WHITEPAPER

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Enhancing and Complementing SCADA Systems for Modern Industrial Monitoring

Pratexo Power Guardian™ introduces an innovative approach to extracting data from a diverse array of field devices and systems. It excels at processing vast amounts of operational data locally and enhancing it with robust visualization and analytics tools to derive actionable insights. The result is increased reliability, efficiency, and flexibility of complex electrification infrastructure.

For professionals in industrial operations and control, the burning question often is: "Why not stick with a traditional SCADA system for this?"

As one would expect, the answer to that question is not simple, hinging primarily on:

- The specific infrastructure and devices you need visibility over
- Your short and mid-term goals for system scalability

In this whitepaper, we explore how Power Guardian is designed to tackle the operational and lifecycle challenges of traditional SCADA systems. We'll discuss potential overlaps and demonstrate how Power Guardian enhances existing SCADA solutions.

This whitepaper is a must-read if your organization is:

1. Seeking a future-proof solution to monitor energy assets and optimize operations
2. Experienced with SCADA and evaluating the advantages of next-generation architectures
3. Managing electrical assets through an existing SCADA system but encountering technical, operational, or functional constraints

SCADA in the Industrial Setting

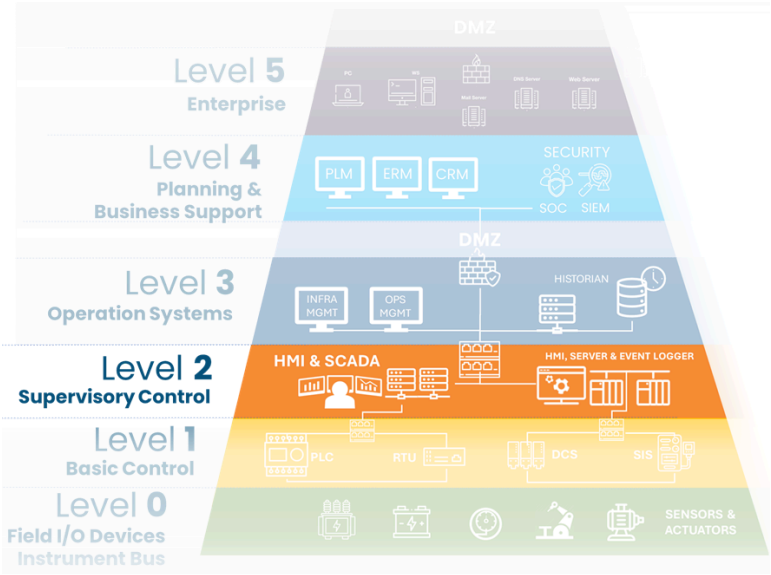
Traditional SCADA (Supervisory Control and Data Acquisition) architectures have been around for decades, emerging with modern automation and control in the early 1960s. Their primary focus has always been to enable users to operate facilities efficiently.

Over the years, SCADA systems have undergone numerous revisions. Significant milestones include the introduction of OPC interfaces in the late 1990s, which aimed to standardize industrial protocols, and the integration of IoT and web technologies in the early 21st century.

Despite these updates, the core of SCADA architectures remain consistent. It starts with programmable logic controllers (PLCs) or remote terminal units (RTUs). These microcomputing devices interface with a variety of devices such as factory machines, Human-Machine Interfaces (HMIs), sensors, and end devices. They collect data from these sources and transmit it to SCADA software on computers.

SCADA software is tasked with processing, distributing, and displaying this data. This enables operators and other personnel to analyze information and make near real-time decisions. The functionality of SCADA fits within a broader ecosystem, often represented by the five-level Purdue Model for Industrial Control Systems (ICS).

