Taxonomy and Survey of IoT Cloud Use Cases

Tamás Pflanzner, Attila Kertész

Cloud computing [1] enables flexible resource provisions that has become hugely popular for many businesses to take advantage of responding quickly to new demands from customers. Internet of Things (IoT) systems recently appeared as a dynamic global network infrastructure with self configuring capabilities [2], in which things can interact and communicate among themselves and with the environment through the Internet by exchanging sensor data, and react autonomously to events and influence them by triggering actions with or without direct human intervention. According to recent reports in this area (e.g. [3]), there will be 30 billion devices always online and more than 200 billion devices discontinuously online by 2020. Such estimations call for an ecosystem that provides means to interconnect and control these devices with cloud solutions, thus user data can be stored in a remote location and can be accessed from anywhere. There is a growing number of cloud providers offering IoT-specific services, since cloud computing has the potential to satisfy IoT needs such as hiding data generation, processing and visualization tasks. While each provider offers its own set of features, two critical features they all have in common are the ability to connect devices and to store the data generated by those devices.

In this paper we study and investigate 9 IoT cloud providers in detail, and identify 4 use cases arose from joint utilization of IoT and cloud systems. The related works suggest that the following IoT cloud cases can be derived: 1 – a local, ad-hoc IoT system that can be formed from near-by things (e.g. smart watch) to perform a certain task. 2 – a cooperative IoT Cloud system, in which some tasks of an application run in a smart device, and some run in the cloud. 3 – a bridged IoT cloud system, where a smart device can act as a bridge or gateway to collect and move sensor data to the cloud. Finally, 4 – a direct IoT cloud system, where a thing (such as a smart TV) communicates with the cloud directly.

IoT application developers do not only have to decide which cloud provider to use, but they also have to choose which combination of protocols and data structures best fits their application. To aid the design, development and testing processes of these systems, an IoT device simulator could be useful to emulate real devices or sensors. Therefore we also gather the requirements for basic functionalities of such a simulator, i.e. to send and receive messages, generate sensor data (for one or more devices), and react to received messages.

The main contributions of this work are: (i) a survey and classification of IoT cloud providers, (ii) a taxonomy of IoT cloud use cases represented by cloud-assisted IoT applications and (iii) a proposal for an IoT device simulator to support further research on IoT device management. Our future work will address the development of a generic IoT device simulator to aid IoT application development with the surveyed providers, based on the identified use cases and requirements. Such a simulator can be used in the future to help cloud application developers to learn IoT device handling and to evaluate test IoT environments without buying real sensors.

References

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