

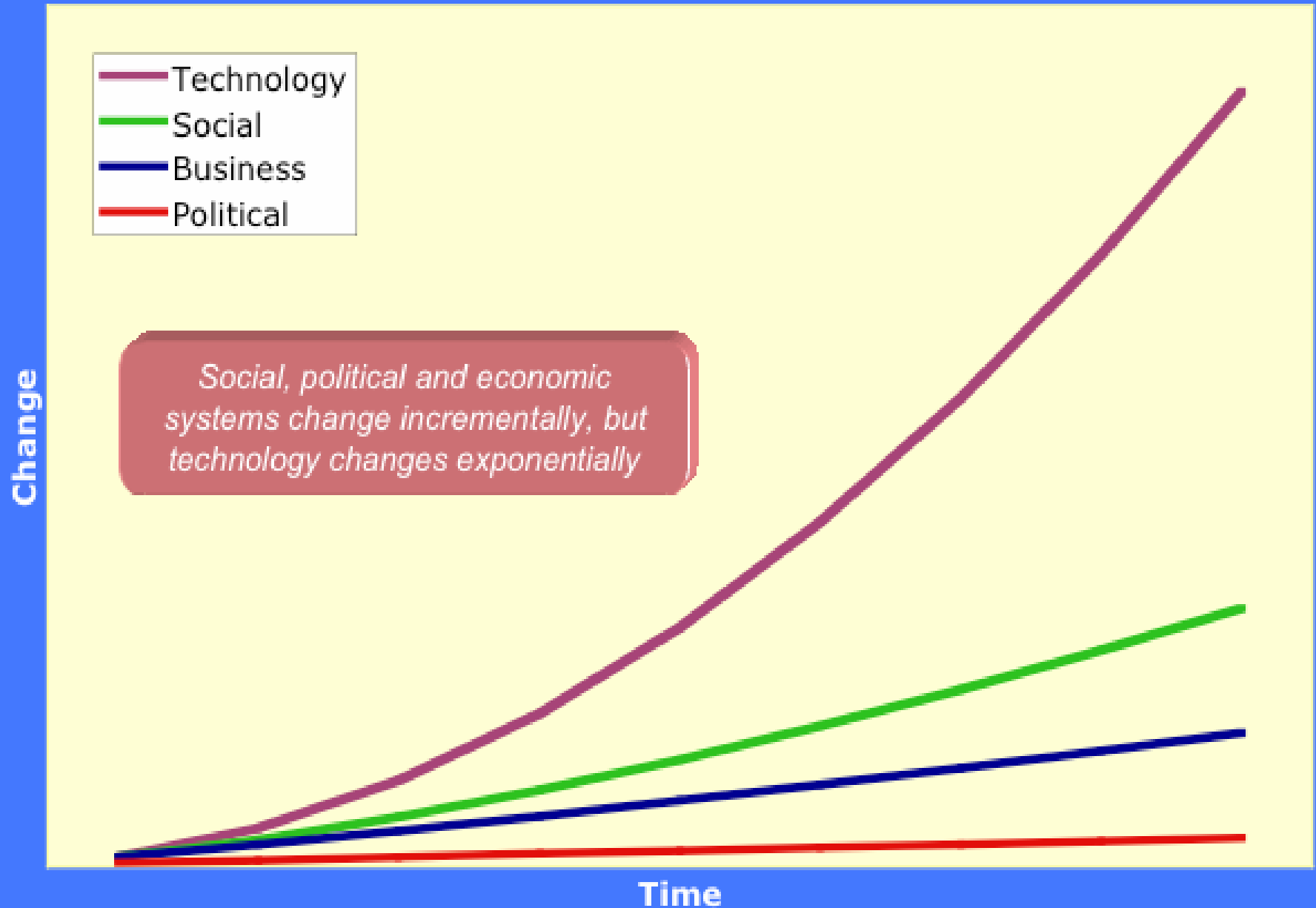


WITSML™
and
Intelligent Oilfield Operations
David Archer

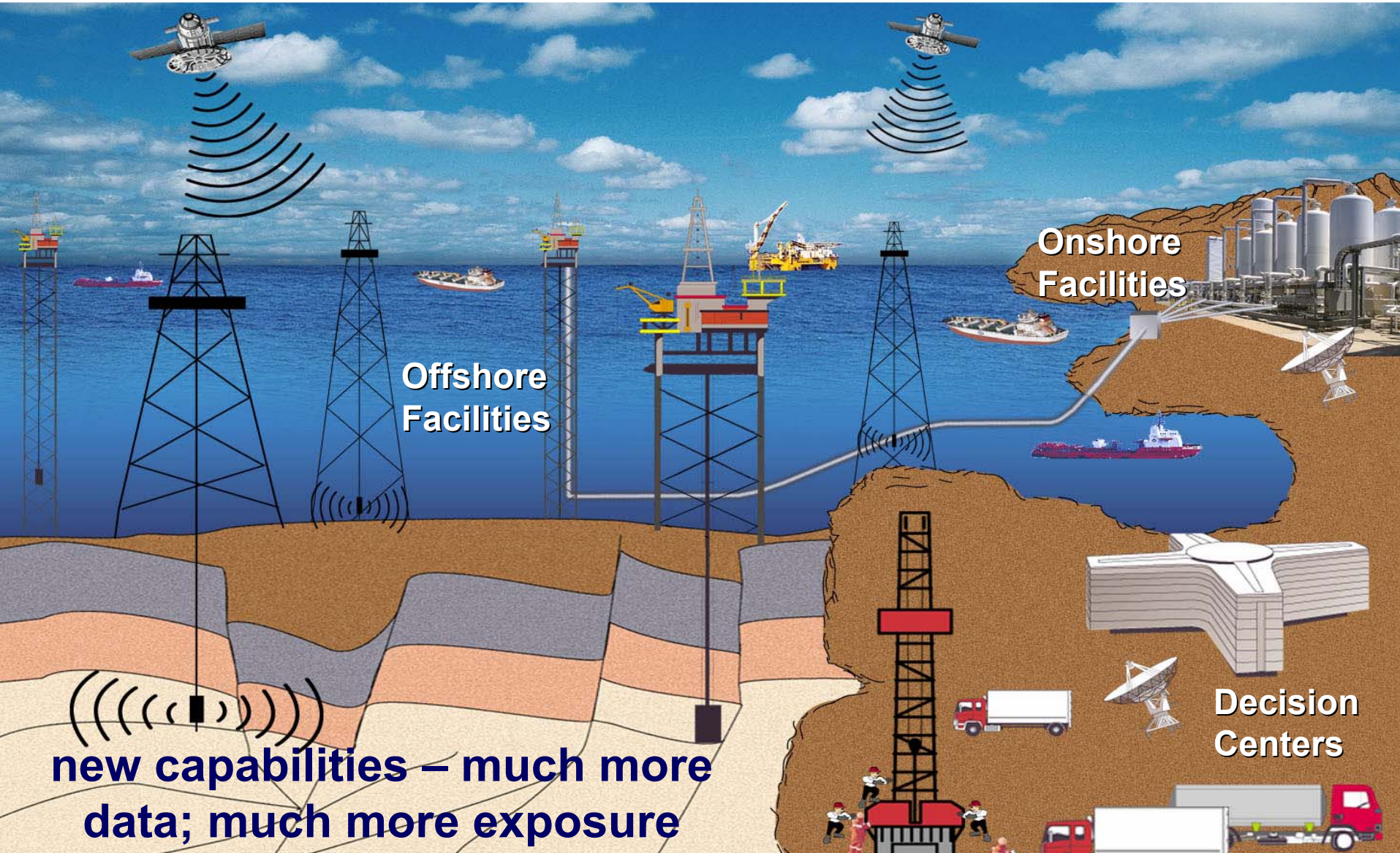
MIT Data Center
M-Alliance: Applications in the Petroleum Industry
21 September 2005

Law of Disruption

Source: Downes & Mui, "Unleashing the Killer App"



