ENERGISTICS & DIGITALIZATION
Moving Beyond Data Integration

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February 27, 2019

PDS Group

» Company Overview
  • PDS => Petrotechnical Data Systems
  • Fusion of IT expertise and upstream E&P expertise
  • Offices in Houston, London, Aberdeen, the Hague, and Sofia in Bulgaria
  • 25 year history of consulting and bespoke software for oil and service companies

» PDS Brands
  • Ava focused on streamlining and enhancing geological modeling
  • WITSMLstudio focused on:
     ▪ Integrating with existing systems to deliver existing data as WITSML
     ▪ Bringing drilling data inhouse for analytics via WITSML
     ▪ Providing open source WITSML technology to the community
Agenda and Objectives

» Agenda
  • What is digital transformation?
  • How do we build the technology?
  • How can standards facilitate successful and sustainable transformation?
  • How can Energistics support digitally transformed organizations?

» Objectives:
  • Examine digitalization in the context of Energistics and its standards
  • Look at where standards currently play a role and where they do not
  • Stimulate future discussions on expanding the role of standards in digitalization

What is Digital Transformation?

Minority Report
Digitalization and Digital Transformation

» **Digitalization** is innovative digital technology and digitized processes

» **Digital Transformation** is radical change that leverages Digitalization
  - New people
  - New roles
  - New skillsets
  - New workflows
  - New teams
  - New organizations
  - …

» Revolutionary (*), not evolutionary
  * Goals defined by and changes carried out by current organizations

Digital Transformation Journeys

Data Science Pyramid
https://sensecorp.com/the-data-science-pyramid/

Automation Pyramid
Digital Transformation Journeys

Analytics Hierarchy


Digital Technology at the Foundation
### Building the Technology

#### Invest in the Base and Build Upwards

<table>
<thead>
<tr>
<th>Data</th>
<th>Garbage In = Garbage Out</th>
<th>Will never be a solved problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform</td>
<td>Enable rapid innovation and delivery</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Support new workflows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deliver new insights</td>
<td></td>
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<tr>
<td></td>
<td>Enable new ways of working</td>
<td></td>
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</tbody>
</table>

#### Current Energistics Focus

- Streamlined Acquisition
- Good Quality Data
- Standardized Access
- Agile Frameworks
- High Value Applications

[https://thetowerinfo.com/buildings-list/burj-khalifa](https://thetowerinfo.com/buildings-list/burj-khalifa)
Digital Transformation Building Blocks

Core Concepts
- Big Data
- Data Lakes
- Cloud Computing
- Edge Computing
- IoT

Enabling Processes
- Lean
- Agile
- Responsive

Enabling Techniques
- Data Science
- Deep Learning / AI
- Digital Twins
- Data Analytics
- Process Automation
- Microservice Architectures

Enabling Technologies
- Blockchain
- 3D Printing

Digital Transformation Computing Model

Ingestion: Message Queue Consumers, APIs, Direct Data Store Connections
Data Flows: Message Queues, Direct Connections, Data Orchestrations
Processing: Stream Processing, Batch Processing, Event Processing
Data Stores: SQL, NoSQL, Data Lakes
Consumption: Message Queue Producers, API, Direct Data Store Connections
Technologies Enabling Digital Transformation

Message Queues
- ActiveMQ
- MSMQ
- RabbitMQ
- Kafka
- NiFi

Complex Event Processing
- SQLstream
- Streambase
- Apache Flink
- WebSphere Business Events
- SAP ESP
- Oracle Event Processing
- Informatica RulePoint

ActiveMQ
- MSMQ
- RabbitMQ
- Kafka
- NiFi

Data Stores
- SQL Server / Oracle
- MongoDB
- Cassandra
- Google Big Table
- Amazon Red Shift
- Microsoft CosmosDB
- SAP HANA
- Apache HBase

Complex Event Processing
- SQLstream
- Streambase
- Apache Flink
- WebSphere Business Events
- SAP ESP
- Oracle Event Processing
- Informatica RulePoint

Business Intelligence
- Spotfire
- Tableaux
- PowerBI
- Excel
- QlikView
- Chartio
- Locker

Complex Event Processing
- Apache Spark

Stream Processing Engines
- Storm
- Azure Stream Analytics
- Kinesis
- Cloud Dataflow
- Apache Beam

ML / Data Science
- TensorFlow
- R
- Matlab
- Python

Batch Processing
- Apache Spark

ERP / CRM / HR / Finance / Logistics
- EnterpriseOne
- SAP
- PeopleSoft
- Salesforce
- Dynamics
- Sage
- NetSuite

Business Intelligence
- Spotfire
- Tableaux
- PowerBI
- Excel
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- Locker

ML / Data Science
- TensorFlow
- R
- Matlab
- Python

Master Data Management
- IBM Infosphere Information Server
- SAS Data Management
- PowerCenter Informatic
- Dell Boomi
- Profisee Master Data Management
- SAP NetWeaver MDM
- Teradata MDM

