Connecting mobile IMS services With Web applications

Marc Bailly
Orange Labs
2 Avenue Pierre Marzin
22300 Lannion
+33296052367
Marc1.bailly@orange-ftgroup.com

Philippe Menard
Orange Labs
2 Avenue Pierre Marzin
22300 Lannion
+33296052829
Philippe2.menard@orange-ftgroup.com

ABSTRACT
In this paper, we analyze the current context about mobile applications and web applications and the convergence that is forecast. We analyze the technical ways and associated impacts to interconnect mobile IMS Services with Web applications and then we try to identify some of the mains functions of multimedia IMS-Web Gateways depending on the uses cases they ensure.

Categories and Subject Descriptors
D.3.3 [**Computer-Communication Networks**]: Network Architecture and Design – Network communications, Network topology, Packet-switching networks.

Keywords
IMS, Web, IMS-Web Gateway, multimedia, mobile, real-time applications, convergence.

1. CONTEXT
For telecom operators, the current mobile applications rely on the operators mobile Core Network which is divided in two main parts:

- The Circuit Switched (PLMN) network where main service offer is traditional voice call and legacy messaging service (SMS). Service evolution of the Circuit Switched is controlled by the operator and is rather slow. The standardization supervises this evolution and guaranties the inter-working of the whole set of services between operators. This domain uses specific and dedicated technologies.

- The Packet Switched network where the operators and third party developers are offering more and more services additionally to the mobile Web access (TV on mobile, Geo-localization, etc). This remains controlled by the operators as the radio access capacity is limited. This is an innovating world where the operators and device manufacturers are pushing new services and developers are offering new services (Iphone applications). This changed the way to think about telecom applications as they are no longer provided only by the operator.

Currently, there is no direct relationship between these two coexisting worlds. But this may evolve with some planned evolutions in the operators' mobile network infrastructure:

- Operators are currently moving to IP-based technologies (IMS [1] infrastructure) on fixed network. In mobile context, circuit switched world is also likely to decrease and migrate toward IP world (R4 and then IMS or IMS-like solution). The main reasons of such evolutions are costs reasons and the current proposed services remain iso-functional.

- The IMS is also likely to support additional multimedia services. A concrete example of such trend is the services defined in Rich Communication Suite (RCS [2]) Initiative. The RCS Initiative is a joint effort of some leading industry players to speed up and facilitate the adoption of applications and to provide an interoperable, convergent, rich communication experience based on IMS (content sharing, messaging, and presence). The offered services are linked to the mobile identity and natively integrated in the device.

Packet Switched world associated with Web 2.0 is likely to go on evolving with its own dynamic.

2. IMPACTS & PROBLEMATIC
This network evolution of the circuit switch network toward IP combined with the Web 2.0 approach will offer new opportunities to couple both worlds.

Leveraging on the access offers to their customer, the operator will continue to save and create business value by adding in their offers more and more packaged and well integrated services. In the same time they will try to find new business. The operators will leverage on their network and service infrastructure, on their access offer and on the value brought by handling their customer identity and AAA.

There's general agreement that SIP [3] is the protocol for redeveloping core telco services. But SIP alone is not enough to enable an operator to deliver a rich set of revenue-generating services to the market. An “IMS centric vision 'for all services' to compete against the Internet” is no longer considered. The IMS will not be the global telecom network of the future, but it will

Digital Object Identifier: 10.4108/ICST.MOBIMEDIA2009.7504
http://dx.doi.org/10.4108/ICST.MOBIMEDIA2009.7504

coexist and collaborate with web. This shall allow operator to create new values thanks to technological convergence, system openness and an infrastructure considered as agile for Telco.

The collaboration between Web world, PS world and IMS world will be facilitated by:

Technological convergence around IP

The technology compatibility between IMS and Web technologies will facilitate opportunities to provide converged IMS-Web conversational or multimedia services. IMS brings IP to the telecoms world. The usage of IP-based technologies (SIP, RTP [4], MSRP [5], etc) for voice and multimedia applications will ease to bring closer the CS world to the PS and more generally to the Web world.

The deployment of pure client server application like TV over IP or portal with web technologies will bring new opportunities for converged and combined services.

Mobile opening

One of the values of services provided by the Telcos is the integration and ease of use. The integration of service in the mobile device plays here a major role. This was mainly achieved on non open platform, through standardization and close commercial link between operator and mobile provider. The service development cycle is here slow and heavy but well controlled.