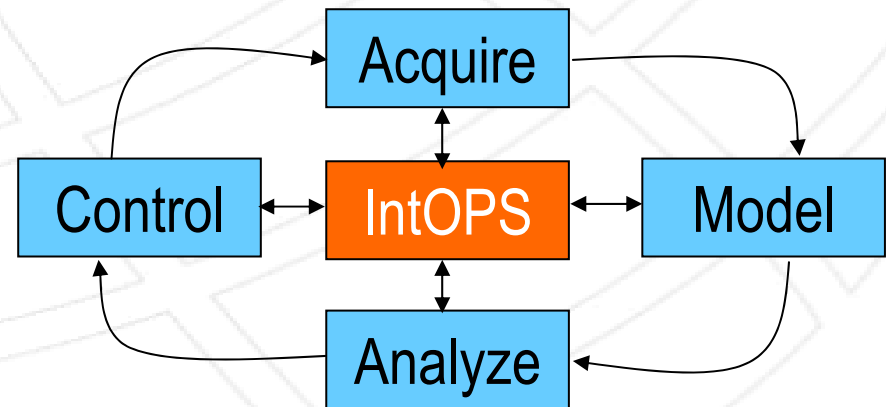
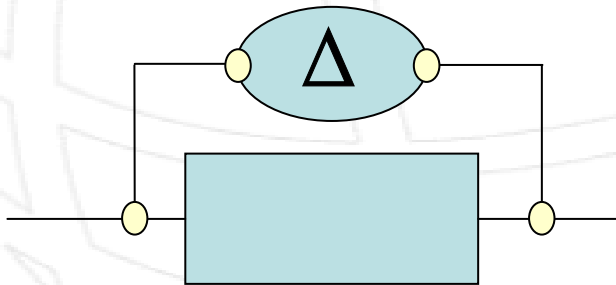
Oil fields of the future: real-time oil and gas operations



Smart Systems

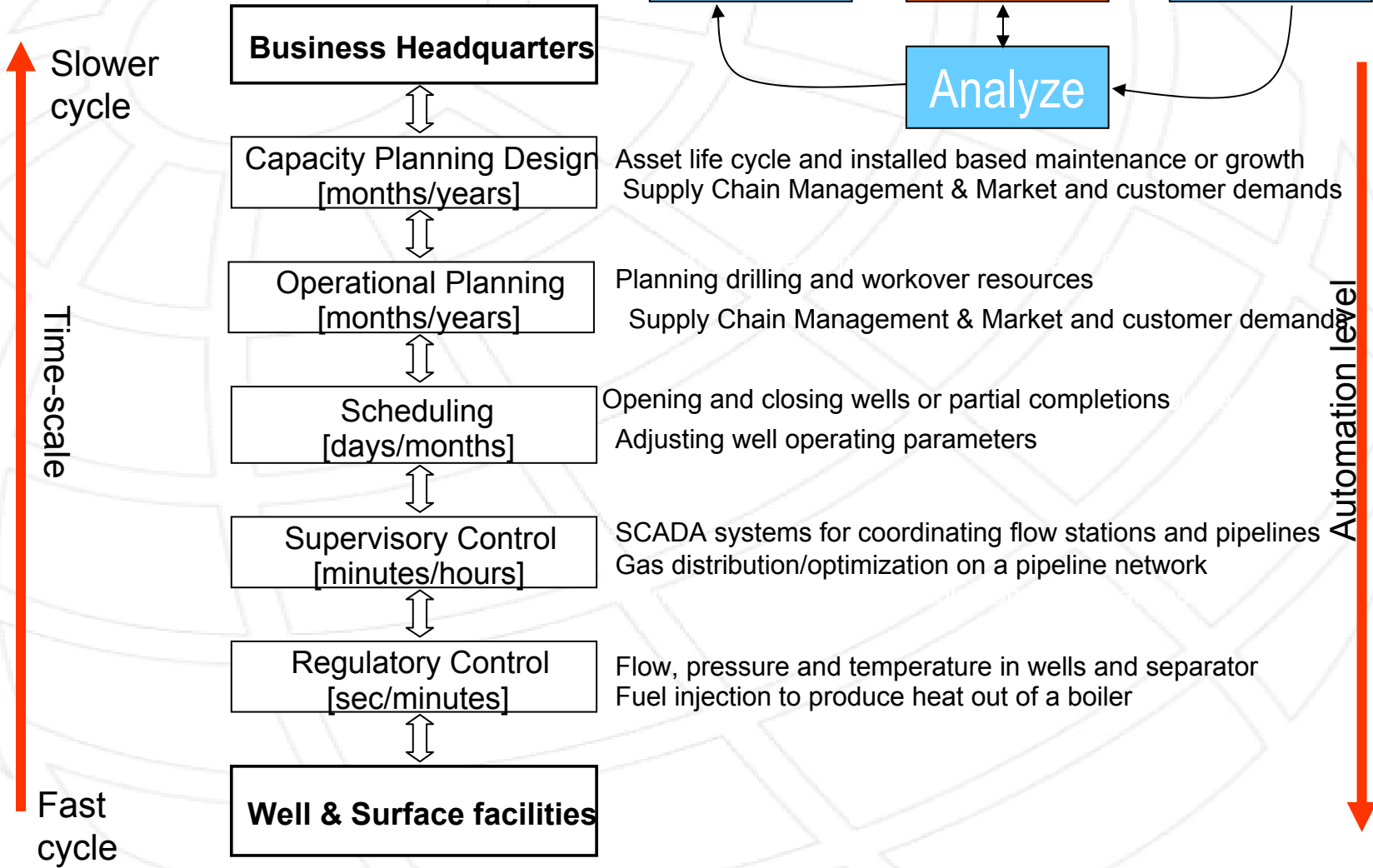
The basic approach of all “smart technology” is measure-model-control

- measure system properties
- model actual vs desired behaviour
- derive required correction parameters (*adaptive control*)
- implement control



IntOPS = Integrated Operations

Time Scales (10⁶ range)



The Problem?

- **Theorem 1:** 50% of the problems in the world result from people using the same words with different meanings
- **Theorem 2:** The other 50% of the problems results from people using different words with the same meaning

Stan Kaplan, Risk Analysis, Vol. 17, No. 4, 1997



Some facts

Not-for-profit consortium

Founded in 1990

Location: Houston, London

Members + SIG Members: > 80

Oil

BP, ChevronTexaco, ExxonMobil,
Hydro, ONGC, Pioneer, Shell, Statoil, Total...

Service / Software

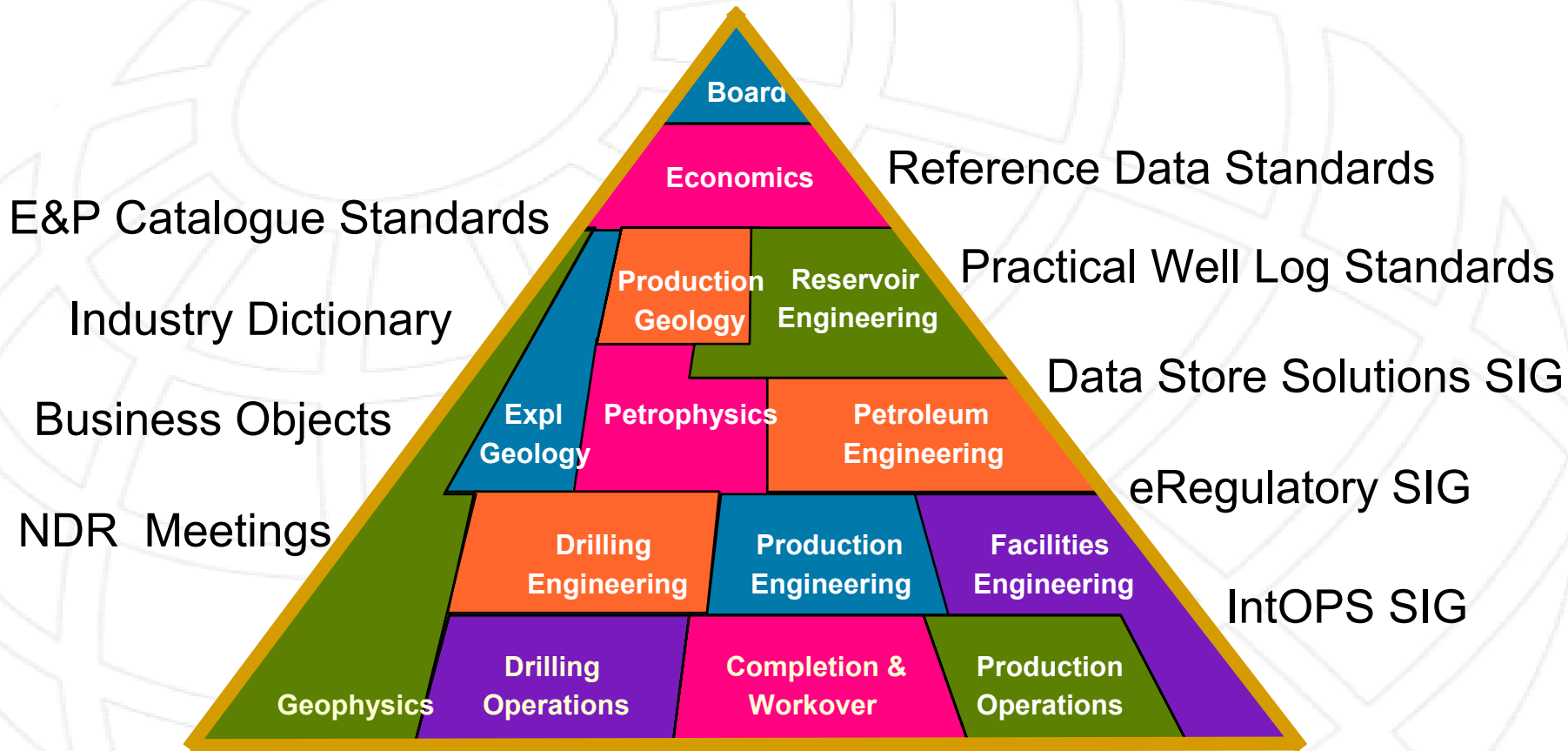
Halliburton, Paradigm, Schlumberger, Baker Hughes...

