OPEN Project

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ABSTRACT

One great limitation in the area of ubiquitous computing is the lack of capability to change interactive devices, and to continue using the application session without the need to start it from the beginning on the target device. Migratory applications, as defined in the context of OPEN, can solve this problem.

Advancing the development of such migratory applications has been a goal for OPEN, and it motivated the contributions the OPEN project made to different standards bodies. This deliverable is a report on the dissemination of the OPEN results and the impact on standardisation activities. The standards bodies the project has used or contributed to are presented as well as the relevant standards and any contributions. In addition a potential future contribution is presented. Further dissemination activities round off the report.

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1. INTRODUCTION

This document is about standardisation activities relevant to the OPEN project. In the first version we selected standards bodies according to the following criteria:

- The standards body is relevant not only to the subject area but to the technologies OPEN is interested in, for example, while mobility is an area relevant to us, implementation details of 3G networks are not.
- The standard body must be open, allowing us to both influence it and use its results.
- In order to have realistic possibilities to influence the standards body, some involvement by OPEN member companies should already be in place.

The first version, D7.3 [1], contained information about all the standards bodies and standards selected according to these criteria.

In this current version we have narrowed the focus to the standards bodies that OPEN has made a contribution to as well as the important standards actually used during the project implementation.

2. OVERVIEW OF SOME RELEVANT ORGANIZATIONS AND STANDARDS

This section includes some relevant organizations and the OPEN contribution to their standards, and some standards that have been used within the project. Each organization/standard is shortly presented, followed either by a description of the OPEN contribution or by the way it has been used in the project. The standards bodies to which the project made contributions are:

World Wide Web Consortium (W3C)
Open Mobile Alliance (OMA)

The standards bodies whose standards the project used are:

Open Services Gateway initiative (OSGi)
Internet Engineering Task Force (IETF)

There is also one standards body that the project could potentially contribute to in the future:

Khronos

2.1. WORLD WIDE WEB CONSORTIUM

To paraphrase its home page, http://www.w3.org/Consortium/, the World Wide Web Consortium (W3C) is an international community where member organizations, a full-time staff, and the public work together to develop Web standards and guidelines. At the beginning of 2010 the W3C had 334 members from academia and business, and 61 staff members.

W3C work is carried out by various types of groups (Working, Interest, Incubator, Coordination, Technical Architecture Group, and Advisory Board). Membership in such groups is open to W3C members and other invited parties.

W3C has a policy of openness, which lets members of the public participate in W3C via discussion lists, events, blogs, translations, and other means. Explicit policies of W3C to promote openness include [2]:

1. All standards are available publicly at no cost
2. W3C adopted a Patent Policy in 2004 with the stated goal of assuring "that Recommendations produced under this policy can be implemented on a Royalty-Free (RF) basis."
3. The W3C Process requires that groups address public comments
4. All technical comments are handled on their merits, whether they are made by W3C Members or the public.
5. W3C's process is vendor-neutral.

6. W3C's persistence policy seeks to ensure that standards will be available at the same URI, unchanged, indefinitely.

In line with its policy of openness, W3C groups work with the public through specification reviews as well as contributions of use cases, tests, and implementation feedback.

2.1.1. W3C: ORGANIZATION OF WORK

W3C work is organized by groups of different types [3]:

Working Groups

Working Groups typically produce deliverables (e.g., standards track technical reports, software, test suites, and reviews of the deliverables of other groups).

Interest Groups

The primary goal of an Interest Group is to bring together people who wish to evaluate potential Web technologies and policies. An Interest Group is a forum for the exchange of ideas.

Coordination Groups

A Coordination Group manages dependencies and facilitates communication with other groups, within or outside of W3C.

Incubator Groups (XG)

Incubator Groups, 'XG' for short, foster rapid development, on a time scale of a year or less, of new Web-related concepts. Target concepts include innovative ideas for specifications, guidelines, and applications that are not (or not yet) clear candidates for development and more thorough scrutiny under the current W3C Recommendation Track.

In addition to these groups, W3C has chartered two permanent groups:

Technical Architecture Group (TAG)

W3C created the TAG to document and build consensus around principles of Web architecture and to interpret and clarify these principles when necessary. The TAG also helps to resolve issues involving general Web architecture brought to the TAG, and helps coordinate cross-technology architecture developments inside and outside W3C. Some TAG Participants are elected by the W3C Members, others are appointed by the W3C Director.

Advisory Board (AB)

The Advisory Board provides ongoing guidance to the Team on issues of strategy, management, legal matters, process, and conflict resolution. The Advisory Board also serves the Members by tracking issues raised between Advisory Committee meetings, soliciting Member comments on such issues, and proposing actions to resolve these issues. The Advisory Board manages the evolution of the Process Document. AB Participants are elected by the W3C Members.

2.1.2. W3C ACTIVITIES RELATED TO OPEN

Many W3C activities overlap with the research topics of OPEN. The Ubiquitous Web Applications (UWA) Working Group is especially relevant to OPEN. It focuses on extending the Web to enable distributed applications spread over many kinds of devices including sensors and effectors. Application areas of interest to the UWA WG include home monitoring and control, home entertainment, office equipment, mobile and automotive [3].

The focus and the application areas of UWA are congruent with OPEN, which advocates a model-based approach to the development of device-adaptable web applications. The potential contribution of W3C standards to achieving this goal is the subject of an on-going W3C XG on model-based UIs. The XG hopes to enable a new generation of Web authoring tools that will make it much easier to create tomorrow's Web applications and to tailor them for a wide range of user preferences and device capabilities. To achieve this, the Model-based User Interfaces Incubator Group will evaluate research on model-based user interface design as a framework for authoring Web applications and with a view to proposing work on related standards.

