International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 03 Issue: 06 | June -2019 ISSN: 2590-1892

Efficient Framework: For Improving Performance of Network Management System

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Abstract **- The IP Multimedia Subsystem (IMS) is a standard open-system design offering multimedia benefits over IP [7]. IMS was initially structured by the wireless principles body third Generation Partnership Project (3GPP). The IMS is in charge of controlling multimedia sessions by methods for the Session Initiation convention (SIP) and the session description convention (SDP) specified by the Internet Engineering Task Force (IETF) [2].IMS is the main component in the 3G engineering which helps it possible to give cellular access to each and every administrations that the Internet gives. IMS is measured as a link involving cellular structure and internet. The IMS contains Network Elements namely Call session control function (CSCF) and Home Subscriber Server (HSS) etc. All these network elements are managed and monitored by a system called network management system (NMS).The functions of NMS includes Fault Management (FM), Configuration Management (CM) and Performance Management (PM).The monitoring of this system manually is a tedious task and it is time consuming. To overcome this, automation can be considered as a solution. Test automation is robust and fastest solutions for ensuring quality in environment. A Framework for NMS should be developed to speed up the execution and to decrease the effort of running test manually. The Robot framework is used for developing Framework and Python for Scripting.**

Keyword: IMS (IP Multimedia Subsystem), Network Management System (NMS), Manual Testing, Automation Testing, Robot Framework.

1. INTRODUCTION

The IMS (IP Multimedia Subsystem) was first given by 3rd Generation Partnership Project (3GPP). The IMS gives multimedia administrations (for example sound, video, content, picture, and blends) for multiple access networks over Packet Switched Networks (PSN), for example, 3G, WLAN, 4G and DSL [1].

IMS is an open institutionalized design used for Communicating with several sort of multimedia service or communication association as of several sort of access either fixed or mobile like 3G mobile, WLAN, Fiber or Ethernet, WiMAX, DSL and so on. It depends on ETSI measures such as SIP for interfaces between building components. IMS can be considered as in charge of making associations among subscribers and network assets and thus assumes main job in application enablement as a scaffold among subscribers and application content suppliers. The Architecture of IMS is given in fig 1.

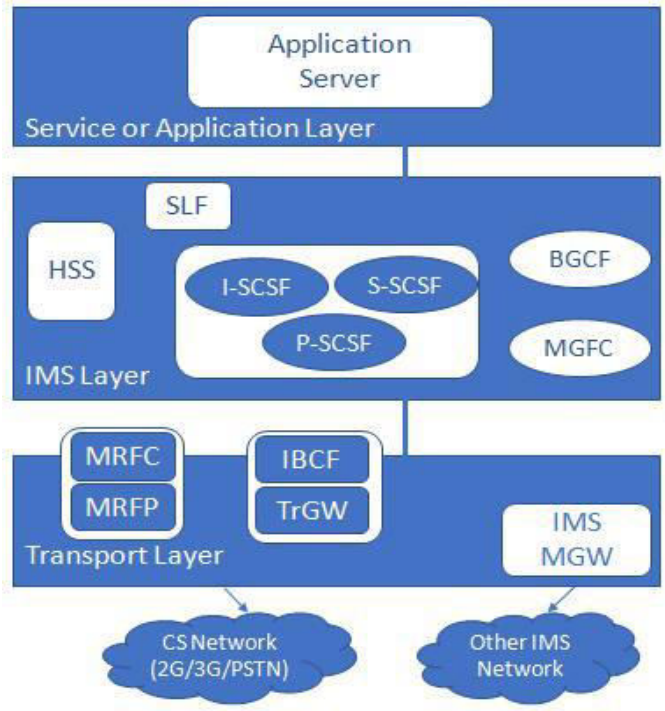

Fig. 1. IMS Architecture

The IMS architecture workflow can be explained as follows:

The Technologies like LTE, PSTN, 2G, internet and 3G use IMS Services by connecting with it. The User Equipment (UE) can contact IMS using SIP signals. The P-CSCF is the entry point of contact in IMS. There are two ways in which P-CSCF talks with UE. (i) UE requests EPS attachment or Request messages of PDN connectivity for P-CSCF address.(ii) UE can make use of DHCP procedure for P-CSCF discovery. The importance of LTE Network in facilitating Volte Call is it helps in IP connectivity of UE to P-CSCF and to exchange these SIP Messages, UE uses this IP connectivity.SIP from UE goes to PDN Gateway then to P-CSCF.