Government / Regulatory / Noncommercial

US DOE, US DOI, UK DTI, Norwegian NPD, IFP...



POSC Standards / SIGs



XML exchange standards, design guidelines, profiles



WellHeader, WellPath,
WellLog, LogGraphics,
ProductionML, etc.

Two parts of Information Transfer

- Mechanical
 - The letter and the envelope
 - The mail service
- General
 - The message content and meaning
 - The transport medium
- Electronic / Internet
 - eXtended Mark-up Language (XML)
 - Internet technologies (http, Web services etc,)

POSC is focussed here



and here

Standards – a Refresher

- A Standard is a set of agreements to do something in a common, shared way
 - Agreements of need, design, usage, evolution
- “Ascribe to standards those things that are routine and uncontroversial. Compete on those things that are new and differentiate ones products and services”. After W. Edwards Deming

Benefits of Standards

- Statoil: Standards based Data Management save \$10MM+ per year
- Standards enable quicker, cheaper, better business analyses and decisions
- Examples in other industries (telecoms, railways, internet, ...) and some in E&P demonstrate the benefits of standards to all players

Standards ...

from a major operator's point of view

- *It is better to be common than to be the best*
- *We will get common before we get best*
- Claim
 - *Savings of \$100 Million / year due to internal standardization*

But we have learned that ...

- Standardizing Data Models is not sufficient
- Shared content must also have a standardized representation
- Content must be described “neutrally” with respect to usage
- Loose integration via internet exchange is very powerful

Industry Barriers - after Gartner

- Lack of Integration - too many data sources
- Lack of timeliness of information
- Inconsistency of available sources of information
- Inaccurate / poor quality information
- Inability to access information

Gartner Claim -

Quality and Access are not significant issues for E&P?

Gartner on Standards

- ... Industries with strong rich standards and companies that have strong rich standards just do better from an economic perspective ...
- E&P Standards needed to support
 - Regulatory reporting
 - Asset M&A
 - Portfolio Review
 - Production Optimization

Standards shift the competitive focus

Standardizing IT helps companies get to 'Core' better



WITSML™ – WWW.WITSML.ORG

Wellsite Information Transfer
Standard Markup Language

“The ‘right-time’ seamless flow of
well-site data between operators and
service companies to speed and
enhance decision-making”

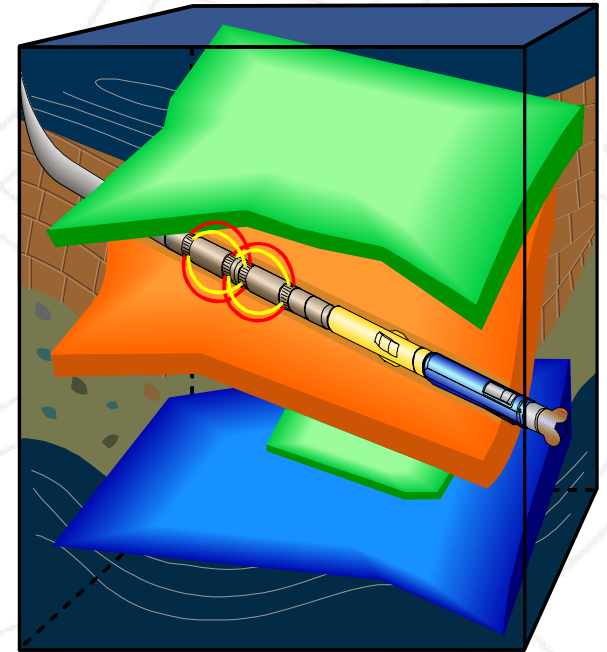


A New Open Information Transfer Standard for the Oilfield

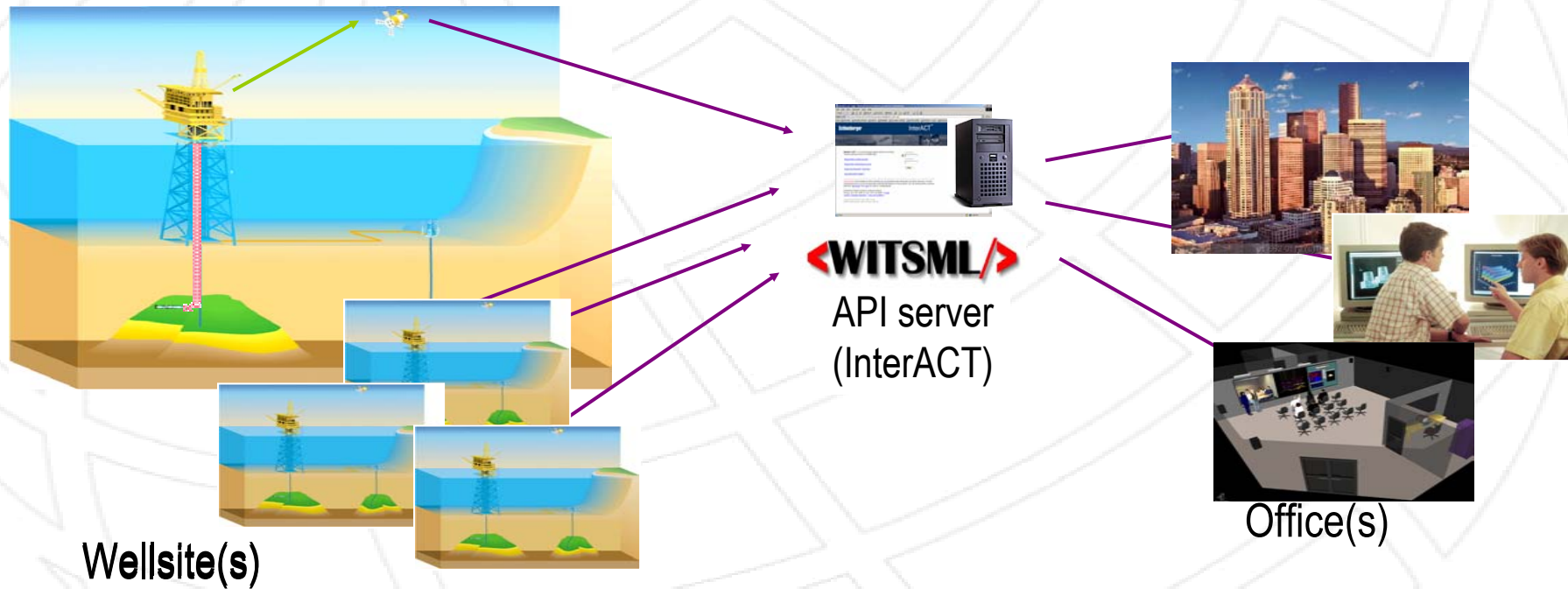


Drilling Issues

- Maximize well productivity
- Minimise formation damage
- Avoid pressure problems
- Steer the drill bit
- Find and stay within hydrocarbon zone
- Requires a combination of different measurements from different companies and collaboration among disciplines (Drilling, Geology, Reservoir)



Sample WITSML Data Flow



Data Objects: Original, New, Updated, Draft

Bottom Hole Assembly Run

Cement Job

Conventional Core

Fluids Report

Formation Marker

Log → Well Log (includes Wireline)

Message

Mud Log

Operations Report

Real Time

Rig / Rig Equipment

Server Capabilities

Sidewall Core

Subscription

Survey Program

Target

Trajectory & Trajectory Station (includes planned & calculated well path)

Tubular / Bit Record / Open Hole

Well

Wellbore

Wellbore Geometry

Risk

Completion / Well Mechanical

Regulatory Permitting and Reporting

Production Activity and Volumes

Distributed Temperature Survey (->1.3.1)

Image Calibration

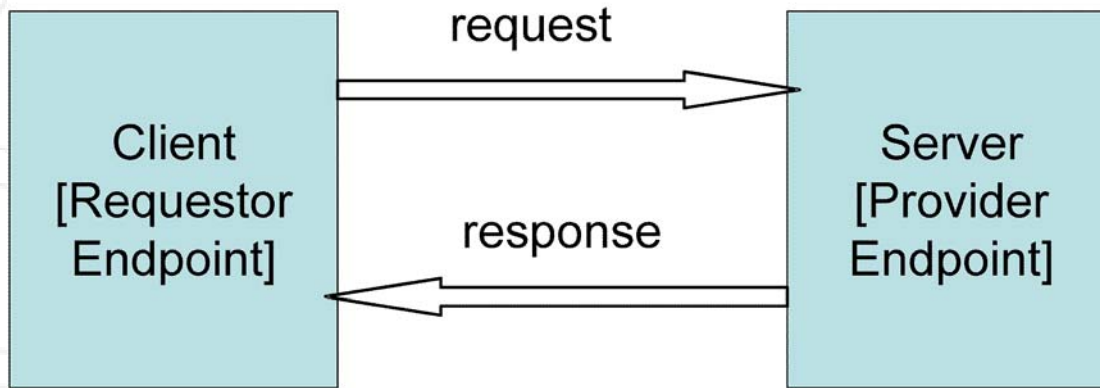
WITSML Messaging

The WITSML standard comprises two sets of specifications – one for vocabulary, one for transport:

- **Data Schema Specifications** – define XML vocabulary for WITSML drilling information (data objects)
- **API (Application Programming Interface) Specifications** – defining an optional set of interfaces exchanging WITSML data objects. In particular, the API defines the client-server behavior (Store) and Publish/Subscribe (Publish) interfaces.

