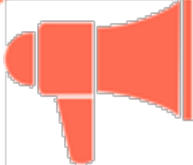# Intelligence at the Edge for Industrial IoT

1

FogHorn Background

Edge Intelligence Software for Industrial IoT

Silicon Valley
Start-Up
Est. 2014

Purpose-Built
Edge
Platform

Key Industrial
Partnerships

Experienced,
Successful
Team

Series A in Q2 2016
Series B in Q4 2017

IIoT and AI Industry Recognition

Gartner Cool Vendor 2017

FROST & SULLIVAN 2017 BEST PRACTICES AWARD — NORTH AMERICAN EDGE INTELLIGENCE-ANALYTICS FOR MANUFACTURING PRODUCT LEADERSHIP AWARD

THE CHANNEL CO. CRN TECH INNOVATORS 2017

IoT BREAKTHROUGH

IoT EVOLUTION IoT Excellence 2017

Hewlett Packard Enterprise | MATTER

#1 Hot IoT Startup to Watch in 2017

THE CHANNEL CO. CRN IoT INTERNET OF THINGS 50 2017

CIO Review 20 MOST PROMISING ARTIFICIAL INTELLIGENCE SOLUTION PROVIDERS - 2017

appcessories
10 Internet of Things Companies to Watch

1. Qualcomm
2. Cisco
3. Intel
4. **FogHorn Systems**
5. Amazon Web Services
6. Microsoft
7. Everythng
8. Google
9. Tesla
10. IBM

THE CHANNEL CO. CRN

The 10 Coolest Tech Startups of 2016

CB INSIGHTS THE AI 100 2018

Ascendancy of Edge Computing

The Rise of the Internet of Things

...IoT devices will grow to as many as 30 billion devices by 2020.

McKinsey & Company. Image: Goldman Sachs.

Industrial Internet

Connected Cities

Connected Homes

Connected Cars

Wearables

Manufacturing

Transportation

Utilities

Oil & Gas

Healthcare

FOGHORN
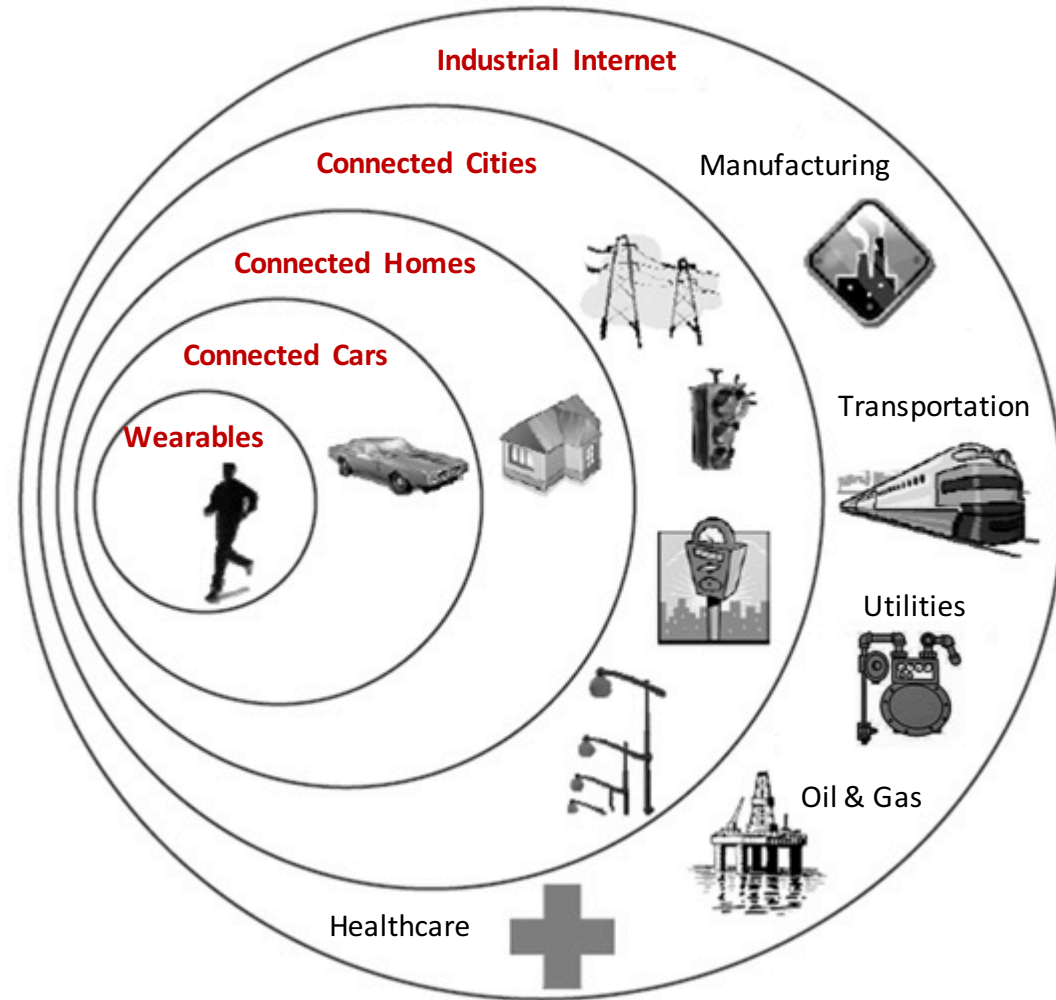
Industrial IoT Data Volume Overwhelming