This XG is evaluating a number of W3C documents for their potential contribution. The XG Charter calls for work on:

- Use cases and requirements for model-based user interfaces
- A description of the Layered Architecture and the formal relationships between layers
- The key benefits of model-based user interfaces for developing Web applications
- A survey of existing work on model-based user interfaces including existing standards
- Recommendations for further work on model-based user interfaces
- Opportunities for standardisation for model-based user interfaces

More information about the Model-based UI XG can be found in the next section.

2.1.3. CONTRIBUTIONS TO W3C MODEL-BASED USER INTERFACE GROUP

The HIIS Laboratory at CNR-ISTI has actively contributed to the W3C Model-based User Interface XG. The mission of this group is to evaluate research on model-based user interface design as a framework for authoring Web applications, and with a view to proposing work on related standards.

Research work on model-based design of user interfaces has sought to address the challenge of reducing the costs for developing and maintaining user interfaces through a layered architecture that separates out different concerns:

1. Application task models, data and meta-data

2. Abstract Interface (device and modality independent, e.g. select 1 from N)
3. Concrete Interface (device and/or modality dependent, e.g. use of radio buttons)
4. Implementation on specific devices, using, e.g., HTML, SVG or Java

Each layer embodies a model of behavior (e.g. dialog models and rule-based event handlers) at a progressively finer level of detail. The relationships between the layers can be given in terms of transformations, for example, between objects and events in adjoining layers. XML is well suited as a basis for representing each layer, with the possible exception of the final user interface, which may be generated automatically, guided by author supplied policies.

High level development suites can be provided to shield authors from the underlying XML representations. For example, a data model could be manipulated as a diagram, while the user interface could be defined via drag and drop operations, together with editing values in property sheets. The development suite would be responsible for maintaining the mappings between layers and verifying their consistency. Authors could choose to provide alternative mappings as needed to address different delivery contexts.

The prime deliverable for the Model-based UI XG is an XG Report on the potential of model-based user interfaces as a framework for authoring web applications. This includes a taxonomy of use cases and recommendations for further work. The following items are either part of the XG Report or will be provided separately:

1. Suggestions for a task modeling language based upon Concur Task Trees.
2. An evaluation of the potential for combining diagrams and rule languages for end to end models, and the relationship to SCXML.
3. An evaluation of various standards and activities like MARIA, a language from the Serv Face Project, as a basis for the abstract user interface, and suggestions for generalizations based upon a gap analysis.
4. Suggestions for a concrete user interface markup language aligned with WAI-ARIA. When the OPEN system generates dynamic web UIs, they comply with the W3C accessibility guidelines, WAI-ARIA.
5. Potential mechanisms for guiding transformations between the different models, particularly from the abstract UI, to the concrete UI and to the final user interface (the implementation).
6. Considerations on using task models for user interaction at runtime, as facilitated by ANSI/CEA-2018.
7. Considerations on using the Cameleon reference framework architecture.

In this XG report we included use cases based on the OPEN project approach for migratory user interfaces, showing how model-based XML user interface languages can be helpful for this purpose. The correspondent section of the report can be found in Appendix A.

Conformant with the openness policies of the W3C, there is a public WIKI for the Model-based User Interfaces XG: http://www.w3.org/2005/Incubator/model-based-ui/wiki/Main_Page. This WIKI is readable by anyone, and editable by members of the XG. Use cases and concepts from OPEN have already been disseminated to XG members, and will also be published in this WIKI as appropriate.

2.2. OPEN MOBILE ALLIANCE

The Open Mobile Alliance (OMA) was founded in June 2002. It includes nearly 200 companies, among them the world´s leading mobile operators, device and network suppliers, information technology companies and content and service providers.

According to its home page, www.openmobilealliance.org, OMA aims to consolidate into one organization all specification activities concerning the enablement of interoperable services. It also aims to facilitate global user adoption of mobile multimedia services. The emphasis is on service enablers and services that are interoperable across countries, operators and mobile terminals, and which meet the needs of the user.

To increase the size of the mobile market, the companies supporting the Open Mobile Alliance will work towards stimulating the rapid and wide adoption of a variety of new, enhanced mobile information, communication and entertainment services.

2.2.1. OMA: ORGANIZATION OF WORK

OMA has a number of technical working groups, horizontal working groups, and committees that are all consolidated in the OMA Technical Plenary. This Plenary is responsible for the technical specification drafting activities, approval, maintenance of technical specifications as well as the resolution of technical issues within the OMA organization.

Further, the Technical Plenary is responsible for the delivery of technical specifications for application and service frameworks, with certifiable interoperability, in a timely manner, enabling deployment of rich mobile applications and services.

At present, there are 12 Technical Working Groups, 4 Horizontal Working Groups and the Release Planning Committee of the Technical Plenary.

One of the new work items that has begun recently at OMA is the Next Generation Service Interfaces(NGSI). In the next section it is shortly described and the contributions of the OPEN project to NGSI are presented.

2.2.2. CONTRIBUTIONS TO OMA NEXT GENERATION SERVICE INTERFACES

The main objective of the Next Generation Service Interface (NGSI) enabler is to define a set of new services for deployment across individual, corporate and general societal user communities. Building on extensions beyond today's Web service APIs for the telephone network (Parlay X

APIs, latest version: 3GPP Release 8 Parlay/Parlay X APIs), NGSI will stimulate the usage of various service enablers by new services and applications. Considering the evolution of the network in the day-to-day life, including information sources, social communities and e-commerce, as well as network access and network infrastructure variety.

The NGSI group believes that introducing interfaces that allow for programmability of network services will open the floodgates to open service creation in this emerging long-tail market (see Figure 1).

