



A2EP – 2xEP Energy Productivity Summit
04-05 April, 2017
Australian National Maritime Museum
Darling Harbour, Sydney

Session 02

2xEP by 2030 by sector - Manufacturing

Michael Bellstedt > presentation follows

Carmel Gillies

Carl Duncan

Denise Swink

Chair: Paul Orton

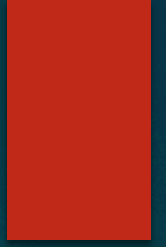


Doing more. Using less.

New IoT Efficiencies with SMART HVACR

DR MICHAEL BELLSTEDT

Would it not be a game changer if....



...your refrigeration system could
tell you that it is wasting energy...

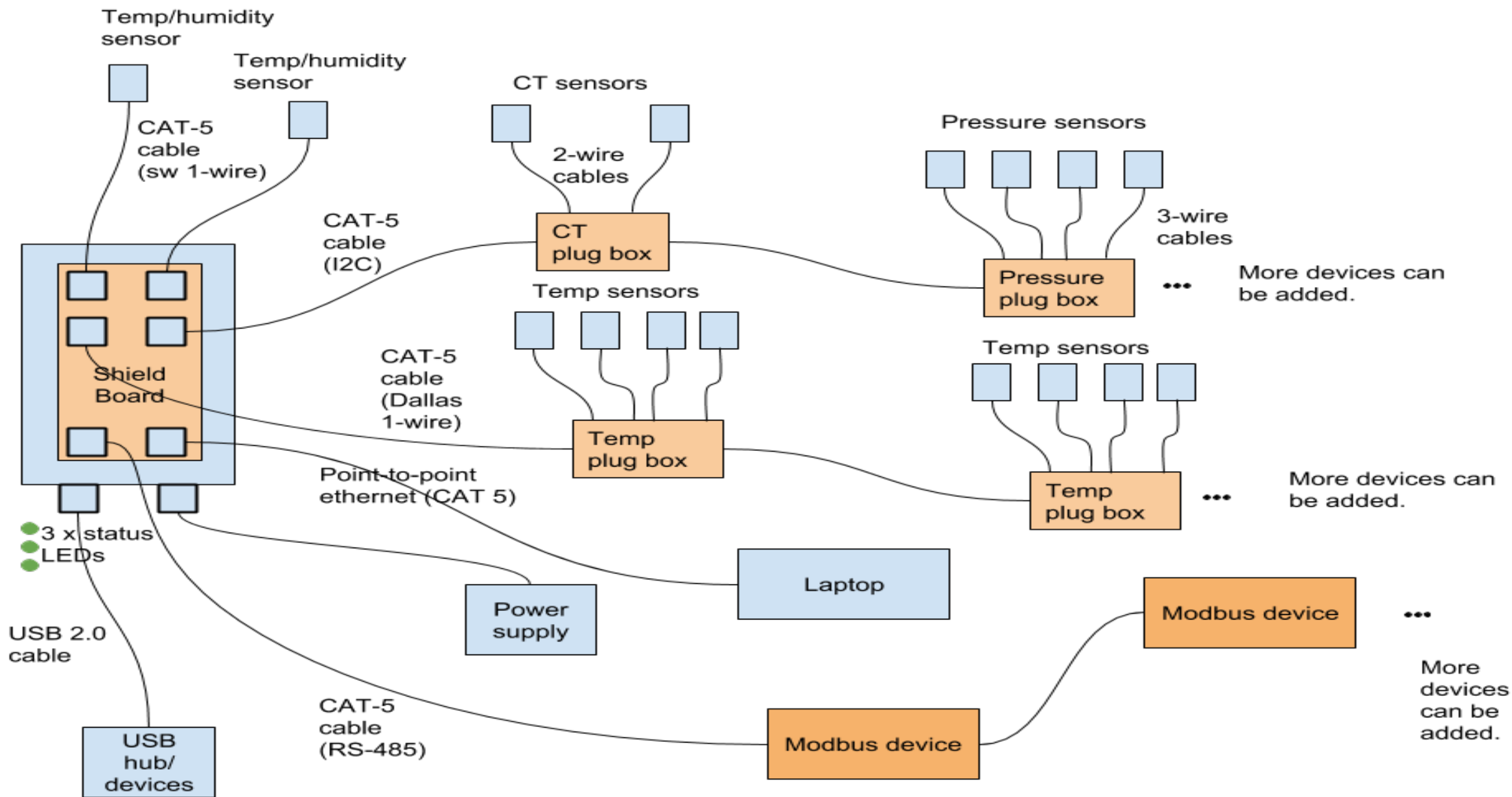
... or that it is about to fail

What problem did we see?

- ▶ Poor refrigeration system health leads to:
 - ▶ Product Loss due to refrigeration failure
 - ▶ Higher Energy Cost due to inefficient operation
- ▶ Most systems have Low to No remote visibility
 - ▶ Service tech has to be on site to do a system health check
