OPEN Project

STREP Project FP7-ICT-2007-1 N.216552

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Title of Document:	Report on OPEN technology for standardisation
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Affiliation(s):	All Partners
Date of Document:	Wednesday, November the 12th , 2008
OPEN Document:	Deliverable 7.3
Distribution:	INTERNAL
Keyword List:	
Version:	

OPEN Partners:

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1. Introduction

This document is about standardization activities relevant to the OPEN project. In order to identify such standard bodies, we have selected them according to the following criteria:

- The standard 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 standard body, some involvement by OPEN member companies should already be in place.

Based on these criteria, we chose to closer review OPEN technology for the Internet Engineering Taskforce, Dublin Core Metadata Initiative, Open Mobile Alliance, possible and ongoing connections to the activities of the World Wide Web Consortium. The document is organised along these bodies.

In addition, the activity of other organisations (eg.: OSGI Alliance, OMG, ..) whose work can be relevant for OPEN Project has also been described. Finally, we focus on the technologies that could be delivered by the OPEN Project and which can be possible object of standardisation.

2. W3C

W3C - The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential. W3C is a forum for information, commerce, communication, and collective understanding.

2.1 W3C Semantic web Activity

The Semantic web group within the W3C could be of great interest to the context management part of OPEN, since it relates a lot to how context is modeled as information, and how it is being accessed. The W3C working group has several sub groups which could be of great interest to either study or follow from an OPEN perspective. In the following, these subgroups are described in details.

RDF Data Access Working Group

Current status:

The work of this group has been focused on developing a data access language, SPARQL, for RDF. Working group concluded on Nov. 30, 2007.

Relevance and participance:

The access language as defined in the IST project MAGNET Beyond, Context Access LAnguage (CALA) provides a very efficient way for applications to gain access to the needed information. One of the strong points in this query language is that it allows scoped queries in terms of e.g. network domain (node local, cluster or inter cluster network), and other types as time based or geographical scopes are envisioned but currently not implemented. The CALA has already shown its power in this framework, and as such further elaboration and exploration for different types of queries and scoping mechanisms could be of potential interest.

OPEN could/should investigate what is the strong/downsides of the SPARQL standard versus the existing implementation of the CALA, and investigate the requirements from OPEN perspective to access of context information.

Rule Interchange Format (RIF) working group

Current status:

This working group is focused on development of interchangeable rules for machine based decisions and inference. The work is ongoing and several drafts have already been launched, such as BLD, FLD, RDF+OWL and more.

Relevance and participance:

In OPEN we envision some context sensitive components, e.g. for triggering migration, which would be driven by rules and policies depending on context information. In this respect, it could be of great interest to review what has been

done within this working group, potentially adapt one or more of these ideas and concept to the OPEN solution.

Web Ontology Language (OWL)

Current status:

Work started on the OWL in 2004 and it is still active in refining and extending the 2004 version of OWL.

Relevance and participance:

The external modeling framework used in the context management framework is based on the OWL DL version, but only to the level that it is being used to keep track of entities subjected for monitoring. There is currently no real effort done in terms of inference logic that uses the ontology in the context management framework, however, future extensions may implement this as needed. However, the models used in the framework must relate to entities within a specific structure with the MAGNET entity as the top entity, which is specialized to the MAGNET project, for which in OPEN we would need to consider context specifically related to service migration leading to ontology work specific to this concept.

The potential development and investigation of context and context ontology for service migration could be a contribution from the OPEN project.

2.2 W3C - Ubiquitous Web Applications Working group

Current status:

The Ubiquitous Web Applications Working Group seeks to simplify the creation of distributed Web applications involving a wide diversity of devices, including desktop computers, office equipment, home media appliances, mobile devices (phones), physical sensors and effectors (including RFID and barcodes). This will be achieved by building upon existing work on device independent authoring and delivery contexts by the former DIWG (Device Independence Working Group), together with new work on handling remote events, device coordination and intent-based events. Among the relevant activities of this group there is that on the Delivery Context Ontology, which is an OWL ontology of key properties for content adaptation and is being developed in cooperation with the Device Description working group and the Open Mobile Alliance (OMA). The aim is to provide a common basis for a number of programming interfaces for accessing the delivery context. Another relevant activity is that on device coordination and resource binding, which involves the means to identify devices and describe the services that they provide, together with a means to search for services and bind to them. The working group started in 2007 and it is currently active.

