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Studies on IPTV over IMS test bed

K. Sundara Raja Raja Perumal[1], D. Vinayagam[2], K. Porkamalapathandevi[3]
Department of Electronics & Communication Engineering[1,2]
Department of Computer Science Engineering[3]
Pondicherry Engineering College[1,3]
Sri Manakula Vinayagar Engineering College[2]
Puducherry, India[1,2,3]

Abstract

IMS (IP Multimedia Subsystem) is an architectural frame work which allows the convergence of Wireless, Wire line networks and internet thereby serving the use of a global platform for the delivery of IP multimedia applications. Thus IMS leads in the greater support of Next Generation Networks (NGN). The cause for IMS a high level technology's design and origin is mainly for the 3rd Generation Partnership Projects (3GPP). The intension of the design and origin of such a subsystem is to enable the service providers to create and deliver value added services to the users on heterogeneous network. IMS is all about sending data (voice, video, files etc) over an instrument using absolutely any kind of networks. The system has been configured to the real IP of 127.0.0.1 using the open source tool of OpenIMSCore. IMS has been configured between the hosts using OPEN IMS CORE test bed on an Open Source platform and initiate the calls between several IMS clients and its registration was evaluated. The traffic parameters of SIP IMS parameter has been verified using Wireshark network analyzer.

Keywords

IMS, OpenIMSCore, UCTIMS Client, CSCF, FHoSS.

1. Introduction

IMS plays an integral part for all future IP next generation converged networks. 3GPP defines IMS as a standard architecture which is capable of providing horizontal, cross-functional layer of intelligence on the top of IP. Such an architecture could deliver and satisfy the multiple needs of the new and rich user to user services, server to user offerings, multi user media services thereby enabling the creation, control and execution strategies of video streaming, IPTV, video gaming on the move and even at home through a PC. Additionally IMS helps in enabling and enhancing real time multimedia mobile services like rich voice services, messaging, video telephony, conferencing and push services. IMS employs various user to user communication services through variety of key mechanisms such as mobility management, session negotiation and management and Quality of Service (QoS). The real picture of the services delivered by IMS could be much more than just real time user to user services.

IMS is a general-purpose, open industry standard for voice and multimedia communications over packet based IP networks. It is a core network technology that can serve as a low-level foundation for technologies like Voice over IP (VoIP), Push-To-Talk (PTT), Push-To-View, Video Calling, and Video Sharing. IMS is based primarily on session initiation protocol (SIP). For carriers, benefits of IMS include increased flexibility to offer new 3G services, and lower costs. It is intended to eventually replace all circuit-based technologies currently used in mobile networks, although it can easily be phased in, in a piecemeal fashion, integrating with circuit-based technologies and existing billing systems, etc.

IMS Core components

As shown in Figure 1, The IP Multimedia Core Network Subsystem is a collection of different functions, linked by standardized interfaces, which grouped form one IMS administrative network. A function is not a node (hardware box): an implementer is free to combine 2 functions in 1 node, or to split a single function into 2 or more nodes. Each node can also be present multiple times in a single network, for dimensioning, load balancing or organizational issues. IMS decomposes the networking infrastructure into separate functions with standardized interfaces between them. Each interface is specified as a "reference point", which defines both the protocol over the interface and the functions between which it operates. The standards do not mandate which functions should be co-located, as this depends on the scale of the application, and a single device may contain several functions.

IMS core functional components are the Call Session Control Functions (CSCF) and the Home Subscriber Server (HSS) (2). There are three different kinds of CSCFs: Proxy-CSCF (P-CSCF), Interrogating-CSCF (ICSCF) and Serving-CSCF (S-CSCF). These components are responsible for routing signal and managing sessions. The PCSCF is the first functional point the User Equipment (UE) contacts on the IMS Core. It maintains IPSec security associations (SA) with UEs and applies integrity and confidentiality protection for SIP signaling (3).The I-CSCF is responsible for assigning a suitable S-CSCF to the UEs and routes incoming requests to it. The S-CSCF handles registration process, downloads authentication data from the HSS and generate challenge to UE. Finally, the HSS is a database containing all user identities, location information and service-related data. Figure 1 shows a simplified architecture of the IMS core (4).

