# Streaming IoT Analytics with the PI Integrator for Azure, Cortana Intelligence and Azure IoT

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# Agenda

1. IoT Analytics Challenges
2. Cortana Intelligence and Power BI
3. PI Integrator for Microsoft Azure & Red Carpet Incubation Program (RCIP)
4. Call to Action

# IoT Analytics Challenges

# Transforming the Value of Data

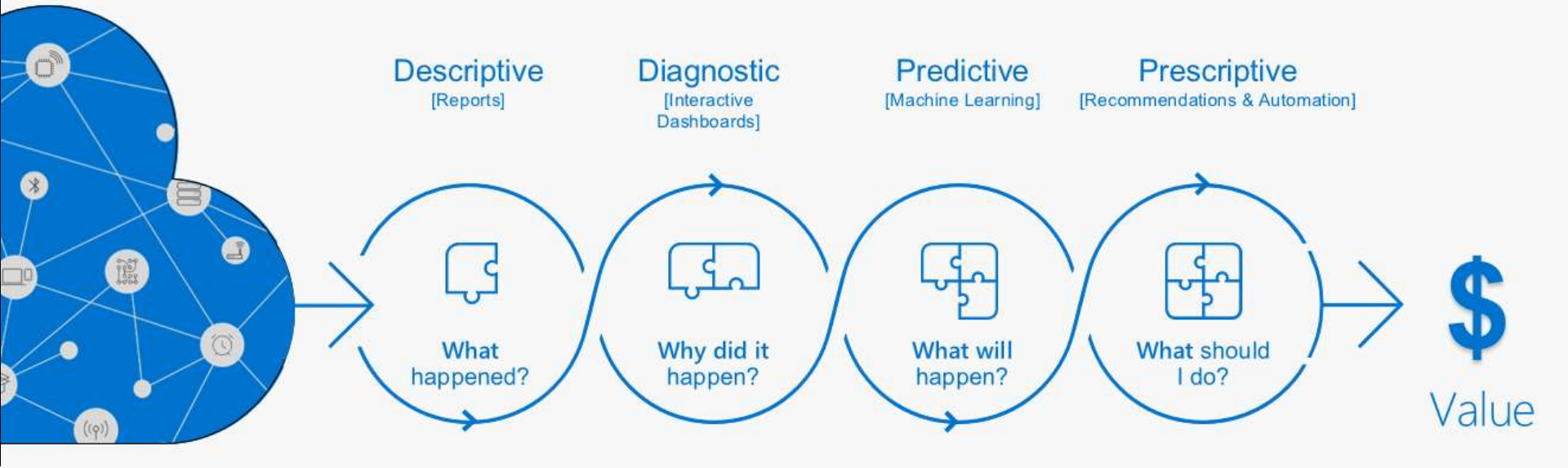
1 | Data

2 | Information

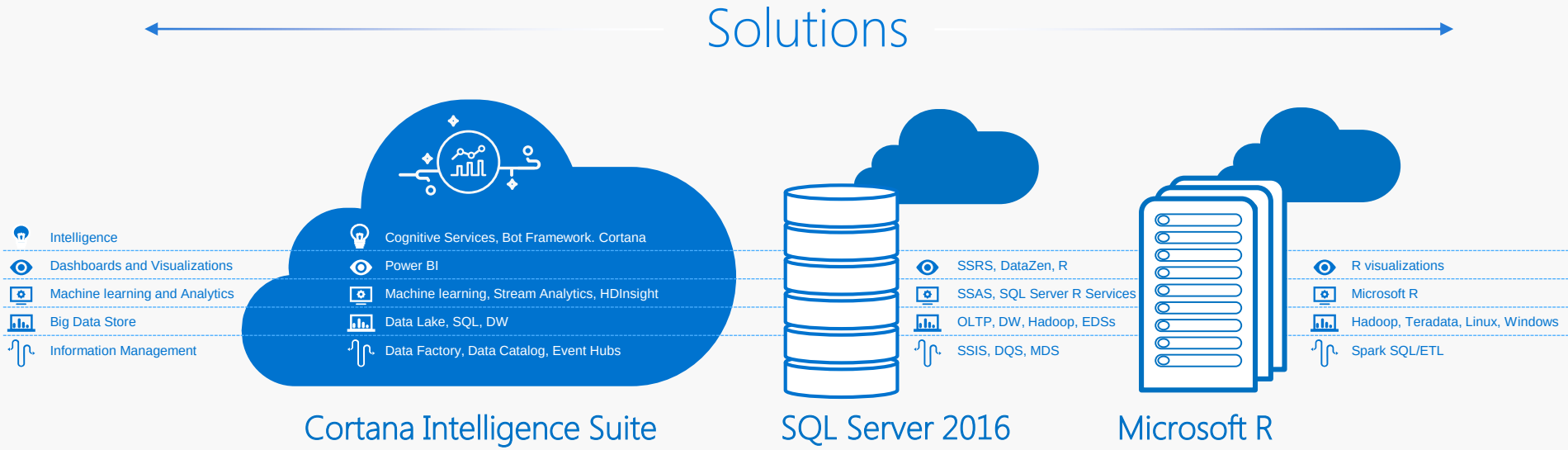
Real-time Decision Support

3 | Intelligence

Business/Operation Intelligence



# Microsoft big data & advanced analytics



# Power BI: experience your data

## Any data, any way, anywhere

### MICROSOFT CLOUD

Microsoft Azure  Office 365

Microsoft Dynamics

### NON-MICROSOFT CLOUD

Acumatica  Marketo  salesforce

comScore  intuit QuickBooks  twilio

### ON-PREMISE DATA

hadoop  SAP  Microsoft SQL Server

ORACLE  TERADATA  IBM

Stream Analytics

