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# Remote Asset Monitoring Unlocks Information

Data acquisition software featuring cloud connectivity provides the key for users to unlock smart device information trapped in their remote assets.

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Today, smart devices are the norm instead of the exception. From the lowliest thermostat to much more complicated systems, most components and equipment are offered as available (or even standard) with some level of intelligence and connectivity. The variety of consumer-facing Internet of Things (IoT) devices and their industrial IoT (IIoT) cousins grows daily but what is the real end-user value in all this IIoT intelligence unless it improves operations and saves money? Users searching for this answer need to take advantage of this newfound potential power and an important part of any optimization solution are a remote access monitoring platform.

Unifying such a wide range of hardware, data types, protocols and networking methods is certainly a tall order. The extremely distributed and granular nature of these products means they are most likely to be implemented piecemeal and not as part of a single project. Any remote asset monitoring platform must therefore be able to connect using many different networks and protocols, and must have the flexibility to scale from just a few devices up to thousands.

While this connectivity and scalability are critical for data acquisition, just obtaining the raw data is not enough. It must be processed in the proper context and offered to users in a sufficiently open (yet secure) format for analysis, so the capability of integrating with other commercial or user-developed applications and databases is essential.

A cloud-based database system meets all of these requirements and more. This white paper will describe how the right software system:

- gathers data from any number of sources,
- processes the data to turn it into actionable information, and
- securely distributes the information to remote users.

Once the right information is in the hands of the right users, they can exploit it for operational benefits.

**Users Are Looking for More**

End users are not interested in experimenting, so gathering data simply because it is possible is not the end-game. Instead, they want to readily take advantage of the most important results that asset monitoring can deliver. As the ARC Advisory Group points out, services and products are expanding to “span the plant lifecycle, from system engineering and design “in the cloud,” to data as a service for operating process plants.”

Any asset monitoring system must offer a comprehensive and easy-to-use central system and software concept. If it is not straightforward to develop, maintain, and add smart device connections—then the asset monitoring system will quickly be ignored. If it is not flexible enough to tap a variety of devices, and crunch raw data into useful information, then it will be discarded.

Users need the resulting actionable information to reduce operating costs. For example, they want to know when environmental systems are running when there is no occupancy, so the operating times can be properly adjusted. Perhaps air or water utility skids are working more than can be explained, prompting a search for money-wasting leakages. These are the types of long-term costs that an asset monitoring system can help discover and eliminate.

From a short-term perspective, a properly configured asset monitoring system can provide a centralized method of indicating alarms or errors, allowing users to provide a much more immediate response. Many times, reacting quickly to a failure means the difference between saving expensive products or discarding them as waste.

An asset monitoring system with all of these features becomes a trusted tool for the end user. Those who use the system provide value within their own operations, and offer excellent service to other internal customers at their company.

**Remote Asset Monitoring Benefits**

Modern commercial, industrial, and utility facilities of all types generally have some level of automation and smart devices spread throughout their site. Many times, these are segregated islands of automation. As time moves on, newly installed or updated systems usually offer more connectivity and smart features. These systems can range from simple area temperature sensors, to more data-intensive devices like power meters, to heavily instrumented packaged equipment like boilers and air compressors.

Yet, “Industry analyst research from Gartner and IDC estimates 80 percent of digital data is dark, meaning not easily accessible or used.” This “dark” data must be fully tapped from smart devices to deliver the benefits listed below.

<u>Remote Asset Monitoring Benefits</u>

- One comprehensive platform aids adoption
- Reduces direct facility costs, such as energy use
- Cuts indirect facility costs, like maintenance
- Aides in identification of root-cause problems, instead of just effects
- Minimizes downtime by improving operator reaction time
- Empowers the right employees to access the right information
- Improves safety
- Supports internal customers

An asset monitoring system may never be quite as simple to implement and use as, for instance, word processing software. However, selecting a single platform with a comprehensive ecosystem of hardware helps ensure adoption. Removing the risks of research and experimentation means those charged with implementing the system can spend their time effectively, and their efforts can quickly add value to the operation.

