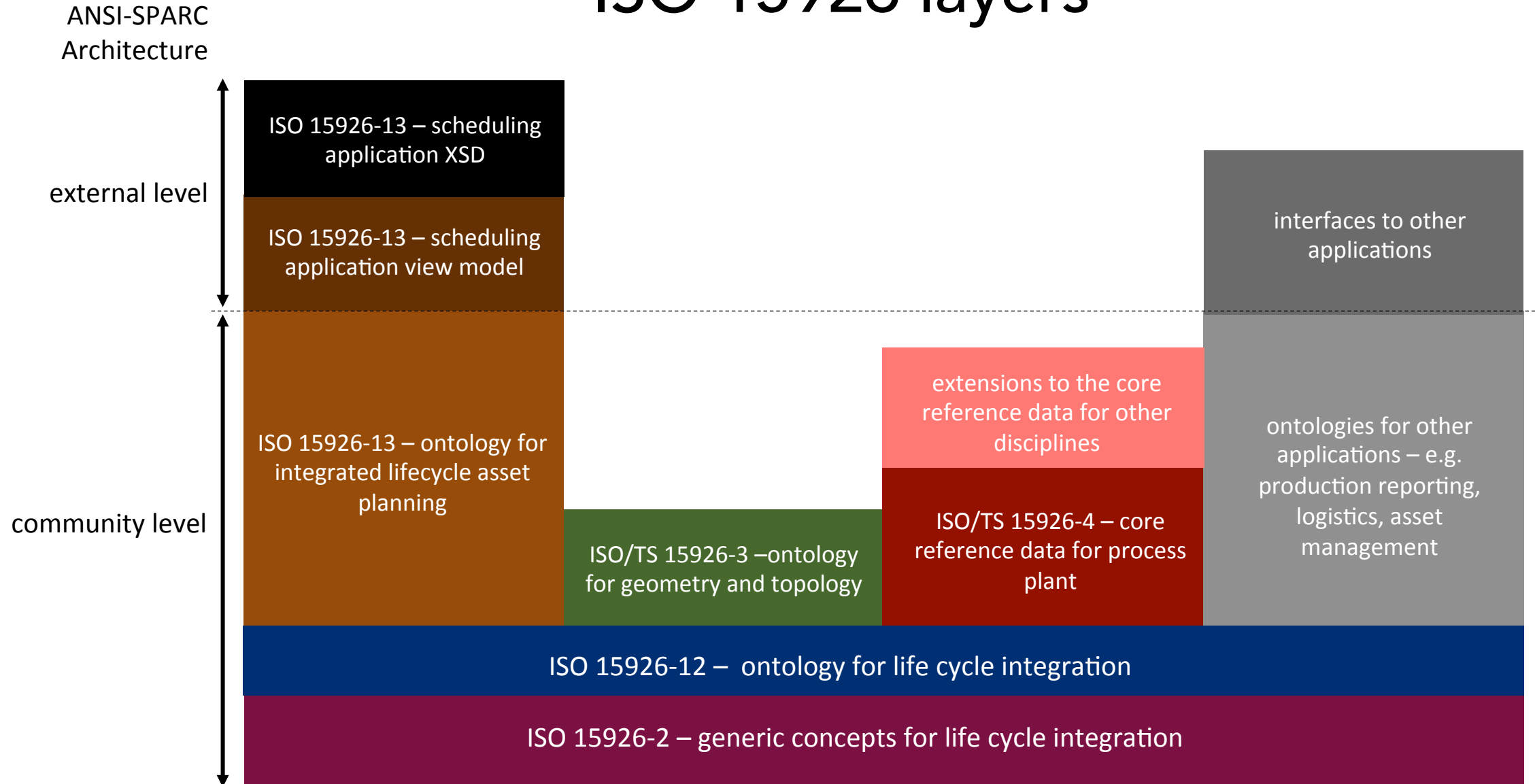# The role of ISO 15926 in integrating data from different sources in the Norwegian Oil and Gas industry

David Leal, CAESAR Systems Limited

# ISO 15926 layers

ANSI-SPARC
Architecture

external level

community level

ISO 15926-13 – scheduling application XSD

ISO 15926-13 – scheduling application view model

interfaces to other applications

ISO 15926-13 – ontology for integrated lifecycle asset planning

extensions to the core reference data for other disciplines

ontologies for other applications – e.g. production reporting, logistics, asset management

ISO/TS 15926-3 –ontology for geometry and topology

ISO/TS 15926-4 – core reference data for process plant

ISO 15926-12 –  ontology for life cycle integration

ISO 15926-2 – generic concepts for life cycle integration

# What is an Ontology?

- A vocabulary that is used to make statements about the world an that is independent of application.

- Different business activities have different models with different scopes.

- But if the models are based on the same ontology, then where their scopes overlap the data is compatible.

