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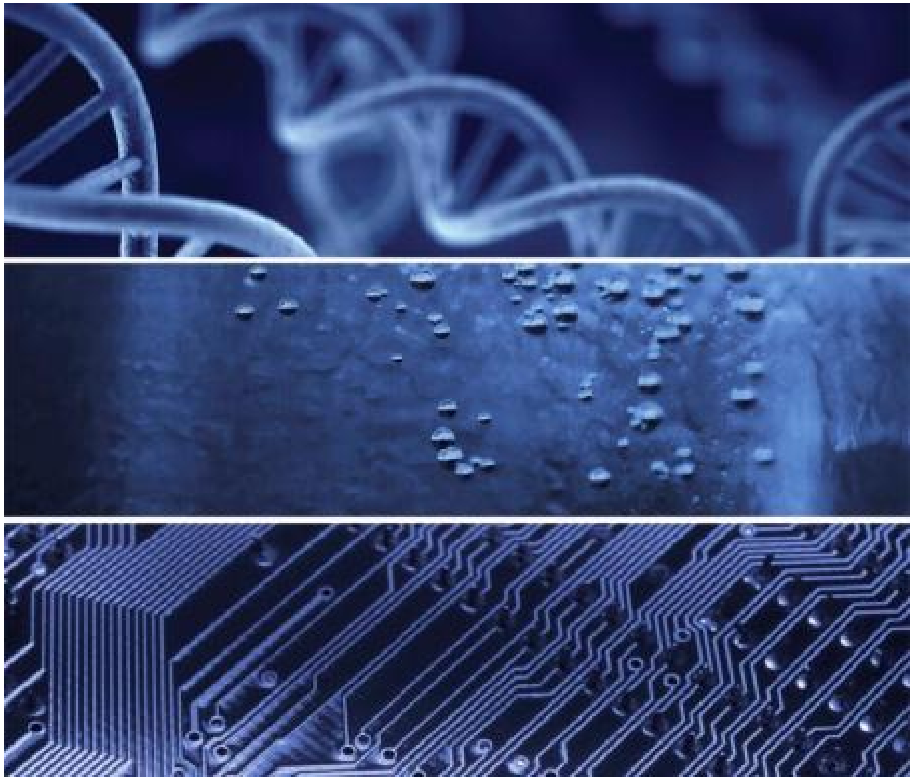
Filtration. Separation. Solution.SM



“Intelligent Fluid Management – Real Time Monitoring”

Driving uptime improvement and cost-reduction by moving to a predictive maintenance approach

NMEC NZ Conference
November 2018

What do we have today?
5 **Pain Points** Every Industrial Team Faces

1. Aggressive timelines and budget constraints
2. Maximising skilled labour resources
3. Lost productivity due to equipment or process failures
4. Identifying risk when implementing improvement projects
5. Not knowing when a system requires servicing until its too late!

OUR CASE STUDY TODAY
FILTRATION & FLUID CONDITIONS

What do we have today?
Filtration Equipment Monitoring

- Filtration is installed to protect critical equipment
- Filter elements are changed on a regular cadence based on:
  - ΔP indication
  - Maintenance schedule
- Both visual and electrical indicators are used to monitor differential pressure (ΔP)
  - **Visual** – easy to install, requires monitoring, no history of data, difficult to use to troubleshoot problems with.
  - **Electrical** – integrates into existing system, may be difficult to install, tricky to look at history.

What do we have today?
Filtration Performance Problems

- **Installation dates recorded remotely**
  - Card on filter housing
  - Maintenance list
- **No information on filter installation**
  - What type of filter installed
  - Is the filter installed
- **ΔP indication near end of life or by-pass valve opening**
  - What is current ΔP across the filter
- **No length of service information**
  - When will the filter need to be changed

What do we have today?
Filtration Performance Monitoring

- Fluid parameters are inspected to monitor the system condition

- Generally fluid monitoring is undertaken in one of the following ways;

    - **Lab samples** – time and labor intensive process, highly depended on sampling method, yields vast amounts of information

