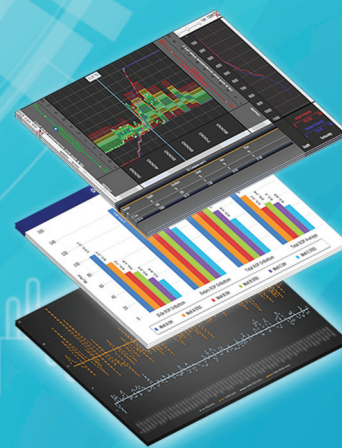


Real-Time Monitoring and Analytics

Improve Data Quality and Rig Crew Performance

for Oman Operator



Challenges

- Missing or corrupt data
- No data standards, no real-time data
- Poor data quality
- Lack of analytical tools to help with decision-making

Solution

- Data aggregation and conversion to WITSML for real-time data
- Constant data monitoring and reporting
- Analytic displays to identify rig performance issues and areas for optimization
- Integration of surface and subsurface teams for improved well placement

Results

- **20%** improvement in overall data quality
- **30%** reduction in weight-to-weight time
- Fully automated the well performance analysis for new technologies trials
- Significant time savings in searching and analyzing data, to allow users to carry out their primary responsibilities in the well construction process
- Major contributor in the optimization process reducing the overall cost per foot by **10%**.

The Challenges

An International Operator in the Middle East came to Petrolink to solve challenges they were having with their existing real-time solution provider. Among the wells being serviced, 20% of them were found to have either no data, corrupted data, or incomplete and poor quality data. There was no data quality control being conducted so it was difficult to determine what data if any were valid. Contractors were not using data standards (WITSML) and only had access to WITS data. They were sending digital files via email—not real-time. Additionally, Mudlogging and MWD data were not available to the drilling team to view in real-time which made it difficult to monitor or analyze well data with an incomplete data set.

The company had no real time analytical solutions. They were limited to the use of conventional electronic document management and reporting tools for analytics which did not provide enough detail for accurate analysis and is only as good as what is entered. Much of their work was manual. For example, during their bit selection trials, the company's drilling engineers were spending a minimum of six hours analyzing data for a single hole section with 10-second data frequency to obtain orientation time. They were assessing the bit performance with manual MWD slide sheets and analyzing the rig surface data row by row.

Real-Time Monitoring and Analytics Improve Data Quality

and Rig Crew Performance for Oman Operator

The Solution

Petrolink implemented its data management solution – taking the first step to standardize the contractor's data. This meant that mudlogging units and cementing contractors were upgraded to WITSML-capable systems and they were able to start sending real-time data, a first for this Operator.

Data aggregation into one system leads to better well placement

The solution involved constant monitoring and reporting of the measurements from rig instrumentation systems and as a result, surface data quality improved. Similar sensor information across multiple vendors' systems was compared for quality control purposes, ensuring data values were consistent. Data was then aggregated from four different vendors into one system, another first for this Operator. And because MWD and LWD data was gathered, the subsurface and drilling teams were brought together to analyze surface and subsurface data, improving the accuracy of well placement and optimizing the overall well construction time. Improving the collaboration between the cross disciplines within the Operator departments was key in this change management process.

KPI analysis highlights areas for optimization

For the analytics component of the solution, several specific displays were implemented to view KPIs like dog leg severity (DLS), tortuosity and bit orientation time, DLS compliance scores and real-time well deviation measurement. For the first time, the Operator was able to view the analysis of the data to track and compare connection and reaming times, activity breakdowns and ROP performance, so that they could optimize their operations.

This analysis became an enabler and integral part of the contractor's service quality meetings and helped the Operator to evaluate crew performance. Similarly, analysis and tracking of issues were reported to the Operator monthly, allowing them to see trends and causes that could be prevented with the appropriate corrective action.



