Automation Testing In Set Top Box

Authors
Karanvir Singh Chib[1], Shubhra Gautam Sharma[2]
1Amity institute of information technology, Amity University, Noida 201303, India
2 Amity institute of information technology, Amity University, Noida 201303, India
Email-karan0518@gmail.com,sgsharma@amity.com

ABSTRACT

Set-Top Box (STB) refers to devices that connect to a television and some external broadcasted signal source. It demodulates/converts the broadcasted signal into audio and visual content that can be displayed on a screen or monitor as well as captured and recorded too. The signal from broadcasted source can be sent via any source of medium like satellite, a cable connection, a telephone line, or an ordinary Very high frequency or Ultra high frequency antenna. Content sent through medium may include combination of video and audio formats, internet web pages and interactive games. So, in order to provide customers proper service every single second software testers with the help of automation testing keeps track on each set of boxes and executes automated test case corresponding to the error or fault.
Keywords— Set-Top Box, Configuration Management System, Automation, Build, Frame, Test cases.

INTRODUCTION

Automation testing of product is commonly used for the production of hardware as well software's. Automation testing allows sequence of tests cases to run at a press of a button and corresponding logs are generated that shows which test cases are passed or failed. The logs which are generated can be seen manually or processed automatically. The logs result determines whether the complete results of test cases are similar to expected outcome/output with respect to current state of the product under testing. Similarly the tests cases can run manually, but this process is time consuming, costly as well as prone to human errors. Manual testing approach is useful in the process that requires tests cases to run frequently as well as recursively, for example in case of regression testing where changes are often made to products that are under test/observation. To automate a various sets of test cases can be costly in sense of the purchasing, designing of testing system equipment's as well as implementation of all those tests cases into software are typically challenging.

But, once the test cases are coded into software the profit in any testing product can be seen quite rapidly particularly if the tests cases are to be run repeatedly. All these Test cases have to be created only once, and also the incremental cost of each test case to be run in testing system is very small as compared to the cost of a human/manual testing .The design as well as the implementation of each test case, which is to be coded in software, may result into an increase in investment of resources at the starting phase but afterward the profit of automation of test cases can be seen. It's very important to keep in mind that the overall value of such an automated testing system will be affected by the rate of automation it performs. Suppose if there exists a possibility of large number of tests cases that are required less frequently but cannot be coded, then the advantages of cost of having an automated test system is decreased. This point will depend on the nature as well as complexity of the automated test product being used.

II. Why Automation Testing in Set Top Box Technology?

Number of organizations had completed huge number of projects which involved the complete s/w integration of a Set-Top Boxes (STB) for different number of Digital TV networks around the globe. Such projects are basically of complex nature and required the involvement to integrate more than one software components from various third-party software designers or developers. The most efficient way to handle the working of these projects is, to integrate as early as possible and after that slowly and steadily building the functionality as well as stability of the software's. For a long period many organization were working with an automated build process which is mainly concerned about the integrity as well as stability of the build can be maintained every time when test cases are executed on it. This approach was mainly useful in the projects where organizations were responsible for building few main components of the build. To have such a build shows that any new modification in code or bug/error fixes in coded software cannot affect the working of build.

We desire to have changes in above build and take this build to the new platform, not only by making the changes in the software but also making it functional for use. This can be achieved by a new automated test system for Set top Box. The New build will be directly initiated by CMS (Configuration Management System) and after that it could be loaded into a Set top Box testing system which would allow running a series of test cases that checks whether the o/p(output)of the et top box matches the expected output regarding each test case.

In Set Top Boxes, the least criteria of testing these systems will be a device called as Remote control or infrared device. When keys are pressed infrared

rays that carries signal /command to the Set Top Box which is considered under the test and collection of debug/fault output from the particular Set top box is collected in the form of serial log. Then these serial logs are examined by group of testers for any abnormal behavior associated with each set top box. These new type of automated systems would be able to verify even the small/normal operation and these systems remain unaffected by any new changes or updates over those systems that just provides integrity by simply checking the build.

In order to attain above mentioned type of automation testing of a number of test cases for a STB technology, an automatic way of capturing the video o/p (output) of the Set top box and by comparing the captured output with the previously defined video settings is necessary. We think a way of programming is required that can increase the flexibility of running these test cases individually for each set of set top boxes. Finally to simulate real-world duration tests of the Set top box, it is necessary to run tests on several boxes simultaneously, rather than just on one single box.

