



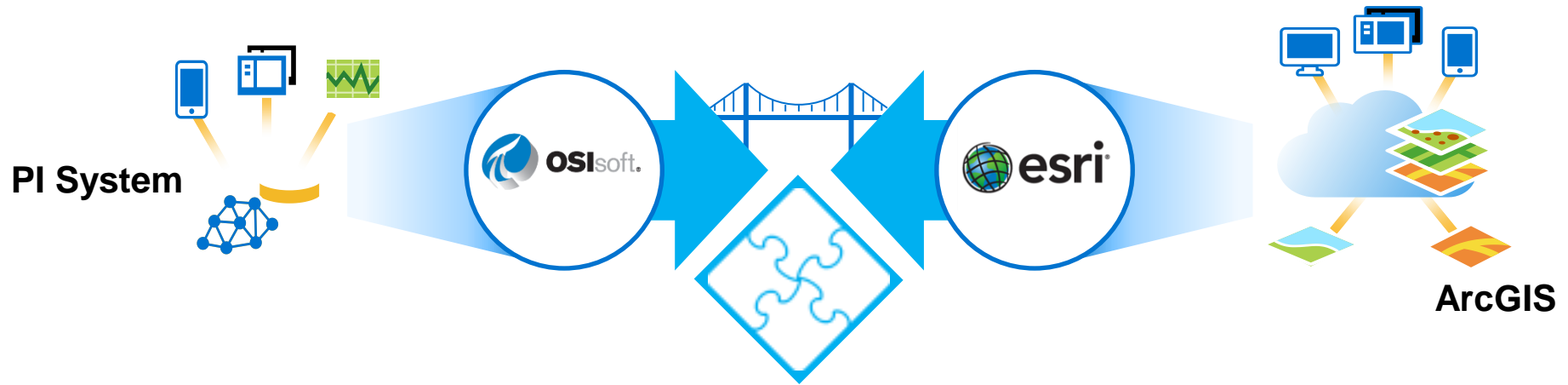
# PI Integrator for Esri ArcGIS: A Journey Through Time and Space

Presented by Vadim Fedorov, Sr. Systems Engineer  
Elizabeth Ammarell, Product Manager

# The Past: Where We Started

# Two companies, one vision

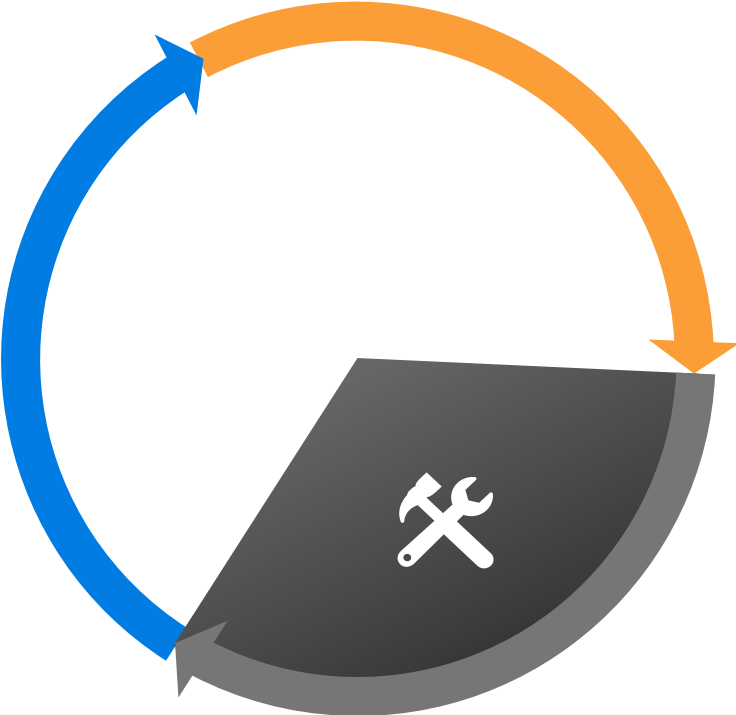
Use data to reveal insights, process improvements and business value.



Transform your data.  
Transform your world.

The Science of Where

# Why need PI Integrator for Esri ArcGIS?



# To leverage space and time data together



# To provide a self-service solution without custom code



Requires **no custom code** or developer technologies

**Minimal** configuration, maintenance, and administration



# To bring together ArcGIS and PI System experts



**PI users** with minimal GIS knowledge and  
**GIS users** with minimal PI knowledge

More **opportunities** due to broader  
access to data and shared applications



# The Present: Where Users Find Value



home / services / CatCanyonWells

### Service CatCanyonWells

[View in services directory](#)

O&G wells in the Cat Canyon field

Created on 03/22/2016 02:15:39 (13 minutes ago)

#### Layers (2)

Layers allow you to select data from the PI System to connect to the ArcGIS Platform. Layer data can be exposed in different ways. You can configure these capabilities after you have created a layer.

[+ Create Layer](#)

[Tile view](#)

Name ↓	Description	Created	Modified	Active connections	
Blockman	Wells operated by Blockman	03/22/2016 02:17:15	03/22/2016 02:17:15	1	<a href="#">✎</a> <a href="#">✖</a>
Dominion	Wells operated by Dominion	03/22/2016 02:20:20	03/22/2016 02:20:20	1	<a href="#">✎</a> <a href="#">✖</a>