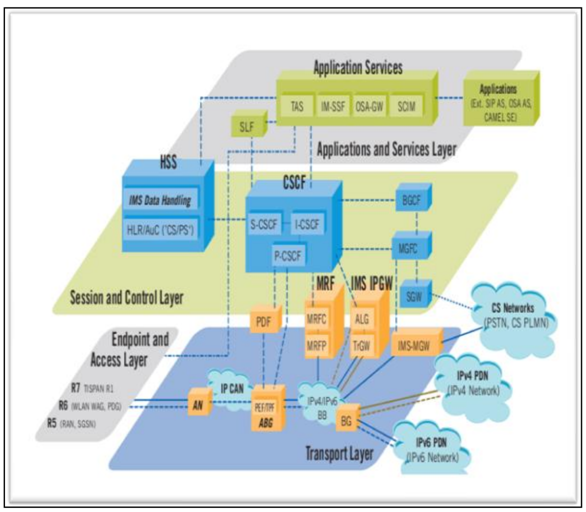


Figure 1: IMS Architecture

Procedures

Registration and session setup are the main categories of IMS procedures.

Registration: The user registration procedure provides mutual authentication between the UE and the IMS network using the 3GPP Authentication and Key Agreement (3GPP-AKA) mechanism (5). The AKA is accomplished by the S-CSCF challenging the UE with a 401 Unauthorized message after receiving the initial REGISTER message from the UE and the UE responding with a second REGISTER message. Figure 2 shows the SIP messages exchange between the IMS components during the registration procedure.

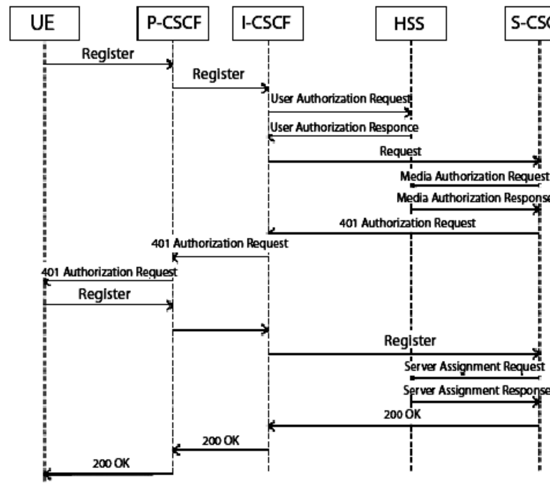


Figure 2: IMS registration procedure

2. IMS configuration using Open IMS Core

The Open IMS Core has been developed by the Fraunhofer Institute for Open Communication Systems (FOKUS) based in Berlin, Germany (6). The Open IMS Core is an open source implementation of IMS Call Session Control Functions (CSCFs) and a Home Subscriber Server (HSS), which together form the core elements of Next Generation Network (NGN) architectures as shown in Figure 4. The components of the implementation are all based upon open source software including the SIP Express Router (SER) and the MySQL database. The software is distributed under the GNU General Public License (GPL Version 2) (7). By deploying the IMS core routing functions on standard off the shelf hardware rather than simulators, application developers are able to quickly develop and test new IMS-based concepts and services without having to concern themselves too much with the underlying routing infrastructure or paying for access to test environments.

Open test-beds are an important means for providing the enabling infrastructure to accelerate innovation through research and development activities. The basic goals of the project are, to fuel interoperability testing and benchmarking, as well as prototyping of technology extensions and innovative multimedia applications for emerging telecommunications networks. As a result, the Open IMS Core project has been adopted by some of the world's leading telecommunications operators and vendors as they trial practical applications of IMS and how these services can interact with the underlying network transport layer (8).

Figure 3: Tomcat server

1. PCSCF **server**

This terminal shows that the PCSCF server has started to run, and the TCP and UDP port has started to function on receiving the local host address 127.0.0.1 as shown in Figure 4.

2. FHoSS **Server**

The Figure 5 shows the tomcat server which is the main server having all the databases of the IMS clients. The FHoSS server starts running for the real IP 127.0.0.1 and the domain name is open-ims.test.

