Android-InsecureBankv2 Reverse Analysis Report

1. Preface

> This project serves as both a home task for an interview and an opportunity for learning Android reverse engineering. The analysis includes static and dynamic analysis of the Android application "InsecureBankv2" hosted on GitHub.
>
> - Task:
>
> **Test Overview and Objective**
> Reverse engineers choose either Android APK or iOS IPA to extract undocumented API endpoints and authentication logic, and demonstrate the ability to bypass a basic anti-debugging measure.
>
> **Deliverables:**
> 1. Written report detailing the approach, tools used, and findings
> 2. Extracted API endpoints and authentication flow (e.g., how tokens are generated)
> 3. Code/scripts used for dynamic analysis, traffic interception, or automation
> 4. (Optional) A brief video walkthrough (5-10min) explaining the process
>
> **Test Details:**
> 1. Static Analysis
>   a. Decompile the APK/IPA
>   b. Identify Key classes/methods related to network communication and authentication
>   c. Document the API endpoints and parameters used
> 2. Dynamic Analysis
>   a. Setup a proxy to intercept app traffic
>   b. Demonstrate ability to hook or patch code to bypass a simple anti-debugging check
>   c. Extract authentication tokens or session data
> 3. Bonus
>   a. Identify and explain any obfuscation or encryption used in the app
>   b. Suggest improvements to app security based on findings
>
> **Evaluation Criteria**
> 1. Technical accuracy and depth of analysis
> 2. Clarity and thoroughness of documentation
> 3. Use of appropriate tools
> 4. Creativity and problem-solving approach
>
> - Target: https://github.com/dineshshetty/Android-InsecureBankv2
> - Tools:
>   - chatgpt !!!
>   - apktool
>   - jadx
>   - Android Studio
>   - BurpSuite
>   - OS: Apple M4 (Macbook Air)
>   - Cmdline tool: iTerm + oh-my-zsh !!!

> - Process:
>   - decide target : Android + InsecureBank
>   - Static Analysis: jadx + chatgpt
>   - Dynamic Analysis: adb + apktool + BurpSuite
>   - Bonus summary
>   - create GitHub repository and upload
> - Time: 2 days

2. Static Analysis

2.1 Tools installation

- Jadx: `brew install jadx`

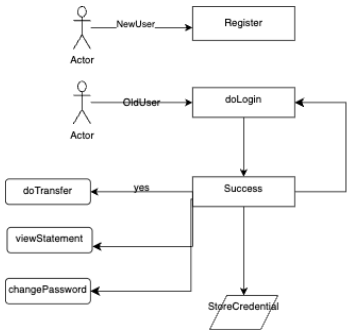
2.2 Download target apk

- `git clone git@github.com:dineshshetty/Android-InsecureBankv2.git`

2.3 Start Static Analysis

```
jadx-gui Android-InsecureBankv2-master/InsecureBankv2.apk
```

2.4 Sequence of login



- new user: createUser
- oldUser: filldata from local -> perform login -> check if success
  - Success -> save Creds(user, pass) ->PostLogin -> (doTransfer / viewStatement / changePassword)
    - api: http://ip:port/dotransfer
      - Post
      - username+password+from_acc+to_acc+amount
    - api: http://ip:port/getaccounts
      - Post

        - username + password
    - api: http://ip:port/changepassword
        - Post
        - username + new password
  - Fail -> WrongLogin -> login

2.5 Login Action

- API:
  - http://ip:port/login
    - post
    - username + password
  - http://ip:port/devlogin
    - post
    - username + password
- **Problems**:
  - Using HTTP, easy to be intercepted by man-in-the-middle (should use HTTPS).

```
String responseString = null;
String serverip = "";
String serverport = "";
String protocol = "http://";
```

  - SharedPreferences 存储用户名密码，安全性很低。（user只做了base64编码，password做了aes对称加密，而且密钥硬编码了(Hardcoded Key)

```
- String key = "This is the super secret key 123";
```

  - 使用android.util.Log 打印登录用户名密码信息，容易被黑客获取
  - 改进措施：
    - 尽量不要本地存储用户密码
    - 不能用android.util.Log 打印登录用户秘密码信息造成信息泄露，可记录脱敏后的username信息
    - 即使存储密码，也建议使用** Android Keystore + AES-GCM
    - 使用https 加密传输

2.6 Change Password Vulnerability

- 没有验证是否本人发起的请求，比如验证当前用户的账号密码 或 手机号二次验证账号本人所有，直接发起了新密码的设置，容易被黑客直接更改正常用户的密码
- 新密码直接通过sms发送到了本人手机号，容易被窃听造成密码泄漏

- 新密码是明文传输的，容易被中间人攻击获取，应该做哈希处理，传输哈希值并存储哈希值。（数据库不应该存储明文密码，应存储密码哈希以防止数据库被攻击后密码泄漏，加密存储也不推荐，因为加密值可以被解密）

3. Dynamic Analysis

> InsecureBank apk版本太老，导致android studio 装不上，于是安装cmdline-tools， 使用sdkmanager 命令行创建低版本API22 的android模拟器。结果还是失败，因为apple M4芯片不能支持 Frida。好在此app本身就是http协议。**（后续会利用其他apk研究https的相关绕过）**

3.1 Emulator Setup

- Install ARM64-compatible Android 6.0 system image:

```
sdkmanager "system-images;android-23;google_apis;arm64-v8a"
```

- Create and launch an emulator:

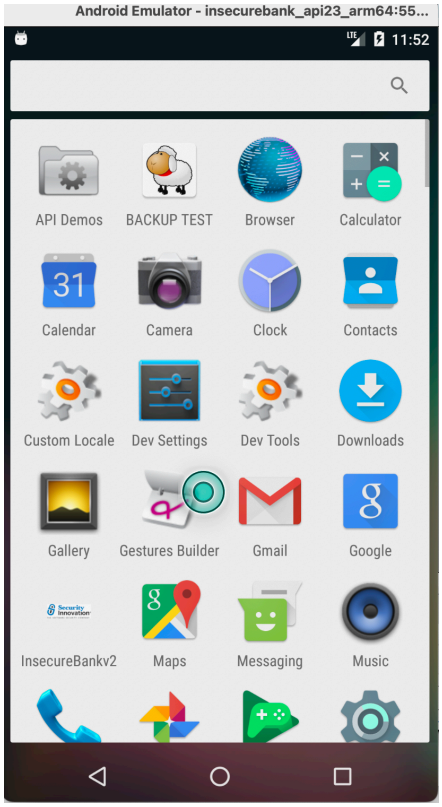
```
avdmanager create avd -n insecurebank_api23_arm64 -k "system-images;android-23;google_apis;arm64-v8a" --device "pixel" --force
```

