New mobile equipment solutions

for enhanced operational performance

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The challenge…

Bringing in mobile equipment into operational views – either because…

1. *TSP's offer a canned set of applications/solutions that don't match needs*
2. *Integrating other equipment into a common operating view was cost prohibitive*

Target Use Cases

- PI Customers who want to expand their operational view to the supply chain assets
- Transportation companies looking for flexible solutions
- Service Providers delivering service level agreements that rely on mobile equipment to deliver

A flexible option for broad range of equipment

Fit for purpose hardware

Support for ancillary equipment

Flexible data collection plan

Edge analytics and local app support

Compared to other solutions?

+

+

FOGLAMP

Let’s talk about how we transform your operations

FogLAMP for Transportation

FogLAMP Values for Developers

- FogLAMP developers build smarter, better, cheaper industrial solutions
  - rapid integration of IIoT sensors and modern machines
  - industrial “brown field” systems
  - remove the complexity and silos
  - common set of administration and application APIs
- Move faster to drive engagements and shorten time to value.
- Open Source Code
- Using FogLAMP, industrial users instantly have a more comprehensive situational awareness view of their operational data sets

Connecting Moving Assets

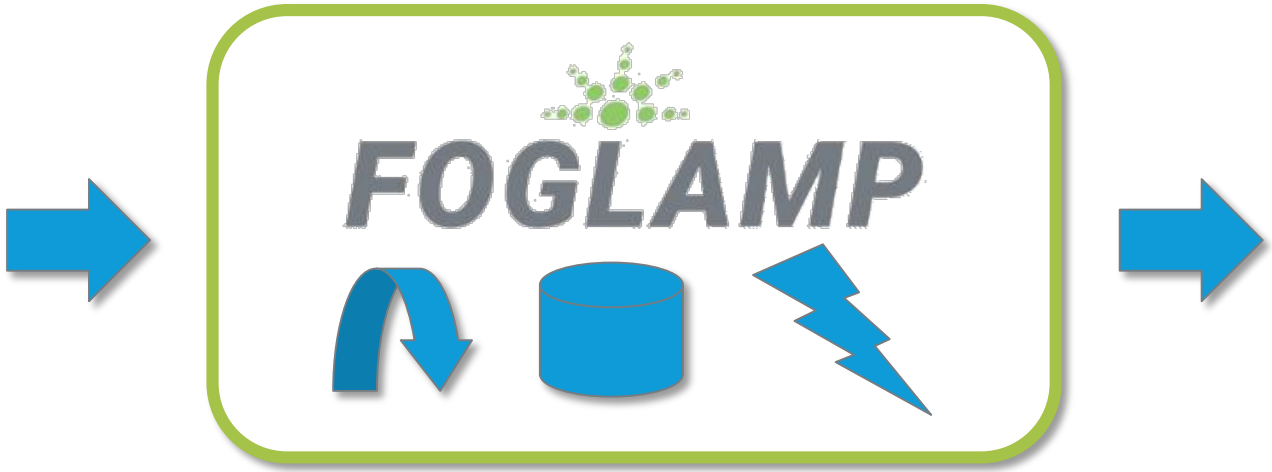
- Operational Visibility
  - Vehicle information
    - engine, location, status, etc.
  - Load attributes
    - volume, weight, temperature, etc.
  - Additional mechanical capabilities
    - lift/swing arm, onboard compressor, etc.
- In-Cab Applications
  - New or integrating with existing

Overall Equipment Efficiency (OEE)

- Maximize Availability + Performance + Quality
  - How available is equipment?
  - How is performance per operation?
  - What is the quality of each operation?
- You can’t know or understand what you can’t measure
- FogLAMP edge intelligence enables In-Cab feedback

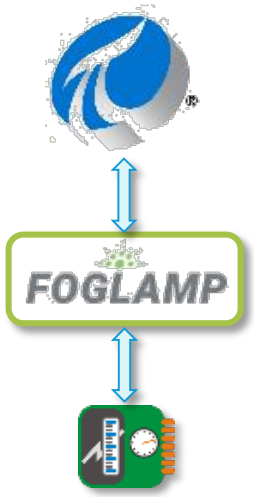
Condition-Based Maintenance (CBM)

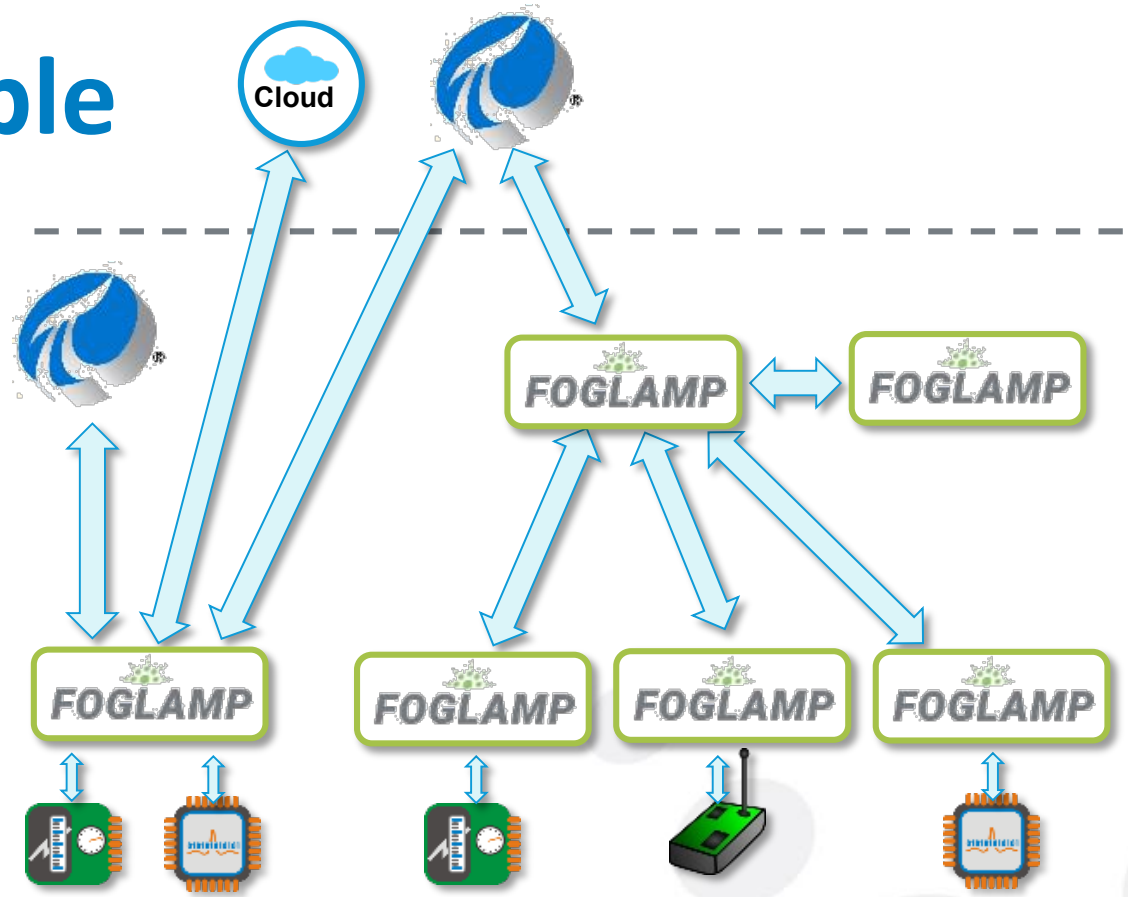
- Use data to predict when equipment needs maintenance
- Benefits
  - Reduce scheduled downtime with predictive maintenance
  - Reduce surprise failures and emergencies with early detection
  - Reduce maintenance cost
- Predictions range from simple to sophisticated
  - Temperature/pressure/etc out of expected range?
  - Advanced Signal Processing (especially for vibration data)
  - Machine Learning (ML) at the edge

