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E.164 based Global Identification scheme for IPTV Service Portability

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***Abstract*-Currently, the IPTV services are provided through a device, called as set-top box which is dependent on the service providers. This becomes a huge constraint to customers who wants to enjoy their IPTV service more than two places and also becomes a huge loss to service providers who wants to encourage more utilization by their customers. The solution for this problem is providing an IPTV service portability that enables customers to access to their IPTV service anywhere without their own set-top box but with any other service provider's set-top boxes. For this service, several technical issues such as global identification, contents and signal transcoding, CAS/DRM utilization, service security are required to be settled. Among them, the most important issues to support an IPTV portability service is global identification. In this paper, we propose a global identification scheme with E.164 using SIP with IPTV global roaming service scenario.**

Keywords: IPTV, service portability, Identification, E.164, SIP, etc.

I. INTRODUCTION

In recent few years, many telecommunication companies have paid attention to the IPTV services. The reason is that if the traditional plain old telephone service (POTS) has enabled us to listen any voice over the world, the IPTV service will allow us to see any video over the world. This means that the IPTV service will give new value to the customers and also will bring a new business market to the business operators. According to the statistics from one of the world's industry market report [1], most of the OECD countries are preparing or already providing the IPTV service. It is also being prepared or provided by over 200 companies and around 10.85 million customers have subscribed by 2007 worldwide.

Currently, to enjoy the IPTV service, a device, usually called as a set-top box (STB) which processes the IPTV service stream and signals is required. Those set-top boxes exist in various forms, as an independent device or with other devices. However, regardless of its form, since the STBs are dependent on their service providers, users cannot enjoy their IPTV service if there isn't the STB which is provided by that service provider. This can be a huge constraint for any users who wants to enjoy their IPTV service more than one place and it is also a loss for those service providers who lose their chance to sell more services.

A novel solution for this problem is providing an IPTV service portability that enables customers to access to their IPTV service anywhere without their own set-top box but with any other service provider's set-top boxes. The term 'service portability' was defined as the ability to access services using any devices, anywhere, continuously with mobility support and dynamic adaptation to resource variations from [2]. However, under the current IPTV service environment, for IPTV services to be realistically portable to users, the concept needs to be expanded as not only for overcoming the limitation of devices but also for overcoming the constraint between service provider-centric device availability.

For the IPTV service portability, users shall be identified globally and the terminal devices should be interoperable by obeying the global standards or at least de facto standard between contracted telcos forming a trusted domain. Otherwise, if the global user identification mechanism is not supported, it is impossible to provide such service, else if the devices are neither interoperable nor trusted, then several technical issues such as contents and signal transcoding, CAS/DRM utilization, service security, and so on are required to be settled. Recently, there have been a few activities to make a globally applicable standard to give interoperability between IPTV services taken by ITU-T IPTV-GSI (Formally Focus Group IPTV), ATIS-IIF, DVB-IPTV, Open IPTV Forum, etc. With lime light on the IPTV service, they have been working hard and publishing their results to the world. However, the activity to set a global identification for IPTV portability has not been studied much.

Hence, in this paper, we propose a global identification scheme for IPTV portability. Since the paper focuses on the identification issue, we assume an IPTV portability service within a interoperable and trusted domain. We take E.164-based telephone number as identifier since the telephone number is the most globally and widely used identification method managed by governments. There have been movements by IETF ENUM working group to find services on the Internet using telephone number. However, this is not widely adopted by current telecommunications service providers and also not feasible for IPTV service portability. Therefore, we propose an E.164 based global identification scheme with softswitch based service architecture utilizing SIP messages. We present our proposed scheme with IPTV global roaming service scenario with their message flows. In addition we discuss about the other technical issues for feasible IPTV service portability as well.

The remainder of the paper is organized as follows. In Section II discuss on the global identification methods with E.164. In Section III, we show the proposed mechanism for IPTV Portability with our proposed scheme and conclude.