Analysis

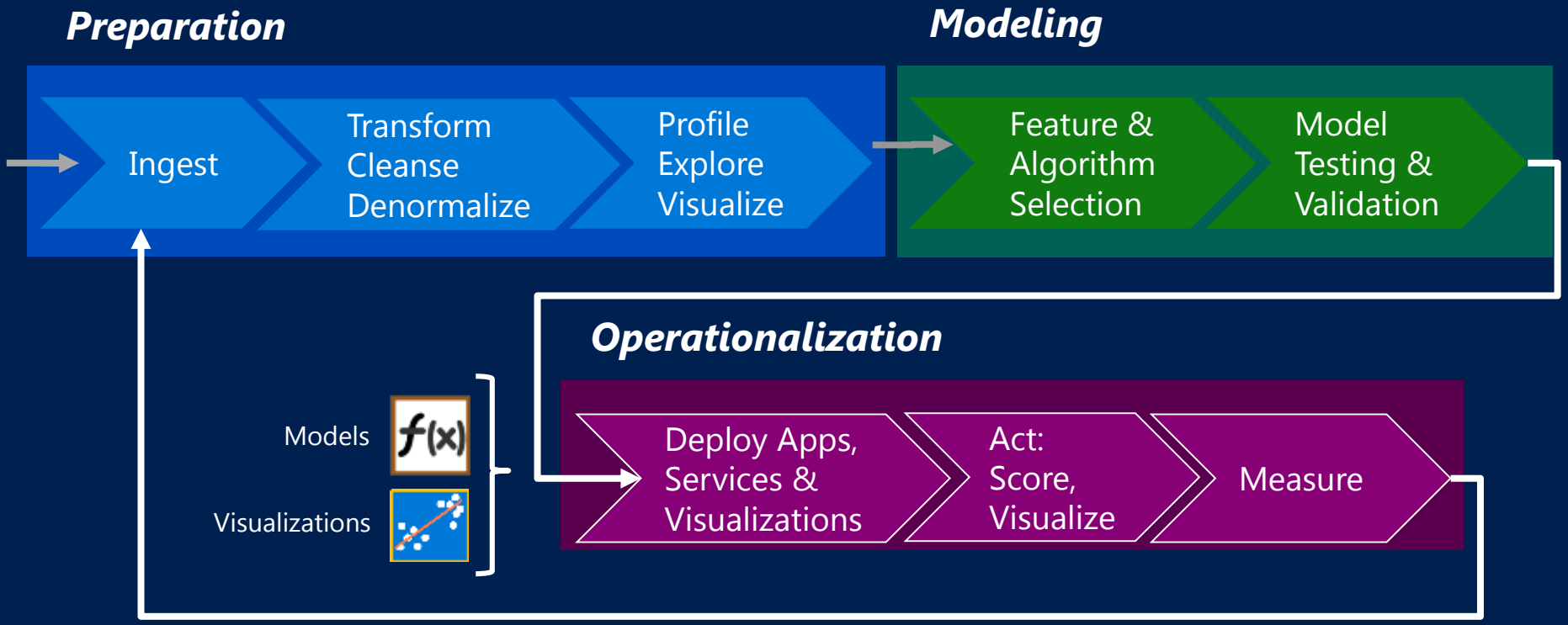
Intelligent Apps

**5,000,000+**
subscribers

**210+**
countries

**200,000+**
organizations

# Typical IoT Analytics Lifecycle



# Typical Planning for Data Science Experiments

Definition of the scope , background information, definition of success criterias etc...

Data field selection, cleansing and transformation

Evaluate model against criterias for success and business goals, model documentation and approval of the model

Use case selection → Data Assessment → Data Preparation → Modelling → Model Evaluation → Deployment

Extraction of the data, exploration and quality verification

Selection of the modelling technique, building the model, test and assessment of the model

Final testing and deployment




# Data Scientist:
## *The Sexiest Job of the 21st Century*

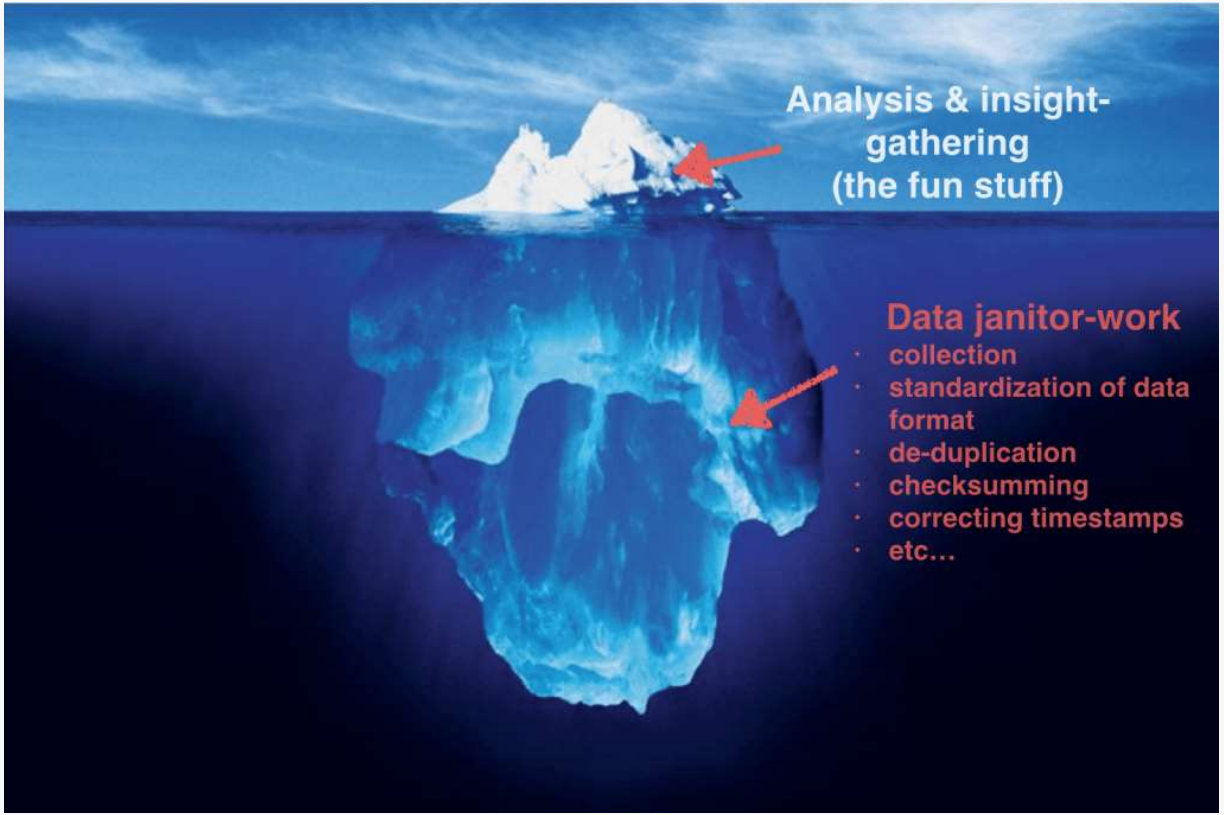
***Meet the people who can coax treasure out of messy, unstructured data.***

