WHITE PAPER

How to Get the Best Out of the IIoT with Predictive Maintenance

Daniel Lai
Product Manager

MOXA®

Abstract

The Industrial Internet of Things (IIoT) is shaping the way industrial applications are designed and implemented today. The IIoT is ushering in a new era of operational efficiency, information transparency, and economic growth. Innovative ideas on how to collect data, how to transform data, and how to use the data to increase efficiency and reduce costs are sprouting up all around us. The IIoT has bridged the gap between the physical and digital worlds and has created one combined space that provides limitless possibilities. In addition, the relentless pursuit of excellence in the IIoT world has renewed an interest in predictive maintenance solutions that ensure higher equipment reliability and system uptime. In this white paper, we look at why computing systems are the pillars of the IIoT and how implementing predictive maintenance for computers can help you achieve operational excellence and reduce downtime.

Why Predictive Maintenance is the only Way to Stay Ahead of the Game

Data is at the core of IIoT-enabled systems. The data collected from edge devices can provide value only if it can be processed instantaneously at the edge of the industrial network where the devices and sensors reside rather than sending all the data to a centralized system. When the data from edge devices cannot be processed locally, valuable time is lost due to delayed responses. In most cases, delays of only a few seconds could mean the difference between a just-in-time fix and a total equipment failure that results in catastrophe. Most businesses today are striving to achieve intelligence at the edge of their industrial network by deploying computers that can collect, process, and analyze data and in some cases even control the edge devices. These computers are often located at unmanned or remote sites. Imagine the consequences if any of these computers have a performance issue or run out of memory, preventing them from performing their role efficiently. Industrial processes will soon get out of hand and industrial equipment will have to be shut down, leading to huge financial losses. If an industrial process gets out of hand because of a failure to detect and fix issues on time, it could also lead to accidents that result in lost lives. For these reasons, computers used in IIoT-enabled systems must be treated as critical equipment, which require a higher level of maintenance strategy than non-critical devices.

Released on July 15, 2016

Moxa is a leading manufacturer of industrial networking, computing, and automation solutions. With over 25 years of industry experience, Moxa has connected more than 40 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for automation systems. Information about Moxa's solutions is available at www.moxa.com.

How to contact Moxa
Tel: 1-714-528-6777
Fax: 1-714-528-6778

Reliable Networks ▲ Sincere Service

Traditionally, companies have maintained their business assets using manual processes that are time-consuming and resource-intensive. The IIoT brings with it a complete paradigm shift with respect to the operation and maintenance of industrial equipment. Instead of waiting for equipment to fail before fixing it, or scheduling time-based maintenance that sometimes leads to unnecessary maintenance of equipment and downtime, companies are adopting predictive maintenance strategies to stay ahead of the game. For example, a predictive maintenance tool for a computer can keep track of any variance from the expected behavior and trigger an alert. These triggers could be based on predetermined threshold values for key computer parts, such as CPU usage, CPU temperature, memory usage, and disk usage. The use of predictive analytics enables users to explore potential root causes and apply appropriate remedies. A predictive maintenance strategy helps identify issues early on and allows equipment repairs to be scheduled in an orderly fashion, thereby providing some lead time to purchase materials for the necessary repairs and reducing the need for maintaining an inventory of key parts. Damaged equipment is replaced before obvious problems occur, and since maintenance work is only performed when needed, the production capacity is likely to increase as well. Moreover, predictive maintenance can deliver 8% to 12% cost savings over time-based maintenance.

How to Implement Predictive Maintenance for IIoT-Enabled Systems

In the past, establishing a predictive maintenance program could require a lot of tedious work and investment, but without tangible benefits. The goal of a successful predictive maintenance program is to enable easy proactive access to data for each piece of critical equipment, so that you can monitor the current status of the equipment by watching the trends and planning maintenance downtime based on these values.

A predictive maintenance tool for computers can help you monitor the computer's health in order to take preventive maintenance measures well in advance to maximize your system uptime. A well-designed dashboard can help you keep an eye on key computer parts such as CPU loading and memory usage. An alarm function can trigger audio or visual alarms and SNMP traps when the parameters go over predetermined thresholds. What's more, some tools also let you configure the tool to trigger these alarms based on user-defined criteria.