Subsurface
- Petrel
- JewelEarth
- DecisionSpace
- RMS
- IMEX
- CoVIZ 4D
- SKUA

Technology Islands

- No standard ways to exchange data across all these technologies
- Each technology interoperates with different subsets

ERP / CRM / HR / Finance / Logistics
- EnterpriseOne
- SAP
- PeopleSoft
- Salesforce
- Dynamics
- Sage
- NetSuite

R

Storm

RabbitMQ

SAP

Redshift

ERP / CRM / HR / Finance / Logistics
- EnterpriseOne
- SAP
- PeopleSoft
- Salesforce
- Dynamics
- Sage
- NetSuite

Subsurface
- Petrel
- JewelEarth
- DecisionSpace
- RMS
- IMEX
- CoVIZ 4D
- SKUA

Drilling
- EDM
- WellView
- SiteCom
- PetroVault

Production
- Prosper
- Saphir
- Carina

IT

Spotfire

R

RabbitMQ

SQL Server

Matlab
Sustainable Transformation through Standards

Transformed Organizations Depend on Data

» Transformed workflows are data-centric
  • The presence, consistency, security and quality of data must be assured

» Innovation drives transformed organizations
  • Data must be provided to the right people in the right way at the right time

» Transformed organizations embrace disruptive change
  • The data landscape must evolve to meet changing business needs

» Data Management is key to transformed organizations
  • How can they do all this efficiently in terms of cost and effort?
Data Standards Support Transformed Organizations

- Data Standards support transformed organizations through:
  - Robust, Secure, Low-Latency Data Transfer
  - Domain-Appropriate Data Models
  - Standard Interfaces
  - Data Assurance Best Practices

- Data Standards further help these organizations avoid:
  - Competing Data Formats
  - Vendor Lock-In with Data Stores
  - Out-Dated Data Exchange Mechanisms
  - Poor Quality Solutions and Unhappy Users

How Is WITSML Used Now?

<table>
<thead>
<tr>
<th>Data Models</th>
<th>Data Interfaces</th>
<th>Applications</th>
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<td>WITSML 1.x</td>
<td>SOAP</td>
<td></td>
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</tbody>
</table>

- Applications:
  - Prescriptive Analytics
  - Predictive Analytics
  - Diagnostic Analytics
  - Descriptive Analytics
  - Data Warehouse
  - Alerting
  - Modeling
  - KPIs
  - Visualization
  - Calculation
  - Data QA
  - ETL
  - Historian
  - Data Aggregation
  - Data Acquisition
  - Process Automation
  - Hardware / PLC
Where Do the New Standards Help?

Data Models
- WITSML 1.x
- WITSML 2.x

Data Interfaces
- SOAP
- OPC UA
- ETP

Applications
- Data Warehouse
- Historian
- Data Aggregation
- Data Acquisition
- Process Automation
- Hardware / PLC

How Could Standards Help in the Future?

Data Models
- WITSML 1.x
- WITSML 2.x
- ??

Data Interfaces
- SOAP
- OPC UA
- ETP
- ??

Applications
- Data Warehouse
- Historian
- Data Aggregation
- Data Acquisition
- Process Automation
- Hardware / PLC
Energistics and Digitalization

Modern Data Integration Challenges

- High Value Applications
- Agile Frameworks
- Standardized Access
- Good Quality Data
- Streamlined Acquisition

Current Energistics Focus

Application
- In-cloud processing of large data
- Cloud ingestion of domain data

Platform
- High-fidelity data+context exchange
- Sub-second sensor to shore
And What About…

» Integrating engineering, finance, logistics and customer data:
  • Adjusting drilling program budget forecast based on revised targets
  • Optimizing activities based on equipment performance and local availability
  • Automatically issuing invoices and payment based on completed services
  • …

» Crossing domains like:
  • Rerunning reservoir simulation based on actual formation tops while drilling
  • Revising production forecast based on revised understanding of geology
  • Revising planned injector well locations based on revised simulation results
  • …

Moving Beyond Data Integration

» How could Energistics help Operators?
  - Enabling high-value workflows like data analytics, ML, automation, etc.
  - Standardizing data quality best practices and procedures

» How could Energistics help service companies / equipment providers?
  - Optimizing workflows to reduce complexity and human error
  - Defining standard touch points for value adding technology

» How could Energistics help the industry as a whole?
  - Defining true best practices in addition to standardizing existing practices
  - Involving new partners to broaden the footprint covered by standards
Why Energistics?

Energistics is an established industry framework for standardization
- Broad E&P domain footprint
- Broad industry participation
- Focus on both data representation and system integration

Various Competing Industry Practices  \[\rightarrow\]  Energistics  \[\rightarrow\]  Coordinated and Standardized Industry Practices

Energistics in a Digitally Transformed World

How will standards be helping:
- Operators?
- Service companies?
- Equipment providers?
- Technology companies?
- Independent software vendors?
- Governments and regulatory bodies?

How could E&P standards benefit:
- Cloud technology?
- Drilling automation?
- Finance? HR? Logistics?

How could more of the industry be involved in defining standards?
How could standards development be improved?
How could adoption and implementation be improved?