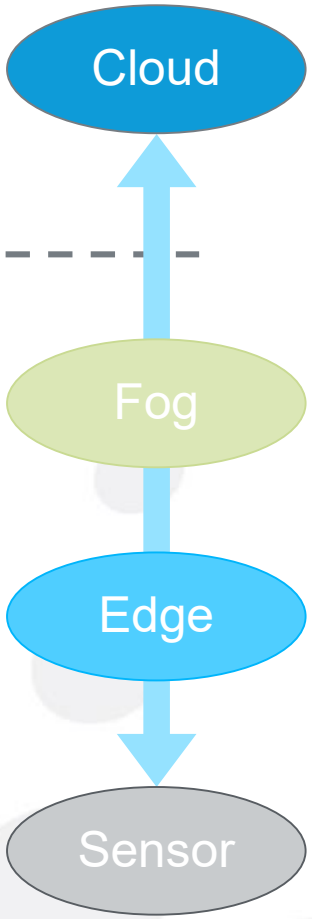


- Collect Data - from any/all sensors
- Transform - filter and transform data in-flight
- Buffer - reliability for poor connectivity
- Act - event engine for anomaly detection
- Integrate - to multiple local/cloud destinations

Flexible and Scalable







FogLAMP is a single device solution or…

Multiple Sensors

Multiple Destinations

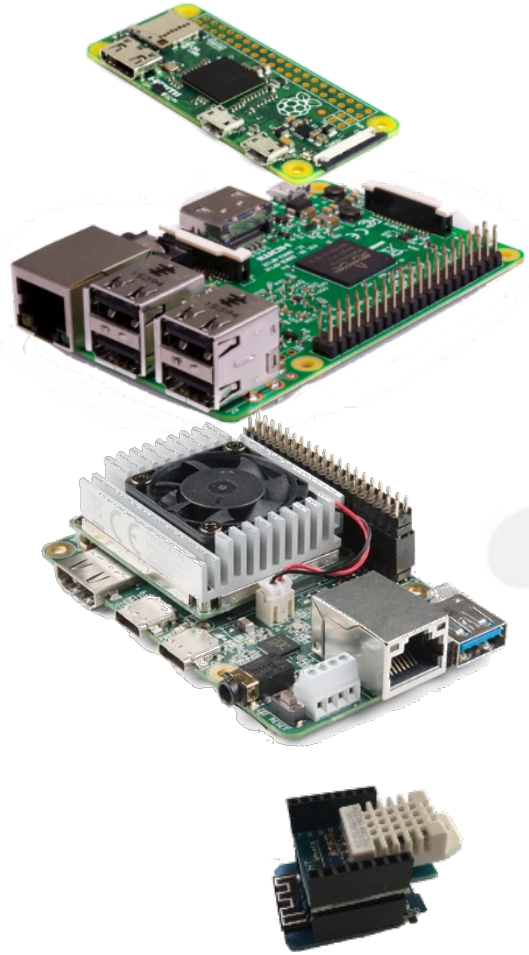
Hierarchy or Mesh

Redundancy / Fail-Over

Transform & Buffer Data at all Layers

Available on Variety of Industrial Hardware

Industrial Gateways



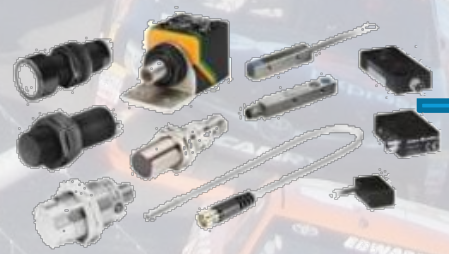
Raspberry Pi & Coral

PLCs & Routers

THE LINUX FOUNDATION LF Edge - Premier Members

General Members

Vehicle Optimization - Digital Twins w/ML



2,000 Sensors
Camera mapping surface

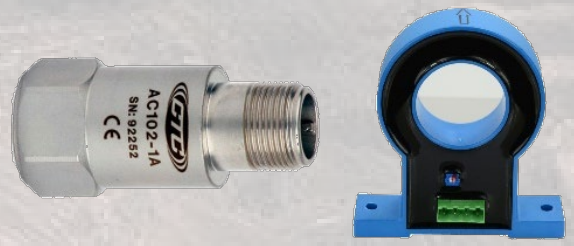
NVidia Server
with FogLAMP

Google Cloud

GT3 Racing Car

Data Collection & Aggregation
Computer Vision ML (track ID)
Optimize Tire Surface on Track
Digital Twin Validation

Metals & Mining



Vibration and Current Sensors

Industrial Gateway with FogLAMP

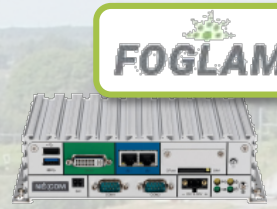
OSIsoft PI

KSB Slurry Pump

Monitor health of slurry pumps
Detect and alarm on cavitation
Predict bearing failure for CBM

