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Development and Interrogation of a Mobile Forensics Testbed for Educational Use

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BSc (Hons) Ethical Hacking

Dd May 2021

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Acknowledgements

I would like to thank Ross Heenan, who acted as my supervisor throughout this project, for his wealth of knowledge and understanding around the subject area and being able to point me in the right direction in times of need.

I would like to thank Allan Shiels for providing me with the Samsung device used in this paper.

I would also like to thank my dad, Nigel, for managing to un-brick the Samsung device during the procedure of this project.

Abstract

Background

Mobile forensics is a sub section of digital forensics in which investigates the acquisition of data from mobile devices for use in court. Law enforcement can face a large number of challenges when seizing and interrogating mobile devices. To combat this, software and tools have been developed to aid in the extraction and analysis of data on a mobile device. These tools however do not work the same on every device. To gain experience in the limitations and specialities of these tools a forensic test bed can be used.

Aim

This project aims to analyse current issues, tools and methods encountered in mobile forensics. This analysis would then be used to compare the amount and variety of data that can be obtained from two different developed test beds with the variance of one device being rooted and the other non-rooted.

Methodology

The practical work included in this paper includes the creation, extraction and analysis of data from two mobile test beds one being a Huawei P10 and the other a Samsung Galaxy S8. To extract and analyse the data a chosen set of tools and methods were used to allow for a fair comparison. The Huawei device represents a non-rooted device and the Samsung device representing a rooted device. This allows for a contrast of what data can be obtained from each of the test beds using the same enumeration techniques.

Results

Using the proposed procedure, two individual test beds were created and enumerated successfully using the chosen set of tools and methods. Limitations were found for what data each tool was able to extract from both the rooted and non-rooted device. This allowed for a view of which

tools could be used for extracting particular types of data from a mobile device.

Conclusion

With the use of both commercial and open-source software, forensic test beds can be created to allow for extraction of a vast amount of information, including images, messages, contacts, notes and more can be obtained from both rooted and non-rooted devices for the use in gaining experience for a forensic investigation.

Keywords

Mobile Forensics, Digital Forensics, Forensic Investigation, Testbed, Open Source

Abbreviations and Notation

Abbreviation/Symbol/Notation	Meaning
CPU	Central Processing Unit
GPU	Graphical Processing Uni
RAM	Random Access Memory
ROM	Read Only Memory
USB	Universal Serial Bus
ADB	Android Debug Bridge
GB	Giga Byte
jpg/jpeg	Joint Photographic Group
png	Portable Network Graphic
PDF	Portable Document Format
NAND	NOT AND
TAR	Tape Archive. File compression archiver
AB	Android Backup file

Table 1: Abbreviations and Notation

1. Introduction

1.1. Background

There are currently over 3.5 billion smartphones around the world (Turner, 2018), in which there are two main ecosystems. These are Apple iOS and Google's Android. As can be seen in the figure below, of the 3.5 billion devices, around 71.9% are running Android and 27.33% are running iOS.

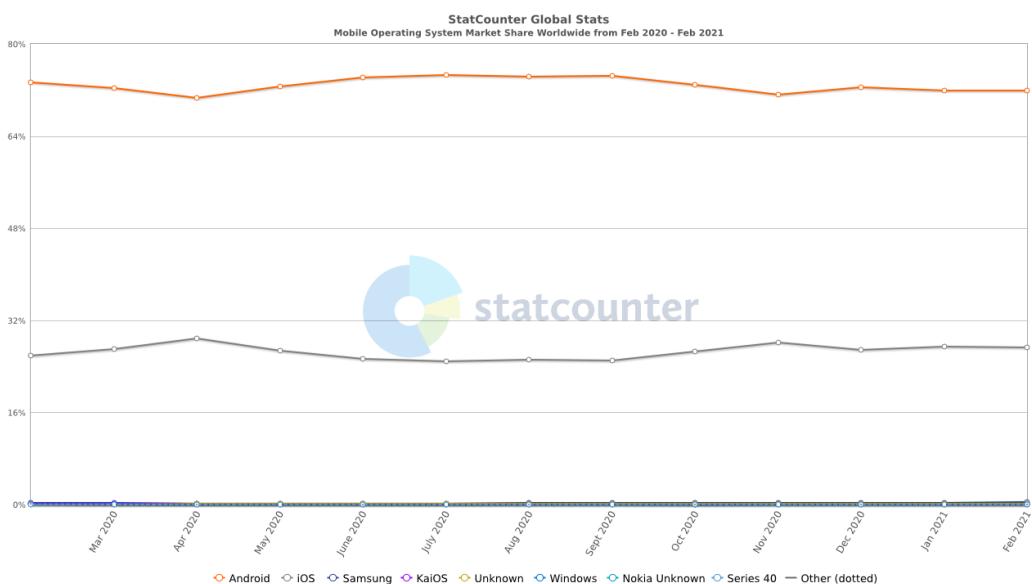


Figure 1: (Mobile Operating System Market Share Worldwide, February 2021)

With the increase of mobile devices over the past decade, there has been a surge in the number of devices that are seized and used as evidence in criminal court cases. As the number of devices have increased over the years, so too has the number of security measures that have been put in place in order to keep these devices secure. This is to help prevent unauthorized users from being able to view or obtain the owner's information that may be stored on the device.

1.2. Current Issues for Law Enforcement

Due to the increase in mobile security measures, it is becoming increasingly difficult for law enforcement to extract the required data needed for a criminal case from mobile devices. Not only do law enforcement agencies face challenges in gaining access to the mobile device (Raghav and Saxena, 2009), due to the advancements in password and biometric validation, they can face further challenges when trying to gain access to information stored on a mobile device that could be used as evidence. A vast amount of data stored on a mobile device is not visible to the user of the device, this can cause issues in terms of being able to extract information as other forensic tools and methods are required in order to extract this information in a forensically sound manner which can be used as evidence in a court of law.

There are a vast amount of devices running different operating systems or variations of operating systems with their own custom touches to them. Having this variation can make extracting data even more difficult as some methods of data extraction could work on one device but not the other due to differences in either software and/or hardware.

1.3. Current Limitations for Tools

There are currently both open-source and commercially available tools that can be used in order to help extract information from mobile devices. Although these tools are possibly able to extract data from a device, they are not verified or endorsed by any of the mobile device manufacturers and therefore cannot guarantee extraction of the correct data or any data at all on every mobile device. Another limitation is the time required to wait on specialist tools becoming available, this can cause a backlog of evidence that requires investigation.

1.4. Application to this Project

For use in this paper, two android devices were used due to the platform holding the largest market share currently in the mobile market. Only free or open-source tools were used when carrying out the data extraction and analysis stages of this project. This was to allow for a comparison between tools that are commonly available that anyone with the relevant skill set or training could use.

1.5. Research Question

Can a suitable mobile forensic testbed be created for educational use?

Specific 1: What tools can be used for data analysis and extraction; are there any limitations to what data can be extracted?

Specific 2: Are there limitations to what data can be extracted from a rooted vs a non-rooted mobile device?

Specific 3: Can the field of mobile forensics be advanced by the creation of an open source mobile test bed?

1.6. Project Aims

The aim of this project is to analyse and evaluate current forensic tools, methods and best practices that are used to extract data from mobile devices and computer systems. This analysis will then be used as a basis to form a procedure to create mobile forensic testbed for the use in comparing and contrasting the limitations of a chosen set of open-source and free tools against a rooted and non-rooted mobile device.

1.7. Scope

As this project is focused towards the extraction and analysis of the different types of data from a mobile device, the scope of this project is limited to these areas. This excludes the process of breaking into the phone in the event that the mobile device is locked and the owner being unwilling to provide the passkey in order to unlock it.

1.8. Overview

Following is the methodology section where the steps that were taken to create each of the test beds will be portrayed. This section will also include the procedure taken for extracting data from each of the individual testbeds. The results from the procedure included will be analysed in order to gain an understanding of what data was able to be extracted from both of the testbeds. This will allow for a comparison between what data you can access through a rooted and non-rooted device. A discussion is included in which portrays what device more data was able to be extracted from and the limitations of each of the chosen tools. A conclusion will be derived from the analysis of the results which will lead into any possible improvements that could have been made during the procedure and any possible future work that can be advanced from this project.

2. Methodology

The implementation section of this project was divided into two different sections. The first being the creation of the two different testbeds, and the second being the extraction and analysis of the data from the mobile devices.

The plan for the creation of the test beds was broken down into the following categories:

- Application Setup
- Browsing Data
- Notes
- Documents
- Downloads
- Messages
- Location Data
- Images
- Audio Files

2.1. Application Setup

Table 2 is a table regarding the details that were used for application setup for each of the applications used during this procedure.

Application	Huawei Details	Samsung Details
Settings	Name: 'Michael's P10' Google: Email: fakemichaelscot.198@gmail.com Password: Michael123!*	Name: 'Michael's Galaxy S8' Email: fakemichaelscott.198@gmail.com Password: Michael123!*
Calculator App	Pin Code: 1593 Where's my birthplace? Dundee Entering '11223344=' into the application prompts the security question	Pin Code: 1593 Where's my birthplace? Dundee Entering '11223344=' into the application prompts the security question
Microsoft Word	Email: fakemichaelscot.198@gmail.com Password: Michael123	Email: fakemichaelscott.198@gmail.com Password: Michael123!*
Reddit	Google sign in	Google sign in
Strava	Google sign in	Google sign in
Spotify	No account used, browsing	N/A

Table 2: Application Setup Data

Browsing Data

Multiple browsers were used in this section of the implementation. To populate the data, the search terms were input into the web browser and the results were navigated through, any links that were clicked on were recorded with the relevant search term that lead to them. Each link was viewed for a short period to give the indication that the user is reading what is present on the webpage.

Notes

The default notes application that is pre-installed on both mobile devices was used to record snippets of data from the suspect. Multiple notes were recorded and saved on each device. The encryption option within the notes application itself was not used, and therefore all notes were not encrypted by default.

Documents

Documents were created on multiple different applications and platforms. On the mobile device, Microsoft Word and Google Docs was used to create documents and save them to the device. Encrypted PDF's were created on a desktop computer and transferred over to the mobile device as the adobe acrobat mobile application did not allow for pdf's to be encrypted through the application.

Downloads

All files downloaded to the mobile device were through the use of web browsers and were initially saved in the downloads folder, any changes to location are noted in the correlating table. The files downloaded include pdf's and audio files.

Messages

These messages are saved as drafts on the device. On the Huawei device, one message was later altered to reflect changes in the scenario.

Location Data

The home address of the suspect and the victim are both stored as saved locations inside of Google maps. When inputting the data into the device, the device was connected to a Wi-Fi-connection through a hotspot from another device, this is to simulate a data connection through a sim card. At the same time once at the starting location, location services were turned on to allow tracking of the mobile device through GPS. The route was then selected, and the device was placed into a pocket as the walk was carried out.

Images

The images stored on the device were taken on the device or transferred from a desktop computer and originally stored in the devices pre-installed gallery. Some of the images were transferred into the fake calculator application or deleted to attempt to hide some data.

Audio Files

Due to not including any personal information into the testbed, any audio files included in the testbed will be created using an online text to speech tool and then inputted into the device.

Summary

Each of the sections above were carried out and the data recorded with the date, contents and any other corresponding data. The recorded data for both the Huawei and Samsung device can be seen in appendix A and appendix B.

2.2. Overview of Tools Used

Included below in table 3 is an overview of the tools used throughout the extraction and analysis stages.

Tool Name	Reference
ADB	(<i>ADB Shell - Android ADB Commands Manual</i> , 18 February 2021)
Adb_export	(Kushnarenko, 2021)
ALEAPP	(Brigs, 2021)
Andriller	(den4uk/andriller, no date)
Autopsy	(<i>Autopsy</i> , no date)
Bulk Extractor	('bulk-extractor', no date)
CyberChef	(<i>CyberChef</i> , no date)
EaseUS MobiSaver for Android	(<i>EaseUS® MobiSaver for Android - Data Recovery for Android Devices</i> , no date)
Exiftool	(<i>ExifTool by Phil Harvey</i> , no date)
Ghost	(<i>EntySec/ghost</i> , 2021)
HiSuite	(<i>HUAWEI Hisuite Free Download- Date Back up & System Update</i> HUAWEI Support Global, no date)
JTR (John The Ripper)	(<i>openwall/john</i> , 2021)
Kobackupdec	(<i>RealityNet/kobackupdec</i> , 2021)
Samsung Smart Switch	(<i>Samsung Smart Switch</i> , no date)

Table 3: Overview of Tools Used

2.3. Backup Procedure

To mitigate some risks of data loss when extracting the data from the mobile device a backup of the device was created. To do this, a few options were considered including:

- Google Sync
- Google Drive
- HiSuite
- Samsung Smart Switch
- 3rd Party Application

Google's own backup system was used for both mobile devices in conjunction with another program. This involves going to the 'Backup & restore' section of the settings application and turning on the option 'Back up to Google'. This allows the option to backup images to Google photos and contacts. All documents, downloads and sound files were also uploaded to Google drive.

Huawei

Due to the model of mobile device being used in this procedure being a Huawei device, Huawei provided software called HiSuite can be used to backup application data and files saved on the mobile device.

To help prevent any issues with loosing data if the device was to become corrupt or have data be lost, both options were used. First HiSuite was used to back up the entire device. This involves connecting the device to a computer through a USB cable, going to quick settings and changing the cable option to 'File Transfer'. The next step is to enable 'Allow Connection Via HDB' and entering the code that appears on the mobile device into the desktop application. At this point the screen in figure 2 should be visible.

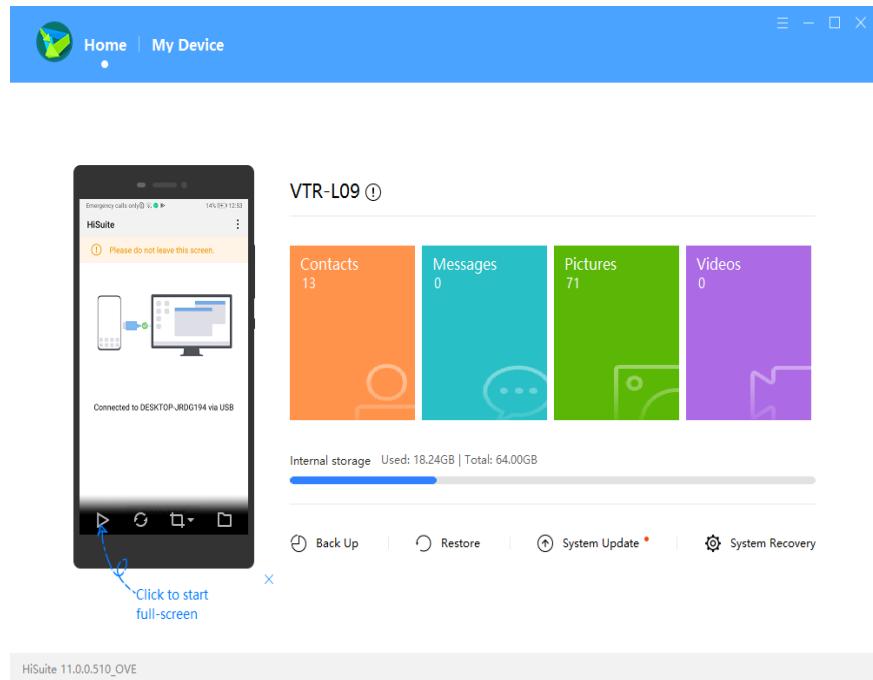


Figure 2: HiSuite Interface

From here, selecting the ‘Back Up’ option and creating a password to protect the backup should start the process. The password created in this scenario was ‘Michael123’. Once the process has been completed, the screen in figure 3 should be visible.

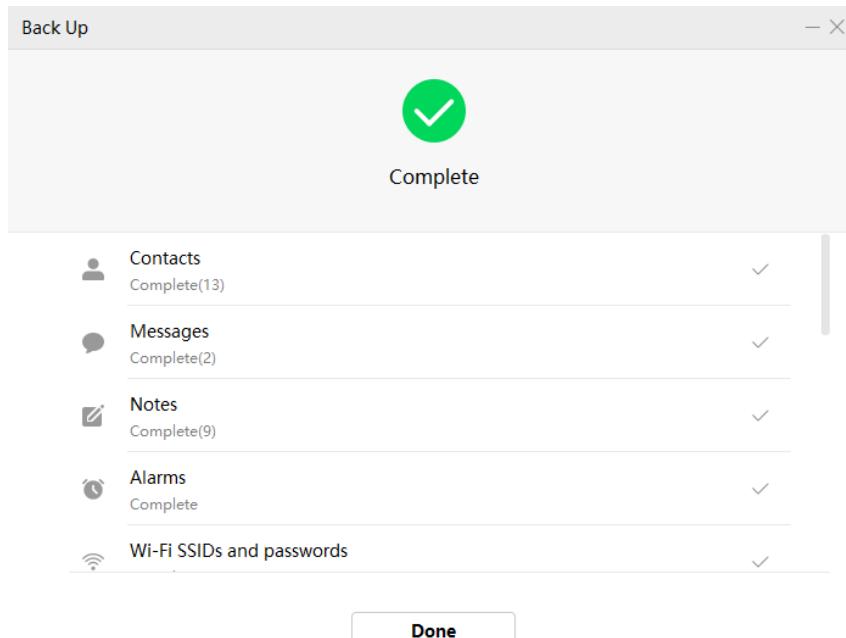


Figure 3: Completed Huawei Backup

Samsung

Samsung provides a piece of software called ‘Samsung Smart Switch’.

This software is available for use on a desktop computer and once installed, the following procedure can be used to back up the Samsung device.

1. Connect the mobile device through the use of a USB cable
2. Launch the software and ensure that the device is connected. The device should appear on the screen with the device name.

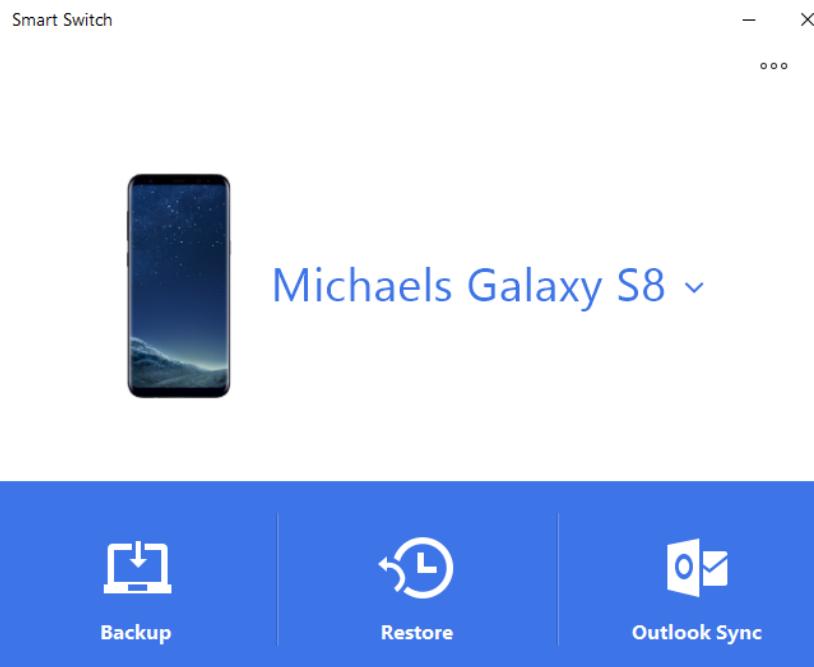


Figure 4: Backup Interface

3. Click the ‘Backup’ option.
4. Once the backup has been complete, the next screen will appear and will display what data has been backed up.

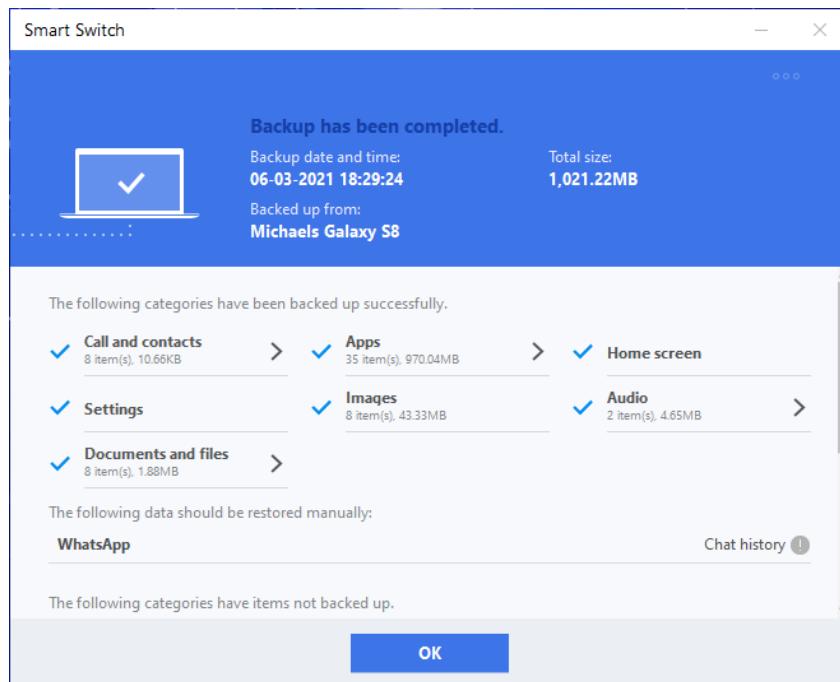


Figure 5: Completed Samsung Backup

2.4. Rooting

All of the tools used in the attempts to root either of the two devices can be found in appendix C.

Huawei P10 (VTR-L09)

Multiple attempts to root this device were made. Many different tools, applications and exploits were attempted during this process. It was found that the bootloader of the device was locked, this was stopping the device from being rooted. Unfortunately, Huawei ended the distribution of bootloader unlock codes in 2018. Huawei was contacted in this event and after being very understanding of the situation, they explained that the database that distributed the unlock codes is no longer available and no codes can be provided. The full conversation can be found in appendix D.

Samsung Galaxy S8

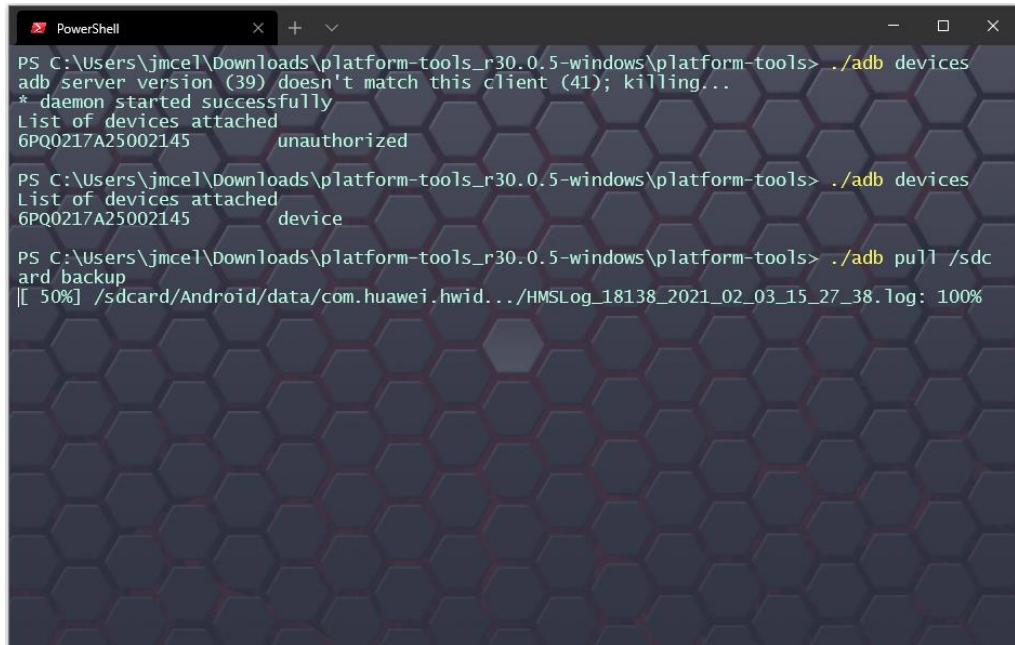
Due to not being able to root the first device, the second device was tested. The same tools and methods attempted against the Huawei P10 device were used against this device. These attempts were unsuccessful; however, another attempt was made using the tools Odin 3.13.1 and Magisk manager 22.0. A guide was used in order to carry out this root (ineed2root, 2020). This attempt to root was successful and allowed for the continuation of the procedure.

2.5. Extraction of Data

Note: Throughout the extraction procedure, the options for USB debugging in developer options was turned on.

ADB - Huawei

Using the command ‘./adb devices’, available devices connected to the computer can be found. As can be seen in figure 6, there is one available device.



```
PS C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools> ./adb devices
adb server version (39) doesn't match this client (41); killing...
* daemon started successfully
List of devices attached
6PQ0217A25002145      unauthorized

PS C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools> ./adb devices
List of devices attached
6PQ0217A25002145      device

PS C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools> ./adb pull /sdcard/backup
| [ 50%] /sdcard/Android/data/com.huawei.hwid.../HMSLog_18138_2021_02_03_15_27_38.log: 100%
```

Figure 6: List Connected ADB Devices

This is the Huawei mobile device that is connected to the computer. On the mobile device, once connected to the computer, a prompt will appear asking to pair with the computer. Once accepted and the command ‘./adb devices’ was ran again, it can be seen in the figure above that the device now appears to be authorized. From here the command ‘./adb pull /sdcard backup’ was run to copy the contents of the ‘sdcard’ folder. This can be seen in figure 7 below.

```

PS C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools> ./adb pull /sdcard/
/sdcard/: 658 files pulled, 0 skipped. 15.3 MB/s (229186916 bytes in 14.259s)
PS C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools> ls

Directory: C:\Users\jmcel\Downloads\platform-tools_r30.0.5-windows\platform-tools

Mode                LastWriteTime       Length Name
----                <-----           ----- 
d----   04/02/2021 15:03          api
d----   05/02/2021 18:32          backup
d----   04/02/2021 18:14        Data_Set_1
d----   04/02/2021 15:03         lib64
d----   04/02/2021 15:06         sdcard
d----   04/02/2021 15:03        systrace
-a----  04/02/2021 15:03      5220352 adb.exe
-a----  04/02/2021 15:03      97792 AdbWinApi.dll
-a----  04/02/2021 15:03      62976 AdbWinUsbApi.dll
-a----  04/02/2021 15:03      247296 dmtracedump.exe
-a----  04/02/2021 15:03      425472 etc1tool.exe
-a----  04/02/2021 15:03    1397248 fastboot.exe
-a----  04/02/2021 15:03      43520 hprof-conv.exe
-a----  04/02/2021 15:03    231594 libwintree-1.dll
-a----  04/02/2021 15:03      494592 make_f2fs.exe
-a----  04/02/2021 15:03    494592 make_f2fs_casemode.exe
-a----  04/02/2021 15:03      1157 mke2fs.conf
-a----  04/02/2021 15:03    752128 mke2fs.exe

```

Figure 7: ADB Pull Command

ADB - Samsung

First, the Busybox apk (*BusyBox for Android - APK Download*, 2020) was downloaded onto a desktop computer. Then using ADB, the application is sideloaded onto the mobile device and installed. This is carried out by using the following commands in a command line:

'adb install busybox.apk'

Once installed, this allows for use of tools such as dd, tar and netcat. On a Kali/Linux machine, using two separate terminals, the following commands can be used in order to copy the logical partitions of the mobile device over to the Kali machine.

Terminal 1:

```

'adb shell'
'su'
'cat /proc/partitions'

```

Terminal 2:

```
'adb forward tcp:8888 tcp:8888'
```

Using the final command for Terminal 1 above, displays all the partitions of the connected mobile device. The partitions for the Samsung device can be seen in figure 8.

```
(kali㉿kali)-[~]
└─$ adb shell
dreamlte:/ $ su
dreamlte:/ # cat /proc/partitions
major minor #blocks name
1       0      8192 ram0
1       1      8192 ram1
1       2      8192 ram2
1       3      8192 ram3
1       4      8192 ram4
1       5      8192 ram5
1       6      8192 ram6
1       7      8192 ram7
1       8      8192 ram8
1       9      8192 ram9
1      10      8192 ram10
1      11      8192 ram11
1      12      8192 ram12
1      13      8192 ram13
1      14      8192 ram14
1      15      8192 ram15
8       0    62464000 sda
8       1      4096 sda1
8       2      4096 sda2
8       3     20480 sda3
8       4      8192 sda4
8       5      8192 sda5
8       6      8192 sda6
8       7     40960 sda7
8       8     47104 sda8
8       9      8192 sda9
8      10    43008 sda10
8      11     1024 sda11
8      12     1024 sda12
8      13      512 sda13
8      14     1024 sda14
8      15      4096 sda15
259     0     16384 sda16
259     1    4454400 sda17
259     2    512000 sda18
259     3     10240 sda19
259     4     30720 sda20
259     5      5120 sda21
259     6     20480 sda22
259     7     1024 sda23
259     8   57204736 sda24
8      16      4096 sdb
8      32      8192 sdc
8      48      8192 sdd
8      49      6144 sdd1
253     0   2097152 vnswap0
dreamlte:/ #
```

Figure 8: Samsung Partitions

Each of the ‘sda’ partitions represent a part of the operating system and its storage. These partitions can be copied over using the following commands:

Terminal 1:

‘dd if=/dev/block/sda | busybox nc -l -p 8888’

Terminal 2:

‘nc 127.0.0.1 8888 > android.dd’

It was noted that the user data is normally located in the ‘/data’ directory of a mobile device. Therefore, to copy over the entire directory to the local machine, the following commands were used.

Terminal 1:

‘tar c data | nc -l -p 8888’

Terminal 2:

‘nc 127.0.0.1 8888 > data.tar’

The collected dd images and tar file were able to be used in conjunction with each other to provide full coverage of the data stored on the device.

Abd-export.sh

Using the tool **abd-exploit.sh** (Kushnarenko, 2021), information regarding contacts, messages and calls can be collected from a mobile device. To use this script the following command was used:

'./adb-export.sh -e content://com.android.calendar/calendars'

A full list of commands used in this procedure can be found in appendix F.