- ▶ Other systems provide a flood of sensor data and threshold alarms, but little intelligence
 - ▶ Too much information without interpretation or diagnosis – noise!!
 - ▶ Remote supervision time-consuming and diagnosis difficult

Get to the root of the problem

- ▶ 24/7 multi-dimensional monitoring and data logging – get the data
 - ▶ Pressure, temperatures, currents, Modbus data...
- ▶ Sensor fusion - use sensor data + data analytics
 - ▶ Generate real “health data” that makes immediate sense to the trained observer
- ▶ Machine learning – learn to predict each system’s operation
 - ▶ When operation deviates from prediction, something is wrong.
 - ▶ Use trained symptom detection to auto-diagnose the problem
 - ▶ Create intelligent and predictive alerts



The Sensor Package

- ▶ DCUs provide cloud connection
- ▶ Sensor boxes
- ▶ A range of sensor types

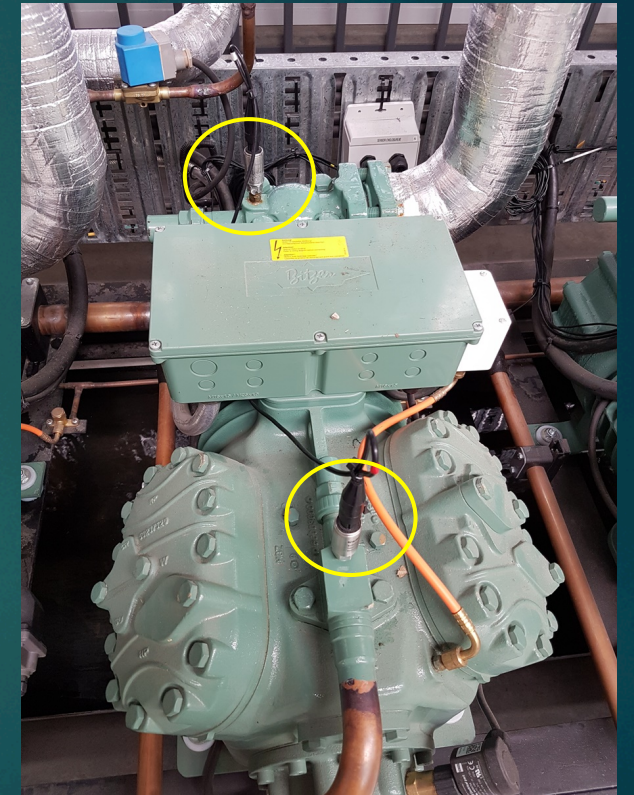
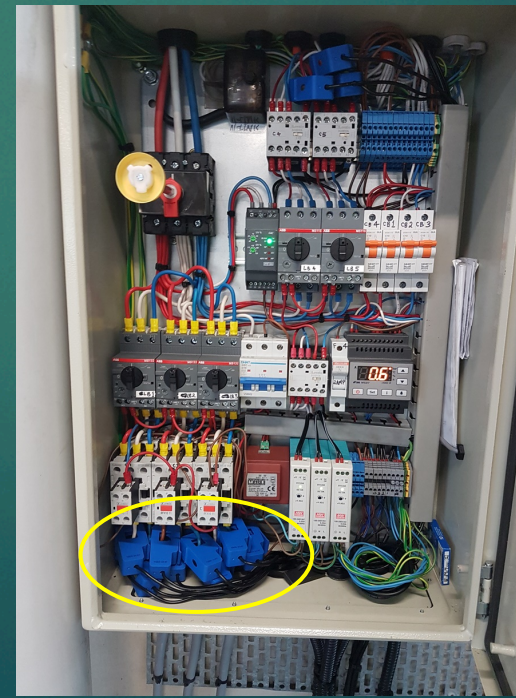