Edge intelligence will drive real value in Industrial IoT

Less than 1 percent of the data being generated by the 30,000 sensors on an offshore oil rig is currently used to make decisions.

McKinsey

Edge solutions are critical for IoT

Cloud models are not designed for the volume of data IoT generates.

Cisco

"Things" generate more data every day[1]

1 PB	Mining
480 TB	Jet engine
24 TB	Automated manufacturing
1 TB	Large refinery
0.8 TB	Large retail shop
0.5 TB	US Smart meters

FOGHORN

Edge Advantage

Maximize insight by analyzing real-time asset data
- Streaming ML
- Clean diverse/noisy OT data for maximum insight
- Determine sensor health in real-time

Apply your best intelligence to the Edge
- Update models on-the-fly
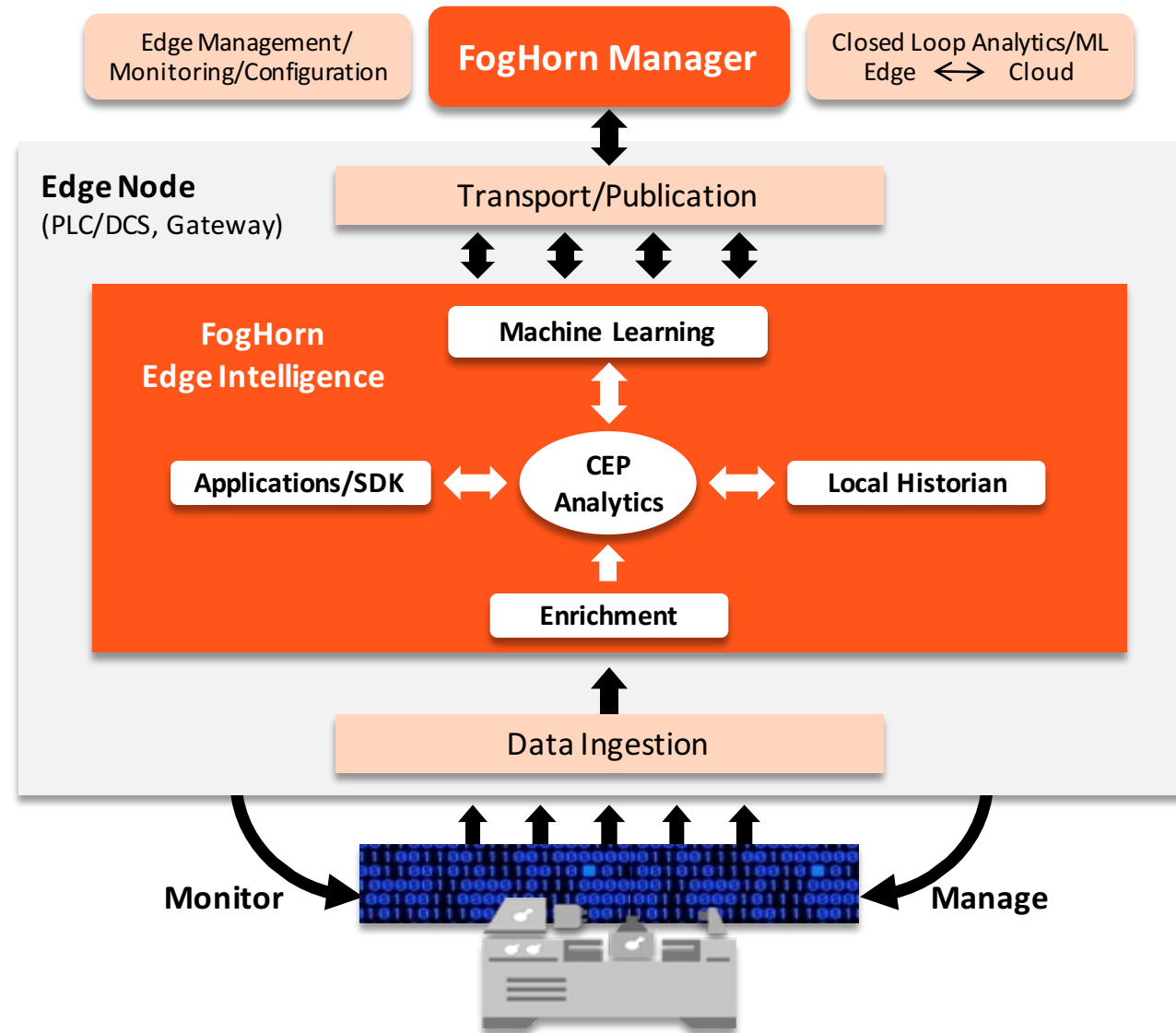- Deploy with confidence

Optimal Edge performance
- Sub millisecond decisioning enables new applications
- Compact, commodity hardware/software foundation, No FPGA

Edge computing shifts processing from central servers or a cloud to the asset. This enables richer data, faster reactions, and lower bandwidth requirements.

FogHorn Edge Intelligence for Industrial IoT

Edge Management/
Monitoring/Configuration

FogHorn Manager

Closed Loop Analytics/ML
Edge ⟷ Cloud

Edge Node
(PLC/DCS, Gateway)

Transport/Publication

FogHorn
Edge Intelligence

Machine Learning

Applications/SDK ⟷ CEP Analytics ⟷ Local Historian

Enrichment

Data Ingestion

Key Customer Benefits
- Lowers bandwidth/hosting costs
- Triggers real-time insights
- Enables proactive use cases
- Maximizes security and privacy

