PREDICTING AN EFFECTIVE MAINTENANCE FUTURE

BIG DATA IS A WELL-RECOGNISED TERM AND CONCEPT, WITH BUSINESSES NOW GRASPING THE IMPORTANCE OF ITS ROLE IN IMPROVING OPERATIONS, PROVIDING COMPETITIVE ADVANTAGE AND POSITIVELY IMPACTING PROFITABILITY – AND THIS IS PARTICULARLY PERTINENT IN THE INDUSTRIAL SPHERE.

With the effective collation of disparate pieces of information about a problem, we can apply artificial intelligence and predict future trends. This concept certainly appears to be the nirvana of solving maintenance issues, providing total visibility of failures before they occur.

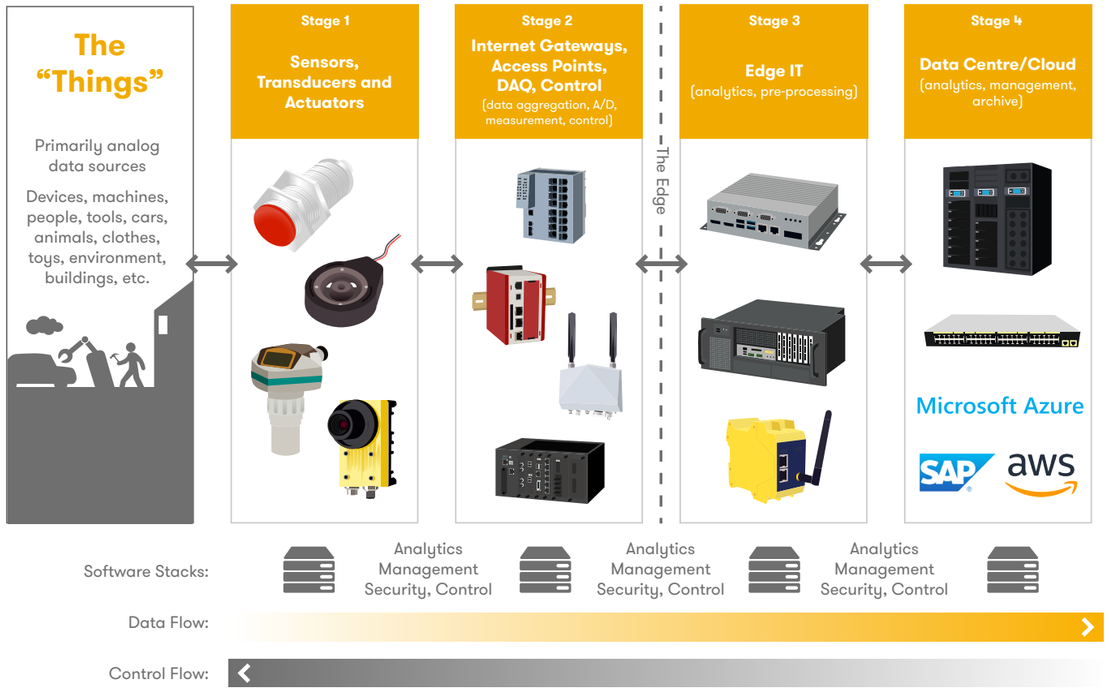
But while this all sounds ideal in theory, the operational reality can be very different. Over the last year, I've spent time with industrial end users trying to get under the skin of the organisations to understand what the real challenges are and explore key barriers to adoption for businesses when it comes to implementing IIoT technologies.

The challenges are varied, and experiences mixed, but there are some common themes that emerge across the board. A major barrier seems to be that IIoT maintenance solutions are difficult to understand and specify, and confusing and fragmented to purchase. Many focus on futuristic benefits, rather than practical results that can be delivered with pace. Implementations can be costly and complex to organise and manage – and could take years to fully and successfully implement. The objectives get blurred and focus shifts to adding new sensors rather than utilising the data which is already available.

There are some specific examples of true predictive maintenance, where the cost of data is a fraction of the cost of the asset or the cost of failure – for example, aero-engines. However, there are substantially fewer success stories within industry. There are several reasons for this:

- **Representative data sets are expensive.**
  Techniques such as full wave form vibration analysis and motor current signature analysis are very mature and are widely deployed on critical assets. However, a single vibration point is likely to cost around £1,000, making mass deployment to medium criticality assets cost prohibitive.

- **Merging different data sets is technically challenging.**
  The issues around the integration of operational technology (OT) and informational technology (IT) are significant: different architecture; different protocols and different approaches to security. Even once the connectivity has been addressed, sensor data will be accurate to the millisecond, but often failure data is reliant on human data capture and may only be accurate to the hour.



- **There's a lack of failure events.**
  Predicting failure using supervised Machine Learning (ML) relies on having large data sets of leading indicators of failure and the associated failure events. However, maintenance professionals work hard every day to prevent and mitigate failure, capturing many potential failures prior to them occurring.

- **Hidden failures have no leading indicators.**
  Many potential failures are hidden, and are only apparent when you operate the system. These failures are found through regularly testing the functions of the system. In this case, not only is there a lack of failure data, but also a lack of indicators.

To mitigate the impact of these issues, the concept of small data can be applied to predictive maintenance. Instead of looking in terms of huge new data sets and complex predictive models, look to extract as much value as possible through limited data sets. Use this to identify where to deploy resources, either labour or investment, to understand the problem more fully. Instead of looking to predict failure, look to identify abnormalities. The steps to address these are:

- Identify what data you already have - which is often a lot more than you think. Modern field devices are full of data, but it's rarely utilised
- From this, choose the parameters that could tell you what is normal or abnormal. For example, monitoring current, voltage and phase angle for all the phases of an induction motor will tell you a lot about how things are changing over time
- Use a suitable data tool to identify normal conditions during a training period. At its simplest, you can do this in Excel, or any of a range of statistical tools
- Once you've identified normal, you are only interested in abnormal readings - use these to trigger deeper investigation through, for example, full wave form vibration analysis, thermography or oil condition monitoring
- Depending on the data tool you use, you can feed back into the model the outcome of the human investigation to improve the validity of the abnormality detecting.

It is clear to me from my engagement with customers across the industrial sector that instead of getting hung up on big data and the daunting, mammoth task of understanding, sourcing and implementing technologies to harness it, that the focus should be on small data that already exists within the organisation. Small data has many benefits through reducing the cost, technology and organisational barriers to entry. Using this data in a smarter way is the key to enhancing your maintenance effectiveness.

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