Seamlessly Integrate Remote Asset Monitoring

Facilities managers from power plants and oil rigs to manufacturing are aware of the need to deploy online asset maintenance strategies to accelerate analysis, improve asset health, and streamline operations. But they are challenged by the difficulty of developing a comprehensive, reliable, online monitoring and maintenance solution.

These difficulties include capture of good, high-quality data, its secure management, and smooth integration of the solution into the installed infrastructure without compromising the system.

Even when a solution has been shown to work in one application, many facility managers are skeptical. Part of the issue, according to Brett Burger, Principal Marketing Manager for Monitoring Solutions at National Instruments (NI), is too few published case studies showing business value. "And even where there are case studies, there's always the thought that each business is a little unique," says Burger.

Despite concerns, maintenance managers recognize the risk of losing millions of dollars due to unscheduled downtime caused by equipment failures. That risk is only increasing in the face of fewer resources, aging equipment, and workforce and skills gaps. Also, as the number of assets scale, so too do inefficiencies, especially if technicians have to manually go to an increasing number of assets spread farther and farther apart, to take measurements.

According to NI's research, technicians spend 80% of their time gathering data, and only 20% of their time analyzing it. And those numbers are getting worse as the number of assets increases.

Instead, many plant managers recognize that they need to look at technologies now available for online condition monitoring and maintenance. "It's better to do it to avoid a very public failure or to end up doing it after a $50 million catastrophe," says Burger.

It's also preferable, says Burger, to be able to plan and schedule maintenance, as needed, using real-time online asset condition monitoring combined with advanced data analytics. In this way, companies can act on their industrial operational data to improve the health of their production assets.

Accurate Data with Open Access Is Key to Monitoring

Solving the problem of real-time monitoring of asset health is where NI chose to focus its experience on computer-based measurement. Its solution is NI InsightCM, a hardware and software combination that provides open access to prescreened, diagnostic-quality, waveform-centric data **(Figure 1)**.

NI's approach is interesting because it specifically doesn't try to be "end to end" in the sense that it does not include specific sensors. Instead, it focuses on acquiring diagnostic-level waveform data from multiple sensors, leaving the design of sensors and interpretation of sensor data to domain experts. On the other hand, the solution is quite comprehensive, giving domain experts analytics and dashboard tools that make it easy to turn data into information.
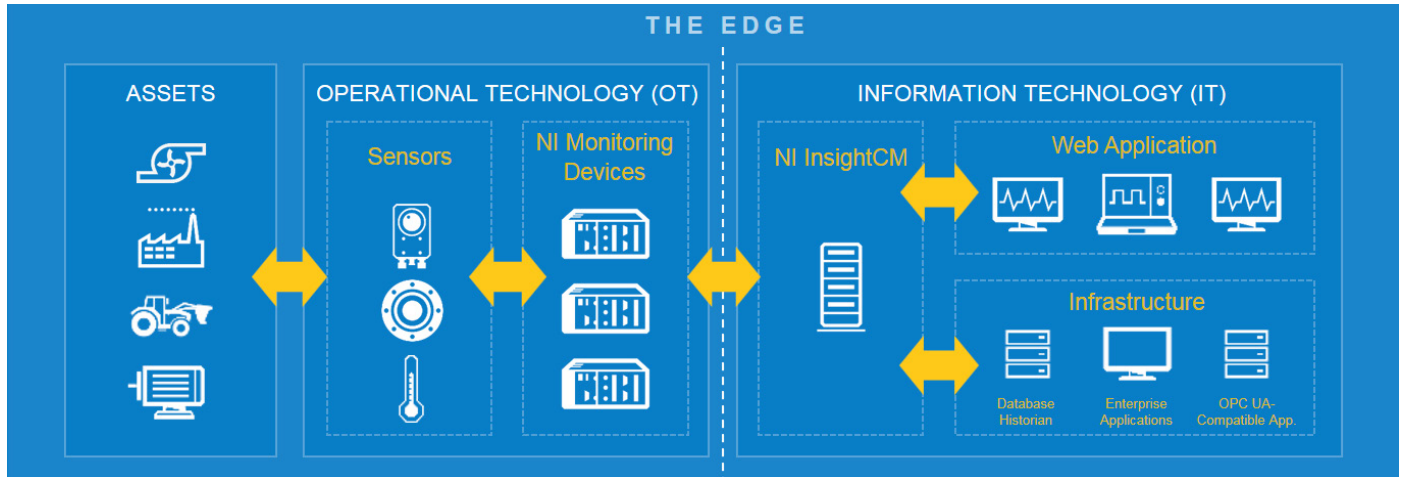
THE EDGE

ASSETS | **OPERATIONAL TECHNOLOGY (OT)** | **INFORMATION TECHNOLOGY (IT)**

Sensors | NI Monitoring Devices

NI InsightCM | Web Application

Infrastructure

Database Historian | Enterprise Applications | OPC UA-Compatible App.

