

Enabling IT/OT Convergence: Operations Data and Advanced Analytics

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10 September 2019

Introduction

Intro into Operations

- Wants to drive and enable operations
- Deep expertise in engineering
- Wants trusted, purpose built and reliable



A man in a dark suit and white shirt is sitting at a desk, smiling as he looks at a laptop. He is holding a pen in his right hand. On the desk, there is a small potted plant, some papers, and a laptop. The background is a blurred office environment.

Intro to IT

- Deep expertise in info systems
- Focused on digital transformation
- Early adopter of new technology

Challenges of Integrating OT & IT Data

Data Management & Integration

OT data is from a variety of dynamic sources

OT data is variable, continuous and time based

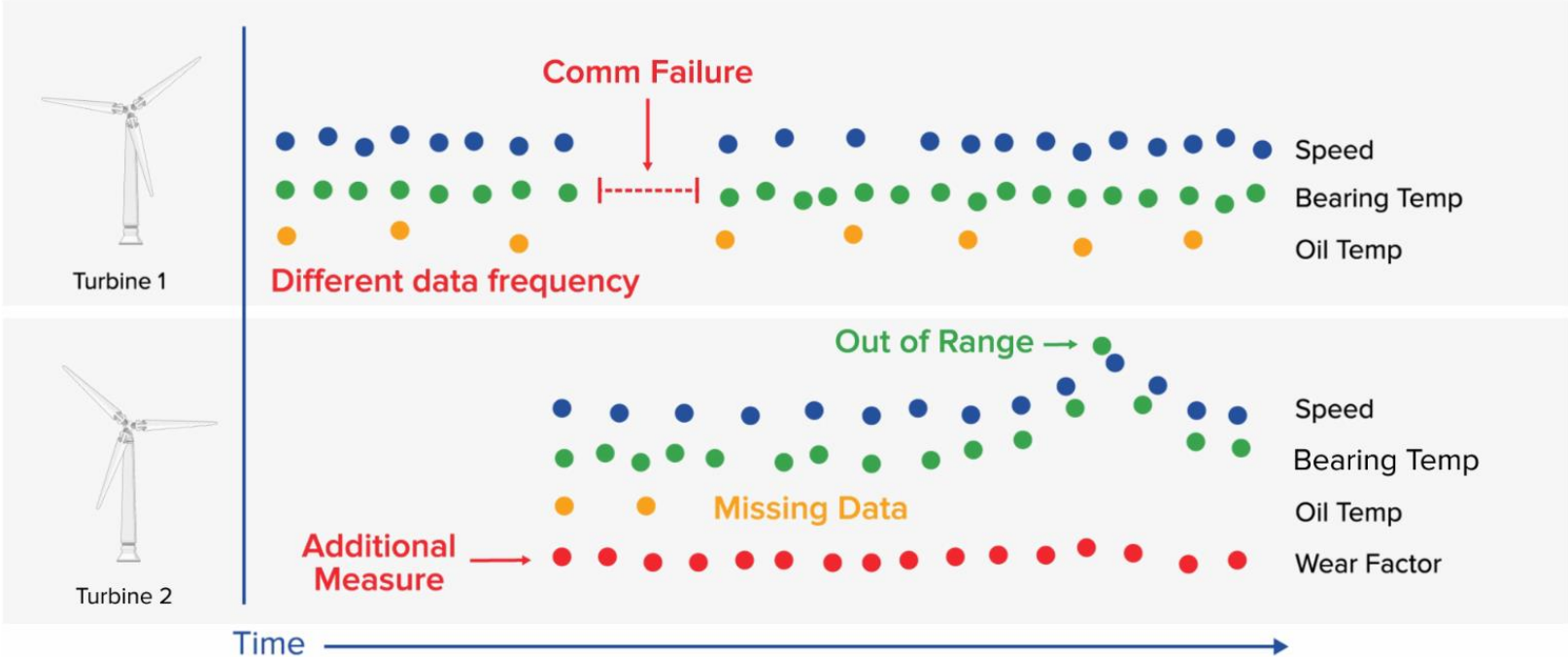
OT data requires context to compare fleets of assets

✓ The PI System standardizes & normalizes OT data

✓ Operations data needs to be prepared for use in IT tools

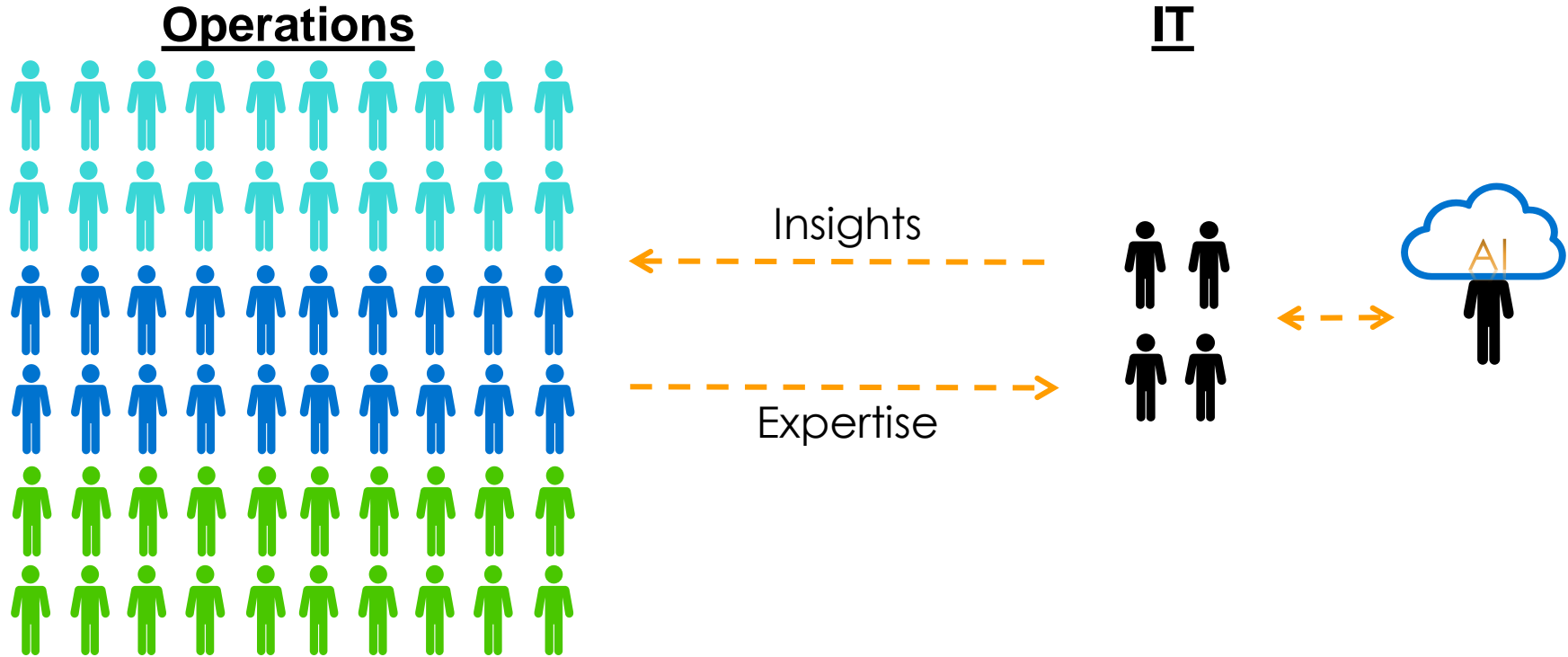
✓ Data Management with AF/EF & PI Integrator *reduces time & complexity* of analysis