II. METHODS FOR GLOBAL IDENTIFICATION

In the service level, there are well-known methods for global identification: E.164-based telephone numbers, IP address, Uniform Resource Locator (URL), and Uniform Resource Name (URN). The E.164 has been used for telecommunication devices, the IP addresses have been allocated for data communications devices, the URL has widely spread for World Wide Web services, and the URN has been used for web-based DataPortability. Among them, the E.164-base telephone number is the most widely used method with high confidence managed by governments. The absolute number of mobile subscribers in the OECD area reached nearly 988 million in 2005, or nearly 80 subscribers per 100 inhabitants.[5] Fourteen OECD countries have reached mobile penetration level greater than 100%, that is, they have more "active" accounts (both subscriptions and prepaid) than the total population.[6] In addition, it is easy to use and remember for users and also gives advantage to telecommunication service operators.

More specifically, E.164 is an ITU-T recommendation which defines the international public telecommunication numbering plan used in the PSTN and some other data networks. It also defines the format of telephone numbers. E.164 numbers can have a maximum of 15 digits and are usually written with a + prefix. To actually dial such numbers from a normal fixed line phone the appropriate international call prefix must be used. E.164 is provides the number structure and functionality for the three categories of numbers used for international public telecommunication. For each of the categories, it details the components of the numbering structure and the digit analysis required to successfully route the calls.

E.164 is structured for both geographic area and global services as shown in Table I and Table II respectively. It is very helpful idea for user presence and global service.

Since E.164 is managed by each government department which is managed communication or related division, it is well managed than other resource like IP address and it is provided user identification. With that reliability, telecommunication companies use E.164 numbers not only for user identification but also for their billing key. Simultaneously, when we use E.164 numbers as IPTV user identification, then we can also do the accounting, charging, and billing based on this numbers. This is also an advantage of using E.164 number as global client identification method for IPTV service.

With all this advantages of E.164 numbers, there have been working on utilizing E.164 telephone number to find services on the Internet by IETF ENUM working group. Fig. 1 shows a example for VoIP service scenario with ENUM. ENUM was developed as a solution to the question of how network elements can find services on the Internet using only a telephone number, and how telephones, which have an input mechanism limited to twelve keys on a keypad, can be used to access Internet services. ENUM at its most basic is the convergence of PSTN and IP networks; it is the mapping of a telephone number from the public switched telephone network to Internet functionalities [7]. "ENUM" has a number of meanings. It is the name of a protocol that resolves fully qualified telephone numbers to fully qualified domain name addresses using a DNS-based architecture. It is the name of a working group of the IETF (Internet Engineering Task Force) chartered to develop protocols that map telephone numbers to resources found on the Internet using the Domain Name System.

Even though ENUM is a good mechanism for many internet services by utilizing E.164 numbers, because its conventional usage environment was dominant to telcos and also was allocated only to the approved operators with limited numbers by national policy, it could not be actively or widely used. In addition, utilizing E.164 numbers for global identification method requires robust infrastructure as telecommunication operators have now, it is also almost closed to conventional operators by their contracts.

Therefore, in this paper, we take the E.164 as a method for global IPTV service user identification. This can be the best option for telecommunication operators to support global IPTV portability service.

TABLE I
NUMBER STRUCTURE FOR GEOGRAPHIC AREA

Country Code	National Destination Code (Optional)	Subscriber Number
	National(significant) number	
cc=1-3digits	Maximum 15-cc digits	

International public telecommunication number for geographic areas (maximum 15 digits)

TABLE II
NUMBER STRUCTURE FOR GLOBAL SERVICES

Country Code	Global Subscriber Number
cc=3digits	Maximum 12 digits

International public telecommunication number for global services (maximum 15 digits)

III. PROPOSED GLOBAL IDENTIFICATION MECHANISM FOR IPTV PORTABILITY

In this chapter, we describe our proposed IPTV portability service scenario using E.164 based global identification through a global roaming service scenario. Even though our proposed scheme can be applied between