Figure 1. InsightCM captures and provides diagnostic-quality, waveform-centric data at the edge using dedicated hardware and software that deftly manages OT-to-IT data flow and management. (Source: National Instruments)

The solution is also "end to end" in the sense that it straddles IT and factory floor operations technology (OT). It stores data using an open file format so it can be easily accessed by third-party software, allowing InsightCM to be integrated into any installed system. Using advanced processing capabilities, InsightCM then enables data filtering and screening at the edge, before sending critical information upstream.

"The main point is that we provide full access to raw data," says Burger. "Also, extensive sensor connectivity options help companies integrate InsightCM into their existing workflows rather than introduce completely new tools to the entire org that require training and expertise."

InsightCM's differentiation starts with the CompactRIO cRIO-9037 rugged, edge node data acquisition and intelligent embedded processing system running LabVIEW **(Figure 2)**. This is a modular, 8-slot scalable system based on an Intel® AtomTM processor E3825 running at 1.33 GHz. The asset sensors connect to the cRIO-9037 sensor input modules, which then convert the sensor inputs to digital data.

Stability and ruggedness of the sensor input modules enable acquisition of diagnostic-quality waveform data. While this is

Figure 2. The cRIO-9037 enables acquisition and edge analysis of multiple waveform data streams to provide diagnostic-level data for further analysis upstream. (Source: National Instruments)

a critical first step, not all the data is useful. To avoid transport and storage of unnecessary data, the Intel Atom processor is used to apply intelligence and analytics at the edge. Using InsightCM software, the processor analyzes the data 24×7 looking for preset triggers. If one of those triggers is met, the data record is sent to the server and flagged if follow-up is needed. This can be done for all the sensor input modules using a single Intel Atom processor E3825.

While many point solutions can acquire, process, and store data, they often do so using a proprietary file format that makes it difficult to use with other software, such as analytics and data presentation tools. NI addressed this in InsightCM by using its open access technical data management solution (TDMS) file format.

With TDMS, the data doesn't have to remain on NI's technology. If necessary, it can be exported in raw form to Excel, a pre-existing histogram, or new analytics or pattern recognition software upstream. This is a critical factor that allows InsightCM to integrate readily with existing and future workflows.

The data captured and filtered by InsightCM can then easily be sent upstream for processing by data analysis and advanced pattern recognition software.

Security Ensures Monitoring Complies with IT Requirements

For any data to be allowed upstream for analysis in the enterprise, IT must be assured the data and the connection are secure. To this end, the typical install of InsightCM is on a more enterprise/business-centric IT network rather than a control network. In some cases, separate networks are created for maintenance data at the plant site.

"This separation of data, while still under IT security control, provides a layer of separation between cyber assets for maintenance versus cyber assets for control," says Burger, adding, "NI monitoring devices used with NI InsightCM have no output to, or control of, the assets to which they are

connected, further distinguishing them from the critical control or protection-oriented cyber-assets." NI uses secure remote password (SRP) for authentication between the asset monitoring systems and InsightCM.

From a user perspective, activity between the client browser and InsightCM can be further secured using SSL encryption. Also, access is role based so IT can restrict access to certain functions by unqualified users.

With solid security, along with ease of integration and availability of diagnostic-level data, the migration to online monitoring has been greatly simplified. Challenges such as scalability and addition of future I/O functions have also been overcome, such that it may not be long before monitoring with quality data enables predictive maintenance.

"From a technology standpoint, I think we will see a lot of innovation in predictive maintenance, where the insight coming from software intelligence will increase while the historical data and domain experience needed to train the software/models decrease," says Burger.

While new approaches will still be met with skepticism, NI has an interesting case study: Duke Energy, the largest power company in the United States, sought to replace its monthly, manual data collection practices with daily, remote data collection and monitoring. By implementing InsightCM, Duke connected 10,000 assets with more than 30,000 sensors, enabling collection, analysis, and management of sensor data at scale. According to HIS Markit, the result was stronger analysis and an ROI of 130% over four years.