The SIP control efficient entities can be called as call session control functions which are defined to assume responsibility for controlling and establishing the session between IMS subscribers and servers [2].They are (i) P- CSCF(Proxy-CSCF), entry point to IMS and Interact with UE using SIP messages. (ii) I-CSCF (interrogating CSCF), at the time of registration I- CSCF allocates S-CSCF to UE and it will contact HSS (Home Subscriber Server) for user Authorization and Authentication to forward it to correct S-CSCF. (iii) Serving CSCF (S-CSCF), helps in session control function for UE. It forwards SIP responses and request to corresponding domains (CS or IMS).If SIP request is destined to CS (Circuit Switched) network, S-CSCF forwards it to BGCF (Breakout Gateway Control Function) otherwise if it destined to another IMS Network, S-CSCF directly forward to IBCF (Interconnection Border Control Function).

The Application Server (AS) helps in executing services. The S-CSCF connects to AS through ISC Interfaces. The Application Server provides Audio/Video configuring, Gaming, Content Sharing and many other services to users. One Application Server can host multiple IMS Applications.

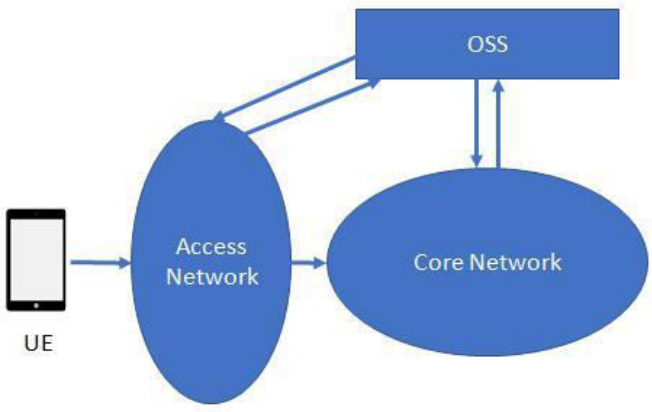

Fig. 2. Core Network and Access Network

The figure 2. Shows Interaction of UE with Core Network and Access Network. The communication of these networks with OSS (Operation Support System).The UE interacts with Access Network through IP and forwards this request to Core Network. The IMS resides in the core network. The functionalities of core network include charging, calling, value added services like gaming and conference calls. The core network and access network interact with OSS. The OSS manages the networks. The OSS contains Element Management System (EMS) and Network Management System (NMS).

2. NEED OF AUTOMATION

Manual testing intends to carry out test activities manually on the system or application with no assistance of automation devices. The means of manual testing are recognized by the applications usefulness. Manual testing is carried out by test plan preparation, writing test case followed by execution. After the execution look for Confirm expected results and Prepare the bug report [3].
The Unit testing, Regression testing, Acceptance testing and Integration testing are some of the types of testing.

In spite of the fact that routine with regards to manual testing is as yet being utilized, it has noteworthy shortcomings. The essential shortcoming is at one time an issue is discovered; it is troublesome or difficult to duplicate the imperfection in light of the fact that the tester does not pursue a pre-characterized arrangement of occasions.

A portion of the shortcomings of manual testing are:

1) Manual methods can't give the sort of extraordinary recreation of most extreme user interaction after some time. People can't keep the rate of cooperation up sufficiently high and sufficiently long.

2) Manual testing does not give the broadness of test inclusion of the product features that is required. Individuals tends to test same code in similar way multiple times so some configuration advances don't get tested.

3) Manual testing by and large does not take into consideration repeatability of order arrangements, so replicating failures is difficult.

4) Manual testing does not perform programmed recording of discrete qualities with each order grouping for following memory use after some time – critical in identifying memory spills.