**Goal:** Improve the efficiency of business workflows and **situational awareness** for Noble's upstream operations



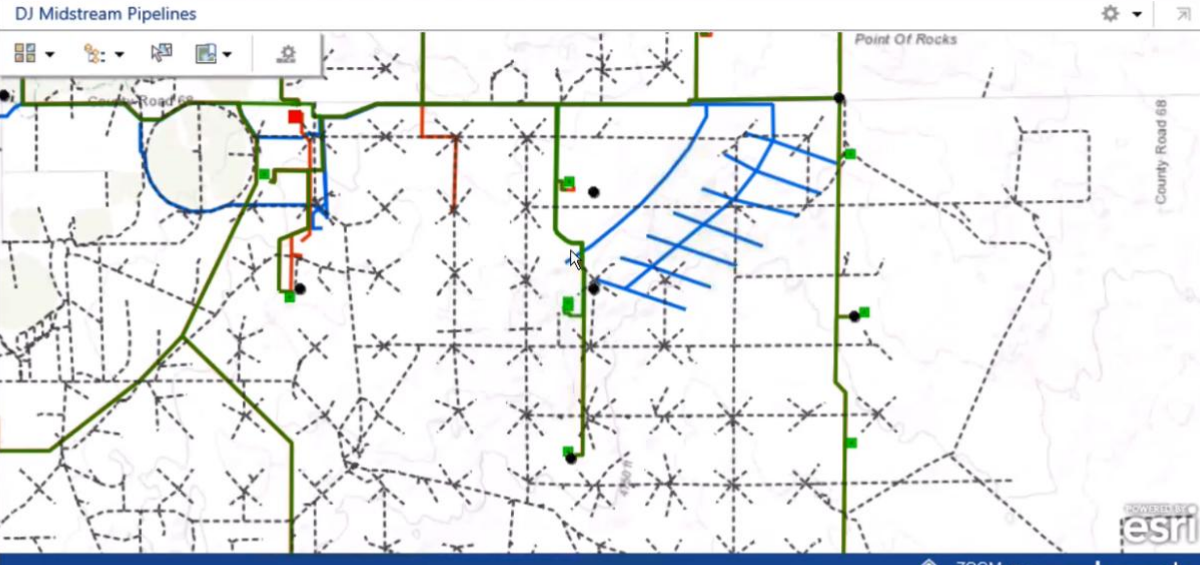
**Result:** A **standard visualization tool**

- Remote asset status
- Production rates
- Weather data
- One map includes details for every location



Legend

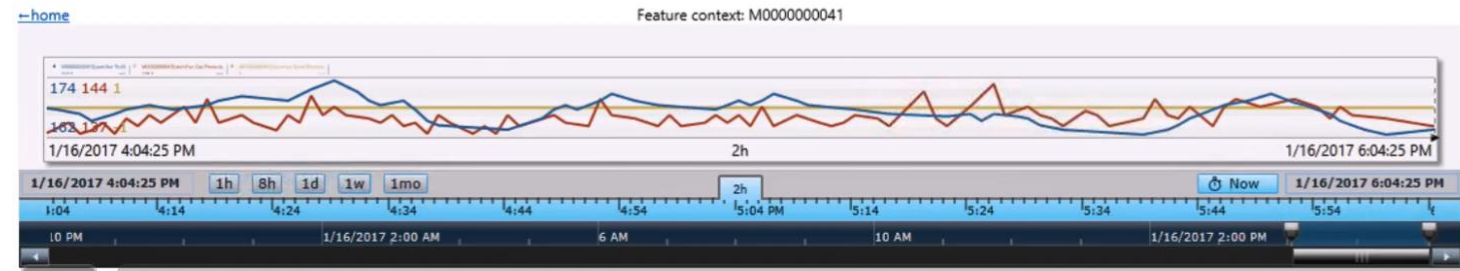
- ▲ D15\_OPERATIONS - Launchers & Receiver
  -
- ▲ D15\_OPERATIONS - Econodes
  - Wells Ranch Econodes to CGF
- ▲ D15\_OPERATIONS - Facilities
  - CPF
  - OPF
  - ▲ Processing Plant
- ▲ D15\_OPERATIONS - NBL Lease Roads
  - Lease Roads
- ▲ D15\_OPERATIONS - Oil Pipelines
  - Oil Pipelines
- ▲ D15\_OPERATIONS - Gas Pipelines
  - Gas Pipelines
- ▲ D15\_OPERATIONS - NGL Pipelines
  - NGL Dinaliner



Launchers...

●	M0000000017	Gas Pressure: 152.10	Trunk Pressure: 0.30
●	M0000000018	Gas Pressure: 0.00	Trunk Pressure: 0.00
●	M0000000019	Gas Pressure: 158.90	Trunk Pressure: 0.00
●	M0000000020	Gas Pressure: 154.80	Trunk Pressure: 0.00
●	M0000000021	Gas Pressure: 157.10	Trunk Pressure: 0.00
●	M0000000022	Gas Pressure: 154.80	Trunk Pressure: 0.30
●	M0000000023	Gas Pressure: 156.20	

Coresight



Average Gas Pressure

No Data

**Goal: Reduce water loss** and **optimize manual process** for monitoring leaks



**WHITE HOUSE  
UTILITY DISTRICT**

**Result: GIS-centric water loss management**

- Automated KPI calculation and data update to ArcGIS
- Access to historical zone and meter details
- Daily review process shortened to 15 minutes
- 2016 water loss savings of \$500,000

“...spending more time finding leaks and managing staff, **rather than managing the data.**”

-Carl Alexander,  
GIS Manager

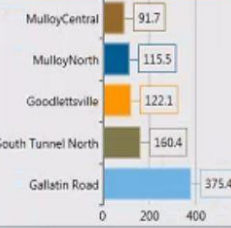
South Tunnel North Zone  
 Cost per Day 462.01  
 GPM at Stake 160.42  
 Min Night Flow 183.10  
 Survey Date 9/21/2016 12:45 AM  
 Target Pf 0.03  
 GPM per Conn 0.24  
 Miles of Pipe 36.13  
 Num of Conn 756  
 Comments target mnf 39