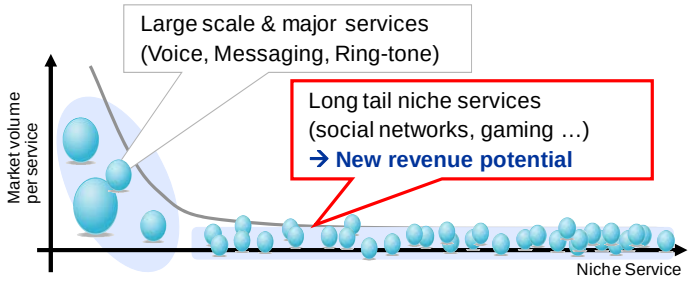

Figure 1: Representation of revenue volume distribution along the changing service market

In OPEN, we have put special care in the interfaces for the Context Management Framework. These provide context information to the whole Migration Platform, which uses it to personalize a wide variety of aspects including access restrictions, user preferences, device discovery, and capability checks.

Given that Network Operators are likely owners of a widely deployed OPEN Migration Platform, it stands to reason that a scalable, standardized interface to access context information is required. With this in mind, the requirements on the context service, as well as the Context Access Language (CALA) used in the CMF for context retrieval in the Migration Platform, have been made into technical contributions at the NGSI group in OMA. The documents with respect to context processing that NEC contributed to NGSI are listed in **Errore. L'origine riferimento non è stata trovata.** B.

Standardisation is currently in progress: the Requirements phase is over, and the actual technical definition of the final standard will be consolidated presently (See Figure 2 for the current overview, including context as an enabler for services at the lower layers). This activity was included in the OMA Pipeline list in 2009.
(http://www.komindesign.com/oma_temp/pages/pipeline.html)

However, the standardization efforts for the CMF have been made within another project NEC is currently working on, called SENSEI.

The overall standardization work in SENSEI included finishing the requirements document, the architecture document, and the technical specification of the NGSI context API. In more details this includes the structuring of the Context Management API, and a basic Context Information

Model. Discussions have been done at the Boston meeting (June 22-26, 2009) and at the Sorrento Meeting (Feb 1st-5th, 2010). Furthermore a set of OMA PhC were conducted to advance the topics between the meetings. Furthermore, three preparation meetings with other participants have been held.

The plans for OMA NGSI are to finish the abstract API specification until the next meeting in April 2010. After that the specification will go into consistency review. After that a REST-like binding of the API will be defined.

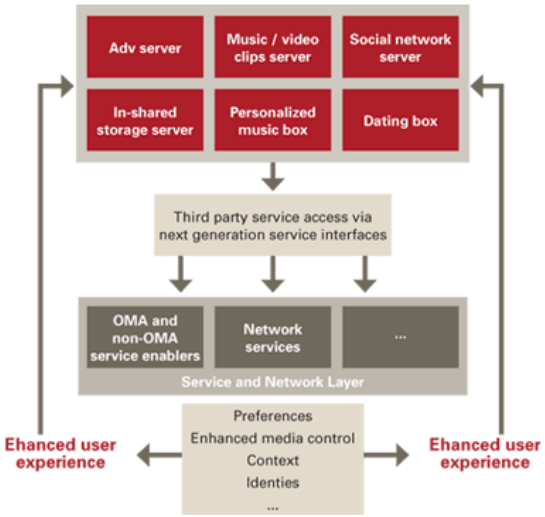

Figure 2: Overview of the NGSI standard

2.3. NEXOF-RA

As stated on its home page [5], the mission of NEXOF-RA is to address comprehensive service-oriented software system architectures and specifications. A first phase is to create a Reference Architecture for NEXOF. This will be followed by a proof of concept to validate this architecture and a roadmap for the adoption of NEXOF as a whole.

To specify the Reference Architecture, an open process has been defined to allow the involvement of all relevant initiatives and organizations concerned with the Future of the Internet.

2.3.1. CONTRIBUTION TO NEXOF-RA

In this first phase of NEXOF-RA, the OPEN Project submitted some ideas regarding the subjects adaptation and service registration. Clausthal participated at four sessions of the kick-off meeting of NEXOF-RA and contributed ideas from OPEN to the discussions about the Reference

Architecture. The ideas are explained in detail in the following position papers which summaries can be found in **Errore. L'origine riferimento non è stata trovata.** C:

Position Paper 1: Definition of Infrastructure Services

Position Paper 2: Design Time Service Composition

Position Paper 3: Service Description

Position Paper 4: Service Discovery

2.4. OPEN SERVICES GATEWAY INITIATIVE

The Open Services Gateway initiative (OSGi) Alliance is an independent non-profit corporation comprised of technology innovators and developers. According to its home page, www.osgi.org, it is focused on the interoperability of applications and services based on the OSGi component integration platform. The alliance provides specifications, reference implementations, test suites and certification for this platform. The OSGi Platform [6] is a universal middleware enabling the development of component-based Java applications. OSGi technology provides a service-oriented, component-based environment for developers, and offers standardized ways to manage the software lifecycle. These capabilities greatly increase the flexibility of a wide range of applications and devices that use the Java platform.

In OSGi components are called *bundles*. Such OSGi bundles come as JAR-files. OSGi has the following advantages for the development of component-based applications:

- The OSGi runtime environment needs only a few kilobytes of memory which makes it possible to run applications even on embedded devices.
- The development of bundles is easy and not burdened with too many middleware aspects. In fact, standard Java code can be converted into a bundle quit easily. Furthermore, the Eclipse IDE offers the functionality to run bundles directly without the need to install them first in an OSGi framework.
- There exist several open source OSGi framework implementations for different platforms and devices like Knopflerfish [7], Concierge or Oscar.
- OSGi offers already some functionality for the integration of new components at runtime, as well as the possibility to migrate code from one device to another.

