Internet of Things (IoT)

Agenda

1. What is IoT with an example
2. What are the applicative areas?
3. How to implement IoT in applications
4. Communication Protocols available in IoT to implement long range and short range applications
5. How does Data Analytics (DA) / Machine Learning (ML) carry forward from data collected in IoT applications?

Section 1 - What is IoT with an example

Internet of Things is the concept of connecting any device to the Internet and/or to other connected devices. The other connected device can either be a sensor or an actuator.

In a brief example, the User would like to implement Smart Home application by maintaining a room temperature of 24°C continually and equipped his / her home with an "Air Conditioner" and a "Room Temperature" sensor.

The temperature data from sensor is collected and transferred to an IoT platform. The logic of Turning an Air conditioner On / Off is saved on IoT platform. Depending on the temperature within the room, the IoT platform forwards the On / Off signals to Air conditioner.

***In the above example, suer should ensure that the Devices or Things (Temperature sensor and Air conditioner) must be connected to Internet.

Section 2 - What are the applicative areas

IoT can be applied into wide range of applications, and it is hard to confine IoT applications to specific fields. With the introduction of terms such as Smart city, Industry 4.0, smart home etc, IoT is widely applied in many use-cases that enable user to connect sensors and actuators to Internet.

Here are few IoT use-cases that attained hue importance and applied in Smart city, Industry 4.0 and Smart Home

1. Smart City – Waste management and collection in City premises
2. Smart City – Ground water level management
3. Smart City – Weather reports and Speed limit control in Busy traffic areas
4. Smart City – Smart parking assistants
5. Smart City – People counter and appointment booking assistants in Public administration offices
6. Smart City – Co2 measurement and control in Schools, Hospitals etc
7. Industry 4.0 - Temperature, Pressure, Vibration monitoring
8. Industry 4.0 – Predictive maintenance applications in Wastewater level monitoring
9. Smart Home – Energy and Water meter consumption in House holds

10. Smart Home - People identification for door unlocking
11. Smart Home – Co2 and Temperature management
12. Autonomous car driving etc

Section 3 - How to implement IoT in applications

As discussed in Section 1, the sensors or devices that provide sensual data should be connected to Internet and transfer the information to IoT platform for User visualisation and to decide on Further steps. Connecting the sensor to internet attains an important value in implementing IoT applications.

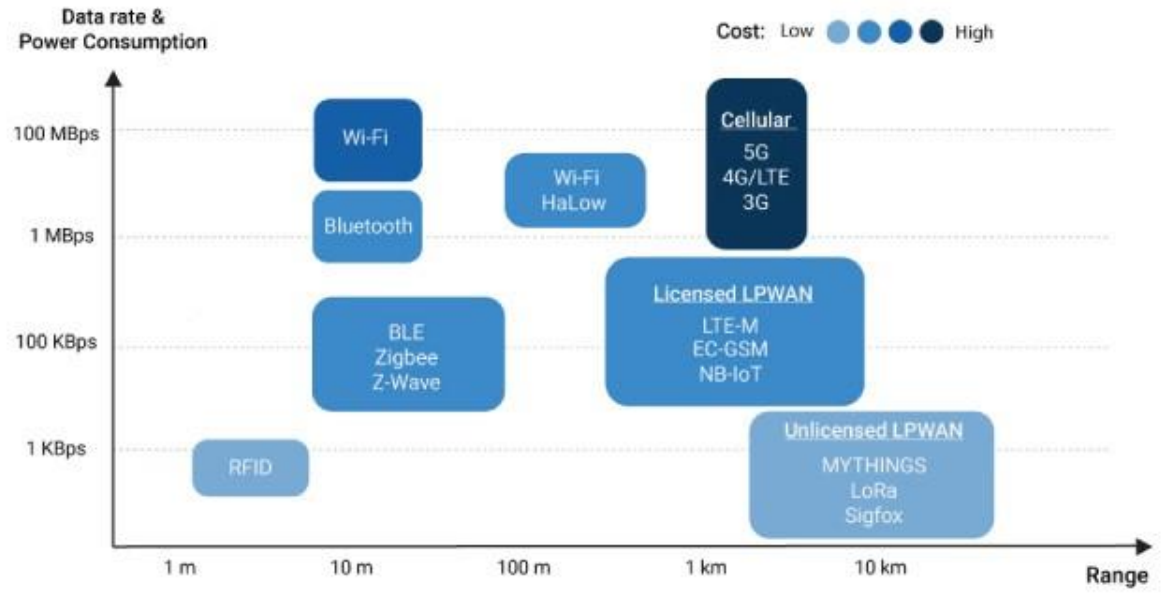
This will be attained using IoT communication protocols, Communication protocols are deployed in an IoT application depending on the User requirements and range of communication (in metres to Kilometres).

We need to keep in mind that IoT in Industry 4.0 applications should work more efficient than M2M (Machine to Machine) communication, which are widely deployed in Industrial applications, to understand the benefits of IoT.

Depending on range of communication, IoT communication protocols are classified into Long range and Short range categories. Either of them has their own pros and cons in data transfer rate and battery consumption. This is explained after the classification of IoT communication protocols below.

Section 4 – Communication Protocols available in IoT to implement long range and short-range applications

Classification of IoT communication protocols



As it is visible in above picture, traditional communication protocols such as Wi-Fi, BLE has higher data rate, but their range is limited to few metres. Due to higher power consumption, it makes it difficult for the end-device to operate for longer time periods i.e. few months to few years.

Whereas the Unlicensed Low Power Wide Area Networks (LoRa, Sigfox, MIOTY) will operate with much lesser data rates and higher range than Wi-Fi and BLE.

The Communication protocols which are listed in above picture other than Wi-Fi, BLE and Unlicensed LPWAN can communicate to distances ranging from few metres to kilometres. With increase in the range, there is an increase in the power consumption.

Section 5 - How does Data Analytics (DA) / Machine Learning (ML) carry forward from data collection in IoT applications

The data collected from sensors using IoT communication protocols is collected and stored and their respective IoT platforms. IoT platforms are huge servers which are associated with huge data bases to apply DA / ML

> Data Analytics : Data Analytics is the ability to do basic descriptive statistics, visualize data, and communicate data points for conclusions.
>
> Machine Learning: ML is the practice of using algorithms to extract data, learn from it, and then forecast future trends for that topic. Traditional machine learning software is statistical analysis and predictive analysis that is used to spot patterns and catch hidden insights based on perceived data.
> ** Collected from https://www.simplilearn.com/data-science-vs-data-analytics-vs-machine-learning-article**

Independent of DA or ML applied in IoT, this will provide the User with valuable insights to the data collected from Devices (sensors) in their applications.

Here is an example of DA and ML in Energy and Water level consumption in House holds

Using **DA**, User can understand the trends of Energy and Water consumption from the data available from recent years in his house. DA can help the User to predict the Energy and Water consumption levels in the current year and act accordingly.

Using **ML**, Energy and Water providers apply algorithms to calculate the price of Energy consumption per kwh and Water consumption per cubic litre and update the consumer with a prediction.