ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

EFFECTUAL REVIEW ON OPEN SOURCE CLOUD ENVIRONMENT FOR GLOBAL COMMUNICATION AND COMPUTING RESOURCES

Ravi Vasdev

M.Tech. Research Scholar

Department of Computer Science and Engineering

Universal Group of Institutes

Lalru, Punjab, India

Priyanka

Head of Department, Assistant Professor

Department of Computer Science and Engineering

Universal Group of Institutes

Lalru, Punjab, India

Abstract

The Internet of Things (IoT) is one of the recent technologies in current era that focus on the interconnection of every object in the real world. We can imagine the real life objects with embedded computing devices and communicating with each other. By this technology, we can track everything from remote location using Internet infrastructure. Using IoT, the inter connection in every system, device, machine, human being, home equipments, office products can be established using existing network resources. As an example or case of IoT, we can track any train by using the messaging service of Indian Railways. As per the instructions, we can send the message SPOT <TrainNumber> to 139. After this message, we get the exact location and upcoming station of that train. In the same way, many taxi or cab services are trying to utilize and implement IoT. Currently, many taxi operators are connected with GPS and we can track the location of that car on mobile phone, tablet or any network connected device. Smart Cities, Smart Home are implemented using IoT in which everything is connected and searchable. At the base level, IoT makes use of sensors and embedded chips which are inserted in the system that we want to monitor and track. RFID (Radio Frequency Identification) based devices are classically used for IoT implementation. The Things, in IoT, refers to a wide variety of devices such as heart monitoring implants, biochip transponders deployed with patients for remote monitoring and prescription, animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include smart thermostat systems and washer or dryers that utilize wifi for remote monitoring.

Keywords : Cloud Computing, Cloud Environment, Internet of Things, Cloud of Things

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

Introduction

Gartner, Inc. forecasts that 4.9 billion connected things will be in use in 2015, up 30 percent from 2014, and will reach 25 billion by 2020. The Internet of Things (IoT) has become a powerful force for business transformation, and its disruptive impact will be felt across all industries and all areas of society. [Source - Gartner Press Release, Barcelona, Spain November 11, 2014 http://www.gartner.com]

Gartner estimates that IoT will support total services spending of $69.5 billion in 2015 and $263 billion by 2020. Consumer applications will drive the number of connected things, while enterprise will account for most of the revenue. Gartner estimates that 2.9 billion connected things will be in use in the consumer sector in 2015 and will reach over 13 billion in 2020. The automotive sector will show the highest growth rate at 96 percent in 2015.

According to a new research by Gartner, The Internet of Things (IoT), which excludes PCs, tablets and smartphones, will generate incremental revenue exceeding $300 billion in services in 2020. The services include hardware, embedded software, communications services and information services associated with the things.

[Source - http://www.gartner.com/newsroom/id/2636073]

Kevin Ashton, cofounder and executive director of the Auto-ID Center at MIT, first mentioned the Internet of Things in a presentation he made to Procter & Gamble. Here's how Ashton explains the potential of the Internet of Things:

> *"Today computers -- and, therefore, the Internet -- are almost wholly dependent on human beings for information. Nearly all of the roughly 50 petabytes (a petabyte is 1,024 terabytes) of data available on the Internet were first captured and created by human beings by typing, pressing a record button, taking a digital picture or scanning a bar code. The problem is, people have limited time, attention and accuracy -- all of which means they are not very good at capturing data about things in the real world. If we had computers that knew everything there was to know about things -- using data they gathered without any help from us -- we would be able to track and count everything and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling and whether they were fresh or past their best."*

Kevin Ashton is known for inventing the term "the Internet of Things" to describe a system where the Internet is connected to the physical world via ubiquitous sensors.

Usage of Sensor Data in Cloud Environment

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

The huge generation, processing and storage of sensor data is involved in the Internet of Things. To manage and control all these aspects, cloud is required. For this, the effective implementation of cloud infrastructure is required. In the upcoming years, the Internet of Things (IoT) will be transformed to the Cloud of Things (CoT) because it will be very difficult to manage huge data or BigData without cloud integration.

Real Life Implementations and Applications of IoT

From building and home automation to wearables, the IoT touches every facet of our lives. Many corporate giants including Texas Instruments, Cisco, Ericsson, Freescale, GE are working in the development as well as deployment of IoT scenarios. The companies are making and developing the applications easier with hardware, software and support to get anything connected within the IoT. A set of key markets exists for the IoT with potential for exponential growth.

- Medical and healthcare systems
- Building and home automation
- Transportation
- Wearables - Smart watch for Location and tracking
- Building & home automation
- Smart cities
- Smart manufacturing
- Employee safety
- Predictive maintenance
- Health care
- Remote monitoring
- Ambulance telemetry
- Drug tracking
- Hospital asset tracking
- Access control
- Automotive

Open Source Cloud Platforms for Internet of Things

Numbers of open source platforms are available to simulate the IoT infrastructure and related protocols.