Relevance and participation

This working group aims toward the extension of the web to enable distributed applications. In this work personalization and delivery of context is an interesting

aspect that could be addressed by the OPEN project in terms of context management. Since OPEN is targeting migratory interactive services in multi-device environments, interesting synergies between these two activities can take place. The work is much aimed toward web applications: since these are also under consideration in OPEN, this work could be interesting to follow and potentially support as well.

In particular, in this working group there are various activities very relevant for the OPEN project because they concern Web application adaptation to different devices; ontologies to model context of use, and device coordination.

2.3 W3C – Web Application Adaptation

Current status:

The goal is to provide a framework for authoring distributed Web applications that minimizes the costs for dealing with a wide diversity of devices through the use of declarative models encompassing both clients and servers. This should be mainly obtained through two standards: DIAL combines a number of existing markup languages (XHTML2, XForms and DISelect) into an authoring language that is designed for content adaptation. DISelect provides authors with the means to select different markup according to the delivery context. DISelect should have the ability to capture all the content resources offered by an author, who should not be constrained to a single delivery target. Instead, the author should be able to provide as many resources and representations as necessary/possible to cover the anticipated/desired delivery contexts. The Recommendation should be described as “how to create a DI language” (or words to that effect) rather than “here is a DI language”. As part of this deliverable, UWA should produce a Recommendation that formalizes the process of integrating DISelect as a language module, using XHTML 1.1 with XForms (and possibly Role and AccessKey) to illustrate how these instructions are applied. This new DI language is intended to be illustrative, though obviously we hope that it would also become a common implementation. Embedding DISelect within markup is just one way in which contextually-sensitive decisions can be represented. It should be possible to make use of DISelect external to the raw content (fragments). An approach such as that adopted by CSS should be considered (as suggested by DIAL Lite), though other mechanisms are possible (e.g. separate template files using XInclude with DISelect to control inclusion). Regarding DIAL, W3C is realizing that the current DIAL presents some challenges for adoption, notably the dependence on XHTML2. In contrast, the relative simplicity of DISelect makes it possible to conceive its integration with alternative host languages, particularly XHTML 1.x, though in theory any XML host language such as SVG. To this end, the UWA should revise DIAL, characterizing the current DIAL as a specific example of combining DISelect with a host language, and separately giving the necessary steps and valuable guidelines regarding the introduction of DISelect into other host languages.

Relevance and participation

In OPEN WP2 Web page adaptation is obtained through a semantic redesign module, which includes rules for transforming Web pages described through logical XML descriptions. We will compare this solution with the standard for adaptation under development in the W3C. We also noted interesting work on distributed DOM http://www.w3.org/2007/uwa/editors-drafts/ddom/ddom-20070810/ whose main purpose is to describe a means to support distributed XML Document Object Models via an XML serialization of DOM events. This enables events raised on one DOM tree to be replicated on a remote copy of that tree. This mechanism can provide a way to take the state of a web page and move it to a new page for a different device, which is useful for migratory web applications. The Delivery Context Ontology under development in the W3C / UWA provides a description of the elements that are in the context of use for the purpose to support adaptation. We plan to compare it with the ontology used in the OPEN Context Manager.

2.4 W3C – Model-Based User Interface

Current status:
The mission of the Model-based User Interfaces Incubator 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. The Model-based User Interfaces Incubator Group will evaluate research on model-based design, including end to end models that extend beyond a single Web page, and assess its potential as a framework for developing Web applications. This will involve consideration of use cases and requirements, the role of existing standards such as SCXML, DIAL/XHTML2 and XForms, and making proposals for new work on standards where appropriate. The group had the first meeting on the 24th of October 2008. CNR-ISTI is one of its initiators.

Relevance and participation
In order to address the variability of interaction resources in the devices available for migration it is important to have logical user interface descriptions that allow the capture and represent the semantics of the user interface elements, which can then be implemented in different ways depending on the resources available still preserving such semantics. For this purpose, the part of the OPEN platform dedicated to the user interface migration exploits logical interface description languages developed at ISTI-CNR, which can also provide useful input for this standardization activity. In particular, in OPEN we will refine XML description languages for user interfaces at various abstraction layers to support adaptation and interoperability across devices with various interaction resources. In addition we will develop both reverse and forward engineering transformations among such various abstraction layers.

In addition we will develop descriptions of context of use (in terms of devices, users, and environments) and rules to take into account it in order to define when activate migration or how to perform user interface adaptation.

