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INGENIOUS SIMPLICITY

Enhanced Production optimisation and asset monitoring

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Agenda

1. Opportunity & Challenges
2. Subsea system
3. Integration subsea
4. Integration topside
5. Aging assets
6. Conclusion

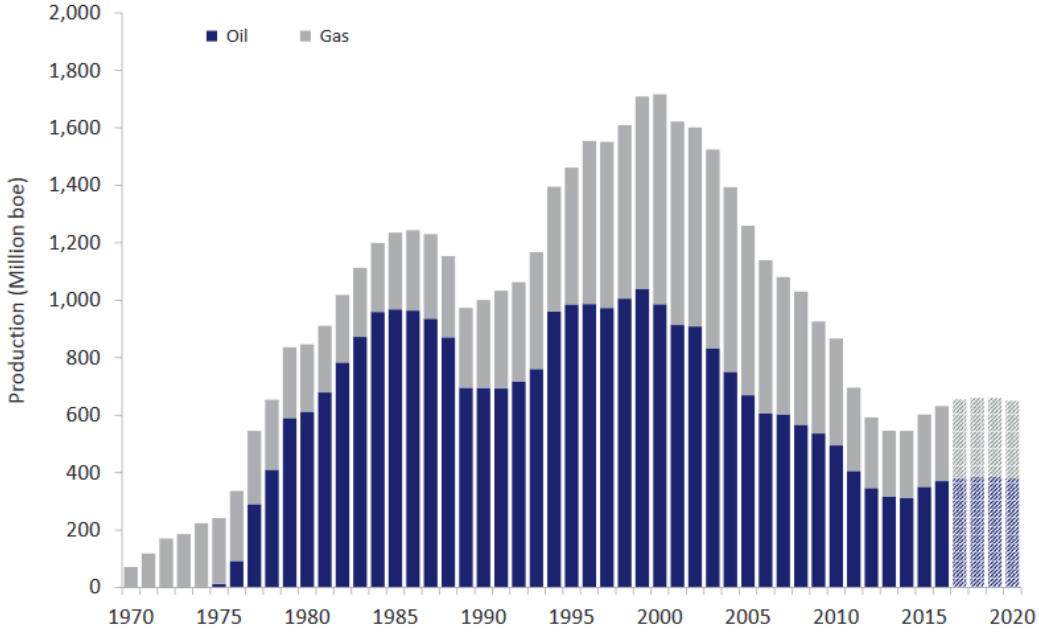
Industry demand / opportunities for digitisation

- **Environmental:** - Improved technology to reduce emissions and discharged fluids coupled with decommissioning of older assets;

- **Efficiency:** - The industry continues to strive to improve production efficiency in a climate of lower oil prices; technology can play its part

- **Aging Assets:** - opportunities for production optimisation, field extensions

With over **80%** of world energy use reliant on fossil fuels the maintenance and optimisation of these often aging subsea assets is an economic and moral necessity for the industry.



Source: Oil and Gas Authority, Oil & Gas UK

Key challenges faced by existing fields

- Performance limitations of existing technology;
  - Ability to support / integrate advanced instrumentation & standards [IWIS/SIIS]
  - Limited diagnostics to support / maintain and optimise existing system
- Open System;
  - Ageing electronics / technology limiting options
  - Proprietary interfaces / protocols limiting options
  - Ability to support new technology
- System reaching original design life limits;
  - Increased risk of unscheduled shutdowns
  - Higher maintenance costs
  - Requirement to provide additional system / asset integrity monitoring

