Technical article

Expanding Cloud capabilities at the network edge

Adoption will lead to a new ecosystem

"Edge" computing – despite its name – has moved into the mainstream. This includes a promising role in industrial automation. As adoption of this solution grows, an evolving ecosystem will support new applications, transform business models, and optimize industrial processes.

Two trends support these statements, which recognize that Edge computing today is being implemented in industrial automation with off-the-shelf technology as development and customization efforts accelerate.

One widely recognized trend is the proliferation of smart sensors, devices, and applications in industrial networks – often referred to as the Industrial Internet of Things (IIoT). As data-generating nodes have become more numerous, the result has been a firehose of myriad and diverse data streams that demand more sophisticated data management solutions. In industrial automation in particular, the firehose effect often exceeds the boundaries of traditional, centralized computing.

At the same time, a trend known as "Industry 4.0" has emerged, in which enterprises embrace any opportunity to improve the efficiency, flexibility, adaptability, and scalability of their automation processes to meet shifts in the market or specific customer needs.

Edge computing's role in industrial automation is a response to these trends, which embodies both a technology solution as well as a 21st century enterprise strategy. Edge computing can be defined as the processing of data at the periphery of a network, at or near the sensors and devices that generate that data. The immediate result is more efficient, reliable, and secure industrial processes that should drive more future-oriented enterprise opportunities, such as preventive maintenance. Process improvements, in turn, can inform enterprise strategy and lead to new business models.

Placed in context, Edge computing may be viewed as an extension of centralized (i.e., "Cloud") computing, which can be integrated to complement existing Cloud platforms and overcome the latter's limitations in response to the "firehose effect".

The role of Edge computing

Edge computing is being employed across diverse industry verticals, such as manufacturing, electric power, oil and gas, and transportation, to name a few. Edge computing's value lies in processing data at its source, where only relevant data is processed in near real-time and transmitted to the Cloud. Large volumes of data from the edge of the network can be sent periodically to a centralized server for archiving and subsequent analysis.

"Edge computing can be defined as the processing of data at the periphery of a network ..."

As a result, Edge computing addresses the limitations of centralized computing, including the potential for a single point of failure, maintenance downtime, as well as the issues of scalability, throughput, bandwidth, latency, cybersecurity, and cost.

Of course, Edge computing alone does not meet all industrial automation needs. Combining IT (containerized, virtualized, redundant, load balancing, Cloud-native) and OT (on-premises/Cloud-based, decentralized, industrialized, protection of customer data) processes into a computing architecture that produces actionable insights delivers the value of Edge computing for real-time industrial automation, while relying on centralized computing for its unique benefits. This IT/OT, Edge/Cloud computing marriage and wider adoption will enable new applications and business models over time.

The stringency of industrial automation requirements, especially for mission-critical industrial applications with strict real-time decision-making needs, evolving OT innovations and cybersecurity needs, means the field is ripe for innovation. A critical mass of participants, including R&D investment, is needed to realize even greater benefits. However, proven technologies available today represent a confident step toward future benefits.

Transforming the OT environment

One key focus in Industry 4.0 is transforming the OT environment, fundamental to industrial automation. Operational Technology (OT) advancements address the monitoring and control of physical processes, systems, devices, and infrastructure in myriad, diverse production infrastructures. Therefore, they offer enormous potential for a transformation that creates value.

OT devices and applications must operate in real time and require sub-millisecond processing speeds, in contrast to Information Technology (IT) based centralized computing, which requires much longer sampling and processing times. The need for OT advancements increases dramatically as devices and sensors proliferate in an IIoT setting. The sampling, processing, and use of data at the network edge, supported by centralized computing, offers a way forward.

The role of a trusted advisor

Enterprises alert to gaining a competitive advantage would be well-advised to explore Edge computing with a trusted advisor with a deep heritage in industrial automation. As a global leader in data and communication networks, Siemens supports automation in industrial and harsh environments, including food and beverage, chemical and pharma, waste and water, electric power, oil and gas, transportation, and more.

Siemens can illuminate typical applications and clear value propositions for Edge computing use cases across industry verticals that include insights into real-time data processing, pre-processing, aggregation, and the conversion of diverse communication protocols into an easily understandable language. Siemens routinely guides enterprises on how industrial processes can be supported by well-designed data and communication networks and how they can be augmented by Edge computing hardware, software, and analytics.