- 启动模拟器（用`adb devices`列出当前模拟器）

```
emulator -avd insecurebank_api23_arm64
```

3.2 Install InsecureBankv2.apk in Emulator

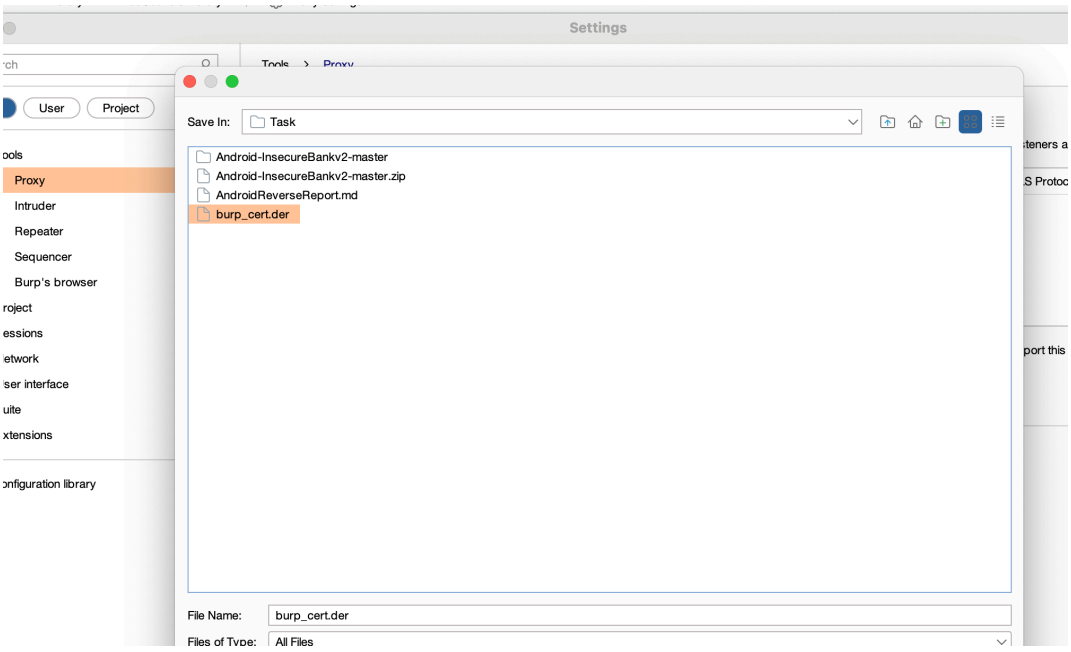
```
adb install ~/Desktop/Task/Android-InsecureBankv2-master/InsecureBankv2.apk
```



3.3 Burp Suite Configuration

- Install Burp certificate to the emulator:

```
adb root
adb remount
adb push burp_cert.der /sdcard/
```



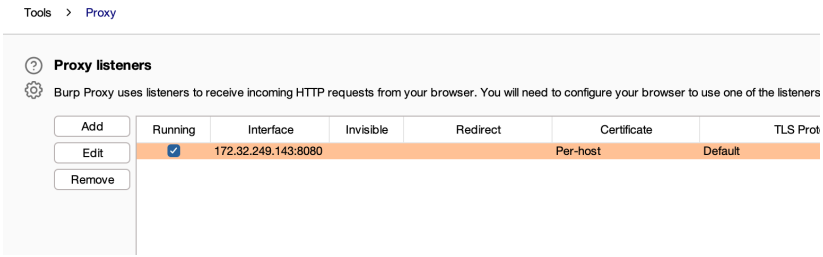
3.4 Frida Installation Issues

- Due to Apple M4 chip compatibility issues, Frida installation failed. Used proxy for interception. And found that InsecureBank use HTTP so don't need frida anymore
-

```
    public static final String MYPREFS = "mySharedPreferences";
    String password;
    BufferedReader reader;
    String rememberme_password;
    String rememberme_username;
    String result;
    SharedPreferences serverDetails;
    String superSecurePassword;
    String username;
    String responseString = null;
    String serverip = "";
    String serverport = "";
    String protocol = "http://";
```

3.5 API拦截测试

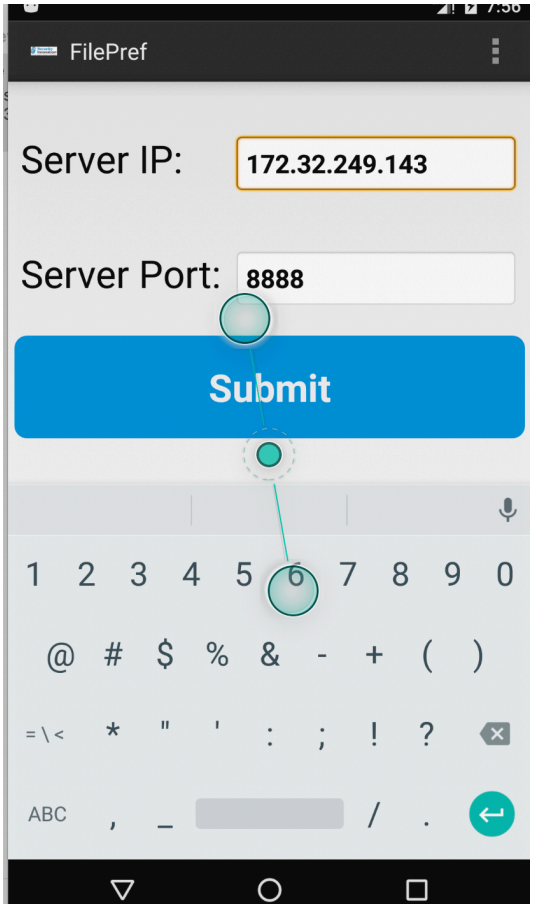
- Burp配置



- 模拟器配置代理：

```
adb shell settings put global http_proxy 172.32.249.143:8080
```

- app中设置后端地址



- **这里之前配置代理地址为10.0.2.2:8888, 走了很多弯路，实际上burp监听此地址，模拟器配置代理这个地址就可以。不要配置为10.0.2.2，否则burp将到本机的请求不会转发到flask.**
- 开启后台

```
cd /Users/keeplook4ever/Desktop/Task/Android-InsecureBankv2-master/AndroLabServer
conda activate
pip install -r requirements.txt
python app.py
```

