



# How To Transform the Capital Value of Your (E&P) Information

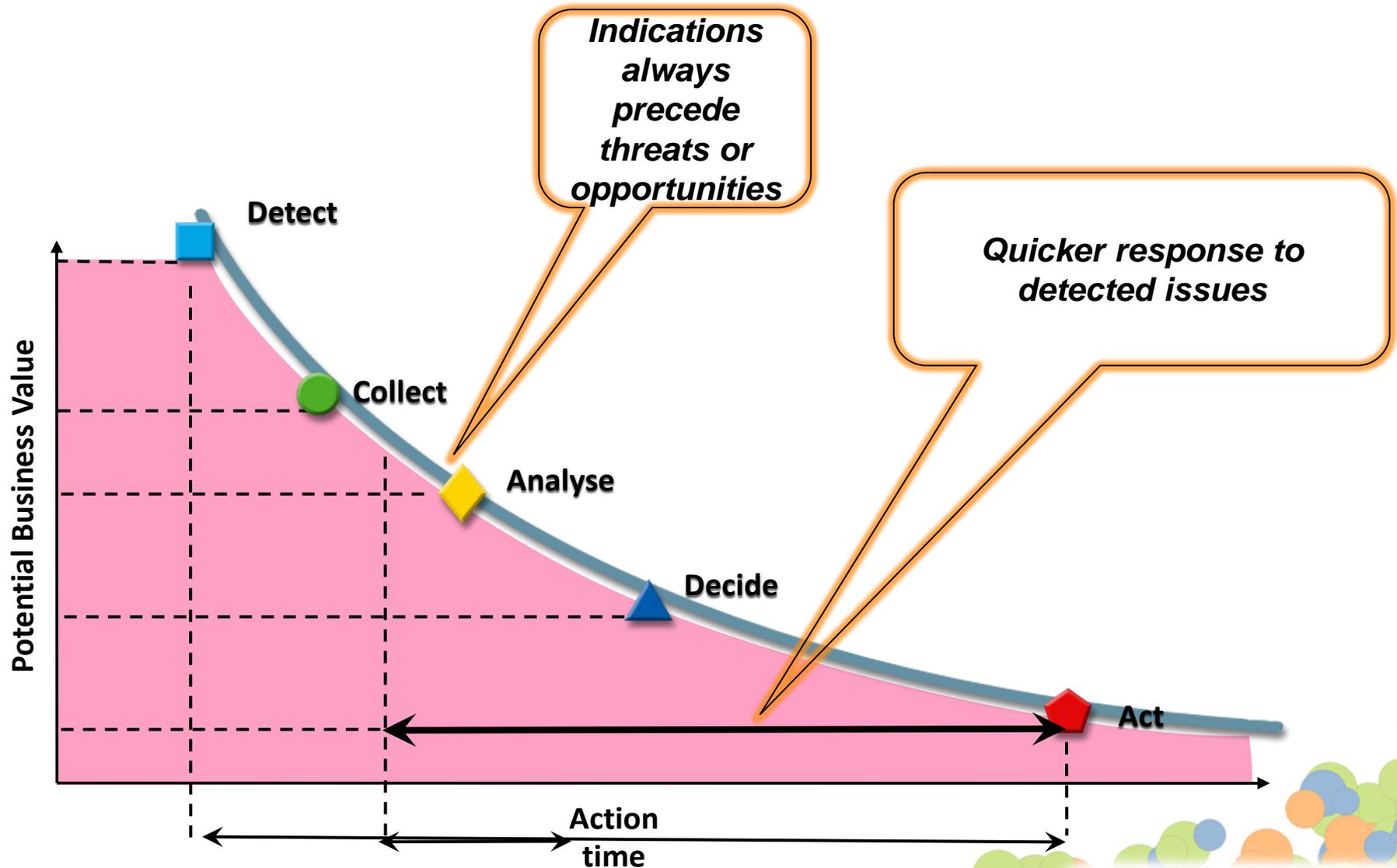
Visual Dashboards to Predictive Analytics. Easy. Fast. Smart.



# Agenda

- Introduction
- Who are TIBCO and our customers?
- Challenge : Data overload and no time
- Status Quo : Vertical applications, spreadsheets, reports ...?
- Solution : Why enterprise data analytics ?
- Success Stories: Here's the evidence
- What could that mean to you ?
- Next steps

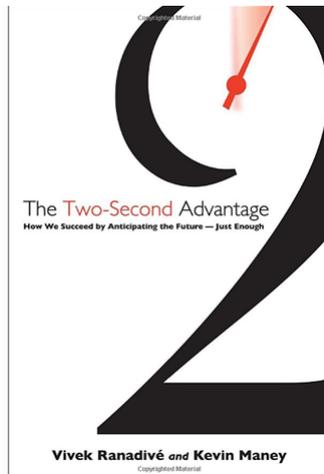
# Collapsing Time to Action



# The Two-Second Advantage

## Pervasive Value of Time.

*“A little bit of the right information, just a little bit beforehand – whether it is a couple of seconds, minutes or hours – is more valuable than all of the information in the world six months later... this is the two-second advantage.”*

