Does Seamless Data Integration Lead to Right Time Well Engineering and Right Time Decisions?

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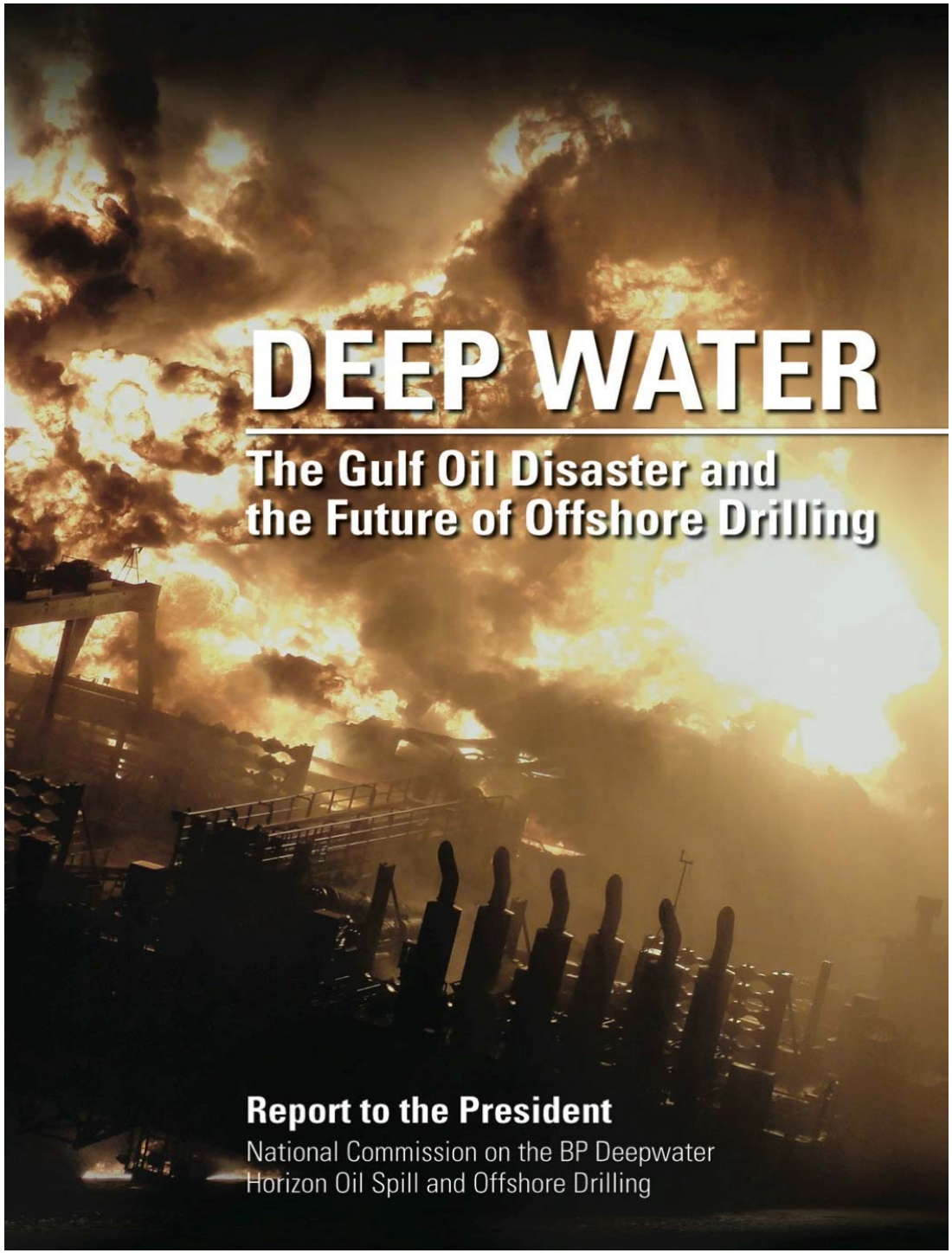

DEEP WATER
The Gulf Oil Disaster and
the Future of Offshore Drilling
Report to the President
National Commission on the BP Deepwater
Horizon Oil Spill and Offshore Drilling