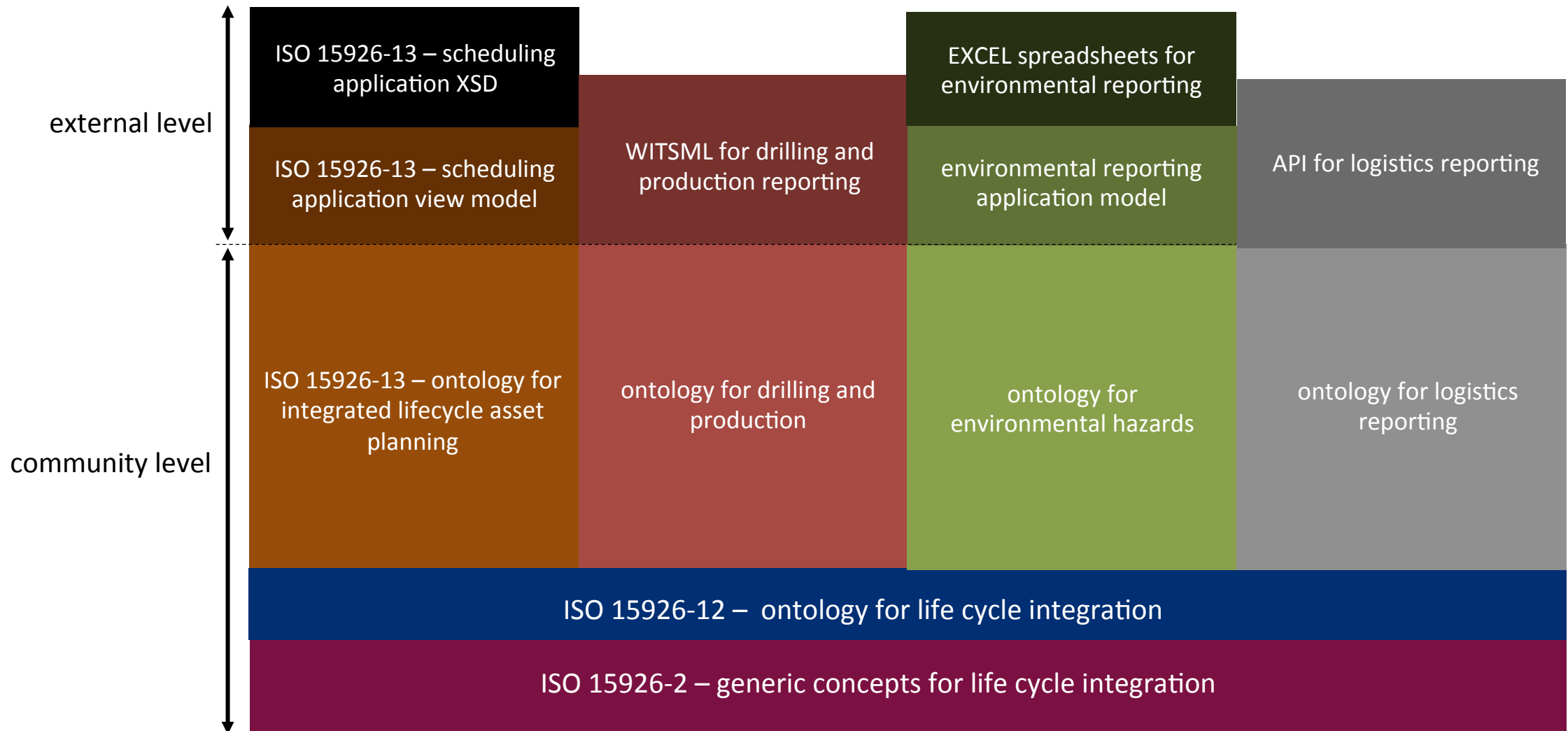- Semantic Web technologies make the use of ontologies practical in business.
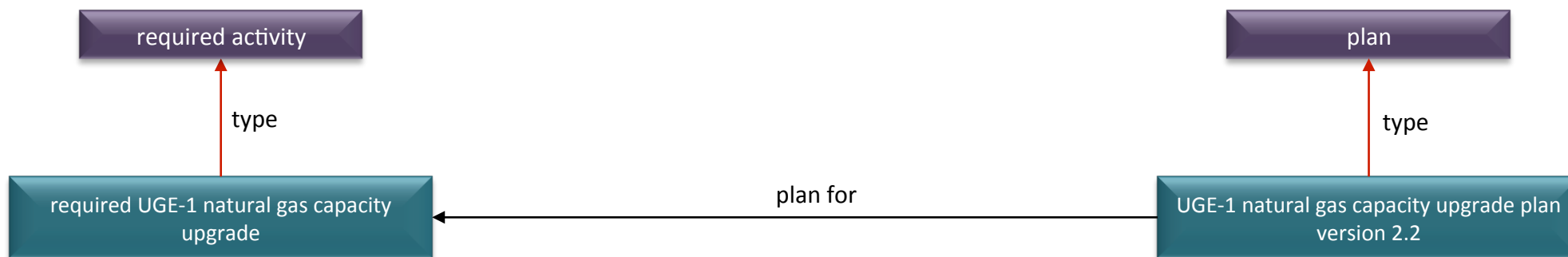


**ontology**: formal statement of an understanding of the world [ISO/CD 15926-12]

# EPIM Hubs

ANSI-SPARC Architecture

external level

community level

| ISO 15926-13 – scheduling application XSD | | EXCEL spreadsheets for environmental reporting | |
| ISO 15926-13 – scheduling application view model | WITSML for drilling and production reporting | environmental reporting application model | API for logistics reporting |
| ISO 15926-13 – ontology for integrated lifecycle asset planning | ontology for drilling and production | ontology for environmental hazards | ontology for logistics reporting |
| ISO 15926-12 –  ontology for life cycle integration | | | |
| ISO 15926-2 – generic concepts for life cycle integration | | | |

# EPIM Reporting hub

- Daily drilling reports, daily and monthly production reports

- Reports to government authorities
    - Safety compliance
    - Licence compliance
    - taxation

