Industrial solutions for real time integration of process and enterprise domains

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Issues addressed

- Technologies required to fully implement Integrated Operations
- The Reference Semantic Model (RSM) and the Information Integration Framework (IIF)
- Challenges solved by the RSM and the IIF
- Possible effects on operational performance

IBM is proud to be a technology partner in the Industry leading this effort.
To fully implement Integrated Operations new technologies and solutions are required

- Sensors
  - Downhole
  - & onboard facilities

- Process control systems

- Broadband communication networks
  - Fiber optic cables & wireless networks

- Decision support tools
  - Real-time monitoring, simulation, optimization & automation of operations

- Web services
  - Open IT standards

- Semantic models
  - Open industry standards

Real-time integration solution

Vendor

Vendor

Operator

This understanding is confirmed by international studies.

Figure 2. Internal Challenges (all performance categories)

- Gap between enterprise resource planning (ERP) and factory floor: 52%
- Incompatible and inconsistent systems: 41%
- Lack of timely information to make informed decisions: 37%
- Lack of strategy to unify information across manufacturing: 33%
- Lack of funds and/or lack of perceived value: 27%

Source: Aberdeen Group May 2006
IBM invests significantly in new, open solutions for the oil industry

- A common reference semantic model (RSM) based on open industry standards
  - Developed by a committee consisting of the industry's main standardization associations and companies using the standards
  - IBM is contributing to the implementation of ISO 15926

- A solution – Integration Industry Framework (IIF) - for transferal of real-time information between the process and enterprise domains
  - Applied by StatoilHydro's Tail IO project
  - Made available to NTNU's IO Centre

Process domain
- Real-time information from many, highly different assets

Corporate domain
- Common asset models
- Common processes and applications
Reference semantic model
Objective

- Develop an implementable reference semantic model that can be used by processing & manufacturing companies to connect
  - Real-time measurements
  - Planning & scheduling information
  - Life cycle information about plant data
- Should not be a data model that constrains the way applications implement the information exchange
  - Facilitate exchange of information
- Should provide a single enterprise hierarchy that models process equipment, measurements and documents connectivity
Reference semantic model
Participating associations and companies

MIMOSA
OAGi
WBF
Energistics
ISA 88
ISA 95
POSC Caesar
OPC
OSIsoft
DNV
DOW
SISCO

IBM

IIF Reference Model

Provide a standard-based model and enterprise taxonomy for:
- Real-time process name space management
- Model Maintenance
- Visual access to process data, KPIs, documents, reports and specifications
IIF Model Adapter

Process events can be defined using rules, and orchestrate initiation and governance of web services and operational processes.

Provides cross enterprise services & utilities to graphically configure, define & subscribe to:

- real time data,
- process events, and
- KPIs
End User Perspective – Real-time monitoring of process equipment
IIF Business Engine

Provides process workflow, initiated by events generated from real time data, alarms or applications.
IIF Visualization

Provides real-time visualization of data through a thin client for viewing and querying of all model based objects across the enterprise:

- Process tags
- Reports
- Equipment specifications
- Alarms…
IIF Data Access

Provides web services for real time data access to model objects:

- Process tags
- Reports
- Equipment specifications

Can be used by any applications, SAP and .net applications included.
IIF External Adapters

“Agile” adapters, i.e., adapters that are RSM model-aware
Supports automated configuration and model updating from “Systems of Authority”
IIF CBS provides web services of common business functions
The RSM and IIF support organization growth as new facilities are added thru organic growth or merger and acquisitions.
In summary, we believe that the IIF solves many of the scalability issues that the industry is facing:

- Automates updating of asset models
  - When systems of authority are updated
- Standardizes access to data across all assets, and protects existing investments
  - Web services and OPC
  - Protects existing investments
- Facilitates development and deployment of common processes and applications across assets
  - No changes to assets required

Increasing risks, costs and time due to an increasing number of processes, equipment, interfaces and events to support
We believe that IIF facilitates implementation of new, truly innovative processes.
Our study has shown that IIF enabled business benefits of Integrated Operations can come from the following areas:

- Small productivity gain can translate into millions of dollars of additional revenue.
- Overview of potential benefit areas

<table>
<thead>
<tr>
<th>IO Benefit</th>
<th>Onshore Oil</th>
<th>Deep Water Oil</th>
<th>Shallow Water Gas</th>
<th>Onshore Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Reservoir Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Better Information</td>
<td>2-5%</td>
<td>3-8%</td>
<td>1-3%</td>
<td>1-3%</td>
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<tr>
<td>– Better Operations</td>
<td>1-2%</td>
<td>1-2%</td>
<td>1-2%</td>
<td>1-2%</td>
</tr>
<tr>
<td>Lower Operating Costs</td>
<td>15-25%</td>
<td>5-10%</td>
<td>10-25%</td>
<td>15-25%</td>
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<tr>
<td>Decreased Capital Costs</td>
<td>-</td>
<td>5-10%</td>
<td>20-30%</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: IBM GBS, 2008
Integrated Operations - StatoilHydro

IIF will enable StatoilHydro to increase the recovery rate of its oil and gas fields from 52% to 70%, representing tens of billions of dollars in added oil revenues.

IIF Enabled Business Benefits

- Expected 5% increase in oil and gas production through a reduction in lost production related unplanned equipment maintenance issues – (Value US$1B/YR)
- Expected 30% reduction in costs through the use of predictive maintenance practices (Value US$200M/YR)
- Extension of oilfield life and increase in production yield through "smart" field management, enabled by real-time wireless sensing of subsurface oil field conditions
- Lower costs and improved employee retention through on-shore consolidation of well monitoring and management
- Increased interdisciplinary collaboration through improved information sharing

Source: “Statoil pumps up production levels through information sharing and 'smart' practices”, IBM Global Solutions Industry Marketing publication, 2007
IBM Research and Technology

Ongoing E&P Research projects in IBM

- IIF development to support IO and ISO 15926 compliance
- Unstructured mesh generation for basin modeling and reservoir simulation
- Large-scale simulation of sedimentary basins
- Ray-tracing using tetrahedral meshes for survey optimization and pre-stack depth migration
- Grid-based visualization (SGE)
- Pattern recognition in seismic and well images
- Data analytics of time-series (Intelligent Oilfields)
- Optimization of large-scale problems coupled with reservoir simulation
- High Performance Computing tools for scientific computing

Technical disciplines in IBM Research

- Chemistry
- Computer Science
- Electrical Engineering
- Material Science
- Mathematics
- Physics
- Cross Disciplinary