Using this list of commands, data such as contacts, messages and system settings can be pulled from the mobile devices directly and saved.

Andriller

Another method was used in order to extract data from the Samsung device. To do this, a python virtual environment was created and Andriller installed. From here launching Andriller using the command:

'Python -m andriller'

A pop-up window will appear as can be seen in figure 9.

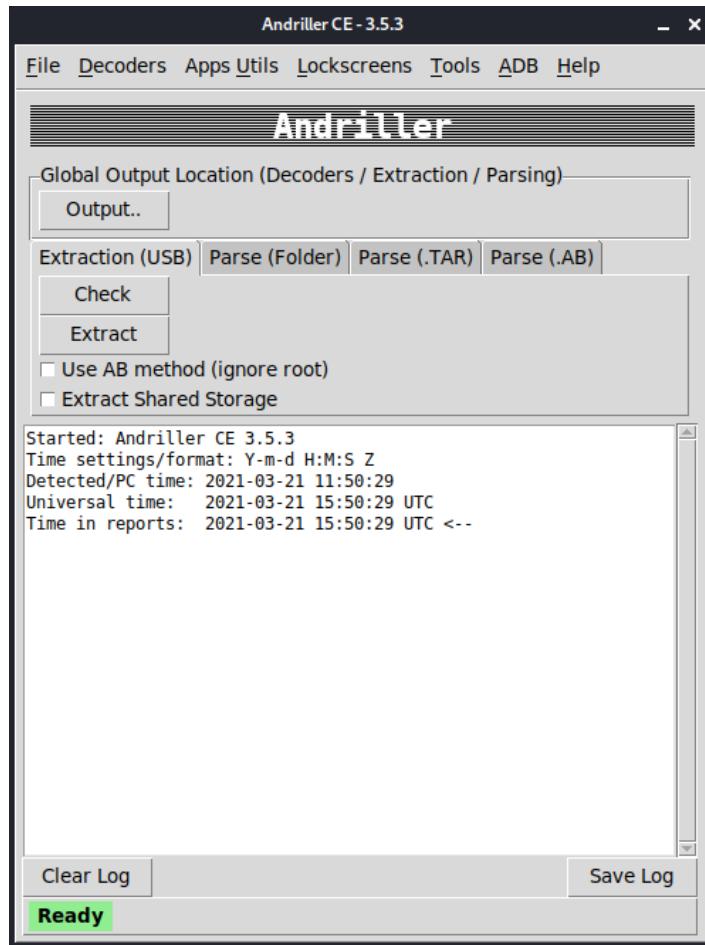


Figure 9: Andriller Interface

From here, the next step is to connect the mobile device to the computer and click the ‘check’ button. This checks to see if the mobile device is connected to the machine properly through ADB. Next, selecting the output directory, checking the ‘Extract Shared Storage’ box and then clicking ‘Extract’, starts the extraction process.

This process creates an AB file. To extract the data from the AB file, android-backup-extractor (Elenkov, 2021) was used. Once installed the following command extracts the AB file to a TAR file.

1. ‘**java -jar target/abe.jar unpack <(PATH TO AB FILE).ab> <(PATH TO OUTPUT).tar>**’

The TAR file was then extracted using the following command:

2. ‘**tar -xvf <(PATH TO TAR FILE).tar>**’

This tar file can then be imported into an analysis program such as Autopsy, run through a tool such as bulk extractor or manually navigated through in order to view the data.

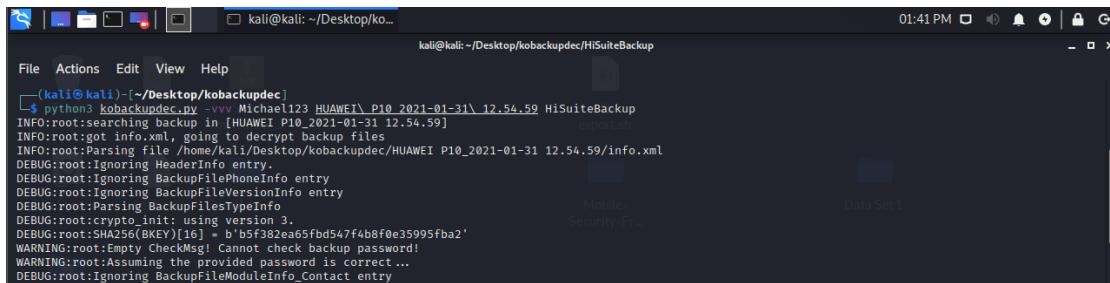
HiSuite & kobackupdec

In conjunction with the HiSuite backup software that was demonstrated in the Backup Procedure section above, the community developed python tool kobackupdec (*RealityNet/kobackupdec*, 2021) can be used to decrypt the backup files created by the HiSuite software. Therefore, not only can the backup files be used as a mobile backup, they can also be used for data extraction. Using the following command with use of the kobackupdec tool can be used to decrypt the created backup file:

1. ‘**Python kobackupdec.py -vvv <PASSWORD> <PATH TO BACKUP> <OUTPUT PATH>**’

<PASSWORD> = password applied in the backup

In figure 10 below, a command to decrypt the Huawei device backup can be seen.



```
kali@kali:~/Desktop/ko... 01:41 PM
File Actions Edit View Help
[ (kali㉿kali) - ~/Desktop/kobackupdec ]
└─$ python3 kobackupdec.py -vvv Michael123 HUAWEI_P10_2021-01-31\ 12.54.59 HiSuiteBackup
INFO:root:searching backup in [HUAWEI_P10_2021-01-31 12.54.59]
INFO:root:got info.xml, going to decrypt backup files
INFO:root:Parsing file /home/kali/Desktop/kobackupdec/HUAWEI_P10_2021-01-31 12.54.59/info.xml
DEBUG:root:Ignoring HeaderInfo entry.
DEBUG:root:Ignoring BackupFileInfo entry
DEBUG:root:Ignoring BackupFileVersionInfo entry
DEBUG:root:Ignoring BackupFileTypeInfo
DEBUG:root:Ignoring BackupFileTypeInfo
DEBUG:root:crypto_init: using version 3.
DEBUG:root:SHA256(BKEY)[16] = b'b5f382ea65fb547f4b8f0e35995fba2'
WARNING:root:Empty CheckMsg! Cannot check backup password!
WARNING:root:Assuming the provided password is correct ...
DEBUG:root:Ignoring BackupFileModuleInfo_Contact entry
```

Figure 10: Decrypt Huawei Backup File

The extracted directories can be input into an analysis program such as Autopsy or Bulk extractor, to possibly reveal important data.

2.6. Analysis of Data

To analyse the contents of each of the mobile devices, multiple tools were used. This allows for the possibility for a larger range of data to be identified and analysed. Included below is an overview of each of the tools used and what device the tool was able to gather data from.

Autopsy

For each of the logical file sets that was extracted from both of the mobile devices, a new Autopsy case was created to allow for separate analysis of what each tool was capable of extracting. This can be carried out using the following procedure:

1. Open Autopsy, the screen below should be displayed.

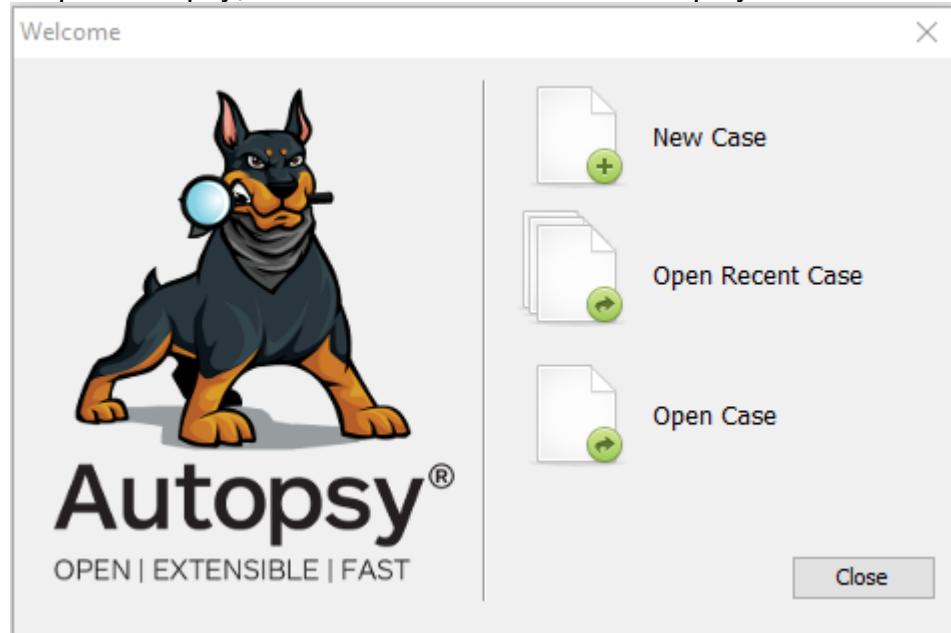


Figure 11: Autopsy Welcome Screen

2. Select 'New Case'
3. Input the name of the tool used for the extraction of the data to be analysed and input the directory for the case to be saved to. Then click next
4. On the next screen click the 'Finish' button
5. On the following screen, choose the option for 'Logical Files' and click next.

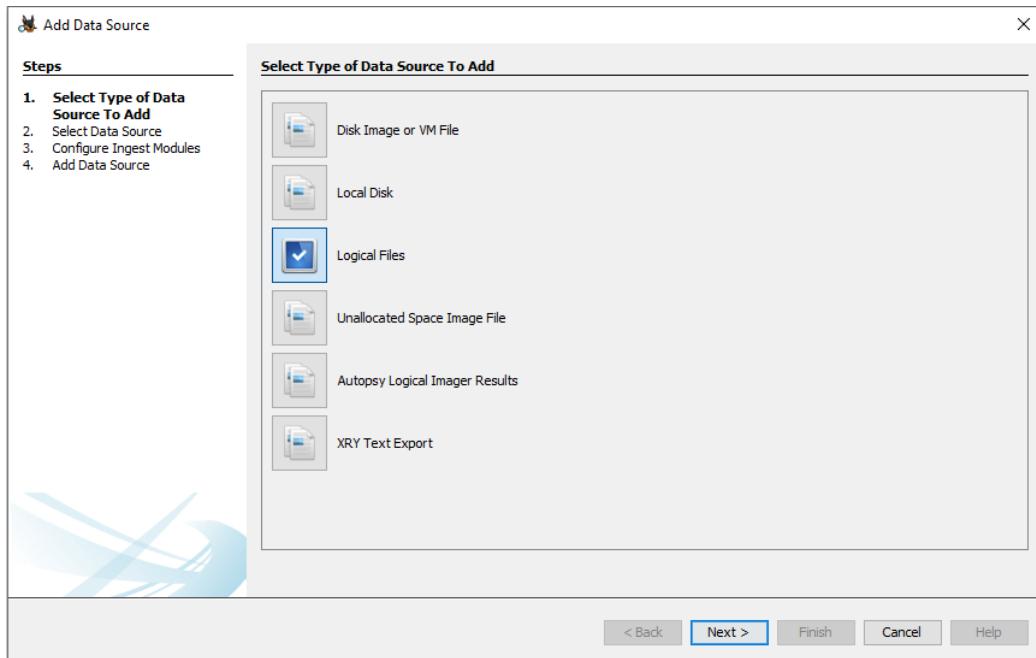


Figure 12: Select Input Method

6. Next, add the extracted files into the sources and click next.

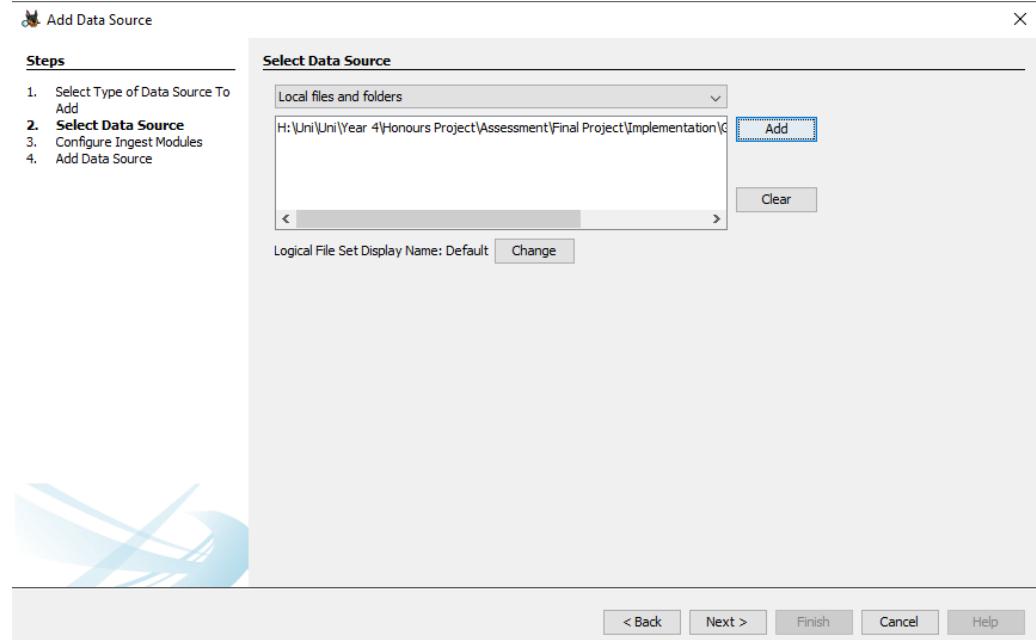


Figure 13: Add Data Sources

7. Ensure all boxes on the following screen are checked and click next, then finish on the following screen.
8. Autopsy will now scan through all the files input and search for relevant user data that is present in the extracted files. Depending on the file size, it can take a considerable amount of time to digest the file sets. Due to this the data processing machine was left on overnight to ingest some of the file sets.

Once the data was ingested into Autopsy, using the file structure system on the left of the screen and the tool bar at the top, data can be analysed and filtered as needed.

Bulk Extractor

Using the bulk extractor tool in Kali against logical file sets can allow for separation and analysis of images, databases and archives and more.

This can be carried out using the following command in a Linux terminal:

1. '***bulk_extractor -R Data\ Set1 -o <PATH TO DIRECTORY>***'

Using this command, multiple types of data is attempted to be filtered and separated into different files. Each of the file names indicates the type of data that is stored inside. Files which contain no data will still be created but will not be populated if no data is found. As can be seen in figure 14 below, a vast amount of different information is attempted to be found using this method.

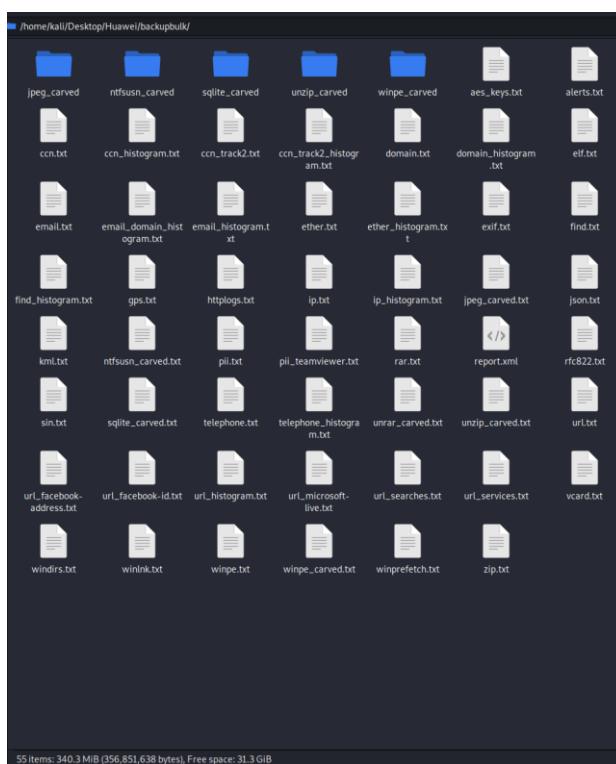


Figure 14: Example Bulk Extractor Output

Taking the output of the bulk extractor and placing the data into Autopsy allows for a further level of analysis in the case that there was data that bulk extractor was able to find data that Autopsy was not able to.

Ghost Exploit

A community developed ADB exploitation tool called Ghost (*EntySec/ghost*, 2021) can be used in order to gain remote access to an android mobile device through an exploit in ADB.

The first step is to install the ‘scrcpy’ package. Then connecting the device to a Linux machine and restarting ADB in TCP mode with port 5555 open for communication. The device is then disconnected from the USB cable. This can be carried out using the following commands.

1. ‘***sudo apt-get install scrcpy***’
2. ‘***adb devices***’
3. ‘***adb tcpip 5555***’

```
(kali㉿kali)-[~]
$ adb devices
List of devices attached
6PQ0217A25002145    device

(kali㉿kali)-[~]
$ adb tcpip 5555
restarting in TCP mode port: 5555
(kali㉿kali)-[~]68.1.151
$ adb devices
List of devices attached 68.1.151:5555...
(kali㉿kali)-[~]> sysinfo
Operating System: Android
(kali㉿kali)-[~]: HUAWEI_P10-aFc105dcbcc673
$ adb devices
List of devices attached
192.168.1.151:5555 [client] device m64-v8a
(kali㉿kali)-[~]
$
```

Figure 15: ADB TCP 5555 Commands

The next step is to start the Ghost framework. This can be carried out by using the following command:

4. ‘***ghost***’

Next, the ‘RHOST’ value was set to the IP of the mobile device. Then the ‘run’ command can be used to run the exploit. The following commands can be used to set the RHOST and run the exploit:

5. ‘***set RHOST <IP ADDRESS>***’
6. ‘***run***’

As can be seen in figure 16, the device was connected to using the console and the system information was displayed through the use of the following remote command.

7. ‘*sysinfo*’

The screenshot shows a terminal window titled "Ghost Framework" running on a Kali Linux system. The terminal displays the following session:

```
root@kali:~# ./ghost.py -i -p 5555
[*] Setting up TCP listener port: 5555
ghost> set RHOST 192.168.1.151
[i] RHOST => 192.168.1.151
ghost> runvnc
[*] Connecting to 192.168.1.151:5555 ...
ghost(192.168.1.151:5555)> sysinfo
[i] Operating System: Android
[i] Computer Hostname: HUAWEI_P10-afc105dcbcc673
[i] Computer Username: VTR-L09
[i] Release Version: 9.0
[i] Processor Architecture: arm64-v8a
ghost(192.168.1.151:5555)>
```

Figure 16: Ghost Framework

The command ‘netstat’ can provide information such as different devices that the mobile device has come in contact with. Another command using ghost is the ‘screen’ command, this allows for remote access to the device and allows control over the device. This can be seen demonstrated in figure 17 below and can allow for viewing of data that may not be extractable through other data extraction methods.



Figure 17: Ghost Screen Copy Command Example

PDF Password Cracking

During the extraction process, password protected PDFs were recovered.

The following procedure, using the Linux command line tool John The Ripper, can be carried out in order to crack the passwords for the recovered PDFs.

In a command prompt in Kali, JTR was cloned from GitHub (openwall/john, 2021), extracted and navigated to. From here navigating to:

1. '**/john-bleeding-jumbo/run'**

Then using the command:

2. '**perl pdf2john.pl <PATH TO PDF>**
/home/kali/Desktop/pdf.hash'

This will extract the hashed password from the file 'Search.pdf' and place it into the file 'pdf.hash'.

The next step is to run the command 'john' against the 'pdf.hash', this will attempt to crack the hashed password.

3. '**john /home/kali/Desktop/pdf.hash'**

As can be seen in figure 18, the hash has been cracked and the following command reveals the cracked password:

4. '**john –show /home/kali/Desktop/pdf.hash'**

```
(kali㉿kali)-[~/john-bleeding-jumbo/run]
└─$ john /home/kali/Desktop/reminder.hash'
Using default input encoding: UTF-8
Loaded 1 password hash (PDF [MD5 SHA2 RC4/AES 32/64])
Cost 1 (revision) is 4 for all loaded hashes
Will run 4 OpenMP threads
Proceeding with single, rules:Single
Press 'q' or Ctrl-C to abort, almost any other key for status
Warning: Only 6 candidates buffered for the current salt, minimum 8 needed for performance.
Almost done: Processing the remaining buffered candidate passwords, if any.
Warning: Only 7 candidates buffered for the current salt, minimum 8 needed for performance.
Proceeding with wordlist:/usr/share/john/password.lst, rules:Wordlist
Password!*          (/home/kali/Desktop/Reminder.pdf)
1g 0:00:00:00 DONE 2/3 (2021-03-11 11:40) 4.347g/s 197895p/s 197895c/s 197895C/s !@#$%..victoria
Use the "--show --format=PDF" options to display all of the cracked passwords reliably
Session completed
```

Figure 18: JTR Output

Decoding Data

Some of the extracted files found during the investigation were found to contain encrypted or obscured data. One of these includes a document with the following string stored inside the document.

```
'SXQgd2FzIG1lbnRpb25lZCBhdCB3b3JrlGxhc3QgbmlnaHQuIFBlb3BsZ  
SBhcmUgYmVpbmcgaW50ZXJ2aWV3ZWQgYnkgdGhlIFBvbGljZSwgdG  
hleeKAmXZlIg5vdCBzcG9rZW4gdG8gbWUgeWV0IGJ1dCBJIGRvbuKA  
mXQga25vdyB3aGVuIHRoZXkgd2lsbCBnZXQgdG8gbWUuIEkgbmVlZC  
B0byB0cnkgYW5kIGldCBvdXQgb2YgaGVyZSwgdGhlcmUgZ29pbmcgd  
G8gZmluZCBvdXQgaXQgd2FzIG1lLiBUaGlzIHdhcyBhbGwgYSBiaWcgb  
WlzdGFrZS4g'
```

Placing this string into a hash analyser, it can be seen that the string type is of base-64 encoding. This can be seen in figure 19.

The screenshot shows the Hash Analyzer interface. At the top, there is a text input field containing the string 'SXQgd2FzIG1lbnRpb25lZCBhdCB3b3JrlGxhc3QgbmlnaHQuIFBlb3BsZSBhcmUgYmV'. Below this is a green 'Analyze' button. The main output area displays the following information:

Hash:	SXQgd2FzIG1lbnRpb25lZCBhdCB3b3JrlGxhc3QgbmlnaHQuIFBlb3BsZSBhcmUgYmV FBlb3BsZSBhcmUgYmVpbmcgaW50ZXJ2aWV3ZWQgYnkgdGhlIFBvbGljZSwgdGhleeKAmXZlIg5vdCBzcG9rZW4gdG8gbWUgeWV0IGJ1dCBJIGRvbuKA mXQga25vdyB3aGVuIHRoZXkgd2lsbCBnZXQgdG8gbWUuIEkgbmVlZCBoobyBocnkgYW5kIGldCBvdXQgb2YgaGVyZSwgdGhlcmUgZ29pbmcgdG8gZ mluZCBvdXQgaXQgd2FzIG1lLiBUaGlzIHdhcyBhbGwgYSBiaWcgbWlzdGFrZS4g
Salt:	Not Found
Hash type:	unknown
Bit length:	2040
Character length:	340
Character type:	base64

Figure 19: Hash Analyser Output

Taking this string and placing it into CyberChef and using the decode from base-64 function, the real contents of the string can be found.

The screenshot shows the CyberChef interface with the following details:

- Operations:** A sidebar on the left containing various data processing tools like Search..., To Base64, From Base64, To Hex, From Hex, To Hexdump, From Hexdump, URL Decode, Regular expression, Entropy, Fork, Magic, Data format, Encryption / Encoding, Public Key, Arithmetic / Logic, and Networking.
- Recipe:** The main area shows a "From Base64" recipe selected. It includes an "Alphabet" dropdown set to "A-Za-zA-Z0-9+/-" and a checked checkbox for "Remove non-alphabet chars".
- Input:** A large text area containing a long Base64 encoded string.
- Output:** A text area showing the decoded output, which reads: "It was mentioned at work last night. People are being interviewed by the Police, they've not spoken to me yet but I don't know when they will get to me. I need to try and get out of here, there going to find out it was me. This was all a big mistake."

Figure 20: CyberChef Output

Manual Analysis

Throughout the extraction process of both devices, a vast number of files are recovered. Although automated tools can be very thorough with their search for specific types of data, some data can also be found manually through manually searching through directories for specific data. Once found, these files can be opened using software such as a DBeaver, a database viewer, or Notepad++, a text editor. Upon opening these files, keywords and phrases can be searched for to reveal important information. Phrases such as 'location', 'gps', 'notes', 'contacts' and more can be used to narrow down the search field for possible relevant information.

2.7. Testing

Verifying integrity of data

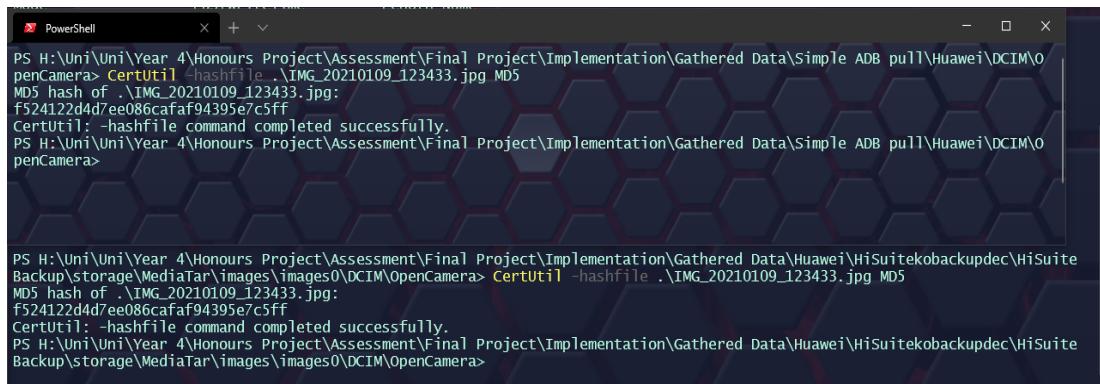
In order to verify that the data being analysed is the same that is stored on the mobile device and in which has been extracted, the following methods can be used to verify the integrity of each of the files gathered.

Hashfile

To verify the integrity of the analysed data, checksums of files were regularly taken. These were compared against checksums of the files from the ADB pull command. The windows command used was as follows

'CertUtil -hashfile <Path to filename> MD5'

An example calculation can be seen in figure 21.



```
PS H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB pull\Huawei\DCIM\OpenCamera> CertUtil -hashfile .\IMG_20210109_123433.jpg MD5
MD5 hash of .\IMG_20210109_123433.jpg:
f524122d4d7ee086cafaf94395e7c5ff
Certutil: -hashfile command completed successfully.
PS H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB pull\Huawei\DCIM\OpenCamera>

PS H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Huawei\HiSuiteBackup\storage\MediaTar\images\images0\DCIM\OpenCamera> CertUtil -hashfile .\IMG_20210109_123433.jpg MD5
MD5 hash of .\IMG_20210109_123433.jpg:
f524122d4d7ee086cafaf94395e7c5ff
CertUtil: -hashfile command completed successfully.
PS H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Huawei\HiSuiteBackup\storage\MediaTar\images\images0\DCIM\OpenCamera>
```

Figure 21: Example Hash Comparison

Copying of Data

Another aspect in which allowed for integrity of files to be maintained, is to take a copy of the extracted data and carry out the analysis on the copied data rather than the original extracted data. This means that if data was to somehow become corrupt or overwritten, the original data is still intact, and another copy can be taken to perform analysis on.

ExifTool

This tool allows for the meta data of images to be analysed. Using the command as shown below, can allow for insight into the make and model of camera/mobile device that the image was taken on.

'exiftool <PATH TO IMAGE>'

Other information that can be found using this tool includes the time and date of when the image was taken, the last edited time and the specific values of the image itself including colour values. This can allow for verification that the found images were taken on the mobile device in question. Using this tool in conjunction with the hashfile tool above can allow for verification that the files originated from the mobile device in question.

Included in appendix E is an example of the command that was used on the files periodically in order to ensure that the file originated from the mobile device.

3. Results

Before the results were collected, a checklist was made in order to give an indication of the number and contents of files that each phone holds. This allows for a reference as to what data the device was populated with and what data can be dismissed. Throughout the procedure of this paper, as each tool was used, the relevant data that each tool was able to extract from both of the devices was recorded. An overview of what data each tool was able to extract from the devices or file systems can be seen below.

Huawei Overview

A	B	C	D	E	F	G	H	I	J
1 HUAWEI	Simple ADB	Ghost	Bulk Extractor	adb-export.sh	Backup cracker & kobackupdec	John the ripper			
2 Application Backups									
3 Audio Files									
4 Browsing Data									
5 Calendar Events									
6 Contacts									
7 Decrypted Data									
8 Documents/Downloads									
9 Email Accounts									
10 Encoded Messages									
11 Encrypted PDF									
12 Google Location Data									
13 Image Location Data									
14 Images									
15 Messages									
16 Notes									
17 Other Devices									
18 Remote Access									
19 Strava Location Data									
20 System Info									
21 Wifi Devices									
22 Wifi Passwords/Hashes									

Figure 22: Huawei Extraction Overview

Samsung Overview

A	B	C	D	E	F	G	H	I	J	K
1 SAMSUNG	Simple ADB	Ghost	Bulk Extractor	adb-export.sh	ADB Export of partitions and directories	John the ripper	Andriller			
2 Application Backups										
3 Audio Files										
4 Browsing Data										
5 Calendar Events										
6 Contacts										
7 Decrypted Data										
8 Documents/Downloads										
9 Email Accounts										
10 Encoded Messages										
11 Encrypted PDF										
12 Google Location Data										
13 Image Location Data										
14 Images										
15 Messages										
16 Notes										
17 Other Devices										
18 Remote Access										
19 Strava Location Data										
20 System Info										
21 Wifi Devices										
22 Wifi Passwords/Hashes										

Figure 23: Samsung Extraction Overview

Simple ADB Pull

Autopsy can analyse and export files that are found in the populated data sets. Autopsy was used for analysis of multiple outputs from different data extraction methods. Following is an overview of the ‘suspect’ files that were found using the adb pull method from each of the mobile devices.

