METHOD OF INTER-WORKING BETWEEN IMS AND NON-IMS (GOOGLE TALK) NETWORKS FOR MULTIMEDIA SERVICES

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Keywords: Inter-working, IMS, SIP, multimedia, XMPP, 3GPP, CSCF, Google Talk.

Abstract: With the evolution of third generation network, more and more multimedia services are developed and deployed. Any new service to be deployed in IMS network is required to inter-work with existing Internet communities or legacy terminal users in order to appreciate the end users, who are the main drivers for the service to succeed. The challenge for Inter-working between IMS (IP Multimedia Subsystem) and non-IMS network is "how to handle recipient's address". This is because each network has its own routable address schema. For instance, the address for Google Talk user is xmpp:xyz@google.com, which is un-routable in IMS network. Hereafter a new Inter-working (IW) solution between IMS and non-IMS network is proposed for multimedia services that include Instant Messaging, Chat, and File transfer, etc. It is an end-to-end solution built on IMS infrastructure. The Public Service Identity (PSI) defined in 3GPP standard (3rd Generation Partnership Project) is used to allow terminal clients to allocate this IW service. When sending the SIP (Session Initial Protocol) request out for multimedia services, the terminal includes the recipient's address in the payload instead of the "Request-URI" header. In the network, the proposed solution provides the mapping rules between different networks in MM-IW. The detailed technical description and the corresponding use cases are present. The comparison with other alternatives is made. The benefits of the proposed solution are highlighted.

1 INTRODUCTION

Nowadays, with the help of 3G IMS network infrastructure rollout (3GPP, 2007), it is possible for operators to deploy and offer different multimedia services, such as Instant Messaging, Chat, and File-transfer, etc., to their subscribers. However before deploying a new multimedia service in the network, operators want to be sure that the new service can increase ARPU (average revenue per user) in order to meet their ROI (Return-On-Investment). One of very important factors for new multimedia services to succeed is to be compatible with legacy system as well as to work with existing Internet communities, e.g. Google Talk (Saint-Andre, 2004). In one word, the service shall appreciate end users as many as possible.

In order to make the multimedia service work across different networks (IMS and non-IMS), the routing mechanism for Inter-working or Inter-operability has to be provided. The mapping rules for the request and response between two different networks shall be set.

Following the layer concept, the Inter-working solution can be provided at control layer or service layer. One of example is BGCF, which provides the telephone (voice) inter-working service between mobile phone and traditional fixed line phone at control layer. However it is difficult to apply this technique to the multimedia applications that reside at service layer. The reason is that at control layer, the information is not enough to differentiate one service from the others. On the other hand, the solution is required to have little impact on IMS core network to facilitate operators to deploy it in the network.

In the following sections, a new IW solution at service layer is proposed. The solution introduces new logics at both terminal and server side. It is defined as one public service using PSI as a service identity. It has no impact on IMS core network. The solution handles any kind of address schema for the recipient. It provides the mapping rule for all the requests and responses travelling among different networks.

Zhu Z. and Brunner R. (2008).
METHOD OF INTER-WORKING BETWEEN IMS AND NON-IMS (GOOGLE TALK) NETWORKS FOR MULTIMEDIA SERVICES.
In *Proceedings of the International Conference on Signal Processing and Multimedia Applications*, pages 251-256
DOI: 10.5220/0001932602510256

2 MULTIMEDIA INTER-WORKING SERVICE

The basic concept of the proposed solution is to introduce a logic function – Multimedia Inter-working (MM-IW) in IMS network. It provides the Inter-working service to terminals (end clients) by publishing its PSI or pre-configured at terminals. When sending the message to the recipient whose address is not SIP URI or Tel URI, the terminal shall send the SIP request directly towards MM-IW instead of the recipient.

The overall architecture of Multimedia Inter-working solution is given in Figure 1 by following 3GPP IMS core network structure and IM Messaging Architecture (OMA, 2007). MM-IW is the key component in the network to provide the Inter-working service. It has a SIP stack to receive and send SIP request and response. It also has the function to control the media plane, such as MRFP, via H.248.

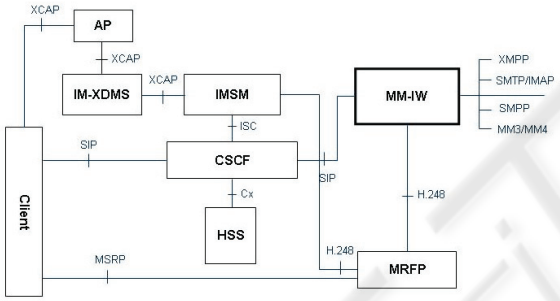

Figure 1: Architecture of MM-IW solution.