Water & Wastewater Management

Flir
Infrared
Cameras

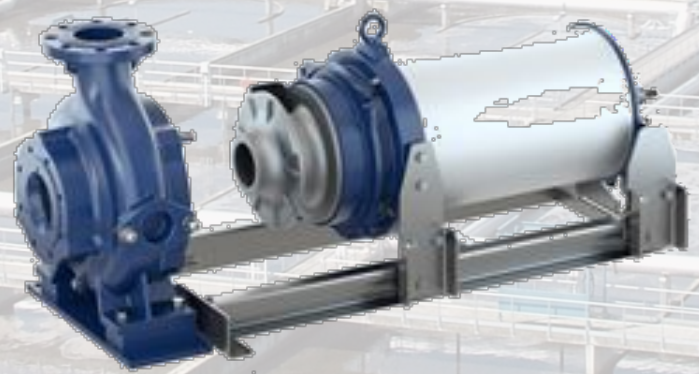


Industrial Gateway
with FogLAMP

OSIsoft PI

kafka ORACLE

Trouble ticketing
via Kafka

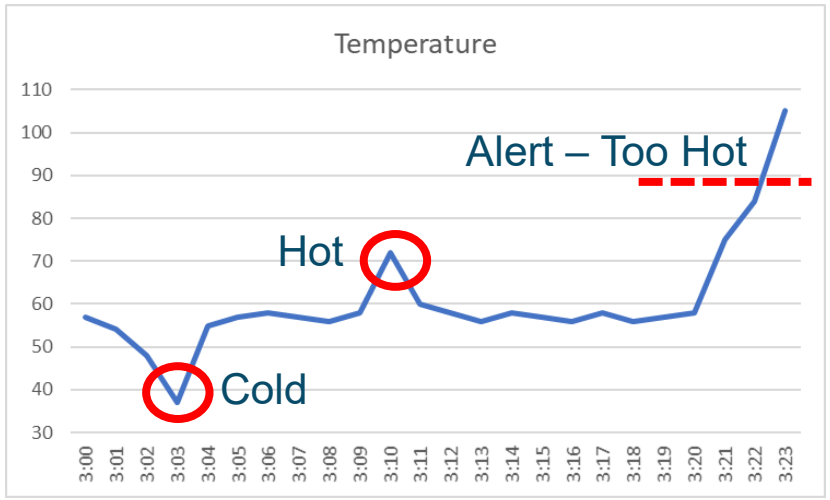


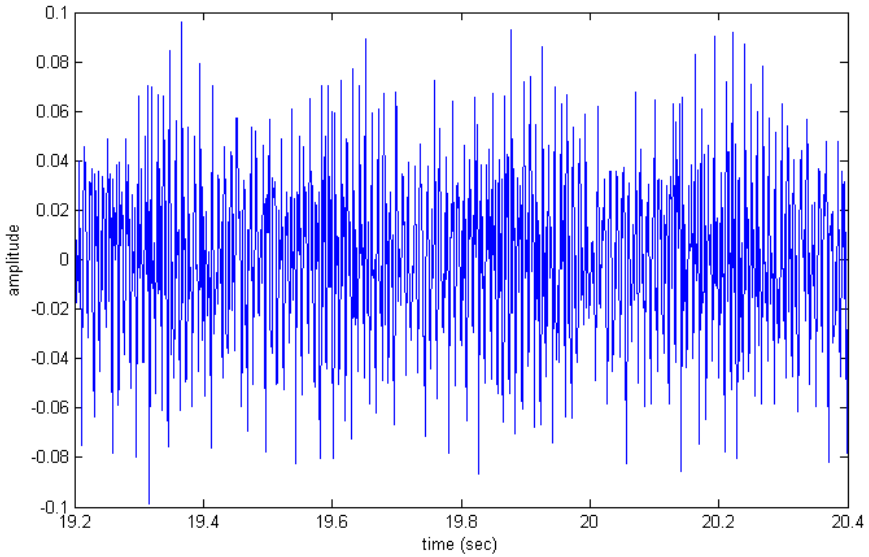
Water & Wastewater Pumps

Monitor health of pumps
Camera measures multiple hot zones
Predict bearing failures

FOGLAMP ARCHITECTURE

High Volume / Low Visibility





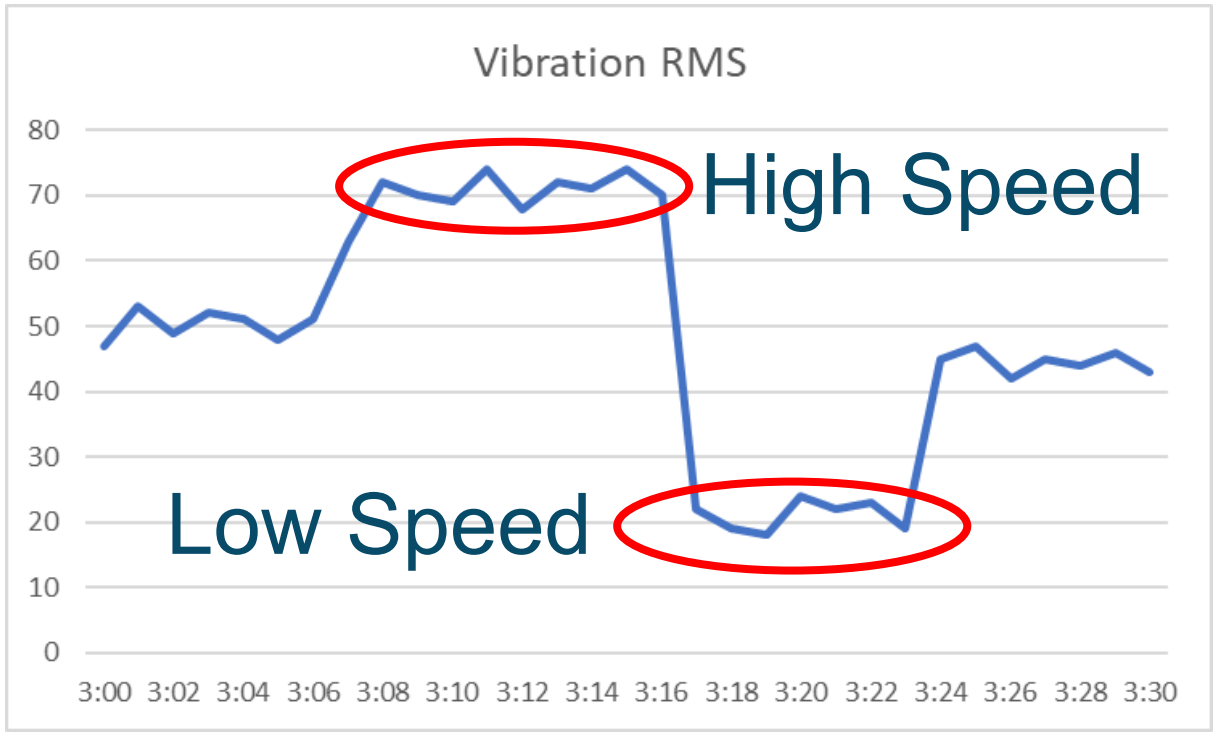
- Graph is Visually Meaningful
- Can Create Alarm Thresholds

