DrillEdge: Application of Case-Base Reasoning*

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Comments

| New problem | > | Old problem |
| Solution to new problem | < | Solution to old problem |

“Testing with DrillEdge technology demonstrated that unscheduled events don’t happen immediately; there are predictable and repeatable symptoms in advance of each event -- on the order of hours, or sometimes even days”--Eric van Oort (Shell).

Case Study: Twist-off Analysis

Example well was in Middle East; test well was in Haynesville play, Louisiana.
Scripts were built on max torque, erratic torque and string stall.
These were used to detect events leading up to a twist-off and to provide actions to mitigate these events.
Testing shows that a drilling engineer using DrillEdge could have detected an impending twist-off in advance – with enough time to relay this information to the rig team in order to make an informed decision about how to proceed.

References


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Marcellus and Uttica Shales
Applying Case-Based Reasoning

Techniques for Enterprise Systems

By Lee Watson

290 pages
Copyright 1997
US$ 73.95, Softcover

A title in the The Morgan Kaufmann Series in Artificial Intelligence Series.

Available: Please call +1-855-844-640 (7:30am to 7:00pm C.S.T.) for availability

Description

Case-based reasoning (CBR) is an intelligent systems method that enables information managers to increase efficiency and reduce cost by substantially automating processes such as diagnosis, scheduling and design. A case-based reasoner works by matching new problems to "cases" from a historical database and then adapting successful solutions from the past to current situations. Organizations as diverse as IBM, GSDA International, VolksWagen, British Airways, and NASA have already made use of CBR in applications such as customer support, quality assurance, aircraft maintenance, process planning, and decision support, and many more applications are easily imaginable.

It is relatively simple to add CBR components to existing information systems, as this book demonstrates. The author explains the principles of CBR by describing its origins and contrasting it with familiar information disciplines such as traditional data processing, logic programming, rule-based expert systems, and object-oriented programming. Through case studies and step-by-step examples, he goes on to show how to design and implement a reliable, robust CBR system in a real-world environment. Additional resources are provided in a survey of commercially available CBR tools, a comprehensive bibliography, and a listing of companies providing CBR software and services.
Case based Reasoning

(CBR)
The Radar
“Our testing with DrillEdge technology produced compelling results and demonstrated that unscheduled events don’t happen immediately. We learned that there are predictable and repeatable symptoms in advance of each event on the order of hours, or sometimes even days.”

- Eric van Oort
Shell -Well Performance Improvement Manager
Frode Sørmo, Chief Technology Officer, accepting Harts E&P Meritorious Engineering Award at this month’s OTC conference.
Many people (claim they) don’t have problems with Hole Cleaning, Stuck Pipe, Lost Circulation etc.

Individually in specific areas this is probably true, but as an industry apparently not. Last slide global, this specific to US.
Case Based Reasoning

New problem

Solution to new problem

Old problem

Solution to old problem
Comparing Drilling Situations
Comparing Drilling Situations
Components of any case

**Drilling Fluid**
- Mud Weight: 1.6
- Type: OBM
- pV: 36
- Yp: 25

**Well Geometry**
- Section start: 4280 MD
- Target depth: 6310 MD
- Bit Type: PDC

**BHA**
- Length: 90
- Stabilizers: 2
- Bit Type: PDC
Case Study
(Middle East well & Haynesville well)
Twist-off analysis

- Example well was in Middle East, test well was in Haynesville play, Louisiana.
- Scripts are built on max torque, erratic torque and string stall.
- Used to detect events leading up to a twist-off and to provide actions to mitigate these events.
- Testing shows that a drilling engineer using DrillEdge could have detected an impending twist-off in advance – with enough time to relay this information to the rig team in order to make an informed decision about how to proceed.
Example Well = Middle East Well
Twist-off analysis #1
Time view showing case response before twist-off.
**Twist-off analysis - #1**

Twist-off occurs at 7:53 AM, at 3,060 m.
First case appears on the radar 3 hrs 12 minutes before the twist off
Time view showing case response immediately before twist-off #2

Cases from Middle East

Cases from 1st twist off on Haynesville well

Pressure dropped

Twist-off

Hookload dropped
Twist-off analysis - #2

Twist-off occurs at 7:22 AM, at 3,143 m.

First case appears on the radar approximately 2 days before the twist off. A bit trip was made, and there were three opportunities to take action before the twist off occurred.
So What?

Fish left in the hole: Bit, NB Roller Reamer, 1x 9-1/2" DC, R reamer, 1 x 9-1/2" DC, shock sub, 2 x 9-1/2", R reamer, 7 x 9-1/2" DC, Jars, 1 x 9-1/2" DC, 0.3 ft of X/O. Ran with 11-3/4" fishing over shot assembly with 9-1/2" basket grapple on top of fish, retrieved the fish to surface and layed down BHA. Connections were excessively torqued up; heated up collars to break the connections. NPT 56 hrs.

Recommended Action:

It is recommended to check the make up torque of all connections while making connections at surface, since it was found that the DC connections were extremely torqued up. Observed high RPM for 8 hours associated with high torque values which can lead to damaging the BHA. It is recommended to follow up optimal drilling practice.

General Experience:

The X/O is always the weak point in the BHA. Extra care should be taken to inspect the X/O box and pin threads and make sure the make up torque is applied correctly. Over torquing the X/O can lead to X/O damage and risk of twist off. On the other hand, over torquing the BHA can happened while drilling under tough conditions, such as high vibration.
# Twist-off analysis #2

Time/depth event file - Bit trip was made after a sequence of events. Twist-off occurred on next run.

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- Bit trip
- Twist Off #2, 3,143m
Time/depth event file – slide 3
Demonstrates few events, no cases, no twist-off to end of data set.

25.08.2010
Time view response from Haynesville before twist-off on Middle East well. Cases first appear on the radar approximately 28 hrs before twist-off.

Cases appear on the radar 30 hours and 360 ft from twist-off.
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Additional Information

- Further details on the case study published in World Oil, April 2011
  “Case-based reasoning system predicts twist-off in Louisiana well based on Mideast Analog.”