2.4.1. OSGI ALLIANCE: ORGANIZATION OF WORK

OSGi Alliance members determine how and when the OSGi Service Platform and specifications will be upgraded, expanded and enhanced, which can benefit the production and provisioning of member companies' offerings.

Vertical and cross-industry needs are served through "expert groups" that tailor the platform without compromising the integrity of the OSGi Service Platform architecture. Current expert groups include the Mobile Expert Group, Vehicle Expert Group and Core Platform Expert Group; members propose and establish charters for new EGs [6].

2.4.2. REALIZATION OF THE PACMAN PROTOTYPE USING OSGI

OSGi was used to implement the OPEN Context Management Framework (CMF) and an OPEN prototype, the PACMAN game. In this section we describe the PACMAN implementation, which benefited from the OSGI features described in the previous section. Similar benefits accrued to the CMF.

The ClU realized the PacMan prototype described in D4.3 [8] by using OSGi. Thus, the game as well as the middleware is implemented in Java. In general the PacMan game consists of two parts:

- The *PacManGame* component
- The Migration Controller

The *PacManGame* component is running on a Personal computer (desktop device) and consists of several subcomponents distinguished, among others, into user interface subcomponents and application logic subcomponents. It has two configurations as introduced in deliverable D4.1 [9]. As no *AccelerationSensorIf* (where 'If' means 'interface') is available, the component runs in a configuration as indicated by the green check in Figure 2.

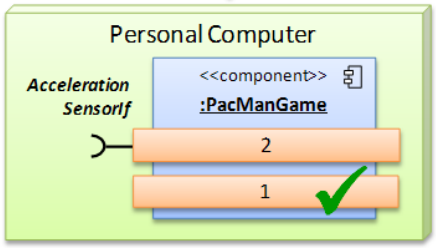

Figure 2: PacMan component running on PC

The migration of the *PacManGame* from the desktop device to the target device is done by the Migration Controller. The target device runs the Migration Controller which receives the code of the *PacManGame*, and restarts it and adapts its behavior to the device. While adapting, the component may change the configuration.

The prototype comes as a set of OSGi bundles which can be installed and executed in arbitrary OSGi runtime environments. The Migration Controller and the PacManGame are realized by one or more OSGi bundles. The Migration Controller comes as MigrationControl.jar.

2.4.3. DESCRIPTION OF COMPONENTS USING OSGI

The Declarative Services (DS) is a part of OSGi, which supports the wiring of services across bundles [10]. DS allows the definition of services via metadata described by extensible markup language (XML) [11]. This can be done without having any dependency on the OSGi platform, e.g. services can be defined as a *Plain Old Java Object* (POJO). Therefore, these services can be tested without the OSGi runtime. When using DS, the OSGi framework controls the service, and keeps track of its use by consumers, so that a service will not be removed, if it is being used. The OSGi service component is also responsible for starting and stopping the declarative services which are also called service components.

Service Components consist of a XML description, which describes the component, and an object (Component Instance). The XML conforms to the schema described in [12]. The information about the service component is included in the component description. This is, for instance, the class name of the component instance and the service interface. A reference to the component description is maintained in the MANIFEST.MF. This is read by the OSGi runtime and the service is created. The following XML [13] is an example description of a component:

```
<?xml version="1.0" encoding="UTF-8"?>
<component name="<name of the service>">
    <implementation class="<full qualified name of the
implementing java class>"/>
    <service>
        <provide interface="<full qualified name of the java
interface>"/>
    </service>
    />
</component>
```

2.5. INTERNET ENGINEERING TASK FORCE

According to its web site, www.ietf.org, the Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. It is open to any interested individual.

The actual technical work of the IETF is done in its working groups, which are organized by topic into several areas (e.g., routing, transport, security, etc.). The IETF working groups are grouped into areas, and managed by Area Directors. The Network working group has issued a document that specifies an Internet standards track protocol for the Internet community, called Request for Comments 1928 (RFC 1928). The following section describes the usage of this standard in the OPEN Mobility Support Module.

2.5.1. SOCKSV5 USAGE IN THE OPEN MOBILITY SUPPORT MODULE

To address the increased usage of firewalls combined with the need for more sophisticated application level protocols designed to facilitate global information discovery, the SOCKSv5 protocol was designed and proposed in RFC 1928. The SOCKSv5 protocol provides a framework for client-server applications in both the TCP and UDP domains to conveniently and securely use the services of a network firewall. The protocol is conceptually a "shim-layer" between the application layer and the transport layer.

In D3.3 [14] and later D3.4 [15] a solution to network session mobility based on SOCKSv5 was proposed and implemented in a prototype. A modified SOCKSv5 proxy server called the Mobility Anchor Point (MAP) is placed in the network path between the client devices and the application servers. The OPEN middleware running on the client device provides a socket library to non-SOCKSv5 applications, through which the application connects to MAP using SOCKSv5. As a result, all network traffic is then going through the MAP. If a migration between a source and a target client device occurs, the network traffic going to and from the source device can be redirected to the target device by the MAP. This makes the migration transparent to the application server.

Our proposed solution in OPEN does not change the SOCKSv5 protocol in RFC 1928. The implementation of the SOCKSv5 proxy server, however, is modified. A non-modified proxy will only forward and receive traffic to and from the same SOCKSv5 client while the modified proxy make it possible to redirect the traffic from one client to another. The modification includes an interface for the MAP to query the OPEN Migration Server, and also a change in the SOCKSv5 proxy connection management to allow for connection redirection. All changes are transparent to the application server and its clients: the MAP will work as normal SOCKSv5 proxy for non-OPEN aware clients. Therefore, our proposed solution should not introduce any compatibility issues with the current SOCKSv5 protocol.