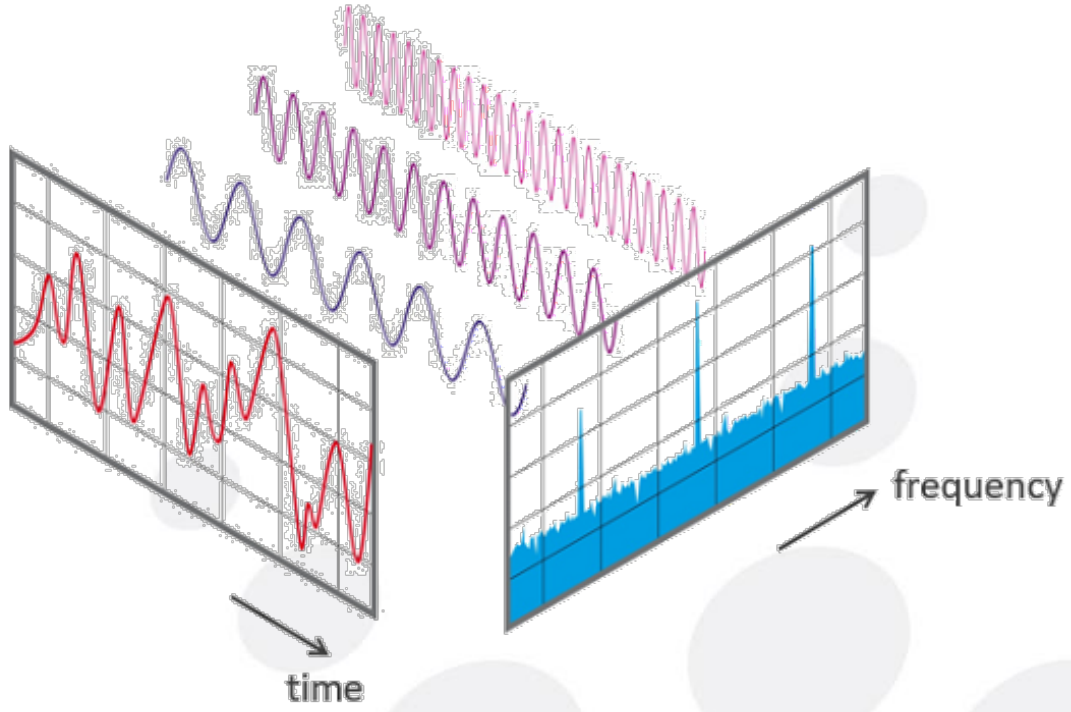
- Low Volume (1 sample/sec)

- Is this Graph Good? Is it Bad? Dunno.
- Can't Create Alarm Thresholds.

- High Volume (10,000+ samples/sec)
  - Wastes expensive bandwidth
  - Consumes Disk/CPU
  - 7gb/hour/sensor is typical

Enriching & Simplifying Data





RMS shows energy of vibration, which shows speed & fatigue.

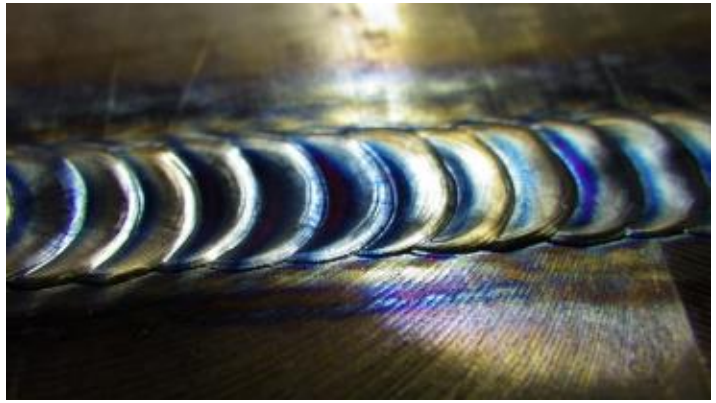
FFT shows energy at different frequencies. Predict problems.

Conditional Forwarding

- Collect continuously, but don't forward any data
- When an error is detected, send the last n minutes of data
- Reduce Bandwidth and Computation / Storage Cost

Machine Learning / Artificial Intelligence

Intelligent Sensors – Image Classification



Is this weld high quality?

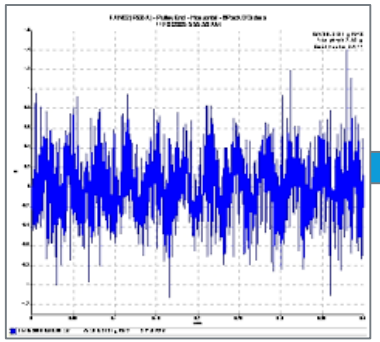
Are there people in this dangerous area?

Anomaly Detection

Is this machine healthy?

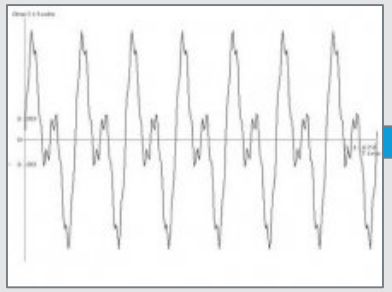
Google TensorFlow - Run ML Models at the Edge Can Leverage TPUs for ML Acceleration

Typical FogLAMP Classification Pipeline

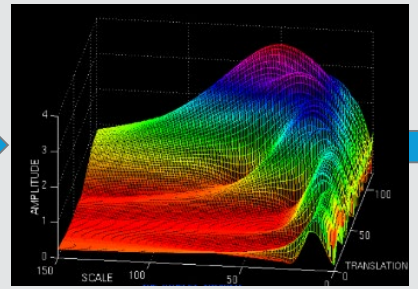


Raw Vibration Data

FOGLAMP



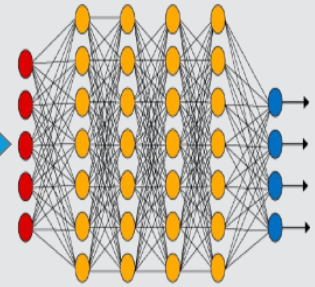
Break into 200ms Segments



Wavelet Packet Transform (similar to FFT)

median: 5.1
mean: 7.3
std dev: 1.1
rms: 14.3
zero crosses: 237
mean crosses: 105
…