Time-series Data is Not Naturally Aligned or Contextualized



Extending Your Opportunity

Bring Operations Insights to the Enterprise

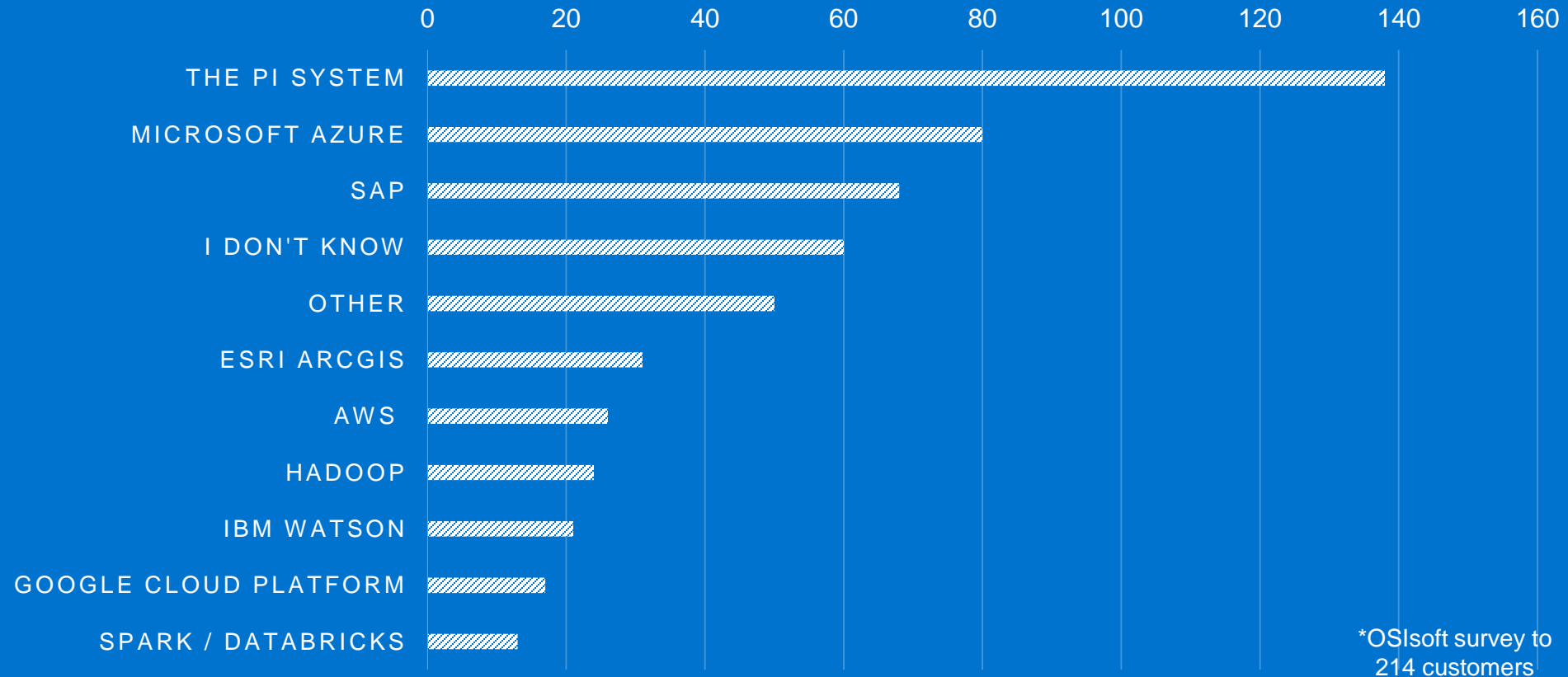


An ERP is not suited to operate your plant,
a PI System is not suited to be your ERP

It's a better together story...

Cloud Strategy

What Technologies are Needed for Enterprise Analytics?



*OSIsoft survey to
214 customers



It's a better together story...

OSIsoft has a multi-cloud strategy designed for *repeatable patterns* with major cloud vendors



