



Big Data Analytics with the PI System

Presented by **LP Page-Morin, Sr. Systems Engineer**

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BIG DATA



" high **volume**, **velocity**, and/or **variety** information assets that demand cost-effective, innovative forms of information processing that enable insight, decision making, and process automation "

---Gartner

The Benefits of Big Data

6% more profitable

83% improved process cycle times

49% had payback in one year or less

54% report ROIs >100%

27% year-over-year increase in revenue

12% less operating expense

5% more productive

Sources: Harvard Business Review, Forbes, IDB

The Big Data Landscape

Apps



Infrastructure



From: <http://www.bigdatalandscape.com/>

Big Data Analytics

Big Data Analytics



- Analytics is required to transform information into intelligence
- More than storage
 - Visual Analytics
 - Machine learning
 - Complex event processing

Is production related to drilling conditions ?



When did the geology change?
How fast the well was being drilled?
What angle was the drill bit?
Sudden changes in production?

Big data analytics and the PI System

Statistical
Analytics



Analytical
Insight



Visual
Analytics

Time Series



Relational



Unstructured



GIS

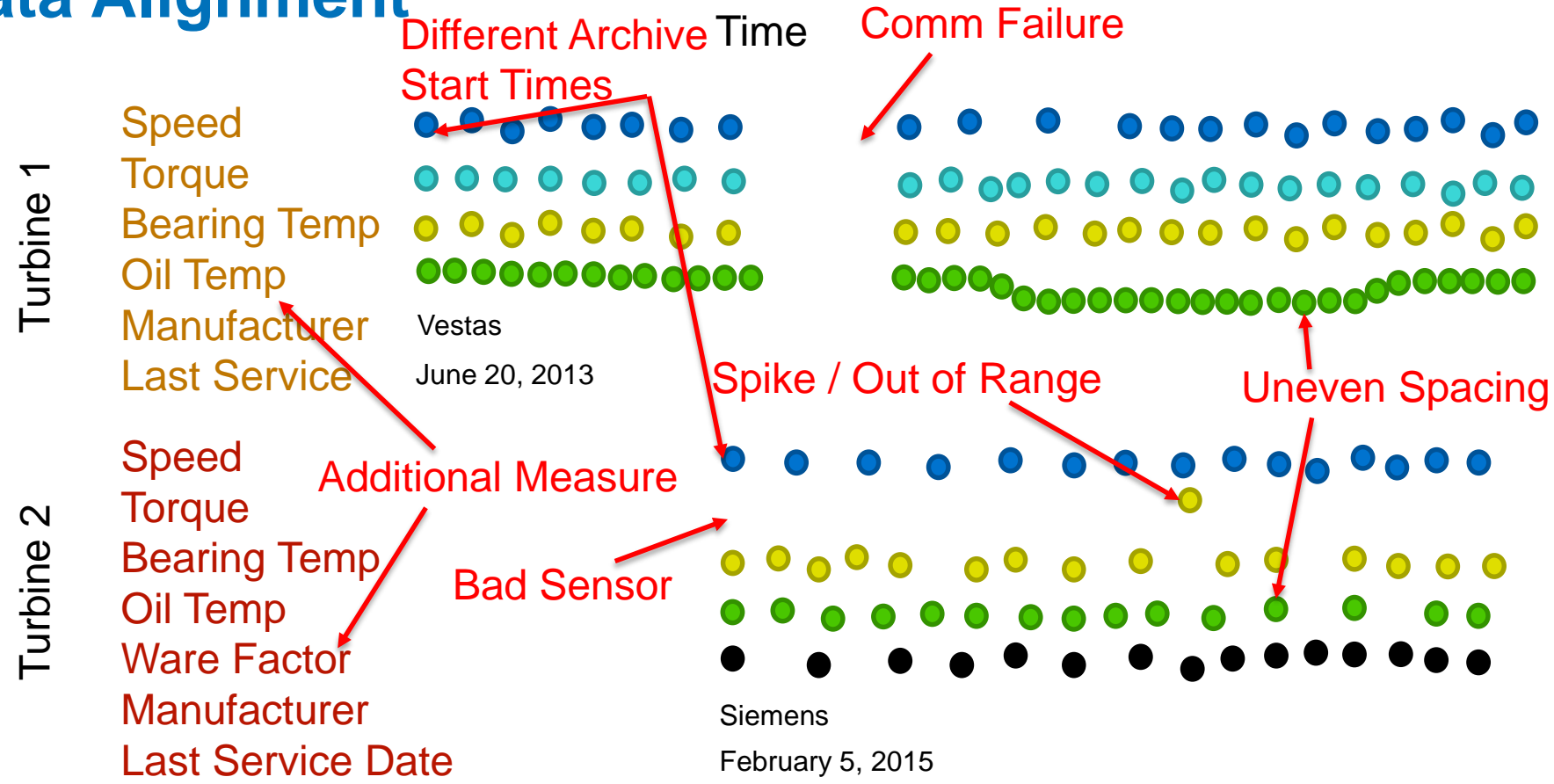


Real-time time series data isn't perfect

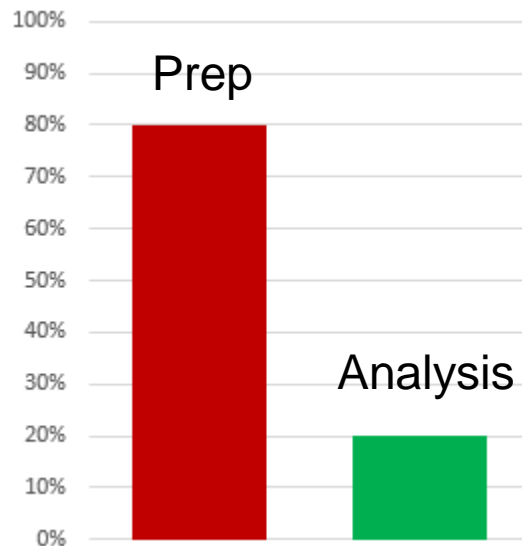


- Naturally incomplete
 - data delays
- Doesn't look like SQL
 - Asset Context
- Not evenly spaced
 - time is framed by events
- Subject to errors in measurement

Data Alignment



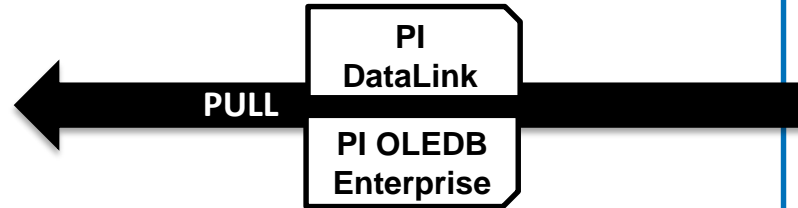
Data Wrangling



Data cleansing and preparation tasks can take 50-80% of the development time and cost

<https://hbr.org/2014/04/the-sexiest-job-of-the-21st-century-is-tedious-and-that-needs-to-change/>

