

New IIoT Application Gateway Technology Enhances DER and Smart-Grid Monitoring

New application gateway technologies at the network edge enable highly-optimized industrial IoT solutions that enhance productivity of existing grid infrastructure. Devices such as MACHGateway®, developed by MACHFU, enable collection of data from grid assets on the state of the grid and rapidly signal changes, enhancing traditional monitoring systems, and increasing reliability and grid capacity. The results – dramatically improved real-time grid awareness, minimized network downtime, reduced operating costs, and heightened, layered security, reducing vulnerabilities of physical and cyber threats to the electric grid.

By John Geiger, Vice President Business Development MACHFU

The traditional grid paradigm of managing the supply of power from large centralized generation is now increasingly being augmented or replaced by distributed energy resources (DERs) on the distribution grid. The adoption of DER's is creating the need for highly distributed automation monitoring and control solutions to maintain power quality on the medium-voltage grids.

DERs consist of physical and virtual assets deployed across the distribution grid, typically close to load, and usually behind the meter. Devices and systems on both sides of the electric meter can help the grid function more efficiently, manage variable generation, and be more resilient under adverse conditions.

Limitations to Building-Out a DER Smart Grid

Traditionally, utilities have used a specific set of grid sensing, control and automation functions tailored to the electric grid application space. The majority of these systems are rooted in aging technologies. The existing grid system significantly lags behind today's Internet-based systems, because utilities replace technology products every few decades. Consequently, utilities have been slow to adopt cloud-based approaches and prefer to transfer data from grid devices to their existing Distribution Automation head-end systems for operations, even if devices support cloud connectivity, such as line sensors (current sensors, voltage sensors, fault indicators, etc.).

This results in an infrastructure that is dominated by legacy and proprietary systems with a historical reluctance to adapt to new, open standards-based paradigms, one that does not facilitate moving to a modern DER smart grid. The key factors at play, and paramount to the resolution of this situation, are:

- a) Connecting new line sensors to Distribution Automation head-end systems, so that existing infrastructure can be utilized and leveraged;
- b) Bringing sensing for DER to the cloud, to take advantage of the benefits of modern cloud platforms;
- c) Maintaining grid security to levels recommended in NISTIR 7628 *Guidelines for Smart Grid Cybersecurity*.

IIoT Application Gateways

A solution to these factors has been realized with the introduction of new industrial IoT application gateway technology. These new Gateways provide a rich set of edge functionality, improving how utilities monitor critical grid data in environments such as substations and medium-voltage distribution networks. They enhance traditional monitoring systems, increasing reliability and grid capacity.

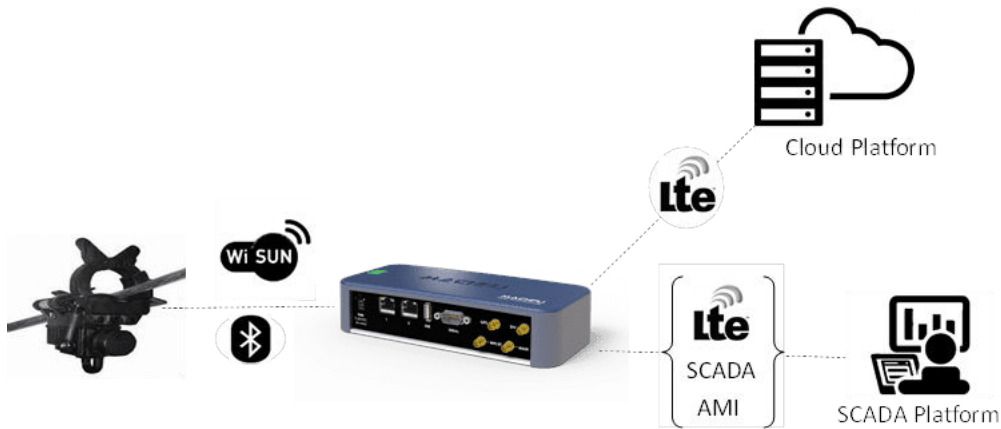
An excellent example of these new IIoT DER gateways is the MACHGateway®, developed by Machfu. Its methodologies support interoperability with existing Distribution Automation systems, line sensors, and adds options for cloud connectivity using a suite of NIST-compliant security..

