

A Study of Implementation Open IMS Platform Setup -Experiences of an IMS Testbed

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Abstract—IP Multimedia Subsystem (IMS) was introduced by the Third Generation Partnership Project (3GPP) to enable 3G mobile systems to provide ubiquitous cellular access to all the services that the Internet provides, with improved Quality of Service (QoS). As such a testbed is quite complex by its very nature, Fraunhofer Institute (FOKUS) known as a leading research institute in the field of open communication systems, has coined in addition the notion of technology focused “playgrounds”. One of these playgrounds is the “Open IMS Playground@FOKUS”. This paper introduces the implementation of OpenIMS, and provides an overview of the “OpenIMS @ FOKUS”. The objective of this project is to outline and explain of procedures taken in setting up IMS Core network using OpenIMS platform by FOKUS. The OpenIMS is created for research and application testing purposes by which it is a lightweight version of IMS components such as P-CSCF, I-CSCF, S-CSCF, HSS etc. As a result, by using Open IMS platform setup, user registration and call between IMS Client are successfully connected.

Key Words — IMS , 3GPP , QoS, P-CSCF, I-CSCF, S-CSCF, HSS

I. INTRODUCTION

Rapid growth in the area of telecommunication technologies nowadays has compelled the network operators to provide seamless integration of all communication applications into a single system. Due to these circumstances IP Multimedia Subsystem (IMS) has established itself as a foundation for future wireless and wireline convergence whereby the interfaces for the service developers based on the IP protocols. [1-3]. IMS is defined by the 3rd Generation Partnership Projects (3GPP and 3GPP2) [4] as a part of the vision for evolving mobile networks beyond GSM.

IMS architecture is at the heart of the Fixed-Mobile Convergence (FMC) and is based on a wide range of Internet Engineering Task Force (IETF) protocols such as Session Initiated Protocol (SIP)[5]. SIP is responsible for creating, modifying and terminating sessions consisting of one or several media streams. In order to access IMS services, mobile devices should be capable and compliant to IMS, and such mobile devices can be referred to as IMS Clients. This conclude a combination of VoIP, presence server,

instancemessaging which is the example that could be operate in heterogeneous network environment[6-7].

The advantages of IMS over the cellular network infrastructure are as follows with the descriptions at [8-10]:

- IMS allows all services to be accessible regardless of the users' access network
- IMS also provides features like security and QoS thus making it a perfect and complete service platform for Next Generation Network (NGN).
- This IMS also enables more flexible ways for operators to charge subscribers, provides a uniform environment for billing as well [4].
- Service providers can integrate voice, video and data services and provide them on a single platform.

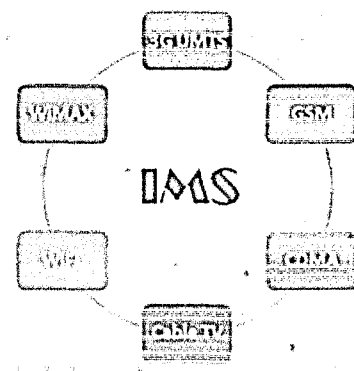


Figure 1. Various access networks supported by IMS

Figure 1 shows various access networks supported by IMS. This paper explores the implementation of Open IMS and explain the procedures taken in setting up and also shares the experience of building a testbed using open source tools for testing IMS clients.

II. Open IMS ARCHITECTURE

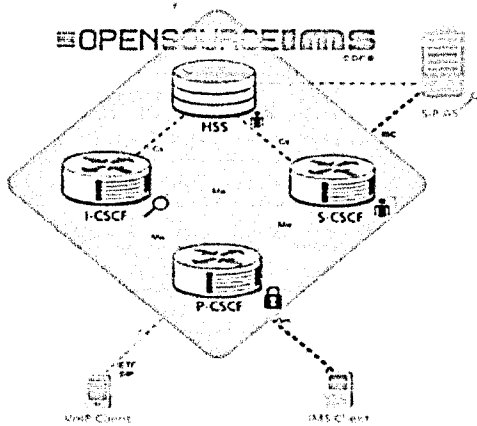


Figure 2. FOKUS Open IMS Core Architecture

Figure 2 above shown FOKUS Open IMS Core Architecture and description of each key components will be briefly explain below.