Total Cost per Day

**\$ 4117.76024183827**

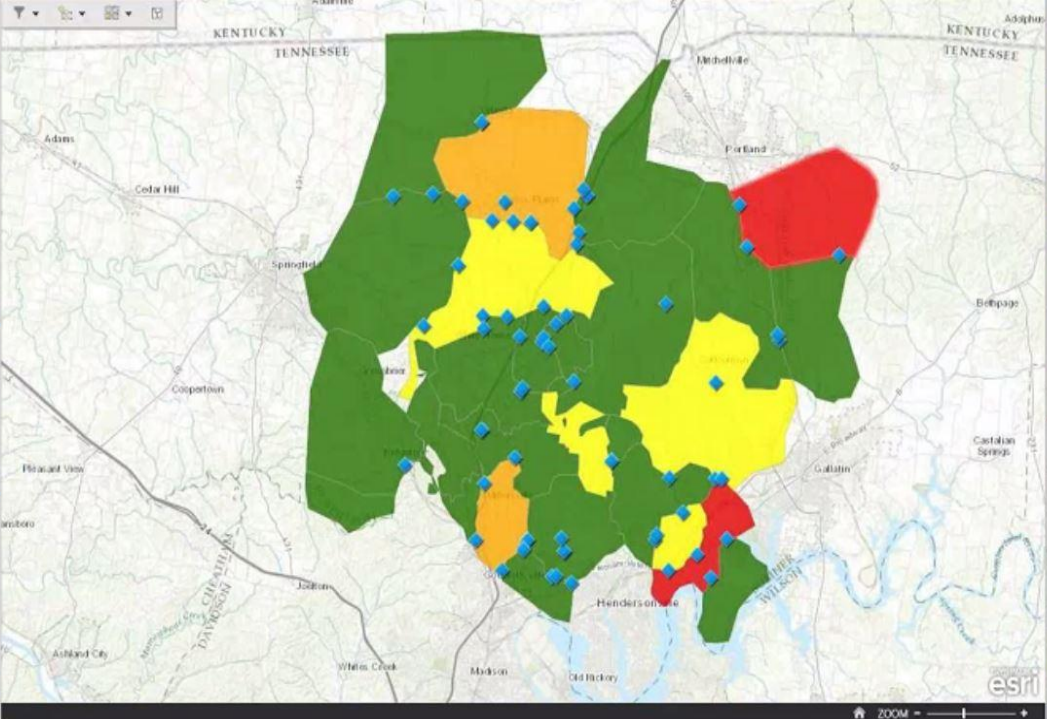
Cost is \$2.00 per 1000 gallons

Top 5 GPM at Stake



Legend

- ◆ DMA Meters
- ◆ DMA Zones (GPM at Stake)
  - Green: -60 to 50
  - Yellow: > 50 to 100
  - Orange: > 100 to 150
  - Red: > 150 to 500

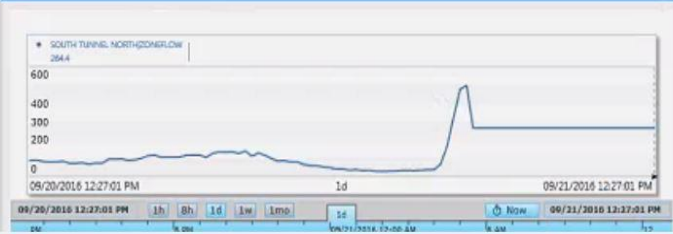


- South Tunnel South  
MNF 56.8399963378906 @ 09/21/2016 2:30:00 AM
- Lower Tyree Discharge  
MNF 4.12087917327881 @ 09/21/2016 2:08:59 AM
- South Tunnel West  
MNF 62.1999893188477 @ 09/21/2016 2:00:00 AM
- Bend Area  
MNF 79.9700012207031 @ 09/21/2016 2:00:00 AM
- BethelWest  
MNF 80.2083587646484 @ 09/21/2016 1:54:19 AM

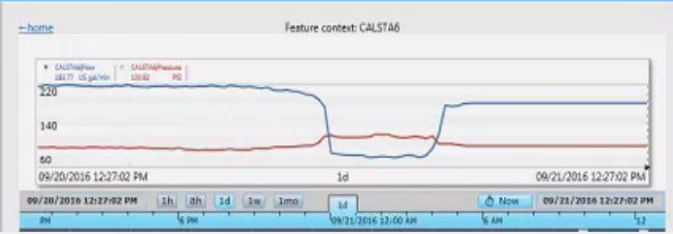
DMA Zone MNF History Web Map



DMA Zone Flow



DMA Meter data



90,000 people served

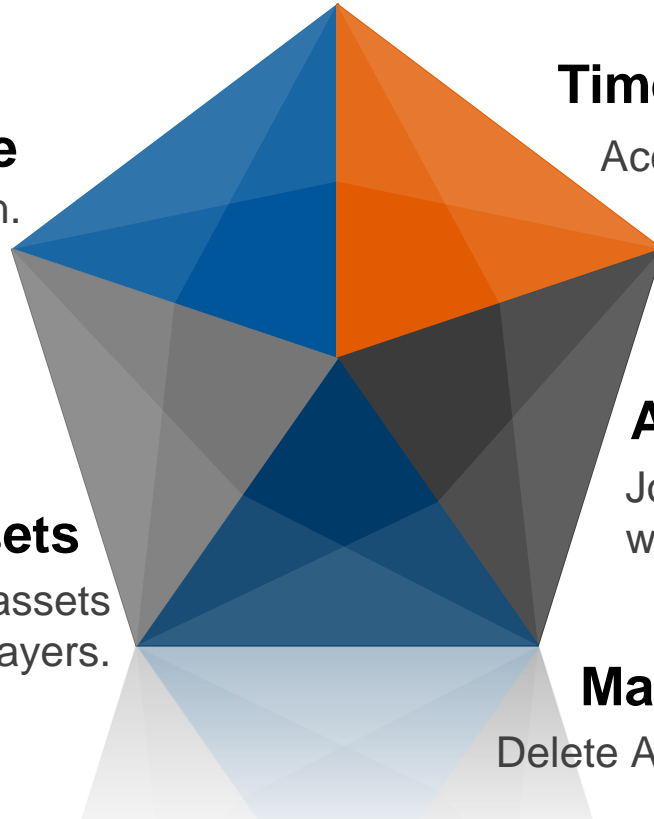
2016 Water Loss Savings \$500,000

# The Future: Where We Are Going

# PI Integrator for Esri ArcGIS 2017

## Architecture

Simplified to ease administration.



## Time-enabled Maps

Access historical PI System data.

## Detection of New Assets

Automatically detect new AF assets and add them to relevant layers.

## Augmented Feature Layer

Join operational data with existing ArcGIS layers.

## Manageability

Delete ArcGIS items from the Integrator.

