ABSTRACT

This paper discusses how the Dell EMC ADDED Value Agile Analytics approach for Oil & Gas simplifies the challenge of leveraging data to drive operational efficiency by using the Dell EMC Big Data Vision Workshop to identify and prioritize use cases based on key parameters such as time-to-value, size-of-impact across the Hydrocarbon Value Chain and required investment.

This enables the pragmatic development and execution of analytics projects using industry-leading Dell EMC petrotechnical IT and analytics building blocks found within the Dell EMC Upstream Data Lake.
Contents

EXECUTIVE OVERVIEW ........................................................................................................3
DELL EMC AGILE ANALYTICS FOR EFFICIENT EXPLORATION & PRODUCTION
OPERATIONS .........................................................................................................................4
DELL EMC UPSTREAM DATA LAKE ....................................................................................5
THE DELL EMC BIG DATA VISION WORKSHOP ...............................................................6
DELL EMC ENERGY PRACTICE – ANALYTICS AND DOMAIN EXPERTISE ...............7
  Experience within the dell EMC energy Team – Use Case Snapshots ..............................7
  Eagle Ford – Lateral Placement of Wells and Well Decline Modeling ..............................7
  Tight Gas – Production Optimization ..............................................................................7
  Steam Assisted Gravity Drainage (SAGD) ........................................................................7
  Predictive Maintenance and Analytics for Drilling Operations ........................................7
CONCLUSION ......................................................................................................................8
EXECUTIVE OVERVIEW

The concept of a Digital Oil Field is nothing new, yet the Oil & Gas industry still struggles to leverage broad-scale big data & analytics in a way that makes it as mainstream and clearly understood as interpretation and modelling processes. Granted there has been some success in areas such as predictive maintenance and drilling optimization, but very little in sustained step-change improvements that have redefined the way production is planned and executed, especially when we look back at 2015 & 2016 Oil & Gas economics and the continued challenge in 2017 and beyond.

One of the key obstacles that make leveraging the power of analytics difficult is the sheer volume and variety of data available to potentially fuel workflows:

- **How do I consolidate data from multiple systems** into a single secure environment (a Data Lake) that scales easily and cost-effectively so it can be more easily managed?

- **How can I create models across heterogeneous data sets** so that benefits can be seen not only in one section of the Hydrocarbon Value Chain, but across multiple domains to produce exponential benefits?

- **How can I execute analytical workloads** at a velocity that is sympathetic to data latency issues so that business planning fundamentals have a larger reliable predictive component?

The good news is that advancements in data storage and computing power have offered solutions to individual technical infrastructure challenges, but putting them together to form a smooth running analytics platform still requires specialist skills.

However, perhaps even more important than the technology challenge is the figuring out of what we should perform meaningful analytics on.

- **Which areas of the business should I look to optimize that will make significant operational impact where savings or increases in value are measured in the tens or hundreds of millions of dollars?**

The pessimism around big data and analytics in general comes through in the August 2015 Gartner report ‘The Demise of Big Data, Its Lessons and the State of Things to Come’, in which the following Strategic Planning Assumption is made:

> “Through 2018, 90% of deployed data lakes will be useless as they are overwhelmed with information assets captured for uncertain use cases”.

Source: Gartner report - The Demise of Big Data, Its Lessons and the State of Things to Come’ Published: 19 August 2015

So what is the answer? We certainly cannot give up on big data & analytics any more than we should give up on making exploration and production more efficient. We need to claw back margins lost to low oil price economics, particularly in the Upstream segment of Oil & Gas.

This whitepaper introduces the Dell EMC ADDED Value Agile Analytics solution for Oil & Gas that combines a robust business assessment approach – the Dell EMC Big Data Vision Workshop – with Dell EMC Oil & Gas technology innovation in a way that actually can and has redefined the way production can be planned and executed in a sustainable way.