WITSML Store Interface

STORE Interface

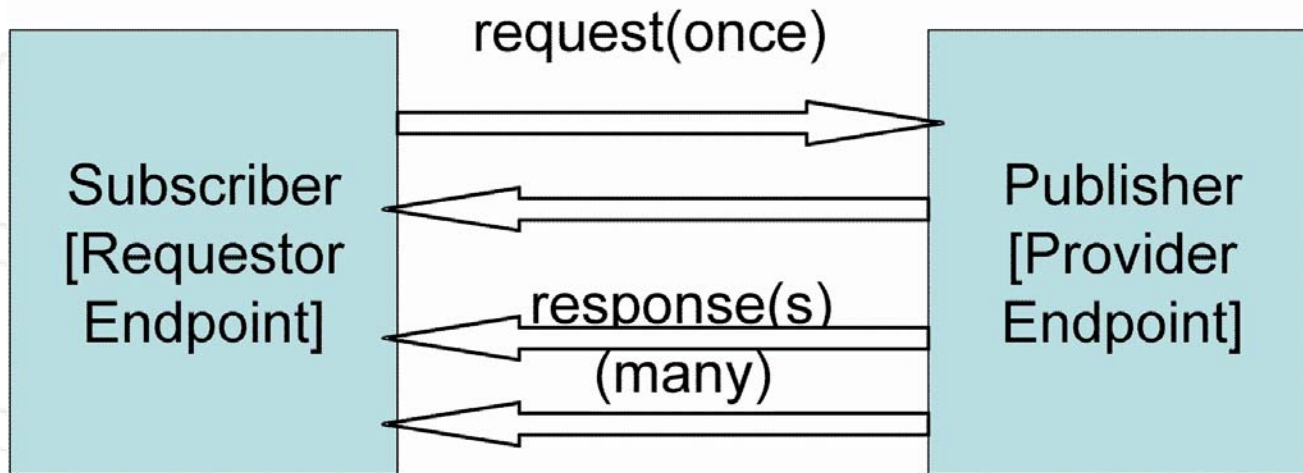


Methods

GetFromStore()
AddToStore()
UpdateInStore()
DeleteFromStore()
GetVersion()
GetCapability()

WITSML Publish Interface

PUBLISH Interface



Methods
Subscribe()
GetVersion()
GetCapability()

- WITSML started as a collaborative effort to update the widely used WITS standard for moving drilling data between rig and office based computer systems
- WITSML is designed for the standards of today's “always on” Internet environment while still accommodating those rigs not yet “Wired”
- WITSML is a POSC standard that is published and available to all to implement
- Real world use of WITSML is happening **NOW**
- The scope of usage is being extended based on practical experience and pragmatic needs via the WITSML SIG

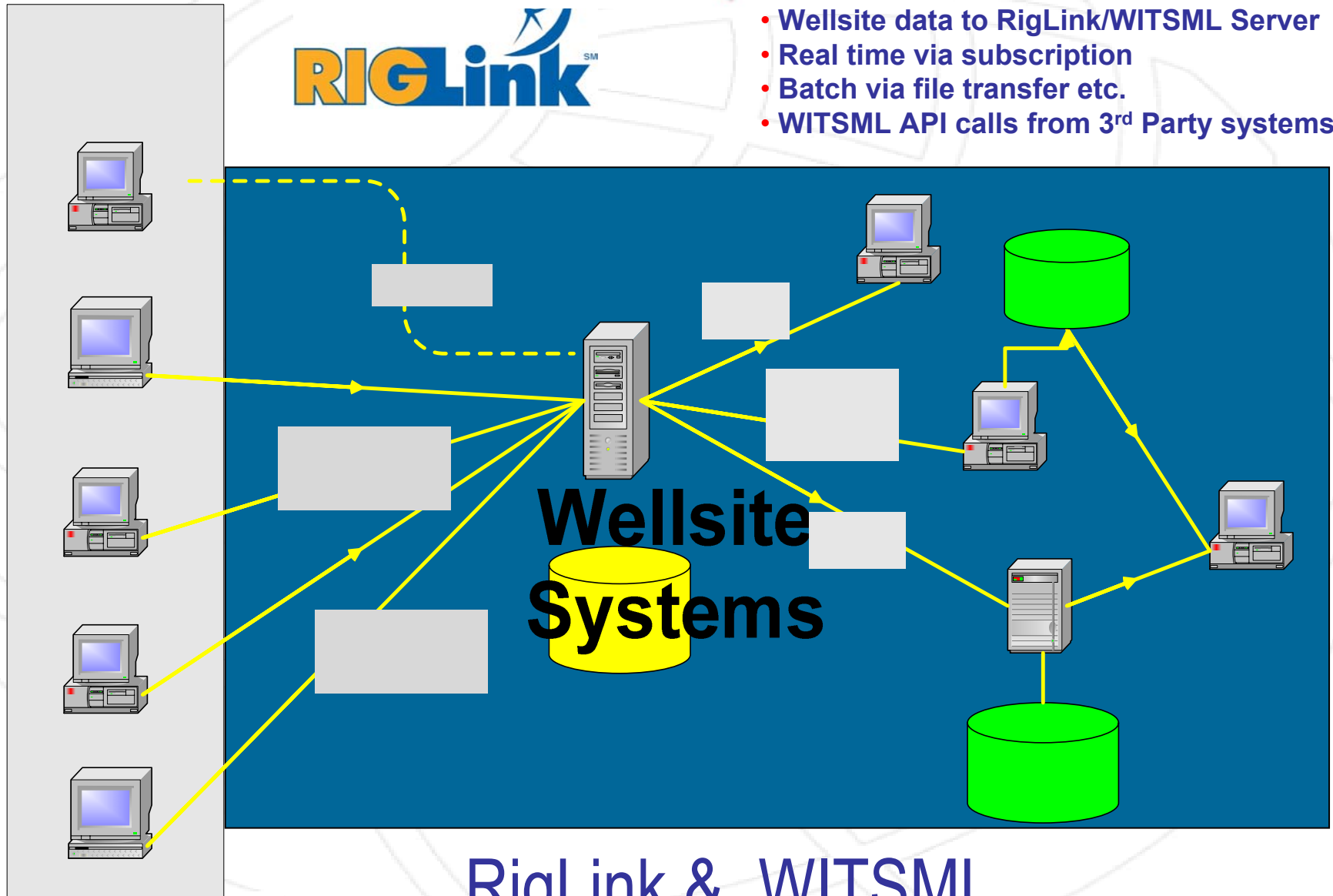
BP Vision

- Automation of many manual processes in current Drilling Data workflows
 - Contractors (Service and Drilling) automatically push data into our corporate data stores
 - Partners can automatically pull data (Not images) for morning reports into their data stores
 - Operators can push statutory reporting data for statutory reports
 - Contractors can share data with one another at the rigsite
- A single standard to make the vision possible, reducing industry costs

