

Cambridge Energy Harvesting Workshop

Practical EH for Powering IoT WSNs

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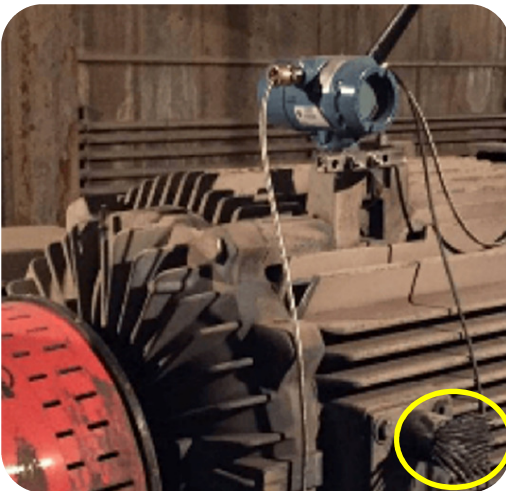
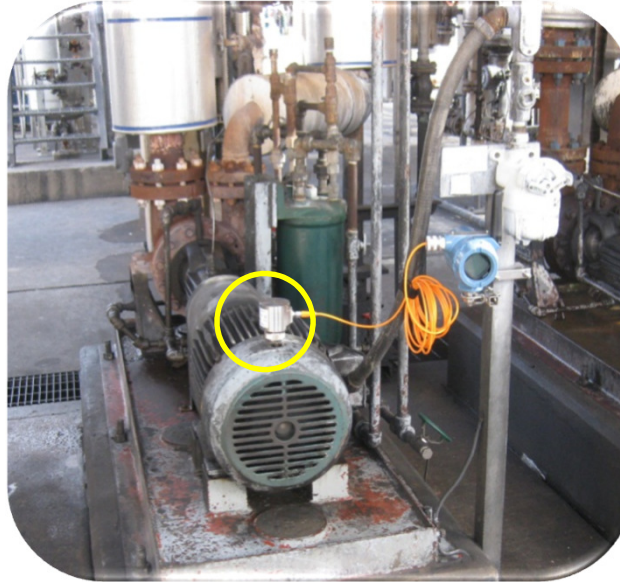
Introduction

- Wireless Sensor Nodes (WSN) have exceptional benefits for IoT but wireless means either
 - Power with Batteries
 - Energy Harvesters
- Maintenance Free Energy Harvesters are viable in many applications
- EH eliminates the reliability and maintenance issues of batteries
- Examples of successful high volume applications