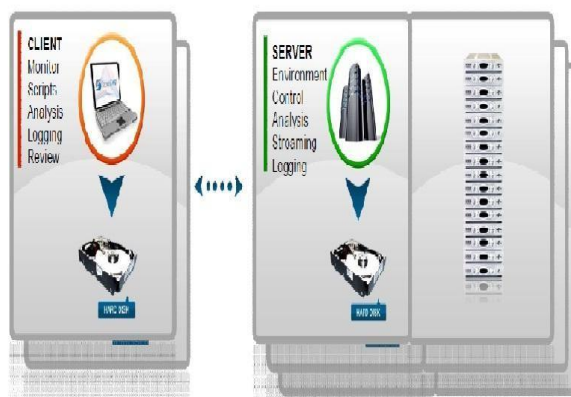## III. METHODLOGY OF SETTOP BOX TESTING CURRENTLY IN USE:

Figure 1: Currently Adopted methodology

Working:

The Set Top Boxes to be tested are installed in a frame/rack with multiple slots. Each slot in the frame/rack can be controlled individually so the same test can be run on many Set top boxes or different tests cases can be run simultaneously on different set top boxes (this approach will be useful for high throughput of functional tests). The server controls the communication with the devices under test, for instance sending Infrared commands to the set-top boxes under test and capturing the audio/video output of each box for further analysis. The client machine is used by the test engineers. It contains all the test scripts which have been created for the particular STB under test. The test engineers configures the test frame/rack with the sequence of tests cases to be run on each set-top box, and the client machine will gather and store all the relevant logging information during the test run. When the test

cases run has completed, the test engineer can review the results to see which tests have passed or failed. In the early stages of such an integrated project, the main focus is typically on functionality, adding a little new functionality every day, until all the functional requirements of the product are implemented or satisfied. As the project progresses, the overall stability of the product increases and towards the end of the integration work, testing becomes very important. For a set-top box, many different test scenarios can be designed, but the most basic ones consist of repeated channel changes and repeated playback and pause cycles. As the s/w becomes more stable, stability problems occur less frequently. In order to observe failures, the tests have to be run from time to time, maybe several days, and this is where the multi-slot rack. Become essential. Running tests simultaneously on multiple boxes greatly enhances the likelihood of detecting a single failure within a reasonable time, and of capturing an associated debug log which might enable the software developers to understand the likely cause of the problem.

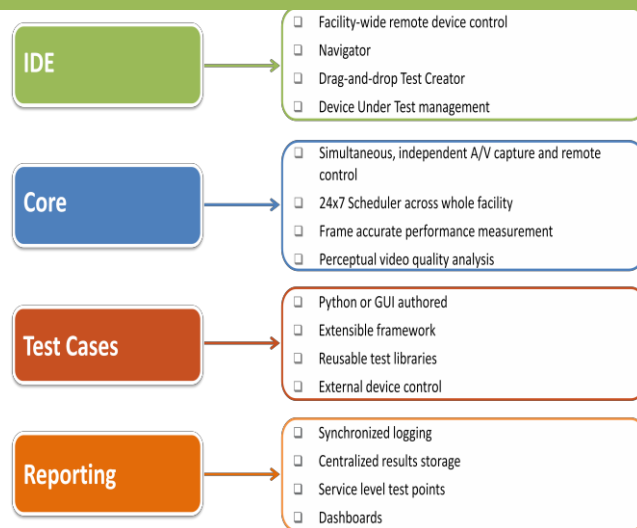## IV. Architecture of Set top Box Testing Environment to be implemented

Figure. 2: Explanation of architecture to be adopted.
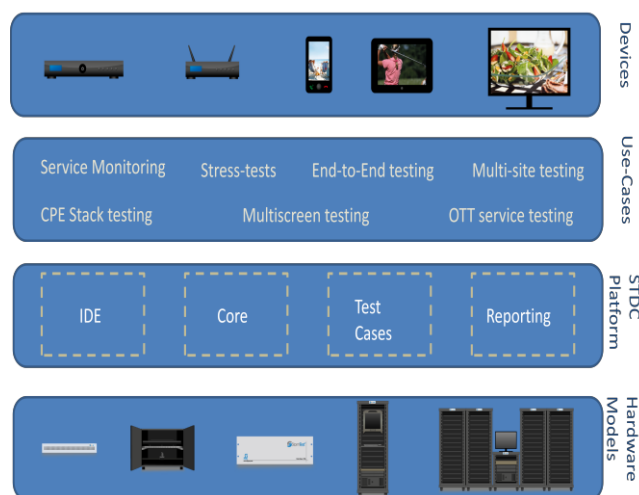

Figure 3:-Devices at each layer of STB.