Real-Time Monitoring and Analytics Improve Data Quality

and Rig Crew Performance for Oman Operator



The Results

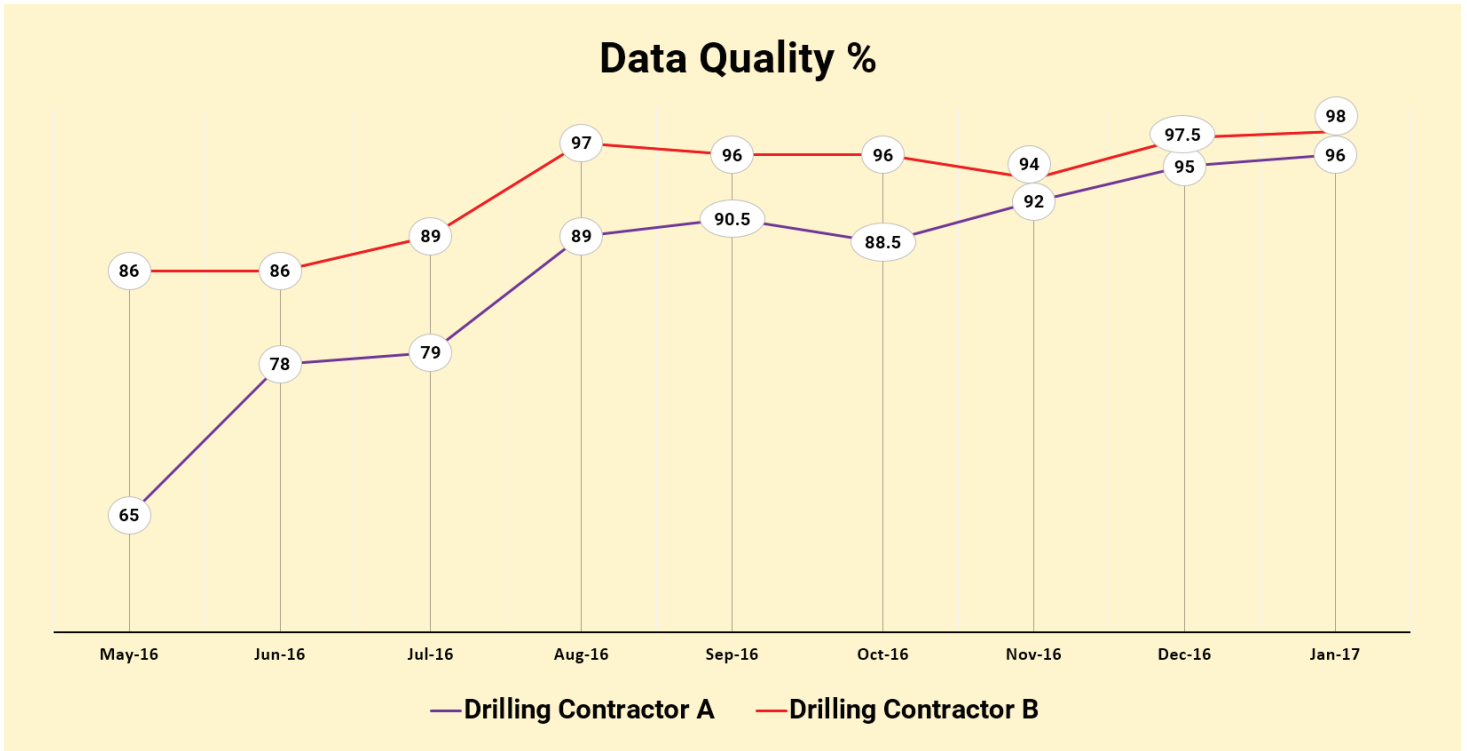
As the implementation progressed, the Operator began using the real-time data on a much larger scale - with users of the system doubling over a year. Rig crew performance began improving with the operator supervision and access to analytics. The availability of data led to a restructuring of morning operational meetings; turning them into brainstorming and troubleshooting sessions, where ideas for improvement were discussed and then implemented.

Roadmap displays help engineers push the bit to the optimum level

ROP performance improved with the use of Petrolink's roadmap displays and engineers used them during step testing to drive the bit to the optimum level. It allowed them to adjust parameters and to quickly see what yielded the best results.

Constant monitoring leads to significant improvement in data quality

One of the biggest improvements during this project was in data quality. This chart illustrates a consistent upward trend with constant monitoring and analysis.