2.5 W3C – Accessibility / ARIA

Current status:

Accessibility of Web content to people with disabilities requires semantic information about widgets, structures, and behaviors, in order to allow Assistive Technologies to make appropriate transformations. ARIA (http://www.w3.org/WAI/PF/aria/) provides an ontology of roles, states, and properties that set out an abstract model for accessible interfaces and can be used to improve the accessibility and interoperability of Web Content and Applications. This information can be mapped to accessibility frameworks that use this information to provide alternative access solutions. Thus, it provides a taxonomy of web page contents that deliver useful information regarding their semantics that can be extended to support user interface adaptation in migratory interactive services.

Relevance and participation

In general, the user interfaces generated by the OPEN platforms should comply with accessibility guidelines because they allow access to everybody, included the disabled. The work in ARIA can be interesting because of the Role attribute, which can be used in order to provide more semantic information of the role of each content element. Thus, facilitating the work of the transformations supporting adaptation to different platforms.

3. Internet Engineering Task Force

The Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors, and researchers concern with the evolution of the Internet architecture. It is open to any interested individual.

3.1 Organization

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.). For OPEN the areas of most interest are Internet and Routing.

The areas are managed by Area Directors, or ADs. The ADs are members of the Internet Engineering Steering Group (IESG). Providing architectural oversight is the Internet Architecture Board, (IAB).

3.2 Working Groups

Within the Internet area, especially two groups could be of interest to OPEN in terms of network mobility management. These are the groups that handle mobility in IPv4 and IPv6 respectively. Depending on the specific technology that we will address in OPEN, either one will be relevant for standardization.

Also, as described in the DoW, a new protocol called Host Identity Protocol (HIP) is subject for investigation in OPEN. Investigation results here could be used to approach the hip IETF working group.

3.2.1 MIP4 (Mobility for IPv4) working group (WG)

MIPv4 is currently being deployed on a wide basis. The scope of the deployment is on a fairly large scale and accordingly, the MIP4 WG will focus on deployment issues and on addressing known deficiencies and shortcomings in the protocol that have come up as a result of deployment experience. Specifically, the working group will complete the work items to facilitate interactions with AAA environments, interactions with enterprise environments when MIPv4 is used therein, and updating existing protocol specifications in accordance with deployment needs and advancing those protocols that are on the standards track.

3.2.2 MEXT (Mobility EXTensions for Ipv6) WG

Mobile IPv6 specifies routing support which permits an IPv6 host to continue using its home address as it moves around the Internet, enabling continuity of sessions. Mobile IPv6 supports transparency above the IP layer, including maintenance of active transport level sessions. In addition, network mobility

mechanisms built on top of Mobile IPv6 allow managing the mobility of an entire network, as it changes its point of attachment to the Internet.

The primary goal of MEXT is to (A) enhance base IPv6 mobility by continuing work on developments that are required for wide-scale deployments and specific deployment scenarios. Additionally, (B) the working group will ensure that any issues identified by implementation and interoperability experience are addressed, and that the base specifications are maintained. (C) The group will also produce informational documentation, such as design rationale documents or description of specific issues within the protocol.

3.2.3 hip (Host Identity Protocol) WG

The Host Identity Protocol (HIP) provides a method of separating the end-point identifier and locator roles of IP addresses. It introduces a new Host Identity (HI) name space, based on public keys. The public keys are typically, but not necessarily, self generated.

Currently, the HIP base protocol works well with any pair of co-operating end-hosts. However, to be more useful and more widely deployable, HIP needs some support from the existing infrastructure, including the DNS, and a new piece of infrastructure, called the HIP rendezvous server.

The purpose of the hip WG is to define the minimal infrastructure elements that are needed for HIP experimentation on a wide scale.

4. Dublin Core Metadata Initiative

The purpose of the Dublin Core Metadata Initiative is an open organization engaged in the development of interoperable online metadata standards that support a broad range of purposes and business models. Their mission and scope of operation is to provide simple standards to facilitate the finding, sharing and management of information, which fits very well to the work related to manage context information in relation to service migration. Thus what could be considered a potential OPEN contribution to this organization is description and information models for context information related to the service migration process, e.g. with basis in the developed scenarios.

4.1 Organisation

The Dublin Core has defined two types of structural entities, namely

- DCMI Community and DCMI Architecture Forum with the goal to exchange of information, general discussion within a specific area of interest.
- DCMI Task Group with the goal to work on concrete task with defined deliverables.

For both types of entities, all can initiate either a community or task group by submitting a proposal to the DCMI Advisory board who officially installs the group or community.

4.1.1 Working groups potentially of interest to OPEN

4.1.1.1 - DCMI Collection Description Application Profile Task Group

This Task Group is responsible for the development of the DCMI Collection Application Profile, establishing procedures for the ownership and maintenance of the profile, and establishing procedures for the ownership and maintenance of terms used in the profile.