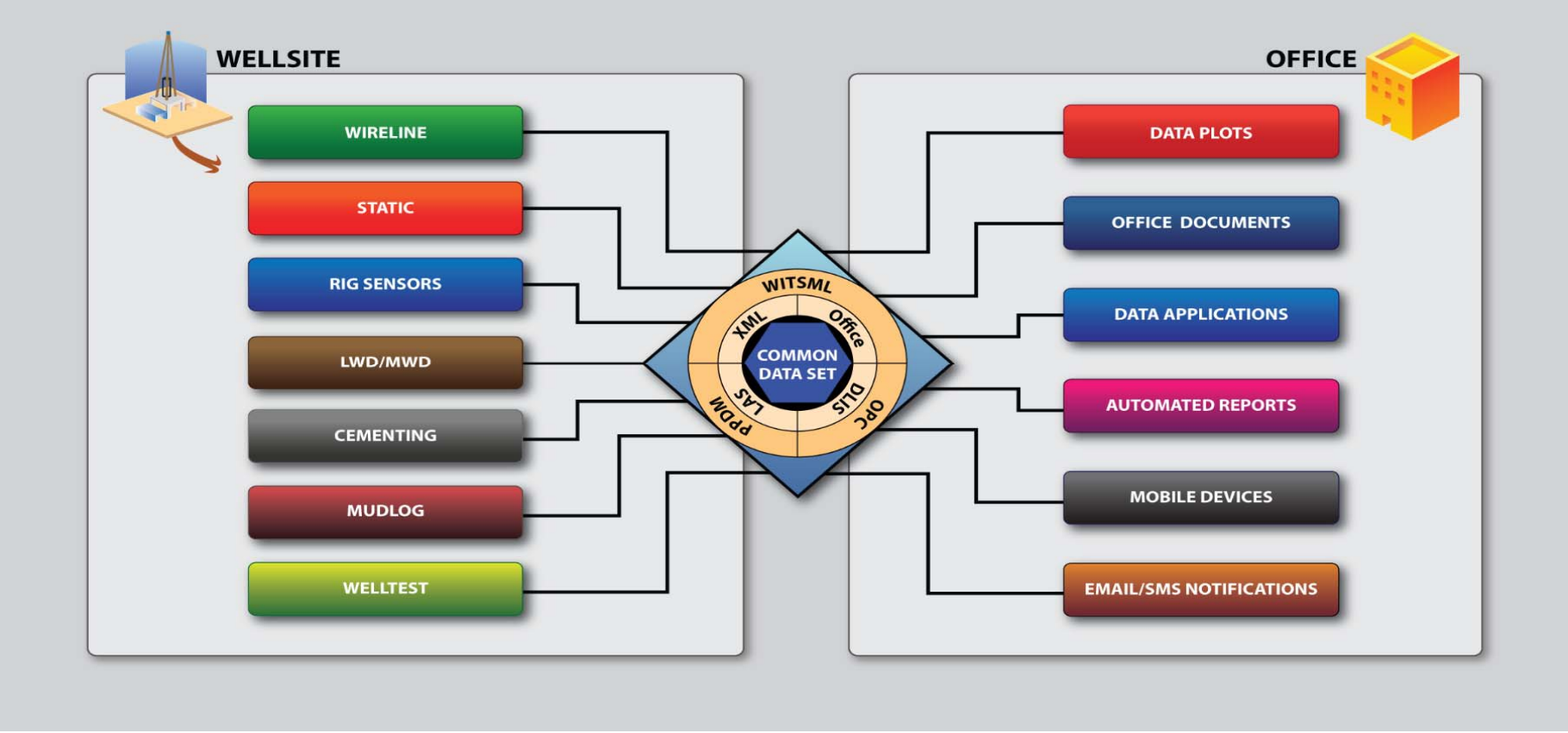
Page 121 of The National Commission Report

The USA National Commission Report on the BP Deepwater Horizon Oil Spill and Offshore Drilling stated on page 121 (http:// www.oilspillcommission.gov/final-report):

"In the future, the instrumentation and displays used for well monitoring must be improved. There is no apparent reason why more sophisticated, automated alarms and algorithms cannot be built into the display system to alert the driller and mudlogger when anomalies arise. These individuals sit for 12 hours at a time in front of these displays. In light of the potential consequences, it is no longer acceptable to rely on a system that requires the right person to be looking at the right data at the right time, and then to understand its significance in spite of simultaneous activities and other monitoring responsibilities."

What is Seamless Data Integration?

- Elimination of time intensive tasks needed for data transfer
- Minimum time for the data reconciliation/QC cycle
- Earlier information to improve decision-making at the rig-site and the operator's office