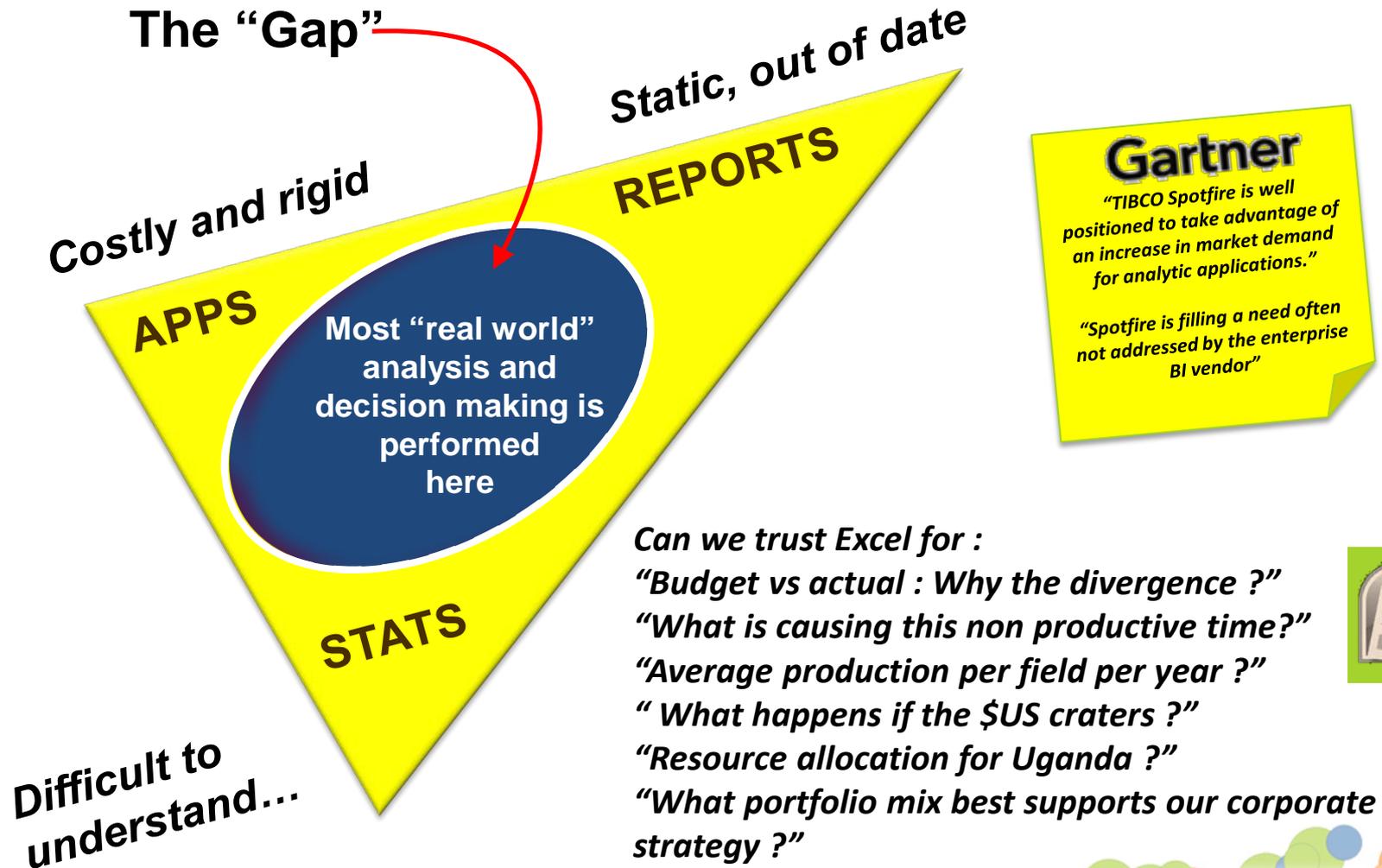


Vivek Ranadivé, Founder, CEO, Chairman TIBCO Software

# Who Enjoys This Insight Today ?



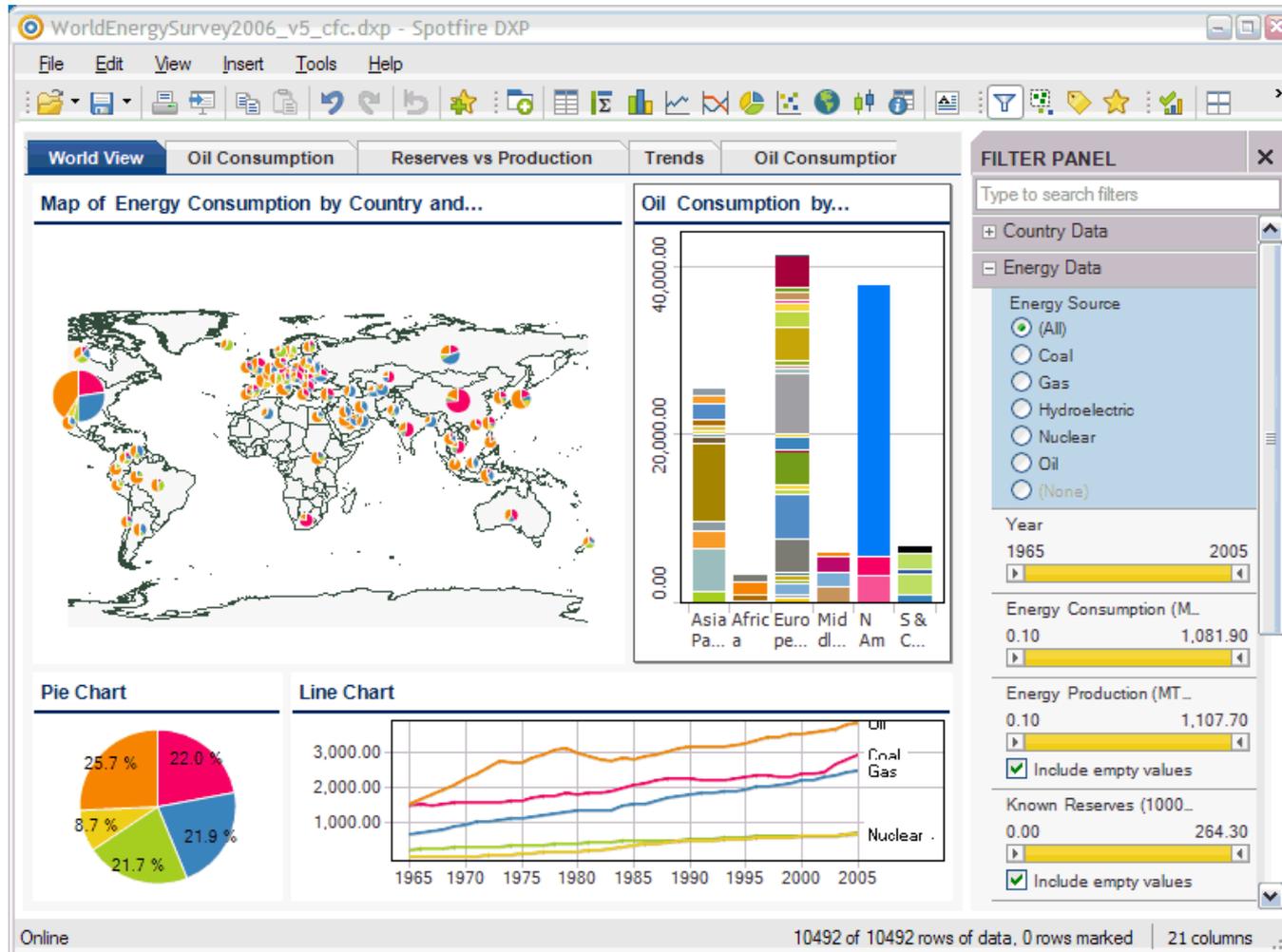
# The Analytical Gap



# How many 3's?



# Asking Any Question Of Your Data



# Start Simple: Classical BI Case

- This questions could be asked:

**Production:** Can you build a Spotfire project so that I can click on any well on a map and display it's production and the production of the surrounding wells within a certain distance?