New open mobile platforms (e.g. Symbian, Iphone, and WinCE) ease the service creation by addressing developer community and providing application store facilitating service deployment.

The telcos will integrate this facility to ease service creation and deployment. Those applications will allow combining Web and operators' core services.

Mashup applications

From Telco perspective, multi media services that could be supported by the IMS network may need to interconnect with Web or Packet Switched worlds. Indeed the core set of features and uses cases need to be extended with additional services coming from the outside IMS world.

While each Telco core service has an intrinsic value, operators will create new business out of the new SIP infrastructure if they can open their core services to Web developer: they need to make these SIP-based core services available for mash-up.

Developers will leverage on this network for voice, real-time interactive multimedia, but also for the value brought by universal identity management.

The Web 2.0 brings the vision to add value to the Web by supporting functions that can only be ensured by the IMS Core network and reciprocally. This approach will extend the need to interconnect the operator networks and Web world.

In conceiving innovative services and bringing those to market in this context the operator may increase their customer adherence.

3. IMS and Web

3.1 General Architecture scenarios

Several scenarios can be set up to technically achieve this IMS and Web services convergence. The purpose of this section is to detail the main classes of possible architecture scenarios.

3.1.1 A gateway in the network interfaces Web and IMS

This first scenario is based on a network element called IMS-Web gateway acting as a bridge between IMS and Web world. This may be used in both ways: either to bring values to IMS services with functions from the Web or to bring values to web applications which can leverage the IMS network for real-time multimedia services.

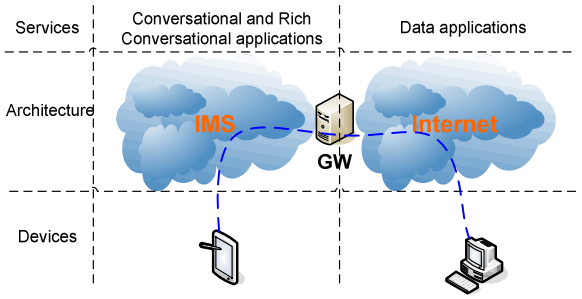

Figure 1: a network gateway interfaces Web and IMS

This IMS-Web gateway concept is a very general concept and may gather several sub-types of products depending on use cases to be covered.

A simple example is the interconnection of two instant messaging services similar, one provided by the operator on top of the IMS and the other one by a Web application provider.

3.1.2 The device interfaces Web and IMS

An alternative solution is to consider the previous bridge function at the device level. The device performs the link between the two worlds. It uses either the Web or the IMS depending on the data that need to be exchanged and the application provides a coherent view and usage of the aggregated data.

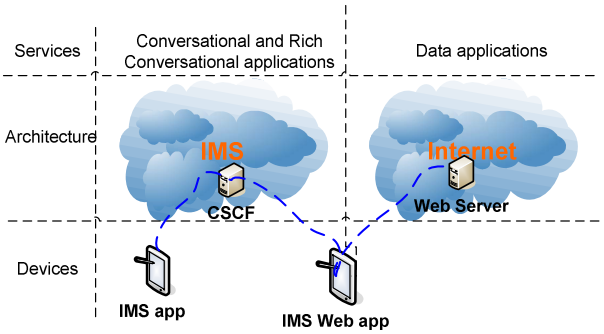

Figure 2: the device interfaces Web and IMS

This architecture does not require any new IMS network element.

An example of application that could be implemented that way is real-time location information sharing with my contacts. Carrying such real-time information could easily be performed thanks to

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IMS. The usage of the real time exchanged information could be used by the device as input to a Web application (Mappy or Google Maps services). Such architecture enables each device application to choose its own web application as the coherency between the IMS and the Web application is only handled by the device.

Nevertheless this solution does not enable to cover all the use cases as a device needs to have the knowledge of both worlds and to make the bridge between them.

3.2 Web-IMS Gateways classification

This paragraph focuses on multimedia gateways scenario described in the previous section. It intends to classify the different types of Web-IMS gateways. Three main categories of IMS-Web multimedia gateways were identified during this analysis and are presented below.

3.2.1 Web Convergence Gateway

Overview: This gateway is used to open the IMS service to users who have a device using Web access. Figure 3 presents this gateway. In that case the same service (service 1) is proposed to user A and B. It's only the way to access to the service that is different (with an IMS device for A and via a Web access for B).