*by Thomas H. Davenport and D.J. Patil*

When Jonathan Goldman arrived for work in June 2006 at LinkedIn, the business networking site, the place still felt like a start-up. The company had just under 8 million accounts, and the number was growing quickly as existing members invited their friends and colleagues to join. But users weren't seeking out connections with the people who were already on the site at the rate executives had expected. Something was apparently missing in the social experience. As one LinkedIn manager put it, "It was like arriving at a conference reception and realizing you don't know anyone. So you just stand in the corner sipping your drink—and you probably leave early."

70 Harvard Business Review October 2012

# Data Scientists perform too much Data janitor-work

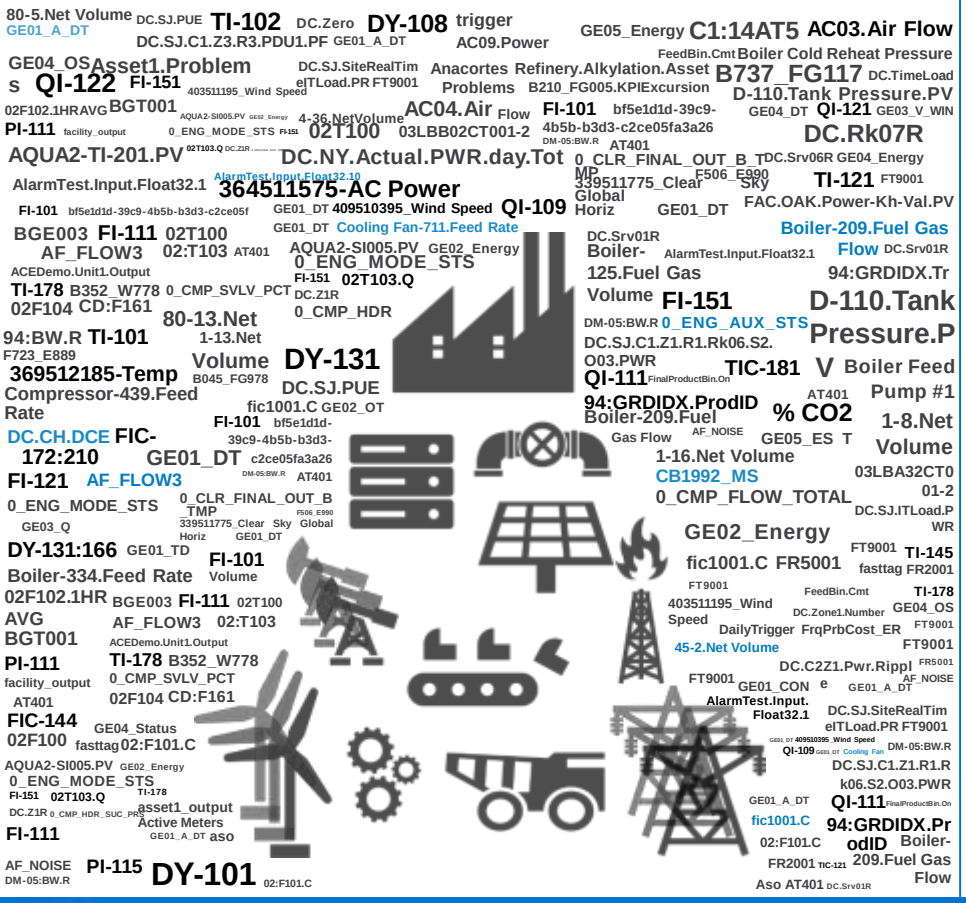


# OSIsoft and Microsoft: Joint Value

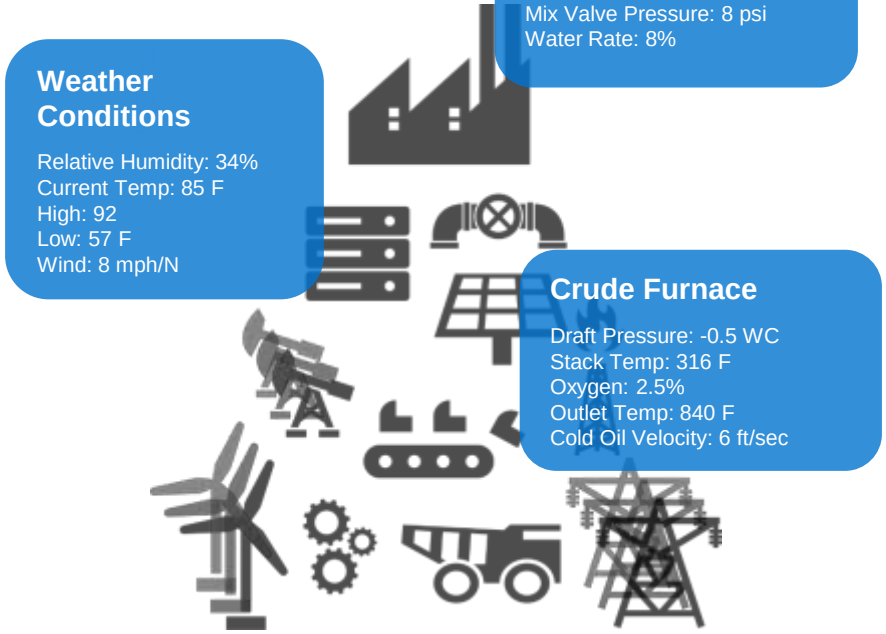
# Observed advance analytics goals

- Augment decision making with data
- Minimize work needed to begin analyzing
- Invest in out-of-the-box, reusable capabilities for advanced analytics
- Prove advanced analytics can achieve a business outcome

# Challenge: making sense of the data




# Solution: PI System



**Crude Desalter**

Operating Pressure: 110 psi
Charge Rate: 14 gph
Mix Valve Pressure: 8 psi
Water Rate: 8%

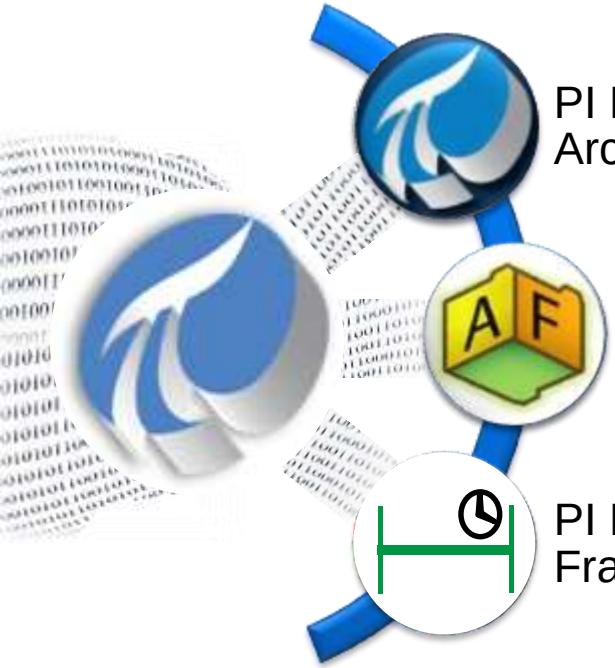
**Weather Conditions**

Relative Humidity: 34%
Current Temp: 85 F
High: 92
Low: 57 F
Wind: 8 mph/N

**Crude Furnace**

Draft Pressure: -0.5 WC
Stack Temp: 316 F
Oxygen: 2.5%
Outlet Temp: 840 F
Cold Oil Velocity: 6 ft/sec