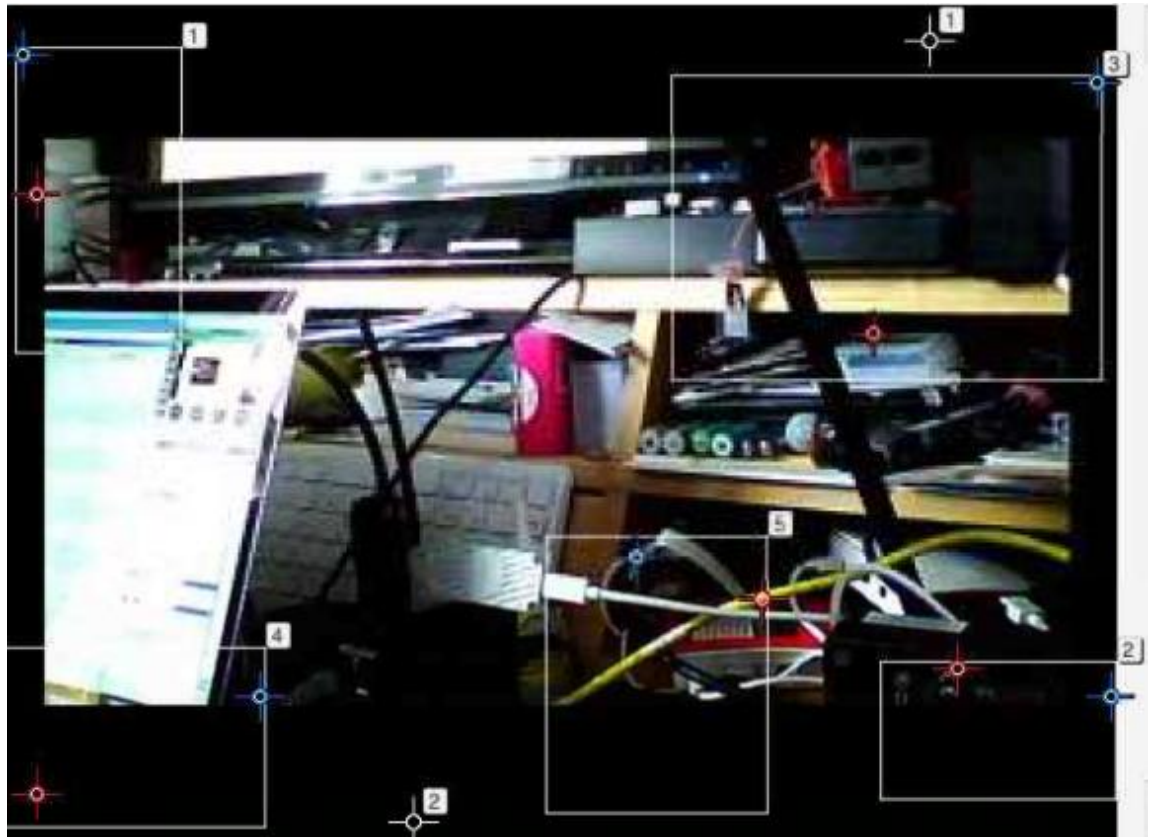
Calculate Features (~30)