Siemens provides customized solutions for implementing customer-specific applications at the edge with a high-performance Edge computing framework that combines industrial-grade hardware, powerful software, and optional connectivity to MindSphere and standard Cloud services. The portfolio of Edge devices from Siemens, such as RUGGEDCOM APE for the RUGGEDCOM RX1500 family and SCALANCE LPE, provide a reliable, secure, and flexible platform for deploying in-house, 3rd party, or self-developed Edge computing applications directly into networks in industrial and harsh environments. Computation at the edge ensures that bandwidth and latency issues are addressed, and only relevant data is sent to the Cloud. Container-based applications can simultaneously run on a single device to perform sophisticated analytics, machine learning, artificial intelligence (AI), predictive maintenance, anomaly detection, and other complex tasks.

Siemens will further expand the Industrial Edge Ecosystem as an open platform for implementing Edge computing solutions as a future option for its customers, so they can easily manage multiple devices and applications at scale. Industrial Edge is an open platform consisting of Edge devices, apps, connectivity, and device management infrastructure.

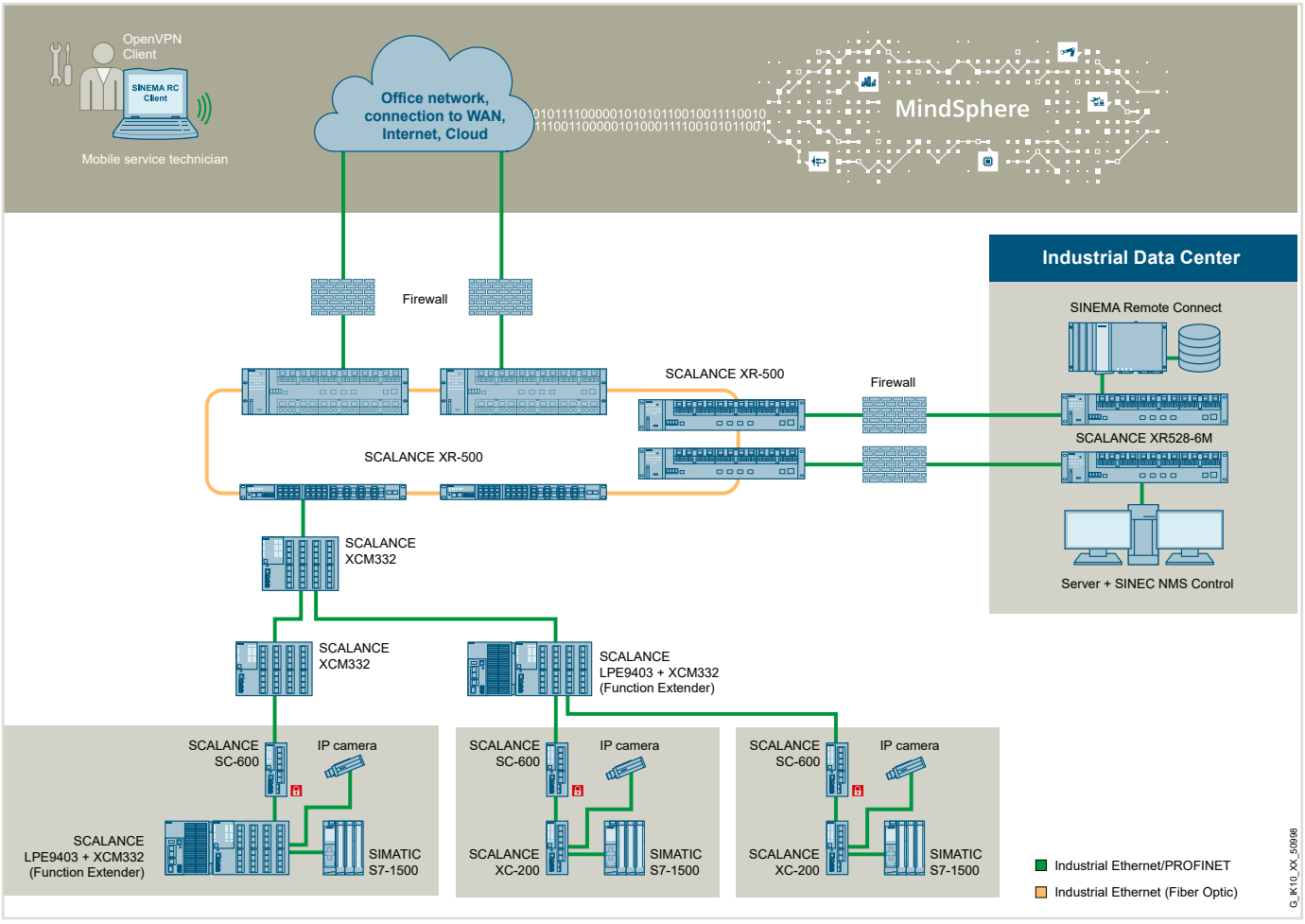
By offering these three pillars – Edge computing, Cloud computing, and Industrial Edge Ecosystem – Siemens provides enterprises with enhanced visibility to make data-driven decisions, reduce CAPEX and OPEX, as well as improve operational efficiency, security, safety, and flexibility for operators and end users across a wide range of industries.

