



Comparative Study of Bluetooth Testing Automation Tools on Android

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Abstract: Bluetooth Protocol stack named as BlueDroid is introduced from Android version 4.2 onwards which replaced the old protocol stack BlueZ. BlueDroid stack is divided into two layers; one is Bluetooth Embedded System (BTE), which implements the core Bluetooth functionality. Another one is Bluetooth Application Layer (BTA), communicates with Android framework applications. This paper describes comparative study of different python based open source tools which are available in market for testing on Bluetooth for Bluetooth Application Layer (BTA).

Keywords: Android Bluetooth, SL4A, BlueDroid, Automation, AndroidViewClient, MonkeyRunner, Kivy.

I. INTRODUCTION

Testing is defined as the process used to verify the system or components of the system with desired specification to find whether it possesses the required specifications or not. Bluetooth is rapidly becoming a popular feature in many different kinds of consumer electronics; especially in cell phones, tablets, and music players, etc and testing of it is becoming difficult. The primary difference between BlueDroid and BlueZ is that HCI (Host Control Interface) layer is included in BlueDroid. HCI is communication protocol between host stack such as computing device, peripheral, cellular telephone, access point to PSTN (Public Switched Telephone Network) network or LAN (Local Area Network) etc and control stack that is Bluetooth devices which is implemented in Linux kernel.

This work has been conceived to study the python based tools because of its advantages such as [1],

1. Python is object-oriented scripting language.
2. Structure of the Python supports object oriented concepts such as polymorphism, operation overloading, and multiple inheritance.
3. Python is an open source software tool. It is freely available hence it can be installed easily.
4. It is highly portable in hence it can be used on any platform. As long as we have a compatible Python interpreter installed, Python programs will run in exactly the same manner, irrespective of platform.
5. It is highly powerful because of following reasons:
 - Dynamic typing
 - Automatic memory management

II. AUTOMATION TOOLS

Testing Automation tools discussed in this paper are,

1. SL4A
2. Kivy

3. MonkeyRunner
4. AndroidViewClient

A. Scripting Layer for Android (SL4A)

The SL4A is an android application introduced by Google. Originally it is named as Android Scripting Environment, and developed by Damon Kohler. It has grown through the contributions of many developers. Figure1 shows Architecture of SL4A. SL4A works as a client server model, scripts written by user with the help of languages supported by the SL4A script engine like Python, Perl, JRuby etc acts as clients. SL4A Remote procedure call (RPC) acts as server. Communication between client and server happens using a remote procedure call mechanism and JavaScript Object notation (JSON) [2].

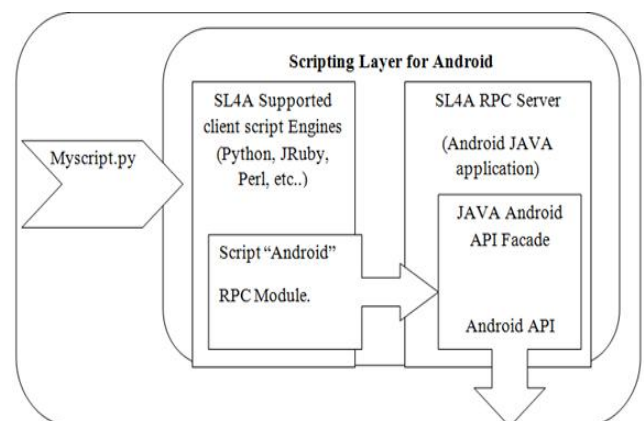


Figure 1.SL4A Architecture

Pros:

1. SL4a source code is available for Android version 4.1 and lesser, hence it is possible to perform white box testing automation.

2. SL4A apk is available which allows to access Android façade API's and it supports all versions of the Android device for black box testing automation.

Cons:

1. Since source code is not available for Android version 4.1 onwards hence it is not possible to perform automation.

B. KIVY

Kivy is one of the python based white box testing tool used for Android. Kivy provides library for multi touch applications, same code can be used in different platforms such as Linux, Windows, MacOSX, Android, iOS. Figure 2 shows architecture of kivy [3].

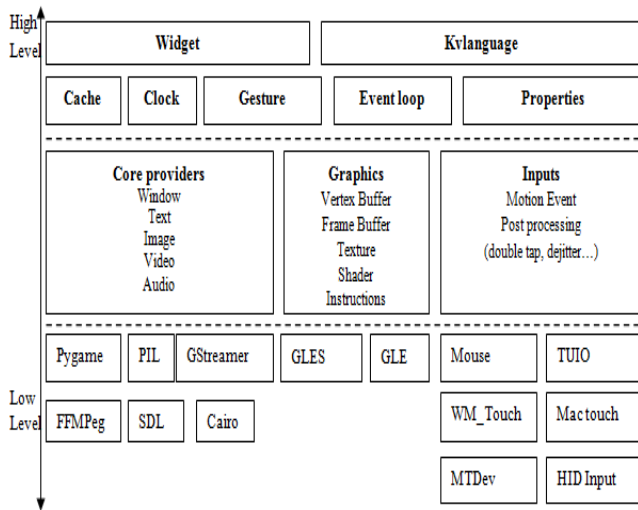


Figure 2. Architecure of Kivy.