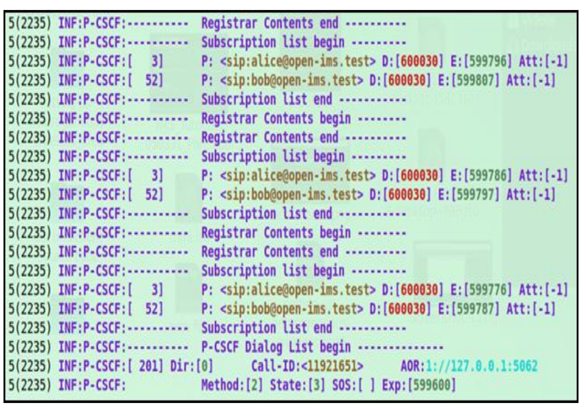


Figure 4: PCSCF Server

Figure 5: SCSCF Server

Figure 6: ICSCF Server

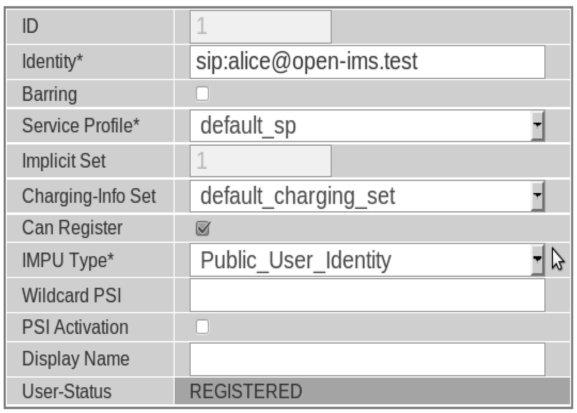
3. SCSCF **server**

The SCSCF server registration process is shown in Figure 5, where the registration begins, which should be listened by 3868 port (9). The peer list starts between the servers. Similarly ICSCF server registration is also shown in Figure 6. The TCP and UDP port address is depicted in the terminal shown below. The diameter peer initialization is done and the initiation is started. The servers, FQDN, vendor identity, realm, product name for both servers are found.

3. UCT IMS client

The UCT IMS Client is designed to use in conjunction with the Fraunhofer FOKUS Open IMS Core (10). The client has been developed by the Communications Research Group at the University of Cape Town, South Africa. The UCT IMS Client is used with this application for IMS Core Network. The UCT IMS client who is created directly for

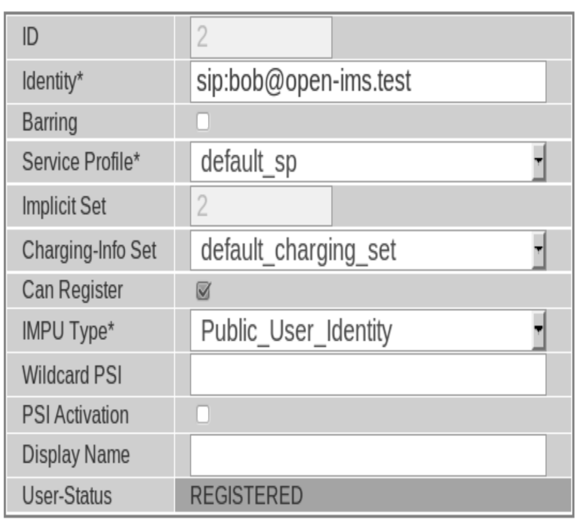
OpenIMS is much more stable than the other kinds of clients (11).
It has very simple interface, hence it's easy to operate. However, the functionalities of UCT IMS client are limited. For example, it doesn't support multiple accounts simultaneously. The paths in these startup scripts are absolute and need to be edited if the installation directory is different from /opt/OpenIMSCore/ and the installation is operational and accessible for the three users such as alice@open-ims.test and bob@open-ims.test (or different domain if all the necessary changes were done)



ID	1
Identity*	sip:alice@open-ims.test
Barring	☐
Service Profile*	default_sp
Implicit Set	1
Charging-Info Set	default_charging_set
Can Register	☑
IMPU Type*	Public_User_Identity
Wildcard PSI	
PSI Activation	☐
Display Name	
User-Status	REGISTERED

Figure 7: UCT IMS Client-Alice

The Alice and Bob are the default users created by the IMStestbed (12). This is the process undergone by all the new users who wants to register with IMS server.



ID	2
Identity*	sip:bob@open-ims.test
Barring	☐
Service Profile*	default_sp
Implicit Set	2
Charging-Info Set	default_charging_set
Can Register	☑
IMPU Type*	Public_User_Identity
Wildcard PSI	
PSI Activation	☐
Display Name	
User-Status	REGISTERED

Figure 8: UCT IMS Client-Bob

4. Results And Discussion

A. Services provided by SIP

Session establishment is the only service which can be provided by SIP. The main function of SIP, is session establishment, management and its extensibility is used for several other services.