The main function of MM-IW is to retrieve the recipient's address from the incoming request/ response, then construct the outgoing request/ response according to the mapping rules. MM-IW resides at the edge of different networks. It makes use of MRFP to handle the multimedia content at media level in IMS network. On the other hand, it also handles (convert and construct) the multimedia content from/towards non-IMS network as shown in Figure 1 for different protocols, e.g. SMPP, SMTP/ IMAP, XMPP, MM3/MM4, etc.

The example of SIP request, e.g. SIP MESSAGE referring to (Rosenberg, 2002, Campell, et al. 2002, OMA-TS 2008), from a terminal to MM-IW is described in Figure 2. It is based upon the mechanism provided in (Garcia-Martin, 2007) and (Camarillo, 2007). "Request-URI" in SIP MESSAGE is set to PSI for MM-IW, which is pre-configured or provisioned to the terminal. A simple and easy version of PSI is proposed hereafter:

sip:oma.iw@operator.com

SIP MESSAGE

```
MESSAGE: sip:oma.iw@operatorA.com
P-Asserted-ID: sip:alice@operatorA.com
To: iwRoutingService <sip:oma.iw@operatorA.com>
From: Alice <sip:alice@operatorA.com>;tag=32331
Require: routing-info
Content-Type: multipart/mixed;boundary="boundary1"

--boundary1
Content-Type: text/plain

Hello world!

--boundary1
Content-Type: application/resource-list+xml
Content-Disposition: routing-info
<?xml version="1.0" encoding="UTF-8"?>
<resource-lists xmlns="urn:ietf:params:xml:ns:resource-lists">
  <list>
    <entry uri="xmpp:sylvia@gmail.com"/>
  </list>
</resource-lists>
--boundary1—
```

Any kind of address schema
mailto:sylvia@gmail.com

Figure 2: Example of SIP MESSAGE towards MM-IW.

In addition, "Require" header is used to demand MM-IW to handle "Content-disposition: routing-info" stored in the payload of the SIP request in XML format referring to (Rosenberg, 2007). As shown in the example, the address of the destination can be any kind of address schema since this address shall never be used for routing purpose inside IMS network.

3 TECHNICAL DESCRIPTION

The proposed Inter-Working solution is an end-to-end solution based on business logics at both MM-IW and terminal. The corresponding flows and mapping rules are described and discussed in detail in the following subsections. Then the use cases are given to cover all basic Inter-working scenarios.

3.1 Logic Flows

3.1.1 Logic Flow at the Terminal (Originating Side)

At the terminal (originating side), when sending SIP request to the recipient, the end user shall decide if the request shall be sent to recipient directly (using normal SIP flow) or through MM-IW. The basic logics to make such kind of decisions are given in Figure 3.

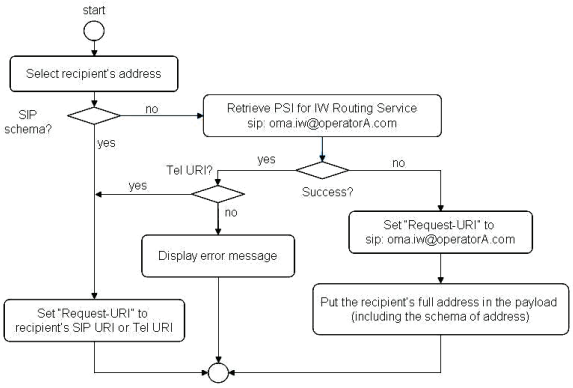

Figure 3: Logic flow at terminal (originating side).

In general, the end user selects a recipient from his contact list, probably only the name. Then the terminal retrieves the corresponding address from the contact list of the sender. It first checks to see if the address follows SIP schema, which is the pre-requisite for routing the message in IMS network.

If the recipient's address is not SIP URI, the terminal retrieves PSI for IW routing service (MM-IW), which is set to "Request-URI" in the outgoing SIP request. Then the recipient's address as well as the message input by the sender is put into the payload of the outgoing SIP request by following the format given in Figure 2.

In case that PSI can not be retrieved, the terminal checks if the recipient's address is Tel URI. If true, the message is sent out by setting recipient's Tel URI in "Request-URI", which requires IMS core network (mainly DNS lookup) to resolve the recipient's SIP address referring to 3GPP.