- Reports to partners in accordance with Joint Operating Agreements

- Internal company reports

**ERH is a single point of interaction for operators to aggregate, validate and communicate the information**
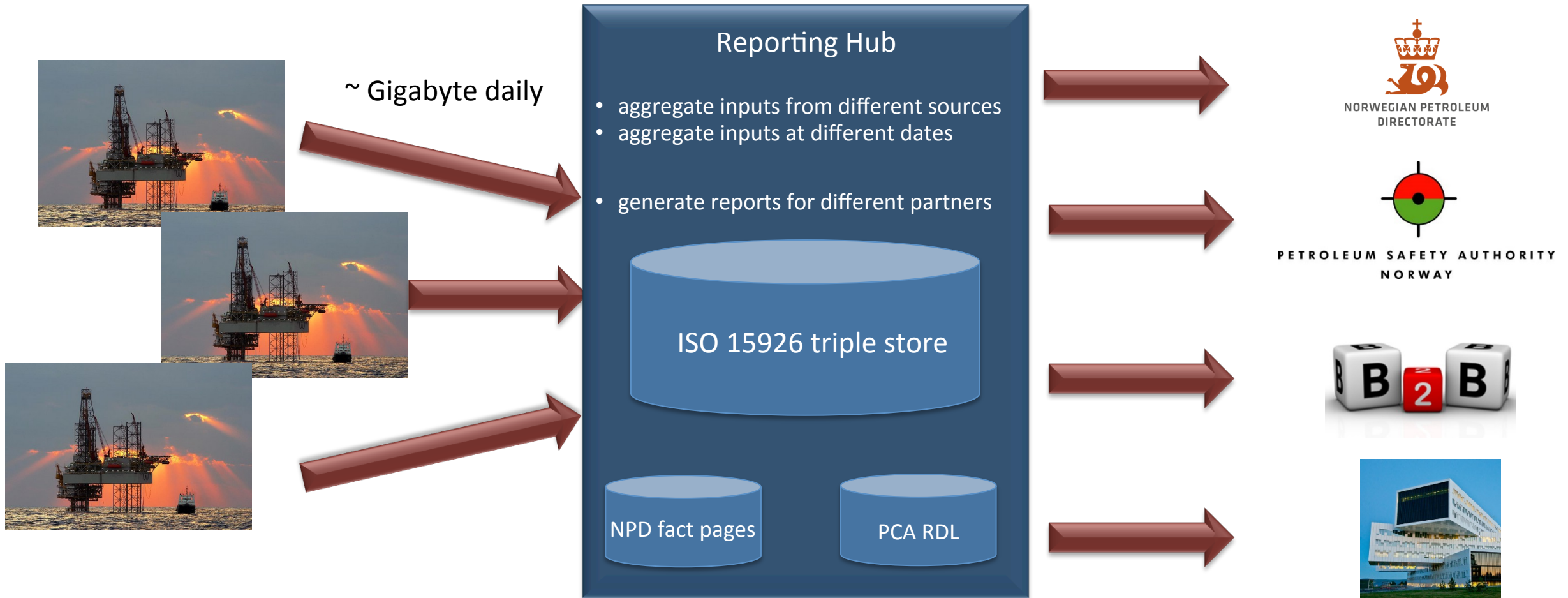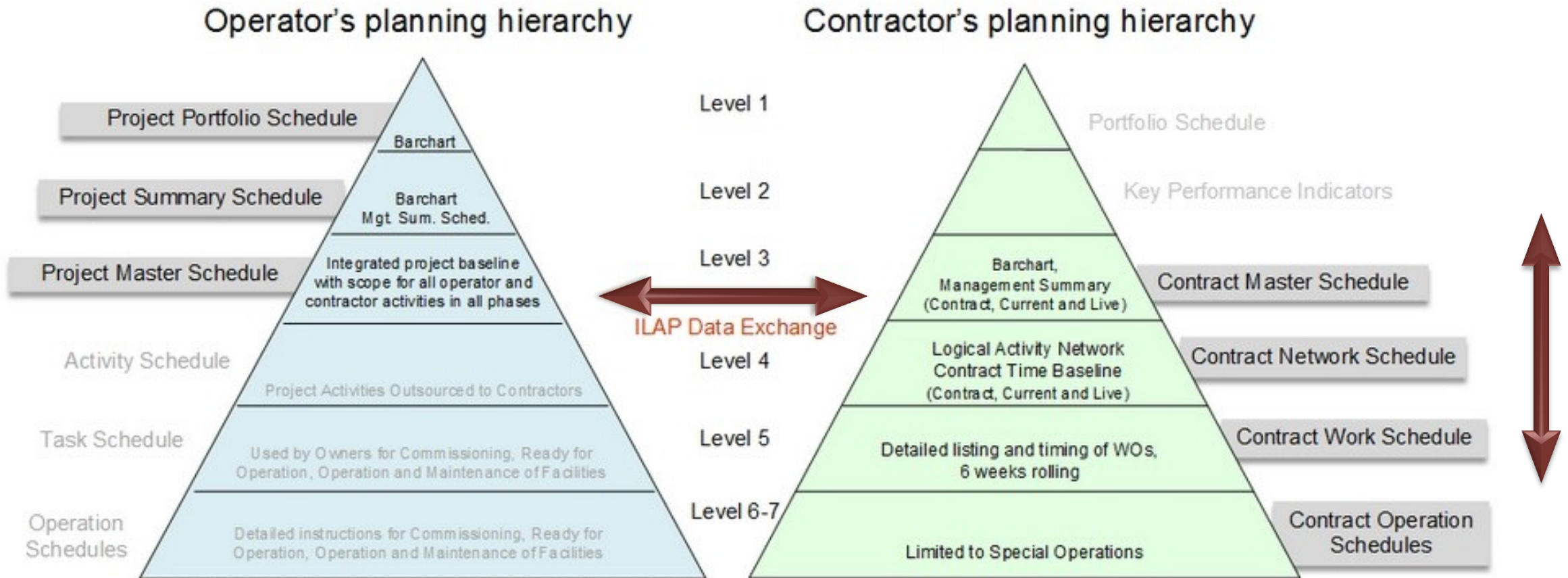
# Reporting hubs