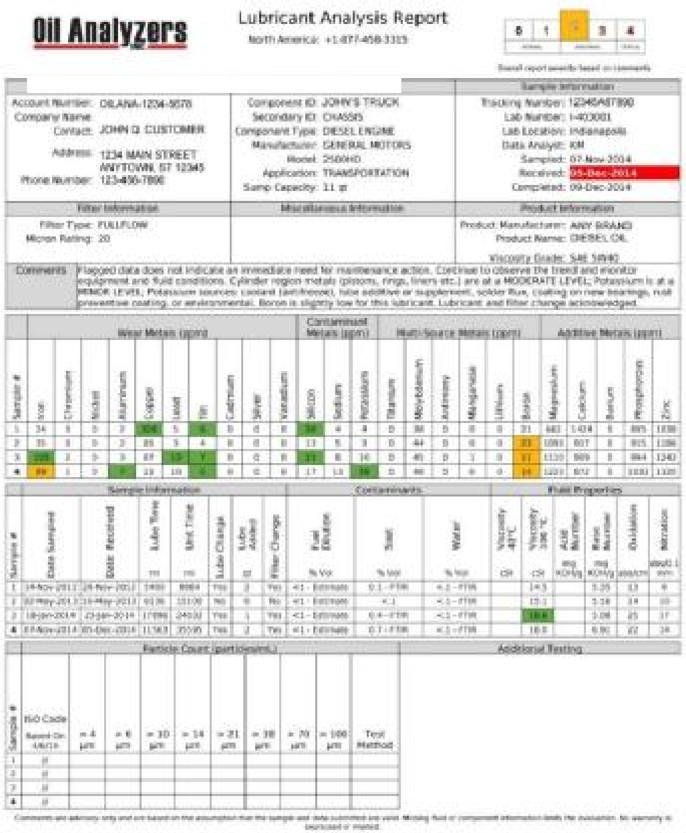
    - **On-line monitoring** – difficult to install, on-site expertise required, interpretation of data, upkeep and maintenance of data management components

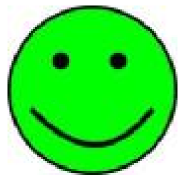
What do we have today?
Fluid Condition - Problems

- Fluid condition monitoring is mostly performed on an interval basis.

- This approach doesn't take into account condition fluctuation between scheduled reviews.

- Poor performance and excess component wear remain potential risks.





Use of Industrial Sensors

- Sensors, monitors, and other Internet-connected devices are increasingly being used to track, monitor, and control physical objects in production plants, traveling on ships, planes, trains and trucks, or at the store.

- Recent reporting in Fortune,

"sensors can be used to continuously monitor machine performance, schedule preventative maintenance, and even predict breakdowns, reducing maintenance costs up to 25 percent, cutting unplanned outages up to 50 percent, and extending machine life by years."

Source: Manyika, James and Michael Chui. "By 2025, Internet of things applications could have $11 trillion impact." Fortune. Jul 22, 2015 http://fortune.com/2015/07/22/mckinsey-internet-of-things/

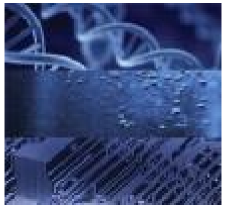
Use of Industrial Sensors in Hydraulic and Lubrication Systems

Filtration Equipment Monitoring

- Differential Pressure
- Fluid Temperature
- Filter Information – Model, Manufacturing, Installation info
- Remaining Filter Service Life

Fluid Condition Monitoring

- Fluid Temperature
- Fluid Viscosity
- Density
- Dielectric Constant
- Contamination Level
- Water Level



Big Data and Predictive Analytics

Data Collection

- Sensors continually monitor filter performance and fluid condition
- Large amount of data – “Big Data”
- Too much data to store or analyze locally