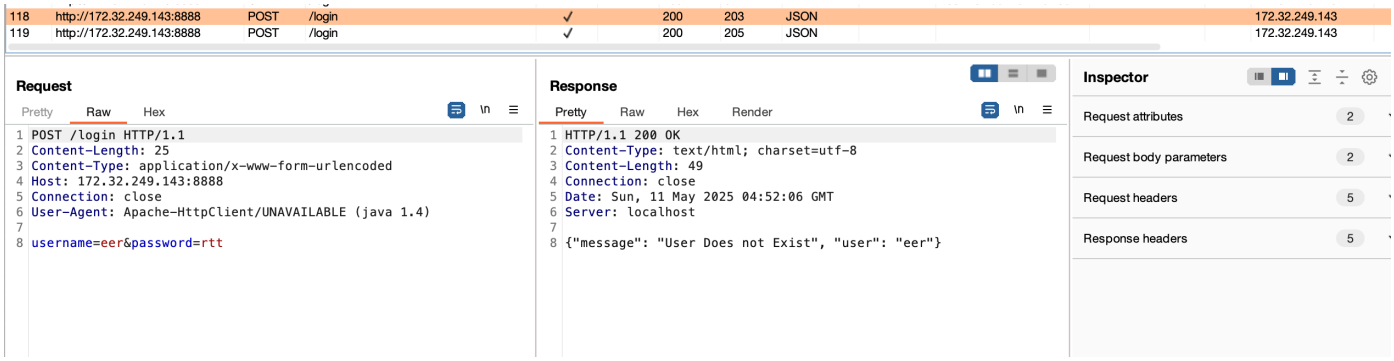
- 报错，重新安装python27环境

```
CONDA_SUBDIR=osx-64 conda create -n py27 python=2.7
CONDA_SUBDIR=osx-64 conda activate py27
pip install -r requirements.txt
python app.py
```

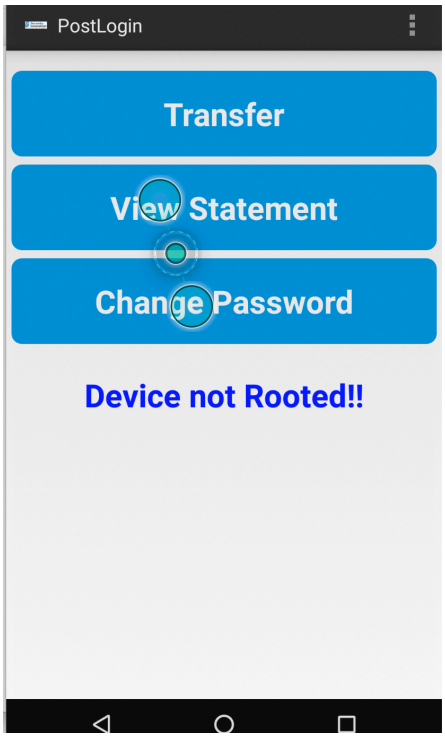
3.6 开始抓包测试

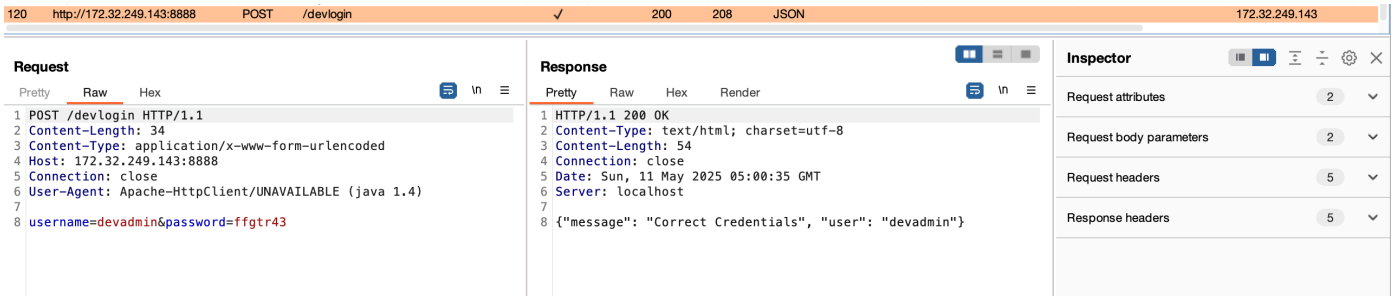
- App 中输入用户名密码：eer/xxxx

```
(py27)  keeplook4ever  ~/Desktop/Task/Android-InsecureBankv2-master/AndroLabServer  python app.py
The server is hosted on port: 8888
u= None
{"message": "User Does not Exist", "user": "eer"}
```

