WHITE PAPER

How OPC UA Software Enhances Big Data Integrity for IIoT SCADA Systems

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Big Data Integrity Is a Critical Factor in the Evolution from Traditional to IIoT SCADA Systems

Over the past several years, SCADA systems have evolved from proprietary, monolithic systems to decentralized, cloud-computing systems. Modern SCADA systems are quickly adopting Industrial Internet of Things (IIoT) technologies, such as cloud services or pub/sub protocols, to collect more data from monitored systems. This move is essentially mandatory, due to the fact that the amount of data involved is expanding at an ever-increasing rate. In fact, the amount of data today's SCADA systems manage is thousands of times greater than traditional SCADA systems from a decade or two ago. IIoT technology provides faster computing speed, more data storage space, and advanced analysis capabilities, giving supervisors the ability to extract valuable business insights from big data, at a lower infrastructure cost and with less maintenance effort. SCADA system operation has changed from passively monitoring equipment status to proactively improving Overall Equipment Effectiveness (OEE) and control. Users are no longer satisfied with basic, printed, trend chart-type reports, but instead demand immediate access to analysis results—more often than not through a cell phone or tablet computer—giving them the ability to make on-the-spot decisions from essentially any location on the planet.

	Traditional SCADA System	**IIoT SCADA System**
Purpose	Remote monitoring and data acquisition	Improving Overall Equipment Effectiveness (OEE)* and process-wide overview of seed data for long-cycle system management. • Preventive maintenance • Predictive analytics
Control	Supervisory control	Optimized proactive control
Reports	Historical trend charts	Analytics for new business models
Alarms	Immediate-action management within the OCC (Operation Control Center)	Dispatch actions to anywhere through mobile devices

*OEE identifies the percentage of resource-usage time that is truly productive.

However, automated analysis can sometimes lead to surprising results, in which case systems engineers would be justified to question whether or not the big data, and the automated analysis, is accurate. Everyone has heard the old adage, "garbage in, garbage out," but the reality is that ensuring the quality and integrity of big data is much easier said than done.

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Smart Data Acquisition Enhances Big Data Integrity

The sheer quantity of data churned out by thousands and thousands of sensors can put a tremendous load on legacy data acquisition methods. For many years now "updating data by polling," which is the norm for SCADA software, has been the industry standard for communication between the server and clients. In the IIoT era, legacy polling methods do not mix well with big data, particularly since by its very nature, polling results in the collection of tons of worthless data from thousands of sensors, leading to high data storage costs and time consuming data analyses. When your sensors spit out data at a frequency much smaller than the polling interval, such as is the case when monitoring a machine's ON/OFF status, "updating by exception" can reduce the amount of data storage and increase the efficiency of data analysis.

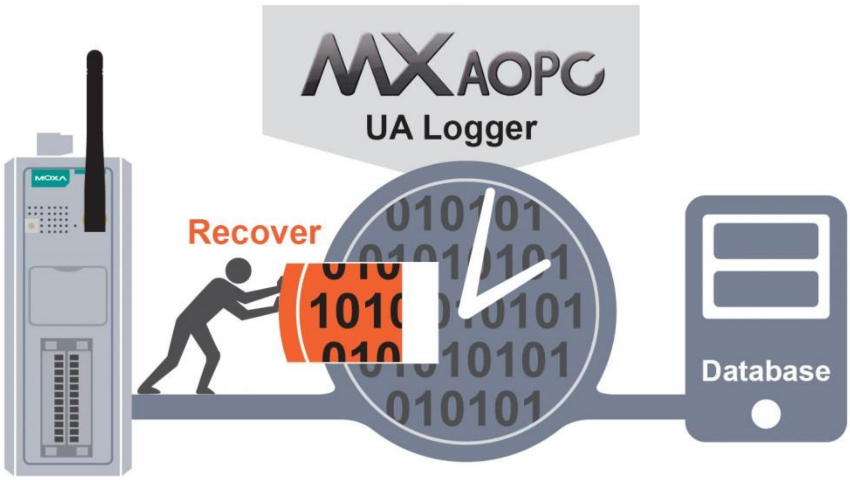
With wireless technology quickly becoming the connection option of choice for IIoT applications, mainly due to its convenience and mobility, the stability of wireless communications is a critical issue. A cause for concern is the inevitable unexpected connection interruptions that plague any wireless network, and which could result in data loss and expensive shutdowns of important business processes. Most SCADA systems support saving data to a database in real time. However, data loss will occur when the network connecting the SCADA software with the remote I/O devices goes offline, or when the SCADA software crashes. A common solution to this problem is to back up data in local storage devices located near the remote I/O devices. However, extra programming effort is required to collect offline data logs from the local storage devices and parse it to a database, since most SCADA software does not provide this kind of solution. The critical drawbacks are:

