

# Application Research of Android Internet TV

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**Abstract:** In recent years, the Internet audio-visual programme has developed rapidly, and Internet TV application users based on the Android platform have grown rapidly. However, due to the large number of malwares on the Android platform and the security risks during the development of Internet audio-visual software, users are faced a huge threat. As for Internet TV application problems, this paper proposes a dynamic analysis of Internet TV applications based on Android platform and developed a software named Android Internet TV Analysis System. The software could supervise and discover application violations in real time, and obtain information such as software names, plugin calls, digital certificates, software versions, software screenshots, etc. It provides evidence for Internet TV application traceability, copyright certification, and enhances the safety of Internet TV application users.

## 1. Introduction

There are a variety of smart TV operating systems based on different companies. For example, the most widely used operating system is Android system; Panasonic and Mozilla have jointly launched the Firefox TV system; Samsung's TV system is called "Smart Hub" based on Tizen OS system, its main screen has bright icons and applications are also constantly enriched; TCL and some brands use Windows systems; LG smart TV uses the webos system. Among them, the Android system has become the most popular and widely distributed smart TV system due to its rich application and convenient operation.

Due to the security flaws in the Android system itself, Internet TV applications have security vulnerabilities [1-3]. At the same time, Internet TV application content sources are complex and diverse. It cannot be effectively supervised in real time [4-5]. Those problems have caused some Internet TV application content not to meet the TV program requirements and give people wrong guidance.

This paper proposes a software named Android Internet TV Analysis System combines the advantages of static analysis and dynamic analysis [6-7]. It provides protection for Internet TV applications by obtaining relevant information and real-time monitoring of application-related behaviors for Internet TV applications. At the same time, the software uses appropriate data analysis strategies (such as software information, plugin calls information, http requests, software screenshots, etc.) to provide the basis for Internet TV application traceability, copyright authentication, and user security.

## 2. Design Principle

### 2.1 Internet TV Application Traceability

The hierarchical traceability map of Internet TV application is shown in the Figure 1. Android Internet TV Analysis System interacts with the "PlayerSvice" component, including "MediaPlayer", "OskExoPlayer", "IJKPlayer" and other modules. The component transmits the command information to the "Local Proxy" via the HTTP requests. After parsing the HTTP requests, the local proxy obtains the required resources through cache management.

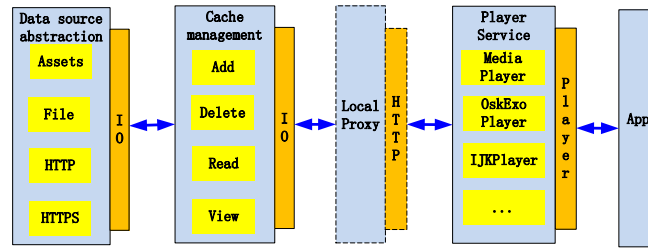


Figure 1. The hierarchical traceability map of Internet TV application

## 2.2 Design Implementation

This paper is aimed at Internet TV application content address analysis through the combination of dynamic and static analysis. Android Internet TV Analysis System integrated different tools such as apktools, Androguard, unzip, dex2jar for software static analysis. And It uses adb connection, Xposed framework, virtual machine simulation, running activity class, analysis log and other technical means to dynamically analyze the Internet TV application apk file. The software could obtain software name, digital signature, location path, HTTP request, md5 value, underlying class name and other information. And it also could monitor the Internet TV application underlying class calls, app real-time screenshot, authority management in real time. The information provides guarantee for the traceability and accountability of Internet TV applications. The implementation process is shown in Figure 2.

