Industrial IOT on Google Cloud

Adesh Sadekar, Sai Ambekar, Praneet Botke, R Thinakar

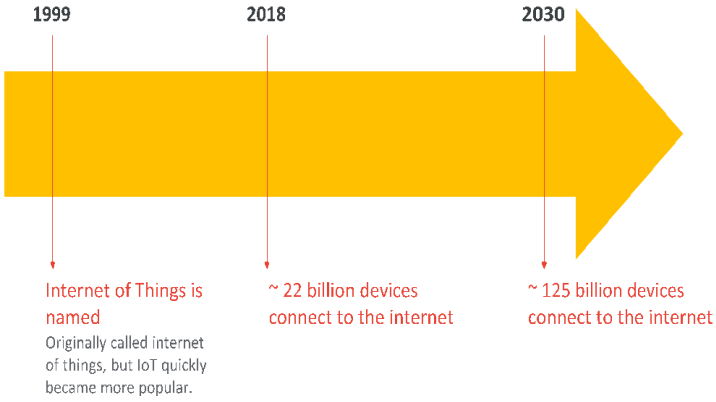
By :- Team STACK

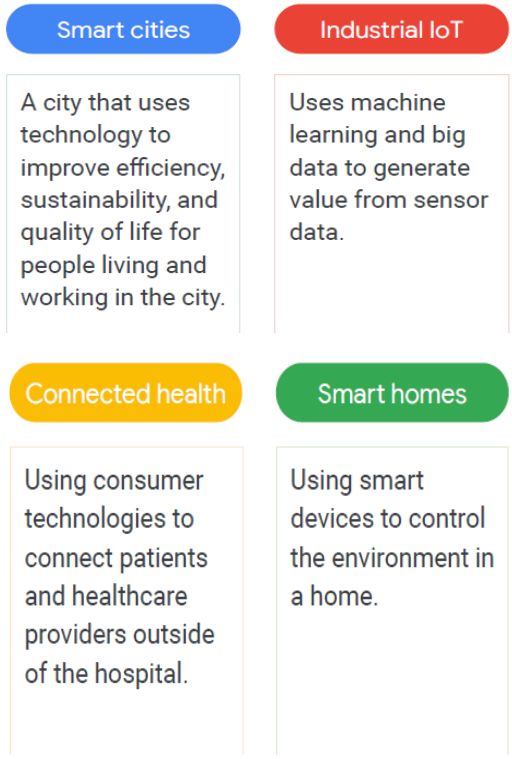
Abstract:-

The prevalence of Internet of Things (IoT) is growing rapidly with increasing influence on our daily life. IoT has received considerable attention in both academia and industry recently and there has been significant studies on security and privacy aspects of IoT and cyber-physical systems. Researchers in academia have developed novel access control models and mechanisms for IoT. On the industry side, companies including cloud services providers like Microsoft, Amazon and Google have deployed Cloud-Enabled IoT Platforms to ensure wide scale adoption. However, there is a lack of consensus between formal IoT access control models proposed in the literature and real-world Cloud-Enabled IoT deployments.

Introduction:-

The amount of attention IoT is getting is growing exponentially. In fact, the term "Internet of Things" wasn't created until 1999. Since then, the field of IoT has grown tremendously. In 2018, the number of installed IoT devices was estimated to be about 22 billion; by 2030, the number is expected to reach 125 billion.





IoT architecture :-

IoT architectures must be capable of scaling connectivity of devices, data ingestion, data processing, and data storage. They must be able to do this quickly while still producing real-time data insights. Sending ever-increasing amounts of data to the cloud slows processor times and requires more bandwidth to transfer and store data.

To mitigate this demand, distributed computing known as fog or edge computing is gaining popularity. The edge refers to the geographic distribution of computing nodes in the network as Internet of Things devices, which are at the "edge" of a network. This in turn increases the demand for devices that are capable of cleaning, processing, and analyzing data locally. The result is that only cleaned metadata is sent to the cloud.

Scaling also means that the ability to easily monitor and maintain thousands of devices must also scale. An asynchronous, scalable communication stack is crucial in bidirectional communication with devices. For example, what happens when thousands of devices must be updated or if they transmit data at the same time? A system that allows for asynchronous communication would be less brittle. A communication protocol that separates sending and receiving, such as Message Queuing Telemetry Transport (MQTT), discussed later in this course, is a necessity in IoT architecture. At the same time, there are cases when commands sent to a device must be accomplished immediately, resulting in a need for synchronous (or near synchronous) behavior.

Google Cloud IoT architecture :-

To create an IoT network capable of responding in near-real time, Google's Cloud IoT Architecture must be capable of doing data import, process, storage, and analysis for hundreds of millions of events per hour from devices all over the world.

To accomplish this, Google's IoT architecture can be divided into three stages: data gathering, data ingest and processing, and data analysis.

Data Gathering

Data The first stage, data gathering, occurs at the sensors and devices. Sensors gather data from the environment and send it to the cloud, either directly or through an intermediary device.

A device will prepare the data for transmission to the cloud. Depending on the network, preparation can include cleaning, preprocessing, analysis, and even machine learning inference.

In Google Cloud IoT architecture the data gathering stage can include Cloud IoT Edge. Cloud IoT Edge is a collection of devices capable of doing real-time analytics and ML. It extends Google Cloud's data processing and ML to billions of edge devices. Edge devices can act on data in real time and predict outcomes locally.

Cloud IoT Edge can run on the Android Things OS or a Linux-based OS. There are two components of Cloud IoT Edge: Edge IoT Core and Edge ML. In this course we will briefly discuss sensors, devices, and device communication. Machine learning will be covered in other courses.

Ingest and process data

Google IoT Cloud processing data encompasses Cloud IoT Core, Cloud Functions, Pub/Sub, and Dataflow. This is a fully managed solution for ingesting and processing IoT data. Using Cloud IoT Core devices are securely connected to the cloud. Pub/Sub receives messages from devices and publishes them for subscribers to read. You use Dataflow to create data pipelines from the device to its destination, which can be BigQuery, Cloud Storage, or Bigtable. For this course you use Google templates to create your pipelines. Use Cloud Functions to create custom pipelines.

Data Analytics and ML

Data analysis and ML can be done on the Edge or on the cloud. Google's Cloud IoT Core Data Analytics and ML are fully integrated with IoT data. Often, the value of IoT analytics comes from combining data from the physical world with data from other sources; for example, online information systems or customer-relationship data. This data often accumulates in various storage systems in Cloud Storage and is accessible to BigQuery and Cloud Bigtable. Combining historical data, metadata, and real time streaming data can lead to deeper and actionable data insights.

Cloud IoT platform stages :-

Google Cloud IoT platform includes the three stages necessary for an IoT pipeline: data ingestion, data processing, and data analysis. For each of the three stages in the pipeline, several smaller tasks need to be completed. Google Cloud IoT platform has created a fully integrated tool set for each stage.

Ingest data :-

Ingest, manage and optimize your IoT device data securely.

Cloud Iot Core is a fully managed service designed to:

- ➢ Help connect, manage, and ingest data from globally dispersed devices.
- ➢ Easily and securely ingest event streams from anywhere, at any scale, for simple, reliable, real-time stream analytics.
- ➢ Seamlessly move IoT data across Google Cloud services.
- ➢ Ingest data with Cloud IoT Core and distribute data with Pub/Sub.

Cloud Iot Edge extends Google Cloud's powerful data processing and machine learning to billions of edge devices, such as robotic arms, wind turbines, and oil rigs, so they can act on the data from their sensors in real time and predict outcomes locally.