Huawei

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	1
Contacts	No
Documents	7
Downloads	8
Images	25
Location	No
Messages	No
Notes	No
Web Search	No
Web History	No
Wi-Fi Config	No

Table 4: Huawei ADB Pull

Samsung

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	2
Calendar Events	No
Contacts	No
Documents	6
Downloads	2
Images	8
Location	6
Messages	No
Notes	No
Web Search	No
Web History	No
Wi-Fi Config	No

Table 5: Samsung ADB Pull

The list of suspect files can be found in appendix G for the Huawei device and appendix H for the Samsung device.

A full list of files pulled using the simple ADB pull method can be found in appendix I for the Huawei device and in appendix J for the Samsung device.

ADB root and partition extraction

As the Samsung device was rooted, escalated privileges were gained, and larger exports were able to be extracted through the use of tar and netcat. The files extracted through this method were entered into Autopsy and an overview of what was found can be seen in table 6.

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	2
Calendar Events	2
Contacts	8
Documents	6
Downloads	2
Images	10
Location	6
Messages	1
Notes	10
Web Search	5
Web History	7
Wi-Fi Config	No

Table 6: Samsung Partition and Directory Extraction

Included in appendix K is a screenshot of the files extracted through this process.

Due to the number of files extracted using this method, they were not included in the appendix due to the word count of the file list being over 130,000 words.

Adb_export.sh

Through the use of this tool, data such as calendars, events, contacts, raw image data and more was extracted. From the Huawei device, contacts, messages, audio file names, image file names and system settings were found. From the Samsung device, calendar events and descriptions, contacts, messages, audio file names, image file names and system settings were found.

Each of the files extracted using this tool can be found in appendix L for the Huawei device and in appendix M for the Samsung device.

Andriller

Unfortunately using the Andriller tool on the Huawei device resulted in no data being extracted. However, using the tool on the Samsung device resulted in gathering data. The gathered data from the mobile device was entered into Autopsy and analysed. The relevant data that was found can be seen in table 7.

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	2
Calendar Events	2
Contacts	No
Documents	6
Downloads	2
Images	8
Location	6
Messages	No
Notes	No
Web Search	No
Web History	No
Wi-Fi Config	No

Table 7: Samsung Andriller

Included in appendix N is a list of all files extracted using Andriller.

Bulk Extractor

Running bulk extractor against the logical file sets extracted from both of the mobile devices allows for identification of images, SQL databases, zip archives, GPS information and more. A vast amount of information is found using this tool, including non-relevant information. This tool can also find duplicate items, an example of this would be finding an image taken on the phone but also extracting the image thumbnail which would be a smaller version with a different has value.

The output of the Bulk Extractor tool was imported into autopsy for analysis and included below is the collected files from the bulk extractor output of the Huawei backup image and from the Samsung TAR image.

Huawei Backup

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	No
Contacts	13
Documents	No
Downloads	5
Images	12
Location	No
Messages	2
Notes	9
Web Search	No
Web History	No
Wi-Fi Config	2

Table 8: Huawei Backup Bulk Extractor

Samsung TAR Extraction

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	No
Calendar Events	2
Contacts	8
Documents	No
Downloads	No
Images	18
Location	8
Messages	No
Notes	7
Web Search	6
Web History	7
Wi-Fi Config	No

Table 9: Samsung Directory Bulk Extractor

Included in appendix O for the Huawei device and in appendix P for the Samsung device is all the files/screenshots of the data that is extracted using this process.

Ghost

Using the ADB Ghost exploit, information regarding other devices in which the mobile device has been connected to, contacts and system information can be viewed and extracted through the use of a command line. Included in appendix Q is the output for the Huawei device and appendix R for the Samsung device.

HiSuite & Kobackupdec

The contents of the Huawei mobile device were backed up using HiSuite and decrypted using Kobackupdec. This allowed for the logical file set to be extracted and analysed. Multiple different files were found in this process. They were analysed in multiple different manners including through the use of Autopsy, Bulk Extractor and manual navigation. The contents of the HiSuite backup were recorded through the use of Autopsy and can be seen in table 10.

Data Type	Data Exported? (Yes/No/Number of Files)
Audio	1
Contacts	13
Documents	9
Downloads	8
Images	12
Location	No
Messages	2
Notes	9
Web Search	No
Web History	No
Wi-Fi Config	2

Table 10: HiSuite and Kobackupdec

Included in appendix S is a list of extracted files from the above method.

John The Ripper

Through the use of JTR, contents of password protected pdf's can be obtained. Two password protected PDF's were extracted, one from either of the mobile devices. Using the procedure demonstrated, the passwords for the Search.pdf from the Huawei device and the Reminder.pdf file from the Samsung device were cracked. The passwords can be seen in table 11.

File Name	Cracked Password
Search.pdf	Michael123
Reminder.pdf	Password!*

Table 11: Cracked Passwords

The contents of the two PDF's can be seen in figures 24 & 25.

They were looking for her tonight, I think they might find her soon. I need to try and act as casual as possible

Figure 24: Search.pdf (Huawei)

PASSWORD (Because I keep forgetting them)

Google: Michael123!*

Figure 25: Reminder.pdf (Samsung)

Manual Navigation

The results from the tools shown above can amount to a lot of important information, however, some information can be missed using these tools. Using manual navigation, the following files were found with reference to data that could be important to an investigation.

```
1 • 'data\data\com.samsung.android.app.notes\databases\sdcod.db'  
2 • 'data\misc\wifi\WifiConfigStore.xml'  
3 • 'data\data\com.google.android.apps.maps\files\directions_as_changed_in_navigation.data.cs'  
4 • 'data\data\com.google.android.apps.maps\files\ new_recent_history_cache_search.cs'  
5 • 'data\data\com.google.android.apps.maps\files\ offline_saved_directions.data.cs'  
6 • 'data\data\com.google.android.apps.maps\files\ saved_directions.data.cs'  
7 • 'data\data\com.google.android.apps.maps\files\users\search\112495771227498566032\places\10'
```

Figure 26: Manually Found Related Files

The contents of the files listed above include note contents, Wi-Fi configuration, including passwords, and location data from google maps. An example of the contents can be seen in figure 27 below and the full file contents of each of the above files can be found in appendix T.

	accountType	accountName	strippedContent	inverTimeStam	aryServerTime	categoryIDStr	noteName	sSyncAccount	syncDocument	nLastSyncTim	_id	UUID	isDeleted	isDirty	title	commandedTo	content
1	NULL		I got an offer today to make some... money, going to giv...	161436789...	161436788...	1	NULL	NULL	0	1	46976171-1...	0	1	Offer		I got an offe...	
2	NULL		I forgot I was supposed to meet George at the usual sp...	161443215...	161443215...	1	NULL	NULL	0	2	46976171-1...	0	1	Forgot		I forgot I wa...	
3	NULL		He gave me the official offer to distribute today. It's a...	161444482...	161444488...	1	NULL	NULL	0	3	46976171-1...	0	1	Generous ...		He gave me...	
4	NULL		It's my first run today. The guy arrived this morning wit...	161451946...	161451946...	1	NULL	NULL	0	4	46976171-1...	0	1	Run		It's my first ...	
5	NULL		Another successful run today	161462401...	161462401...	1	NULL	NULL	0	5	46976171-1...	0	1	Success		Another ...	
6	NULL		They are happy with the couple of runs I've been doing...	161469769...	161469769...	1	NULL	NULL	0	6	46976171-1...	0	1	Progress		They are ...	
7	NULL		No product to run today. Meeting with the boss today o...	161469793...	161469793...	1	NULL	NULL	0	7	46976171-1...	0	1	No shipment		No product ...	
8	NULL		Going to make a run this evening. A bit later than nor...	161478200...	161478200...	1	NULL	NULL	0	8	46976171-1...	0	1	Evening		Going to ...	
9	NULL		Saw the cops on the way to the meet today. Ditched th...	161496598...	161496598...	1	NULL	NULL	0	9	46976171-1...	0	1	Cops		Saw the cop...	
10	NULL		Just on my way to pick up what I left yesterday	161503658...	161503655...	1	NULL	NULL	0	10	46976171-1...	0	1	Pick up		Just on my ...	

Figure 27: Example Contents of Notes Database

Decoded and Encrypted Data

Multiple files extracted from both devices were found to contain encoded data. The file names, encoded data and their decoded data can be found in appendix U.

Also found was documents with what was indicated to be encrypted data. After numerous attempts, this data was not able to be decrypted. To encrypted data can be found in appendix V.

4. Discussion

Summary of Results

To summarise the gathered results, it can be seen that using the proposed procedure, a mobile forensic test bed can be successfully implemented for use to test different data extraction and analysis methods using the chosen set of tools. Analysing the tables of results, when comparing the amount of data that is obtained from the rooted device vs the non-rooted device, more data is able to be recovered from the rooted device. In conjunction with this result, the number and variation of files extracted from the rooted Samsung device vastly outnumbers the contents and number of files that was able to be extracted from the non-rooted Huawei device through the use of the same chosen set of tools and methods. The results were able to successfully demonstrate the strengths and limitations of the chosen set of tools.

Interpretation of Results

A common attribute found between both devices is the missing Strava location data. This data was unable to be extracted from both devices when tested with multiple tools. A study into what data can be extracted from different fitness applications indicates that location data Strava collects for use on the application is not stored locally on the device and is instead uploaded to Strava servers (Hassenfeldt *et al.*, 2019).

Huawei

Each of the tools and methods used was shown to provide a different variation of data from the device. An overview of the number of files each tool was able to extract can be seen in figure 28.

Total Number of Extracted Files vs. Tool Used (Huawei - Web History and location not included)

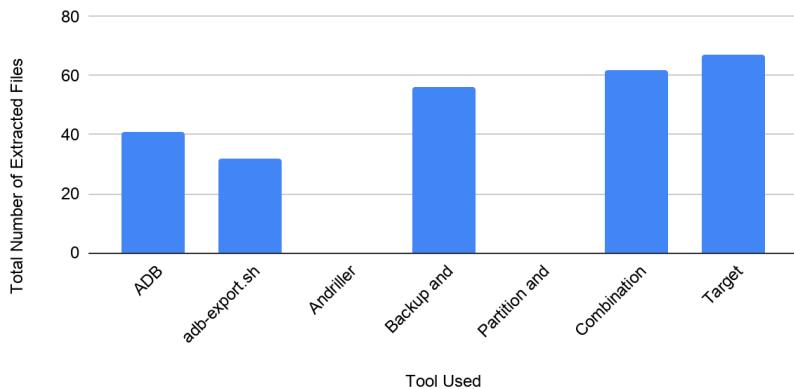


Figure 28: Overview of Huawei Tools

Some tools used in this procedure were found to be more effective than others. As can be seen in the graph above, adb-export.sh extracted the least amount of data. This is due to the limitations of the ADB exploit that is being used in this tool, and the tool only having access to basic mobile device information such as contacts and calendars.

Next in the list is the ADB pull method. This resulted in a larger amount of data to be extracted including images, documents and more.

Andriller was unsuccessful in the extraction of any data from the Huawei device, it is unknown if this is due to restricted access privileges or another possible limitation of the tool.

As can be seen in the graph above, the most amount of data extracted was through the use of backup and decryption software. When compared to other methods, this method involved the use of the HiSuite software provided by Huawei, the device manufacturer. This software is not universal and therefore may not function as expected for other device manufacturers. In conjunction with this, the Kobackupdec tool, used to decrypt the backup, is specifically designed to decrypt the Huawei backup format. This tool is not designed to work with other phone manufacturers backup software and therefore would make decrypting other manufacturers backup formats more challenging.

Due to the device not being able to be rooted, the partition and directory extraction was not able to be carried out.

Not all data entered into Huawei test bed was able to be extracted. Two data types that were not able to be extracted was the Google location history and browsing history in addition to the previously mentioned Strava location data. This is believed to be due to not being able to acquire the correct privileges in order to extract the required data. The created data for these data types are stored in the '/data' directory in the corresponding application folder of the mobile device. This requires root privileges to access in which this device did not have.

Within the Huawei test bed, deleted files were included in the creation of the test bed. These files were found not to be recoverable during the extraction process. It is unknown as to the reason for why these were unrecovered, although possibilities include:

- Limitations of the extraction and analysis tools
- NAND cells being overwritten with new data

Samsung

For the Samsung device, an overview of the number of files each tool or method was able to extract can be seen in figure 29.

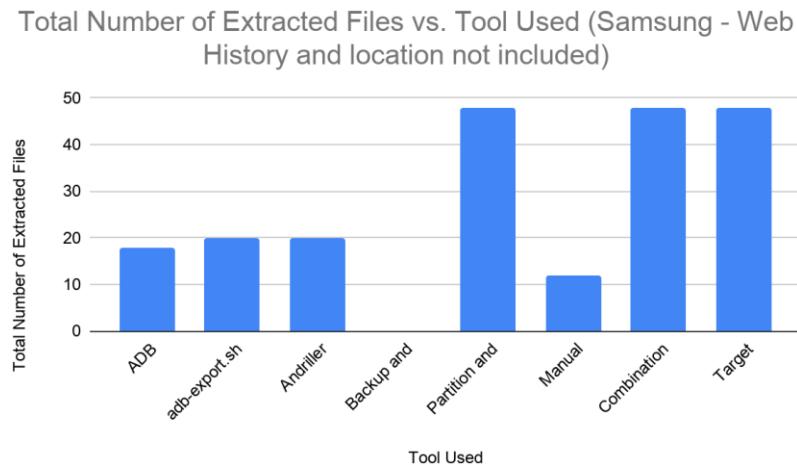


Figure 29: Overview of Samsung Tools

The method involving partition and directory extraction resulted in the most data being extracted from the Samsung device. This method however relies on the device being rooted and therefore may not be possible with all devices. If this is the case, when considering the next best tool, it can be seen that there would be a vast amount of information missing for analysis.

Aside from the Strava location data as mentioned above, every other type of data populated into the Samsung device was extracted.

Although each type of data was able to be extracted from the Samsung device, some of the data was clearer and easier to extract and analyse than others. One type of data that was noticeably harder to obtain was the Google maps location data. Although image location data was found, analysis tools such as Autopsy were unable to locate any Google maps location data. However, through the use of manual navigation and analysis, references to Google Map locations populated into the device were found. This was due to Google maps offline functionality in which saves a copy of the map and possible directions on the device. This data however does not dictate that the user was at that location, but in fact that the location in question has been searched for or maps downloaded onto the device.

Significance of Results

Demonstrated throughout this paper has been the successful creation, extraction, and analysis of a forensic test bed. The success of this indicates that the procedure presented, can be used as guidelines on how investigators can implement their own test bed for the use of training. Although it has been shown in the results that more data can be extracted from a rooted mobile device, there is still a vast amount of information that can be obtained from non-rooted devices through the use of a variety of different tools. Depending on what information is required to be obtained from the device, a rooted device may not be required. It was found that from a non-rooted device, data such as images, audio files, documents, contacts, messages and downloads could be extracted without additional exploitation. These forms of data could be the difference between the suspect being convicted or set free and therefore is vastly important that the data is extracted in a forensically sound manner in order for use as evidence in a criminal court.

Reference to Research Questions and Aim

The aim of this project was to create a procedure in which a forensic test bed can be implemented in order to compare and contrast the amount of information that could be obtained from the use of open-source and free tools on a rooted and non-rooted device. Throughout the project, two test beds, one rooted and the other not, were created with the aim to cover a wide amount of information that could contain information related to that of a simulated crime scenario. A variety of tools was used in order to extract and analyse data from each of the test beds. This allowed for a comparison between the types and amount of data that each tool was able to extract from each of the test beds. Due to this, the aim of the paper has been met as the implementation, extraction and analysis stages were all successful, thus allowing a comparison to be derived from the gathered results.

Reference to Previous Research

As noted in Literature 5, when using forensic tools aspects such as error rates and validation and verification must be considered. This was considered to be an important step during this project in order to verify that the data extracted from each device is the exact same before and after analysis. This was verified using different tools during the procedure such as ExifTool and comparing file hash values. It was found that the tool Bulk Extractor, was found to extract multiple variations of the same file, an example of this is extracting an image and extracting the thumbnail from the gallery. This meant that the original file was required to be found during the analysis in order to verify that the original file was extracted successfully.

As noted in Literature 3, the software suite Autopsy allowed for meta data analysis and file by file analysis. Due to this functionality, Autopsy was a key tool in the analysis of the extracted data. Autopsy allowed for easy viewing and categorisation of data, some of which may not have been noticed by other tools. In some cases, cache files were found by Autopsy which in turn revealed data that otherwise was not present in the extraction files.

Previously it was discussed that there are different types of forensic tools available, both commercially and open-source. This paper demonstrated the capabilities of open source tools and methods. Through the use of commercially available tools, all of the data populated into the test beds may be able to be extracted in a much more efficient and timely manner. However, this was unable to be tested in this project as the cost of such tools can exceed £10,000 and was therefore out of scope of this project. Literature 7 indicated that rooting a mobile device has no effect on the data integrity. Although this was not fully investigated during this paper, it can be noted that it is possible to modify the procedure demonstrated in order to extract information before and after rooting the same device in order to give a comparison between the data sets.

Importance of Work

The procedure carried out in this project allows for an understanding of a methodology that can be used to create, extract and analyse data from a mobile device in an effective manner. The developed test beds and data extraction methods can be used as a basis to form a forensic training suite to train future forensic investigators. This would allow those using the training suite to gain an understanding of some of the hurdles and challenges that face law enforcement when attempting to extract and analyse data from a mobile device.

Critical Evaluation

Overall, during the extraction and analysis stages of the implementation, there were no issues in using the demonstrated tools. However, there was multiple tools that were attempted to be used but were unable to work under the conditions. These tools however may have performed differently when presented with another mobile device.

Problems Encountered

The original plan for the creation of the test beds for this project was to use locations based in and around the Dundee city centre, close to Abertay University. Due to the COVID-19 pandemic, a quarantine was put in place and travel was restricted for non-essential purposes. Considering these events, the local town of Newport was used as the base of this activity. To attempt to prevent any personal data from being present on the device, location services were only turned on when the data was being populated into the devices.

On the first walk using the Huawei device, when taking a photo using the pre-installed camera application, the device would restart without capturing the image. The first time this happened, it caused the device to go into a boot loop. To resolve this issue, the following procedure was carried out.

1. Turn off the mobile device
2. Pressing the volume up and power button at the same time, this should load the device into the boot menu
3. Once in the boot menu, select the 'Clear Cache' option
4. Restart the device

Using the steps above resolved the issue of the device boot looping. It was found however that the device still crashes when attempting to take an image through the pre-installed software. To resolve this issue, a 3rd party camera application, 'Open Camera', was installed. This application allows the user to take images and then stores them in the devices pre-installed gallery application.

Without multiple devices with active sim cards installed, no call or messaging service could be used. To try and combat this, contacts were saved on the devices internal storage and some messages were also saved as drafts on the devices. However, no messages or calls were sent or received from either of the devices.

During the process of attempting to root the Huawei device, it was found that the device was unable to be rooted. Multiple different methods were carried out in order to attempt to root the device. Tools such as KingoRoot, 360 Root, OneClickRoot, Wondershare TunesGo and the psneuter exploit all resulted in no advance in gaining root access to the device. It is believed that the reason behind being unable to root the device was because of the Huawei device having a locked bootloader which runs before the operating system and which unlocking would allow for the root to take place.

Due to being unable to root the Huawei mobile device to gather data from it, another device was sourced. A Samsung Galaxy S8 was sourced in order to attempt to create a second smaller test bed for comparison between a rooted and unrooted device. When attempting to root the Samsung device, an error occurred during the installation process which corrupted the install and cause the device to go into a boot loop. This meant that the device could not boot up into the Android operating system. After contacting Samsung about this issue, they indicated that the device must be sent to them in order for a technician to repair the device. Due to the time and cost associated with this, it was believed that this would not be a suitable option for this. During the following days, numerous attempts were taken in order to attempt to resolve the issue with the device. It was found that original Samsung Galaxy S8 firmware could be flashed onto the device using the same tool, Odin, that was used to root the device. Using this tool, the device was restored to its original functionality.

When extracting data from the Samsung device, each of the images from the different partitions were different sizes. Most of the partitions were fairly small in size, however there was one partition around 5GB in size and two around 50GB in size. Once each of the partitions were extracted, the 5GB partition was imported into Autopsy. The 5GB file took over 4 hours to ingest the information into Autopsy. Due to this length of time for the file, the 50GB files were not processed into Autopsy due to the length of time the computer would need to work in order to ingest the information. Taking the time it took to ingest 5GB it was approximated that the 50GB file would take 40 hours to ingest. The larger partitions however were able to run through bulk extractor as bulk extractor is a multi-threaded application that takes advantage of CPU's with more cores and threads. Bulk extractor is also a lightweight program that only runs in the command line which also increases the speed at which it runs.

5. Conclusion

To conclude this paper, it can be seen from the results that two individual test beds were successfully created and implemented using the proposed procedure. It can also be seen from the above results and discussion that obtaining data from a mobile device can be both a simple and a complex procedure. Although a vast amount of information can be obtained, there is currently no open-source tool available that is able to extract every piece of data from every mobile device in the current market. Instead, multiple tools must be used in conjunction with each other in order to gain a full coverage of the data that is stored on the device.

Demonstrated in this paper are a set of tools that allow for a wide coverage of data to be extracted and analysed from mobile devices. Although results may vary from device to device, the basic premise behind what data each tool can obtain, and the method used in order to obtain the data provide a foundation to build upon.

The two test beds created for this procedure allow for a thorough testing of the chosen tools to find what data can be extracted and analysed, including any limitations each of the tools have. The procedure used to create the two test beds can therefore be used in order to recreate test beds or to use as a basis for an educational based mobile forensic test bed. This would allow for hands on experience for using the chosen tools and methods as a goal has already been set for what data is present on each test bed and what data can be extracted from each individual device and tool.

Implications

Although a vast amount of information can be obtained from a mobile device through the use of free and open-source tools, it cannot be guaranteed that all data can be obtained from a mobile device. There are many dependencies from this including the make and manufacturer of the device, as well as the operating system and system file structure running on the device itself.

Improvements

To improve upon this project, the two test beds created could have been implemented using the exact same model of phone with the same data being populated into each of them. In doing so, this would allow for a complete and fair comparison between the data that can be extracted from a rooted and a non-rooted device using the same set of tools.

Further research and development could have been placed into the extraction of deleted files. The few deleted files that were included in this procedure were unable to be extracted from the mobile devices. Specific methods and techniques could have been researched and tested in order to gain further understanding of the limitations of what type of data can be extracted

Another possible improvement would be to include the use of pay as you go sim cards into the mobile devices. This would allow for communication between device through the use of text messages and voice calls.

Through the addition of this functionality, further analysis could have taken place into testing if any of the tools demonstrated in this paper would be able to extract the call logs and message threads implemented into the devices.

Future Work and Research

With mobile devices slowly replacing the need for desktop computers for a vast amount of the public, this entails that more and more data will be stored and sent to and from mobile devices. To demonstrate this a more detailed and thorough testbed could be created to reflect these changes in society. For this testbed, the timescale could be drastically increased to multiple months or even a year of device use to simulate real-life use of the device. This could include the creation and maintaining of multiple social media accounts, a sim card being installed and used, the inclusion of multiple devices and multiple locations.

Due to the nature of this paper being focused on the extraction and analysis of data, further research could be put into bypassing or unlocking the mobile device. This step is vital in the forensic investigation and further research into ways in which an unwilling suspect's mobile device could be unlocked without any data tampering could be very beneficial to the mobile forensics field.

In addition to the practical work carried out in this project, further practical work and research could be put into what data can be extracted using professional and commercially available forensic tools. Using these tools against a variety of different devices, both rooted and non-rooted, would allow for a full analysis between what data each type of tool is able to extract. This would allow for an understanding of what tool to use against a certain device or if there is a one tool fits all that is available commercially for the use by law enforcement to be able to extract data from a mobile device.

Further analysis could include different communication methods that are used by mobile devices. This can include the use of social media applications such as Facebook, Instagram, and WhatsApp. Through the implementation and use of these applications in a test bed, an analysis can be carried out on tools that can possibly extract and analyse any conversations, messages or images that may have been sent or received using these applications.

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Appendices

Appendix A – Inputted Huawei Data

Contacts

Date	Contact name	Number
02/01/2021	Dad	0123456789
02/01/2021	Dave	11122233344
02/01/2021	Mum	
02/01/2021	Boss	12345678901
02/01/2021	Brother	45678912325
02/01/2021	Tom	25803691471
02/01/2021	Frank	99999999999
02/01/2021	Upstairs neighbour Brian	01234567899
02/01/2021	Downstairs neighbour Angela	33322211166
02/01/2021	Stevie Patterson	77788899955
02/01/2021	Stevie Smith	88899977766
02/01/2021	Margaret Thomson	07946132581
02/01/2021	Sarah <3	5555555555

Google Chrome

Date	Google Search	Links
02/01 /2021	Human psychology	https://news.vcu.edu/article/What_is_the_psychology_behind_violence_and_aggression_A_new_VCU
02/01 /2021	The Science of Violence	
02/01 /2021	How much do we actually know about the psychology of violence	https://www.google.com/amp/s/theconversation.com/amp/how-much-do-we-actually-know-about-the-psychology-of-violence-51533
08/01 /2021	how to ask a girl out	https://www.eharmony.com/how-to-ask-a-girl-out/
08/01 /2021	how to ask a co-worker out	https://www.huffingtonpost.co.uk/entry/how-to-ask-a-coworker-out-date_n_5a53ba3ce4b0efe47ebb8a05
08/01 /2021	is it appropriate to ask a co-worker out	https://hellogiggles.com/love-sex/dating/how-to-ask-out-a-coworker-without-it-being-weird/
08/01 /2021	How to tell if a girl likes me	https://www.wikihow.com/Know-if-a-Girl-Likes-You
09/01 /2021	First date ideas	https://www.google.com/amp/s/www.gq-magazine.co.uk/article/best-first-date-ideas%3famp
09/01 /2021	What if she rejects me	https://thepowermoves.com/when-she-rejects-you/
11/01 /2021	Flower delivery	https://www.prestigeflowers.co.uk/?/?url=https://www.prestigeflowers.co.uk%3Fgclsrc%3Daw.ds%26pk_campaign=202265152&pk_kwd=flower%20delivery&pk_source=google&pk_medium=cpc&pk_content=10185136912&gclid=CjwKCAiAi_D_BRApEiwASslbJyreqY2LNP4ljQBvsAjebKi0JMvktDxjVsUE7Fae59XfoeEis2FxDhoCbCAQAvD_BwE&gclsrc=aw.ds

		<p>https://www.waitroseflorist.com/</p> <p>https://www.flyingflowers.co.uk/</p> <p>https://www.flyingflowers.co.uk/category/thinking-of-you/</p> <p>https://www.flyingflowers.co.uk/product/scented-spring-letterbox/</p>
12/01 /2021	How to deal with nerves	<p>https://www.healthline.com/health/anxiety/nervousness</p> <p>https://www.forbes.com/sites/rebeccanewton/2016/06/28/six-ways-to-overcome-your-nervousness-gremlin/</p>
12/01 /2021	Are butterflies actually in your stomach	<p>https://en.wikipedia.org/wiki/Butterflies in the stomach#:~:text=Butterflies%20in%20the%20stomach%20is,blood%20flow%20to%20the%20organ.</p> <p>https://greatist.com/happiness/why-do-i-get-butterflies-my-stomach</p>
14/01 /2021	Where to buy knives uk	<p>https://www.blades-uk.com/view_items.php?cat_id=19</p> <p>https://www.blades-uk.com/products.php?id=5043</p> <p>https://www.blades-uk.com/products.php?id=2873&name=hibben-alaskan-survival-knife-bk46</p> <p>https://heinnie.com/knives-tools/folding-blade-knives/</p> <p>https://www.knivesandtools.co.uk/en/ct/pocket-knives-and-multitools.htm</p> <p>https://www.knivesandtools.co.uk/en/ct/pocket-knives-and-fixed-blade-knives.htm</p> <p>https://www.knivesandtools.co.uk/en/ct/pocket-knives-and-fixed-blade-knives.htm?ss_cid=1-819&ms_fk_brand=Kershaw</p> <p>https://www.knivesandtools.co.uk/en/pt/-kershaw-injection-3-0-3820.htm</p>
16/01 /2021	raven manual	<p>https://www.evike.com/products/41519/</p> <p>https://www.evike.com/images/large/GP-WE-M1911-1.jpg</p> <p>https://www.evike.com/images/large/GP-WE-M1911-2.jpg</p>

		https://www.evike.com/images/large/GP-WE-M1911-3.jpg https://www.evike.com/images/large/GP-WE-M1911-4.jpg https://www.evike.com/images/large/GP-WE-M1911-5.jpg https://www.evike.com/images/large/GP-WE-M1911-6.jpg https://www.evike.com/images/large/GP-WE-M1911-7.jpg
16/01 /2021	Kershaw injection manual	3.0
16/01 /2021	Kershaw injection manual pdf	http://img1.wfrcdn.com/docresources/8639/15/155435.pdf
20/01 /2021	Australian visa application form pdf	https://immi.homeaffairs.gov.au/form-listing/forms/1419.pdf
24/01 /2021	'voicemaker.in' (incognito mode)	https://voicemaker.in/

Microsoft Edge

Date	Google Search	Links
17/01/ 2021	'will I feel guilt'	https://www.healthline.com/health/mental-health/how-to-stop-feeling-guilty
17/01/ 2021	'what is guilt'	https://www.goodtherapy.org/learn-about-therapy/issues/guilt#:~:text=Guilt%20is%20a%20feeling%20people,Sometimes%20it's%20even%20productive

17/01/2021	'how to get blood out of clothes'	https://www.goodhousekeeping.com/home/cleaning/a30982648/how-to-get-blood-out-of-clothes/#:~:text=If%20fresh%2C%20sponge%20the%20stain,until%20the%20stain%20is%20gone
17/01/2021	'hot to get clean a knife'	https://www.instructables.com/Clean-A-Knife-1/ https://www.wikihow.com/Clean-a-Knife
20/01/2021	'how long does it take to move house'	https://moving.tips/bonus-tips-and-tricks/how-long-does-it-take-to-move-cross-country/#:~:text=How%20long%20does%20a%20cross%20country%20move%20take%3F,driver%20typically%20covers%20about%20400-500%20miles%20a%20day.#:~:text=How%20long%20does%20a%20cross%20country%20move%20take%3F,driver%20typically%20covers%20about%20400-500%20miles%20a%20day.
20/01/2021	'how long does it take to get a visa'	https://visaguide.world/us-visa/processing-times/#:~:text=It%20takes%20from%203%20to,up%20to%20two%20other%20workdays.