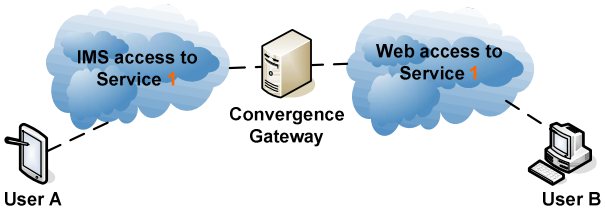

Figure 3: the convergence gateway as a new access to a service

With such a gateway it becomes possible to extend the IMS service customer base by providing a Web access to the service for non IMS users while being transparent for the IMS application. This can also be used to extend the service uses cases as the service become available from a Web access. This may enrich and ease the way to access the IMS service for the end user: this web access can turn out to be easier than the access from the mobile device. In these cases, the gateway behaves as any others IMS endpoints and proposes a Web or Web 2.0 interface.

Typical use case: Such a scenario is applicable to a Video Sharing service. This service is part of the RCS set of services. In this context, the GSMA Video Share Phase 2 [6] specification includes scenario of communication between a mobile user and a PC user. Figure 4 presents the architecture associated to this use case.

① User A initiates video sharing session towards user B using a standard SIP session establishment procedure.

② The IMS and the Video Sharing application server will handle the decision to terminate the call on the Web. This decision is made on application logic.

③ et ④ The content sharing session is forwarded to the content sharing "Web convergence gateway" that provides the link between IMS and Web world.

⑤ The session is terminated on B side on his PC using the Web access to the service. Note there are many possible technology available here, this can be RTSP [7] streaming, RTMP [8] (Flash) or progressive download.

In this scenario the gateway mainly perform protocol adaptation in order to offer the service over the Web. From a connection point of view, there is a SIP & media session established between A's device and the Web Convergence Gateway and a web session between the "Web Convergence Gateway" and the user B's browser.

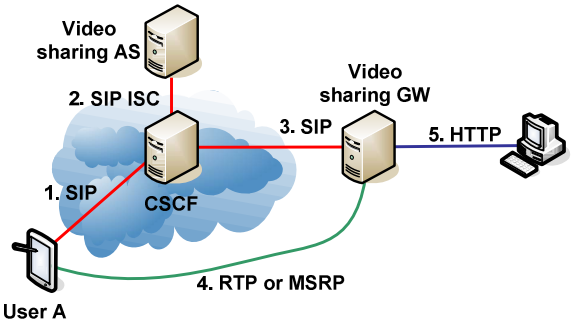

Figure 4: the Web content sharing gateway

Interfaces: SIP protocol is used on interface ① to handle call initiation, on interface ② for ISC [9] to handle IMS / AS interface and on interface ③ for the call establishment toward the Video Share Convergence Gateway. Media RTP & MSRP interfaces are used on interface ④. Web based interface (HTTP, RTSP streaming, RTMP (Flash), progressive download…) is used on interface ⑤.

3.2.2 Interconnection Gateway

Overview: This type of gateways covers the case of the interconnection or interworking of two different services, one being provided by the IMS network (Service 1) and the other one by an application of the Web world (Service 2) (refer to Figure 2). This extends the set of uses cases of each of the interconnected service.

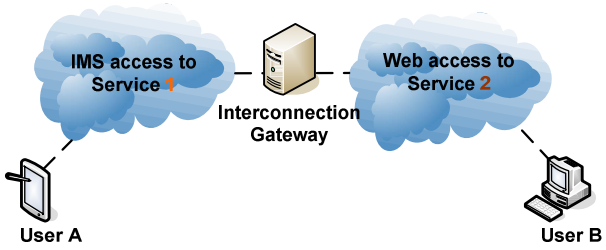

Figure 5: the interconnection gateway links an IMS service and a Web application

In that case the Web application term is generic and gathers all the applications provided on Internet (based on HTTP or also on any other protocol).