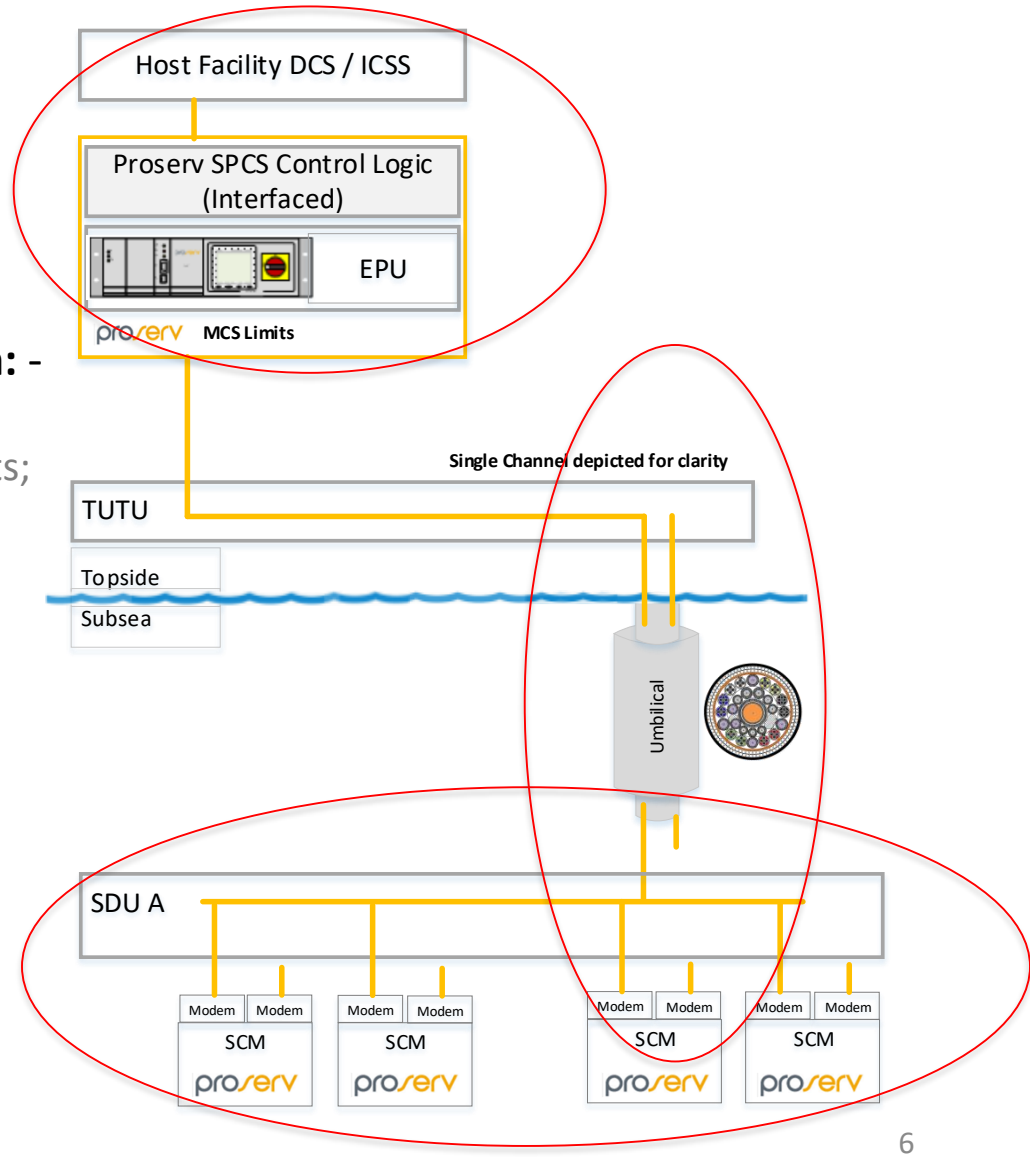
Subsea instrumentation / Devices

- New instrumentation
  - Multiphase meters
  - Sand detectors
  - Corrosion monitoring
  - Leakage detection systems
  - Expert diagnosis systems
  - Video surveillance
  - 4D seismology
  - Intelligent Well instrumentation
- Higher bandwidth
- Open interfaces

Instrument	Relative bandwidth requirement (min / max)
Pressure and temperature	Low
Flow meters	Low/Medium (Even High for some applications)
Sand detectors	Low/Medium
Corrosion monitoring systems	Low/Medium
Vibration monitoring devices	Medium/High
Subsea cameras	High
Acoustic monitoring systems	Medium
Valve / Injector Actuators	Low

Typical Subsea Production / Data System

- **Subsea Control / Data modules:** - provides control and monitoring of production system including provision of instrument interfaces;
- **Infield Umbilical(s) and Distribution:** - facilitates the required field power and communication distribution requirements;
- **MCS / EPU:** - providing system power, functional logic and integration to installation control and data systems;



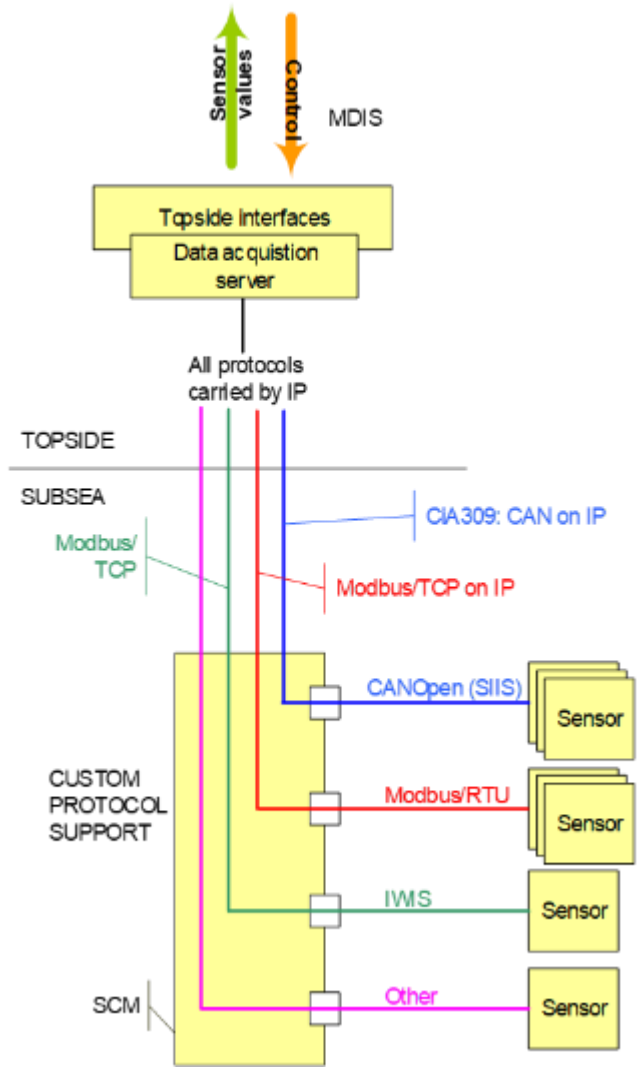
Standardisation of Subsea interfaces

- **Intelligent Well Interface Standardisation (IWIS): -** assisting the integration of down hole power, communication and control systems.

- **Subsea Instrument Interface Standardisation (SIIS):** - industry JIP which developed an open standard to provide compliant interfaces for device integration into the control system.

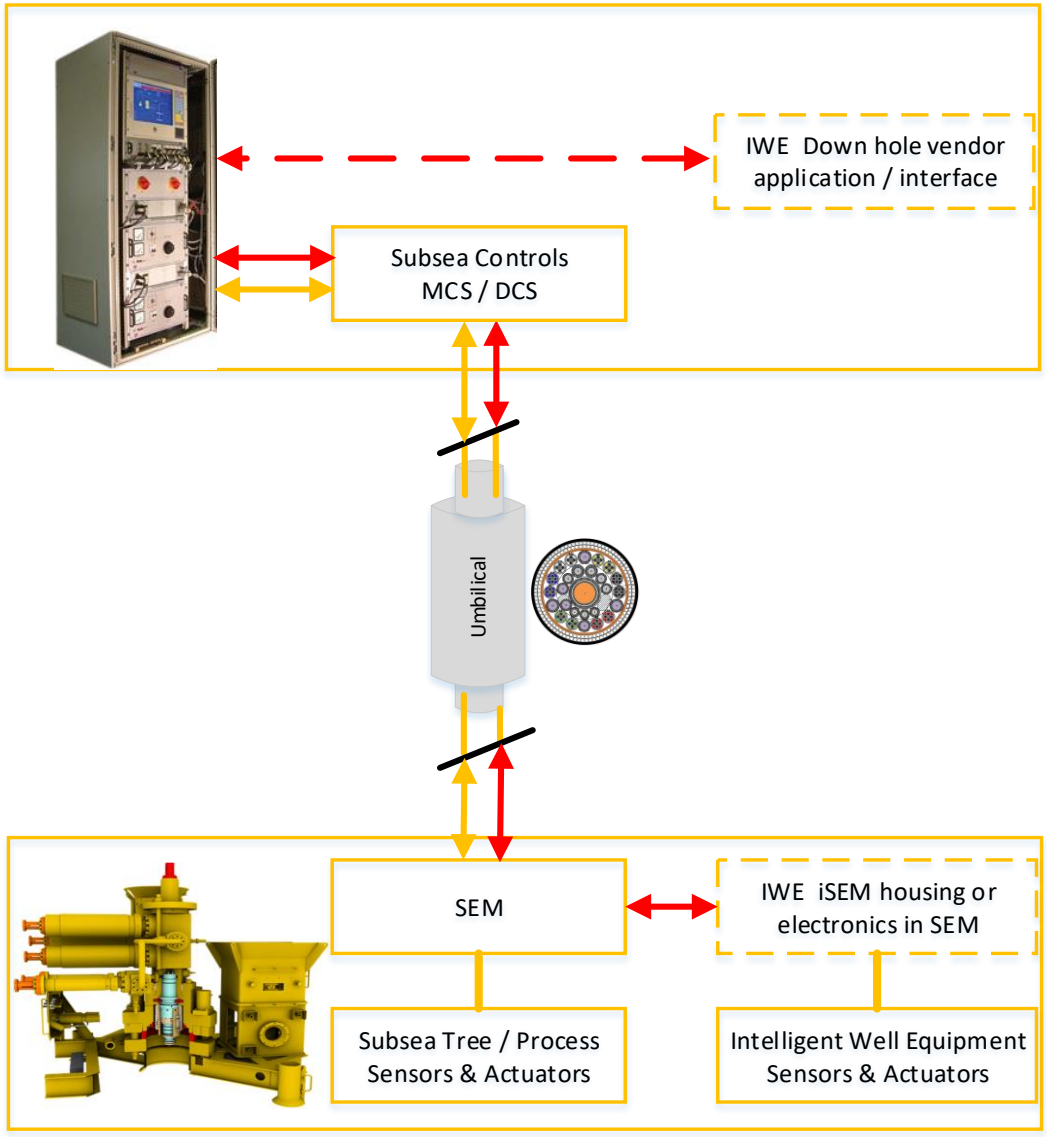
- **SEAFOM™: -** Joint Industry Forum aimed at promoting the growth of fibre optic monitoring system installations in the upstream oil and gas industry.