Firefox

Date	Google Search	Links
23/01/2021	'flee the country'	
23/01/2021	'how to flee the country'	https://www.quora.com/You-have-24-hours-to-flee-your-country-How-do-you-do-it

Tor

Date	Google Search	Links

23/01/ 2021	'cyberchef'	https://gchq.github.io/CyberChef/
24/01/ 2021	'naturalreaders' ,	https://www.naturalreaders.com/online/
24/01/ 2021	'voicemaker.in'	https://voicemaker.in/
25/01/ 2021	'cyberchef'	https://gchq.github.io/CyberChef/

Notes

Date Created	Contents
02/01/2021	'She makes me so angry; I wish I didn't work with her. Why does she have to say the things she says? I sometimes wish she would just... disappear.'
08/01/2021	'I think Sarah likes me, she seemed nice today'
09/01/2021	'I can't stop thinking about her'
09/01/2021	'I saw her house today, can't believe I got so close'
12/01/2021	'I didn't get the chance to speak to her today, but I'm going to do it tomorrow'
12/01/2021	RSA Encryption of 'This is a test' Screenshot included
13/01/2021	'I've had enough, she keeps changing her mind on how she treats me. Today was the last straw, she's going to regret this.'

18/01/2021	'I can't get what I've done out of my head'
21/01/2021	Encrypted code of the screenshot of the knife order email
23/01/2021 (deleted shortly after, reference as a quick note)	'Michael123'

Documents

Date	Name	Contents
16/01/2021	Order.docx	'It arrived today, it looks so simple and sharp. Shame what I'm going to use it for but I've made my decision. The hinge is a bit sticky so I will have to look at the manual to see if I can fix that.'
17/01/2021	Document.docx	'She did it again last night, she wouldn't even look at me., I'm going to do it right now. I've arrived, she's not home yet. I'm going to wait for her to appear. She's here. She took her dog out for a walk. I'm going to hide for when she comes back. I did it, there is such a mess. I need to clean up'
19/01/2021	Search.pdf	Encrypted pdf created on a desktop and transferred over to the mobile device. The

		password to unlock the pdf is 'Michael123'.
21/01/2021	Complaining.pdf	Created on Google Docs and made available offline, downloaded to the mobile device.
21/01/2021	Image.docx	Encrypted code of the screenshot of the knife order email
23/01/2021	Work.jpg (File extension is changed to hide the fact it is a document)	Base-64 encoded message reading 'It was mentioned at work last night. People are being interviewed by the Police, they've not spoken to me yet but I don't know when they will get to me. I need to try and get out of here, there going to find out it was me. This was all a big mistake'
25/01/2021	Run.docx	Octal then base-64 encoded message reading 'I'm on the run, I don't know how much time i have left. They're catching up to me.'

Downloads

Date	Name	URL	Description
16/01/2021	Raven 1911 Manual Pages	https://www.evike.com/images/large/GP-WE-M1911-1.jpg https://www.evike.com/images/large/GP-WE-M1911-2.jpg https://www.evike.com/images/large/GP-WE-M1911-3.jpg https://www.evike.com/images/large/GP-WE-M1911-4.jpg https://www.evike.com/images/large/GP-WE-M1911-5.jpg	Separate files for each of the pages of the manual.

		https://www.evike.com/images/large/GP-WE-M1911-6.jpg	
16/01/2021	155435.pdf	http://img1.wfrcdn.com/docresources/8639/15/155435.pdf	Kershaw blade company knife 2013 catalog
20/01/2021	1419.pdf	https://immi.homeaffairs.gov.au/form-listing/forms/1419.pdf	Australian visitor visa application

Messages

Date	Contact	Content
08/01/2021	Boss	Sorry I'll be a bit late into work tonight, going through some stuff
08/01/2021	Sarah <3	Hey, how are you doing? X
18/01/2021 (edited message)	Sarah <3	Hey, how are you doing? X I'm so sorry

Location Data

Date	Start Location	End Location	Application Used

09/01/2021	Newport on Tay, Blyth Hall (This will act as the suspects home)	Newport on Tay, Waterstone Crook (This will act as the victim Sarah's house)	Google Maps
09/01/2021	Newport on Tay, Waterstone Crook (This will act as the victim Sarah's house)	Newport on Tay, Blyth Hall (This will act as the suspects home)	Google Maps
10/01/2021	Newport on Tay, Blyth Hall	Newport on Tay, Waterstone Crook	Google Maps
10/01/2021	Newport on Tay, Waterstone Crook	Newport on Tay, Blyth Hall	Google Maps
12/01/2021	Newport on Tay, Blyth Hall	Newport on Tay, Co-operative Shop	No application was used (Location services was turned on)
12/01/2021	Newport on Tay, Co-operative Shop	Newport on Tay, Blyth Hall	No application was used (Location services was turned on)
13/01/2021	Newport on Tay, Blyth Hall	Newport on Tay, Waterstone Crook	Strava
13/01/2021	Newport on Tay, Waterstone Crook	Newport on Tay, Blyth Hall	Strava (All in 1 session on Strava)

17/01/2021 (Walk to murder scene)	Newport on Tay, Blyth Hall	Newport on Tay, Waterstone Crook	Google Maps
17/01/2021 (Walk from murder scene)	Newport on Tay, Waterstone Crook	Newport on Tay, Blyth Hall	Google Maps
23/01/2021	Newport on Tay, Blyth Hall	Newport on Tay, Co-operative Shop	Strava
23/01/2021	Newport on Tay, Co-operative Shop	Newport on Tay, Blyth Hall	Strava

Images

Date	Location	Description	Number of Images
09/01/2021	Gallery	Image taken of the Waterstone crook building from the car park	1
09/01/2021	Gallery	Image taken of the front grass area of the building	1
09/01/2021	Gallery	Image taken of the car park outside the building	1
09/01/2021	Gallery	Image taken of the main building, closer photo than the original one	1

10/01/2021	Gallery	Image taken closer and around the building.	7
12/01/2021	Gallery	Screenshot of encrypted note	1
13/01/2021	Hidden Gallery Calculator app	Images taken of the building in the dark and some illuminated light outside lights.	6
13/01/2021	Strava	Images taken of the building in the dark and some illuminated light outside lights.	2
16/01/2021	Hidden Gallery Calculator app (Encrypted)	Image of a knife that was ordered that has arrived at the suspects house	1
16/01/2021	Hidden Gallery Calculator app (Encrypted)	Image of the knife open, with a box of knives behind it	1
16/01/2021	Hidden Gallery Calculator app (Encrypted)	An image of the knife half open with a gun (airsoft) in a case behind it	1
17/01/2021	Hidden.zip, located in the root directory of the internal storage and then deleted on the 20/01/2021	Images of a 'bloody knife'	2

20/01/2021	Deleted image	image of a notebook reading 'I think they found her. I'm not safe, I need to get out of here. Maybe they won't find me but I guess I need to be careful'	1
21/01/2021	Gallery	Screenshot of an email with the order of the Kershaw knife was transferred to the device, encrypted and original was deleted.	1
26/01/2021	OpenCamera.zip in OpenCamera folder in DCIM	3 Images of the suspects house/street. 2 of these images had the file extensions changed to front.pdf and side.wav. These 3 files were then compressed into a folder called OpenCamera.zip	3

Audio Files

Date	Filename	Contents

24/01/2021	What Done.mp3	I've I've done but it's eating me up inside. I killed her and I regret doing it, but I can't admit it. They will send me to jail and I can't handle that.'
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Appendix B – Inputted Samsung Data

Contacts

Date	Contact name	Number
27/02/21	Boss, Possible	75315925846
27/02/21	Dad	22222222222
27/02/21	Hannah	25487652893
27/02/21	Jim	12345678911
27/02/21	Mum	11111111111
27/02/21	Ross	09876543211
27/02/21	Sis	45678912385
28/02/21	Fixer	99999999999

Google Chrome

Date	Google Search	Links
26/02/21	How much does weed cost	https://wayofleaf.com/blog/how-much-does-weed-cost-in-the-uk
27/02/21	What is the jail time for distribution	https://www.drugwise.org.uk/what-are-the-penalties-for-possessing-or-supplying-drugs/

Microsoft Edge

Date	Google Search	Links
02/03/2021	Average prices of different drugs	https://www.drugwise.org.uk/how-much-do-drugs-cost/ https://www.addictionresource.net/blog/cost-of-illegal-drugs/
02/03/2021	Average prices of different drugs pdf	https://www.researchgate.net/publication/274566295_Understanding_Drug_Pricing
02/03/2021	Average prices of different drugs pdf download	https://gh.bmjjournals.org/content/bmjjigh/3/1/e000571.full.pdf

Firefox

Date	Google Search	Links
05/03/2021	Password hasher	https://www.md5hashgenerator.com/

Tor

Date	Google Search	Links
03/03/2021	'voicemaker.in'	https://voicemaker.in/

Calendar

Date	Event Name	Event Time	Event Description

05/03/2021	Client Meeting in person	17:00	£10 worth of weed
03/04/2021	Client meet	16:30	£10 worth of coke

Notes

Date Created	Title	Contents
26/02/21	Offer	I got an offer today to make some money, going to give it a think over but it sounds like it could be good money.
27/02/21	Forgot	I forgot I was supposed to meet George at the usual spot today. Need to head out quick to make it just in time.
27/02/2021	Generous Offer	He gave me the official offer to distribute today. It's a nice offer, he showed me the ropes. I don't think I can back out now.
28/02/2021	Run	It's my first run today. The guy arrived this morning with the goods. He gave me a number for another guy in case anything goes wrong. Going to the drop off point now.

01/03/2021	Success	Another successful run today.
02/03/2021	Progress	They are happy with the couple of runs I've been doing. They said they may introduce me into the selling business. Would make more money than I am at the moment.
02/03/2021	No shipment	No product to run today. Meeting with the boss today out in the open to get the price list for possibly selling product.
03/03/2021	Evening	Going to make a run this evening. A bit later than normal but should get it done in time for pick up. Should get a list of names as well for possible clients at some point.
05/03/2021	Cops	Saw the cops on the way to the meet today. Ditched the product in a nearby shrub. Took a photo of the location so I remember. Will need to go back tomorrow to recover it though

		unless I could be in some trouble.
06/03/2021	Pick up	Just on my way to pick up what I left yesterday.

Documents

Date	Name	Contents
28/02/2021	Reminder.pdf	Encrypted PDF with the password 'Password!*' with the contents being the password to the Google account setup on this device.
02/03/2021	Price List.docx	List of prices for contraband.
04/03/2021	Clients.docx	Table including 2 columns, name and address. With 4 client names: Bill, John, Emma and Tony.
04/03/2021	Suspicious.docx	'Was getting some strange looks when I was making my run today. Everyone seemed to be keeping their distance, is there something I don't know?'
05/03/2021	Passwords.docx	Test
05/03/2021	Passwords.xlsx	Table including the following password data: - 'Back gate' - '7ce30eeb956b8bbdecfdb304b556edba' - 'Key Locker' - 'd3c95acb3f4a091abb1fdc056dc68c1c' - 'Gun Case' - '8787a227a6aea36594f3a290e9604122'

Downloads

Date	Name	URL	Description

02/03/2021	E000571.full.pdf	https://gh.bmj.com/content/bmigh/3/1/e000571.full.pdf	Estimated cost of potential prices for the WHO essential medicines list
03/03/2021	Potential Order.mp3	https://voicemaker.in/	Voice note for a potential order of weed

Messages

Date	Contact	Content
02/03/2021	Boss, Possible	On my way now

Location Data

Home and work locations have been set for this device.

Date	Start Location	End Location	Application Used
27/02/2021	Blyth Hall	Waterstone Crook	Google Maps
28/02/2021	Blyth Hall	Waterstone Crook	Google Maps

28/02/2021	Waterstone Crook	Blyth Hall	Google Maps
01/03/2021	Blyth Hall	Blyth Hall (Loop from Waterstone Crook)	Strava (Exported to Google Drive, 3 images taken on the same day saved to the walk on strava)
02/03/2021	Blyth Hall	Victoria Park	No application used for this, test for location history through Google.
03/03/2021	Blyth Hall	Waterstone Crook	Strava
03/03/2021	Waterstone Crook	Blyth Hall	No application used for this, test for location history through Google.
04/03/2021	Blyth Hall	Waterstone Crook	Google Maps
04/03/2021	Waterstone Crook	Blyth Hall	Google Maps
05/03/2021	Blyth Hall	Kirk Road (Pedestrians Crossing sign)	Google Maps
06/03/2021	Blyth Hall	Kirk Road	Google Maps

Images

Date	Location	Description	Number of Images
27/02/2021	Waterstone Crook (Images are Geo tagged)	2 images of the front of the building. 1 image of a salt bin which indicates “drop point”. 1 image of car park.	4
28/02/2021	Waterstone Crook (Geo tagged)	Image of salt bin	1
01/03/2021	Waterstone Crook (Geo tagged)	1 image of the car park. 1 image of the building. 1 image of the salt bin	3
05/03/2021	Kirk Road (Pedestrians Crossing Sign, Geo tagged) Images have been encrypted in the hidden calculator app)	2 images of the crossing sign and surround shrubs.	2

Audio Files

Date	Filename	Contents

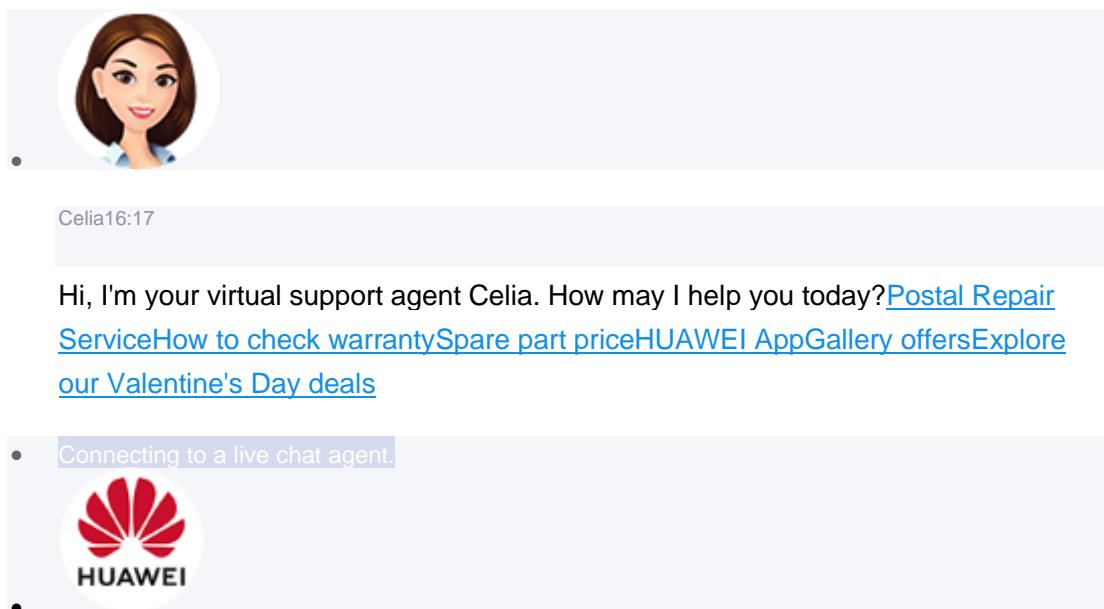
03/03/2021	Potential order.mp3	Voice note reading: 'Hi I would like to place an order for 60 pounds worth of weed. Is this something you can accommodate?'
04/03/2021	Rhyme.mp4	A docx file with a couple of tongue twisting rhymes.

Appendix C – Rooting Tools

Tool Used	Rooted (Yes/No), Reason	Reference
KingoRoot	No, permission denied	(<i>KingoRoot for Android, the best One Click Root Tool/APK for free.</i> , no date)
360 Root	No, permission denied	('Download 360 Root APK v8.1.1.3 (Latest Version)', 2017)
Wondershare TunesGo	No, permission denied	([Wondershare] <i>TUNESGO - Must-Have Phone Manager for Android and iPhone</i> , no date)
PotatoNV	No, permission denied	(Smirnoff, 2021)
Psneuter	No, permission denied	(<i>tmzt/g2root-kmod</i> , no date)

Framaroot	No, permission denied	(Framaroot 1.9.3 apk free Download - ApkHere.com, no date)
Huawei-honor-unlock-bootloader	No, permission denied	(*New* July 2020 Unlock bootloader of Huawei devices (Kirin 960/659/655), no date)
Odin	Yes, Samsung	(Download Odin 3.13.1 - Samsung Odin download with ROM Flashing Tool, 2021)
Magisk	Yes, Samsung	(Download Magisk Manager Latest Version 22.0 For Android 2021, 2021)

Appendix D – Huawei Conversation



The screenshot shows a mobile messaging interface. At the top, there's a circular profile picture of a woman with brown hair and a blue top. Below the profile picture, the name "Celia" and the time "16:17" are displayed. The main message area contains the following text:

Hi, I'm your virtual support agent Celia. How may I help you today? [Postal Repair Service](#) [How to check warranty](#) [Spare part price](#) [HUAWEI AppGallery](#) [offers](#) [Explore our Valentine's Day deals](#)

At the bottom of the message area, there's a small note: "Connecting to a live chat agent." To the right of this note is the Huawei logo, which consists of eight red petals forming a flower shape, with the word "HUAWEI" written below it.

Alex is at your service.

End chat



Alex16:17

Hello Jonah. Thank you for contacting Huawei UK & Ireland. If you are not from the UK or Ireland, may we kindly request that you find and change your location to your corresponding service country. Please enable your browser audio using the options on the top left. My name is Alex, may I start by taking the serial number of your Huawei device and I will try to help you.



Alex16:18

What is your email address please?



• 16:18

Alex16:18

Thanks.



Alex16:18

How can I help?

• 16:18

Hello, this may be a bit of a strange request

• 16:19

But i am using a Huawei p10 vtr-l09 as a mobile device in my honours project at university



Alex16:19

Okay.

• 16:19

My field of study is Ethical Hacking and am creating a mobile forensics test bed



Alex16:20

I see.

• 16:20

I have setup a test bed on this device and am required to image the device

• 16:20

This involves routing the device which i believe requires a open bootloader



Alex16:20

Ah okay.

• 16:20

Which Huawei used to give codes out to unlock, but have stopped this service

• 16:20

Is there any way to get help with this?



Alex16:21

Unfortunately we don't provide bootloader codes to any customer's anymore.



Alex16:21

We understand you would like to unlock the bootloader code for your phone. In response to your enquiry, we would like to inform you that the unlock code application service has ended, as of July 25th, 2018, to ensure user experience and safety. Moreover, unlocking the bootloader of a device voids the warranty and it wasn't recommended since it was the source of multiple software issues due to unauthorized software modifications. Huawei used to provide users with corresponding unlock codes to meet personalized requirements due to the usage of different ROMs, which is an extra service and does not belong to consumers' rights. However, due to possible problems caused by unlocking your device (such as system built-in function failure, device freezing, and power consumption increase) we will no longer provide the code. Should you have any other issues or questions, feel free to contact us at any time.

• 16:21

So i am unable to get this code? Even though the phone is way out of warranty period?



Alex16:22

Yes unfortunately we don't even have access to the database to generate these codes anymore.



Alex16:22

My apologies for this.

• 16:23

Is there any other way to unlock the bootloader without exploitation?



Alex16:23

I can't advise on that, my apologies again.

• 16:23

Guess i'll try and exploit it, thanks for your help



Alex16:23

No problem, anything else I can help you with?

• 16:23

That is everything thank you



Appendix E – ExifTool Example Command

```
[~/Data Set 1/scd/DCIM/OpenCamera]
ExifTool Version Number : 12.22
File Name : IMG_20210109_123433.jpg
Directory :
File Size : 2.3 MB
File Modification Date/Time : 2021:01:04 10:06:10-05:00
File inode Change Date/Time : 2021:01:09 10:24:09-05:00
File Permissions : rwxr--r-
File Type : JPEG
File Type Extension : image/jpeg
Exif Byte Order : Big-endian (Motorola, MM)
Resolution Unit : inches
Make : HUAWEI
Camera Model Name : YTR-L09
Software : VTR-L09 9.1.0.252(C432EIR1P9)
Modify Date : 2021:01:09 12:34:33
YCbCr Positioning : Centered
Maker Note Unknown Text :
Document Name :
EXIF :
    ISO : 50
    Exposure Program : Program AE
    F Number : 2.2
    Exposure Time : 1/35s
    Sensing Method : One-chip color area
    Sub Sec Time Digitized : 455129
    Sub Sec Time Original : 455129
    Sub Sec Time : 455129
    Subject Distance Range : Unknown
    Sharpness : Normal
    Focal Length : 4.0 mm
    Flash : Auto, Did not fire
    Saturation : Normal
    Light Source : Daylight
    Contrast : Normal
    Metering Mode : Multi-segment
    White Balance : Auto
    Scene Capture Type : Standard
    User Comment : Invalid EXIF text encoding for UserComment
    power@mgnz-n-contentid>
    Interoperability Index : R08 - DCF basic file (sRGB)
    Interoperability Version : 0100
    Focal Length In 35mm Format : 27 mm
    Max Aperture Value : 2.2
    Digital Zoom Ratio : 1
    Exposure Compensation : 0
    Create Date : 2021:01:09 12:34:33
    Exif Image Height : 3968
    White Balance : Auto
    Brightness Value : <2
    Date/Time Original : 2021:01:09 12:34:33
    Exif Image Width : 2976
    Exposure Mode : Auto
    Compressed Bits Per Pixel : 0.8
    Aperture Value : 2.2
    Components Configuration : Y, Cb, Cr, -
    Color Space : sRGB
    Scene Type : Directly photographed
    Custom Rendered : Custom
    Shutter Speed Value : 1/999963365
    Exif Version : 0210
    Flashpix Version : 0100
    File Source : Digital Camera
    X Resolution : 72
    Y Resolution : 72
    Thumbnail Offset : 1245
    Thumbnail Length : 34129
    Compression : JPEG (old-style)
    JFIF Version : 1.01
    Image Width : 2976
    Image Height : 3968
    Encoding Process : Baseline DCT, Huffman coding
    Bits Per Sample : 8
    Color Space : YCbCr
    YCbCr Sub Sampling : YCbCr4:2:0 (2 2)
    Aperture : 2.2
    Image Size : 2976x3968
    Modify Date : 2021:01:09 12:34:33
    Scale Factor To 35 mm Equivalent: 6.0
    Shutter Speed : 1/35s
    Create Date : 2021:01:09 12:34:33.455129
    Date/Time Original : 2021:01:09 12:34:33.455129
    Modify Date : 2021:01:09 12:34:33.455129
    Thumbnail Image : (Binary data 34129 bytes, use -b option to extract)
    Circles Of Confusion : 0.004
    Field Of View : 11.7 deg
    Focal Length : 4.0 mm (35 mm equivalent: 27.0 mm)
    Hyperfocal Distance : 1.61 m
    Light Value : 11.7
```

Caption 1: ExifTool example command and output

```
ISO : 50
Exposure Program : Program AE
F Number : 2.2
Exposure Time : 1/35s
Sensing Method : One-chip color area
Sub Sec Time Digitized : 455129
Sub Sec Time Original : 455129
Sub Sec Time : 455129
Subject Distance Range : Unknown
Sharpness : Normal
Focal Length : 4.0 mm
Flash : Auto, Did not fire
Saturation : Normal
Light Source : Daylight
Contrast : Normal
Metering Mode : Multi-segment
White Balance : Auto
Scene Capture Type : Standard
User Comment : Invalid EXIF text encoding for UserComment
power@mgnz-n-contentid>
Interoperability Index : R08 - DCF basic file (sRGB)
Interoperability Version : 0100
Focal Length In 35mm Format : 27 mm
Max Aperture Value : 2.2
Digital Zoom Ratio : 1
Exposure Compensation : 0
Create Date : 2021:01:09 12:34:33
Exif Image Height : 3968
White Balance : Auto
Brightness Value : <2
Date/Time Original : 2021:01:09 12:34:33
Exif Image Width : 2976
Exposure Mode : Auto
Compressed Bits Per Pixel : 0.8
Aperture Value : 2.2
Components Configuration : Y, Cb, Cr, -
Color Space : sRGB
Scene Type : Directly photographed
Custom Rendered : Custom
Shutter Speed Value : 1/999963365
Exif Version : 0210
Flashpix Version : 0100
File Source : Digital Camera
X Resolution : 72
Y Resolution : 72
Thumbnail Offset : 1245
Thumbnail Length : 34129
Compression : JPEG (old-style)
JFIF Version : 1.01
Image Width : 2976
Image Height : 3968
Encoding Process : Baseline DCT, Huffman coding
Bits Per Sample : 8
Color Space : YCbCr
YCbCr Sub Sampling : YCbCr4:2:0 (2 2)
Aperture : 2.2
Image Size : 2976x3968
Modify Date : 2021:01:09 12:34:33
Scale Factor To 35 mm Equivalent: 6.0
Shutter Speed : 1/35s
Create Date : 2021:01:09 12:34:33.455129
Date/Time Original : 2021:01:09 12:34:33.455129
Modify Date : 2021:01:09 12:34:33.455129
Thumbnail Image : (Binary data 34129 bytes, use -b option to extract)
Circles Of Confusion : 0.004
Field Of View : 11.7 deg
Focal Length : 4.0 mm (35 mm equivalent: 27.0 mm)
Hyperfocal Distance : 1.61 m
Light Value : 11.7
```

Caption 2: Continued ExifTool example output

Appendix F – ADB Export Command List

./adb-export.sh -e (Command)

- content://com.android.calendar/calendars
- content://com.android.calendar/events
- content://com.android.calendar/attendees
- content://com.android.calendar/reminders
- content://com.android.calendar/extendedproperties
- content://com.android.contacts/contacts
- content://com.android.contacts/directories
- content://com.android.contacts/deleted_contacts
- content://com.android.contacts/raw_contacts
- content://com.android.contacts/data
- content://com.android.contacts/data/phones
- content://com.android.contacts/raw_contact_entities
- content://com.android.contacts/status_updates
- content://com.android.contacts/groups
- content://com.android.contacts/aggregation_exceptions
- content://com.android.contacts/photo_dimensions
- content://media/external/images/media
- content://media/external/images/thumbnails
- content://media/external/audio/media
- content://media/external/audio/genres
- content://media/external/audio/playlists
- content://media/external/audio/artists
- content://media/external/audio/albums
- content://media/external/video/media
- content://media/external/video/thumbnails
- content://settings/system
- content://settings/secure
- content://settings/global
- content://settings/bookmarks
- content://user_dictionary/words

Appendix G – Samsung ADB Pull Extracted Files

Name	Date modified	Type	Size
335-Clients.docx	20/03/2021 18:52	Microsoft Word D...	13 KB
336-Passwords.docx	20/03/2021 18:52	Microsoft Word D...	12 KB
337-Passwords.xlsx	20/03/2021 18:52	Microsoft Excel W...	9 KB
338-Price List.docx	20/03/2021 18:52	Microsoft Word D...	13 KB
339-Reminder.pdf	20/03/2021 18:52	Adobe Acrobat D...	51 KB
340-Rhyme.mp4	20/03/2021 18:50	MP4 File	12 KB
341-Suspicious.docx	20/03/2021 18:52	Microsoft Word D...	12 KB
344-e000571.full.pdf	20/03/2021 18:52	Adobe Acrobat D...	1,157 KB
345-Potential Order.mp3	20/03/2021 18:50	MP3 Format Sound	38 KB
326-20210227_141036.jpg	20/03/2021 18:50	JPG File	6,648 KB
327-20210227_141045.jpg	20/03/2021 18:50	JPG File	7,791 KB
328-20210227_141050.jpg	20/03/2021 18:50	JPG File	8,687 KB
329-20210227_141055.jpg	20/03/2021 18:50	JPG File	4,164 KB
330-20210228_142122.jpg	20/03/2021 18:50	JPG File	4,567 KB
331-20210301_143947.jpg	20/03/2021 18:50	JPG File	4,156 KB
332-20210301_143951.jpg	20/03/2021 18:50	JPG File	3,029 KB
333-20210301_143957.jpg	20/03/2021 18:50	JPG File	5,340 KB

Caption 3: List of files pulled from Samsung device using the ADB pull method

Appendix H– Huawei ADB Pull Extracted Files

Name
18-h-048edaa3-5c61-48a6-91f4-7d58a12b2483+a
19-h-13421a4b-14a2-490e-8b76-7419933f6cc3+a
20-h-18d4926b-c44e-4b8d-95e8-bf62c3e36e76+a
21-h-420789de-969e-4d6c-9447-b104c51202b7+a
22-h-a5b1dcbb-9445-44d3-b4e3-2ce4b39d0898+a
23-h-e90857d7-027f-441c-8568-852b821d239e+a
517-IMG_20210109_123433.jpg
518-IMG_20210109_123440.jpg
519-IMG_20210109_123537.jpg
520-IMG_20210109_123557.jpg
521-IMG_20210110_123805.jpg
522-IMG_20210110_123826.jpg
523-IMG_20210110_123831.jpg
524-IMG_20210110_123841.jpg
525-IMG_20210110_123919.jpg
526-IMG_20210110_123923.jpg
527-IMG_20210120_182435.jpg
531-Document.docx
532-Image.docx
534-order.docx
535-run.docx
536-Search.pdf
537-work.jpg
539-1419.pdf
540-155435.pdf
541-Complaining.pdf
542-GP-WE-M1911-1.jpg
543-GP-WE-M1911-2.jpg
544-GP-WE-M1911-3.jpg
545-GP-WE-M1911-4.jpg
546-GP-WE-M1911-5.jpg
547-GP-WE-M1911-6.jpg
548-GP-WE-M1911-7.jpg
593-635a0443c3ac1214724d969143b663d3128.cache
604-7850d8ba7d9490d482410745f43a2cd3128.cache
613-8df5a464e4f5da9340976aa2d24550cd128.cache
632-b51c55d405c7b963f956c2fb3de1f30c128.cache
1026-Screenshot_20210112_175240_com.example.andro...
1081-front.pdf
1082-IMG_20210126_165433.jpg
1083-side.wav
What I've done .mp3

Caption 4: List of files pulled from Huawei device using the ADB pull method

Appendix I – Huawei File List (Simple ADB Pull)

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\chartboost

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Alarms

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Android

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\DCIM

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Documents

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Download

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\FolderLock Encrypted Data

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Huawei

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\HuaweiSystem

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\MediaTar

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Movies

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Music

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Notifications

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\OSapplock

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Pictures

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Podcasts

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Ringtones

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Huawei\Sounds

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\.chartboost\css

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\.chartboost\html

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\.chartboost\images

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\.chartboost\js

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\.chartboost\templates

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\chartboost\videos

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe_Files in this directory are very important
Please do not delete!

