

Context-Aware Systems

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Abstract: Our daily living experiences can be simplified by computing systems that are aware of an individual's context. By context, we mean any information which can be used to characterize the situation of an entity, which may be a person, device, place, or object. Context-aware system is one that can detect relevant information and adapt in order to improve an interaction. Context-awareness is an important component of most ubiquitous computing applications. This paper provides a brief introduction into context-aware systems.

Keywords: context-awareness, context-aware systems, context-aware computing, context-aware services

I. INTRODUCTION

Context-awareness (CA) is getting a lot of attention these days since it allows automatic adaptation of devices, systems, and applications to user's context change. The context provides information about the current status of people, places, things, and devices in the environment [1]. Context can be acquired from sensors, middleware infrastructure or context server. It may include an individual's location, blood pressure, or current activities.

The term "context-aware" was first introduced by Schilit and Theimer in 1994. Since then, there has been a growing community of researchers orbiting around it. Context-awareness captures the idea that technology plays a more proactive role in our lives. It is a user-centric view of computing and it leads to automation, adaptation, and personalization.

A context-aware system (CAS) is an application that adapts to several situations involving user, network, and the application itself. It is one in which applications have knowledge of their surrounding environment, which is composed of people, computing devices, and things. The fundamentals of CAS include context-aware models, context-aware control, context-aware algorithms, context-aware networks, and context-aware computing [2]. The basic components of a typical CAS interacting with a user is shown in [3].

Context-aware (or sentient) systems are part of ubiquitous or pervasive computing environment; they sense the users' physical and virtual surrounding to adapt systems behavior accordingly. They offer smart service discovery, delivery and adaptation all based on the current context.

II. APPLICATIONS

Context-aware systems can be implemented in several ways depending on requirements and conditions such as location of sensors. Over the years, engineers and researchers have developed some prototypes using context-aware computing techniques. Context-aware Systems (CASs) can be found in the areas of wearable computing, mobile computing, robotics, and intelligent user interfaces. Other applications include [4]: (1) customer communications, (2) mobile marketing, (3) connected billboards, (4) smart digital signage, (5) hassle-free access, (6) in-store shopping experience, (7) airport

experience, (8) employee training, (9) healthcare, (10) mobile learning system, (11) industrial assembly, (12) intelligent transportation, (13) automatic biometric recognition system, and (14) information security. Major industry leaders like Coca-Cola, Citi, IBM, and Zurich Insurance are just a sampling of those investing in context-aware technology.

III. BENEFITS AND CHALLENGES

The major advantage of context-awareness is that allows for the design of applications that can use information about context to automatically adapt their behavior to a dynamic environment [5]. For example, it is not feasible to process all the data collected by sensors connected to the Internet of things. Context-awareness becomes important in deciding what need should be processed [6].

Context awareness is one of the major challenges to be addressed when developing ubiquitous computing systems. To implement a CAS requires addressing some issues [7]: How does the system represent context internally? How frequently does the system need to consult contextual information? It has been argued that there are human aspects of context that cannot be sensed by technological means, not to talk about CAS acting on our behalf. Because of this, the commercial application of CAS is still restricted to sensing [8].

Besides this, many issues remain to be addressed. Security and privacy issues often do not receive enough attention. Another major issue is trust, which is somewhat determined by system reliability. We cannot often assume systems are highly reliable because context information is often incomplete and imperfect [9]. In mobile CAS, the incompleteness of information is in terms of missing data, while the imperfectness indicate uncertain context. These issues should be taken into consideration from the initial stages of the design.

CONCLUSION

A context-aware system is a ubiquitous system, which is able to adapt its behavior automatically according to the gathered context information. Two main technologies that make ubiquitous computing feasible are portable computers and wireless communications. Context aware systems are a promising approach to facilitate and mediate communication in our daily-life activities. They are a potential technology for mobile devices. They are going to shape computing and communication of the future.

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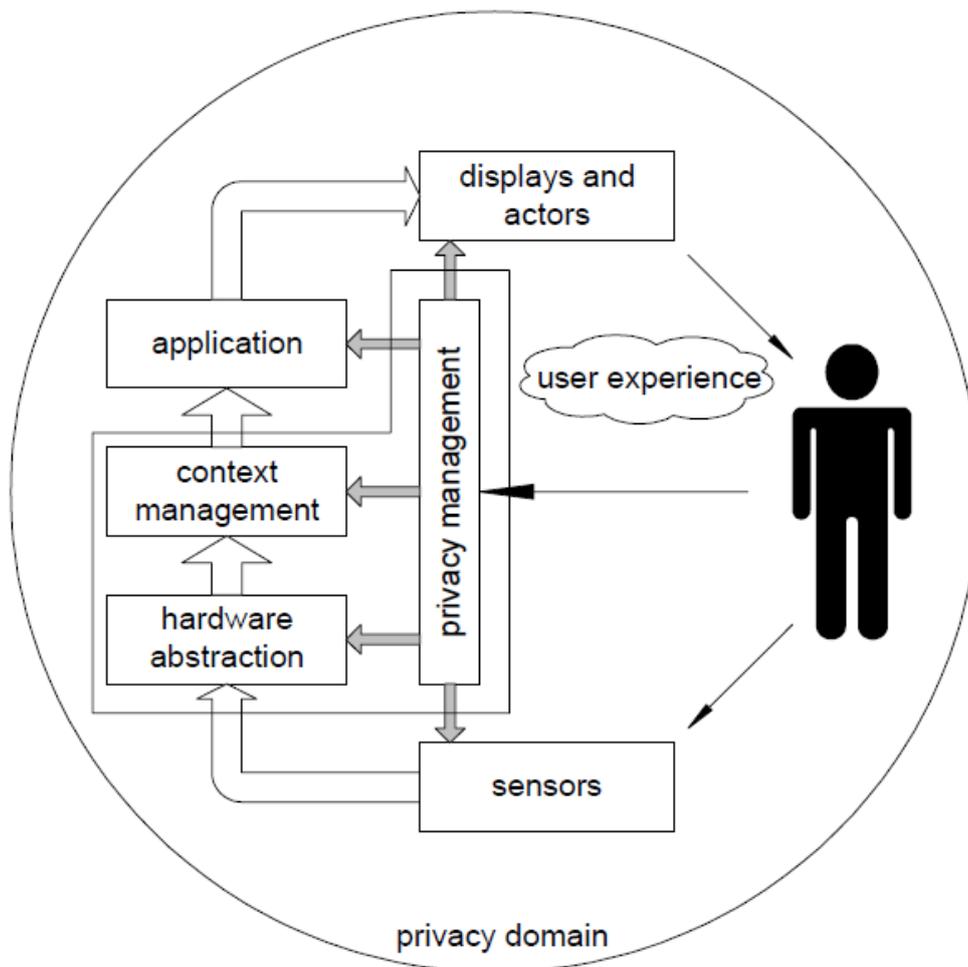


Figure 1: Basic components of a typical CAS interacting with a user [3].