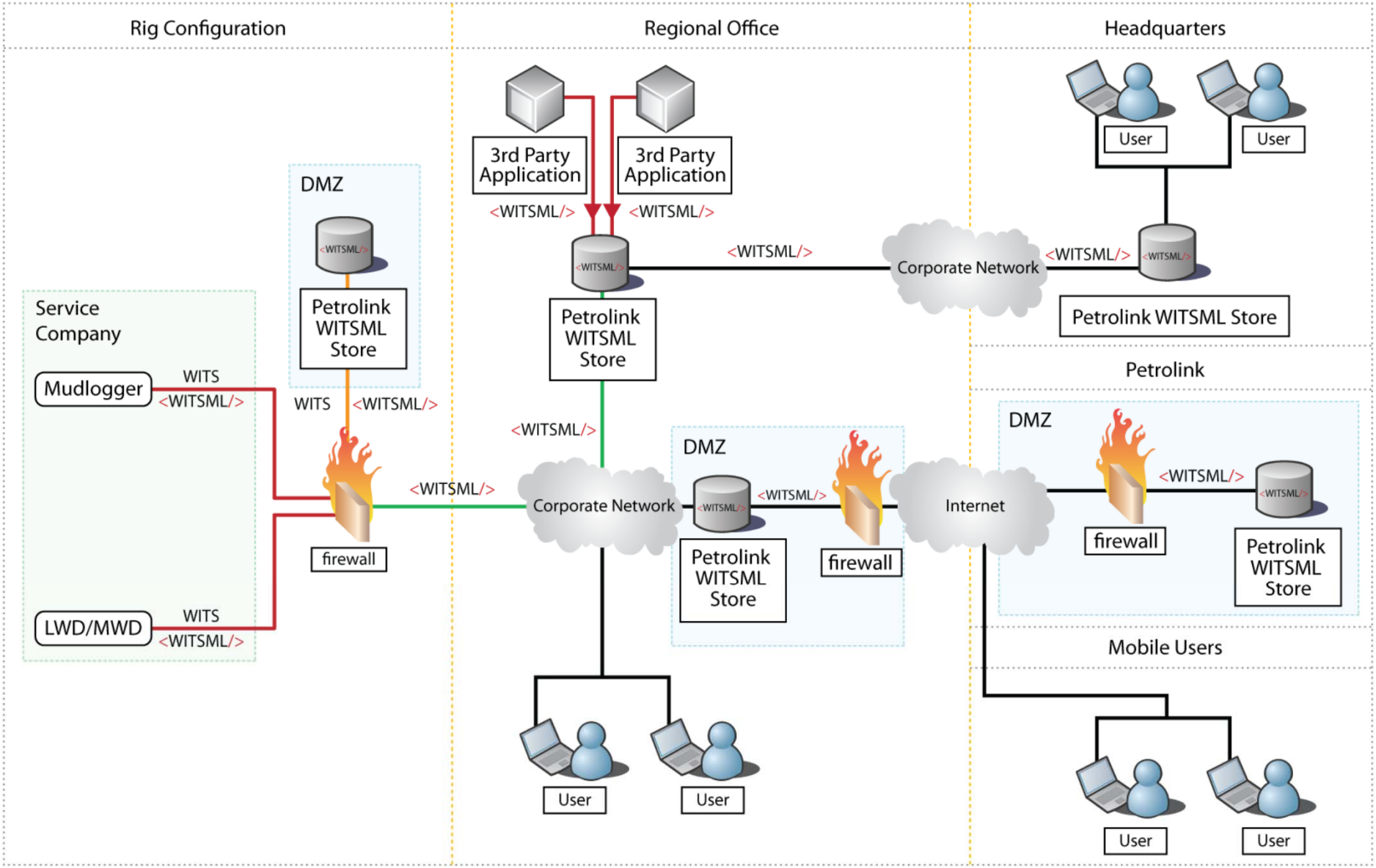
The Components of Data Integration

- Real-Time and Static Data
- Collect
- Convert to one standard (WITSML)
- Aggregate
- Store (database)
- Visualise
- Calculations for alerts and alarms
- Store to store synchronisation
- Export data for analyses (third party applications)
- Import analysed data (written back to database)

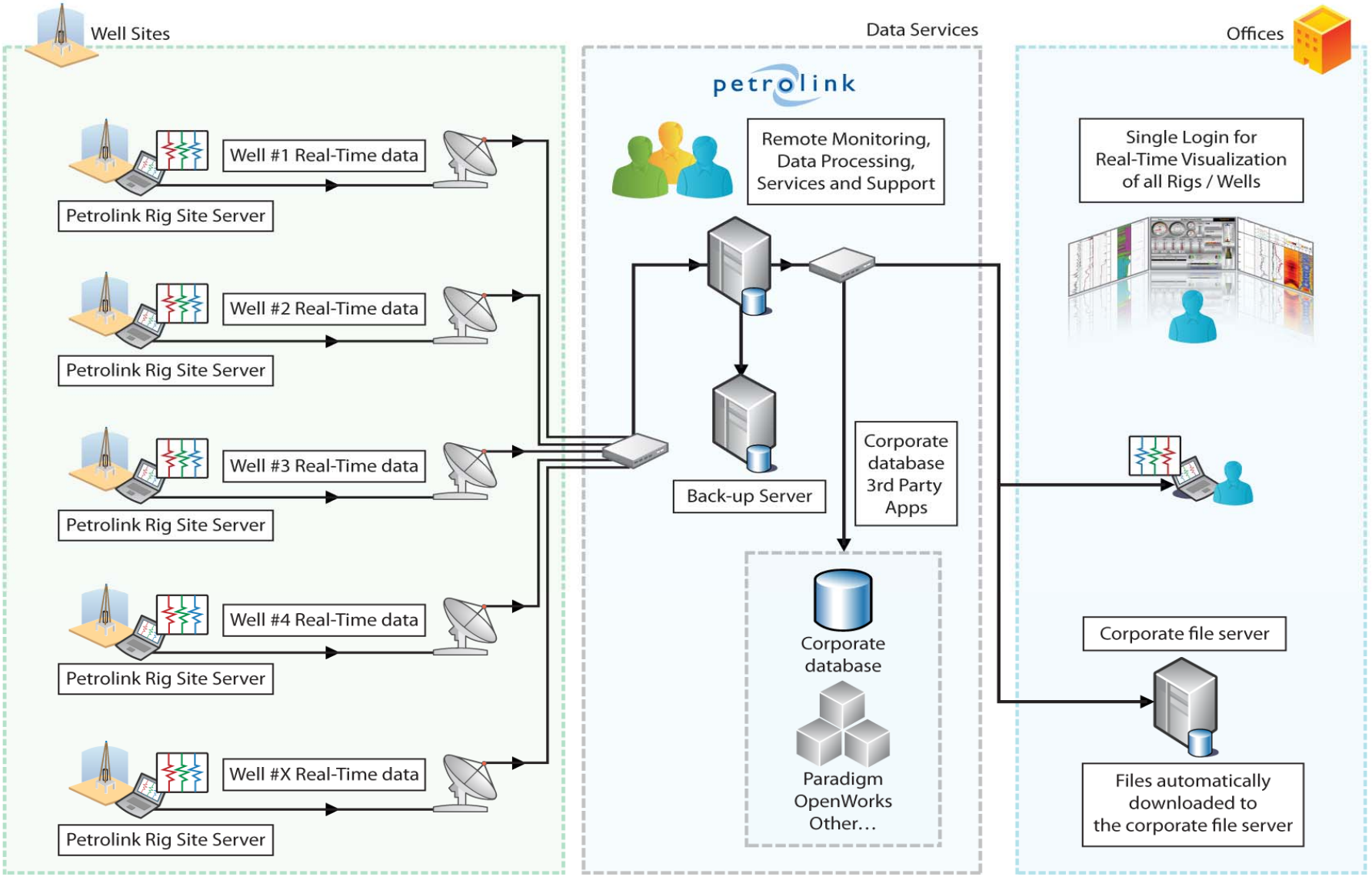
Rig-Site Data Collection

- Data management should start at the point of acquisition
- Real-Time Data
  - Rig drilling sensors (surface)
  - Mudlogging acquisition unit (surface)
  - MWD/LWD (downhole)
  - Cementing unit
  - Well testing (surface and downhole)
- Static (Batch) Data that is unstructured
  - Drilling reports / Geology reports
  - Mudlog plots and corresponding digital data
  - Interpreted lithologs (cuttings)
  - MWD/LWD plots and corresponding digital data (*.LAS & DLIS)
  - Wireline plots and corresponding digital data (*.LAS & DLIS)
  - Photographs (bit, cores)
  - Other files (*.docx, *.xlsx, *.pdf, etc.)