In this suite of solutions, Siemens Professional Services works hand-in-hand with their customers to ensure they obtain technologically and financially sound solutions that fit their most challenging requirements.

Siemens' implementation strategy is designed to provide maximum uptime for industrial networks and protection of valuable assets. Therefore, the process of shifting from the centralized Cloud to a hybrid Cloud-Edge computing architecture is seamless, safe, and reliable for ongoing industrial automation processes.

Timely maintenance

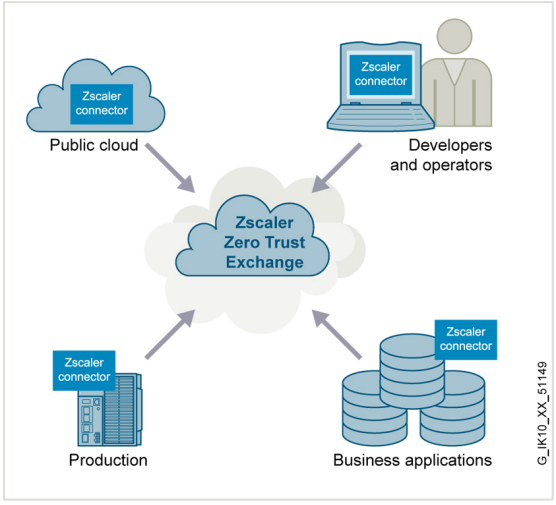
Pre-processed data analytics at the network edge can be used to plan maintenance and avoid production downtime. The SCALANCE LPE local processing engine collects data from machine sensors and sends it to higher-level, centralized Cloud-based platforms (for example, MindSphere), using an application for sensor data analysis. The Cloud then alerts operators, who can securely and remotely connect to individual machines (for example, via SINEMA Remote Connect) to perform maintenance tasks. The pre-processing of data ensures only application-specific data reaches the Cloud for further analysis.



SCALANCE LPE collects and analyzes data from machine sensors, then sends it to the Cloud, enabling operators to provide timely maintenance.

