



Improving Distribution Reliability with Smart Fault Indicators and the PI System

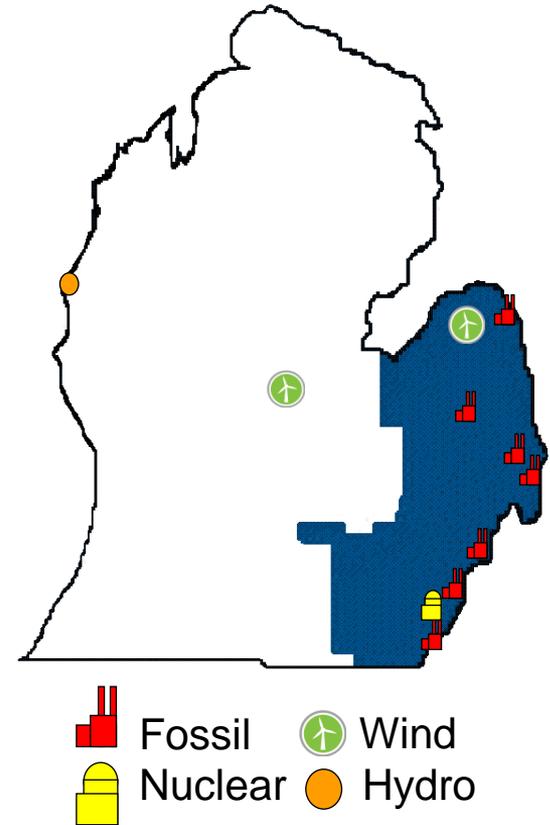
Presented by **Cameron D. Sherding**, *Sr. Software Engineer*



Profile of DTE Electric

- 12th Largest US electric utility
- 2.2 million customers
- 671 distribution substations
- 46,000 miles of power lines

Customer	Count	Load
Residential	1,920k	34%
Commercial	197k	44%
Industrial	1k	22%



Business Challenges

Reduce CAIDI = average duration of power outage

1. Ground crews need to locate faults faster

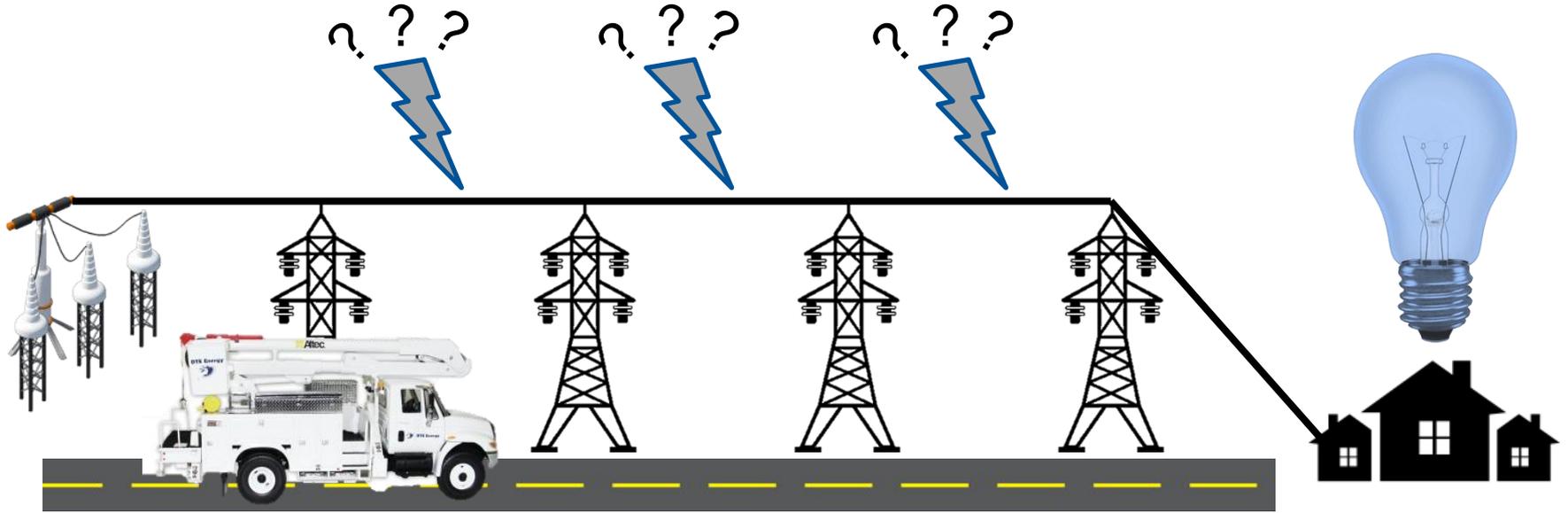
- Quickly locating the source of these faults is critical to minimizing restoration time
- Circuit patrol times can take up to an hour

2. Increase visibility of electrical load on circuits

- Aging substations may be demoed in the near future
- SCADA is not a cost-effective option