- **Subsea Wireless Group (SWiG): -** industry network promoting interoperability for subsea wireless communications (radio frequency, acoustic, free-space optic, inductive power, hybrid).



Standardisation of Subsea interfaces - IWIS

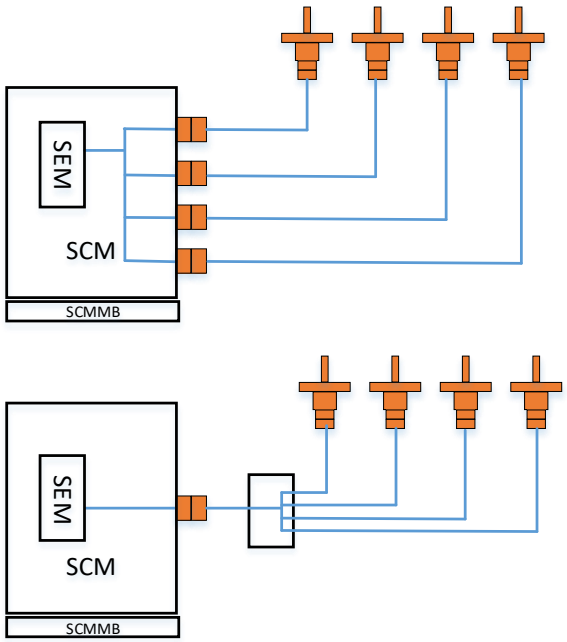
- **Concept of IWIS: -** to provide a transparent interface between IWE and topside vendor application;
- Well Pressure / Temperature monitoring;
- Intelligent well control;



SIIS L2 topology

Provides ‘subsea mateable’ interfaces from subsea control systems which do not have to be pre-defined in terms of the instrumentation to which they will subsequently be attached.

The communication protocol is CANopen (CiA 443) over an ISO 11898-3 (fault tolerant) physical layer [default bit-rate 50kbit/s].



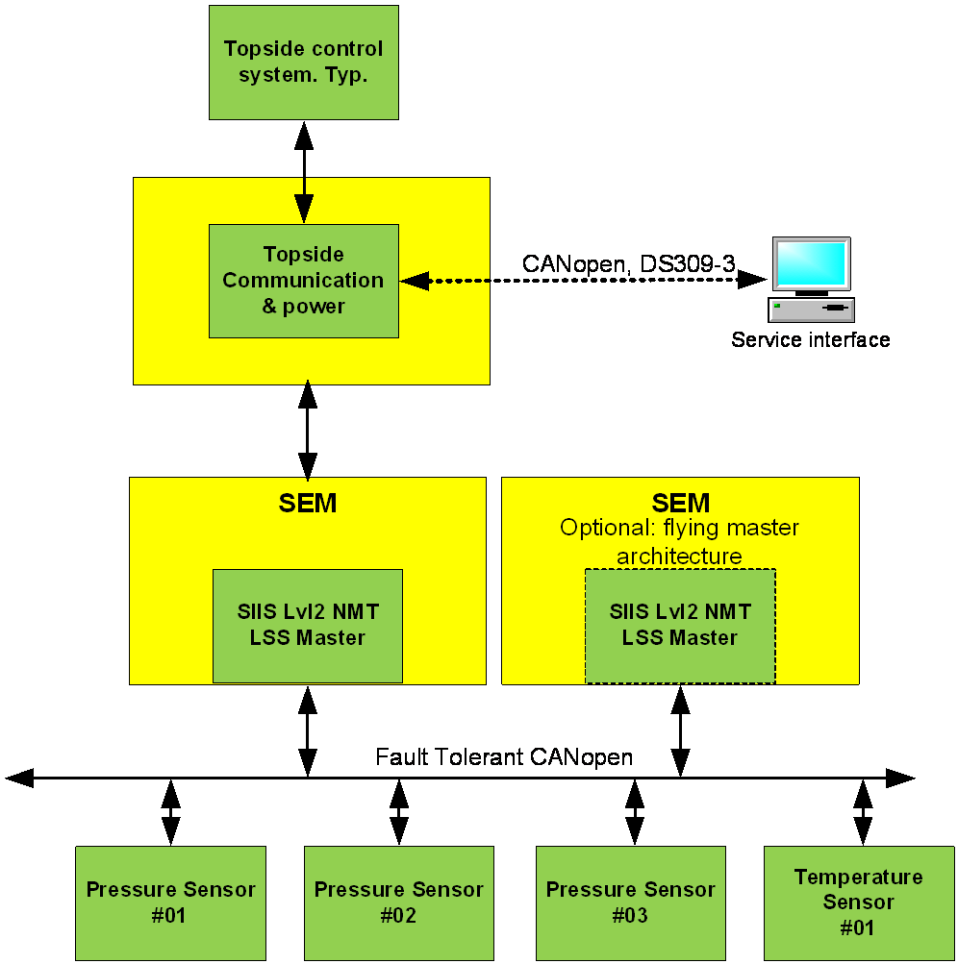
Basic CANopen interface configurations

SIIS level 2 supports multi-measurand devices that can be distributed on a multi-dropped ‘star’ topology