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# Simplified Integrator architecture

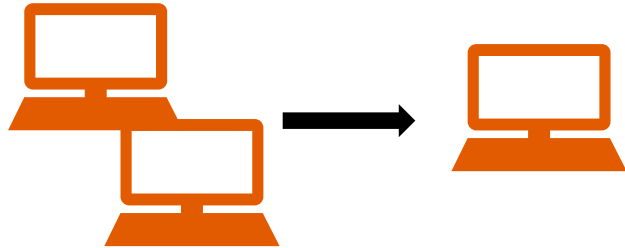
---

PI Integrator for  
Esri ArcGIS  
**Application Server**

+

PI Integrator for  
Esri ArcGIS  
**Data Relay**

**PI Integrator for  
Esri ArcGIS**



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Merged Data Relay and Application Server

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Requires single executable and installation

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Removed dependency on Microsoft IIS

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Application runs as a self-hosted web service

---

# PI Integrator for Esri ArcGIS 2017

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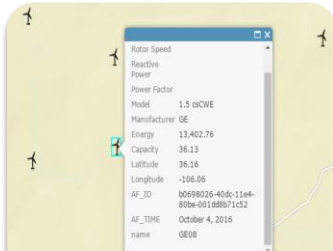
## Augmented Feature Layer

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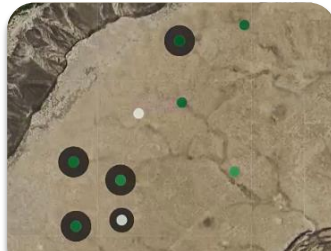
# Time-enabled maps reveal insights hidden in the data



Review historical data when alarms are triggered



Validate and compare asset routes



Investigate incident cause and effect



Evaluate conditions across various regions



Combine data sources and tools

**Elements**

- World
  - Alabama
  - Alaska
  - Arizona
  - Arkansas
  - California
    - Amador
    - Butte
      - 18614
      - 44255
      - 49879
      - 92337
      - 98656
    - Calaveras
    - Colusa
      - 14109
      - 26697
      - 28074
      - 3055
      - 3279
      - 36705
      - 37399
      - 44287
      - 45568
      - 47961
      - 57521
      - 60575
      - 61088

Elements  
Event Frames  
Library  
Unit of Measure  
Analyses

14109

General Child Elements Attributes Ports Analyses Version

Excluded attributes are hidden.

Filter

	Name	Value	Data Reference
Category: <None>			
<input checked="" type="checkbox"/>	FID	14030	<None>
<input checked="" type="checkbox"/>	GUID	{C799335A-4E02-40B9-8A14-99E3C5F0A922}	<None>
<input checked="" type="checkbox"/>	LATITUDE	39.04084332	<None>
<input checked="" type="checkbox"/>	LONGITUDE	-121.9768316	<None>
<input checked="" type="checkbox"/>	Pressure	189.61265563964844	PI Point
<input checked="" type="checkbox"/>	Production	166.26390075683594	PI Point
<input checked="" type="checkbox"/>	Temperature	52.391155242919922	PI Point
<input checked="" type="checkbox"/>	WELL_ID	14109	<None>

Group by:  Category  Template

Name:

Description:

Properties:

Categories:

Default UOM:

Value Type: <Anything>

Value:

Data Reference:

Settings...

Limits Forecasts

# PI Integrator for Esri ArcGIS 2017

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Delete ArcGIS items from the Integrator.

# Augmented feature layers combine PI data with geometry from ArcGIS into a single time-enabled layer

Pipeline0011

General Child Elements Attributes Ports Analyses Noti

Filter

Name	Value
Downstream Pressure	53.7464828
MAOP	100
Name	Pipeline0011
Upstream Pressure	96.03381
Volume Flow	124.95192

ArcGIS REST Services Directory

[Home](#) > [services](#) > [Hosted](#) > [pipelines \(FeatureServer\)](#) > [pipel](#)

[JSON](#)

**Layer: pipelines\_static (ID: 0)**

**Geometry Type:** esriGeometryPolyline

**Fields:**

- objectid ( type: esriFieldTypeOID ,
- upstream\_compressor\_station ( ty
- pipe\_diameter ( type: esriFieldTyp
- mileage ( type: esriFieldTypeDoub
- length\_classification ( type: esriFi
- friction\_coefficient ( type: esriFiel
- downstream\_compressor\_station
- arcgis\_feature\_shape ( type: esriI
- name ( type: esriFieldTypeString ,



# PI Integrator for Esri ArcGIS 2017

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## Manageability

Delete ArcGIS items from the Integrator.



# Improved system manageability

---

Delete Integrator-created ArcGIS objects from the Integrator

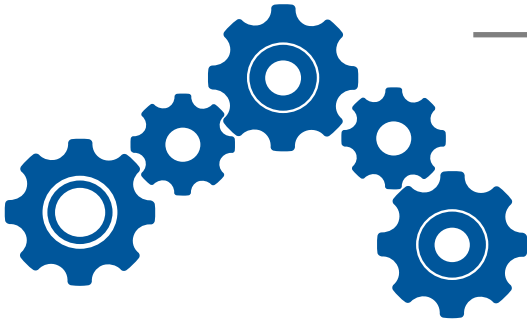
---

No need to log into ArcGIS Online or Portal for ArcGIS

---

No need to log into GeoEvent Server Manager

---



## Service Power Generation Service ✖

Power Generation Service

Created on 02/20/2017 09:51:14 (17 hours ago)

Layers (1)

Layers are used to select PI System data to connect to the ArcGIS platform. You can configure multiple layers within a single service.

+ Create Layer

Tile view

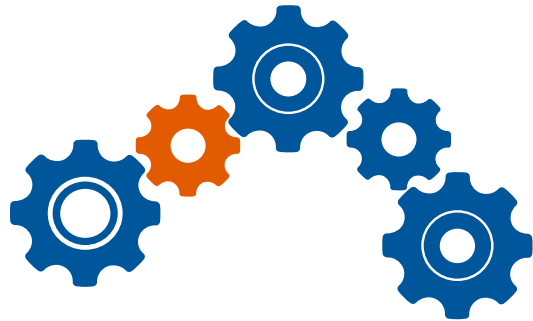
Name ↓	Description	Created	Modified	Time-enabled	GeoEvent
Wind Turbines Layer	Wind Turbines Layer	02/20/2017 09:54:03	02/20/2017 09:54:03		✓ ✖