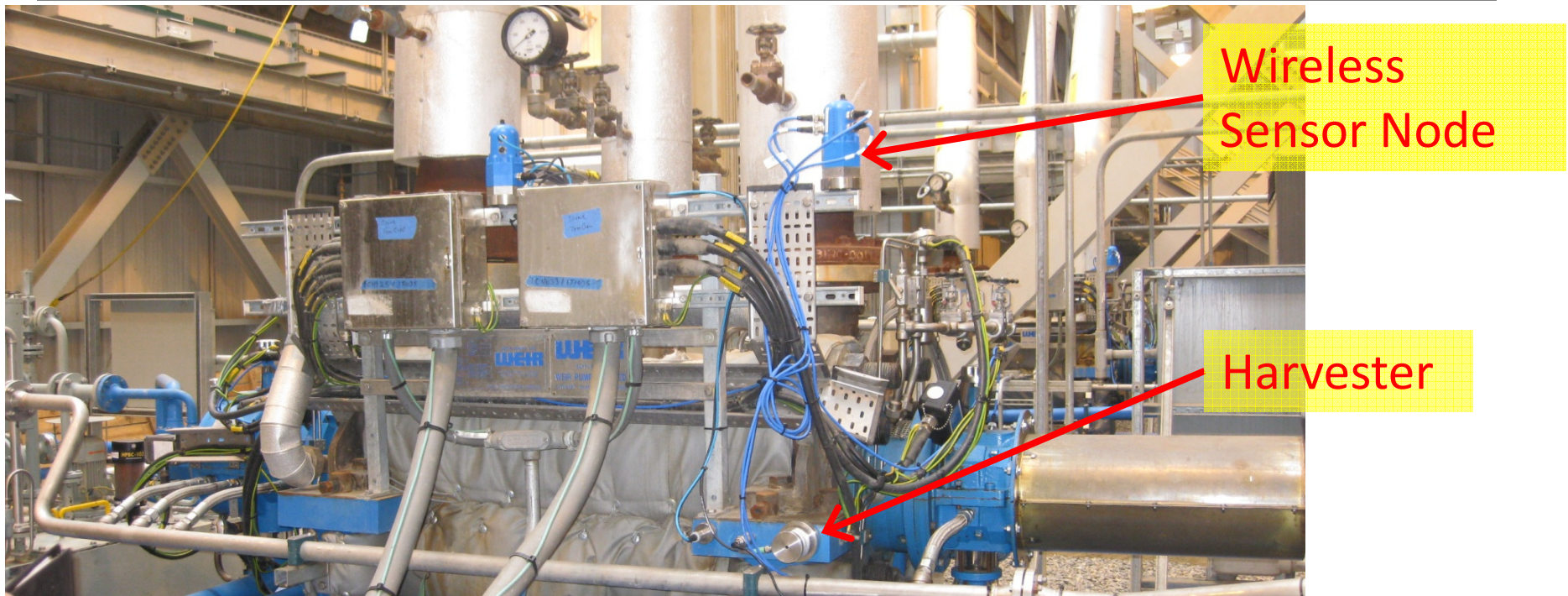
Energy Harvesting Requirements

- Suitable source of energy to be harvested
 - Vibration, Light, Heat, Transmitted Power
- Power Management
- Duty Cycle Energy Storage
- How much power?
 - Once/day for high data volume e.g. Vibration Spectra
 - Once/second for low volume e.g. Temperature
 - <https://www.isa.org/standards-and-publications/isa-publications/intech-magazine/2011/october/special-section-energy-harvesting/>