V. FEATURES OF STB TESTING

In the above section I mention few features of an automated testing system required for set top box which is necessary in providing higher degree of automation for number of STB boxes under test . But, there are number of more features that are

required to be added in above mentioned in order to achieve a highest degree of automation in the digital set-top box. The following features that we have proposed for Set top box are Discussed below:-

5.1Client/Server Architecture:-

This architecture is basic of many products. It is commonly used as it is easiest to understand and implement. In STB Testing it shows how testers are physically separated from STB locations – client can be anywhere connected on the network.

Infrared device

Each Set top box in the testing frame must be controlled individually by an Infrared red device corresponding to that box. The Infra-red commands are sent to the box under the control of software that is further controlled by the client machine and at server end where the test engineer or testers has to select the test case(s) with respect to output received from each set top box.

Coded Test Cases

Coded test cases in the system must be easily coded with the help of a scripting language/programming language that can be quite easily understand by a typical test engineer or tester as it will allow the test engineer/tester to create new or modified test cases when changes are required.

Capturing Audio/Video

Capturing audio and video for fault occurrence are most common operation in set top box.

Logs Generated From Serial Port

Mostly a set-top box in its integration phase, will deliver all of its output to tester through/from its serial port. This will provide useful information whenever and wherever a bug occurs. Further this information will help the developers/testers to know the depth of the problem caused by bug. This is the most important step in STB testing. The testing system must be able find and store all these serial logs coming from every set top boxes in the frame during testing process.

Analysis of Images & OCR

It is important to capture full resolution images from the live video stream for every Set top boxes and compare it with the images taken from other set top boxes as well as reference images that are previously stored at server. The image comparison must be very fast to provide a good resolution to client. Text recognition can also be done for which an integrated OCR engine with testing system is required ,which could supports different languages of the world.

Carrier Independent

Mainly an automated test system must support all the carrier mediums. This point must be kept in consideration by different OEM's and Operators worldwide while the development of digital STB's.

Review by tester

No doubt Use of an automated test system increases quantity of results but it also require

post analysis of human. To ensure this can be done efficiently would act as crucial feature of the automated testing system.

Testing of User interface

User interface on the client machine that allows test engineer to do the following:

To do start up test on every slots.

Continuous Monitoring of every log is necessary step.

Comparison of screenshot of image of live video for resolution difference.

Automatic motion detection on the video output is necessary.

Proper CMS Integration (Configuration management system)

The testing system should integrate with the CMS while in use during the development as well as integration of project in such a way, that it became possible for each instance to configure the system along with a new build of the latest code and then load this new build in various set top boxes in the frame and run a chosen set of test cases.

Proper Integration with Defect tracking system

It is important to properly integrate testing system with database of defect tracking system. It is must for testing system to automatically detect and update a defected detection in its database whenever a test is found to fail.

VI. CONCLUSION

Manual testing of Set Top Box takes more time, cost, and may contain errors. But most routine STB testing can be automated which may overcome manual testing approach. Better use of automated STB testing is mainly for final Quality assurance cycles and approvals at the Operator's site before the launch of Set Top Boxes. But a lot of investment saving and project overall performance can also be generated by the correct approach toward automation throughout the Set top box integration phase and development phase. All the automated test cases developed during STB integration phase can be re-used during testing at the Operator's site as part of the final test cycles i.e. during pre-launch and again in testing during legacy maintenance. We have shown that significant benefit can be gained from automating tests as early as possible in the STB integration cycle. It is not feasible, nor advisable, to attempt to automate all of the tests, manual testing never goes away, but that effort can now be focused on more rigorous manual tests. Integration of the automated test solution with the other elements of a development and test environment can further improve the automation outcome. The advantage of identifying and resolving problems of integration phase as early as possible in a product development lifecycle is well known and might be applicable to STB integrations. Use of such automated testing

throughout the STB integration can greatly reduce time and cost and ultimately increase the end product quality.

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