Reducing direct costs, especially energy and utility usage, is usually the most obvious savings opportunity. Variable speed drives and electrical devices can supply direct power consumption data, equipment runtimes can be easily monitored, and water consumption can be tracked with flowmeters. All of these can be used to quickly ferret out unexpected energy usage. Once a baseline is established, users can implement threshold alarms to warn of future excursions.

**Preventative Maintenance and Root-Cause Analysis**

A less obvious opportunity for long-term savings revolves around preventive maintenance. An asset monitoring system is ideally suited for tracking equipment runtimes and the number of operations for cyclic equipment. Even in the absence of other wear-sensing methods, these pieces of data can be used to baseline when equipment should be serviced, ideally to avoid failure in operation.

Reducing direct and indirect costs can also lead to another benefit in the form of identifying root-cause problems. For instance, once a piece of equipment is baselined at a certain power consumption level, any unexpected increases may point to impending mechanical failure. Similarly, excessive water consumption may be due to filters being backwashed too often or unseen leaks. This type of information is invaluable in helping maintenance personnel target the actual problems.

An effective asset monitoring system provides improved visibility to operators, maintenance, and management regarding how a site is running. The term “situational awareness” is often used with respect to automation to indicate how well operators are made aware of alarm conditions. Solid asset monitoring can help this term apply in a larger meta-sense to the overall health of the facility and its assets. The right data visibility allows users to recognize and respond to anomalies in the quickest possible way. Rapid reactions cut costs and help avoid downtime.

Local personnel have the greatest need for the information, which can be provided in a quick-glance dashboard context, or exported into deep-dive tabular reports. For many operations, especially those with distributed sites, leveraging this information into the cloud where it can be accessed by remote personnel using desktop or personal devices takes this power to the next level. By putting the right information into the hands of the right employee, every member of the organization is empowered to improve the bottom line.

Enhancing operations doesn’t just mean increasing profits. When a site’s systems are monitored and maintained properly, workers are subjected to far fewer unexpected repairs. This in turn leads to a safer working environment. Minimizing the unexpected helps maximize safety.

All levels of an organization can benefit from a robust and accessible remote asset monitoring system, whether they are on the operations, maintenance, or management

teams, or any other internal customer. Here are the qualities necessary for a solid remote asset management platform.

**Remote Asset Monitoring Requirements**
To realize the benefits listed above, the remote asset monitoring system must meet certain requirements as listed and explained below.

Remote Asset Monitoring Requirements

- Single platform and project file
- Edge computing capable; must interact with smart serial or Ethernet devices, IIoT devices, and even classic hardwired I/O connections
- Easy to deploy and maintain remotely
- Open architecture for scalability and flexible hardware integration
- Data preprocessing options to provide actionable information
- Open and seamless interfaces with other systems
- Built-in web services for system diagnostics
- Security for equipment and information protection
- Breakpoint resume capability to ensure data transmission and connectivity

Many different smart device connectivity options and communication protocols have come and gone over the years. Oftentimes proprietary versions have fallen out of favor due to their restrictive nature, while more open types, especially RS-232/485 based serial versions, have persisted due to their accessibility. Older protocols are not always plug and play, but they get the job done.

One approach for connecting to the wide range of classic and contemporary devices found at typical facilities is to cobble together a variety of hardware and software. The downsides are many and obvious. This type of project all too often becomes an experiment, with end users investigating new options to incorporate each new family of field device. The resulting jumble is hard to use and tougher to maintain.

A better solution begins with a single hardware and software platform offering all of the necessary connection options, and the ability to consolidate mounds of data into useful information. The configuration should be handled through a single project file, so users only need to learn how to use one comprehensive environment. This also simplifies deployment and backups. The TagLink ecosystem (Figure 1) offered by industrial automation leader Advantech is an example of hardware and software optimized to make remote asset monitoring a reality.