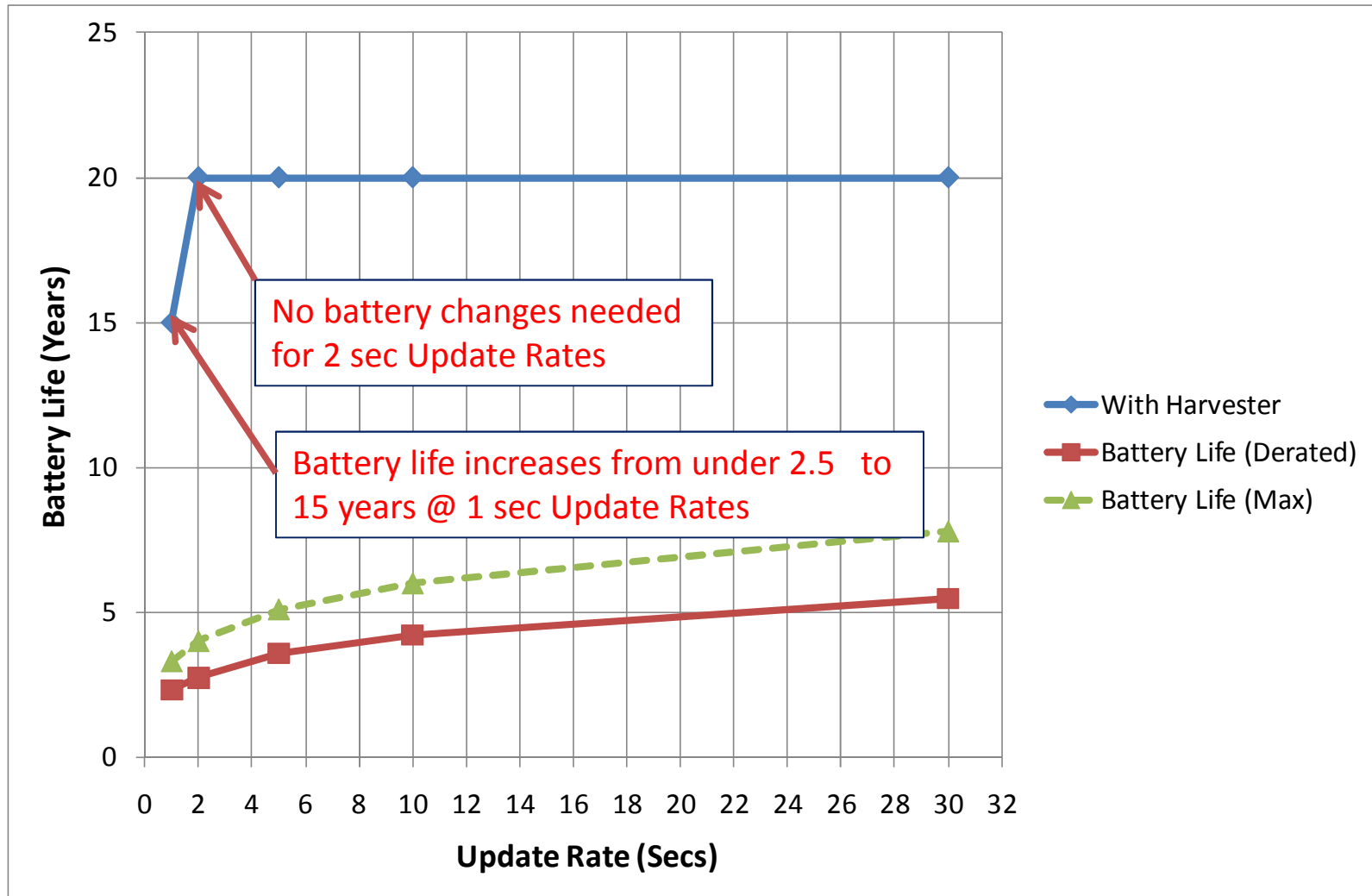
Example Installations – GE, Emerson WSNs



