Excelling at the Edge: Achieving Business Outcomes in a Connected World
Mastering the 4 Ps of Intelligent Edge Processing – Presence, Performance, Power, and Protection
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As the Internet of Things (IoT) becomes more pervasive, businesses need a way to cleanse, filter, and enrich data being collected by more and more sensors making their way into more and more connected things. Intelligent processing at the edge makes this possible. It allows businesses to use presence, performance, power, and protection as competitive differentiators by moving business logic closer to the point of origination – the edge.
Connectivity among things has existed for decades. Machine-to-machine communication (M2M) has been a mainstay to support mission-critical processes in asset-intensive industries such as utilities and manufacturing.

What’s different about the Internet of Things is its reach. Very few industries will be untouched by connectivity among people, technology, and things, representing an unparalleled shift in technology. Previously offline things – clothing, appliances, and accessories – are becoming connected and are sharing data. Many experts predict that there will be trillions of things collecting data in less than 10 years. You can imagine the amount of data these things will generate, and the opportunity this presents.

This surge in connectivity is a step change that brings with it new challenges at what we call the edge. The edge is the periphery of the enterprise – in things and devices where the sensors are located. Without some way to cleanse, filter, and enrich data, and take action at the edge, the signal-to-noise ratio can obscure any meaningful insight from the data. What’s more, businesses need to take measures to ensure data security. Traditional security practices aren’t adequate for a distributed environment in which sensors operate.

The key value proposition for intelligent edge processing is that it enables data collection and local processing at the edge of the enterprise, and then sends results to a centralized digital core. The edge provides a massive reduction in data transfer, and it alleviates demand on your resources to exponentially speed time to value.
Realizing Value at the Edge

Connected things will generate an unrelenting volume of data. To send this data to a centralized core or to the cloud for processing would overload current architectures. These systems would have to be rearchitected and scaled to handle increased demand for storage and processing. Businesses can accomplish more by moving data processing and filtering closer to the point of origination – the edge.

To have a connected business, you must be able to move the assessment, decision, and action out from central offices to the physical world. The edge can push the workload to the periphery of your network and send only valuable insights to the cloud or a centralized location. This means enabling the edge to gather information, evaluate the possibilities, and execute a business process that realizes value. Intelligent processing at the edge of the enterprise also satisfies the need to use data when you don’t have access to the cloud. It gives you autonomy by allowing you to gain processing power without dependency on a central brain.

Intelligent edge processing applies business logic to translate data into business outcomes. That’s the differentiator, as compared to IoT connectivity that simply triggers alerts based on data patterns. Today’s businesses require a responsiveness that is not provided by analytics on historical data, decisions based upon operational considerations only, or fragmented or unreliable execution. Fluid and continuously evolving, data at the edge combines multiple sources, including unstructured or semi-structured information, that must be oriented to its business value. Today’s responsiveness requires situational awareness, business context, and that actionable business processes be executed reliably at the edge.

ACHIEVING SITUATIONAL AWARENESS

Situational awareness is a term that has different connotations depending on the context. In the military, for example, situational awareness can refer to being aware of all elements and influences pertaining to a mission-critical situation. It requires using intelligence to understand what’s happening in the moment to support decisions. In business, situational awareness is similar.

Intelligent processing at the edge enables situational awareness by allowing companies to use available intelligence to support decisions for the well-being of the business. It enables you to look at the present state and possibly predict future outcomes before making decisions or taking action.

An intrinsic value of intelligent edge processing is that it enables you to act on data in real time. Beyond an ability to reach more customers in the moment of a purchase decision, the speed with which you act on intelligence can result in greater business value. It removes the latency of sending data on a round-trip journey from the edge to the enterprise and back again.

The overall reduction in data transfer that the edge provides is massive. The overall business value it enables is unprecedented.
UNIFYING OT AND IT DATA FOR BUSINESS CONTEXT

When collecting data from assets in geographically dispersed locations, you can’t assume that every connected sensor and the subsequent streams of data will provide value intrinsically. In many cases, the data collected by connected things tells only half of the IoT story. It tells the operational side based on the data that is collected during operations, referred to as operational technology (OT) data. For example, OT data can include temperature readings or inventory sensor on/off states. What’s missing from OT data is the bigger picture – how this information relates to the business. It’s missing the information technology (IT) data stored in large enterprise software systems, which are required to make business decisions from IoT data. For example, operational tasks such as maintenance activities can require labor costs and availability for scheduling work orders or automated parts procurement. Intelligent edge processing can host all required data to execute locally with operational and business context.