<WITSML/>

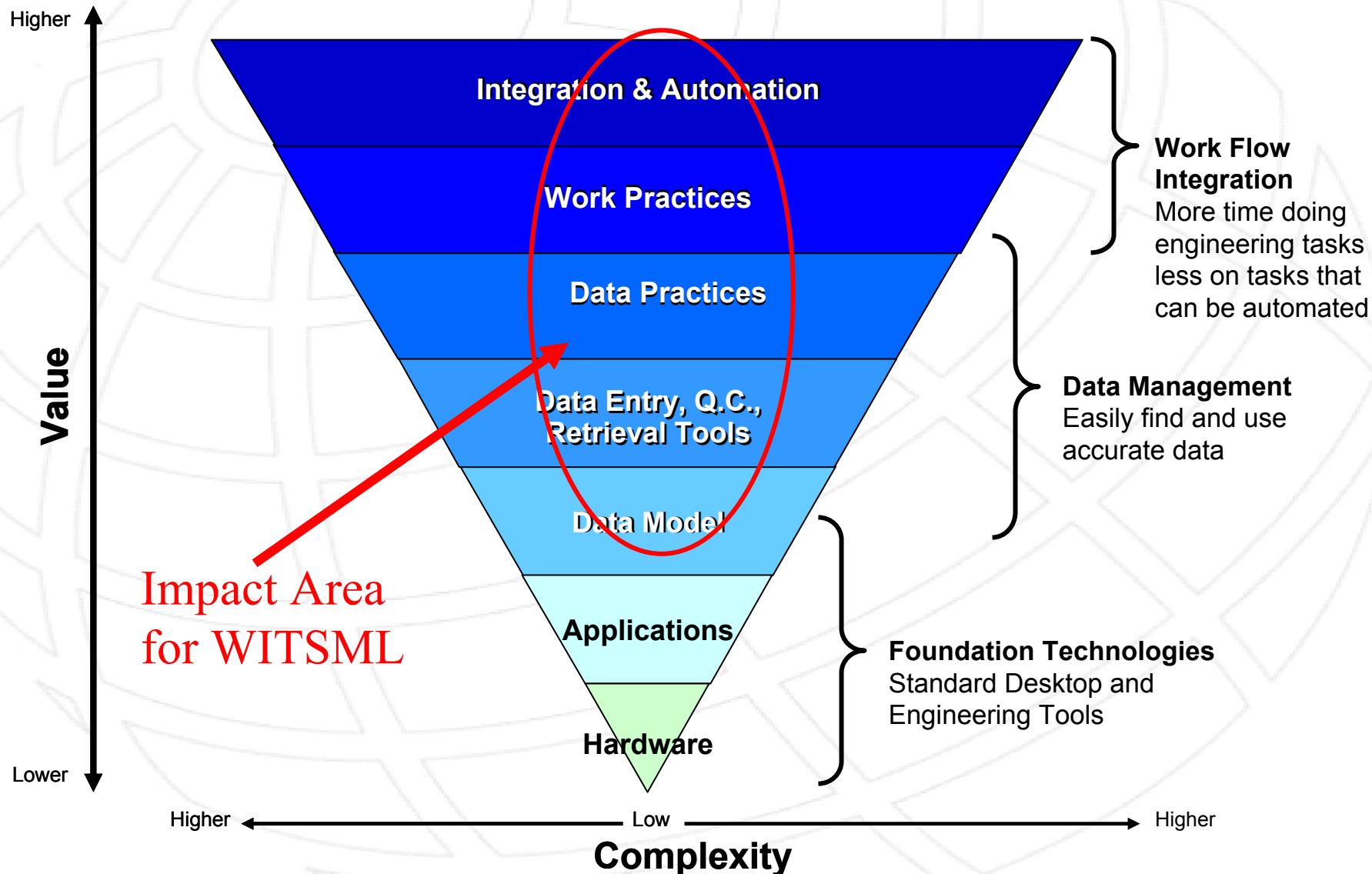
RIGLinkSM

- Wellsite data to RigLink/WITSML Server
- Real time via subscription
- Batch via file transfer etc.
- WITSML API calls from 3rd Party systems



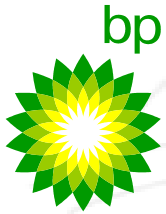
RigLink & WITSML

Integration Value Hierarchy



Impact Area
for WITSML

<WITSML/>



ExxonMobil



HYDRO

ChevronTexaco



TOTAL



PIONEER
NATURAL RESOURCES



HALLIBURTON

Landmark
A Halliburton Company

Schlumberger



INTER ACTION



Weatherford



Knowledge Systems

SMITH TECHNOLOGIES



dti

US Synthetic

UPEG



OpenSpirit



roxar
The Reservoir Company



UNLOCK YOUR POTENTIAL



MD Totco

A Varco Company



wellstorm



Seismic Micro-Technology, Inc.



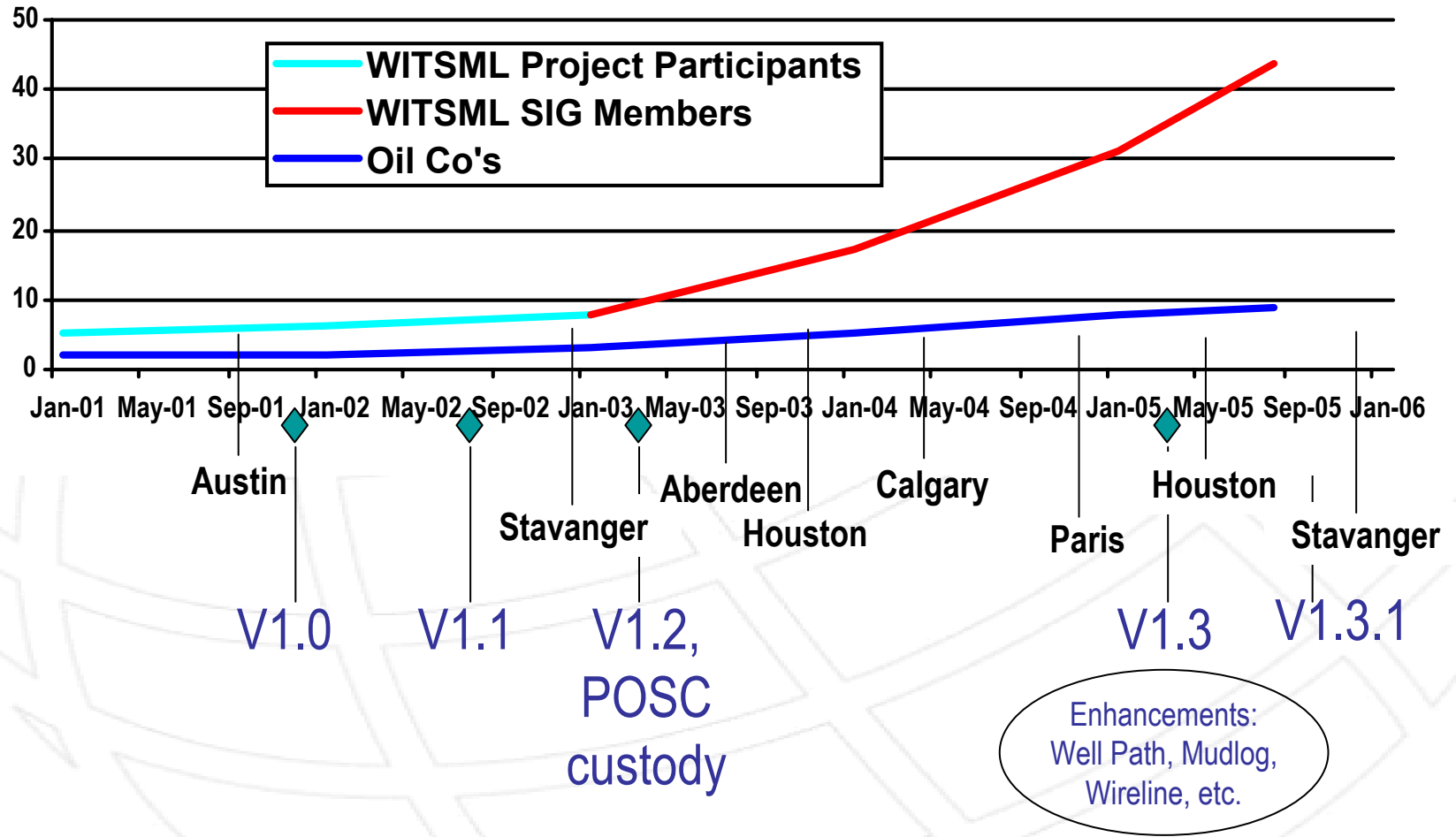
IDS DataNet

Independent Data Services



POSC

Timeline: Participation, Seminars, Releases



Data Objects: Original, New, Updated, Draft

Bottom Hole Assembly Run

Cement Job

Conventional Core

Fluids Report

Formation Marker

Log → Well Log (includes Wireline)