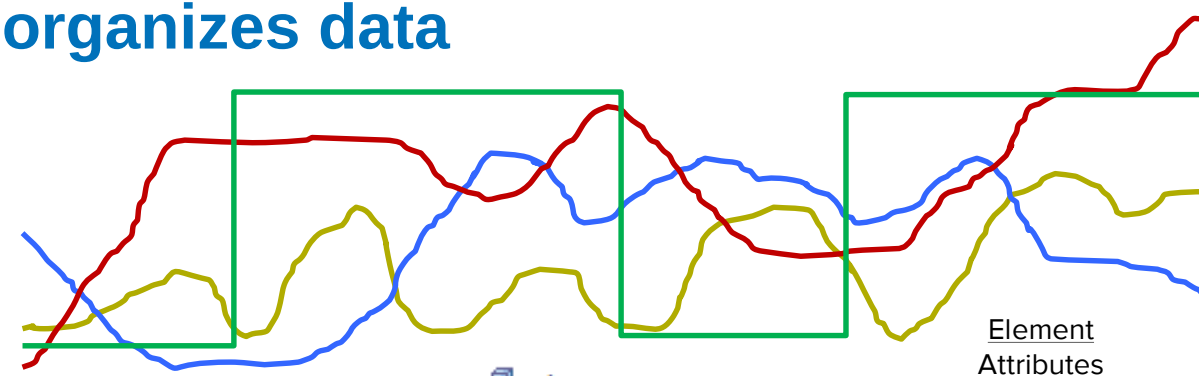
# PI System stores and organizes data

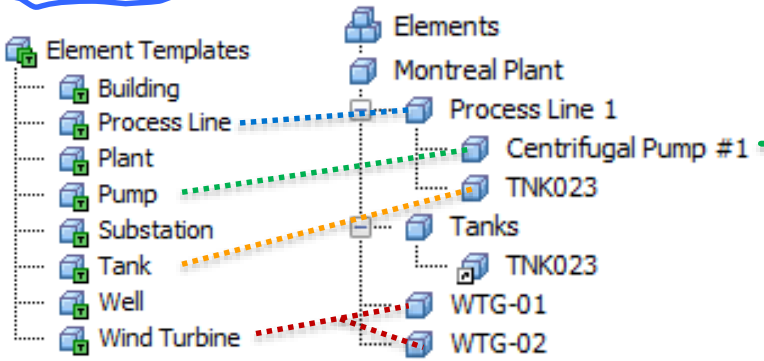


PI Data Archive

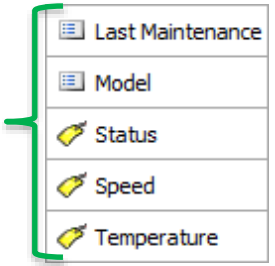
PI Asset Framework

PI Event Frames

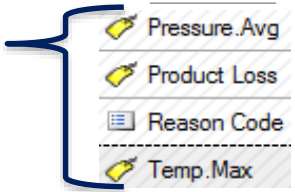





Element Attributes




Event Frame Attributes




Process Excursion

Startup

Downtime

Shift

Shutdown

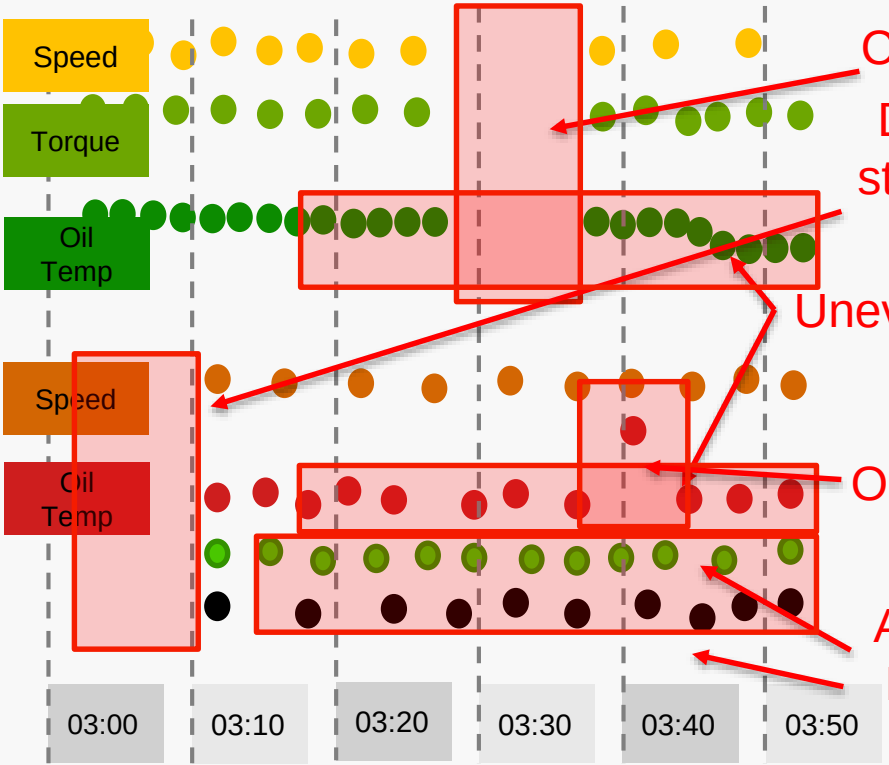
Batch

Environmental Excursion

Grade Change