- Drilling reporting hub users
  - BG, BP, COPNO, Exxon, Lundin, Marathon, Shell, Talisman, Total

- Production reporting hub users
  - Wintershall, GDF, Statoil, BP, COPNO

- Went live in December 2013

- Reports validated against the Norwegian Petroleum Directorate "Fact Pages"
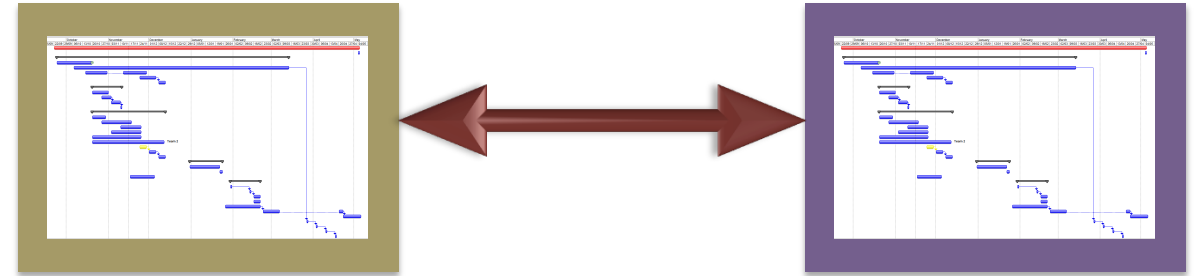
# Reporting hubs



~ Gigabyte daily

**Reporting Hub**

- aggregate inputs from different sources
- aggregate inputs at different dates

- generate reports for different partners

ISO 15926 triple store

NPD fact pages

PCA RDL

# ILAP – Integrated Lifecycle Asset Planning

- Support communication within the planning hierarchy



Operator's planning hierarchy / Contractor's planning hierarchy

Operator's side:
- Project Portfolio Schedule — Barchart (Level 1)
- Project Summary Schedule — Barchart Mgt. Sum. Sched. (Level 2)
- Project Master Schedule — Integrated project baseline with scope for all operator and contractor activities in all phases (Level 3)
- Activity Schedule — Project Activities Outsourced to Contractors (Level 4)
- Task Schedule — Used by Owners for Commissioning, Ready for Operation, Operation and Maintenance of Facilities (Level 5)
- Operation Schedules — Detailed instructions for Commissioning, Ready for Operation, Operation and Maintenance of Facilities (Level 6-7)

ILAP Data Exchange

Contractor's side:
- Portfolio Schedule (Level 1)
- Key Performance Indicators (Level 2)
- Contract Master Schedule — Barchart, Management Summary (Contract, Current and Live) (Level 3)
- Contract Network Schedule — Logical Activity Network Contract Time Baseline (Contract, Current and Live) (Level 4)
- Contract Work Schedule — Detailed listing and timing of WOs, 6 weeks rolling (Level 5)
- Contract Operation Schedules — Limited to Special Operations (Level 6-7)

# ILAP – Integrated Lifecycle Asset Planning

- funded by:
  - ConocoPhillips Scandinavia AS
  - ENI Norge AS
  - Statoil Petroleum AS

- contractor:
  - EPIM (Exploration and Production Information Management Association) - www.epim.no
  - established and governed by operators on the Norwegian Continental Shelf

- standardisation:
  - PCA (POSC Caesar Association) - www.posccaesar.org
  - a major driver of ISO 15926 development

- interface development
  - Safran, Primavera, SAP

# Legacy systems and ISO 15926

existing interfaces and exchanges – some standard, some proprietary
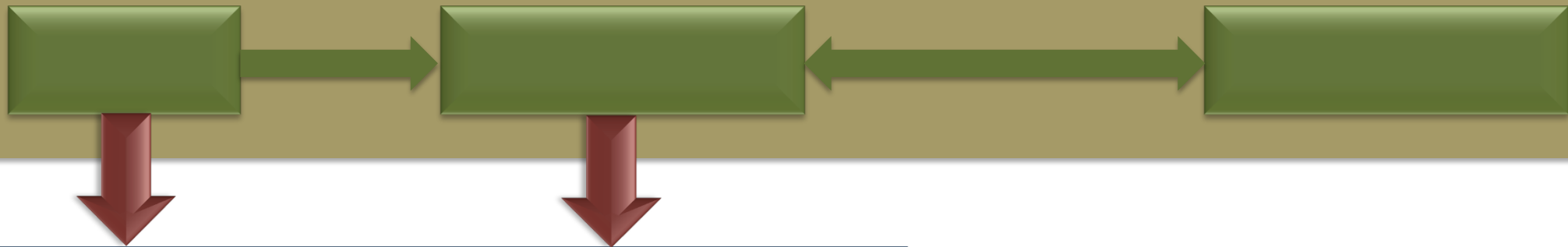
ISO 15926 data integration

multiple plans for same project → evolution through time

multiple plans for same facility → conflicts between plans

multiple drilling reports for same facility → regulatory oversight

multiple productions reports for same facility → time history

multiple productions reports for adjacent facilities → interactions

production and environmental reports → analysis of activities

plans and logistics reports → monitoring of plans

Completely new applications working on merged data

# EPIM "hubs"

- reporting hub
  - drilling and production reporting
  - statutory requirement for operators on the Norwegian Continental Shelf
  - legacy – WITSML standards from Energistics

