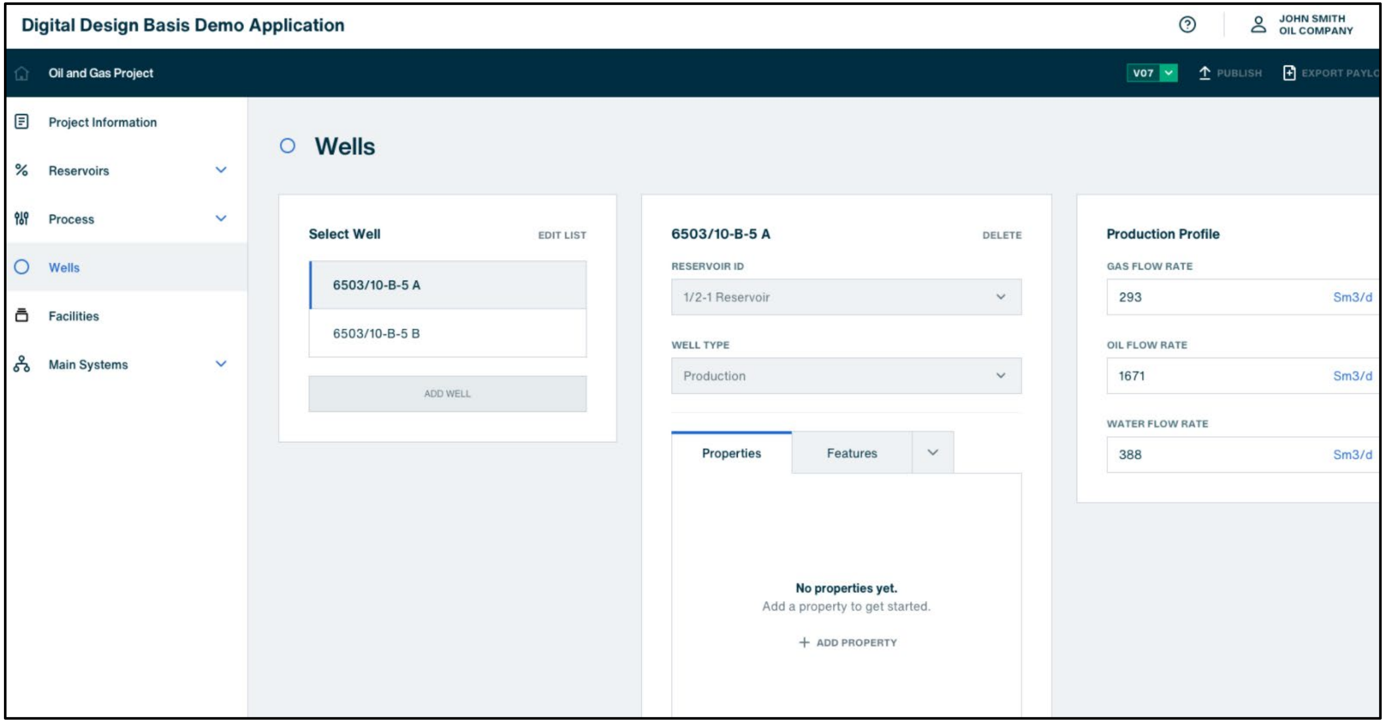


First we define the reservoir properties.