Since the migration process would include application and service interaction across different devices, with potential different ownership and profiles, the work carried out in this working group could be interesting to follow and/or potentially contribute to.

4.1.1.2 - DCMI Date Encoding Task Force

The purpose of the DCMI Date Encoding Task Force is to develop and implement one or more encoding formats that support the interchange of common types of dates and times as identified by the Dublin Core community.

For context, time is a key important element. The way it is represented needs to be aligned with standards, hence following what is ongoing here is of interest to the OPEN project.

4.1.1.3 - DCMI Accessibility Community

The DCMI Accessibility Community is a forum for individuals and organizations involved in implementing Dublin Core in a context of accessibility, with the objective to enhance interoperability of accessible resources through the use of Dublin Core metadata.

For access to context information, the work carried out in this community could be of potential interest to the OPEN project as the topic addressed needs also to be considered for service migration process.

5. Open Mobile Alliance (OMA)

OMA is an organization founded on the basis of the old WAP Forum and also integrating industry initiatives like:

- LIF - The Location Interoperability Forum
- SyncML Initiative
- MMS-IOP - Multi Media Messaging Interoperability Process
- Wireless Village
- MGIF - Mobile Games Interoperability Forum
- MWIF – Mobile Wireless Internet Forum

The mission of OMA is to produce specifications for enablers for mobile data services. In addition to providing specifications, OMA also takes on the role as a catalyst for consolidation of standards bodies like IETF, 3GPP, W3C, 3GPP2, JCP.

The OMA is a focal point of mobile service specifications, providing standardized middleware components and defining service enablers along with interfaces with applications.

5.1 Organization

About OMA

As described in http://www.openmobilealliance.org/index.html, OMA is the leading industry forum for developing market driven, interoperable mobile service enablers.

OMA was formed in June 2002 by nearly 200 companies including the world's leading mobile operators, device and network suppliers, information technology companies and content and service providers. The fact that the whole value chain is represented in OMA marks a change in the way specifications for mobile services are done. Rather than keeping the traditional approach of organizing activities around 'technology silos', with different standards and specifications bodies representing different mobile technologies, working independently, OMA is aiming to consolidate into one organization all specification activities in the service enabler space.

OMA is the focal point for the development of mobile service enabler specifications, which support the creation of interoperable end-to-end mobile services. OMA drives service enabler architectures and open enabler interfaces that are independent of the underlying wireless networks and platforms. OMA creates interoperable mobile data service enablers that work across devices,

service providers, operators, networks, and geographies. Toward that end, OMA will develop test specifications, encourage third party tool development, and conduct test activities that allow vendors to test their implementations.

OMA has pioneered significant consolidation of mobile service enabler organizations with the integration of the WAP Forum, Location Interoperability Forum (LIF), SyncML Initiative, MMS-IOP (Multimedia Messaging Interoperability Process), Wireless Village, Mobile Gaming Interoperability Forum (MGIF), and the Mobile Wireless Internet Forum (MWIF) into OMA. This consolidation promotes end-to-end interoperability across different devices, geographies, service providers, operators, and networks, and further supports OMA's market and user requirements focus to guide the specification work.

Significant new work in OMA is leading to the development of mobile service enablers in areas such as Device Management, Push-to-talk Over Cellular, Mobile Broadcast, and more.

The Goals of OMA

1. Deliver high quality, open technical specifications based upon market requirements that drive modularity, extensibility, and consistency amongst enablers to reduce industry implementation efforts.

2. Ensure OMA service enabler specifications provide interoperability across different devices, geographies, service providers, operators, and networks; facilitate interoperability of the resulting product implementations.

3. Be the catalyst for the consolidation of standards activity within the mobile data service industry; working in conjunction with other existing standards organizations and industry fora to improve interoperability and decrease operational costs for all involved.

4. Provide value and benefits to members in OMA from all parts of the value chain including content and service providers, information technology providers, mobile operators and wireless vendors such that they elect to actively participate in the organization.

Openness

Maintaining an open organization is key to OMA's vision for broad industry participation and adoption. Being able to see and comment on early versions of documents and contributions allows external organizations to be more involved in and aware of evolving service enablers. In support of this, OMA has established an Openness policy ensuring public availability of a vast majority of the documents produced within the OMA Technical Plenary. These documents are made available for members and non-members.

In addition to the OMA Enabler Releases which are automatically made publicly available, OMA has made available to the general public documents such as: organization charts, Working Group charters, OMA work programme, draft and approved specifications, problem reports, change requests, member input contributions and high-level test scenarios.

