

The What, Who, Where, When, Why and How of Context-Awareness?

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ABSTRACT

Context-awareness is widely thought to be an important enabling technology for developing ubiquitous, handheld and wearable computer applications. It describes the ability of a computing device or program to sense, react to, or adapt to the environment in which it is running. In order to understand better how we can use context and facilitate the building of context-aware applications, we need to understand more fully what constitutes a context-aware application and what context is. This workshop will attempt to address these issues by asking the six “W” questions of context-awareness: ‘what, who, where, when, and why?’. These five questions underpin the sixth meta-question of ‘how’, for example ‘how do we build context-aware applications?’

Keywords

Context, context-awareness, handheld computing, mobile computing, wearable computing, ubiquitous computing.

INTRODUCTION

When humans talk with humans, they are able to use implicit situational information, or *context*, to increase the conversational bandwidth. Unfortunately, this ability to communicate does not transfer well to humans interacting with computers. In traditional interactive computing, users have an impoverished mechanism for providing input to computers. By improving the computer’s access to context, we increase the richness of communication in human-computer interaction and make it possible to produce more useful computational services. The use of context is becoming increasingly important in the fields of handheld and ubiquitous computing, where the user’s context is changing rapidly. However, context-awareness is not well understood, and tools and techniques for developing context-aware applications are still in their infancy. Hence we are proposing this workshop, in order to facilitate discussion on the nature of context-awareness and its utility in handheld and ubiquitous computing.

CONTEXT-AWARENESS

The term context-awareness was introduced by Schilit *et al.* (1994) [5] to describe a new class of computer software application that exploits the changing environment of a mobile computer user [2]. These computer applications sense the environment in which they are running (their context) and adapt their behaviour according to the application’s context, and any changes which may occur to that context. Typically, the contexts of interest might include where you are, who you are with and what computational resources are nearby [5], although the range of physical or logical environmental variables which could be sensed or acted upon is potentially infinite.

The former types of context are most relevant to the office computing environment. These have been explored widely in projects based on Active Badges which were developed at Olivetti Research Laboratory [3] and on the ParcTab, developed at Xerox Parc [6]. In these environments, the emphasis has been on integrating mobile and stationary computing devices in order to provide ubiquitous access to information, communication and computation resources. This was termed a ‘mobile, distributed computing system’ by Schilit *et al.* (1994) [5] to reflect the fact that the people were mobile as well as the computers. In other words, people, by moving around the office environment could change rapidly their access to relevant information and the availability of communications and computational resources.

A more recent definition of context is due to Dey & Abowd (1999) [1] who defined it as ‘any information that can be used to characterize the situation of an entity, where an entity can be a person, place, or physical or computational object’. They went on to define context-awareness or context-aware computing as ‘the use of context to provide task-relevant information and/or services to a user, wherever they may be’. Following on from this, three

important context-awareness behaviours that an application might exhibit can be identified:

- the presentation of information and services to a user,
- the automatic execution of a service, and
- the tagging of context to information for later retrieval.

Researchers in context-awareness have come to realise that there is a pressing need to obtain a better understanding of what context is in order to facilitate the exploitation of context through context-aware applications [1, 4].

FORMAT OF THE WORKSHOP

Goals

The overall goal of the workshop is to bring together leading researchers in the field in order that they can consolidate their understanding of what the main research challenges in context-aware computing are. At present, we think these challenges include:

- the development of a taxonomy and uniform representation of context types;
- the development of infrastructures to promote the design, implementation and evolution of context-aware applications; and
- a discovery of compelling context-aware applications that assist our everyday interactions with ubiquitous computational services.

Subtopics

We need a much better understanding of context-awareness if we are going to find solutions to the above research challenges. In order to improve our understand of what these challenges are, and to facilitate discussion at the workshop, we propose to structure the workshop around the following *six* questions.

1. *What* is context?
2. *Who* might benefit from an awareness of their context; whose context is important to who, or what?
3. *Where* can an awareness of context be exploited?
4. *When* is context-awareness useful?

5. *Why* are context-aware applications useful?

Answers to these five questions underpin the higher level, meta-question of:

6. *How* do we implement context-awareness so that we can develop context-aware applications?

In other words, consideration of the ‘how’ question ends in the other five “W” questions. These six questions can be summarised as the *what, who, where, when, why* and *how* of context. (The questions are only illustrative; participants are encouraged to place their own interpretation on the what, who, how of context-awareness, and so on.)

REFERENCES

1. Dey, A.K. & Abowd, G.D. (1999). *Towards a better understanding of context and context-awareness*. GVU Technical Report GIT-GVU-99-22, College of Computing, Georgia Institute of Technology, Atlanta, Georgia.
2. Fitzmaurice, G.W. (1993). Situated information spaces and spatially aware palmtop computers. *Communications of the ACM*, 36: 39-49.
3. Harter, A. & Hopper, A. (1994). A distributed location system for the active office. *IEEE Network*, 8: 62-70.
4. Pascoe, J., Ryan, N.S. & Morse, D.R. (1999). Issues in developing context-aware computing. To be presented at *International Symposium on Handheld and Ubiquitous Computing (HUC 99)*, Karlsruhe, Germany, September 1999.
5. Schilit, B.N., Adams, N.I. & Want, R. (1994). Context-aware computing applications. *Proceedings of the Workshop on Mobile Computing Systems and Applications*, pp 85-90. IEEE Computer Society, Santa Cruz, CA.
6. Want, R., Schilit, B.N., Adams, N.I., Gold, R., Petersen, K., Goldberg, D., Ellis, J.R. & Weiser, M. (1995). An overview of the ParcTab ubiquitous computing experiment. *IEEE Personal Communications*, 2: 28-43.