**Drilling:** Where was the most challenging interval in my last drilled side-track?

**OPEX:** What are my lifting costs, over time, by foreman, by region?

What are my transportation cost?

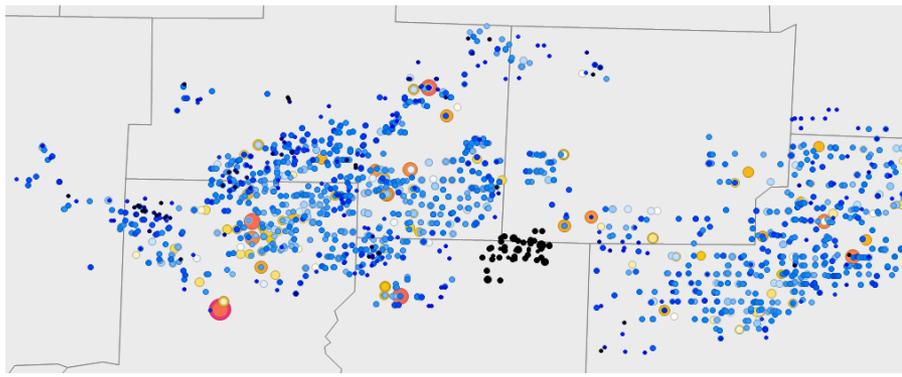
How can we control costs of services? Which is the most efficient services provider

- Answer:

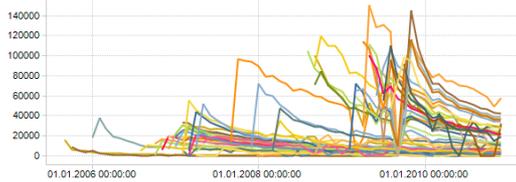
Yes, and you can do a lot more.

# Examples: Production

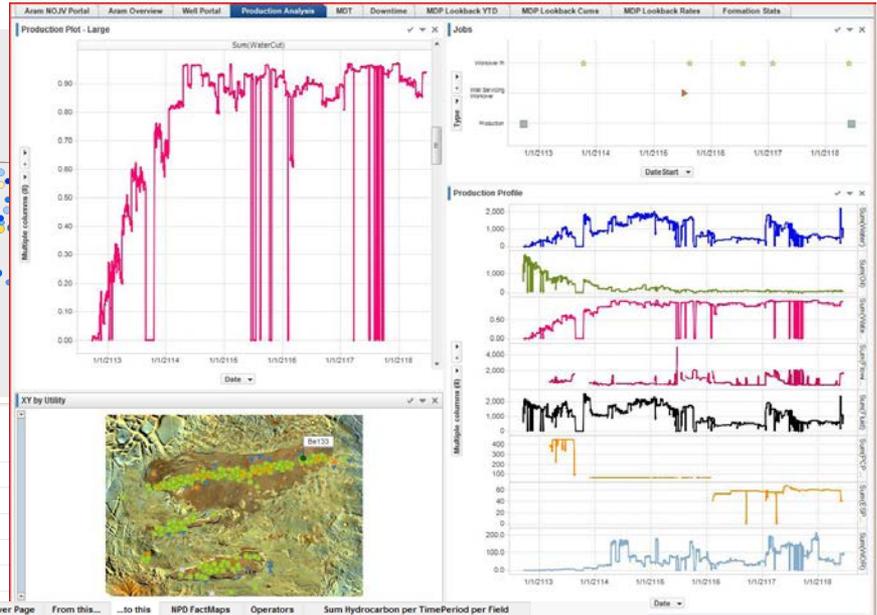
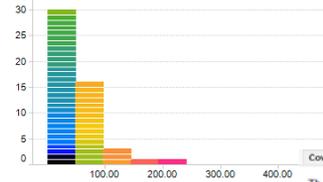
Map View of Wells



Decline Curves - Chronological



EUR Distribution for selected wells



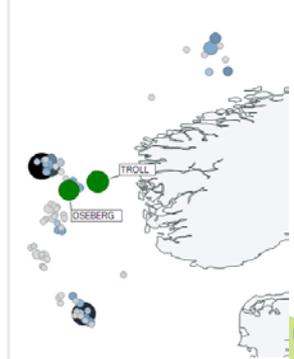
Field production (Oil, Gas, Water)



