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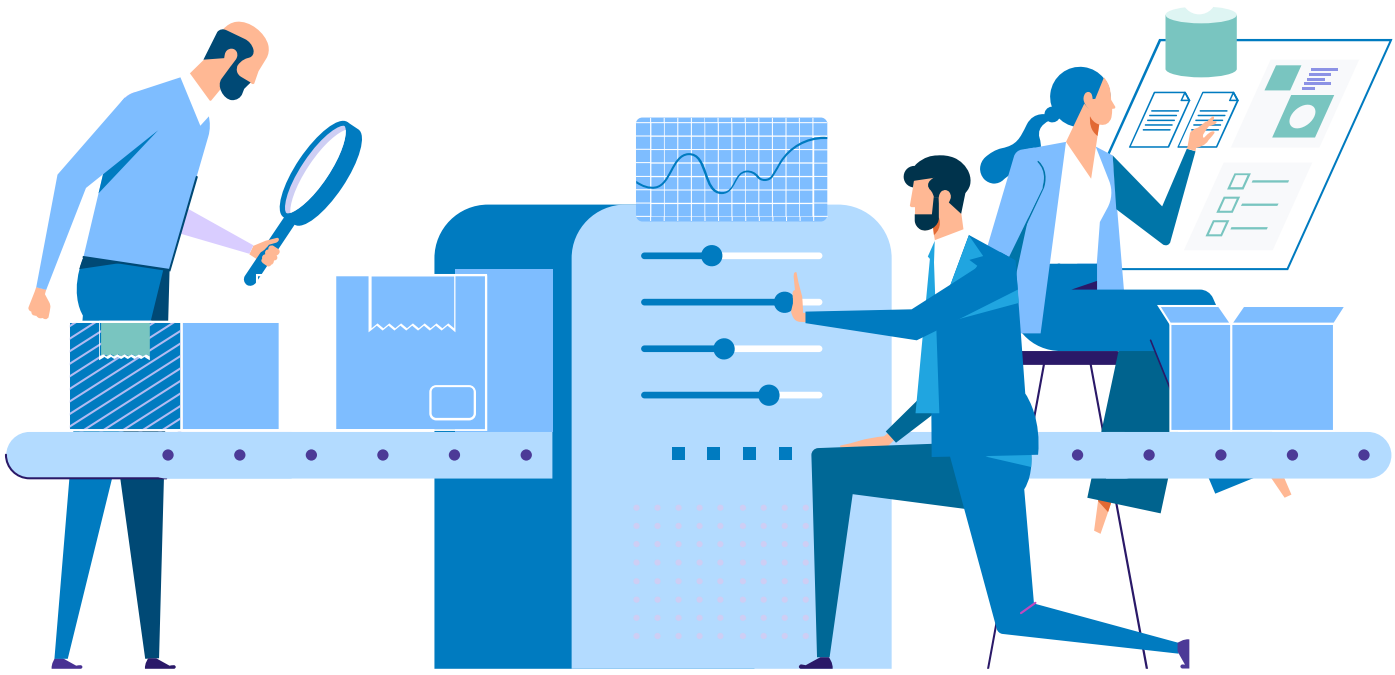
BOSCH DeviceBridge

