OPEN Platform for Migration of Interactive Services: Architecture and Evaluation

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ABSTRACT

One important aspect of ubiquitous environments is to provide users with the possibility to freely move about and continue to interact with the available applications through a variety of interactive devices such as cell phones, PDAs, desktop computers, intelligent watches, or digital television sets. Migratory applications are able to follow the user by sensing changes in the user’s context and adapting to available devices, ideally without interrupting the user experience. However, applications themselves must contain functions to monitor context information, coordinate a migration, handle application adaptation, and interact with the user during the migration process. To make life easier for developers and users of migratory applications, an integrated Migration Service Platform (MSP) is proposed, where all the common migration functions are centralised. The authors show how the platform is realised as middleware that contains a server for the central functions and lightweight client-side running on the end-user devices. The authors show how migratory applications can interact with the platform and thereby do not have to contain migration functions themselves. The authors describe the challenges following the centralisation of a migration platform that can support different types of applications, both games and business applications, implemented with either web-technologies or as component-based applications.

Keywords: Context-Awareness, Middleware, Migration Service Platform, Service Continuity, State Adaptation

INTRODUCTION

One important aspect of ubiquitous environments is to provide users with the possibility to freely move about and continue to interact with the available applications through a variety of interactive devices such as cell phones, PDAs, desktop computers, digital television sets or intelligent watches. In such environments one potential source of significant frustration is that
people have to start their application session over again from the beginning after changing to a different interactive device.

Migratory applications can overcome this limitation. Migratory applications are applications able to follow users, sense the user’s context (where context is any information that can be used to characterise the situation of an entity (Dey, 2001), and adapt to the changing context, e.g., set of available devices, while also preserving the continuity of application sessions, thereby ensuring the continuity of the tasks supported by the application. No proper migration occurs if there is a contextual change and an adaptation of the application features to the new device, but there is no continuity in the resulting user activity because, for instance, the user has to restart from the beginning when the new configuration is activated. Likewise, a situation in which there has been a context change, and also the state of the application has been preserved, cannot be properly called migration, if adaptation necessary, but not performed.

Therefore, migration encompasses three major aspects: context change, which regards discovery, access and selection of context information; adaptation, which covers the problems of adapting the application to the characteristic of the new context based on the available context information; and continuity, on how to guarantee continuity in task performance. As is described in Section State of the art, there are already several approaches solving the parts of migration separately (e.g., for adaptation or continuity) but our approach is innovative as it provides a holistic solution for the migration problem.

The OPEN project provides an integrated solution to the migration problems able to address all three aspects in a Migration Service Platform (MSP), a middleware for migratory applications. This paper describes how the MSP handles the major challenges of migration by aggregating required functions that are shared between migratory applications into one middleware layer.

The rest of the paper is organised as follows. In Section Scenarios and requirements, we describe the two domains of interest for the project, namely games and business applications. We exemplify the domains with relevant scenarios. Then, the requirements to the integrated platform that can support both domains are derived. Work related to migration, or parts of a migration process, that are relevant for OPEN is described in the State of the Art Section. Then, we present the architecture of our proposed migration platform, and finally we draw the conclusions.

SCENARIO AND REQUIREMENTS

Migratory applications that enable a continuous access across different devices can improve the overall user experience and provide new application use-cases. Ideally, the migration platform should be able to take all existing applications and make them migratory. In the OPEN project we have focused on specific classes of applications, in particular, Web applications and distributed applications in the game and business domains. Migratory applications existed in neither of these domains before the OPEN project, and the span of different application technologies enforces the platform to be general enough to support many new applications and technologies.

Two representative scenarios from the domains are presented and the requirements to the platform are derived from the scenarios subsequently.

Migratory Games

Thomas is a college student who loves Formula 1 and spends several hours a day playing video games. He is used to watch all F1 Grand Prix races on his laptop while playing video games on his game console connected to the Plasma TV.

Thomas has left the study room of his college library just a few minutes before the start of the first Grand Prix of the season. He starts playing with the mobile phone while waiting for the bus on his way home. Thomas invites his
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