Data Analysis and Reporting

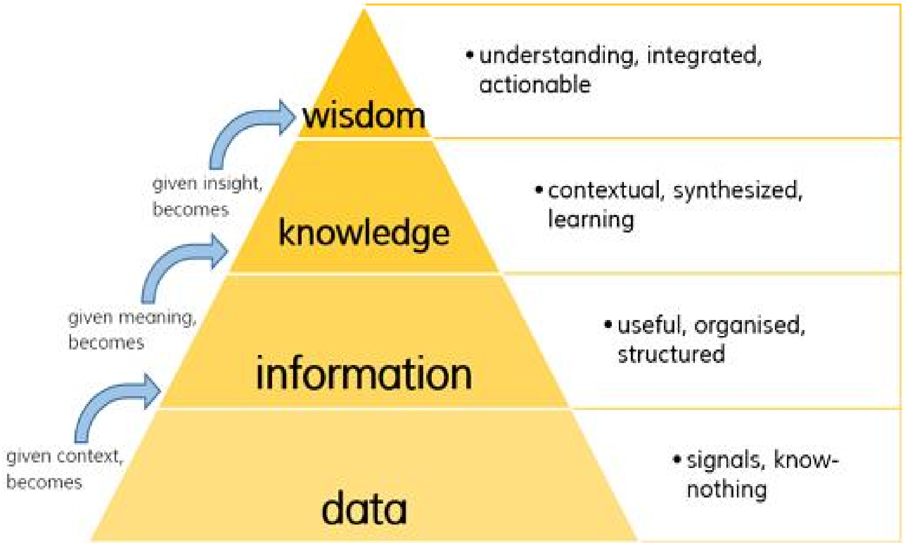
- Data is transmitted via wireless network to the cloud
- Intelligent software translates the data, maps it against historical trends, process variables, and predictive algorithms,
- Data then presented through a reporting and notification system – Predictive Analytics

Predictive Analytics

In order to draw useful knowledge from data, analysis must be undertaken.

The purpose of this analysis is to;

- Give Context to the data, &
- Offer insight into **how** and **why** the data changed



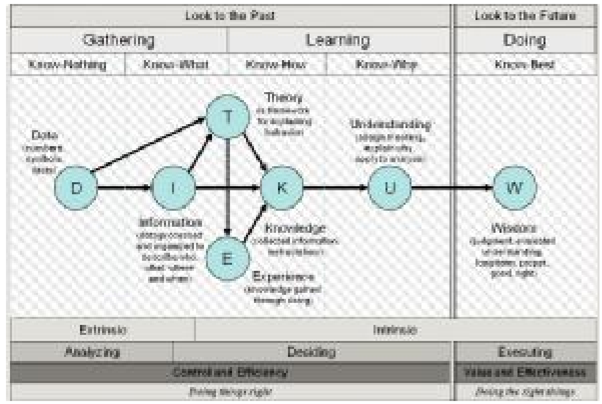
Predictive Analytics

Once the how and why is understood we can then identify leading indicators of events well before the event has occurred.

This is **Predictive Analytics**

Predictive Analytics example: Using ΔP to determining element life.

Data	ΔP i.e. 35psid (2.5bard)
Information	max ΔP = 50psid, 50 days in service
Knowledge	Element is approaching end of life
Wisdom	Element has 10 days of life left



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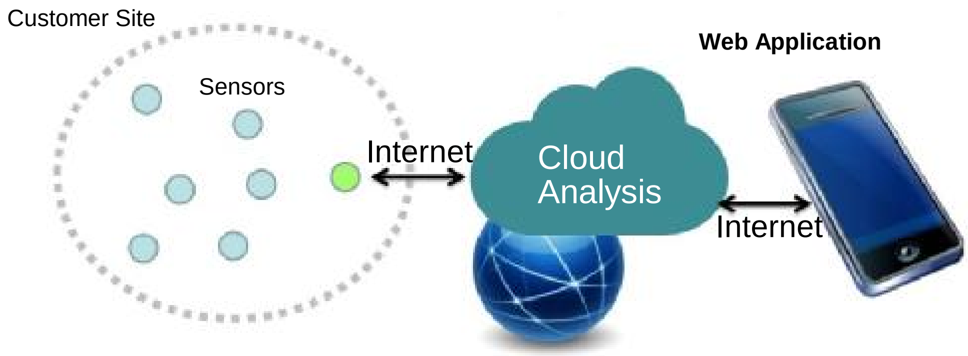
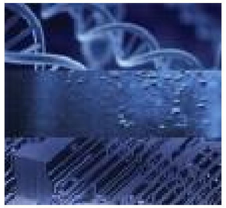
Cloud Based Data Storage and Analysis



'User' has:

- Sensor data views & analysis
- Predictive monitoring
- Configurable notification