Azure



Google
Cloud Platform

Repeatable Patterns for Extending into Cloud

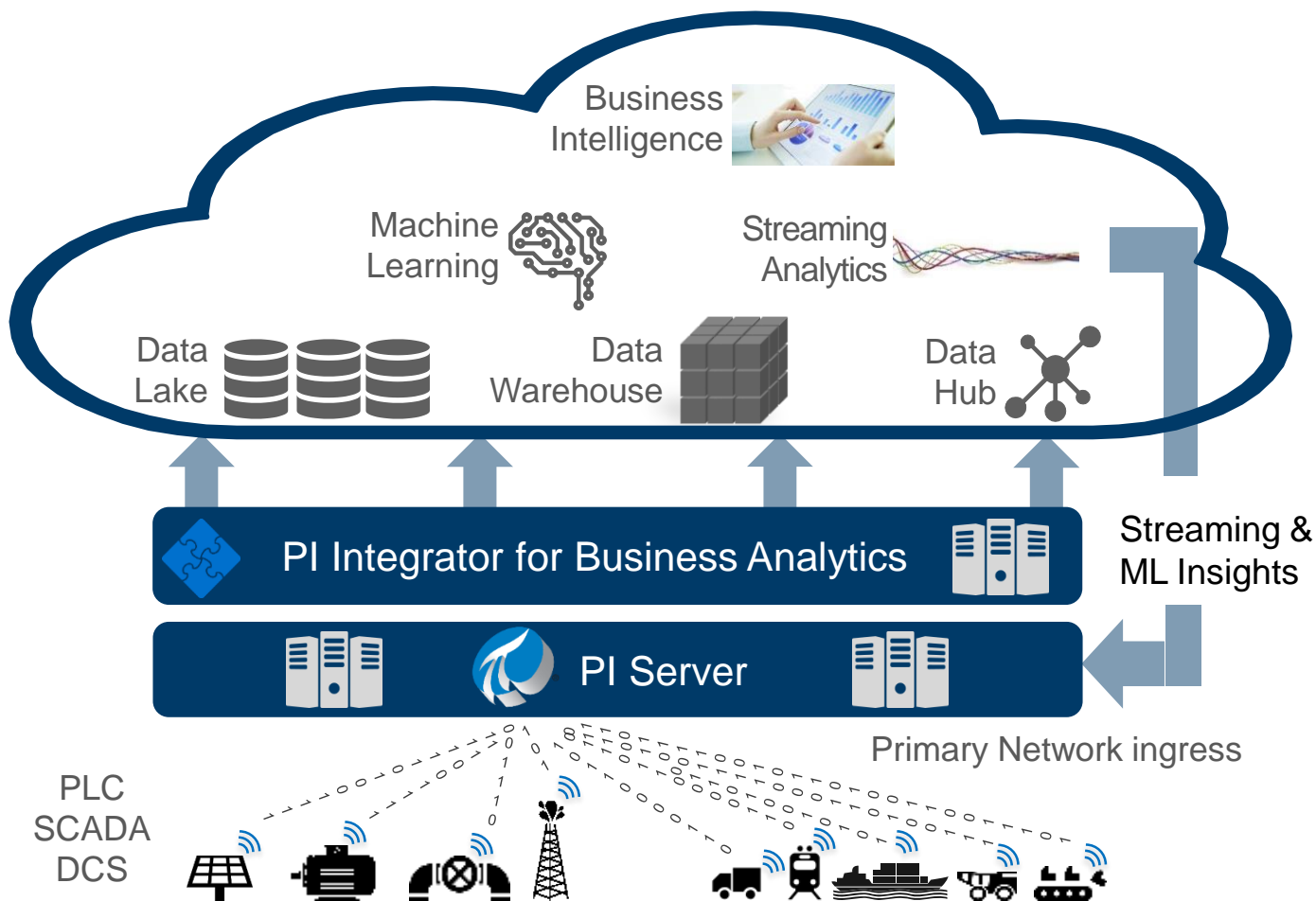
**Data
Science**

**Virtualized
PI System**

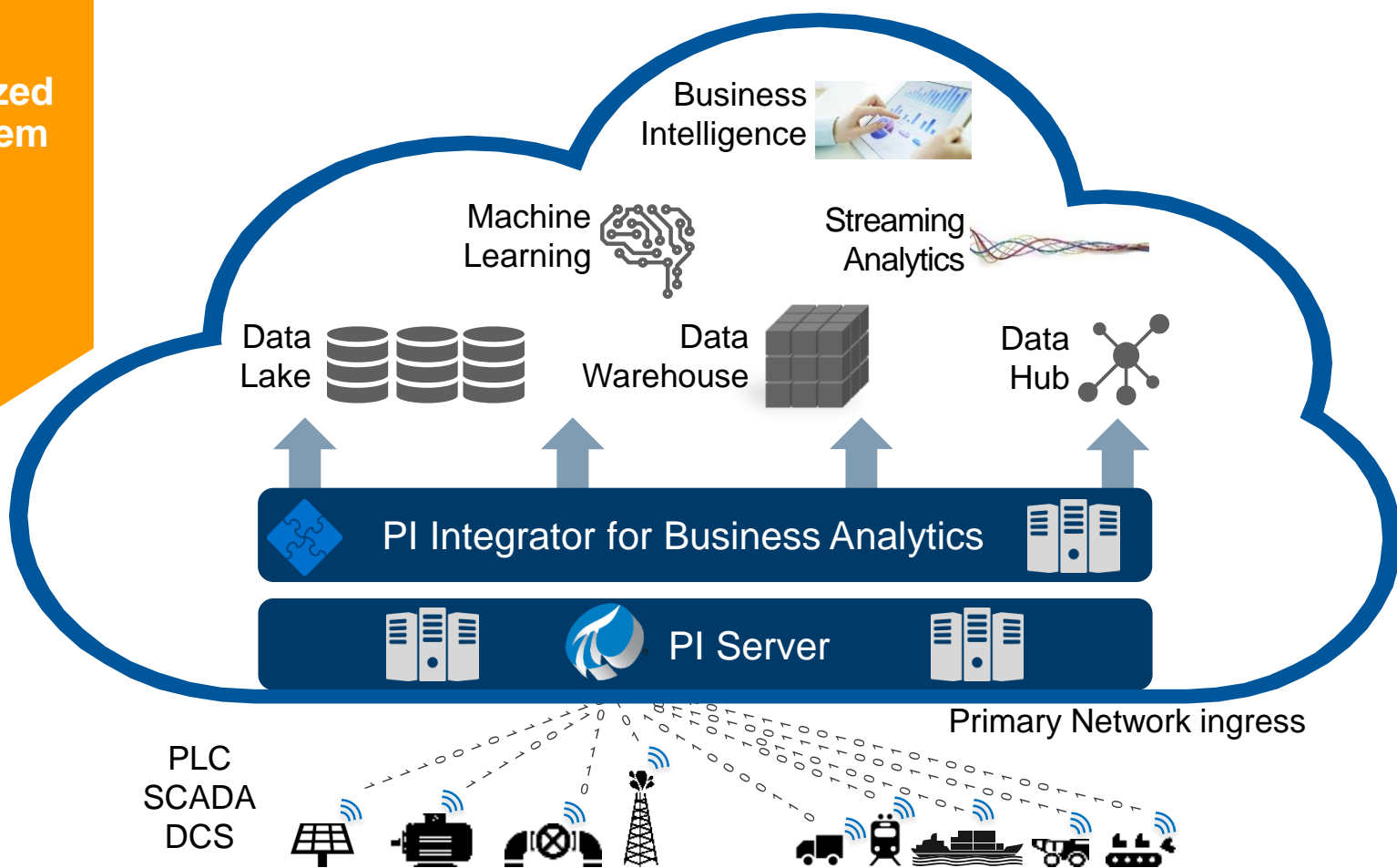
**Architecting
for IoT**

**An Enterprise Data Management & Integration strategy is
necessary for success**

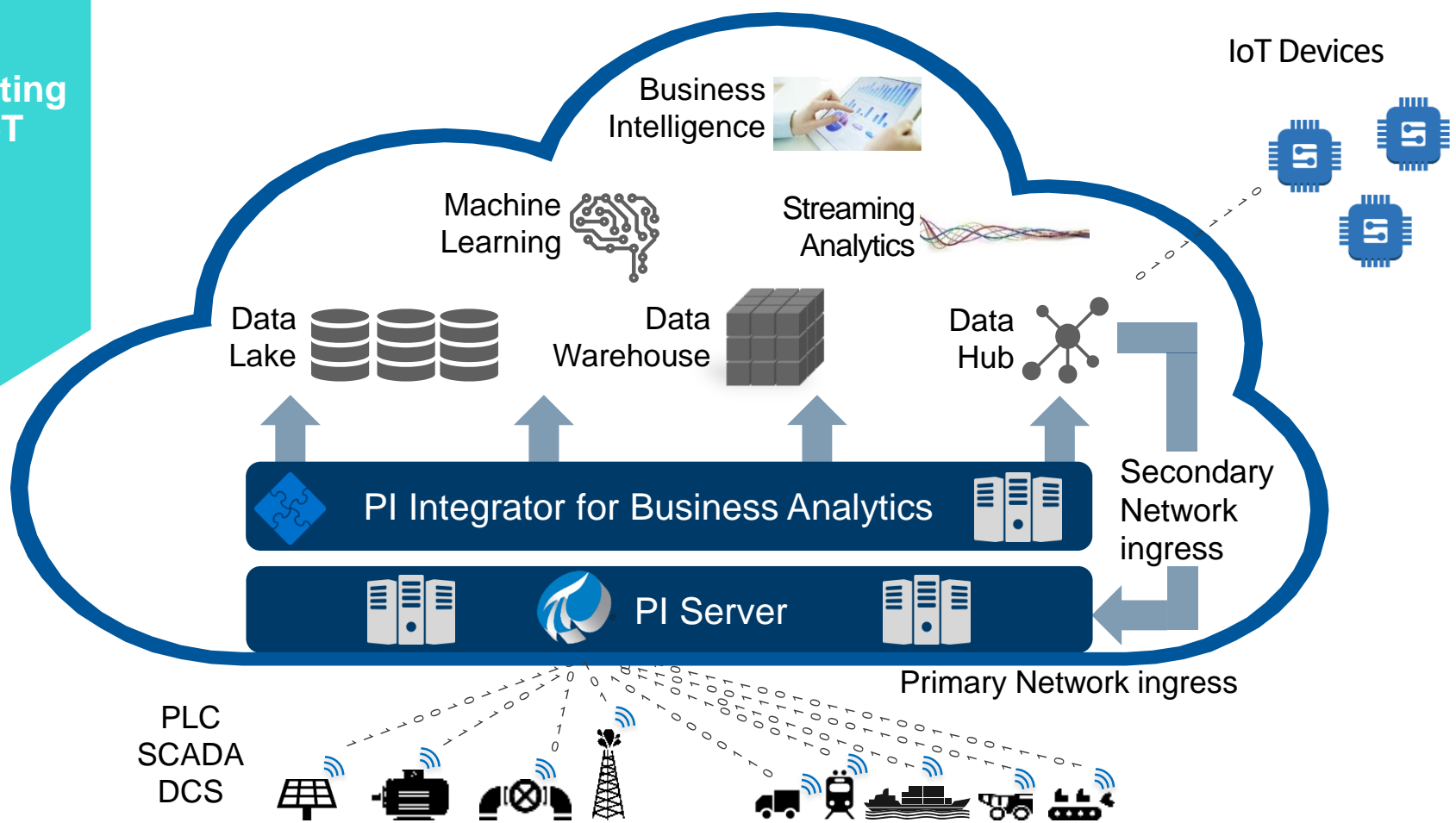
Data Science



Virtualized PI System



Architecting for IoT



Advanced Analytics

Success When Used to Augment Decisions

Greater Operational Efficiency



Henkel (with pmOne) **predict when a transition occurs** for an exothermic reaction, **saving 5% of process time.**

Enhanced Ability to Prevent Costly Failures



Invenergy (with SparkCognition) **predict catastrophic gearbox failures** at least **one month in advance.**

Better Environmental Protection