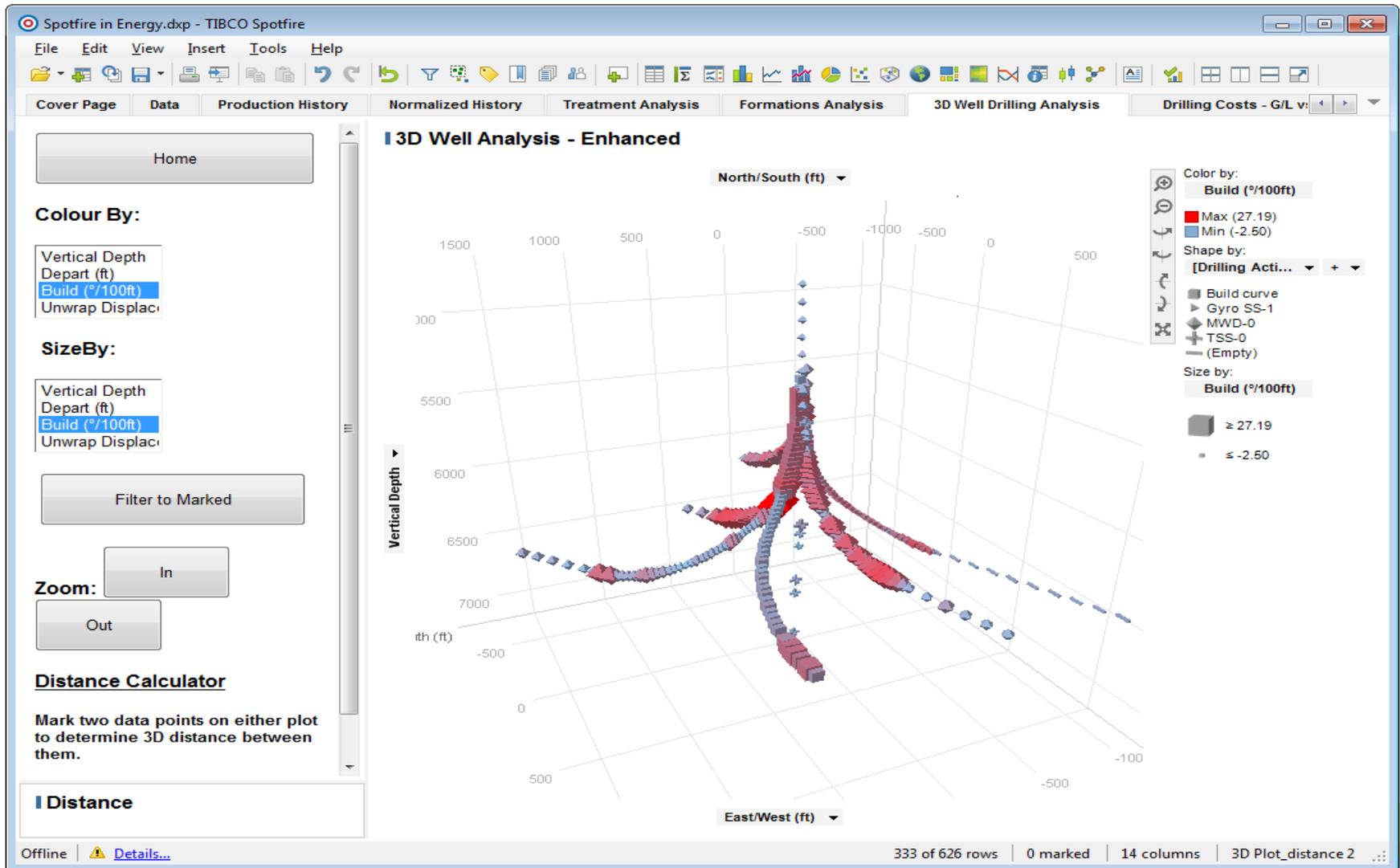
Field Name & Hyperlink to NPD Field Info W

field_name	NPDID_field-	h
OSEBERG	43625	C
OSEBERG	43625	C

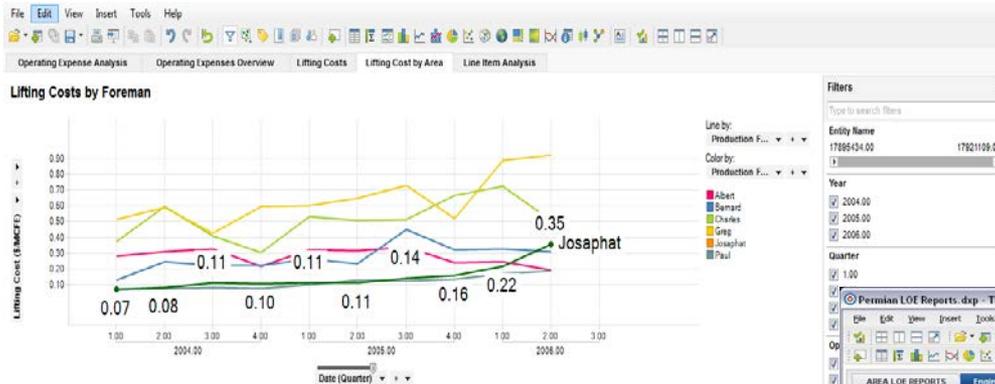
Norwegian oilfields



# Example: 3D View of drilling parameter



# Examples: OPEX > West Texas Lifting costs



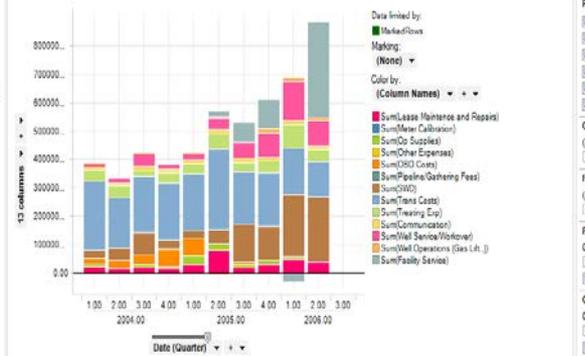
**Lifting Cost Breakdown**

The above chart shows a comparison for each foreman of the lifting costs. Several of the foremen have increasing lifting costs, meaning that the cost of operations are increasing.

Select a foreman on the plot to see a breakdown of each cost item that contributes to the total. The tool tip on the resulting curve will show you the cost item detail.

Do you see any costs that seem to be leading to the increase in lifting costs? What can we do about them?

Concentrate on SWD or Salt Water Disposal.



