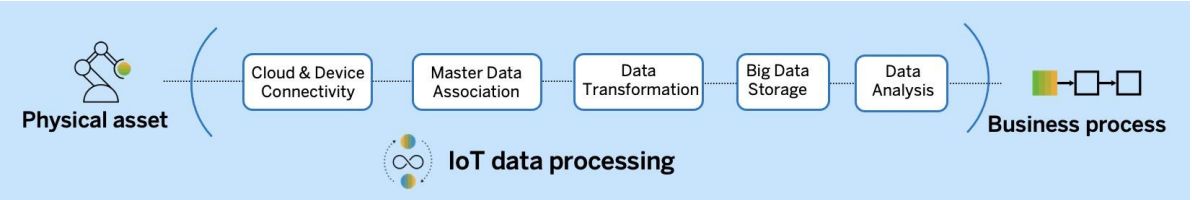
Gartner (source) forecasts that by 2024, at least 50% of digital business solutions in production will be IoT-enabled, and by the end of the year 2021, more than 50% of large enterprises will deploy at least one edge computing use case to support IoT or immersive experiences.

Industry 4.0 refers to the "digital transformation of industrial process by connecting machines, processes, and people". Digital requires a data infrastructure to ingest, store, analyze, and manage large amounts of data generated by machines, sensors, devices, vehicles, and other industrial equipment. Transformation of processes involves putting data in the context of business; (e.g. industrial processes like manufacturing, procurement, logistics, asset management, or services processes across industries

Embedded business context is the key differentiation for Industrial IoT

Enterprise IoT goes beyond device connectivity; it is all about enabling the transformation of IoT sensor data into business outcomes in Industry 4.0 applications by associating and analyzing it with relevant business context. This means we need several capabilities or services to drive a business process more intelligently from a physical asset (like a silo equipped with a sensor).



We need the capabilities to connect the physical asset to the cloud and ingest the sensor data, to associate the sensor data with master data and transform it to generate business insights and store it and finally, powerful integration services to trigger business processes in the Intelligent Suite. Here are few examples to explain in a more tangible way - the concept of turning IoT signals to business insights.

Example	Raw Sensor Data	Business Context	Transformation	Business Insight
Replenishment Optimization	Silo/Container empty Space Distance	• Material ID • Plant & Storage Location	Calculate Material Volume over Time	Consumption Rate
Predictive Maintenance	Temperature, Pressure, Vibration, Current, etc.	• Asset Master Data • Business Partner	Compute Health Score KPIs based on Predictive Models	Maintenance Service
Marketing Campaign Performance Evaluation	Retail cooler door state (open/close)	• Business partner • Current promotions	Calculate device-consumer interactions per hour	Marketing effectiveness

Let us focus on the first use case of IoT driven replenishment of receptacles such as silos and containers. Fill level sensors in silos usually measure the distance from the sensor to the surface of the material inside the silo. But what you need is the volume or weight of the material in the silo to order the right quantity of the material to replenish the silo. This means you need to transform the distance into a weight, which needs master data describing the geometry of the silo and the density of the material. You can also calculate the consumption rate based on the weight measured at the current time and the weight obtained from the previous measurement. The consumption rate provides an additional insight to more precisely determine the right time for replenishment. But to automatically trigger the replenishment business process, you also need data about the

plant and storage location. So, it is the business context that enables us to automatically trigger a purchase requisition in the ERP system or automatic stock correction in systems like SAP S4 Hana.

The second example is predictive maintenance. The raw sensor data that you would typically receive from an asset are readings of temperature, pressure, vibration, electrical current, and so on. But that raw data by its own is again meaningless. You need to know details like which asset is sending this data, what are its specifications and which customer is operating the asset. It is only by associating the sensor data with this business context, that we can turn it into meaningful data, for instance, compute a health score and trigger a service call for the customer.

IoT in Cloud vs Edge and their Interoperability

The Edge and the Cloud are two complementing pillars of Internet of Things. IoT data correlated with business process data can run on the Edge and the Cloud depending on scenarios such as: processing closer to the data source, near real-time processing, amount of data to be processed, historical data analysis, network availability etc.

Cloud-to-Edge interoperability is important where customers can choose to run IoT enabled business processes on their Edge or on the Cloud allowing for distributed computing across the Cloud and multiple Edge nodes. Customers can train predictive or machine learning models on the Cloud and deploy them on the Edge, design interoperable rules, and actions across the Cloud and the Edge and send command signal all the way from the Cloud to the Edge to the sensors. In other words, Edge computing is like the “subconscious mind”. It will take care of the routine within the constraints of the “known”, whereas cloud computing is like the “conscious mind”. It will watch out for the “unknown”, requiring superior brain power.

To conclude - the time for Industry 4.0 is now, and it goes far beyond just smart manufacturing; so, the imperative for Industry 4.0 should be to connect the entire company from front office to back office; orchestrating sales, service, logistics with production, to transform the way you work. Applications enabled by IoT in the Cloud and Edge can put Industry 4.0 to work companywide, so that companies can stay connected with their customers and with their customers’ customers, integrate with their partners – and most of all – really be ahead of the competition.

The views expressed in this article are those of the author and may not reflect those of SAP.

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