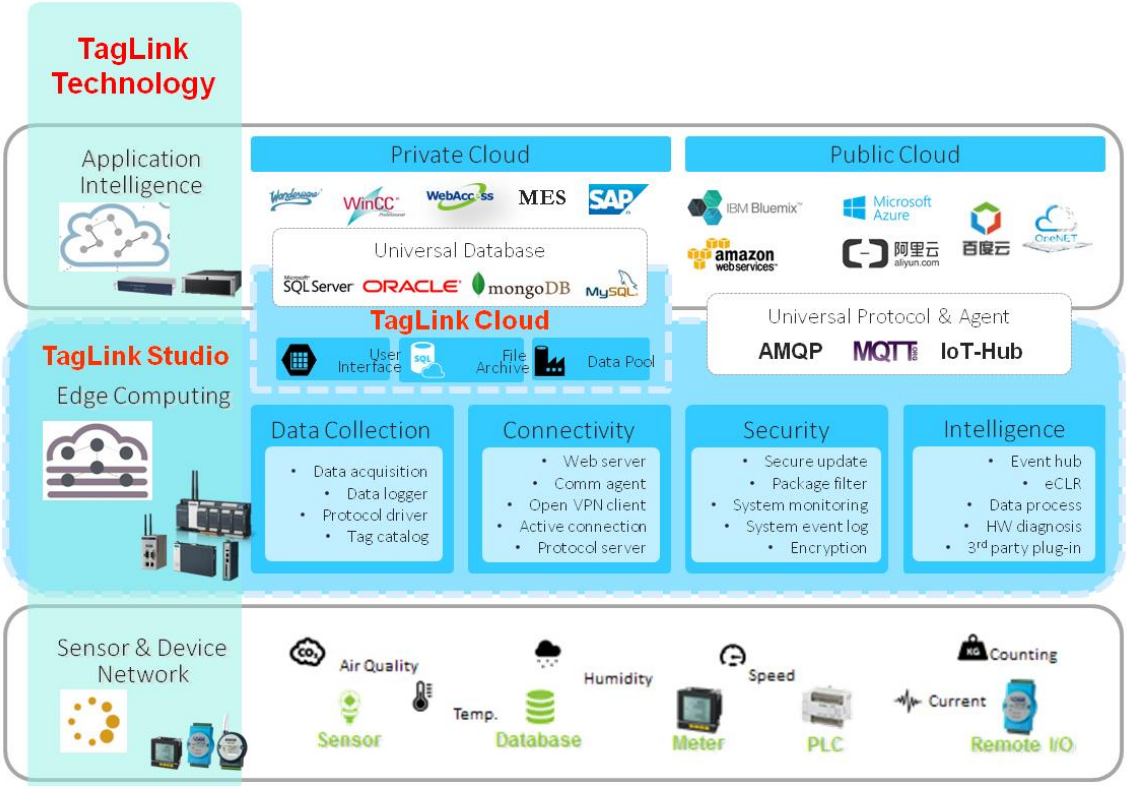


Figure 1

The edge of the system is where the data is first collected. As noted earlier, the edge may require connectivity to many types of old and new physical media and communication protocols. Fortunately, today's smart devices are heavily aligned with various protocols on wired and wireless Ethernet, which facilitates the task of integrating devices.

Figure 2

Older equipment has historically relied much more heavily on serial connectivity. Of course, some site equipment may be considered to be further out on the "dumb" end of the spectrum. Basic relay control panels and older skid systems may not have any smart connectivity, but that doesn't mean they need to be scrapped. Even though they may be simple, there is a good chance they can provide a hardwired contact warning of trouble. Even that tiny bit of information could prove useful.

Edge computing hardware must be able to handle the spectrum of connectivity requirements. To this end, Advantech offers various families of hardware targeted at connecting virtually all field devices. For Ethernet and serial needs, the ECU-1000 series of industrial communication gateways (ICGs) provides numerous ports bundled into a robust platform with integrated wireless connectivity (Figure 2).

ICGs can readily be installed where needed throughout a facility, and connected to the target devices.

Where the application requires less in communication protocols, but needs classic hardwired I/O and perhaps some local level of control, the ADAM-3600 series intelligent remote terminal unit (iRTU) offers these capabilities in a modular and expandable format, again with integrated wireless connectivity (Figure 3). An iRTU is particularly well suited as an all-in-one solution for any new automation site, and for retrofitting into legacy systems.