**Filters**

Type to search filters

Entity Name  
17895434.00 17921109.00

Year  
 2004.00  
 2005.00  
 2006.00

Quarter  
 1.00

**Permian LOE Reports.dxp - TIBCO Spotfire**

AREA LOE REPORTS | Engineer LOE Reports | Foreman LOE Reports | Pumper LOE Reports | Single Well | Scorecard | Page

Engr Select	Category Select	Engr - \$ Diff	Engr - Avg LOE/BOE	Foreman - \$ Diff
AUSTRI	CHEMICAL	\$150.0k	\$6.95	\$100.0k
ERIC	CONTRACT LA	\$100.0k	\$1.57	\$100.0k
JED	DIRECT EX	\$90.0k	\$1.09	\$20.0k
KAT	ELECTRIC	\$0.0	\$1.21	\$0.0
MIQUEL	SUB-SURF	-\$50.0k	\$0.95	-\$40.0k
ROBERT	SURFACE	-\$200.0k	\$1.33	-\$47.0k
SMD	SMD	-\$200.0k	-\$54.0k	-\$100.0k
WORKOVERS	WORKOVERS	-\$377.1k	\$0.00	-\$120.0k

**Engr - Production**

629037.61  
592068.47  
3654302042.00  
1780174582.77  
349568.68  
163097.22

**Foreman - Avg LOE/BOE**

BAILEY GAIL LO  
LOOKLAR CR  
MURRAY CARL

**Engr - \$ Amount**

\$1.79M  
\$1.57M

**Engr - Lifting Costs LOE/BOE**

\$7.40  
\$6.30

Color by: LOE Sub Cat...  
Legend: CHEMICAL HOT OIL, CONTRACT LABOR, DIRECT EXP MISC, ELECTRIC, SUB-SURFACE, SURFACE, SMD, WORKOVERS

10904 of 20780 rows | 398 marked | 19 columns | Data Table



# Next Step: The Engineers Desktop

A Platform to build analytical applications for:

- Petro physical properties from cores
- Geochemical data analysis
- Expected ultimate recovery prediction, decline curve analysis
- Integrating Desktop Apps via OpenSpirit
- Monitoring drilling performance
- Bit degradation
- Well information systems by pulling together everything relevant (maps, well header info, production data, geological data, well logs, pressure surveys etc.)
- Injector performance and producer correlation
- Simulation results visualization, history matching
- ... and may more

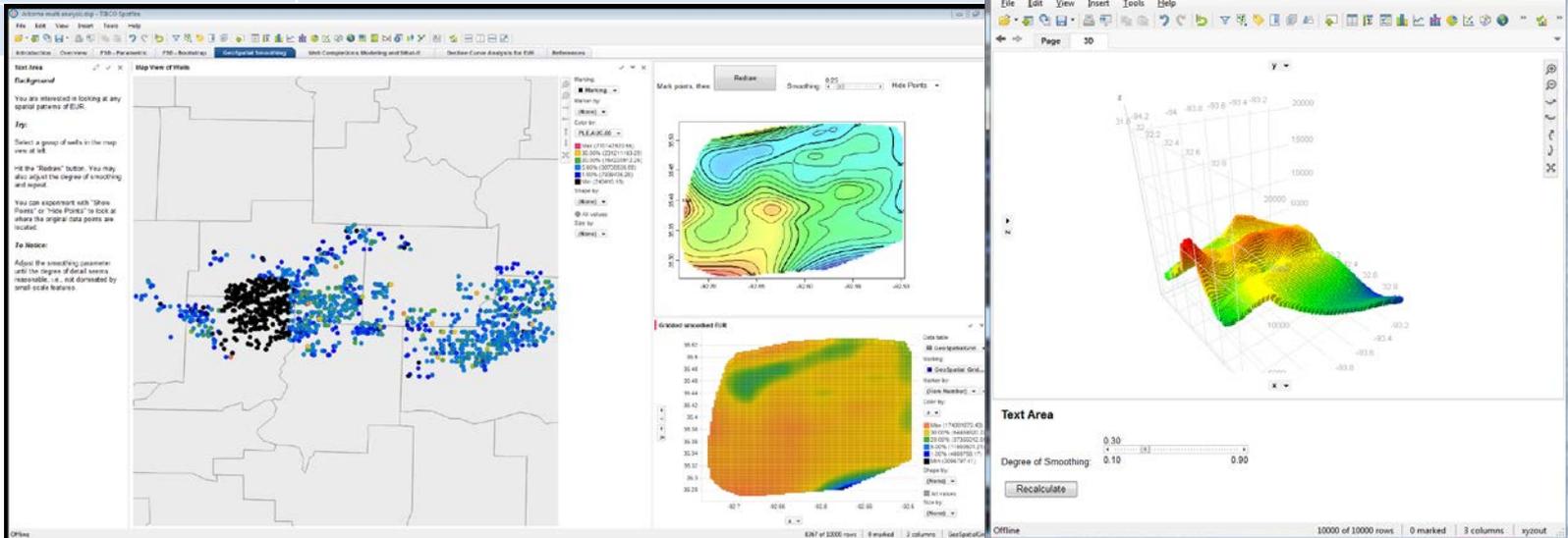
# Example : EUR Prediction

<b>Use Case/Solution:</b>	<b>EUR Prediction Decline Curves, Type Curves</b>
<b>Description:</b>	Fit large numbers of gas well production decline curves automatically to make timely assessments of properties and to make forecasts of future production over lifetime of each well.
<b>Department:</b>	Planning
<b>MBO:</b>	VP of resource planning
<b>Business Challenge:</b>	Current software tools cannot scale to fitting thousands of wells. Current fast methods do not leverage the most recent theory from academia. Accurate fitting is essential for evaluating production differences from different operators & drilling techniques.
<b>Value:</b>	Efficient and transparent implementation of modern decline curve fitting methods