OpenIoT - OpenIoT is an open source middleware for getting information from sensor clouds, without worrying what exact sensors are used. OpenIoT is now included in the teaching program (syllabus) of Santa Clara University, CA, USA. The master program includes theory in Internet of Things and practical experience. OpenIoT among other IoT tools from CISCO, ARM etc are pioneers in this program in the University. Dr Martin Serrano from the OpenIoT project will be teaching IoT principles and also facilitate lab experiments and projects for the students that will be using the OpenIoT middleware. This is the first wide adoption of OpenIoT in education and outside of Europe. [Source - http://openiot.eu]

OpenIoT is a joint effort of prominent open source contributors towards enabling a new range of open large scale intelligent IoT (Internet-of- things) applications according to a utility cloud computing

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

delivery model. OpenIoT is perceived as a natural extension to cloud computing implementations, which will allow access to additional and increasingly important IoT based resources and capabilities. In particular, OpenIoT provides the means for formulating and managing environments comprising IoT resources, which can deliver on-demand utility IoT services such as sensing as a service.

OpenIoT is pertinent to a wide range of interrelated scientific and technological areas spanning:

(a) Middleware for sensors and sensor networks,

(b) Ontologies, semantic models and annotations for representing internet-connected objects, along with semantic open-linked data techniques

(c) Cloud/Utility computing, including utility based security and privacy schemes.

From a more technical point of iew, the OpenIoT middleware infrastructure allows flexible configuration and deployment of algorithms for collection, and filtering information streams stemming from the internet-connected objects, while at the same time generating and processing important business/applications events.

AllJoyn

Originally created by Qualcomm, this open source operating system for the Internet of Things is now sponsored by one of the most prominent IoT organizations - The AllSeen Alliance, whose members include the Linux Foundation, Microsoft, LG, Qualcomm, Sharp, Panasonic, Cisco, Symantec and many others. It includes a framework and a set of services that will allow manufacturers to create compatible devices. It's cross-platform with APIs available for Android, iOS, OS X, Linux and Windows 7.

Contiki

Contiki is the open source OS for the Internet of Things. It connects low-power microcontrollers to the internet and supports standards like IPv6, 6lowpan, RPL and CoAP. Other key features include highly efficient memory allocation, full IP networking, very low power consumption, dynamic module loading and more. Supported hardware platforms include Redwire Econotags, Zolertia z1 motes, ST Microelectronics development kits and Texas Instruments chips and boards. Paid commercial support is available.

Raspbian

While the Raspberry Pi was intended as an educational device, many developers have begun using this credit-card-sized computer for IoT projects. The complete hardware specification is not open source, but much of the software and documentation is. Raspbian is a popular Raspberry Pi operating system that is based on the Debian distribution of Linux.

RIOT

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

RIOT bills itself as "the friendly operating system for the Internet of Things." Forked from the FeuerWhere project, RIOT debuted in 2013. It aims to be both developer- and resource-friendly. It supports multiple architectures, including MSP430, ARM7, Cortex-M0, Cortex-M3, Cortex-M4, and standard x86 PCs.

Spark

Spark is a distributed, cloud-based IoT operating system. Spark includes a Web-based IDE, a command-line interface, support for multiple languages, and libraries for working with many different IoT devices. It has a very active user community, and a lot of documentation and online help are available.

Freeboard

Freeboard aims to let users create their own dashboards for monitoring IoT deployments. The code is freely available on GitHub or you can try the service for free if you make your dashboard public. Low-priced plans are also available for those who want to keep their data private. Sample dashboards oon the site show how they can be used to track air quality, residential appliances, distillery performance or environmental conditions in a humidor.

Exciting Printer

Exciting offers an open source kit for experimenting with IoT printing. It makes it possible to build your own small printer and use that printer to print out information obtained from various IoT devices. For example, it could print out a list of daily reminders, the weather report, etc. And in a interesting twist, if you want to contact the project owners, you can draw a picture that will be printed on the IoT printer in their office.

DeviceHive

This project offers a machine-to-machine (M2M) communication framework for connecting devices to the Internet of Things. It includes easy-to-use Web-based management software for creating networks, applying security rules and monitoring devices. The website offers sample projects built with DeviceHub, and it also has a "playground" section that allows users to use DeviceHub online to see how it works.

Devicehub.net

Devicehub.net is the open source backbone for the Internet of Things. It's a cloud-based service that stores IoT-related data, provides visualizations of that data and allows users to control IoT devices from a Web page. Developers have used the service to create apps that track health information, monitor the location of children, automate household appliances, track vehicle data, monitor the weather and more.

IoT Toolkit

The group behind this project is working on a variety of tools for integrating multiple IoT-related sensor networks and protocols. The primary project

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

is a Smart Object API, but the group is also working on an HTTP-to-CoAP Semantic mapping, an application framework with embedded software agents and more. They also sponsr a meetup group in Silicon Valley for people who are interested in IoT development.

