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Cloud Computing and Software-Based Internet of Things

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Abstract: ***It is very challenging task to deal with IoT Cloud Systems due to complexity involved in diversity of requirements such as resource consumption and runtime governance. Approach to IoT cloud computing includes IoT resources and IoT capabilities in APIs in order to easy access of cloud storage. Software defined IoT cloud systems should be deployed in a such way that which achieves dynamic and on demand provisioning.***

Keywords: Internet of Things, Cloud Computing, Resource Capability, Sensors and Actuators, Datacenters

I. INTRODUCTION

Cloud provides unlimited storage, network capabilities as well as it reduces burden of user from storage and resource maintenance. Cloud IOT provides an feasible runtime infrastructure for IOT systems. IoT cloud offers pay as per use model which helps in reducing costs and ultimately reduces burden of users. It helps in the creation of cross development applications. Most of the systems which were present earlier mainly focuses on data and device integration by using physical sensors and actuators.[1]

Cloud IoT is booming day by day. For system designers it is a challenging task as to satisfy requirements as well as to provide flexibility in using cloud resources. It is very difficult to achieve due to diverse requirements such as runtime services, communication network and elasticity concerns. So resources should be accessed in a unified manner. IoT systems should be scale up or scale down as per resource and service requirement. When a demand for data source is high, it should be scale up accordingly. It is important to visualize IoT resource capabilities. By encapsulating fine grained IoT resources and IoT capabilities in systematic API one can uniformly access, configure and operate IoT cloud systems. [9]

Framework focus for this IoT cloud system is on dynamic, on-demand provisioning of the software-defined IoT cloud systems. By supporting centrally managed configuration, this model simplifies provisioning of such systems and enables flexible runtime customizations. [10]

A. Scenario

Consider example of electric vehicles which are deployed worldwide. Main features include fault history, battery information, crash history, location of vehicle, driving history and vehicle information such as serial number, charging status. Vehicles communicate with the help of cloud storage. On cloud system different FM systems are there to manage data of vehicles such as information regarding real time vehicle status, remote diagnostics and remote control.

Following are some features of FM subsystem which are important -

1. FM subsystem are nothing but services which are hosted on the cloud and which are rely on IoT resources.
2. FM system has different requirements regarding communication protocols such as fault alarm should be pushed on to the cloud.
3. FM system spawns multiple cloud instances which is distributed on different geographic locations.

II. RELATED WORK

There differenct approaches were used to enable convergence of IoT and Cloud Computing. Many authors deal with IoT infrastructure virtualization and its management on cloud platforms, some utilize the cloud for additional computation resources. In some systems the authors mostly focus on utilization of cloud's storage resources for Big-IoT-Data and integrating IoT devices with enterprise applications based on SOA paradigm. [2][3]

In [4] the authors develop an infrastructure virtualization framework for wireless sensor networks. It is based on a content-based pub/sub model for asynchronous event exchange and utilizes a custom event matching algorithm to enable delivery of sensory events to subscribed cloud users.

In [5] the authors introduce sensor-cloud infrastructure that virtualizes physical sensors on the cloud and provides management and monitoring mechanisms for the virtual sensors. However, their support for sensor provisioning is based on static templates which is contrary to approach that do not support dynamic provisioning of IoT capabilities such as communication protocols.

SenaaS [6] mostly focuses on providing a cloud semantic overlay atop physical infrastructure. They define an IoT ontology to mediate interaction with heterogeneous devices and data formats, exposing them as event stream services to the upper layers.

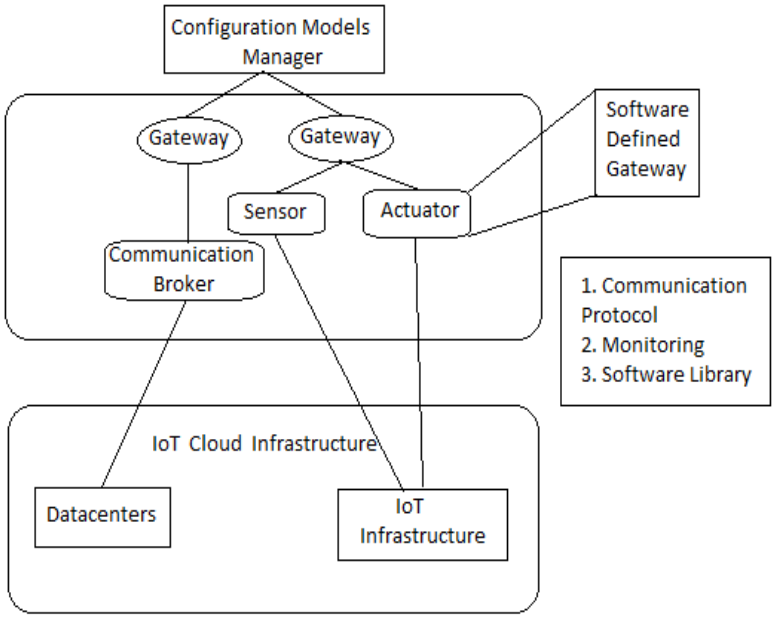
OpenIoT framework [7] utilizes semantic web technologies and CoAP [8] to enable web of things and linked sensory data. They mostly focus on discovering, linking and orchestrating internet connected objects, thus conceptually complementing our approach.

Most of these approaches focus on different virtualization techniques for IoT devices and data format mediation. They also enable some form of configuration, e.g., setting sensor poll rates.

III. PROPOSED WORK

Features of IoT cloud includes

1. API Encapsulation - Resources and capabilities of IoT are encapsulated which achieves uniform access of functionalities of IoT cloud.
2. IoT resources should support self service consumption.
3. Units should be specified using well defined API.
4. Process should be automated in order to enable dynamic configuration.
5. Elasticity should be achieved using well defined API.



Enablers of Cloud IoT System

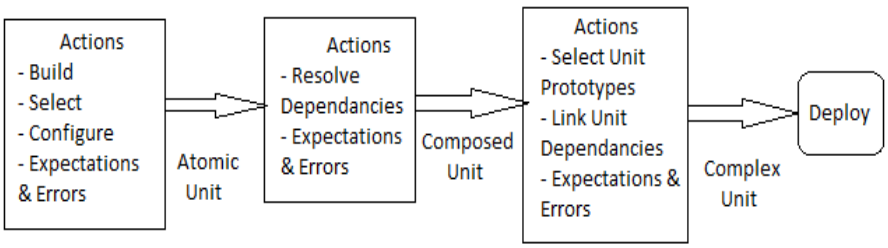
To allow flexible customization, there is need to enable resource consumption in good way. Unit Prototypes are seen as resource containers which are used in higher level units. These are hosted on cloud and exposed via software-defined APIs. By using APIs unit prototypes can be dynamically coupled with late run time mechanism. Classification of Cloud IoT can be done in 3 categories such as atomic, composed and complex.

Features for software based IoT cloud are as below.

1. It defines software - defined APIs which is used to access Cloud IoT in unified manner.
2. It can add functional capabilities like communication protocols dynamically.

A. Design Issue :

Building and deploying includes creation and selection of IoT units and configuring the complex units. In the deployment phase, deploying software defined units with dependency units and required runtime mechanisms.



Automated Defined IoT Systems

There are 3 levels of configurations which can be performed

1. Select atomic units
2. Configure composed units
3. Link the complex units

IV. CONCLUSION

Software based Cloud IoT achieves dynamic configuration and runtime governance. Resources and capabilities of cloud are used in flexible manner by encapsulating them in software defined API. Automated unit composition and managed configuration are techniques for provisioning software-defined IoT systems.

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BIOGRAPHY

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