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New collaboration model for environmental monitoring

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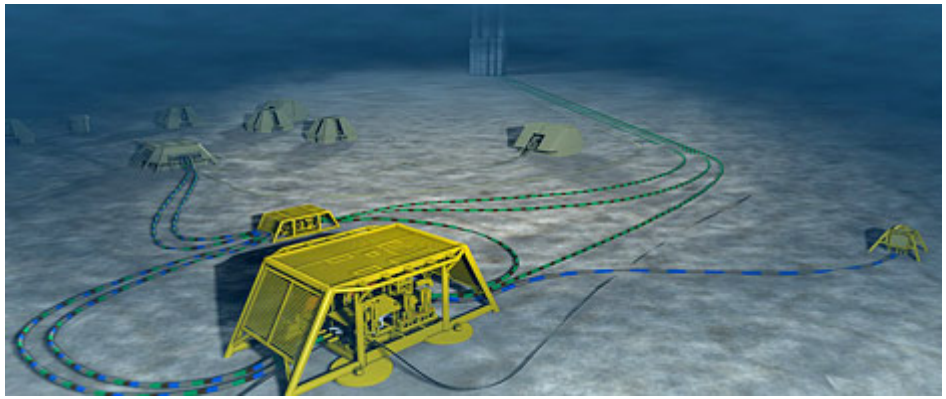
Scope for the presentation

- Introduction and business context
- Environmental monitoring concepts and challenges
- Research and technology development areas
- Semantic challenges

Subsea equipment

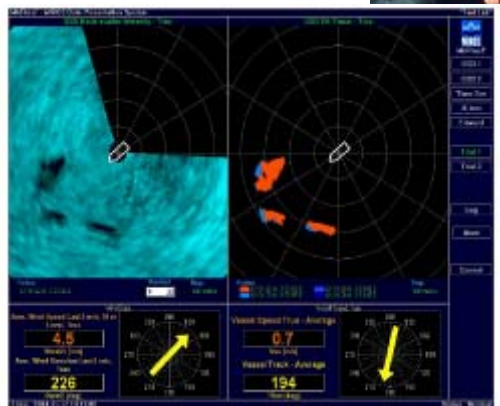
Increasing complexity



Current Practice - Monitoring regimes

To be carried out by independent 3rd party

- Point samples of selected physical/chemical and biological parameters
  - Sediments
  - Water column
  - Soil
  - Ground water
- Remote sensing
- Follow-up after spills
- Visual surveys



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Current Practice - challenges

- Flexibility
  - Monitoring must be suited to the actual habitat
  - Physical sampling may harm sensitive habitats
- Response time of point sampling
  - Significant time lag between impact occurrence and detection
- Cost-effectiveness
  - Can be improved through integration in design and operations

Infrastructure and sensor platform (example)

CEM (Cable end module)

- Subsea connection to infrastructure (communications and power)
- Connection for sensor platform

Lander

- Echo sounder, environmental sensors

Paradigm shift

From “expeditionary” offline sampling

To continuous environmental monitoring

Gain

licence to operate

by demonstrating

prudent operations in sensitive areas

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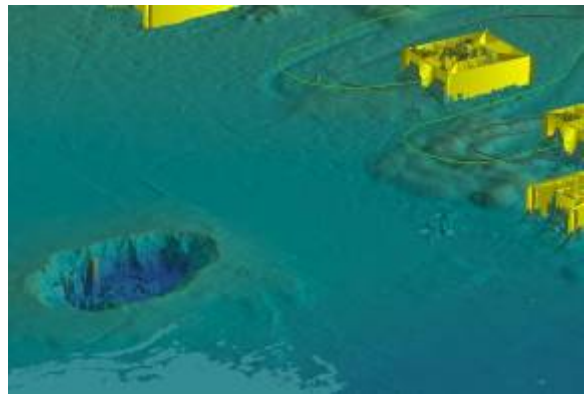
Business case illustrations

Monitoring in challenging areas

- Areas covered with ice periods of the year
  - Combine environmental and condition monitoring of equipment
- Discharge permits for planned operations
  - Corals and drill cuttings discharges at Morvin
- Areas with activities restrictions parts of the year
  - Longer activity windows
- Sensitive areas
  - Coastal areas of particular interest e.g. Nordland VII
  - Calcareous algae Peregrino