These documents can be found within the Release Program of the OMA Web site.

OMA Technical Plenary

The OMA Technical 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.

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 at 12 Technical Working Groups, 4 Horizontal Working Groups and the Release Planning Committee of the Technical Plenary.

OMA Membership

Since its inception in June 2002, the Open Mobile Alliance has grown to more than 300 companies representing mobile operators, device and network suppliers, information technology companies, and content providers

5.2 Working Groups

The following selected working groups are relevant for ICT-OPEN.

OMA Converged IP Messaging – this working group is relevant as they are discussing migration of messaging session across many terminals of a user. Furthermore, NEC as an ICT-OPEN partner is active in this working group.

The following working groups might have impact on ICT-OPEN, though it is unclear how technology from OPEN might relate towards them or whether ICT-OPEN can influence them:

Device Management – provide life-cycle support for applications. Can be used to provide the necessary code and activate the application.

Location – interoperability of Mobile Location Systems end-to-end.

Presence & Availability – Presence and availability services enable applications to exchange dynamic information (e.g. status, location, and capabilities) about resources (e.g. users and devices).

Games services – Specification, interfaces and protocols for network gaming.

5.2.1 OMA Converged IP Messaging (CPM)

The CPM Enabler provides common building blocks, by reuse of existing blocks and by defining new ones, to allow for both the consolidation of present and the creation of future interpersonal interactive multimedia communication services which accommodate different user experiences such as deferred and Immediate Messaging, session-based messaging, and half duplex/full duplex conferencing.

CPM supports one-to-one and one-to-many personal communications, and also communication with Applications. CPM enables the creation of services that allow users to:

- communicate without knowing what network access technology is being used,
- have parallel conversations, each with different Media Types,
- concurrently associate several devices with themselves,
- personalise their services by setting preferences to indicate, for example, which device(s) messages should be sent to,
- store any type of message and Media in the network, and
- seamlessly make the transition from legacy voice, video and messaging services such as MMS and SMS to CPM based services.

The efficient use of resources (e.g. radio bandwidth) by all of CPM's features will be taken into consideration in the design of the CPM Enabler.

The CPM Enabler will provide the following functions:

1) **User Addressing and Multi-device environment (N:M scenario)**: Aiming for best user experience in today's heterogeneous world for services, networks and devices, the CPM Enabler supports a multi-address and multi-device environment. Therefore the CPM Enabler supports the following addressing scenarios:

- Handling of single or multiple addresses on a single device.
- Handling of single or multiple addresses on multiple devices.
- Support for receiving different Media Types over different devices on a per user basis.

The above scenarios can be realized with a single or multiple access points. User preferences are a way to provide for address/device/access point selection. The user's capability for device selection in conversation can be controlled via user preferences.

2) Conversation Handling: The CPM Enabler supports the following conversation requirements:

- Immediate and Deferred Messaging (with temporary server storage of CPM Conversation and subsequent delivery; with mailbox storage, notification, and subsequent retrieval).
- 1-1, 1-N, and 1-Application CPM Conversation with the selection of any kind of Media (single or multiple).
- Add or remove Media at the invocation and any time during a CPM Conversation.
- Add or remove users at the invocation and any time during a CPM Conversation.
- Start a CPM Conversation by sending a CPM Message or establishing a CPM Session.
- Change of user's device during a CPM Conversation without disrupting the conversation.

3) Presence Support: The CPM Enabler provides a flexible interaction with the Presence Enabler. While CPM has to provide the needed support for presence, the invocation of the service itself does not require the presence service, and does not mandate an always-on condition for the CPM Users.

4) Media Support: CPM supports discrete (text, images, video clip, audio clip, voice clip, binary files) and continuous (e.g. bidirectional voice, streaming video) Media.

5) Group Communication and Management: The CPM Enabler supports the invocation of CPM Group Conversation for CPM Pre-defined and Ad-hoc Groups, which can be modified during CPM Conversations.

6) Inter-working with Non-CPM Communication Services: The CPM Enabler defines inter-working with Non-CPM Communication Services.

7) Network-based Storage: CPM aims to provide a consistent user experience and it therefore includes a network-based storage for:

- The user's address books which are independent of user's services.
- The Media.
- The CPM Messages and CPM Session Histories (e.g. stored with contact, time, messages, shared Media to allow filtering of histories to user's views).All these data can be synchronized to all the devices of the CPM User. The storage capabilities are subject to user preferences and service provider policies.