- EQ (equipment) hub
  - standard format for equipment information

- environment hub
  - environmental impact reporting
  - statutory requirement for operators on the Norwegian Continental Shelf
  - legacy – standard Excel spreadsheets
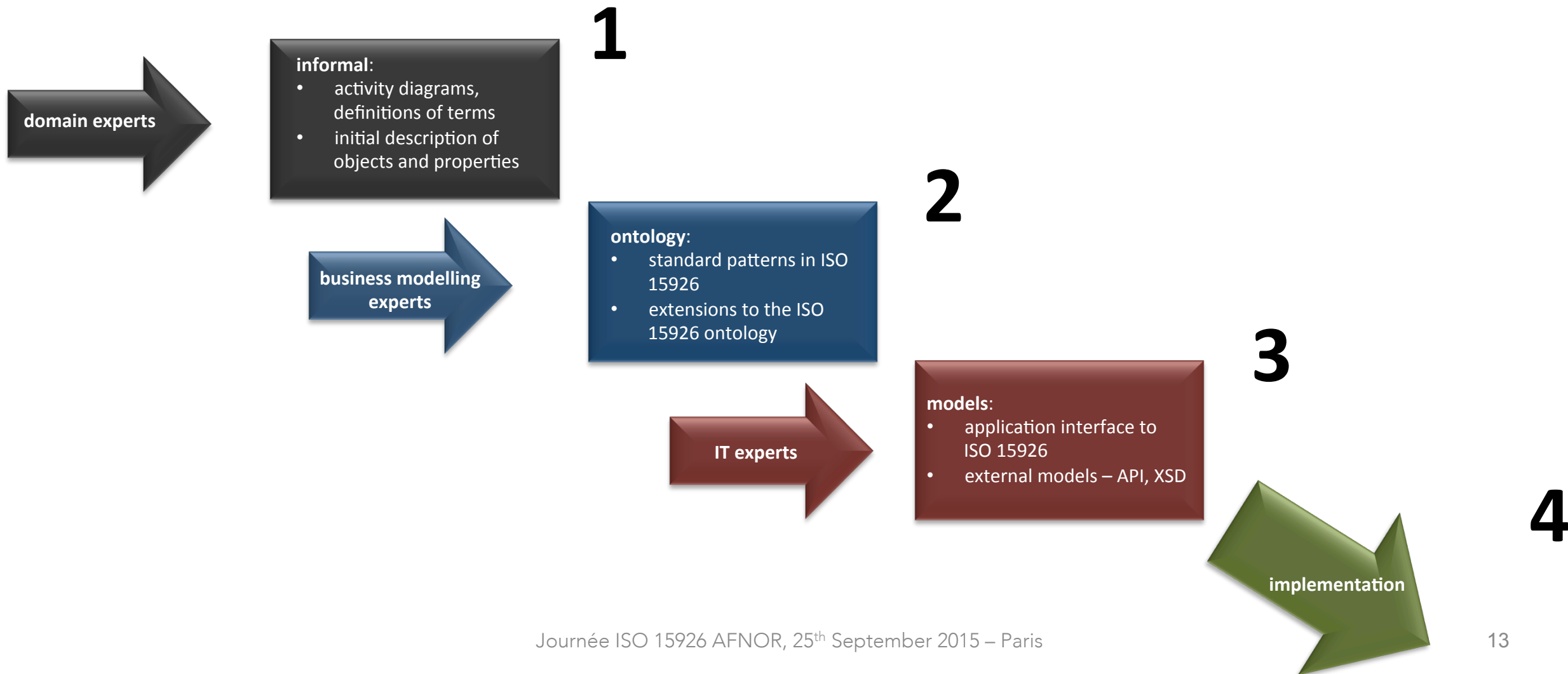
- logistics hub
  - tracking of CCUs (Cargo Carrying Units) along the supply chain