- Third-party or in-house software engineers need to create additional software to handle data completeness. Developing this kind of software is costly and difficult to integrate and maintain.
- An operations engineer needs to define the start and end time of the data loss duration for each remote I/O device, and the engineer needs to manually trigger the data completeness process, increasing the chance of collecting duplicate data or neglecting the data-loss duration altogether.

A solution that provides an automatic data completeness function can save users a lot of development and maintenance effort.

Adopting OPC UA Software to Implement Smart Data Acquisition

SCADA software and OPC servers have traditionally been based on a client-server polling model. About ten years ago, Moxa introduced its patented Active OPC concept, which is implemented by Moxa's ioLogik products. The ioLogik can poll local meters and sensors as frequently as it likes without putting any burden on the Ethernet network, and only sends readings to the OPC server (over the Ethernet network) when certain pre-configured conditions are met. Engineers can decide between updating data by polling and updating data by exception. Deciding which option to choose depends on two factors: (1) the frequency with which sensor readings change, and (2) the urgency with which you need to know that a reading has changed. The Moxa white paper How OPC UA Servers Facilitate Efficient SCADA Device Data Management explains the details of the concept.



When used together, Moxa's ioLogik 2500 series, MX-AOPC UA Server, and MX-AOPC UA Logger form a turnkey solution that provides real-time data acquisition, data buffering in local storage devices, and automatic data completeness after network failures. MX-AOPC UA Logger imports data from MX-AOPC UA Server into a database in real time. When the network fails and then recovers, the logger automatically retrieves data logs, with timestamp matching the duration of the disconnection, from the data buffers of specific ioLogik 2500 devices, and then pushes the supplementary data into the database.

Big data quality and integrity are fundamental requirements of a successful IIoT. As companies adopt more IIoT solutions and analysis methods, it is important to keep improving data acquisition methods as well. With Moxa's smart data acquisition methods, data acquisition becomes more efficient and accurate, and companies are better able to extract more valuable business insights from IIoT solutions.