Intelligent edge processing brings together OT and IT to enrich sensor data with business context. It simplifies common IoT processing patterns and extends the digital business core to enable immediate action. For example, intelligent edge processing can trigger real-time safety alerts using data processed from multiple sensors.

Because intelligent edge processing is localized, it becomes the clear choice for use cases. How long do you want to wait for context information from the core when two construction cranes are going to collide? This type of scenario requires real-time analysis and response. Edge processing strengthens data integrity by sending only the data the digital core needs for analytical analysis. It also allows you to take advantage of the centralized digital core without the high cost of unnecessary volumes of data being transmitted.

TRIGGERING ACTIONABLE BUSINESS PROCESSES

With solid situational awareness overlaid with business context, the value of IoT data is realized by taking action to achieve the desired business outcome. You’re able to make sense of a large quantity of data from a large quantity of sensors and simplify the processing of those data streams to identify patterns.

For example, in retail you can use IoT data to “sense” when new products are coming into a stockroom. You can automate the process to verify receipt of the items against original purchase orders and then acknowledge receipt by the creation of a materials document. You can also use IoT data to sense when a product is under the specified minimum quantity and then automatically initiate a purchase requisition to reorder that product. Intelligent edge processing can host all required data to execute locally with operational and business context.

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With intelligent edge processing, you have many scenarios such as these along the edge. Data is processed and combined to create a singular view of reality. If you have only a limited amount of resources to apply to a problem, edge processing allows you to maximize the resources available for that compute-intensive problem and take advantage of what the IoT can offer.
As we’ve established, data-collecting sensors are making their way into billions of connected things. Businesses need a way to cleanse, filter, and enrich the volume of resulting data. Intelligent edge processing makes this possible by allowing businesses to use presence, performance, power, and protection as competitive differentiators that create value where it’s needed most – the edge.

**PRESENCE**
Historically, the flow of data has run from sensors through networks to databases and back to humans executing in the office. In a digitally transformed world, to be quicker, businesses must move this execution intelligence from the office to the edge. Complex analytics and logic that have evolved to supplement human decision making must now run in a more autonomous fashion to enable action from device to device without human intervention.

Intelligent edge processing is all about where this occurs. Algorithms, syncing architecture, and customized database technology allow businesses to process IoT data locally, where it’s created and needed for consumption, with syncing and central transmission occurring more securely, efficiently, and opportunistically. Processing power at the edge reduces the amount of sensor data that must be transmitted and, thus, the cost associated with data transmission. It delivers data and insight where you need it when you need it, as the following examples demonstrate.

**Driving Retail Sales with Automated Reordering and Receiving**
At the edge in retail, it’s important to keep the shelves stocked. Empty shelves equate to lost sales. If there’s a gap at the shelf, you need to know why. Conversely, you don’t want to overstock. Better predictability avoids both scenarios. Being able to gather and process data at the edge allows you to predict the selling path to better match inventory to demand.

Sensor data coupled with situational awareness can indicate an event pattern associated with foot traffic to trigger automated reordering and receiving. You can set up predictive replenishment that factors in an accurate count of your existing stock. Then, intelligent processing can enable a fast and efficient way of receiving goods. When inventory arrives, whether it’s a loose item or a unit pack, the items can be shelved for correct tracking.

**Enhancing Worker Safety with Automated Incident Reports**
Intelligent edge processing can automate the creation of an incident report to help ensure worker health and safety. Take, for example, an offshore oil rig. If the rig is in transit, external communication can be compromised due to geographical location and satellite access. Because workers have no external communication, there is no access to cloud-based solutions or enterprise-based solutions that are on shore.

Intelligent edge processing removes the latency of sending data on a round-trip journey from the edge to the enterprise and back again.
With intelligent edge processing, sensors enable the capture and interpretation of certain conditions against specified criteria. Built-in logic can process sensor data and automate an incident report that includes context-sensitive findings from the relevant sensors. So rather than manually recording data and physically creating a report, both tasks happen immediately at the edge. With edge processing running locally, an automated notification system can also alert the appropriate people to an incident even when minimal communication capabilities are available, enabling supervisors and workers to take immediate action.