Click to delete  
Integrator  
layer



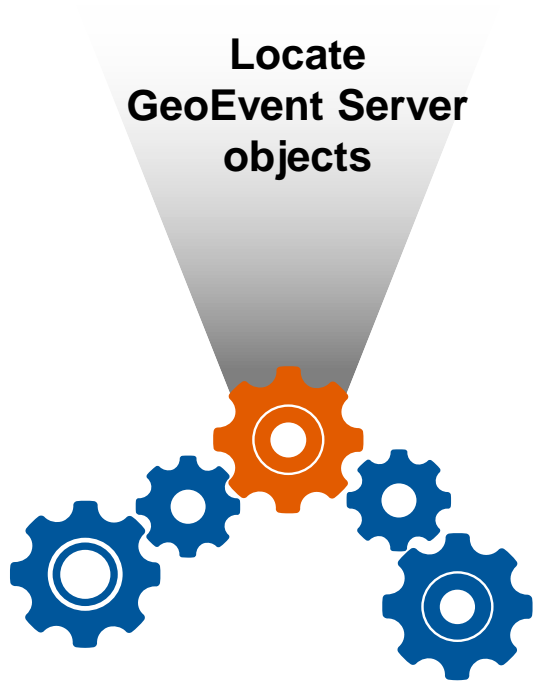
## Locate ArcGIS feature service



[home](#) / [services](#) / [Power Generation Service](#) / [Wind Turbines Layer](#) / [delete-wizard](#)

**1. Feature Service Environment** 2. GeoEvent Server Environment 3. Confirmation 4. Summary

- ✓ Portal for ArcGIS credentials verified.
- ✓ **Feature service** 'power\_generation\_service' was found



1. Feature Service Environment
- 2. GeoEvent Server Environment**
3. Confirmation
4. Summary

- ✓ You are connected to GeoEvent Server **dpnagis105m1 GeoEvent**.
- ✓ GeoEvent Server objects can be deleted from 'https://dpnagis105m1.osisoft.int:6143'

**The following GeoEvent Server objects can be deleted from this layer:**

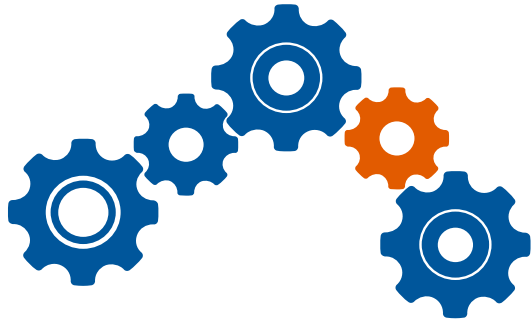
**Service:** pigeo-power-generation-service-wind-turbines-layer-service

**Input:** pigeo-power-generation-service-wind-turbines-layer-ws-in

**Output:** pigeo-power-generation-service-wind-turbines-layer-fs-update-out

**GeoEvent Defintion:** pigeo-power-generation-service-wind-turbines-layer-ws-in

## Delete all discovered items



home / services / Power Generation Service / Wind Turbines Layer / delete-wizard

1. Feature Service Environment 2. GeoEvent Server Environment **3. Confirmation** 4. Summary

Status of the Layer Delete Wizard:

**Feature Service Environment:** 'power\_generation\_service' can be deleted from 'https://dpnagis105m1.osisoft.int/portal'

**GeoEvent Server Environment:** GeoEvent Server objects can be deleted from 'https://dpnagis105m1.osisoft.int:6143'

**Integrator Environment:** Layer ready to delete

After you click Delete, the process might take several minutes to complete. Do not close the browser or navigate away from this page until the process is complete.

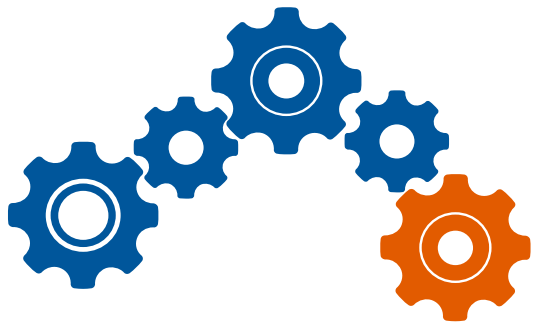
Delete

1. Feature Service Environment 2. GeoEvent Server Environment 3. Confirmation 4. **Summary**

Delete Summary:

- ✓ **Feature Service:** 'power\_generation\_service' was deleted successfully for 'https://dpnagis105m1.osisoft.int/portal'
- ✓ **GeoEvent Server:** All GeoEvent Server objects for this layer were deleted successfully on 'https://dpnagis105m1.osisoft.int:6143'.
- ✓ **Layer:** 'Wind Turbines Layer' was deleted successfully for 'PI Integrator for Esri ArcGIS'
- ✳️ All objects associated with this layer have been deleted.

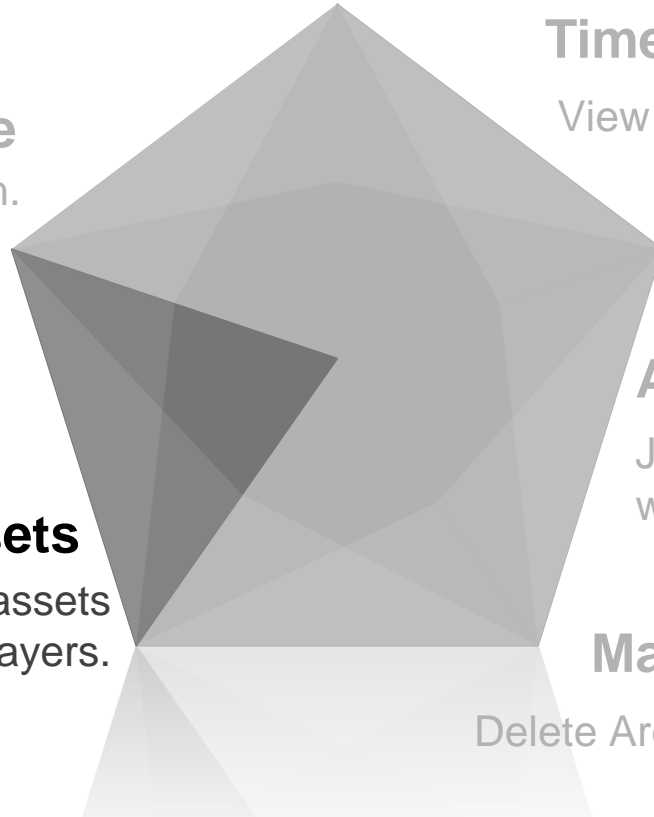
**Deleted layer  
cleaned up**



# PI Integrator for Esri ArcGIS 2017

## Architecture

Simplified to ease administration.