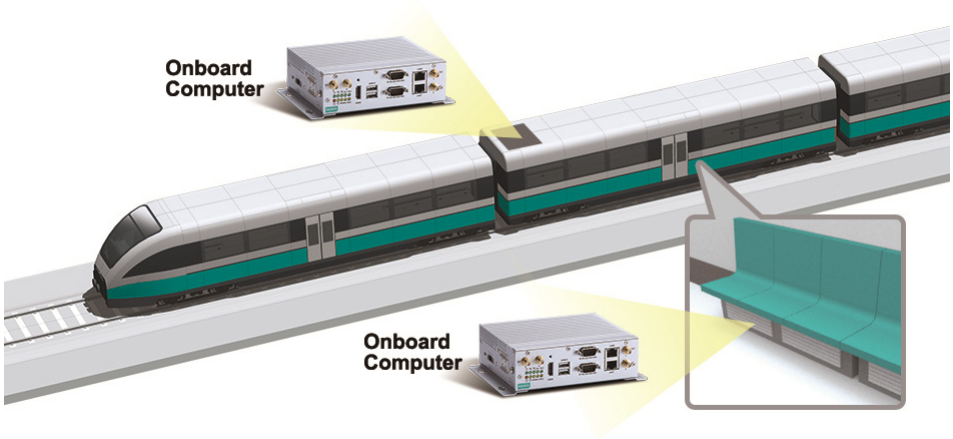
Additional capabilities that aid predictive maintenance are:

- Easy-to-use remote monitoring functions
- A ready-to-use tool that runs on a Windows or Linux OS
- RESTful APIs that give you access to the key-part parameters

Remote Insights: Rolling Stock, Power, and Marine Case Studies

In this section, we illustrate the importance of predictive maintenance for rolling stock (rail), marine, and power segments using remote-site scenarios.

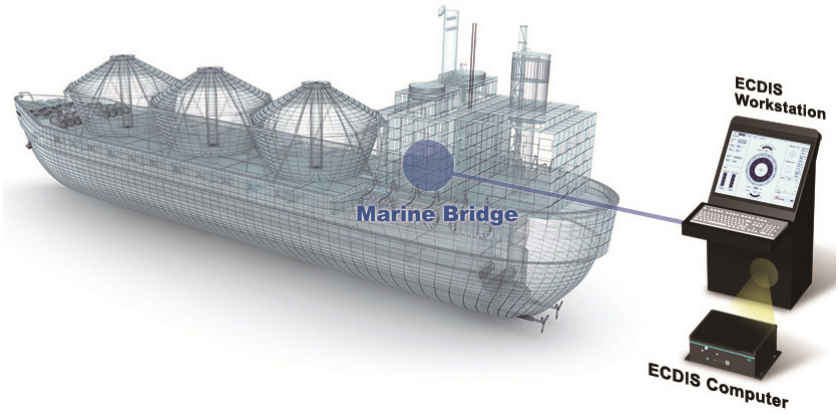
- **Rolling Stock:** In a metro transit system, computers are widely deployed in onboard control and video recording systems. As space is very limited on refurbished rolling stock, computing systems are often installed at places that are hard to reach and maintain such as cabinets, compartments under passenger's seats, or on the ceiling. Having ready access to a computer's current condition (storage, CPU, memory) so that you can implement a preventive maintenance routine is an important aspect of ensuring a smooth transit system.



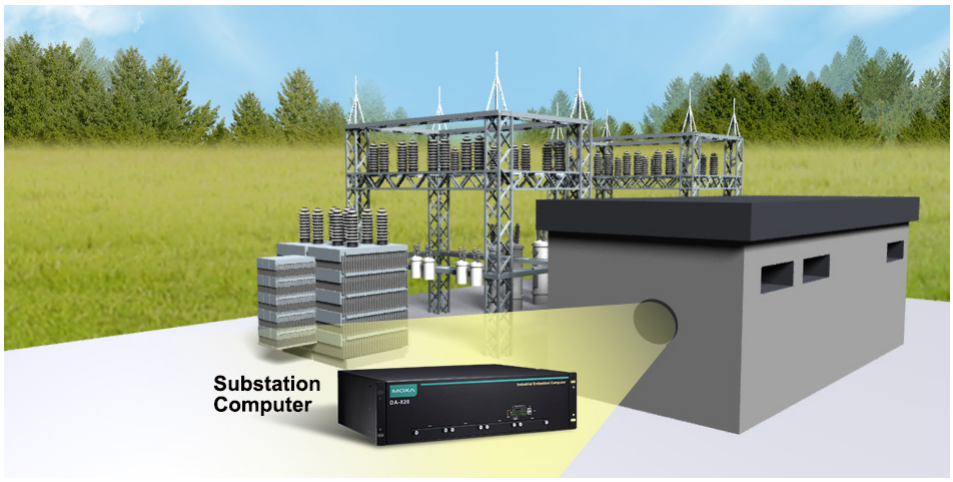
- **Marine Bridge:** An electronic chart display and information system (ECDIS) is one of the most important systems on a ship's bridge. An ECDIS system takes real-time information from sensors deployed on equipment, such as speed logs, radar, wind stations, AIS, and gyrocompasses into consideration when planning the ship's voyage. It combines the information from the sensors with information on dangerous areas or areas of special attention on the route to chart a safe course for the ship. Hence, a reliable and durable computer is crucial for running the ECDIS system. Information on the status of the key parts of the ECDIS computer can be monitored by integrating the computer's key-part data with the bridge system using monitoring APIs or by another means. In addition, an alert function can help provide warning messages when a parameter associated with a key part goes over a preset threshold. One example is when CPU usage exceeds a threshold due to system software errors. When this happens, an alert message is sent out so that the crew can deal with the problem before things get out of hand.