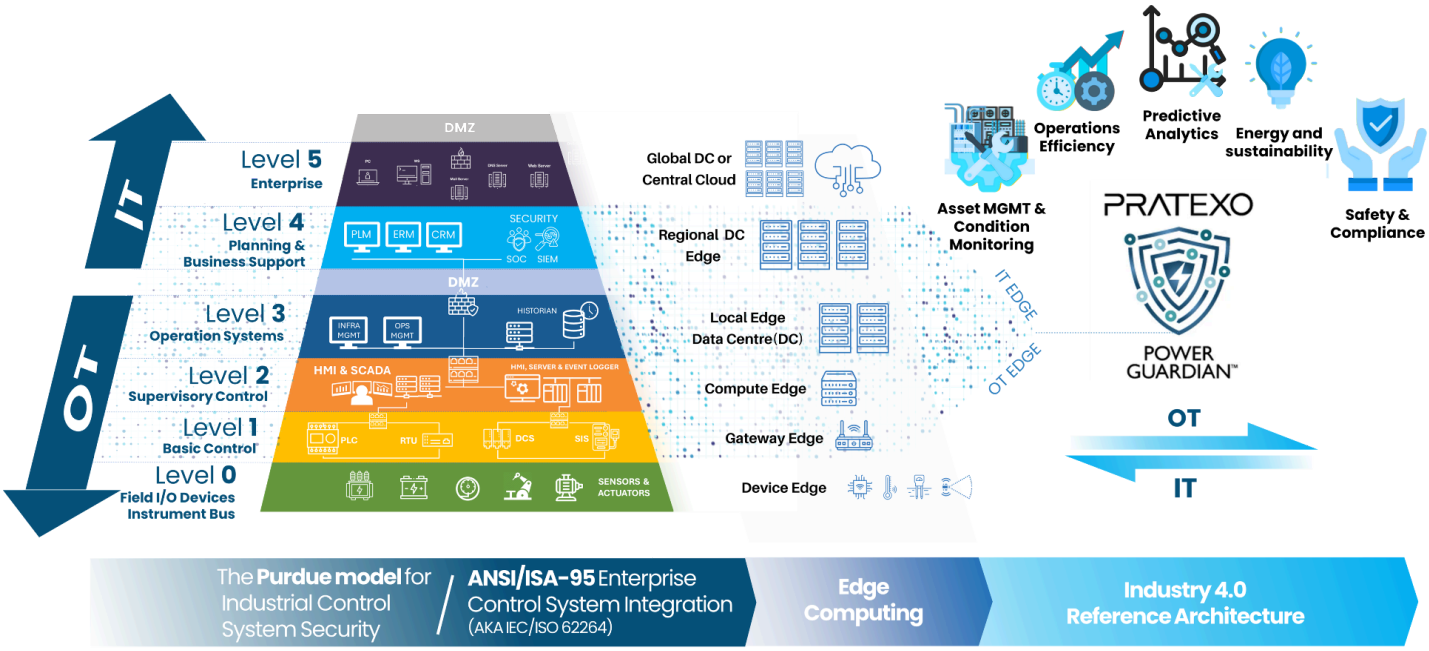
The role of SCADA systems in monitoring and controlling industrial assets is undeniably critical, and existing market solutions perform this task effectively. However, the rapid shift toward digital transformation necessitates the integration of new types of assets into increasingly dynamic infrastructures. These infrastructures require shorter and more frequent integration cycles and demand advanced data analytics and visualization capabilities.



The established "good" is no longer sufficient to meet the demands for larger system integration, increased data volumes, and accelerated innovation cycles. Traditional SCADA architectures were not designed to address these evolving needs. Now let's delve into why this is the case and how Pratexo Power Guardian™ overcomes these challenges.

Centralized Islands of Automation vs. Distributed Edge Architecture

SCADA systems rely on a centralized architecture, where a central server controls and monitors data from multiple nodes. As control systems age and expand, additional nodes are added, resulting in a fragmented array of platforms for HMI/SCADA, historians, MES, APM, advanced applications, and engineering systems. This creates disparate islands of automation with multiple single-purpose nodes that are challenging to maintain and operate.



While Power Guardian can be deployed entirely on-premises, it does so by employing a distributed compute architecture, where devices can communicate directly through edge computing as required, potentially reducing reliance on a single central hub. Furthermore, Power Guardian leverages a microservices-based architecture to dynamically allocate software services across various edge compute layers based on latency requirements and available computational resources. This approach consolidates multiple software services into a shared cluster of edge servers. With fewer devices deployed, there are fewer devices to maintain, less panel space and wiring required, and all software assets are housed in a single, redundant, industrially hardened edge infrastructure. This streamlined setup simplifies implementation in industries requiring GMP, validation, and regulation.

Data Collection

SCADA systems gather data on equipment statuses, such as current and operational state, to alert operators to any infrastructure issues requiring immediate action.

To collect and transmit this data, SCADA systems often rely on proprietary communication protocols and software frameworks. Integrating SCADA with other devices or systems necessitates specialized protocols, formats, or standards unique to the SCADA product and device technology. While these proprietary technologies offer optimal performance for real-time data exchange and processing, they complicate the integration of new vendors or equipment. Adding a new digital sensor to an operational SCADA system is like trying to upgrade the engine of a moving car—you can do it, but no one wants to be speeding down the highway while you're under the hood with a wrench.

