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Using Advanced Analytics to Predict Equipment Failure

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A growing number of organizations in asset-intensive industries are investing in advanced analytics to help them predict the failure of mission-critical equipment or assets. We explore best practices for improving the effectiveness and efficiency of these predictive asset management initiatives.

Key Challenges

- The cost of unplanned downtime can be significant, and traditional approaches to ensuring high levels of equipment utilization have reached their limit.
- Collecting and managing equipment data is complicated by legacy data formats, a lack of communication infrastructure and a lack of an enterprise strategy for managing operational technology (OT) data.
- Effectively inferring equipment failure often involves analyzing large volumes of extraneous data, which can require using new forms of advanced analytics unfamiliar to the organization.
- Projects to use advanced analytics to predict equipment failure are often local and fail to gain traction across the enterprise.

Recommendations

CIOs and IT leaders in industries with mission-critical operational assets:

- Work with the business to develop a strategy for collecting and managing the OT data necessary to support predictive asset management projects.
- Invest in data science and analytics skills to help ensure that each project is successful and, more importantly, build the capability to deliver similar projects enterprisewide.
- Develop a strategy for proactively identifying and supporting predictive asset management opportunities, as well as existing projects started by the business.

Introduction

"Prediction is very difficult, especially about the future." — Danish physicist Niels Bohr

Even in an increasingly digital world, physical infrastructure and equipment are still the backbone of many businesses. This is particularly true for businesses that operate in asset-intensive industries, such as agriculture, manufacturing, mining, oil and gas, transportation, and utilities. These organizations, which depend on the safe and reliable operation of their physical assets for the production and delivery of products and services to market, put a high premium on being able to predict when a piece of mission-critical equipment will fail. And advanced analytics will play an increasingly important role in delivering on the promise of better predictability of equipment failure. This is referred to in this research as "predictive asset management."

Predictive asset management is a subset of the asset performance management (APM) market. From "Asset Performance Management Transforms How Operational Assets Are Managed and Maintained":

> APM encompasses the capabilities of data capture, integration, visualization and analytics tied together for the explicit purpose of optimizing the performance of assets to increase availability, minimize costs and reduce operational risks. It includes the following different, but often complementary, practices: condition-based maintenance, *predictive forecasting*, reliability-centered maintenance (RCM) and risk-based maintenance.

Predictive forecasting has long been the goal for reliability engineers and others responsible for managing asset performance. Until recently, it has been an elusive goal due to technology limitations and project costs. But advances in sensor technology, communications technology, information management, and analytics are now making it possible to better predict equipment failure. The result has been a surge of investments in predictive asset management solutions. The investments are being made by small independent software vendors, such as Mtell, as well as large original equipment manufacturers (OEMs), such as GE and Siemens. And it will continue to be a major investment area for the next 10 years as globalization, regulatory oversight, social media scrutiny and complex value chains reduce the room for error in managing operational assets.

Analysis

Work With the Business to Develop a Strategy for Collecting and Managing the OT Data Necessary to Support Predictive Asset Management Projects

Not all data is equally valuable when it comes to predicting the failure of assets. Identifying the necessary data (whether it's already being captured or not) starts with clearly defining the scope of the project. The data required for predictive asset management can be quite extensive in order for the analytical engine to create a useful "failure signature." The data used by advanced analytical engines to predict failure is largely OT data. OT data is the time series production, equipment condition and event data that is used to control and monitor physical processes. Availability and access to this data varies by industry, age of assets and the OT data management maturity of an organization. Most companies have relegated the collection and management of OT data to

individual business units or even single sites. The end result is a patchwork of approaches to data collection and storage. The situation is further complicated by the procurement and use of equipment from a diverse set of OEMs. Older equipment — regardless of manufacturer — has limited, if any, instrumentation (or sensors) attached to it, and the presence of sensors on newer equipment depends on each OEM's own business strategy.

Predicting equipment failure does not always require data from the equipment itself. It is sometimes possible to infer failure from seemingly extraneous data, such as production data, ambient temperature, and data from peripheral equipment. Regardless, some form of OT data is required to effectively apply advanced analytics to predict equipment failure. The availability of the necessary data today varies by industry. Some industries — such as aerospace, petrochemicals and power generation — are more likely to have the data readily available and accessible. In other industries, the costs of widespread sensor deployment and supporting management infrastructure have been too high, so organizations are more recently beginning to address the challenges of OT data management.

OT data management is also complicated by the lack of communication infrastructure, whether it be Wi-Fi in a plant for capturing sensor data or wireless backhaul on a remote oil production facility or mine. And the business groups responsible for OT are not typically empowered, nor do they have the knowledge, to make decisions on communications infrastructure. Given that investing in the necessary wireless infrastructure can be costly, IT's expertise and vendor relationships are critical.