FogHorn Differentiators
- Tiny footprint
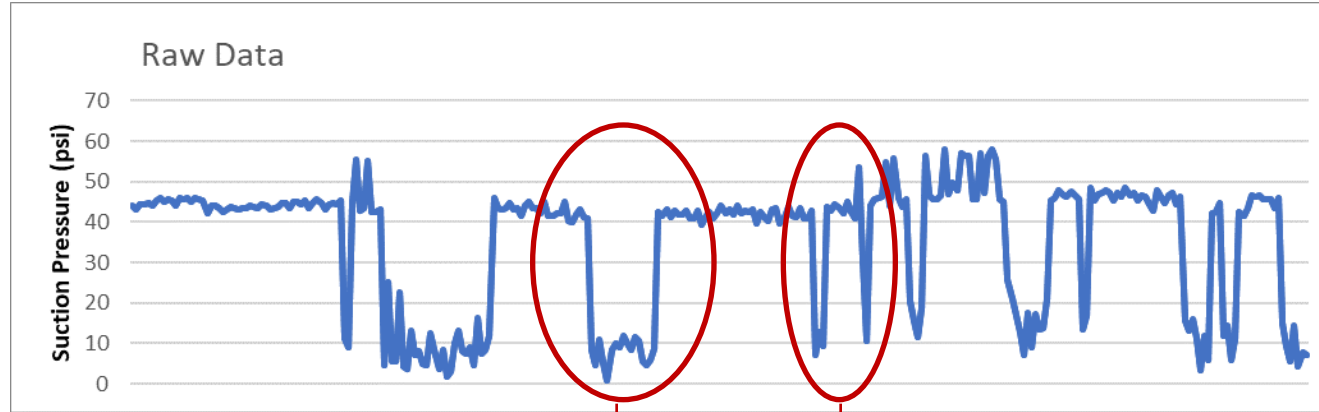- OT-centric
- Cloud agnostic

Main Use Cases
- Condition Monitoring
- Predictive Maintenance
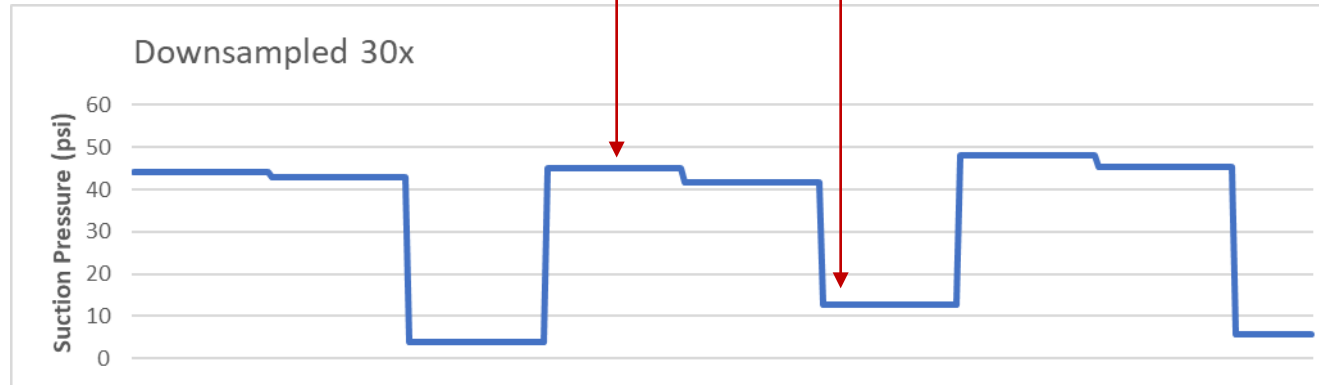- Asset Performance Management
- Industrial Process Optimization

Monitor

Manage

Edge Processing Advantages for Analytics/ML

Edge (GB's)

Raw Data

Suction Pressure (psi)

70
60
50
40
30
20
10
0

Significant events missed

Insignificant events (sensor fluctuations) appear significant

Cloud (MB's)

Downsampled 30x

Suction Pressure (psi)