Shop floor to Top floor Integration made easy

Content

1. Summary



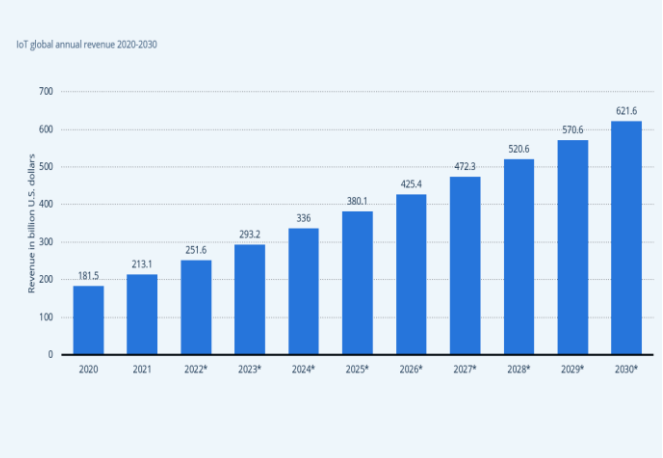
In today's world, manufacturing companies are in the pursuit of faster productivity, increased transparency, higher quality and enhanced operational efficiency. With the rising adoption of automation and rise in volume of productivity to meet market demands, most manufacturers have a mix of modern and legacy assets working in unison in the in the shop floor. Faster adoption of digitization is driving the manufacturers to stand out in the market

Operational Managers need to have real time insights to ensure smooth uninterrupted production. e.g., Process Performance, Machine unavailable, machine consuming more energy, down time due to material unavailability, Peer Machine comparison. These insights could be enabled only if the machines are connected and the data such as machine availability is available in the IT Systems in real time.

Machine connectivity is the key for a modern industry. It is the most basic need that has to be fulfilled first to enable the right data to be made available in the IT Systems to assist the management in making data driven decisions.

2. Introduction

The Internet of Things, or IoT, refers to the billions of physical devices around the world that are now connected to the internet, all collecting and sharing data. These devices are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.



Why are we seeing a surge in IOT Projects?

Smaller powerful and highly affordable computer chips.

- Sensors have become more affordable and reliable; they are also being built in very small form factors to ensure that it can be placed in tiny devices at the same time consuming very little power.

Availability of Wi-Fi network everywhere.

- Gone are the days where getting connected to a WI-FI of building a Wi-Fi infrastructure was challenging and not to mention the bandwidth limitations in Wi-Fi. With the 4G and 5G technologies, the bandwidth is high which enables low latency and the cost of setting up a reliable and stable infrastructure is low.

Lower cost of data storage

- Increase in the availability and affordability of cloud platform which could be scaled up as required, at the same time managing these are not complex.

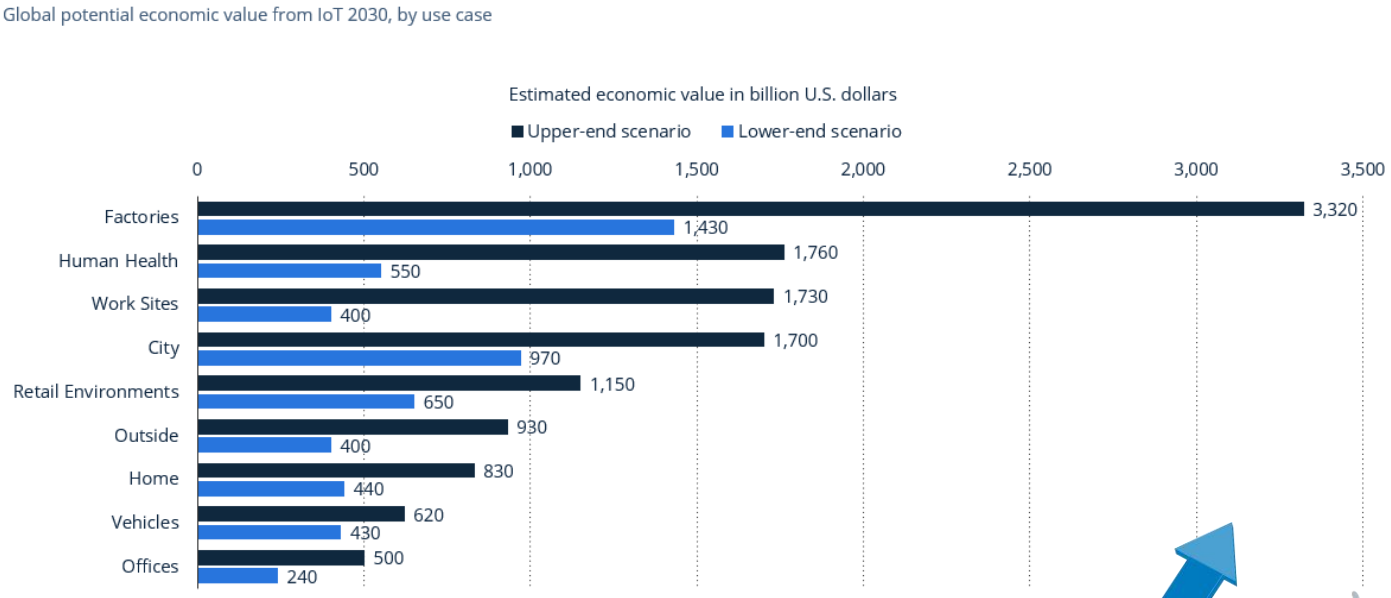
These devices would range from ordinary household objects to sophisticated industrial tools. We are going to explore the use of IOT in Industrial systems.