An Example Workflow Diagram



Multiple Rig with Static Data Workflow



Data Conversion

- WITS to WITSML

A WITS Level 0 Data Stream

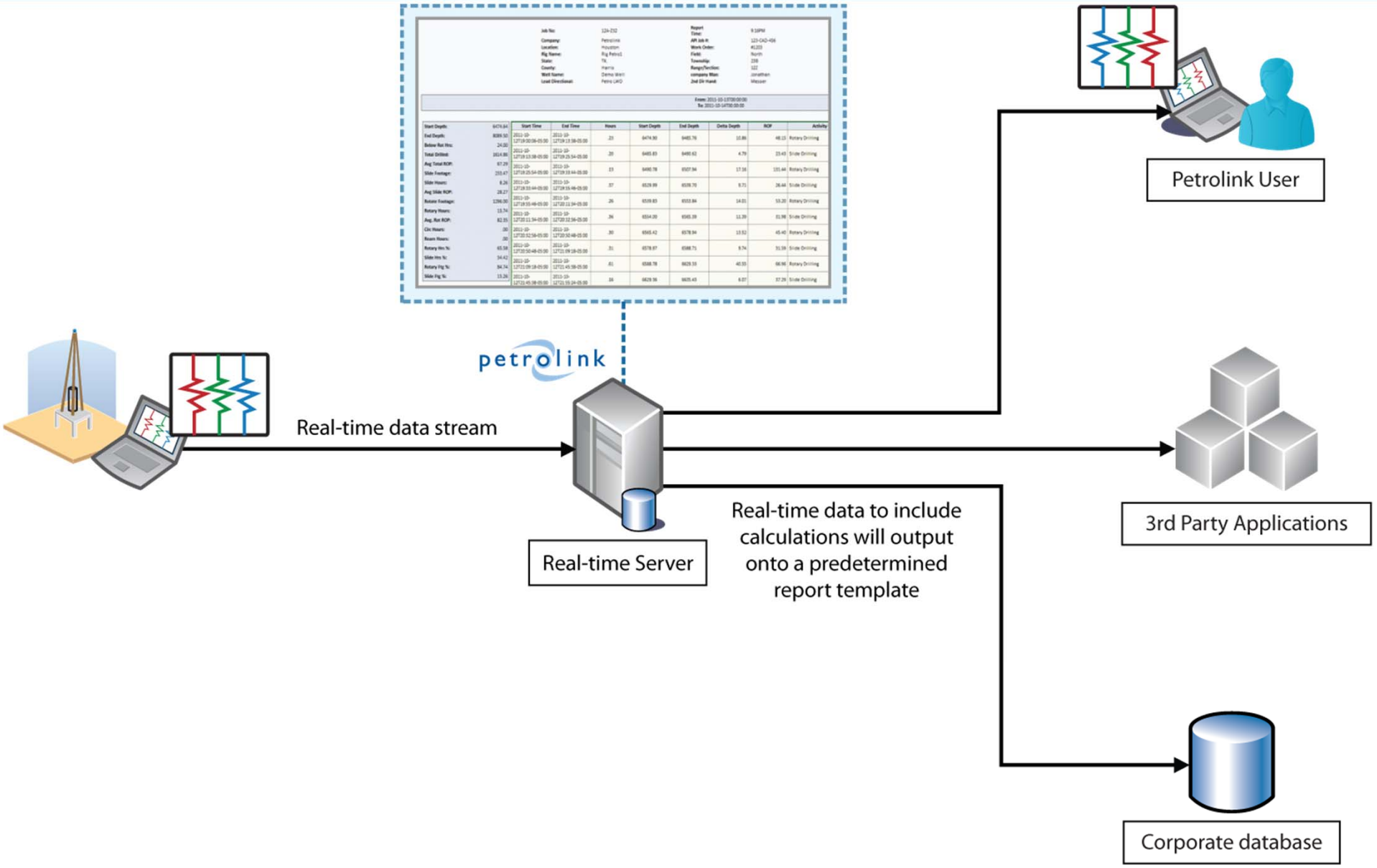
```
&&
0801Petrolink
08021
080812635
082180.23
!!
&&
0801Petrolink
08021
080812635.5
082181.48
```

A WITSML Data Stream

```
<nameWell>Petrolink Test Well</nameWell>
<nameWellbore>Sidetrack1</nameWellbore
<nameLog>D1</nameLog>
    <logCurveInfo>
      <mnemonic>DEPT</mnemonic>
      <unit>FT</unit>
      <mnemAlias>DEPTH</mnemAlias>
      <nullValue>-999.25</nullValue>
      <startIndex>12635</startIndex>
      <endIndex>14386</endIndex>
      <columnIndex>1</columnIndex>
```