Typical use case: Such type of gateway may be used to interconnect an IMS-based Instant Messaging (IM) service provided by the mobile operator with a similar service working on the Web side. On the mobile IMS side, the Open Mobile Alliance (OMA [10]) defines the standards OMA Presence [11] and OMA SIMPLE IM [12] to provide such services. In the Web world, several different others standardized or proprietary protocols are

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used to support IM services. In this example we assume that XMPP protocol is used by the Web IM application provider (this is typically the case of Google Mail & Google Talk). XMPP community provides extensions so that it can be used over an HTTP transport layer [14]. Figure 6 presents the architecture associated to this use case.

① User A via his IMS messaging service side wants to send an instant message to User B using Web XMPP application. The A device sends a SIP request which may be a SIP MESSAGE or an INVITE to establish a MSRP connection.

② The IMS and the Content Sharing application server will handle the decision to terminate the call on the Web XMPP side. This decision is made on the routing logic.

③ The SIP-XMPP interconnection gateway will perform advanced protocol adaptation to translate the SIP request into XMPP request and will handle identity adaptation to associate SIP identity with XMPP identity.

④ The XMPP request containing the message sent by A is routed through the XMPP network and delivered to B.

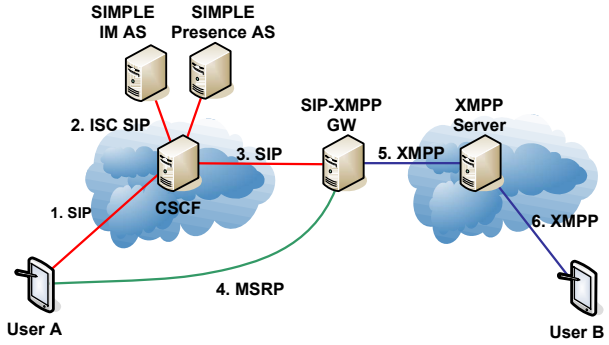

Figure 6: The SIMPLE-XMPP Gateway

Interfaces: SIP interface are used on Interface ① to handle call initiation, interface ② for ISC and on interface ③ to handle call establishment toward the Interconnection Gateway. Media RTP or MSRP are used on interface ④. XMPP or XMPP over HTTP are used on interfaces ⑤ and ⑥

3.2.3 *Interaction Gateway*

Overview: The Interaction gateway is used to offer a user or a third party application an additional way to interact with a service provided by the IMS. Combining the IMS application with the associated Web application enables to provide a global enriched application.

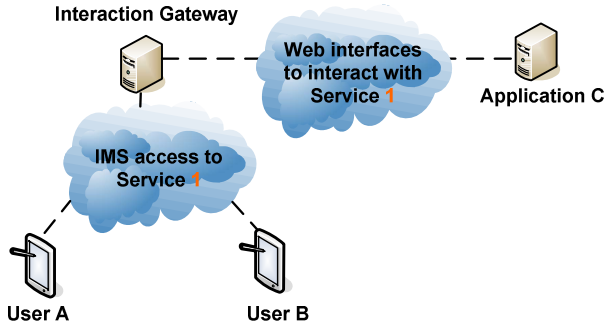

Figure 7: the interaction gateway offers new interface to interact with IMS services

Such a gateway provides Web Interfaces used in typical B2C or B2B scenarios.

Typical use case: A click-to-call application is a classical example which uses such a gateway. Similarly there are also multimedia applications that work that way as a content push service via such a gateway. In the click-to-call context a user is able to initiate a call from a Web application. The call initiation and control is a service provided to Web application by the Telco networks. This is currently well known as a typical Web 2.0 application between Telco and Web world. Figure 8 presents the architecture associated to this use case.

① User A is browsing a directory on the web. He wants to place a call. He clicks on the entry.

② The Web server gets the request and translates it towards the C2C Interaction gateway.

③ The interaction gateway initiates the call between both users.

④ The call progress is reported from C2C interaction gateway toward the Web server.

In this scenario the interaction gateway mainly offers a service that can be used by applications over the web (directory, social networks etc…).