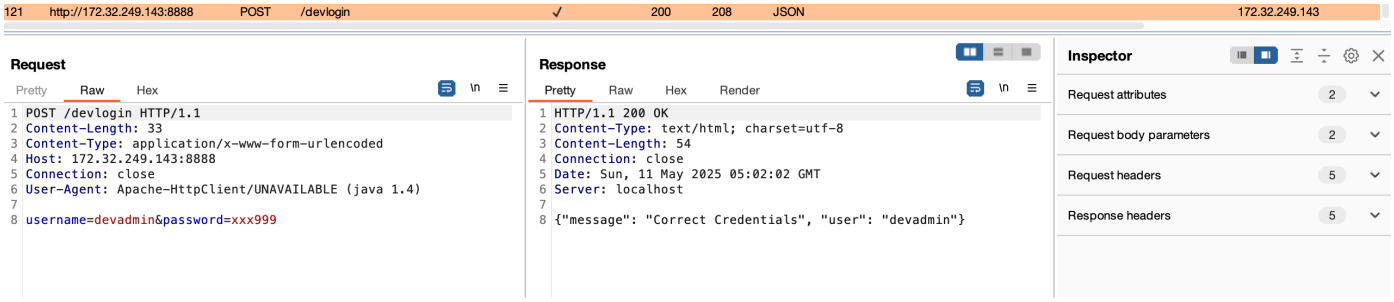


- 因为之前代码审计发现devadmin 用户名，于是用此用户名登录看看效果：是否是后门：果然是直接登录成功



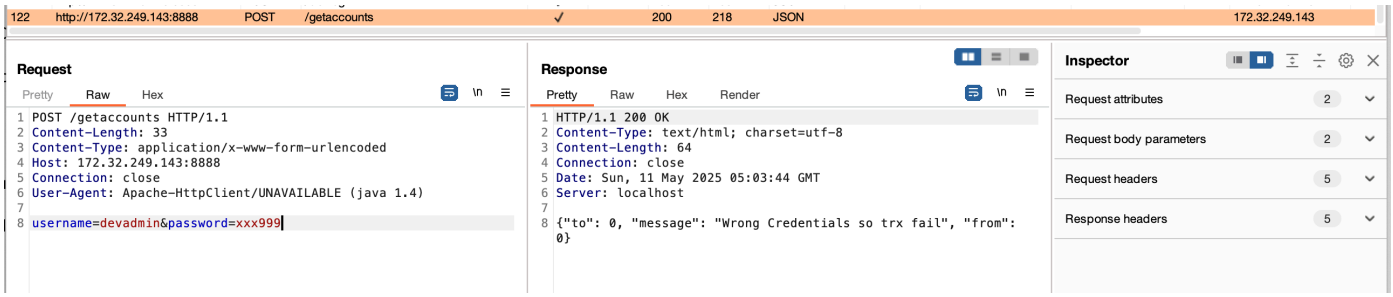


- 再次验证应该是不校验密码的，更改密码试试：devadmin/xxx999, 果然登录成功，验证了devadmin账号为开发测试账号直接登录后台无校验。

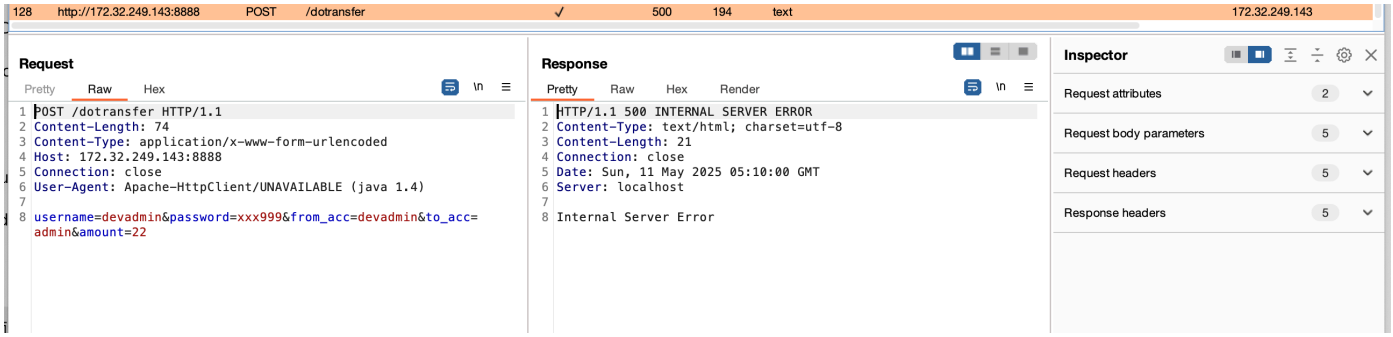


- Transfer接口抓包：

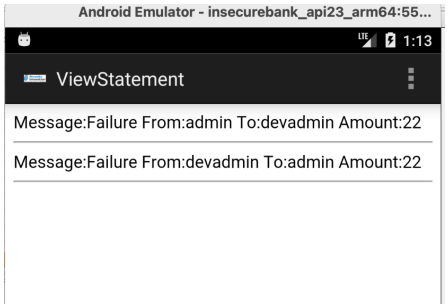
发现之前静态审计中的 /getaccounts接口。此接口可根据暴力破解来猜测获取平台注册用户账号密码。



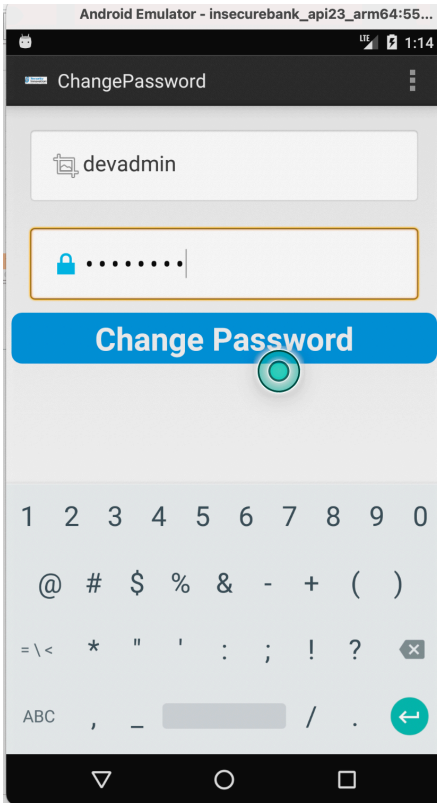
- dotransfer接口：这块是传递的username+password判断用户权限，但如果黑客拿到任一用户的账号密码，就可以直接设置任意转账给黑客，只需要to_acc=hacker 就可以了。由于后台实现error因此无法测试。