To overcome the disadvantages of Manual Testing, Automation testing came into picture. This approach is explained below.

Automation testing can be defined as performing sequence of activities to execute test case using an automation tool. The Automation software take care of the system under test by entering the test data and compare the estimated and actual results then detailed report is generated.
The automation testing process activities includes test plan, designing and implementation of test followed by execution of test and analysis of result. There are many approaches of test automation. the most used or significant types of test automation are API driven testing and Graphical user interface testing.

Following are noteworthy advantages of test automation are given below [4]:

1) Production of a dependable framework.
2) Improvement of the nature of the test
3) Testing a huge test network (various dialects on various OS platforms).
4) Allows for repeatability of direction arrangements, , so reproducing failures is almost impossible.
5) Automated Tools run tests fundamentally quicker than human clients.

2.1 Automation Tools

There are several automation tools which are used for different kind of testing namely functional and regression testing etc. Some of the tools are selenium, mabl, QTP (Micro Focus UFT), Rational Functional Tester, WATIR, SilkTest and many more.

Selenium is a Software testing tool utilized for Regression Testing. The Mozilla Firefox web browser is supported by Selenium IDE. It can be used with framework like TestNG and JUnit. It gives a way to transfer recorded scripts in languages like python, java, Ruby and c#. It permits to embed comments amidst the script for better understanding and troubleshooting.

The Selenium is used for web applications. It uses the web elements to automate the web pages. The elements can be identified by 7 identifiers namely id, Name, Tag Name, Partial Link Text, Xpath, Link text and Class Name.

2.2 Automation Framework

Framework can be defined has collection of guidelines for automation. It provides the environment for execution of test scripts. The framework gives the client with several advantages which helps to create, execute and report the automation test scripts productively. The framework Improves test organizing, Improve re-convenience and it also helps in non-technical analyzers to involve in the code.
There are several types of frameworks used for automation of test scripts. They are categorized as follows:

1) Data Driven
2) Keyword Driven
3) Modular
4) Hybrid

Robot-Framework

Robot framework is open source framework for automation and it is based on key driven [5].this framework uses tabular format of data syntax which is easy to use. The framework helps in utilizing the test libraries written in languages like python etc.
At the point when test execution is begun, the system initially parses the test information. The keywords are provided by libraries. The framework then uses these keywords and interacts with the system which is under test. Libraries can speak with the framework either straightforwardly or utilizing other test instruments as drivers.
Command line is used for the execution of the test. Subsequently you get report and log in HTML formats and also as XML output. These give broad investigate what your framework does. The following fig shows he architecture of robot framework. The Fig 3 shoes the architecture of Robot Framework.

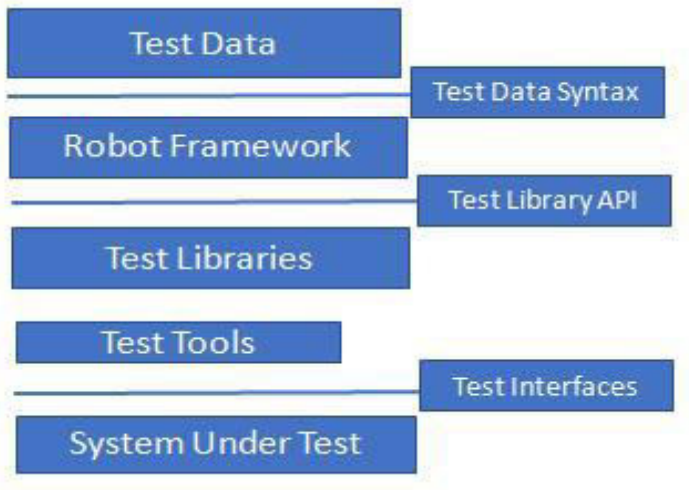

Fig. 3 Robot Framework

3. NETWORK MANAGEMENT SYSTEM

Network Management System (NMS) role is to monitor, control, analyse and manage telecommunication networks. It uses a virtualized hardware platform. This network management system covers all essential steps for a network operation centre, from receiving information on network problems to diagnosing and solving the problem. Each Network application is optimized for a number of specific

tasks. The main applications groups are Configuration, Reporting, Monitoring, Administration, User Assistance, and Security.