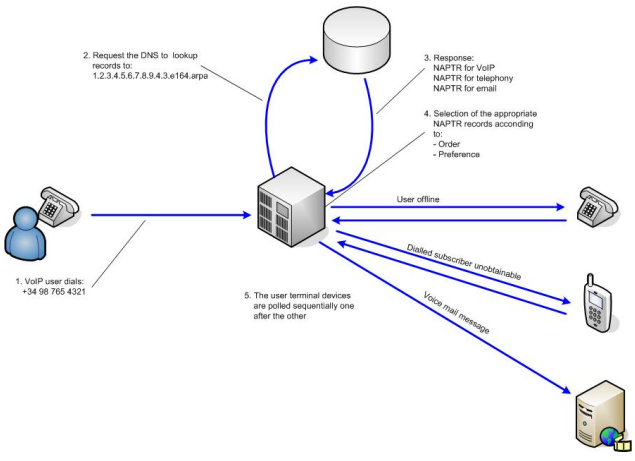

Figure 1. Call forwarding with ENUM for VoIP [14]

different telcos in a country or within a telco's service networks, the global roaming service scenario can be the one of the most clear and practical example for IPTV portability service.

A. IPTV Global Roaming Service Scenario

Fig. 2 depicts the network configuration for our IPTV global roaming service scenario. A user wants to enjoy his IPTV service while he is instantly stays in another place where another Telco B's set-top box is installed. For example, a user who is subscribed to Telco A has gone for his business trip to another country. In his hotel, there was a television with IPTV set-top box which belongs to Telco B in that country and he wants to enjoy his IPTV service provided by Telco A. Within this scenario, the Telco A's network becomes home network and the Telco B's network becomes visited network. The Fig 3 shows message flow of this scenario focusing on the user identification procedures. One thing to note is that, since telecommunication operates run their networks with proper security, we assume that the Telco A and Telco B regard each other's network as 'trust domain' so that there is no inter-domain security check.

B. User Identification Procedure

As we presented before, we use E.164 numbers as global identification method, Session Initiation Protocol (SIP) and diameter for signaling. For a user to be able to enjoy their IPTV service in other Telco's environment Telco B should be able to identify the user and forward its request to the user's subscribed domain and Telco A should be able to receive, process, and send relevant messages transmitted by other Telco, so that the user can be identified, authenticated, and ready by its original operator, Telco A. This requires three things to be added to legacy telco's IPTV service operational environment.

Firstly, the routing capability between different telcos is required. This gets done by some routers based on the client identifier. In this proposed scenario, we can take advantage from E.164's geographic area structure where classified by 'Geo Code'. Dependent on this advantage, we can do this procedure without much of additional complexity. As shown in Fig. 2, <1> the initial REGISTER message being sent to a softswitch of Telco B, <2> gets forwarded to the Telco A's relevant softswitch, <1-1> by recognizing the E.164 number in 'From' field with its national code and then the 'prefix' allocated to each telecommunication service providers.

Secondly, some mechanism to help softswitch to recognize whether the request is made for IPTV service or other services such as VoIP is required. For this, we have utilized the 'User-Agent' field within the SIP REGISTER Method to indicate that this message has been sent from an IPTV service terminal by adding some words, e.g., (IPTV STB), as shown in the Fig 4. By doing so, when the Telco A's softswitch receives a REGISTER message, <3> then it knows that this request is for IPTV service and forwards the message to a proper IPTV server. In this time, it sends the query message with DIAMETER to its HSS to confirm whether the user is truly subscribed or not.

Thirdly, a mechanism for user authentication and authorization across the different telcos is required. In our proposed scenario, we utilize 'Authorization' field within the SIP REGISTER method as shown in the Fig 4. When a user sends REGISTER message for the first time, the 'Authorization' field has no value except its username as shown in the Fig 4. When the message is being forwarded to its proper IPTV server, then <3-1> responsible server i.e., HSS or other IPTV server looks up its database and if the user is truly subscribed to their IPTV service, then <4> responses with authentication vector and then <5, 6> softswitch sends SIP 401 Unauthorization message which is filled with authentication vectors within the 'Authorization' field. Then <7> a user's IPTV terminal device calculates response value from received 'nonce' value and user's password and relevant information and send REGISTER message again. Once <7~10-1> the registration with authentication succeed, then <11~13> the softswith assigns an IPTV Application server for future service request and sends 200 OK message back to the user. When <13-1> the Telco B's softswitch receives the 200 OK, then it also registers this E.164 number with 'triggering point' of proper IPTV Application Server information and then <14> the registration procedure gets done by user to receive the 200 OK message. The rest of procedure depicts general IPTV service usage case.