Inbuilt CAN node self detect and configuration;

Diagnostic data tunnel access to the device layer

SIIS L2 interfaces



SIIS level 2 architecture, providing transparent access to subsea devices

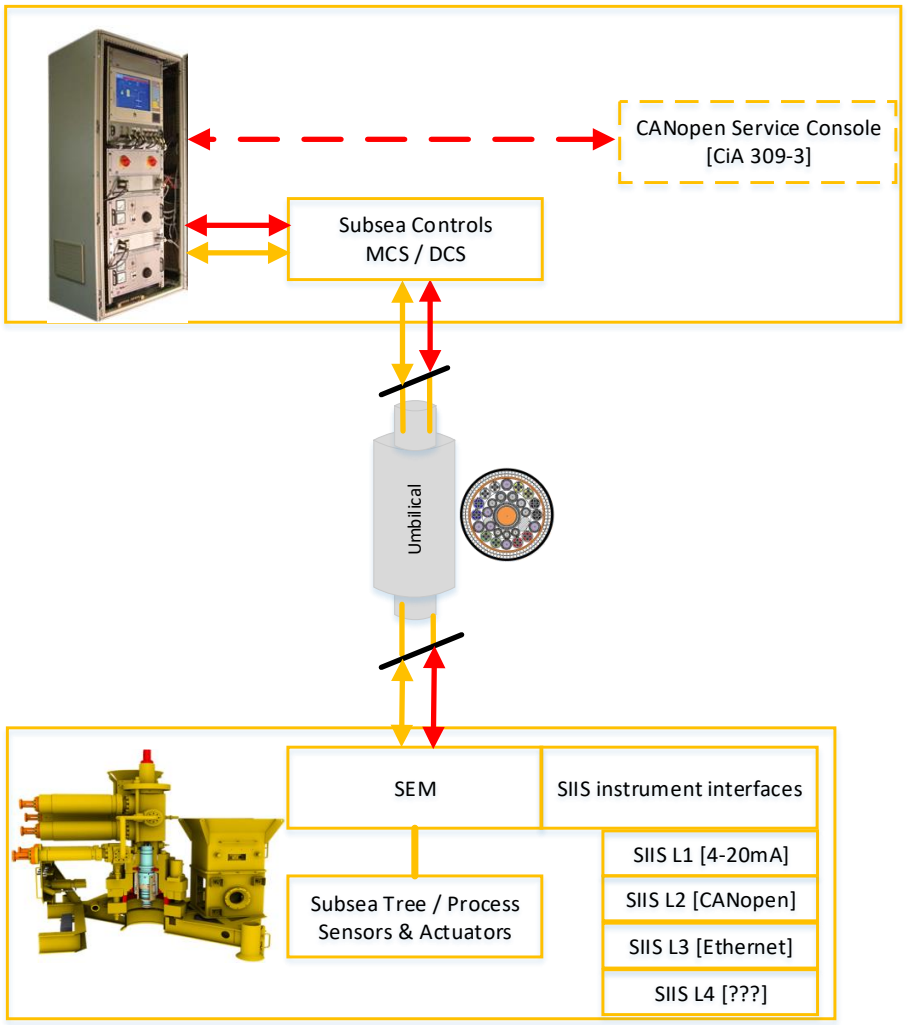
Standardisation of Subsea interfaces - SIIS

Concept of SIIS: - to provide options for device interfacing and integration into the SPCS;

Array of process instruments e.g. Pressure / Temperature monitoring;

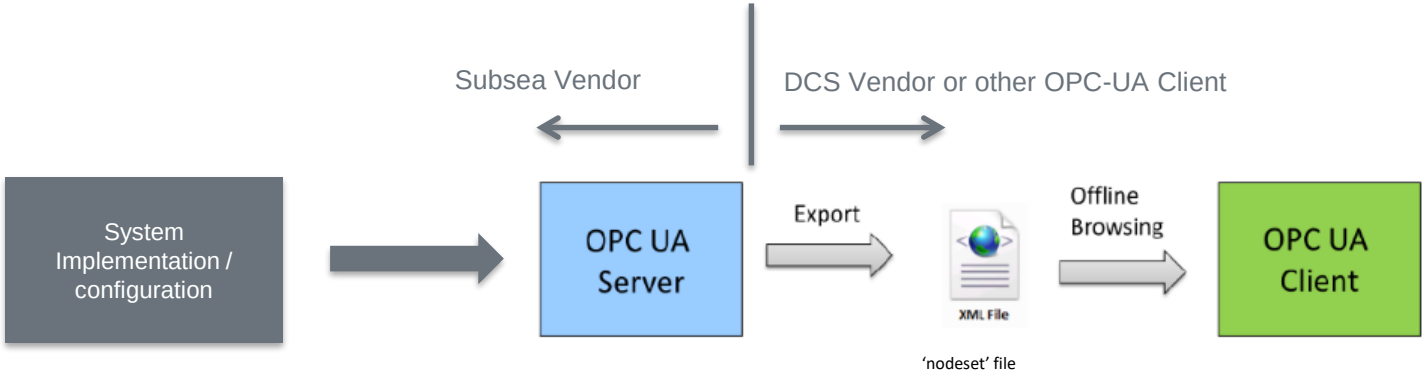
Specialist process and condition monitoring devices;

Could future instruments / devices be more interactive? Would the existing defined SIIS interfaces suffice.. room for an L4?