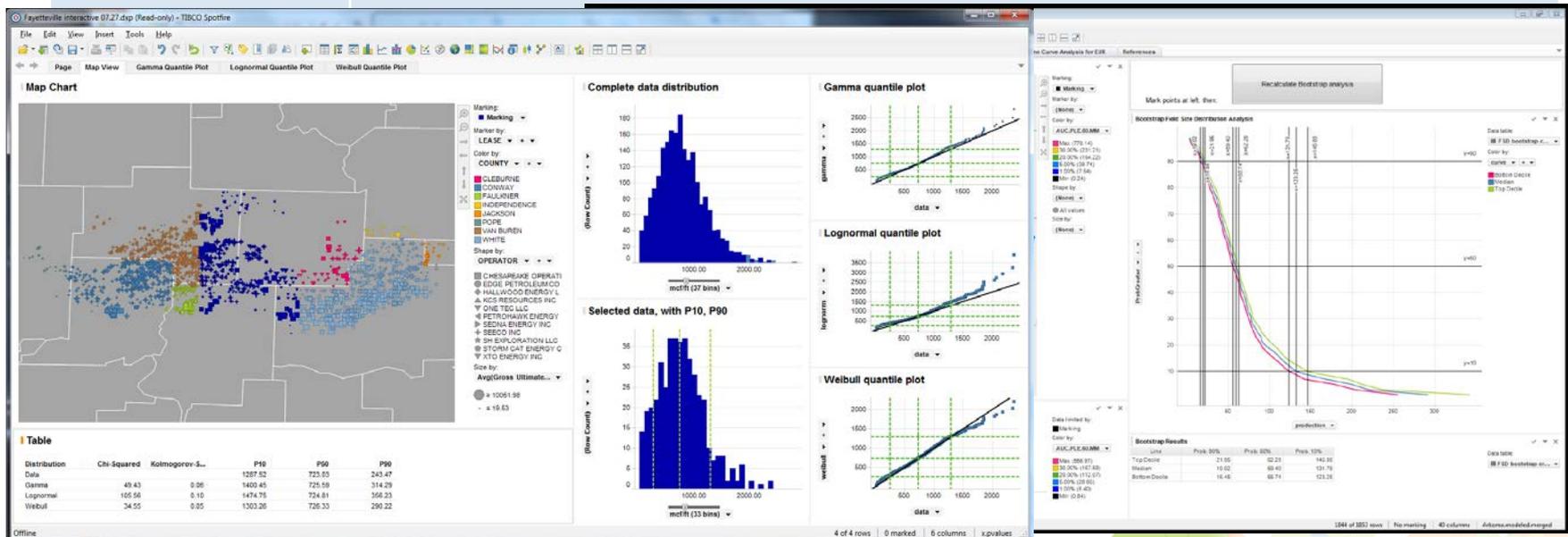
# Example : Spatial Mapping of Reserves

<b>Use Case/Solution:</b>	<b>Produce smooth map of oil/gas well lifetime production (EUR)</b>
<b>Description:</b>	Allows users to look for geographic patterns of production in order to plan new wells
<b>Department:</b>	Planning
<b>MBO:</b>	VP of resource planning
<b>Business Challenge:</b>	EUR Data is at geographically scattered points. Variability in data can obscure overall geographic variability so it is difficult to discover production 'hot spots'. Tool is needed to reveal regional patterns.
<b>Value:</b>	From geographically scattered well locations, produce smooth map of potential EUR for planning purposes. Clear and transparent view of geographical variability lets planners value property more accurately and make competitive bids on new property acquisitions, and plan development of existing properties more accurately.



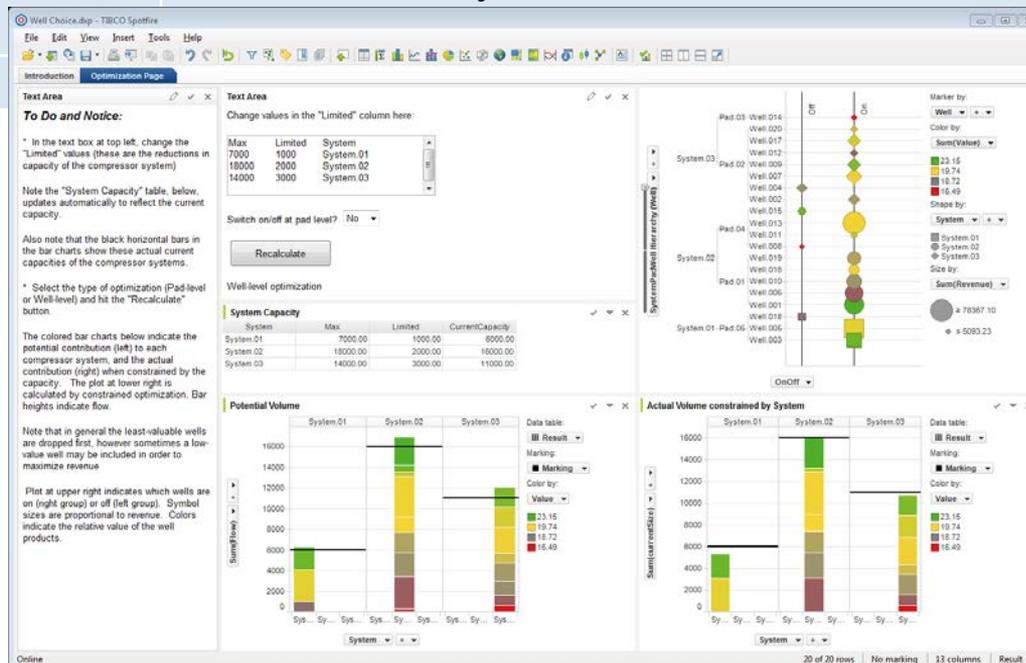
# Example : Probabilistic Field Reserve Estimate

<b>Use Case/Solution:</b>	Estimate probable reserves for a future well
<b>Description:</b>	From historical well reserve data for an oil/gas well field, estimate the probable production reserves for a new well at the 10%/ 50%/ 90% probability levels.
<b>Department:</b>	Planning
<b>MBO:</b>	VP of resource planning
<b>Business Challenge:</b>	The potential of a future well is probabilistic. Many current methods assume a particular family (e.g. lognormal) to estimate reserves of a new well, but these methods are least accurate where most needed, in estimating worst/best case scenarios (p10, p90)
<b>Value:</b>	Rapid calculation of familiar solutions (e.g., lognormal) as well as modern methods (bootstrapping) to estimate these critical numbers.



# Example : Well Choice

<b>Use Case/Solution:</b>	<b>Choose which gas wells to operate, given limited downstream compressor capacity</b>
<b>Description:</b>	Limited capacity of downstream compressors means not all gas wells can be operated. Solution calculates which wells to operate vs temporarily shut down in order to maximize revenue according to current commodities markets, given finite capacity of downstream compressor capacity
<b>Department:</b>	Planning
<b>MBO:</b>	VP of resource planning
<b>Business Challenge:</b>	Limited compressor capacity means analysts must choose which combinations of wells to operate. Commodities market variability means that individual wells change in relative value from day to day so optimum selection of wells can change as well. Difficult and time-intensive problem to solve without efficient numerical tools.
<b>Value:</b>	Numerical optimization methods can easily find the best combination of wells to operate given the valuation of different hydrocarbon constituents in the Commodities market.