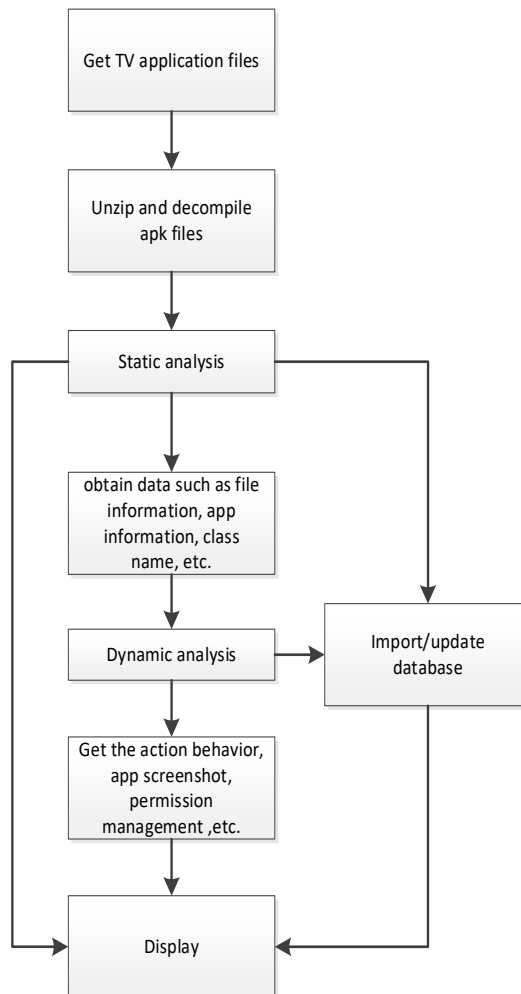


Figure 2. The implementation processes

### 1. Preparation work.

The software obtains the Internet TV application apk installation file through the network, TV box app market and other channels.

### 2. Decompression and decompilation.

The software unzip the apk file. Then it decompiles the apk file to get the code through different tools, such as apktool, dex2jar, jd-gui, zipfile, CFR, androguard, unzip, etc.

### 3. Static analysis.

The software analyzes the code of the apk file to obtain information about all activities, services, receivers, provider names, software names, sizes, digital signatures, location paths, MD5 values, HTTP requests, etc. Data is stored in the database finally.

### 4. Dynamic analysis.

Dynamic analysis starts all activities based on static analysis results through the adb command, so as to analyze and obtain software real-time class calls, app real-time screenshots, authority management and other information, and data is stored in the database finally.

### 5. Displaying analysis results.

Displaying dynamic and static analysis results on the web page.

### 6. Software prototype design and development.

The main functions of the software include dynamic and static analysis of the apk file, analysis and displaying results, and other functions.

## 3. Test Analysis

### 3.1 Test Environment

Test computer: Huawei MateBook Xpro, CPU: Intel CORE i7 855U, RAM: 8GB, tertiary cache: 8MB, CPU frequency: 1.8GHz.

Tset intelligent TV set-top box: MI3 MDZ-18-AA, operating system: Android 5.1.

Test Internet TV application: qiyiguofficial-v9.1.2.86169.

Software download address: <http://app.iqiyi.com/tv/player/index.html>.

Test process: First, we start the Test TV and intelligent TV set-top box, then we connect the box and the experiment computer with the USB data cable to configure the TV box parameters. Next, we get the root permission and the adb debugging function. The Android internet TV application analysis software is started. Software upload the “qiyiguofficial” to static analysis, and then install the “qiyiguofficial” to the box to start dynamic analysis.

### 3.2 Test Results

The internet TV application analysis software obtains data such as related information, class name, activity list, static url request, etc. Dynamic analysis obtains software real-time http and https requests, play component calls, database information, screenshots and other data through running all activity classes and analyzing logs. The main results are shown in Figure 3, Figure 4 and Figure 5, respectively, including software-related information, real-time http requests, and real-time screenshots.



Figure 3. Software-related information

Figure 3 shows the apk information through static analysis, including whether the apk file is available, MD5 value, the packet size, the software name, and the Android version.