Industrial IOT are generally referred to IOT devices that are used across several industries, such as

- **Manufacturing**
- **Logistics**
- **Oil and Gas**
- **Transportation**
- **Energy / Utilities**
- **Mining and Metals**
- **Aviation**
- **and other industrial sectors**

They support multiple protocols. Most common being HTTP, TCP, HTTP, OPC UA, MQTT, REST, JSON, IOT, IOTE, DDS, etc.

The IOT Related Uses for Industries are on the rise.



Its indicated that especially with Industries use cases such as Optimizing Operations and condition monitoring would be the key growth sectors.

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2.1 Optimizing Operations

Optimizing Operations is a wider stream and encompasses a much larger scope of work ranging from using IOT data for

Real Time Visualization

When implemented correctly, real time visualization of production data is not only a great way of presenting data but also let the management and other decision makers analyze and manage critical business metrices.

Automatic Data Capture from Machine for quality and traceability.

Digitization of machine data is usually considered as the first steps towards digitalization in Industry. Acquiring it automatically, where data is collected, stored, pre-processed (Validation, Filter, Transformation, etc.) and sending it to upstream IT systems falls is one of the key factors for an organization to be Industry 4.0 compliant.

Enabling poke / yoke in production to ensure quality and reliability.

The value of using Poka-Yoke is that they help people and processes work right the first time, which makes mistakes impossible to happen. These techniques can significantly improve the quality and reliability of products and processes by eliminating defects.

Monitoring data from machines for any anomaly or defects and alerting the user before the next process using IIOT data from the machines, assists in eliminating human and mechanical errors.

2.1 Optimizing Operations

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Assist in planning inventory.

Automated stock replenishment consists of the implementation of automated transportation, storage, and/or management systems to speed up the supply of raw materials or finished products to warehouse locations or production lines.

Using IIOT Data to automate replenishment triggers, by receiving production confirmation data from machine or material consumption data from pallet or rack, prevent stockouts and ensure that pickers always have the items they require to prepare orders.

Manufacturers can further leverage IOT by introducing sensors that could be monitored in real time in their products and monitor their assets for equipment failures. E.g., Automotive companies can have sensors that can predict potential failure and send alerts to the driver. Machine Manufacturers can send alerts to users for possible machine breakdowns.

2.2 Condition Monitoring

This specific use case assists in monitoring the condition & performance of an asset, by predicting machine health & safety through real-time monitoring of various parameters.

Monitoring data from sensors enables continuous remote monitoring of each machinery, the data can be analyzed, and the application be programmed to provided alerts when an anomaly is detected e.g., machines deviating from required tolerances.

Sensors when installed on rotary or fixed assets (machines) can provide data such as Temperature, Vibration, Rotation Speed, Position, etc.

Anticipating machine failures before they occur, assists you in avoiding the following scenarios

Minimize downtime

To Many assets, failure would result in substantial losses if production.