A solitary network system for monitoring, estimating and configuring the system and administrations. Open and all around reported interfaces for the increases of future system advances and new OSS system. High adaptability toward dealing with development of system as well as administrations, and innovation lifecycle prerequisites. Wide help intended for client specific augmentations to adjust system to a specific business procedures and requirements. Broad multi-vendor integration (MVI) capability, giving off-the-rack integrations to more than 50 different types of third party network elements [6].

3.1 Development of framework for NMS

The Framework is developed for Network Management System for managing, controlling and monitoring the system. The network management system will perform many functions namely FM, PM, CM and Session Management etc.

The Fault Management job is to recognize, detach, give warning of and right faults experienced on the system. The objective of Performance Management is to screen and quantify different parts of performance with the goal that general performance can be equitably assessed and kept up at a settled upon level. Optionally, performance management permits early detection of corrupting conditions, which permits arrange overseers and designers to act in a proactive way to guarantee ideal system performance. The objective of Configuration Management is to halfway screen configuration parts of system gadgets, for example, configuration record management, stock management and software management.

Thus, a Framework is developed for monitoring all these functions namely FM, PM and CM are working properly for giving expected result. The Fig 4 gives the Framework of Automation.

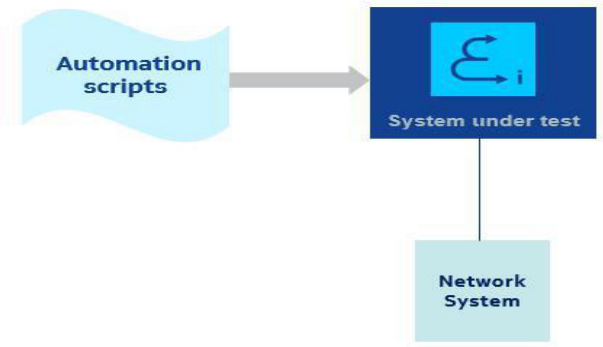

Fig. 4. Automation Framework for NMS

The Framework is developed using selenium and Robot framework and scripting is done using python language. Several external libraries are used in framework depending on application which is being automated. The Selenium Library is used for web applications where elements are identified by locators like Id, Class and Xpath etc. The Remote Swing Library is used for testing java application especially java web Start Applications. The SSH Library is used for communicating with remote machine using secure connection.

The Framework uses the IDE called RIDE. The Fig 5 shows the test case format in RIDE IDE.

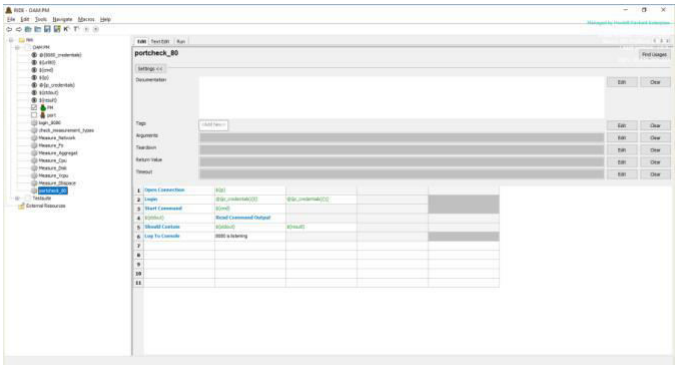

Fig. 5 Test Case Format

3.2 Implementation of Framework

The execution of the automated test cases will happen by triggering Jenkins in Continuous Integration (CI) Environment. Continuous Integration (CI) is an improvement practice that expects developers to incorporate code into a common repository many times in a day. Always Each commit is confirmed through a automated build, enabling developers to identify issues early. By incorporating routinely, you can recognize mistakes and errors rapidly, and find them all the more effectively.

