CASE STUDY

SIMULARITY Predicts Oil Well Failure

Using Real Time Analytics and Downhole Sensor Data to Predict Failures

While automation offers many potential benefits in the upstream value chain of exploration, development, and production, some of the biggest opportunities are in production operations, such as reducing unplanned downtime." **- Digitizing Oil and Gas Production, Article, McKinsey and Company, August 2014**

"Oil and gas companies are faced with intense pressure to deal with low oil prices. Now is a good time to tighten the belt and focus on becoming more efficient and working smarter. The companies that will survive and prosper are the ones that know how to ... apply analytics to improve operations output. If a company does not have operations excellence, they need to get it." **- Chris Niven, IDC Energy Insights Research Director**

The Oman Incident:

On December 9, 2015, at 4:56pm local time, a Progressive Cavity Pump (PCP) driven oil well in Oman known as "AV0902" suffered a break in the sucker rod string approximately 4700 feet below the surface.

The unexpected shutdown required a completion workover service and replacement parts amounting to approximately $75,000. Industry average turn around for artificial lift repair is a week which also amounted to another 2,100 barrels of lost production. (At $40 per barrel = $84,000)

The Solution:

Earlier in the year, AV0902 had been outfitted with an innovative permanent down-hole gauge system which had 12 different sensor measurements including: intake and discharge temperature and pressures, downhole speed, rotor position, twist, downhole vibration, and more.

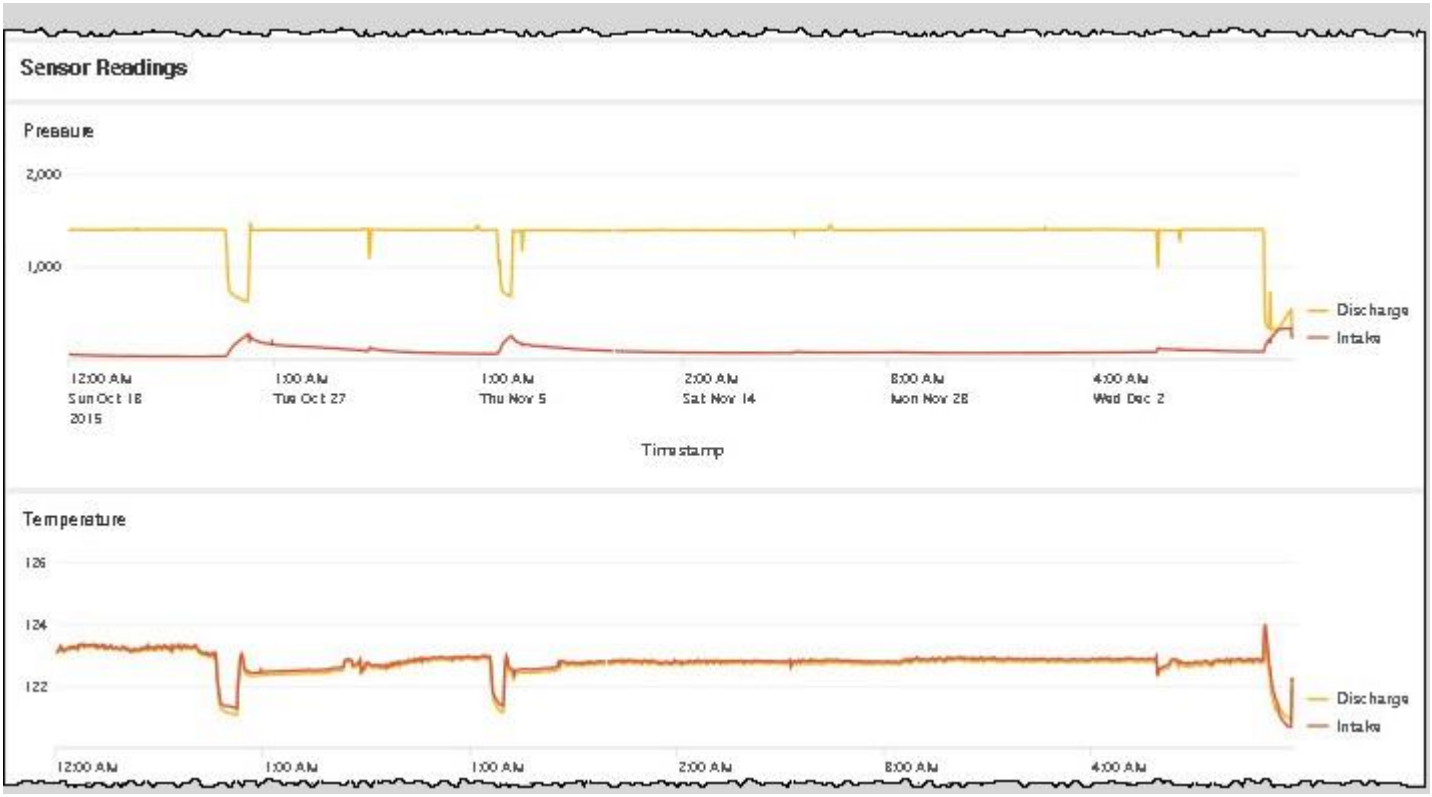
10/7/2015	5:05:00	46.5964	122.99	1405.31	122.954	0	0	1219826	1267396	1	109	151.135	15
10/7/2015	5:06:00	46.6906	122.99	1399.01	122.954	0	0	1219955	1267546	-1	148	151.146	13
10/7/2015	5:07:00	46.6138	123.008	1397.4	122.954	0	0	1220095	1267697	0	147	151.113	21
10/7/2015	5:08:00	46.5804	123.008	1397.55	122.954	0	0.051	1220245	1267849	1	180	151.121	14
10/7/2015	5:09:00	46.3657	123.008	1397.49	122.954	0	0.051	1220391	1267998	3	143	151.121	14
10/7/2015	5:10:00	46.4876	123.008	1396.26	122.954	0.053	0	1220531	1268150	2	125	151.141	13
10/7/2015	5:11:00	46.9764	122.99	1396.45	122.954	0	0	1220683	1268302	-1	180	151.132	15
10/7/2015	5:12:00	46.8255	122.99	1406.34	122.954	0	0	1220826	1268454	0	120	151.108	14
10/7/2015	5:13:00	46.5659	123.008	1398.13	122.936	0	0.051	1220976	1268603	2	112	151.103	16
10/7/2015	5:14:00	46.8589	123.008	1396.24	122.936	0	0	1221114	1268755	1	150	151.134	13
10/7/2015	5:15:00	46.9517	123.008	1396.78	122.93	0	0	1221259	1268907	1	109	151.116	13