Reducing Maintenance Cost

Performing maintenance in advance would help to maintain the asset in good health, maintenance can be scheduled and planned to optimize the cost rather than performing ad hoc during a break down scenario.

Enhanced Safety

Malfunction or breakdown in some cases also exposes employees to hazardous conditions.

3. Manual Data Acquisition

When machine connectivity is not available, manual system is deployed for capturing the necessary data. All production related data has to be manually captured and entered in the IT Systems. The Manual system takes a tremendous amount of time, resources, and labor.

Data in manual systems is often siloed, creating the opportunity for redundancy or even a second round of human error. Differences in simple things such as rounding, or miscalculation will create gaps and inaccuracy.

The first step necessary in a manual data collection strategy is data entry. This entry consists of forms, tags, or the ever-present clipboard. Data is recorded either at intervals for speed or output count. Or it may be recorded as needed for data such as quality rejects.

Raw data must often be contextualized before it is passed to the next step. Manual data collection may mean noting the downtime reason between output counts to connect the dots on why something occurred. Again, this manipulation is highly subjective and inaccurate.

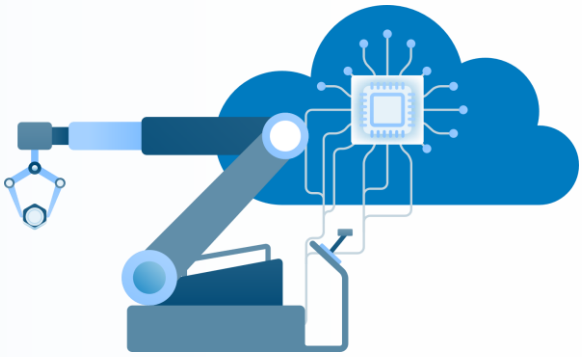
In manual data collection systems, workflows at best consist of written documentation such as “standard work” plaques or other triggers and reminders. Workers must identify and locate the written section of the workflow if they are new or running a product run that is not common.

In addition to slowing down productivity, such systems must be manually updated.

4. Business Challenges due to Manual Data Acquisition

4.1 No Real Time Visibility of Production Status

The Start and stop of a production process, the production parameters (settings / configurations) that is used to execute the process etc. is not available in real time. They are manually captured and entered in the system. Either the user inputs the data or a supervisor who inspects the line frequently captures the data in the It System. This increases additional process and man-effort.



4.2 Manual Record Keeping

All records are to be maintained or captured manually, which are susceptible to manual errors. Human errors such as omission, bias, and transposition plague efforts to accurately record production factors. These also increase the use of paper in the shop floor.

All records are also to be maintained and hence the documents occupy a lot of storage space. They can get missed, damaged accidentally and also requires high man-effort to search when required.

4.3 Low Reaction Speed to incidents

Scenarios such as Machine or inventory availability is communicated to the respective teams with delays and hence there would be a considerable delay for the planning team to send a new plan or the logistics team to send inventory, this increases the downtime at the shop floor.

5. Solution

5.1 Digitization

In an automated shop floor data capture system, the factors are captured by IoT-enabled devices where they are partially processed at the edge and sent to a cloud-based platform for analysis. Manual Papers are replaced, the data can be pre-process and can be send to the IT System on premise or to a Data Lake on cloud.

5.2 Multi-controller Support

Shop floor automation is predominantly operated by controllers like PLC, SNC, SCADA, etc. These controllers are of huge variants. Data Acquisition applications support connectivity to Multiple Controllers preferably covering some of the widely used industrial controllers.

5.3 Legacy controller Support

It's essential that the Legacy systems are part of your digital transformation journey. Data from legacy system should also be digitally collected.

5.4 Communication Protocols

Application should be able to support commonly available protocols such as Modbus TCP, S7 Protocol, Ethernet/IP, MC Protocol, OPC UA/DA, MT Connect, FOCAS, DDE, MQTT, etc.

5.5 Deployment at EDGE

Deployment at EDGE in a production environment and on Gateway at Remote Environments, ensures low latency for Alerts, The EDGE application can also assist in reducing the load of the IT application by pre-processing the date at EDGE level.