Connecting Line Sensors to Legacy Systems

Augmenting the existing grid infrastructure with application gateways, like MACHGateway, enables older assets to meet the required performance of real-time, smart-grid applications.

Pushing Data in Real Time

Distribution Automation has relied on the centralized polling of sensor data. This results in significant latency and limited ability to scale. These IIoT gateways gather sensor data locally and create data models, perform analytics and share the results using secure Internet connectivity methodologies, while maintaining connectivity with existing Distribution Automation solutions.



MACHGateway, for example, constantly gathers device data at the edge, assessing the system state as often as every second, compared to a traditional 15 minute or longer polling interval. The data gathered is used to create a data model that can be easily understood by other applications and translated to other protocols, allowing the data to be shared in real time with the ecosystem of emerging IloT applications.

Leveraging Cellular Infrastructure

Historically, connectivity to Distribution and Automation systems has been done using narrowband, non-IP-based transparent private wireless networks. Extending traditional legacy polling over cellular was accomplished with secure tunneled IP-encapsulated polls through a cellular modem. IloT gateways enable grid monitoring devices to take full advantage of cellular connectivity.

Enhancing Sensing with LPFAN

The advent of IoT has brought many new standards-based, low-power, field-area-networking sensors, using connectivity standards including ZigBee, Thread, Bluetooth and WiSUN. The sensors are easy to install, and scavenge power from the power line making them highly economical to deploy.

IloT Gateways provide connectivity to these devices and the ability to convert the sensor data to legacy protocols, such as DNP3, and provide modern cloud-based connectivity. This allows gateways to incrementally add new sensing solutions to existing monitoring systems.

Leveraging DER to the Cloud

As complexity of the distributed grid continues to expand, there is a need to be able to manage many more devices; to define methods by which utility automation systems can securely discover, request, and manage resources on the grid. The need to rapidly scale is creating opportunities to monitor and control the grid using cloud-based application.

But the modern cloud speaks a different language from most grid legacy systems and devices. What has been needed is a way to translate legacy systems to the cloud, as well as communicate with existing back-end systems, without disrupting existing operations. IIOT application gateways are able to connect to cloud-based infrastructure, and share real-time data and analytics with cloud-based applications.

Application gateways, like MACHGateway, form secure connections with cloud systems enabling cloud connectivity, providing real-time cloud monitoring to enhance traditional polled SCADA, increasing the breadth and scale of what can be monitored. They fully utilize cellular's high bandwidth and low latency, using applications such as AWS IoT/ -SparkPlug via MQTT or AWS API Gateway via HTTPS connectivity.

Enhancing Grid Security

Existing grid monitoring using legacy protocols lacks robust cyber security, and is vulnerable to cyber-attacks. Application gateways can minimize legacy attack surface by locally polling the grid asset, limiting access of the data to systems using well-vetted, open standard-based security methodologies. In addition, application gateways support the ability to update and patch the security to adapt to reduce physical and cyber vulnerabilities.

Application gateways based on Machfu's platform, have defense-in-depth security built across the layers of the communications stack all the way up to the application layer. Consequently, they implement the best practices of IT security, considerably exceeding that provided by SCADA systems.

More Flexible, Secure and Cost-Efficient Smart Grids

These new application gateways help DERs move from legacy and proprietary solutions to open, standardized web-based solutions that enable sharing of data across the enterprise, without abandoning the infrastructure that is already in place.

They provide many features that simplify the development of edge applications by reducing the time to create and integrate them, reducing development time from months or years, to weeks or even days. This enables innovative edge applications to be created and rapidly integrated to existing infrastructure and IloT applications

Adding new line sensors to existing legacy devices on proprietary wireless networks brings tremendous value for DER grids. As well as legacy devices taken to the cloud for remote configuration, management and field force operations. Such gateways enable flexibility, security and high cost-efficiencies within DER grids.

About MACHFU:

Machfu simplifies the complex landscape of Industrial IoT by easily connecting data at the edge to the cloud and legacy enterprise systems, for business analytics. Its products, the Machfu Platform and Gateway, bring edge-to-enterprise connectivity to existing industrial infrastructure that can be deployed and scaled quickly.

Machfu's gateway platform has the hardware interfaces, device protocol libraries, cloud protocol libraries and legacy SCADA system connections to enable connecting any industrial device to any back-end system easily.

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