Traditional Data Delivery



BUSINESS TOOLS



TIBCO Spotfire®



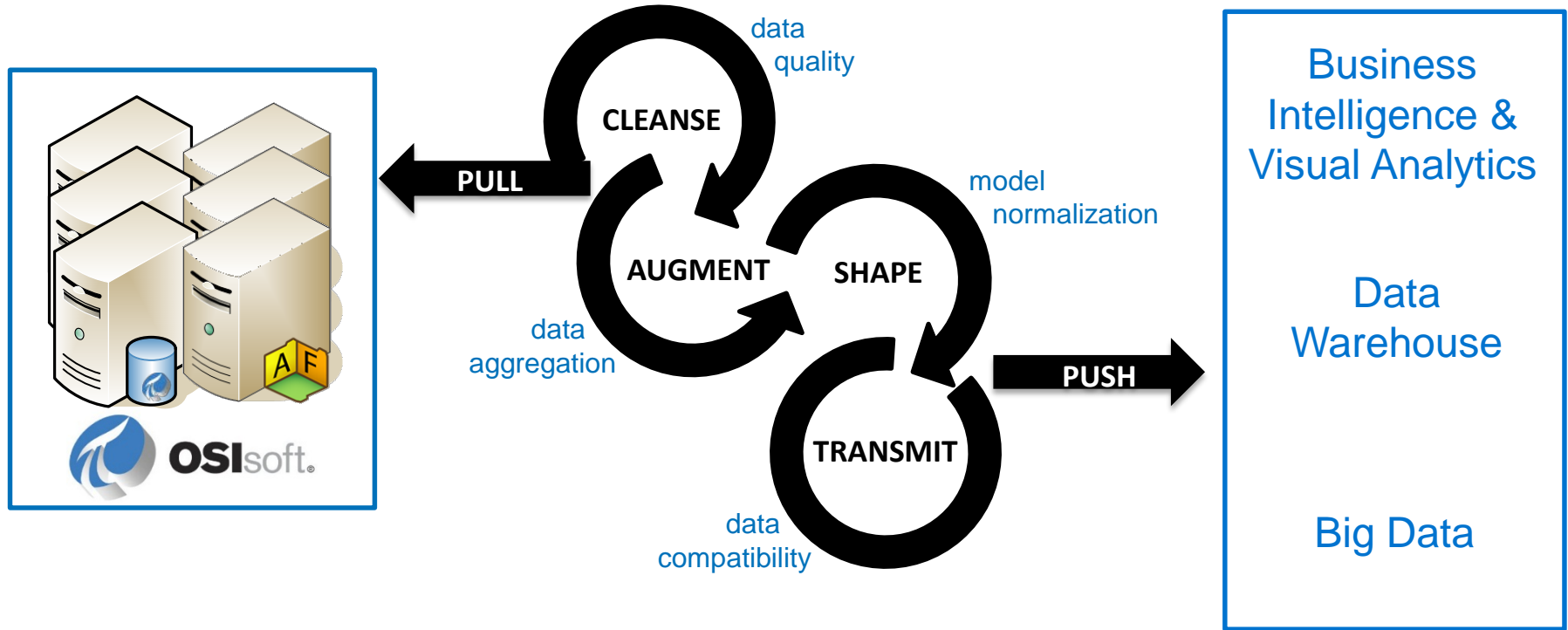
Excellent for “small” datasets

- Hours, days, 1-2 months

Does not scale to “large” datasets

- 6 months, 3 yrs...
- “High Density” data - Drilling

PI Integrator for Business Analytics



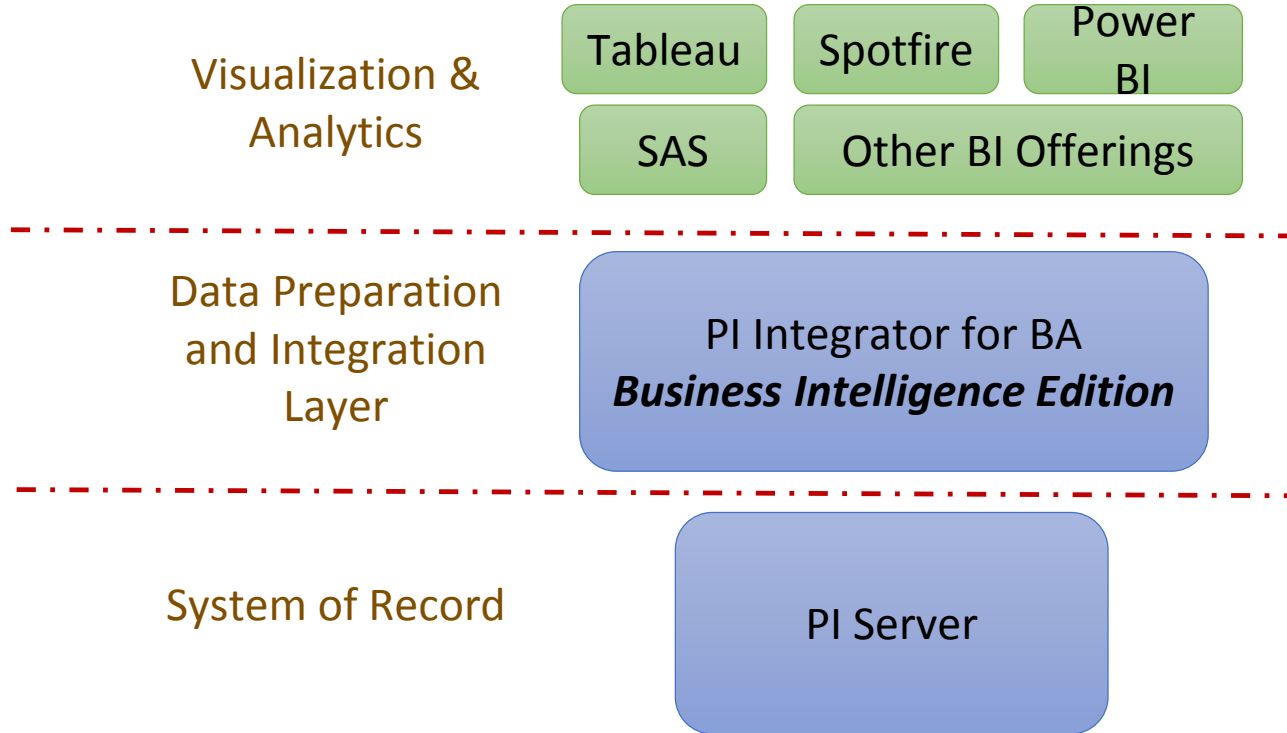


PI Integrator for Business Analytics: BI edition

- Create PI Views
- Access decision ready data via ODBC
- Best solutions to provide access to analytics tools
 - Tibco Spotfire, Tableau, Microsoft Power BI
 - SAS, Cognos, Oracle
 - Most Dashboarding tools



Business Intelligence & Visual Analytics



PI Integrator x localhost:7777/Designer

Apps PI Integrator PI Integrator Admin

OGDrillingRealTime-test

Select Data > Modify View > Publish

Source Assets	Asset Shape	Matches
Server: DFPIAF Database: PetroLux Assets <ul style="list-style-type: none"> Asset Lists Key Performance Indicators PetroLux Corporation <ul style="list-style-type: none"> Downstream Midstream Petrochemicals Upstream <ul style="list-style-type: none"> Conventional Gas Conventional Oil <ul style="list-style-type: none"> Athabasca Field Cold Lake Field Fort McMurray Field <ul style="list-style-type: none"> Maintenance Vehicles Well Pad 001 Well Pad 002 	Asset Shape Shapes Rig <ul style="list-style-type: none"> Bit Weight Block Height Diff Press Flow In Rate Hole Depth Hook Load Mud Weight In Pump Pressure ROP Top Drive RPM Top Drive Torque Well ID Well Name Well Name State Bit Position 	Matches Found 2 Matches <ul style="list-style-type: none"> Drill1 Drill2