Case Study: Radio Station Equipment Monitoring

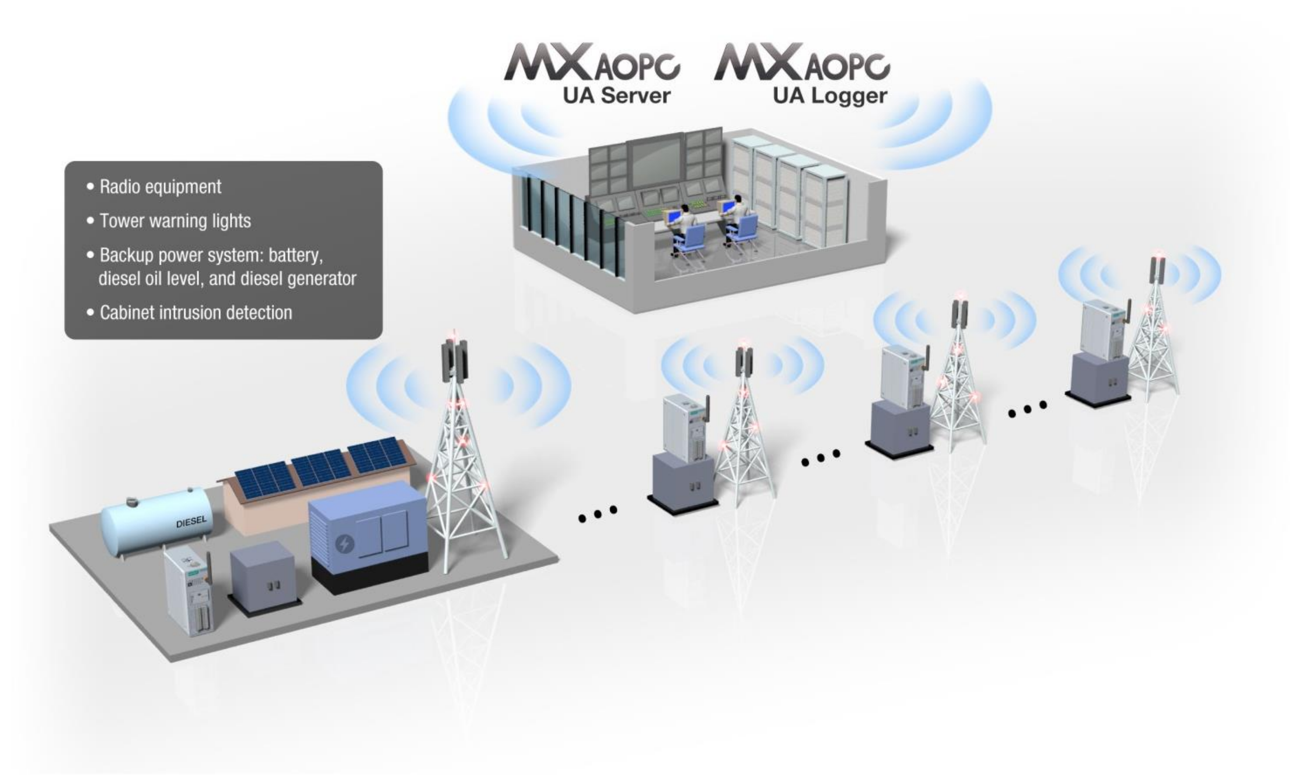
Many leading wireless carriers throughout the world are looking for cost-effective and efficient ways to manage remote, unmanned sites. The traditional method of sending maintenance personnel on regular, onsite visits is both inconvenient and costly. The obvious solution is to make it possible for maintenance engineers to remotely monitor and manage the unmanned sites efficiently, and proactively maintain and control their systems to prevent system downtime. In addition, since interruptions in wireless transmission are inevitable, during the disconnection period, data is saved to a local RTU. When the wireless network is back online, the data can be sent back to the central database automatically.

One solution provider uses Moxa's ioLogik 2542-HSPA-T, MX-AOPC UA Server, and MX-AOPC UA Logger combined with their own SCADA software on a private cloud to provide a nationwide solution for radio station equipment monitoring. With this solution, engineers can monitor:

- radio equipment
- lighting on radio towers to ensure compliance with flight safety regulations
- the backup power system, including the battery, diesel oil level, and diesel generator
- cabinet intrusion detection indicators, equipment rooms, and areas that are off limits

In one application, about 100 unmanned sites are being monitored. One ioLogik 2542-HSPA-T is installed at each site. Each ioLogik monitors 12 analog inputs and updates the data to MX-AOPC UA Server using a percentage change strategy. The ioLogik also monitors 8 digital inputs and updates data to the server by exception, resulting in a dramatic reduction in the amount of data that needs to be transmitted. In addition, the amount of storage space required at the central site is greatly reduced. Whenever the connection between the ioLogik 2542-HSPA-T and MX-AOPC UA Server gets disconnected, it saves the data in its local storage drive for backup purposes. Once the connection is back up and running, the MX-AOPC UA Logger automatically retrieves the data from the local storage drive and pushes the data to the central database.

Moxa's ioLogik 2542-HSPA-T, MX-AOPC UA Server, and MX-AOPC UA Logger not only make it easy for the solution provider to transmit data to the database in real time, this combination of tools provides complete data by automatically pushing supplementary data, stored locally during disconnection periods, to the central database. The system not only enhances data integrity, it also provides SCADA engineers with prompt and accurate data analysis.



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