Better ways to integrate drilling with subsurface data

Courtyard by Marriott Mumbai, Wednesday, February 4, 2015
USE THE CRS DATABASE TO SIZE THE MARKET.

THAT DATA IS WRONG.

THEN USE THE SIBS DATABASE.

THAT DATA IS ALSO WRONG.

CAN YOU AVERAGE THEM?

SURE. I CAN MULTIPLY THEM TOO.
Agenda

Upstream Global Organisations

New developments & Data explosion

Industry trends for better performance & collaboration

Drill the right hole & Drill the hole right

Enterprise view of an organization’s data through MDM

Drilling and Subsurface data integration - Bigdata Way

Summary & Conclusions
Upstream global Organisations

REMOTE OPERATIONS CENTER
ONSITE RESOURCES
REMOTE INTERNAL RESOURCES
REMOTE EXTERNAL RESOURCES

Drilling
Maintenance
Production Optimization
Logistics


Data Quality
Simplification / Standardization
Integration
Optimization
Agenda

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New Industry Developments – Exploration

Geophysics

**Broadband**
- Towed-streamer – provides broader frequency image.

**Nodal seismic**
- Deployed on the seafloor-
- higher quality & the full-
- azimuth data

**Wide-azimuth (WAZ)**
- Multiple source boats shooting from a variety of directions

**Coil shooting**
- Vessels shoot in a circular rather than a linear pattern

**Streamer Configuration**
- Snake / Flat Conventional / Slant configuration

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**Cable Profiles**

1. Flat conventional 8m
2. Flat deep 25m
3. Snake streamer 25 +/- 10m
4. Flat deep 35m
5. Slant linear 8–35m
6. Slant 8–25. Flat at 2.5km
7. Slant 8–35. Flat at 2.5km
8. Ultra deep 60m
9. Slant linear 8–60m
10. Slant 8–60. Flat at 2.5km
11. Slant 8–45 at 2.5km, flat till 5km up to 8m
**Processing:**
Reverse time migration
Full waveform inversion - Helps bandwidth preservation.

**Interpretation:**
- Uncertainty modeling - error bars to indicate the level of uncertainty present in the model
- Quantitative interpretation - to quantify reservoir properties - , lithology, and rock and fluid properties.

**Multiphysics**
- Seismic data integrated with well logs, gravity and magnetic, and electromagnetic data – not new.
- Technologies for joint inversion of the data
Data explosion Challenges

- To ingest, validate, and analyze high volumes (size and/or rate) of data
- Access & Assess mixed data (structured & unstructured) - Multiple sources
- **Dealing with unpredictable content with no apparent schema or structure**
- Enabling real-time or near-real-time collection, analysis, and answers

Need of the hour

- High-velocity capture, discovery, analysis.
- Shift in computing architecture so as
  - Data storage requirements
  - Server processing required to analyze large volumes of data

Confusion – Big Data Storage / Big Data analytics

- Develop analytics processes that were faster and more scalable than traditional data warehousing
- Value extract value from unstructured data produced daily by web users.
- Big Data storage, such as Scale-out-NAS and Object-based storage are not new
- IT handles a lot of data for applications that generate huge volumes of unstructured data
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Regulatory compliance
Enterprise data transparency

Master Data Management
Data governance
Enterprise-level BI
Service-oriented architecture – connections to business intelligence

IT trends for better performance and collaboration.

Right-shoring

Information quality
Semi-structured and unstructured data
Actionable Business Intelligence

Traditional BI approaches – won’t solve the master data problem for operational systems
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D&C processes

- Onshore control room work processes
- Change management support

- Fast update of geo & reservoir models - Decision space environment
- Well planning and drilling optimisation
- Condition based maintenance applications

Drilling Ops Optimisation: Integrated Drilling Monitoring, Early warning & Response System

- Work processes and decision support
- Automatic real-time monitoring
- Global RTOC
  - Integrate competency and information towards decisions (COE)
- Safe and reliable data and communication infrastructure
  - Standard implementation
  - Reducing NPT through better collaboration

- Real-time processing and analysis
- Drilling Ops Monitoring
- Hydraulic Frac- micro-seismic monitoring
- Down hole flow, P and T measurement

- Data transmission from sensors to surface to desktop - WITSML
- Safe and reliable offshore network
- Standards and protocols, applications integration
- D&C Data Management platform - EDM

Appraisal → Select → Define → Execute → Close out

Sub-Surface

Drilling
Exploration Plan

Blowout scenario - highest volume of oil may be released.
Estimated flow rate, total volume, and maximum duration of the potential blowout

Assumptions and calculations underpinning the worst case discharge scenario.
Measures to enhance ability to prevent a blowout.

