International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 05, May-2015

Experimental Platform for Interconnecting IOT Systems

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***Abstract*—There has been much work done to evolve Internet of Things (IOT) to a new form of technology and its enormous applications. There are many application specific systems being developed and deployed independently with their different type of resources and operations. These systems are connected to the internet but mostly disjoint from each other. The future vision of IOT is to have everything connected, in order to capitalize on everything connected it is necessary to have interconnectivity of these IOT systems. This paper suggests abstractly a platform that works with the existing systems to allow integration and interoperability of everything irrespective of their dependency.**

Keywords—Internet of Things, interconnectivity.

I. INTRODUCTION

Internet of Things (IOT) is connecting physical objects or things to the internet, yet there is much more to it. It is not just connecting them to the internet, it is about autonomy, computation, usefulness and interconnectivity. Things such as refrigerators, television and even a toothbrush can be connected, mostly based on application. IOT is evolving rapidly and incorporating many fields of computer engineering as it has very high potential of applications. This concept is quickly being adopted in many systems such as home automation, medicine, elderly care, recreation, tourism, and many more. A whole new type industry is booming upon IOT. It has been estimated to have 50 billion connected devices by 2020 [1]. There are many things already and to be connected to the IOT using a greatly accepted reference architecture [2], but by different solution systems and owned by different entities. IOT is applicable for probably everything and promises exceptional returns in real world, but it is neither possible to implement it using a single backbone platform infrastructure nor by a single business solution. Although they are connected to the Internet, they are not connected with each other. This plagues the fundamental concept of "everything connected".

II. RELATED WORK

The IOT no longer remains a generic term but a standardized defined technology, a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things [3], recommended by International Telecommunication Union (ITU-T Y.2060) and approved in June 2012.

The IOT-Architectural Reference Model Deliverable 1.3 (IOT-ARM D1.3) [4], is a newest version of architectural reference model to develop concrete solution systems based on application. This architectural model is developed considering standardization of the systems and interoperability. The reference model allow a standard interface to interact the systems and devices with each other. This provides connectivity yet connectivity is needed to be established explicitly provided by solution systems. Although things beings connected as the IOT, there is requirement for the multiple things to be aware of each other to be able connect it. There can be many things connected over multiple systems and can benefit by connecting with each other, but they need to be or explicitly made aware of each other.

Some of the most researched application IOT systems are Smart wearables, mobile devices, healthcare devices, home automation, geological sensing, and many more. The IOT systems are application derived business specific solutions. These solutions are more intranet rather than internet of Things [8].

The system comprises of multi-tier subsystems mainly comprising of objects used for sensing, automation and processing, which are connected to the internet using mostly HTTP, CoAP and MQTT protocols. The internet works as the communication backbone for the systems, Cloud as service and Cloud as Infrastructure is used for business management and supporting infrastructure respectively for solution IOT systems.

III. PLATFORM FOR IOT SYSTEMS INTERCONNECTIVITY

In order to have a place where Solution system can look up for things and its resources availability for utilization a platform can be used, where the things can put their availability and, things can look up for other things availability [5]. Such a platform will allow to keep log of things which will help them in their autonomous discovery and utilization irrespective of the system dependency. The devices must be modeled as a standard general interface or dynamic interface for some very specific applications.

The IOT Interconnectivity platform shown in "Fig. 1" would allow a platform which can be implemented for all IOT systems to map there things, resources and process and similarly able to find them and discover them for ease of utilization directly by things. As denoted a global scenario shows multiple IOT systems that exists and an interconnectivity IOT systems platform to bind them.