8) Application Support: The CPM Enabler supports a generalized interface for VAS to communicate with.

5.2.2 OMA Games services

The Games Services (GS) Working Group is the continuation of the former Mobile Games Interoperability Forum (MGIF).

The goal of the Games Services group is to define interoperability specifications, application programming interfaces (API's) and protocols for network enabled gaming. Thus, it points to have mobile games developed and deployed, so they can interoperate more efficiently with platforms and networks within OMA specifications.

This implies, as final aim, consistent cost savings for developers as well for platform/service providers.

More particularly, there are three areas of interest being taken forward:

1. MEGA framework for API spec
2. Game framework for various platforms
3. Game data sharing

1. **MEGA framework** deals with a common interface, based on C++ and Java, to be used during creating games for different platforms. It specifies a **Porting Area**, depending on platform, for 2D and 3D images, which involve also the characteristics of media, network (TCP as mandatory) and system; on it an **Engine Area** is developed, that specifies all the sorts of interfaces for images and audio or every kind of packet flow. All the specific game features are built over these two areas.

2. **Game framework** focuses on re-usable design for gaming software system too, based on **API**; definition for exchange format of events and resource data **(REF)** have to maximize the re-usability in different platforms (Windows, Linux, Symbian, Solaris, Android, …), while maintaining the compatibility. It also allows developers to concentrate on application, instead of specific environment. The base is made on Porting and Engine areas (as in MEGA), with these kinds of APIs to be defined:

   Porting area: graphics, media, network, system

   Engine area: sound, model, sprite, client, screen

   Resource Exchange Format(REF) is the key element to standardize for any kind of exchange of events at any distance.

The proposals for these two areas are coming from Ensoft Co., Ltd., which wants to enlarge the Framework to mobile game platforms.

3. **Game data sharing** is necessary for enabling seamless game play during device migration, while also maintaining additional data, save data, rankings, and so on. SK Telecom is the main actor on this side

   Some specifications in order to do this are needed, by defining a data sharing platform acting as a server, and the access procedures to it from PC, phone, IPTV, *et cetera.*

   A set of possible use cases has already been defined, and also four specifications areas:
   - Communication protocol
   - Exchange interface
   - Data format
   - Security

5.3 Relevance and Participation

The OMA CPM enabler is relevant to ICT OPEN as it includes the migration between multiple devices of a user including providing the state of the applications. ICT OPEN results like device selection, migration triggers, or the application logic reconfiguration can be immediately applied here.

It should be noted that the CPM enabler targets a specific application class. This application class might not be in the center of the ICT OPEN focus. Nevertheless, techniques form ICT OPEN can be applied to CPM.

Some of the other working groups like device management, location, and presence & availability management could provide useful standards for ICT OPEN. It is unclear whether and how ICT-OPEN can influence these bodies.

NEC Europe Ltd. is an active member of OMA and contributor to this standardization body. The members of NEC working in ICT-OPEN have direct relationship to the delegates in OMA.

From the other hand, Games services working group could be interested to that part of OPEN project that focuses on gaming; in fact, they are dealing with the same topics of migration between different platforms and devices. VF is an active member of OMA and its delegates in OMA could be involved in order to take forward this item.

NEC plans to update their OMA delegates on the achievements of the ICT-OPEN project once architecture and first results are available. This will then allow to determine the area in which ICT-OPEN can support the standardization effect.

VF plans to update its OMA delegates on the achievement of ICT-OPEN projects in order to verify whether ICT-OPEN can be taken in consideration for standardization activities,

6. Khronos Group

The Khronos Group is a “member-funded industry consortium focused on the creation of open standard, royalty-free APIs to enable the authoring and accelerated playback of dynamic media on a wide variety of platforms and devices. 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” [Khronos08].

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's abstraction, file system access and mathematical operations
- Cross-platform computation
- Streaming media
- File formats

There are several aspects of the OPEN framework that are related and relevant to these topics:

The discovery of devices and the management of device platform capabilities is closely related to platform and OS APIs defined by the Khronos Group.

Also OPEN could give some promising results regarding streaming technologies for digital content and media data, especially in the context of the IP.TV-related prototype application.

NLE-IT’s work on multicore programming interfaces is closely related to activities in the Khronos Group.

The new Compute Working Group of Khronos aims for creating “royalty-free, open standards for programming heterogeneous data and task parallel computing across GPUs and CPUs. The creation of this open standard is intended to enable and encourage diverse applications to leverage all available platform compute

resources on a wide range of platforms". The goal is to "provide a multi-vendor, portable interface for coordinating all the many-core GPUs and multi-core CPUs within a system" [Khronos08]. Apple has proposed the Open Computing Language (OpenCL) specification as a starting point for a standard for cross-platform computation on multicore and manycore architectures [Khronos08].