# Example: Decline Curve Analysis

Equations used in modeling Decline Curves

Arps Hyperbolic decline

$$q = q_i(1 + bD_i t)^{-1/b}$$

(Arps, 1944)

Power Law Exponential Decline

$$q = \hat{q}_i \exp(-D_\infty t - \hat{D}_i t^n)$$

(Ilk et al., 2008)

SPE 116731

Exponential vs. Hyperbolic Decline in Tight Gas Sands — Understanding the Origin and Implications for Reserve Estimates Using Arps' Decline Curves  
D. Ilk, Texas A&M University, J.A. Rushing, Anadarko Petroleum Corp., A.D. Perigo, Anadarko Petroleum Corp., and T.A. Blasingame, Texas A&M University



Arkoma multi analysis projector.dxp - TIBCO Spotfire

File Edit View Insert Tools Help

Introduction Overview FSD - Parametric FSD - Bootstrap GeoSpatial Smoothing Well Completions Modeling and What-If Decline Curve Analysis for EUR

**Text Area**

Mark points, then:

**Map View of Wells**

**Type Curve for selected Wells**

**Fitted Parameters for "Hyperbolic" and "Power Law Exponential" Models**

ID.match	npts	q.i	D.inf	D.ihat	n.exp	Hyp.qi	Hyp.b	Hyp.Di	PLE.q.60	days.to.PLE.q10
20300152576	15.00	26136526...	0.00	4.70	0.11	82303.65	0.93	0.07	14420.95	22359.64
20300152621	57.00	84437887	0.00	23.51	0.03	7110612.	1.23	4625.	2731.21	47443.20
20300152737	58.00	88605.67	0.00	0.29	0.36	33987.17	0.67	0.01	25394.82	15861.25
20300153111	50.00	21755.61	0.00	0.24	0.29	12353.96	1.87	0.00	9942.51	177132.33

**Decline Curves - Chronological**

**Time-Normalized Decline Curves and Theoretical Fit**

**Decline Curve Analysis for EUR**

FSD bootstrap VLines

DCA.loop.metrics.df

DCA.loop.fitted.df

ID.well

Type to search in list

(All) 51 values

20300152576

20300152621

20300152737

20300153111

20300153187

20300153190

20300153230

20300153312

20300153317

20300153358

20300153359

20300153364

t.Date

01.09.200... 01.12.201...

t.calendarDays

-1460.56 1917.44

t.cumFlowDays

-1460.56 1917.44

q.data.mscf

0.00 150262.00

51 of 51 rows | 1 marked | 82 columns | DCA.loop.metrics.df

# The Prooven Value

## Technical Challengers:

- Real Time Production and Drilling Monitoring
- Enterprise Wide Integration and SOA Projects (OpenSpirit Connect)

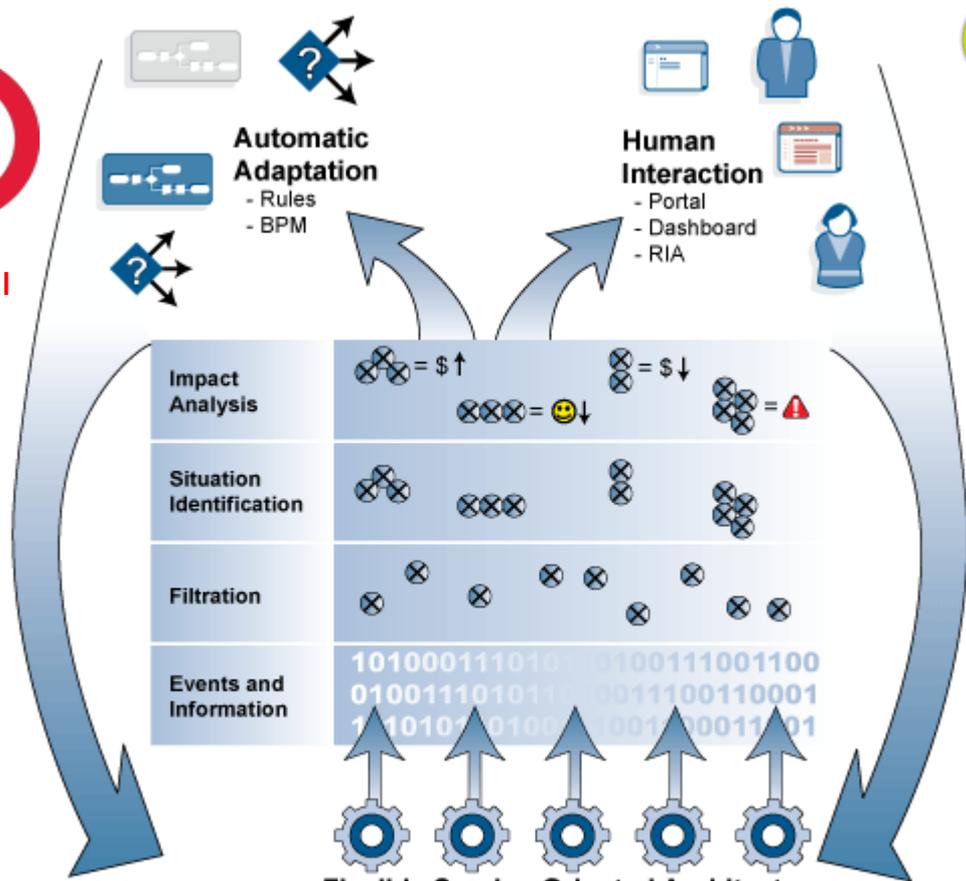
## Large Financial and Reputational Impact:

- Non Productive Time Analysis in Drilling Operations
- HSSE: Health Safety Security Environment

# Real Time Production and Drilling Monitoring

- How can I best leverage on my investment in real time data collection
- Data volumes are extremely large and cleaning, validating and aggregating takes too long before I can use real time data
- How can I use the real time data to act on it in a timely fashion?
  - Can I get immediate an alert when a choke is closed and the submersible pump is still running?
  - How can I identify a watercut increase at a specific well and alert all relevant people, even if I do not know all the relevant people
  - How can I associate a pressure drop with a possible tubing corrosion
- How can real time data give the added value to our business processes we expect? Collecting and aggregating real time data (**data in motion**) and move them in a dumb way to the production data base (**data at rest**) does not justify the investment.
- Can I use my predictive simulation results and compare real time data against them? Can a recalibration of the model be triggered automatically ?