mW to Monitor MW - Power Generation Plant

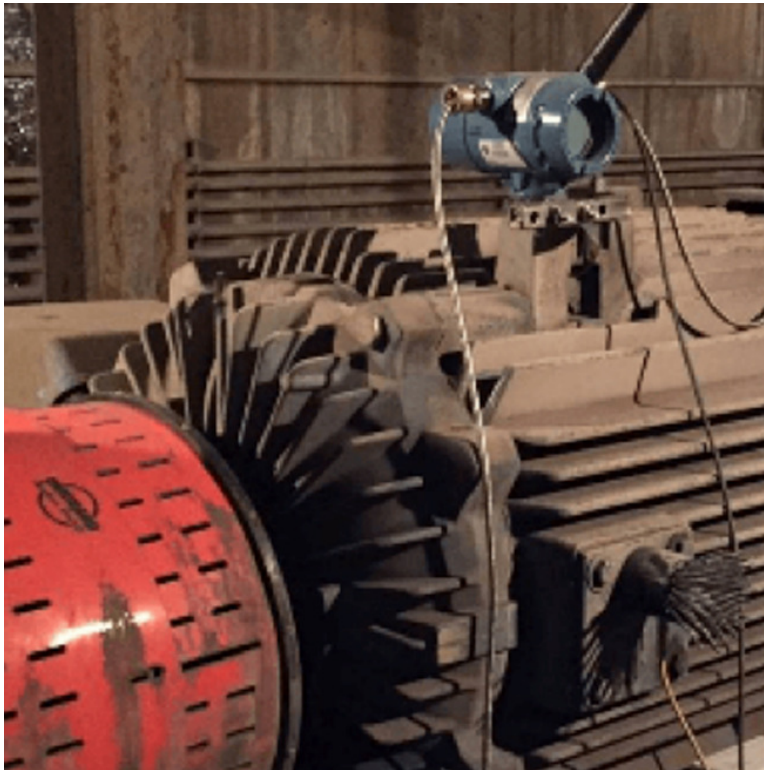


Impact of Using Harvesters



Important Improvements using Energy Harvesters

Thermal Harvester Applications

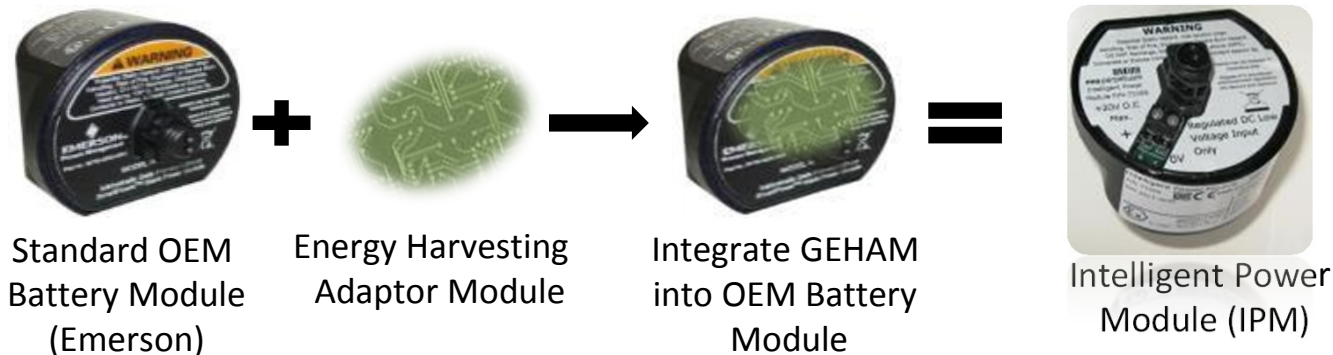


Harvester Interchangeability

- WSNs can be powered by different types of EH
- Needed Interchangeability
 - Isa 100.18 Power Sources for WSNs
- Now IEC 62952 Power sources for a wireless communication device –
 - Part 3: Generic energy harvesting adapter module published June 2017

Intelligent Power Module

Enables interface of WSN wireless transmitter to multiple external energy harvesting sources and 24V DC power.

