

Ubiquitous Computing

L3 Context Aware

By: Dr. Abdussalam Nuri Baryun

System Considerations

- Location, Location, Location
- Privacy
- Automation
- Modeling Context

Context Dimensions/Types


- A user or device context is difficult to model because it has many dimensions, such as location, the identity of devices close by, who else is present, the time, and environmental factors such as sound, motion, temperature, orientation, and other physical variables, many of which can be measured through on-platform *sensors*.

Concept of Context

- Context-aware computing is: “software that examines and reacts to an individual’s changing context.”
 - Schilit, Adams, & Want 1994
- “...aware of its user’s state and surroundings, and help it adapt its behavior”
 - Satyanarayanan 2002

Context Definition

- *Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.*

- “any information that can be used to characterize the situation of an entity.” (Dey et al., 2000)
 - Identity (Who)
 - Activity (What)
 - Time (When)
 - Location (Where)
- Who + What + When + Where  Why

Category or Taxonomy

- A categorization of context types will help application designers uncover the most likely pieces of context that will be useful in their applications.
- There are certain types of context that are, in practice, more important than others.

These are ***location, identity, activity and time.***

Schilit et al. (1994) claim that the important aspects of context are as follows: where you are, whom you are with, and what resources are nearby.

Elements of the environment:

- *Computing environment*—available processors, devices accessible for user input and display, network capacity, connectivity, and costs of computing, etc.
- *User environment*—location, collection of nearby people, and social situation, etc.
- *Physical environment*—materials, medium, lighting and noise level, etc.

Schilit's Categories and features

- To get information or to execute a command and whether the task is executed manually or automatically.

	manual	automatic
information	proximate selection & contextual information	automatic contextual reconfiguration
command	contextual commands	context-triggered actions

Table 1: Context-Aware Software Dimensions

- Pascoe (1998) defines context to be the subset of physical and conceptual states of interest to a particular entity.
- Dey et al. (1998) define context to be the user's physical, social, emotional, or informational state.
- These definitions, although closer to an ideal definition, are too specific.
- Context is all about the whole situation relevant to an application and its set of users. It is not possible to enumerate which aspects of all situations are important, because this will change from situation to situation.
- For example, in some cases, the physical environment may be important, whereas in others it may be completely immaterial.

Pascoe's Taxonomy

- **Contextual sensing**
- **Contextual adaptation**
- **Contextual resource discovery**
- **Contextual augmentation**

Dey's Taxonomy

- 1. Presentation of information and services to a user (P)*
- 2. Automatic execution of a service (E)*
- 3. Tagging of context to information for later retrieval (T)*

- Context widget: is responsible for acquiring a certain type of context information and it makes that information available to applications in a generic manner, regardless of how it is actually sensed.
- Context server: gathers the context about an entity (e.g., a person) from the available context widgets, behaving as a proxy to the context for applications.

Dey et al. (2000) Table 1. Application of context and context-aware categories

System Name	System Description	Context Type				Context-Aware		
		A	I	L	T	P	E	T
Classroom 2000 [1]	Capture of a classroom lecture			X	X			X
Cyberguide [1]	Tour guide		X	X		X		
Teleport [2]	Teleporting	X	X	X			X	
Stick-e Documents [3,4,5]	Tour guide		X	X	X	X		X
	Paging and reminders	X	X			X		X
Reactive Room [6]	Intelligent control of audiovisuals	X	X	X			X	
GUIDE [7]	Tour guide			X		X		
CyberDesk [8,9,10]	Automatic integration of user services	X				X	X	
Conference Assistant [11]	Conference capture and tour guide	X	X	X	X	X		X
Responsive Office [12]	Office environment control			X	X		X	
NETMAN [13,16]	Network maintenance			X		X		
Fieldwork [17,18,22]	Fieldwork data collection			X	X	X		X
Augment-able Reality [19]	Virtual post-it notes			X		X		X
Context Toolkit [24]	In/Out Board		X	X	X	X		
	Capture of serendipitous meetings		X	X	X		X	X
Active Badge [28]	Call forwarding		X	X		X	X	

Presentation, Execution, Tagging

- The final feature, *contextual augmentation*, is the ability to associate digital data with the user's context. A user can view the data when he is in that associated context. This feature does not exist in Schilit's taxonomy.
- Pascoe and Schilit both list the ability to exploit resources relevant to the user's context, the ability to execute a command automatically based on the user's context, and the ability to display relevant information to the user.