Wellsite Information Transfer Standard Markup Language

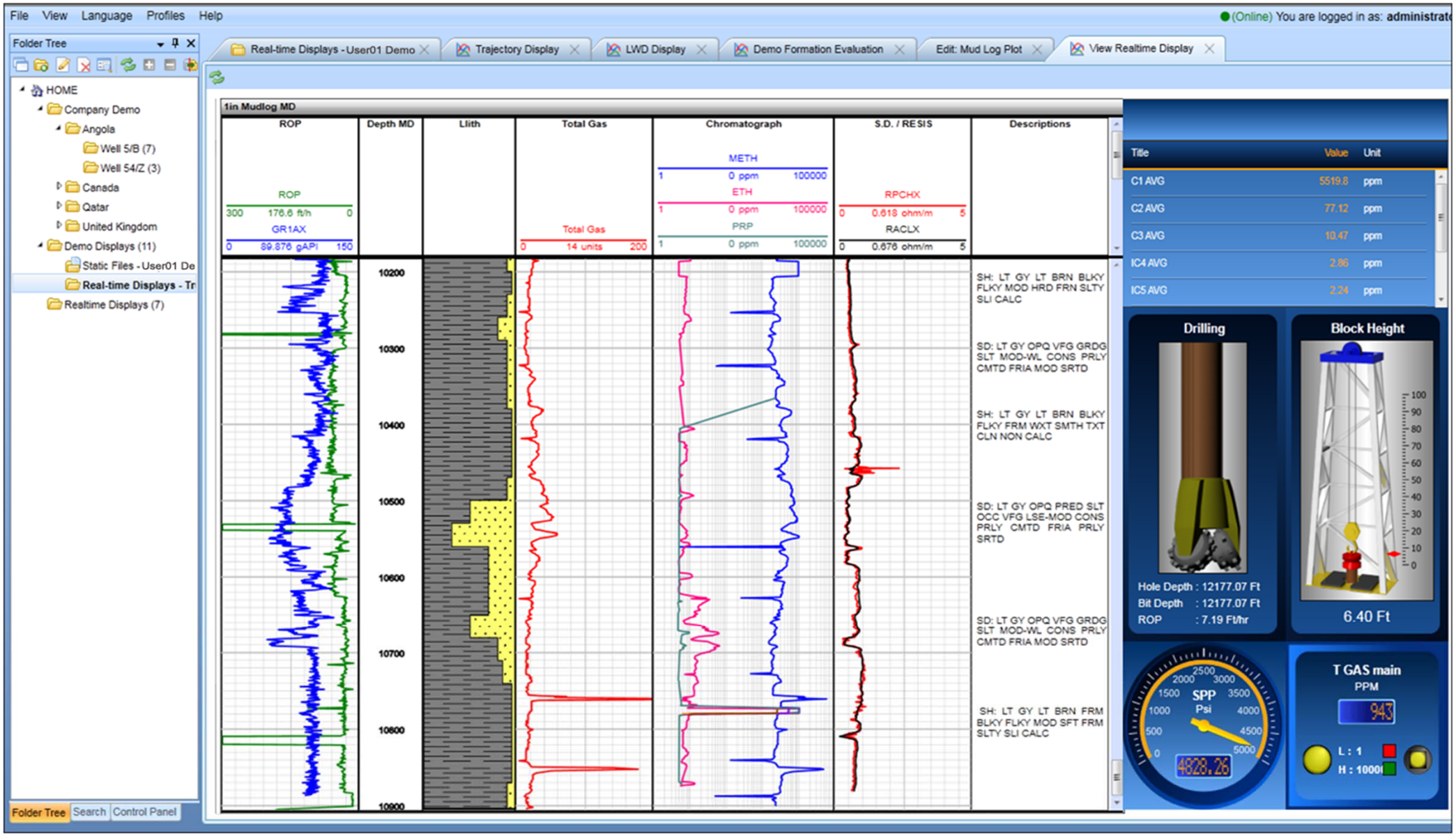
Extracting Reports From Real-Time WITSML Data