Analyze with Machine Learning model

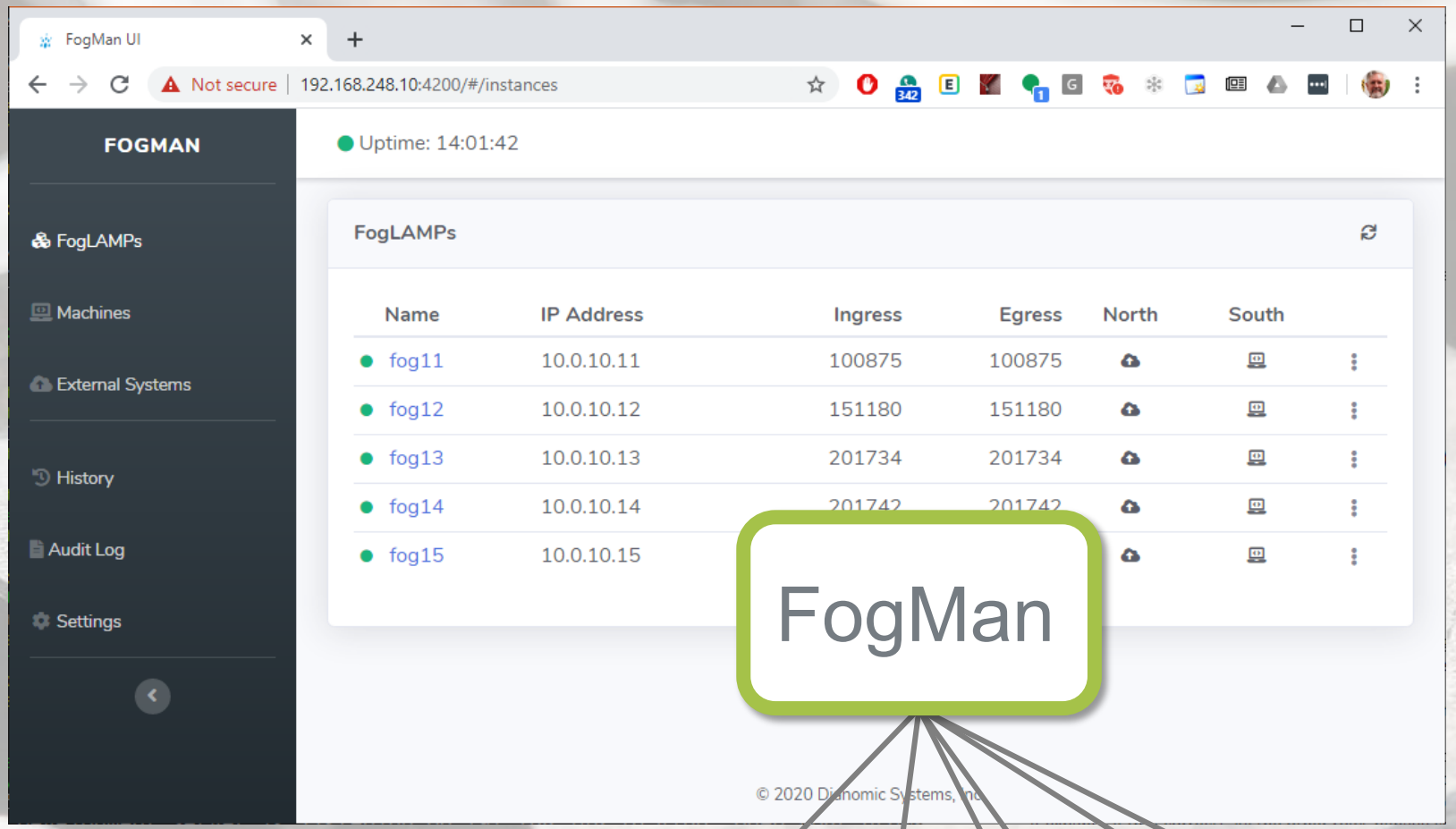
Classify: Good / Bad

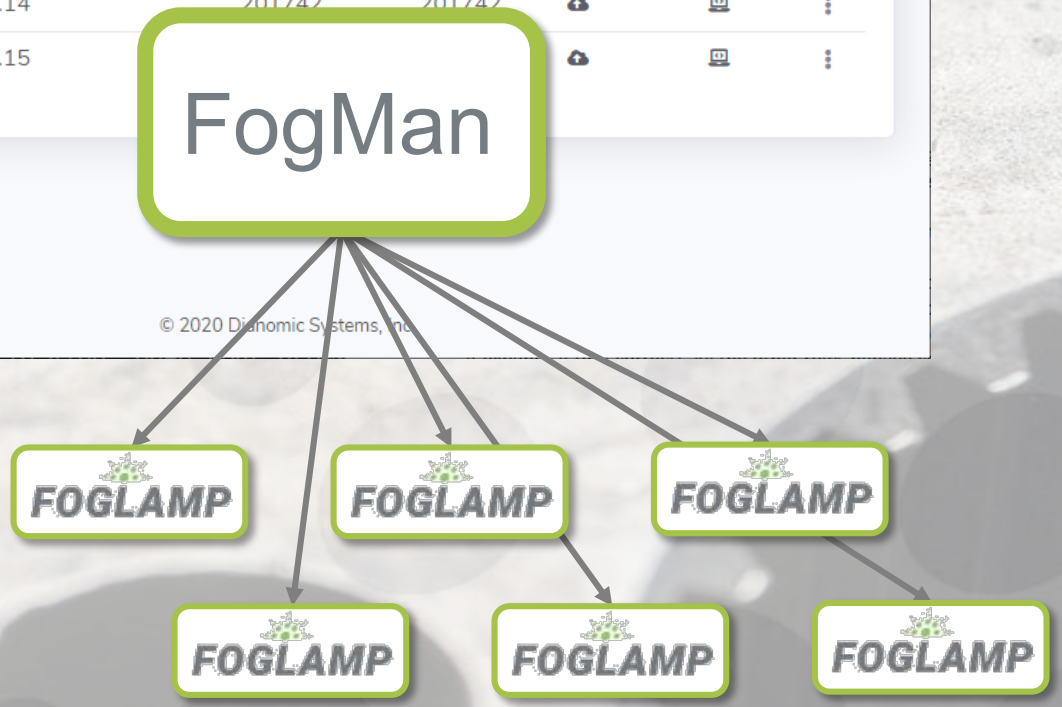
Thermal Imaging



FOGMAN

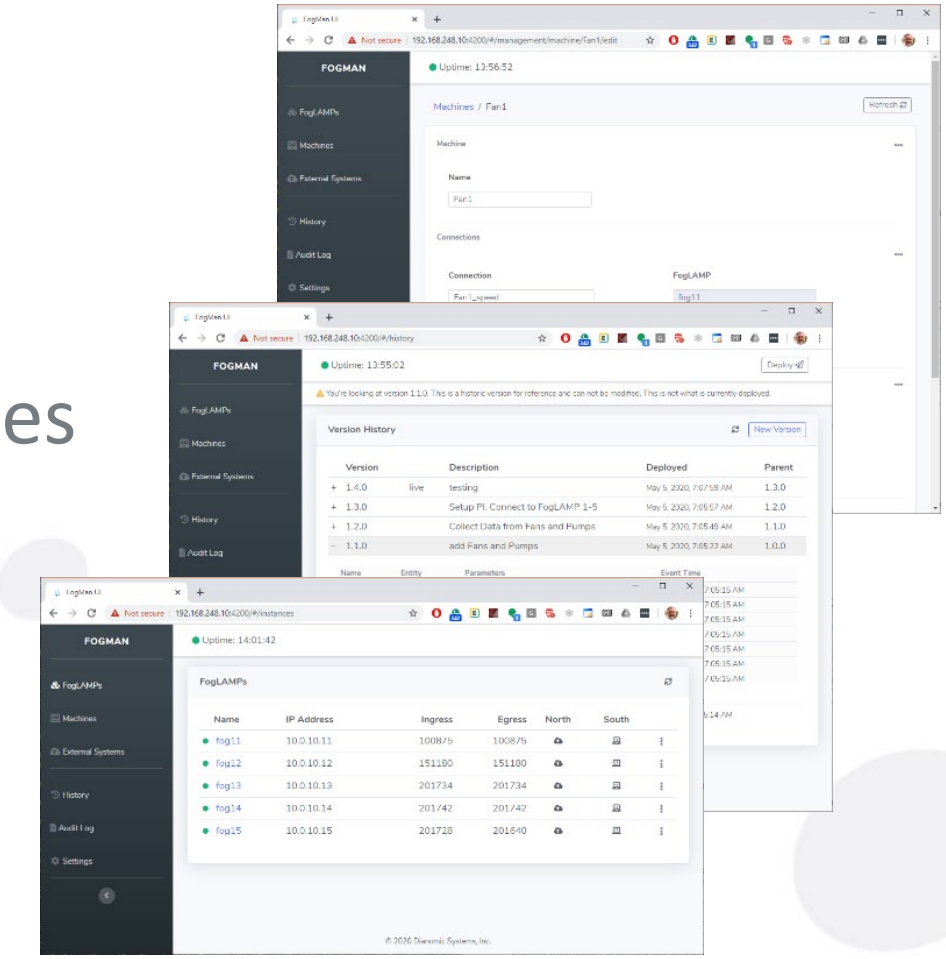
Centralized FogLAMP Management





Centralized Management - FogMan

- Central Configuration Management
- Auto Discovery for Easy Provisioning
- Templating for scalable setups & changes
- Machine & External Systems focus
- Security from device to destination
- Device and Data Monitoring
- Hosted in GCP or On-Prem



NEXCOM

Mobile Computing Solution Profile

Patrick Lai

Committed to Customer Success

Nexcom Overview

- Founded 1992 Nexcom has built a solid business by working with industry to understand problem sets and deliver targeted solutions

- Mobile Computing Solutions (MCS) is the division exclusively focused on working with mobility customers.

- Nexcom has partnered with Dianomic to help systems Integrators deliver contextualized data from industrial vehicles to a customers PI System

Nexcom MCS Product Portfolio – Sized to fit your needs

VTC Series In-Vehicle Computer

- General purpose high performance telematics computer
- CAN/OBD, BT, WiFi, 3G/LTE, GPS + DR, multi SIM integration
- IP Protection
- Smart power management

VMC Series Rugged Vehicle Terminal

- Design for outdoor application
- Vibration-, shock- dust- & water-proof
- Wi-Fi/ 3G/LTE, CAN/OBD, GPS + DR, high precision GPS integration
- Suitable for Port / harbor / warehouse
- applications

MVS Series Modular Vehicle Computer Systems

- Modular design for Flexible I/O expansion
- PoE, IP65, VMS S/W, 3G/LTE, BT, WiFi integration
- Easy to customize different I/O interface for various telematics applications

nROK Series Railway Computer

- Fanless and rugged design
- PoE, VMS S/W, CAN/OBD, GPS + DR, multi-storage, WiFi, 3G/LTE integration
- Isolated 24-110VDC power input
- EN50155 certified
- Wide operating temperature

ATC Series Advanced Telematics Computer w/ GPU

- Design for ANPR, facial recognition and autonomous driving applications
- Nvidia GPU, PoE, Desktop CPU, multi HDMI, multi storage, CAN/OBD integration
- High performance in video analytics

PoE Solution

- Design for video surveillance, ANPR, facial recognition and WIFI sharing applications
- Comply with 802.3af/at with RJ45 connector and M12 connector
- Fabless and rugged design, suitable for public safety in vehicle and train

IP Solution

- Up to IP65~IP67 rating protection against water and dust
- Compact and robust, can survive in any tough environment
- Design for critical and reliable long lasting applications

MCS Competitive Differentiation for Transportation

On-Board Devices

- Cover from Sensor Cluster, Data Gateway to Edge Application Server
- Design for Tough Environment
- Modularized Design
- Open Source Platform