Temperature

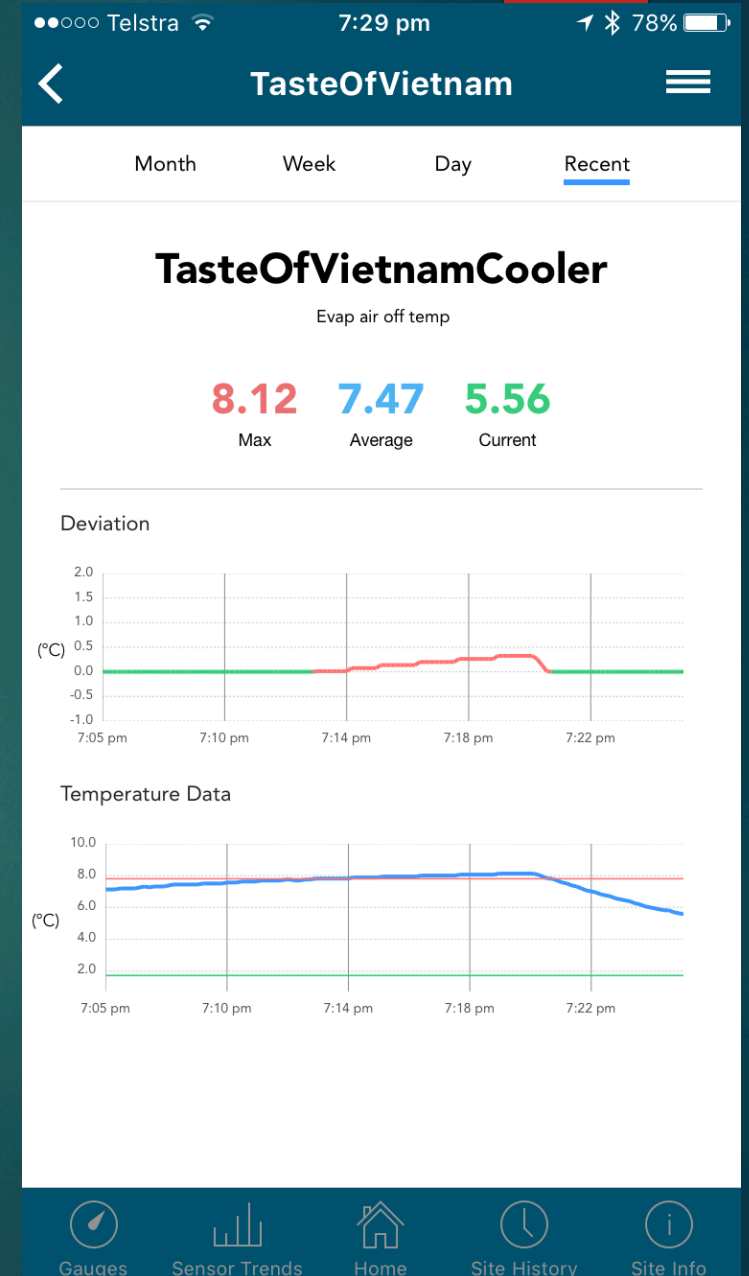
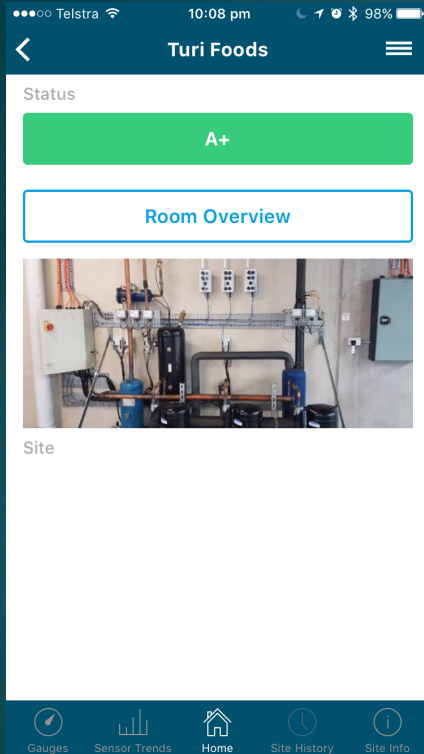
Current