Jenkins is defined as an open source Continuous Integration server fit for organizing sequence of activities which helps in accomplishing the process of Continuous Integration in automated design. Jenkins is totally written in Java. Its server-based application which requires a web server namely Apache Tomcat. The main reason Jenkins turned out to be so mainstream is that of its checking of rehashed assignments which emerge amid the improvement of a project.

By utilizing Jenkins, programming organizations can quicken their product improvement procedures, because Jenkins can Automate build and test at a fast rate. The Jenkins helps in total improvement lifecycle of programming from structure, testing, recording the product, conveying and different phases of a product advancement lifecycle.

The Automated test cases are committed and the software is built and immediately Jenkins will test the build and recognizes the error in early stages of development life cycle. The Fig 6. Shows the flow of execution by Jenkins.

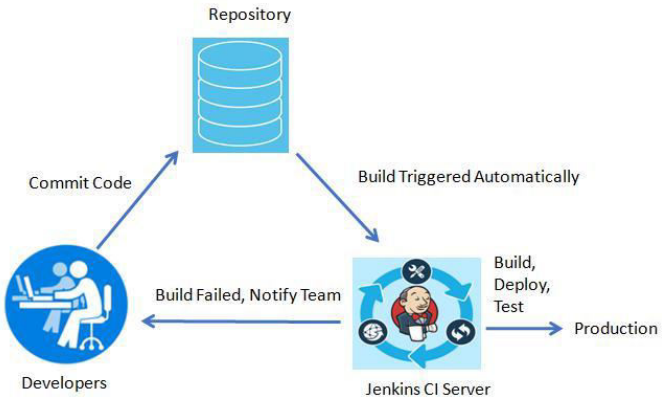

Fig 6. Flow of Execution

The execution reports are generated as logs in HTML formats and also as XML output. The Fig. 7 shows the test case log report.

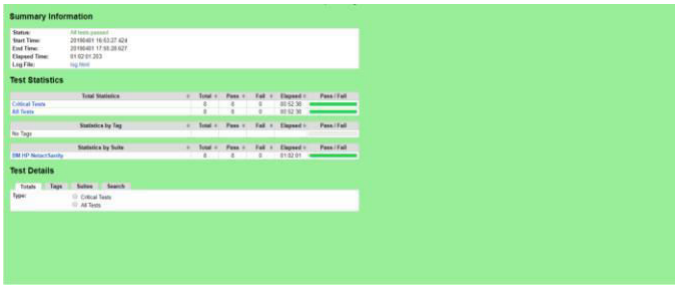

Fig. 7 robot test case log report.

The Fig 8 shows the report of all test cases passed. The reports are in HTML format.

Fig. 8 Report for all test case pass

4. RESULTS

The Advantage of working with Robot Framework is to facilitate test case writing pursue regular work stream with test case preconditions, activity, confirmation lastly tidy up.
All reports are consequently produced by checking everything and distributed in pages. The below table shows the comparison of manual as well as automation testing time.

Table 1. Results of Manual and Automation

Test Mode	No. of Test Cases	Time (in Hours)
Automation	12 Test cases per 1 suite (10 test cases)	00:45 hrs
	12 Test cases per 10 suite (100 test cases)	09:00 hrs
Manual	12 Test cases per 1 suite (10 test cases)	06:00 hrs(approx)
	12 Test cases per 10 suite (100 test cases)	72:00 hrs(approx)

From The above table results, we can say that the automating the test cases reduced the time of execution, no manual intervention and it improves the work efficiency.

5. CONCLUSION

From this paper we can understand the basic architecture of IMS and importance of IMS in providing multimedia services and IMS usefulness telecommunication network. Benefits of automation over manual testing. In order to assure the efficiency of automation test, a framework for network management is put forward. A appropriate framework is developed to make the test process more effective, stable and eventually increasing the quality of the network management system by reducing the time of execution. The Framework gives the test reports and required log reports with screenshots. At last the manual and automation test results are compared.

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ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all the people who supported me in completing this project. I thank my Professor in BMSCE College for her continuous support throughout the academics. This project is supported by Nokia Solutions and network Private Limited. I would like to thank my mentors in Nokia Organization for guiding me.

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