At the end, the message is sent to IMS network if all the steps succeed or the error message is displayed for the failure cases.

3.1.2 Logic Flow at MM-IW

At MM-IW, when receiving the request, it shall first decide if the request can be routed back to IMS network or not according to the mapping between Tel URI and SIP URI.

If the mapping succeeds, the request shall be proxy back to IMS network. Otherwise, the request shall be sent to the IW GW (Inter-Working Gateway), which maps the SIP request to the corresponding protocol based upon the recipient's address (schema plus content of the address).

If no corresponding IW GW exists, the error message is sent back to the message sender.

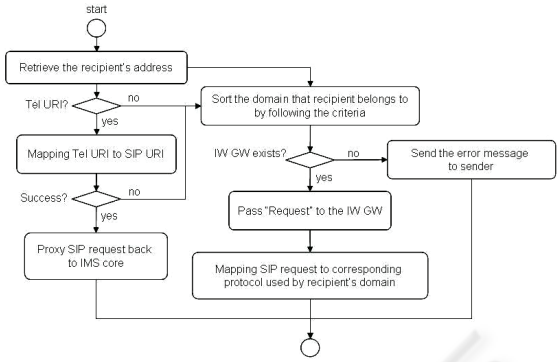

Figure 4: Logic flow at MM-IW.

3.1.3 Logic Flow at the Terminal (Terminating Side)

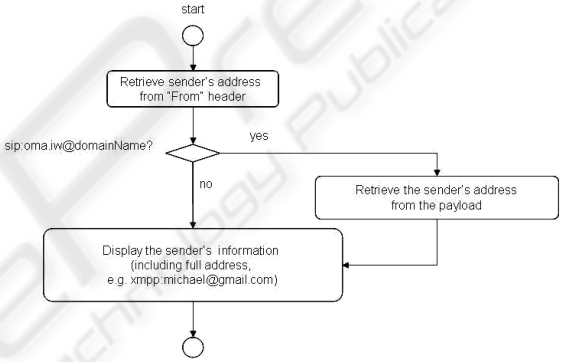

Figure 5: Logic flow at terminal (terminating side).

At the terminal (terminating side), when receiving SIP request, the end user (recipient) shall check to see if "From" headers in the request presents the address of MM-IW hosted in the recipient's or sender's operator domain. If yes, the sender information shall be retrieved from the payload of the received SIP request. The basic flows to make such kind of decisions are described in Figure 5

3.2 Mapping Rules

The mapping rules for the message between IMS and Google Talk are given as an example in Figure 6 and 7.

In the message flow from IMS to Google Talk, "From" header in the SIP request is mapped to "From" header in XMPP message format. The recipient's address that is stored in payload of the SIP request is mapped to "To" header in XMPP message format referring to (Saint-Andre, 2004).

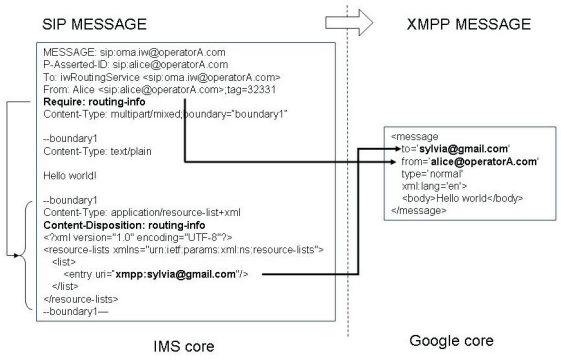

Figure 6: Maps from SIP to XMPP (message).

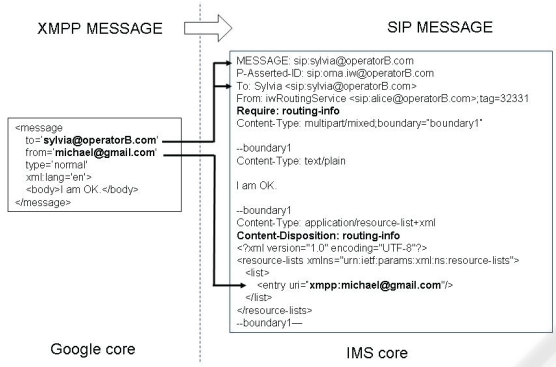

Figure 7: Maps from XMPP to SIP (message).