Figure 3

Both these product families feature compact and robust packaging, adapted for the tough environmental conditions likely to be encountered. They can be installed far and wide where needed, using the on-board wireless options to network together and up to a central unit. Advantech's TagLink Studio provides a centralized software environment for configuring, maintaining, and obtaining data from these ICGs and iRTUs. All of these features make it easy to deploy and maintain the edge computing hardware.

The ICG and iRTU approach answers another need, which is scalability. Rarely can remote monitoring systems be implemented in one fell swoop. When the edge computing devices take the form of smaller building blocks, they lend themselves to being added and retrofitted incrementally as needed. New equipment can be originally provisioned with these devices, and then easily merged into the larger system as appropriate. ICGs and iRTUs offer the right kind of open architecture and flexible hardware integration to ensure successful integration.

**Transforming Data into Actionable Information**

Another significant concern with any asset monitoring system regards the difference between data and information. Any platform must have the capability to perform a level of preprocessing at the edge. At the simplest level, this involves scaling the values to useful engineering units, while more complex strategies include calculations, algorithms such as threshold recognition, and any other advanced processing that can return actionable information to users. This type of computing horsepower is offered by ICGs and iRTUs.

Once useful information is identified, it must be collected and made available in a suitable format. The asset monitoring system ideally provides private cloud and/or web-based public cloud connectivity to achieve this goal. Open interfaces to all major databases and data storage protocols must be natively available.

In this way, end users can be assured that data can be archived in a robust manner, and any higher-level applications they develop now or in the future can access the information. The solution must also include integrated diagnostic services able to monitor the connection and hardware integrity, and indicate it to users to facilitate troubleshooting.

Any cloud-ready solution must incorporate comprehensive security and protection against malware and viruses. The end user's data must be protected from prying eyes, and wherever command and control is a possibility, unauthorized users must remain locked out. Support of industry standard protocols and APIs is mandatory for defending and preserving connections.

One other feature specifically applicable and desirable for data gathering systems is the ability to buffer data on to local device storage during any network communication interruptions. Since ICGs and iRTUs are often located at a system's periphery and are connected wirelessly, they generally have this feature natively included. Storing and forwarding data in this manner is an advanced feature which is challenging to develop from scratch, but when built-in it is easy to implement, and is always crucial for widely distributed project sites.

A properly executed remote asset monitoring platform enables key performance indicators (KPIs) to be derived, which in turn form the basis for driving positive change. *Plant Services* magazine highlights the importance of efficient KPI generation. "New software and technology options enable a more streamlined approach. Rather than waiting weeks or even months to receive reports, executives can now sometimes instantly receive actionable KPI data and analytics in dashboards and reports. Some software tools even go so far as to identify the root cause of problems and suggest possible solutions."

**Distributed Solar Monitoring**

Distributed monitoring at a solar power generation site provides an example of where an ICG-based asset monitoring system can be installed to great advantage (Figure 4).