Message

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Operations Report

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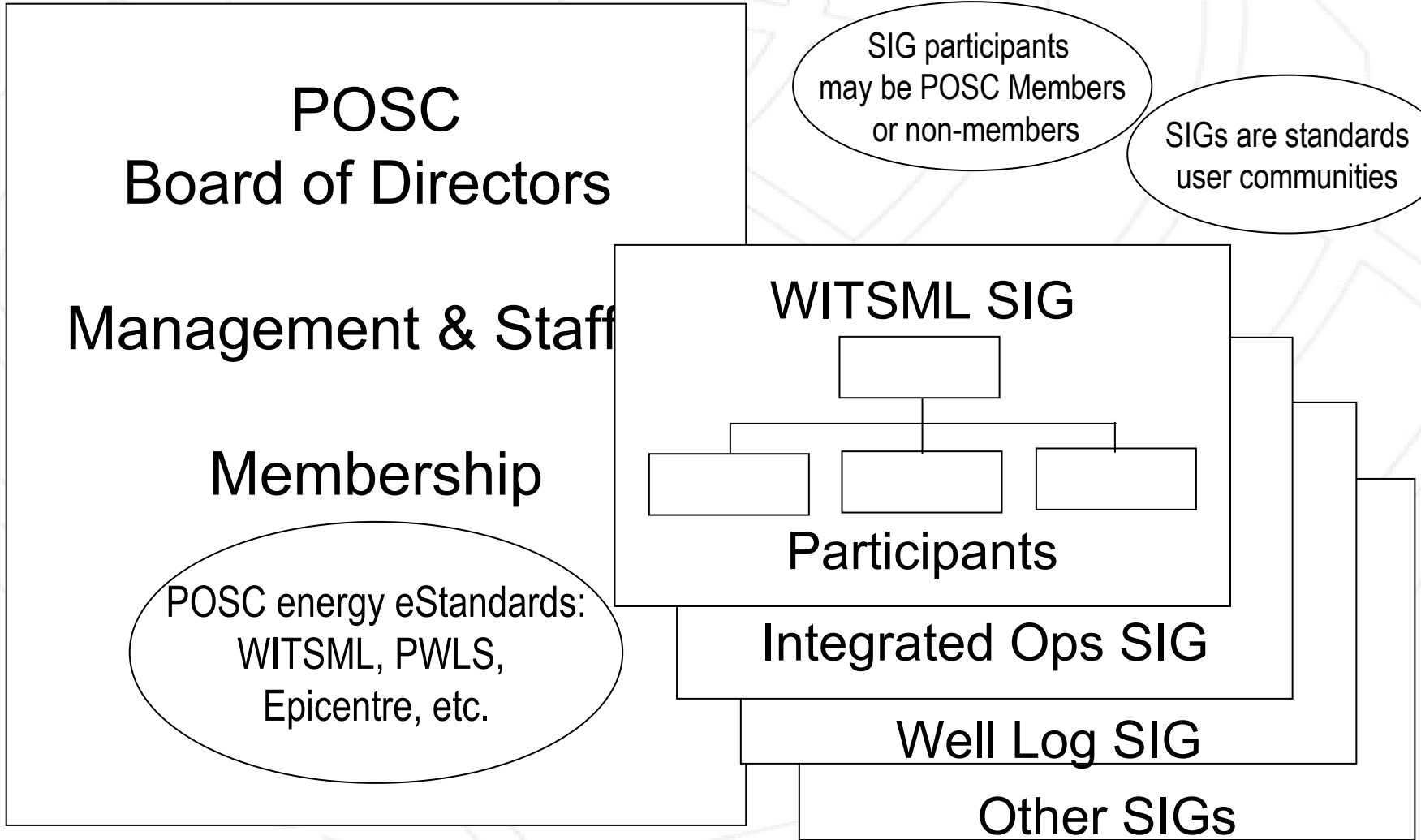
Regulatory Permitting and Reporting

Production Activity and Volumes

Distributed Temperature Survey (->1.3.1)

Image Calibration

Process



SIG Teams

Steering
Committee

Plan and review SIG activities;
coordinate semi-annual meetings,
seminars, exhibitions; discuss and
agree on future plans

Technical
Teams

Recognize and agree
on detailed requirements;
correct and improve;
first-line reviewers

Use Case &
Requirements
Team

Identify and agree on
areas of expansion;
organize study and
requirements sub-teams

Implementation
Support Team

Share experiences using
WITSML-enabled products;
facilitate user dialogue;
recommend improvement

Document References

- WITSML Standards
 - Specifications (data, interfaces)
 - Sample data
 - Startup toolkit
- WITSML Community
 - Records of past events: presentations, notes, agendas
 - SIG Contact information
 - Test Server availability information
 - Mailing lists and Discussion Forums
 - Issue tracking; draft specifications for review
- Web Sites
 - www.witsml.org and www.posc.org



Benefits

- Active and visible WITSML community
- Shared funding of WITSML custody, support, and promotional activities
- Active outreach to align WITSML with other initiatives
 - Within POSC, the expansion of WITSML architecture across all technical E&P data transfer standards: Integrated Operations (Production), Well Log (Wireline), Regulatory, Laboratory, Reference, etc.
 - Within the industry with other industry groups: UKOOA and US MMS (well path), PPDM (use of POSC exchange and reference standards), Government agencies (regulatory), XML and SOA (OASIS, W3C, OpenGIS, OpenGroup), etc.
- Vendor neutral promotion of WITSML use and maintenance of WITSML specifications and materials



Why has the WITSML initiative been successful?

The Right Initial Players - clear focus

BP & Statoil with Baker, Halliburton, Schlumberger, and NPSi

Strong Commitment

Initial funding by oil companies; Oil & service companies remain engaged after initial delivery

Effective Processes

Practical, incremental approach

Clear focus on target outcomes - through implementation

Frequent communications - steering & technical teams

Choice of Technologies

XML, SOAP

Comprehensive Output and Documentation

XML Schemas + Server API + sample implementation

Openness / Evolution

Public seminars and presentations

Transfer to POSC in early '03 -- commercially neutral custody, publication, promotion and evolution



<WITSML/>



ExxonMobil



HYDRO

ChevronTexaco



TOTAL



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POSC

Integrated Operations

=

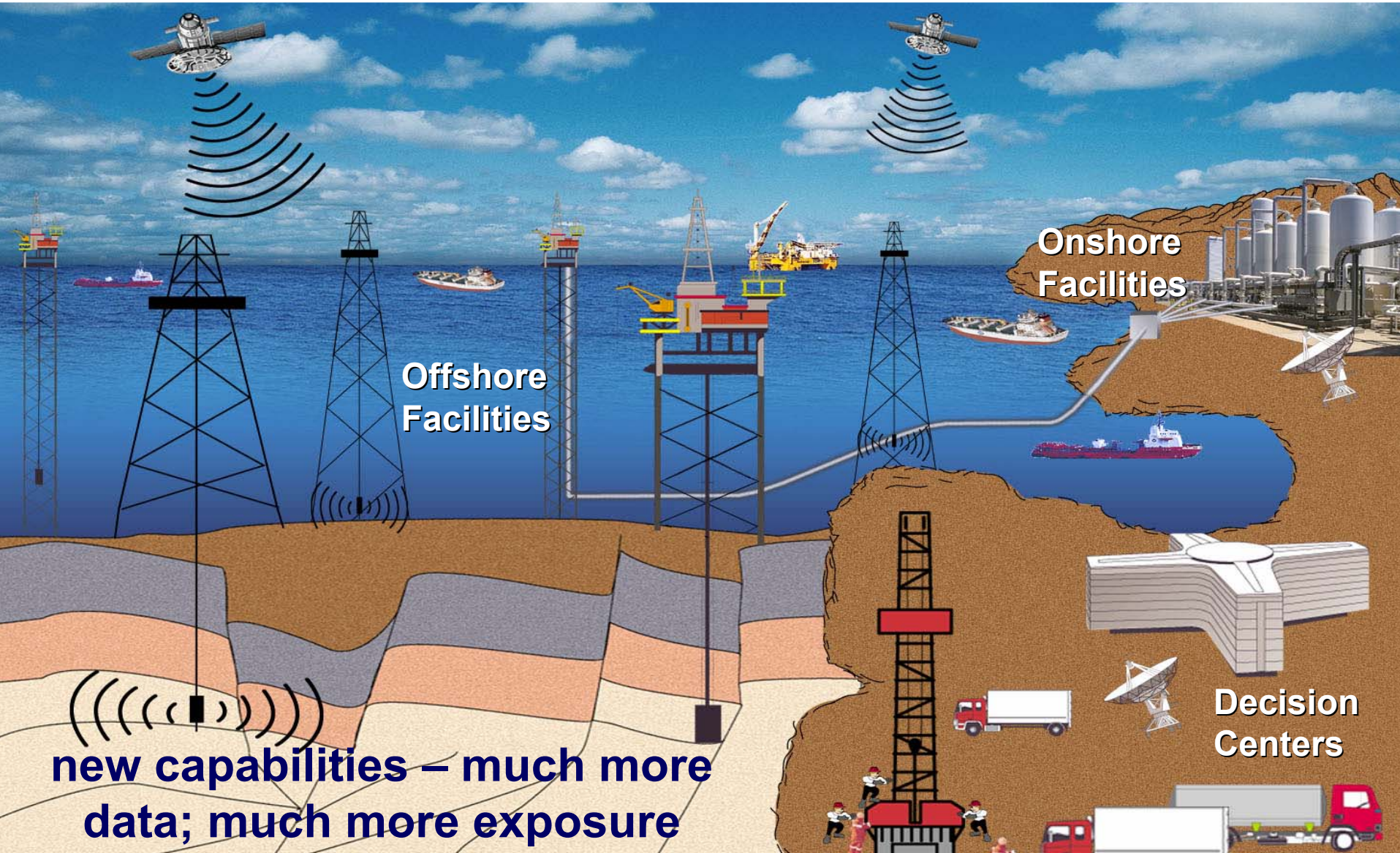
{Smart Field, Digital Oilfield of the Future, eField, iField...and Intelligent Oilfield Operations}

Does this sound familiar?