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\db

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\decrypt

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\picture

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\db\privacy_safe.db

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\picture\c-3e4f6b78-f760-4d2b-b18b-
eb15a25a038e+a

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\picture\c-4b7ab802-45bd-4478-83ec-
09e5ba731960+a

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\privacy_safe\picture\c-c0dcc5f3-76e6-415c-8fc3-
6a44f850ffe6+a

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-048edaa3-5c61-48a6-91f4-7d58a12b2483+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-13421a4b-14a2-490e-8b76-7419933f6cc3+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-18d4926b-c44e-4b8d-95e8-bf62c3e36e76+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-420789de-969e-4d6c-9447-b104c51202b7+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-a5b1dc3-9445-44d3-b4e3-2ce4b39d0898+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\privacy_safe\picture\h-e90857d7-027f-441c-8568-852b821d239e+a
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\obb
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\.nomedia
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.adobe.reader

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.android.chrome
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.android.contacts
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.android.gallery3d
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.android.providers.media
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.android.vending
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.example.android.notepad
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.docs
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.docs.editors.docs
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.docs.editors.sheets
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.docs.editors.slides
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.maps

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.apps.photos
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.gm
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.gms
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.googlequicksearchbox
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.music
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.tts
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.videos
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.google.android.youtube
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.hld.anzenbokusucal
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.android.pushagent
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.android.thememanager

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.camera
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.health
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hidisk
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hifolder
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.KoBackup
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.lbs
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.phoneservice
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.search
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.systemmanager
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.microsoft.emmx

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.microsoft.office.word
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.msi.logogame
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.murderminute.murder
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.reddit.frontpage
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.spotify.music
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.strava
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.touchtype.swiftkey
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
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pull\Huawei\Android\data\com.adobe.reader\files
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pull\Huawei\Android\data\com.google.android.apps.maps\files

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pull\Huawei\Android\data\com.google.android.apps.maps\testdata

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pull\Huawei\Android\data\com.google.android.apps.maps\cache\diskcache

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pull\Huawei\Android\data\com.google.android.apps.maps\cache\diskcache\map_cache.db

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pull\Huawei\Android\data\com.google.android.apps.maps\cache\diskcache\map_cache.db-wal

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pull\Huawei\Android\data\com.google.android.apps.maps\testdata\voice\en_GBc142e508\._HEAD_EAST.mp3

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pull\Huawei\Android\data\com.google.android.apps.maps\testdata\voice\en_GBc142e508\voice_instructions_unitless.zip

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pull\Huawei\Android\data\com.google.android.apps.photos\files

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pull\Huawei\Android\data\com.google.android.gm\cache

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pull\Huawei\Android\data\com.google.android.googlequicksearchbox\files

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16_49_40.log
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16_56_23.log
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pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_10890_2021_02_03_15_14_19.log
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pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_12069_2021_02_03_15_16_26.log

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21_01_31_12_53_02.log

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21_01_31_12_54_06.log

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pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_13448_20
21_01_31_12_54_53.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_13736_20
21_02_03_15_18_17.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14043_20
21_02_03_15_19_04.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14064_20
21_01_31_12_55_31.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14225_20
21_02_03_15_19_05.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14354_20
21_01_31_12_56_00.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14426_20
21_01_31_12_56_00.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_14710_20
21_02_03_15_19_43.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_15409_20
21_02_03_15_21_29.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_15497_20
21_02_03_15_21_29.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_15853_20
21_02_03_15_22_03.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_16439_20
21_02_03_15_23_55.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_16545_20
21_02_03_15_23_55.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_17760_20
21_02_03_15_26_44.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_17791_20
21_02_03_15_26_45.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_18023_20
21_02_03_15_27_37.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_18138_20
21_02_03_15_27_38.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_18387_20
21_02_03_15_27_59.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_18880_20
21_02_03_15_29_26.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_03_15_11_53.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_03_15_11_58.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_03_15_14_20.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_03_15_23_55.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_04_15_02_12.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2642_202
1_02_04_15_02_38.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2658_202
1_01_31_12_49_05.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2658_202
1_01_31_12_53_02.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2658_202
1_01_31_13_01_27.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2683_202
1_02_05_18_28_35.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2683_202
1_02_05_18_28_58.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2700_202
1_02_04_15_02_12.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2709_202
1_02_03_15_11_53.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_2778_202
1_02_05_18_28_35.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_3414_202
1_02_03_15_11_56.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_3540_202
1_01_31_12_49_07.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_4259_202
1_02_04_15_02_22.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_4316_202
1_02_05_18_28_43.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_4451_202
1_01_31_12_49_00.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_4629_202
1_02_05_18_28_46.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_5428_202
1_02_03_15_12_04.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_6962_202
1_02_04_15_02_53.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7002_202
1_02_04_15_02_53.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7002_202
1_02_04_15_12_57.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7049_202
1_02_05_18_29_13.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7166_202
1_02_03_15_12_26.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7237_202
1_02_03_15_12_26.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7324_202
1_01_31_12_49_31.log

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Project\Implementation\Gathered Data\Simple ADB

pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7380_202
1_01_31_12_49_32.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7442_202
1_02_04_15_02_56.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_7592_202
1_02_04_15_02_57.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_8955_202
1_02_04_15_17_54.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_9701_202
1_01_31_12_50_20.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\HMSLog_9788_202
1_01_31_12_50_21.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\push.log

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pull\Huawei\Android\data\com.huawei.hwid\files\Log\push_1611426083.log

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.hwid\files\Log\push_1611753735.log

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pull\Huawei\Android\data\com.huawei.KoBackup\files

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ed59ac854c4aaa
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pull\Huawei\Android\data\com.huawei.lbs\files\b\w\index.bin
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pull\Huawei\Android\data\com.huawei.lbs\files\b\w\master.bin
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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pull\Huawei\Android\data\com.huawei.lbs\files\b\w\1d1f\tindex.bin
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.phoneservice\cache
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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Android\data\com.huawei.search\cache
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ndroid.shopping_appDataTar

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DataTar

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Project\Implementation\Gathered Data\Simple ADB

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Project\Implementation\Gathered Data\Simple ADB

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Light.ttf
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Medium.ttf
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pull\Huawei\OSapplock\hidefile-wal

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pull\Huawei\OSapplock\hideiaudio

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pull\Huawei\OSapplock\hideiaudio-shm

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pull\Huawei\Pictures\.Gallery2

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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Pictures\Screenshots

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pull\Huawei\Sounds\.vtdata

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pull\Huawei\Sounds\CallRecord
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Project\Implementation\Gathered Data\Simple ADB
pull\Huawei\Sounds\.pictures\.nomedia
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pull\Huawei\Sounds\.pictures\20210131125334_picture.jpg

Appendix J – Samsung File List (Simple ADB Pull)

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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\.chartboost
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\.face
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\.privacy_safe
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Alarms
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Android
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\data
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\DCIM
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Documents
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Download
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Movies
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Music
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Notifications
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Pictures
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Playlists
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Podcasts

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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\SSE
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\TitaniumBackup
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\chartboost\css
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pull\Samsung\chartboost\videos
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\face\collage
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pull\Samsung\privacy_safe_Files in this directory are very important Please do not
delete!
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Project\Implementation\Gathered Data\Simple ADB pull\Samsung\privacy_safe\db
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Project\Implementation\Gathered Data\Simple ADB
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Project\Implementation\Gathered Data\Simple ADB
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H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.cover.ledcover\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.desktopcommunity\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.easyMover\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.easyMover.Agent\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.easyonehand\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_bd.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_its.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_its_ter.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_r.0

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_r.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_vts_com.sec.a
ndroid.gallery3d_default.0
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_vts_com.sec.a
ndroid.gallery3d_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_vts_inaka_com
.sec.android.gallery3d_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_vts_labl_com.s
ec.android.gallery3d_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\cache_vts_no_pois_c
om.sec.android.gallery3d_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\cache\debug
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.gallery3d\files\Trash
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.ofviewer\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.splitsound\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.widgetapp.easymodecontactswidget\fil
es
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.widgetapp.samsungapps\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.android.widgetapp.webmanual\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.hearingadjust\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.sec.vsim.ericssonnsds.webapp\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.skype.raider\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.skype.raider\cache\com.skype.raider.0.log

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.skype.raider\cache\com.skype.raider.0.log.lck
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.skype.raider\cache\com.skype.raider.v8.0.log
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.skype.raider\cache\ts_configuration.jwt
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_bd.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_its.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_its_ter.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_r.0
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_r.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_vts_com.strava_default.0
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_vts_com.strava_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_vts_inaka_com.strava_default.
m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_vts_lbl_com.strava_default.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\cache_vts_no_pois_com.strava_defa
ult.m
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\cache\debug
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.strava\files\52b19f83-b2a5-4e15-b0d9-
5b339624d013-activity.fit
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB

pull\Samsung\Android\data\com.strava\files\ce6bc8ed-f9d3-4609-8c31-2208dd374956-activity.fit
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.topjohnwu.magisk\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.topjohnwu.magisk\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache\.nomedia
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache\UnityAdsCache-
4cd03f5d050fdc92bdbf17419e19641568d93cd85d259a85ef6dfc252c51a725.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache\UnityAdsCache-
5ad266ec316dbbee5aba452808fe7618bff33761dc3b491a57e8444c5c1d79f29.webm
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache\UnityAdsCache-
c0ef416f6c57003d892cb5ed7e480d4071d7f8e15613a50db78a9a27e5c7213d.png
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.wangcheng.logo\cache\UnityAdsCache\UnityAdsWebApp.html
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\com.whatsapp\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\de.axelspringer.yana.zeropage\cache
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\org.mozilla.firefox\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\org.mozilla.firefox\files\Download
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\org.torproject.torbrowser\files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\data\org.torproject.torbrowser\files\Download

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Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\media\com.paranoiaworks.unicus.android.sse
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\media\com.topjohnwu.magisk
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\obb\nomedia
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\obb\com.microsoft.office.excel
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Android\obb\com.microsoft.office.word
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\data\com.keramidas.TitaniumBackup
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\DCIM\thumbnails
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\DCIM\Camera
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\thumbnails\thumbdata4--1967290299
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\thumbnails\1614522059438.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\thumbnails\1614609583114.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\thumbnails\1614955043612.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210227_141036.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210227_141045.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210227_141050.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210227_141055.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210228_142122.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210301_143947.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210301_143951.jpg

H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\DCIM\Camera\20210301_143957.jpg
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Clients.docx
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Passwords.docx
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Passwords.xlsx
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Documents\Price
List.docx
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Reminder.pdf
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Rhyme.mp4
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Documents\Suspicious.docx
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Download\adb_root.zip
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Download\e000571.full.pdf
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Download\Potential Order.mp3
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\Samsung\Music
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\Samsung\Music\Over_the_Horizon.mp3
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\SSE\Files
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB
pull\Samsung\SSE\Steganograms
H:\Uni\Uni\Year 4\Honours Project\Assessment\Final
Project\Implementation\Gathered Data\Simple ADB pull\Samsung\SSE\Texts

Appendix K – Samsung ADB Root Extraction File List

Name	Date modified	Type	Size
418-e000571.full.pdf	20/03/2021 18:57	Adobe Acrobat D...	1,157 KB
420-Potential Order.mp3	20/03/2021 18:56	MP3 Format Sound	38 KB
423-20210227_141036.jpg	20/03/2021 18:55	JPG File	6,648 KB
424-20210227_141045.jpg	20/03/2021 18:55	JPG File	7,791 KB
425-20210227_141050.jpg	20/03/2021 18:55	JPG File	8,687 KB
426-20210227_141055.jpg	20/03/2021 18:55	JPG File	4,164 KB
427-20210228_142122.jpg	20/03/2021 18:55	JPG File	4,567 KB
428-20210301_143947.jpg	20/03/2021 18:55	JPG File	4,156 KB
429-20210301_143951.jpg	20/03/2021 18:55	JPG File	3,029 KB
430-20210301_143957.jpg	20/03/2021 18:55	JPG File	5,340 KB
455-Reminder.pdf	20/03/2021 18:57	Adobe Acrobat D...	51 KB
456-Clients.docx	20/03/2021 18:57	Microsoft Word D...	13 KB
457-Price List.docx	20/03/2021 18:57	Microsoft Word D...	13 KB
458-Rhyme.mp4	20/03/2021 18:56	MP4 File	12 KB
459-Suspicious.docx	20/03/2021 18:57	Microsoft Word D...	12 KB
460-Passwords.docx	20/03/2021 18:57	Microsoft Word D...	12 KB
461-Passwords.xlsx	20/03/2021 18:57	Microsoft Excel W...	9 KB
10728-History	20/03/2021 18:59	File	136 KB
14954-contacts2.db	20/03/2021 18:58	Data Base File	4 KB
mmssms.db	20/03/2021 18:58	Data Base File	332 KB
shrubs.jpg	29/03/2021 19:17	JPG File	79 KB
sign.jpg	29/03/2021 19:17	JPG File	38 KB
15855-sdoc.db	20/03/2021 18:56	Data Base File	144 KB

Caption 5: List of files extracted using ADB root and copying partitions and directories

Appendix L – Huawei ADB Exploit

Contacts.csv

last_time_contacted,phonetic_name,is_private,custom_ringtone,contact_status_ts,pinned,photo_id,photo_file_id,contact_status_res_package,notification_tone,title,contact_chat_capability,contact_status_icon,display_name_alt,sort_key_alt,is_care,in_visible_group,starred,contact_status_label,phonebook_label,is_user_profile,has_phone_number,display_name_source,company,has_email,phonetic_name_style,send_to_voicemail,is_camera_card,lookup,phonebook_label_alt,photo_uri,phonebook_bucket,starred_order,contact_status,display_name,sort_key,photo_thumb_uri,has_name,c

ontact_presence,in_default_directory,times_contacted,vibration_type,_id,
name_raw_contact_id,phonebook_bucket_alt
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Dad, Dad, 0, 1, 0, NULL, D, 0, 1, 40, NULL, 0, 0, 0, 0,
1276i613762570d510ec8, D
contact_last_updated_timestamp=1614786480413, NULL, 4, -1, NULL,
Dad, Dad, NULL, 1, NULL, 1, 0, NULL, 1, 1, 4
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Mum, Mum, 0, 1, 0, NULL, M, 0, 0, 40, NULL, 0, 0, 0, 0,
1276i59c2ec8888743010, M
contact_last_updated_timestamp=1614786480617, NULL, 13, -1, NULL,
Mum, Mum, NULL, 1, NULL, 1, 0, NULL, 2, 2, 13
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Dave, Dave, 0, 1, 0, NULL, D, 0, 1, 40, NULL, 0, 0, 0, 0,
1276i559840ef0eb9cc45, D
contact_last_updated_timestamp=1614786480481, NULL, 4, -1, NULL,
Dave, Dave, NULL, 1, NULL, 1, 0, NULL, 3, 3, 4
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Boss, Boss, 0, 1, 0, NULL, B, 0, 1, 40, NULL, 0, 0, 0, 0,
1276i1ee526280934197e, B
contact_last_updated_timestamp=1614786480603, NULL, 2, -1, NULL,
Boss, Boss, NULL, 1, NULL, 1, 0, NULL, 4, 4, 2
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Brother, Brother, 0, 1, 0, NULL, B, 0, 1, 40, NULL, 0, 0, 0,
0, 1276i285f66a989060f76, B
contact_last_updated_timestamp=1614786480565, NULL, 2, -1, NULL,
Brother, Brother, NULL, 1, NULL, 1, 0, NULL, 5, 5, 2
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Tom, Tom, 0, 1, 0, NULL, T, 0, 1, 40, NULL, 0, 0, 0, 0,
1276i267610d8897a6d8b, T
contact_last_updated_timestamp=1614786480583, NULL, 20, -1, NULL,
Tom, Tom, NULL, 1, NULL, 1, 0, NULL, 7, 7, 20
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Frank, Frank, 0, 1, 0, NULL, F, 0, 1, 40, NULL, 0, 0, 0, 0,

1276i7efbd2398edd6ca2, F
contact_last_updated_timestamp=1614786480327, NULL, 6, -1, NULL,
Frank, Frank, NULL, 1, NULL, 1, 0, NULL, 8, 8, 6
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Brian Upstairs Neighbour, Brian Upstairs Neighbour, 0, 1,
0, NULL, U, 0, 1, 40, NULL, 0, 0, 0, 0, 1276i2e9af761882f5414, B
contact_last_updated_timestamp=1614786480543, NULL, 21, -1, NULL,
Upstairs Neighbour Brian, Upstairs Neighbour Brian, NULL, 1, NULL, 1,
0, NULL, 9, 9, 2
NULL, NULL, 0, NULL, NULL, 0, NULL, NULL, NULL, NULL, NULL,
NULL, NULL, Angela Downstairs Neighbour, Angela Downstairs
Neighbour, 0, 1, 0, NULL, D, 0, 1, 40, NULL, 0, 0, 0, 0,
1276i3b49013e0b16ac7c, A
contact_last_updated_timestamp=1614786480524, NULL, 4, -1, NULL,
Downstairs Neighbour Angela, Downstairs Neighbour Angela, NULL, 1,
NULL, 1, 0, NULL, 10, 10, 1
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h_TH,fi_FI,in_ID,mk_MK,sl_SI,ms_MY,vi_VN,hr_HR,nl_NL,ca_ES,hi_IN,
ko_KR,en_GB,iw_IL,my_ZG,my_MM,eu_ES,gl_ES,ka_GE,az_AZ,uz_UZ,
km_KH,si_LK,ur_PK,kk_KZ,lo_LA,be_BY,bn_BD,ne_NP,tl_PH,jv_Latn
25340, spline_start_lux_default_brightness, 11.867317

159, syskey_sound_hwt, /system/media/audio/ui/Effect_Tick.ogg
25352, screen_auto_brightness, 12
171, enable_annoy_card_1, 0
176, enable_annoy_card_2, 0
24366, proximity_wnd_status, 0
63, no_write_sms_package,
com.huawei.android.ds,com.android.mediacenter,com.huawei.hwid,com.
huawei.security,com.huawei.hisuite,com.android.phone,com.huawei.rem
oteassistant
758, curr_wallpaper_offsets, -1,-1,-1,-1
23022, volume_music Speaker, 7
261, hw_def_theme,
/data/hw_init/product/region_comm/oversea/themes/Atmospheric.hwt
76, custom_number_delete_bracket, true
19, notification_light_pulse, 1
274, theme_calendar_path, /system/media/audio/notifications/Bongo.ogg
222, notification_sound, content://media/internal/audio/media/54
276, theme_alarm_alert_path,
/system/media/audio/alarms/Forest_Melody.ogg
1080, tips_changed_navbar, 0
14833, wifi_ap_manual_connect, 0
129, show_sdn_priority, false
1255, wifipro_manual_connect_ap, 0
197, next_alarm_formatted,
5, volume_alarm, 12
0, volume_music, 11
4, volume_voice, 12
122, predefined_hotline_numbers,
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pożarna;all:26002:999:0,Pogotowie ratunkowe;pl:26002:112:0,Połączenie
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pożarna;all:26003:999:0,Pogotowie ratunkowe;pl:26003:112:0,Połączenie

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288, wifi_csp_dispaly_state, 1
283, message_path, /system/media/audio/notifications/Bongo.ogg
225, ringtone, content://media/internal/audio/media/99
117, noreply2self, true
52, hw_displayafterfirstring, 0
65, app_name_calculate_two_lines, true
220, verifition_sms_protect_enable, 1
45, def_cust_toolbox_tile,
wifi,bt,flashlight,sound,rotation,hishare,airplane,data,location,screenshot,
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108, hw_spnnull_defaultspn,
23212,23201,yesssl;23212,23203,yesssl;23212,23205,yesssl;23212,23207,yesssl;23212,23210,yesssl;23212,23211,yesssl;23212,23213,yesssl;23212,23217,yesssl;23212,23219,yesssl;23212,23214,yesssl;
103, hw_show_lte_for_mcc, 260;23001;26201;23203;23207
77, dialpad_touch_tone_type, 0
97, hw_notUseVirtualNetCust, 214
56, hw_ussd_ime_type_class_phone, 1
90, hw_hide_eap_sim_method, 262
21150, is_get_ntp_time, 1
195, hsm_netassistant, 1
14, hearing_aid, 0
215, first_boot_flag, 1

36, cloud_per_dwonload_time, 604800000
70, custom_certify_picture, product/hw_oem/VTR-L09/media/VTR_L09.png
25338, spline_offset_brightness_last, 11.867317
133, voicemailNumber_disabled, -1
219, enable_always_allow_mms, 1
146, eye_comfort_morewarm, 26
40, show_mms_expired_status, 1
2, volume_ring, 10
25343, screen_auto_brightness_adj, -0.90588236
147, smart_backlight_enable, 1
191, hsm_notification, 1
29, hw_omacp_apn_policy, 2
78, eas_default_check_interval, -2
21385, screen_brightness_mode, 1
92, hw_launcher_share_layout_config, true
958, alarm_alert_set, 1
9, mute_streams_affected, 47
106, hw_show_sdn_name_in_calllog, true
23700, hdb_enabled, 1
68, hw_theme_sort,
Aquatic##Atmospheric##Bloom##Chic##Elegance##Greeny##DailySpace##Backstage##Glaze##Taste##Dream##Flowers
120, plmn_remind_data_service,
26006,26003,26001,26002,21401,26098,26044,21407,26012,26033
15, tty_mode, 0
210, fingersense_letters_enabled_support, 1
130, sim_number_length, 23
16, screen_brightness_for_vr, 86
959, ringtone_set, 1
21391, spline_is_user_change, 0
270, font_scale, 1.0
11, dim_screen, 1
89, hw_front_cam_videomode, VideoMode

101, hw_show_4_5G_for_mcc, 286
762, hw_gesture_learn_record, LEFT_BACK
85, hw_default_front_timer_value, 0
757, is_scroll, 0
38, is_email_anr_support, 1
47, enable_email_contact_in_mms, true
160, physic_navi_haptic_feedback_enabled, 1
193, hsm_antivirus, 0
25307, 0_plmn_servicestate_to_settings, Emergency calls only
23830, bt_tether_on, 0
208, fingersense_multiwindow_enabled_support, 1
137, touch_disable_mode, 1
182, hsm_bootstart, 0
23, allow_all_devices_connection, 1
21185, hw_reading_mode_display_switch, 0
188, hsm_harassment, 1
48, hw_apn_hide_by_plmn,
23415:pp.vodafone.co.uk:payg.mobilebysainsburys.co.uk;23415:wap.vod
afone.co.uk:payg.mobilebysainsburys.co.uk;23415:payg.mobilebysainsbu
rys.co.uk:pp.vodafone.co.uk,wap.vodafone.co.uk
280, calendar, content://media/internal/audio/media/54
186, hsm_filedelete, 1
91, hw_iccid_language, true
279, theme_email_path, /system/media/audio/notifications/Bongo.ogg
957, notification_sound_set, 1
118, operator_name_separate, 1
102, hw_show_lte,
23001;26201;23203;23207;26001;26002;26003;26006;26044;26098
7, volume_bluetooth_sco, 7
164, sdn_info_on_SIM1, no_sdn_number_in_sim_card
165, sdn_info_on_SIM2, no_sdn_number_in_sim_card
60, mpdn_plmn_matched_by_network,
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5873,405874,405875,405876,405877,405878,405879,405880,405881,40
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2310,74810,71610,70401,74001,740010,73003,71606,70403,704030,71
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0380,310490,310530,310560,310580,310590,310640,310660,310800,31
0950,311180,51503,50506,41409,23820,23401,23402,23411,23425,234
26,23439,23457,23494,23101,23203,23207,23001,21901,26201,22004,2
0420,22603,22606,23102,29702,90137,90144,90146,26889,26203,2940
1,22003,33000,330120,73004,42507,732123
163, sdn_info_show_in_calllog, no_sdn_number_in_sim_card
30, lockscreen_sounds_enabled, 0
39, plmn, 460003#46003#460011#46011#45502#45507,en_US,China
Telecom;460003#46003#460011#46011#45502#45507,zh_CN,中国电信
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;460001#46001#460009#46009,zh_HK,中國聯通
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网络;999999#99999,zh_HT,未知網絡;999999#99999,zh_TW,未知網絡
;999999#99999,zh_HK,未知網絡
157, simpleui_mode, 1
50, hw_customized_networkType,
GPRS:GPRS;EDGE:EDGE;UMTS:UMTS;HSDPA:HSPA;HSUPA:HSPA;
HSDPA+:HSPA+;HSUPA+:HSPA+;LTE:4G;CA:4G+
211, hw_rcs_version_code, 90103307
217, last_dealed_icc_number, 0
300, accelerometer_rotation, 1
284, email_content://media/internal/audio/media/54
206, fingersense_smashshot_enabled_support, 1
275, theme_notification_sound_path,
/system/media/audio/notifications/Bongo.ogg
21383, hw_screen_temp_brightness, 4
25341, spline_ambient_lux, 9.0
144, spline_calibration_test, 0
21867, spline_ominlevel_time, -1
23998, screen_off_timeout, 2147483647
21384, hw_screen_brightness_mode_value, 1
28, discard_invalid_omacp, 1

216, cota_version_backup, 1.0
1076, ai_navigationbar, 0
41, vibrate_when_ringing, 1
212, alarm_alert, content://media/internal/audio/media/38
175, show_network_speed_enabled, 0
209, fingersense_letters_enabled, 0
22, pointer_speed, 0
54, hw_invert_txtrc_packages, google*,facebook*
116, list_roaming_open_area,
23408,26002,23430,23431,23432,23434,23486,23210,23205,23433,260
06,27211,27205,26098
31, omacp_supportnaponly, true
174, vn_key_for_specialimsi0,
189, hsm_powermanager, 1
141, mplink_db_condition_value, 0
24, advanced_visual_effect, 1
1379, weather_secret_notify_remind, 2
104, hw_show_lte_tile, false
196, startup_guide_frp_is_valid, 0
295, skytone.policy.status, 0
761, hw_gesture_choose_record, 1
173, vn_key0,
200, persist.sys.fingerjoint.c, com.huawei.camera;com.huawei.camera
204, persist.sys.fingerjoint.e,
com.android.chrome;com.google.android.apps.chrome.Main
202, persist.sys.fingerjoint.m,
com.android.mediacenter;com.android.mediacenter.PageActivity
203, persist.sys.fingerjoint.w,
com.huawei.android.totemweather;com.huawei.android.totemweather.We
atherHome
114, inline_as_att, true
205, fingersense_smartshot_enabled, 1
293, smart_network_switching, 0
213, alarm_alert_path, /system/media/audio/alarms/Forest_Melody.ogg

140, mode_ringer_streams_affected, 422
87, hw_forward_popedom, true
83, hw_2gonly_psnotallowed, 23410
187, hsm_phonescan, 1
59, ipcall_enabled, 0
169, is_support_hifence, 0
995, hisearch.policy.status, 1
25339, spline_last_lux_default_brightness, 11.867317
98, hw_ons_hplmn_ex,
2140354,2140606,2140612,2140613,240080635,240080735,23806009,2
40077,240078,2380172,2382089,2382098,2382097,2382096,2382095,2
382094,2382093,2382092,2382091,2382090,2382000,2380225,2380227
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207520,26207500,2140602,23801374,23801343,23801381,23207718,23
20776,23207799,2420507,2420508,2420595,24202,23801362
6, volume_notification, 10
199, already_show_roaming_plus_dialog, 0
1079, float_tips_notification, state_send
185, hsm_spacefree, 1
177, power_saving_on, 0
111, hw_szlTextView_hint, true
64, plmn_ut_ignore_cs_service, 65507
292, gearhead:driving_mode_settings_enabled, 0
13, dtmf_tone_type, 0
20, dtmf_tone, 1
192, hsm_protect_app, 1
14937, wifipro_manual_connect_ap_configkey,
1075, systemui_single_tips_already_shown, 1
282, message, content://media/internal/audio/media/54
124, reg_plmn_custom,
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3820;22803,29502;22801,29501;27202,27205
168, is_support_hardware_geofence, 1

33, volume_ring_speaker, 15
115, isShowNetworkType, 0
143, support_sensor_feature, 0
86, hw_default_support_call_barring, 1
105, hw_show_sdn_name_in_call, true
271, system_locales, en-GB
1077, enable_navbar, 0
136, wifi_off_default, false
75, change_sort_by_lang, hu_HU:2,2
184, hsm_processmanager, 1
109, hw_sst_pnn_by_mccmnc, 22299,22288
3, volume_system, 15
74, black_languages,
tr_CY,es_EA,es_IC,en_XA,ar_XB,zh_Hant_ZG,zh_Hans_ZG
172, sim_apn_opkey0, NULL
226, ringtone_path,
/system/media/audio/ringtones/Huawei_Tune_Living.ogg
301, ota_service_updated, 0
21230, softap_name_changed, 1
94, hw_networkmode_gstyle, true
285, email_path, /system/media/audio/notifications/Bongo.ogg
181, hsm_permission, 0
99, hw_roam_hplmn_ex,
2380101,23801374,23801343,23801381,2380171,2380172,42507,24007
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190, hsm_netcontroller, 1
145, eye_comfort_lesswarm, 6
135, wifi_notdel_notedit, Wifi+;Wifi Extra; Wifi
Extra;VodafoneWiFi;Vodafone NL Wifi;Vodacom.smallcell
96, hw_noservice_display, true
35, apn_pro_editable, 1