**Automating Work Orders to Sustain Equipment Health**

Intelligent edge processing can be applied to the creation of work orders. If the result of processing sensor data at the edge indicates a malfunction or problem, intelligent edge processing automates the creation of a work order with context-sensitive findings from the relevant sensors. In this scenario, the data doesn’t trigger a human health and safety incident report but rather a corrective work order. What’s different in this scenario compared to traditional maintenance practices is that it happens automatically at the edge. Although the plant can be completely disconnected from the cloud or a centralized maintenance execution system, work orders are created and visible to be executed and assigned to someone on-site to address the issue.

**PERFORMANCE**

In manufacturing, traditional M2M connectivity was enabled by expensive and proprietary control networks. Adding a new sensor could cost thousands of dollars, and the only network available to integrate it was the mission-critical process control network. One had to be very selective when choosing which operational parameters to monitor. A couple of hundred thousand sensing points were considered a huge manufacturing complex. Data was collected once a second from the control system and archived in minute snapshots into process historians.

With the IoT, billions of connected devices will produce a continuous stream of data that traditional data storage technologies will be unable to handle. Intelligent edge processing provides a solution by better managing large data volumes, storing only what is relevant, and detecting events in real time, thus enhancing business performance.

Intelligent processing at the edge requires complex event processing, such as collecting data from IoT sensors, aggregating inputs, looking at related complex events, and identifying what outputs, insights, or actions are needed. Any business process – whether complex or not – can be extended to the edge to bridge OT to IT actions, as these examples illustrate.

Intelligent edge processing combines information technology and operational technology to enrich business processes with context-sensitive sensor data.
Sustaining the Golden Batch in Manufacturing

Batch manufacturing requires a careful, dynamic balance of many different factors, such as maximizing output and quality while simultaneously minimizing waste and production time. To achieve this balance, manufacturers can adopt a golden-batch approach, where an idealized production run is used as an example for future production runs. In this manner, operators carefully observe and export current batch data for further analysis to determine how closely current batches are following the ideal golden batch.

With intelligent edge processing, operators are now able to evaluate batch data in-stream at the edge to make predictions or determine trends within the current data. Edge calculations provide insights much more quickly than collecting and sending data to the cloud or a centralized location for processing and analysis. Intelligent edge processing enables operators to identify deviations early on and determine almost immediately if corrective changes can be made or if a process should be stopped and restarted immediately to reduce waste and equipment downtime. It offers better insights into potential problems before they occur, thereby reducing the amount of downtime and the level of investment in products that are not up to quality standards and maximizing the time production lines are working at near-optimum efficiency.

Monitoring Exposure Levels

In the workplace, many conditions exist that are not necessarily observable without the collection and processing of sensor data. Hydrogen sulfide gas is not generally detectable by humans until those levels are dangerous. A human will indicate this by passing out. In such situations, you need a system that can act in real time to identify spikes in exposure and notify supervisors and workers to take precautions or evacuate an area.

An external sensor with connectivity can capture a worker’s environment – if you want to measure gas levels, oxygen levels, or sound levels, for example – and keep that data at the edge for processing. Whether using predefined rules or ad hoc logic, you can take the raw data and aggregate it to identify overexposure so workers and supervisors can be notified immediately.

POWER

Achieving business results typically requires some change to your business processes, such as making modifications to increase efficiency or engage customers. For tangible business value to be realized, operational decisions or actions must eventually impact a business process.

If improved performance demands that analytics and logic are applied at the edge, then the business process must be executed at the same time and location. That’s the power behind intelligent edge processing. For real business value, complex business processes are connected to the device and are executed closer to the device – or even on the device itself. The following examples demonstrate this.
Intelligent edge processing provides the context to support the resulting decision and business process. All data points are not equal. Edge processing helps plant workers see the whole picture before taking action.

Remote Mining Operations
The power behind intelligent edge processing is apparent in situations where there is little or no connectivity to back-end systems. Let’s use a mining pit as an example. Whether connected or not, there are critical operational processes that need to take place at a mine site. Work orders fall into this category, as does the need to track inventory used for maintaining or fixing equipment. As parts are used to make repairs when communication to the mine location is not available, the back end is not up to date on current stockroom levels. Workers have no way of keeping a record of inventory used for maintaining or fixing equipment.