In the reverse flow, "To" header in XMPP message is mapped to both "Request-URI" and "To" header in the outgoing SIP request. "From" header in XMPP message is mapped to the resource list captured in the payload of the outgoing SIP request. Furthermore, MM-IW shall include its own address in "From" header as shown in Figure 7 to indicate the message is injected by MM-IW.

3.3 Use Case Discussion

3.3.1 Flow from IMS to Google (Originating IW)

This is a basic scenario in which Alice, an IMS user, sends an Instant Message towards Sylvia who is a Google Talk user.

The message arrives at S-CSCF for Alice. It is forwarded to IMS Messaging server (IMSM) based upon the ISC trigger (IMS Service Control, referring to 3GPP standard) since it is IM. Then the S-CSCF routes message towards MM-IW after resolving PSI to IP address by doing DNS lookup.

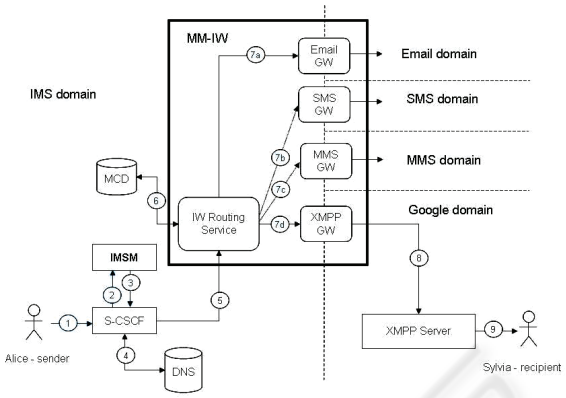

Figure 8: Flow from IMS to Google (Originating IW).

IW routing service in MM-IW verifies if the sender is allowed to use the service by checking the sender's profile in user database (MCD). Then the message is forwarded to XMPP GW since the recipient is a Google Talk user. Eventually the message is delivered to the recipient via XMPP server.

3.3.2 Flow from IMS to IMS using Tel URI

The scenario is that Alice only has Sylvia's telephone number. She wants to send IM to Sylvia using Tel URI instead of SIP URI.

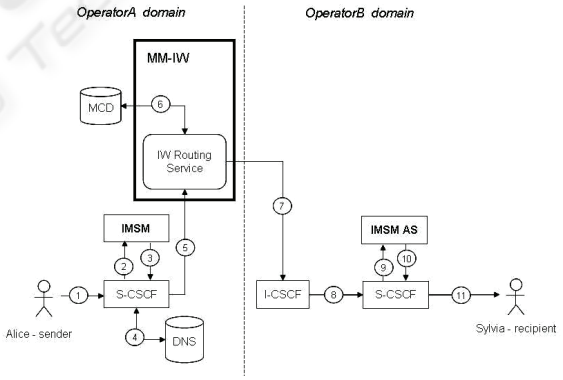

Figure 9: Flow from IMS to IMS using Tel URI.

Since the recipient's address is Tel URI, the terminal at originating side puts the recipient's address in the payload of the message according to flow in Figure 3. The message is sent to MM-IW.

IW routing service figures out that the recipient's address – Tel URI can be mapped back to SIP URI (DNS lookup, not shown in Figure 9). Then IW routing service replaces Tel URI with the found SIP URI and proxy the message back into IMS network.

The message is eventually delivered to the recipient via terminating S-CSCF.

3.3.3 Flow from IMS to Google (Terminating IW)

The scenario is that Alice sends IM to Sylvia. However, at that time, Sylvia is "un-registered" in IMS network but she can be accessed via Google Talk account. The message shall be delivered to Sylvia via Google Talk domain.

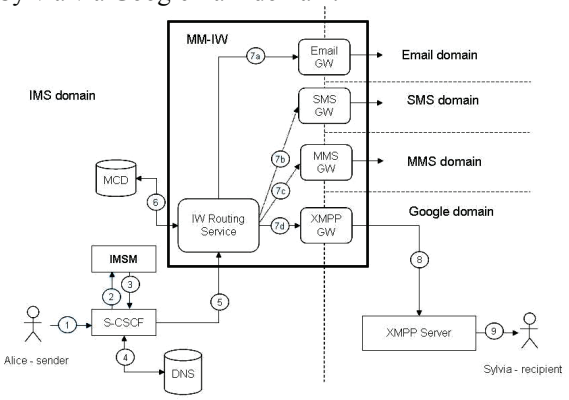

Figure 10: Flow from IMS to Google (Terminating IW).