2.6. KHRONOS

The Khronos Group is a “member-funded consortium focused on the creation of royalty-free open standards for parallel computing, graphics and dynamic media on a wide variety of platforms and devices” [16]. All Khronos members are able to contribute to the development of Khronos API specifications, are empowered to vote at various stages before public deployment, and get early access to specification drafts and conformance tests.

There are several working groups in Khronos that cover topics like:

- Mobile and embedded platform and OS abstraction APIs. This includes, e.g., operating system resource abstraction, file system access and mathematical operations
- Cross-platform computation
- Streaming media
- File formats

2.6.1. POTENTIAL FUTURE CONTRIBUTION TO KHRONOS

In OPEN NEC Laboratoires Europe (NLE) worked on a topic covered by Khronos, namely, APIs for rendering graphics on multicore devices.

NLE considers Khronos to be an important standardisation body with regard to multicore technologies. However, NLE are currently not member of the Khronos group and therefore do not participate in Khronos standardisation activities. Possible future participation will depend not at least on the acceptance and take-up of NLE's multicore technology by the scientific community in projects such as OPEN.

3. DISSEMINATION ACTIVITIES

This section gives an overview of the dissemination strategies of all partners in the period from February 2009 (M13) to January 2010 (M24). It reflects dissemination in the scientific community and beyond. Academic partners also look ahead to events in the scientific community which are considered to be opportunities for dissemination as of January 2010. Past dissemination activities are listed in D7.2 [17] and D7.4 [18].

3.1. SCIENTIFIC COMMUNITY

OPEN can potentially contribute to several scientific communities. The main means of contribution are the publication of conference and journal contributions, the organization of events and workshops as well as direct contacts to particular research groups. We start with the dissemination activities accomplished by the academic partners: Clausthal University, Aalborg University and CNR-ISTI.

3.1.1. CLAUSTHAL UNIVERSITY

As the main research of Clausthal University is on application logic configuration using context information, they have successfully submitted the following conference contributions:

> D. Niebuhr, A. Rausch. Guaranteeing Correctness of Component Bindings in Dynamic Adaptive Systems, Proceedings of the 35th EUROMICRO Conference on Software Engineering and Advanced Applications (SEAA), Track on Service and Component Based Software Engineering (SCBSE).
>
> D. Niebuhr, A. Rausch, C. Klein, J. Reichmann, R. Schmid. Achieving Dependable Component Bindings in Dynamic Adaptive Systems – A Runtime Testing Approach, Proceedings of the 3rd Third IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO 2009).
>
> A. Rausch, D. Niebuhr, M. Schindler, D. Herrling. Emergency Management System, Proceedings of the International Conference on Pervasive Services 2009 (ICSP 2009).

In addition to, and on the basis of, the conference publications, Clausthal University plans to publish a doctoral thesis within the OPEN project. It will basically deal with adapting the component instance wiring during runtime based on context information.

Clausthal University presented the OPEN middleware at the following events:

Event	Date and Location	Activity
CeBIT	3- 8 March, 2009 Hannover, Germany	Presentation of the middleware

Informatics days	19 – 21 June, 2009 Clausthal-Zellerfeld University, Germany	Presentation of the middleware
ICSP 2009	16 – 17 May, 2009 Vancouver, Canada	Presentation of the middleware

Table 1: Clausthal University: Dissemination

3.1.2. AALBORG UNIVERSITY

Aalborg University has a focus on IP based communication networks, especially regarding performance and dependability aspects. Aalborg University disseminated the OPEN ideas during the following events:

Event	Date and Location	Activity
Open house	4 March, 2009 Aalborg, Denmark	Show of OPEN demo for a full day for attracting potential students from highschool to the engineering education
Forskningens Døgn (A day of Research)	22 – 24 April, 2009 Aalborg, Denmark	3 lectures presenting OPEN Project and related research
Media on the Move	5 May, 2009 Aalborg, Denmark	1 invited talk about OPEN project and concept

Table 2: Aalborg University: Dissemination

3.1.3. CNR-ISTI

CNR-ISTI mainly contributes to the areas of Human-Computer Interaction and Ubiquitous Systems. They published in these areas the following journal papers:

> Paternò F, Santoro C. and Spano L.D. . MARIA: A universal, declarative, multiple abstraction-level language for service-oriented applications in ubiquitous environments, ACM Transactions on Computer-Human Interaction (TOCHI), Volume 16 , Issue 4 (November 2009) .
>
> Paternò F., Santoro C., Scorcia A. Ambient intelligence for supporting task continuity across multiple devices and implementation languages. In: Computer Journal, Oxford University Press on behalf of The British Computer Society, 2009.

F.Paternò, G.Zichitella, End-User Customization of Multi-Device Ubiquitous User Interfaces accepted for the 5th international Workshop on Model-driven Development of Advanced User Interfaces, 2010.

As a member of the Open Alliance for Service Front Ends [19] CNR-ISTI has presented the ideas from OPEN at the ServiceWave 2008 SFE workshop that took place on the 13th of December 2009 in Madrid, Spain.