Chris Lenzsch

Solutions Manager – Upstream Analytics & IoT
Dell EMC Global Energy Program
DELL EMC AGILE ANALYTICS FOR EFFICIENT EXPLORATION & PRODUCTION OPERATIONS

The Dell EMC ADDED Value Agile Analytics approach enables the rapid organized processing of data to extract timely actionable insight that drives step-changing efficiencies. It is used to appraise, design and implement digital oilfield and big data & analytics projects to improve productivity and reduce well and facility downtime.

The methodology accelerates the move towards a single version of operational truth by building an Upstream Data Lake with a use-case-oriented incremental approach. What is revealed by the Upstream Data Lake will optimize operational and strategic planning to enable you to make and execute better decisions faster.

A key example of applying big data & analytics to derive operational efficiencies is Production Optimization. Leveraging an Upstream Data Lake boosts your ability to create comprehensive reservoir views in order to more clearly understand recovery potential by:

- Building Predictive and Prescriptive Models that:
  - Improve production and reserves forecasting to drive better Inventory Update Reporting (IUR)
  - Optimize completions and engineering designs for more efficient production operations

- Deploying of Predictive Analytics to:
  - Optimize drilling/treatment for production ‘sweet spots’ – including best-placement, steering and timing
  - Enrich drilling and completion models with operational factors to reduce non-productive time (NPT) and to increase efficiencies across reservoir and asset lifecycles

So how is Dell EMC’s approach unique and why is it successful?

**Dell EMC ADDED Value Agile Analytics**

Although technology is a vital ingredient to big data & analytics success in Oil & Gas, it is not by itself the complete answer. Dell EMC’s collective Energy team experience has culminated in a recipe for success encapsulated in the Dell EMC ADDED Value Agile Analytics approach with the following ingredients:

<table>
<thead>
<tr>
<th>Delivery mechanism</th>
<th>What it provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytics Engine</td>
<td>Pre-integrated environment in which models can be built and executed in real-time or batch</td>
</tr>
<tr>
<td>Data Management Platform</td>
<td>Data storage platform supporting heterogeneous data sets, and that easily scales linearly in capacity and performance</td>
</tr>
<tr>
<td>Data Science</td>
<td>Proven Dell EMC expertise in the use of advanced analytics to solve major industry challenges</td>
</tr>
<tr>
<td>External Intelligence</td>
<td>Carefully selected use-case-relevant Public and Industry Institution data to enrich model creation</td>
</tr>
<tr>
<td>Domain Expertise</td>
<td>Deep and broad Dell EMC experience of Oil &amp; Gas workflows across the Hydrocarbon Value Chain</td>
</tr>
</tbody>
</table>
The Dell EMC Upstream Data Lake enables the bringing together of use-case-relevant data from an unlimited range of upstream sources needed to perform meaningful analytics regardless of data type. The Upstream Data Lake is built up incrementally, driven by prioritized use cases identified through the Dell EMC Big Data Vision Workshop, which will be discussed in the next section.

Although storing and consolidating data into one easily accessible environment brings tremendous benefits in terms of creating a comprehensive picture of operations, the Dell EMC Upstream Data Lake goes way beyond the capabilities of an extremely scalable data store. It enables higher levels of business agility by also becoming an engine for efficiently executing analytics workloads directly within the Data Lake platform. This capability is delivered using built-in advanced analytics through the Big Data Suite from Pivotal.

The suite is designed to cater for extreme data volumes of all types, as well as to perform analytics across the full velocity spectrum – from real-time workflows with advanced continuous learning through to longer running pattern-detection workloads.

The potential benefits of Agile Analytics for both conventional and unconventional fields are staggering. In a recent case spanning 10,000 wells, analytics using Dell EMC solutions has shown an increase in oil production projections of 8-14% and decreases in completion costs of more than 5%.

The true complexity of an analytics environment (as shown in the diagram above) that can meet and beat the big data challenge in Oil & Gas is often underestimated. Dell EMC solves this problem by providing the building blocks and the best practice integration means by which the deployment complexity is simplified and easily managed so that the appropriate technology is quickly in place to address each type of identified analytics workload.

