Chapter 1
Ubiquitous and Cloud Computing:
Ubiquitous Computing

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ABSTRACT

Recently, great developments in computing and telecommunication technologies caused big amounts of data flow over Internet, especially due to increasing smart device users. Within the last few years, ubiquitous communication has improved with new telecommunication and transmission infrastructures and also enriched with new services. The focus of ubiquitous computing is presenting environments including computing and communication abilities that are integrated with users. Mobile and pervasive computing present many opportunities about exploring various factors all over the world with searching large habitats and species. The services and applications are presented via a heterogeneous environment over many different devices by the ubiquitous system. Accordingly, ubiquitous computing is becoming more popular because of the new research developments and great technological advances in wireless communication networks, cloud computing, Internet technologies, mobile and distributed computing.

INTRODUCTION

Today, the term of ubiquitous computing, also called as *pervasive computing* was introduced in (Weiser,1991). The basic idea behind the ubiquitous computing is providing a surrounding intelligence at anywhere and anytime with accomplishing every kind of tasks by many network devices to provide more comfortable life for people.

Day by day, the sensor usage increases by mounting them at many devices to be able to utilize at inside or outside of a definite area. Today, most of the world population use these computations and sensing capable devices in their daily life together with the improved and new generation mobile devices that have data processing and storage capabilities. Because, the amount of information transmission between users, devices and environments increase and human activity contexts are produced. Thus, an

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ambient intelligence (AmI) infrastructure is presented for the pervasively existing intelligence at the covering area around which is delicate to the human presence and also ubiquitous computing (UbiComp) applications are deployed. Human centric ubiquitous computing systems own the facilities of mobility and pervasiveness. A ubiquitous computing system should be fault tolerant, robust and it should be able to adapt the changing factors around itself. Also, in a ubiquitous computing system, the heterogeneity of hardware, networks and operating systems should be masked and also novice users should be able to utilize the system easily. Ubiquitous computing systems combine multi-disciplinary research areas, thus security and privacy is the most important topics for each one of the multidisciplines.

To provide security, there should be interdisciplinary collaboration between the networking, security, software, sensing and architecture disciplines. Ubiquitous computing systems own an interaction through multimodal interfaces that have non visual sensitivity. In addition to this, the system includes implicit interaction with mere presence of the user, human computer interaction, human physical interaction and intelligent agents interaction. Because of having an interdisciplinary structure, the system benefits from the developments at the considered disciplines like energy consumption and green transportation, lately (Zaharakis & Komninos, 2012).

Basically, ubiquitous and pervasive computing focuses on developing an intelligent area by seamless service access for users with determining the applications and needs. And another aim of ubiquitous computing is developing service provisioning to improve the life quality of people by the help of the basic computing and networking infrastructures. Besides, providing resources for the high level requirements of applications that include context and needs of the users together with providing efficiency is also one of the main aims of the system. Some of the considered applications are health care, social networking, assisted living, smart spaces and logistics. These applications have reliability, adaptability, context-awareness and flexibility properties.

The system is composed of wireless communications and Bluetooth, Zigbee, LTE and Wi-Fi are the most known of them. Furthermore, these smart device technologies are also used with Radio Frequency ID (RFID) tags, sensors, wearable computers and smart phones by the help of the last improvements about small sensors to provide ubiquitous services and enlarge their usage areas. Here, with the system, multiple device programming and providing interaction between them is performed. Also, service management, context and data facilities are performed together with solving the battery insufficiency problem at resource constraints.

Ubiquitous computing systems can not directly utilize from middleware design methods which are generally used at distributed computing systems. The reasons can be summarized as three layers. The first one is about the power consumption and energy limits of the devices. Because of the collaboration of the system with embedded devices and sensors, it needs a lightly implementing middleware since these devices occupy finite energy. Next, the heterogeneity and complexity of the network structures, operating systems and devices should be hidden in and between them because the heterogeneity at ubiquitous computing systems is higher than mobile and distributed structures. Third, in ubiquitous computing systems, the applications need context awareness and service orientation facilities to serve situation aware services. Here, to be able to provide the derivation of higher level context, the collection and processing of raw context with some mechanisms are used. Eventually, these systems own vital facilities about commerce, health care, traffic and transport management applications. To support these applications, there should not be an interruption or the users should not be disturbed. Especially, health care applications should work permanently, the interruptions in milliseconds may affect the life qualities of old and disabled people who need permanent medical care during their lifes' definite period. Also,