United Utilities proved an ability to accurately **predict combined sewer overflows 6 hours before an incident.**

Five Considerations Before Starting with Advanced Analytics

1. Gaps in data collection
2. Poor data quality
3. Low # of modes
4. Unknown relationships
5. Natural skepticism

MIND THE GAP

How does the PI Integrator help you with these obstacles?

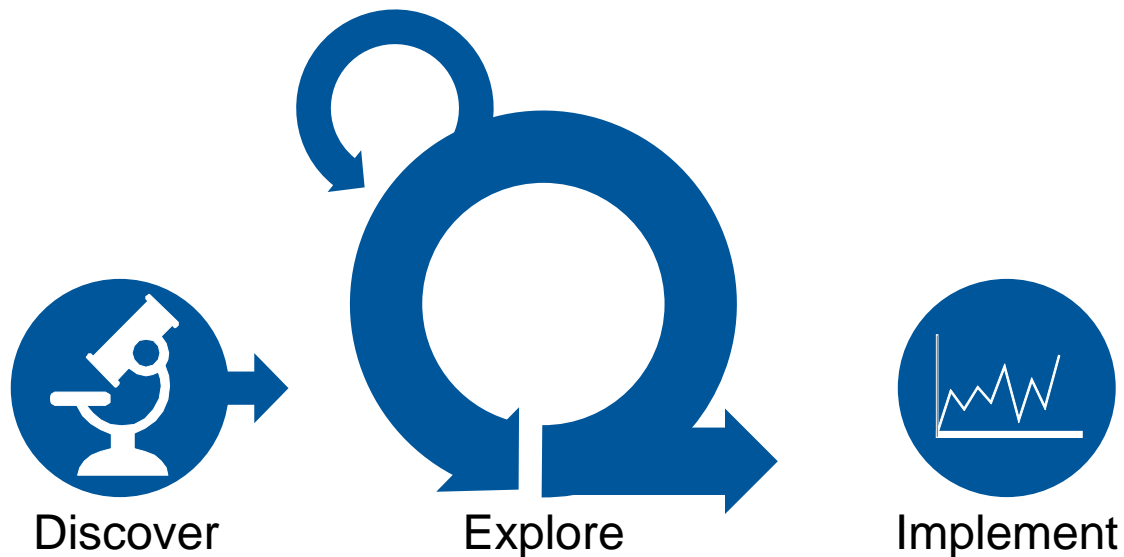
1. Gaps in data collection – filter or interpolate
2. Poor data quality – filter unreasonable values
3. Low # of modes – determine modes by indexing on events
4. Unknown relationships – work with data experts, no code needed
5. Natural skepticism – involve SME in iterative training without requiring a lot of their time

MIND THE GAP

How do you reduce
the **uncertainty** of
what can be achieved
with **advanced analytics** ?