Referring to Figure 10, after receiving the message from the S-CSCF, the terminating IMSM finds out that the recipient is "un-registered". IMSM forwards the message towards MM-IW directly following step 10. The IW routing service in MM-IW checks the recipient's preference in user database, such as MCD. Then it decides to send the message to XMPP GW for Google IW.

XMPP GW maps the SIP request to XMPP message format by applying the mapping rule referring to Figure 6 and sends the message to the recipient via XMPP server.

3.3.4 Flow from Google to IMS

The scenario shown in Figure 11 is that Alice wants to use her Google Talk account to send an IM to Sylvia.

When the message arrives in XMPP GW, IW routing service retrieves the recipient's address. IW routing service might check if the recipient exists in the operator domain and the recipient is allowed to receive the message from Google Talk users.

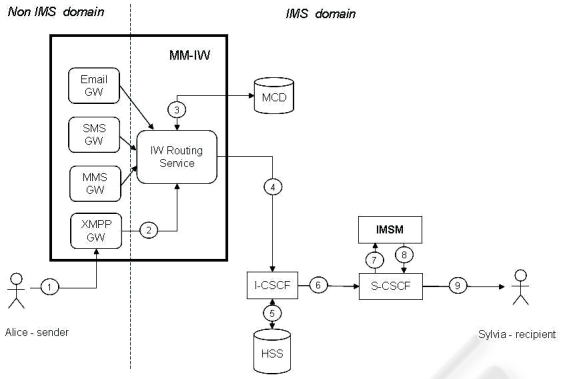

Figure 11: Flow from Google to IMS.

After the SIP URI is identified for the recipient, the message is mapped from XMPP format to SIP request by following the mapping rules shown in Figure 7.

The IW routing service sends the message to I-CSCF, which will route the message towards the terminating S-CSCF after consulting with HSS. Then the terminating IMSM is involved and the message is delivered to the recipient.

4 COMPARISON

One of alternative solutions for the inter-working between IMS and non-IMS network was proposed in (Costa-Requena et al., 2004). The URI parameter is used to carry the address schema of the destination. The example given in their patent publication is for the interoperability between wireless village client and IMS client. The address of wireless village (wv) is mapped to SIP address and vice versa.

`wv:bob@operatorB.com is mapped to sip:bob@operatorB.com;(user=wv).`

The conversion of recipient's address between two address schemas is done either at terminal or IMS network (CSCF, or GW). The solution has the impact on IMS core network, which is not the case for the proposed solution.

The other alternative is to encode recipient's address in Request-URI of SIP request, such as:

`sip:bob@gmail.com.iw.operator.com`

The domain name, iw.operator.com, is provisioned into DNS, which is used to route the corresponding SIP request to the IW node. However, this solution

can not carry the information of the destination scheme, e.g. xmpp.

5 SUMMARY

The proposed MM-IW solution provides the service to allow end users to send/receive IM to/from their friends in non-IMS network. In contrast to other existing IW solutions, it is deployed at service layer and has no impact on IMS core network. The solution is well suit for IMS architecture.

The impact on the IMS terminal client is limited since it only requires verifying the schema of the recipient against SIP URI at sending side and the sender's address at the terminating side. The proposed MM-IW is neither terminal-based IW solution nor purely network-based IW solution. It is the solution that requires the logics from both terminal and network.

The proposed MM-IW provides the foundation to bring different messaging users together (IMS or non-IMS users). It will benefit not only end users but also operators.

The further investigation on generic mapping rules among different protocols is under the way.

ACKNOWLEDGEMENTS

This work is fund by Ericsson Canada Inc. under Ericsson DMMP technology leadership project (2008).

TERMINOLOGY

Acronym	Definition
3GPP	3rd Generation Partnership Project
ARPU	Average Revenue Per User
BGCF	Breakout Gateway Control Function
CSCF	Call Session Control Function
DNS	Domain Name System
GW	Gateway
HSS	Home Subscriber Server
I-CSCF	Interrogating CSCF
IETF	Internet Engineering Task Force
IMAP	Internet Message Access Protocol
IMS	IP Multimedia Subsystem
IMSM	IMS Messaging
ISC	IMS Service Control
IW	Inter-Working
MCD	Messaging Common Directory
MM-IW	Multimedia IW
MMS	Multimedia Messaging Service
MRFP	Multimedia Resource Function Processor
ROI	Return on Investment
SMS	Short Messaging Service
SMPP	Short Message Peer-to-Peer Protocol
SMTP	Simple Mail Transfer Protocol
XMPP	Extensible Messaging and Presence Protocol

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