IOT OPEN SOURCE ARCHITECTURE/ (OIC-open interconnect consortium)

It is also called network to network architecture.

There is a need for organisations to provide a validated, modular, flexible IoT architecture that is built to be open, interoperable and cost effective. The architecture should deliver end-to-end open source IoT that addresses enterprise level IoT needs. The characteristics of open source IoT architecture are:

- Loosely coupled, modular and highly secure
- Platform independent framework
- Scalable, more flexible and can be deployed anywhere
- Based on open standards
- Streaming analytics and machine learning
- Open and interoperable on the hybrid cloud
- Application agility and integration
- No vendor lock-in, since there are no rigid architectures or proprietary formats and components

Importance of OIC

- Improve efficiency
- Reduce cost
- Improve customer experience

Why open source makes sense for IoT

- Today, IoT promotes the adoption of different open source technologies, standards and protocols that help devices communicate with one another. The following are the drivers that prompt organisations to adopt open source technologies for IoT.

- 1. **Cost:** Adoption of open source IoT frameworks involves no costs at all, as these are free for use. This encourages the community and organisations to implement IoT without any hesitation.

- 2. **Innovation:** Open source code from the community helps in building newer applications, leading to more innovation and agility. The developers are able to build different products, which will be interoperable across different OSs such as Android, Windows, iOS and Linux.

- 3. **Open APIs:** Use of open source APIs for the IoT framework offers a common gateway for different software, hardware and the systems to communicate with one another.

- 4. **Libraries:** An open source IoT framework offers a wide range of libraries, SDKs and open source hardware like Raspberry Pi and Arduino, ensuring that companies remain on the cutting-edge of technology by using different open sourced tools to customise IoT platforms.

- 5. **Security:** Open source software can protect individuals' data by implementing really strong encryption for the use of the general public (SSH, SSL, PGP, etc), and hence supply the building blocks for mobile security and the protection of data.

- 6. **Interoperability:** Adoption of open source solves the problem of interoperability.

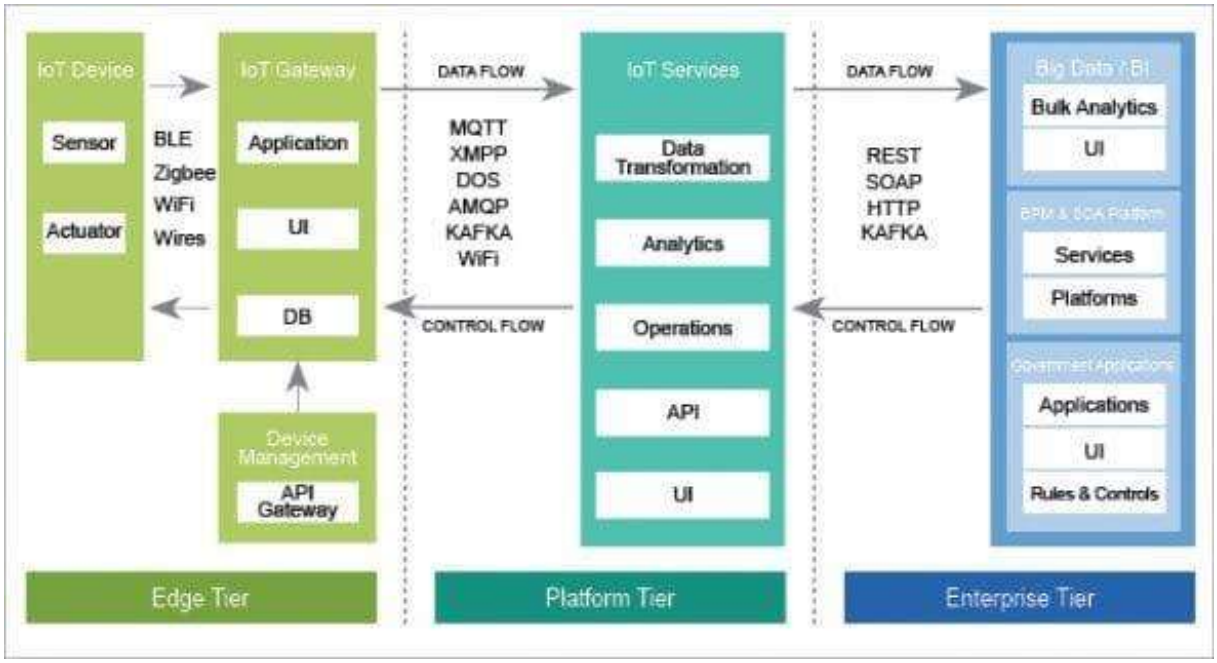

Figure 1.

The figure1 depicts the IoT logical reference architecture as three tiers — edge, platform and enterprise. These tiers process the data flows and control flows based on usage activities across the enterprise systems. They span three networks.

1. **Edge:** This consists of IoT devices and the IoT gateway. The architectural characteristics of this tier, including its breadth of distribution and location, depend on the specific use cases of the enterprise. It is common for IoT devices to communicate using a relatively short range and specialised proximity network, due to power and processing limitations. The IoT gateway contains a data store for IoT device data, one or more services to analyse data streaming from the IoT devices or from the data store, and control applications. This gateway provides endpoints for device connectivity, facilitating bi-directional communication with the enterprise systems. It also implements edge intelligence with different levels of processing capabilities.