- *Proxy Call State Control Function (P-CSCF)*

The Proxy Call State Control Function is the first contact to the IMS network from any access network. It behaves like a proxy accepting requests and either serves them internally or forwards them.

- *Interrogating Call State Control Function (I-CSCF)*

The Interrogating Call State Control Function is the contact point within an operator's network for all connections destined to a subscriber of that network operator. It routes the SIP request to the next destination, which is usually an S-CSCF.

- *Serving Call State Control Function (S-CSCF)*

The Serving Call State Control Function performs the session control services for the endpoint. S-CSCF in the IMS is responsible to keep session control, handle registration services, route traffic and send accounting information to charging entities.

- *Home Subscriber Server (HSS)*

The Home Subscriber Server is the equivalent of the HLR (Home Location Register) in 2G systems. It is the master database of an IMS that stores IMS user profiles including individual filtering information, user status informations and location information.

- *Application Server(AS)*

Application Servers main responsibilities are to process incoming SIP messages, originate SIP requests, add value added services and send accounting information.

III. IMPLEMENTATION OF THE OpenIMS

The scope for this paper covers setups and experience for implementing the IMS network based open source solution from Fraunhofer Institute for Open Communication Systems (FOKUS) known as Open IMS [11].

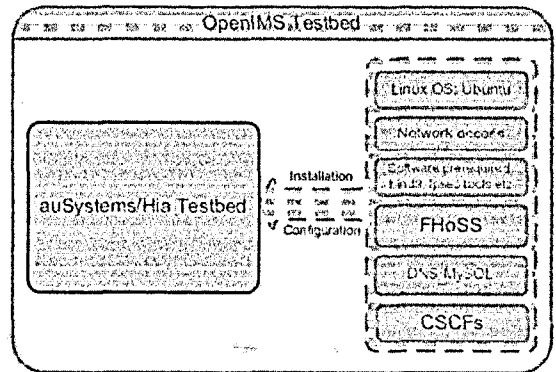


Figure 3. Setting up of Open IMS testbed

As shown in figure 3, before installing the key components of Open IMS, the testbed requires prerequisites in hardware, network and software. A current Linux desktop class machine is needed for hardware prerequisites and Ubuntu 10.04 is used in this project as Operating System[12]. The IMS Testbed is work in progress and not stable yet, though it can perform minimal IMS functionalities, such as user registration.

IV. RESEARCH METHODOLOGY

This chapter explains the process flow and the method being carried out at each process towards the installation testbeds of Open IMS. It is also to ensure that each phase will go through evaluation before proceeding to the next step. Figure 4 shown below describe the process involve and how this process are managed.

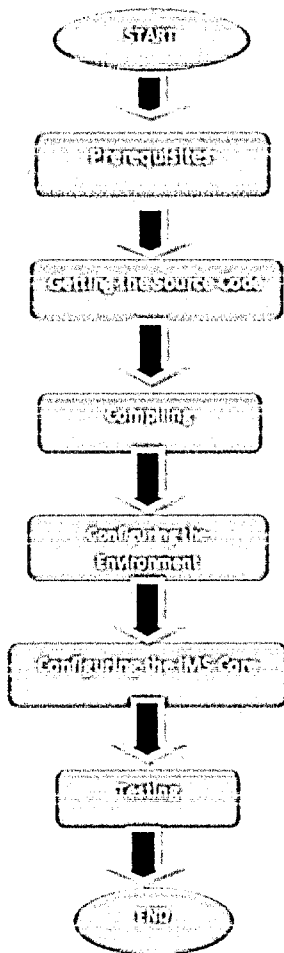


Figure 4. Flowchart of Methodology

1. Prerequisites

Prior to the installation, 100 Mbytes of disk space are needed in order to ensure the system will work well. Subversion (svn) is used to obtain the necessary source codes from Berlinsubversion servers. Next, GCC3/4, JDK 1.6, Ant, and Make are installed for the Java development use. In this case, MySQL is needed as a database management system (DBMS) which is supported by HSS, I-CSCF and other functions that require a DBMS. Linux kernel version 2.6 and IPsec-tools, are installed to use the IPsec [14]. Developed libxml2, libmysql, bison and flex are required to install as well. The bind 9 is used as name server of this project and Mozilla Firefox as a project browser. As the requirements have already fulfilled, the installation and configuration of the FhoSS, the core components of Open IMS is started.