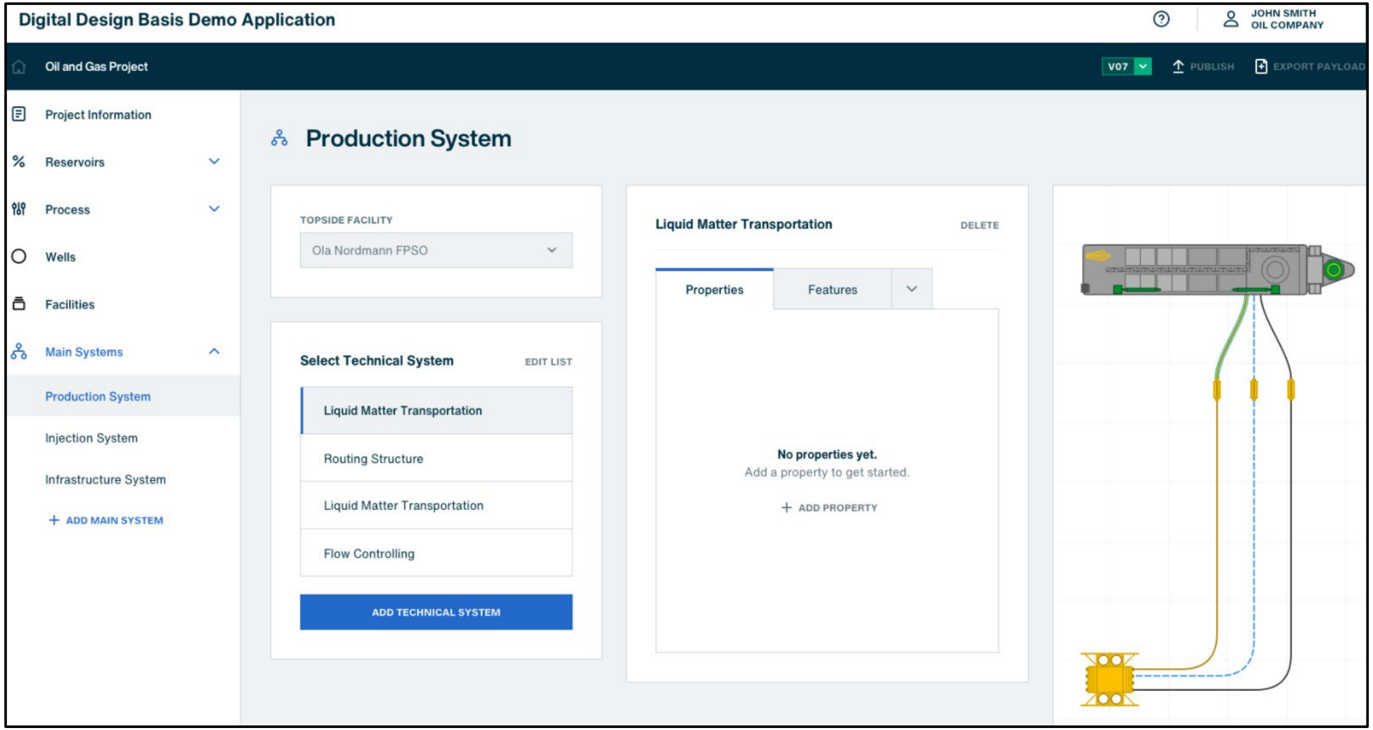
Fluid properties are an important part of the DDB. We manage either full analyses or analysis with pseudo-components.



Then we can define the wells.

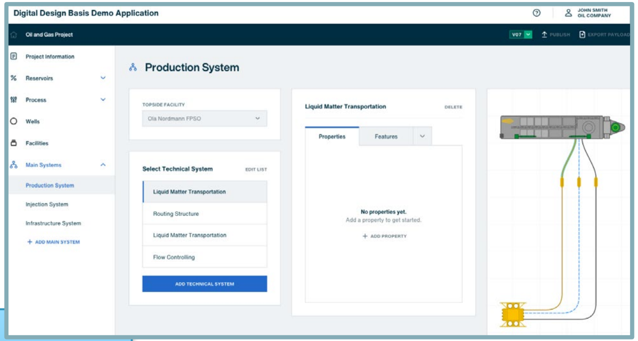


Then we define the technical systems.
The types of technical systems are consistent with **IEC/ISO81346.**



The Operator works in a software application and can share Design Basis data with the EPC, who can use it use it in their applications by relying on the same common data model.

Operator Digital Design Basis Tool

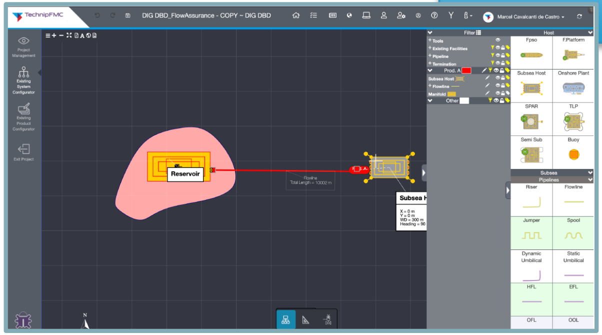


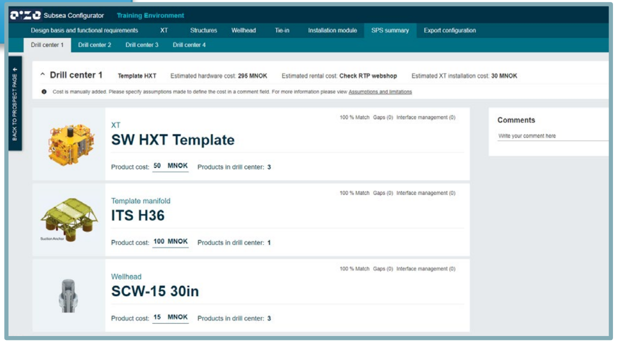
Common Data Model

TechnipFMC

Subsea Studio FD

Define SURF scope based on Design Basis parameters from DDB Operator tool.