Attributes filter

Select All

- Chemical Use
- Fuel Gas
- Number of Tanks
- Number of Wells
- Oil Forecast

Select Data > **Modify View** > Publish

+ Add Column 20 Columns		Edit Row Filters 1 Row Filters		Edit Value Mode Interpolated Values Every 1 seconds		Start Time 3/27/2013, 12:00:00 AM										End Time 7/7/2014, 12:00:00 AM	
Rig	LocalTime	Day	Hour	WeekDay	Bit Weight	Block Height	Diff Press	Flow In Rate	Hole Depth	Hook Load	Mud Weight In	Pump Pressure	ROP	Top Drive RPM	Top Drive Torque	Well ID	Well Nam
Name	TimeStamp	Day	Hour	Day of the Week	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Drill1 (RO)	2013-03-27 03:19:00	27	3	Wednesday	0.00	78.78	1.43	50.00	1.42	48.30	10.90	123.04	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:20:00	27	3	Wednesday	0.00	78.85	1.01	50.00	1.42	48.30	10.90	122.63	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:21:00	27	3	Wednesday	0.00	78.83	1.11	50.00	1.42	48.40	10.90	122.71	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:22:00	27	3	Wednesday	0.00	78.80	1.56	50.00	1.42	48.10	10.90	123.31	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:23:00	27	3	Wednesday	0.00	78.81	0.74	50.00	1.42	48.10	10.90	122.41	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:24:00	27	3	Wednesday	0.00	78.81	1.23	50.00	1.42	48.30	10.90	122.63	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:25:00	27	3	Wednesday	0.00	78.80	0.55	50.00	1.42	48.50	10.90	122.14	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:26:00	27	3	Wednesday	0.00	78.83	1.58	50.00	1.42	48.40	10.90	123.38	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:27:00	27	3	Wednesday	0.00	78.78	1.96	50.00	1.42	48.30	10.90	123.24	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-03-27 03:28:00	27	3	Wednesday	0.00	78.81	1.77	50.00	1.42	48.60	10.90	123.53	0.00	0.00	0.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:40:00	2	22	Tuesday	11.60	32.64	33.16	595.00	10025.69	231.40	10.20	2744.59	0.00	0.00	1562.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:41:00	2	22	Tuesday	10.40	32.46	35.36	595.00	10025.69	232.50	10.20	2741.70	0.00	0.00	1601.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:42:00	2	22	Tuesday	10.60	32.57	32.28	595.00	10025.69	232.60	10.20	2742.31	0.00	0.00	1605.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:47:00	2	22	Tuesday	14.90	32.25	6.53	596.00	10026.21	228.30	10.20	2721.55	0.00	0.00	1543.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:49:00	2	22	Tuesday	0.00	36.25	6.78	595.00	10026.21	237.20	10.20	2713.55	0.00	0.00	1581.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:50:00	2	22	Tuesday	0.00	35.08	46.28	596.00	10026.21	236.60	10.20	2703.22	0.00	0.00	1593.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:51:00	2	22	Tuesday	0.00	34.28	68.94	596.00	10026.21	242.60	10.20	2714.47	0.00	0.00	1574.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:52:00	2	22	Tuesday	0.00	33.82	8.39	595.00	10026.21	239.30	10.20	2656.50	0.00	0.00	1574.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:53:00	2	22	Tuesday	0.00	33.05	35.55	595.00	10026.21	237.50	10.20	2680.76	0.00	0.00	1582.00	Well-2370R671	Well1 Drill1
	2013-04-02 22:54:00	2	22	Tuesday	0.00	32.67	99.61	595.00	10026.21	238.40	10.20	2749.77	0.00	0.00	1587.00	Well-2370R671	Well1 Drill1
2013-04-09 21:26:00	9	21	Tuesday	0.00	96.00	77.60	590.00	16964.25	267.30	10.80	3587.81	0.00	0.00	1530.00	Well-2370R671	Well1 Drill1	
2013-04-09 21:27:00	9	21	Tuesday	0.00	95.86	106.55	590.00	16964.25	266.10	10.80	3619.76	0.00	0.00	1519.00	Well-2370R671	Well1 Drill1	

Active Well

Select Data > Modify View > Publish

Target Configuration DFSQL

DFSQL ▼

Target----

PI View

DFSQL

File

HDFS

Summary

Shape and Matches

- There are **2 Matching Instances**.

Timeframe and Interval

- Your Start Time is **3/27/2013, 12:00:00 AM**
- Your End Time is **7/7/2014, 12:00:00 AM**
- Your Time Interval gets an interpolated measurement every **1m**

Does everything look good?