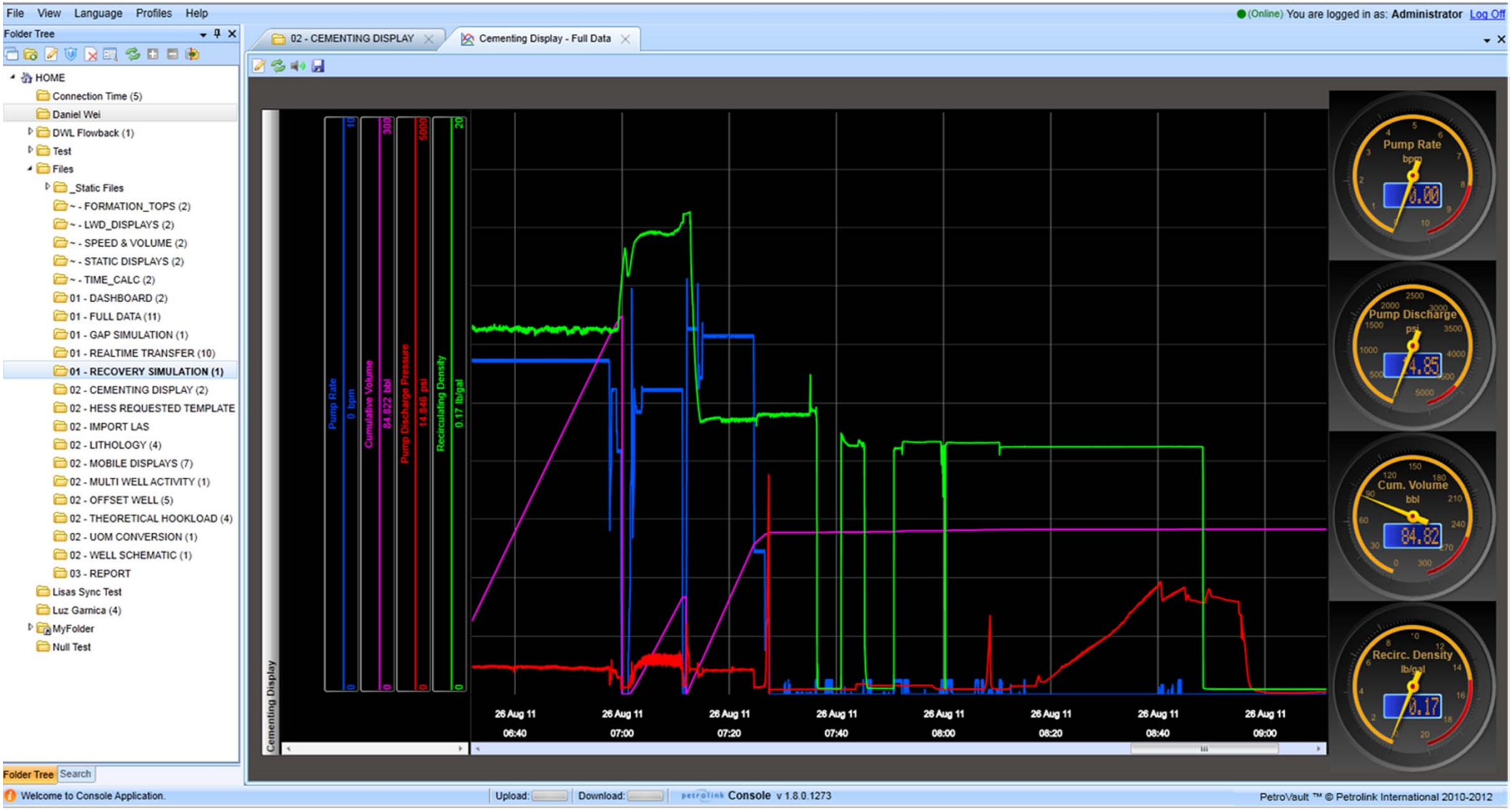
Importance of the WITSML Data Standard

- Energistics is an E&P industry supported body
- WITSML is Web based and built on XML technology
- Platform and language independent
- A data standard that is evolving to meet industry requirements
- Supports most types of well data:
  - Mudlogs
  - MWD/LWD
  - Drilling Sensors
  - Mud
  - Directional Drilling
  - Daily Drilling Report