- Pascoe goes further in terms of displaying relevant information to the user by including the display of context, and not just information requiring further selection (e.g., showing the user's location vs. showing a list of printers and allowing the user to choose one).
- Pascoe's taxonomy does not support the presentation of commands relevant to a user's context.

- Dey and Abowd (2000a) combine the ideas from these two taxonomies and take into account the three major differences.
- Tagging is the same as Pascoe's contextual augmentation.
- This last taxonomy has two important distinguishing characteristics/features:
 - the decision not to differentiate between information and services, and
 - the removal of the exploitation of local resources as a feature.

Example: Home Context-Aware

Different requirements of offices:

- Usability
- Usefulness
(even if it is just wasting time)
- Social acceptance
- Privacy protection
- low cost
- zero administration

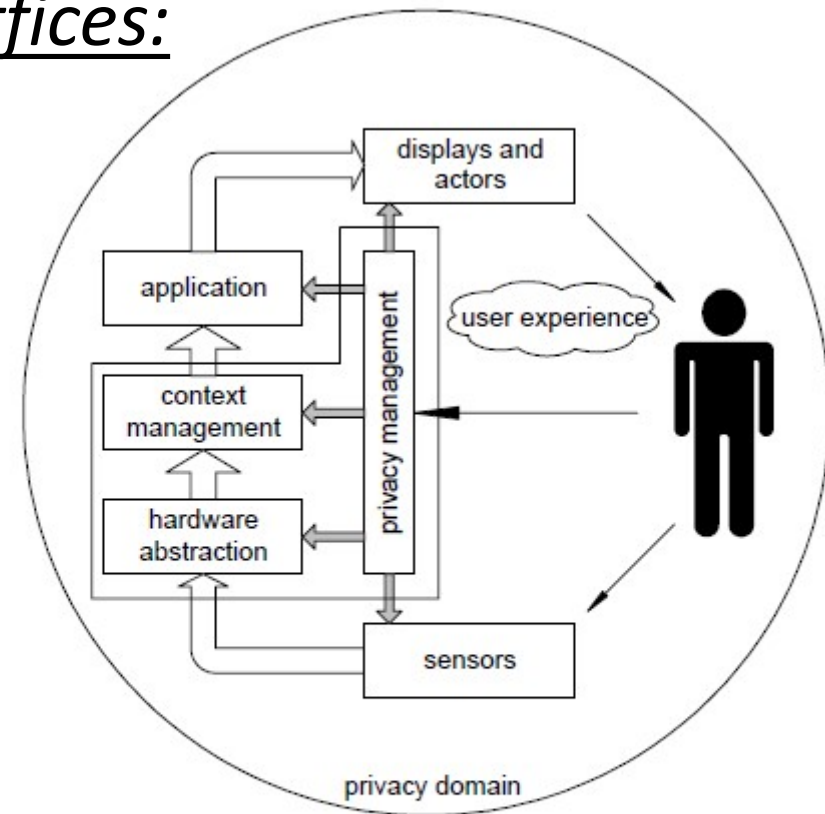


Figure 1. Basic components of a context-aware system interacting with a user.

Questions

- How to determine and conclude whether an application is context-aware-app or not?
- Compare between the three context aware taxonomies of Schilitz, Pascoe, and Dey?
- How to understand the boundaries of context-aware computing, and select context to use, structure context in applications, and decide what context-aware features to implement?

References

- [1] Weiser, M., The computer for 21st century, 1991.
- [2] John Krumm, Ubiquitous Computing Fundamentals, 2010.
- [3] Anind K. Dey and Gregory D. Abowd ,
Towards a Better Understanding of Context and
Context-Awareness,