## Time-enabled Maps

View historical PI System data.

## Augmented Feature Layer

Join operational data with existing ArcGIS layers.

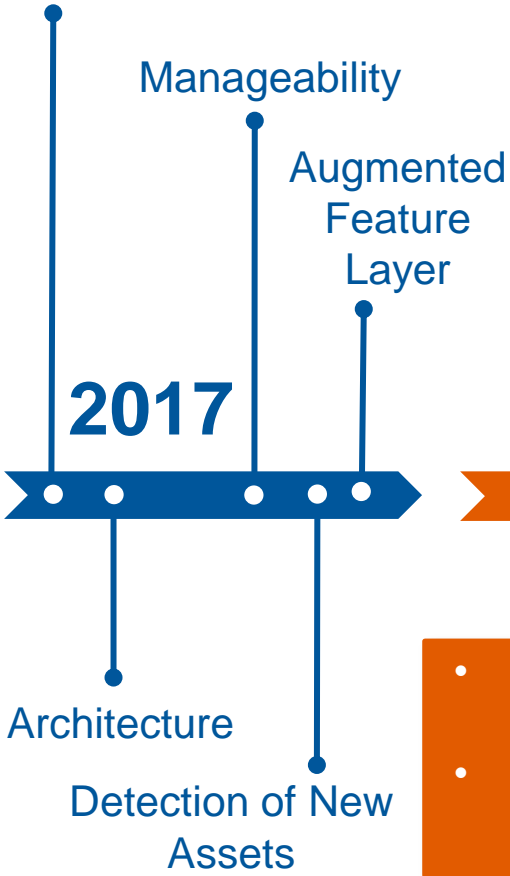
## Detection of New Assets

Automatically detect new AF assets and add them to relevant layers.

## Manageability

Delete ArcGIS items from the Integrator.

# Time-enabled Maps



# Asset Synch & Management

- Bi-directional synch between PI and ArcGIS
- Select which assets and data to include

## H2 2018



### Move to Integrator Framework

- Create layers from shapes instead of element templates
- Consistent user experience for PI Integrators

# Visualization

- Maps in PI Vision
- Operations Dashboard
- Web AppBuilder
- Notifications

## Research



### Analytics at Scale

- ArcGIS spatiotemporal big data store
- Distributed analytics with GeoAnalytics Server
- Insights for ArcGIS



# Move to Integrator Framework

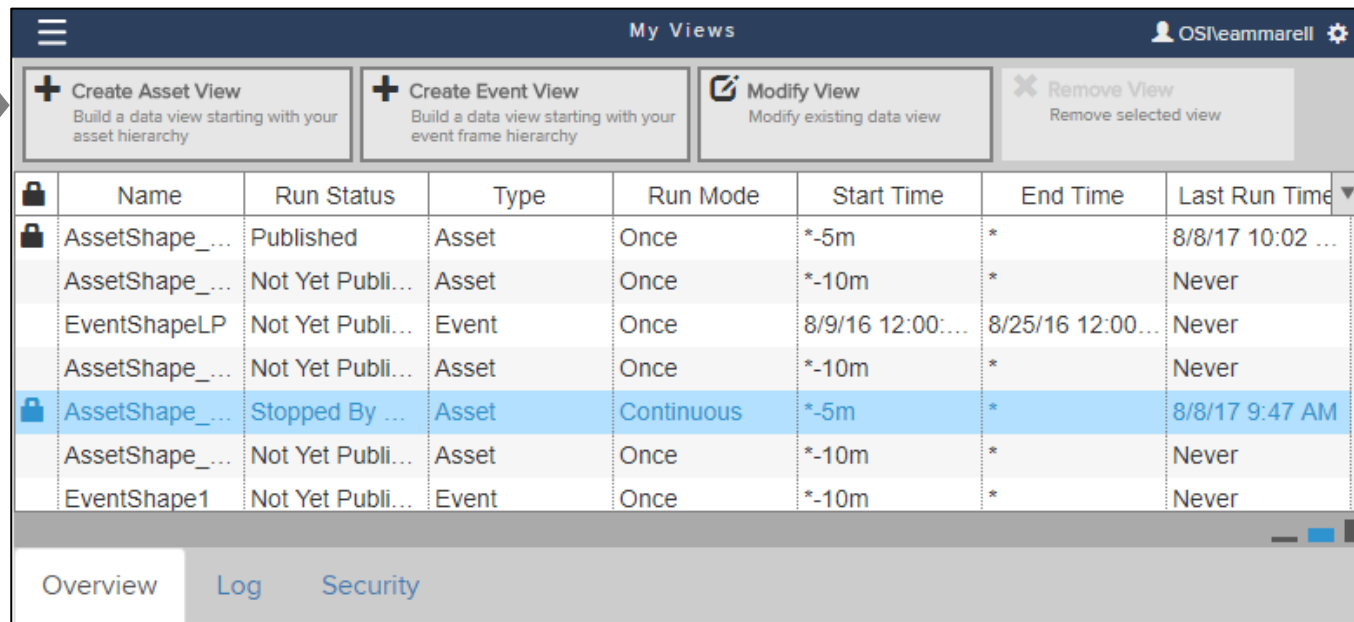
Standard UI

Flexible Data Set

Event Frames

Scale

All PI Integrators share a similar modern user interface. Customers have the same experience across the product line.