Spill Response
surface intervention to stop the blowout, availability of a rig to drill a relief well and rig package constraints;
Estimates of the time it would take to contract for a rig, move it onsite, and drill a relief well;
Geographical & Reservoir Information

Geological Info
- Structure Maps for producible sand
- Top and base
- Maximum drainage area
- Thickness of hydrocarbon sand
- Cross-section of hydrocarbons bearing zones
- Seismic Data used in well site location
- Data sources G&G interpretation Applications

Reservoir Info
- Reservoir pressure data & drive mechanisms;
- Drainage area, depletion rates & Production history;
- Static and flowing pressures and temperatures;
- Skin damage, Coning and Bridging;
- Pressure-volume-temperature characteristics of the fluid;
- Hydrostatic pressure
- Nodal analysis data
Field Summary

Prospect/Field and Summary of Well Plan

Wellbore:
Well cross section showing with casing program:
Casing/liner sizes (outside and inside diameters) and setting depths.
Various hole sizes as the well progresses
Water depth at proposed location
Plot of surface and bottom hole location
Wellbore completion configurations
Casing and open-hole sizes

Data Sources: Analog Outputs from Corresponding Applications like Landmarks Drilling Suite/G&G apps
No Drilling Surprises

Data attributes / information to be monitored

- Lithology Prediction – Startigraphic
- Formation Pressure - Seismic / Legacy well data
- Discontinuity - Seismic
- Well Path - EDM/ Openwork’s/

Data / information Sources

- Lithology Prediction – Stratigraphic (LWD – Gamma Ray etc)
- Formation Pressure - Seismic / Legacy well data – PWD
- Discontinuity - Seismic - MWD
- Well Path - WITSML drilling

Collaboration / Interactions with:

- G&G teams
- Drilling engineers
- Real time data vendors and operators.
Wellbore Stability

Data attributes / information to be monitored:
- LOT / PIT studies
- Pore Pressure and Fracture gradient zones
- ECD & hydraulics
- Fracture Model–Core Studies and GMI
- Micro-seismics / EDM

Data / information Sources:
- Pore Pressure and Fracture gradient zones - PWD
- ECD & hydraulics - WITSML
- Fracture Model – Bore hole imagery/ Array sonic

Collaboration / Interactions with:
- G&G teams
- Petro-physicists
- Drilling engineers
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Enterprise view of an organization’s data

Data Governance through proper master data management encompasses the people, processes, and technology required to create a consistent data and information set.

Data Governance To Look into

- Master data stores: Single, true, and corrected version of the data
- Master data management: Set of processes and tools to collect and supply unique instances of each entity to the end user, spatially or otherwise
- Data access: How is the trusted data presented to the end user, spatially or otherwise
- Database management systems
- Data integration platforms
- Meta data management repositories
- Data modeling tools and so on
MDM Solution Definition – Analysis Approach

1. Study of “As-IS” and “To-Be” scenario
   A. Strategy
   B. Standards
   C. Business process
   D. Functionality
   E. Needs of integration

2. Cross functional teams
   A. Map data to A apps
   B. Key business entities
   C. Data/information flows and Workflows

3. Master reference data attributes
   A. Drilling, rig, production
   B. HR, Legal, Financial

4. Customize assessment criteria -
   A. Distribute assessment attributes / attribute validation rules

   Assessment Dimensions
   - Strategic Fitment
   - Cost Effectiveness
   - Criticality & complexity
   - Data/Appli. characteristics
   - System Support
   - Technical maturity
   - System TCO

5. Master Data elements Assessment
   A. Data Governance Organization and Processes
   B. Business rules with associated meta-data and references
   C. Standard master reference Data (All ETL L ops)

6. MDM System – Distributed / Centralised / virtual / federated
   A. Data security and Access
   B. Data portals

Success Factor
   Key usage scenarios, and start performance testing early in the implementation cycle
Phased approach to MDM

Geographic Area Coverage
- World regions - what’s key? North America, Australia, North Sea?

