READI: Ontology-based requirements management for industry

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DNV

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The READI JIP

Shaping the future of digital requirements and information flow in the oil and gas value chain



READI 🥏

The need for better requirements management

Current work processes are manual, inefficient, and costly.



Existing resources and related initiatives

READI is one of several ongoing O&G digitalisation projects using ontologies.

- ISO 15926 widely accepted in O&G
 - Part 14 built for OWL DL and automated reasoning
- PCA, CFIHOS, DEXPI reference data libraries
- ISO/IEC 81346 functional/physical/locational breakdown of assets, adapted for ontologies and O&G in READI
- Reified Requirements Ontology representation convention
- Unit of measure ontologies, including QUDT.org
- OMG ontologies for countries and languages
- FIBO for organisations
- SKOS, PROV-O, etc., from W3C

Ontology patterns with OTTR: give meaning to data

- OWL is akin to an assembly language for ontologies.
- OTTR provides a template language for facts at domain-specialist granularity.
- Apply templates to lift data into a common ontology language.



READI representation of requirements

- Requirements are normative. Where *a* is an organization, and *A* and *B* are classes, a requirement has the form,
 - *a* requires that: every *A* is a *B*
- OWL DL lacks normative reasoning
 - Capture requirements as reified normative propositions
 - READI applies the <u>Reified Requirements Ontology</u>
- Approximate reified requirements with OWL axioms to obtain useful quality checks from OWL reasoning.
 - semantically equivalent requirements duplicates
 - superfluous requirements one is strictly stronger

• Precise and consistent requirements means improved quality and reduced cost

READI digital requirements service

There is a range of technologies available. Assemble them the right way.

- OWL: Enable large, consistent multidomain vocabularies
- RDF endpoints and Linked Data: Disseminate the agreed conventions
- Cloud applications with SQL backend: Established practice for services

READI adopted in current capital projects

• NOA and KRAFLA: Largest new projects on Norwegian Continental Shelf

- Around €5B investment (CAPEX)
- More efficient field development
- More efficient operations, from 2026/2027
- Requirements management
- Shared asset models, built on ontology-based, machine-readable industry standards

- Considerable interest across the power industry, including wind energy (offshore and onshore), grid operators, hydropower
 - READI contributes to transforming the industry for "intelligent data"
 - ISO/IEC 81346

Information Modelling Framework: Semantic asset models



READI applied to asset models

A *digital twin* of an industrial asset can be checked for conformance with requirements, using automated reasoning.



Resources for further exploration

- READI: https://readi-jip.org/
 - Presentations
 - Webinar recordings
 - ISO/IEC 81346 Reference Designation System for Oil and Gas
- Reified Requirements ontology:
 - https://w3id.org/requirement-ontology/ontology/core
- OTTR: https://www.ottr.xyz/
 - Specifications
 - Software
 - Primer
 - Tutorials



Bringing the oil and gas industry together Share practises and requirements for improved cost efficiency and safety

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Reducing complexity and risk for errors in work processes and information exchange



Enabling the automation of critical business processes and design

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