IoT 를 위한 Microservices 접근법에 대한 조사

A Survey on Microservices Approach for the Internet of Things

The future of Internet of Things ecosystem seems to be worth it, however by using a monolithic approach we might end up by dealing with complexity of the system as long as the statistics show that by 2020 IoT devices will reach around 50 billion. The microservice architecture approach utilizes the service-oriented architecture together with best practices and latest developments in software virtualization to overcome complexity issues, allow reusability of services or microservices instead of creating new ones. The microservice architecture provides secure platforms if it is developed and deployed in a container. Thus, this paper surveys on the microservices, microservices architecture and containers, microservices based Internet of Things.

I. INTRODUCTION

With the evolution of technologies, terrestrial based new IoT is going to emerge, the world is moving towards the multiple services the traditional monolithic architecture pattern Service Oriented Architecture (SOA) [1] started showing problems. It became difficult to define the granularity of a project because of the complex systems and hundreds of interfaces. That is when the microservices come in. Its aim is to create applications that are developed around business domains and could be developed, handled and decomposed into services that communicated through APIs and network-based messaging protocols.

II. EVOLUTION OF INTERNET OF THINGS

The advancing Internet technologies are expanding the boundaries of the Internet connectivity are becoming cheap and ubiquitous, even in developing counties or rural areas. Device processing power and storage capabilities are significantly increasing while their size is becoming smaller which extremely appropriated for equipped with different type of sensors and actuators; the combination between small devices and multifunction sensors producing an extensively across communities where devices are able to connected and communicate over the Internet, has the ability to sense, compute, act and effectively become part of the Internet. Furthermore, physical objects are increasingly equipped with RFTD tags (Radio-Frequency Identification (RFTD)), NFC tags (Near Field Communications (NFC)) or other electronic bar code that can be scanned by smart devices such as tablet, smart phone and other small device embedded with RFTD/NFC readers. This combination connects between the physical world and cyberspace via the smart device, thus enhancing the
Internet capabilities toward the next generation of Internet can be called the "Internet of Things" [2].

III. EVOLUTION OF MICROSERVICES

The microservice architecture was not invented but emerged from good practice. It has proven to be applicable for highly scalable, fast changing, distributed applications on the cloud. Some successful examples of adopters are Netflix [3], Amazon and Soundcloud [4]. Microservices and the SOA approach in the IoT / CPS have the same goal: building one or multiple applications from a set of different services.

Microservices originate from the enterprise software domain with large monolithic software which is composed by several applications that have shown to be hardly maintainable and scalable beyond a certain point. Thus, the idea is to split up the monolith into smaller, modular pieces. Here is the example in (Fig 1).

A) Containers

There is a history of virtualization, where one operating system is running on top of another for example VirtualBox or VMWare, or emulated. That allows to control the application environment by playing with how the virtual Operating System (OS) is provisioned and can make the application immune to changes in the parent OS which is running a Windows version 7 on Windows 10 to get some old applications to run. Since running an entire OS to get the environment right for a single application can be pretty inefficient and slow to set up, that is when a container comes in. The container is an application that provides a controlled environment for other applications that looks like an OS to those applications. So, the best way to develop and deploy microservices is by using either virtual machine or the containers. In this paper we are going to adopt for containers.

B) Advantages of microservices

Nowadays many companies are planning to migrate to microservices architecture, some companies such as Amazon, Netflix, eBay have been convinced by this technology. Compared to a monolithic architecture, the microservices approach bring up a bunch of advantages such as:

- Tackles the complexity problem of an application development by breaking the process into manageable chunks or services,
- Provides the much-needed independence to the developers,
- Scaling of the applications under microservices become easy as long as it allows each service to be scaled independently,
- Microservices architecture services are easy to use and understand.

Many other advantages are described in (Fig 2).

IV. IOT BASED MICROSERVICES

In the IoT architecture the small services or applications seem to be already given as they align with the capabilities of the embedded devices they represent. There is a bare minimum of centralized management of these services, which may be written in different programming languages and use different data storage technologies. There are some similarities in the goals of microservices and the internet of things, namely:

- Lightweight communication
- Independent deployable software,
A minimum of centralized management, and independent development techniques and technologies [2].

We could then group according to the similarity and put them into a container for more scalability and high maintenance, in that case the architecture would look like in (Fig 3).

(Fig 3) IoT based microservice Architecture

In this figure, we split and grouped all the similar IoT microservices in a container. These grouped services or microservices will be deployed in an edge close to the user for assuring latency, reusability and more advantages offer by an edge architecture, many previous papers talked about edge computing in IoT such as Edge-Centric Distributed Discovery and Access in the Internet of Things [4].

CONCLUSION

In this paper we had a brief overview on IoT, microservices, microservices architecture. we discussed about how we can combine IoT and microservices that could lead us to a secure and complete IoT architecture. We can reuse services or objects [4] in another service by calling its objects instead of creation another new service. however, we did not talk more in detail about protocols (REST, CoAP, HTTP...), standards (OneM2M, OMA...) that will be suitable for this architecture. Thus, in the future work we would like to dig deeper on how this architecture will be absolutely implemented by analyzing the feasibility.

Furthermore, we would like to survey on lightweight based microservices for underwater wireless sensor network which is still unexplored due to many environment constraints or challenges such as: high propagation delay, energy conservation is different, multipath and fading of signal. Hope this paper gives computer scientists an insight on how great the federation of IoT and microservices is.

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