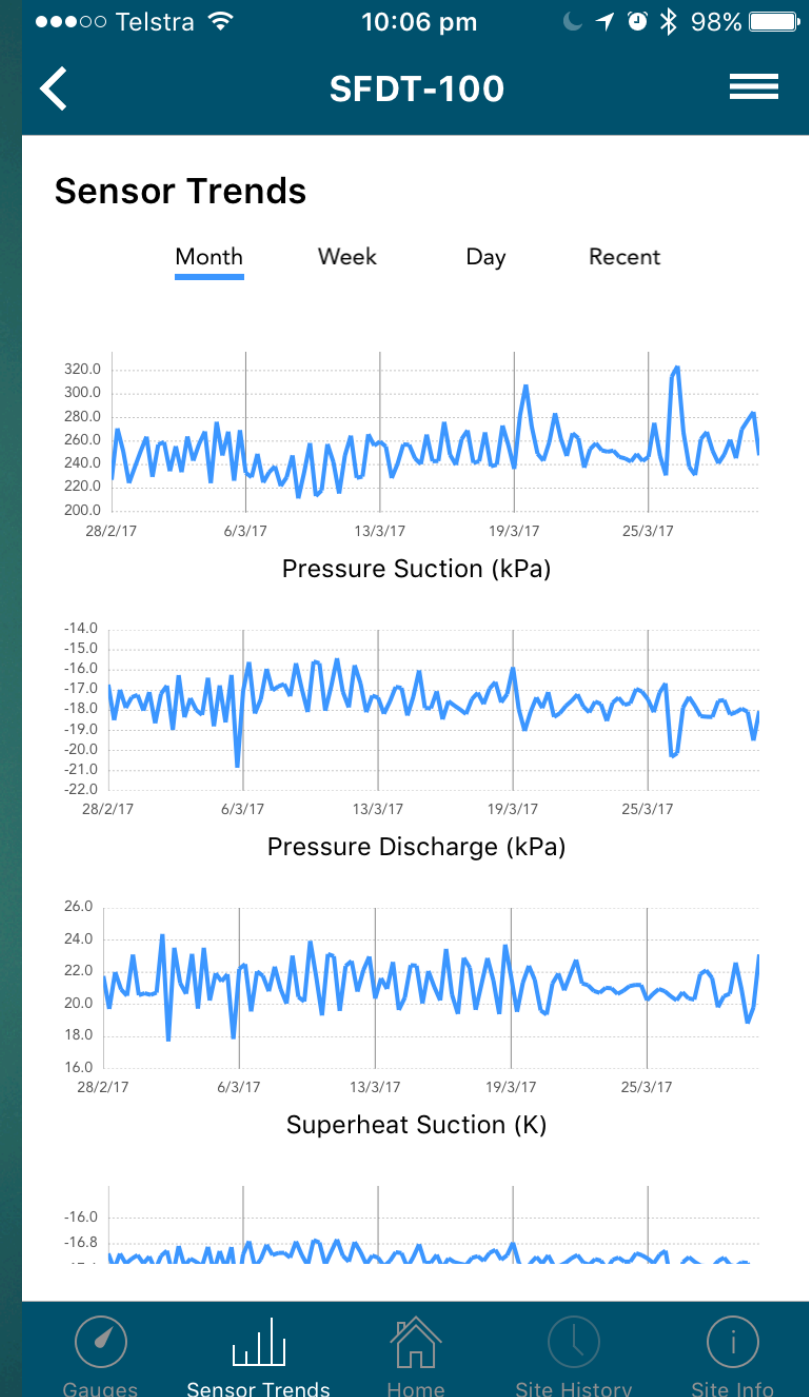