HTTP Requests	
Number	HTTP Requests
1	HttpHook: RESPONSE: METHOD: GET URL: http://218.12.228.140/wangsuodncc.inter.ptty.gilv.tv/cdn/tv/20181109/apk/2_3_154172756432.poon...
2	HttpHook: RESPONSE: METHOD: GET URL: http://msg.ptty.gilv.tv/b?pf=38p=318p1=3128p2=31218mac=00-9E-C8-DF-75-668u=tv_c0eafcafc1...
3	HttpHook: RESPONSE: METHOD: GET URL: http://msg.ptty.gilv.tv/v5/b/pendata?v=9.1.2.861698p1=3_31_3128ua_modcl-kungfuandabdevice_...
4	HttpHook: RESPONSE: METHOD: GET URL: http://mixer.cupid.ptty.gilv.tv/mixerfa=tv_c0eafcafc18a145780b0716891d4f88_15378407063598b=8c...
5	HttpHook: RESPONSE: METHOD: GET URL: http://msg.ptty.gilv.tv/b?pf=38p=318p1=3128p2=31218mac=00-9E-C8-DF-75-668u=tv_c0eafcafc1...
6	HttpHook: RESPONSE: METHOD: GET URL: http://msg.ptty.gilv.tv/b?pf=38p=318p1=3128p2=31218mac=00-9E-C8-DF-75-668u=tv_c0eafcafc1...
7	HttpHook: RESPONSE: METHOD: GET URL: http://724.165.124.56/wangsuodncc.inter.ptty.gilv.tv/cdn/tv/20180711/apk/1_3_238/i3_153130769674...
8	HttpHook: RESPONSE: METHOD: GET URL: http://static.ptty.gilv.tv/ex/tv/app/1_1_2232_1502457435264.poon PARAM: null[HTTP/1.1 200 OK]Acc...
9	HttpHook: RESPONSE: METHOD: GET URL: http://data2.itv.ptty.gilv.tv/itv/liveChnList/1181/2/0?tv=0&version=9.1.2.86169 PARAM: null[HTTP/1.1 2...

Figure 4. Real-time http requests

Figure 4 shows the real-time HTTP request through dynamic analysis.

Figure 5 shows the real-time screenshot through dynamic analysis. The left side is the activity class that is running when the screenshot is taken, and the right side is the real-time screenshot display. The TV screen and the running activity class can be obtained in real time when the illegal behaviors appear. The function provides evidence for the accountability of the illegal behaviors.

Activity Name	Screen Shot
com.gala.video.child.ChildLeadingActivity	
com.gala.video.child.ChildMainActivity	
com.gala.video.hook.delegate.ActivityProxy	
com.gala.video.app.epg.PluginHomeActivity	

Figure 5. Real-time screenshots

## 4. Summary

In order to solve the problem that the hidden threats existed when the users use the Internet TV application and the inaccuracy of the mapping between the terminal functions and the network service address of the Internet TV service address traceability analysis, the research on the implementation method of the Internet TV application based on the specific Android version is carried out. This paper proposes a dynamic and static analysis scheme for Internet TV applications, obtains application-related information, and real-time supervision of application-related behaviors, and provides a reference for the establishment of a complete behavior analysis chain for Internet TV service traceability.

## References

- [1] Zhang Xiaolong, Wei Zhigang. Research on security reinforcement technology of Android mobile intelligent terminal based on trusted computing. Science and Technology Innovation Guide. Vol.15(2018) No.06, p.164+166.
- [2] Zhao Yuehua, Liu Jia. Analysis and Design of Android APP Security Reinforcement System. Computer Program. Vol.44(2018) No.02, p. 187-192.
- [3] Wu Zhongchao. Analysis of the security attack and defense of Android system. Network Security Technology and Application, Vol.08(2017), p.101-103+112.
- [4] Yan Yange. Thoughts on the development of cultural TV programs. Publishing Wide Angle, Vol.22(2018), p. 55-57.

- [5] Jia Yanfang. The Influence of Entertainment on TV Programs in the New Media Age. *Research on Communication*, Vol.32(2018), p. 93.
- [6] Feng Bo. Research and implementation of key technologies for software security development (Ph.D, Beijing University of Posts and Telecommunications, China 2010). p. 28-30.
- [7] Xiao Qiang. Research and implementation of Android malicious code detection technology (Ph. D, Beijing University of Posts and Telecommunications, China 2017). p. 30-32.