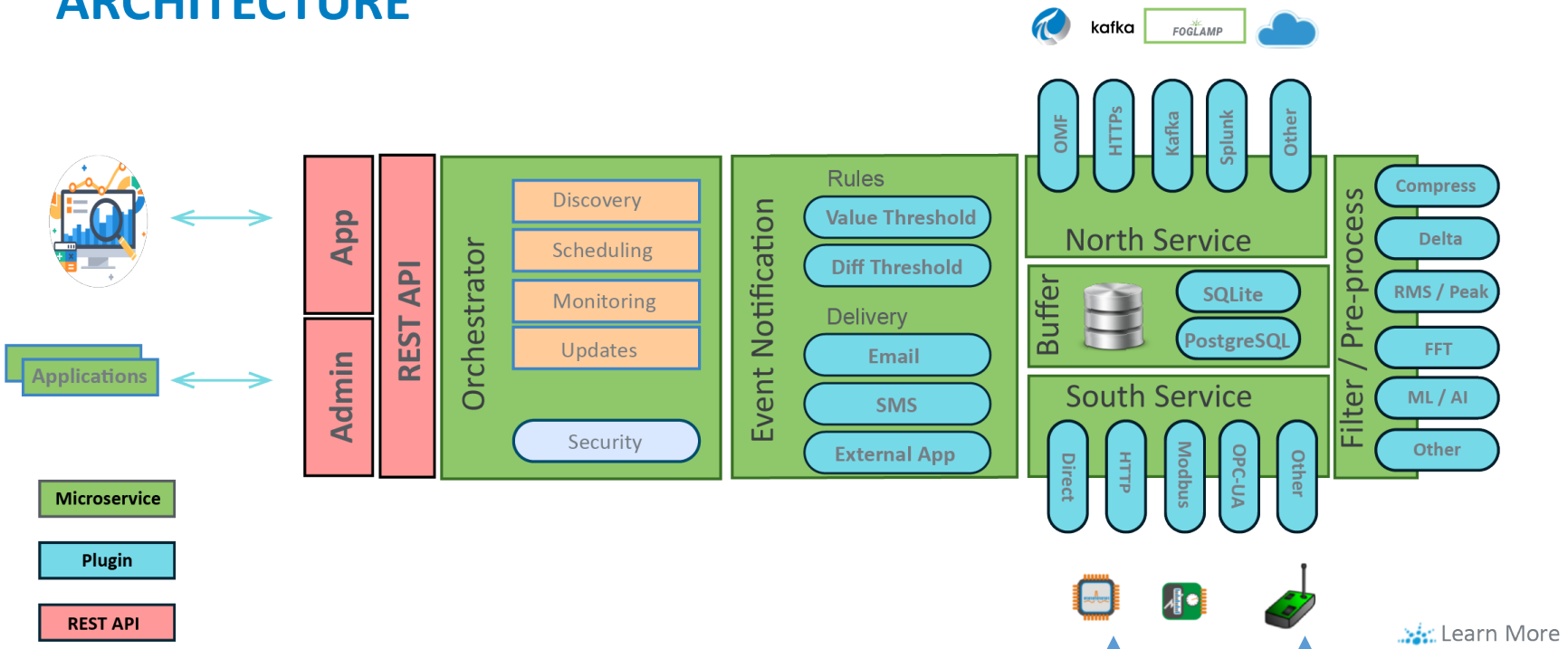
Software Value-added

- Support all SDKs of Windows & Linux
- MCU code Modification Service
- CANBUS API Porting plus MCU Integration
- Android BSP and Driver porting Services
- Application SW Development by Request

Building Blocks

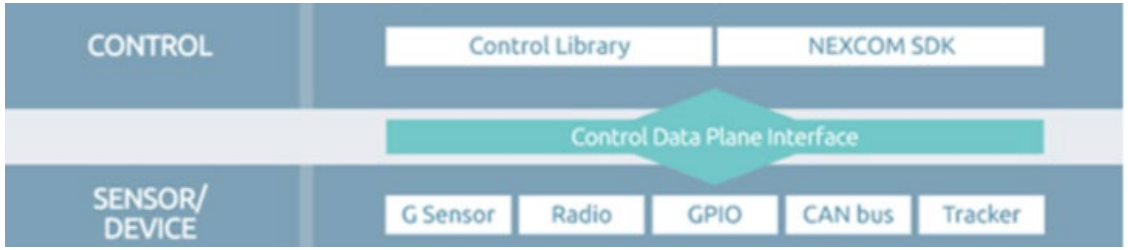
- Connectivity – Voice/Data/GPS
- Telematics – CAN & OBDII
- FM Radio, TV Tuner, DVB-T Bundle
- Isolated power & IO inputs
- Rich IOs, Car Defined Connectors and Sensor interface

FOGLAMP ARCHITECTURE

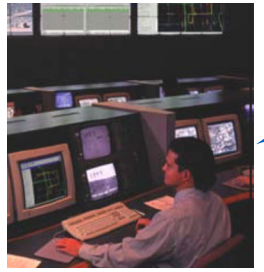


FOGLAMP **VTC 1910**

Plug-In **SAE J1939 / J1708**



Fleet Management Application



Fleet Manager

5G/LTE/WiFi

Sub Network A (Body System)

Air conditioner

Door

Head Lamp

FOGLAMP

CAN1

Heavy-Duty Vehicle

CAN2

Dual Carriers

Engine

Steering

Brake

Sub Network B (Engine & Powertrain System)

Anti-Fatigue System

- Mining Truck Equipped Edge Computing VTC1910 with Anti-Fatigue sensors reduces the possibility of accidents

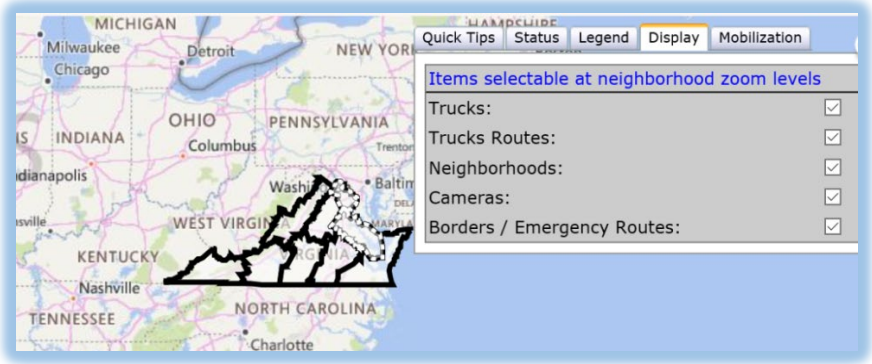
- In order to reduce accidents which caused by fatigue driving, the mine companies invested in the anti-fatigue system
- The system must be invisible to reduce the metal rejection from the drivers, therefore, the sensors are in the driver seat
- The driver's voice quality is also used for real time monitoring and alarm feedback makes safety for the whole journey.

