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Internet of Things (IoT) Interoperability Success Criteria

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ABSTRACT

To deliver more value to customers, companies are striving to offer more digital services, and the internet of things (IOT) is the main enabler to maximize such value. However, one of the major challenges companies are facing is digital service integration with other providers, where IoT platform is playing important role to achieve such integration opening door for interoperability within actors in the IoT ecosystem. There have been a little research addressing IoT platforms interoperability from business value perspective, considering technical and non-technical factors as selection criteria to adopt such platforms. This paper uses a case study as a method. To validate the suggested interoperability criteria, interviews were conducted for IoT platform providers and two things providers. It was observed that considering technical factors alone when selecting IoT platform make companies oversee the value technology add to their business as IoT platform is not only about technology but also about business model in which this platform will be operating and the company position and role in IoT ecosystem. The paper contributes by providing criteria to achieve interoperability for IoT platform from both technical and business aspects.

KEYWORDS

Business Model, Internet of Things, Interoperability, IoT Platform

INTRODUCTION

Internet-of-things is a network of physical object that is collecting and exchanging data through embedded sensors, electronics, software and network connectivity (Triantafyllou, Sarigiannidis, and Lagkas, 2018). Integration is a key component of the IoT as it aids in communicating the collected data to servers where analytics and other operations can be performed. Integration platforms is needed to provide integration between different vertical services being provided (Giudice et al., 2015). However, the development of new services that require the integration of multiple IoT services are faced by fragmentation in IoT service stack. This will open the door to unlock new capabilities and provide horizontal integration amongst services.

Cloud can offer an effective solution for IoT service management and composition as well as for implementing applications and services that exploit the things or the data produced by them (Li et al., 2016). The integration and interoperability with mainstream business software platforms is

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enhanced and extended by real-time analytics, business intelligence and agent-based autonomous services. Information sharing maybe rewarded through incentives, thus, transforming the internet-of-things from a cost-focused experiment to a revenue-generating infrastructure that enable the trading of enriched information and accelerate business innovation (Vermesan & Freiss, 2014). The cost might also exist due to the changes in the processes (Savić, 2019).

As a developing business technology area, it comes with several challenges as it has different aspects from traditional IT (Pettey, 2016). By year 2030, billions of objects and devices such as vehicles, refrigerators, washing machines, etc... are expected to be connected (Giudice, Campanella, & Dezi, 2015). All objects will be connected to a network which means information and communication systems will be invisibly embedded in the everyday life (Gubbia et al., 2013). To facilitate communication, data flow, device management an abundance of IoT platform solutions that provide connectivity for sensors and actuators to the Internet is being experienced (Mineraud et al., 2016). These platforms must meet the expectations of different players in the IoT ecosystem, including device providers, application developers, and end-users, among others to gain a widespread adoption. (Affia, et al., 2019; Mineraud et al., 2016).

A wide range of IoT integration platforms became recently available. They can support entire development to deployment of IoT applications and systems. The first challenge companies are facing when considering the exploitation of IoT is choosing the suitable IoT platform to serve their business purposes (Andersson and Mattsson, 2015). Several Cloud platforms can be used for IoT applications, varying from simple data collection platforms for amateurs to complex multiple domain semantic integration offerings (Noura, 2019). The IoT platforms are evaluated from the perspective of how widely they cover the defined interoperability requirements of IoT application providers, IoT things providers and IoT Platform providers throughout the lifecycle of their application or service. (Aly et al., 2018).

It is not an easy challenge, technology leaders are required to evaluate and select from a wide range of technologies ranging from open source software to turnkey IoT platforms to cloud based (Janakiram, 2016). This research is an attempt to develop criteria to Identify main selection criteria for IoT (Middleware) integration platform. The purpose of this study is to understand IoT interoperability among different IOT platforms. To achieve this, there is a need to identify core components of IoT platform and review IoT platform integration capabilities which helps in selecting an interoperable IoT platform. Accordingly, this research help to answer the following question: *How to achieve interoperability in IoT platforms?*

THEORETICAL BACKGROUND

Elements of IoT Ecosystem

IoT originates in the possibility of connecting people, goods and operations over the internet through a global network. IoT is defined as the connection of physical objects and placed via internet (Bonanomi, et al. 2019; Noura, Gaedke, & Atiquzzaman, 2018). Through the IoT, things acquire greater utility, thereby increasing the services that they offer to consumers (Giudice et al., 2015). IoT is the next wave of internet, many definitions emphasize the different aspects of IoT (O'Brien, 2016). IoT is a concept and a paradigm that consider pervasive presence in the environment of a variety of objects that can through wireless and wired connection and unique identifiers can interact with each other and cooperate with other things/objects to create a new application/Service and reach common goals (Cubo, Nieto, & Pimentel, 2014).. (Vermesan, Freiss, 2014). Weber & Weber (2010) defines IoT as "a world where physical objects are seamlessly integrated into the information network, and where the physical objects can become active participants in business processes.

IoT can interact without human intervention (Shancang Li et al, 2015). It describes a vision where objects become part of the Internet: where every object is uniquely identified and accessible