# Challenge: cleaning & preparing sensor-based data

## Solution: PI Integrator for Microsoft Azure




Comm Failure

Different start times

Uneven Spacing

Spike / Out of Range

Additional Measure

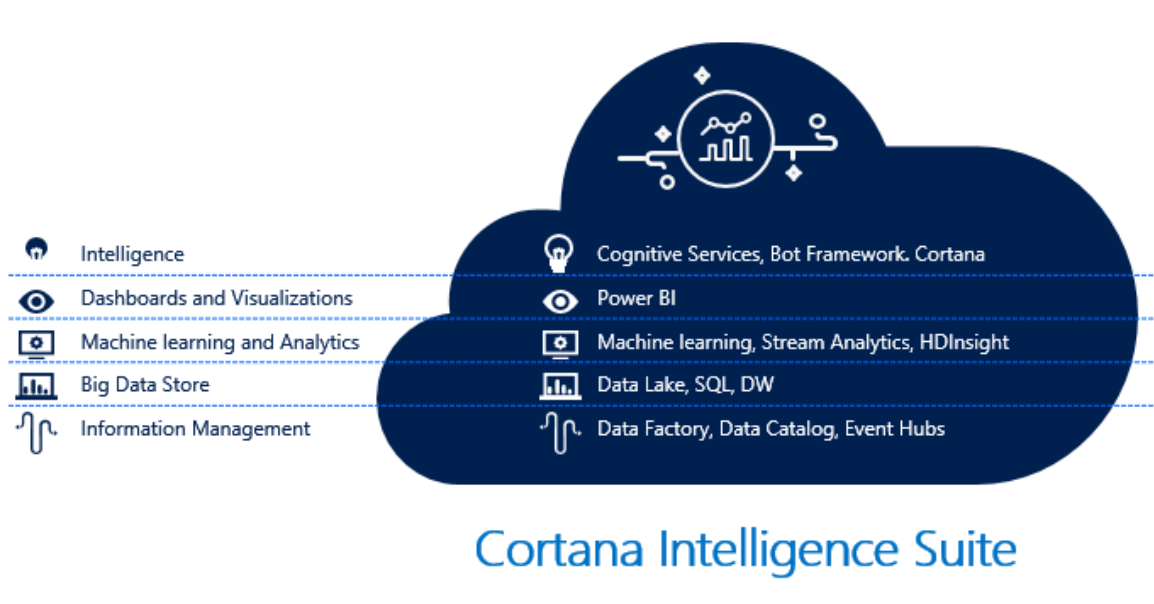
| | Speed | Torque | Oil Temp | Speed | Oil Temp |
|---|---|---|---|---|---|
| 03:00 | 9.8 | 25 | 50 | X | X |
| 03:10 | 10 | 24 | 50 | 10.0 | 60 |
| 03:20 | 10 | 25 | 50 | 10.2 | 60 |
| 03:30 | X | X | X | 9.8 | 60 |
| 03:40 | 9.9 | 25 | 50 | 10.0 | 120 |
| 03:50 | 9.9 | 25 | 45 | 10.1 | 60 |