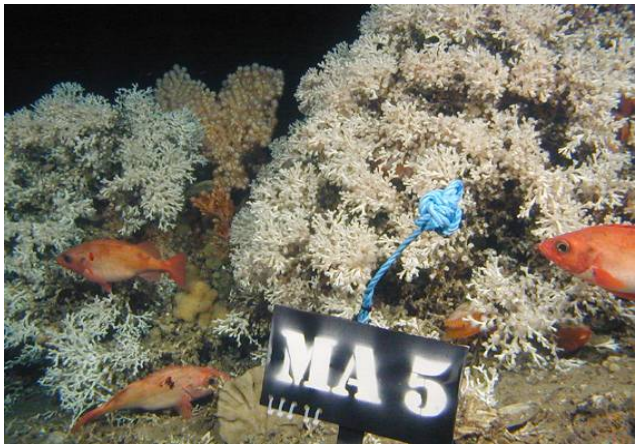
Condition monitoring

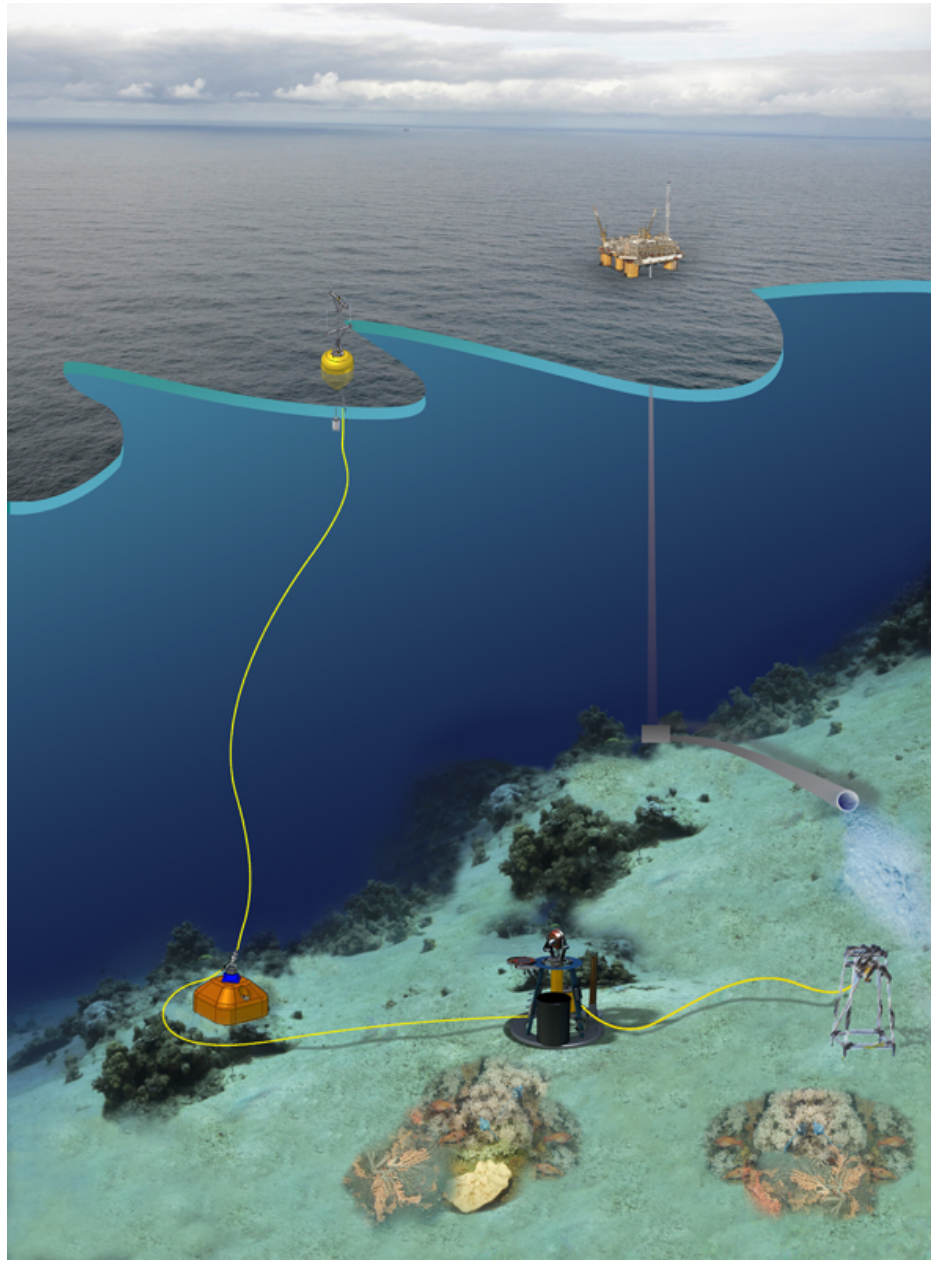
- Production leaks (subsea and surface) and technical condition
- Leaks from injections (produced water, drill cuttings, CO_2)



