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Enabling Adaptive Context Views for Mobile Applications Negotiating Global and Dynamic Sensor Information

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Abstract:

Mobile devices with Internet access and large amounts of sensors, pushes the development of intelligent services towards new forms of pervasive applications. These applications are made context-aware by utilizing information from sensors and hence the context of a situation, in order to provide a better service. Based on this, the focus of this thesis is on the challenge of creating context awareness in mobile applications. That both utilizes dynamic context information from globally available sensors and provides adaptive views of relevant context information to applications.

The first challenge is to identify the properties of an architecture that provides scalable access to information from global sensors within bounded time, because existing systems do not support these properties in a satisfactory manner. The majority of related systems employ a centralized approach with limited support for global sensor information due to poor scalability. Therefore, this thesis proposes a distributed architecture capable of exchanging context between users and entities on a peer-to-peer overlay. Pervasive applications can thus utilize global sensor information in a scalable and manageable way within predictable time bounds.

The second challenge to support continually changing and evolving context information, while providing it as both adaptive and manageable views to applications. To address this particular problem, this thesis proposes the usage of a locally stored evolving context object called a context schema. In detail, this schema contains all context information that is considered as being relevant for a specific user or entity. Furthermore, this thesis proposes an application interface that can provide snapshots of the evolving context schemas as adaptive views. These views can then be used in context-aware mobile applications, without inducing unnecessary delays.

By successfully addressing the challenges, this thesis enables the creation of pervasive and adaptive applications that utilize evolving context in mobile environments. These capabilities are made possible by enabling access to global sensor information based on a distributed context exchange overlay, in combination with evolving context schemas offered as views through an application interface. In support of these claims, this thesis has developed numerous proof-of-concept applications and prototypes to verify the approach. Hence, this thesis concludes that the proposed approach with evolving context information has the ability to scale in a satisfactory manner and also has the ability to dynamically offer relevant views to applications in a manageable way.