

IEC 61850 standard lets data center devices change functions and talk to all their neighbors



Until recently, data center substations have been dangerous and unfriendly creatures. They have bristled with miles of bulky copper wiring. The intelligent electronic devices (IEDs) that protect the substation and control its high-voltage power flow each have had separate, isolated functions, haughtily refusing to talk with each other if they were from different families. And switchgear troubleshooting often led to exactly that—trouble, shooting through systems and technicians, unless exacting procedures were employed.

The implementation of the global IEC 61850 standard, however, has transformed the substation into a digital environment as friendly as any home network of computers, printers and phones. The 61850 communication architecture has enabled the creation of one standard on which all electrical power devices can operate and communicate, much as any computer or server can communicate with any other device via Transmission Control Protocol/Internet Protocol (TCP/IP).

Instead of copper wire, digital substations connect devices and systems with optical fiber, resulting in lower wiring costs, substantially reduced space requirements, safer maintenance, the ability to monitor and control IEDs remotely, and for the first time the ability for devices supplied by different manufacturers to communicate with each other.

Bringing 61850 inside the data center

The value of 61850 in substations has become so evident, in fact, that now engineers are beginning to look for ways to bring the standard inside the data center to protect, control and automate medium- and low-voltage systems.

Steven Kunsman, ABB vice president of business development and marketing for substation automation and a member of the international working group that developed the 61850 standard, notes that IEC 61850 originally was intended for the communications architecture inside the substation fence. “We knew, however, this would be expanded beyond the substation,” he says. “Once engineers started to realize some of 61850’s benefits, there was no reason not to take advantage of it.”

Kunsman cites three particular benefits of the new standard that can be of critical importance for systems inside the data center, as well as in the substation:

- **Interoperability:** Previously, IEDs from a variety of manufacturers used protocols that did not work together. “The interoperability of the 61850 open standard allows multiple vendors to build to the same standard and play together in the same system,” Kunsman says. “It is not plug and play, but devices can be easily integrated and reengineered for the system.”
- **Free allocation of functions:** The 61850 standard offers more than just a protocol for communicating. It defines a complete architecture with protocol, data modeling and representation of standardized functions. These functions no longer are tied to dedicated IEDs. “They can sit on a switchgear IED or, some day, they could be running in a centralized computer,” according to Kunsman. “The system does not care.” Each device will support a list of functions outlined by the vendor and designed to the same standards as those from every other vendor. So any device in the system can be used to carry out any of the standardized functions.
- **Future-proofing:** Since 61850 is a digital standard, it can be applied to any future method of transmitting digital information. Today data centers use Ethernet, but in the future communication could be carried out via wireless or cloud-based systems. “The standard allows for advancement in technology over time,” Kunsman says, “and with minimal rework to preserve system functionality while preserving the major investment.”

ABB has developed several technologies that can be critical to successfully bringing 61850 from the substation to the data center itself, including the ABB Relion family of products. These relays for protecting breakers, motors, transformers and other systems have been designed to implement the core values of the 61850 standard in bringing the interconnected high voltage transmission lines to the medium-voltage power from the substation into the data center.

Then, ABB EMax2 air circuit breakers, also incorporating 61850, manage low-voltage systems within the center. The EMax2 Power Controller function, patented by ABB, keeps power usage below the limit set by the user, disconnecting non-priority utilities, such as electric car-charging stations, when overall consumption is high and reconnecting them as soon as usage limits allow. It also automatically activates generator sets and other auxiliary power suppliers.

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Mark Reed, director of the ABB North America Data Center Initiative, also points out that the ABB Decathlon® for Data Centers data center infrastructure management system can play a central role in conveying 61850 benefits to data center systems. Built on an open platform, Decathlon provides tools to manage a flexible network of power, cooling and IT systems, automating the monitoring and control of devices across the center. The 61850 component inside Decathlon is the same component used in substation relays.

“Decathlon communicates through many different protocols, including 61850, so today’s intelligent electronic devices all can communicate up to Decathlon,” Reed explains. “With everything coming into a common system, you can have a more robust alarm-management system, it is easier to implement a redundant strategy, and the whole center becomes more reliable.”

Reed likens Decathlon operating on the 61850 standard to systems for monitoring and troubleshooting a car. “Decathlon’s asset management application will give you what amounts to a ‘check engine’ light for your data center. Your car does not break down immediately after that warning appears on your instrument panel. It is there to warn you of an impending problem. In a similar way, Decathlon’s diagnostics let you schedule maintenance around your down time, so that you have a reliability-centered maintenance strategy that predicts when issues may occur.”

Furthermore, instead of exposing maintenance techs to the hazardous electrical systems, 61850 allows them simply to diagnose from any connected computer to quickly discover exactly what is wrong. Software maintenance tools developed using 61850’s substation configuration language allow for the import of the entire system for easy diagnosis of system behavior, regardless of manufacturer.

Beyond simplifying data center architecture, enabling all devices to communicate with each other, eliminating huge amounts of wiring and offering point-and-click methods for monitoring and troubleshooting, the IEC 61850 standard also can help make data centers more secure. While 61850 itself does not define any security features—that is achieved through a technical security standard called IEC 62351—it provides an open architecture that supports security systems from a variety of vendors.

“Many of the security features used for transmission substations can be employed in the data center,” Kunsman says. “ABB ensures that 61850-compliant products not only enable higher availability and higher resiliency but also are tested in our Device Security Assurance Center (DSAC) to mitigate security vulnerabilities. Every product as part of the

development process must be validated in the DSAC to be sure that we are providing cyber-secure products and systems to our customers.”

While 61850 offers tremendous benefits to data centers, not every center can totally switch over to 61850-compliant devices right away. “Products like Relion relays allow you to migrate to 61850 over time,” Kunsman points out, “and if you have Ethernet in place, you can run 61850 alongside DNP or Modbus protocols. You have the physical infrastructure with Ethernet. Now it is just a matter of running multiple protocols through it.”

Continuing the 61850 standard story by bringing it into data centers can write a new chapter in efficiency, safety and savings for data center owners.

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