"Send this claim report to legal and have them print it out for accounting. Then have accounting re-enter it into the system and send it to the adjusters in the field. Have the field update the numbers. Then get it back to me so I can update the reinsurance company. And hurry."

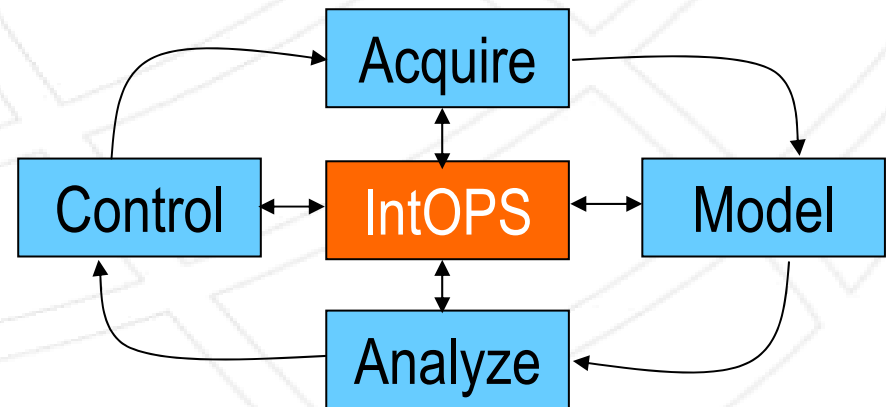
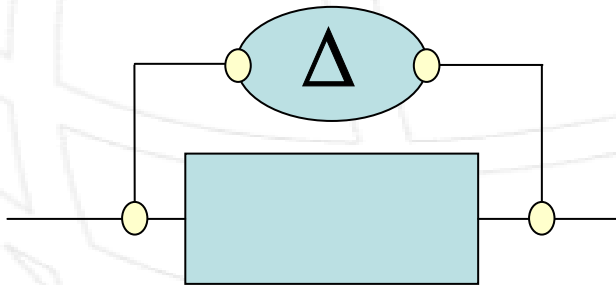
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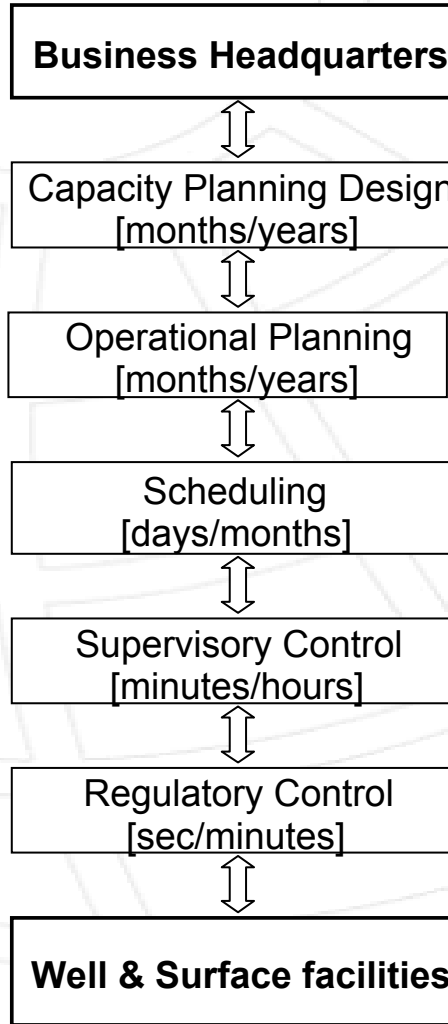
IntOPS = Integrated Operations

Time Scales (10⁶ range)

Slower cycle

Time-scale

Fast cycle



Asset life cycle and installed based maintenance or growth
Supply Chain Management & Market and customer demands

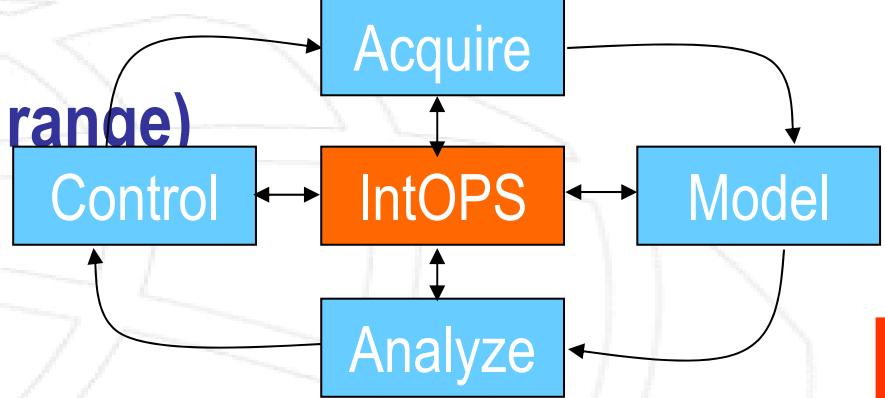
Planning drilling and workover resources
Supply Chain Management & Market and customer demand

Opening and closing wells or partial completions
Adjusting well operating parameters

SCADA systems for coordinating flow stations and pipelines
Gas distribution/optimization on a pipeline network

Flow, pressure and temperature in wells and separator
Fuel injection to produce heat out of a boiler

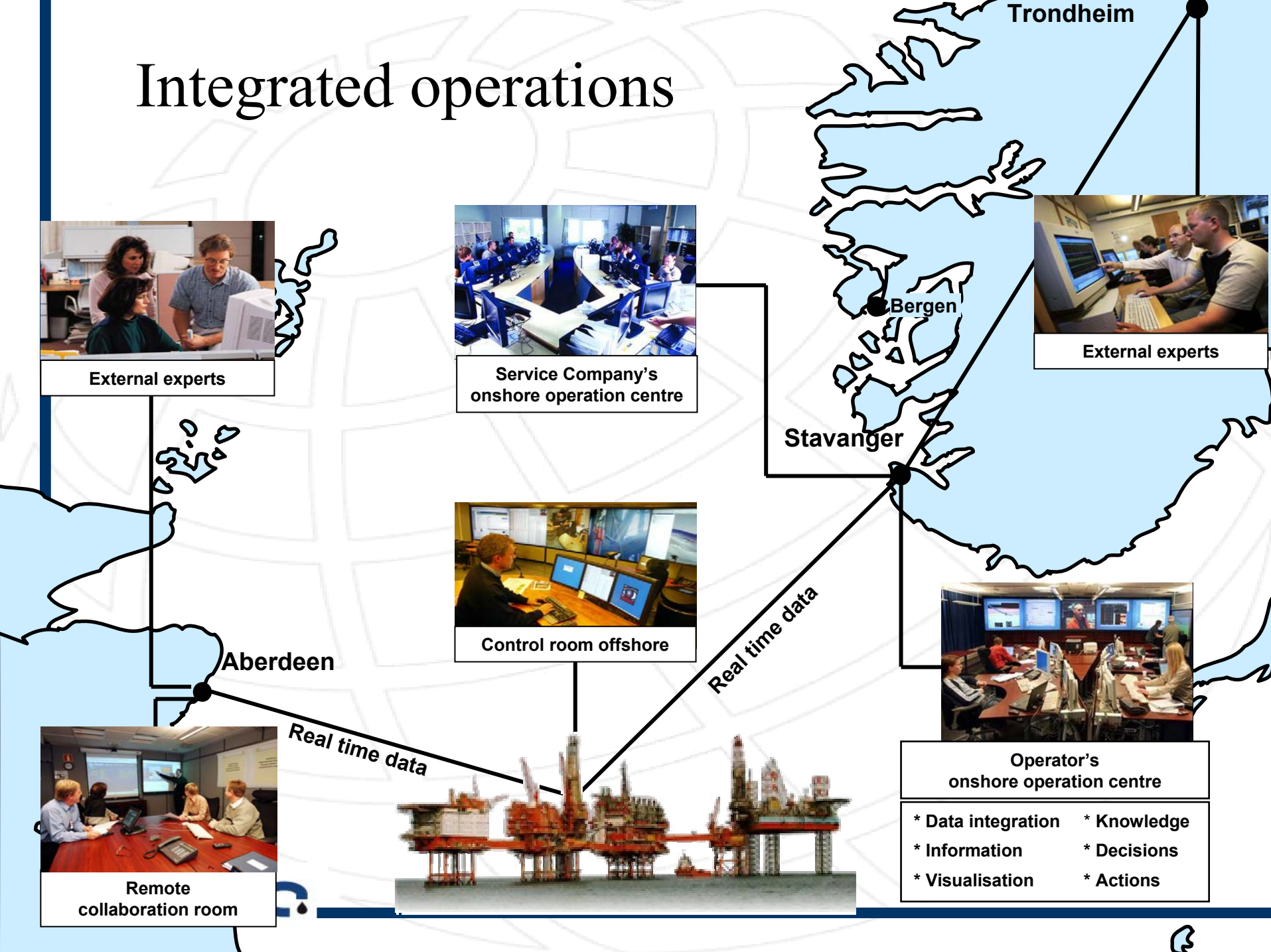
Automation level



IntOPS SIG

- DTS
 - Produce and published initial specification in Q2 of '05
 - Follow-up with pilot testing
- IIP (integrated Information Project) - Norway
 - Participate in Steering Committee and working groups
 - Collaborate on daily production reporting XML schema
- Production Data Transfer Standards Development
 - Exploit existing work to produce draft specifications
 - ProductionML draft - March 2005
 - Production Reporting draft & Pilot - Fall 2005
 - PRODML Project

