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A SURVEY ON IOT PLATFORM

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Abstract:

Internet of things is empowering the things to access internet. Thus the environment is monitored by sensing the environment and the data are transferred to cloud by internet connectivity of the things. The monitoring environment comes closer in spite of distance. There are several platforms that provide services such as data analytics, business analytics, notification, etc. Each platform provides a specific service. This paper mainly aims to give an overview of various platforms for IOT. This would help the users to choose their platform that is suitable for their application.

Introduction:

Internet of things is a network of things connected to the internet. The object is a physical object that can be a vehicle parking field, any machines, even light can be controlled. The things are embedded with the sensors(to sense the environment), electronics(for various functionalities such as connectivity) and software (for integrity of things to other things). The internet of things is a trending subject. The things when connected to internet, users can access the things through the internet and has a control over the things. The things are able to sense and be identified uniquely. By giving things access to the internet, the environment is monitored, gets notified and taken action to control the environment. The application of the IOT is in many fields including home automation, logistics and transportation, agriculture, healthcare, banking, energy management system, smart city, smart parking system, smart traffic control system. The IOT was first coined by the Kevin Ashton in 1999 who established a laboratory in MIT for connecting the objects through RFID. In 2005 the IOT is mentioned by ITU. In 2010 Google developed a car that is fully connected to the internet which could access the map and accordingly get automated by self. This is an important project in the field of IOT. In 2010 the Bluetooth low energy protocol was developed that enables the objects to be connected with low power consumption. Various technologies that enable the connectivity and the communication over the network of objects are Bluetooth, Zigbee, WI-Fi, 4G LTE. Each of these technologies differs in their range of transmission, power consumption, and speed. Based on the application the technology that is used to provide connectivity and power constraints, the technology chosen may vary.

Technologies	Range	Power
Wi-Fi	50-100 meters	High
Bluetooth	10 meters	Low
zigbee	10-100 meters	Very low

Table 1: List of Enabling Technologies Provide Connectivity between Objects

Internet of things is the evolving concept that is beginning to dominate the future years. There will be millions of devices in 2020 as predicted by the Cisco.

The things can be anything as shown in fig 1 it can be a smart watch or a vehicle like car that is connected to the internet through a gateway. The gateway can be minicomputer or a microprocessor that is based on the requirement of the system to deploy. In order to attain the IOT to its fullest the platforms, operating environment has to be developed to easy the process of the IOT system deployment. So this paper is

mainly devoted on the current platform that supports the IOT implementation. This gives the various platforms, their working and their service provided by each platform.

Figure 1: Things connected to the internet

State of Art:

Xively:

This platform provides a platform as a service for building an IOT APP. The things are connected to the xively platform by protocols such as REST, HTTP, and MQTT [1]. It ensures security by having a secure server with device and user authentication by their API key which is assigned to them while registering as a new user [2]. It provides a SDK for Arduino, android, python, java, PHP, RUBY. It provide three services such as directory as a service by provide storage space to store data, data as a service in which we can make a data analysis and business as a service for a connected business and product. The xively also provides a unique API for the data visualization that is being stored in cloud [3]. Xively has also has been won many awards as an IOT technology innovator in 2015 and also many awards in year 2013 [11].

Axeda:

Is a platform that provides the storage space to store the data of the things analyses the data and get notified. The axeda supports the MQTT protocol for the communication with the axeda cloud. It has a middleware called IOT connectivity to easy integrate and connect the things to cloud. It also has SDK to build the APP and to access the data through web app. The axeda cloud providers have also obtained an ISO 27001:2013 certificate for ensuring security in axeda cloud. The axeda cloud also works with protocol such as SOAP, REST [3].The grovey scripting engine is there to support the application development. The axeda provide connectivity between things and cloud by axeda wireless protocol [3], [4].

Thingworx:

It is an IOT APP development platform that allows the user to developers to develop them own application. The data communication and device control in turn is through REST protocol, MQTT [3], [4]. There is a codeless mash up builder that allows the user to create their own APP without any need to code. It also allows the social networks to collaborate with users such as twitter, LinkedIn, google + [4]. SQUEAL is a search engine that is used to data analysis, search and query the data repository stored in cloud [2] Thing watcher is software that is used to detect the anomalies and gives alerts. The thing predictor is software that predicts an event by considering the key

factors suggested by the thing watcher. Thing optimizer is software that is used to improve the performance by using the predictions in thing predictor. Thus the thing worx analytic server uses the thing watcher, thing predictor and thing optimizer and provides a better data nalytics.

Thing Square:

Is a platform each connected objected runs a wireless thing square mist os. It ensures the secure connectivity by the AES protocol. Thing square IDE is a web based IDE to build online mist APP [3]. This thing square mist is a gateway through which the things are connected in the form of mesh. The visibility of the device is within the mesh [4].

Bug Swarm:

The bugs lab was started in the 2006 and introduced their first hardware called bug in 2008. That enables the open source IP enabled hardware. Swarm is a rest based messaging platform for IOT launched by bug lab in 2010. Using swarm the rest based messages can be send to things and make control over the environment, make notification etc. They launched dweet and freeboard platform for the IOT in 2014. Dweet is a tweet of things. It is publish subscribe based model where publish is the tweet of things data and the subscribers are the one who follow the things. We can even buy a lock on thing so that the only registered user with key can follow the thing and subscribe the data from the thing. Freeboard is a data visualization dashboard and that gives the user to design their own data visualization. The user can create their own interface layout and the way to be display the data and allows the user to share user's public/private mode. This freeboard is more compatible with the dweet.