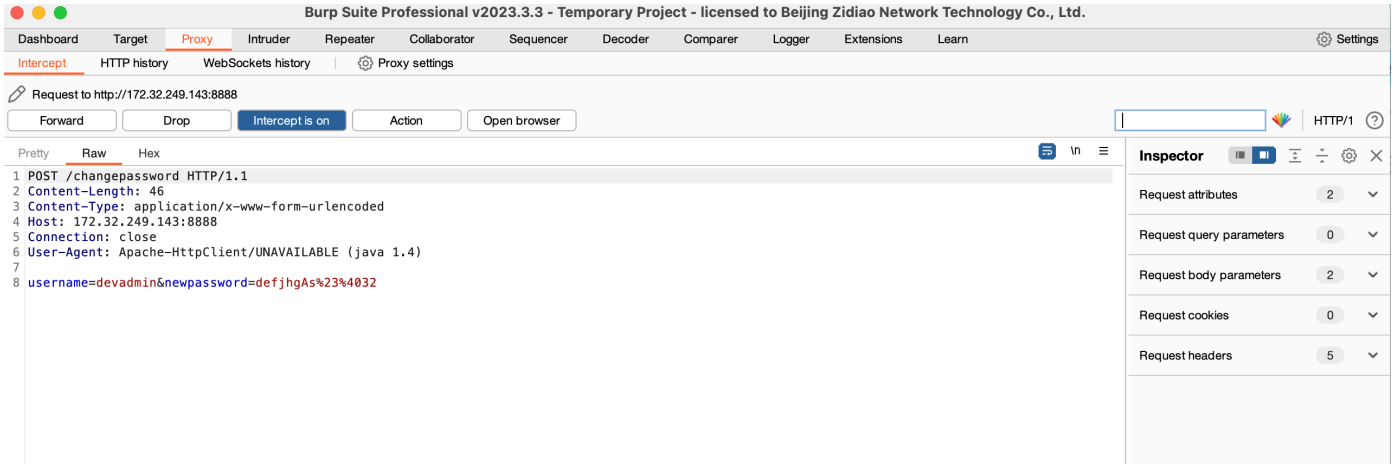
- viewstatement：



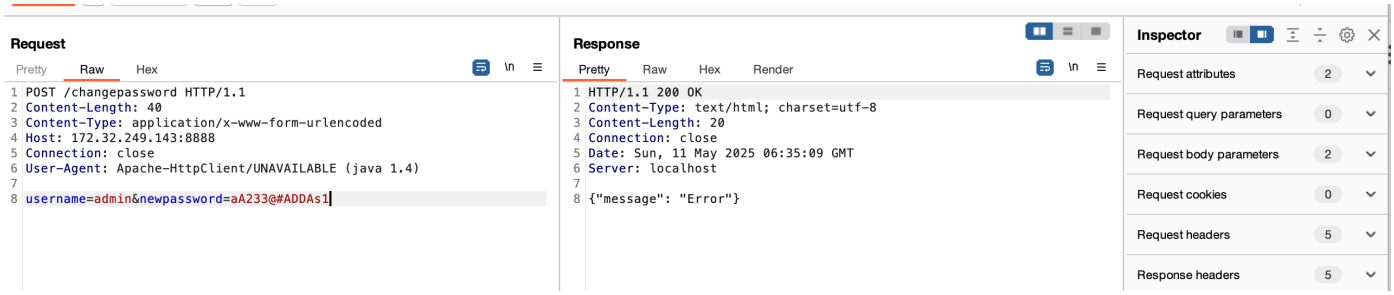
- 测试 changepasswd



- 对此请求进行拦截，并改包重放：



- 如下图，可正常重放(response code;200, message: Error是后台错误忽略) 此处可更改任意存在用户的密码，极其严重漏洞。



3.7. rebuit sdk for admin

> 在静态代码分析中看到“button_CreateUser"的显示鉴权: 只有"R.string.is_admin"才会显示。尝试进行break:

```
@Override // android.app.Activity
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_log_main);
    String mess = getResources().getString(R.string.is_admin);
    if (mess.equals("no")) {
        View button_CreateUser = findViewById(R.id.button_CreateUser);
        button_CreateUser.setVisibility(8);
    }
    this.login_buttons = (Button) findViewById(R.id.login_button);
    this.login_buttons.setOnClickListener(new View.OnClickListener() { // from class: co
        @Override // android.view.View.OnClickListener
        public void onClick(View v) {
            LoginActivity.this.performlogin();
        }
    });
    this.createuser_buttons = (Button) findViewById(R.id.button_CreateUser);
    this.createuser_buttons.setOnClickListener(new View.OnClickListener() { // from clas
        @Override // android.view.View.OnClickListener
        public void onClick(View v) {
            LoginActivity.this.createUser();
        }
    });
    this.fillData_button = (Button) findViewById(R.id.fill_data);
```

1. 安装apktool

```
brew install apktool
```

2. 反编译apk:

```
apktool d ~/Desktop/Task/Android-InsecureBankv2-master/InsecureBankv2.apk -o
insecurebank_dec
```

3. 更改res/values/strings.xml中的"is_admin" 为 "yes":

```
<string name="hello_world">Hello world!</string>
<string name="is_admin">yes</string>
<string name="loginscreen_password">Password:</string>
<string name="loginscreen_username">Username:</string>
```

4. 重新打包并签名

```
apktool b InsecureBank_decoded -o InsecureBankv2_admin.apk
apksigner sign --ks debug.keystore --ks-key-alias androiddebugkey --ks-pass
pass:android InsecureBankv2_admin.apk
```

其中apksigner没找到，于是用命令“find ~/Library/Android/sdk/build-tools -name apksigner" 找到apksigner 命令位置：

```
/Users/keeplook4ever/Library/Android/sdk/build-tools/35.0.1/apksigner
/Users/keeplook4ever/Library/Android/sdk/build-tools/36.0.0/apksigner
```

于是使用绝对路径来签名：

```
/Users/keeplook4ever/Library/Android/sdk/build-tools/35.0.1/apksigner sign \
  --ks debug.keystore \
  --ks-key-alias androiddebugkey \
  --ks-pass pass:android \
  InsecureBankv2_admin.apk
```

报错没有 `debug.keystore` 于是生成：

```
keytool -genkey -v -keystore debug.keystore \
  -storepass android -alias androiddebugkey \
  -keypass android -keyalg RSA -keysize 2048 -validity 10000
```

4. 将打包签名后的apk包加载到模拟器中：

```
adb install -r InsecureBankv2_admin.apk
```

报错后卸载原来的apk重新安装：

```
adb uninstall com.android.insecurebankv2
```

5. 可看到已经成功展示了"Create User"按钮：由于此接口后台未实现，但不影响证明利用此编译好的apk可以直接创建任意账号（越权，理论上只有admin才可以，极其严重漏洞）

4. Bonus for credentials and access control

4.1. 直接暴露后台数据库地址和库表

应用定义了一个自定义 `ContentProvider` 用于追踪用户信息，但未设置访问权限，导致其内容可以被任意 App 查询、篡改。经测试，攻击者可通过 `content://com.android.insecurebankv2.TrackUserContentProvider/trackerusers` URI 获取、删除或伪造用户记录。此外，数据库字段存在明文存储风险，未采用任何访问控制或日志审计，建议限制导出权限，并加密存储敏感字段。

```
/* loaded from: classes.dex */
public class TrackUserContentProvider extends ContentProvider {
    static final String CREATE_DB_TABLE = " CREATE TABLE names (id INTEGER PRIMARY KEY AUTOINCREMENT,  name TEXT NOT NULL);";
    static final String DATABASE_NAME = "mydb";
    static final int DATABASE_VERSION = 1;
    static final String PROVIDER_NAME = "com.android.insecurebankv2.TrackUserContentProvider";
    static final String TABLE_NAME = "names";
    static final String name = "name";
    static final int uriCode = 1;
    private static HashMap<String, String> values;
    private SQLiteDatabase db;
    static final String URL = "content://com.android.insecurebankv2.TrackUserContentProvider/trackerusers";
    static final Uri CONTENT_URI = Uri.parse(URL);
    static final UriMatcher uriMatcher = new UriMatcher(-1);

    static {
        uriMatcher.addURI(PROVIDER_NAME, "trackerusers", 1);
        uriMatcher.addURI(PROVIDER_NAME, "trackerusers/*", 1);
    }

    @Override // android.content.ContentProvider
    public int delete(Uri uri, String selection, String[] selectionArgs) {
        switch (uriMatcher.match(uri)) {
            case 1:
                int count = this.db.delete(TABLE_NAME, selection, selectionArgs);
                getContext().getContentResolver().notifyChange(uri, null);
                return count;
            default:
                throw new IllegalArgumentException("Unknown URI " + uri);
        }
```