Save and Close

Publish

File Edit View Insert Tools Help



Page

Data

OGDrillingRealTime-C...

Type to search columns

NUMBERS

Bit Position

Bit Weight

Block Height

Day

Day2

Diff Press

Flow In Rate

Hole Depth

Hook Load

Hour

Month

Mud Weight In

Pump Pressure

ROP

Top Drive RPM

Top Drive Torque

WeekOfYear

TIME

LocalTime

CATEGORIES

ROP per Top Drive RPM and Hole Depth

Top Drive RPM

0.04 0.11 0.23 0.36 0.54 0.81 1.32 33... 35... 48... 49... 51... 58... 59... 59... 60... 68... 71... 73... 89...

748.51

1940.07

2837.87

3956.21

4600.26

5336.19

6189.17

6837.87

7451.14

8056.48

8583.32

9146.35

9508.63

9678.64

9795.54

9895.06

10050.11

10190.81

10347.19

10496.47

10676.85

10960.43

11312.75

11691.20

12106.29

12542.79

12890.81

13227.77

13534.14

13951.88

14296.67

14596.02

14885.52

15224.27

15550.94

15850.17

16206.97

Data table:

OGDrillingReal...

Colors:

Max

Average

Min

Filters

Type to search filters

OGDrillingRealTime-Crew-Shift

Crew

Type to search in list

(All) 4 values

CREW A

CREW B

CREW C

CREW D

Shift

Type to search in list

(All) 2 values

Day

Night

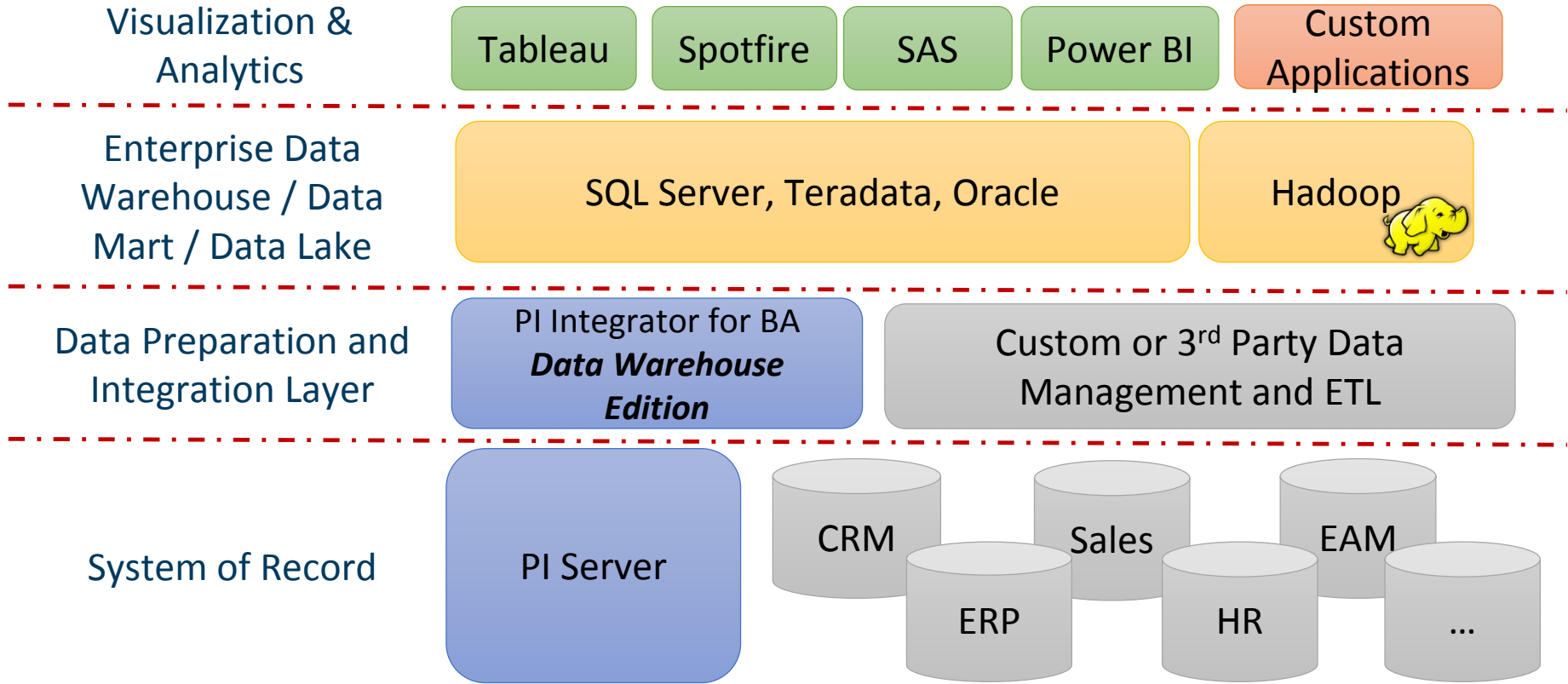
OGDrillingRealTime-Crew-Shift

Avg(ROP)

PI Integrator for Business Analytics: Data Warehouse and Big Data Edition

- Data Warehouse Edition
 - Export to SQL server
 - Export to text file
 - Other DB coming soon: Oracle, Teradata
- Big Data Edition
 - Export to Hadoop (HDFS)
 - Hortonworks, MapR, Cloudera and others

