Moving Beyond Supervisory Control and Data Acquisition (SCADA)

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ABSTRACT

Remote connectivity and monitoring for generator sets offers multiple opportunities to enhance reliability, increase efficiency, regulate emissions, optimize performance and reduce cost in distributed power settings – all without expensive capital investment in on-site IT infrastructure.

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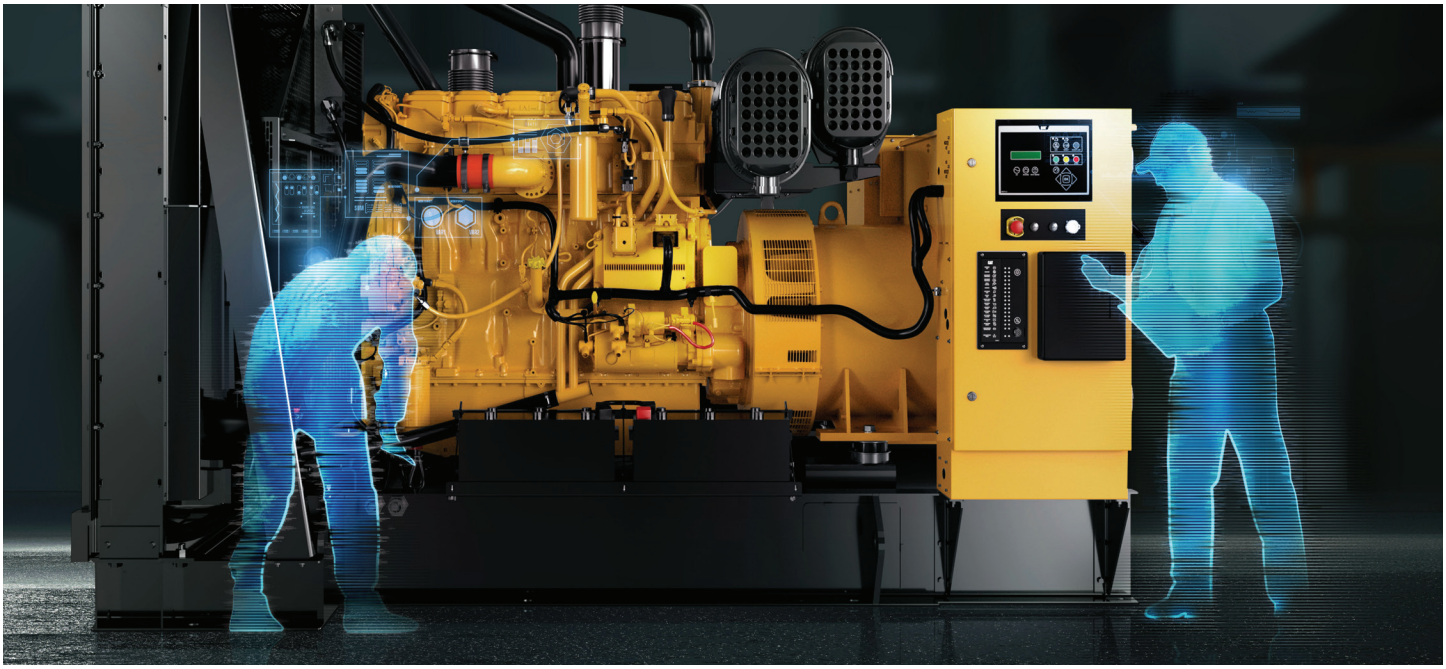
INTRODUCTION



The days of technicians monitoring generator sets by reading gauges and making adjustments by turning dials or wrenches are long gone.

SCADA systems years ago replaced most manual checking of performance, fine-tuning of operations, and storage and analysis of data. But today, SCADA is being eclipsed by remote monitoring and control via internet and wireless communications.