To summarize, marine users are looking for the following key benefits in a predictive maintenance system:

1. RESTful APIs to integrate the computer monitoring function with the ECDIS system.
2. An alert function to help prevent potential problems before they occur.



- **Power:** Unmanned power stations are increasingly becoming the norm in remote, hard-to-reach sites. A predictive maintenance tool is required to maintain critical equipment, including computers, in an unmanned substation and remotely monitor and control the equipment to ensure that the substation functions smoothly.



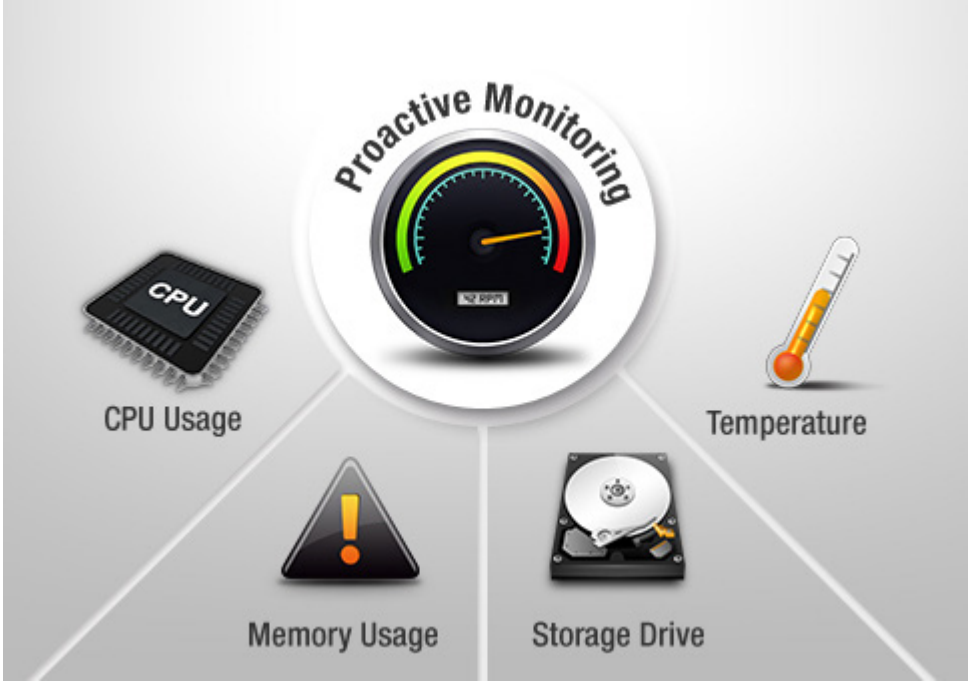
Moxa's Solution

Moxa's predictive maintenance solution, called Proactive Self-Maintenance, helps businesses monitor the health of computers deployed in their IIoT-enabled systems in order to perform preventive maintenance measures, thus maximizing system uptime.

Proactive Monitoring provides a dashboard for keeping an eye on CPU usage, memory usage, storage partition usage, the operating temperature of the CPU and motherboard, and the redundant-power monitor. It can trigger relay outputs to provide either visual or audio alarms, and can also send out SNMP traps. The tool can be configured to trigger these alarms based on user-defined criteria.

- Remote monitoring in a few clicks: Proactive Monitoring provides an easy-to-use utility for setting up the threshold and time period for the key parts you'd like to monitor. It lets you specify when an alert should be generated and the type of alert (audio, visual, SNMP traps) to generate.
- Ready-to-use tool: Proactive Monitoring is supported on both Windows and Linux operating systems, making it a ready-to-use tool for every business.
- Easy customization with APIs: For system integrators or users who already have their own dashboards, Proactive Monitoring provides APIs for easy integration of data.

Proactive Self-Maintenance is currently available on the V2201, V2403, MC-1100, MC-7200, and DA series of computers.



Moxa's rugged industrial computers with built-in proactive monitoring solution help you reduce the costs of remote system maintenance and maximize your system uptime. Moxa x86 industrial computers are a product of Moxa's solid system engineering process designed with customer's needs in mind. Moxa offers a range of rugged and fanless computing solutions that includes compact DIN-rail mountable computers like the MC-1100 and V2201 series, wall-mountable V2403 and MC-7200, and 19" rackmountable DA series. All of these computers are available in wide temperature models to fulfill any industrial automation need in the IIoT environment.

Credits and Sources

1. **Operations and Maintenance Best Practices: A Guide to Achieving Operational Efficiency**
http://www.pnl.gov/main/publications/external/technical_reports/pnnl-13890.pdf