Data Aggregation and Visualisation



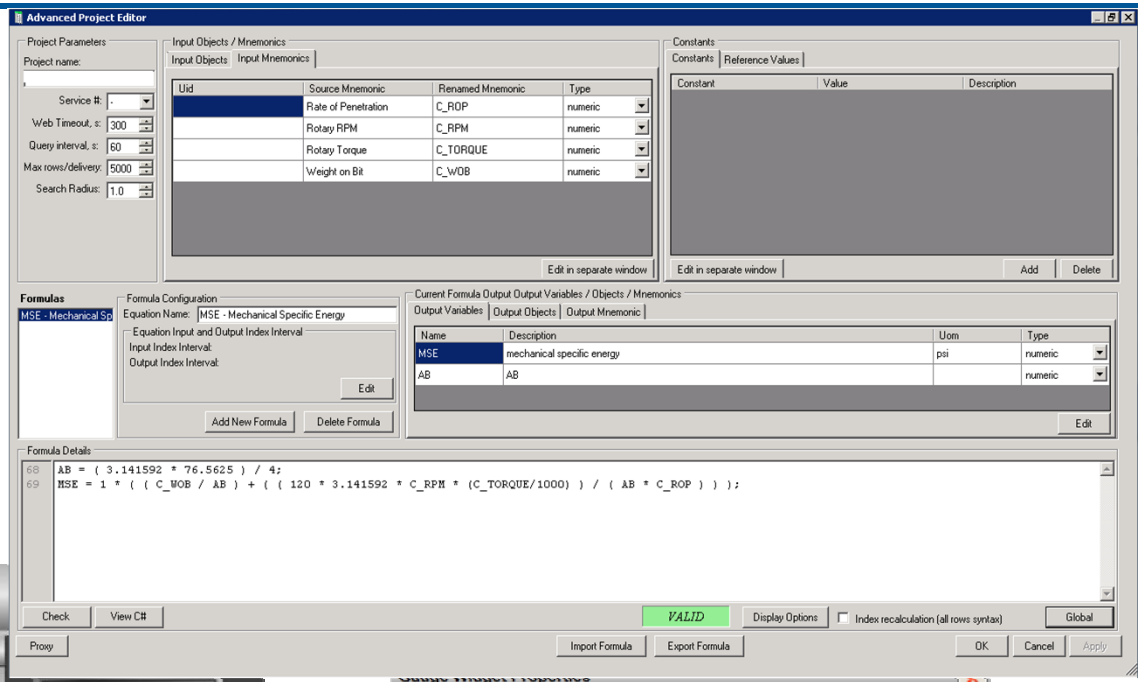
Cementing Job Display

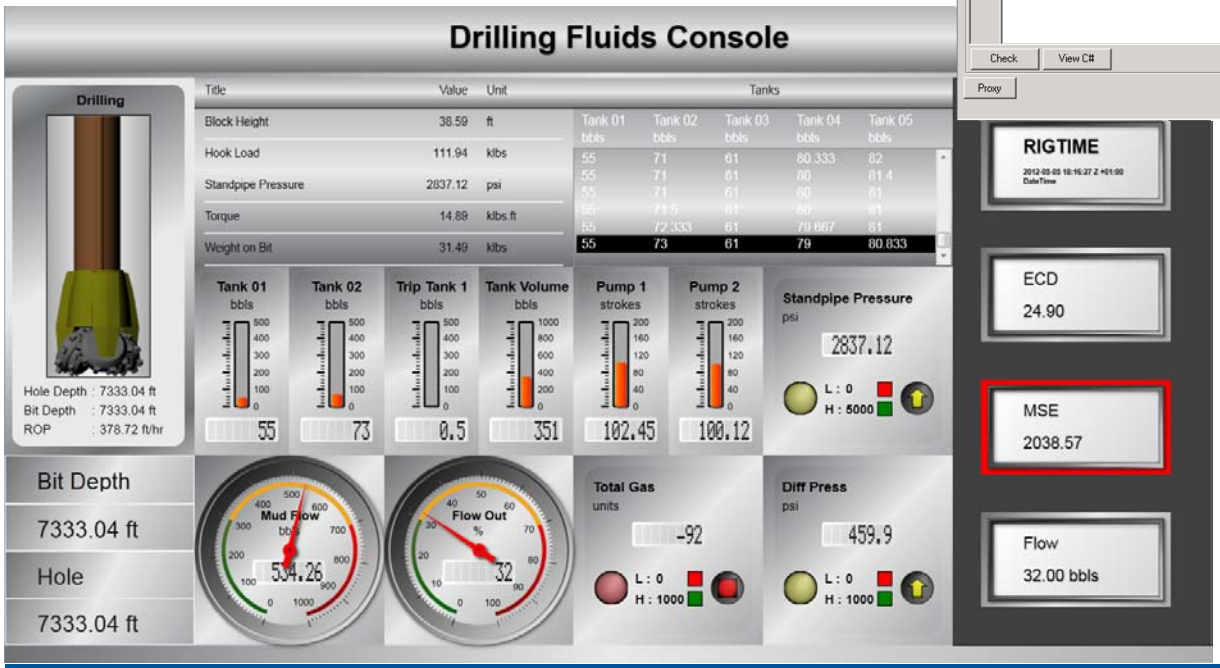


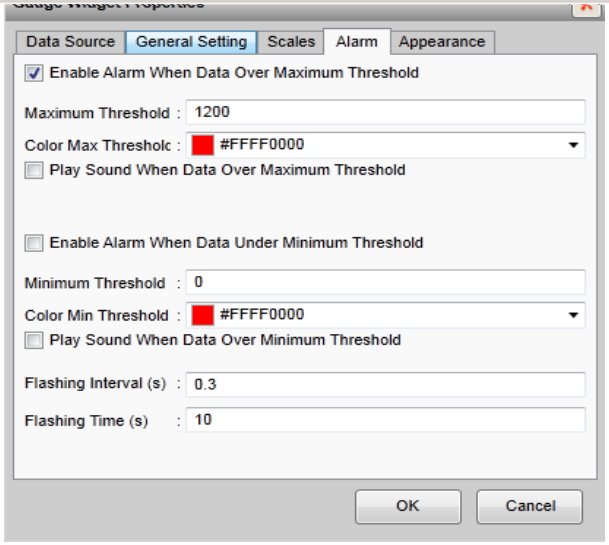
Displays On Mobile Devices

Calculations for Alerts and Alarms

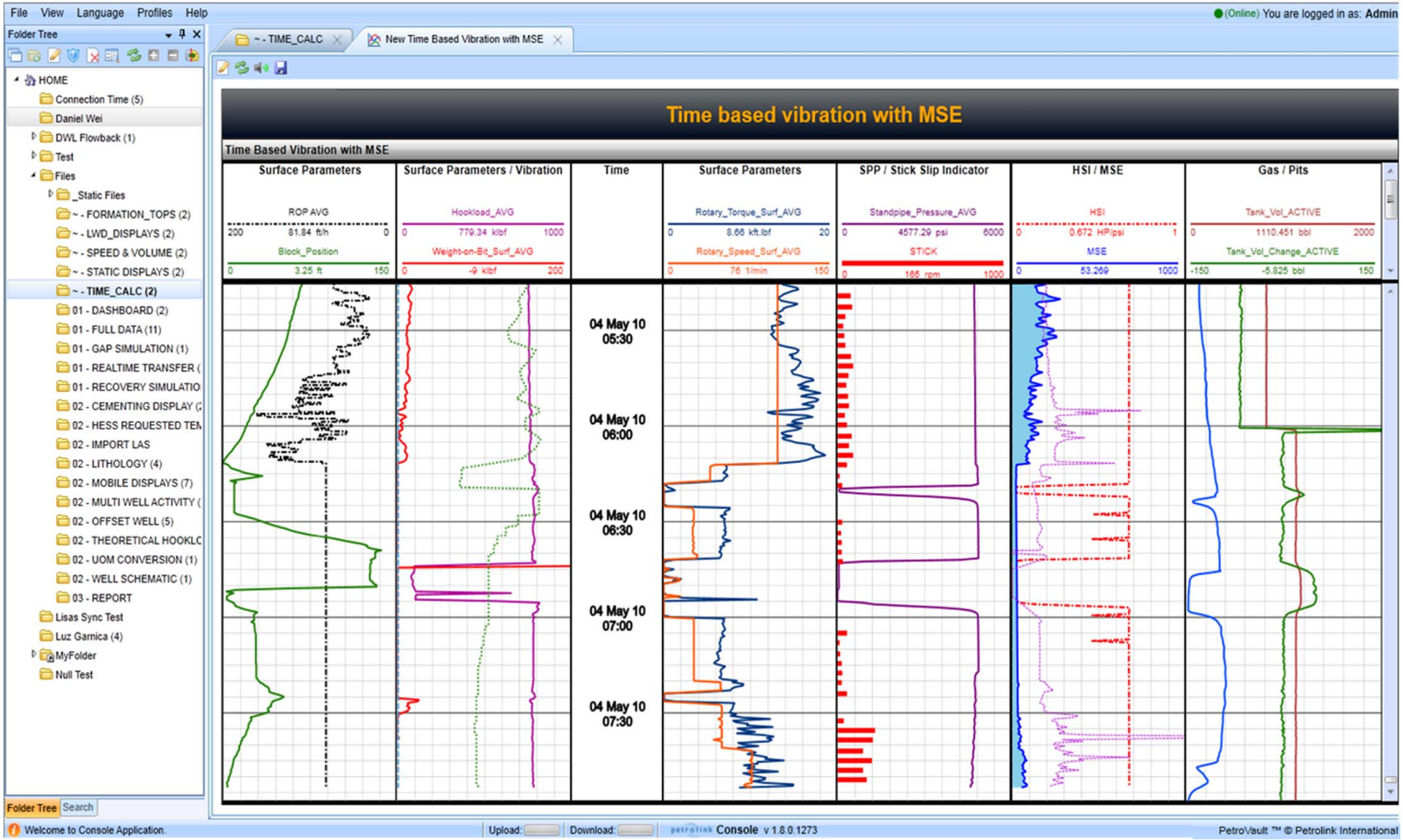
- MSE calculation
- Ability to set alert thresholds
- Display alarm







