Open Pervasive Environments for migratory iNteractive services (OPEN)

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1 Introduction

An important aspect of pervasive environments is to provide users with the possibility to move freely around and continue their interaction with applications through a variety of interactive devices such as cell phones, PDAs, desktop computers, digital television sets, intelligent watches and alike. Indeed, in a mobile and dynamic environment a potential source of frustration is that users will have to restart their session whenever a change of interactive device is needed.

Migratory interactive services can overcome this limitation and support continuous task execution. This implies that interactive services are able to follow users and adapt to the changing context of use while preserving their internal state. The OPEN[1] project [1] provides integrated solutions able to address three aspects: device change, state persistence and content adaptation. This is obtained through a middleware capable of considering and integrating various aspects: adapt and preserve the state of the application parts dedicated to interact with end users; support mechanisms for reconfiguring application logic to provide interoperability between different devices; and identify suitably flexible mechanisms available in the underlying network layers to support user mobility and pervasive usability. Furthermore, the middleware is able to interoperate with existing technologies. Thus, the main objectives of OPEN are to:

- Offer seamless and transparent support to interactive applications when users change devices of interaction as well as available services;
- Offer natural and personalised interaction possibilities by exploiting different interaction modalities supporting the mobile user;
- Exploit the wide availability of network technology to offer reliable services in the context of migration between different devices and services;
- Propose an infrastructure in order to increase possible services and application migration scenarios in several contexts (services for citizens, business, games, new interactive and collaborative methods in work or educational applications, and so on).

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[1] The OPEN project is a multidisciplinary consortium combining the expertise of three technological world leaders, three well known research organizations, and one SME.

2 Service migration scenarios

OPEN considers several different scenario types [2]:

- **Game development**: A major challenge when porting games between different platforms is rewriting the user interface, which should be changed, and possibly restructured, to match the specific target requirements. Developing games from scratch as migratory applications running on a migration platform, will allow for effortless migration between gaming platforms, without the burden of rewriting the user interface for the various target platforms that have to be supported.
- **Game play**: A Pac-Man gaming scenario has been considered for illustrating the need of migratory capabilities for enriching a game user experience by utilising more devices when playing. One example in the scenario is when an additional player of Pac-Man joins the game: the player can start to control a ghost by using his/her own mobile terminal and without the need to restart the game. The game is hereby migrated in real-time to work in an augmented gaming environment.
- **Web-based applications** are described in OPEN to investigate the potential of using several devices simultaneously, with multi-modal interaction. Supporting multi-modal interaction requires a migratory infrastructure capable of adapting and controlling the involved components, e.g. the user interface, the application logic and the networking.
- **Component based applications** pose additional requirements onto a migration platform, as such services may have real-time constraints or expect to function in environments with dynamic characteristics. Scenarios illustrating these applications have been devised for OPEN containing for example hand-over of ongoing audio calls and use of migratory tools in ad-hoc networking environments.

3 Functional architecture for migration

Fig. 1 shows the developed functional architecture encompassing the functionalities required for supporting migratory services. The architecture is multi-dimensional: First, it consists of 3 functional layers; presentation, application logic and middleware. Second, it illustrates the division between migration platform and migratory service/application. Finally, the architecture contains glue between migratory applications and the migration platform – a communication interface connecting layers, functional components in the platform and the applications of the platform.
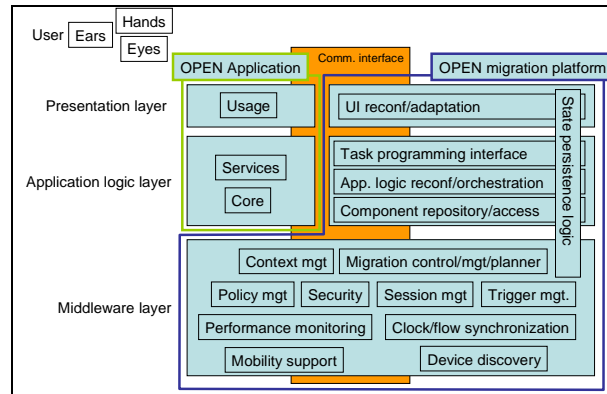
Fig. 1. OPEN architectural framework [3]

- **Presentation layer** – Support of multi-modal interfaces enabling the users to interact with various types of services (at home and on the move) including multimedia applications with different QoS-requirements and end-system capabilities.
- **Application logic layer** – Provision of an adaptive and configurable service platform, especially dynamically installable core services, to create a seamlessly integrated multi-device environment. The inclusion of dynamically changing context information in the migration decision and process will allow for more efficient and more flexible migration solutions.
- **Middleware layer** – OPEN will provide integrated support for both migration of user interfaces and dynamic configurability of services, together with additional functionalities, such as opportunistic interaction and semantic discovery. OPEN will deliver new solutions based on peer-to-peer architectures. With the inclusion of adequate QoS-aware mobility support solutions, transparency of the migration will be achieved for peer subsets that do not implement the full OPEN service platform.

4 Outlook and future work

OPEN uses an iterative approach to scientific and technical development, so that the results and practical experience obtained during application development and during test-bed evaluation will feed the refinement of the migratory service platform developed in the next iteration. Moreover, such results will also be useful to identify extended scenarios in which platform and related services improvements will be applied.

References

[1]   http://www.ict-open.eu, Jul 2008
[2]   OPEN D1.1: Requirements for OPEN service platform, May 2008
[3]   OPEN D1.2: Initial OPEN service platform architectural framework, Sep 2008