

Chapter 61

Security in Cloud of Things (CoT)

Bashar Alohal

Liverpool John Moores University, UK

ABSTRACT

With IoT era, development raises several significant research questions in terms of system architecture, design and improvement. For example; the requirement of virtual resource utilization and storage capacity necessitates making IoT applications smarter; therefore, integrate the IoT concept with cloud computing will play an important role. This is crucial because of very large amounts of data that IoT is expected to generate. The Cloud of Things (CoT) is used to connect heterogeneous physical things to the virtual domain of the cloud. Despite its numerous advantages, there are many research challenges with utilization of CoT that needs additional consideration. These include high complexity, efficiency, improving reliability, and security. This chapter introduces CoT, its features, the applications that use CoT. CoT, like all other networked functions, is vulnerable to security attacks. The security risks for CoT are listed and described. The security requirements for CoT are identified and solutions are proposed to address the various attacks on CoT and its components.

INTRODUCTION

Through the years, the era of information technology and pervasiveness of digital technologies have showed an exponential growth. The rising number of technological improvements offers a wealth of new services. Recently, Internet of Things (IoT) has attracted attention since it involves several applications, including smart grid, control systems, remote healthcare, smart mobility, traffic flow management and so on. In addition, it is expected to grow in terms of its deployment as well as its applicability in various application areas. The term IoT was coined by Kevin Ashton in 1999, which meant any entity that has a chip placed inside it or addressable on a network with an IP-address and can connect to wireless or wired network infrastructure (Gratton, 2013). These are everyday objects with ubiquitous connectivity and communicating and operating constantly. The use of IoT leads to a smart world with ubiquitous computing and provides services that enables remote access and intelligent functionality (Chaouchi, 2013). IoT enables real-time analysis of data flows that could improve efficiency, reliability and economy

DOI: 10.4018/978-1-5225-8176-5.ch061

Security in Cloud of Things (CoT)

of systems. For example, connecting all appliances in the smart house can save electricity by efficient monitoring. Thus, IoT provides convenience in day-to-day living and makes an intelligent use of resources in a home (Parwekar, 2011).

CoT represents an important extension of IoT. CoT refers to the virtualization of IoT infrastructure to provide monitoring and control. IoT deployments typically generate large amounts of data that require computing as well as storage. A cloud infrastructure that can provide these resources can effectively offload the computing and storage requirements within the IoT network to the cloud. An added benefit is the ability to virtualize the underlying IoT infrastructure to provide monitoring and control from a single point. An application using IoT could therefore become a smart application. A CoT connects heterogeneous appliances to the virtual cloud domain. Both tangible and intangible objects (home appliances, sensor-based and network-enabled) and surrounding people can be integrated on a network or into a set of networks (Sun, Zhang, & Li, 2012).

CoT suggests a model consisting of a set of services (or commodities) that are delivered just like the traditional commodities. In other words, CoT can provide a virtual infrastructure which can integrate analytic tools, monitoring devices and visualization platforms (Parwekar, 2011). Moreover, CoT is a recent technological breakthrough that can enable end-to-end service provisioning for users and businesses to directly access applications on demand from anywhere, anytime (Sun et al., 2012). The emerging CoT services will enable a new generation and intelligent use of a collection of applications that will be fed with real time and analysis.

CoT, as a connected universe of things, can become a tangible reality in the future. Connected devices and things, ranging from sensors to public transport, will send huge of data that should be effectively managed and processed. However, cyber-attacks on critical infrastructure, recently, have highlighted security as a major requirement for CoT. A compromise of the CoT can have drastic effects, sometimes nation-wide and on people's lives. So, a CoT infrastructure should be secure. This chapter will present an overview of some of the concepts related to CoT. After introducing CoT, it continues to present the architecture and the applications of CoT. In addition, the security requirements for the CoT are discussed and the security challenges are highlighted. Specifically, the threats to the CoT are discussed. The chapter concludes with a discussion on the existing security solutions and a mention of the open research issues.

BACKGROUND

Overview of CoT

IoT on which CoT is based, is a new IT paradigm that describes an imagined reality of trillions of things connected to each other. It is transmitting valuable data that is stored, processed and analyzed by computers to control and addresses all sorts of human activities, ranging from healthcare, road traffic, emergency management, retail, crime prevention, lighting, energy and power and/or transportation. IoT is closely linked with the concepts of "smart city", "ubiquitous computing" (Vasseur & Dunkels, 2010), and other paradigms that describe new technological reality in which sensors and microcontrollers are embedded in various things and integrated into human living. This results in increased comfort and security. IoT unites several individual technologies, including machine-to-machine (M2M), supervisory control and data acquisition (SCADA), a system designed for industrial remote monitoring & control of equipment, wireless sensor networks (WSN) and radio-frequency identification (RFID). All these systems and

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/security-in-cloud-of-things-cot/224628

Related Content

Volunteer Computing on Mobile Devices: State of the Art and Future Research Directions

Cristiano Tapparello, Colin Funai, Shuroq Hijazi, Abner Aquino, Bora Karaoglu, He Ba, Jiye Shiand Wendi Heinzelman (2015). *Enabling Real-Time Mobile Cloud Computing through Emerging Technologies* (pp. 153-181).

www.irma-international.org/chapter/volunteer-computing-on-mobile-devices/134205

A Review of Quality of Service in Fog Computing for the Internet of Things

William Tichaona Vambe, Chii Changand Khulumani Sibanda (2020). *International Journal of Fog Computing* (pp. 22-40).

www.irma-international.org/article/a-review-of-quality-of-service-in-fog-computing-for-the-internet-of-things/245708

A Review of Security Challenges in Cloud Storage of Big Data

Sara Usmani, Faiza Rehman, Sajid Umairand Safdar Abbas Khan (2019). *Cloud Security: Concepts, Methodologies, Tools, and Applications* (pp. 1440-1459).

www.irma-international.org/chapter/a-review-of-security-challenges-in-cloud-storage-of-big-data/224641

Edge Computing: A Review on Computation Offloading and Light Weight Virtualization for IoT Framework

Minal Parimalbhai Patel and Sanjay Chaudhary (2020). *International Journal of Fog Computing* (pp. 64-74).

www.irma-international.org/article/edge-computing/245710

Distributed Consensus Based and Network Economic Control of Energy Internet Management

Yee-Ming Chen and Chung-Hung Hsieh (2022). *International Journal of Fog Computing* (pp. 1-14).

www.irma-international.org/article/distributed-consensus-based-and-network-economic-control-of-energy-internet-management/309140