Morvin, Norway

- Located in the Norwegian sea
- Area with cold water coral structures
- On-line monitoring before, during and after drilling
  - Physical/chemical data
  - Visual monitoring
- Real time monitoring proved no harm to the coral structure





What do we want to measure?

Sensor/Parameter	Parameter	Data type	Location
Echo sounder	Biological activity (presence of fish, sea mammals and corals etc), gas bubbles, particles in the water columns	Echogram, large data files that needs expert interpretation	Range
Camera with light	Visual observation	Video and/or still pictures	Range
Recording Doppler Current Profiler (RDCP) or equivalent	Current speed and direction Temperature Conductivity Pressure Oxygen Turbidity (amount of particles in water) Fluorescence	Time series, vector data Point data	Point source
Sediment trap		Samples to be analysed in the laboratory	Point source
Hydrophone	Biological activity	Echogram, large data files that needs expert interpretation	Range
Hydrocarbon sniffers	Presence of hydrocarbons	Point data	Point source

Development focus areas

1. Sensor technology
2. Communications infrastructure
3. Information access, interfaces, integrity and security
4. Information work spaces, collaboration and work practices
5. Environmental data analysis

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Integrated Environmental Monitoring

Business Operations
- Planning
- Decision making
- Workflow

Knowledge Sharing & Analytics
- Learning
- Analysis
- Sense making

Information & Collaboration
- Virtual interaction
- Coordination
- Shared awareness

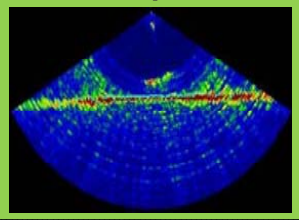
Intelligent Infrastructure
- Access
- Connect
- Sense