In contrast, Power Guardian is designed to collect data from a broader range of assets, encompassing physical equipment, environmental conditions, power sources, and more. Rather than merely functioning as an alert system, Power Guardian focuses on providing comprehensive device monitoring suited for *predictive maintenance and assisting decision-making.* While both SCADA and Power Guardian can store historical data, the extensive data collected by Power Guardian is inherently more suitable for *in-depth data analysis.*

Unlike SCADA real time monitoring focus, Power Guardian emphasizes analyzing historical data to optimize long-term efficiency and performance.

Data Convergence

SCADA systems are designed to monitor and control specific industrial processes, inherently creating data silos. This specialization is logical and necessary for their intended purpose. In a typical SCADA setup, sensors relay data to PLCs or RTUs, which then transmit this data to a central system. Operators access this data through a Human-Machine Interface (HMI) tailored to a particular industrial process. While effective, this high degree of specialization often comes at the expense of flexibility.

Power Guardian addresses the operational challenge of integrating and correlating data from disparate systems into a unified whole. It translates machine languages into open internet protocols, facilitating seamless data integration.

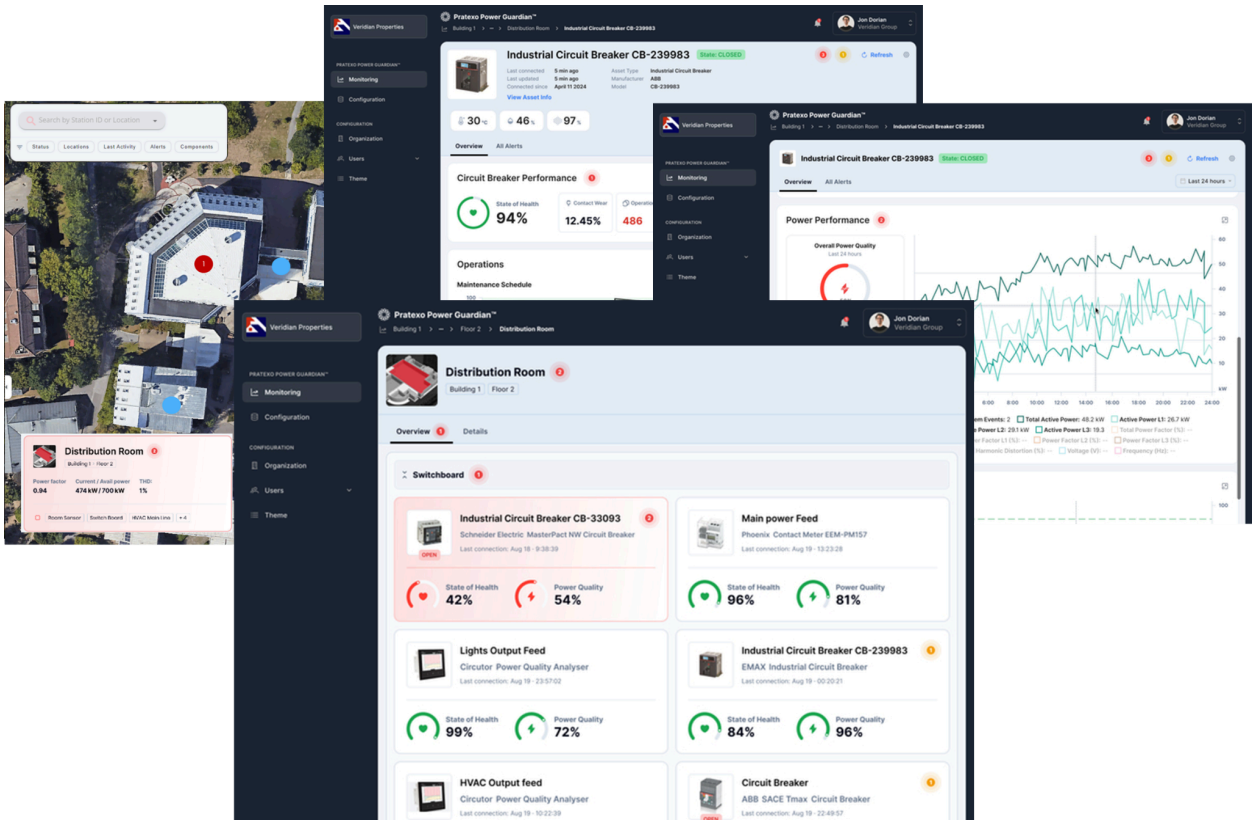
This translation and standardization of data streams enhances data accessibility beyond the confines of an HMI. Data can be analyzed on a local computer platform or moved to a central private or public cloud for advanced AI analytics and machine learning. Industrial IoT programmers and engineers can access this data in their preferred formats using JSON and SQL queries. Achieving this level of data convergence with a traditional SCADA system would require IT teams to configure a complex array of data adapters. Power Guardian, however, can often perform this integration quickly, simplifying the process and enhancing operational efficiency.