Event	Date and Location	Activity
EUD 2009 Conference	2 - 4 March, 2009 Siegen, Germany	Presentation: Cicero Designer: an Environment for End-User Development of Multi-Device Museum Guides
Future Internet Assembly + SFE Alliance Meeting	13 - 14 May, 2009 Prague, Czech Republic	Presentation: OPEN Project
EU Collaboration Meeting	9 -13 June, 2009 Bruxelles, Belgium	Presentation: OPEN Project
Interracion 2009	September 2009 Armenia, Columbia	Invited Talk on Migratory User Interfaces in Multi-device Environments
Mobile HCI	September 2009 Bonn, Germany	Presentation: OPEN Project

Table 3: CNR-ISTI: Dissemination

Furthermore, CNR-ISTI is hosting and co-organizing a workshop together with the W3C Model-Based User Interface Incubator Group (MBUI XG). This workshop on Future Standards for Model-Based User Interfaces is going to take place from the 13th to the 14th of May in Rome, Italy.

It will focus on opportunities and challenges for:

- A survey of existing UI design tools and opportunities for introducing Model-Based solutions.
- Demonstrating the advantages of Model-Based approaches and their application to key scenarios.
- Standardization of Model-Based and Model-Driven Conceptual Frameworks for the development of context-sensitive User Interfaces, e.g. the Cameleon Reference Framework.
- Standardization of the semantics and syntaxes (e.g. XML syntaxes) of the different models (Task, Abstract UI, Concrete UI).
- Relationship and complementarities with existing standards (ANSI/CEA-2018, MDA, XForms, HTML, Browser scripting APIs, ...),

- Relationship between Model-based approaches and current work on UI controls and Ajax library APIs for use in design-time and run-time environments.
- The role of Model-Based approaches for improving the quality and reducing errors in application user interfaces.
- The role of Model-Based approaches for improving the accessibility of application user interfaces
- The role of Model-Based approaches for reducing the costs of developing and delivering Web application user interfaces in the face of wide variations in devices, modes of interaction and software.
- The role of Model-Based approaches for nomadic user interfaces where users switch devices in the midst of using an application.
- Relationship between Model-Based approaches and the current state of the practice, for example, XML languages for the description of concrete user interfaces for the desktop environment.

3.2. INDUSTRIAL GROUPS AND OTHER DISSEMINATION CHANNELS

SAP Research organized a couple of meetings with SAP´s group working on Performance Optimization Applications (POAs) in order to plan a project for the exploitation of OPEN results for POAs. The meetings took place on the 24th of April 2009, 13th of July 2009 and 3rd of February 2010. The topic of each meeting was to explore the possibilities for a context server for POAs. The discussions are still going on and a final plan is expected to be elaborated at the middle of this year.

3.3. ALL PARTNERS

A further dissemination channel for all partners is the publishing of a book that will summarize the work and results from OPEN. The outline for the book is the following:

1. Introduction (CNR)

2. Where it's useful to migrate, and what is specific to that environment and adaptation opportunities from the Mobile Operator perspective by Vodafone

3. State of the art (Aalborg and CNR)

4. The OPEN Migration Platform Architecture (NEC)

5. User interface Migration based on the Use of Logical Descriptions (CNR)

6. Service Migration Network Support (Aalborg)

7. Application logic reconfiguration based on application and component descriptions (Clausthal)

8. Design and development of a migratory application based on MSP (Arcadia)

9. Migratory services in an emergency scenario (SAP)

10. Integration of User Interface and Application Logic Migration (the PacMan Example)

11. Consideration of Multicore Capabilities in Migration Environments (NEC)

12. The usability evaluation and the programmability assessment of migration (Vodafone and Technological partners)

12. Potential exploitation

14. Conclusions

The OPEN consortium is going to apply for the Human-Computer Interaction Series of Springer, however other well-known publishers will be also taken in consideration.

4. CONCLUSIONS

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 and that is why they are the main scope of the OPEN project. Migratory applications, as defined by OPEN, are applications which are able to follow users, sense the users' context (where context is any information that can be used to characterize the situation of an entity), and adapt to the changing context, e.g., set of available devices and networks, while also preserving the continuity of application sessions, thereby ensuring the continuity of the tasks supported by the application.

OPEN contributed to standards bodies in order to advance the goal of overcoming limitations when moving around and interacting with applications through different devices.

The W3C contribution is primarily concerned with User-Interface Logical Descriptions and Adaptation with the goal of supporting migration and adaptation of web applications.

The OMA contribution is mainly concerned with the context information, which is maintained in the CMF, and which is needed to enable migration.

Use of the IETF RFC 1928 enabled session mobility for users, so that they don't need to restart the migrated application.

Use of OSGi enabled the realization of a more flexible CMF and applications.

As a whole, the contributions OPEN made to standards bodies and the standards contribution to OPEN are both of great significance for the advancement in the development of migratory applications.

Further contributions of OPEN, that disseminate the project activities and results, are the contributions to conferences, workshops, and other projects. Another dissemination channel will be the publishing of a book that summarizes the main ideas and results from the project.

BIBLIOGRAPHY

[1] Open partners. *D7.3: Report on OPEN technology for standardisation*. 2008.

[2] http://www.w3.org/Help/

[3] http://www.w3.org/Consortium/activities

[4] http://www.w3.org/2007/uwa/

[5] http://www.nexof-ra.eu/

[6] www.osgi.org

[7] http://www.knopflerfish.org/index.html

[8] Open partners. *D4.3: Prototype for application logic reconfiguration*. 2009.

[9] Open partners. *D4.1: Solutions for application logic reconfiguration.* 2009.

[10] http://www.eclipse.org/resources/resource.php?id=378

[11] http://www.vogella.de/articles/OSGi/article.html#declarativeservices

[12] http://go2.wordpress.com/?id=725X1342&site=hexor2k.wordpress.com&url=http%3A%2F%2Fwww.osgi.org%2Fxmlns%2Fscr%2Fv1.0.0%2Fscr.xsd

[13] http://hexor2k.wordpress.com/2008/08/27/osgi-declarative-services/

[14] Open partners. *D3.3: System support for application migration*. 2010.