# Challenge: implementing data science experiments

Quick deployment of resources

Off-the-shelf data science tools

## Solution: Cortana Intelligence Suite



# Leveraging the PI System and Cortana Intelligence to Increase Process Efficiency


## COMPANY and GOAL

Deschutes Brewery is the 7th largest craft brewery in US, and wanted to maximize production with its existing infrastructure to fund construction of a 2nd brewery in Roanoke, VA

## CHALLENGE

Batch's phase transition happens between manual density measurements occurring every 8-10 hours

- Impact: Losing up to 72 hours in production time

## SOLUTION

Use data science to achieve accurate predictive analytics for determining a batch's density measurements

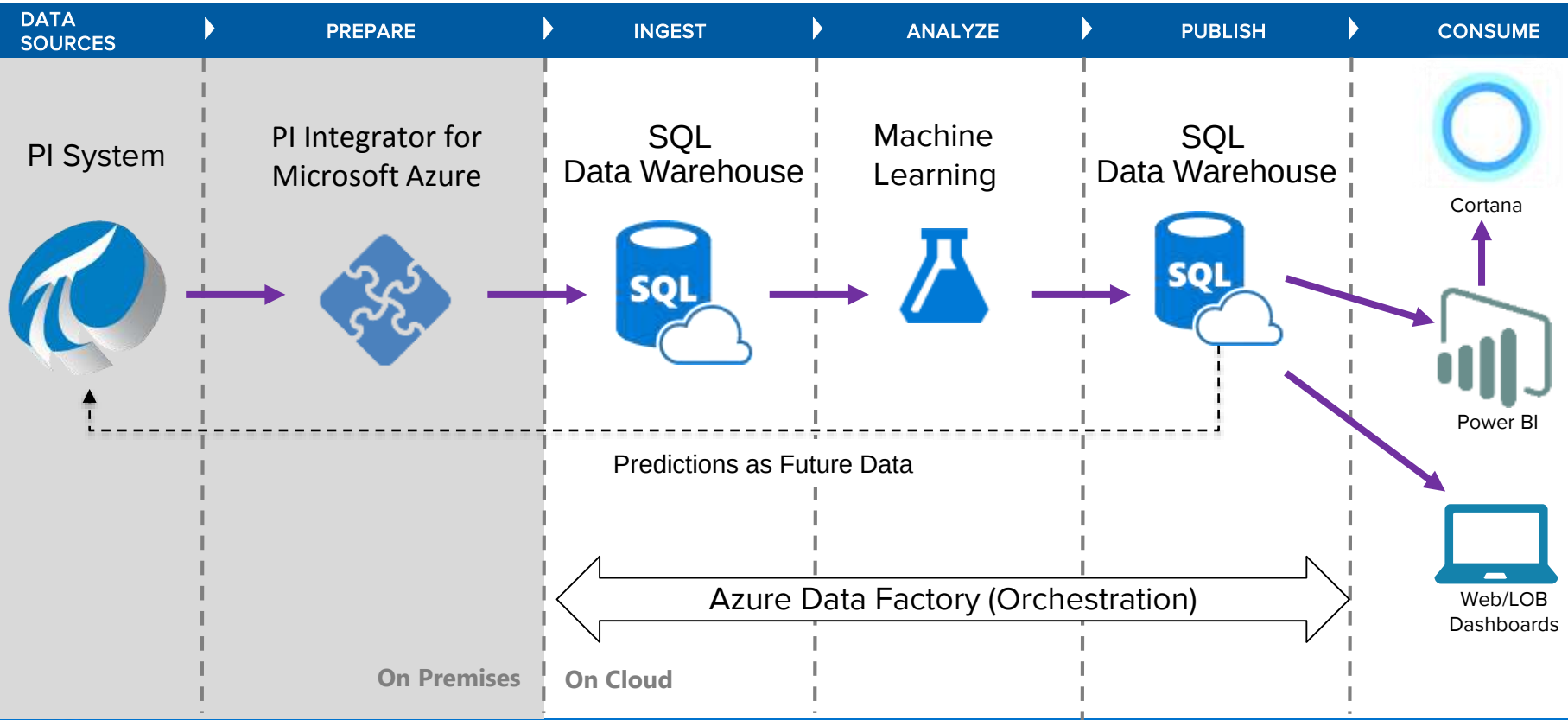
- PI System
- PI Integrator for Microsoft Azure
- SQL Data Warehouse
- Azure Machine Learning
- Azure Data Factory