Adopt Iterative Workflows that Include SMEs

... and use technology that support these workflows



Discover



Discover

Data preparation capabilities that accelerate training algorithms or creating views for BI Tools:

- Common nomenclature
- Aligned data
- Normalized measurements across assets
- Complex filtering by
 - Asset type
 - Event type

Select Data > **Modify View** > Publish

Back Next

+ Add Column 9 columns

▼ Edit Row Filters 1 Row Filters

≡ Edit Value Mode Interpolated Values Every 1 minute

Start Time ~1d

End Time *

Apply

Wind Turbine	TimeStamp	Day of the Week	Active Power	Apparent Power	Bearing A Temperature	Capacity	Rotor Speed	Operati
GE01	3/18/2019 10:52:57.477 AM	Monday	1,517.787	1,523.764	42.523	62.831	19.927	90.403
GE01	3/18/2019 10:53:57.477 AM	Monday	1,518.78	1,517.996	42.515	62.877	20.39	90.421
GE01	3/18/2019 10:54:57.477 AM	Monday	1,528.438	1,527.098	42.507	62.924	19.877	90.44
GE01	3/18/2019 10:55:57.477 AM	Monday	1,524.599	1,525.12	42.498	62.97	20.002	90.459
GE01	3/18/2019 10:56:57.477 AM	Monday	1,521.875	1,521.751	42.49	63.016	19.913	90.478
GE01	3/18/2019 10:57:57.477 AM	Monday	1,525.674	1,531.629	42.481	63.063	19.726	90.497
GE01	3/18/2019 10:58:57.477 AM	Monday	1,535.935	1,536.558	42.473	63.109	20.013	90.516
GE01	3/18/2019 10:59:57.477 AM	Monday	1,517.37	1,519.13	42.465	63.155	20.232	90.535
GE01	3/18/2019 11:00:57.477 AM	Monday	1,528.547	1,529.658	42.456	63.202	20.065	90.554
GE01	3/18/2019 11:01:57.477 AM	Monday	1,529.736	1,524.135	42.448	63.248	19.922	90.573
GE01	3/18/2019 11:02:57.477 AM	Monday	1,517.794	1,525.652	42.439	63.294	19.955	90.592
GE01	3/18/2019 11:03:57.477 AM	Monday	1,505.852	1,512.247	42.431	63.341	19.708	90.61
GE01	3/18/2019 11:04:57.477 AM	Monday	1,519.556	1,521.107	42.423	63.387	20.054	90.627
GE01	3/18/2019 11:05:57.477 AM	Monday	1,519.952	1,523.781	42.414	63.433	20.173	90.644
GE01	3/18/2019 11:06:57.477 AM	Monday	1,523.877	1,508.615	42.406	63.48	19.949	90.662
GE01	3/18/2019 11:07:57.477 AM	Monday	1,533.151	1,532.751	42.397	63.526	19.94	90.68
GE01	3/18/2019 11:08:57.477 AM	Monday	1,525.437	1,526.634	42.389	63.572	19.999	90.698
GE01	3/18/2019 11:09:57.477 AM	Monday	1,523.269	1,518.825	42.381	63.619	19.862	90.716
GE01	3/18/2019 11:10:57.477 AM	Monday	1,522.443	1,522.936	42.372	63.665	20.009	90.733
GE01	3/18/2019 11:11:57.477 AM	Monday	1,509.033	1,522.19	42.364	63.712	19.63	90.75
GE01	3/18/2019 11:12:57.477 AM	Monday	1,524.965	1,525.264	42.355	63.758	20.008	90.767
GE01	3/18/2019 11:13:57.477 AM	Monday	1,511.918	1,508.629	42.347	63.804	19.621	90.784
GE01	3/18/2019 11:14:57.477 AM	Monday	1,519.61	1,523.788	42.339	63.851	19.749	90.801
GE01	3/18/2019 11:15:57.477 AM	Monday	1,526.237	1,524.405	42.33	63.897	19.949	90.818
GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	63.943	19.886	90.835
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	63.99	19.921	90.855
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	64.036	19.992	90.876
GE01	3/18/2019 11:19:57.477 AM	Monday	1,518.829	1,519.512	42.296	64.082	20.067	90.893
GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
GE01	3/18/2019 11:21:57.477 AM	Monday	1,515.018	1,516.249	42.28	64.175	19.828	90.926
GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943



Select Data > Modify View > Publish

Source Assets

Server: DFPIAFSERVERPRD

Database: Power Generation

Assets

- Generation
 - Equipment List
 - Fossil Generating Station
 - Matador 1 CCGT
 - OSIsoft Power
 - PowerCo
 - Solar Power Generation Fleet
 - Wind Power Generation Fleet
 - Big Buffalo Wind Farm
 - Black Mesa Wind Farm
 - GE01
 - GE02
 - GE03
 - GE04
 - GE05
 - GE06
 - GE07

Attributes: Filter

Select All

- Active Power
- Apparent Power
- Apparent Power (calc)
- BatchWindBinFilter

Select Data > Modify View > Publish

Source Assets

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Attributes: Filter

Select All

- Active Power
- Apparent Power
- Apparent Power (calc)
- BatchWindBinFilter

Begin from common
nomenclature & hierarchy



Discover

Pick from measurements
that shape the model or view

Edit Filters

☐ Asset Name

GE05

☒ Asset Template ☐ Search Derived Templates

Wind Turbine

☐ Asset Category

Wind Turbine

+ Add Filter

Cancel

Save

Filter based on
similar assets

[illegible]

Discover

Select all data from a particular event type

Create New Event Frame Row Filter

Enter Event name or string match pattern

Event Template

Wind Curtailment

×

Shape Tree

Wind Turbine

Related Shape Asset is **any**

Drag an element from the Shape Tree to specify

+ Add Event Condition

[illegible]

Event Frame	Related Asset	Start Time	End Time
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2018-08-15 19:43:21	GE06	8/15/2018 7:43:21 PM	12/31/9999 11:59:59 PM
GE06 2019-03-06 11:31:52	GE06	3/6/2019 11:31:52 AM	3/6/2019 11:41:37 AM
GE06 2019-03-06 11:31:52	GE06	3/6/2019 11:31:52 AM	3/6/2019 11:41:37 AM