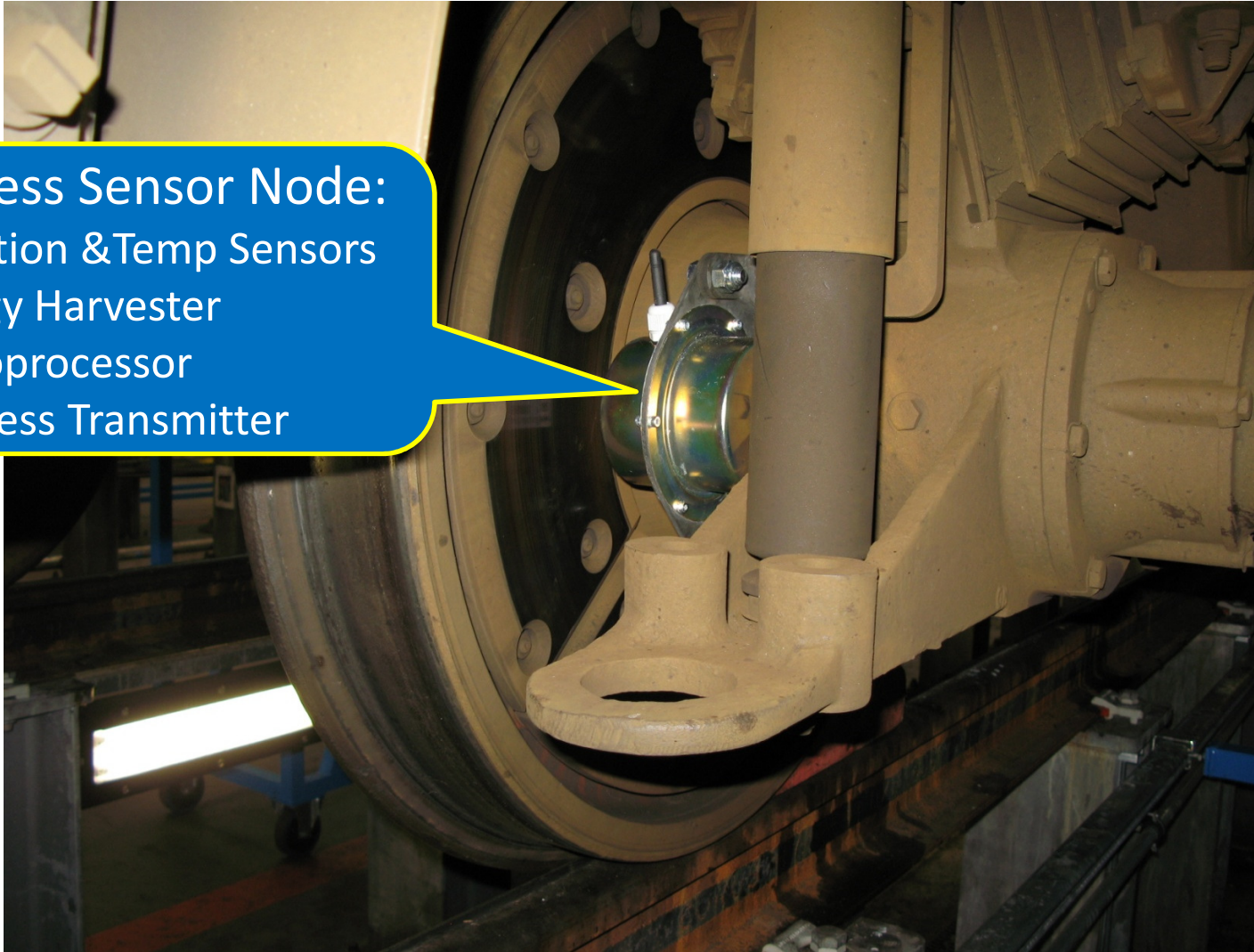


- **Capability:** Battery powered WSN's to use external power sources
- **Flexible Voltage:** Wide range of input voltage levels: 8V – 24V.
- **Power Available:** Integrated robust capacitive storage
- **Intelligent:** Intelligent Power Management circuitry
- **Safe:** Intrinsic safety designed in. Zone 0, Class 1 Division 1
- **Convenient:** Same form, fit & function as original OEM battery module
- **Economics:** Eliminate battery change costs & logistics for > 10 years