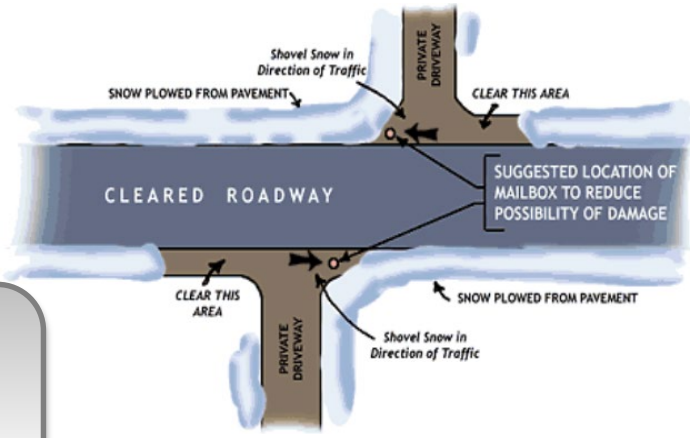
VTC1910-S

- Super slim and ruggedized design
- Smart power management via software control
- Wide operating temperature -40°C ~ 70°C
- An advanced GPS receiver supports GPS/Glonass/QZSS/Galileo/Beidou

Snow Plow

GPS



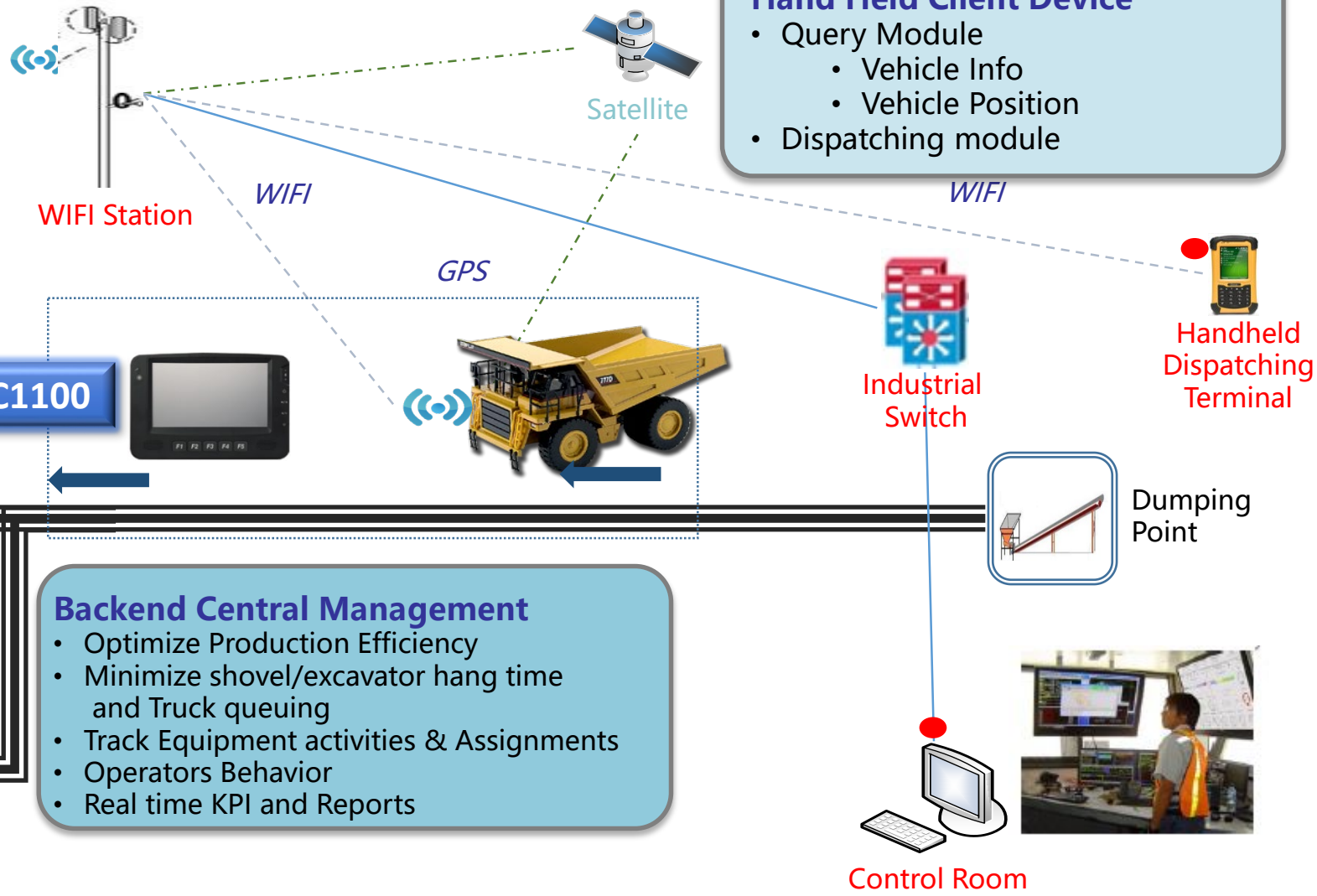


- Columbus Ohio, US Smart City Award winner 2016
- Model: VMC1100 (7”), 300+ fully integrated systems deployed
- Application: Snowplow Fleet Management
- SKF: Connectivity 4G LTE/GPS, IP54, Compact Rugged , Programmable Function Key, Audio speakers, with Custom snow operation software
- Plough routes for city arteries, Precise Sanding/Salting, GPS positioning

Application in Mining Fleet and How It Works

Fleet dispatching terminal
- WIFI and GPS tracking/position
- Assignment and update status
- Monitoring system
  - Driver fatigue
  - Speed exceeding
  - Seat belt
  - Blind spot
  - Tire
- GPS/Telematics

Hand Held Client Device
- Query Module
  - Vehicle Info
  - Vehicle Position
- Dispatching module



Backend Central Management
- Optimize Production Efficiency
- Minimize shovel/excavator hang time and Truck queuing
- Track Equipment activities & Assignments
- Operators Behavior
- Real time KPI and Reports

Webinar Summary

- Large market with wide array of needs which are converging into a single solution
- It takes a village to deliver a converged solution: Hardware, Edge SW, Enterprise, **and Integration**
- OSIsoft + Dianomic + Nexcom + SME + Integration = Mobile Equipment Solution

Reference Customer Program

- Partners to deliver initial deployments
- Additional support
- Development systems
- Training if needed


謝謝
KEA LEBOHA
TAPADH LEIBH
고맙습니다
БАЯРЛАЛАА
MISAOTRA ANAO
SALAMAT
DZIĘKUJĘ CI
NGIYABONGA
TEŞEKKÜR EDERIM
GRÀCIES
OBRIGADO
شكرا
DANKIE
TERIMA KASIH
DANKON
TANK
TAPADH LEAT
KÖSZÖNÖM
СПАСИБО
MULȚUMESC
РАКМЕТ СІЗГЕ
HVALA
FAAFETAI
OSIsoft®
GO RAIBH MAITH AGAT
ESKERRIK ASKO
MAHADSANID
БЛАГОДАРЯ
GRACIAS
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THANKYOU
ТИ БЛАГОДАРАМ
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DI OU MÈSI
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ÞAKKA ÞÉR
ありがとうございました
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HATUR NUHUN
PAXMAT САГА
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MATUR NUWUN
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