Quickly preview events
after applying filter



Discover

Include multiple
filters to clean
data

Row Filters

Event Row Filter 1

Criteria 1: Match Event Frames where Event Template = Wind Curtailment Related Shape Asset is **any**

Add New Row Filter

String

Include rows based on whether the contents of a column match a string pattern

Digital

Include rows based on whether the contents of a column contain certain digital values

Add Numeric Row Filter

Inclu

Inclu

Bearing

+ Add

Numeric Filter 1

Include rows where all of these conditions are true

Bearing A Temperature > -273.15

Event Row Filter 1

Criteria 1: Match Event Frames where Event Template = Wind Curtailment Related Shape Asset is **any**

Add New Row Filter

String

Include rows based on whether the contents of a column match a string pattern

Digital

Include rows based on whether the contents of a column contain certain digital values

Numeric

Include rows based on whether the contents of a column contain certain numeric values

Null Values

Include rows where the contents of a column contain a value

Event Frame

Include rows where certain Event Frames are active

Close

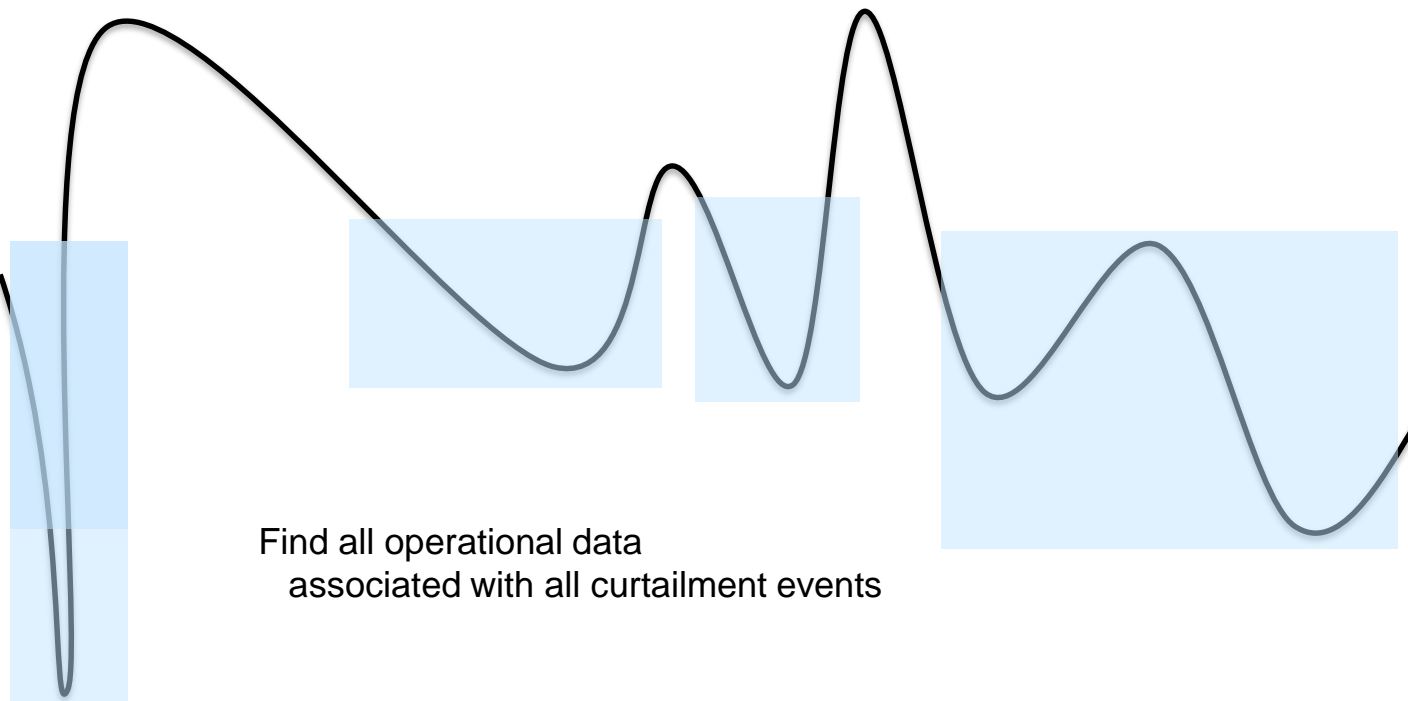
OSIsoft.

Perth Seminar 2019

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Discover



Find all operational data
associated with all curtailment events

Remove outliers



Discover

Operational data of an asset that is usable by algorithms or BI Tools!!



- Asset Context
- Data Alignment
- Asset Normalization
- Filtered on a Curtailment Event Type
- Filtered for $T > -273.15\text{ C}$

Select Data > **Modify View** > Publish

Back Next

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GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	63.943	19.886	90.835
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	63.99	19.921	90.855
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	64.036	19.992	90.876
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GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
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GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943





Discover

Select where you
want to publish

One-time bulk or
incrementally
push

Benefit from native integration to
AWS, Azure, Hadoop, and SAP HANA

Source Events

Server: DFPIAFSERVERPRD
Database: Power Generation

Event Frames: Assets

Event Shape: Wind Curtailment

Matches: Found 100+ Matches

Search Shape

Event Shape: Wind Curtailment

Attributes: Filter

Select All

- Active Power
- Expected Power
- Manufacturer
- Production Delta
- Production Loss
- Turbine
- Wind Turbine

Matches: Found 100+ Matches

- GE09 2017-01-01 10:43:39
- GE09 2017-01-01 10:43:39
- GE09 2017-01-01 10:43:39
- GE09 2017-01-01 10:43:39
- GE01 2017-01-01 13:14:15
- GE01 2017-01-01 13:14:15
- GE01 2017-01-01 13:14:15
- GE01 2017-01-01 13:14:15

Attributes: Filter

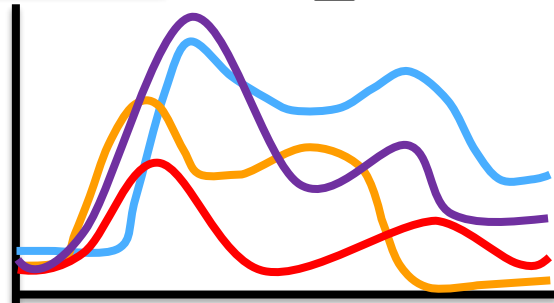
Select All

- Active Power
- Apparent Power
- Apparent Power (calc)
- BatchWindBinFilter
- Bearing A Temperature
- Bearing B Temperature
- Bearing Shaft Temperature
- Blade 1 Error
- Blade 2 Error
- Blade 3 Error
- Blade Total Error
- Blade1, Actual Value
- Blade1, Set Value
- Blade2, Actual Value
- Blade2, Set Value
- Blade3, Actual Value



Discover

What if you want to analyze events relative to each other?