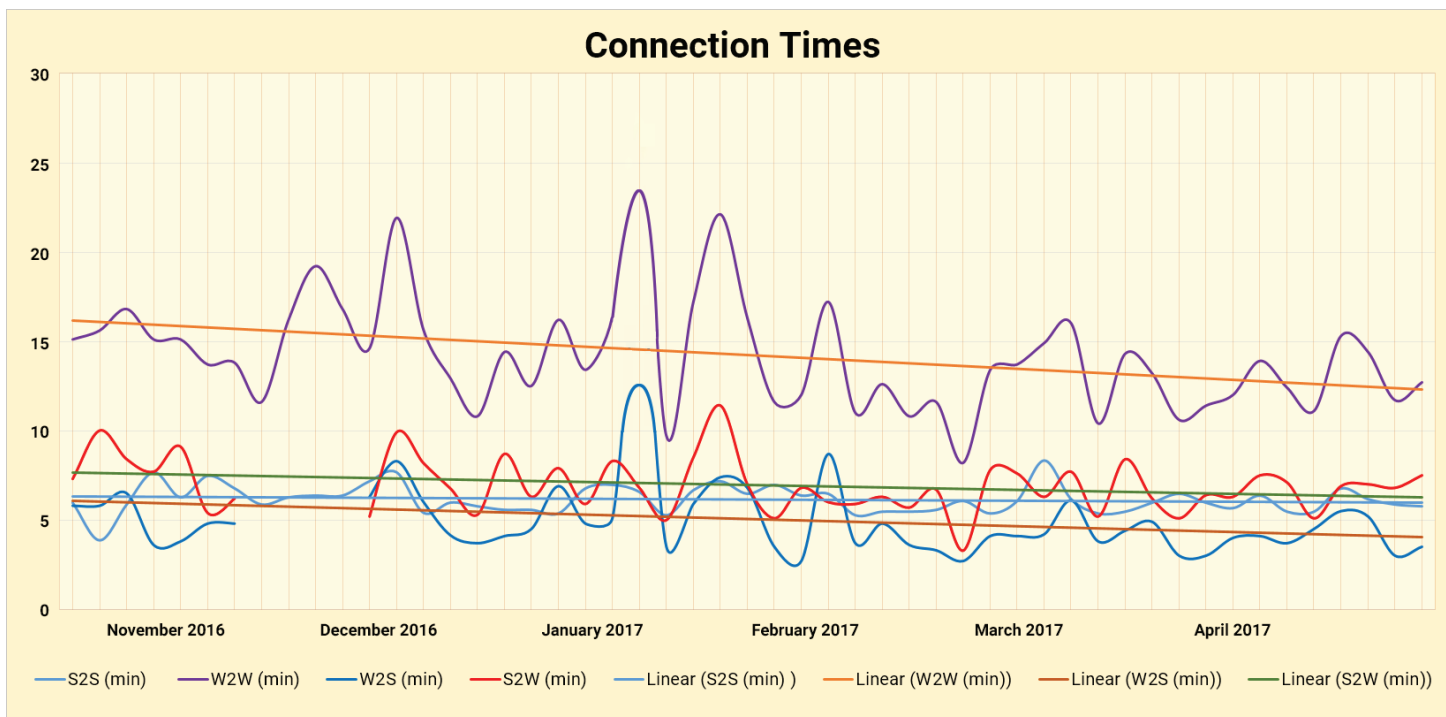


Real-Time Monitoring and Analytics Improve Data Quality

and Rig Crew Performance for Oman Operator

Reduction in weight-to-weight time helps optimize operations

Another example of a positive operational impact was the result of a study done on connection times. The chart below shows a chronological connection time analysis over a five month period. The average weight-to-weight (W2W) time per well dropped from 15 minutes to 9 minutes – a significant reduction in Non-Productive Time (NPT) which accounted for substantial cost savings.



From hours to minutes, drilling engineers more quickly identified the right bit for the job

Finally, the Operator had major gains during bit trials. Previously, the drilling engineers were spending a minimum of six hours analyzing data for a single hole section with a low frequency of data (10 seconds) to obtain orientation time. With the implementation of Petrolink's RigMetrix™ logic, the results were obtained quickly by analyzing high-frequency data (one second) and comparing results from various wells so that they could quickly determine the appropriate bit for the job.

Future Plans

Going forward, the Operator will be implementing this solution in other business units, making it a model for optimizing operations. There are plans for opening a 24x7 operations center intended to positively change the operator's work culture for the planning, execution and evaluation of the drilling life cycle.

"Petrolink has taken our data visualization to a new level with the help of various tools like Dogleg KPI, 3D trajectory with collision risk offsets and drilling roadmaps."

Senior Drilling Engineer