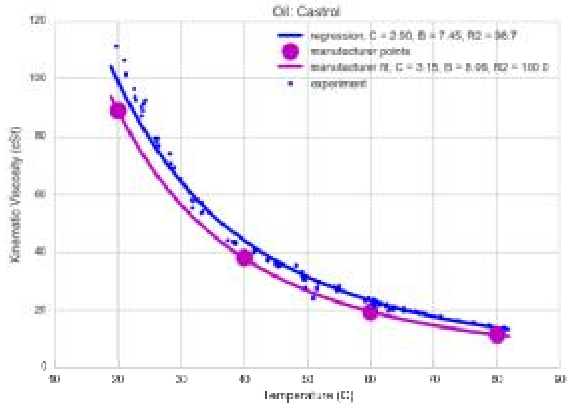
Users have real-time access to their monitors and to historical trending of process data, system health status, and notifications stored in the cloud:

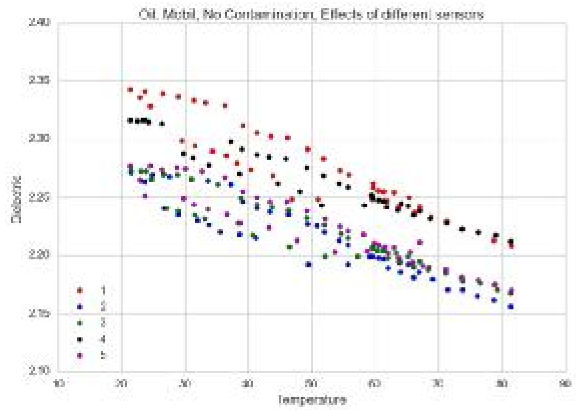


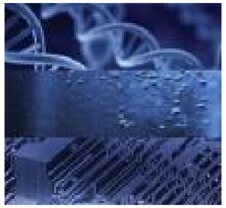
Predictive Data Analytics

- Industrial sensors can be used to monitor filter and fluid conditions in lubrication and hydraulic systems

- Using the raw sensor data, cloud based algorithms are used to calculate system critical information which is easily interrelated and acted upon by users. Information obtained from the algorithms include;
  - Generic system health
  - Filter life remaining
  - Troubleshooting assistance
  - Indication of fluid changes

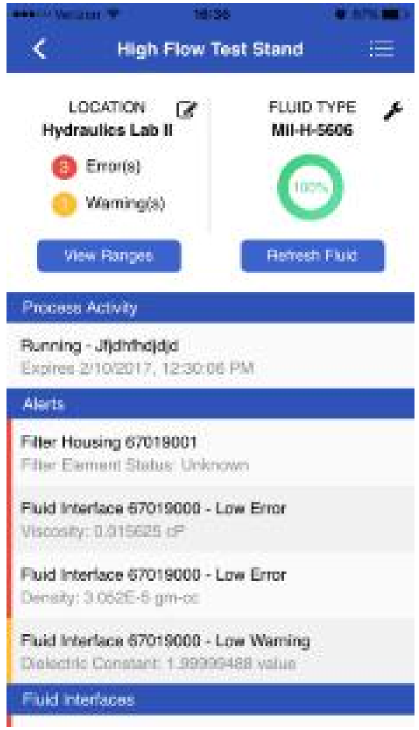






Predictive Data Analytics

- The predictive data analytics package will also have the ability to learn from the fluid system.
- By analyzing the historic trends of the system future behaviors can be predicted more accurately.
- Analysis can be locally accessed via a tablet or smart phone, helping streamline the maintenance process and improve site efficiency.
- This means less downtime through mitigation strategies being put in place, and predicting maintenance upsets before they occur.



Addressing the Pain!

Lower Maintenance Costs by up to 30%	Reduce cost of unscheduled shutdowns by more 50%	Increase productivity by up to 40%
• Reduction in filter spend • Less labor hours required to maintain filtration and fluid systems • Optimize filter element change out intervals and	• Greatly increase chances of detecting failure events before they affect the system • Speed up root cause analysis to determine the best actions that need to be taken to prevent a failure	• Enable site to focus on functions critical to production, improving yields • Decrease the loss of production and lose of labor hours associated with unscheduled shutdowns

Summary

- Existing filter performance and fluid condition monitoring methods are hard to install, output limited data and do not provide data interpretation
- Using a series of in line sensors connected to a cloud based reporting system, real-time availability of data instantly flags performance issues and warns of potential problems and provides predictive analytics of the system health
- Analysis can be locally accessed via a tablet or smart phone, helping streamline the maintenance process and improve site efficiency
- Analysis results in less downtime through mitigation strategies being put in place, and predicting maintenance upsets before they occur

Thank You !

Any Questions ?