The benefit of using the Dell EMC ADDED Value Agile Analytics methodology is clear. In a recent case spanning 10,000 wells, analytics using Dell EMC solutions showed a potential increase in oil production of 8-14%, and decreases in completion costs of more than 5%. In another case, a large Independent was able to uncover that if they spent an extra $40M on unconventional drilling operations, they would see a $200M return over 3 years.
The Dell EMC Big Data Vision Workshop requires an Oil & Gas company to make a relatively low cost investment in identifying areas across the hydrocarbon value chain where big data & analytics technology can be applied to solve a business problem.

The workshop identifies key use cases and associated business benefits and value, and then ranks the opportunities based on parameters including size of investment needed, and Key Performance Indicators (KPIs) such as potential rate-of-return and reach-of-impact across the hydrocarbon value chain. This use case identification stage is the key to avoiding what Gartner warns about in their August 2015 report ‘The Demise of Big Data, Its Lessons and the State of Things to Come’ and it cannot be done successfully without 3 things of which Dell EMC’s Energy Practice has in abundance:

1. **Exploration and Production domain expertise**
   - Dell EMC’s Energy team contains industry technology architects and domain experts with several years of experience working directly for oil & gas companies or oil field services organizations

2. **Proven experience in applying big data & analytics technology to solving challenging Oil & Gas industry matters**
   - The team draws from a wealth of knowledge based on actual career big data & analytics projects

3. **Data Lake technology innovation**
   - Dell EMC data storage portfolio that supports heterogeneous data types and scales easily and cost efficiently
   - Dell EMC analytics & big data suite with high-performance capabilities

With a suitable high-impact use case identified and scoped both architecturally and fiscally, a Proof-of-Value project is planned and executed. The results generated from the exercise are validated and if sufficiently proven, the analytics particulars are operationalized to deliver production value.
DELL EMC ENERGY PRACTICE – ANALYTICS AND DOMAIN EXPERTISE

Dell EMC is a demonstrably competent partner that helps Oil & Gas companies use big data & analytics as an effective operational efficiency tool for making better decisions faster.

The work we do focuses on value enablement drivers that range from reducing Non-Productive Time (NPT) to accelerating production at reduced costs, including:

- Well and Asset down-time Reduction and Performance Evaluation
- Artificial Lift Optimization
- Predictive Asset Maintenance

In essence, Dell EMC’s Energy Practice contains a team experienced in deploying data science, data mining and predictive analytics to provide well and production optimization that deliver measurable bottom line impact.

EXPERIENCE WITHIN THE DELL EMC ENERGY TEAM – USE CASE SNAPSHOTS

Eagle Ford – Lateral Placement of Wells and Well Decline Modeling
The Eagle Ford project focused on Lateral Placement of Wells and Well Decline Modeling with and without gas lift. The challenge in both areas was due to the lack of first-principle models to help engineer and operate in shale assets. Models were developed using well life cycle data including gamma ray, micro seismic, drilling, fracturing, and production data from 100 operating wells to determine the production ‘type-curve’. The analytics approach used multivariate, non-linear neural network technologies coupled with signal processing and statistical pre-processing to validate and improve the data robustness. The models were then used to plan and deploy new wells more efficiently and then to optimize the existing ones. The solution is now used on over 900 wells and shows a 10-20% uplift in decline performance of previous wells.

Tight Gas – Production Optimization
The objective of the Tight Gas project was to facilitate and optimize completion performance relative to production performance. The intent was to schedule completions by time and production process type based upon the predicted production of each well.