# TIBCO Reference Architecture for Complex Event Processing



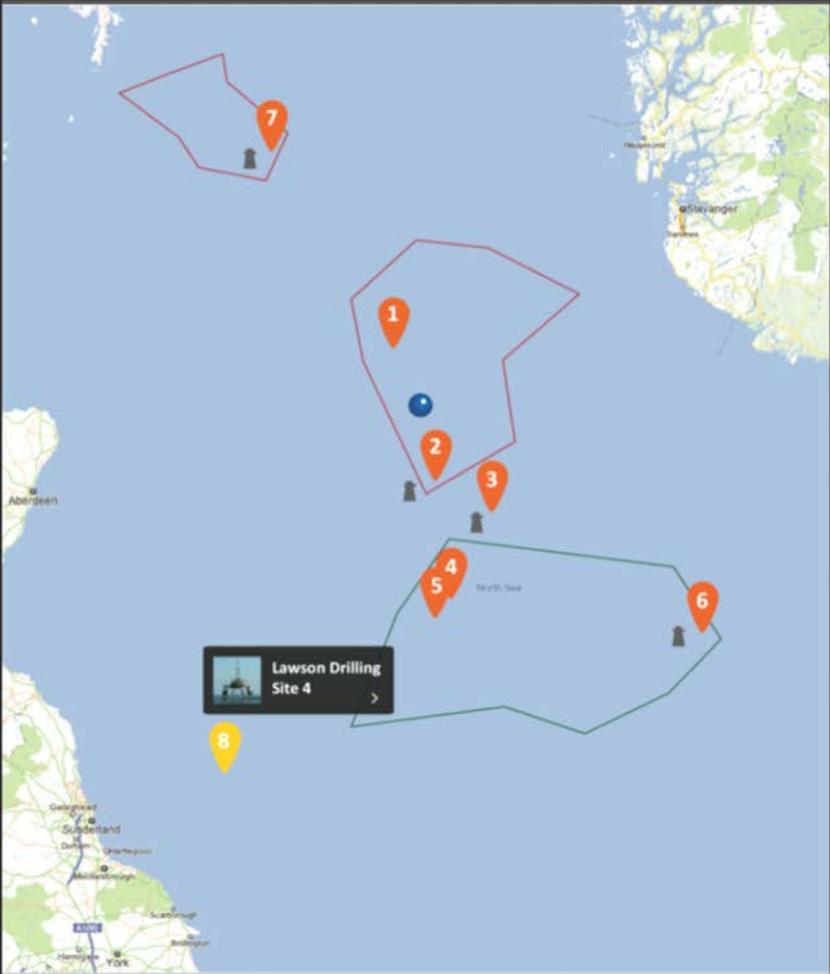
Decision Processing

Event Processing



# Harness the collective intelligence of an Oil Well

**Back** **Map** **Reality**



**Show All** **People** **Subjects**

**Back** **Reply** ▲ ▼

 **Greg Evans** Our mud pump is vibrating violently. Here's a video showing the issue.



 Lawson Drilling Site 4 

 4 Replies  7 Likes

01/25/2012at 11:30 AM

 **Red Phillips** We had a similar issue last week over here at Site 3. You need to replace the pistons and valves and it should work fine.

01/25/2012at 11:50 AM

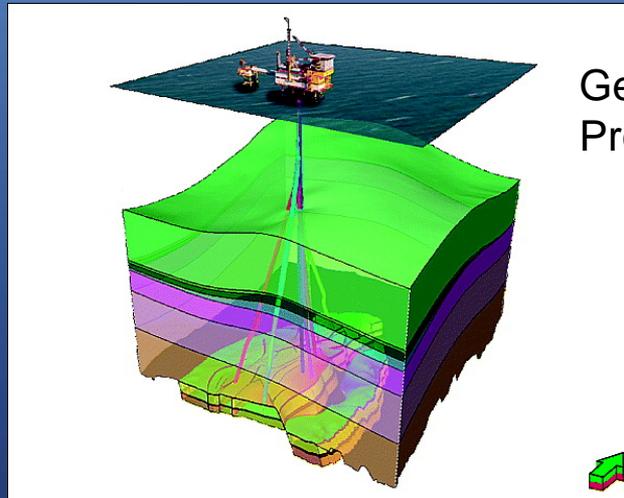
 **John Davis** We actually have a bunch of pistons that will fit the

Write a reply ...

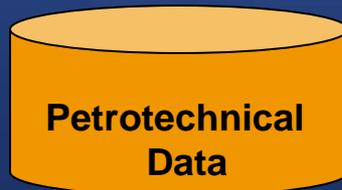
# Integration in the G&G Domain

Reservoir Engineering GeoFrame to Well Master

★ Time Optimization



Well Master



**Petrotechnical Data**

**TIBCO EMS Messaging**

- Data available to multiple systems
- Reliable delivery



**Well Data**

**TIBCO OpenSpirit**

- Connectivity
- Abstracted data model
- Coordinate and unit system awareness



**WELL DATA**

“COMPLETION DATE, TOTAL DRILL DEPTH, TOTAL DRILL DEPTH UNIT OF MEASURE, SURFACE LATITUDE, SURFACE LONGITUDE, WELL NAME”

**TIBCO OpenSpirit Connect**

- PPDM support built in



# Takeaway where TIBCO can help:

- Complex Event Processing and Real Time Analytics is the Solution to leverage on your investment in automatic data collection from production and drilling operations.
- Use of a horizontal platform for SOA and analytics guarantees cost effectiveness of the solution by scalability into upstream activities but also to organization units outside of E&P
- Enterprise Social Media leverages on the collective intelligence of the company and helps to transfer knowledge from experienced engineers to young professionals without creating disruptions in the business



**Thank You**