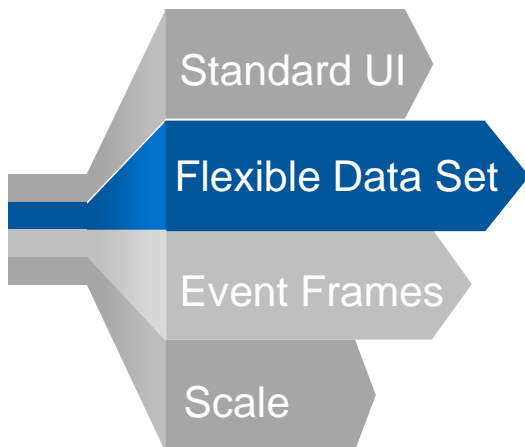


The screenshot displays the 'My Views' interface. At the top, there are four action buttons: 'Create Asset View' (Build a data view starting with your asset hierarchy), 'Create Event View' (Build a data view starting with your event frame hierarchy), 'Modify View' (Modify existing data view), and 'Remove View' (Remove selected view). Below these buttons is a table with columns: Name, Run Status, Type, Run Mode, Start Time, End Time, and Last Run Time. The table contains several rows of data, with one row highlighted in blue. At the bottom of the interface, there are three tabs: 'Overview', 'Log', and 'Security'.

	Name	Run Status	Type	Run Mode	Start Time	End Time	Last Run Time
🔒	AssetShape_...	Published	Asset	Once	*-5m	*	8/8/17 10:02 ...
🔒	AssetShape_...	Not Yet Publi...	Asset	Once	*-10m	*	Never
	EventShapelP	Not Yet Publi...	Event	Once	8/9/16 12:00:...	8/25/16 12:00...	Never
	AssetShape_...	Not Yet Publi...	Asset	Once	*-10m	*	Never
🔒	AssetShape_...	Stopped By ...	Asset	Continuous	*-5m	*	8/8/17 9:47 AM
	AssetShape_...	Not Yet Publi...	Asset	Once	*-10m	*	Never
	EventShape1	Not Yet Publi...	Event	Once	*-10m	*	Never

# Move to Integrator Framework

Build data sets based on “shapes” rather than simple AF templates. Allows for more comprehensive and informative layers.



Search Shape	Matches
<ul style="list-style-type: none"><li>Asset Shape<ul style="list-style-type: none"><li>Plant<ul style="list-style-type: none"><li>Process<ul style="list-style-type: none"><li>Quality</li><li>Reliability</li></ul></li><li>Equipment<ul style="list-style-type: none"><li>Boiler   Pump<ul style="list-style-type: none"><li>Fuel Gas Flow</li><li>Process Feedrate</li><li>Water Flow</li><li>Water Savings - Analysis</li></ul></li></ul></li></ul></li></ul></li></ul>	<ul style="list-style-type: none"><li>Found 16 Matches<ul style="list-style-type: none"><li>Houston<ul style="list-style-type: none"><li>Cracking Process<ul style="list-style-type: none"><li>Quality</li><li>Reliability</li></ul></li><li>Equipment<ul style="list-style-type: none"><li>B-210<ul style="list-style-type: none"><li>Fuel Gas Flow</li><li>Process Feedrate</li><li>Water Flow</li><li>Water Savings - Analysis</li></ul></li></ul></li></ul></li></ul></li></ul>

