Chapter 52
IoT and Cloud Computing: The Architecture of Microcloud-Based IoT Infrastructure Management System

Oleksandr Rolik
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Ukraine

Sergii Telenyk
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Ukraine & Cracow University of Technology, Poland

Eduard Zharikov
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Ukraine

ABSTRACT

The Internet of Things (IoT) is an emerging technology that offers great opportunities that is designed to improve the quality of consumers' lives, and also to improve economic indicators and productivity of enterprises, and more efficient use of resources. IoT system refers to the use of interconnected devices and distributed subsystems to leverage data gathered by sensors and actuators in some sort of environment and to take a proper decision on a high level. In this chapter, the authors propose an approach to Microcloud-based IoT infrastructure management to provide the desired quality of IT services with rational use of IT resources. Efficiency of IT infrastructure management can be estimated by the quality of services and the management costs. The task of operational service quality management is to maintain a given level of service quality with the use of minimum IT resources amount in IoT environment. Then, the maximum efficiency can be achieved by selecting such control when actual level of service corresponds to the coordinated with business unit and can be achieved by minimal costs. The proposed approach allows the efficient use of resources for IT services provision in IoT ecosystem through the implementation of service level coordination, resource planning and service level management processes in an integrated IT infrastructure management system based on hyperconvergence and software-defined principles. The main goals of this chapter are to investigate the state of art of the IoT applications resource demands in the context of datacenter architecture deployment and to propose Microcloud-based IoT infrastructure resource control method.

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INTRODUCTION

The IoT is considered as a widely distributed and locally intelligent network of smart objects. The IoT enables many new enhancements to fundamental services such as city administration, education, healthcare, public safety, real estate, transportation and other sectors. Business success greatly depends on the IT-services quality. It makes the scientific and applied problem of development IoT infrastructure management concept important.

According to IEEE P2413 project, architecture of IoT has three main layers: Applications, Networking and Data communication, Sensing. In each layer there are many devices and protocols that interconnect through layers to deliver definite services according to specific domain. In this paper we consider the technologies that make the functioning of the Application and the Data communication layer possible.

At the same time, IT infrastructure ensures the functioning of the Application layer, and complex of low-level design and management systems ensures the functioning of Sensing layer.

The increase in business demand for IT services in the IoT area and the emergence of new services lead to the need of developing and implementing new approaches to the IT infrastructure management.

Modern IT infrastructure management systems are complex and are integrating solutions from different manufacturers. The increasing complexity of IT management is accompanied by the growth in the cost of operations. The main task of IoT infrastructure management is to maintain a coordinated level of IT services with the rational use of IT infrastructure resources in terms of virtualization, clustering, distribution and increasing the amount of user requests.

In this paper, the authors provide an overview of the vision, architecture, and benefits of the proposed IoT infrastructure management system based on the Microcloud concept.

Thus, the authors' objectives in this chapter are: 1) to analyze existing IoT solutions, 2) to analyze the use of Cloud in the IoT applications, 3) to develop an approach to service quality management in the IoT systems, and 4) to analyse the technologies that will enable developed solution.

BACKGROUND

The IoT facilitates new possibilities in many industries and creates additional load on the datacenter due to the additional number of devices being placed into the network and enormous increasing demand of data exchange and processing. IoT turns out to be much more complex than just deploying new applications, connecting more computers, mobile devices and sensors to the network.

Given the current challenges, which are created by the IoT spreading, enterprises will need to take into account relevant technology deployments and implement internal change management to be ready to the IoT load.

The Internet of Things is defined by IoT European Research Cluster (IERC) as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes and virtual personalities, use intelligent interfaces, and are seamlessly integrated into the information network (Sundmaeker, Guillemin, Friess, & Woelfflé, 2010).

Many emergent IoT applications will be delivered on-demand through a cloud environment. Thereby, the need to employ new adequate datacenter technologies arises. They would offer high productivity, reliability and elasticity in a scalable fashion.