Hunt Oil Company

Real Time Drilling Models with TIBCO StreamBase

February 13, 2019
Agenda

• Introduction to Hunt Oil Co.
• HOC Drilling Data Sources (…and their problems)
• StreamBase and the Drilling Accelerator at HOC
• Ongoing Development and Plan Forward
• What HOC Likes about StreamBase
• Acknowledgments
• Questions
HOC’s Current Worldwide Operations

Key Points
- Hunt was founded in 1934 and is one of the largest privately-owned independent oil companies in the world
- Headquarters in Dallas, TX
- Operations on four continents in all types of environments
  - Harsh Desert
  - Rain Forest
  - Mountainous Terrain
  - Offshore
  - Domestic Onshore
- Significant investments in LNG infrastructure projects in Yemen and Peru

Overview

Core Values
- Respect for the Individual
- Humility
- Community-Centric
- Creativity
- Commitment to Excellence
- Teamwork
- Honesty
- Integrity

Mission Statement
The mission of Hunt Oil Company is to be a growth-oriented industry leader respected throughout the world for the quality and competency of its people, the efficiency and scope of its operations and its rich heritage of honesty and integrity.
HOC Drilling Data Sources (…and their problems)
HOC Drilling Data Sources (…and their problems)

• Sensor data needs contextual data to be useful
  o MSE needs bit size, mud motor rev/gal, max differential, max torque, etc
  o Broom Plots need drill string components, mud weights, directional surveys, etc
  o How do they come together?
    • EDR systems sit outside our corporate firewall, our reporting database is inside the corporate firewall
    • So we’re left with manual ETL processes

• 1Hz EDR data is too big for batch or ad hoc analyses
  o 20 day well generates 1,728,000 lines of 1Hz data
  o Excel can only open 1,048,576 lines
  o Engineers love Excel!

• Even Python, R, JS, or [insert your favorite programming language here] applications we give to engineers to do these calculations are too slow
  o An application that runs every 6 hours provides insight that can be up to 6 hours late

• Third party services are nice but you are subject to their development roadmap
HOC Drilling Data Sources (…and their problems)

Aggregate
Model
Alert

Drilling Engineers and Foremen
In early 2018 HOC was approached by TIBCO about a PoC of StreamBase

Using the IoT Drilling Accelerator, we connected to our WITSML data almost immediately

Comes “Out of the Box” with a number of features:

- Data normalization
- MSE
- Rig state
- Survey recording
In early 2018 HOC was having issues with bits being damaged beyond repair (DBR) and identifying diminished performance before bit condition became so severe:

"I think it might be the formation let's give it another 3 hours and see if it gets better..."

"I'm going to pull the last few wells of data and compare them, I'll call you back..."
StreamBase and the Drilling Accelerator at HOC

Rotating:
- Consistent RPM
- Erratic Toolface

Sliding:
- Erratic RPM
- Consistent Toolface
StreamBase and the Drilling Accelerator at HOC

\[
\text{abs}(((\text{CurrentToolface} - \text{PreviousToolface} + 180) \mod 360) - 180)
\]

45 second window standard deviation of toolface change
StreamBase and the Drilling Accelerator at HOC

• Model Construction
  - Bit Wear Model Based on a Shell SPE paper*
  - Used a calculated feature called Wear Factor (WF)
  - Choosing algorithm
  - Selecting relevant features and creating engineered features

• Validate & Test, Iterate
  - Quality Metrics
    - Shell’s model didn’t work for our data set
  - Generalization – ability to adapt to new unseen data
  - Deployed in development environment in StreamBase
  - Monitor and adapt model as needed
  - Model 4 has been running since September and currently building Model 5

\[ WF = \frac{5 \times WOB}{ROP/RPM_{Bit}} \]

Figure 2—Comparison of green bit and worn bit performances

StreamBase and the Drilling Accelerator at HOC

- Model deployment made easy
  - Data Scientist converted his model to PMML
  - Built in adapter loads PMML files directly into StreamBase

PMML

Predictive Model Markup Language
StreamBase and the Drilling Accelerator at HOC

Guess how this bit came out?
StreamBase and the Drilling Accelerator at HOC

…and how about this bit?
Moving ahead with edge deployment at rig site

- Connect directly to WITS0 data from EDR
- Reduce latency
- Reduce issues due to limited bandwidth
- Reduce problems with WITSML reliability
Ongoing Development and Plan Forward

• Currently developing module to generate broom plots
  – Uses a python script for soft string calculations
  – Loads surveys from the Live Data Mart
  – Loads drill string and mud weight from WellView
  – Runs every time a survey is taken and publishes result to the Live Data Mart
  – Working on module record accurate Pickup and Slackoff values
What HOC Likes about StreamBase

- Not a single use case solution
  - Provides a powerful and flexible end-to-end solution for real time data gathering, processing, and visualizing
  - Takes the place of several open source packages
  - Includes easy to use IDE with visual programming in EventFlow

*Cao, D., Loesel, C., Paranji, S. 2018 Rapid Development of Real-Time Drilling Analytics System Presented at IADC/SPE Drilling Conference and Exhibition, 6-8 March, Fort Worth, Texas, USA. SPE-189595-MS https://doi.org/10.2118/189595-MS*
What HOC Likes about StreamBase

• Gives us back control over model development and deployment timing
  – Small team of 3 Data Scientists and 1 confused Drilling Engineer can go from idea to testing in less than 6 weeks
  – We can develop models we are confident will work on our data and can respond quickly to fix them if they don’t
What HOC Likes about StreamBase

• Spotfire X and Spotfire Data Streams
  – Spotfire X connects directly to the LDM with Spotfire Data Streams
  – Present data to end users in a familiar environment
  – Can also embed LiveView Web visualizations
What HOC Likes about StreamBase

• The Drilling Accelerator
  – Gave us a starting point to jump start our real time initiatives
  – Gives operators a common framework to work with
What HOC Likes about StreamBase

• HOC’s commitment to the accelerator
  o The structure and framework for our bit wear model is being rolled into the accelerator
  o HOC has decided to continue contributing to and improving the accelerator
  o Our goal is to create a community of operators that developing applications and contributing to the accelerator
    • By using the accelerator operators can share development resources and support each others efforts
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  - Niket Chitre
Thank You

Questions?
So we left streambase running for the weekend to see how it would do. The good news is that it’s working great. It’s making the motive calls and binning the on bottom hours like it should.

The bad news is I forgot to turn off the twilio module and we have a bit of a bust in it. A bit finally tripped the wire of wear condition 3 so it’s now sending me 10 texts every 10 seconds. And none of us are anywhere near a computer so it’s probably just going to eat up the $15 trial credit twilio gave you and then (hopefully) shut down. Just wanted to give you a heads up in case you start getting emails from twilio about it.

lol. thanks!
Hey That Toolface Looks Funny
Hey That Toolface Looks Funny
The Time We Literally Didn’t Know How to Turn It On