21, sound_effects_enabled, 0
57, hw_weatherclock_myloc_show_first, true
58, hwdefault_CheckIntervalt, 15
73, battery_percent_switch, 1
43, channel_version_vc_hiApp, hw_meafnaf
42, channel_version_vc, hw_eu, hw_la, hw_spcseas, hw_in, hw_eea, hw_ru
125, reg_plmn_roam_custom,
1:26098,26001;1:26098,26002;1:26098,26003;2:20827,20825;2:20827,2
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107, hw_skip_data_roaming_gid, 28,b2,b3,c3,B2,B3,C3
296, hsm.policy.status, 0
25309, fingerprint_slide_switch, 1
88, hw_front_cam_photomode, PortraitMode
127, select_open_configure_wi_fi_hotspot, 1
969, hicare_nps_enabled, 2
100, hw_set_mtu_by_mccmnc,
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0;23594,1440;23494,1440
132, theme_no_online, false
198, motion_triple_finger_shot, 0
128, should_write_sms_package,
com.pushbullet.android,com.huawei.vassistant,com.hello{text}.hello,com.g
oogle.android.googlequicksearchbox,com.hutchison3g.threeintouch
25353, screen_brightness, 12
218, vibrate_on_message, 1
223, notification_sound_path,
/system/media/audio/notifications/Bongo.ogg
46, disable_forbidden_network, false
278, theme_message_path, /system/media/audio/notifications/Bongo.ogg
113, hw_vmtag_follow_language, 23213
66, colors_themes,
white+golden,/data/hw_init/product/region_comm/oversea/themes/Chic.h
wt;black+tarnish,/data/hw_init/product/region_comm/oversea/themes/Atm
ospheric.hwt;black+blue,/data/hw_init/product/region_comm/oversea/the
mes/Atmospheric.hwt;white+silvery,/data/hw_init/product/region_comm/o
versea/themes/Aquatic.hwt;white+pink,/data/hw_init/product/region_com
m/oversea/themes/Bloom.hwt;white+green,/data/hw_init/product/region_c
omm/oversea/themes/Greeny.hwt
23149, notification_management_store_millis, 1611602451744
82, enable_sdn, true

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72, apnReminder_plmn, 23415
281, calendar_path, /system/media/audio/notifications/Bongo.ogg
110, hw_status_bar_operators, 1
61, need_captive_portal_by_hplmn,
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112, hw_theme_support_hwid, true
277, theme_ringtone_path,
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zztel,21421,21407,+34640001222|telefonica_spain,26211,21407|O2
UK,23410,21407|CYFROWY
POLSAT,26012,21407|KODOTEL,25037,21407|MOVICEL,63104,21407|
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VENEZUELA,73404,21407|TEMECU - MOVISTAR
ECUADOR,74000,21407|TMCH MOVISTAR,73002,21407|TMCOL -
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GUATEMALA,70403,21407|TMPA - MOVISTAR
PANAMA,714020,21407|TMPE - MOVISTAR PERU,71606,21407|TMU -
MOVISTAR
URUGUAY,74807,21407|VIVO,72406,21407|VIVO,72410,21407|VIVO,7
2411,21407|VIVO,72423,21407|OMV ONO
(Puro),21418,21407|OPTIMUS,26803,21407|TELEFÓNICA DE COSTA
RICA,71204,21407|Telefónica Móviles

Chile,73007,21407|Vitelcom,311470,21407|STA
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811,21407|Tesco,27211,20601|Telenet,20605,20610|UPC
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AT,23213,20408|Ziggo,20415,20601|iD,27216,20601|Vodafone_Netherla
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cablecom,22853,20601|UPC Hungary,21671,20601|UPC
Austria,23213,20601|UPC Ireland,27215,20601|BT
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007|ICE,24214,20404|Fastweb,22208,22801,+393756004141|Orange
Spain,21403,26832|Telekom SI,29341,22102
49, hw_contacts_filter_number, true

Appendix M – Samsung ADB Exploit

Contacts.csv

last_time_contacted,phonetic_name,is_private,custom_ringtone,contact_
status_ts,pinned,photo_id,photo_file_id,contact_status_res_package,link
_count,link,contact_chat_capability,contact_status_icon,display_name_alt
,sort_key_alt,in_visible_group,starred,contact_status_label,phonebook_la
bel,is_user_profile,has_phone_number,display_name_source,has_email,
phonetic_name_style,send_to_voicemail,lookup,phonebook_label_alt,sec
_custom_vibration,photo_uri,phonebook_bucket,contact_status,display_n
ame,sort_key,photo_thumb_uri,link_type1,contact_presence,sec_custom
_alert,sec_led,display_name_reverse,in_default_directory,times_contacte
d,dirty_contact,_id,name_raw_contact_id,phonebook_bucket_alt
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contact_last_updated_timestamp=1614432059950, NULL, NULL, 13,
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Calendar.csv

originalAllDay,account_type,exrule,facebook_schedule_id,mutators,origin
allInstanceTime,sticker_type,rrule,secExtraCal,secOriginalSyncId,contact
EventType,calendar_access_level,facebook_photo_url,eventColor_index,
guestsCanInviteOthers,facebook_mem_count,allowedAttendeeTypes,gue
stsCanSeeGuests,latitude,availability,lastSynced,facebook_hostname,rda
te,cal_sync10,account_name,calendar_color,dirty,calendar_timezone,pac
kagId,hasAlarm,uid2445,deleted,organizer,eventStatus,customAppUri,c
anModifyTimeZone,customAppPackage,displayColor,original_id,secExtra
Others,calendar_displayName,sticker_group,sticker_ename,allDay,allow
edReminders,filepath,canOrganizerRespond,lastDate,longitude,contact_a
ccount_type,visible,calendar_id,hasExtendedProperties,selfAttendeeStat
us,allowedAvailability,isOrganizer,_sync_id,name,phone_number,calenda
r_color_index,_id,facebook_post_time,dtstart,sync_data9,sync_data8,exd
ate,sync_data7,secTimeStamp,sync_data6,contact_data_id,sync_data1,
description,eventTimezone,title,contact_id,ownerAccount,sync_data5,syn
c_data4,sync_data3,sync_data2,duration,guestsCanModify,cal_sync3,cal
_sync2,maxReminders,cal_sync1,cal_sync7,cal_sync6,cal_sync5,availab
ilityStatus,cal_sync4,cal_sync9,cal_sync8,setLunar,facebook_service_pr
ovider,accessLevel,eventLocation,facebook_event_type,facebook_owner
,eventColor,secExtra4,eventEndTimezone,secExtra3,original_sync_id,ha
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Audio.csv

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s_sound,year_name,genre_name,recently_played,most_played,recently_
added_remove_flag,is_favorite,bucket_id,bucket_display_name,title_sear
ch_key,title_pinyin,composer_pinyin,genre_name_pinyin,_display_name_
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recording_mode,is_ringtone_theme,is_notification_theme,is_alarm_theme

e,datetaken,is_secretbox,artist_id:1,artist_key,artist,artist_search_key,artist_pinyin,album_id:1,album_key,album,album_search_key,album_pinyin
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Images.csv

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2445 0 3550 1960, -1, NULL
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Settings.csv

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245, SMLDM_BEARER, 0, com.samsung.sec.android.application.csc
166, record_calls Automatically_type, 0, android
213, cmf_color_code, zs, android

1132, aod_show_state, 0, com.android.systemui
224, aod_s_view_cover, 1, com.samsung.android.app.aodservice
159, lock_screen_allow_rotation, 0, android
124, lock_adaptive_color, 1, android
688, ntp_server1, 5, android
266, turn_over_lighting, 0, com.samsung.android.app.cocktailbarservice
480, game_no_interruption_white_list, NULL,
com.samsung.android.game.gametools
192, sec_display_poc_default_position, 0, android
32, hover_zoom_magnifier_size, 2, android
382, com.sec.android.inputmethod.virtual_navigation_bar_height, 99,
com.sec.android.inputmethod
142, intelligent_sleep_mode, 0, android
104, sim1_value, 0, android
221, night_mode_start_time, 1260, com.samsung.android.app.aodservice
131, dualclock_menu_settings, 1, android
182, videocall_settings, 0, android
205, need_dark_font, 0, android
201, add_info_com_sec_android_daemonapp#weather, 0,
com.android.systemui
183, anykey_mode, 0, android
160, interactionarea_switch, 0, android
256, country_cert_info_enable, 0,
com.samsung.sec.android.application.csc
225, aod_notifications, 1, com.samsung.android.app.aodservice
44, surface_palm_swipe, 1, android
43, surface_palm_touch, 1, android
29, flash_notification, 0, android
67, SEM_VIBRATION_NOTIFICATION_INTENSITY, 5, android
807, volume_music Speaker, 10, android
152, display_night_theme, 0, android
91, easy_mode_camera, 0, android
305, shown_max_brightness_dialog, 0,
com.samsung.android.SettingsReceiver

185, dark_theme, 0, android
176, roaming_assistance_setting, 0, android
78, notification_light_pulse, 1, android
206, need_dark_statusbar, 0, android
267, edge_lighting, 1, com.samsung.android.app.cocktailbarservice
73, led_indicator_voice_recording, 1, android
40, motion_pick_up_to_call_out, 1, android
348, media_mount_count, 0, com.samsung.android.MtpApplication
262, SOFTWARE_UPDATE_WIFI_ONLY2, 1, com.wssyncmldm
315, notification_sound, content://media/internal/audio/media/148,
com.samsung.sec.android.application.csc
379, com.sec.android.inputmethod.height, 780,
com.sec.android.inputmethod
218, aod_mode_start_time, 0, com.samsung.android.app.aodservice
1178, mtp_open_session, 0, com.samsung.android.MtpApplication
20, all_sound_off, 0, android
171, voice_input_control_incomming_calls, 0, android
306, time_zone_db_auto_updated, 0,
com.samsung.android.SettingsReceiver
76, display_battery_percentage, 0, android
173, call_answer_vib, 0, android
54, double_tab_to_wake_up, 1, android
250, autoredial_mode, 0, com.samsung.sec.android.application.csc
313, ringtone_CONSTANT_PATH,
?path=%2Fomr%2Fres%2Fmedia%2Faudio%2Fringtones%2FT_Rington
e.mp3&is_drm=0&title=T_Ringtone&is_cached=1,
com.samsung.sec.android.application.csc
4, volume_alarm, 11, android
7, volume_bixby, 7, android
0, volume_music, 7, android
3, volume_voice, 4, android
196, white_lockscreen_wallpaper, 0, com.android.systemui
126, show_password, 1, android
177, unknown_mode, 0, android

30, adaptive_brightness, 1, android
301, db_smartlock_supported, 1, com.samsung.android.SettingsReceiver
197, white_lockscreen_navigationbar, 0, com.android.systemui
312, ringtone, content://media/internal/audio/media/150,
com.samsung.sec.android.application.csc
252, call_extra_volume, 1, com.samsung.sec.android.application.csc
26, torch_light, 0, android
90, easy_mode_switch, 1, android
98, easy_mode_splanner, 0, android
66, VIB_RECVCALL_MAGNITUDE, 5, android
50, hdr_effect, 0, android
68, SEM_VIBRATION_FORCE_TOUCH_INTENSITY, 4, android
202, sip_key_feedback_vibration, 1, com.sec.android.inputmethod
19, hearing_aid, 0, android
101, phone1_on, 1, android
106, phone2_on, 1, android
242, badge_for_dm_security, 0, com.samsung.android.lool
322, double_tab_launch, 3, com.sec.android.app.camera
139, lock_to_app_enabled, 0, android
143, nearby_scanning_enabled, 1, android
115, sim2_value, 0, android
340, FOTA_CLIENT_HEARTBEAT_PERIOD, 0, com.wssyncmldm
169, display_caller_info_card, 1, android
129, people_stripe, 1, android
282, k2hd_effect_from_user, 0, com.sec.android.app.soundalive
132, lock_noticard_opacity, 45, android
122, screen_transition_effect, 1, android
145, send_mms_block_list, 0, android
1, volume_ring, 11, android
1168, homescreenPreview_capturetime_land, 1615061673374,
com.sec.android.app.launcher
75, simple_status_bar, 1, android
38, motion_engine, 1, android

18, default_vibration_pattern,
content://com.android.settings.personalvibration.PersonalVibrationProvid
er/1, android
148, blue_light_filter_scheduled, 0, android
260, android.contacts.SORT_ORDER, 2,
com.samsung.sec.android.application.csc
318, notification_sound_CONSTANT_PATH,
?path=%2Fomr%2Fres%2Fmedia%2Faudio%2Fnotifications%2FT_Mess
agetone.mp3&is_drm=0&title=T_Messagetone&is_cached=1,
com.samsung.sec.android.application.csc
207, need_dark_navigationbar, 0, android
376, screen_brightness_mode, 1, com.android.settings
23, access_control_keyboard_block, 0, android
203, face_widget_res_id,
com.sec.android.daemonapp#weather:2131886820,
com.android.systemui
876, last_status_logging, 1614869940837, com.android.settings
248, min_minder, 0, com.samsung.sec.android.application.csc
35, reduce_animations, 0, android
510, alarm_alert_set, 1, com.google.android.gsf
13, mute_streams_affected, 47, android
127, lte_mode_switch, 1, android
369, servicebox_page_gravity, 8388611, com.android.systemui
195, white_lockscreen_statusbar, 0, com.android.systemui
55, tty_mode, 0, android
251, call_noise_reduction, 1, com.samsung.sec.android.application.csc
164, record_call_storage_setting_value, 0, android
281, SOUNDALIVE_GENRE_INDEX, 0, com.sec.android.app.soundalive
58, short_press_app,
com.sec.activemode/com.sec.activemode.MainActivity, android
1076, high_brightness_mode_pms_enter, 0, android
181, int_call_svc_value, , android
511, ringtone_set, 1, com.google.android.gsf
157, font_scale, 1.0, android

15, dim_screen, 1, android
172, proximity_sensor, 1, android
28, add_info_music_control, 1, android
372, servicebox_music_last_pkg, , com.android.systemui
179, incoming_intcall_lock, 0, android
877, status_logging_cnt, 2, com.android.settings
163, record_calls_notification_on_off, 1, android
321, double_tab_launch_component,
com.sec.android.app.camera/com.sec.android.app.camera.Camera,
com.sec.android.app.camera
1127, com.sec.android.inputmethod.candidate_height, 147,
com.sec.android.inputmethod
154, display_night_theme_scheduled_type, 2, android
239, adaptive_fast_charging, 1, com.samsung.android.lool
194, scheduled_to_apply_special_theme, 0,
com.samsung.android.themecenter
63, one_handed_op_wakeup_type, 0, android
167, videocallmessage_settings, 1, android
21, access_control_power_button, 1, android
341, FOTA_CLIENT_HEARTBEAT_ADD, , com.wssyncmldm
151, blue_light_filter_off_time, 420, android
149, blue_light_filter_type, 2, android
123, set_shortcuts_mode, 1, android
60, lock_application_shortcut,
1;com.samsung.android.dialer/com.samsung.android.dialer.DialtactsActiv
ity;1;com.sec.android.app.camera/com.sec.android.app.camera.Camera,
android
146, blue_light_filter, 0, android
186, any_screen_running, 0, android
135, settings_ui, 1, android
165, record_calls Automatically_on_off, 0, android
193, support_aod_infinity, 1, com.android.systemui
116, sim3_value, 0, android
244, wbamr_mode, 3, com.samsung.sec.android.application.csc

509, notification_sound_set, 1, com.google.android.gsf
48, aod_mode, 1, android
187, mobile_keyboard, 0, android
6, volume_bluetooth_sco, 7, android
478, game_incoming_call_type, 1,
com.samsung.android.game.gametools
81, lockscreen_sounds_enabled, 1, android
278, user_rotation, 0, android
284, samsung_eula_agree, 1, com.sec.android.app.SecSetupWizard
84, tube_amp_effect, 0, android
134, screen_mode_automatic_setting, 1, android
233, lock_clock_adaptive_colors, ffd2cdfa;ffffadcd9;ffbbb4fa;fffac4c0,
com.android.systemui
370, servicebox_music_last_title, , com.android.systemui
51, hdr_effect_intensity, 1, android
324, accelerometer_rotation, 1, com.sec.android.app.SecSetupWizard
70, led_indicator_charing, 1, android
1174, enable_mtp_settings, 0, com.samsung.android.MtpApplication
261, android.contacts.DISPLAY_ORDER, 2,
com.samsung.sec.android.application.csc
47, enable_smart_capture, 1, android
53, screen_off_pocket, 1, android
227, qs_detail_content_secondary_text_color, -6842473,
com.android.systemui
178, outgoing_intcall_lock, 0, android
92, easy_mode_contacts, 0, android
302, screen_off_timeout, 30000, com.samsung.android.SettingsReceiver
96, easy_mode_messages, 0, android
253, vibrate_when_ringing, 1, com.samsung.sec.android.application.csc
283, k2hd_effect, 0, com.sec.android.app.soundalive
345, mtp_usb_connection_status, 0,
com.samsung.android.MtpApplication
277, hide_rotation_lock_toggle_for_accessibility, 0, com.android.systemui

311, alarm_alert, content://media/internal/audio/media/149,
com.samsung.sec.android.application.csc
22, access_control_volume_button, 1, android
42, motion_overturn, 1, android
158, auto_adjust_touch, 0, android
87, pointer_speed, 0, android
133, automatic_unlock, 1, android
136, psm_backup_haptic_feedback, -1, android
156, display_night_theme_off_time, 420, android
64, one_handed_op_show_hard_keys, 0, android
232, edge_lighting_wallpaper_color, silver, com.android.systemui
200, sip_key_feedback_sound, 1, com.sec.android.inputmethod
10, volume_music_bt_a2dp, 8, android
102, select_icon_1, 0, android
107, select_icon_2, 1, android
108, select_icon_3, 2, android
109, select_icon_4, 3, android
110, select_icon_5, 4, android
240, wireless_fast_charging, 1, com.samsung.android.lool
216, aod_mode_end_time, 0, com.samsung.android.app.aodservice
810, servicebox_show_music_oobe_text, 0, com.android.systemui
269, restore_panel_list, NULL,
com.samsung.android.app.cocktailbarservice
170, enable_call_protect_when_calling, 1, android
49, aod_mode_before_psm, 1, android
188, mode_ringer_streams_affected, 294, android
103, select_name_1, SIM 1, android
111, select_name_2, SIM 2, android
112, select_name_3, SIM 3, android
113, select_name_4, SIM 4, android
114, select_name_5, SIM 5, android
72, led_indicator_missed_event, 1, android
371, servicebox_music_last_artist, , com.android.systemui
5, volume_notification, 11, android

128, samsung_pay, 1, android
174, call_end_vib, 0, android
37, master_motion, 1, android
117, sim4_value, 0, android
94, easy_mode_gallery, 0, android
39, motion_pick_up, 1, android
265, cocktail_bar_enabled_cocktails,
com.samsung.android.app.appsedge.edgepanel.AppsEdgePanelProvider
, android
323, gearhead:driving_mode_settings_enabled, 0,
com.google.android.gms
153, display_night_theme_scheduled, 0, android
228, qs_panel_tile_text_color, -14342875, com.android.systemui
34, background_location_noti_enable, 1, android
263, contact_setting_list_filter, -2|||, com.samsung.android.contacts
17, dtmf_tone_type, 0, android
943, FOTA_CLIENT_POLLING_TIME, 1615620638138,
com.wssyncmldm
79, dtmf_tone, 1, android
226, qs_detail_content_primary_text_color, -14342875,
com.android.systemui
189, support_split_sound, 1, android
1128, FOTA_CLIENT_HEARTBEAT_TIME, 0, com.wssyncmldm
137, show_button_background, 0, android
806, volume_ring_speaker, 7, android
307, NearbyDownloadTo, /storage/emulated/0/Download,
com.samsung.android.SettingsReceiver
62, any_screen_enabled, 0, android
65, VIB_FEEDBACK_MAGNITUDE, 2, android
1182, auto_brightness_transition_time, 617, android
258, volume_system_speaker, 1, android
150, blue_light_filter_on_time, 1140, android
255, time_12_24, 24, com.samsung.sec.android.application.csc
119, prefered_voice_call, 1, android

211, vowifi_menu_enable, 0, com.sec.epdg
276, system_locales, en-GB, android
147, blue_light_filter_opacity, 5, android
71, led_indicator_low_battery, 1, android
350, sdcard_launch, 0, com.samsung.android.MtpApplication
88, multi_window_enabled, 1, android
210, finger_magnifier, 0, android
264, edge_handler_position_percent, 50.0,
com.samsung.android.app.cocktailbarservice
8, volume_music_headset, 8, android
1186, mtp_running_status, 1, com.samsung.android.MtpApplication
2, volume_system, 6, android
140, high_brightness_mode_user_enable, 1, android
155, display_night_theme_on_time, 1140, android
380, com.sec.android.inputmethod.height_landscape, 540,
com.sec.android.inputmethod
24, access_control_time_set_hour, 0, android
238, badge_for_dm_battery, 0, com.samsung.android.lool
247, call_conn_tone, 0, com.samsung.sec.android.application.csc
82, sound_alive_effect, 0, android
259, block_emergency_message, 0,
com.sec.android.app.safetyassurance
41, motion_merged_mute_pause, 1, android
342, FOTA_CLIENT_REGISTRATION, 1, com.wssyncldm
204, face_widget_order,
servicebox_music;servicebox_calendar;servicebox_alarm;com.sec.androi
d.daemonapp#weather, com.android.systemui
190, pms_notification_panel_brightness_adjustment, 1, android
161, automatic_answering_enable_sharedpref, 0, android
95, easy_mode_internet, 0, android
347, mtp_usb_conditions_met, 0, com.samsung.android.MtpApplication
254, sound_effects_enabled, 0,
com.samsung.sec.android.application.csc
1160, mtp_event_status, 0, com.samsung.android.MtpApplication

46, db_split_screen_view_shortcut, 0, android
287, send_security_reports, 1, com.sec.android.app.SecSetupWizard
89, country_code, 011, android
479, game_no_interruption, 0, com.samsung.android.game.gametools
138, notification_reminder_app_list,selectAll, android
59, long_press_app,
com.sec.android.app.music/com.sec.android.app.music.common.activity.
MusicMainActivity, android
243, launcher_current_screen_grid, 5x5, com.sec.android.app.launcher
237, videocall_type, -1, com.sec.imsservice
214, aod_content_type, 0, com.samsung.android.app.aodservice
105, multisim_selective_popup, 0, android
320, DEBUG_RINGTONE, content://media/internal/audio/media/148,
com.samsung.sec.android.application.csc
303, preload_list, , com.samsung.android.SettingsReceiver
199, onehand_direction, 1, com.sec.android.inputmethod
9, volume_music_headphone, 8, android
45, db_popup_view_shortcut, 0, android
1187, mtp_drive_display, 0, com.samsung.android.MtpApplication
125, lockscreen_ripple_effect, 0, android
367, settings_locale_changed, 0, com.android.settings
118, sim5_value, 0, android
268, edge_lighting_show_condition, 0,
com.samsung.android.app.cocktailbarservice
191, lockscreen_wallpaper, 0, android
236, voicecall_type, -1, com.sec.imsservice
1176, scon_is_running, 0, com.samsung.android.oneconnect
338, FOTA_CLIENT_TEST, 0, com.wssyncmldm
1183, screen_brightness, 75, android
212, lockscreen_minimizing_notification, 0, com.android.systemui
36, remove_animations, 0, android
168, videocall_speaker, 1, android
300, access_control_enabled, 0, com.samsung.accessibility
100, default_app_selection_option, 1, android

198, aod_lock_share_page_key_order,
servicebox_clock;servicebox_music, com.android.systemui
33, hover_zoom_value, 1, android
74, button_key_light, 1500, android
241, badge_for_dm_scoreboard, 0, com.samsung.android.lool
180, int_call_svc_enabled, 1, android
1155, mtp_sync_alive, 0, com.samsung.android.MtpApplication
346, media_player_mode, 0, com.samsung.android.MtpApplication
286, samsung_errorlog_agree, 1, com.sec.android.app.SecSetupWizard
144, device_visibility_enabled, 0, android
184, volumekey_mode, 0, android
246, call_end_tone, 1, com.samsung.sec.android.application.csc
175, call_popup, 0, android
69, volume_waiting_tone, 2, android
231, show_a11y_button, 0, android
280, SOUNDALIVE_AUDIO_PATH, 0, com.sec.android.app.soundalive
27, personal_mode_enabled, 0, android
223, aod_edgeclock_pos, 1, com.samsung.android.app.aodservice
25, access_control_time_set_min, 0, android
162, answeringmode_auto_time, 2, android
304, boottime, 1, com.samsung.android.SettingsReceiver
249, alertoncall_mode, 1, com.samsung.sec.android.application.csc
505, check_epdg_connect, 0, com.android.settings
93, easy_mode_email, 0, android
77, haptic_feedback_enabled, 0, android
31, screen_notification, 0, android
97, easy_mode_music, 0, android
222, night_mode_end_time, 420, com.samsung.android.app.aodservice
99, easy_mode_video, 0, android
285, samsung_eula_agree_hqm, 1,
com.sec.android.app.SecSetupWizard
11, volume_music_remote_submix, 15, android
317, alarm_alert_CONSTANT_PATH,
?path=%2Fomr%2Fres%2Fmedia%2Faudio%2Falarms%2FT_Alarmtone

.mp3&is_drm=0&title=T_Alarmtone&is_cached=1,
 com.samsung.sec.android.application.csc
 420, aod_home_force_pressed, 1, android

Appendix N – Andriller Extracted Files

Name	Date modified	Type	Size
861-Passwords.xlsx	24/04/2021 19:31	Microsoft Excel W...	9 KB
862-Passwords.docx	24/04/2021 19:31	Microsoft Word D...	12 KB
863-Suspicious.docx	24/04/2021 19:31	Microsoft Word D...	12 KB
864-Rhyme.mp4	24/04/2021 19:31	MP4 File	12 KB
865-Price List.docx	24/04/2021 19:31	Microsoft Word D...	13 KB
866-Clients.docx	24/04/2021 19:31	Microsoft Word D...	13 KB
893-20210301_143957.jpg	24/04/2021 19:31	JPG File	5,340 KB
894-20210301_143951.jpg	24/04/2021 19:31	JPG File	3,029 KB
895-20210301_143947.jpg	24/04/2021 19:31	JPG File	4,156 KB
896-20210228_142122.jpg	24/04/2021 19:31	JPG File	4,567 KB
897-20210227_141055.jpg	24/04/2021 19:31	JPG File	4,164 KB
898-20210227_141050.jpg	24/04/2021 19:31	JPG File	8,687 KB
899-20210227_141045.jpg	24/04/2021 19:31	JPG File	7,791 KB
900-20210227_141036.jpg	24/04/2021 19:31	JPG File	6,648 KB
902-Potential Order.mp3	24/04/2021 19:31	MP3 Format Sound	38 KB
867-Reminder.pdf	24/04/2021 19:31	Adobe Acrobat D...	51 KB
904-e000571.full.pdf	24/04/2021 19:31	Adobe Acrobat D...	1,157 KB

Caption 6: List of files extracted using the Andriller tool

Appendix O – bulk extractor Huawei backup image

Wi-Fi-config

Hex Text Application File Metadata Context Results Annotations Other Occurrences													
Table wifiConfig 2 entries Page 1 of 1 ⏪ ⏩ Export to CSV													
wep_key0	Port	DNS1	psk	DNS2	Host	ssid	GateWay	Exclusion...	key_mgmt	Network...	IPAddress	hiddenSSID	
			[REDACTED]			"vodafone2.4GHz"			WPA_PSK			false	
			"12345678"			"Jonah OnePlus 6"			WPA_PSK			false	

Caption 7: Wi-Fi config file for Huawei device found through use of bulk extractor tool

SMS

Hex Text Application File Metadata Context Results Annotations Other Occurrences										
Table sms_tb 2 entries Page 1 of 1 ⏪ ⏩ Export to CSV										
date	creator	address	read	date_sent	subject	sub_id	reply_pa...	type	body	seen
161099483...	com.android.mms		1	0		0	0	3	Hey, how are you doing? X I'm so sorry	0
161012220...	com.android.mms		1	0		0	0	3	Sorry I'll be a bit late into work tonight, going through some stuff	0

Caption 8: SMS database file for Huawei device found through use of bulk extractor tool

Notes

Hex		Text	Application	File Metadata	Context	Results	Annotations	Other Occurrences				
Table		comhuaweiprovider...		9 entries	Page 1 of 1		< >		Export to CSV			
id	title	content										
I02WJVLTR04635I9DDCJ21N0TPXXJKDX5JDM035EQIHGZH1G80PBNUHOBYFVBN2CLO4CIRW4HXP...		Text I02WJVLTR04635I9DDCJ21N0TPXXJKDX5JDM035EQIHGZH1G80PBNUHOBYFVBN2CLO4CIRW...										
I can't get what I've done out of my head.		Text I can't get what I've done out of my head.										
I've had enough, she keeps changing her mind on how she treats me. Today was the last straw, she'...		Text I've had enough, she keeps changing her mind on how she treats me. Today was the last straw...										
E02WTHWQLIW8PK1LV5HJRCJII6Q0756EWWKG04BTY46Y7C4F9U4EDKIAUCC72C859Q849TOJD...		Text E02WTHWQLIW8PK1LV5HJRCJII6Q0756EWWKG04BTY46Y7C4F9U4EDKIAUCC72C859Q849...										
I didn't get the chance to speak to her today, but I'm going to do it tomorrow.		Text I didn't get the chance to speak to her today, but I'm going to do it tomorrow.										
I saw her House today, can't believe I got so close		Text I saw her House today, can't believe I got so close										
I can't stop thinking about her		Text I can't stop thinking about her										
I think Sarah likes me, she seemed nice today		Text I think Sarah likes me, she seemed nice today										
She makes me so angry, I wish I didn't work with her. Why does she have to say the things she says...		Text She makes me so angry, I wish I didn't work with her. Why does she have to say the things she...										