Zero Trust

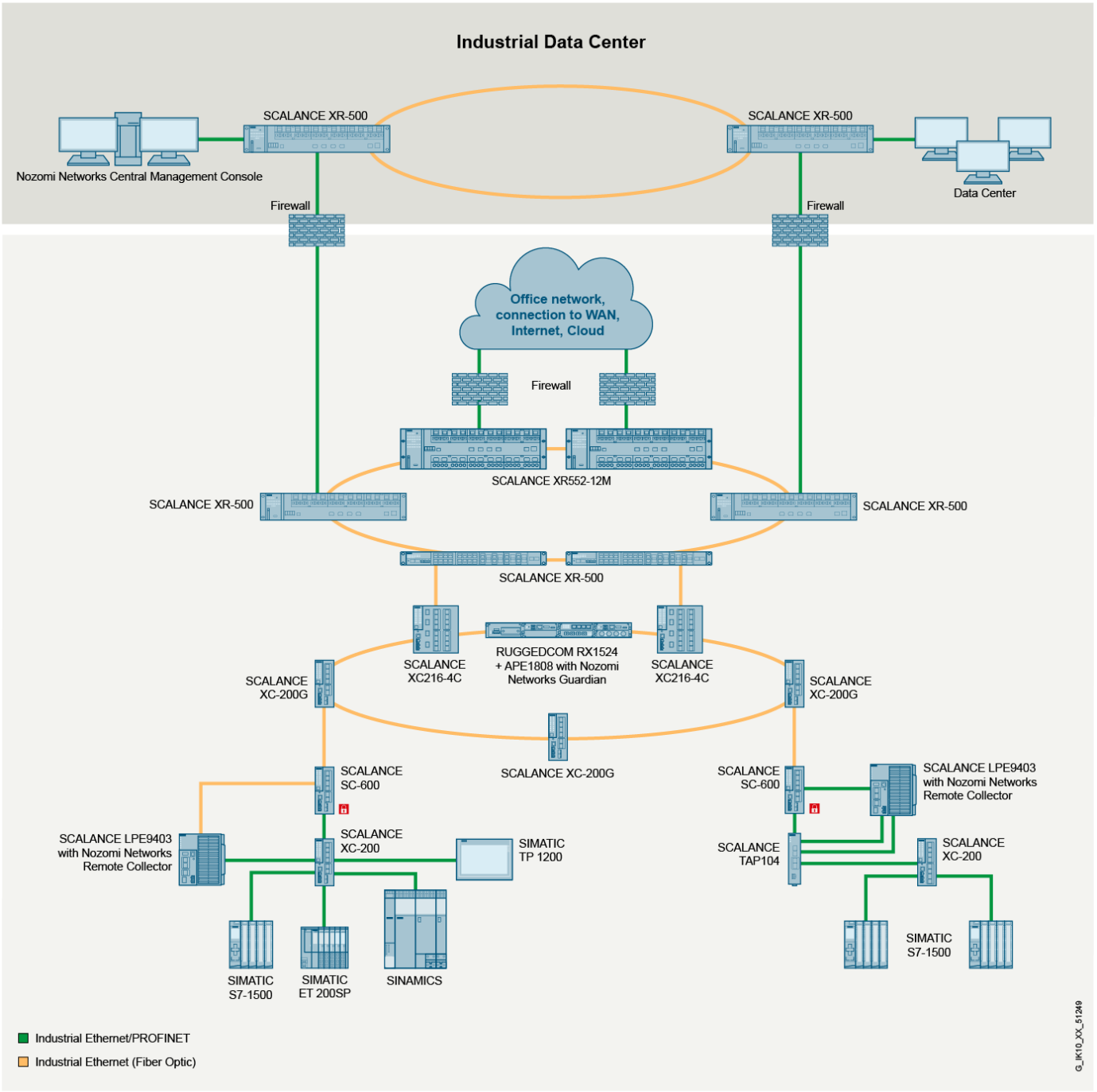
Figure 2 shows how IT approaches will be adapted for OT. SCALANCE LPE is based on Zero Trust – a proven security principle known from IT networks. Participating devices, users, and software resources are identified and authorized before gaining access to systems and applications of the industrial network. Access is hereby strictly limited to the current request. SCALANCE LPE accommodates Zscaler Private Access, a cloud-based security solution developed by Zscaler Inc., which was further developed and adapted to OT needs through its partnership with Siemens. The containerized solution can easily be installed on the local processing engine and enables fast, direct, flexible, and highly secure remote access to industrial automation environments from anywhere. Combining SCALANCE LPE and Zscaler Private Access enriches the "Defense in Depth" concept by Zero Trust principles.



Providing access to Edge and IIoT ecosystems for application development and operation personnel

Cybersecurity at the Edge

Siemens' anomaly-based intrusion detection system (IDS), in partnership with Nozomi Networks, offers deeper visibility into the network to provide rapid detection, localization, and improved resilience in the event of a cyberattack. This IDS solution provides an asset inventory, status, and behavior of every device in the network. The SCALANCE LPE hosts the Nozomi Networks Remote Collector, which continuously scans network data traffic and transmits data to the Nozomi Networks Guardian, an on-premises data collection and analysis system.



SCALANCE LPE hosts the Nozomi Networks Remote Collector and takes asset visibility and anomaly detection to the network edge. Nozomi Networks Guardian, hosted by the RUGGEDCOM APE on the RUGGEDCOM RX1500 platform, scans for data stream anomalies relevant to a baseline traffic behavior.

The Nozomi Networks Guardian sensor, in turn, is deployed on the RUGGEDCOM APE on the RUGGEDCOM RX1500 series Multi-Service Platform, inspects the network for anomalies, and alerts operators to threats. Meanwhile, Nozomi's Central Management Console (CMC) consolidates data from their various Guardians deployed throughout the network and sends it upstream to the Cloud for further analysis. The immediate benefit is improved network stability and security as anomalistic behavior and cyber threats are swiftly detected and addressed.

Siemens makes current, off-the-shelf technology available to clients, enabling them to realize immediate benefits. The expertise and confidence in delivering value are based on Siemens' evolving portfolio of hardware and software, which supports continuous innovation, ensures cybersecurity, meets regulatory mandates, and delivers on resilience and cost requirements.

The full unique value proposition of Edge computing in industrial automation is yet to be realized. As digitalization brings several benefits and the Industrial IoT delivers on its promise, the resulting data streams must be better managed. The integration of Edge and Cloud delivers value today, and enterprises with an eye to the future can lay the groundwork for future innovation and greater value down the road.

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