The customer wanted to know:

- What caused the failure?
- Could it have been predicted and avoided?
- Were there other things happening deep in the well which still need to be investigated?

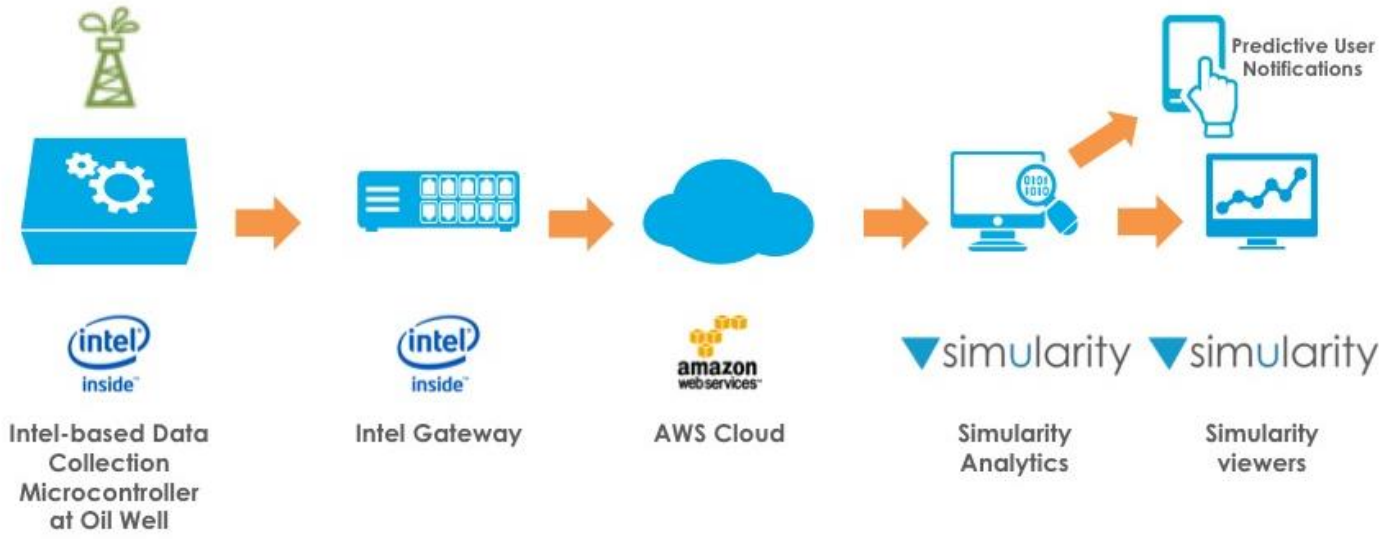
Simularity provided the answer. Based in the Silicon Valley area of California, Simularity has developed innovative software that can analyze large volumes of time-series data in real time at the edges of the network. By capturing real time data from multiple sources, the artificial intelligence software can ‘learn’ what’s normal and predict incidents **before they happen**, including “time to failure” estimates and explanations for its conclusions.

For the AV0902 incident, Simularity’s AI, running on an Intel-based server, analyzed the data for each sensor (see below) and learned the complex correlations between the sensor variables.



After a normal period, two significant alerts appear 45 and 33 days in advance of the failure.

Reference Architecture:



Results:

Had the customer known beforehand that this failure was looming (Alert 2), things would have been different:

- The downhole artificial lift system could have been programmed to operate differently to avoid stressful situations that can lead to cause sucker rod string failure.
- The meantime between failure could have been extended improving the operating expenditure of the Oman production field.
- Artificial lift repair and workover costs could have been planned more effectively to reduce lost production.
- Reduced employee and management stress and lower chance of on-site mistakes, increased safety

Had Simularity been in place, the artificial lift system could have lasted longer and repair turnaround could have been quicker.

> *"Our AI was designed to predict incidents by looking at large volumes of real time sensor data - the kind of data that is generated by the Internet of Things. We are excited to work with the Oil and Gas industry in helping our clients realize significant savings through production efficiency and predictive maintenance."* - **Liz Derr, CEO, Simularity**

About Simularity: A Silicon Valley based software company that focuses on artificial intelligence, embedded software, and predictive analytics for the industrial Internet of Things. Simularity's software runs on Intel-based servers, gateways, and microcontrollers http://www.simularity.com.

About GeoPSI: Permanent downhole gauge system was provided by Geo Pressure Systems Inc. (GEO PSI), a world wide provider in downhole instrumentation systems that are used for increasing production, reducing workover expenses, and providing reservoir intelligence www.geopsi.com.

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