

INTERNET OF THINGS (IoT): AN INTRODUCTION

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ABSTRACT

The Internet of Things is an emerging topic of technical, social, and economic significance which has found a variety of applications in different fields. At the same time, however, the Internet of Things raises significant challenges that could stand in the way of realizing its potential benefits. The paper provides an insight into the basic definition of Internet of Things, its application, implementation and challenges faced in its realization

Keywords: Ubiquitous computing, IoT, Human Computer Interaction

1. INTRODUCTION

Ubiquitous computing is a term that was given by Mark Weiser. It is an emerging concept in computer science where computing can be done anytime and anywhere. These types of computing can occur using any device, at any location, and in any format. A user interacts with the computer, which can exist in many different forms, including laptop computers, tablets and terminals in everyday objects such as a fridge or a pair of glasses. The underlying technologies to support ubiquitous computing include Internet, advanced middleware, operating system, mobile code, sensors, microprocessors, new I/O and user interfaces, networks, mobile protocols, location and positioning and new materials. Since, real world objects are involved; it is also known as physical computing or the Internet of Things. This concept will provide a breakthrough in the field of artificial Intelligence and Human Computer Interaction (Vermesan & Friess, 2013).

The internet which first began with desktop computers and then evolved to laptops, tablets and mobile phones is now going a step further and extending to real world everyday objects. The physical items can now be controlled remotely from **anywhere**. Apart from the field of computer science it is also finding applicability in different fields like business, economy, agriculture, healthcare, etc. At the same time, however, the Internet of Things raises significant challenges which could adversely affect its applicability. Hacking of Internet-connected devices, surveillance concerns, and privacy fears already have captured public attention. Technical challenges still remain a major concern for developing IoT based applications.

2. APPLICATIONS

- **Smart Homes:** Developing smart homes has caused a revolution in designing residential homes. The smart home products would save energy, time and money. A Smart Home would enable the owner to control house hold jobs at the house even from a remote location. For example, switching on the air conditioner or heaters minutes before reaching home, switching on / off the lights, controlling the washing machine, etc. Although such smart homes have been implemented but the cost of establishing such homes is still a major restriction that limits its usage (Lueth, 2016).

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- *Wearable Devices:* Wearable devices include wrist watches or glasses that are installed with sensors and software which collect and analyze data. Companies like Google and Samsung have invested heavily in building such devices. These devices broadly cover fitness, health and entertainment requirements. A major challenge for developing such systems are that it should be light weight, small in size and should have very low power consumption (Kashyap, 2016).
- *Traffic Monitoring:* Vehicles should be capable of optimizing its operation, fuel consumption, pollution control, maintenance and comfort of passengers. A breakthrough will be achieved if such smart traffic could be developed as it would drastically reduce road accident causalities. By installing sensors and using web applications, citizens can also find free available parking slots across the city.
- *Industrial Internet:* Industrial Internet is the new buzz in the industrial sector, also termed as Industrial Internet of Things (IIoT). It is empowering industrial engineering with sensors, software and big data analytics to create brilliant machines. IIoT holds great potential for quality control and sustainability. Applications for tracking goods, real time information exchange about inventory among suppliers and retailers and automated delivery will increase the supply chain efficiency.
- *Smart Cities:* Smart city is another buzzword gaining immense interest from the public. Smart surveillance, automated transportation, smarter energy management systems, water distribution, urban security and environmental monitoring all are examples of internet of things applications for smart cities. It will solve major problems faced by the people living in cities like pollution, traffic congestion and shortage of energy supplies etc. Products like cellular communication enabled Smart trash will send alerts to municipal services when a bin needs to be emptied (Lueth, 2016).
- *Agriculture:* With the continuous increase in world's population, demand for food supply is extremely raised. Governments are helping farmers to use advanced techniques and research to increase food production. Smart farming is one of the fastest growing field in IoT. Farmers are using meaningful insights from the data to yield better return on investment. Sensing for soil moisture and nutrients, controlling water usage for plant growth and determining custom fertilizer are some simple uses of IoT (Kashyap, 2016).
- *Healthcare:* The concept of connected healthcare system and smart medical devices bears enormous potential not just for companies, but also for the well-being of people in general. Research shows IoT in healthcare will be massive in coming years. IoT in healthcare is aimed at empowering people to live healthier life by wearing connected devices. The collected data will help in personalized analysis of an individual's health and provide tailor made strategies to combat illness (Kashyap, 2016).

3. IoT IMPLEMENTATION

IoT implementations use different technical communications models, each with its own characteristics. Four common communications models include: Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing (Vermesan & Friess, 2013). These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user. Further, for the IoT to function three major components are required: Devices, Communication Network and Computing and Storage machines. IoT platforms connect the sensors and data network to one another, integrating with back-end applications to provide insight into large volumes of data. For example, healthcare with IoT networks can trigger an alarm automatically when a device with a particular sensor, senses something wrong with the person wearing it.