Discover

Index views
of operational
data by
events

Compare
events on a
timescale
relative to
start of the
event

Wind Turbine	Wind Curtailment	Event Frame Start Time (Local)	TimeStamp	Event Frame Relative Time Second	Production Loss	Turbine	Manufacturer
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		0	0.398	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		600	0.412	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		1200	0.405	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		1800	0.407	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		2400	0.345	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		3000	0.391	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		3600	0.346	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		4200	0.377	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		4800	0.407	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		5400	0.379	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		6000	0.326	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		6600	0.31	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		7200	0.333	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		7800	0.241	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		8400	0.119	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		9000	0.147	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		9600	0.219	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		10200	0.322	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		10800	0.287	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		11400	0.321	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		12000	0.353	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		12600	0.375	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		13200	0.179	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		13800	0.057	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		14400	0.175	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		15000	0.201	GE09	GE
Generation\Wind Power Generation Fleet\Windy Valley Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		15600	0.075	GE09	GE
Generation\Wind Power Generation Fleet\Black Mesa Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		0	0.101	GE09	GE
Generation\Wind Power Generation Fleet\Black Mesa Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		600	0.101	GE09	GE
Generation\Wind Power Generation Fleet\Black Mesa Wind Farm\GE09	GE09 2017-01-01 10:43:39	1/1/2017 10:43:39 AM		1200	0.101	GE09	GE

Explore



Adjust a new
view starting from
the previous view

Implement



Create a stream of features for your algorithm

Begin from the shape of your training data



Implement

Adjust object if needed and determine how it updates

Pick a messaging hub to stream to

Select Data > **Modify View** > Publish

Shapes

Asset Shape

Wind Turbine

- Active Power
- Apparent Power
- Bearing A Temperature
- Capacity
- Operating Efficiency
- Rotor Speed

Message Designer

Schema Options
Syncing mode (fattended)

Message Trigger
Trigger a new message when 1 key value change

Backfill Data
Do not backfill data

Message Filters
0 filters

Trigger a message in regular time intervals: 1 minutes

Trigger a new message when the key value(s) selected below have changed

Trigger a message when any of the selected key values have changed

Trigger a message when all of the selected key values have changed

Trigger on ☐ Archive Data ☒ Snapshot Data

Message Content

```
{
  "Wind Turbine": "Wind Turbine (Name)",
  "Active Power": "Active Power (Value)",
  "Apparent Power": "Apparent Power (Value)"
}
```

Preview

Preview Start Time: *Sh

Preview End Time: *

```
{
  "Wind Turbine": "GE01",
  "Active Power": 1155.0897216796875,
  "Apparent Power": 891.489990234375,
  "Bearing A Temperature": 37.61890411376953,
  "Capacity": 6.590443134307861,
  "Operating Efficiency": 95.18331493280601,
  "Rotor Speed": 19.7457275390625,
  "Timestamp": "2019-03-15T01:26:19.4230957-07:00"
},
{
  "Wind Turbine": "GE01",
  "Active Power": 1118.7607421875,
  "Apparent Power": 889.1935424804688,
  "Bearing A Temperature": 37.61298751831055,
  "Capacity": 6.515948295593262,
  "Operating Efficiency": 95.89685325688397,
  "Rotor Speed": 19.595481872558594,
  "Timestamp": "2019-03-15T01:26:33.1416015-07:00"
}
```

Select Data > **Modify View** > Publish

Target Configuration

Veresai Stream

Run Mode

First Run

*

Summary

Shape and Matches

- There are 75 Matching Instances

Timeframe and Interval

- Your Start Time is *
- Trigger a new message as values change

Publish

Summary

Capabilities That Streamline Advanced Analytics

- Context
- Normalization
- Event Marking
- Iterative Workflows
- Operationalization

Select Data > **Modify View** > Publish Back Next

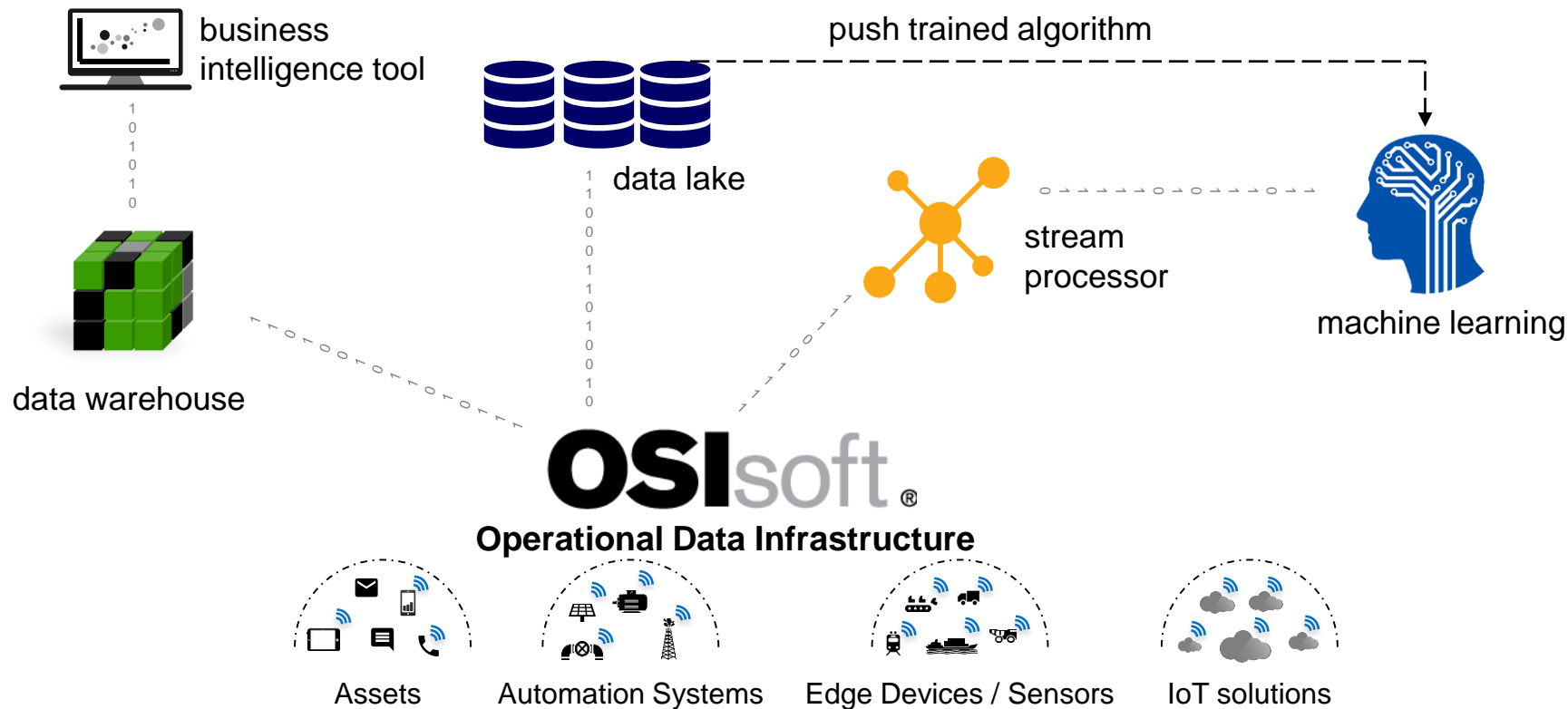
+ Add Column
9 columns
▼ Edit Row Filters
1 Row Filters
⚙ Edit Value Mode
Interpolated Values
Every 1 minute
Start Time
*-1d
End Time
*
Apply