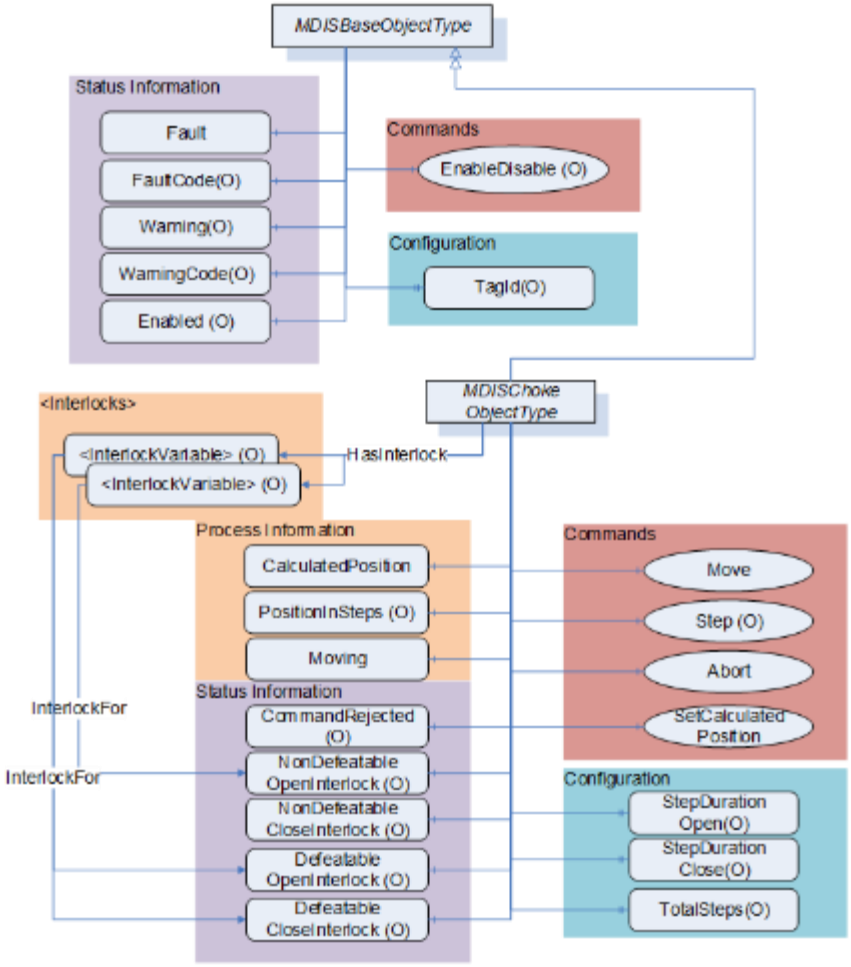
OPC-UA Interoperability

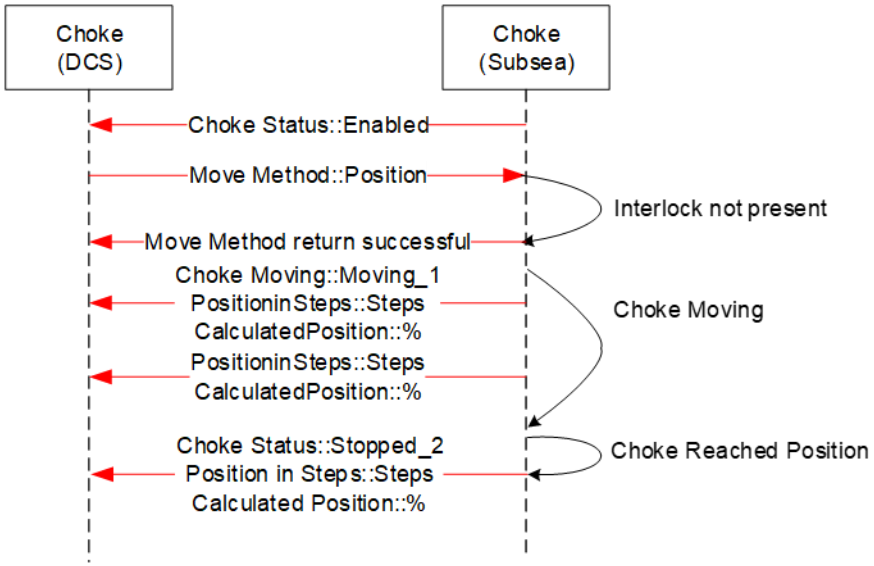
OPC UA provides an information model framework, which can expose vendor defined information in a standard way.
Importantly, **all OPC UA** clients are expected to be able to discover and use vendor defined information.



The MDIS specification is an example of an OPC UA Information Model designed to meet the needs of developers and users in the offshore oil and gas industry.

MDIS OPC-UA Objects Choke example





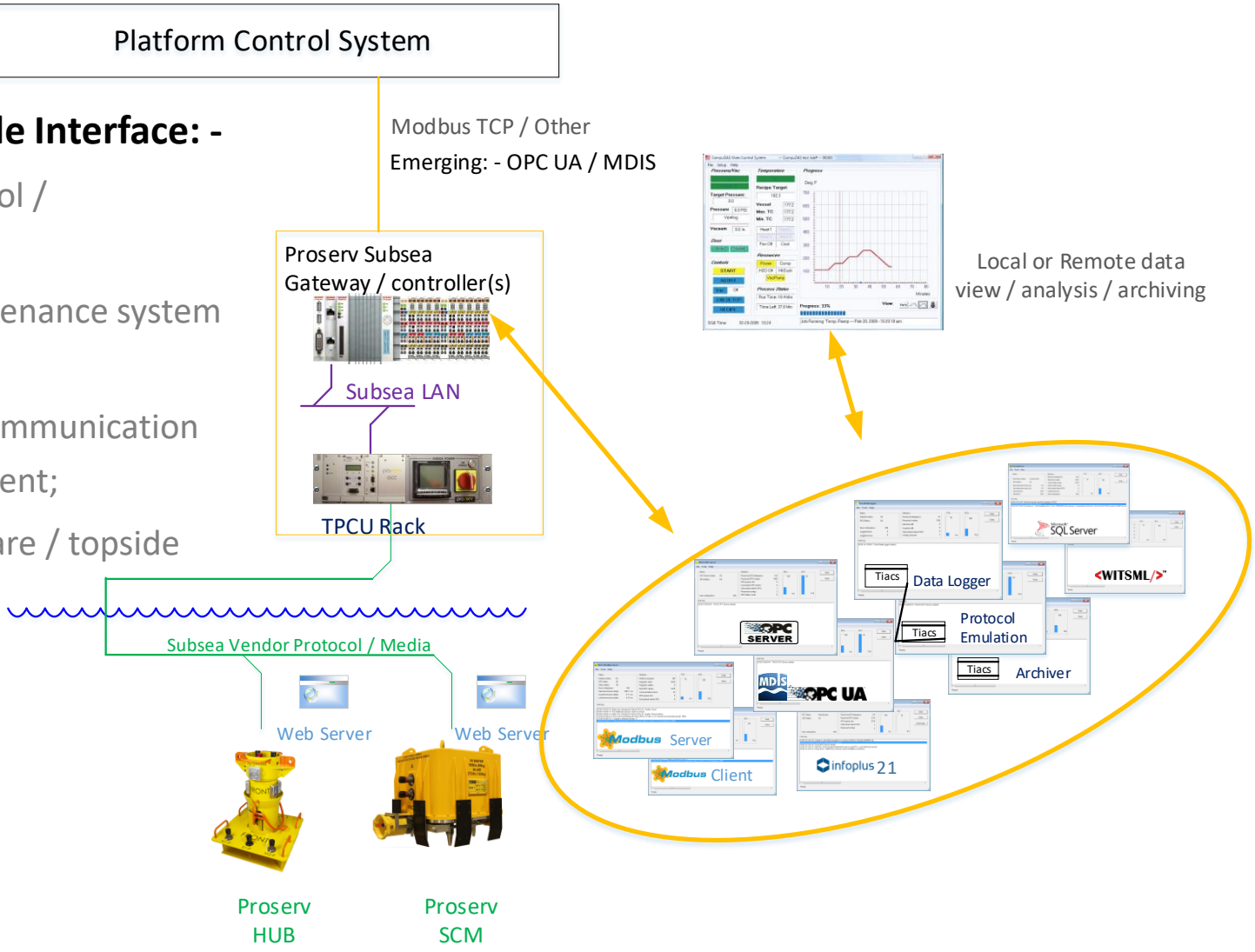
The object properties and behaviour is specified in the MDIS specification. The protocol is open and tools to test and verify is available.