5.6 Data Modelling

A standard data structure is necessary for IT application, like Analytics, to work efficiently. Raw Data from multiple sources can be merged and delivered as a single combined payload in formats such as JSON, XML, etc.

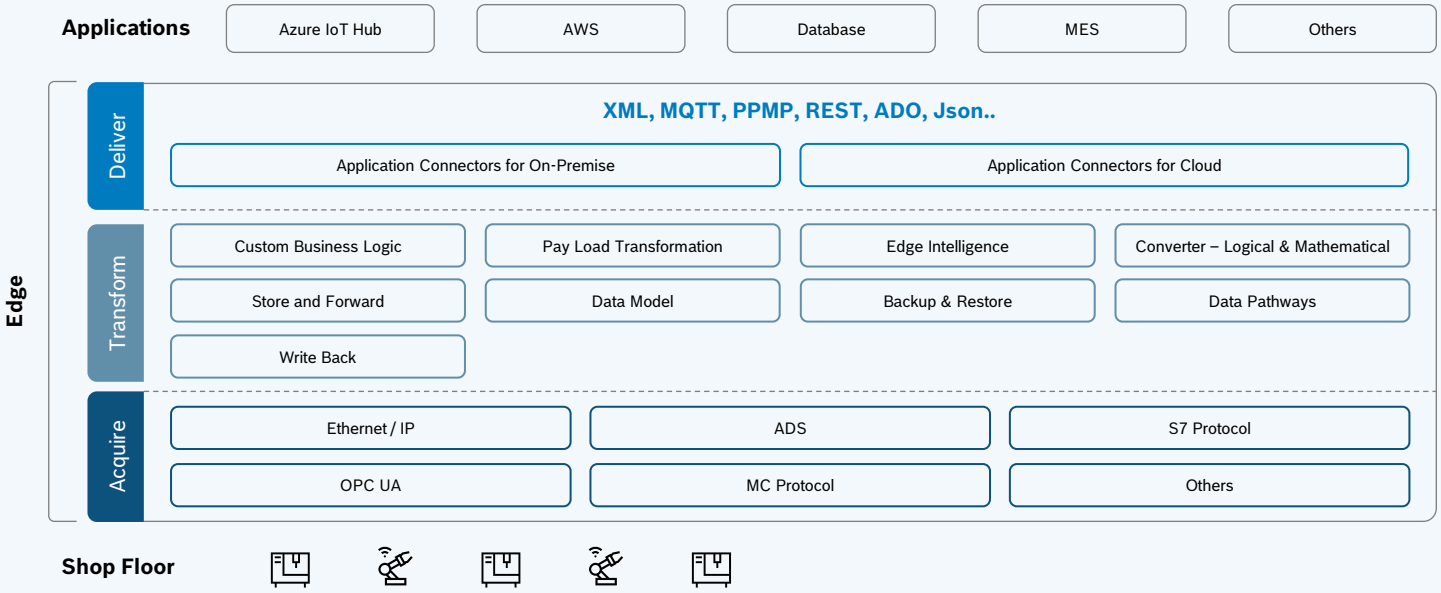
5.7 Data Transformation

Adding of Business Rules will ensure that raw data is rightly processed before it is sent to the next level. This should ideally be a no code or low code solution where a user can easily configure complex rules and filters.

5.8 Cyber Security

Security of data, for data at rest or data in motion, is to be ensured so there no threats. The latest security guidelines need to be followed.

6.Functional View



7.Software Components

A Platform independent application, could be deployed on Windows or Linux based systems.

8.Benefits

- Single solution to collect data from disparate devices
- No (or minimum) modification of Controller/Machine programs
- Plug and Play solution. Easy to configure & deploy
- Near Real time data acquisition

9.Implementation

Plug and Play installation, requires very little implementation support.

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Shop floor to Top floor Integration made easy