60
50
40
30
20
10
0

Control logic, streaming analytics and ML inferences achieve far higher fidelity on live data
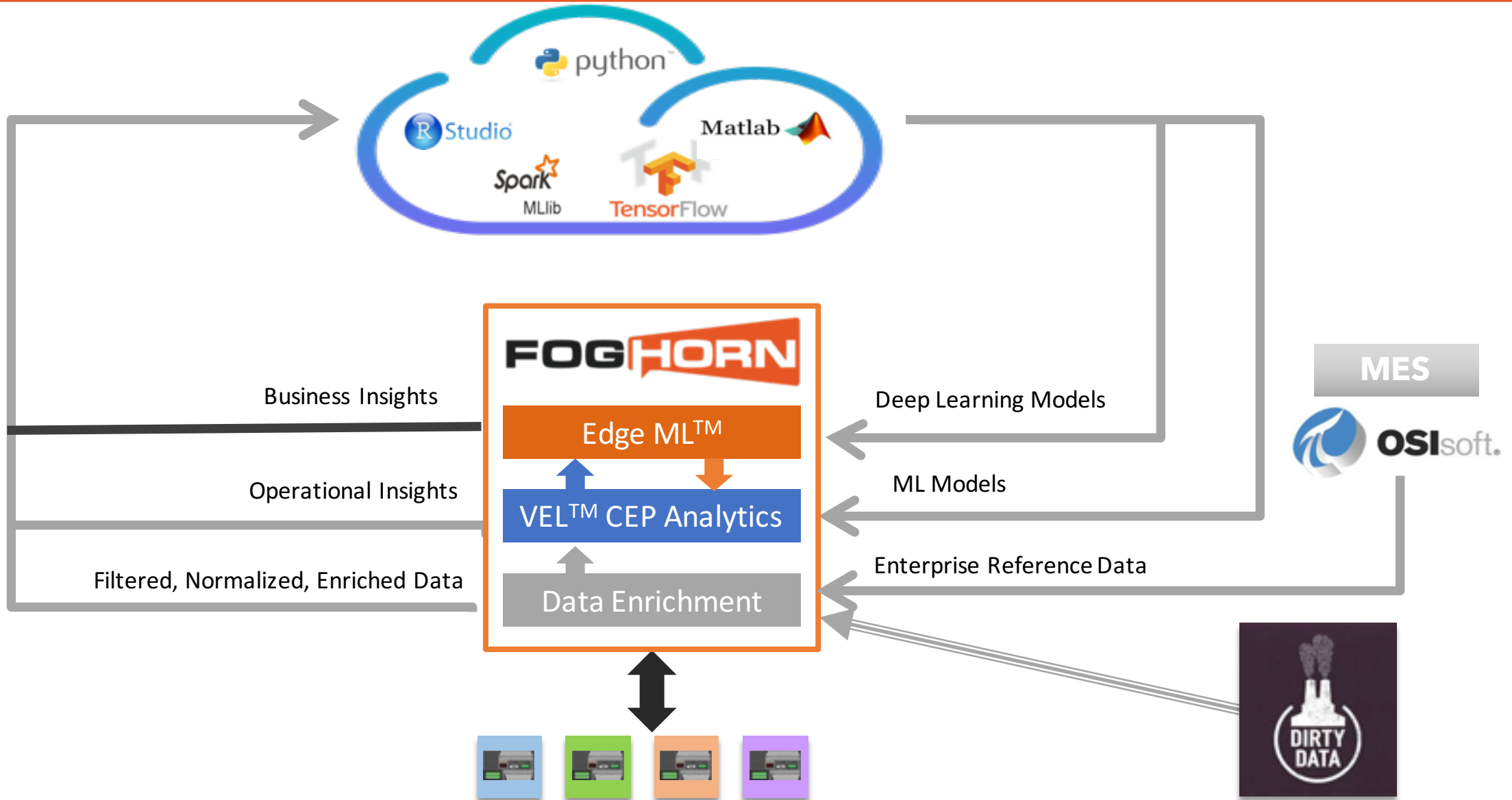
Edge processing delivers:

- **Higher quality, cleaner data**
- **Reduction in false positives**
- **Maximum insight**
- **Faster response**
- **Better inferences**
- **Fault tolerance**

Closed Loop Machine Learning

FogHorn IIoT Partner Ecosystem

Industrial Solution Providers

Cloud Infrastructure and AI/ML Companies

IIoT Consultants and SIs
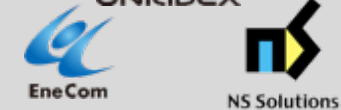
IIoT Semiconductor Developers