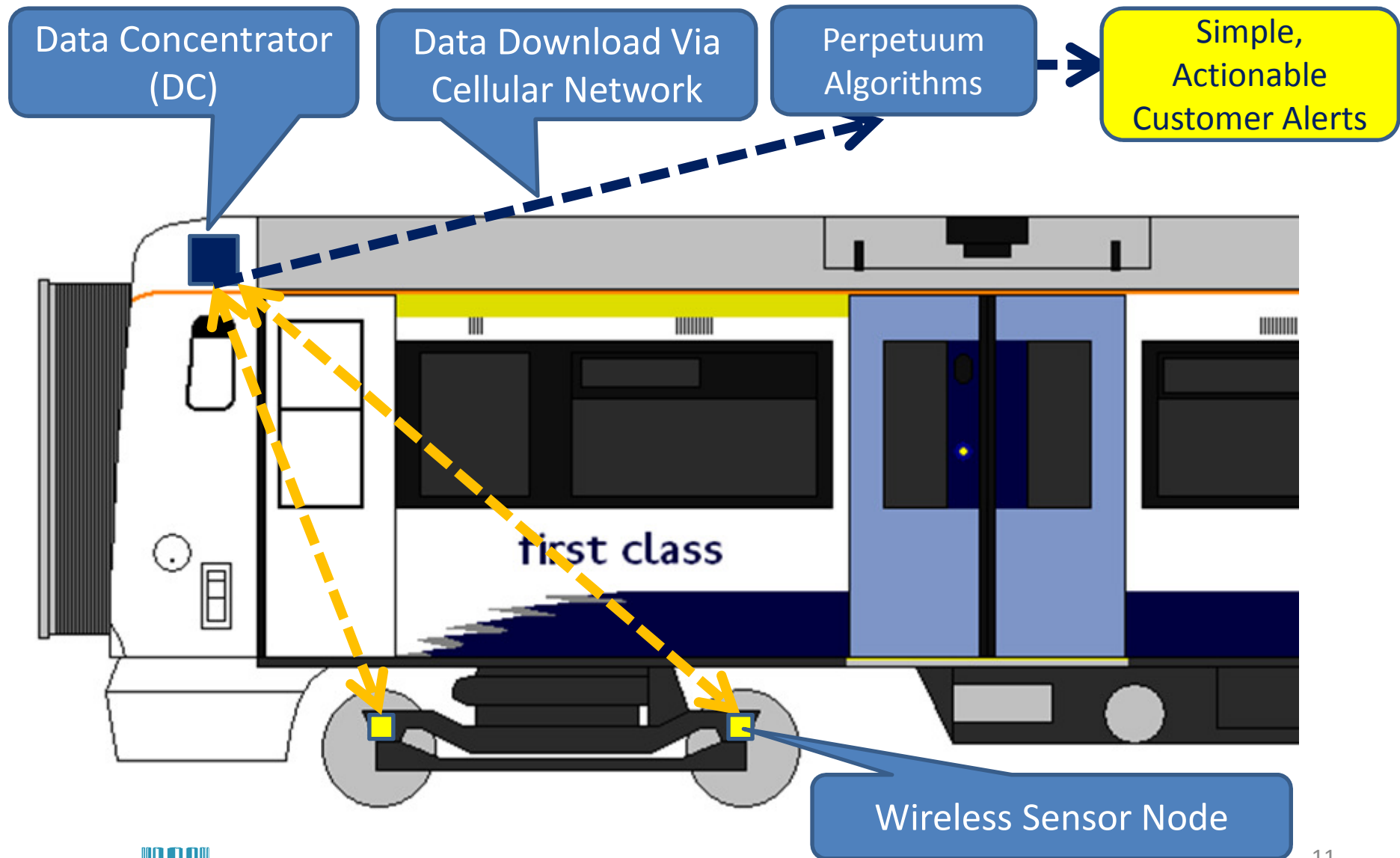
Challenging Application - Trains

Wireless Sensor Node:

