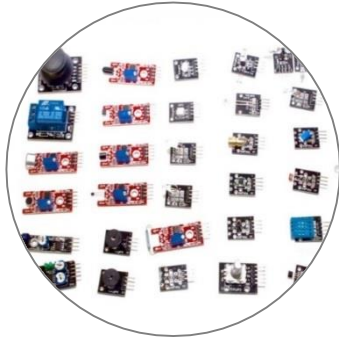




IIoT Enables Digital Transformation



Cheap, and tiny
sensors



Decreasing compute
and storage costs



New abilities to
process and analyze
data



Ubiquitous
connectivity

Sensors on the Entire Supply Chain will
Automate and Transform Business

Challenges

- » Industrial SCADA systems are secure and reliable but also
 - » Tightly regulated/controlled
 - » Geographically challenging
 - » Expensive
- » Massive Fragmentation and Complexity in Sensors
- » Large Brownfield needs to be supported/extended

Dianomic simplifies IIoT data by supplying **FogLAMP**, an open source sensor-to-cloud fabric that connects people to the data they need to operate their business.

Predictive Maintenance

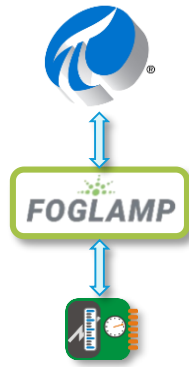
- » In Industry, Efficiency is Everything
- » Maximizing Asset Availability/Usage is Critical
- » Strategies
 - » Reactive Maintenance (Run-To-Failure)
 - » Failures are a surprise, and resolving creates emergencies
 - » Preventive/Proactive Maintenance
 - » Down-time during maintenance/inspection
 - » Significant cost of maintenance
 - » Can still have surprise failures
 - » Predictive Maintenance
 - » Use advanced data analysis to predict when equipment needs maintenance
 - » Reduced downtime and cost



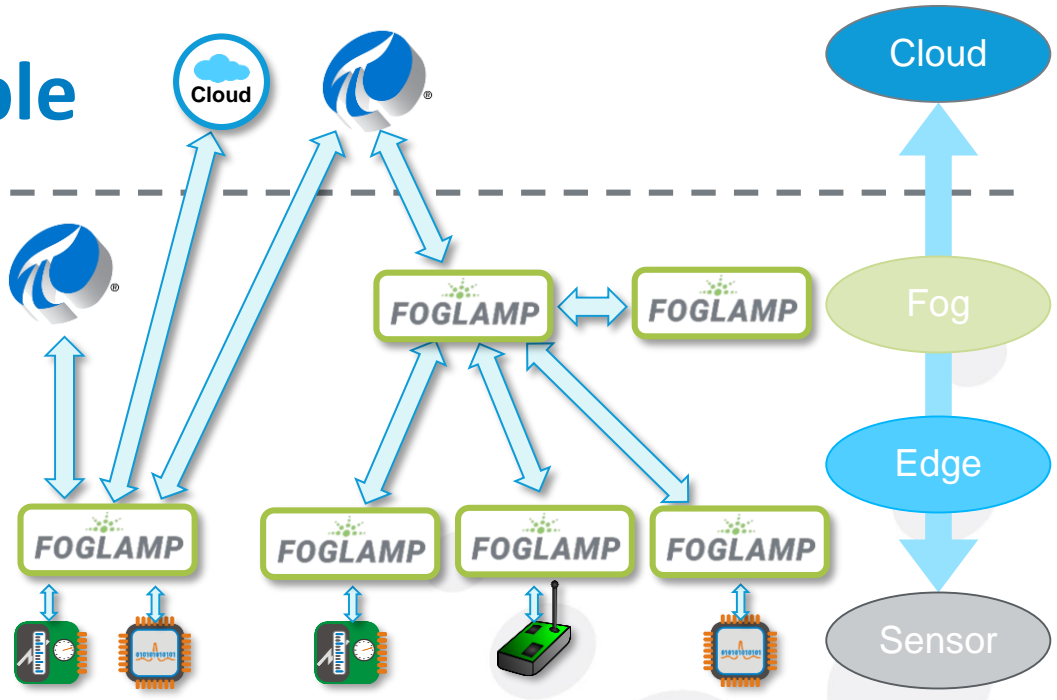


- ➔ Collect Data
 - from any/all sensors
- +
- Aggregate
 - combine and organize data
- ↻ Pre-Process
 - filter and transform data in-flight
- 🗄 Buffer
 - reliability for poor connectivity
- 📈 Edge Analytics
 - visualize data on the edge
- ➔ Deliver Data
 - to multiple local/cloud destinations

Flexible and Scalable



FogLAMP is a single device solution or...