[15] Open partners. *D3.4: Final communication and context management solution for migratory services.*2010.

[16] www.khronos.org

[17] Open partners. *D7.2: Dissemination and Exploitation and Collaboration Plan*. 2008.

[18] Open partners. *D7.4: Dissemination and Exploitation and Collaboration Plan*. 2009.

[19] http://sfe.morfeo-project.org

A. APPENDIX - CONTRIBUTION TO W3C ACTIVITIES IN THE AREA OF MODEL-BASED USER INTERFACE DESIGN

The HIIS Laboratory of CNR-ISTI has been one of the founding members of the Model-Based User Interfaces Incubator Group (MBUI-XG) in W3C. During the last year the MBUI-XG has evaluated research on MBUIs, including end-to-end models that extend beyond a single Web page, and has assessed its potential as a framework for developing context-sensitive Web applications. This work has produced a report, which has been published by W3C on May 6 2010 and is available at http://www.w3.org/2005/Incubator/model-based-ui/XGR-mbui-20100504/

This report gives an overview of the main results achieved by such an Incubator Group. This publication is part of the Incubator Activity, a forum where W3C Members can innovate and experiment. W3C has also organized a Workshop on Future Standards for Model-Based User Interfaces (13-14 May 2010, Rome) to identify opportunities and challenges for new open standards in this area, particularly concerning the semantics and syntaxes of task, abstract and concrete user interface models. The workshop is hosted by CNR-ISTI.

In the report the work carried out in WP2 in the OPEN project is indicated as an important use case of model-based approaches for user interfaces. Indeed, migratory user interfaces are interactive applications that can transfer among different devices while preserving the state and therefore giving the sense of a non-interrupted activity. The basic idea is that devices that can be involved in the migration process should be able to run a migration client, which is used to allow the migration infrastructure to find such devices and know their features. Such client is also able to send the trigger event to the migration server, when it is activated by the user. At that point the state of the source interface will be transmitted to the server in order to be adapted and associated to the new UI automatically generated for the target device.

Figure 13 shows how the abstraction layers are exploited to support migratory UIs, by showing the various activities that are done by the Migration Server. This solution has been developed in the EU OPEN Project [OPEN]. First of all the migration approach supposes that various UI models at different abstraction levels are associated to the various devices involved in a migration: such UI models are stored/manipulated centrally, in the Migration Server.

The current architecture assumes that a desktop Web version of the application front-end exists and it is available in the corresponding Application Server: this seems a reasonable assumption given the wide availability of this type of applications. Then, from such final UI version for the desktop platform, the Migration Server automatically generates a logical, concrete UI description for the desktop platform through a reverse-engineering process. After having obtained such a concrete UI description for the desktop platform, the Migration server performs a semantic redesign of such Concrete User Interface [PSS08] for creating a new, concrete, logical description of the UI, adapted to the target device.

The purpose of the semantic redesign is to preserve the semantics of the user interactions that should be available for the user but to adapt the structure of the UI to the resources available in

the target device. It may happen that some task is not supported by the target device (e.g. a long video cannot be rendered with a limited mobile phone).

For all the tasks that can be supported the semantic redesign identifies concrete techniques that preserve the semantics of the interaction but supports it with techniques most suitable for the new device (for example in mobile devices it will replace interactors with others that provide the same type of input but occupying less screen space). In a similar way also page splitting is supported: when there are pages too heavy for the target device they are split taking into account their logical structure so that elements logically connected remain in the same page. Thus, the groupings and relations are identified and some of them are allocated to newly created presentations so that the corresponding page can be sustainable by the target devices.

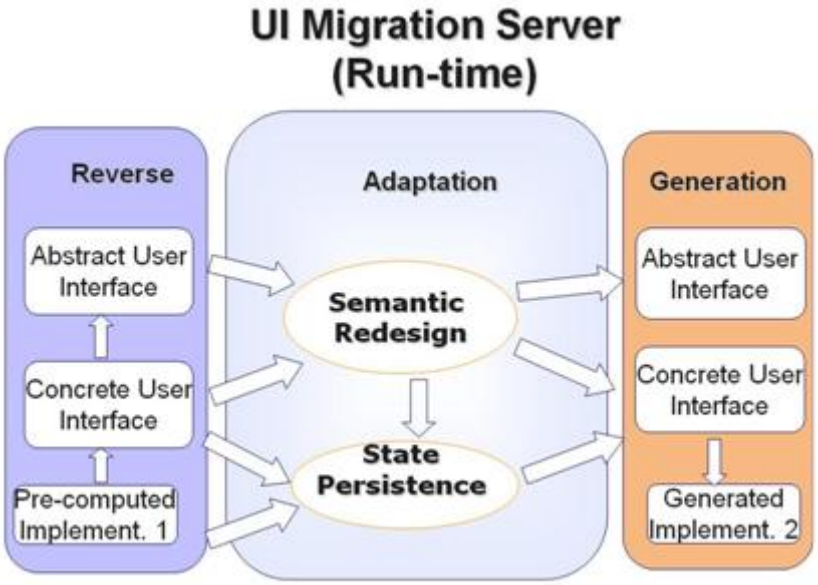

Figure 13 - The relationships among abstraction layers supporting migration

References

[OPEN]

*OPEN (**O**pen **P**ervasive **E**nvironments for migratory i**N**teractive Services) Project* (EU ICT STREP FP7-ICT-2007-1 N.216552) http://www.ict-open.eu/

[PSS08]

Fabio Paternò, Carmen Santoro, Antonio Scorcia, *Automatically adapting web sites for mobile access through logical descriptions and dynamic analysis of interaction resources*. AVI 2008: 260-267