以上代码直接暴露后台server数据库地址和库表名称，极容易造成数据泄露。可直接使用adb查询用户如下：发现用户jack+devadmin

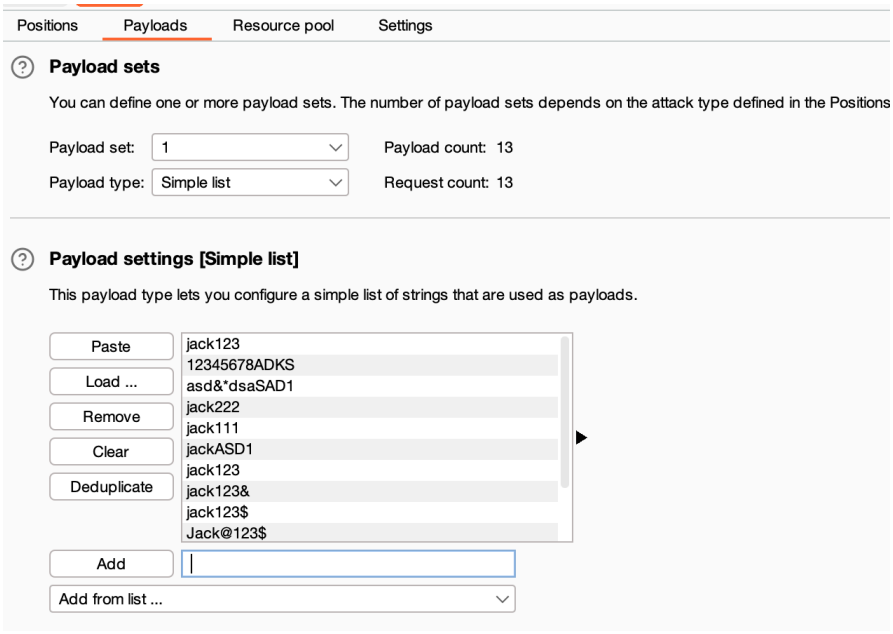
```
adb shell content query --uri
content://com.android.insecurebankv2.TrackUserContentProvider/trackerusers
```

```
(py27)  keeplook4ever  ~/Desktop/Task/Android-InsecureBankv2-master  adb shell content query --uri content://com.andro
id.insecurebankv2.TrackUserContentProvider/trackerusers

Row: 0 id=1, name=devadmin
Row: 1 id=2, name=jack
```

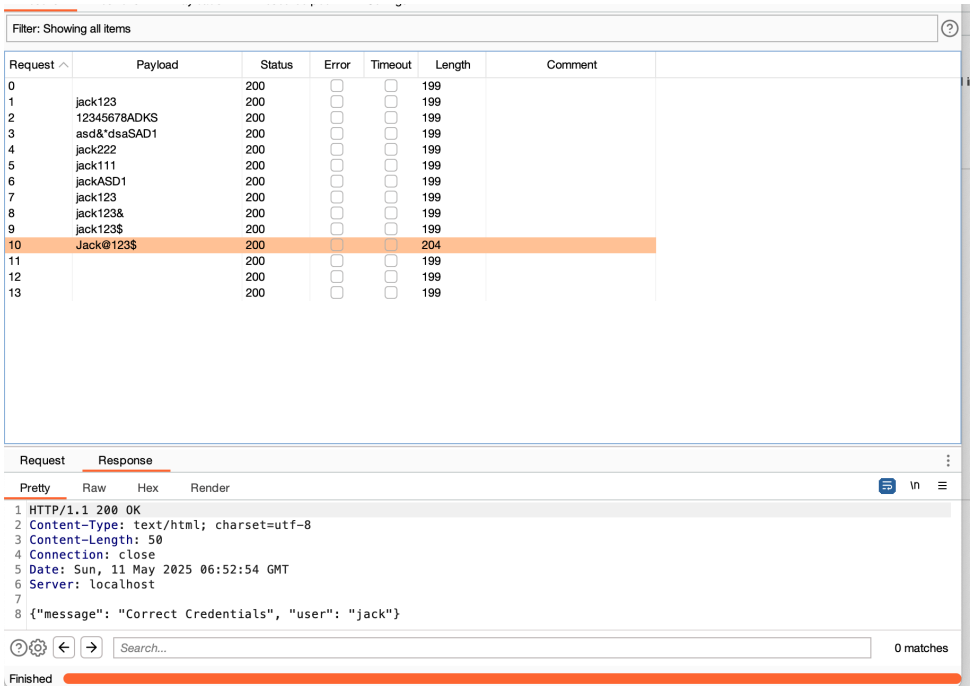
4.2. login 爆破，登录记录未使用sessionid/token标识。

以jack用户名为例，构造password payloads:



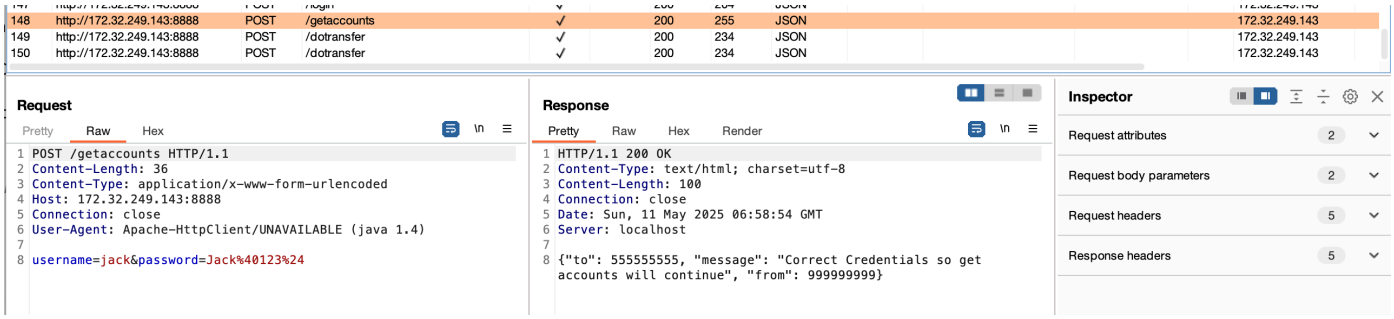
发起攻击结果如下：可通过response length不同瞬间筛选出成功爆破的密码。

修复建议：对于同一设备登录尝试次数要有限制，比如登录失败3次在5分钟内，就可以弹出验证码或禁止当前设备/ip发起登录请求。不建议用账户锁定（当黑客爆破正常用户时，可能会使得正常用户的账号被锁定。）