Integrated operations



Trondheim

Bergen

Stavanger

Aberdeen



External experts



Service Company's onshore operation centre



External experts



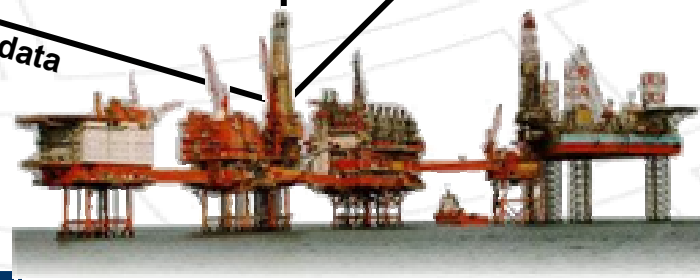
Control room offshore



Operator's onshore operation centre



Remote collaboration room



Real time data

Real time data

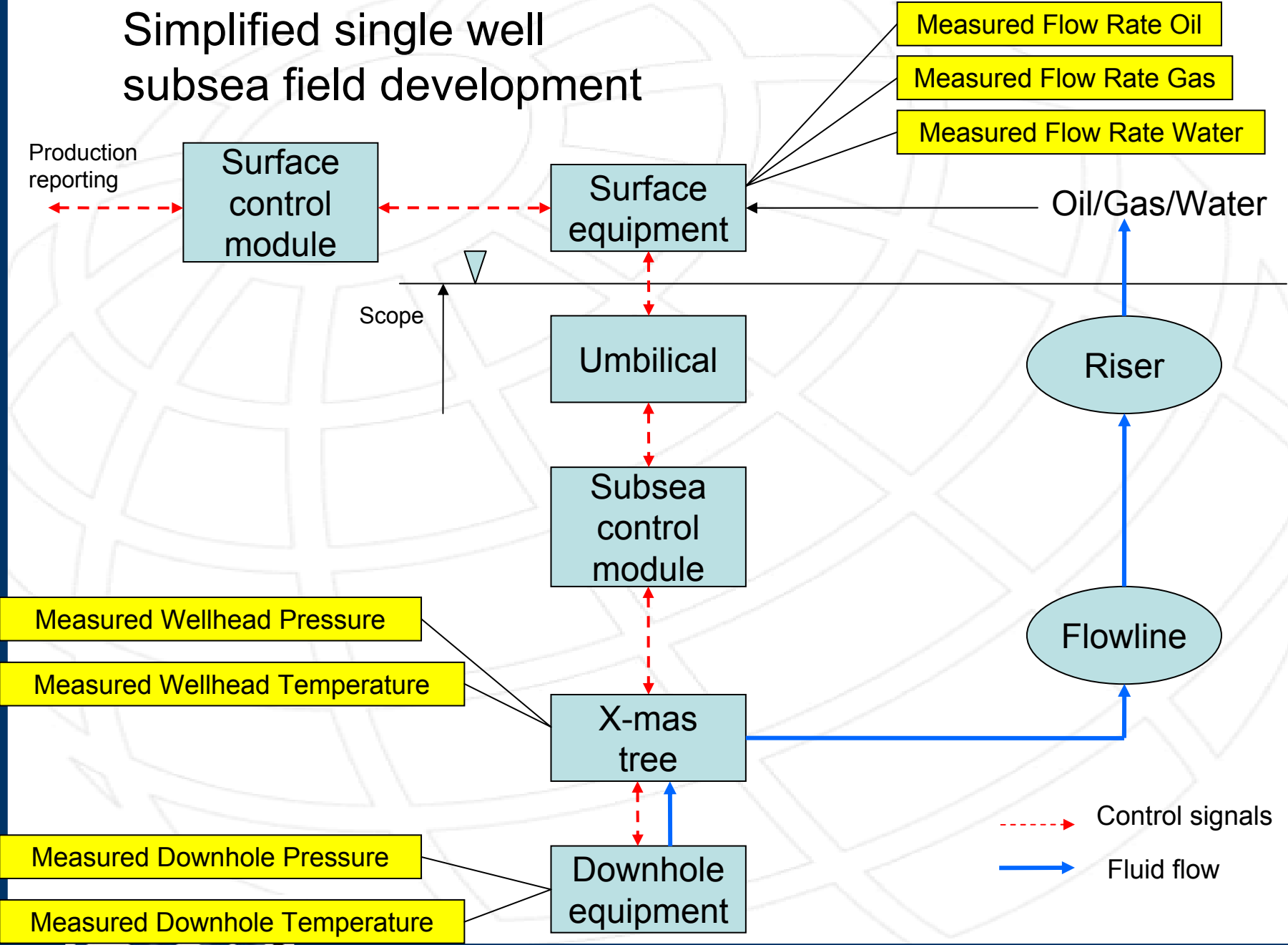
- | | |
|--------------------|-------------|
| * Data integration | * Knowledge |
| * Information | * Decisions |
| * Visualisation | * Actions |

Scope of the Project (IIP)

- To integrate the following information in one standard
 - 4C / 4D seismic
 - Drilling and logging
 - Well production
 - Safety and automation system
 - Monitoring and operation of subsea system
 - Maintenance system data
 - Reservoir reliability data
- To investigate real time decision support systems that
 - Classify and retrieve information using Web Ontology Language (OWL)
 - Use rule based notification
 - Visualize subsurface and operational data
 - Automatically link production control and reservoir simulation tools (option)

Surface - Well - Subsurface Integration!

Simplified single well subsea field development



Petroleum Industry Data Dictionary (PIDD)

- What is the PIDD Dictionary?
 - The content of the PIDD Dictionary consists of intellectual contributions from several corporations, regulatory agencies and the United States Government. These organizations have donated staff, who compiled, edited and clarified the content.
 - The PIDD Dictionary content is used by industry standards organizations, corporations and government bodies.
- What is the Objective for the Dictionary?
 - Those who created the content of the Dictionary intend that the content be made available and accessible to the industry without restriction.
- Who Manages the Content? Who owns it?
 - The Dictionary Work Group of the PIDX Standards Subcommittee has responsibility for the content of the Dictionary. This Work Group is also responsible for Dictionary modifications and maintenance.
 - PIDX owns the content and is entitled to administer it.
 - The American Petroleum Institute (API) holds the copyright of the content.
- Web Sites:
 - <http://www.pidx.org>
 - <http://w3.posc.org/pidd>

PRODML: A Shared Solution for Upstream Oil and Gas Companies to Optimize Their Production

- PRODML is a dynamic project to help each producer independently optimize its oil and gas production. **PROD**uction **xML**, or PRODML, will develop commercial software products within 12 months to improve data exchange and work process efficiency in production optimization.
- This collection of companies, known as the PRODML Working Group include: BP, Chevron, ExxonMobil, Shell, Statoil, eProduction Solutions, Halliburton, Invensys, Kappa Engineering, Microsoft, OSIsoft, Petroleum Experts, Schlumberger, Sense Intellifield, TietoEnator, and POSC.
- PRODML will build on the earlier success of WITSML™, a similar XML-based standard for drilling information. WITSML™ (**W**ellsite **I**nformation **T**ransfer **S**tandard **M**arkup **L**anguage) is now an open industry standard maintained by POSC (Petrotechnical Open Standards Consortium). PRODML will extend the WITSML™ effort to include data needed for field production optimization.
- Production optimization involves integrating real time data from specialty, multi-vendor software applications and streamlining work processes to enable oil and gas field operational efficiencies. PRODML will develop the necessary XML-based data exchange solutions as an open industry standard. After a working PRODML pilot is launched, POSC will maintain the standard and make it publicly available.



Questions?

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