It shall be easy and cost effective to integrate and test a DCS and MCS system in near future.

Topside Control / Monitoring Interface

Subsea Vendor Topside Interface: -

- Vendor specific control / communication logic;
- 3rd Party data / maintenance system integration;
- Subsea power and communication provision / management;
- Topside (DCS) hardware / topside integration;

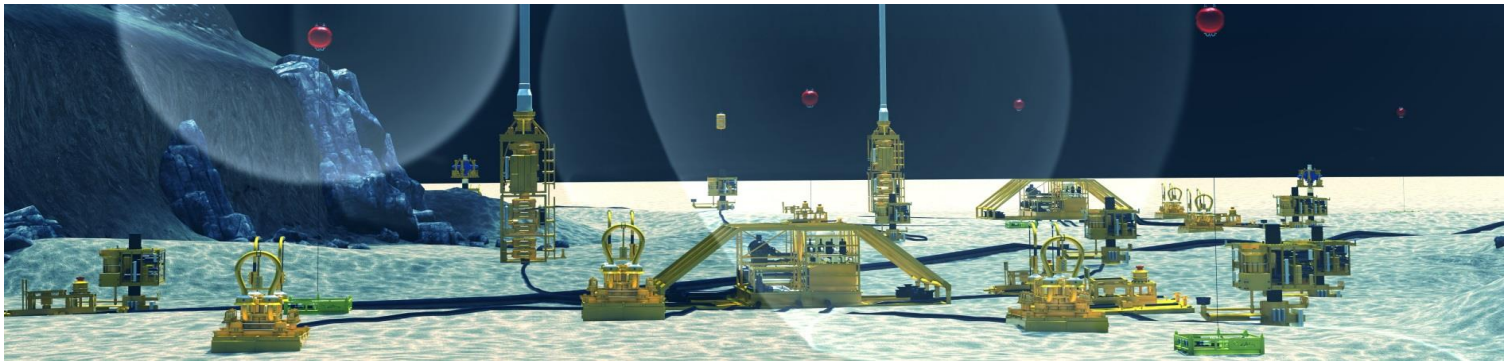


Subsea / Topside communication technologies

Umbilical's the data highways of subsea..

Providing a range of power (AC / DC) and communication technologies (Fibre Optic, powerline); in addition to the chemical / hydraulic subsea requirements for production control systems;

Umbilical-less based solutions using wireless technologies supporting requirements for control, monitoring and positioning applications.