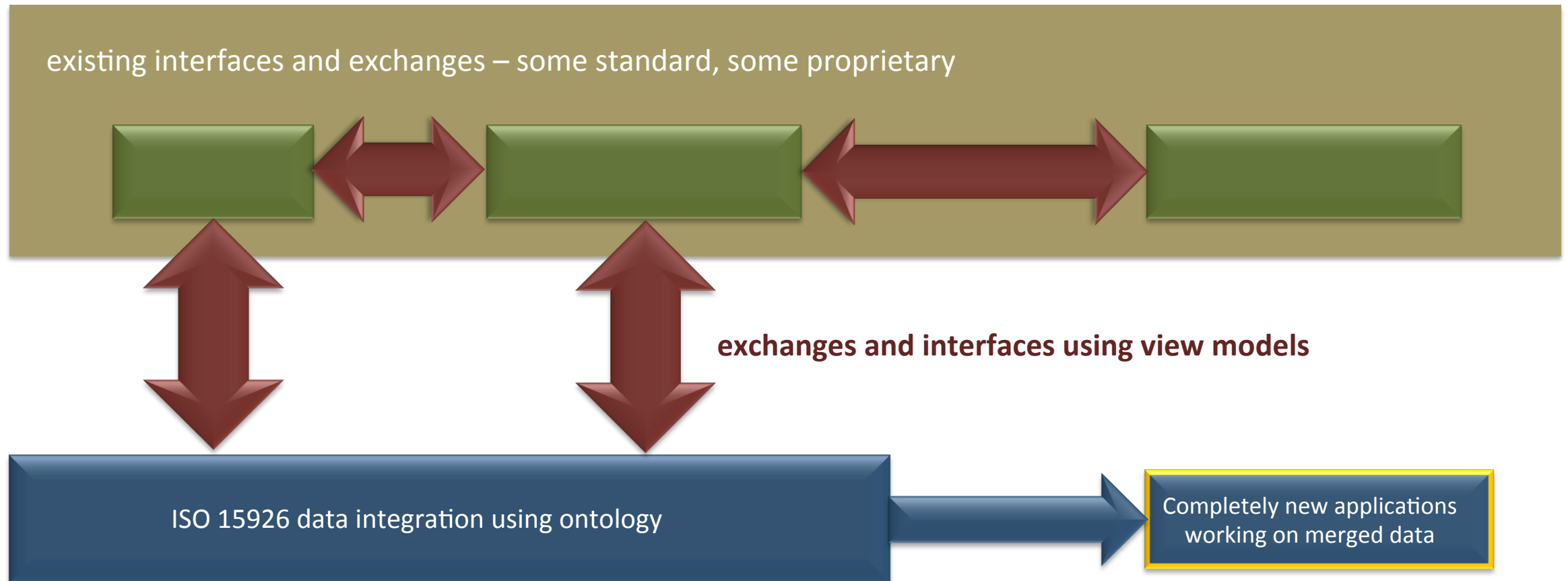# A standardised development approach

## baseline:

- semantic web technologies
    - RDF, OWL, SPARQL, triple stores
    - increasingly regarded as mainstream

- ISO 15926 model
    - practical, validated 4D ontology
    - usage defined in ISO 15926 part 2
    - represented as OWL in ISO 15926 part 12

- reference data
    - initial set in ISO 15926-2
    - oil and gas extensions in the PCA RDL

# A standardised development approach

## GIM (Generic Information Modelling) methodology:

**1**

**domain experts** →

**informal**:
- activity diagrams, definitions of terms
- initial description of objects and properties

**2**

**business modelling experts** →

**ontology**:
- standard patterns in ISO 15926
- extensions to the ISO 15926 ontology

**3**

**IT experts** →

**models**:
- application interface to ISO 15926
- external models – API, XSD

**4**

**implementation**

# Legacy systems and ISO 15926 - again

existing interfaces and exchanges – some standard, some proprietary

exchanges and interfaces using view models

ISO 15926 data integration using ontology

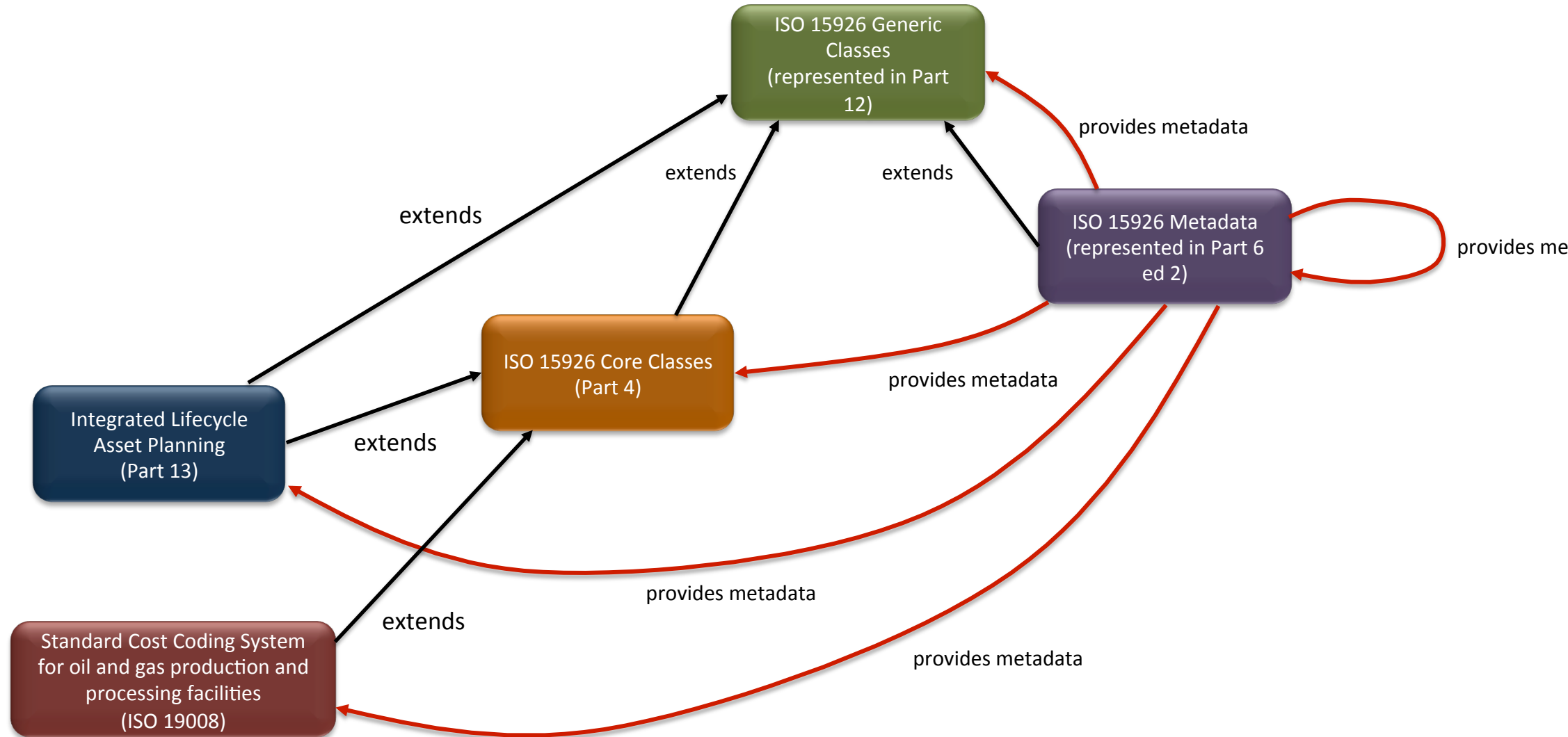Completely new applications working on merged data