Reservoir Type Coverage
- more about conventional or unconventional reservoirs

Asset Life Cycle Coverage
- Exploration, drilling, facilities? Or Enterprise

Functionality Features
- Tools features like Versioning, reference values, data aggregation?
MDM - Architecture Options

**DISTRIBUTED**
- Transaction Data
- Local Reference Data

**CENTRALIZED**
- Transaction Data
- Centrally Managed Master Reference Data

**VIRTUAL**
- Transaction Data
- Local Reference Data
- Virtual Master Data

**FEDRATED**
- Transaction Data
- Local Reference Data
- Centrally Managed Master Reference Data
Typical D/IM integration Architecture

Application Server / Framework

Controller
(Task, Actions and Processes Manager)

Data Transformation Services
(Entitlement, Conversions, Data Transfers)

MDM Layer - Data Access Services

Generic Services
- User Management
- Authentication
- SSO
- Messaging Events

Adaptors

Shape Files

E & P Oracle Data Stores

Adaptors

Oracle Data Stores

Adaptors

SAP

LDAP

AD
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Business Case: Drilling and Subsurface Data integration - Big Data way..

HadoopDB architecture:

- MapReduce job
- SQL query
- Master Node
  - HDFS
    - Name Node
  - Job Monitor
  - MapReduce Framework
  - InputFormat Implementations
  - DB Adaptor
- SMS planner
- Catalogue
- Data Loader
- Tasks
- External Govt DB’s
  - Task Monitor
  - DB
  - Data Node
- Internal PT KM systems
  - Task Monitor
  - DB
  - Data Node
- External Public / Private DB’s
  - Task Monitor
  - DB
  - Data Node
Knowledge Enabled Enterprise

**INTEGRATED INFORMATION SYSTEM**

- **E&P Data Management, DBA & Reporting**
- **Geographical Information System**
- **Drilling & Production Apps**
- **Project/Program Management**
- **Asset Management**
- **Quality**
- **Maintenance, Land & Production Acc.**
- **Petroleum Technical & Geosciences Systems**
- **Corporate Systems**
- **Document mgmt system**
- **HR & Payroll**
- **Oracle Financial**

**Connections**
- **Openspirit & other connectors**
- **User Data Login ID**
- **GIS map snapshot**

**Database**
- **Well Number**
- **Priority**
- **Field Location, Well**
- **Cluster Data, Co-ordinates, Rig Capabilities**
- **Drilling Start Date, Drilling Finish date**
- **EDM well number**
- **Reservoir, Drilling date, Work over date**
- **Completion type, Current well type**

**System Details**
- **MESC Number**
- **Rig and well Data**
- **Well Completion Attributes**
- **PIES Well Number**
- **Well Completion Attributes**
- **MESC numbers per well**
- **Date of availability**
- **Quantity on order**

**Tools and Applications**
- **Microsoft Project**
- **IBM FileNet Synergis Adept**
- **ESRI ArcGIS /Google Earth**
- **Prosource, Petrobank, PPDM -3.8**
- **Epoch RigWatch**
- **Landmark OW , WTS**
- **OSIsoft PI, IHS PERFORM , WI –LOWIS**
- **Schlumberger PIPESIM , Halliburton Landmark**
- **Schlumberger, Roxar ,KAPPA**
- **Merrick Systems**
- **Quorum Business Solutions**
- **Landmark TOWcs**

**Integration & Collaboration**
- **Enterprise integration & Improved collaboration: Structured and unstructured content Synchronisation**

**Data and Information Flow**
- **Location, well, rig, job, well category, scenario, project details, reservoir details, rig remove dates, completion details, spud date, coring, logging, injection.**
- **Prognosis issue date, elevation, easting, northing**
- **Liquid rate, water rate, gas rate, production rate**
- **GOR values, water cut, WARR parameters**
- **Job number, Planned cost, well details**
- **Drawing details**
- **Access to the images/documents**
- **Drawing Number**
- **Cost details**
- **HR & Payroll**
- **Oracle Financial**
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- Process Improvement – MDM
- Facilitates convergence of business intelligence and operational apps.

**Key Drivers**

Seamlessly integrating technologies creates new dimension in Decision making
- Seamless Information sharing
- Resource Planning
- Key component of what’s often Ease in remote monitoring and control of operations
- Contain Costs & Reduce turnaround times

*Integration of data from the main streams (Drilling, Wells, Seismic, Facilities) through MDM (People, Process and Technology-Tools/Software)*
"Finance here - we're not sure about this Hadoop thing... Could you just dump it all into Excel for us?"

Thank You