- Instant Messaging between Alice and Bob

Instant messaging in the SIP is the real-time (or almost real-time) exchange of text messages between the users. MESSAGE method is a SIP extension standard, which exploits the existing SIP infrastructure for delivering instant messages and unifies the communication between users (13). Users don't have to use separate applications, devices and infrastructures for different means of communication, thus enhancing the user experience.

B. Calling Remote Client

Once the IMS testbed is created, the IMS clients should register with the IMS testbed. The link is established between the IMS subscribers (Alice and Bob) (14). The incoming call from Bob to Alice is shown in the Figure 9. The link establishment and corresponding signal flow is shown in the testbed. The registration delay and session setup delay is also obtained from the UCT IMS client module. Once the session is started, the video and the instant messaging windows open and the exchanging of message between the users occur.

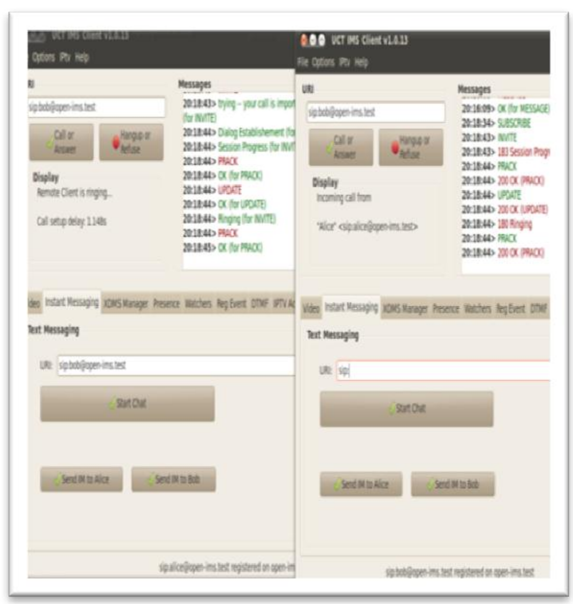


Figure 9: Voice Call Received by Alice

C. Instant Messaging between Alice and Bob

Instant messaging is the real-time (or almost real-time) exchange of text messages between the users (15). SIP offer short individual messages, mostly text this is accomplished by exchanging MESSAGE requests. MESSAGE method is a SIP extension standardized Exploiting existing SIP infrastructure for delivering instant messages unifies the communication between users 1.Users don't have to use separate applications, devices and infrastructures for different means of communication thus enhancing the user experience is shown in Figure 10.

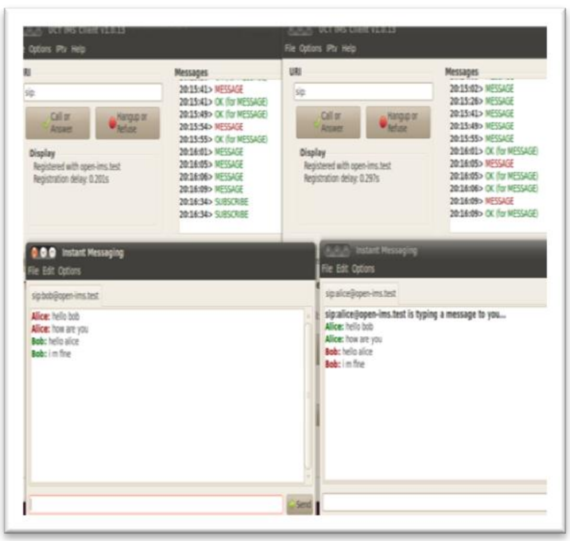


Figure 10: Instant messaging between Alice and Bob

D. Network setting Tools

Table 1 depicts the details of the parameters used to set the network into IMS network according to the applications (16).Some of the basic parameters are shown below: OS (Ubuntu 10.04), name server is done by Bind9, for database management MySQL is used and for java_home, OPENJDK1.6 is used.

Table 1: Network setting tools

Operating System	Ubuntu 10.10
Name Server	Bind9
Database(Hss)	Mysql
Java	Openjdk1.6
Host Ip	127.0.0.1
Domain Name	Open-Ims.Test

The registration delay and session setup delays for voice calls for different kinds of users are tabulated in Table 1. This can be verified for both home and roaming network. From this table, it is inferred that the delay is less for home network than the roaming network.

E. Internet protocol television

IPTV (Internet Protocol Television) is a system through which Internet television services are delivered using the architecture and networking methods of the IP suite over a packet switched network infrastructure. Next generation network based IPTV is responsible for the delivery of streaming media as Live TV and Video on Demand. In combination with TV services (Linear TV and Video on Demand) this yields into so called triple play (data, VoIP and IPTV) and quadruple play (including mobility aspects) environments. IPTV can be seen as a main feature to compete against the cable operators in their particular domain.

