**Industrial IoT on Google Cloud Platform**

*Foundations of GCP*

The Internet of Things is growing rapidly. The term was coined in 1999, and as of 2018 there are roughly 20 billion devices connected to the internet. This number is expected to inflate to at least 125 billion by 2030. This is being driven by:

* The movement towards ***smart cities*** – cities which use technology to improve efficiency and sustainability for inhabitants and workers.
* The ***industrial*** need for IoT, in other words, the application of ML and AI to forecast and predict in business.
* The use of ***technology******in******health***, to improve healthcare services as well as help to provide them easier.
* The push towards ***smart******homes*** – using technology to control the home environment.

***RFID*** (radio frequency identification) ***tags***were the beginning of IoT, first implemented in 2000 because of the need for logistics. This enabled the option to receive radio signals in a widespread manner. This spread to many other fields like security, food safety, and transport, to make the IoT we have today.

There are 3 main components to the IoT:

* ***Devices*** – tech that interacts with the environment by gathering data or performing actions. Examples include phones, fitness trackers and cameras. The main idea is that they can convert information from the physical world into digital data.
* ***Gateways*** – anything that ensures that devices are securely connected to the cloud. The main use cases are to control messaging, and sometimes do real-time analytics and M, which is called edge computing. Note that it is not necessary for a device to connect to the cloud through a gateway, but it is popular.
* ***Cloud***– the part that handles computation, data storage and the bulk of the analytics.

Applications of the IoT can be very useful. They may include:

* ***Accelerating******businesses*** *–* this means unlocking valuable insights about your company that can aid its growth when made use of. If done in real time this is called ***real time asset tracking****.*
* ***ML******on******the******Edge*** *–* when you use information from sensors to run an ML model. This is called ***predictive maintenance***.
* ***Improving operational efficiency*** *–* this is the act of managing global assets on the cloud. For example, embedding cloud connected sensors in company transport vehicles is called ***supply chain management***.
* ***Localization intelligence*** *–* this is the act of visualizing the location of assets in real time and using this data elsewhere.

However, there are many challenges within the field of IoT:

* ***Connectivity****:* At present, IoT relies on a server/client model to authenticate, authorize, and connect devices to nodes in the network. Although this model works for hundreds or even thousands of devices, it will become unworkable as numbers grow to the millions and billions per network. Without proper throughput design considerations, bottlenecks may occur during the information exchange at the server. In the future, off-loading tasks to the edge will become important. This means that IoT networks will need devices capable of handling data analysis, machine learning, and data gathering.
* ***Brownfield deployment (legacy infrastructure)****:* As IoT devices and networks age and new technology emerges, brownfield deployment will become an issue. Companies will need to confront the task of integrating new devices and technologies into existing networks.
* ***Security and compliance****:* As you may have seen, hacking IoT devices has already occurred. Everything from baby monitors, to cars, to refrigerators has been exploited. As networks grow, without adequate security, each added node can become a potential opening for hacking.
* ***Dealing with non-standard communication protocol****:* Networks will need to handle ever-increasing amounts of data from sensors. Data handling, processing, and storing will increase as data input loads increase, while at the same time, the value of data increases with the size, depth, and frequency of data available to data analytics.
* ***IT/OT convergence***: The integration of information technology and operational technology is converging with industrial applications of the Internet of Things. IT has traditionally been data-centric, while OT has been used to monitor events. IoT has blurred this distinction as devices monitor and generate massive amounts of data. Enterprise and industrial operations will need to modify and adjust their processes to accommodate IoT devices and data.
* ***Get actionable intelligence from data:***The value of data increases as the ability to get actionable intelligence from it increases. IoT analysis will need to be able to handle unstructured data, massive amounts of real-time data, and outliers in real time.