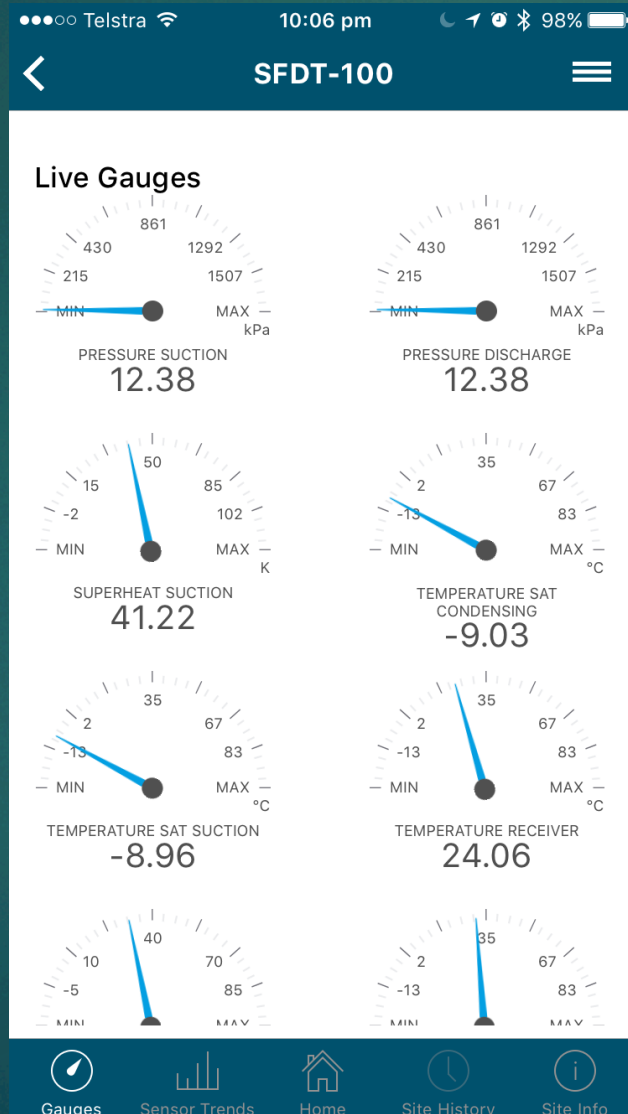
A deployment example