Planned Activities

We will follow the activities of the Khronos Group very closely. Whenever the results of the OPEN project seem appropriate for standardization, e.g. in the area of multicore programming interfaces, active participation will be taken into consideration.

7 OSGi Alliance

The OSGi Alliance (Open Service Gateway initiative) is a non-profit corporation founded in March 1999. It is a worldwide consortium of technology innovators that advances a proven and mature process to assure interoperability of applications and services based on its component integration platform. The OSGi Service Platform is delivered in many Fortune Global 100 company products and services and in diverse markets including enterprise, mobile, and home.

The alliance provides specifications, reference implementations, test suites and certification to foster a valuable cross-industry ecosystem. Member companies collaborate within an egalitarian, equitable and transparent environment and promote adoption of OSGi technology through business benefits, user experiences and forums.

Adoption of the component-based platform reduces time-to-market and development costs because it enables integration of pre-built and pre-tested modules. It reduces maintenance costs and provides aftermarket opportunities because networks are used to dynamically update or deliver services and applications in the field.

Alliance members represent diverse markets including SmartHome, automotive electronics, mobile and enterprise. Member company industries include leading service and content providers, infrastructure/network operators, utilities, software developers, gateway suppliers, consumer electronics/device suppliers (wired and wireless) and research institutions.

There are three membership opportunities with different levels of access to and influence over OSGi technology specifications: *Full Members, Adopter Associates and Supporters*.

Full Members lead the alliance and specification development. They have full voting rights and are eligible to serve as director, officer or committee leader and can participate in any OSGi Alliance committees, meetings, events and email lists. Certification testing is included in full membership. This level of membership is open to any organization at any revenue level. The OSGi Alliance expects members to actively contribute to the development of the specifications but no specific rules on the levels of contribution are set.

Adopter Associates gain early access to specifications created by full member companies. This level of membership is open to any organization at any revenue level. Member companies collaborate within an egalitarian, equitable and transparent environment and promote adoption of OSGi technology through business benefits, user experiences and forums.

Supporters OSGi Alliance Supporters can display the OSGi Alliance logo on their Web sites to identify support and usage of the technology. Supporters are able to contribute to RFPs (Request For Proposals), receive meeting discounts and will be kept up to speed with newsletters and interest announcements.

8 OMG: CORBA

Object Management Group (OMG) facts are:

- Founded in 1989
- Over 470 member companies
- The largest and longest standing not-for-profit, open-membership consortium which develops and maintains computer industry specifications.
- Continuously evolving to remain up to date while retaining a position of thought leadership.

OMG has been an international, open membership, not-for-profit computer industry consortium since 1989. Any organization may join OMG and participate in the standards-setting process. A one-organization-one-vote policy ensures that every organization, large and small, has an effective voice in our process. The membership includes hundreds of organizations, with half being software end-users in over two dozen vertical markets, and the other half representing virtually every large organization in the computer industry and many smaller ones. Most of the organizations that shape enterprise and Internet computing today are represented on the Board of Directors of the OMG.

OMG Task Forces develop enterprise integration standards for a wide range of technologies, including: Real-time, Embedded and Specialized Systems, Analysis & Design, Architecture-Driven Modernization and Middleware and an even wider range of industries, including: Business Modeling and Integration, C4I, Finance, Government, Healthcare, Legal Compliance, Life Sciences Research, Manufacturing Technology, Robotics, Software-Based Communications and Space.

OMG's modeling standards, including the Unified Modeling Language™ (UML®) and Model Driven Architecture® (MDA®), enable visual design, execution and maintenance of software and other processes, including IT Systems Modeling and Business Process Management. OMG's middleware standards and profiles are based on the Common Object Request Broker Architecture (CORBA®) and support a wide variety of industries.

CORBA is OMG's open, vendor-independent architecture and infrastructure that computer applications use to work together over networks. Using the standard protocol IIOP (Internet Inter-ORB Protocol), a CORBA-based program from any vendor, on almost any computer, operating system, programming language, and network, can interoperate with a CORBA-based program from the same or another vendor, on almost any other computer, operating system, programming language, and network.

9. OPEN Technology for Standardisation

This chapter points to the technology defined by the project that we believe should be standardized for reasons given below. Technical details are given in referred deliverables.