Mango

Mango bills itself as "the world's most popular open source Machine-to-Machine (M2M) software." Web-based, it supports multiple platforms. Key features include support for multiple protocols and databases, meta points, user-defined events, import/export and more.

Nimbits

Nimbits can store and process a specific type of data—data that has been time- or geo-stamped. A public platform as a service is available, or you can download the software and deploy it on Google App Engine, any J2EE server on Amazon EC2 or on a Raspberry Pi. It supports multiple programming languages, including Arduino, JavaScript, HTML or the Nimbits.io Java library.

OpenRemote

OpenRemote offers four different integration tools for home-based hobbyists, integrators, distributors, and manufacturers. It supports dozens of different existing protocols, allowing users to create nearly any kind of smart device they can imagine and control it using any device that supports Java. The platform is open source, but the company also sells a wide variety of support, ebooks and other tools to aid in the design and product development process.

SiteWhere

This project provides a complete platform for managing IoT devices, gathering data and integrating that data with external systems. SiteWhere releases can be downloaded or used on Amazon's cloud. It also integrates with multiple big data tools, including MongoDB and ApacheHBase.

ThingSpeak

ThingSpeak can process HTTP requests and store and process data. Key features of the open data platform include an open API, real-time data collection, geolocation data, data processing and visualizations, device status messages and plugins. It can integrate multiple hardware and software platforms including Arduino, Raspberry Pi, ioBridge/RealTime.io, Electric Imp, mobile and Web applications, social networks and MATLAB data analytics. In addition to the open source version, a hosted service is also available.

Arduino

Arduino is both a hardware specification for interactive electronics and a set of software that includes an IDE and the Arduino programming language. Arduino is a specialized tool for making computers than can sense and control more of the physical world than your desktop computer.

Eclipse IoT Project

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

Eclipse is sponsoring several different projects surrounding IoT. They include application frameworks and services; open source implementations of IoT protocols, including MQTT CoAP, OMA-DM and OMA LWM2M; and tools for working with Lua, which Eclipse is promoting as an ideal IoT programming language. Eclipse-related projects include Mihini, Koneki and Paho. The website also includes sandbox environments for experimenting with the tools and a live demo.

Kinoma

Owned by Marvell, the Kinoma software platform encompasses three different open source projects. Kimona Create is a DIY construction kit for prototyping electronic devices. Kimona Studio is the development environment that works with Create and the Kinoma Platform Runtime. Kimona Connect is a free iOS and Android app that links smartphones and tables with IoT devices.

M2MLabs Mainspring

Designed for building remote monitoring, fleet management and smart grid applications, Mainspring is an open source framework for developing M2M applications. It capabilities include flexible modeling of devices, device configuration, communication between devices and applications, validation and normalization of data, long-term data storage, and data retrieval functions. It's based on Java and the Apache Cassandra NoSQL database.

Node-RED

Built on Node.js, Node-RED describes itself as "a visual tool for wiring the Internet of Things." It allows developers to connect devices, services and APIs together using a browser-based flow editor. It can run on Raspberry Pi, and more than 60,000 modules are available to extend its capabilities.

Conclusion

As the domain of IoT is much diversified, there is lots of scope of research for the scholars and practitioners. In IoT, the following research areas can be worked out by the research scholars including Security and Privacy Issues in smart objects, Resource Oriented Architecture, Cloud of Things, Cross Platform Compatibility and Efficiency Issues, Quality of Service, Fog Computing and its association with IoT, Social Structure of IoT, Compatibility and Adaptability of IoT with IPV6 and upcoming technologies.

References

[1] Ostermann S, Iosup A, Yigitbasi N, Prodan R, Fahringer T, Epema D. A performance analysis of EC2 cloud computing services for scientific computing. InInternational Conference on Cloud Computing 2009 Oct 19 (pp. 115-131). Springer, Berlin, Heidelberg.

[2] Armbrust M, Fox A, Griffith R, Joseph AD, Katz R, Konwinski A, Lee G, Patterson D, Rabkin A, Stoica I, Zaharia M. A view of cloud computing.

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 4 July 2017

International Manuscript ID : 23482001V5I4072017-02

(Approved and Registered with Govt. of India)

Communications of the ACM. 2010 Apr 1;53(4):50-8.

[3] Mell P, Grance T. The NIST definition of cloud computing.

[4] Li H, Dai Y, Tian L, Yang H. Identity-based authentication for cloud computing. Cloud computing. 2009:157-66.

[5] Qian L, Luo Z, Du Y, Guo L. Cloud computing: An overview. Cloud computing. 2009:626-31.

[6] Buyya R, Yeo CS, Venugopal S, Broberg J, Brandic I. Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. Future Generation computer systems. 2009 Jun 30;25(6):599-616.

[7] Sookhak M, Gani A, Khan MK, Buyya R. Dynamic remote data auditing for securing big data storage in cloud computing. Information Sciences. 2017 Feb 20;380:101-16.