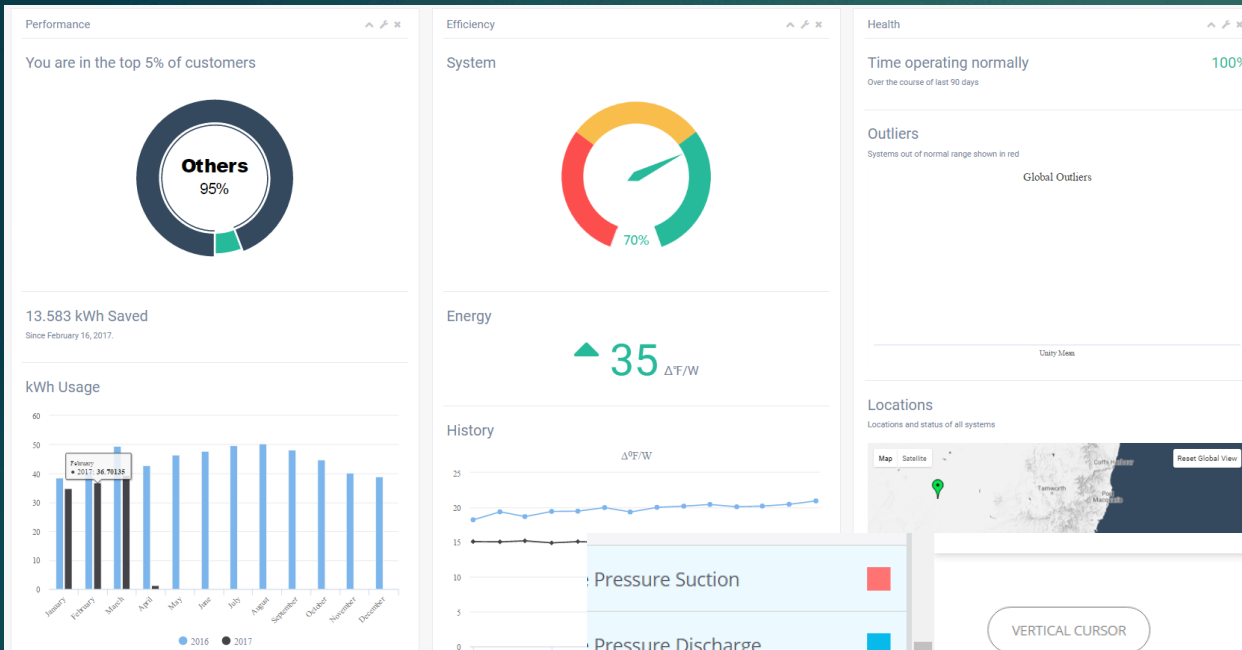
IoT App – user dashboard