Surfacing of Insights

The primary method for SCADA systems to generate insights from the processes they monitor and control is through the Human-Machine Interface (HMI) component.

Typically, this involves a panel on an operational terminal or a dedicated workstation computer. While users can technically access real-time data from anywhere, they do so through an interface specifically designed for SCADA real-time monitoring. This HMI is custom-designed, developed, and delivered as part of a SCADA integration project, incurring significant costs each time changes are requested.

In contrast, Power Guardian excels in data convergence and highlighting cross-system interactions. It is built with versatility and scalability at its core. Graphical interfaces can be tailored to showcase interactions between systems, and various data analytics tools can be utilized to uncover new insights.



SCADA systems notify you when things go wrong; Pratexo Power Guardian™ not only identifies what went wrong but can also provide insights on how to improve operations.

Scalability

SCADA's traditional architecture puts it at a disadvantage; as a system tailored for real-time control of very specialized industrial processes, its performance can be seriously hindered by taking it beyond what it was originally designed to do. If an organization has the need to quickly expand operations and connect hundreds of new equipment endpoints to an existing SCADA setup, it becomes relatively easy to flood any SCADA system in the market with data.

A common IT approach for handling increased data loads involves automatic horizontal and vertical scaling of data services, real-time data filtering and aggregation, or a combination of both. Traditional SCADA systems, however, are not designed for this. Most SCADA systems store limited data for a fixed period; they excel at hard real-time processing (at the millisecond level) but struggle with increased data loads due to limited processing power and storage capacity. On the financial side, it is worth pointing out that traditional SCADA licensing often requires payment for every piece of equipment and tag added; i.e., 5 devices with 10 data tags being X number of dollars; which makes it difficult, if not impossible, to add sensors or devices aggressively at scale after the fact.

Power Guardian excels at transforming data in real-time, facilitating seamless adaptation and integration with new technologies. Pratexo's edge platform's plug-in architecture simplifies scaling for industrial users, enabling data to be processed and stored either at the edge or in the Private/Public cloud, based on organizational requirements. By running all software as microservices over an orchestrated container cluster, Power Guardian ensures that both horizontal and vertical scaling of functions easily adjust to the data load.

Cyber Security

Many SCADA systems were originally built decades ago, without security as a primary concern. Even modern SCADA solutions often rely on obscurity for their security, leveraging physical or network isolation to protect their software environments and hardware components. In some organizations, SCADA systems operate in completely isolated control rooms, accessible only to authorized personnel. Security in these cases can be straightforwardly enforced with locks and other physical security measures.

However, the convergence of IT and OT in recent years has driven SCADA systems to connect increasingly with IT networks, creating additional entry points for potential cyberattacks. This expansion increases the attack surface in an environment where, traditionally, Security by Design has not been a pressing concern or a practice. Consequently, a variety of SCADA security solutions have emerged, adding another layer of cost for organizations.

Power Guardian combines the strengths of both OT and IT security landscapes. It leverages the security isolation of on-prem OT deployments while being deeply rooted in Industrial IoT and modern software design practices, with cybersecurity as a fundamental focus. Security features include encryption of data both in transit and at rest, certificate-based authentication, secure boot processes, container security, code signing, code review and screening, and vulnerability testing, among others.

Key Takeaways

It's important to emphasize that SCADA systems and Pratexo Power Guardian™ are not mutually exclusive. These technologies serve different purposes and can work together to enhance your industrial processes.

While Power Guardian can fulfill many of the same functions as SCADA systems, the reality is that legacy SCADA systems are entrenched in most modern industrial environments. They have a proven history of compliance and reliability that should not be overlooked. Additionally, operational teams are familiar with these systems, which plays a significant role in their continued use.

SCADA systems excel at providing hard real-time alerts and remote control of operations. If you already have one in place and have no pressing requirements on scalability, there is no reason to stop using it for these functions.

Power Guardian empowers organizations that:

- Work in industries where data-driven insights are critical for informed decisions
- Seek to embrace microservices and container-based adaptability to handle scalable growth and changing demands
- Value cross-device functionality as a key feature for collaborative ecosystems
- Aim to adopt proactive maintenance strategies through data analysis

In most cases, rather than replacing existing SCADA infrastructure, it is more effective to augment your current system with Power Guardian. This approach opens up new possibilities for large-scale analytics and optimizations.

By working together, SCADA systems and Pratexo Power Guardian™ can significantly improve industrial operations on a large scale, ensuring the maximum reliability, efficiency, and flexibility of complex electrification systems.

PRATEXO
POWER GUARDIAN™