## RESULTS

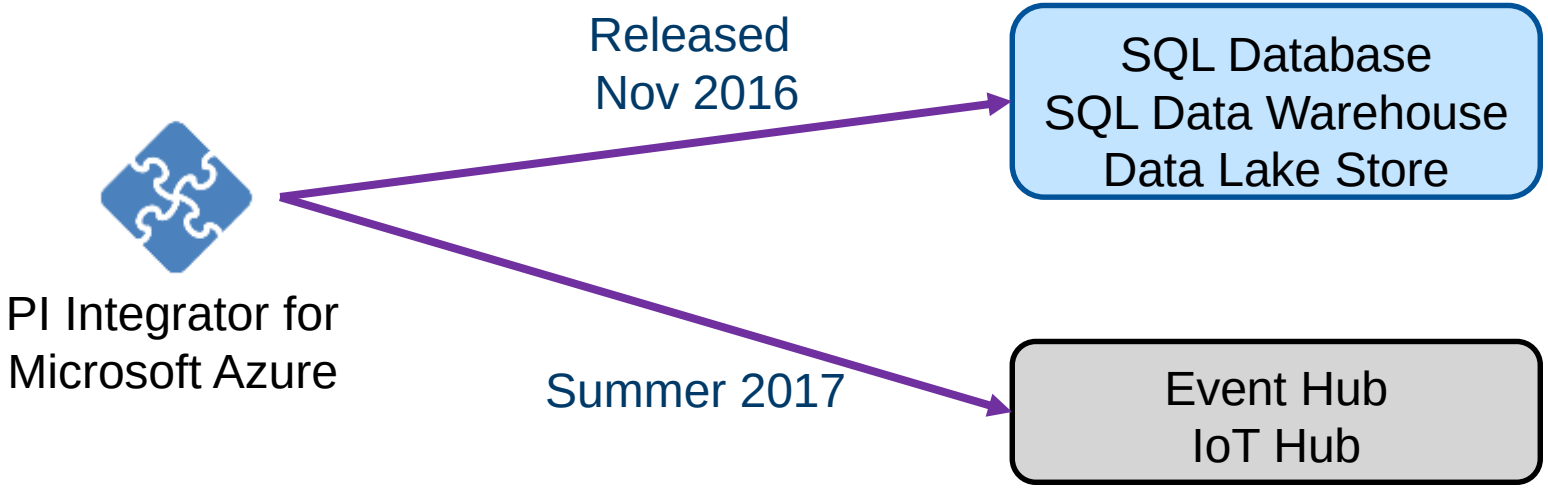
Ability to eliminate production time losses and increase production capacity

- Accurate predictions of when a batch's phase transitions from fermentation to free rise

# An example of how to operationalize predictions



# Bridging the PI System and Microsoft Azure



# Announcing

Red Carpet Incubation Program (RCIP)

a limited service offering
alongside Microsoft
that uses a process
to accelerate advanced analytics projects

for selected customers

# Call to Action & Summary

# Analytics Journey => Transforming the Value of Data

## 1 | Data

Basic Analytics

Boiler-209.Fuel Gas Flow DC.Srv01R 94:GRDIDX.Tr igger AC09.Power GE01_DT 409510395_Wind Speed QI-109 GE01_DT Cooling Fan-711.Feed Rate DM-05:BW.R DC.SJ.C1.Z1.R1.Rk06.S2.O03.PWR QI-111 FinalProductBin.On 94:GRDIDX.ProdID Boiler-209.Fuel Gas Flow fic1001.C FR5001 1-8.Net Volume Coal Motor Load 02F100.TOT.EV 3LBA32CT001-2 DC.SJ.PUE TI-102 DC.Zero DY-108 DC.SJ.C1.Z3.R3.PDU1.PF GE01_A_DT 403511195_Wind Speed DC.Srv01R Boiler-125.Fuel Gas Volume 1-16.Net Volume CB1992_MS 0_CMP_FLOW_TOTAL GE02_Energy Anacortes Refinery.Alkylation.Asset Problems B210_FG005.KPIExcursion AlarmTest.Input.Float32.1 AQUA2-TI-201.PV DC.SJ.SiteRealTimeITLoad.PWR FT9001 FI-101 bf5e1d1d-39c9-4b5b-b3d3-c2ce05fa3a26 DM-05:BW.R AT401 0_CLR_FINAL_OUT_B_TMP F506_E990 339511775_Clear Sky Global Horiz GE01_DT D-110.Tank Pressure.PV Boiler Feed Pump #1 FT9001 GE01_CON AlarmTest.Input.Float32.1 FIC-144 02F100 fasttag FI-151 0_ENG_AUX_STS DC.C2Z1.Pwr.Ripple GE01_A_DT FI-111 02F102.1HRAVG BGT001 PI-111 facility_output GE05_Energy C1:14AT5 1-8.Net Volume AC03.Air Flow FeedBin.Cmt Coal Motor Load Boiler Cold Reheat Pressure 02F100.TOT.EV B737_FG117 DC.TimeLoad 03LBA32CT001-2 D-110.Tank Pressure.PV DC.SJ.ITLoad.PWR GE04_DT QI-121 GE03_V_WIN TI-145 FR2001 DC.Rk07R DC.Srv06R TI-178 GE04_OS GE04_Energy TI-121 FT9001 FT9001 FT9001 FAC.OAK.Power-Kh-Val.PV FR5001 AF_NOISE FeedBin.Cmt DY-131 DC.Zone1.Number DC.SJ.PUE fic1001.C DailyTrigger GE02_OT FrqPrbCost_ER GE01_DT

## 2 | Information

Descriptive & Diagnostic Analytics

**Weather Conditions**

Relative Humidity: 34%
Current Temp: 85 °F
High: 92 °F
Low: 57 °F
Wind: 8 mph/N

**Crude Furnace**

Draft Pressure: -0.5 WC
Stack Temp: 316 °F
Oxygen: 2.5%
Firebox Temp: 860 °F
Outlet Temp: 840 °F
Cold Oil Velocity: 6 ft/sec