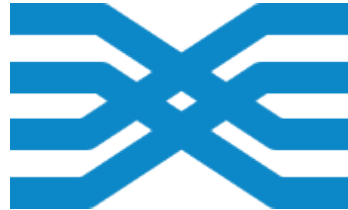
Data Warehouse Architecture



PI Integrator for SAP HANA

- Native Integration with HANA Smart Data Access (SDA)
- Data is brought into memory on demand
- Focus on BI, Reporting, and Predictive Analytics

BUSINESS PROCESSES



INDUSTRIAL PROCESSES



Conclusion

PI Complements Big Data Solutions

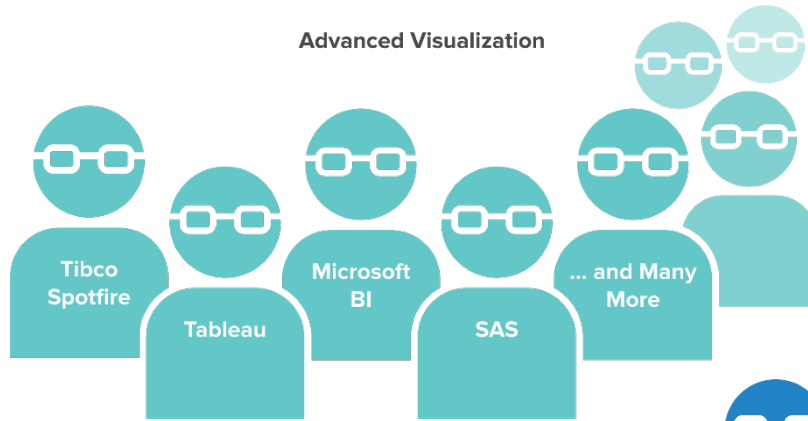
Problem	PI System	Big Data	Why?
Collect and store data from a variety of real-time and operational sources	✓		The PI System contextualizes your data, collects natively from a variety of sources and efficiently stores data at less than 10% of the size of big data
Ask questions about a few to hundreds of data points	✓		The PI System is highly tuned for instantaneous answers about your data vs. waiting for minutes or hours for your answer to come from a big cluster
Ask questions about the entire PI archive		✓	Big data is excellent for asking questions about large data sets and finding hidden patterns. Requires writing code and doing analysis in batches vs real-time
Operationalizing and capturing knowledge from analyses	✓		The PI System is the best place to capture knowledge from big data and visual analytics and apply it in real time across all your assets and operations
Deriving correlations and insights from the entire PI archive and external data		✓	Big data is essential for large inspection queries that require complex descriptive analytics, pattern searching, and joining non-PI data