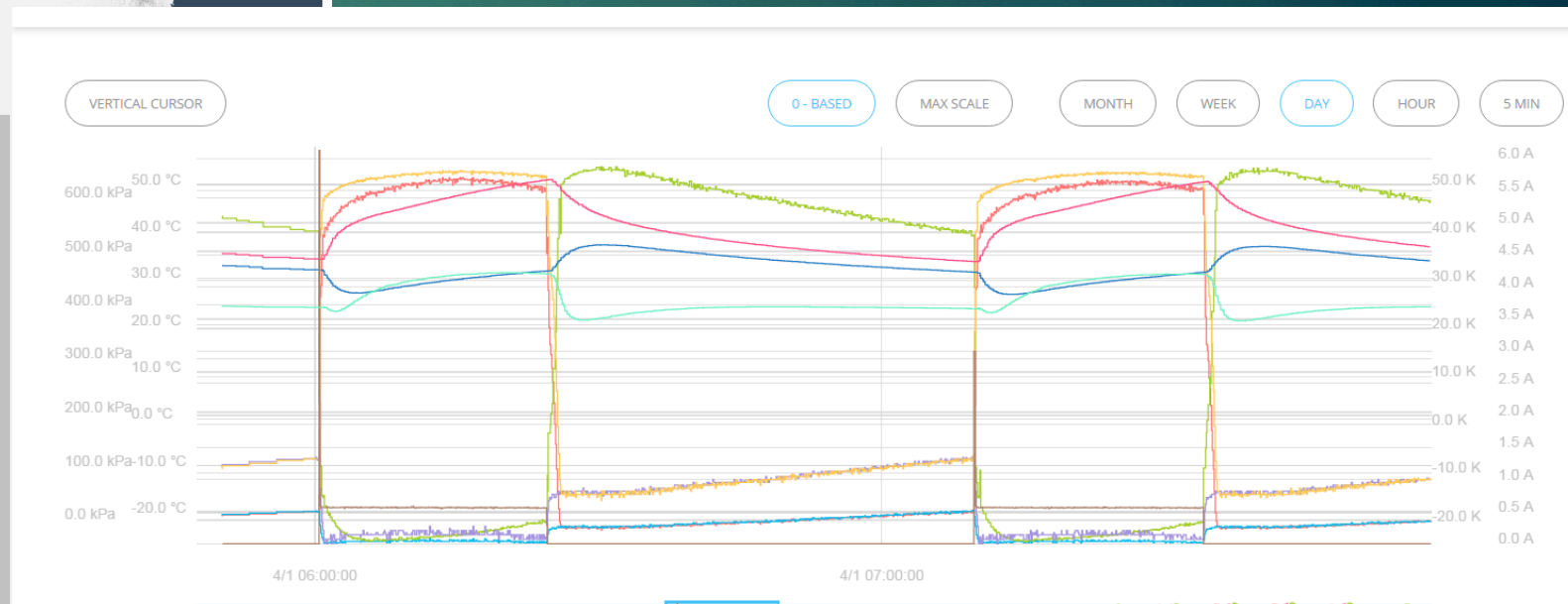
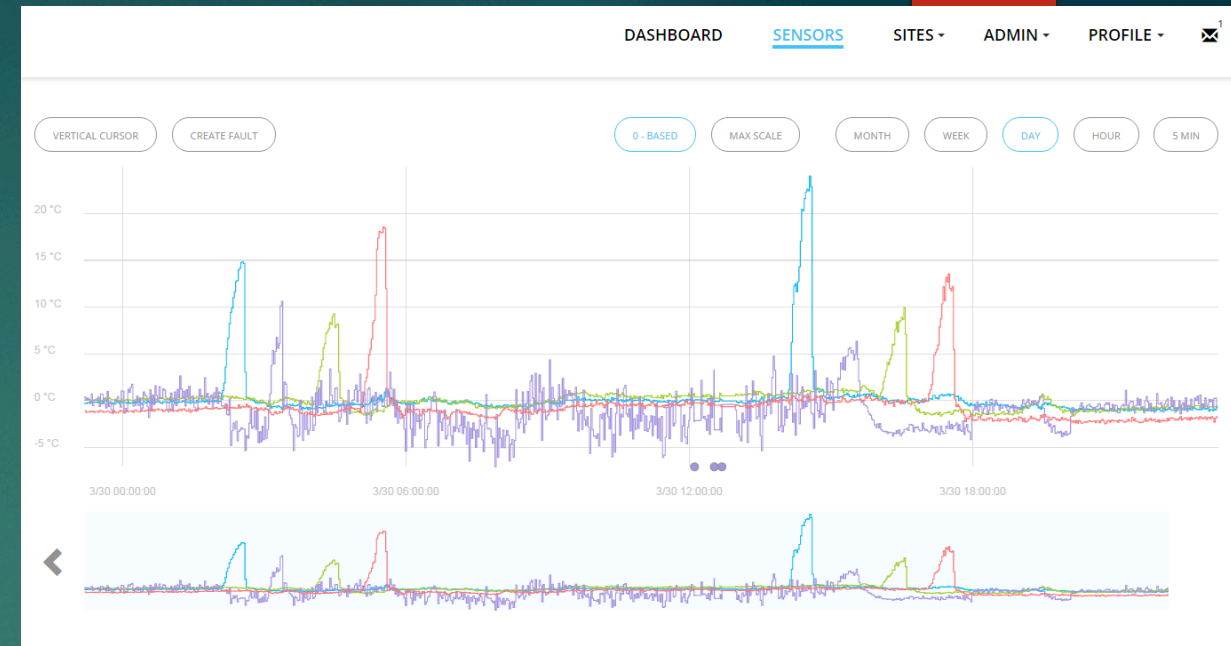
IoT App – technician