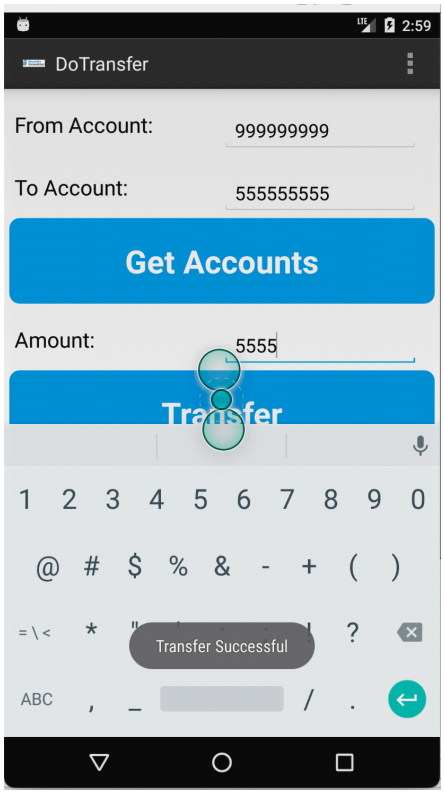


4.3. transfer没有做校验，当前转账的from是否是当前登录用户：

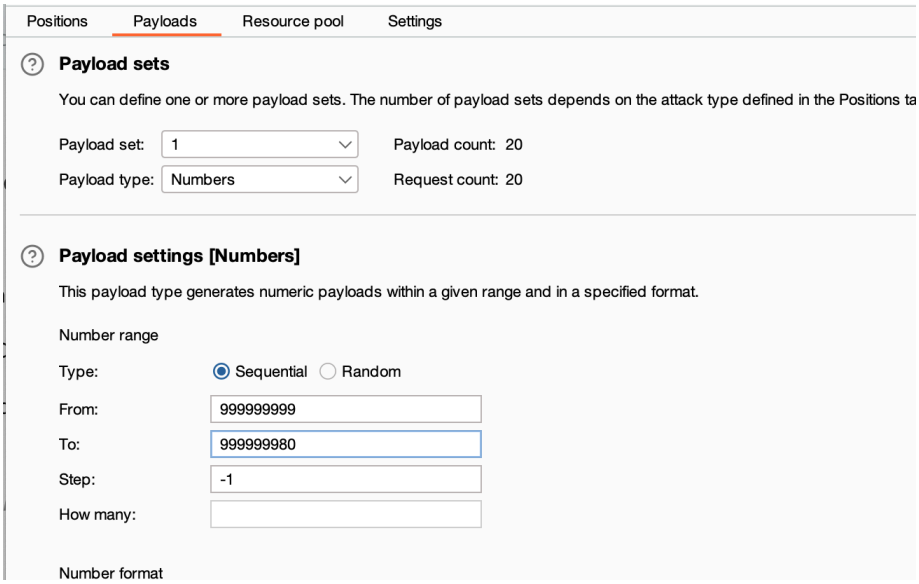
输入：from account: admin, to account: jack，获取当前登录用户jack的账号：555555555，admin：999999999

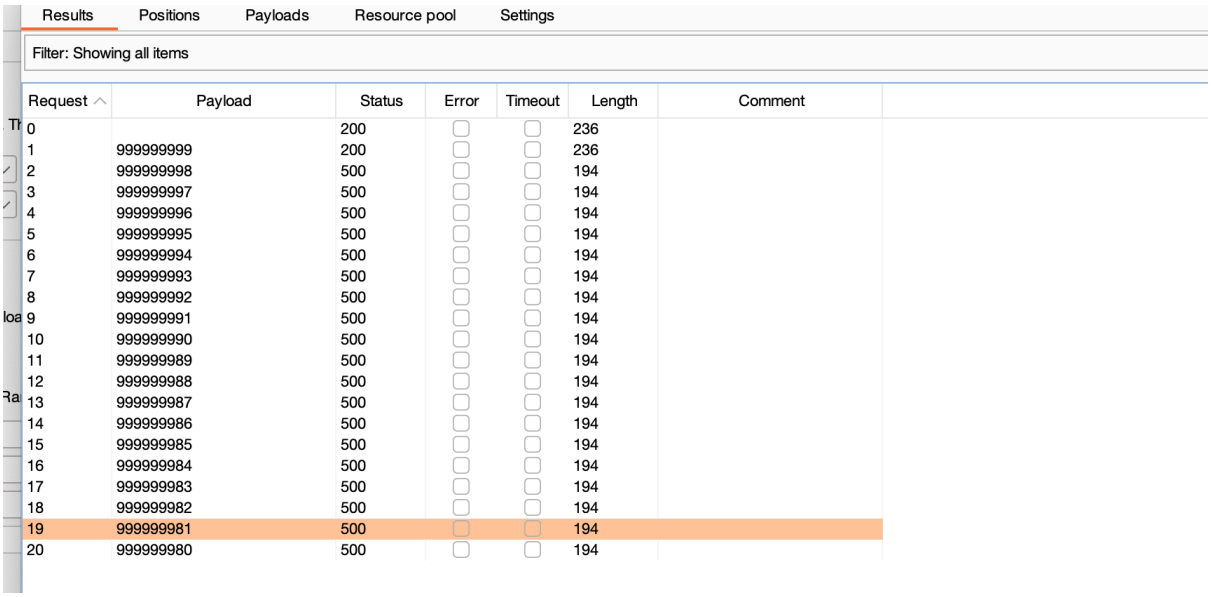


尝试transfer接口：发现转账成功。



这样可以直接便利所有账号，把每个账号的钱都转给jack，造成越权。用10000测试，测试20个账号：如下：





Request	Payload	Status	Error	Timeout	Length	Comment
0		200			236	
1	999999999	200			236	
2	999999998	500			194	
3	999999997	500			194	
4	999999996	500			194	
5	999999995	500			194	
6	999999994	500			194	
7	999999993	500			194	
8	999999992	500			194	
9	999999991	500			194	
10	999999990	500			194	
11	999999989	500			194	
12	999999988	500			194	
13	999999987	500			194	
14	999999986	500			194	
15	999999985	500			194	
16	999999984	500			194	
17	999999983	500			194	
18	999999982	500			194	
19	999999981	500			194	
20	999999980	500			194	

发现只有999999999账号转成功了，说明此次payloads账号中其他uid不存在，由于时间限制不做更多尝试。

4.4. 密码加密密钥硬编码，且使用本地存储和日志

```
/* loaded from: classes.dex */
public class CryptoClass {
    String base64Text;
    byte[] cipherData;
    String cipherText;
    String plainText;
    String key = "This is the super secret key 123";
    byte[] ivBytes = {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};

    public static byte[] aes256encrypt(byte[] ivBytes, byte[] keyBytes, byte[] textBytes) throws UnsupportedEncodingException, NoSuchAlgorithmE
        AlgorithmParameterSpec ivSpec = new IvParameterSpec(ivBytes);
        SecretKeySpec newKey = new SecretKeySpec(keyBytes, "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
        cipher.init(1, newKey, ivSpec);
        return cipher.doFinal(textBytes);
    }

    public static byte[] aes256decrypt(byte[] ivBytes, byte[] keyBytes, byte[] textBytes) throws UnsupportedEncodingException, NoSuchAlgorithmE
        AlgorithmParameterSpec ivSpec = new IvParameterSpec(ivBytes);
        SecretKeySpec newKey = new SecretKeySpec(keyBytes, "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
        cipher.init(2, newKey, ivSpec);
        return cipher.doFinal(textBytes);
    }
```

这块代码的问题：

- 密钥硬编码，容易被逆向破解泄露，相当于明文传输

- 静态，全零的Initialization Vector, 在CBC模式下，造成密码泄漏：相同密码明文总是生成相同密文。
- 不安全的AES模式：CBC虽然加密强，但无法保证数据完整性，应该使用AES-GCM 模式

这里是升级使用GCM和随机IV的代码示例：

```
SecureRandom random = new SecureRandom();
byte[] iv = new byte[12]; // GCM 推荐 12 字节 IV
random.nextBytes(iv);

SecretKeySpec keySpec = new SecretKeySpec(keyBytes, "AES");
GCMParameterSpec gcmSpec = new GCMParameterSpec(128, iv);

Cipher cipher = Cipher.getInstance("AES/GCM/NoPadding");
cipher.init(Cipher.ENCRYPT_MODE, keySpec, gcmSpec);

byte[] cipherText = cipher.doFinal(plainText.getBytes());
```

