Supporting Mobile Context-Aware Applications on a Global Scale

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Abstract
Existing context services mostly support context-aware applications inside a closed, tightly-scoped environment. In order to provide a user with real pervasive computing experiences, a context service must be able to support roaming applications across different environments. We propose a global context infrastructure to address this issue. We discuss the general architecture of the context infrastructure and the design of the context service in one local environment, which is based on a context flow language and the corresponding run-time environment.

1. Introduction
Context-aware computing is considered as one of the key enabling technologies for pervasive computing. Without proper software support, developing context-aware applications is tedious and painful. The need for a context service to simplify the development of context-aware applications has been addressed by various projects such as Context Toolkit. However, most of them only provide support for applications inside one local environment. However, it is possible that applications in one environment will be interested in context information in another environment. Besides, due to user’s movement, roaming applications may want to get context information from each environment that the user visits. We have proposed a global context infrastructure to address these issues.

2. Design of the context infrastructure
We consider a global context infrastructure consists of two layers. The upper layer is a network overlay of partially connected nodes. Each node is an area in physical terms. The function of the upper layer is to disseminate context information across different environments. The lower layer concerns the management of context information in one local environment such as collecting, processing and providing context information to applications.

Context is about properties of entities (people, devices, artifacts and software) and relations among them and it is user and application specific. In existent context service such as IBM Owl, applications just choose context from available context provided by a context service. For roaming applications, we believe that it is not feasible for a context service to try to predict the entire possible context that applications need. We consider that the context requirement for one application can be expressed as data flow. We apply the principle from the end-to-end argument in system design and propose that the context service only provides basic facilities to locate sources and dynamically compose the flow. The application developers are responsible for specifying how to compose the flow. The context flow captures 3 elements: the constraints over the sources which is used to select sources based the quality of information such as accuracy, freshness, confidence; the constraints over the structure over the flow and the constraints over the deployment of the flow. Besides specifying the connections among components, the structure aspects also include two kinds of context components: user-provided component for personalizing context information such as aggregating, filtering data and environment-provided component for navigating to local entities such as from user’s location to nearby printers. The deployment constraints over the flow are used to tackle the resource variability. The context flow has been realized as an XML-based language.

3. Conclusion
We have proposed a context service\(^1\) based on a context flow language to support roaming applications. We are implementing a prototype of the proposed context service and plan to build context-aware applications to test its feasibility.

\(^1\) Further details can be found at http://www.cis.strath.ac.uk/~wang/mdm2004.pdf