Caption 9: Notes database file for Huawei device found through use of bulk extractor tool

Appendix P – bulk extractor Samsung tar image

Notes

Hex												Text	Application	File Metadata	Context	Results	Annotations	Other Occurrences
Table		sdock		7 entries	Page 1 of 1		< >		Export to CSV									
pedContent	serverTimestamp	categoryserver...	category...	noteName	msSyncA...	msSyncD...	msLastS...	_id	UUID	isDeleted	isDirty	title						
Data not shown	1614367890039	1614367884815	1					0	1	46976171-1965-ebf8-0000-0177dfa4b0ee	0	1	Offer					
Data not shown	1614432153598	1614432153598	1					0	2	46976171-1965-ebf8-0000-0177e3a719dd	0	1	Forgot					
Data not shown	1614444881523	1614444881523	1					0	3	46976171-1965-ebf8-0000-0177e4698e02	0	1	Generous Offer					
Data not shown	1614519509794	1614519464803	1					0	4	46976171-1965-ebf8-0000-0177e6dc1325	0	1	Run					
Data not shown	1614624014190	1614624014190	1					0	5	46976171-1965-ebf8-0000-0177ef172db9	0	1	Success					
Data not shown	1614697745937	1614697693476	1					0	6	46976171-1965-ebf8-0000-0177f37b9fc	0	1	Progress					
Data not shown	1614697939521	1614697911121	1					0	7	46976171-1965-ebf8-0000-0177f37e0a9b	0	1	No shipment					

Caption 10: Notes database file for Samsung device found through use of bulk extractor tool

Chrome History

Hex												Text	Application	File Metadata	Context	Results	Annotations	Other Occurrences			
Table		urls		13 entries	Page 1 of 1		< >		Export to CSV												
id	url	title							visit_count	typed_c...	last_visit_time										
1	https://www.bing.com/search?q=Average+price+of+different+drugs&setmkt=en-GB&PC=EMMIX20...	Average price of different drugs - Bing							1	0	13259175324128654										
2	https://www.drugwise.org.uk/how-much-do-drugs-cost/	How much do drugs cost? - DrugWise							1	0	1325917532290743										
3	https://www.addictionresource.net/blog/cost-of-illegal-drugs/	The Average Cost Of Illegal Street Drugs - Addiction Resource							1	0	13259175347690475										
4	https://www.bing.com/search?q=Average+price+of+different+drugs&FORM=RBY050&PC=EMMIX2...	Average price of different drugs - Bing							1	0	13259175445013904										
5	https://www.bing.com/search?q=Average+price+of+different+drugs+pdf&setmkt=en-GB&PC=EM...	Average price of different drugs pdf - Bing							2	0	13259175503729603										
6	https://www.researchgate.net/publication/274566295_Understanding_Drug_Pricing	(PDF) Understanding Drug Pricing							2	0	13259175476208578										
7	https://www.researchgate.net/publication/274566295_Understanding_Drug_Pricing/link/5522ad3f0c...	ResearchGate							1	0	13259175473691735										
8	https://googleads.g.doubleclick.net/dbm/click?sa=L&ai=CDeaJmU-YPzsh6DxqlE9r54CLL_zhRhgB2...								1	0	1325917549048729										
9	https://get.simplybusiness.co.uk/campaign/landlords-insurance/?mkt_medium=Display&mkt_source=...								1	0	1325917549048729										
10	https://www.bing.com/search?q=Average%20price%20of%20different+drugs%20pdf%20downlo...	Average price of different drugs pdf download - Bing							1	0	13259175532086016										
11	https://www.bing.com/search?q=Average+price+of+different+drugs+pdf+download&qs=r&scope...	Average price of different drugs pdf download - Bing							1	0	13259175638329963										
12	https://www.bing.com/search?q=Average+price+of+different+drugs+pdf+download&qs=r&scope...	Average price of different drugs pdf download - Bing							1	0	13259175647278932										
13	https://www.bing.com/search?q=Average+price+of+different+drugs+pdf+download&qs=r&scope...	Average price of different drugs pdf download - Bing							1	0	13259175659771133										

Caption 11: Google Chrome history database file for Samsung device found through use of bulk extractor tool

Bing/Microsoft Edge History

The screenshot shows a table titled "BingSearchHistory" with the following data:

_id	_DISPLAY_NAME	_QUERY_STRING	_URL	_IS_EXP...	_IS_PIN	_LAST
1	Average price of different drugs	Average price of different drugs		0	0	2021-03-02 16:17:24
2	Average price of different drugs pdf	Average price of different drugs pdf		0	0	2021-03-02 16:17:27

Caption 12: Microsoft Edge history database file for Samsung device found through use of bulk extractor tool

Downloads

The screenshot shows a table titled "downloads" with the following data:

_id	uri	method	entity	no_integ...	hint	otaupdate	_data	mimetype	destination
29	http://gh.bmj.com/content/bmjgh/3/1/e000571.full.pdf						/storage/emulated/0/Download/e000571.full.pdf	application/pdf	6

Caption 13: Downloads database file for Samsung device found through use of bulk extractor tool

Contacts

The screenshot shows a table titled "Account" with the following data:

Device	Type	Items
LogicalFileSet1	Phone	1
LogicalFileSet1	Phone	2
LogicalFileSet1	Phone	2
LogicalFileSet1	Phone	2
LogicalFileSet1	Phone	1
LogicalFileSet1	Phone	2
LogicalFileSet1	Phone	1
LogicalFileSet1	Device	12
LogicalFileSet1	Phone	1

Caption 14: Contacts database file for Samsung device found through use of bulk extractor tool

Calendar

The screenshot shows a table titled "Events" with the following data:

_id	_sync_id	dirty	mutators	lastSynced	calendar_id	title	eventLoc...	description	eventC...
1	64pm6dpg6sp6b9g68s34b9k64rjabbb2cks32b9mc8s38phl6kp62oj26g	0	0	2	Client meet			£10 worth of coke	
2	6koj8o9p69gmabb1c4r30b9k60o62b9o6go3ebbb64rm4d1nc5h38ob26s	0	0	2	Client Meeting in person			£20 worth of weed	

Caption 15: Events database file for Samsung device found through use of bulk extractor tool

gps.txt

```
# BANNER FILE NOT PROVIDED (-b option)
```

url_searches.txt

```
# BANNER FILE NOT PROVIDED (-b option)
# BULK_EXTRACTOR-Version: 1.6.0 ($Rev: 10844 $)
# Feature-Recorder: url
```

```
# Filename: data
# Histogram-File-Version: 1.1
n=168 %s
n=31 what+is+the+jail+sentence+for+distribution
n=29 how+much+does+weed+cost
n=25 Average+price+of+different+drugs+pdf+download
n=16 Average+price+of+different+drugs
n=9 fr_tos
n=9 water
n=8 Average+price+of+different+drugs+pdf
n=8 m_ws_serp_gethelp
n=8 ponyfill.
n=7
        Average%20price%20of%20different%20drugs%20pdf%20downlo
ad
n=7 password%20hasher
n=5 AMP
n=5 chrome_custom_tabs
n=5 contact_relationships
n=5 navigate_web_stories
n=3 %1
n=3 %s+%s
n=3
        Sports;B.ZeroStateStartActivityForResult=true;S.ZeroStateTapToU
pdateDeeplinkUrl=googleassistant:
n=3 googleapp_browser
n=3 manage_podcasts
n=3 weather
n=3 ws_searchdata
n=2 %%24%
n=2
        %7B%22_type%22%3A+%22Suggestions%22%2C+%22instrume
ntation%22%3A+%7B%22_type%22%3A+%22ResponseInstrumentation
%22%2C+%22pingUrlBase%22%3A+%22https%3A%5C%2F%5C%2Fw
```

ww.bing.com%5C%2Fapi%5C%2Fping%3FIG%3D1221EF54D7704BFA
9E07DE4AB37FF0F8%26CID%3D279DEBD67CF6604D32BDE43C7DA
E6161%26ID%3D%22%2C+%22pageLoadPingUrl%22%3A+%22https%
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n=2 %TERMS%

n=2 5ded741496c77f49c3adf33a496b0a8164ae

n=2 Blyth+Hall+Community+Centre

n=2 Eden+Springs++The+Water+%26+Coffee+Company+Dundee

n=2 Rechnungsversand+und+RechnungOnline

n=2 Scottish+Water++Bullion+House+Dundee

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3A%5C%2F%5C%2Fwww.bing.com%5C%2Fapi%5C%2Fp

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n=1 Alcohol

n=1 Asian

n=1 Average+price+of+different+drugs+p

n=1 Average+price+of+different+drugs+pd

n=1 Chinese

n=1 Fast%20Food

n=1 Indian

n=1 Mexican

n=1 Pizza

n=1 St.+David%27s+Day

n=1 Telefonieren+und+Einstellungen

n=1 Thai

n=1 Verf%C3%BCgbarkeitspr%C3%BCfung

n=1 WAStickerApps

n=1 Wings

n=1 anschluss+und+verf%C3%BCgbarkeit

n=1 bar

n=1 bauherren

n=1 bestellung

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```

Appendix Q – Huawei Ghost exploit

```
ghost(192.168.1.151:5555)> sysinfo
[i] Operating System: Android
[i] Computer Hostname: HUAWEI_P10-afc105dcbcc673
[i] Computer Username: VTR-L09
[i] Release Version: 9
[i] Processor Architecture: arm64-v8a
ghost(192.168.1.151:5555)>
```

Caption 16: sysinfo command output using Ghost exploit for Huawei device

```
ghost(192.168.1.151:5555)> view_contacts
[*] Getting Contacts information ...
No result found.
ghost(192.168.1.151:5555)>
```

Caption 17: view_contacts command output using Ghost exploit for Huawei device

```

tcp6 0 0 HUAWEI_P10-afc105:34922 lhr48s23-in-f14.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:50882 lhr25s15-in-f3.1e:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:47640 ecs-160-44-207-11:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:60932 ecs-80-158-16-161:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:44610 lhr25s27-in-f10.1:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:36476 a104-96-81-34.dep:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:51266 ecs-160-44-199-22:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:50640 lhr25s15-in-f3.1e:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:49742 ecs-160-44-207-21:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:58206 ecs-80-158-20-103:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:52990 lhr48s09-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:50886 lhr25s15-in-f3.1e:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:47630 ecs-160-44-207-11:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:37320 lhr35s07-in-f10.1:https ESTABLISHED
tcp6 0 185 HUAWEI_P10-afc105:59434 lhr25s32-in-f14.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:54684 lhr48s22-in-f10.1:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:49608 ecs-160-44-207-21:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:47274 ecs-80-158-20-104:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:33272 ber01s14-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:34998 lhr48s23-in-f14.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:50770 ecs-80-158-34-152.:5223 ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:36662 a104-96-81-34.dep:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:47634 ecs-160-44-207-11:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:47632 ecs-160-44-207-11:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:33386 ber01s14-in-f10.1:https TIME_WAIT
tcp6 0 32 HUAWEI_P10-afc105:42174 ecs-80-158-2-190.r:6447 FIN_WAIT1
tcp6 0 0 HUAWEI_P10-afc105:58208 ecs-80-158-20-103:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:49144 ::ffff:104.18.8.13:http ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:33910 mrs04s09-in-f202..https ESTABLISHED
tcp6 env 0 0 HUAWEI_P10-afc105:43166 ecs-160-44-195-25:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:40898 lhr48s27-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:49150 ::ffff:104.18.8.13:http ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:47302 lhr48s08-in-f2.1e:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:59590 lhr25s26-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105d:5555 DESKTOP-JRDG194.b:60312 ESTABLISHED
tcp6 0 32 HUAWEI_P10-afc105:42110 ecs-80-158-2-190.r:6447 FIN_WAIT1
tcp6 0 0 HUAWEI_P10-afc105:53014 lhr48s09-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:50638 lhr25s15-in-f3.1e:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:58342 ecs-80-158-20-103:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:51404 ecs-160-44-199-22:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:58348 ecs-80-158-20-103:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:59514 lhr25s26-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:42232 ecs-80-158-2-190.r:6447 FIN_WAIT2
tcp6 0 0 HUAWEI_P10-afc105:59536 lhr25s26-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:37360 lhr35s07-in-f10.1:https TIME_WAITED
tcp6 0 0 HUAWEI_P10-afc105:44298 lhr25s15-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:34808 lhr48s23-in-f14.1:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:54682 lhr48s22-in-f10.1:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:50884 lhr25s15-in-f3.1e:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:37550 lhr35s07-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:37550 lhr35s07-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:42090 ecs-80-158-2-190.r:6447 FIN_WAIT2
tcp6 0 0 HUAWEI_P10-afc105:53454 wl-in-f188.e100.n:5228 ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:59604 lhr25s26-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:33274 ber01s14-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:58204 ecs-80-158-20-103:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:54676 lhr48s22-in-f10.1:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:49744 ecs-160-44-207-21:https TIME_WAIT
tcp6 0 0 HUAWEI_P10-afc105:58200 ecs-80-158-20-103:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:33388 am16s22-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:59666 ecs-80-158-23-146.:http ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:37582 lhr35s07-in-f10.1:https ESTABLISHED
tcp6 0 0 HUAWEI_P10-afc105:44990 lhr25s26-in-f3.1e:https TIME_WAIT
udp 0 0 HUAWEI_P10-afc10:bootpc vodafone.broadba:bootps ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:57417 lhr35s07-in-f10.1:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:53781 ber01s14-in-f4.1e:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:47958 lhr25s02-in-f10.1:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:54117 lhr25s26-in-f3.1e:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:52225 lhr25s25-in-f14.1:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:56499 216.239.38.195:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:52713 ber01s14-in-f4.1e:https ESTABLISHED
udp 0 0 HUAWEI_P10-afc105:48988 lhr25s31-in-f14.1:https ESTABLISHED

```

Caption 18: netstat command output using Ghost exploit for Huawei device

Appendix R – Samsung Ghost exploit

```

ghost(192.168.1.28:5555)> sysinfo
[i] Operating System: Android
[i] Computer Hostname:
[i] Computer Username: dreamltxx
[i] Release Version: 9
[i] Processor Architecture: arm64-v8a
ghost(192.168.1.28:5555)>

```

Caption 19: sysinfo command output using Ghost exploit for Samsung device

```

ghost(192.168.1.28:5555)> view_contacts
[*] Getting Contacts information ...
No result found.
ghost(192.168.1.28:5555)>

```

Caption 20: view_contacts command output using Ghost exploit for Samsung device

```

ghost> set RHOST 192.168.1.28
[*] Set RHOST to 192.168.1.28
ghost> run
[*] Connecting to 192.168.1.28:5555 ...
ghost(192.168.1.28:5555)> netstat
[*] Getting network information...
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp     0      0 Michael-S-Galaxy-S:49672 lhr48s11-in-f5.1e:https TIME_WAIT
tcp     0      0 Michael-S-Galaxy-S:509580 lhr48s21-in-f14.1e:https ESTABLISHED
tcp     0      0 Michael-S-Galaxy-S:38004 ams16s22-in-f14.1e:https TIME_WAIT
tcp     0      0 Michael-S-Galaxy-S:55660 lhr48s27-in-f10.1e:https TIME_WAIT
tcp     0      0 Michael-S-Galaxy-S:48962 lhr25s11-in-f5.1e:https TIME_WAIT
tcp     0      0 Michael-S-Galaxy-S:53982 lhr25s26-in-f3.1e:https ESTABLISHED
tcp     0      0 Michael-S-Galaxy-S:51882 lhr25s31-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:38008 ams16s22-in-f14.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:51850 lhr25s31-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:50480 lhr48s21-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:88.5555 DESKTOP-JRDG194.b:53489 ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:51576 lhr25s15-in-f10.1e:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:43776 ec2-52-17-88-53.e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:35854 mil04s24-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:48952 ams16s21-in-f194.1e:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:50562 lhr48s21-in-f10.1e:https TIME_WAIT
tcp6   347    0 Michael-S-Galaxy-S:60414 ec2-54-229-178-18:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:52820 lhr25s25-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:51470 lhr25s15-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:37928 ams16s22-in-f14.1e:https ESTABLISHED
tcp6   env    0 Michael-S-Galaxy-S:47846 lhr48s09-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:53940 lhr25s26-in-f3.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:35052 par2ls06-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:43718 lhr25s26-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:37926 ams16s22-in-f14.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:48906 ec2-34-249-199-70:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:48902 ec2-34-249-199-70:https TIME_WAIT
tcp6    0      1 Michael-S-Galaxy-S:51638 lhr25s15-in-f10.1e:https SYN_SENT
tcp6    0      0 Michael-S-Galaxy-S:58750 ::ffff:52.114.159:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:44578 lhr25s15-in-f3.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:41984 mrs04s10-in-f234.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:37474 ::ffff:13.107.42.1e:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:51498 lhr25s15-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:56074 ::ffff:52.114.132:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:38056 ams16s22-in-f14.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:58766 ::ffff:52.114.159:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:51468 lhr25s15-in-f10.1e:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:40950 ::ffff:220.242.18:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:41966 mrs04s10-in-f234.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:444672 lhr25s15-in-f3.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:47860 lhr48s09-in-f10.1e:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:37924 ams16s22-in-f14.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:51862 lhr25s31-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:36360 lhr48s11-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:59616 ::ffff:52.17.138:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:34498 ws-in-f188.1e100.n:5228 ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:36442 lhr48s11-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:52866 lhr25s25-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:41668 208.24.120.34.bc:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:35852 mil04s24-in-f10.1e:https ESTABLISHED
tcp6    0      0 Michael-S-Galaxy-S:45742 5.165.107.34.bc.g:https TIME_WAIT
tcp6    0      0 Michael-S-Galaxy-S:60224 lhr25s25-in-f4.1e:https ESTABLISHED
udp     0      0 Michael-S-Galaxy-S:60399 lhr25s31-in-f10.1e:https ESTABLISHED
udp     0      0 Michael-S-Galaxy-S:60487 ams16s22-in-f14.1e:https ESTABLISHED
udp     0      0 Michael-S-Galaxy-S:bootpc vodafone.broadband:bootps ESTABLISHED
udp     0      0 Michael-S-Galaxy-S:41289 lhr48s21-in-f14.1e:https ESTABLISHED
udp     0      0 Michael-S-Galaxy-S:57827 lhr25s26-in-f3.1e:https ESTABLISHED

```

Caption 21: netstat command output using Ghost exploit for Samsung device

Appendix S – HiSuite and Kobackupdec Extracted File List

Name	Date	Type	Size
219-Screenshot_20210112_175240_com.example.android.notepad.jpg	12/01/2021 17:52	JPG File	164 KB
221-work.jpg	20/03/2021 18:16	JPG File	12 KB
224-IMG_20210120_182435.jpg	20/01/2021 18:24	JPG File	2,622 KB
225-IMG_20210110_123923.jpg	10/01/2021 12:39	JPG File	2,726 KB
226-IMG_20210110_123919.jpg	10/01/2021 12:39	JPG File	2,458 KB
227-IMG_20210110_123841.jpg	10/01/2021 12:38	JPG File	1,201 KB
228-IMG_20210110_123831.jpg	10/01/2021 12:38	JPG File	2,676 KB
229-IMG_20210110_123826.jpg	10/01/2021 12:38	JPG File	1,992 KB
230-IMG_20210110_123805.jpg	10/01/2021 12:38	JPG File	2,418 KB
231-IMG_20210109_123557.jpg	09/01/2021 12:35	JPG File	1,560 KB
232-IMG_20210109_123537.jpg	09/01/2021 12:35	JPG File	1,933 KB
233-IMG_20210109_123440.jpg	09/01/2021 12:34	JPG File	2,831 KB
234-IMG_20210109_123433.jpg	09/01/2021 12:34	JPG File	2,342 KB
236-GP-WE-M1911-1.jpg	20/03/2021 18:16	JPG File	347 KB
237-GP-WE-M1911-2.jpg	20/03/2021 18:16	JPG File	437 KB
238-GP-WE-M1911-3.jpg	20/03/2021 18:16	JPG File	538 KB
239-GP-WE-M1911-4.jpg	20/03/2021 18:16	JPG File	507 KB
240-GP-WE-M1911-5.jpg	20/03/2021 18:16	JPG File	349 KB
241-GP-WE-M1911-6.jpg	20/03/2021 18:16	JPG File	291 KB
242-GP-WE-M1911-7.jpg	20/03/2021 18:16	JPG File	353 KB
411-HiSuiteBackup_data_data_contact.db____0.sqlite3	24/04/2021 20:10	SQlite3 File	16 KB
413-HiSuiteBackup_data_data_Memo.db____0.sqlite3	24/04/2021 20:10	SQlite3 File	88 KB
415-HiSuiteBackup_data_data_sms.db____0.sqlite3	24/04/2021 20:10	SQlite3 File	20 KB
A 720-155435.pdf	20/03/2021 18:15	Adobe Acrobat D...	15,702 KB
A 721-1419.pdf	20/03/2021 18:15	Adobe Acrobat D...	689 KB
A 722-Complaining.pdf	20/03/2021 18:15	Adobe Acrobat D...	16 KB
WB 724-order.docx	16/01/2021 15:48	Microsoft Word D...	12 KB
WB 725-Document.docx	17/01/2021 16:30	Microsoft Word D...	12 KB
A 726-Search.pdf	20/03/2021 18:15	Adobe Acrobat D...	43 KB
WB 727-Image.docx	21/01/2021 15:44	Microsoft Word D...	88 KB
WB 728-run.docx	25/01/2021 20:48	Microsoft Word D...	12 KB
J What I've done .mp3	20/03/2021 18:15	MP3 Format Sound	76 KB

Caption 22: List of files extracted using the HiSuite and Kobackupdec tools

Appendix T – Manual Navigation

File 1 – Notes

data\data\com.samsung.android.app.notes\databases\sdcod.db

Database Structure		Browse Data	Edit Pragmas	Execute SQL	New Record	Delete Record
Table: sd़oc						
accountType	accountName	strippedContent				
Filter	Filter	Filter	Filter	Filter	Filter	Filter
1 NULL	I got an offer today to make some money, going to give it a think over but it sounds like it could be good money.				161436789...	161436788... 1
2 NULL	I forgot I was supposed to meet George at the usual spot today. Need to head out quick to make it just in time				161443219...	161443215... 1
3 NULL	He gave me the official offer to distribute today. It's a nice offer, he showed me the ropes. I don't think I can back out now.				161444492...	161444488... 1
4 NULL	It's my first run today. The guy arrived this morning with the goods. He gave me a number in case anything goes wrong. Going to the drop off point now.				161451950...	161451946... 1
5 NULL	Another successful run today.				161462401...	161462401... 1
6 NULL	They are happy with the couple of runs I've been doing. They said they may introduce me into the selling business. Would make more money than I am at the moment.				161469774...	161469769... 1
7 NULL	No product to run today. Meeting with the boss today out in the open to get the price list for possibly selling product.				161469793...	161469791... 1
8 NULL	Going to make a run this evening. A bit later than normal but should get it done in time for pick up. Should get a list of names as well for possible clients at some point.				161478200...	161478173... 1
9 NULL	Saw the cops on the way to the meet today. Ditched the product in a nearby shrub. Took a photo of the location so I remember. Will need to go back tomorrow to recover it though unless I could be in some trouble.				161496598...	161496591... 1
10 NULL	Just on my way to pick up what I left yesterday				161503658...	161503655... 1

Caption 23: Contents of data\data\com.samsung.android.app.notes\databases\sdcod.db file

File 2 – Wi-Fi Config

data\misc\wifi\WifiConfigStore.xml

```
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
```

```
<WifiConfigStoreData>
```

```
<int name="Version" value="1" />
<NetworkList>
<Network>
<WifiConfiguration>
<string name="ConfigKey">"Jonah OnePlus
6" WPA_PSK</string>
<string name="SSID">"Jonah OnePlus 6"</string>
<null name="BSSID" />
<string name="PreSharedKey"><REMOVED FOR PRIVACY></string>
<null name="WEPKeys" />
<int name="WEPTxKeyIndex" value="0" />
<boolean name="HiddenSSID" value="false" />
<boolean name="RequirePMF" value="false" />
<byte-array name="AllowedKeyMgmt" num="1">02</byte-array>
<byte-array name="AllowedProtocols" num="1">03</byte-array>
<byte-array name="AllowedAuthAlgos" num="1">01</byte-array>
<byte-array name="AllowedGroupCiphers" num="1">0f</byte-array>
<byte-array name="AllowedPairwiseCiphers" num="1">06</byte-array>
<boolean name="Shared" value="true" />
<int name="Status" value="2" />
<null name="FQDN" />
<null name="ProviderFriendlyName" />
<null name="LinkedNetworksList" />
<string name="DefaultGwMacAddress">ea:ce:03:1d:30:0f</string>
<boolean name="ValidatedInternetAccess" value="true" />
<boolean name="NoInternetAccessExpected" value="false" />
<int name="UserApproved" value="0" />
<boolean name="MeteredHint" value="false" />
<int name="MeteredOverride" value="0" />
<boolean name="UseExternalScores" value="false" />
<int name="NumAssociation" value="8" />
<int name="CreatorUid" value="1000" />
<string name="CreatorName">android.uid.system:1000</string>
<string name="CreationTime">time=02-27 13:36:50.050</string>
```

```
<int name="LastUpdateUid" value="1000" />
<string name="LastUpdateName">android.uid.system:1000</string>
<int name="LastConnectUid" value="1000" />
<boolean name="IsLegacyPasspointConfig" value="false" />
<long-array name="RoamingConsortiumOls" num="0" />
<string name="RandomizedMacAddress">02:00:00:00:00:00</string>
<long name="semCreationTime" value="1614433010050" />
<long name="semUpdateTime" value="1614961403036" />
<long name="LastConnectedTime" value="1615036160715" />
<boolean name="isVendorSpecificSsid" value="false" />
<int name="AutoReconnect" value="1" />
<boolean name="semIsRecommended" value="false" />
<byte-array name="SamsungSpecificFlags" num="0"></byte-array>
<int name="SEM_AUTO_WIFI_SCORE" value="0" />
<int name="WapiPskKeyType" value="0" />
<int name="WapiCertIndex" value="0" />
<null name="WapiAsCert" />
<null name="WapiUserCert" />
<boolean name="CaptivePortal" value="false" />
<boolean name="UsableInternet" value="false" />
<int name="SkipInternetCheck" value="0" />
<int name="NextTargetRssi" value="0" />
<int name="EntryRssi24GHz" value="-78" />
<int name="EntryRssi5GHz" value="-75" />
</WifiConfiguration>
<NetworkStatus>
<string
name="SelectionStatus">NETWORK_SELECTION_ENABLED</string>
<string
name="DisableReason">NETWORK_SELECTION_ENABLE</string>
<null name="ConnectChoice" />
<long name="ConnectChoiceTimeStamp" value="-1" />
<boolean name="HasEverConnected" value="true" />
</NetworkStatus>
```

```
<IpConfiguration>
<string name="IpAssignment">DHCP</string>
<string name="ProxySettings">NONE</string>
</IpConfiguration>
</Network>
<Network>
<WifiConfiguration>
<string
name="ConfigKey">"vodafone2.4GHz";WPA_PSK</string>
<string name="SSID">"vodafone2.4GHz";</string>
<null name="BSSID" />
<string name="PreSharedKey"><REMOVED FOR PRIVACY></string>
<null name="WEPKeys" />
<int name="WEPTxKeyIndex" value="0" />
<boolean name="HiddenSSID" value="false" />
<boolean name="RequirePMF" value="false" />
<byte-array name="AllowedKeyMgmt" num="1">02</byte-array>
<byte-array name="AllowedProtocols" num="1">03</byte-array>
<byte-array name="AllowedAuthAlgos" num="1">01</byte-array>
<byte-array name="AllowedGroupCiphers" num="1">0f</byte-array>
<byte-array name="AllowedPairwiseCiphers" num="1">06</byte-array>
<boolean name="Shared" value="true" />
<int name="Status" value="2" />
<null name="FQDN" />
<null name="ProviderFriendlyName" />
<null name="LinkedNetworksList" />
<string name="DefaultGwMacAddress">d4:35:1d:04:0c:82</string>
<boolean name="ValidatedInternetAccess" value="true" />
<boolean name="NoInternetAccessExpected" value="false" />
<int name="UserApproved" value="0" />
<boolean name="MeteredHint" value="false" />
<int name="MeteredOverride" value="0" />
<boolean name="UseExternalScores" value="false" />
<int name="NumAssociation" value="63" />
```

```
<int name="CreatorUid" value="1000" />
<string name="CreatorName">android.uid.system:1000</string>
<string name="CreationTime">time=02-25 14:25:20.989</string>
<int name="LastUpdateUid" value="1000" />
<string name="LastUpdateName">android.uid.system:1000</string>
<int name="LastConnectUid" value="1000" />
<boolean name="IsLegacyPasspointConfig" value="false" />
<long-array name="RoamingConsortiumOls" num="0" />
<string name="RandomizedMacAddress">02:00:00:00:00:00</string>
<long name="semCreationTime" value="1614263120989" />
<long name="semUpdateTime" value="1614615937469" />
<long name="LastConnectedTime" value="1615065416001" />
<boolean name="isVendorSpecificSsid" value="false" />
<int name="AutoReconnect" value="1" />
<boolean name="semIsRecommended" value="false" />
<byte-array name="SamsungSpecificFlags" num="0"></byte-array>
<int name="SEM_AUTO_WIFI_SCORE" value="4" />
<int name="WapiPskKeyType" value="0" />
<int name="WapiCertIndex" value="0" />
<null name="WapiAsCert" />
<null name="WapiUserCert" />
<boolean name="CaptivePortal" value="false" />
<boolean name="UsableInternet" value="false" />
<int name="SkipInternetCheck" value="0" />
<int name="NextTargetRssi" value="0" />
<int name="EntryRssi24GHz" value="-78" />
<int name="EntryRssi5GHz" value="-75" />
</WifiConfiguration>
<NetworkStatus>
<string
name="SelectionStatus">NETWORK_SELECTION_ENABLED</string>
<string
name="DisableReason">NETWORK_SELECTION_ENABLE</string>
```

```
<string name="ConnectChoice">"Jonah OnePlus  
6"&"WPA_PSK</string>  
<long name="ConnectChoiceTimeStamp" value="1614961366212" />  
<boolean name="HasEverConnected" value="true" />  
</NetworkStatus>  
<IpConfiguration>  
<string name="IpAssignment">DHCP</string>  
<string name="ProxySettings">NONE</string>  
</IpConfiguration>  
</Network>  
</NetworkList>  
<PasspointConfigData>  
<long name="ProviderIndex" value="0" />  
</PasspointConfigData>  
</WifiConfigStoreData>
```

File 3 – Google Maps Directions

data\data\com.google.android.apps.maps\files\directions_as_changed_in_navigation.data.cs

```

'
q
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4}'0't7L@!\'4' '''
Kirk Rd, Newport-on-Tay(4
Kirk Rd
Newport-on-Tay    Kirk RoadNewport-on-Tay'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAQoATAA'' ''@J=
Kirk Road, Newport-on-Tayb owejIXG6Pv7U2rGpCzjkov-5V8J-
W4ZIRX
%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Kirk Rd, Newport-
on-Tay"}'0't7L@!\'4' ''('0'*Kirk Road, Newport-on-
Tay"BCg4SCg2jB6MhFXG6Pv44ARAR'
xB995 and Kirk Rd'
'''RVPUse caution - walking directions may not always
reflect real-world conditions.H
'
'
'''Z'''
'
'''
'''B*(
B'MF88L@!'8'' ''k58L@!$' 'J
''z
Walk z

south-eastz
  on z
Kilnburnz
  towards z
Scott
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIBygAMAA8Pb'Kilnb
urn:enBGBb0Scott St*Scott Street2Scott Street:enBGBzP' -
@JD'' ''6
  0Walk south-east on Kilnburn towards Scott Street'
'(' '' ''20Walk south-east on Kilnburn towards Scott
Street'.....'.
'''<step maneuver='TURN' meters='673'>Turn <turn
side='RIGHT'>right</turn> onto <roadlist><road
lang='en'>Cupar Rd</road></roadlist></step>' ''B*(
○ '!8L@!V'^T'7S'8L@!x"-:' ''R'Continue to follow B995Hz'
no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCAkoADAAz
Turn z

```



```

>8At the roundabout, continue straight onto Boat
Road/B946 '( ''):8At the roundabout, continue straight
onto Boat Road/B946'.....'
''<step maneuver='ROUNDABOUT_EXIT' meters='533'>Exit the
roundabout onto <roadlist><road lang='en'>Boat
Rd</road></roadlist></step>'''B*(
'/:48L@!{'Xs' ''28L@!' ;'g'''R'Continue to follow
B946Hz'      no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCBIoADAAz
Exit the roundabout onto z
Boat Rdz
/z
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIESgDMAA8
@HbB946:enBGBb)'Boat Rd*    Boat Road2  Boat
Road:enBGBb'B946:enBGBzG'
@!J;''''-
'Exit the roundabout onto Boat Road/B946 '( '')'Exit the
roundabout onto Boat Road/B946'.....'
''''B*(
@T''7L@!''x T'''-]'7L@!''s''z
Turn z
leftz
onto z
Shepherdz
'z
s Rd2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIEygEMAA8@Hb;''
Shepherd's Rd*Shepherd's Road2Shepherd's Road:enBGBz>' -@
J2''''$'
TTurn left onto Shepherd's Road '( '' Turn left onto
Shepherd's Road'.....'
w'o"fb*(
a'7uL@!''d''' ''7L@!?'@'X''z
Turn z

rightz
onto z
Bridge
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFCgFMAA8@Hb3'
Bridge St*
Bridge Street2
Bridge Street:enBGBz=' -@J1''''#
VTurn right onto Bridge Street '( '' Turn right onto
Bridge Street'.....'