Multiple Sensors

Multiple Destinations

Hierarchy or Mesh

Redundancy / Fail-Over

Pre-process & Buffer Data at all Layers



- » Reliable and Resilient – like a cable modem
- » Low-Effort Provisioning and Maintenance
- » Small (<50m memory required)
- » Fast (15,000 readings/second)

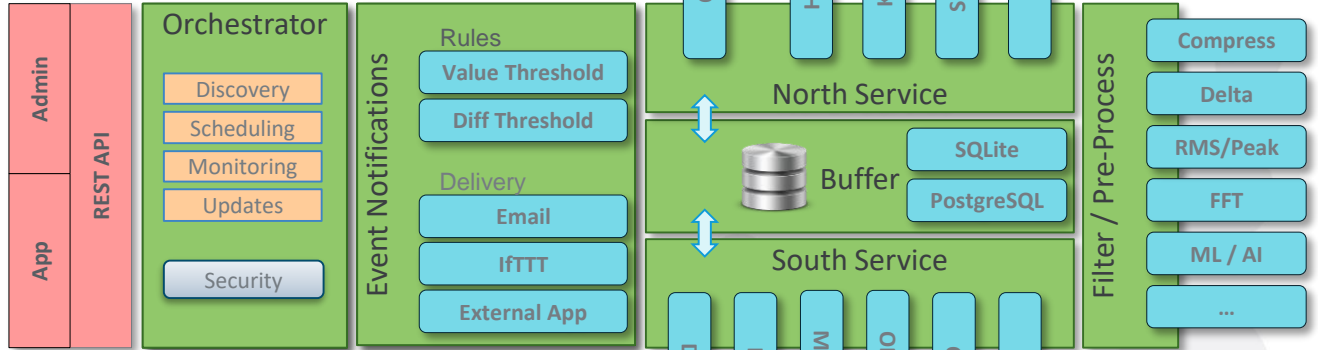
Available on Variety of Industrial Hardware



FOGLAMP ARCHITECTURE



Applications



Legend:

- Micro Service (Green box)
- Plugin (Light Blue box)
- REST API (Red box)

Collect Any Data

- » Many Existing South Plugins
 - » Modbus, OPC-UA, HTTPS, CoAP, MQTT
 - » Assorted directly-connected sensors
 - » PT100 temperature, AM2315 humidity, etc
- » Pluggable – Build Your Own
 - » Easy API and sample code
 - » Build your own
 - » Customize existing plugins
 - » Python or C++
 - » Async or Polled
- » Open Source Community – many plugins in time



Filters, Events and Applications

- » Filter or transform data in-flight
- » Hooks allow access at ingress or egress
- » Python or C++
- » Typical Usages
 - » Filtering (compress data or only send deltas, etc.)
 - » Intelligent Filtering (upon error send last 30 mins)
 - » First-level analysis (Peak detection, RMS, FFT, etc.)
 - » Meta-data transformation
 - » Machine Learning models at the edge
- » Event Alerting at the Edge
 - » Rules – ex. Temperature goes over threshold
 - » Delivery Mechanisms – ex. Email, SMS, Run External App



REST API Access



» Admin APIs

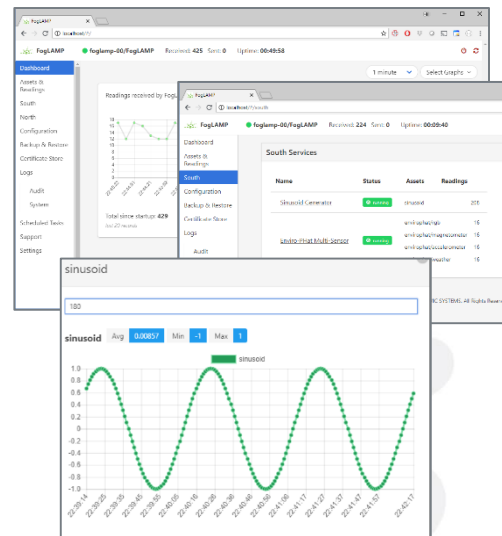
- » All Configuration and Monitoring are possible via REST
- » Build your own Automated Scripts
- » Integrate into existing Management Consoles & Tools
- » All out-of-the-box FogLAMP GUI capabilities delivered via REST

» Data APIs

- » All Asset and Readings info available
- » Build your own Edge Analytics and Visualizations

FogLAMP Management

- » Out-of-the-box FogLAMP GUI
 - » Setup, Configuration, Monitoring, Analytics of a single FogLAMP
 - » Source code is open-source and extensible
- » REST interfaces make it easy to build:
 - » Automated scripts
 - » Your own management consoles
 - » Integration into existing management consoles & tools
 - » All out-of-the-box FogLAMP GUI capabilities are delivered via REST
- » Puppet
 - » Manage at scale with Puppet
 - » Puppet client is available on most Linux's



Implementations

Wind Farm

- **Need:** Predictive maintenance turbine bearings
- **Problem:** Remote, No GE SLA, \$150K per incident, monitored in PI with all other power generation
- **Solution** FogLAMP + Nokia private LTE + Advantech connected to PI
- **Result:** Nokia OEM and Advantech go-to-market FogLAMP contracts

Factory

- **Need:** Exact humidity and temp for autoclaves and paint booths
- **Problem:** Wasted fuselage & wings, monitored by PI w/ rest of factory
- **Solution** FogLAMP + temp and humidity sensors + PI + monitor for workers
- **Result:** First FogLAMP customer. More GA use cases

Energy Co.

- **Need:** Monitor \$M substation transformers before they overheat
- **Problem:** Transformer's sensors too expensive to connect & no easy way to send to PI
- **Solution:** FogLAMP Modbus Input and Substation wifi to PI
- **Result:** 7x24x365 monitor of transformers as component of grid, proactive maintenance

Example: Private Mobile broadband in 42 square miles wind park



Realtime data streams, increased sensor use, fiber replacement



Analytics, performance, failure analyses: 90% operational gains from failed pitch assemblies

Remote worker connectivity for production and also safety



ADVANTECH

DIANOMIC

NOKIA