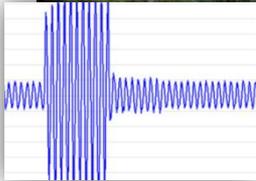
Business Challenge

Patrol times are long when you don't know where the fault is

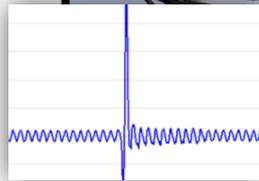


Examples of Ground Faults

Contact with Trees



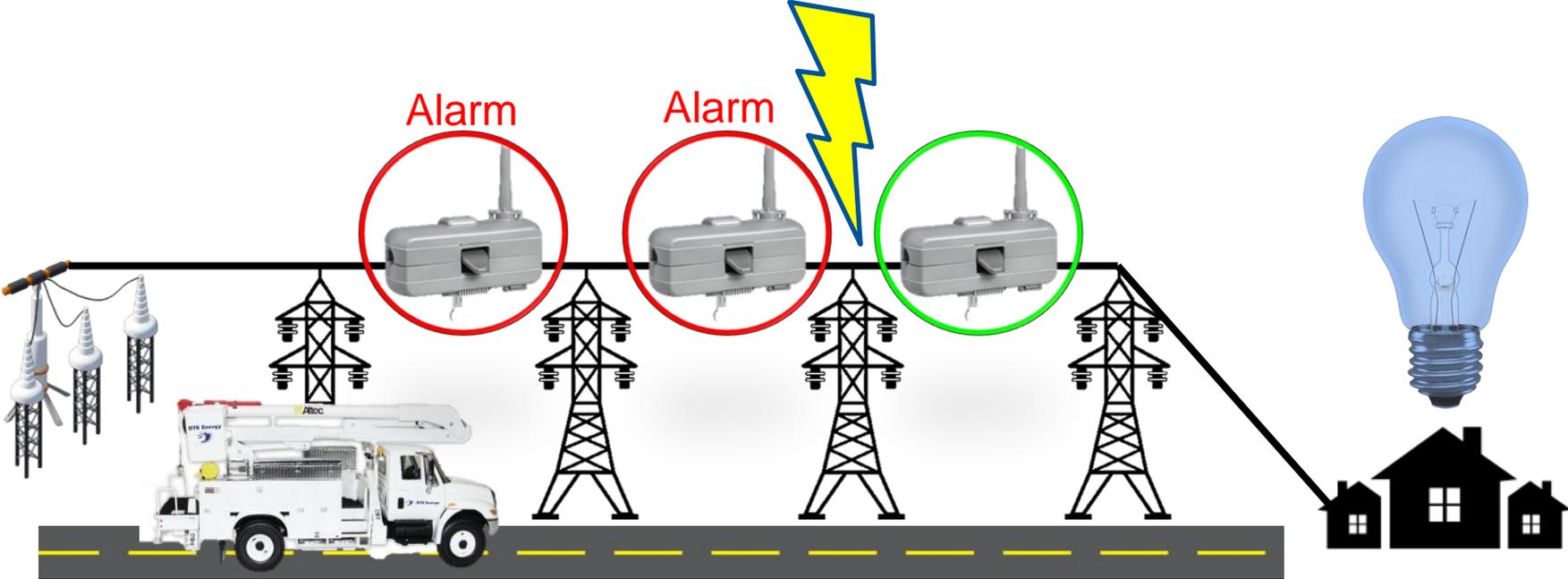
Failing Pole Top Transformer



Failing Underground Cable

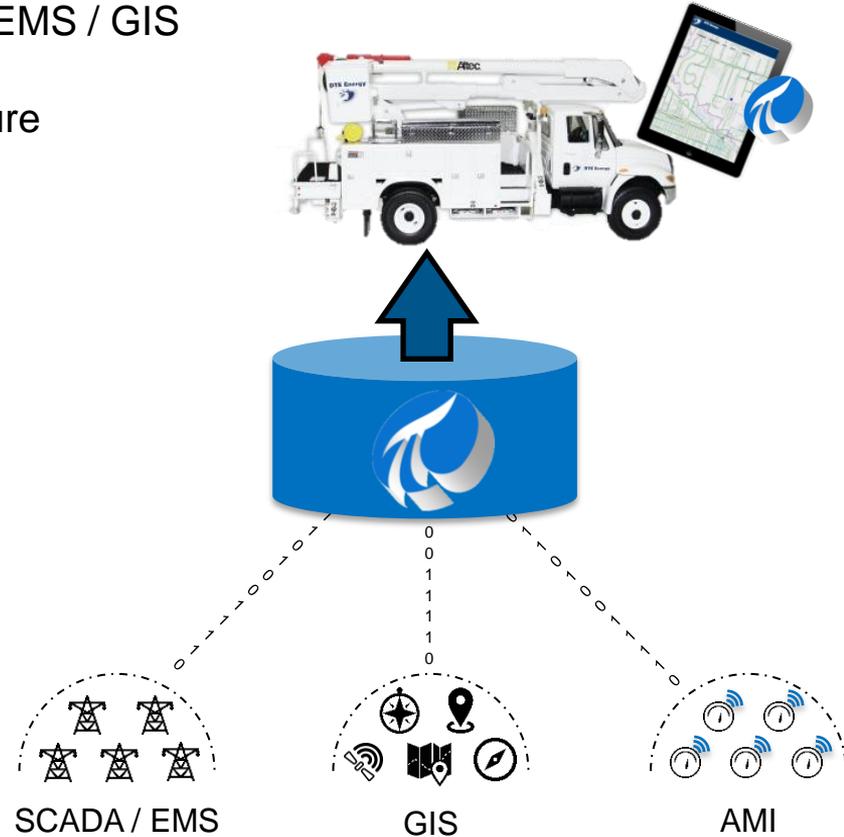
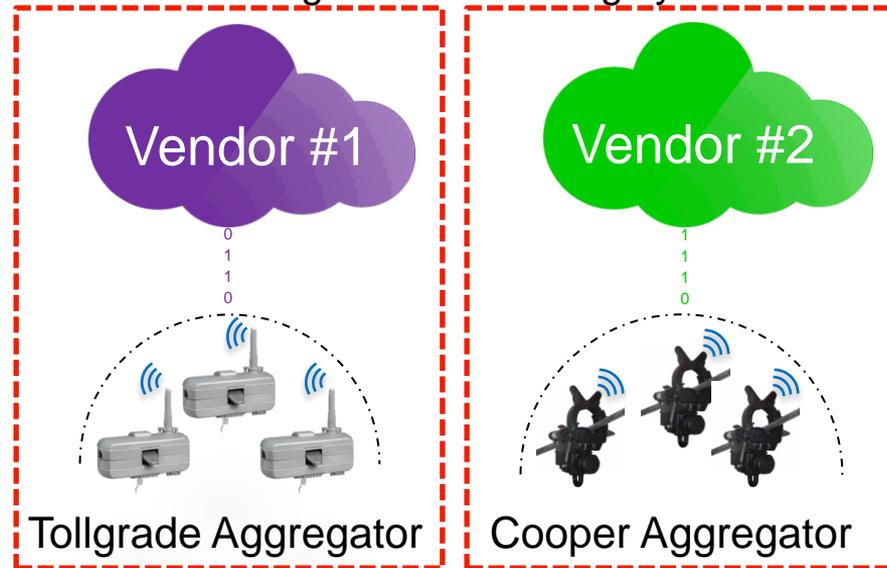


Sensors provide visibility into fault location



Downsides with going straight to the cloud

- Data is isolated from other OT data eg: SCADA / EMS / GIS
- Requires training a team on new tools
- Complicates using new sensor vendors in the future
- Project requirements
 - Must host our own data
 - Must integrate with existing systems



An Infrastructure Approach to using IoT Sensors

Benefits

- Agnostic to sensor providers
- Easily scale from POC to full size deployment
- Seamless integration with backend systems

The Full PI stack at work

- **Collect:** PI Interface for DNP3
- **Store/Contextualize:** PI Server / AF
- **Deliver:** PI Notifications / AF SDK / Esri Arc GIS / Coresight



Tollgrade Aggregator



Cooper Aggregator



SCADA / EMS



GIS



AMI

Advantages of Wireless Sensors vs SCADA

- Capital Expense
 - SCADA is **\$30K** per install
 - Wireless is **\$5k** per installation
- Deployment Time
 - SCADA takes **months** to deploy
 - Requires a shutdown
 - Significant construction
 - Wireless takes **hours** to deploy
 - Can be installed on live wires
 - 1 bucket truck and 2 people



Web Based Status Dashboard – Outage Response Team

Normal Conditions

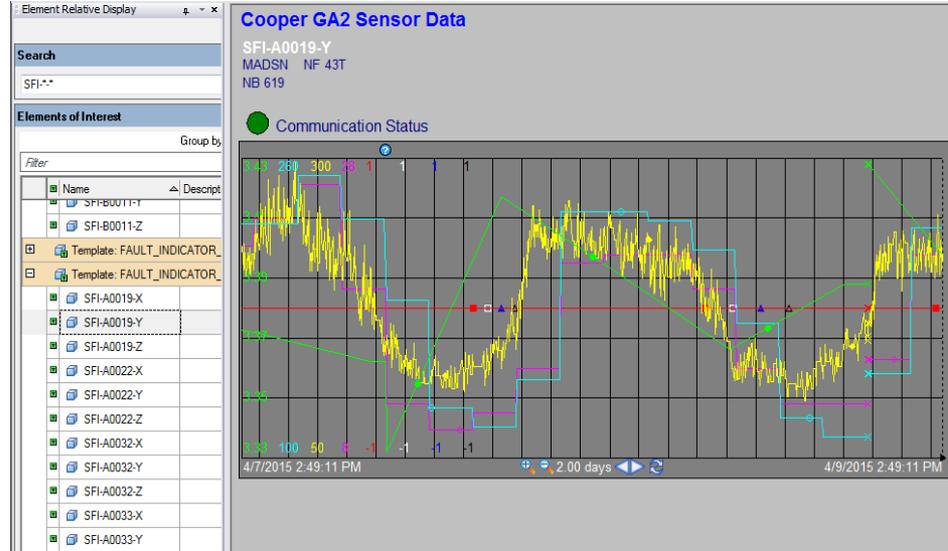
Circuit	SFI	Type	X Amps	Y Amps	Z Amps	Status	Fault	Fault Amps X	Fault Amps Y	Fault Amps Z	Status
<input type="text"/>											ALL
ALNPK1369	SFI-A0118	Tollgrade	252	234	235	●●●	●●●	-	-	-	Normal
ALNPK1671	SFI-A0117	Tollgrade	80	81	55	●●●	●●●	-	-	-	Normal
ALNPK1671	SFI-A0115	Tollgrade	75	73	74	●●●	●●●	-	-	-	Normal
ALNPK1833	SFI-A0116	Tollgrade	145	0	130	●●●	●●●	-	-	-	Normal
ALNPK1916	SFI-A0113	Tollgrade	218	160	197	●●●	●●●	-	-	-	Normal
ALNPK2044	SFI-A0112	Tollgrade	285	229	247	●●●	●●●	-	-	-	Normal

During Fault

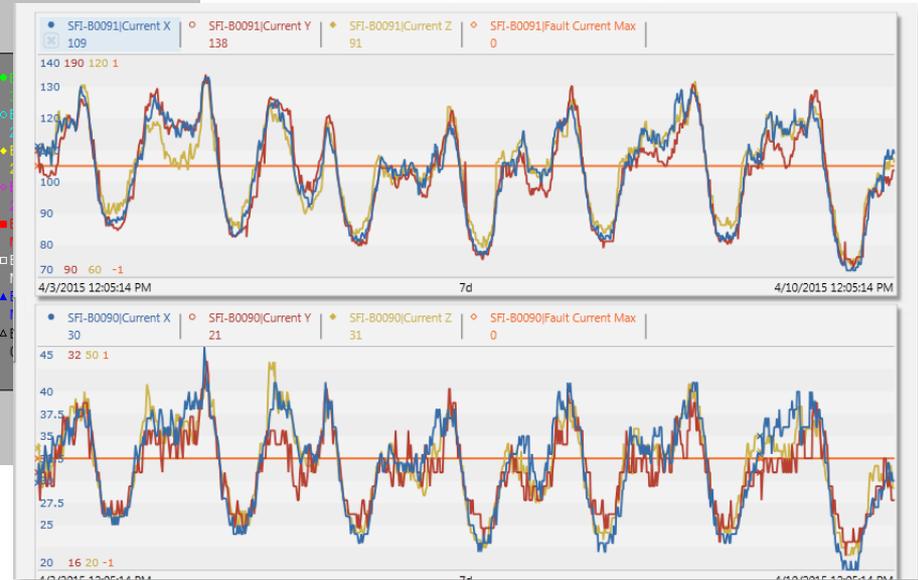
PATON8920	SFI-H0163	42.484643	-83.220885	0	0	25	×××	●●●	×●●	0	0	0	Power Out
PATON8920	SFI-H0160	42.502483	-83.214623	0	0	0	×××	●●●	●●●	0	0	0	Telemetry Error
PATON8920	SFI-H0161	42.502313	-83.214563	0	0	0	×××	×●×	●●●	3520	0	3520	Telemetry Error
PATON8920	SFI-H0162	42.488473	-83.221135	0	0	0	×××	●●×	●●●	0	0	3520	Telemetry Error

Historical Data – Engineers/Planners

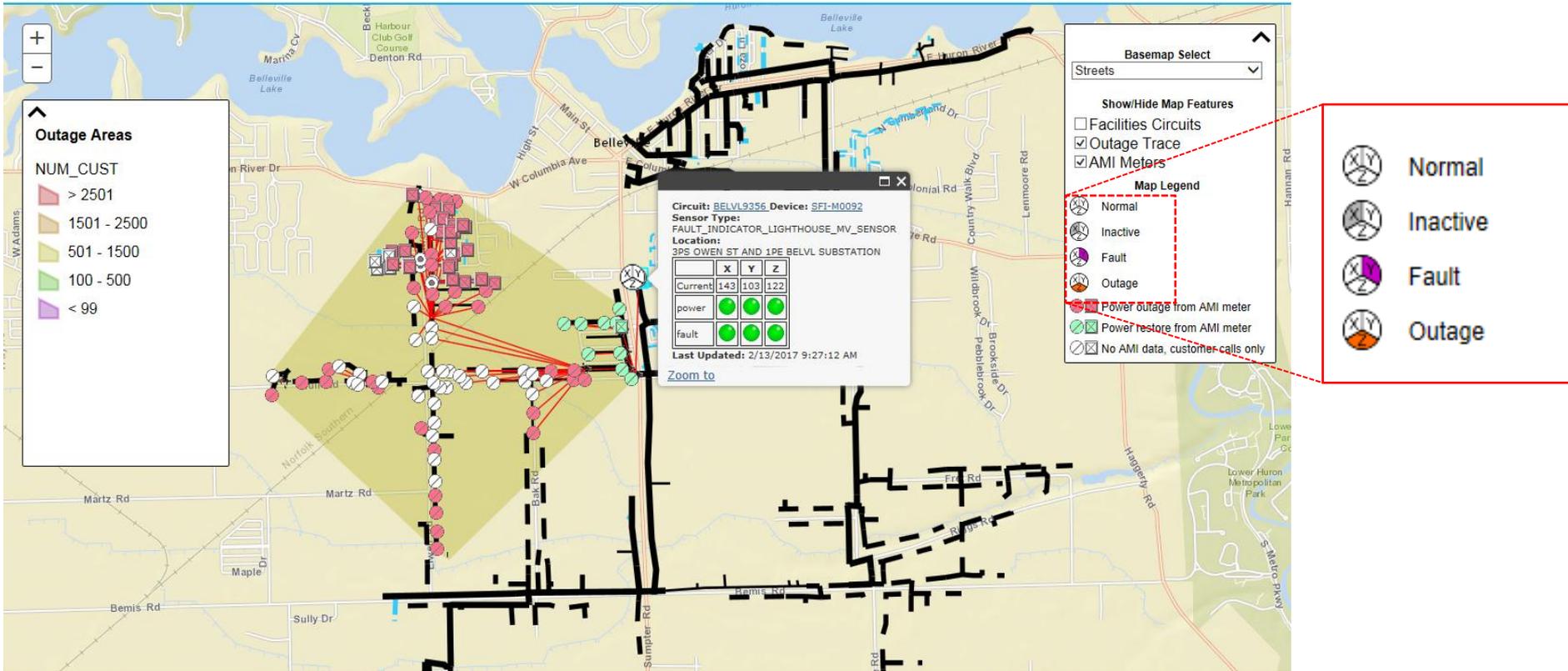
Display used by engineers



Display used by planners



Outage Map – Service Operations and Dispatch



Outage Map – Engineering and Operations

SFI-A0175
TURNR 1189 0

	X	Y	Z
Current	55	122	82
status	●	●	●
fault	●	●	●

Current

- SFI-A0175|Current X 55.1
- SFI-A0175|Current Y 122.3
- SFI-A0175|Current Z 81.7

Power Failure

- SFI-A0175|Power Status X 0
- SFI-A0175|Power Status Y 0
- SFI-A0175|Power Status Z 0

Fault

- SFI-A0175|Fault Status X 0
- SFI-A0175|Fault Status Y 0
- SFI-A0175|Fault Status Z 0

Max Fault Current

- SFI-A0175|Fault Current Max 0

Fault Current (look for step change)

- SFI-A0175|Fault Current X 0
- SFI-A0175|Fault Current Y 0
- SFI-A0175|Fault Current Z 0

Project History

2014

- **95 locations**
- Proof of Concept

2015

- **600 locations**
- AF SDK Map Integration

2016

- **1200+ locations**
- Full scale deployment

2017

- **3000 locations**
- PI Integrator for Esri ArcGIS
- Underground Fault Detection
- CYME project

Eliminated
6.6M
Customer Outage
Minutes

**Avoided
Spending**
\$25M
For equivalent
SCADA solution

DTE Energy: Reliability Through Innovation

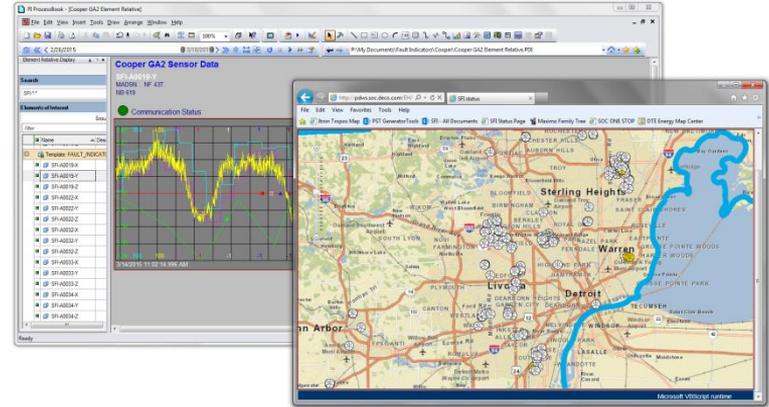
“As an innovative utility, we were looking for solutions to get more real-time reliability data out of our distribution grid, particularly on older legacy and poorly performing circuits.”

“Now that we have better real-time visibility into our grid, we can safely restore power faster and better plan our capital investments around aging assets before they cause outages.”

Vince Dow

Vice President, Distribution Operations, DTE Energy

DTE Energy



Business Challenges

- Determining where to send crews during outages to minimize patrol time
- Integrating data from different types of sensors with multiple backend systems
- Allow crews to visualize real-time sensor data in the field and engineers to visualize historical data in the office

Solution(s)

- Feed all sensor data into PI System using PI Interface for DNP3
- Utilize Asset Framework and Notifications to push events to field and DMS
- PI Coresight and PI ProcessBook to visualize historical data
- Utilize PI Integrator for Esri ArcGIS

Results and Benefits

- Visualization of sensor status on circuit map allows crews to divide circuit into segments and narrow search for faults. Expecting to eliminate at least **6.6 million customer outage minutes annually**.
- History of device operation and circuit data gives valuable visibility into legacy parts of the system. To date, avoided spending **\$25 million for equivalent SCADA solutions**.

Contact Information

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Less Wires, More Data: Harnessing new technology at the network edge

Presented by **Martin Davis, Vice President of IT, J.D. Irving Ltd**
Keith Flynn, President & Founder, RtTech Software Inc.





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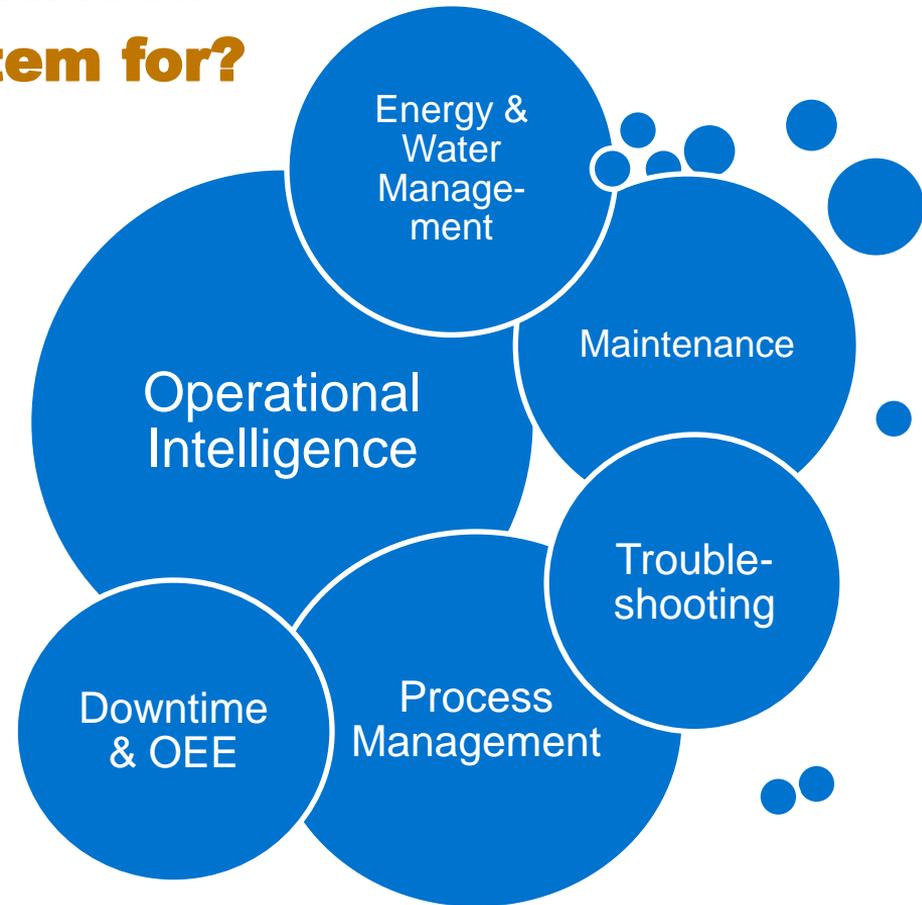
Operational Intelligence

*Powered by **The PI System***

IoT & OSIsoft – J.D. Irving & RtTech

What do we use the PI System for?

- Used across our Manufacturing plants
- Includes:
 - Paper Mills
 - Tissue converting
 - Diaper
 - Frozen Food



IoT & OSIsoft – J.D. Irving & RtTech

IIoT Opportunities

- Capturing information, from anywhere, in real-time
- Optimizing production flow
- Condition-based maintenance automatically creating work orders
- Adjusting production speeds automatically to maximize production while minimizing energy
- Automated vehicles making data-driven decisions
- Transportation and Marine operations

IoT & OSIssoft – J.D. Irving & RtTech

Common Challenges

- Assets not connected to the PI System have no real-time visibility
- What about limitations?
 - Isolated areas of a plant or in the field (outside the plant)?
 - Poor network quality?
 - Mobile assets?
- Or aging or outdated controls with low connectivity?
 - Upgrades are costly. Rip and Replace
 - Networking and installation significant

IoT & OSIssoft – J.D. Irving & RtTech

RtTech Relationship

- RtTech and JDI are long term partners
- JDI helped design & develop RtDUET
- RtDUET and RtEMIS key components of our architecture
- Piloting Cipher
 - Scalable IIoT solution
 - Connect more to PI

RtDUET
INCREASE ASSET UTILIZATION.

RtEMIS
ELIMINATE ENERGY WASTE.

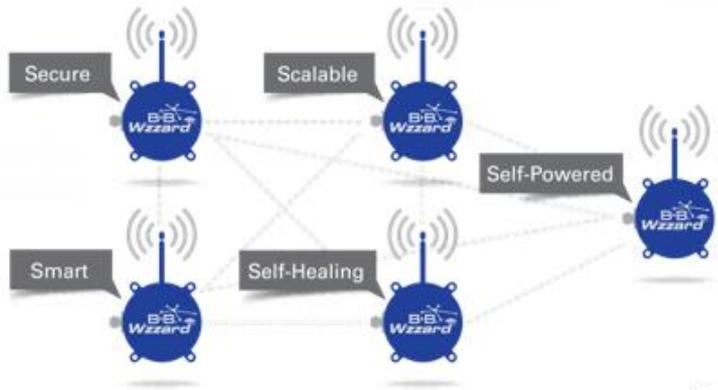
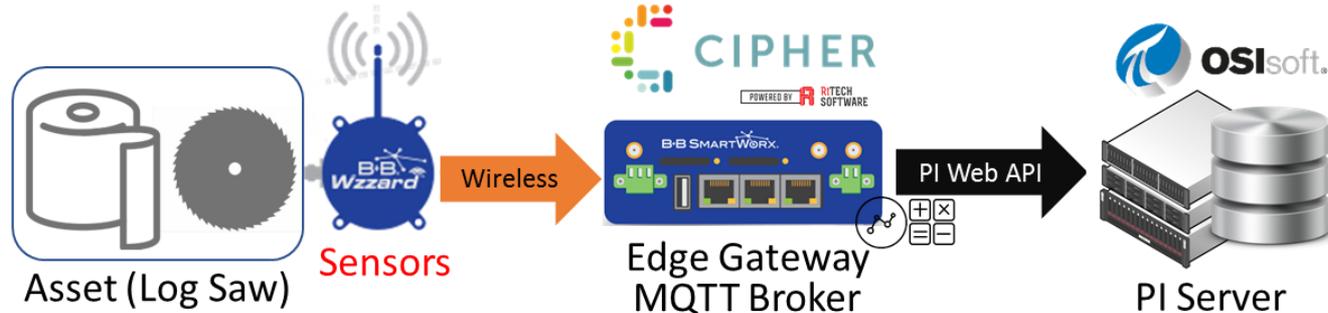
CIPHER
POWERED BY **RT** RITECH SOFTWARE
IoT application Software

- Cipher is a drop-in Industrial IoT solution
 - Cost effective “No Rip and Replace”
 - Data from remote assets, integrated in real-time into the PI System
 - **Seamless integration to your existing PI system**



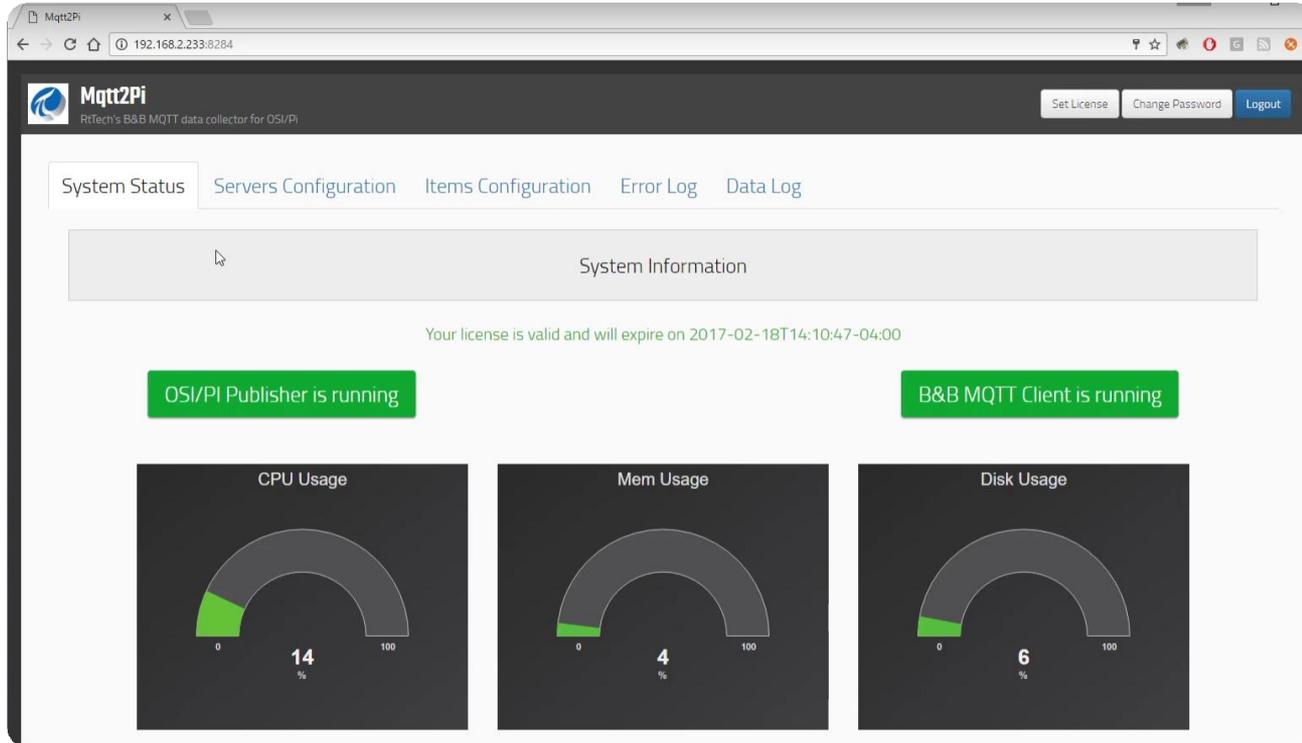
IoT & OSIsoft – J.D. Irving & RtTech

Solution: Less Wires, More Data



IoT & OSIssoft – J.D. Irving & RtTech

Cipher Connect Embedded Web



Monitor 10 Assets:

\$1000 per PLC CAPEX

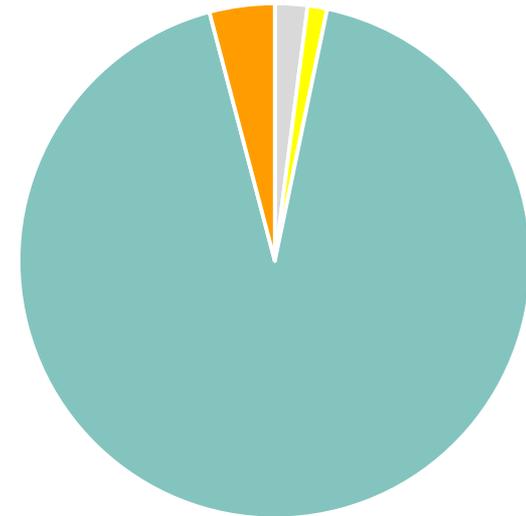
\$300 per device installation

\$15/ft cabling/conduit & installation

\$1000 System commissioning/test

Total Project = \$31,500

“The main cost of an asset monitoring system isn’t the system itself, but the cabling deployment costs.”



- PLC
- PLC Install
- Cabling & Installation
- System Commissioning/Test

Wired vs Wireless: Savings

Monitor 10 Assets:

\$600 Wzzard Gateway

\$300 Gateway Installation

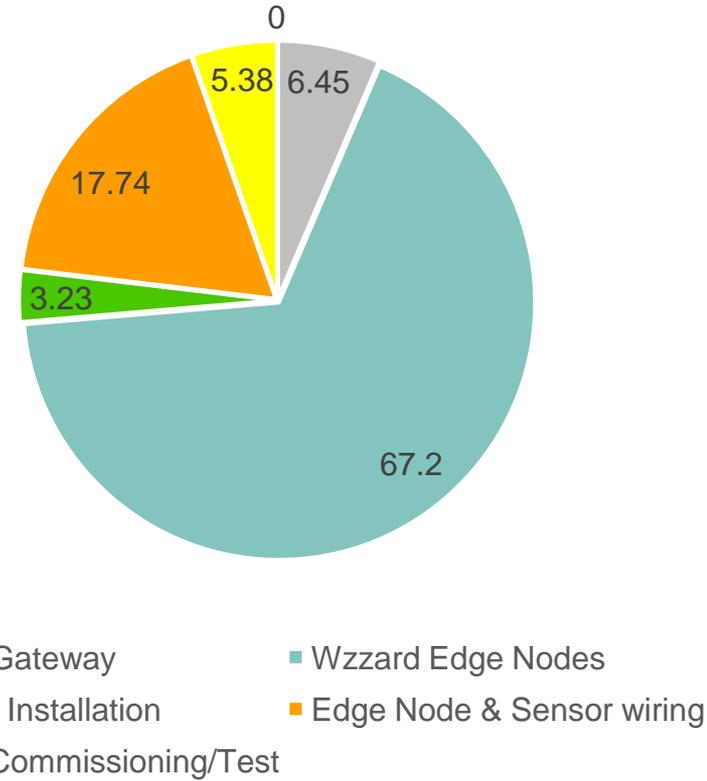
\$6250 – 13 Edge Nodes

\$1650 Edge Node/Sensor Install

\$500 commissioning/ test per site

Total Project = \$9,300

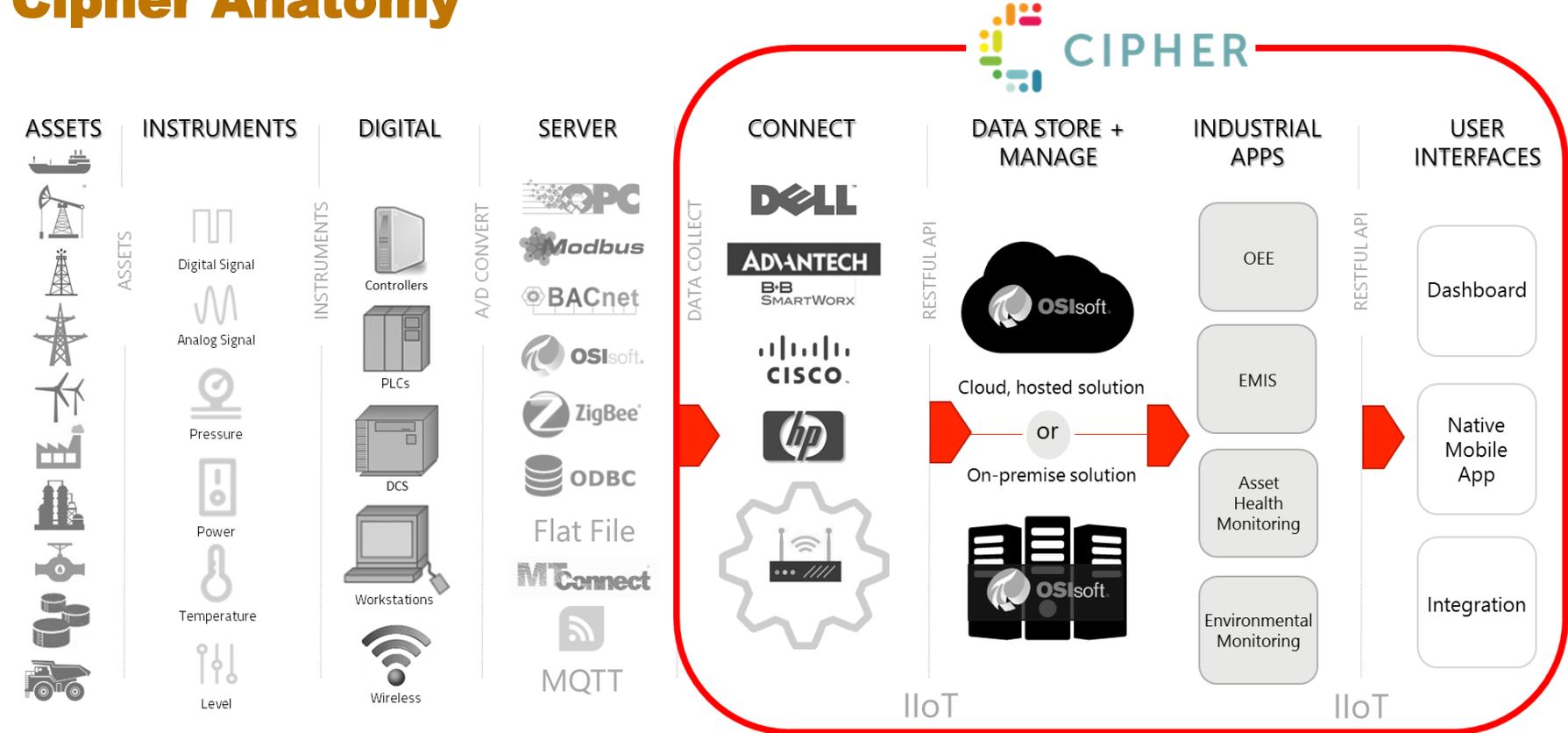
\$22,200 in savings, nearly 70% !



- Wzzard Gateway
- Gateway Installation
- System Commissioning/Test
- Wzzard Edge Nodes
- Edge Node & Sensor wiring

IoT & OSIsoft – J.D. Irving & RtTech

Cipher Anatomy



Contact Information

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Questions

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

State your **name & company**





THANK
YOU