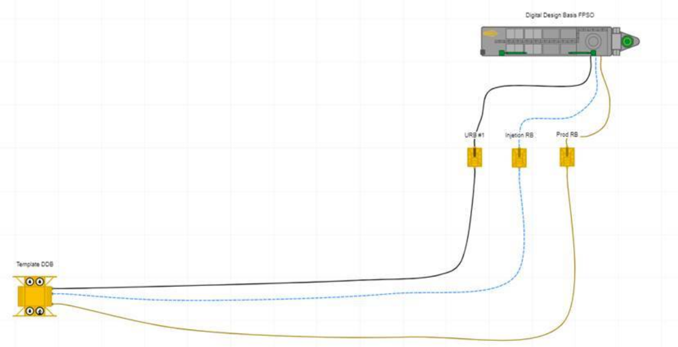


AkerSolutions

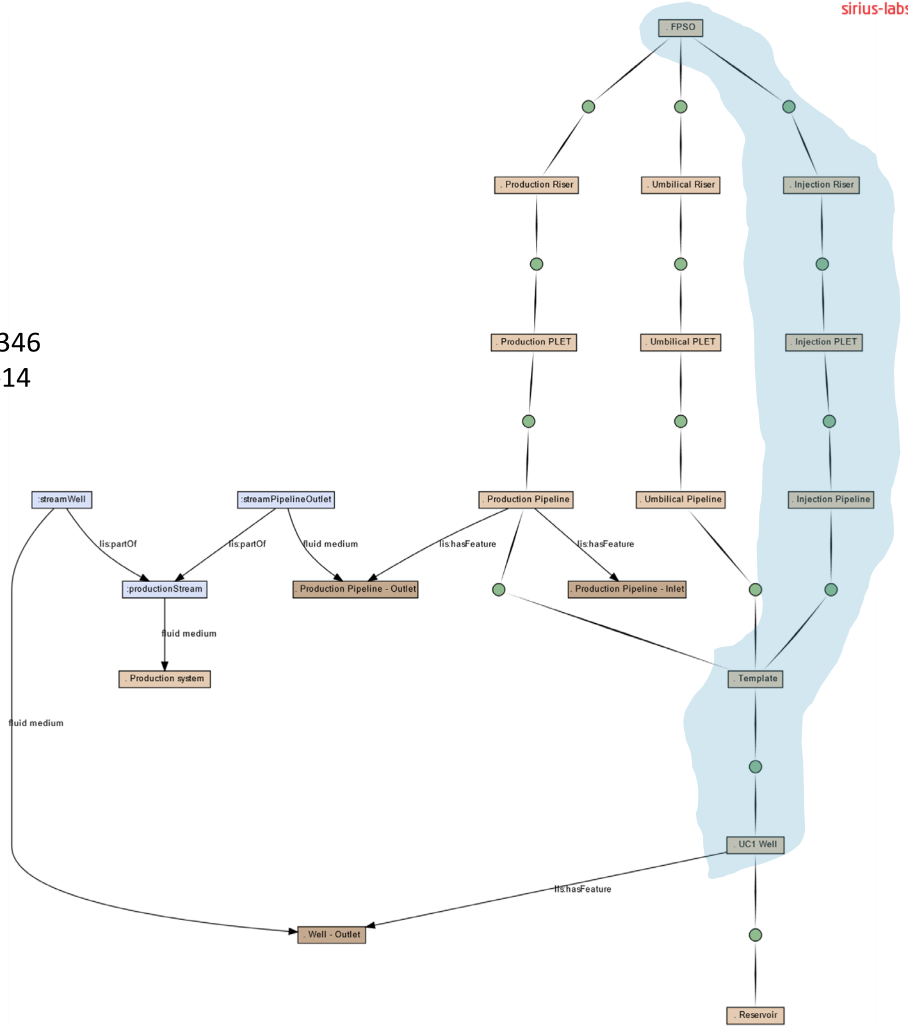
Subsea Configurator

Define SPS scope based on Design Basis parameters from DDB Operator tool.

The Digital Design Basis model is built around a breakdown into standard **technical systems** (IEC/ISO81346, READI and O&G RDS)
The model reflects the topology of the field layout.



IEC/ISO81346
ISO15026-14
OWL, RDF



READI

https://readi-jip.org/reference-designation-system-for-oil-and-gas/

Lessons Learned and Observations

- It was possible to implement a DDB model using W3C semantic standards (OWL, RDF), public reusable ontologies (e.g. ChEBI) and ISO15926.
- Tooling and software was all open-source.
- The data model is open-source (and will be shared soon) – but not the data!
- The IEC/ISO81346 system breakdown approach from READI could be used.
- Consistency of units of measurement remains a challenge in all interoperability. Need agreement about quantity types and unit representation.
- We looked here at parameters, i.e. requirements that can be reduced to a number, not functional requirements per se.
  - Transforming textual requirements to numbers, bits and bytes is hard.
- We have been able to link in fluid properties into the common data model.

Conclusions

- A consortium of operators and competing EPC companies demonstrated that a common data model can be used to capture and share design basis data in early phase development.
- Semantic modelling made this representation possible and allowed data to be entered in a structured way and be consumed by engineering applications.
- We need to have more projects like this, where consortia along the supply chain work with academia and software vendors to agree on interoperability standards by working on real, non-trivial problems.
- The lessons from this project have been taken up in further, ambitious initiatives by each of the partners.