Effective OT data collection and management requires an enterprise approach and, therefore, increasing IT involvement. It is one of the tenets of Gartner's IT/OT convergence, alignment, and integration research and recommendations. The solution may be as simple as deploying an enterprise-class data historian, but data fragmentation will result without disciplined guidance on data management, such as developing a consistent tag namespace across the organization. In addition, there are international standards and industry consortia, such as Open Platform Communications (OPC), which can help define enterprise semantic models for process data; however, their use is complicated by the presence of legacy equipment and instrumentation. Bottom line: Having an enterprise-driven strategy for OT data management is necessary to address the diversity of systems, standards and data integration approaches found in most organizations.

Invest in Data Science and Analytics Skills to Better Support Both Existing and Future Predictive Asset Management Projects

The data science and advanced analytics skills necessary to support predictive asset management projects are not typically the same as those required to support other types of advanced analytics projects. Most of the vendors and products used for predictive asset management projects will not be familiar to IT departments. Vendors such as ABB, Detechtion Technologies, GE, Mtell and Schneider Electric sell advanced analytics products specifically designed to address the requirements of predictive asset management and, in some cases, designed for specific types of equipment. (These are OT vendors, and large ones, such as ABB, GE and Schneider, sell a wide variety of OT technologies.) More general advanced analytics packages — such as those from IBM and SAS (see "Magic Quadrant for Advanced Analytics Platforms") — have also been used in the market, but are less prevalent. Therefore, investing on the data science and analytics skills to

support predictive asset management projects requires developing a familiarity with a new class of vendors and products.

More often than not, most organizations looking to apply advanced analytics to predict equipment failure will rely on the software vendor's own consulting services to deploy the solution. While these services can be costly (often several times the cost of the software itself), it is frequently necessary to use them initially to ensure a successful project. Best practice is to assign resources to work with the consultant to acquire the necessary skills internally so that changes can be made to the models in the future, and the analytical tool can be applied to other applications and other locations.

Assigning resources to learn by working side by side with the vendor's own consultants is a necessary, but not sufficient, practice if the goal is to build skills that can be applied across the organization. In most projects, the resources assigned are local resources, and when the project is finished, their focus frequently shifts elsewhere. It is also the case that these resources are not typically part of corporate IT, because the project was initiated locally, and IT is not perceived to have the resources to support it. The rare exceptions are organizations where IT and OT management are aligned, and IT has already invested in the resources to support the projects.

For IT organizations working in asset-intensive industries, investing in data science and advanced analytics skills with a focus on predictive asset management is an investment that will help support continuous improvement efforts, regardless of the status of current investments by the business. However, if advanced analytics expertise already exists in the business ("citizen data scientists"), then consider bringing that expertise into IT as opposed to trying to re-create it. By investing in the necessary advanced analytic skill sets and getting involved in predictive asset management projects, IT can help ensure each project is successful and, more importantly, build the capability to deliver similar projects enterprisewide.

Develop a Strategy for Proactively Identifying and Supporting Predictive Asset Management Opportunities as Well as Existing Projects Started by the Business

Most predictive asset management projects are initiated and executed at a local level. The end result may very well be a successful project, but it will be a successful *local* project, and the benefits will not extend beyond one location. In addition, local projects are not necessarily executed with the same rigor as an enterprisewide initiative, raising questions about the choice of vendor and product, as well as project costs. It is not unusual for a local team to choose a product based on hearing about if from a colleague, seeing it at a conference or finding it on the Internet. They may not be aware of similar products that can deliver the same or better results at a lower cost. This is fundamentally the difference between how IT is managed (centrally) as opposed to OT (distributed).

IT should develop a strategy to identify existing projects or deployments of advanced analytics in support of predictive asset management, and offer to work with the business to achieve the desired results. The more expertise IT can bring to the table (per the recommendations above), the better. In most cases, the business will welcome the assistance; however, be prepared for resistance rooted in skepticism of IT's knowledge of the technologies used for predicting equipment failure. IT should approach the opportunity as a way to deliver new services to the business and not as a way to simply control another technology domain.

IT should also work with the business to identify potential opportunities for deploying advanced analytics in support of predictive asset management. While most asset-intensive organizations have at least looked at the possibilities, many have yet to start down the path of deploying any technology. In these scenarios, IT should be proactive in identifying opportunities, building the expertise and developing a business plan. Given the advances in analytical tools to predict equipment failure, it's inevitable that organizations with mission-critical assets will invest in advanced analytics to help ensure safe and reliable operations.

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"The Internet of Things Revolution: Impact on Operational Technology Ecosystems"

"Industrial Analytics Revolutionizes Big Data in the Digital Business"

"Asset Performance Management Transforms How Operational Assets Are Managed and Maintained"

"The Confluence of Operational Technology and Big Data"

"Magic Quadrant for Advanced Analytics Platforms"

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