Managing Inventory in the Retail Environment
Traditionally, core software systems provide retailers with a view of store inventory. Daily sales are calculated and sent to the back end to be reconciled across many processing hubs to adjust stock levels. The net quantity is then sent back to the store level, typically after overnight processing.

With intelligent edge processing, you don’t have to wait for the back end to tell you what separate systems have aggregated. Sensors process inventory coming in and going out on the fly. Data is synchronized to keep the back end up to date. At the same time, this information is available at the edge, so stock information is accurate and enables immediate replenishment or reordering.

Making Equipment Decisions
When managing assets within a physical plant, maintenance personnel not only need to monitor equipment for potential failure. They need to identify the best course of action when there is a problem or failure. For example, if a machine breaks down, could it be swapped for another machine, or could that machine’s parts be cannibalized to repair the problematic one? Do new parts need to be ordered? Is this machine a critical part of the process requiring immediate attention? In large plants with hundreds and thousands of moving parts, answering these questions can be a very complex process.

In a digitally transformed world, businesses must move intelligence from the office to the edge in a more autonomous fashion.
With the IoT, billions of connected devices will produce a continuous stream of data that traditional data storage technologies will be unable to handle.
PROTECTION
Since intelligent processing historically was executed within back-office IT systems, security was implemented here as well. It was neatly contained within an internal network, typically with internal resources where user identity was known – company employees. In the IoT world, many sensors from many different networks may be required for a business process. Communication does not depend on four walls for protection.

The identities of IoT sensors may not be known or trustworthy. Consider the distributed denial-of-service attacks that shut down major Web sites across the United States and Europe in October 2016. Experts have traced the source of these attacks to a botnet of IoT devices with weak security. Intelligent processing protection at the edge clearly requires special safeguards.

Supporting Secure Identities
The IoT is about diversity and openness. However, different sensors and hardware have different levels of sophistication when it comes to identification and security implementation. Some sensors are driven by microcontrollers that do not have enough memory to encrypt communications. Therefore, it is important that the edge is open to a wide variety of protocols and can support secure protocols and mechanisms for node or thing identity.

IoT sensors speak different dialects and have unique identities. The rules of unique identification don’t necessarily have a common denominator universally. There may be a common protocol, but it’s not necessarily guaranteed to be unique everywhere.

That’s a concern businesses can handle at the edge. Intelligent edge processing enables a way to uniquely identify these sensors and to either enforce or create a façade around the unique identity.

Some sensors may require more identity and security than others. For example, you may want to put many tiny temperature sensors in a room. You may not be interested in knowing the exact identity of each sensor, and it may not even be feasible to do so. But you need to have something that’s capable of handling identity capture and proper white-listing of things.

Being open is key to succeeding in the edge. Many well-thought-out edge solutions are trying to remain agnostic and open to the protocols connected things use to communicate.

Securing the Transmission of IoT Data
The ability to identify a node in the system and allow or deny it services is one aspect of intelligent processing protection. It comes down to identity and authorization. Then there is encryption and security of data, which cover data in motion as well as data stored on the edge device itself.

The ability to encrypt databases, to secure your channels, and to use secure protocols whenever possible is critical for success on the edge. Especially from the edge to the cloud or to an on-premise server, that communication absolutely must be secured. At the point where the edge talks to the enterprise, you must use all your enterprise’s secure channels.
Moving Compute Power to the Edge

Considering the amount of data that will be generated by the IoT, it’s not practical to ramp up the number of disk drives to store all the data from all the new sensors being manufactured. Even if you could install bigger computers at your headquarters, how big is big enough? Data volume just keeps growing.

We live in a world where everything is connected. Everything is online. We’ve added digital sensors and connected devices. We can capture an incredible amount of information. But if you have sensors just throwing data at you, there is no value, only volume. It’s time to take that intelligence to the next level to make processes simpler, more efficient, and more effective.

The solution is to move some of that compute power to the edge. That’s where the real value of the IoT lies – processing data intelligently at the edge. That’s how you get volume and power and scale to achieve meaningful business outcomes.

It’s time to take IoT data and intelligence to the next level to make processes simpler, more efficient, and more effective.

LEARN MORE

To learn more about intelligent edge processing and how it can enable you to use presence, performance, power, and protection as competitive differentiators, visit sap.com.