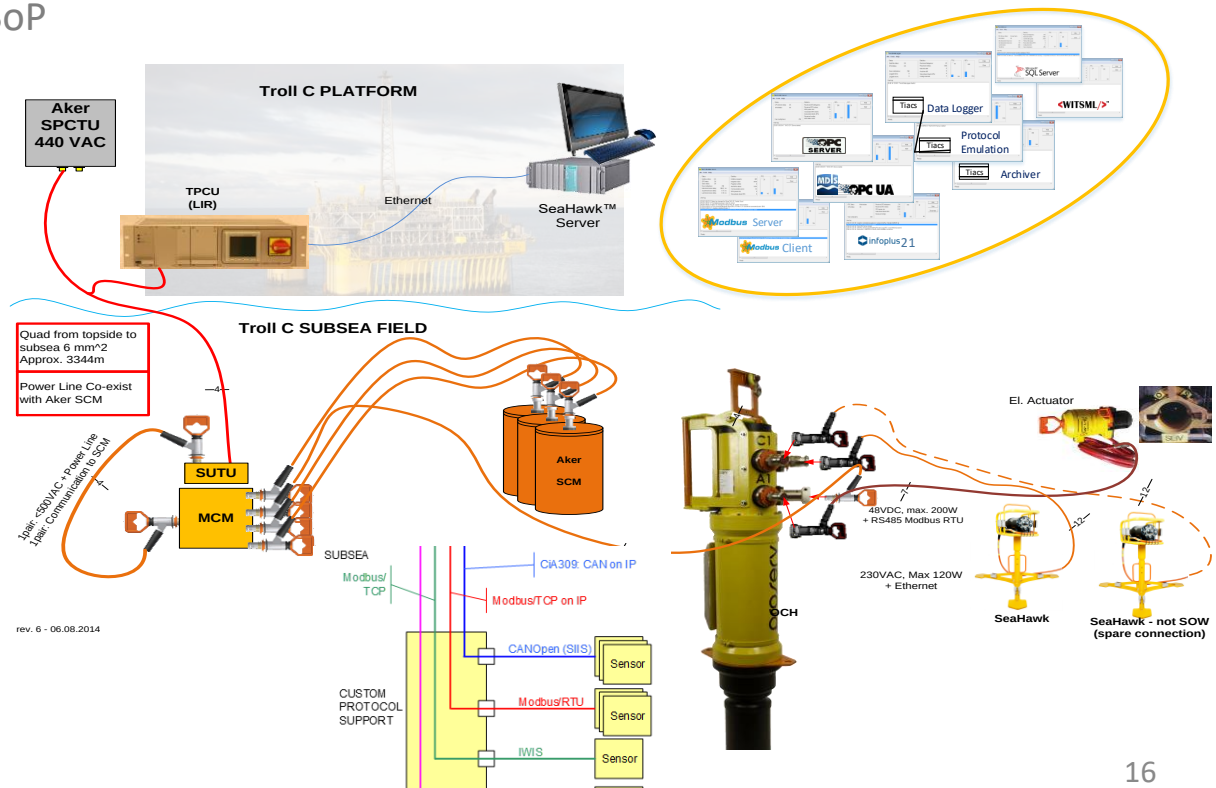


Aging assets realising opportunities of digitisation

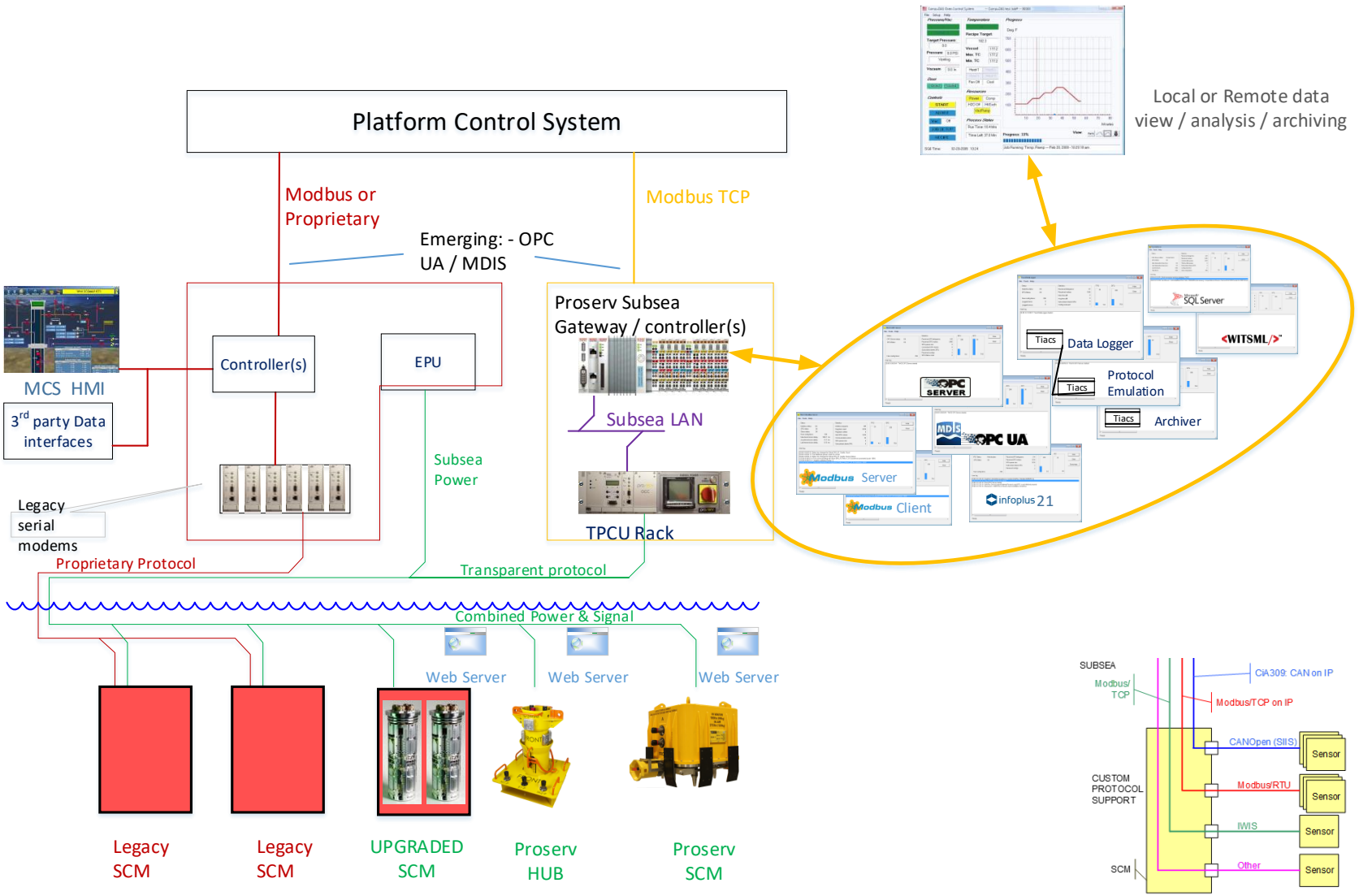
With in excess of 4500 subsea wells globally the potential exists for digitisation to enhance maintenance and performance.

Key technology for connecting creating instrument / Surveillance / data networks: -