Remote monitoring, also commonly called connected services, is increasingly accepted for distributed generation sites. Among many benefits, it enables operators to receive continuous data on engine and electrical parameters, receive real-time alerts and alarms, detect engine or generator faults that could threaten a shutdown or failure to start, and generally optimize business performance.

DIVERSE APPLICATIONS

Distributed generation is growing as electric utilities increasingly rely on decentralized power sources. These can include not just gas or diesel generator sets and turbines but also wind and solar installations, with or without energy storage. Some installations combine two or more of these sources, providing flexibility to optimize cost, sustainability, and other imperatives in meeting electric energy demand.

Distributed resources may or may not be grid-connected. Common settings include small municipalities, universities, military bases, heavy industries (especially where utility power is unreliable), remote mine sites, and small utilities and independent power producers looking to supplement their centralized generation assets.

All of these, plus backup power systems for hospitals, data centers, and other facilities where uninterrupted power is critical, are candidates for remote monitoring. The capabilities of remote monitoring have different values depending on the power application.

ADVANTAGES OVER SCADA

Remote monitoring significantly exceeds the capability of SCADA. Typically, a SCADA system exists inside the facility firewall; there is limited ability to extract data to the outside and to monitor and compare gensets across multiple sites. The ability to trend data over time is also limited, usually to about 30 days. The primary function of SCADA is basic control and the setting of limits for alerts and alarms.

On the other hand, remote monitoring systems, such as Cat® Connect from Caterpillar, can monitor an essentially unlimited number of gensets at sites around the world and display them all in a single dashboard view (see Figure 1). It can synthesize data across multiple sites and geographic areas and help users compare the performance of sites and individual assets. An entire year of data is retained for trending and analysis. In addition, data can be archived for up to 10 years, enabling users to compile extensive reports for compliance documentation or for internal and external audits.

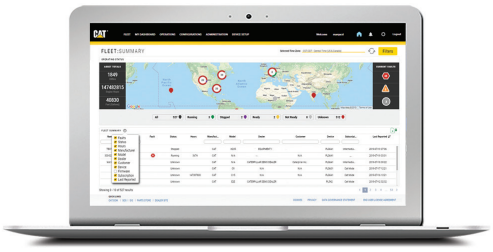


Figure 1

On a basic level, remote monitoring provides more proactive oversight than SCADA typically can. For example, trending capability can detect a condition, such as an air filter becoming obstructed or oil or other fluid deteriorating, before a SCADA alarm is triggered, so staff can make a scheduled repair.

On a deeper level, remote monitoring lets users combine machinery data with business data to support more effective problem-solving and better-informed operating decisions that further strategic goals. Remotely collected data can be fed to a web-based asset monitoring application for analysis to help drive business insight.

Remote monitoring can also help distributed generators deal with the coming wave of retirements among domain experts in power facilities. It enables a smaller number of skilled people to exert control and provide support across multiple facilities and large geographies.

SIMPLE TO IMPLEMENT

The monitoring technology itself is relatively simple. Machine data is captured and stored in the generator set controller. A configuration file translates that data into language that can be read by the monitoring application. A telematics device then sends the data to the application as often as once per second for the operators to view and analyze.

Connecting a manufacturer's current-model genset controller to its own remote monitoring application (for example, a Cat generator set to Cat Connect) is generally a simple half- to four-hour procedure. Connecting an older-generation controller, or another manufacturer's controller, may require extra engineering to create the necessary configuration files because there is no single industry standard for remote monitoring in electric power applications.

A remote monitoring deployment starts with a site assessment that takes an inventory of the gensets, their controls, and the data those controls collect. The results determine the complexity of the required engineering needed to create custom configuration files. The next step is to test the data to verify that it accurately reflects the generator set operating parameters. Once engineered, deployed, and tested, a remote monitoring application such as Cat Connect can monitor a genset fleet of essentially unlimited size with units of different ages and from a diverse mix of manufacturers.

Cat Connect technology's (Product Link™ hardware) end-to-end system is designed with multi-layer security controls and safeguards to protect against unauthorized access and disclosure (seen in Figure 2).