Asset control room

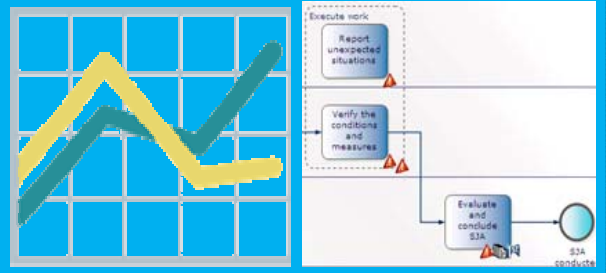
Central support functions

Emergency response

Domain experts



Information & work processes



External organisations

Sensors & sensor platforms

Existing sensors & sources

Stationary ocean observatory

Mobile

Background photo: Harald Pettersen

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Semantic challenges

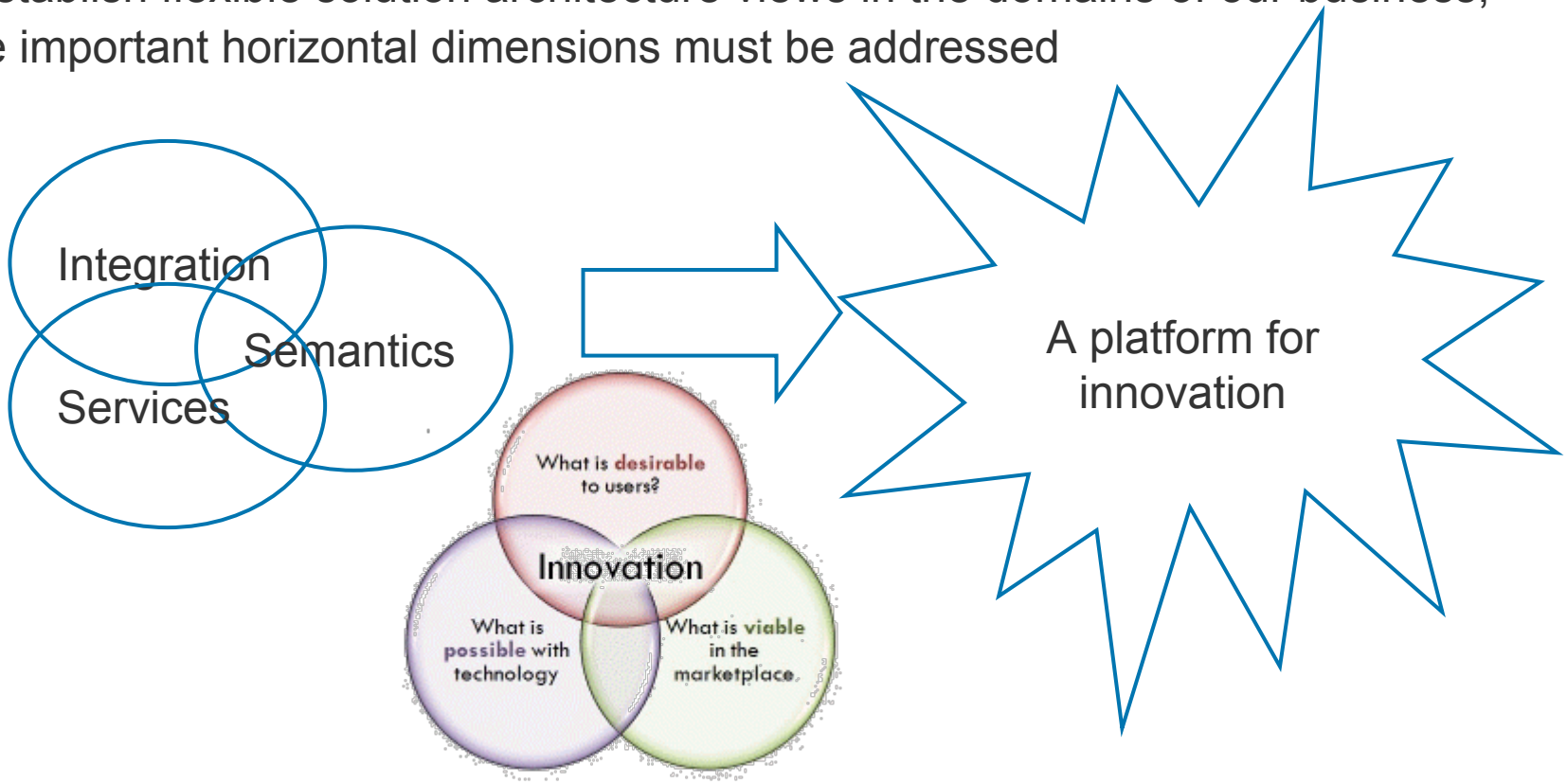
- Existence of numerous point to point solutions
- Very little system integration
- Poor level of standardization
- Need for semantic technologies in system integration