```

```

| 'F"DB*(  

'8'. '7L@! ''1'''7' Q7L@! ''U''1' z  

Turn z  

leftz  

to stay on z  

Bridge  

St2, 0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFsgGMAA8@Hb3 '  

Bridge St*  

Bridge Street2  

Bridge Street:enBGBzB' -@  

J6''''(  

T"Turn left to stay on Bridge Street '("'''$"Turn left  

to stay on Bridge Street'.....'  

v''''B*(  

&'1|7L@!'='='''T'w7L@!)`f' z  

Turn z  

leftz  

onto z  

Kirk  

Rd2, 0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFigHMAA8@Hb) 'Kir  

k Rd* Kirk Road2 Kirk Road:enBGBz8' -@  

J, ''''  

TTurn left onto Kirk Road '(''$'Turn left onto Kirk  

Road' ''0 .....'  

: ''''B*(  

': ''u7L@!' '鬚  

'}'0't7L@!\'4'''2, 0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFy  

gIMAA8bNewport-on-Tayb  

Kirk Roadz/' '  

J%''''  

You have arrived.  

' (''+''*', 0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q7FcIDSgAMAA  

**  

Europe/London2GMT  

4  

Kirk Rd  

Newport-on-Tay Kirk RoadNewport-on-Tay'  

;  

_1'%l[@]'4'''}'0't7L@  

.....%'QA(  

': ''u7L@!' '鬚'}'0't7L@!\'4'''}'0't7L@!\'4'''*;  

0Xz'f@'0^> ''V'5'~7L@  

'&'B' '4B''''%' pBB  

' 'G' '7L@!@'Çô'"(*Yn9DYM6iM5-  

DhbIPxeef8AM2, 0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q-  

CQIDCgDMAAHbGB'w  

72 ft  

>203 ft

```

```

43 ft"
>203 ft*
1161 ft2 30 ft:'F''\'''B '$
HP'' 'B'
P'***'D'w'o'm'&'2'...
'S'':f'6'-'
'*7'm'7'K'f'i'$'A'Y' B'
[ /4'9'L'
'E'W'('1'@'\D'X'
%'')'E'
'#"R'&%'P's'k'a'+2'S'J'*'7"-'
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QuPIBCB0oCTAA'
...
...
'18 min'
...
'b'/dir/56.439189,-2.9408787/Kirk+Road,+Newport-on-
Tay/data=!4m13!4m12!1m1!4e1!1m5!1m1!1s0x48865b7ec257b9ff:
0xa2e4380ba9b1dad4!2m2!1d-
2.9443471!2d56.4332451!2m2!6e0!7e2!3e2;
'@ap'@'0&$'''G''7L@
%QA*Yn9DYM6iM5-DhbIPxeef8AM'
'æ'/*'28'@'J$f4d9150b-390e-4785-8715-
7d6f481160eb

'
('0
X
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4}'O't7L@!\'4'(
(2'
@Hrr'*0@' @P' (0'8'@'P'X'
...
'(p'8@'B
'B
'A
~
a
'''[X78L@!"pi"'
Your location('0-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAMoADAA'@'*'"BCg
wSCg3S76MhFe1BP_4=
'
'
q
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4}'O't7L@!\'4'"

```

```

Kirk Rd, Newport-on-Tay(4
Kirk Rd
Newport-on-Tay      Kirk RoadNewport-on-Tay'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAQoATAA''@J=
Kirk Road, Newport-on-Tayb owejIXG6Pv7U2rGpCzjkov-5V8J-
W4ZIRX
%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Kirk Rd, Newport-
on-Tay"}'0't7L@!\'4'''('0'*Kirk Road, Newport-on-
Tay"BCg4SCg2jB6MhFXG6Pv44ARAR'
xB995 and Kirk Rd'
'''RVPUse caution - walking directions may not always
reflect real-world conditions.H
'
'
'''Z'''
'
'''
'''B*(
B'MF88L@!'8''''''k58L@!$'''J
''z
Walk z

south-eastz
  on z
Kilburnz
  towards z
Scott
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIBygAMAA8Pb'Kilnb
urn:enBGBb0Scott St*Scott Street2Scott Street:enBGBzP' -
@JD''''6
  0Walk south-east on Kilburn towards Scott Street'
'(''20Walk south-east on Kilburn towards Scott
Street'.....'
''<step maneuver='TURN' meters='673'>Turn <turn
side='RIGHT'>right</turn> onto <roadlist><road
lang='en'>Cupar Rd</road></roadlist></step>'''B*(
 '!8L@!V'^T'7S'8L@!x"-:' ''R'Continue to follow B995Hz'
no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCAkoADAAz
Turn z

rightz
  onto z
Cupar Rdz

```



```

roundabout onto <roadlist><road lang='en'>Boat
Rd</road></roadlist></step>''''B*(
'/:48L@!}''28L@!';'g'''R'Continue to follow
B946Hz'      no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_info_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_qu_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCBIoADAAz
Exit the roundabout onto z
Boat Rdz
/z
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIESgDMAA8
@HbB946:enBGBb)'Boat Rd*    Boat Road2  Boat
Road:enBGBb'B946:enBGBzG'
@!J;'''-
'Exit the roundabout onto Boat Road/B946 '(())'Exit the
roundabout onto Boat Road/B946'.....'.
''''B*(
@T'7L@!'x T'''-]'7L@!'s'z
Turn z
leftz
onto z
Shepherdz
'z
s Rd2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIEygEMAA8@Hb; '
Shepherd's Rd*Shepherd's Road2Shepherd's Road:enBGBz> '-@
J2'''$
    TTurn left onto Shepherd's Road '(() Turn left onto
Shepherd's Road'.....'
w'o"fb*((
a'7uL@!'d' 7L@!'?@'X'z
Turn z

rightz
onto z
Bridge
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFCgFMAA8@Hb3'
Bridge St*
Bridge Street2
Bridge Street:enBGBz=' -@J1'''#
    VTurn right onto Bridge Street '(() Turn right onto
Bridge Street'.....'
| 'F"DB*((
'8'.7L@!'1'''7'Q7L@!'U'1'z
Turn z
leftz

```

```

to stay on z
    Bridge
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFsgGMAA8@Hb3 '
Bridge St*
Bridge Street2
Bridge Street:enBGBzB' -@
J6''''(
    T"Turn left to stay on Bridge Street '("'''$"Turn left
to stay on Bridge Street'.....'.
v''''B*(
&'1|7L@!=='''T'w7L@!)`f'z
Turn z
leftz
onto z
Kirk
Rd2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFigHMAA8@Hb)'Kir
k Rd* Kirk Road2 Kirk Road:enBGBz8' -@
J,''''
    TTurn left onto Kirk Road '(''$'Turn left onto Kirk
Road'.'0 .....'.
:'''B*(
':''u7L@!'鬚
'}'O't7L@!\'4'''2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIFy
gIMAA8bNewport-on-Tayb
Kirk Roadz/'
J%'''
    You have arrived.
'(''+''*,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q7FcIDSgAMAA
*'*'
Europe/London2GMT
4
Kirk Rd
Newport-on-Tay Kirk RoadNewport-on-Tay'
;
    _1'%l'@]'4'''}'O't7L@
.....%'QA(
':''u7L@!'鬚}'O't7L@!\'4'''}'O't7L@!\'4'''';
    0Xz'f@'0^>   'V'5'~7L@
'&B'4B''''%'pBB
'G''7L@!@'Çô'"(*Yn9DYM6iM5-
DhbIPxeef8AM2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q-
CQIDCgDMAAHbGB'w
72 ft
>203 ft
43 ft"
>203 ft*
1161 ft2 30 ft:'F'`\'''B '$
HP' 'B'

```

```
P'***'D'w'o'm'&''2
'S'@':f'6-
'*'7'm'7'K'f'i'$'A'Y' B'
[ / 4 9'L
'E'W'('1'@'\D'X'
%'')E'
'#'R'&%'P's'k'a+'2'S'J'*'7"-0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QuPIBCB0oCTAA'
...
...
...
'18 min'
...
'b'/dir/56.439189,-2.9408787/Kirk+Road,+Newport-on-Tay/data=!4m13!4m12!1m1!4e1!1m5!1m1!1s0x48865b7ec257b9ff:0xa2e4380ba9b1dad4!2m2!1d-2.9443471!2d56.4332451!2m2!6e0!7e2!3e2;@ap@'0&$'G'7L@
%QA*Yn9DYM6iM5-DhbIPxeef8AM'æ'/*'28'@'J$f4d9150b-390e-4785-8715-7d6f481160eb
```

File 4 – Google Maps Cache Search

`data\data\com.google.android.apps.maps\files\new_recent_history_cache_search.cs`

```
...
nà'''c
    Kirk Road Kirk RoadNewport-on-Tay">%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4*}'0't7L@!\\'4'
```
...
Blyth Hall Community CentreBlyth Hall Community Centre
Blyth St, Newport-on-Tay DD6
8DB">%0x48865c807d32d51d:0x5f9bf96cc1ee02c0*'x'C8L@!
'
'

+0ahUKEwiL0v3G3pvvAhWRGBQKHUjJACYQ19oCCAMoAA'
"67 Waterston Crook, Newport-on-Tay67 Waterston
CrookNewport-on-Tay">$0x48865b7ca2ecf199:0x690bc57abdace84*',I7L@!'0'Z
Europe/London'112495771227498566032_WAA
```

## File 5 – Google Maps Offline

data\data\com.google.android.apps.maps\files\offline\_saved\_directions.data.cs

```
'''f6
'
'
o'y=8L@!'g'
'('0
X
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Xm'_u7L@!&
N3'();;
 R '@O$' 'G' '7L@
 %' QA2'
@Hrr'*0@' @P' '(0'8'@'P'X''
 '
 '@'B
'B
'A
~
a
'''[X78L@!"pi'''
Your location('0'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAMoADAA''@'*'"BCg
wSCg3S76MhFe1BP_4=
'
'
q
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4}'O't7L@!\'4' ''
Kirk Rd, Newport-on-Tay(4
Kirk Rd
Newport-on-Tay Kirk RoadNewport-on-Tay'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAQoATAA''@J=
Kirk Road, Newport-on-Tayb owejIXG6Pv7U2rGpCzjkov-5V8J-
W4ZIRX
%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Kirk Rd, Newport-
on-Tay"}'O't7L@!\'4' ''('0'*Kirk Road, Newport-on-
Tay"BCg4SCg2jB6MhFXG6Pv44ARAR'
xB995 and Kirk Rd'
'''RVPUse caution - walking directions may not always
reflect real-world conditions.H
'
'
'''Z'''
'
'''B*(
```

```

B'MF88L@!'8'''''k58L@!$''']
' 'z
Walk z

south-eastz
 on z
Kilburnz
 towards z
Scott
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIBygAMAA8Pb'Kilnb
urn:enBGBb0Scott St*Scott Street2Scott Street:enBGBzP' -
@JD''''6
 @Walk south-east on Kilburn towards Scott Street'
'(''20Walk south-east on Kilburn towards Scott
Street'.....'
''<step maneuver='TURN' meters='673'>Turn <turn
side='RIGHT'>right</turn> onto <roadlist><road
lang='en'>Cupar Rd</road></roadlist></step>'''B*(
 '!8L@!V'^T'7S'8L@!x"-:''R'Continue to follow B995Hz'
no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCAkoADAAz
Turn z

rightz
 onto z
Cupar Rdz
/z
B9952,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQICCgBMAA8@HbB99
5:enBGBb,'Cupar Rd*
Cupar Road2
Cupar Road:enBGBb'B995:enBGBz?' -@J3''''%
 VTurn right onto Cupar Road/B995 '(!Turn right onto
Cupar Road/B995'0
w''''B*(
blg7L@!t'J,'~'8'>a7L@!L'u'~'z
Turn z

rightz
 onto z
Kirk
Rd2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQICigCMAA8@Hb)'Kir
k Rd* Kirk Road2 Kirk Road:enBGBz9' -@J-''
 VTurn right onto Kirk Road '(!Turn right onto Kirk
Road'0

```

```

:'''B*(
F+R's7L@!g']''}'O't7L@!\'4'''2,0ahUKEwj024f03pvvAhWfQUEAH
cXzBz4Q9iQICygDMAA8bNewport-on-Tayb
Kirk Roadz/'
J%'''
 You have arrived.
'('&''*,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q7FcIBigAMAA
**'
Europe/London2GMT
4
Kirk Rd
Newport-on-Tay Kirk RoadNewport-on-Tay'
;
 _1'%l[@]4'''}'O't7L@
.....%QA(
F+R's7L@!g']''}'O't7L@!\'4'''}'O't7L@!\'4'''';
 0Xz'f@xe-#''9''17L@
'*'''4B''''%''pB*Yn9DYM6iM5-
DhbIPxeffAM2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q-
CQIBSgCMAAH'bGB'm
72 ft
>203 ft72 ft"
>203 ft*
)135 ft2
3 ft:
 B
 HP'$
1B946'''RVPUse caution - walking directions may not
always reflect real-world conditions.H
"""
 "Z"
 ...
'''E":B*(
ROQ'28L@!'''t'''k58L@!$'''J
''z
Walk z

north-westz
on z
Kilburnz
 towards z
Blyth
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIDigAMAA8Pb'Kilnb
urn:enBGBb0Blyth St*Blyth Street2Blyth Street:enBGBzP' -
@JD'''6
 @Walk north-west on Kilburn towards Blyth Street'
'(''20Walk north-west on Kilburn towards Blyth
Street'.....

```

```

'<step maneuver='TURN' meters='35'>Turn <turn
side='LEFT'>left</turn> onto <roadlist><road
lang='en'>High St</road></roadlist></step>#"B*(
'u#';8L@!'K'}''i'I8>8L@!9'''z
Turn z
leftz
onto z
High Stz
/z
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIDygBMAA8@Hb-
'High St*
High Street2
High Street:enBGBb'B946:enBGBz?' -@
J3''''%
 TTurn left onto High Street/B946 '(!!!Turn left onto
High Street/B946'::::::::::::::::::
'b<step maneuver='ROUNDABOUT_ENTER_AND_EXIT'
meters='12'>At the roundabout, continue straight</step>"B*(
' '''98L@!' ''C'''/'':48L@!}'Xs ''z0,
*At the roundabout, continue straight onto z
Boat Rdz
/z
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIECgCMAA8
@Xb)'Boat Rd* Boat Road2 Boat
Road:enBGBb'B946:enBGBzX' "@JL''''>
 >8At the roundabout, continue straight onto Boat
Road/B946 '(:8At the roundabout, continue straight
onto Boat Road/B946'::::::::::::::::::
'<step maneuver='ROUNDABOUT_EXIT' meters='533'>Exit the
roundabout onto <roadlist><road lang='en'>Boat
Rd</road></roadlist></step>'''B*(
'/:48L@!}'Xs ''''28L@!';'g'''R'Continue to follow
B946Hz' no_id_set*F
@@/maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCBIoADAAz
Exit the roundabout onto z
Boat Rdz
/z
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIESgDMAA8
@HbB946:enBGBb)'Boat Rd* Boat Road2 Boat
Road:enBGBb'B946:enBGBzG'@!J;''''-
'Exit the roundabout onto Boat Road/B946 '(())'Exit the

```





```
'.....%''QA*Yn9DYM6iM5-DhbIPxeef8AM 'H' '/*
...../'2j<'68L@! '' '' @'
```

## File 6 – Google Maps Saved Directions

data\data\com.google.android.apps.maps\files\saved\_directions.data.cs

```
'.....$fQ
'
'
o'y=8L@!'g'
'('0
X
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Xm'_u7L@!&
N3';';
 R '@O$' 'G' '7L@
 '% QA2'
@Hrr'*0@' @P' (0'8'@'P'X'
'...
'...'@'B
'B
'A
~
a
'''[X78L@!"pi"""
Your location('0'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAMoADAA''@'*'"BCg
wSCg3S76MhFe1BP_4=
'
'
q
Kirk Road, Newport-on-
Tay%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4}'O't7L@!\'4'''
Kirk Rd, Newport-on-Tay(4
Kirk Rd
Newport-on-Tay Kirk RoadNewport-on-Tay'-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q_bwBCAQoATAA''@J=
Kirk Road, Newport-on-Tayb owejIXG6Pv7U2rGpCzjkov-5V8J-
W4ZIRX
%0x48865b7ec257b9ff:0xa2e4380ba9b1dad4Kirk Rd, Newport-
on-Tay"}'O't7L@!\'4'''('0'*Kirk Road, Newport-on-
Tay"BCg4SCg2jB6MhFXG6Pv44ARAR'
xB995 and Kirk Rd'
'''RVPUse caution - walking directions may not always
reflect real-world conditions.H
```

```

'
'
'''Z'''
'
'''
''''B*(
B'MF88L@!'8'''''k58L@!$''']
''z
Walk z

south-eastz
 on z
Kilburnz
 towards z
Scott
St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIBygAMAA8Pb'Kilnb
urn:enBGBb0Scott St*Scott Street2Scott Street:enBGBzP' -
@JD''''6
 @Walk south-east on Kilburn towards Scott Street'
'(''20Walk south-east on Kilburn towards Scott
Street'.....'
''<step maneuver='TURN' meters='673'>Turn <turn
side='RIGHT'>right</turn> onto <roadlist><road
lang='en'>Cupar Rd</road></roadlist></step>'''B*(
○'!8L@!V'^T'7S'8L@!x"-:' ''R'Continue to follow B995Hz'
no_id_set*F
@//maps.gstatic.com/mapfiles/traffic_report/svg/ic_qu_inf
o_v2.svg('*K
E//maps.gstatic.com/mapfiles/traffic_report/svg_dark/ic_q
u_info_v2.svg('-
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCAkoADAAz
Turn z

rightz
 onto z
Cupar Rdz
/z
B9952,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQICCgBMAA8@HbB99
5:enBGBb,'Cupar Rd*
Cupar Road2
Cupar Road:enBGBb'B995:enBGBz?' -@J3''''%
 VTurn right onto Cupar Road/B995 '(!Turn right onto
Cupar Road/B995'0'....'
w''''B*(
blg7L@!t'J,'~'''8'>a7L@!L'u'~'z
Turn z

rightz

```

```

 onto z
Kirk
Rd2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQICigCMAA8@Hb)'Kir
k Rd* Kirk Road2 Kirk Road:enBGBz9' -@J-''
 VTurn right onto Kirk Road '(''Turn right onto Kirk
Road'''0
:'''B*(

F+R's7L@!g']''}0't7L@!\4'''2,0ahUKEwj024f03pvvAhWfQUEAH
cXzBz4Q9iQICygDMAA8bNewport-on-Tayb
 Kirk Roadz/'

J%'''
 You have arrived.
'('&''*,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q7FcIBigAMAA
**'

Europe/London2GMT
4
Kirk Rd
Newport-on-Tay Kirk RoadNewport-on-Tay'
;
 _1'%l[@]4'''}0't7L@
.....%QA(
F+R's7L@!g']''}0't7L@!\4'''}0't7L@!\4'''';
 0Xz'f@xe-#''9''17L@
'*'''4B''''%''pB*Yn9DYM6iM5-
DhbIPxeff8AM2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q-
CQIBSgCMAAH'bGB'm
72 ft
>203 ft72 ft"
>203 ft*
)135 ft2
3 ft:
 ''''B
 HP'$

lB946' '''RVPUse caution - walking directions may not
always reflect real-world conditions.H
"""
 "Z"
"""

''E":B*(

ROQ'28L@!'''t'''k58L@!$'''J
''z
Walk z

north-westz
 on z
Kilburnz
 towards z
Blyth

```

St2,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIDigAMAA8Pb' Kilnb  
urn:enBGBb0Blyth St\*Blyth Street2Blyth Street:enBGBzP' -  
@JD''''6  
0Walk north-west on Kilnburn towards Blyth Street'  
'(''20Walk north-west on Kilnburn towards Blyth  
Street'.....  
'<step maneuver='TURN' meters='35'>Turn <turn  
side='LEFT'>left</turn> onto <roadlist><road  
lang='en'>High St</road></roadlist></step>#"B\*(  
'u#';8L@!'K'}'i'I8>8L@!9'''z  
Turn z  
leftz  
onto z  
High Stz  
/z  
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIDygBMAA8@Hb-  
'High St\*'  
High Street2  
High Street:enBGBb'B946:enBGBz?' -@  
J3''''%  
TTurn left onto High Street/B946 '(!Turn left onto  
High Street/B946'.....  
'b<step maneuver='ROUNDABOUT\_ENTER\_AND\_EXIT'  
meters='12'>At the roundabout, continue straight</step>B\*(  
''98L@!'''C'''/'':48L@!}'\*s''z0,  
\*At the roundabout, continue straight onto z  
Boat Rdz  
/z  
B9462,0ahUKEwj024f03pvvAhWfQUEAHcXzBz4Q9iQIEcgCMAA8  
@Xb)'Boat Rd\* Boat Road2 Boat  
Road:enBGBb'B946:enBGBzX' "@JL''''>  
>8At the roundabout, continue straight onto Boat  
Road/B946 '(:8At the roundabout, continue straight  
onto Boat Road/B946'.....  
'<step maneuver='ROUNDABOUT\_EXIT' meters='533'>Exit the  
roundabout onto <roadlist><road lang='en'>Boat  
Rd</road></roadlist></step>'''B\*(  
'/:48L@!}'\*s''''28L@!';'g'''R'Continue to follow  
B946Hz' no\_id\_set\*F  
@@/maps.gstatic.com/mapfiles/traffic\_report/svg/ic\_qu\_inf  
o\_v2.svg('\*K  
E//maps.gstatic.com/mapfiles/traffic\_report/svg\_dark/ic\_q  
u\_info\_v2.svg(' -  
0ahUKEwj024f03pvvAhWfQUEAHcXzBz4QyI0GCBIOADAAz  
Exit the roundabout onto z  
Boat Rdz  
/z





```

' . . .
'b' /dir/56.439189,-2.9408787/Kirk+Road,+Newport-on-
Tay/data=!4m13!4m12!1m1!4e1!1m5!1m1!1s0x48865b7ec257b9ff:
0xa2e4380ba9b1dad4!2m2!1d-
2.9443471!2d56.4332451!2m2!6e0!7e2!3e2;
' '@ap'@'0&$' 'G' '7L@
' %' 'QA*Yn9DYM6iM5-DhbIPxeef8AM ' 'u' /*
' . . . /'2' 'Hc7L@!' '\A' ' ' @'

```

## File 7 – Google Maps Places

data\data\com.google.android.apps.maps\files\users\search\1124957712274985660  
 32\places\10  
 3>,%C8L@! ¶‡  
 Ä\* \_\_\_\_\_  
 Home256.439548,-2.9409298@ X  
 3ÒbDH7L@! 2 žÄ\* \_\_\_\_\_  
 Work256.431888,-2.9521668@X

## Appendix U – Decoded Data

### Huawei

| A | B         | C                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                               |
|---|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | File Name | Encoded Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Decoded Contents                                                                                                                                                                                                                                              |
| 1 | Work.jpg  | SXQgd2FzIG1lbRpb25lZCBhdCB3b3JrlGxhc3Q<br>gbmInaHQulFBlb3BsZSBhcmUgYmVpbmcgaW<br>50ZXJ2aWV3ZWQgYnkgdGhlIFBvbGljZSwgdGh<br>leeKAmAIXZIIG5vdCBzG9rZW4gdG8gbWUgeW<br>VOIGJ1dCBJIGRvbukAmXQga25vdyB3aGVuIHR<br>oZXkgd2lsbCBnZXQgdG8gbWUulEkgbmVlZCB<br>0byB0cnkgYW5kIGdldCBvdXQgb2YgaGVyZSw<br>gdGhlcmUgZ29pbmcgdG8gZmluZCBvdXQgaX<br>Qgd2FzIG1lLiBUaGlzIHdchyBhbGwgYSBiaWcg<br>bWlzdGFrZS4g                                                                                 | It was mentioned at work last night.<br>People are being interviewed by the Police, they've not spoken to me yet but I don't know when they will get to me. I need to try and get out of here, there going to find out it was me. This was all a big mistake. |
| 2 | Run.dox   | MTExIDQ3IDE1NSA0MCAxNTcgMTU2IDQwIDE<br>2NCAxNTAgMTQ1IDQwIDE2MiAxNjUgMTU2ID<br>U0IDQwIDExMSA0MCAxNDQgMTU3IDE1NiA0N<br>yAxNjQgNDAgMTUzIDE1NiAxNTcgMTY3IDQw<br>IDE1MCAxNTcgMTY3IDQwIDE1NSAxNjUgMTQ<br>zIDE1MCA0MCAxNjQgMTUxIDE1NSAxNDUgND<br>AgMTExIDQwIDE1MCAxNDEgMTY2IDE0NSA0M<br>CAxNTQgMTQ1IDE0NiAxNjQgNTYgNDAgMTI0<br>IDE1MCAxNDUgMTcxIDQ3IDE2MiAxNDUgNDA<br>gMTQzIDE0MSAxNjQgMTQzIDE1MCAxNTEgMT<br>U2IDE0NyA0MCAxNjUgMTYwIDQwIDE2NCAxN<br>TcgNDAgMTU1IDE0NSA1NiA0MA== | I'm on the run, I don't know how much time I have left. They're catching up to me.                                                                                                                                                                            |
| 3 |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                               |

Caption 24: Decoded Huawei Data

## Samsung

| A               | B                                                                                                                                                      | C                                                                      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| File Name       | Encoded Contents                                                                                                                                       | Decoded Contents                                                       |
| 1 Password.xlsx | Use Password<br>Back Gate 7ce30eeb956b8bbdecfdb304b556edba<br>Key Locker d3c95acb3f4a091abblfdc056dc68clc<br>Gun Case 8787a227a6aea36594f3a290e9604122 | Use Password<br>Back Gate 6758<br>Key Locker 5569<br>Gun Case 66453789 |
| 2               |                                                                                                                                                        |                                                                        |

Caption 25: Decoded Samsung Data