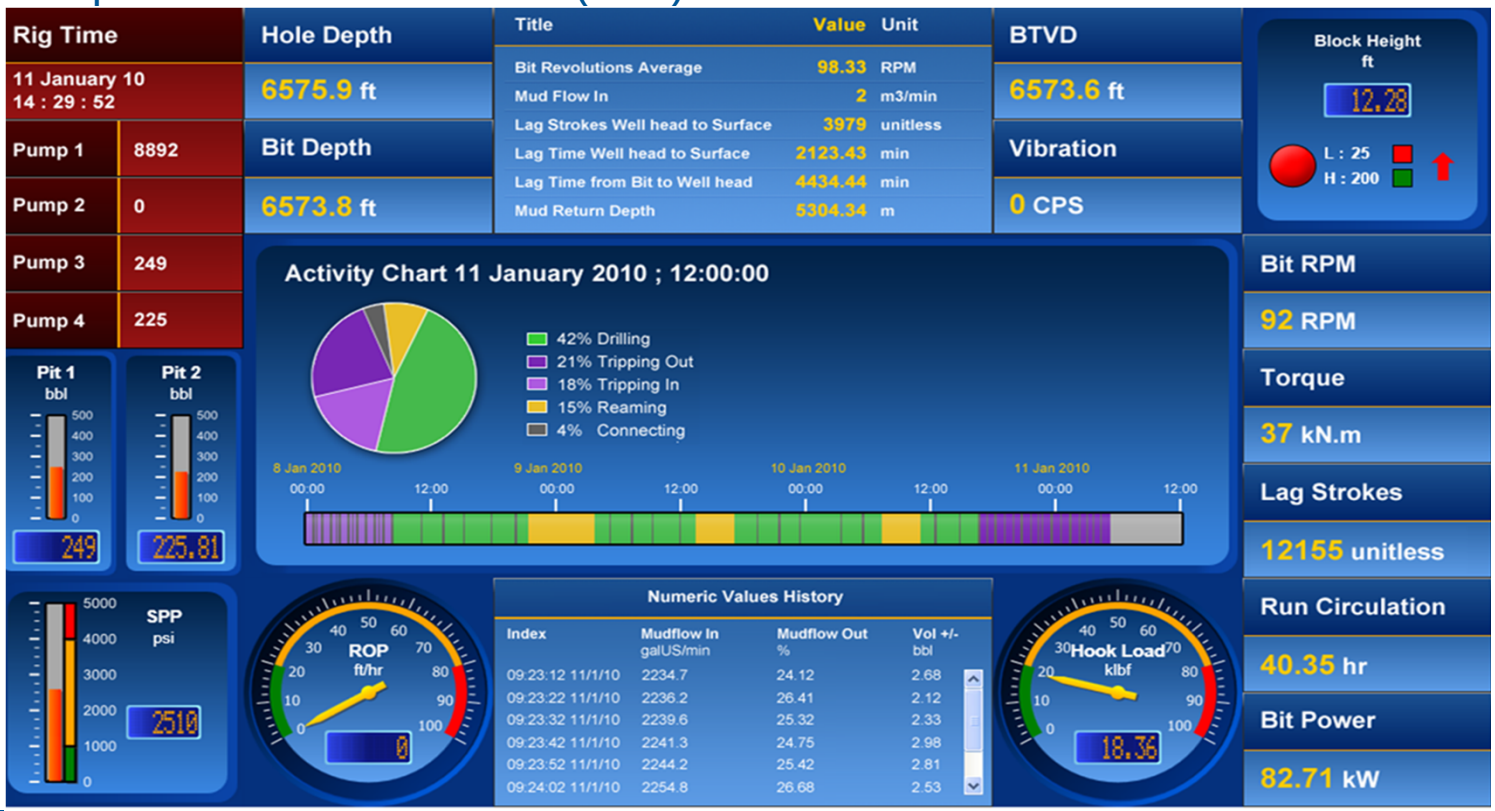
Time Based Plot With MSE Calculation



Activity Code Calculation

Data is recorded every 15 seconds, and stored 3 minutes for Analysis. The Trend is analysed:

- Drilling: Hole Depth = Bit Depth
- Circulating: Pipe not moving (Bit) and Standpipe Pressure (SPP) is above some threshold (currently 100 psi)
- Reaming: Pipe moving and SPP above threshold
- Trip IN / OUT: Bit depth trend depth increasing / decreasing without circulation (as defined above) and bit depth < hole depth more than one stand (120')
- Pipe Connection: Off bottom, pipe moving and bit depth <hole depth for LESS than one stand , and not circulating, and IN SLIPS (hook load < threshold)



WITSML Third Party Applications

- Openworks
- Seabed
- Petrel
- Techlog
- Interactive Petrophysics
- DSP-One
- EDM / Decision Space
- DrillEdge by Verdande
- DrillScene by Sekal
- GEO by SDC Geologix
- Gravitas by HRH
- MS Excel

Conclusions

- Lower costs by improving the speed and quality of solving engineering problems and decision making
- Safer operations through collaborative decision making
- Total well information capture, aggregation, delivery and visualization by integrating with all service company data acquisition units
- WITSML connectivity to third party applications and databases
- Additional well information capture is provided by capturing unstructured static data sent in batch mode

Conclusions Continued

- A collaboration environment that improves multi-disciplinary communication between rig personnel, service company personnel, office based operational and technical professionals
- More efficient integrated decision making since the speed and accuracy of responses to operational drilling events are optimized
- Independence from service companies allows the operator to access and control the workflow of well data instantly
- Highly scalable platform that supports one rig or multiple rigs around the world

Thank you!

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