Fig 1: Device to Device Connection

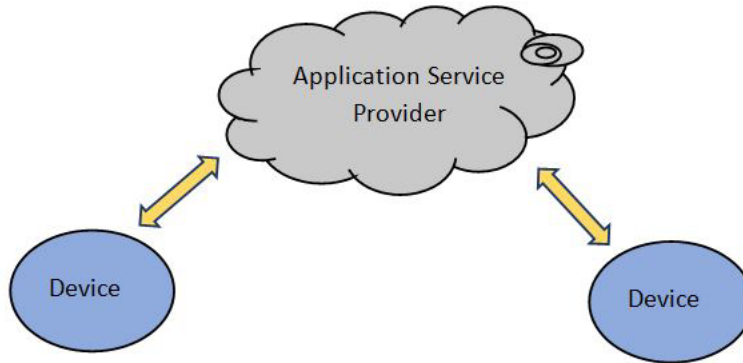


Fig 2: Device to Cloud Communication

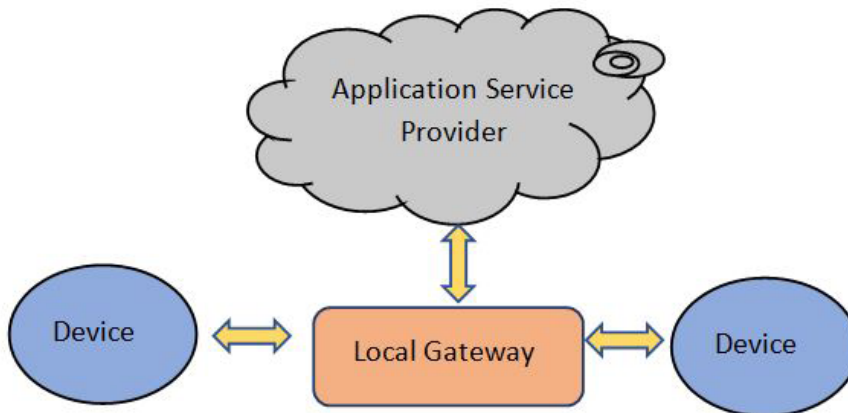


Fig 3: Device to gateway communication model

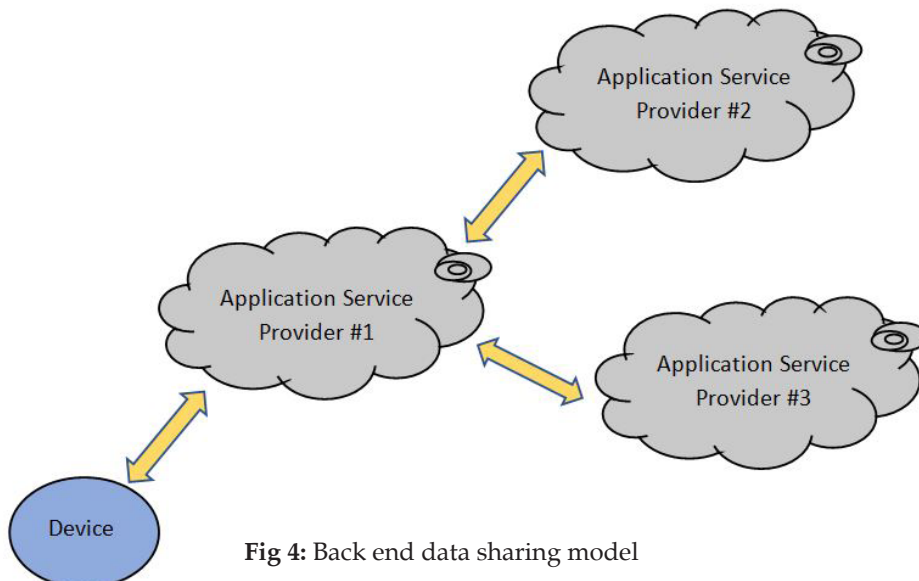


Fig 4: Back end data sharing model

4. IoT CHALLENGES

The major concerns related to IoT are (Rose, Eldridge, & Chapin, 2015):

- *Infrastructure:* The availability of high end infrastructure is essential for implementing IoT. The devices and the wireless network should be reliable for actual realization.
- *Physical location:* As the Internet of Things is strongly rooted in the physical world, the notion of physical location and position are very important, especially for finding things, but also for deriving knowledge. Therefore, the infrastructure has to support finding things according to location.
- *Security and Privacy:* Major security concerns include identification, confidentiality, integrity, authentication and authorization. With the increase in hacking incidents, the IoT application to be developed should be reliable.
- *Network Issues:* The widespread use of IoT depends on the wireless network it uses for communication. The networking challenges need to be addressed to enable using the technology efficiently.

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