IIoT Gateway Suppliers

Industrial IoT Use Cases

Manufacturing APM and Process Intelligence

Drilling Equipment Predictive Maintenance

Pipeline Leak and Corrosion Detection

Compressor/Valve Predictive Analytics

Pump Condition Monitoring and Predictive Maintenance

Turbine Performance Monitoring and Optimization

Renewable Energy Output Forecasting

Wind Turbine Optimization anf Predictive Msintenance

Mining Equipment Tracking And Asset Optimization

Locomotive Fuel Consumption and Remote Monitoring

Smart Cities and Smart Buildings

Intelligent Real-Time Health Monitoring

Improving Capacitor Production Yield

ANALYTICS/ML ON WINDING MACHINE DATA DETECTS EARLY DEFECTS

CHALLENGE

- Hard-to-detect failure conditions reducing yield and increasing scrap
- No real-time monitoring of large amounts of sensor data
- No OT-centric analytics for manufacturing team members

FOGHORN SOLUTION

- FogHorn VEL™: Real-time analytics on winding machine sensor data
- EdgeML™: ML on normalized data streams for real time failure alerts
- Iterative refinement of VEL analytics and ML models to assist operators

BENEFITS

Improve yield, reduce scrap

Deliver real-time analytics to OT staff

Smart, not scheduled, maintenance

FOGHORN

Automated Flare Stack Monitoring

REAL TIME VIDEO ANALYTICS AND ROOT CAUSE CORRELATION ANALYSIS

CHALLENGE

- Monitor large number of flare stacks
- Limited communications / compute resources
- Ensure compliance with environmental/regulatory requirements
- Reduce large spend on maintenance and compliance

FOGHORN SOLUTION

- FogHorn installed into existing gateways (<1Gb)
- Real time audio / video analysis of flare feeds
- Convolutional neural networks (CNN) for deep learning
- Sensor fusion correlate flare state with compressor audio

BENEFITS

Lower Opex and maintenance costs

Broad compliance monitoring

Improved safety

Locomotive Operational Efficiency

ON-BOARD ANALYTICS DRIVE CENTRALIZED OPERATIONAL OPTIMIZATION

CHALLENGE

- Optimize fuel usage
- Detect sub-optimal operating conditions
- Reduce mobile networking costs of monitoring

FOGHORN SOLUTION

- FogHorn installed into on-board hardened data collection systems
- RT analytics on idling & throttle data based on location, speed & time
- Proactive alerts sent to command centers for operational optimization
- Video only sent on abnormal conditions reducing cellular costs

BENEFITS

Reduction in fuel and cellular costs

Optimize crew and train performance

Ensure safe operating conditions

Optimizing Elevator Performance

50+ ML MODELS ON TINY CONTROLLERS DELIVER PREDICTIVE MAINTENANCE

CHALLENGE

- Monitor 1.5M+ elevators / escalators deployed globally
- Limited communications / compute resources
- Mine sensor information for actionable insights
- Reduce inspection / repair fees of ~ $2K/event

FOGHORN SOLUTION

- FogHorn installed on existing motion sensor kits, <1 Gb footprint
- CEP time-aligns state and activity data in <20 lines of code
- 40+ ML models generate predictive maintenance alerts

BENEFITS

Smart, not scheduled, maintenance

Reduce costly repair and servicing

New managed service revenue

Wind Farm Output Forecasting

REAL TIME TURBINE CONTROLS-DRIVEN MACHINE LEARNING FORECASTS

CHALLENGE

- Monitor large volumes of windmills
- Limited communications / compute resources
- Accurately predict, report and meet 24 hour power generation goals

FOGHORN SOLUTION

- FogHorn installed into existing gateways
- Models trained on 20+ attributes to predict power generation
- Real-time scoring on power generation with alerts for problems
- Enables technician tuning of settings or revised forecast

BENEFITS

Alerts with 90 minutes lead time

Constantly updated power forecasts

Ensure government compliance

Intelligence at the Edge for Industrial IoT