Sensor Cloud:

This is designed early to support the micro stain wired and wireless sensor as cloud storage but it also supports other third party sensor by open source API. It sends notification by SMS and email. It has a mathengiene that allows the user to design their own data visualization tool to make a meaningful sense on their data. All the transaction are encrypted and then transmitted to the sensor cloud. It also allows the users to add a threshold value to a sensor value and time that can send the alert when the event occurs. Real time data is accessed by forming a virtual live port between the gateway and cloud by means of live connect. Math engine is a tool provided by the sensor cloud to visualization of the data. It also alows to integrate the ipython notebook that uses python code for the data visualization.

Thing Speak:

Is an open source cloud platform for IOT. Data from various thing or sensor or a website can send data to the thing speak cloud and we can visualize the data stored in the thing speak and it is also possible to customize the visualization to a specific time. We can also perform a mash up from various data channels and make better meaningful data. It also allows the user to act on environment by either sending notification or trigger the IP connected thing in environment.

EvryThng:

Evrythng is a platform for smart products that connects the products to the web and provides real-time application such as web based application. It uses an OAuth protocol to connect the external application to the products. Each products are digitally identified by active digital identity (ADI) and we can even set the threshold condition trigger an action send a text alert message. Reactor is an engine deployed in evrything to make decision and customize the work flow. The connectivity technologies supported by the evrything is QR code, RFID, BLE, NFC. The communication protocol supported by

it is MQTT, COAP, web sockets. Thnghub local cloud gateway software is used to solve the connectivity between different communication protocols. It works in low latency in offline and also has a local API.

Every Ware Device Cloud:

Every ware device cloud is a platform according to the eurotech framework that provides end to end solution and various services as API development, dashboard and reports on the data stored in cloud. The MQTT protocol is used for communication. They also provide much hardware to provide an end to end solution. We can also receive the notification by tweet, SMS, e mail, phone call, and dashboard. It can also integrate with other service providers such as sales force, twitter, Face book, Google Aps.

iDigi device cloud: it is a public device platform. It has about 175 security controls to ensure security of consumer's data. ethrios cloud connector is an SDK package to enable information from device to cloud. It also allows third party data exchange. It also allows bidirectional communication. It allows the user to define the threshold data and send notification is send automatically and schedule a task automatically.

Platform	Integration To Cloud	Supporting Protocols	Security	Type of Analytics	Application Mostly Used
Xively	Rest API	HTTP/HTTPS MQTT	SSL/TSL	Data Analytics, Business Analytics	Healthcare
Axeda	Rest API	MQTT, SOAP, REST, AMMP	SSL/TSL AES 128, RSA 2048	Data Analytics	Home Automation
Thingworx	Rest API	MQTT, XMPP, COAP, DDS,	TLS/AES 128	Data Analytics	Home Automation, Smart Traffic Management
Thing Square	Thing square mist	IPV6,RPL, 6lowPAN	AES protocol SSL	Data Analytics	Home Automation, Transportation
Bugswarm	Rest API, JSON	HTTP	RC4 based encryption protocol	Data Analytics	Smart Irrigation
Sensor cloud	Rest API	HTTP	TLS	Data Analytics	Home Automation
Thing speak	Rest API	HTTP	SSL	Data Analytics	Healthcare, Social IOT, Home Automation
Evrythng	Rest API	MQTT, COAP, web sockets	SSL	Data Analytics	Healthcare,
Every ware Device Cloud	Rest API	MQTT v 3.1	SSL	Data Analytics	Healthcare

Idigi Device Cloud	Rest API	MQTT	SSL	Data Analytics	Healthcare

Table 2: comparison of a list of cloud platforms

Discussion:

IOT is a combination of sensor network technology, cloud computing and big data concepts. The main part of the cloud computing in IOT is to provide data storage and services for accessing the data and for setting notification/alert. In this paper we have discussed some of the cloud platforms. Mostly the cloud platform provides REST based web services. The protocols supported by the platforms mostly are HTTP and then MQTT. The security of the data transmission to the cloud is ensured by SSL handshake protocol. Only some of the cloud providers like Xively and Sensor cloud use TSL handshake protocol. Each user is given an API key for during registration process is used as an authentication purpose. Data analytics services are provided by the all cloud providers and some providers such as Thing speak, Bug swarm provides mash up of various sensor data in a built in widgets and also allow the user to custom their widgets. All cloud providers give services to send notification in form of SMS or mail and some platforms such as Axeda and Every ware device cloud provide notification through call. Cloud platforms like Xively, Thing speak, Evrythng, Every ware device cloud, and Idigi device cloud can be used in healthcare domain as it supports MQTT protocol where the publisher are the users who are wearing the health sensors and the subscribers are the physicians. Axeda, Thingworx, Thing square, Sensor clouds, Thing speak, can be used for the home automation domain as in case of home automation the information shared is to be more secured and even in Thing speak platform where the information can be shared privately. Thing square, Thingworx, can also be used to traffic management as the traffic management that has TLS/ SSL and AES security protocol. Bug swarm can be used for smart irrigation that uses a simple HTTP protocol for communication.

Conclusion:

Thus in this paper we have taken a list of cloud providers for IOT, the protocols supported by them and their special features such as some engines for data analytics or a middleware to connect any things to cloud dynamically and their special services such as business analytics services and notification call and manually setting some threshold value and when the event happens the cloud can triggers the action in an environment. Thus this paper mainly aims to provide a general knowledge about some IOT cloud platforms, their services and security by cloud providers.

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