4.5 获取账号密码密文，解密用户密码

1. 在前面发现登录后直接将账号密码存储到了运行时本地的sharedPreference:

```
import android.content.SharedPreferences;
```

```
private void saveCreds(String username, String password) throws UnsupportedEncodingException, InvalidKeyException, NoSuchAlgorithmException, NoSuchPaddingException, InvalidAlgorithmParameterException, IllegalBlockSizeException, BadPaddingException {
    SharedPreferences mySharedPreferences = DoLogin.this.getSharedPreferences("mySharedPreferences", 0);
    SharedPreferences.Editor editor = mySharedPreferences.edit();
    DoLogin.this.rememberme_username = username;
    DoLogin.this.rememberme_password = password;
    String base64Username = new String(Base64.encodeToString(DoLogin.this.rememberme_username.getBytes(), 4));
    CryptoClass crypt = new CryptoClass();
    DoLogin.this.superSecurePassword = crypt.aesEncryptedString(DoLogin.this.rememberme_password);
    editor.putString("EncryptedUsername", base64Username);
    editor.putString("superSecurePassword", DoLogin.this.superSecurePassword);
    editor.commit();
}
```

2. 运行以下命令开启shell调试，找到存储的账号密码数据：(前提模拟器打开运行态)

```
adb shell
run-as com.android.insecurebankv2
cd shared_prefs
cat mySharedPreferences.xml
```

得到内容如下：

```
keeplook4ever ~/Documents/FirstStepInReverse main adb shell
root@generic_arm64:/ # run-as insecurebankv2
run-as: Package 'insecurebankv2' is unknown
254|root@generic_arm64:/ # run-as com.android.insecurebankv2
d shared_prefs/                                                    <
root@generic_arm64:/data/data/com.android.insecurebankv2/shared_prefs $
cat mySharedPreferences.xml
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
<map>
    <string name="EncryptedUsername">ZGV2YWRtaW4=
    </string>
    <string name="superSecurePassword">i2soXgauVzM8iD/TBS8cbQ==
    </string>
</map>
root@generic_arm64:/data/data/com.android.insecurebankv2/shared_prefs $
```

3. 解密账号密码
    1. EncryptedUsername 已知用base64 `ZGV2YWRtaW4=`，解码如下：`devadmin`
    2. superSecurePassword 使用AES加密 `i2soXgauVzM8iD/TBS8cbQ==`，代码如下：

```java
/* loaded from: classes.dex */
public class CryptoClass {
    String base64Text;
    byte[] cipherData;
    String cipherText;
    String plainText;
    String key = "This is the super secret key 123";
    byte[] ivBytes = {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};

    public static byte[] aes256encrypt(byte[] ivBytes, byte[] keyBytes, byte[] textBytes) throws UnsupportedEncodingException, NoSuchAlgorithmException, NoSuchPaddingException, Inval
        AlgorithmParameterSpec ivSpec = new IvParameterSpec(ivBytes);
        SecretKeySpec newKey = new SecretKeySpec(keyBytes, "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
        cipher.init(1, newKey, ivSpec);
        return cipher.doFinal(textBytes);
    }

    public static byte[] aes256decrypt(byte[] ivBytes, byte[] keyBytes, byte[] textBytes) throws UnsupportedEncodingException, NoSuchAlgorithmException, NoSuchPaddingException, Inval
        AlgorithmParameterSpec ivSpec = new IvParameterSpec(ivBytes);
        SecretKeySpec newKey = new SecretKeySpec(keyBytes, "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
        cipher.init(2, newKey, ivSpec);
        return cipher.doFinal(textBytes);
    }

    public String aesDeccryptedString(String theString) throws UnsupportedEncodingException, InvalidKeyException, NoSuchAlgorithmException, NoSuchPaddingException, InvalidAlgorith
        byte[] keyBytes = this.key.getBytes("UTF-8");
        this.cipherData = aes256decrypt(this.ivBytes, keyBytes, Base64.decode(theString.getBytes("UTF-8"), 0));
        this.plainText = new String(this.cipherData, "UTF-8");
        return this.plainText;
    }

    public String aesEncryptedString(String theString) throws UnsupportedEncodingException, InvalidKeyException, NoSuchAlgorithmException, NoSuchPaddingException, InvalidAlgorithm
        byte[] keyBytes = this.key.getBytes("UTF-8");
        this.plainText = theString;
        this.cipherData = aes256encrypt(this.ivBytes, keyBytes, this.plainText.getBytes("UTF-8"));
        this.cipherText = Base64.encodeToString(this.cipherData, 0);
        return this.cipherText;
    }
}
```

4. 编写解密python代码如下：

```python
from Crypto.Cipher import AES
import base64

# 从 APK 中找到的 key 和 IV
key = "This is the super secret key 123".encode("utf-8")
iv = bytes([0] * 16)

# 密文 Base64 解码
cipher_b64 = "i2soXgauVzM8iD/TBS8cbQ=="
cipher_bytes = base64.b64decode(cipher_b64)

# 解密
cipher = AES.new(key, AES.MODE_CBC, iv)
plaintext = cipher.decrypt(cipher_bytes)
```

```
# 去除填充
pad_len = plaintext[-1]
plaintext = plaintext[:-pad_len]

print("Decrypted password:", plaintext.decode("utf-8"))
```

运行解密代码解出密码如下：

```
(base)  keeplook4ever  ~/Documents/FirstStepInReverse  main ±  python decrypt.py
Decrypted password: iioop
```

4.6. AndroidManifest.xml 配置不当

1. `android:debuggable="true"` 调试模式打开，可被任意USB调试工具（adb shell, frida, re-framework) 附加

   应改为 `android:debuggable="false"` 或者直接删除该配置

2. `android:allowBackup="true"` 开启则允许攻击者通过 `adb backup`, 建议修改为 `android:allowBackup="false"`

3. 多个组件直接对外暴露

```
<activity android:name="...DoTransfer" android:exported="true"/>
<activity android:name="...ViewStatement" android:exported="true"/>
<activity android:name="...PostLogin" android:exported="true"/>
<activity android:name="...ChangePassword" android:exported="true"/>
<receiver android:name="...MyBroadCastReceiver" android:exported="true"/>
<provider android:name="...TrackUserContentProvider" android:exported="true"/>
```

任意 App 可直接发送 Intent 调用这些 Activity，可能绕过认证跳转到敏感页面

暴露的 Provider 允许第三方读写数据库 `trackerusers`

暴露的 Receiver 可能被滥用触发内部操作（如广播注入）

建议：设置 `android:exported="false"` 或添加 `android:permission` 来限制访问

5. To Be Continued

1. 高版本Android和android市场上apk 的研究（此次InsecureBank为demo学习版）

2. Https 绕过和 Frida 等的研究

3. 更多adb用法研究