Internet of Things Architecture and Applications: A Survey

AN Shreeram

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1 Topic Summary

This is a review of the research paper "Internet of Things Architecture and Applications: A Survey" by Tabassum Ara, Pritam Gajkumar Shah and M. Prabhakar. The authors talk about what is Iot and how IoT devices are seemingly integrated into modern lifestyle and how it impacts. Later on they talk about its applications, architecture and its security.

2 Key contributions from the author(s)

The internet of things (IoT) is an expansion of Internet where all the physical objects like home appliances, vehicles, sensors, actuators, mobile phones etc. are also gaining the ability to sense and communicate with each other without any involvement of human being. IoT devices are classified into resource constrained and resource rich devices.Resource rich devices like a smart phone, standard personal computer or a server have enough hardware, software and memory which support TCP/IP protocol, where as resource constrained devices like microcontroller based devices, sensors and actuators do not have sufficient hardware/software capabilities that support TCP/IP Protocol. The authors have classified Iot into four different categories

- Personal and home
- Enterprises
- Utilities
- Mobile

The authors say, according to the eight nation's survey, more than 50 percent of the respondents are willing to embrace networked medical technology. When applying Iot in health sector they come across protecting patient privacy and their sensitive data, intentional disruption etc. IoT for food chain supply has three parts; filed devices, backbone system and communication infrastructure.They

have given a complete overview of system architecture for an urban IoT for various applications like air quality, noise monitoring, traffic congestion, city energy consumption, smart parking and smart lighting etc. The authors12,13 have applied IoT technology in agriculture area. IoT based monitoring system is developed to gather environmental information to increase the growth of the crop.

"Architectural considerations for smart object networking" describes how resource constrained embedded devices can make use of IP based protocols. Refrigerator, car, front doors, bulbs etc have been hacked. Internet of things is becoming a playground for the hackers.There are four different forms of communication pattern in Iot.They are

- Device to Device

Devices are generally manufactured by different companies. So, the devices are required to interoperate and communicate with each other for smooth experience. Communication among these devices requires the different vendors to agree on the protocol stack and their design aspects like protocols, information model used, data model used to encode, IP address configuration mechanism etc.

- Device to Cloud
- Device to Application Layer Gateway

Here the devices from the same vendor collect data from the environment and send it to the their own cloud for processing. Both the device and the cloud service will be of the same vendor to avoid interoperatability issues. In device to application layer gateway it is the same as the device to cloud but there will be an addition gateway through which all the data will pass through. This gateway will generally be a smartphone using IPv4 or IPv6.

- Back-End Data Sharing

Normally users required to export and analyze data in combination with data from other sources. This architecture supports granting access to the uploaded sensor data to third parties. It allows the data collected from single IoT device to be aggregated and analyzed. This is generally organized into three layers: Perception layer, network layer and application layer. Perception layer deals with physical devices. Network layer collects data from these devices and transmit to the application layer, where all the processing and decision making takes place. This arrangement was not enough to address all the things that goes on behind the devices. So they updated Miao, Wu suggested five layer architecture of Internet of Things since with the help of three/four layer structure all the features of IoT can't be expressed. According to Paul reference architecture of IoT consists of five layers. International Telecommunication Union (ITU)22 recommends that architecture of Internet of Things may consists of five layers;

- Sensing Layer

- Access Layer
- Network Layer
- Middleware Layer
- The Application Layer

Indu Bala Thingam24 has proposed six layer architecture by introducing two more layers MAC layers and processing and storage layer.

There are also huge security concerns in these Iot devices.RFID system threats, which includes abuse of tags, reader risks and personal privacy leak.The authors27 have identified various security challenges including authentication, authorization, encryption and cache poisoning etc. Wearable IoT collects sensitive information like location and movement activities which compromises the privacy of the user.Sachin Babar et.al.29 has proposed a cube structure as a modeling mechanism for security, trust and privacy in the IoT. This structure has three dimensions; security, trust and privacy.

Shivraj VL have proposed30 OTP scheme based on identity based elliptic curve. Where hash function is replaced by a new function which is based on Identity Based Encryption (IBE) scheme.This process is repeated desired number of times. This scheme requires fewer resources for the operations, since the keys are not stored. Elliptic Curve Cryptography (ECC) has much more benefits in public key cryptosystems which are small key length, lower consumption power, faster computation, and small bandwidth.Pinol have implemented a light weight cryptography model for resource constrained IoT using ECC for Contiki OS. A mathematical model is developed in which all the primitive functions of ECC are implemented. The authors have evaluated that Jacobian coordinate system is the better choice with respect to the improvement in performance. IoT interconnects heterogeneous devices manufactured by various companies. Marin have proposed a novel key negotiation protocol where elliptic curve cryptographic algorithm is used with 32 bit processor; NXP/Jennic 5148- and 16 bit processor; MSP430-based IoT devices.The IoT embraces the guarantee of improving human lives through amplification and automation. It also helps to improve decision making and outcomes in a various application areas like medical, manufacturing, transportation, education etc.by integrating various existing technologies together in a novel way, the IoT has the high potential to reshape human life.

3 My Views on the Paper

I think that Iot devices when integrated properly with enhanced security than what is existing right now is going to drastically improve our lives in every possible way. The best examples are health and agriculture. We can live longer by diagnosing all the diseases and produce more and healthier foods for consumption. Improvement in transport will greatly improve our country's economy. It will make mundane tasks easier. We don't want all the information to be stored

on the smartphone and don't want to connect all the devices to connect to the internet for security and privacy reasons. So,I think it is a great technology to develop and use it even more with necessary precaution.

4 Agreements, pitfalls and fallacies

I agree that all the Iot devices make our lives easier and not only for us consumers but also for the industries. The current state of Iot is not gaining trust due to the invasion of privacy of the consumers in order to collect data and process it somewhere else by the companies. There is also security concerns on how the data is being sent to the companies and whether other people can see our data. Iot devices by default do not have hardware capability to take care of encrypting the data, So generally smartphones take care of it while sending the data. There needs to be a standard protocol to be followed by all the devices and encryption of data should be improved for safe transmission of data.