2. Getting the Source Code

As the Subversion is successfully installed, fresh code can be downloaded from this site; <http://svn.berlios.de/svnroot/repos/openimscore>. The source code is pre-configured to work from a standard file path [12].

3. Compiling

Before proceeding for compiling, Java Development Kit (JDK) version 1.6 is installed. Once JDK installed, Ant is used to build and install the HSS.

4. Configuring the Environment

FOKUS Open IMS Core is preconfigured to work with the domain "openims.test" and IP address of default loopback device, "127.0.0.1". In order to configure the environment, home domain (openims.test) is replaced into (openims-uitm.dnszone), and replaced 127.0.0.1 where required with current IP address, and change the database passwords. For this reason, instead of having to change manually, a configuration script (configurator.sh) under directory: `/opt/OpenIMScore/ser_ims/cfg/` is used. For the host names for the core functional components to be recognizable in the network, a minimal DNS server was set up using BIND9 for address mapping. MySQL server was also installed since the HSS requires a database to store data such as private and public user identities. To get a client registered, the scscf.cfg file is modified to enable the MD5 authorization as the default authentication.

5. Configuring the IMS Core

MySQL and DNS should have been working at this point. Due to that, the configuration files are copied to the Open IMS Core folder and then the CSCFs and HSS are run each in a new terminal tab. The configuration files such as: pcscf.sh, icscf.sh, scscf.sh and fhoss.sh should have run in parallel. For each of the CSCFs and the HSS, log messages can be observed periodically showing information such as the status of the connection or any error messages if any.

6. Testing

The last step is testing. All the prerequisites and other steps are successfully installed and configured by now. With two IMS clients needed with soft phone of Boghe installed, the testing for making call can be done.

V. RESULTS AND DISCUSSION

Based on the process flow and the method being carried out at each process towards the installation testbeds of Open IMS, these are the screenshot of fews installation that had been made.

Figure 5 shows the Dig command for hss.openims.uitm to check whether the DNS is working properly. Query:1, ANSWER:1, AUTHORITY:1, ADDITIONAL:1 showed that DNS is working well as there are answer back for every Query and Authority status.

```

root@administrator-desktop: /opt/OpenIMSCore/ser_ims
File Edit View Terminal Help
<> Dig 9.7.0-P1 <> hss.openims.uitm
: global options: +cmd
: Got answer:
:-->HEADER<< opcode: QUERY, status: NOERROR, id: 38648
: flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 1

: QUESTION SECTION:
:hss.openims.uitm.                IN      A

: ANSWER SECTION:
hss.openims.uitm.                86400  IN      A      10.8.82.28

: AUTHORITY SECTION:
openims.uitm.                   86400  IN      NS      ns.openims.uitm.

: ADDITIONAL SECTION:
ns.openims.uitm.                86400  IN      A      10.8.82.28

: Query time: 0 msec
: SERVER: 10.8.82.28#53(10.8.82.28)
: WHEN: Tue Jun 5 15:23:35 2012
: MSG SIZE rcvd: 83
root@administrator-desktop: /opt/OpenIMSCore/ser_ims#