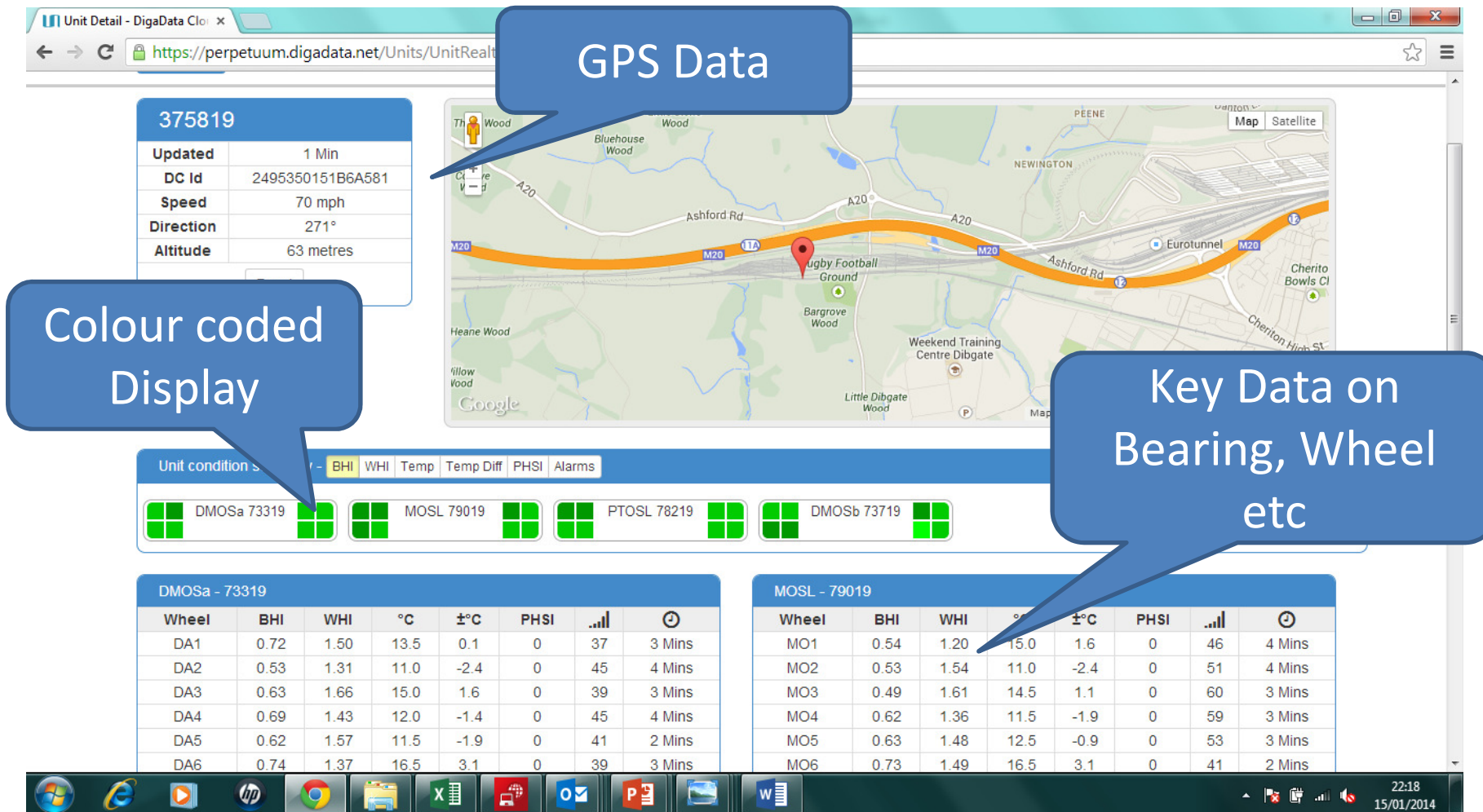
- Vibration & Temp Sensors
- Energy Harvester
- Microprocessor
- Wireless Transmitter



