Models for Mobile Context Awareness

Russell Beale[1], Peter Lonsdale[2], and Mike Sharples[3]

[1]r.beale@cs.bham.ac.uk
School of Computer Science
[2]p.lonsdale@bham.ac.uk, [3]m.sharples@bham.ac.uk
School of Engineering
University of Birmingham
Birmingham B15 2TT UK

Mobile devices are everywhere: PDAs. mobile phones, laptops and notebooks are in everyday use by everyday people. They are slowly extending their roles as we learn to make a feature of their mobility and connectivity. In order to achieve this effectively we need to get hold of information about the user, their tasks and interests, and the environment they are in, and then put it to good use to allow us to provide timely support. This context is important because it allows us to make use of the environment in a way that supports the user. For example, we can envisage the scenario of a mobile phone that is aware of its user's location and activity and will not disturb an important meeting. But the same phone, being aware of its user's call list and calendar will permit a call from a pregnant wife. In this way the user themselves form part of the environment they occupy, and we can use information about the user to further enhance our contextual model.

Context is useful in three respects. Firstly, it relates the services to time and location, and to the user's needs and interests, ensuring that they are useful, learnable and enjoyable. Secondly, it provides for more effective use of resources, which is especially important in the mobile situation, with many different limitations – device processing power, display ability, media capabilities, network bandwidth, connectivity options, intermittent connections – and other aspects of the situation competing for attention. Thirdly, by providing more appropriate information delivered most effectively, it allows the user to focus much less on the technology and more on the actual situation they are in.

We consider context not as a static phenomenon but as a dynamic process, where context is constructed through the user's interactions with the learning materials and the surrounding world over time. All of these domains provide information in themselves, and can interact with the others in a variety of ways, building a rich model of the current world and hence allowing the system to be more specific in what it offers the user. A simple example clarifies these concepts: environmental information such as geographical position allows us to provide location-specific information, e.g. detail on exhibits in a museum. Other user information such as the identification and presence of another person allows us to create a peer-to-peer network for informal chat. But the combination of the two may allow us to determine that the other user is a curator, and we can provide the mechanisms for one to give a

guided tour to the other. The combination of models is potentially richer than each on their own.

Instead of a rigid definition, our intention is to provide a hierarchical description of context as a *dynamic process with historical dependencies*. By this we mean that context is a set of changing relationships that may be shaped by the history of those relationships.

A snapshot of a particular point in the ongoing context process can be captured in a *context state*. A context state contains all the elements currently present within the ongoing context process that are relevant to a particular learning focus, such as the user's current *project*, *episode*, or *activity*[1]. A user may at any one time be engaged in a number of simultaneous activities and episodes that relate to one project, and they may have several ongoing projects each of which has its own set of relevant activities and episodes.

A *context substate* is the set of those elements from the context state that are directly relevant to the current learning or application focus, that is to say those things that are useful and usable.

Context features are the individual, atomic elements found within a context substate and each refers to one specific item of information about the user or their setting (for example current task or location). In our description of context, context features an indivisible and refer to only one item of relevant information about the user or their setting.

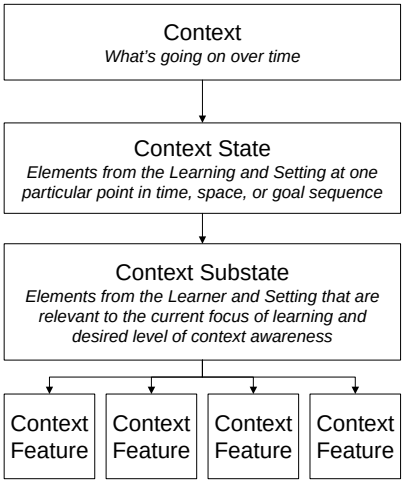

Fig. 1. Context hierarchy

This model can be conceptualized using a film metaphor. The context is the whole film; plot, characters and all. The context state is the current scene, with the context substate being a frame in that scene. Context features are the individual actors, props and so on within the scene. This captures both the hierarchical compositionality of context and its temporal nature.

This system has been implemented in Java using web services, and forms the basis of the MOBIlearn context architecture, which has undergone preliminary trials [2] and will be evaluated in major trials in museum, MBA and medical scenarios in the near future.

References.

1. Vavoula, G. and Sharples, M. (2002). KLeOS: A personal, mobile, knowledge and learning organisation system. In *Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education*, IEEE Computer Society Press.
2. Beale, R. and Lonsdale, P. (2004). Mobile Context Aware Systems: the intelligence to support tasks and effectively utilise resources. In *Proceedings of Mobile HCI 2004* Glasgow. (to appear).