```

Figure 5. Screenshots of Dig command

As shown in Figure 6 below, shows the information status of P-CSCF when connecting with the user registration for Open IMS by FOKUS.

```

root@administrator-desktop: /opt/OpenIMSCore
File Edit View Terminal Tabs Help
root@administrator-desktop: /opt/OpenIMSCore
S(2224) INF P-CSCF: Subscription list end
S(2224) INF P-CSCF: Registrar Contents begin
S(2224) INF P-CSCF: Registrar contents end
S(2224) INF P-CSCF: Subscription list begin
S(2224) INF P-CSCF: Subscription list end
S(2224) INF P-CSCF: Registrar Contents begin
S(2224) INF P-CSCF: Registrar Contents end
S(2224) INF P-CSCF: Subscription list begin
S(2224) INF P-CSCF: Subscription list end
S(2224) INF P-CSCF: P-CSCF Dialog List begin
S(2224) INF P-CSCF: P-CSCF Dialog List end
S(2224) INF P-CSCF: Registrar Contents begin
S(2224) INF P-CSCF: Registrar Contents end
S(2224) INF P-CSCF: Subscription list begin
S(2224) INF P-CSCF: Subscription list end
S(2224) INF P-CSCF: Registrar Contents begin
S(2224) INF P-CSCF: Registrar Contents end
S(2224) INF P-CSCF: Subscription list begin
S(2224) INF P-CSCF: Subscription list end
S(2224) INF P-CSCF: Registrar Contents begin
S(2224) INF P-CSCF: Registrar Contents end
S(2224) INF P-CSCF: Subscription list begin
S(2224) INF P-CSCF: Subscription list end

```

Figure 6. Screenshot of P-CSCF

Figure 7, show S-CSCF. As shown, log messages show user registration contents when begin and end.

```

root@uitm-laptop: /opt/OpenIMSCore
File Edit View Terminal Tabs Help
root@uitm-laptop: /opt/OpenIMSCore
4(11491) Peer List: ---
4(11491) S(Closed) hss.openims-uitm.com.my:3868 D[ ]
4(11491)
5(11482) INF S-CSCF: Registrar Contents begin
5(11482) INF S-CSCF: Registrar contents end
4(11491) Peer List: ---
4(11491) S(Closed) hss.openims-uitm.com.my:3868 D[ ]
4(11491)
5(11482) INF S-CSCF: Registrar Contents begin
5(11482) INF S-CSCF: Registrar contents end
4(11491) DB:peer timer(): Peer hss.openims-uitm.com.my State 0
4(11491) DB:E1 Snd Conn Req(): Peer hss.openims-uitm.com.my
4(11491) INFO:peer connect(): Trying to connect to 192.168.0.128 port 3868
4(11491) WARNING:peer connect(): Error opening connection to to 192.168.0.128 p
rt 3868
4(11491) Peer List: ---
4(11491) S(Closed) hss.openims-uitm.com.my:3868 D[ ]
4(11491)
4(11491) Peer List: ---
4(11491) S(Closed) hss.openims-uitm.com.my:3868 D[ ]
4(11491)
5(11482) INF S-CSCF: Registrar Contents begin
5(11482) INF S-CSCF: Registrar Contents end

```

Figure 7. Screenshot of S-CSCF.

Figures 8,9,10,11, 12 and 13 below shows User Registration process of making call between IMS Clients that had been installed Boghe[13]. By default, FHoSS comes provisioned with a couple of sample users: alice and bob. User registration steps for alice and bob are similar. Thus, will focus registration made by alice.

Figure 8 shown the Authentication Required for FHoSS Web Console, where user can enter as 'hssAdmin' and the password is 'hss' to read and manage the console.

```

File Edit View History Bookmarks Work Help
Connecting...
10.8.82.28:5000
Redirecting to the FHoSS Web Console... If not redirected automatically please click here.

```

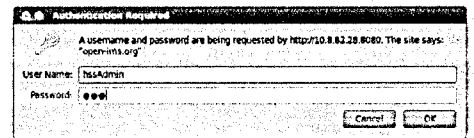


Figure 8. Screenshot of Authentication Required to FHoSS Web Console

Figure 9 and 10, shows IMS Subscription user whose create identity as:alice@openims.uitm.