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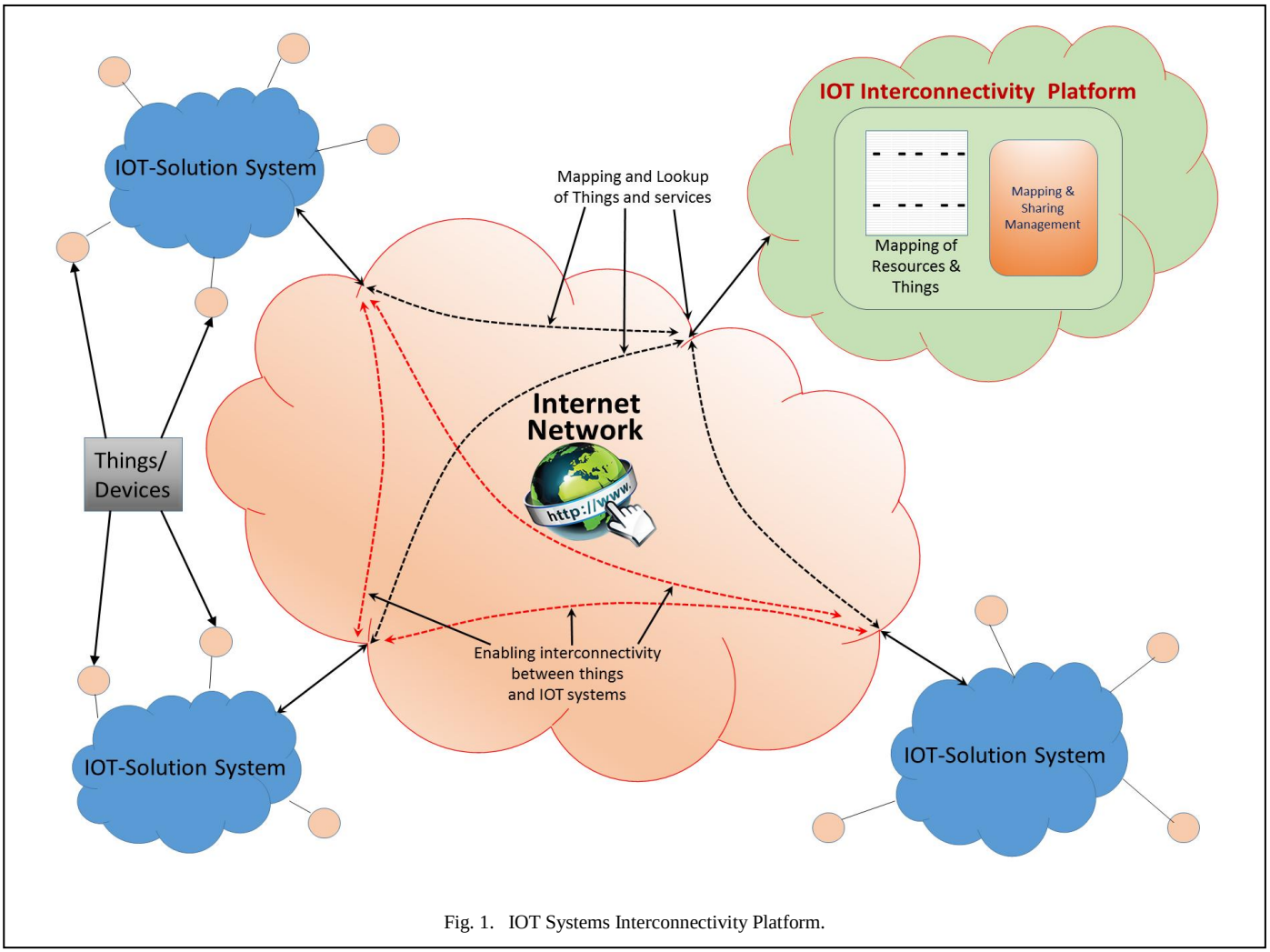

Fig. 1. IOT Systems Interconnectivity Platform.

A. *Components Of IOT Interconnectivity Platform*

The main part of the platform is a Map Matrices in which the Things, services and process can be stored. The matrices contains the name the thing or a process, or a service, as well as its location in the Internet, and the service it may provide. The second part is the management system which fetches requests from different sources to either store a new record look up for already stored. The record comprises of the schema of The Thing. It is more of a map of available for access and usage rather than the service, process or Thing.

B. *Working of Platform*

IOT solution systems usually which are more business oriented and are business process services can keep a record of the services or Things that they may like to share are allow access. The sharing may be of abstract, dynamic or open in nature which may allow direct access, data abstract access and even provide security by such abstraction. Whenever the management systems gets a request from a Thing or System, it maps the thing or more precisely stores the record. When a system or a thing in order to lookup other Things can send a request for its particular requirement and the management system will respond appropriately with the details of the thing. Then when a thing can read the data and start direct communication to the other Thing. This platform works as mapping and discovery of Internet of Things. The Platform can work at a global scale for enabling "Things to Talk" [], over multiple IOT solution system. The Things can communicate in a non-dynamic standard way.

IV. ISSUES

The biggest issue that may be foreseen is of security. A standard security protocol must be developed or existing security protocols must be used in authentication of request as Things with more closeness personal or sensitive entities become more vulnerable.

The existing IOT business solution although uses a standard reference architecture, but when it comes to interoperability over multiple systems, it may not be standard [6]. To resolve this a common interface standard must be developed, or a more dynamic management system must be evolved for such interconnectivity.

The platform must be tested not as a simulation but by implementation over multi IOT system interconnectivity as there are multiple variables that may require to test as things usually represent physical objects. The platform must be evolved by identifying issues and integrating solution to the platform

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V. FUTURE WORK

The design being novel must be evolved upon testing. Stake holders of different IOT solution systems must come together to implement this platform as an initial experimental platform for a prototype IOT system and incrementally evolve it through testing. The platform can be utilized as a business process by which existing business solution [7], can benefit. After the platform is evolved to a robust and stable form it must be standardized.

A global Map of Things can be studied upon to realize even more potentials and its applications of this systems. This view indeed will allow easier discovery of Things and utilizing each other.

VI. CONCLUSION

The presented platform has an excellent potential to evolve into a global IOT interconnectivity standard. Simple yet innovative idea can easily provide a solution to the issue of Interconnectivity that has been plaguing this technology. The issue as identified is more of focus rather than technical. Hence such a platform must be experimentally tested and evolved to a global standard

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