# Move to Integrator Framework

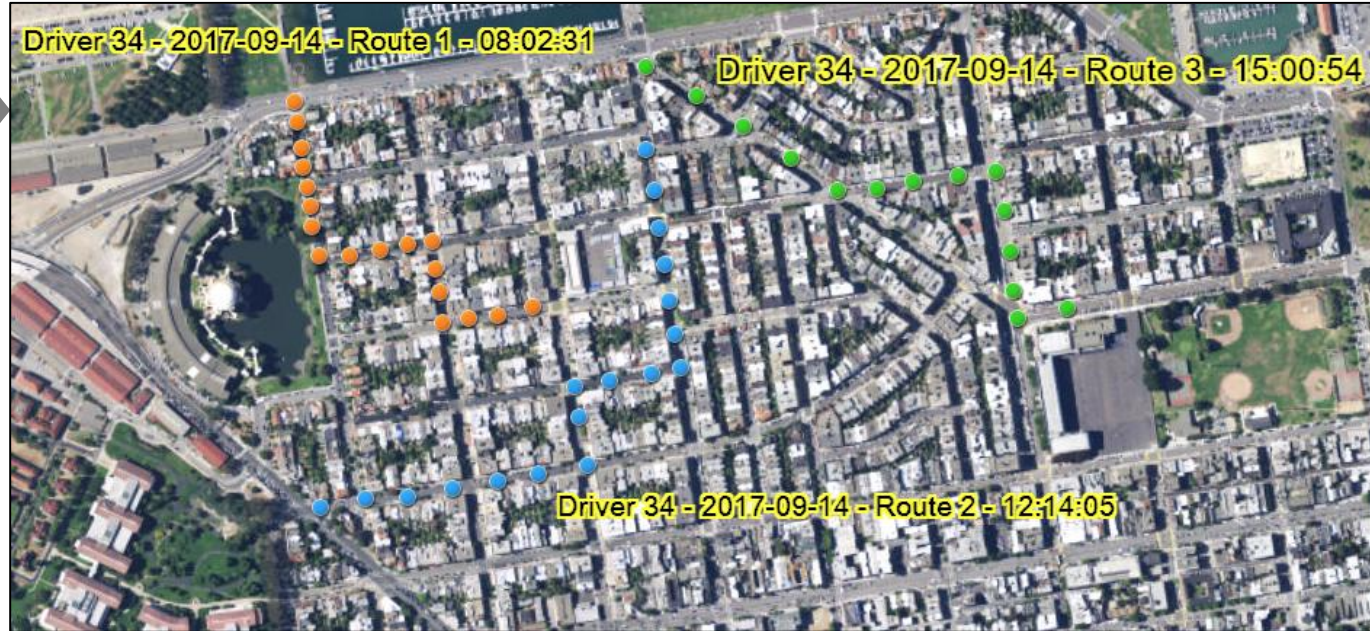
Standard UI

Flexible Data Set

Event Frames

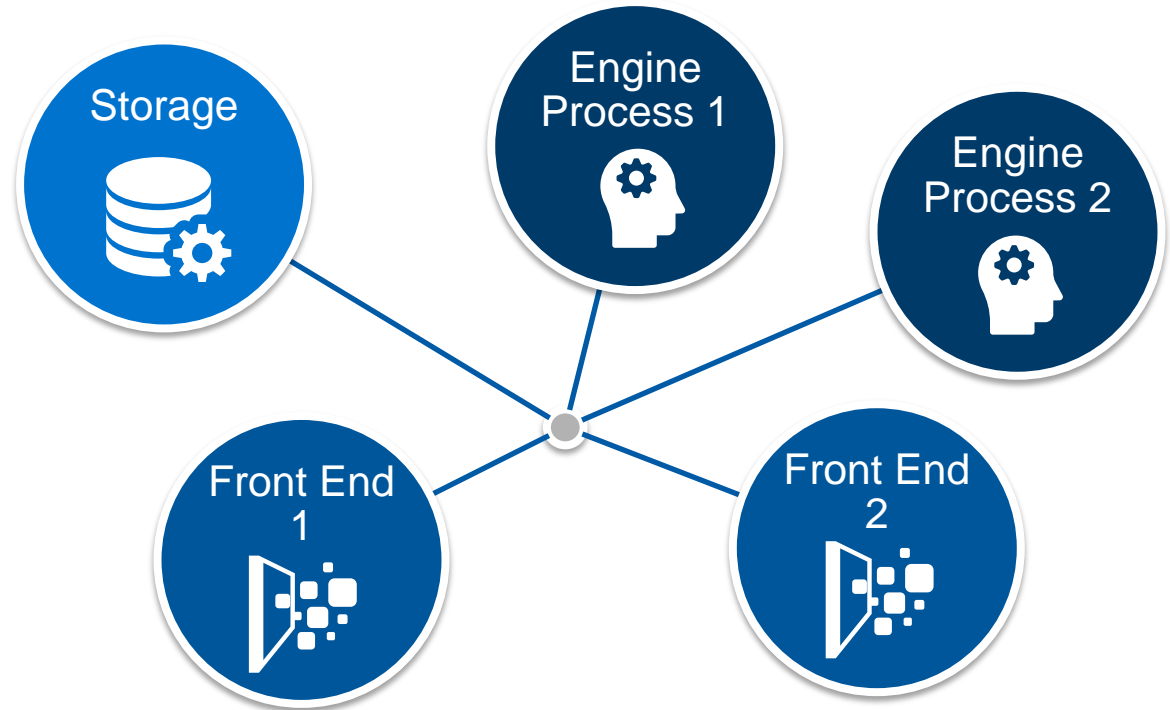
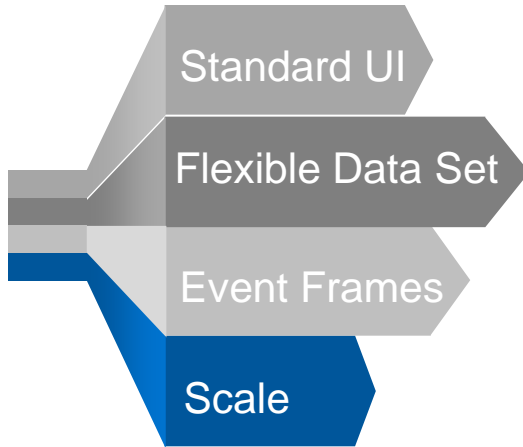
Scale

Utilize data from event frames and assets in maps and spatial analytics.



# Move to Integrator Framework

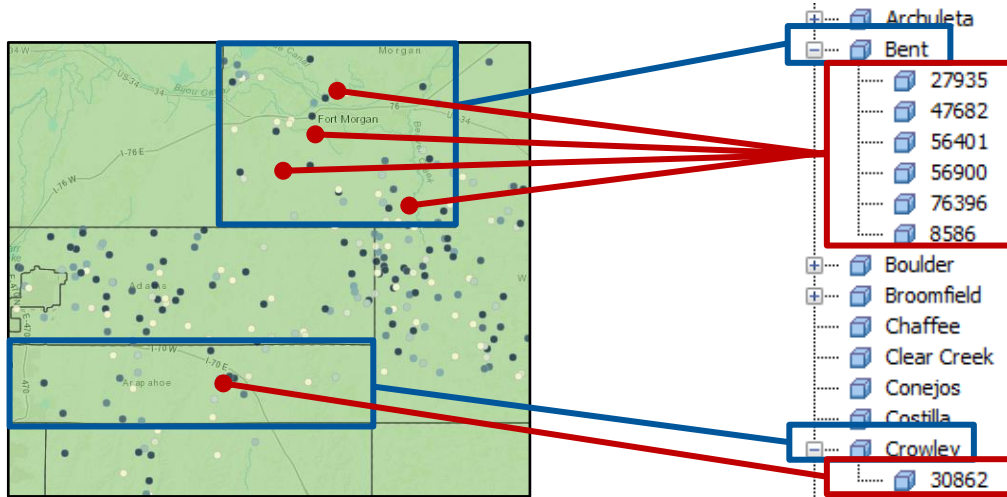
Leverage distributed processing to improve scale and performance.



# Asset Sync and Management

Assets added or removed in one system propagate to the other system.  
Data flows in both directions between ArcGIS and the PI System.

## Counties + Wells



New geographic areas are added or new equipment comes online in ArcGIS

Corresponding AF elements and PI tags are created

Assets retired or regions closed in the PI System

Related ArcGIS features removed from maps

# Solve more problems, more efficiently

“...spending more time finding leaks and  
managing staff,  
**rather than managing the data.**”  
-Carl Alexander,  
GIS Manager

**Vadim Fedorov**

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Sr. Systems Engineer

OSIsoft



**Elizabeth Ammarell**

[eammarell@osisoft.com](mailto:eammarell@osisoft.com)

Product Manager

OSIsoft



## Questions

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

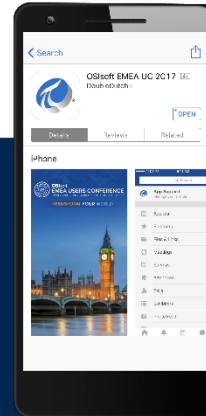


State your **name & company**

## Please remember to...

Complete the Online Survey for this session

**Download the Conference App**



- View the latest agenda and create your own
- Meet and connect with other attendees

Search **OSISOFT** in the app store

Download on the

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GET IT ON

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HTML



감사합니다

Danke

谢谢

Merci

Gracias

**Thank You**

ありがとう

Спасибо

Obrigado