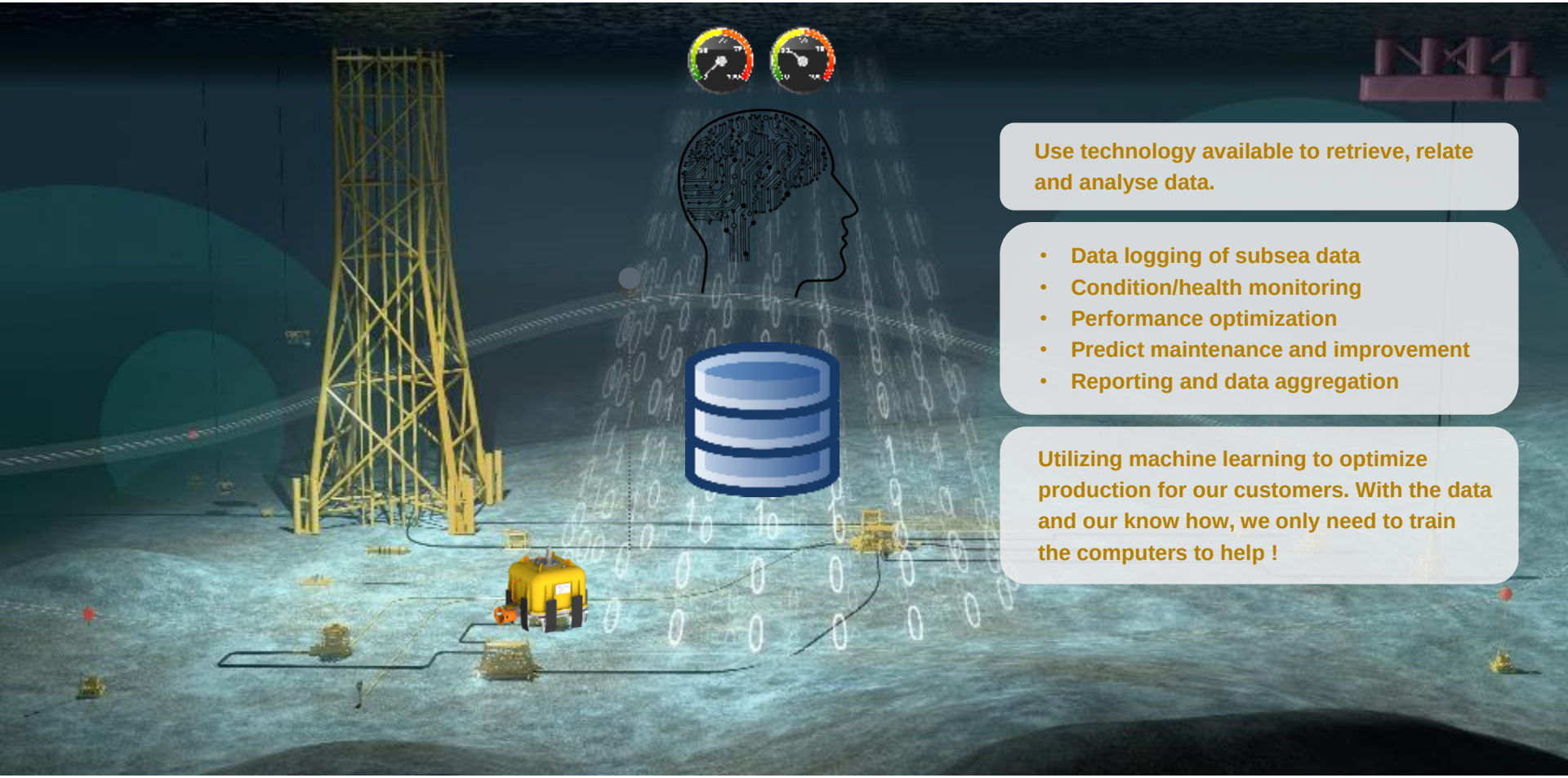
Fibre Optic; generally new developments;
Powerline; CoP or CaP; limitations of bandwidth can be addressed by co-exist technologies;
Wireless; secondary controls eg BoP



Incorporating digitisation into existing / aging fields



Subsea Future Technology



Use technology available to retrieve, relate and analyse data.

- **Data logging of subsea data**
- **Condition/health monitoring**
- **Performance optimization**
- **Predict maintenance and improvement**
- **Reporting and data aggregation**

Utilizing machine learning to optimize production for our customers. With the data and our know how, we only need to train the computers to help !

Conclusion

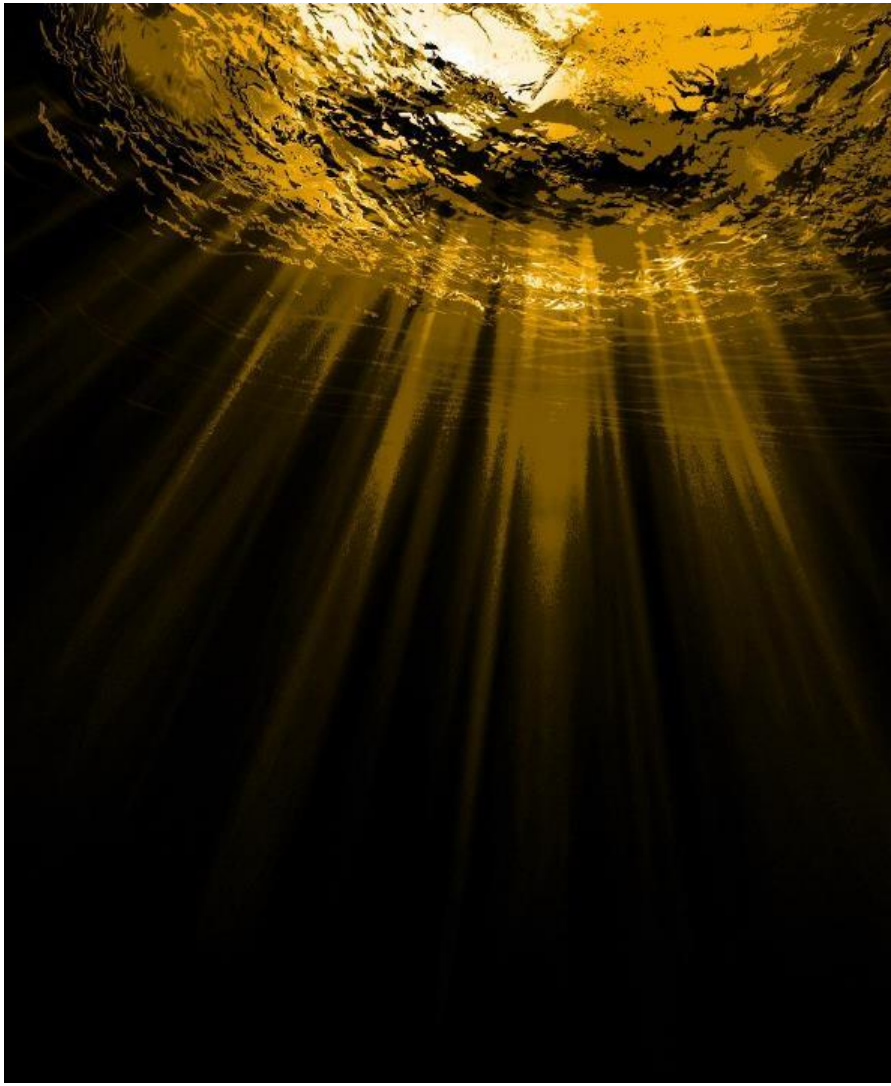
Standardisation; in recent years the industry has developed subsea and topside standards delivering open and interoperability; it may be required to develop these further to provide greater interoperability etc

Technology; exists to enhance production and address the demands of aging and environmentally located systems; specifically co-exist / wireless to overcome limitations when enhancing / extending existing infrastructure functionality.

Digital future; as with other industries the benefits of digitisation such as operational efficiency, safety and improved system visibility are tangible however, the industry must engage and manage to reap the maximum benefits in a competitive environment.

Thank You

Any Questions?



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