Kivy provides its own API's and allows python scripts to access Android API's hence it possible to auomate white box tesing. But to perform bluetooth testing it needs give special permission that cannot be done in the pyhton scripts. In this case it is necessary to create Application Package (apk) which includes build.py file, in which permission can be added.

Pros:

1. Kivy provides library for creating applications on android.
2. Allows the user to perform white box testing.

Cons:

1. Kivy runs only on android device with SDCARD and OpenGL ES 2.0.
2. It needs to create apk for bluetooth testing hence requires more time.

C. MONKEYRUNNER

The monkeyrunner is an UI level automation tool used to automate the android applications. Python is the scripting language supported by monkeyrunner but the functionality of the tool is depends on Jython. Monkeyrunner has an ability to control android device and emulator with help of commands

such as touch screen, press button etc [4]. Monkeyrunner includes three different modules such as MonkeyRunner, MonkeyDevice and MonkeyImage each module provides their own API's.

Pros:

1. The tool set up is simple and easy.
2. It is possible to perform 24 hours testing.
3. Helps to meet the Time to market within scheduled period.
4. Helps to perform regression testing, functional testing as well as extended automation.

Cons:

1. The touch API provided by monkeyrunner works based on the coordinate of the device, but coordinates will differ from device to device.

D. Android View Client

AndroidViewClient is python based UI layer testing automtion tool, used when the complexity of achieving the desired goals is too high [5]. This tool allows to execute the python scripts by using monkeyrunner command till version 3.2.0. Because upto this version it is supported by monkeyrunner and implementation is based on Jython. From AndroidViewClient 4.0 onwards it is completely python tool and not supported by monkeyrunner, hence python scripts can be executed by using python commands.

API's provied by AndroidViewClient work on basis of object id as well as text present on current view of the device.

Pros:

1. The working of the tool doesn't depend on the size or coordinates of the device and emulator.
2. Performance in terms of speed of executing scripts is high in latest versions.

Cons:

1. Speed of the execution is little low in lower versions of Android View Client.

III. RESULT AND ANLAYSIS

Performance of each tool is analyzed by testing bluetooth functionality of Android device 4.2 onwards. The Bluetooth testing is be done by using SL4A by writing python scripts with help of Android Façade API's exposed by the SL4A to the scripts. SL4A doesn't provide API's to handle notifications, for example toggle Bluetooth state is one of the API provided by the Sl4A to power on Bluetooth. It requires the user to click on either Allow or Cancel button it shows it requires human intervention. But the objective is to automate the complete testing. Hence this tool is not suitable for this work. Bluetooth testing with help of kivy is done by creating android application package for giving the permission. Since it provides its own API's for creating scripts, but for Bluetooth, apk creation is the need. This requires more time for testing, which leads to increase in time to market. But it allows scripts to access the Android API's; hence it is suitable for BTE testing. Bluetooth testing with help of monkeyrunner is done by using API's provided by different modules of monkeyrunner such as MonkeyRunner,

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MonkeyDevice, and MonkeyImage. These API's can be used only at the UI layer hence only BTA layer testing is performed. AndroidViewClient provides higher level operations and has the ability of obtaining the tree of views present at any given moment on the device with the help of uiautomatorviewer and performs operations on it. Uiautomatorviewer is tool available as part of Android SDK (Software Development Kit). API's provided by AndroidViewClient are suitable for BTA layer testing.

IV. CONCLUSION

Since SL4A doesn't provides API's required to automate the Bluetooth testing such as touch or press. Hence this is not suitable for Bluetooth testing automation. But this can be used to test Bluetooth functionalities of Android device with version 4.0 with help of available source code. From 4.1 onwards this can be achieved by using SL4A apk. Since kivy provides access to Android API's this is suitable for automating BTE layer testing instead BTA layer. Monkeyrunner has a drawback with working of touch API it works based on coordinates of the device but coordinates depends on the size of the device same scripts cannot be used to test different devices. Hence this is also not suitable. AndroidViewClient works based on object id and text present on device during run time. And speed of execution is also high. Hence this can be used to perform BTA layer testing automation of Bluedroid Bluetooth stack.

V. REFERENCES

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