Wind Turbine	TimeStamp	Day of the Week	Active Power	Apparent Power	Bearing A Temperature	Capacity	Rotor Speed	Operati
GE01	3/18/2019 10:52:57.477 AM	Monday	1,517.787	1,523.764	42.523	62.831	19.927	90.403
GE01	3/18/2019 10:53:57.477 AM	Monday	1,518.78	1,517.996	42.515	62.877	20.39	90.421
GE01	3/18/2019 10:54:57.477 AM	Monday	1,528.438	1,527.098	42.507	62.924	19.877	90.44
GE01	3/18/2019 10:55:57.477 AM	Monday	1,524.599	1,525.12	42.498	62.97	20.002	90.459
GE01	3/18/2019 10:56:57.477 AM	Monday	1,521.875	1,521.751	42.49	63.016	19.913	90.478
GE01	3/18/2019 10:57:57.477 AM	Monday	1,525.674	1,531.629	42.481	63.063	19.726	90.497
GE01	3/18/2019 10:58:57.477 AM	Monday	1,535.935	1,536.558	42.473	63.109	20.013	90.516
GE01	3/18/2019 10:59:57.477 AM	Monday	1,517.37	1,519.13	42.465	63.155	20.232	90.535
GE01	3/18/2019 11:00:57.477 AM	Monday	1,528.547	1,529.658	42.456	63.202	20.065	90.554
GE01	3/18/2019 11:01:57.477 AM	Monday	1,529.736	1,524.135	42.448	63.248	19.922	90.573
GE01	3/18/2019 11:02:57.477 AM	Monday	1,517.794	1,525.652	42.439	63.294	19.955	90.592
GE01	3/18/2019 11:03:57.477 AM	Monday	1,505.852	1,512.247	42.431	63.341	19.708	90.61
GE01	3/18/2019 11:04:57.477 AM	Monday	1,519.556	1,521.107	42.423	63.387	20.054	90.627
GE01	3/18/2019 11:05:57.477 AM	Monday	1,519.952	1,523.781	42.414	63.433	20.173	90.644
GE01	3/18/2019 11:06:57.477 AM	Monday	1,523.877	1,508.615	42.406	63.48	19.949	90.662
GE01	3/18/2019 11:07:57.477 AM	Monday	1,533.151	1,532.751	42.397	63.526	19.94	90.68
GE01	3/18/2019 11:08:57.477 AM	Monday	1,525.437	1,526.634	42.389	63.572	19.999	90.698
GE01	3/18/2019 11:09:57.477 AM	Monday	1,523.269	1,518.825	42.381	63.619	19.862	90.716
GE01	3/18/2019 11:10:57.477 AM	Monday	1,522.443	1,522.936	42.372	63.665	20.009	90.733
GE01	3/18/2019 11:11:57.477 AM	Monday	1,509.033	1,522.19	42.364	63.712	19.63	90.75
GE01	3/18/2019 11:12:57.477 AM	Monday	1,524.965	1,525.264	42.355	63.758	20.008	90.767
GE01	3/18/2019 11:13:57.477 AM	Monday	1,511.918	1,508.629	42.347	63.804	19.621	90.784
GE01	3/18/2019 11:14:57.477 AM	Monday	1,519.61	1,523.788	42.339	63.851	19.749	90.801
GE01	3/18/2019 11:15:57.477 AM	Monday	1,526.237	1,524.405	42.33	63.897	19.949	90.818
GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	63.943	19.886	90.835
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	63.99	19.921	90.855
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	64.036	19.992	90.876
GE01	3/18/2019 11:19:57.477 AM	Monday	1,518.829	1,519.512	42.296	64.082	20.067	90.893
GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
GE01	3/18/2019 11:21:57.477 AM	Monday	1,515.018	1,516.249	42.28	64.175	19.828	90.926
GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943

Summary

- Advanced Analytics
 - Start with a small project that involves SMEs
 - Use an iterative approach to your projects
- PI Integrators
 - Support analytics workflows with **drag-and-drop data preparation** for SMEs
 - Provide **native integration** to a variety of advanced analytics platforms and BI Tools
 - Sends curated data via **bulk** and **incremental uploads** and **streams**

PI System Accelerates and Operationalises Advanced Analytics



**New!**

Support for Amazon

PI Integrator for
Business Analytics
2018 R2PI Integrator for
SAP HANA
2017PI Integrator for
Esri ArcGIS
2017 SP1

Category	Destination	Standard	Advanced		
General	PI ODBC or Flat Files	✓	✓	✓	
Relational Database	SQL Server	✓	✓		
	Azure SQL Database	✓	✓		
	Oracle RDBMS	✓	✓		
Data Warehouse	SAP HANA Smart Data Integration			✓	
	Apache Hive	✓	✓		
	Azure SQL Data Warehouse	✓	✓		
	Amazon Redshift	✓	✓		
Data Lake	Hadoop HDFS	✓	✓		
	Azure Data Lake Store	✓	✓		
	Amazon S3	✓	✓		
Messaging Hub	SAP Streaming Analytics			✓	
	Apache Kafka		✓		
	Azure IoT Hub or Event Hubs		✓		
	Amazon Kinesis Data Streams		✓		
GIS	ArcGIS GeoEvent Server				✓