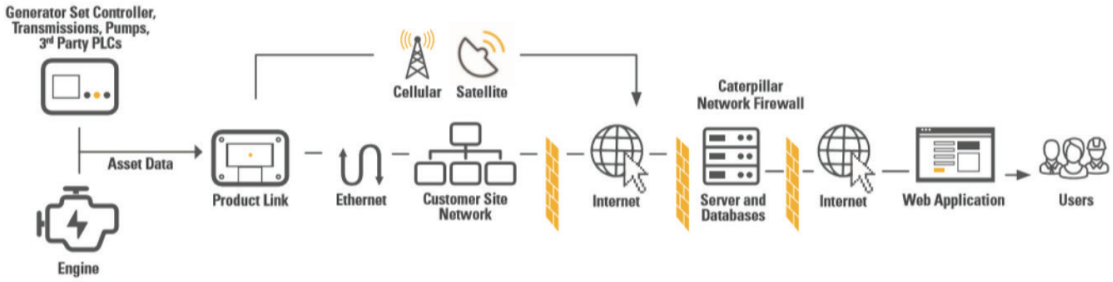


Figure 2: End-to-End Architecture of Cat Connect Technology and Services

MONITORING IN ACTION

Remote monitoring does not completely relieve operators of physical site and equipment inspections. While most data is captured digitally, visual inspection remains valuable for detecting abnormal conditions such as leaking fluid or corroded battery terminals. This information can be merged with remote monitoring data to help operators proactively identify issues that would cause downtime or a failure of a generator set to start.

After this troubleshooting and diagnostics, field work can be planned remotely by accessing manufacturers' product support information and maintenance schedules. Operators can use the application to collaborate with a service provider and schedule repairs or maintenance at an opportune time. The tasks performed are documented in the application. Once the genset is restarted, operators can observe through the application that all faults and alarms have been cleared.

SAFEGUARDING DATA

As in any data communication, data security is essential in remote genset monitoring. Monitoring providers have their own end-user license agreements, which tend to be complex and legalistic. In essence, though, an effective agreement boils down to four basic principles:

- **Transparency.** Users must opt in, and no data is collected without their explicit approval.
- **Protection.** Data security measures are regularly improved to protect collected data against loss and unauthorized access.
- **Value creation.** Data is used to add value to customers, such as by improving safety, reducing ownership cost, checking and maintaining product health, enhancing service quality, and driving development of better products.
- **Respect for data rights.** The same data privacy and security policies apply to service vendors and other third parties who may work with customers' data.

Within the genset user's operation, data is password-protected; only authorized persons have access and managers can define what level of data rights each person has.

A LOOK AHEAD

Today's SCADA and remote monitoring systems feature interfaces with two-dimensional graphics, alarms and alerts, and simple overviews of operating data. The arrival of virtual reality (VR) and augmented reality (AR) make such presentations seem primitive by comparison, like first-generation video games.

VR and AR help users process and contextualize data by presenting it in three dimensions. For remote troubleshooting, for example, it is already possible for an engineer at a remote monitoring provider to have a digital twin of a genset on screen, overlaid with machine data. Meanwhile, a technician stands in front of the physical genset, but with a matching 3D image on a tablet computer, again with machine data overlaid. This kind of collaboration can significantly help the two parties talk through, contextualize, and solve problems.

On a grander scale, there is movement toward a virtual power plant where remote expects can digitally “walk through” the facility and discuss issues with maintenance and operations teams. Travel and training cost are significantly reduced.

Beyond monitoring, maintenance, and operations, VR and AR hold potential to attract younger people into the distributed power industry. Increasingly, newer generations expect VR and AR to be part of their work environment.

Irrespective of those developments, remote monitoring for distributed generation is here to stay. Given its relative simplicity and low cost and the value users can derive, it has become an essential tool for extracting the maximum business advantage from distributed power applications.

LET’S DO THE WORK.™

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