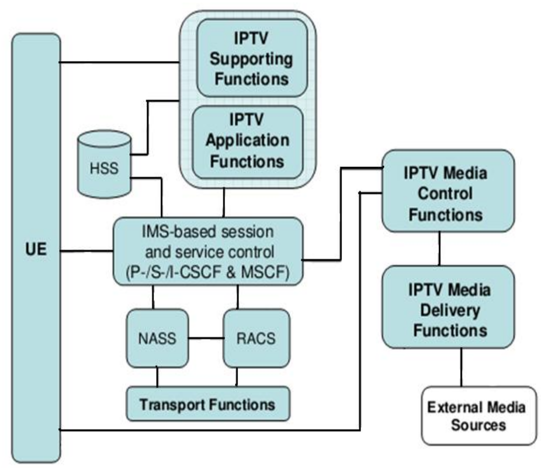


Figure 11: IPTV architecture

IPTV Media Functions are in charge of controlling and delivering the media flows to the UE representing the media server infrastructure. As the logical entity is split into Media Control Functions (MCF) and Media Delivery Functions (MDF) in large scale deployments to allow the construction of distributed media server infrastructures (17). The tasks of Media Control Function (MCF) include the handling of the media flow control, managing the media processing, monitoring the status of connected MDFs, managing interaction with the UE (e.g. trick mode commands), and handling interaction with the IPTV service control function (SCF) (18).

Additionally this function keeps an accurate view on status and content distribution related to the different

MDFs. In distributed environments the selection of an appropriate MDF is also the task of the MCF together with charging vector generation.

5. Conclusions and Future Research

A. Conclusion

The aim of the project is to configure the IMS heterogeneous environment and networks using OpenIMSCore open source test bed setup. IMS is configured in the host by resolving the configuration of the IP addresses and Domain Naming Server (DNS) is configured using Barkley Internet Naming Domain (BIND 9) which helps in resolving a host in another domain. Therefore, after resolving the servers it starts running parallely where the registration entity begins.

In this project a call initiation procedure between the two IMS client was examined in detail and every step was compared to the specifications and standards defining this process. The system has been configured to the real IP of 127.0.0.1 using the open source tool of OpenIMSCore. The traffic parameters of SIP IMS has been verified using Wireshark network analyzer.

B. Future work

The future work could be intended to implement an IPTV over this IMS platform. The main resource for media services is the IMS platform where all the IP networks can be integrated into it. Therefore, IPTV can be implemented with the help of media delivery function and media control function in the future. Moreover by using user equipment, call can be made to the IMS server from the environment as well. And also the recent advances in wireless client devices and multimedia communications have motivated relevant standardization efforts, such as the IP Multimedia System (IMS) to support session control, mobility, and interoperability in all-IP next generation networks. One of the most challenging issues in IMS-based solutions is service continuity during handoffs, i.e., the capacity to maintain service provisioning and avoid flow interruptions when clients roam through different wireless APs by minimizing or eliminating handoff delays and packet losses, especially during vertical handoffs among different wireless technologies.

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K. Sundara Raja Raja Perumal was born in Puducherry, India, October 22, 1988. He received his B.Tech. degree by the year 2010 in the discipline of Electronic & Communication Engineering at Regency Institute of Technology, Affiliated to Pondicherry University, Yanam, U.T. of Puducherry, INDIA. He has completed his Master degree by the year 2012 in the discipline of Electronic & Communication Engineering (ECE) at Pondicherry Engineering College, Puducherry, INDIA, (2010-2012). His research interests are in the areas of IMS, wireless communication, Third Generation Wireless Networks.

D. Vinayagam was born in Puducherry, India, August 7, 1988. He received his B. Tech. degree by the year 2010 in the discipline of Electronic & Communication Engineering at Regency Institute of Technology, Affiliated to Pondicherry University, Yanam, U.T. of Puducherry, INDIA. He has completed his Master degree by the year 2012 in the discipline of Electronic & Communication Engineering (ECE) at Sri Manakula.

K. Porkamalapathandevi received her B.Tech. degree in Computer Science and Engineering from Pondicherry University, Puducherry, in 2009, M.Tech. degree in Information Security from Pondicherry University, Puducherry, in 2011. Her research interests cover security issues in Wireless Networks. At present, she is working in Tata Consultancy Services, Chennai.