Energy Efficiency

Downtime

Total Production

## 3 | Intelligence

Predictive & Prescriptive Analytics

# Need OT Context – "must" for Analytics & IoT

***Operational Context***

**Time-series data**
- Temperature
- Pressure
- Flow

**Asset details**
- Name
- Model
- Manufacturer

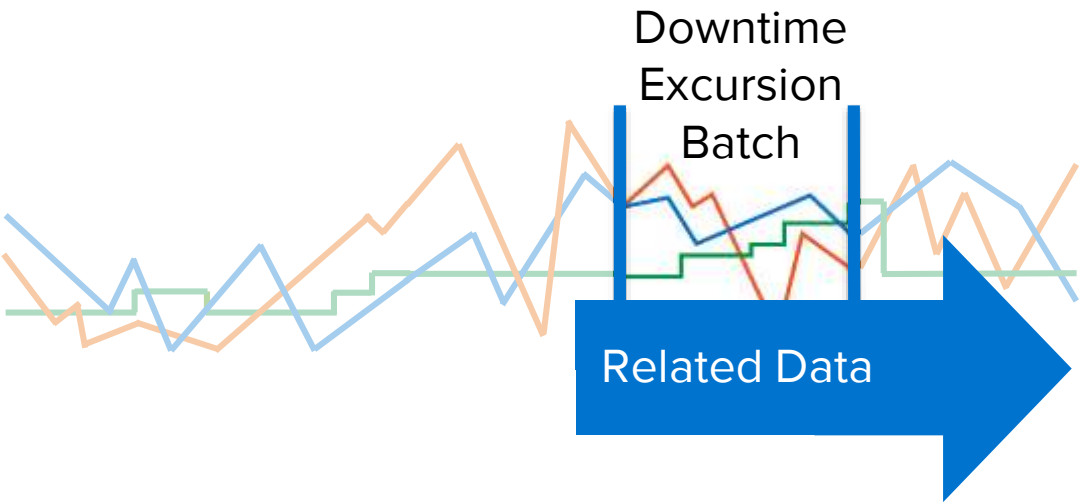
**Process**
- Well drilling
- Site


***High Value Insights Require Data Context***

- Which asset performs best?
- Which conditions are optimal?
- What are the indicators of failure?
- What leads to unsafe conditions?
- What causes quality issues?

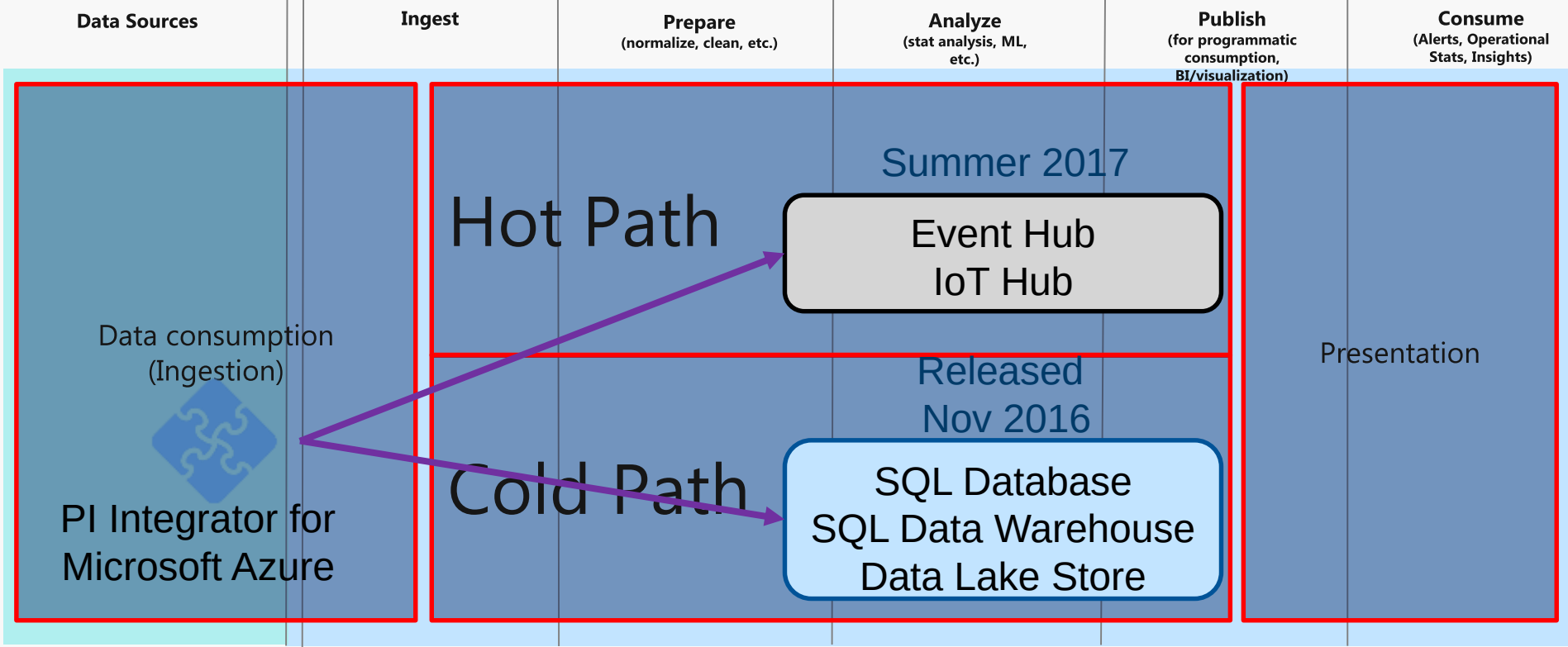
# Asking How & Why: PI Event Frames easily identifies events for deeper root cause analysis

- The most powerful way to automatically bookmark PI time-series data
- More meaningful use for engineers and business users
- Easier to find, analyze, and report on




| Event Attribute | Value |
|---|---|
| Name | Ex 20141215-0002 |
| Start | 15-Dec-2014 10:35:02 |
| End | 15-Dec-2014 10:47:26 |
| Duration | 12 min, 24 sec |
| Asset | Boiler-352 |
| Excursion Type | High Violation |
| Fuel Gas Flow.Avg | 37.12 k sft3/h |
| Fuel.Start | 823.48 k sft3/ton |
| myPIKPI.Max | 47.19 bbl/d |

# Streaming and Batch – IoT Analytics

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# Red Carpet Incubation Program (RCIP)

HANNOVER MESSE 2017, 24 - 28 April

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DRAFT

# Power BI and PI Integrator for Microsoft Azure