In particular, we believe that the following features of OPEN architecture make it worth standardizing:

9.1 User Interface Logical Descriptions and Adaptation

In order to manage the complexity derived from the wide variety of interactive devices logical descriptions of user interface are important in order to capture the semantics of the user interface elements and structure, and preserve it across various implementation languages. These languages are applied and extended in the WP2 activity in addition to specific solutions for supporting user interface adaptation at run-time while user are interacting with an application moving from one device to another.

9.2 Mobility support

The existing solutions for network mobility regard mobility of a device. Within OPEN we consider the individual flows even of a single network connection, as we may only need to re-direct some flows as only part of the application may be moved during migration. Still, this redirection needs to be transparent to remote servers or peers, that may not implement OPEN mobility support. Such extension of the existing mobility support (both in IPv4 and IPv6) would be a subject for standardization.

Moreover, the existing solutions mainly expect support from an infrastructure in terms of forwarding nodes (in mobile IP called Home Agents). Since such infrastructure support may not always be present in OPEN we also consider purely ad-hoc networking scenarios. To assure mobility support even in these ad-hoc scenarios, we may have to develop new technology or techniques based on existing technology that enables migration during such ad-hoc device mobility.

9.3 Multicore Software Technology

Multicore processors are currently hitting the market at enormous speed and multi-processing in all its variants is seen as the way into the future of computational systems.

But parallel programming of multiprocessor systems is considered to be one of the greatest challenges that application developers will face today and will be an even bigger issue in the near future because of the advent of manycore architectures that integrate several 100’s of processors on a chip.

It will not be feasible anymore to just move specific sub-systems to a dedicated processor (as it is mostly done today), but the increased complexity and sheer number of compute units that need to be fed in order to leverage the full performance of a microprocessor will make it necessary to utilize novel approaches in the areas of special programming languages, runtime environments and parallel programming libraries.

The Task programming interface (TPI) developed by NEC [ARM07] is an efficient and versatile solution for multicore programming. The key concept is based on a work stealing scheduling system that ensures dynamic load balancing and is easy to use: Application programmers can concentrate on identifying independent work units (tasks), the scheduling of tasks is done automatically by the library.

The toolkit uses multiple threads internally to leverage multicore CPUs. The innovative adaptive load-balancing implementation always utilizes the full processing performance provided by the CPU.
Especially the system automatically adapts to changing numbers of available cores at runtime which is a key advantage with respect to application migration.
It also supports disabling of CPU cores at runtime, without interruption of the running application and with no special requirements on the programmer's side. This behavior is especially useful for mobile and embedded devices as application performance can be adapted with respect to power consumption and battery life.

We foresee the need for standardization of interfaces of these multicore programming libraries as there will be a larger number of different solutions by different vendors available, which will all be based on similar concepts but only differ in form of implementation, interfaces and supported systems. Without standardization, handling this diversity of systems would make the already complicated process of parallel programming even worse. NEC already presented a unified interface for multi-core systems as an example, and formulated many requirements to a basic work stealing interface as a first step to an open standard proposal. (see [MuCoCos08])

10. Summary and Conclusions

In this document we considered and discussed several standardizations and their relevance to the OPEN project.

First of all we considered the W3C which develops interoperable technologies to lead the Web to its full potential. After that we had a look at the Ubiquitous Web Applications Working Group which seeks to simplify the creation of distributed Web applications involving a wide diversity of devices.

The mission of the Model-based User Interfaces Incubator Group is instead 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. 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.

Then, we have the Dublin Core Metadata Initiative whose purpose is an open organization engaged in the development of interoperable online metadata standards that support a broad range of purposes and business models.

We conclude that especially mobility support and multicore software technology is worth it to be standardized in the OPEN project.

The major role to the OPEN project plays the Open Mobile Alliance which is an organization founded on the basis of the old WAP Forum and also integrating industry initiatives.

Then, we gave an overview of the activities of the Khronos Group which is a member-funded industry consortium focused on the creation of open standard, royalty-free APIs to enable the authoring and accelerated playback of dynamic media on a wide variety of platforms and devices. We introduced the OSGi Alliance that is a worldwide consortium of technology innovators that advances a proven and mature process to assure interoperability of applications and services based on its component integration platform. Finally we looked at the Object Management Group (OMG), an international, open membership, not-for-profit computer industry consortium, and on CORBA which is OMG's open, vendor-independent architecture and infrastructure that computer applications use to work together over networks.

This deliverable outlines the standardization activities that OPEN Consortium has judged relevant for the Project. This is a first release, a more refined and consolidated version of this Deliverable has been planned in the continuation of the project.

11. References

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