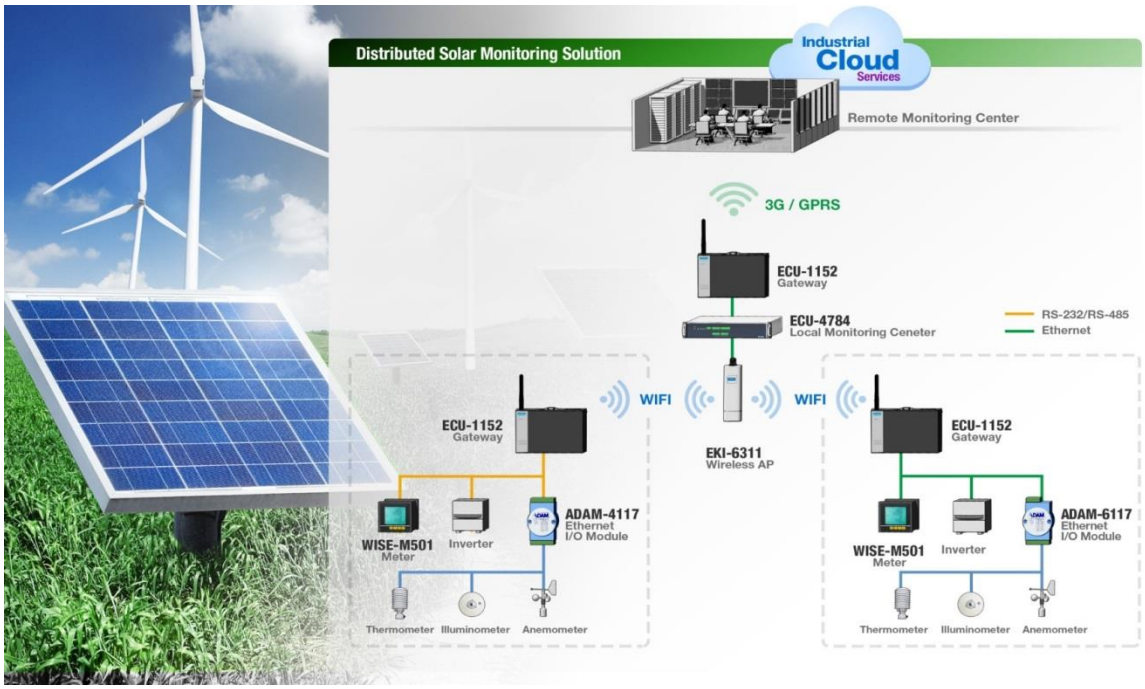

Figure 4

These sites typically have a significant quantity of smart devices, and a certain amount of classic hardwired I/O to monitor instrumentation. These components are often widely dispersed over a site.

Relatively large quantities of power meters and inverters represent the significant smart devices at these sites. There are typically packaged controls for articulating solar panels or operating support systems. Other instrumentation includes environmental sensors for temperature, wind and sunlight levels. Operators must understand the local conditions and how well each area of the site is operating to identify and correct inefficiencies.

Strategically locating Advantech ECU-1152 ICGs throughout the site positions them for connection to the target devices, while at the same time minimizing the amount of costly field wiring. The local ICGs interconnect on-site using Wi-Fi, and are concentrated to another ICG for uplinking to the cloud over 3G or GPRS cell communications.

Periodically-polled data is made available via the cloud, so a remote monitoring center can keep an eye on operations. Any deviations from the expected norms alert personnel to take a closer look. Information histories in the database can be analyzed at a later date so longer-term trends become evident. These types of trends could indicate that solar panels are becoming dirty and less efficient or even that equipment like an inverter is approaching imminent failure.

An ICG-based system clearly checks all the boxes when it comes to monitoring a distributed site like a solar generating facility.

**HVAC Monitoring**
Even when a facility is all under one roof, there are some compelling reasons to implement an iRTU-based asset monitoring system (Figure 5).