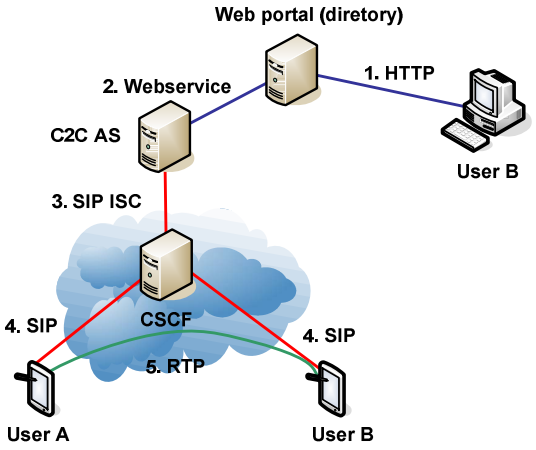

Figure 8: The Click to Call Web interface

Interfaces: The interface ① handles the web application between user and the Web server and is based on Web technologies. This encompasses the triggering of the service and the notifications of call progress. The interface ② is a M2M interface based on Web services. It relies on an agreement between the Telco and the service provider (which may be the Telco via its portal in the C2C use case). The SIP interface is used on interface ③ and ④ to control the session establishment and the media flow (interface ⑤).

3.3 Web-IMS Gateways functions

Each sub-type of Web-IMS gateways may be characterized by some specific functions which are listed and detailed below.

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3.3.1 Web Convergence Gateway functions

This paragraph identifies the main functions that may be necessary to integrate in such IMS/Web gateway.

Multimedia transcoding: Different set of protocols and technologies are used by the IMS and the Web Infrastructures. IMS uses SIP as the main signaling protocols and use different media protocols depending on the media type (RTP for audio and video, MSRP for image or file transfer). In the Web application world, several technologies are used to carry multimedia streams (Flash with RTMP, HTTP Progressive download, RTSP and RTP etc).

When the gateway is used to extend IMS multimedia services to Web (and reciprocally), transcoding between media format is necessary. Depending on the use cases the transcoding functions could also adapt the contents to email formats or Instant messaging notifications, etc.

Web Portal or TV Link: Extending the mobile IMS application with a new type of access, the convergence gateway shall ensure this access convergence and make the service available on new interfaces such as TV or Web portal.

Multimedia storage association: When used as a service access extension enabler, the association with a storage enabler may be necessary to ensure some use cases. The storage function may be part of the gateway or may be ensure by an external storage.

Control of the data exchanged: As the Web-IMS interconnection extends the contents that become available to the mobile world, the operator may require to have some functions to filter the content that transit from the Web to the IMS devices (antivirus functions, children protection program, etc).

Notifications: The Gateway may provide notification functions based on legacy bearers (SMS/MMS) or IP-based bearers (email, Instant messaging notification, notification on TV, etc) to inform the Web user of an action initiated on IMS side.

3.3.2 Interconnection Gateway functions

This type of gateways may also rely on the functions of service continuity gateways but also require implementing the following functions.

Identity Association: As soon as two different services are interconnected, the question of identity is raised. In 'classical' voice calls interconnection, this question is not raised as both domains use the same kind of identifiers which are telephone numbers. The identity used in mobile is unique: the MISDN, which is standardized and used all over the world. But as Web applications are using their own and dedicated identifiers (emails, login, etc), interconnection with IMS requires setting up a link between the different types of identity.

The way the gateway has the knowledge of the identity association is dependant on the implementation. This can be configured by the operator or by the user via customer care on the gateway (e.g. Route Content Sharing Sessions from IMS to Facebook or Orkut). Or this can be set by the device and transmitted in the signaling. The gateway interprets the parameter and applies the desired behavior.

Advanced protocol translation: As it was described in the context section, IMS and Web worlds are using their own technologies to implement their own services. As soon as services of both worlds need to be interconnected, a rich protocol translation platform shall be performed. This is going further that the basic protocol translation required for Web Convergence Gateway as this implies in that case to interconnect two different services which have their own protocol and functions.

3.3.3 Interaction gateway functions

The Interaction Gateway may implement a wide set of functions as the use cases case covered by this type of gateway are very vast. Nevertheless in every cases implement the following general function is required:

API or User Interfaces: The Web Interaction Gateway shall offer users or third party application API or interfaces to control or get information from the service rendered in the IMS network.

4. CONCLUSION

This paper dealing with the relationship between IMS applications and Web applications show the opportunities to bring closer the two worlds. Thanks to the convergence of underlying technologies and by opening the IMS to the Web, the operator and the Web applications providers will be able to offer richer services to users. Both parties will benefit from these new applications. The associated technical impacts will be to develop and deploy new network elements, described in this document as a general IMS-Web gateway concept. This Web-IMS gateway will have to support some specific functions of functions depending on the role of the gateway in Web-IMS collaboration use case.

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