Communications



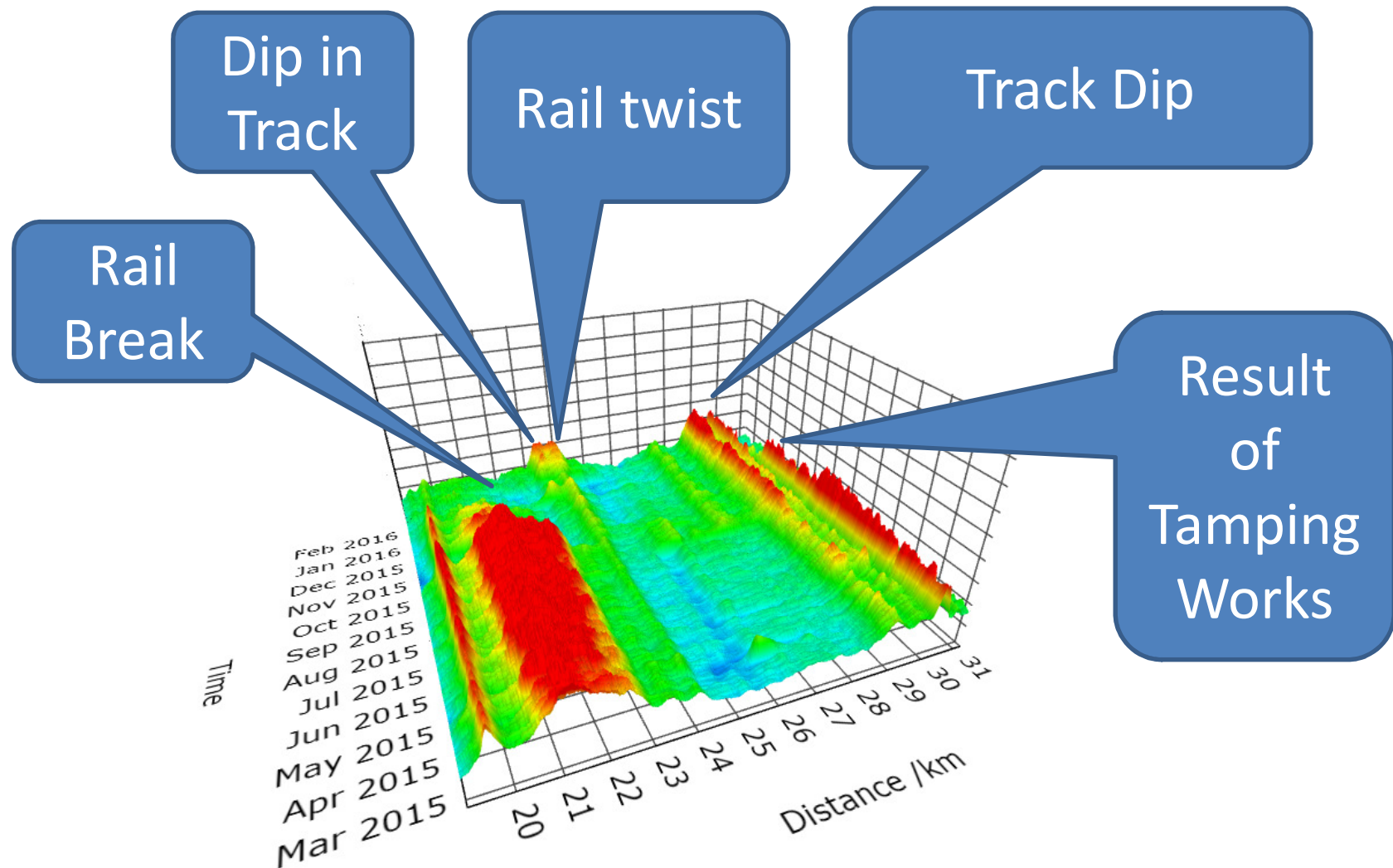
Simple Display of Key Information



Bearing Degradation



Track Features



Live Monitoring on Trains

- Axle Bearings



- Wheels



- Gearboxes



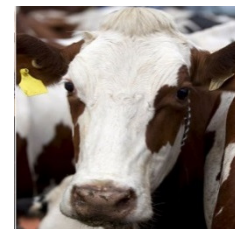
- Traction Motors



- Track



- Cows



Summary - Energy Harvesting

- Now mature technology
- High Volume Applications
- Maintenance Free IoT
- Keys to Success
 - Adequate Power Generation
 - Management of power
 - Storage of Energy
 - Laws of Physics **not** Moore's Law

Cow on Track – Train in Field