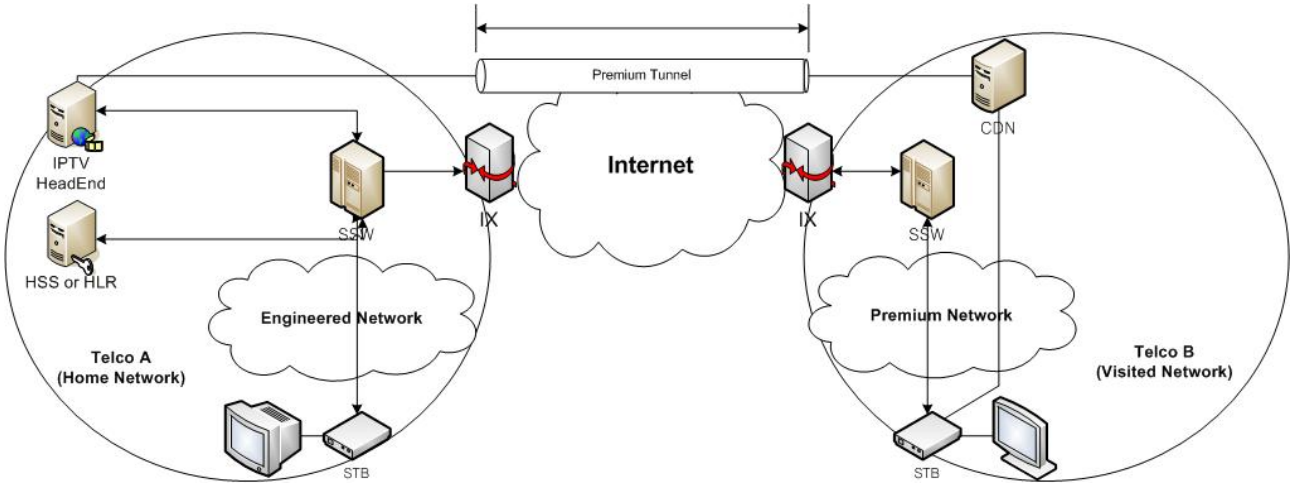

Figure 2. IPTV Service Architecture between two telecommunication companies

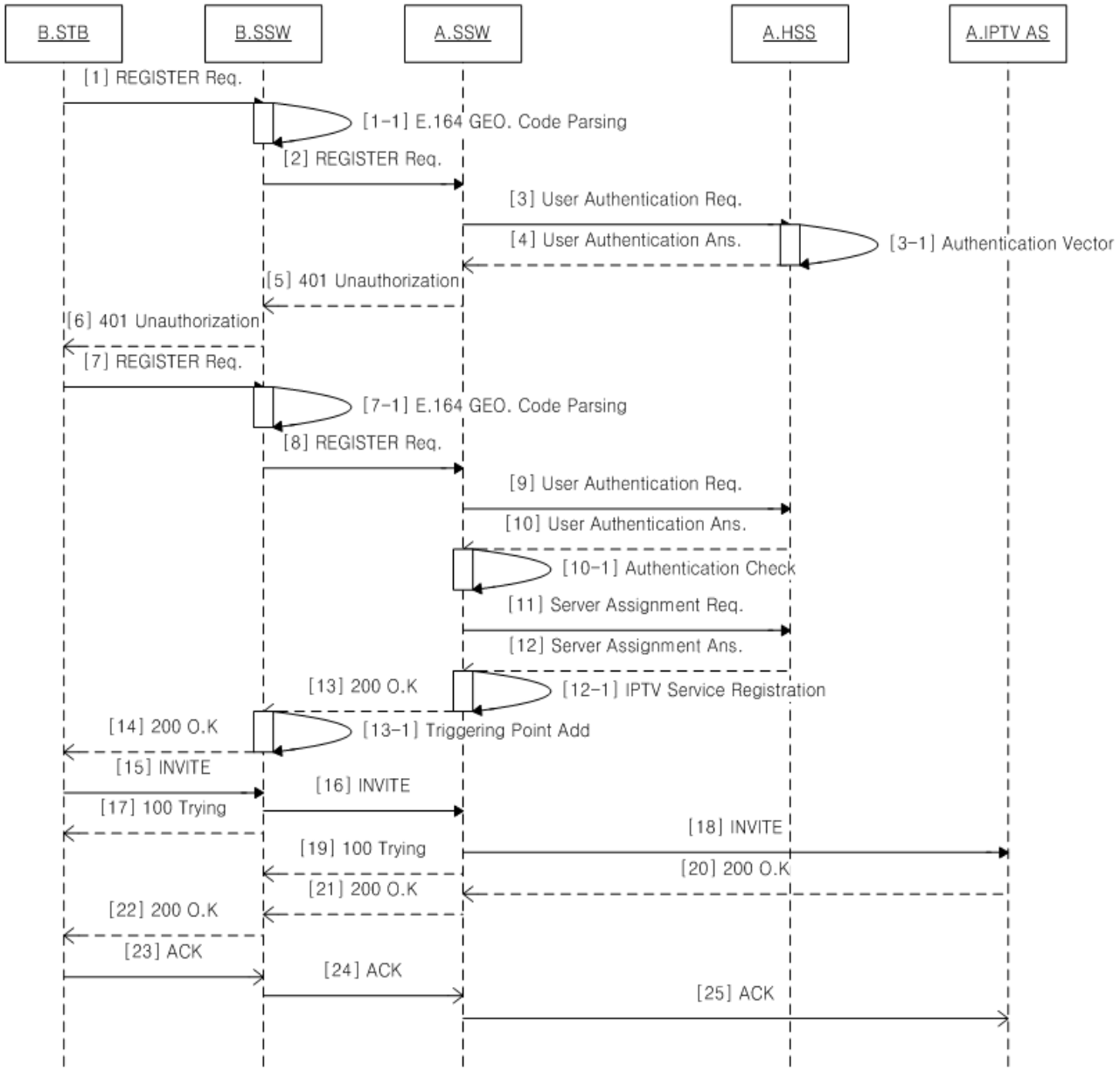

Figure 3. Global identification service process

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REGISTER sip:bnlab.icu.ac.kr SIP/2.0
From:
<sip:82119518xxxx@example.com>;tag=4561c4561
To: <sip:82119518xxxx@example.com>;tag=324591026
Call-Id: 9ce902bd23b070ae0108b225b94ac7fa
Cseq: 1 REGISTER
Contact:<sip:82119518xxxx@222.111.222.111;
      LINEID=05523f7a97b54dfa3f0c0e3746d73a24>
Authorization: Digest username="82119518xxxx@exa
      mple.com", realm="", nonce="", response=""
Expires: 3600
Date: Thu, 30 Sep 2004 00:46:53 GMT
Accept-Language: en
Supported: sip-cc, sip-cc-01, timer, replaces
User-Agent: IPTV Device /2.1.11 (IPTV-STB)
Content-Length: 0
```

Figure 4. SIP REGISTER message for IPTV service registration

IV. CONCLUSION

Whenever providing a service, a federated identity model takes a key role for managed service provisioning, i.e., user identification, service accessibility control, personalized service offering, accounting and charging. With this importance, the E.164-based telephone numbers are very simple and powerful method with many advantages. Hence, in this paper, we have presented a a global identification scheme with E.164 using SIP with IPTV global roaming service scenario. We describe our proposed IPTV portability service scenario using E.164 based global identification through a global roaming service scenario.

Despite all its advantages, however, using E.164 for global identity needs to solve some problems. Presently, most E.164 resources are managed by telecommunication. Also it is not opened because a telecommunication company thought that E.164 is their exclusive possession.

It partially makes sense but it is a big obstacle. If they open E.164, they have more advantage like Open API or Open Source. Because they can charge and bill for their subscribers when they using other services.

ACKNOWLEDGMENT

This work was supported in part by the MKE (Ministry of Knowledge Economy), Korea, under the ITRC(Information Technology Research Center) support program supervised by the IITA(Institute of Information Technology Advancement" (IITA-2008-(C1090-0801-0036)) and also was supported by the NIA (National Information Society Agency), KOREA under the KOREN program, [Development of Open-IPTV Technologies for Wired and Wireless Networks] as well.

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