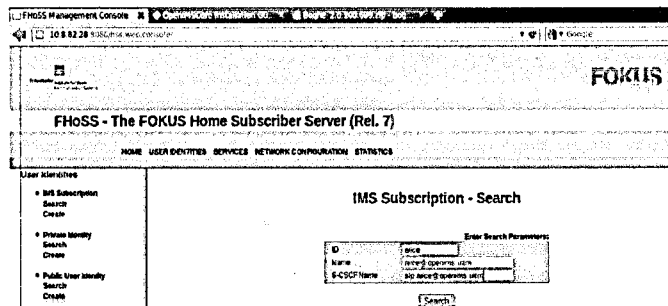


Figure 9. Screenshot of IMS Subscription

IMS Subscription - Search

Enter Search Parameters:

Name	alice@openims.uitm
Public Identity	sip:alice@openims.uitm

[Search]

Figure 10. Close-up of IMS Subscription

As shown in figure 11, in this setup, the SIP phone used is Boghe. An example for IMS User Endpoint Configuration i.e. alice is as below:

- Private Identity: alice@openims.uitm
- Secret Key: alice
- Public Identity: sip:alice@openims.uitm
- Realm: openims.uitm.com
- Strict Proxy: sip:pcscf.openims.uitm:4060

Figure 11. Boghe, IMS Client

IMS level authentication is basically the procedure by which the network authenticates the user i.e. *alice@openims.uitm* and *bob@openims.uitm* and then authorizes them to access the IMS services. The call between alice and bob can be illustrated in the figure 12.

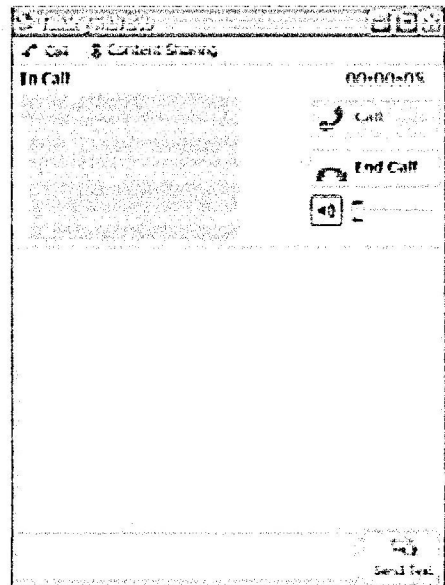


Figure 12. In Call Audio Screen when talking to Bob

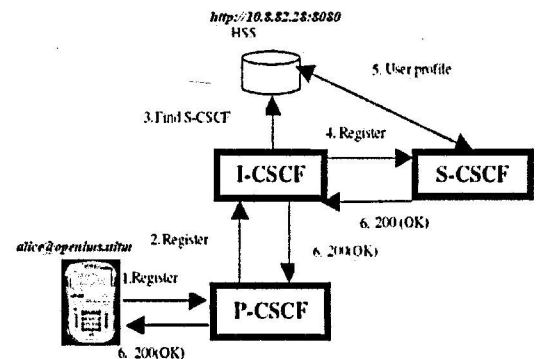


Figure 13. User Registration Process

Figure 13 shows the IMS registration allows the User Equipment (UE) to use IMS services. Once UE obtain an IP connectivity bearer and discover an IMS entry point, the P-CSCF the UE is successfully authorized, the UE is able to initiate and receive sessions. During the registration procedure it will go through I-CSCF, then SIP request to the next destination will be route to S-CSCF by refer to user data profile stored in HSS. Both the UE and the P-CSCF learn which S-CSCF in the network will be serving the UE. The call between alice and bob has been successfully made through the IMS Core network that handle the registration and call routing.

VI. CONCLUSION

The testbed established allowed to explore the features of IMS architecture in general, and also getting the hands-on experience on the implementation of Open IMS by FOKUS. Basic knowledge of using Linux Command is a must to make installation and configuration go smooth. Upon completion on this, it may conclude that the overall network architecture system is complex. It involves significant local configurations. Proper setups and substantial local configurations of IMS core network domain, application servers and clients are required to achieve successful result of making call between IMS Client. Future work can be done to implement the Real-time Transport Protocol (RTP) to allow audio and video sessions, to add the presence functionality for instant messaging, and improve the IMS Client for interoperability with other IMS networks.

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