Semantic challenges
-More on the semantic model

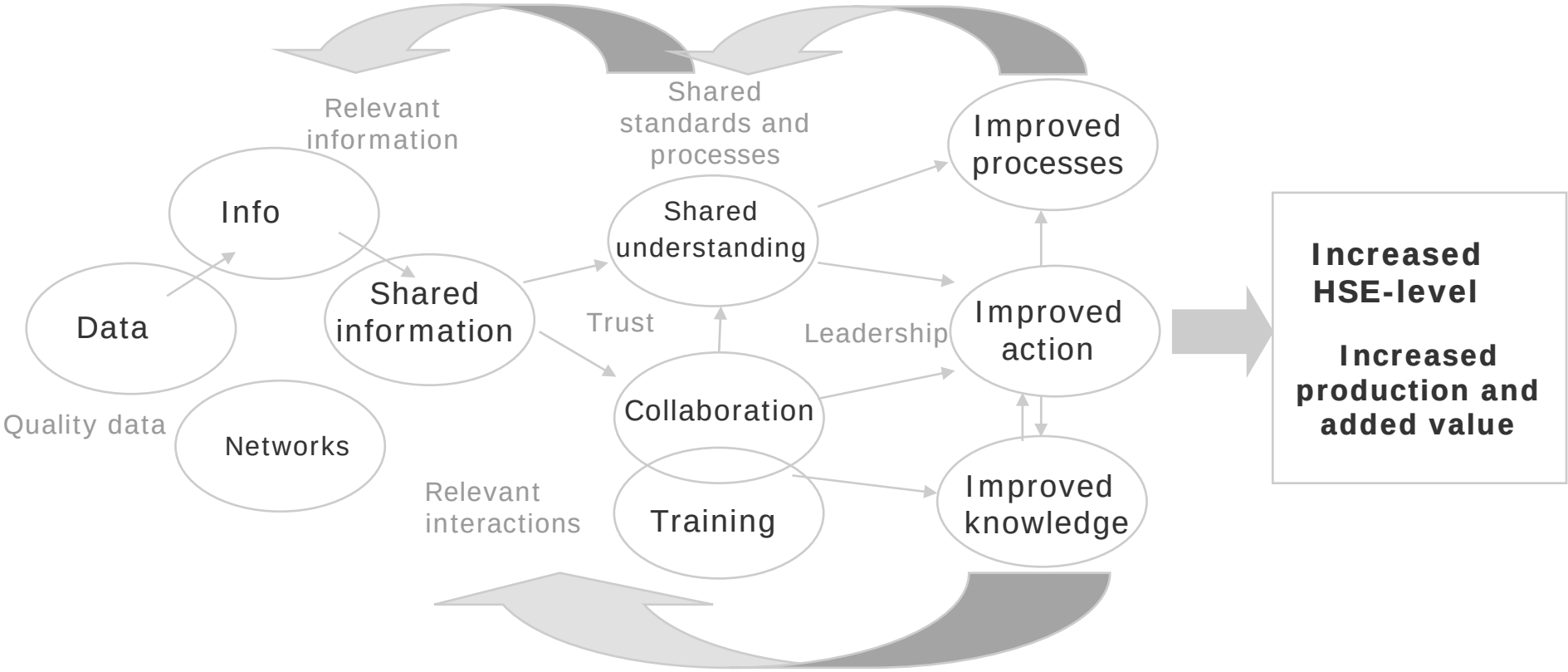
- Representing the domain complexity
  - Understanding the data captured and representing it using semantic technologies such as ontologies.
- Making sense of the data
  - Knowing what “environmental impact” is and applying modelling rules so that impact may be deduced.
- Given the different data sources e.g: oceanographic, echo sound, video, benthic data, weather data and spatial metadata:
  - What can we infer from this as new “knowledge”?
  - How will this new knowledge be used?
  - How will it affect/support daily operations?
- Integration: Mapping the new model to the Statoil’s new data integration layer

Driving innovation

- Architectural governance and integration technology guidance is needed to establish new solutions for environmental momitoring
- To establish flexible solution architecture views in the domains of our business, three important horizontal dimensions must be addressed



Taking the value out of semantics and the ontologies



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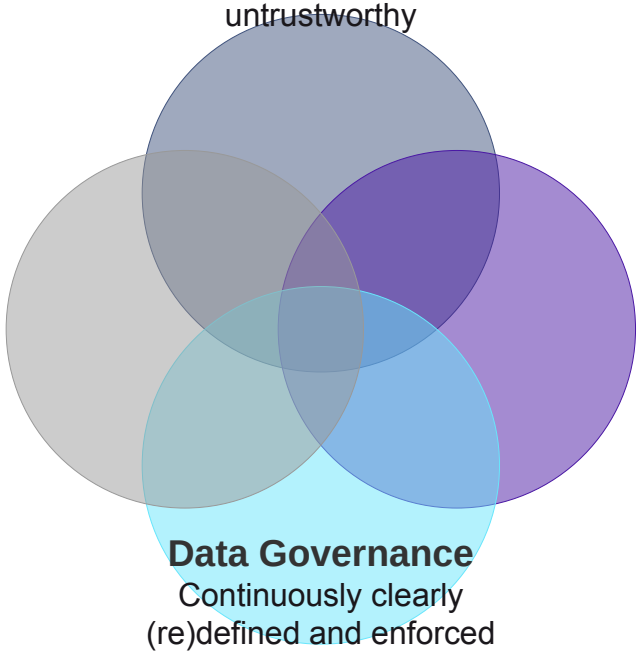
Global trends in Information Management increasingly reference the following 4 elements as critical pillars.

Data Quality
Without data quality information becomes unreliable and untrustworthy

Master Data Mgt.
Shared master data across the enterprise is fundamental to provide the business with a 'single truth.'



Meta Data Mgt.
Clearly defined and used key data throughout the enterprise provides consistency

Data Governance
Continuously clearly (re)defined and enforced Strategies, policies, guidelines & procedures ensure Effectiveness by supporting the business operations.

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Summary

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Thank you

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