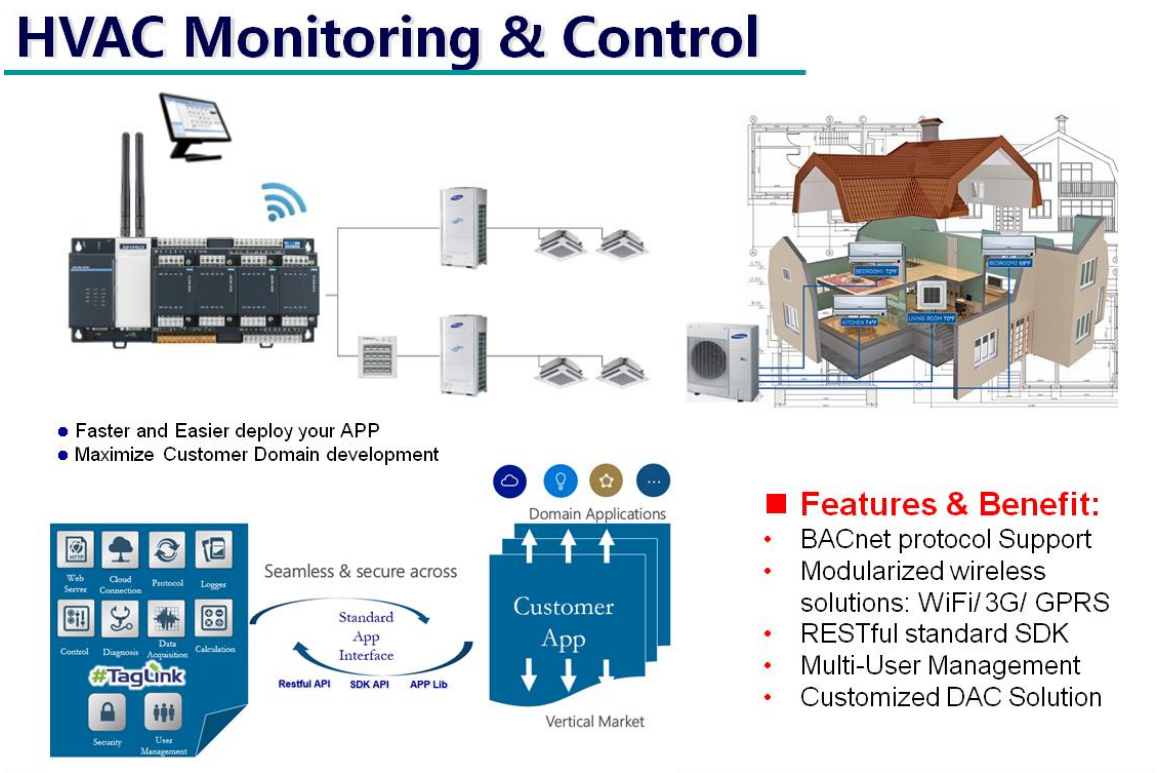


Figure 5

A common application benefiting from asset monitoring is any typical heating, ventilation, and air conditioning (HVAC) system. In particular, smaller standalone HVAC packages or medium-sized installations generally have enough automation to control the temperature, but may not include higher level features. An iRTU integrated with basic HVAC systems can add the control functionality needed to initiate energy saving programs.

The reason that an iRTU provides the best fit here is the inclusion of hardwired I/O for interfacing with basic HVAC systems to monitor key temperatures and power usage, or provide enable/disable commands. Many HVAC platforms utilize the BACnet protocol, which is supported by Advantech's ADAM-3600 series hardware, which provides more comprehensive data gathering.

Each HVAC controller maintains its nominal functionality, as it was originally installed and designed to do. An iRTU installed near each major HVAC controller interconnects using available I/O signals, while the iRTUs themselves uplink to the cloud (or an ICG) using Wi-Fi or a cellular solution.

The supervisory asset monitoring system now has access to all useful data for displaying on dashboards and logging to a database. In addition, users can easily implement basic control functionality. They can disable HVAC systems during times of low occupancy, or even temporarily stop them in order to perform load shedding during peak energy use times. Hardwired I/O connectivity means the control options are extensive.

An iRTU-based system is therefore an excellent choice for adding remote access monitoring to existing packaged equipment, and even extending functionality to include remote control.

**Conclusion and Outlook**

The devices and systems available today to operate both commercial and industrial facilities offer an exceptional level of connectivity and intelligence, and even older equipment has data which can be gleaned. Yet this wealth of information is wasted unless users implement a remote asset monitoring platform.

This platform must be capable enough to connect to contemporary and legacy devices, while being easy to implement and use on a daily basis. It must provide sufficient standalone capabilities, and must also excel at open and secure connection with user applications and cloud-based databases.

Once assets are properly monitored and the information is available, users have a basis for detecting functional problems and waste. This actionable information empowers end users to fix deficiencies and optimize processes to reduce operational costs. Operations and maintenance personnel can respond quickly to trouble and minimize downtime. Internal customers are rapidly able to receive real value from the remote asset monitoring system.

To truly be successful, a remote asset monitoring system must offer a sufficient range of software and hardware products to achieve the required connectivity and provide advanced data preprocessing features. On the other hand, to facilitate development and deployment, a single software platform must be able to provide the entire range of capabilities, so end users don't need to learn how to use multiple software solutions. An open architecture lends itself to flexible design options and scalable installations. Secure web services are required to ensure robust data transmission and powerful remote access and diagnostics features.

Implementing an asset monitoring platform—such as the Advantech ecosystem of TagLink software, ECU-1000 series ICGs, and ADAM-3600 series iRTUs—is an excellent way to achieve the benefits listed in Table 1 by meeting the Table 2 requirements. This type of platform truly offers a comprehensive turnkey solution for remote asset monitoring.