Web Interface



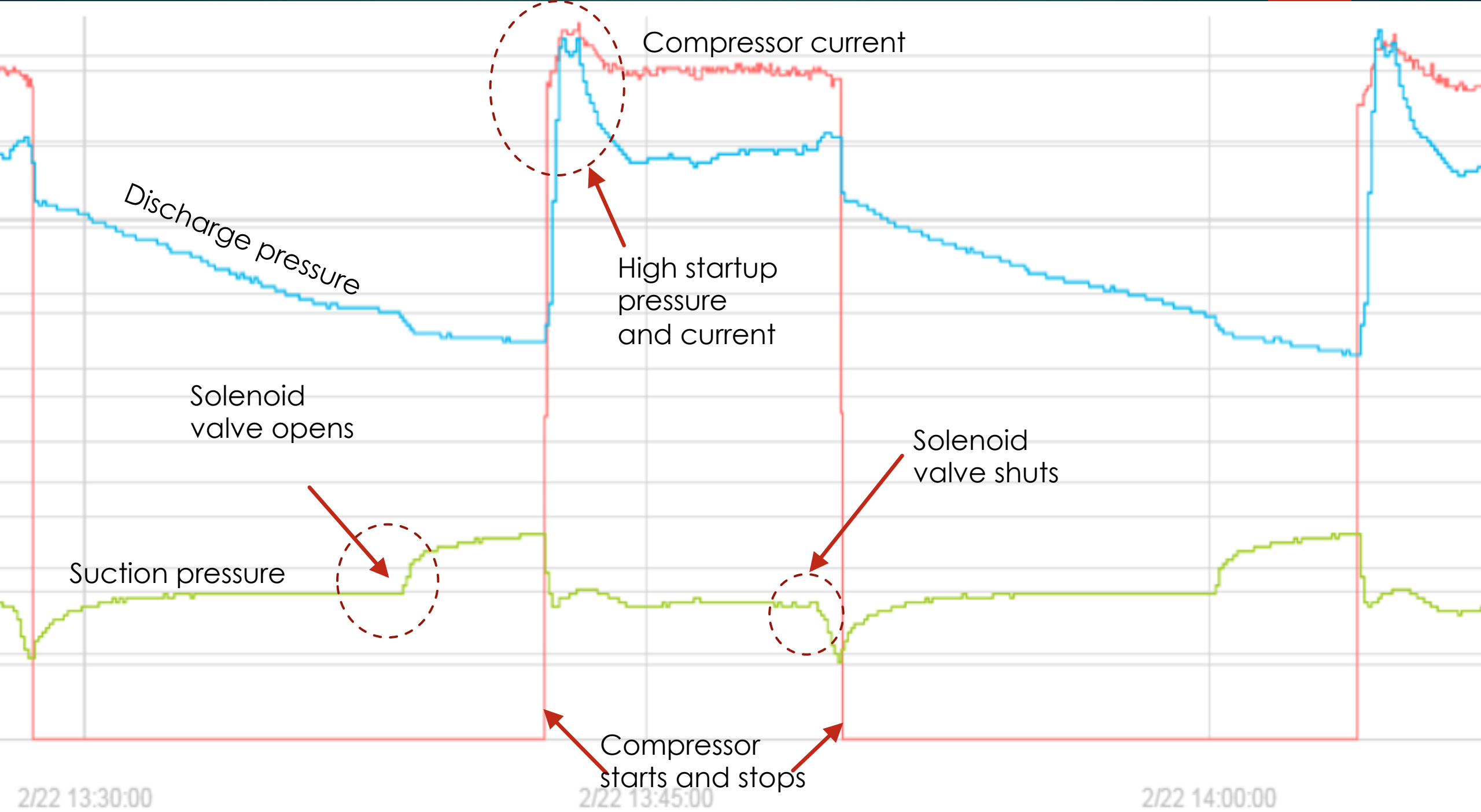
- Pressure Suction
- Pressure Discharge
- Superheat Suction
- Temperature Sat Condensing
- Temperature Sat Suction
- Temperature Receiver
- Temperature Suction
- Temperature Discharge
- Compressor 1ph (30A)



Fault recognition, machine learning and predictive fault finding

- ▶ Recognition of normal operation and deviations from normal
- ▶ Training the algorithms - ongoing WIP
- ▶ Examples:
 - ▶ Refrigerant loss
 - ▶ Short cycling of compressors
 - ▶ Condenser fan failure
 - ▶ Compressor wear or valve leakage





In summary...

- ▶ IoT makes it easy to deploy sensors and collect data
- ▶ Sensor fusion converts the flood of sensor data into something usable
- ▶ Machine learning interprets the data and detects changes
- ▶ Machine learning correlates detectable symptoms to known causes
- ▶ The result is real, actionable alerts providing diagnosis of a fault often before it causes a problem.
- ▶ All of this saves time and money, and minimizes energy and product losses.