**reliable and extensible exchanges and interfaces defined with respect to the ISO 15926 integration model**

# ISO TC 184/SC 4 future architecture
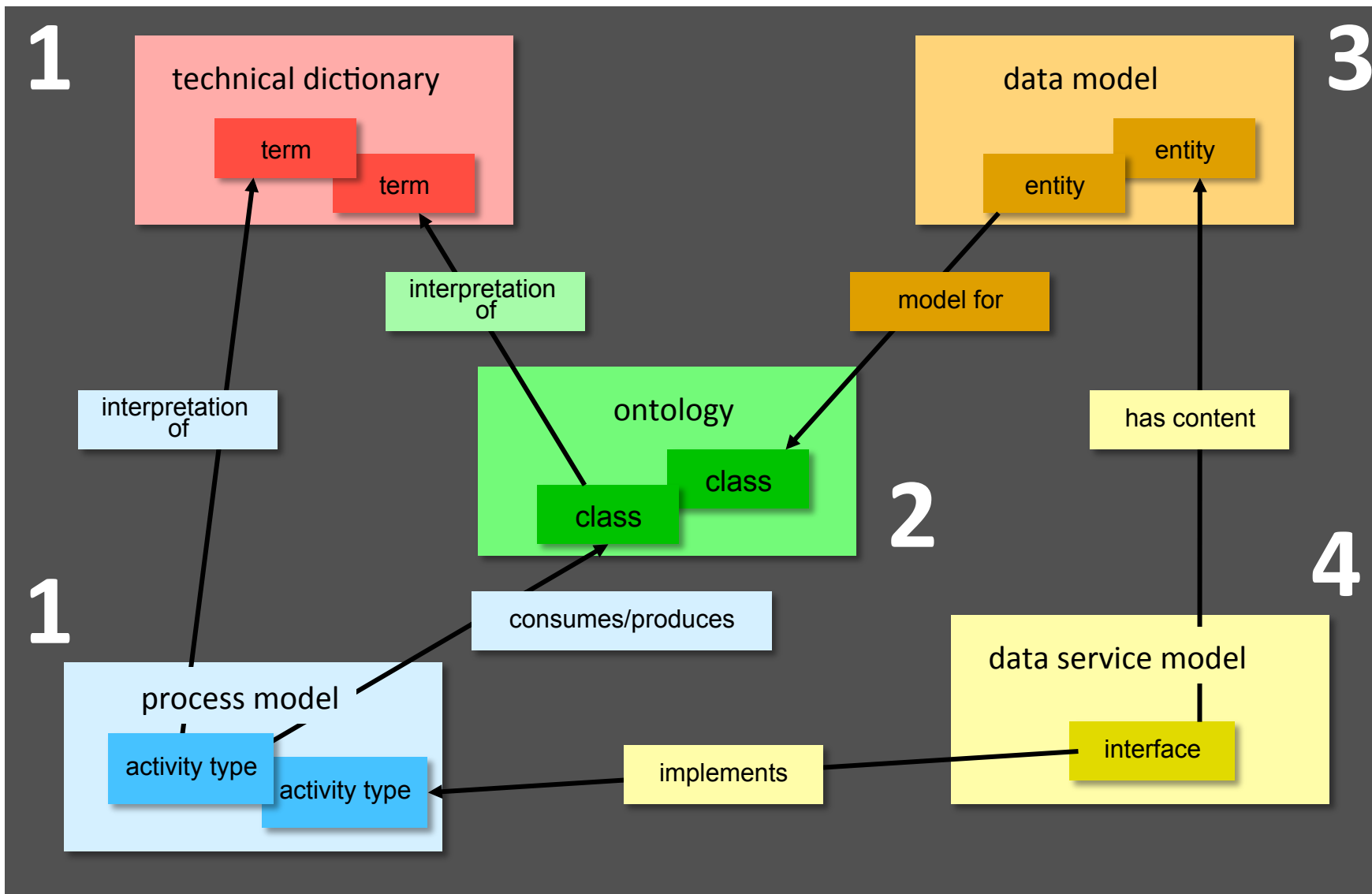
# Layering of ontologies in ISO 15926

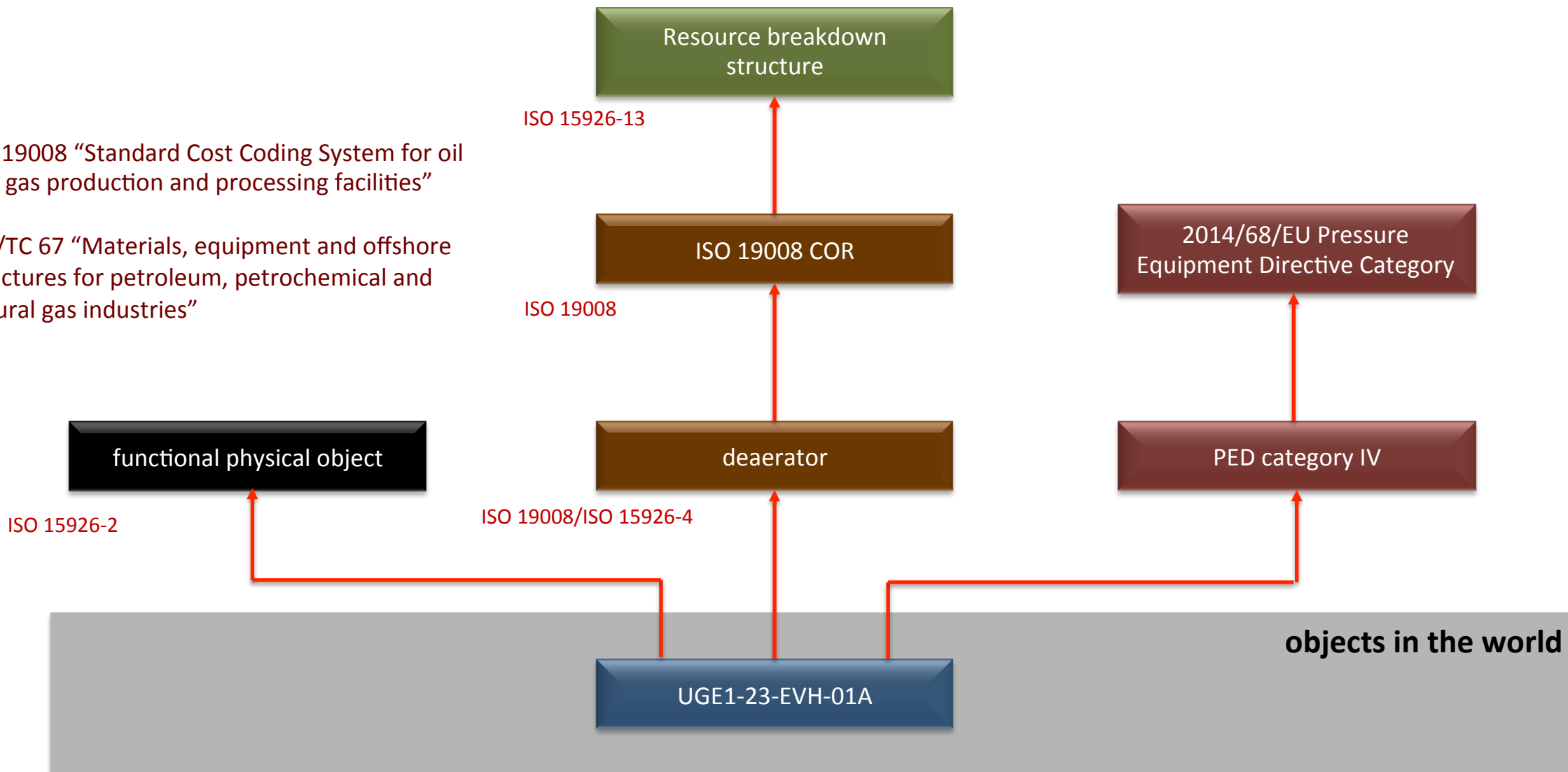# What is special about ISO 15926?

- based upon objects that exist in the world and their classifications

- formal approach to the modelling of change
  - "4D" – compatible with engineering analysis
  - intuitive to engineers

- formal approach to the modelling of roles
  - roles are objects
  - they have properties

## described in part 2, represented as OWL in part 12

# Objects and classifications

ISO 19008 "Standard Cost Coding System for oil and gas production and processing facilities"

ISO/TC 67 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries"

Resource breakdown structure

ISO 15926-13

ISO 19008 COR

ISO 19008

2014/68/EU Pressure Equipment Directive Category

functional physical object

deaerator

PED category IV

ISO 15926-2

ISO 19008/ISO 15926-4

objects in the world

UGE1-23-EVH-01A

# A challenge – documentation and education

**1**

Definition of concepts in natural language

Descriptions of relationships in a mixture of language and informal diagrams

Descriptions of business scenarios – more or less informal

This step relies upon ISO 15926 knowledge, and particularly the methodology described in ISO 15926-2. Projects such as the EPIM "hubs" have created standard implementation patterns.

People are needed to apply the ISO 15926 approach

**2**

An ontology represented in OWL that complies with the philosophy of ISO 15926-2 and that is an extension of ISO 15926-12.
In may cases, little extension is required, but merely documentation of how the existing ISO 15926-12 ontology is used.

This step requires general IT and Semantic Web knowledge.

The application ontology or model is often derived from legacy systems.

The mapping can be implemented in languages such as SPIN.

**3**

An application ontology or model that supports a business scenario that is mapped to the ISO 15926 ontology

# Conclusion

- The EPIM hubs are a successful implementation of:
  - exchange formats and interfaces derived from ISO 15926 ontologies
  - integration of data based upon ISO 15926 ontologies
  - semantic web technologies and triples stores handling gigabytes of data

- ISO 15926 ontologies are a key part of a development process that leads to compatible exchange formats and interfaces

- ISO 15926 provides a high level of semantic precision because definitions are held in an ontology/reference data library and are not re-invented for different exchange formats and interfaces

- **Data integration via ISO 15926 with Semantic Web technologies works and is scalable**