Before you get started

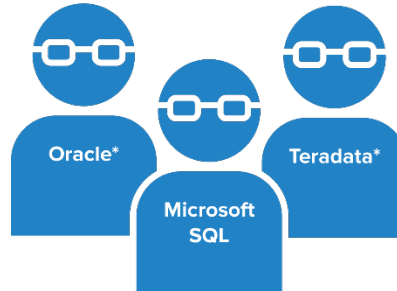
- Ask internally, at your company, if there is a Big Data Initiatives and which tools are already in used
 - Leverage existing infrastructure
- Organizing the data is key:
 - Proper AF structure required
 - Link to Metadata (ID)

What Systems Are Supported?

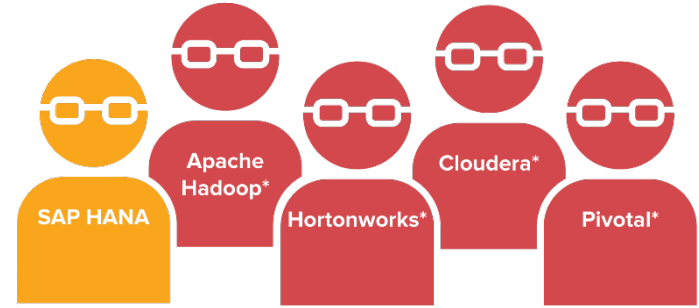
Advanced Visualization



Data Warehouse



Big Data*



*Coming Soon, Stay Tuned!

Proven technology - Early Adopter Program



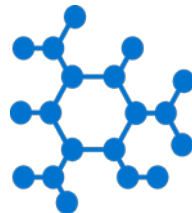
Merck
Regeneron



Devon Energy
Noble Energy
NOV



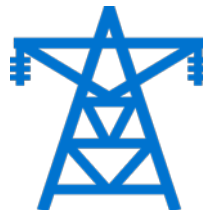
EDF-RE



BASF



Cemex
Alcoa GRP



China Southern Grid
SDG&E



Freeport McMoRan

	BI Edition (Q4-2015)	Data Warehouse Edition (Q4-2015)	Big Data Edition (2016)	SAP Hana Edition (Q4-2015)
PI Views - Client side ODBC	X	X	X	
Native Connections				
- SQL Server		X	X	
- Flat File		X	X	
- SAP Hana				X
- Oracle		(2016)	X	
- Hadoop			X	

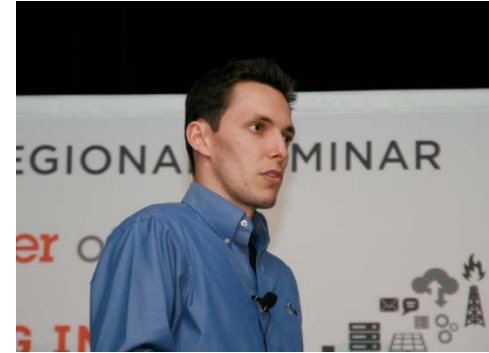
Contact Information

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Sr. Systems Engineer

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Questions

Please wait for the **microphone** before asking your questions



State your **name & company**

Please remember to...

Complete the Survey
for this session



The **Power of Data**

DECISION READY IN REAL-TIME

Evaluation Form (Seminar Location - Date)

Name: _____

Company: _____

Email: _____

Quality and content of the presentations

Poor Good Excellent N/A

Welcome	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Journey To Real-Time Operational Intelligence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Power of Connection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tank Level Management System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unleash your Infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information on the Spot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wrap-up/Seminar Conclusion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Quality and organization of the seminar

Choice of date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time allowed for lunch/breaks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice of presentations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Break and time allowed for the presentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado