T&D Introduction

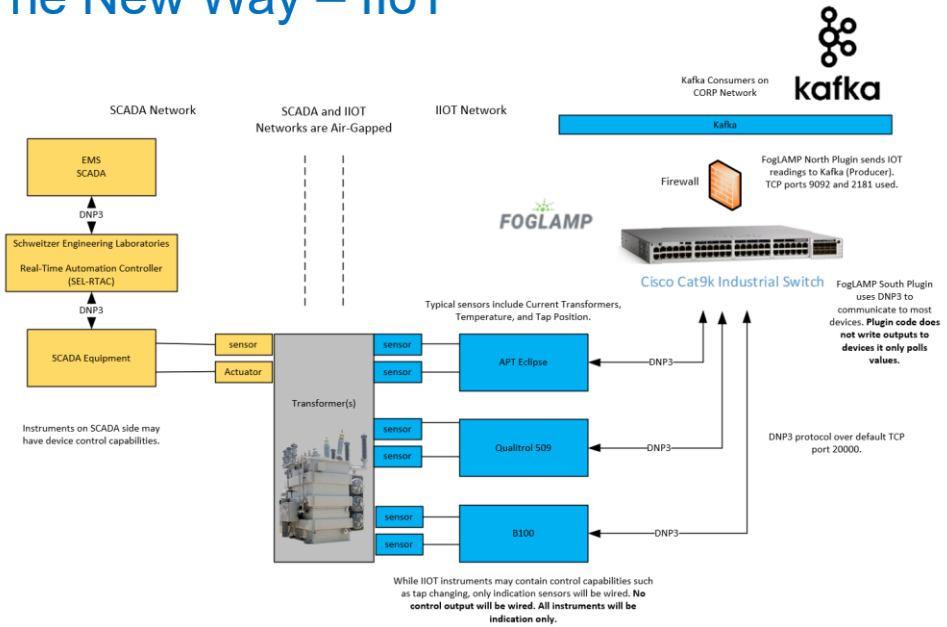
JEA IIOT Progress with FogLAMP

Michael Eaton and Rob Raesemann

The Old Way – Traditional OT Integration

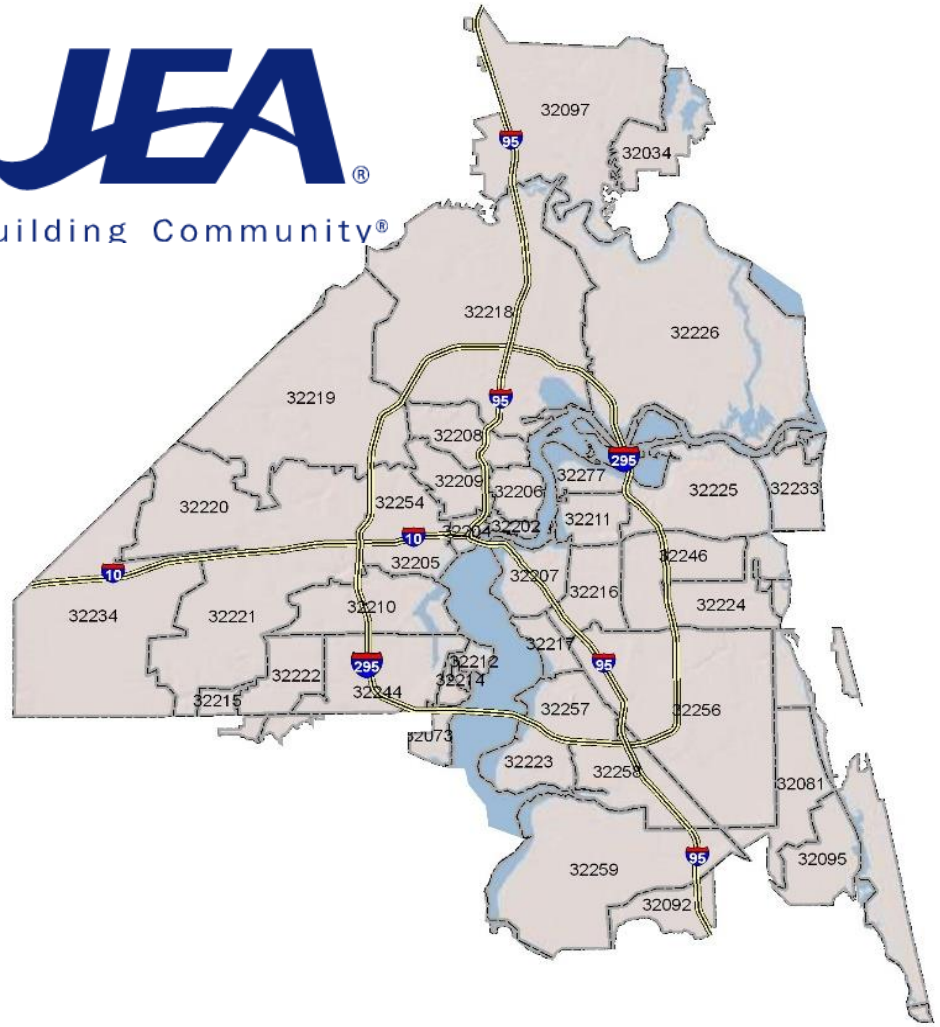
The limits to traditional approaches to OT integration encountered while trying to solve business needs for condition based maintenance necessitate a new approach. Our use of the IIOT framework, FogLAMP, demonstrates its ability to satisfy our use cases.

The New Way – IIoT



JEA at a Glance

JEA Building Community®



- Electric, Water and Sewer Utility of Jacksonville, Florida
- 8th largest municipal electric utility in the US
- Service area approximately 900 square miles
- 7000 miles of electric distribution line – 56% underground
- Customers:
  - Electric – 470,000
  - Water – 350,000
  - Sewer – 272,000
- Approximately 1900 employees
- 2019 System Peak:
  - 3105 MW Winter
  - 2771 MW Summer

New or improved technologies have forced changes to business models

- Available consumer products for energy efficiency are cheaper and improving exponentially.
- Greater push from regulators and political groups for clean energy.
- Stakeholders expect greater operating efficiencies, customer, and community service.
- Greater reliability and lower operating costs with reduced staff.







JEA Record of Innovation

- We did IT/OT integration before anyone knew what it was
- Central Enterprise PI System implemented in the late 90's
  - Electric Generating Plants
  - Electric Transmission & Distribution
  - Potable and Waste Water Systems
  - Neural Network Predictive Models for Electricity and Water Demand
  - Well Field Pump Optimization
  - ML Models for Combustion Optimization

Why IIoT?

Drivers

- Historic IT/OT Integration Techniques have inherent limitations
  - Cybersecurity
  - Change Management
  - Operations Prioritized
- Reduced Cost of Computer Power and Sensors is fundamentally changing the equation
- Business Units More Aware of Technology Options
- No Longer Driven Primarily by Operations
  - Asset Management
  - Customer Interaction/Customer Facing
  - Performance

Effects

- Much Larger Number of Data Streams/PI Data
- Increased Volume of Data
- Increased User Demand
- We Used to Push, Now We are Pulled
- More diverse data streams. Not everything is just a tag.

Why IIoT?

SCADA

- Mission – Control System for Safe and Reliable Operation of Critical Assets
- Focus – Five/Six Nines & Do Not Disturb
- Primary Consumers
  - Operations
  - Operations
  - Operations
- Tradeoffs
  - Limited Network/Compute Resources
  - Expensive
  - Limited Data Collection
  - Legacy Computer Architecture
  - Heavy Compliance/Audit

IIOT

- Mission – Maximize Information for the Business
- Focus – Collect, Process, Analyze all Data
- Primary Consumers
  - Operations
  - Engineering
  - Maintenance
  - Business
- Tradeoffs
  - No Control
  - IT Reliability and Security
  - New and Different

IIoT Drivers – Clouds and Services

- Business Units discover “Cloud” offerings that solve a problem (We are Pulled)
  - Vendor has their solution to collect data and stores in “The Cloud”. Data becomes siloed.
- Problems
  - Who owns the data?
  - How to integrate with standard BI tools?
  - How to combine with other company data?
  - How do other users even know that this data exists?
- We Would Like to Address These Issues at Scale

IIoT Drivers – Advanced Use Cases

- Condition Based Maintenance
  - Ubiquitous sensors and lowered monitoring costs enable monitoring that was previously prohibitively expensive.
  - Run it until it breaks is too expensive
- Enhanced Situational Awareness
  - Cheap data networks and computing allows collection of data from distributed sources like never before.
- Data Integration
  - Data Silos are not acceptable
  - Users expect all data to be readily accessible and to integrate with existing tools.

IIoT Drivers – Requirements

Open Hardware and Software

- Fast, Efficient, Cheap

Modern Protocols

- Accommodate slow intermittent links when needed
- High throughput when needed
- Open and Standards-Based
- No Numerical Address to Tag Mapping
- Values in Engineering Units – No need to scale on client side
- Secure – Support Encryption and Certificates
- Reduced Latency
- Support multiple data types for facilitate new use cases (vibration, video)

Separate Networks

- Focused on Data Collection
- Reliable but Not Mission-Critical
- Reduced Regulatory Burden
- Streamlined Change Management
- Faster to Modify and Change as Needed

Edge Processing

- Intelligence Spread Out at the Edge, Not Stacked on a Central Server
- Incorporate Open Source Tools, ML Libraries

Interoperability

Open REST-based API's

Enterprise Scale Management

- Containerization
- Monitoring
- Upgrading and Patching
- Commercial Support, Training

Specific Use Case – Electric Transmission & Distribution

- **Problem** – Expensive equipment failures that could have been prevented if more information available. A single incident can cost over $1 million.
- **Opportunity** – Relatively inexpensive sensors are available to collect information that could prevent failures.
- **Challenge** – Tens, Hundreds, Thousands of these new inexpensive sensors will need to be integrated into the network

The Old Way – Traditional OT Integration

"You want to put how many devices on the network?"

"We'll take a few of the tags, but not everything."

Edge Device

Rich Data Stream of Sensor Information from Edge Devices

Existing Industrial Control Systems

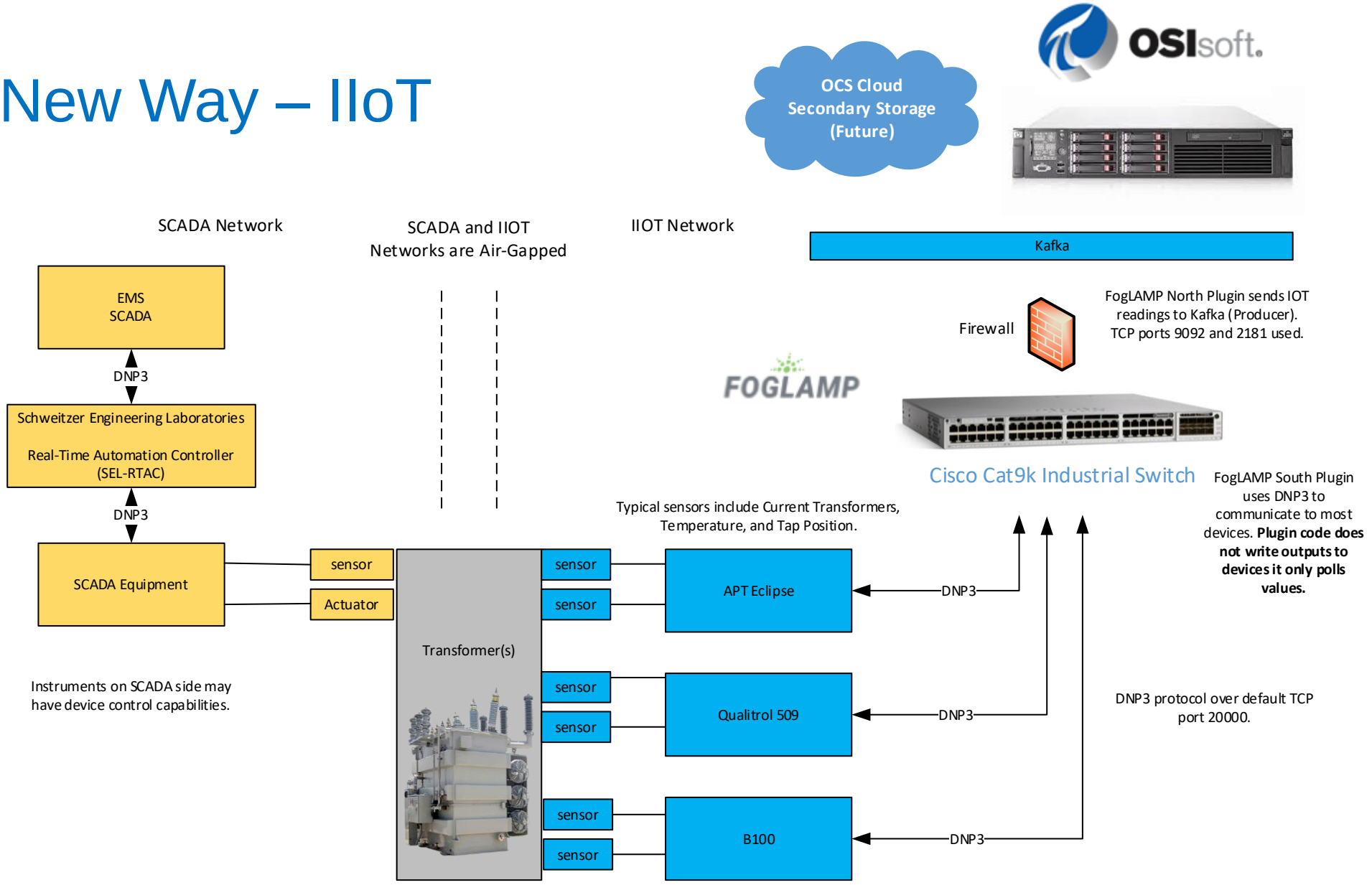
"We don't have enough licensed tags to hold all of that information."

"We have enough trouble managing our network already and this information is not critical to system operation."

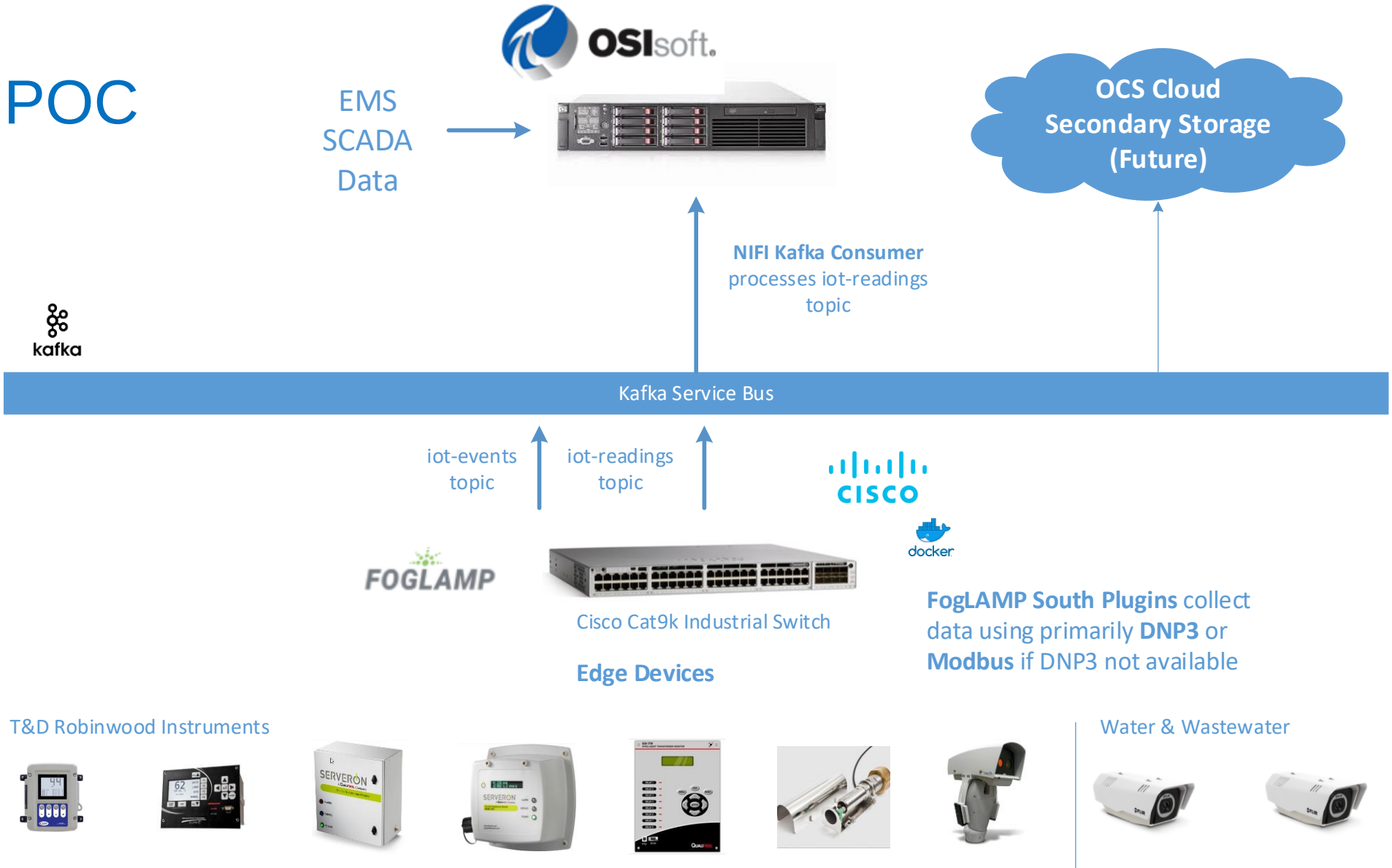
"I don't think we can talk to that."

"Load is high, we are hands off this week."

The New Way – IIoT



IIOT POC



Eventual Scale – T&D

- **Substations**
  - Approximately 70
  - 4 types of sensors/substation (Currently testing more than one of each type)
  - Approximately 30 sensors/substation
  - 70 FogLAMP instances deployed (one/substation)
- **Tools to Scale up, scale out and secure**
  - Templatized Deployment
  - Evaluating Dianomic's FogMAN
  - Security
    - SSL to Kafka (data in motion)
    - Separate secured networks at each substation with firewall
    - FogLAMP nodes password secured

Our Experience with FogLAMP

- Getting started
- User interface, configure, provision
- User/developer training
- Ease to build
  - Data mappings
  - South protocols
  - North integrations
  - Filters, Rules, Events
  - Applications

Challenges

- **The Technology is not the Hard Part**
  - Almost too many options
- **Used to Managing Proprietary Solutions**
  - Open Source is a new Thing for OT and the Utility Industry (risk averse)
  - Community Development – Good strategy to address the diversity of equipment in industrials
  - Support
  - Training
- **Training**
  - More advanced skillset is required
- **Even with separate networks, security is a larger concern in industrial environments than a generalized IOT solution.**
- IIoT at Industrial Scale requires supporting more different types of devices than generalized IOT.
- IIoT requires supporting different types of signal processing (vibration, acoustic, IR video)
- **Vendor Balkanization**
  - Everyone has their own cloud and standards
  - Some vendors are not there yet – Old Legacy Equipment
  - We propose our open-source solution, FogLAMP

FOGLAMP

Future Use Cases

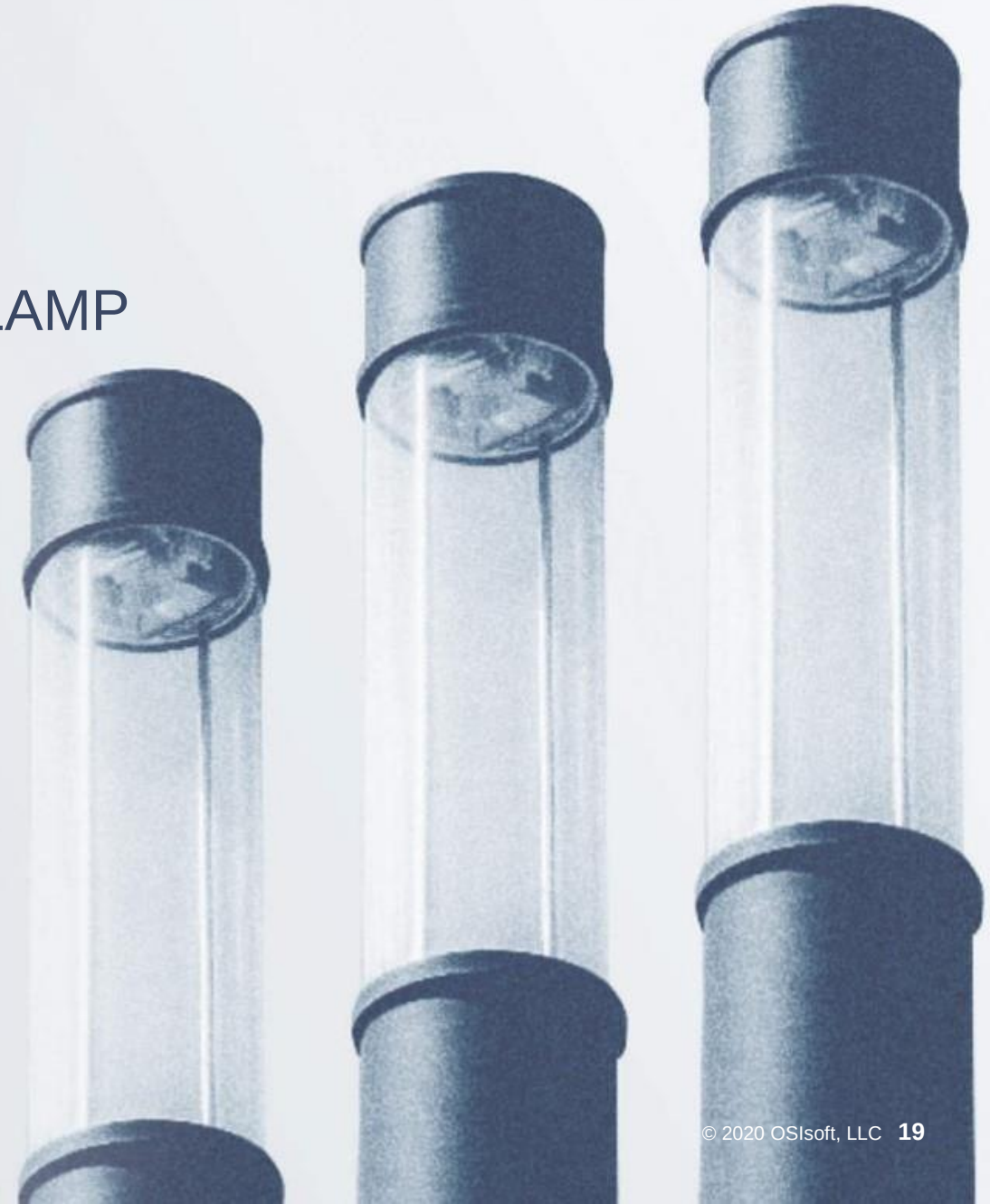
- **Other Business Units**
  - Water/Wastewater
  - Electric Generation
  - Renewables?
- **FLIR Infrared Cameras**
  - Touchless Temperature Monitoring
- **Vibration Monitoring**
  - Requires high-speed sampling
  - Edge analysis – Fourier Transforms and other algorithms
- **Commercial support and training from Dianomic**
- Tools to manage and secure at scale from Dianomic, Zededa, IBM and Intel.

- **We like that FogLAMP is focused on industrial use cases and needs**

FOGLAMP

Thank you

JEA IIOT Proof of Concept Progress with FogLAMP



Michael Eaton and Rob Raesemann

Michael Eaton

- Michael Eaton graduated with an engineering degree from Clemson University. The last twenty years of his career has been in the utility industry.
- As a strong engineering professional, his skills and knowledge include the Smart Grid, SCADA, IT Strategy, Integration, and Enterprise Architecture. He has acquired experience with developing architectures, IT strategies, and governances to align with the utility's business goals.
- Eaton managed software application service delivery for key essential enterprise business applications - GIS and Asset Management systems and has implemented process control optimization applications in electric production and water production using ML/AI methods and technologies.

Rob Raesemann

- Rob Raesemann graduated with an electrical engineering degree from the University of Florida.
- He has spent the last 20 years as a technology consultant concentrating on IT/OT integration in many industries such as electric generation, electric transmission and distribution, water and wastewater, mining, manufacturing, pharmaceuticals, and marine.
- He has worked extensively with the OSIsoft PI System for 24 years on varied projects from global rollouts to application development.