B. APPENDIX - OMA CONTRIBUTION WITH RESPECT TO CONTEXT PROCESSING

NEC has contributed the following documents

- OMA-REQ-NGSI-2009-0037-CR_Context_Management.doc
- OMA-REQ-NGSI-2009-0038-CR_Context_Information.doc
- OMA-REQ-NGSI-2009-0039-CR_Context_Management_Security.doc
- OMA-ARC-NGSI-2009-0038-CR_Context_Description
- OMA-ARC-NGSI-2009-0038R01-CR_Context_Description
- OMA-ARC-NGSI-2009-0046-INP_CTX_Query_and_Subscription
- OMA-ARC-NGSI-2009-0047-INP_CXT_Provisioning
- OMA-ARC-NGSI-2009-0047R01-INP_CXT_Provisioning
- OMA-ARC-NGSI-2009-0048-INP_CTX_Announcement_and_Discover
- OMA-ARC-NGSI-2009-0048R01-INP_CTX_Announcement_and_Discover
- OMA-ARC-NGSI-2009-0058-INP_CR_TS_CTX_section_1_to_4
- OMA-ARC-NGSI-2010-0005-CR_Changes_on_the_queryContext_operation
- OMA-ARC-NGSI-2010-0005R01-CR_Changes_on_the_queryContext_operation
- OMA-ARC-NGSI-2010-0005R02-CR_Changes_on_the_queryContext_operation
- OMA-ARC-NGSI-2010-0006-CR_Changes_on_the_subscription_related_operations
- OMA-ARC-NGSI-2010-0007-CR_Changes_on_the_notifyContext_operation
- OMA-ARC-NGSI-2010-0008-CR_Changes_on_the_updateContext_operation
- OMA-ARC-NGSI-2010-0008R01-CR_Changes_on_the_updateContext_operation
- OMA-ARC-NGSI-2010-0008R02-CR_Changes_on_the_updateContext_operation
- OMA-ARC-NGSI-2010-0008R03-CR_Changes_on_the_updateContext_operation
- OMA-ARC-NGSI-2010-0015-INP_Context_Element_structures
- OMA-ARC-NGSI-2010-0016-CR_TS_Context_Operation_Scopes
- OMA-ARC-NGSI-2010-0037-CR_TS_Context_notifyContext_bugFix
- OMA-ARC-NGSI-2010-0037R01-CR_TS_Context_notifyContext_bugFix
- OMA-ARC-NGSI-2010-0040-INP_Context_Restrictions___Notify_Conditions
- OMA-ARC-NGSI-2010-0041-CR_TS_Context_ServiceDescription
- OMA-ARC-NGSI-2010-0041R01-CR_TS_Context_ServiceDescription
- OMA-ARC-NGSI-2010-0041R02-CR_TS_Context_ServiceDescription
- OMA-ARC-NGSI-2010-0048-CR_UpdateContextResponse_and_StatusCode
- OMA-ARC-NGSI-2010-0050-CR_UpdateContext_operation_description

C. APPENDIX - POSITION PAPERS

DEFINITION OF INFRASTRUCTURE SERVICES

Title: A Component Model supporting Proactive Configuration of Service-Oriented Systems

Summary

Components within Service-oriented Systems require a mechanism to get in touch with offered services. A traditional approach from the field of Web Services is a discovery agency provided by the infrastructure, where service providers register and service requestors submit their queries. In the field of dynamic adaptive systems we deal with systems which change their behavior according to the needs of their users during runtime based on context information. Therefore, the wiring of service providers and service requestors – known as the system configuration – may change often. As a consequence of the dynamics the service requestor should not take care about the service discovery. Instead we propose to have a configuration component available within the infrastructure, capable of wiring the system configuration.

DESIGN TIME SERVICE COMPOSITION

Title: A Component Model supporting Proactive Configuration of Service-Oriented Systems

Summary

Components within Service-oriented Systems require a mechanism to get in touch with offered services. A traditional approach from the field of Web Services is a discovery agency provided by the infrastructure, where service providers register and service requestors submit their queries. In the field of dynamic adaptive systems we deal with systems which change their behavior according to the needs of their users during runtime based on context information. Therefore, the wiring of service providers and service requestors – known as the system configuration – may change often. As a consequence of the dynamics the service requestor should not take care about the service discovery. Instead we propose that the system configuration should be computed from the required and provided services automatically.

SERVICE DESCRIPTION

Title: A Component Model supporting Proactive Configuration of Service-Oriented Systems

Summary

Components within Service-oriented Systems require a mechanism to get in touch with offered services. A traditional approach from the field of Web Services is a discovery agency provided by the infrastructure, where service providers register and service requestors submit their queries. In the field of dynamic adaptive systems we deal with systems which change their behavior according

to the needs of their users during runtime based on context information. Therefore, the wiring of service providers and service requestors – known as the system configuration – may change often. As a consequence of the dynamics the service requestor should not take care about the service discovery. Instead we propose a component model enabling proactive configuration of service-oriented systems which will be described in this paper.

SERVICE DISCOVERY

Title: A Component Model supporting Proactive Configuration of Service-Oriented Systems

Summary

Components within Service-oriented Systems require a mechanism to get in touch with offered services. A traditional approach from the field of Web Services is a discovery agency provided by the infrastructure, where service providers register and service requestors submit their queries. In the field of dynamic adaptive systems we deal with systems which change their behavior according to the needs of their users during runtime based on context information. Therefore, the wiring of service providers and service requestors – known as the system configuration – may change often. As a consequence of the dynamics the service requestor should not take care about the service discovery. Instead we propose, that the infrastructure queries each component, which services it requires and delivers service implementations.