2. **Platform:** This receives, processes and forwards control commands from the enterprise tier to the edge tier. The platform tier consolidates, processes and analyses data flows from the edge tier, and provides management functions for devices and assets. It also offers non-domain-specific services such as data operations and analytics.

3. **Enterprise:** This tier receives data flows from the edge and platform tiers, and issues control commands to them. The enterprise tier implements enterprise domain-specific applications and decision support systems, and provides interfaces to end users, including operations.

The architecture enables bi-directional communication with devices via the intelligent-edge IoT gateways. Data is routed through the IoT integration hub for application integration within the enterprise applications and for aggregation into the centralised data management platform for deep analysis and machine learning.

Users of the IoT system include both humans and digital objects. Humans typically interact with the IoT system using smartphones, personal computers, tablets or specialised devices. In all cases, the IoT system provides some form of application that connects the human user with the rest of the IoT system.

The architecture allows:

- Connection, provision, and management of millions of distributed IoT devices and gateways with added security
- Simplification of data flow management with intelligence and analytics at the edge
- Provision of a comprehensive, centralised advanced analytics and data management platform with the ability to build or refine machine learning models and the pushing of these models to the edge
- To put security in the forefront, with pre-integrated security and manageability across devices, access, authentication and applications, as well as data that is in-motion and at-rest
- Utilisation, application development, deployment and integration services

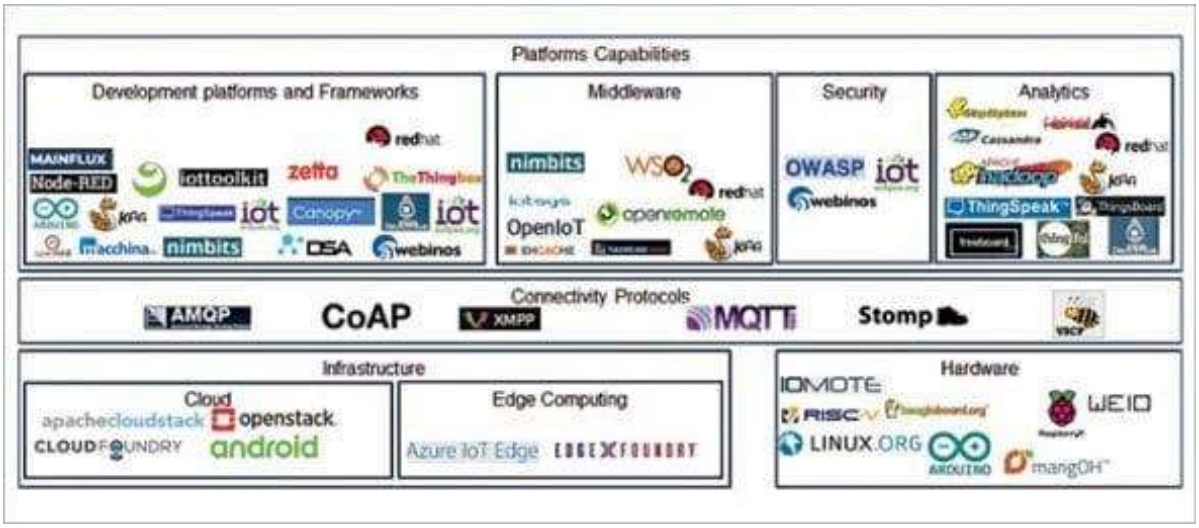

Figure 2.

This Figure 2 depicts the open source IoT ecosystem.

There are many opportunities for enterprises to use IoT to make business services more efficient and customer-centric. IoT can help enterprises achieve their most important goals by:

- Significantly impacting the customer experience, and delivering a unified product and service experience
- Delivering huge cost savings
- Improving employee productivity
- Improving customer requests and service delivery
- Improving innovation

The open source IoT frameworks achieve efficient delivery and manage highly secure, reliable and scalable IoT solutions.

Without open standards and common protocols, the devices may not be able to speak to one another. While many IoT devices ultimately connect back to the Internet, the methods they use to communicate with one another and with local control hubs are often proprietary or poorly documented.

Open source technology enables permissionless, low-risk innovation that could accelerate the search for new cutting-edge use cases. For big enterprises and startups alike, open source represents the ability to explore new technologies without big, upfront financial commitments, and with fewer concerns over future royalties or intellectual property lawsuits.

Open source is an established reality in the Internet of Things. It is already being used by the vast majority of IoT developers — 90 per cent of them use open source technology at least occasionally, while 60 per cent also contribute to open source projects.

We can find high quality open source alternatives for any type of proprietary tool or technology used by developers. This can be an opportunity or a threat. It is a threat if you have a closed source offering that faces competition from an open source option that's also free.

Open source represents a giant opportunity for enterprises—a way to gain efficiencies and stimulate innovation by commodifying the non-core, non-differentiating parts of the technology stack, just like standards are.