The challenge was to improve time-to-production by significantly reducing the heavy engineering analysis usually required. The solution took data from over 1000 historical wells – logs, cores, drilling data (mud, chemicals, etc.), completions data (ISIP, frac fluid, proppant type, perf, depths, etc.), and past production data (IP30). A data model was created between the wells construction parameters and production and was used to classify potential production of new wells into quartiles. The quartiles determined whether the completion design for a well was automatically chosen and scheduled or if it was passed off to reservoir and completions engineering for further evaluation. The model was constantly refreshed with new data using a variety of techniques including automated history-matching of the reservoir and completions models used for the engineering. These history matches significantly improved engineering accuracy.

Steam Assisted Gravity Drainage (SAGD)
The SAGD project objective was to use data modelling to optimize the placement of wells during drilling relative to their proximity to the water table. The challenge is that the lower production well in a SAGD pair needs to be set relatively deep relative to the upper steam injection well but not too close to the water table since that can cause corrosion of the well itself and risks plugging the production ports with salts. The key is to steer both wells a certain distance above the water table.

By performing analytics on historical data, a correlation was determined between seismic and drilling data and production problems. The correlation was used in the planning of new wells to identify the problem signature in the drilling data to ensure proper well placement. This model was qualitative in nature and used a Self-Orgaized Mapping technology.

Predictive Maintenance and Analytics for Drilling Operations
Drilling Equipment Failure Prediction: Customer engaged Pivotal due to high rate of unplanned downtime of drilling equipment that resulted in lost revenue and risky working conditions for operators. The main challenge the customer experienced was the ability to effectively bring together different data sources (structured and semi-structured) at scale to make better, predictive decisions to positively impact costs and efficiency metrics.

An exploration and production data lake was created using data from drill rig sensors (torque, rpm, weight-on-bit) and operator-entered data (comments on events/failures) to effectively address these challenges. The team successfully created an advanced analytics solution that combined semi-structured text data with highly structured sensor data to achieve a highly effective model that predicted drilling equipment failure with enhanced accuracy and ease-of-interpretability. Outputs from this successful predictive modeling effort set the stage for the development of early warning systems for drilling equipment failure, saving tens of thousands of dollars from much reduced failure incident rates and unplanned downtime.
CONCLUSION

There is no doubt that Oil & Gas companies are looking more closely than ever at analytics as a way of balancing cost-cutting against the need to boost operational efficiency. Continuous remote monitoring of drilling rigs, pumps, pipeline, storage facilities and other equipment is on the rise, as one of the highest Efficiency Increase-to-Cost Savings ratios comes from predictive asset maintenance.

When added to more effective reservoir modelling, companies could eliminate half of their unplanned well outages and save hundreds of millions of dollars annually while also maximizing output.

There is no shortage of point IT and field operations technology ready to be implemented, but industry experience shows that integrating both sets of technologies (IT and field) into analytics workflows that deliver timely actionable insight is a huge challenge.

The Dell EMC ADDED Value Agile Analytics approach for Oil & Gas simplifies the challenge by using the Dell EMC Big Data Vision Workshop to identify and prioritize use cases based on key parameters such time-to-value, size-of-impact across the Hydrocarbon Value Chain and required investment. This enables the pragmatic development and execution of analytics projects using industry-leading Dell EMC petrotechnical IT and analytics building blocks in the Dell EMC Upstream Data Lake.

Crucially, the Dell EMC Energy team contains technology architects and domain experts with several years of experience working directly for Oil & Gas companies or Oil Field Services organizations, and draws from a wealth of knowledge based on actual career big data & analytics projects.
The information in this publication is provided “as is.” EMC Corporation makes no representations or warranties of any kind with respect to the information in this publication, and specifically disclaims implied warranties of merchantability or fitness for a particular purpose.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC®, EMC, and the EMC logo, are registered trademarks or trademarks of EMC Corporation in the United States and other countries. All other trademarks used herein are the property of their respective owners. © Copyright 2016 EMC Corporation. All rights reserved. Published in the USA. 11/06 white paper H14778

EMC believes the information in this document is accurate as of its publication date. The information is subject to change without notice.

EMC is now part of the Dell group of companies.