Chapter 29
Internet of Things Testing Framework, Automation, Challenges, Solutions and Practices:
A Connected Approach for IoT Applications

Karthick G. S.
Bharathiar University, India

Pankajavalli P. B.
Bharathiar University, India

ABSTRACT

The internet of things (IoT) is aimed at modifying the life of people by adopting the possible computing techniques to the physical world, and thus transforming the computing environment from centralized form to decentralized form. Most of the smart devices receive the data from other smart devices over the network and perform actions based on their implemented programs. Thus, testing becomes an intensive process in the IoT that will require some normalization too. The composite architecture of IoT systems and their distinctive characteristics require different variants of testing to be done on the components of IoT systems. This chapter will discuss the necessity for IoT testing in terms of various criteria of identifying and fixing the problems in the IoT systems. In addition, this chapter examines the core components to be focused on IoT testing and testing scope based on IoT device classification. It also elaborates the various types of testing applied on healthcare IoT applications, and finally, this chapter summarizes the various challenges faced during IoT testing.

DOI: 10.4018/978-1-6684-3694-3.ch029

INTRODUCTION: OVERVIEW OF INTERNET OF THINGS TESTING

The IoT is an outcome of technological revolution which interrelates the unified computing devices, mechanical instruments, hi-tech electronic machines and humans that are equipped with capacity to exchange data over a network. The IoT was first formulated with the back support of Radio Frequency Identification (RFID) that can be applied to track the location of objects (Luigi Atzori et al, 2010). For example, products in the shopping malls are interconnected to their own network, which enables tracking the location of products and increases the billing process flexible at the point of sales depots. Every individual product is exclusively identified and categorized based on its RFID. This uses machine-to-machine networks and these resembles the IoT through network connected systems and data/information. The likelihood of connecting objects to the network allows tagging, tracing and reading of data from objects with greater technical efforts, technology of this era established called as IoT.

The essentials that emerged the IoT in current and future applications have been elaborated comprehensively and have been characterized by many authors. (Gubbi et al., 2013) and (Li et al., 2015) has discussed about the major components and architectural elements in IoT. The millions of sensing elements, actuators and other devices are exist at the lowest level of the IoT. Each of which requires a unique identification and addressing schemes because of their deployment are at large scale and also have high degree of constraints such as energy and computational resources. Communication is another important element which interconnects ‘n’ number of heterogeneous devices for providing smart services. Some of the short and long range technologies used for communications in IoT applications which may include Wireless Sensor Networks (WSNs), Radio Frequency Identification (RFID), IETF Low power Wireless Personal Area Networks (6LoWPAN) (G. Montenegro et al., 2007) and protocols like IEEE 802.11 (Wi-Fi), IEEE 802.15 (Bluetooth). As IoT devices generates a vast amount of raw data, thus increases the need of data storage and analytics. The data analytics, processing and machine learning in most of the IoT applications are deployed via cloud services. The IoT services are classified as Identity related, information aggregation, collaboration aware and ubiquitous services (Al-Fuqaha et al., 2015). Identity related services provide the unique identification for every deployed thing. Information aggregation services are responsible for collecting and storing the data received from sensors. Collaborative aware services make use of the data provided by information aggregation services to take decisions and to provide smartness to the system. Ubiquitous services enables the users to access the services without geographical restrictions (Al-Fuqaha et al., 2015). (Li et al., 2015) categorized the generic service-oriented architecture as sensing layer, network layer, service layer and interface layer.

The IoT is the interconnection of uniquely identifiable embedded physical objects with the prevailing network infrastructure (Gubbi et al., 2013). The occurrence of the IoT rapidly increasing the amount of connected devices, which simultaneously ignited the companies to provide IoT testing services. While considering IoT systems ranges from home appliances, security systems and other devices are communicated to the mobile applications. Those IoT enabled devices may unsuccessful in the connected environment and at the same time users also become more unaccustomed to the connected IoT devices. Usually the users will expect the technologies to work perfectly from the beginning. Thus the importance of focusing on developing the quality IoT products will be the game changer.

The various vertical areas which are impacted by the evolving IoT technology can be classified based on type of network availability, coverage, scalability, heterogeneity, user participation and repeatability (Sebastien Ziegler et al., 2013) (Ericsson, 2011). The following Figure 1 depicts the categorization of IoT applications.