学习练手——XCTF黑客精神

原创

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分类专栏： CTF学习 文章标签： java android 算法

本文链接：https://blog.csdn.net/WuYu_AS/article/details/118857117

一 环境

手机：Pixel 1

系统：Android 8.1

软件：IDA 7.5、JADX

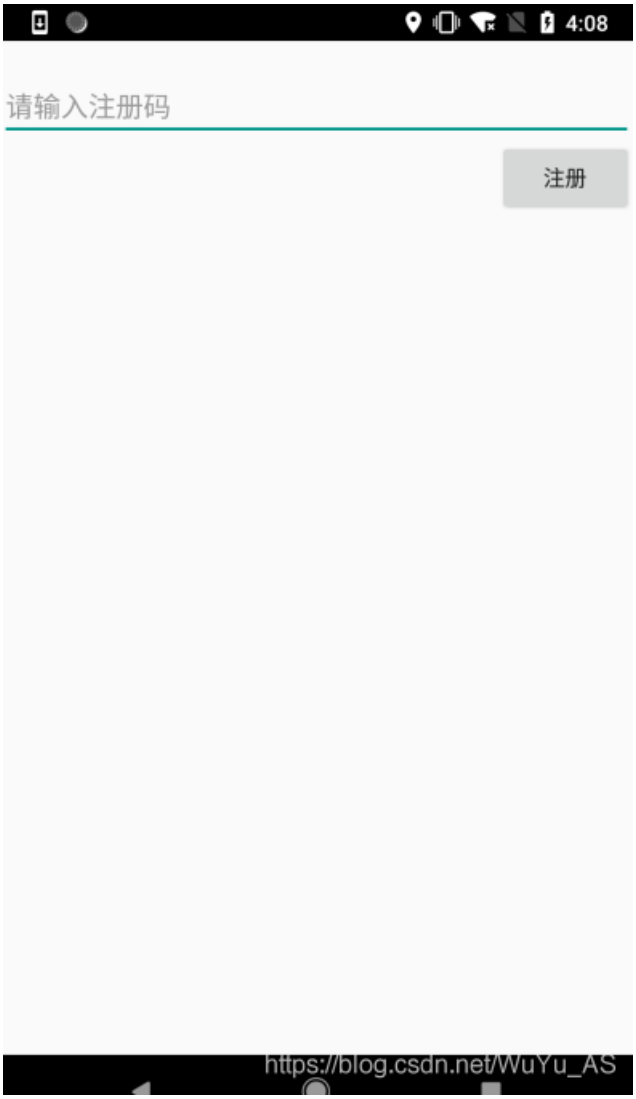
难度：简单

apk资源

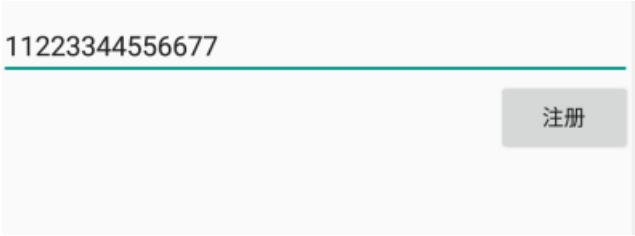
```
链接：https://pan.baidu.com/s/1iEBK__qeWKQAg9KFVraskA
提取码：jn3p
```

二 分析流程

1.打开点击自由正义分享，再点击注册，会进入了注册界面



2.输入1122334455667，再点击注册，点击好吧就会退出APP(点击对话框外的任意地方，不会退出APP)



3.打开JADX，搜索"您的注册码已保存"，然后看到了关键的saveSN

```
public class RegActivity extends Activity {
  private Button btn_reg;
  private EditText edit_sn;

  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_reg);
    this.btn_reg = (Button) findViewById(R.id.button1);
    this.edit_sn = (EditText) findViewById(R.id.editText1);
    this.btn_reg.setOnClickListener(new OnClickListener() {
      public void onClick(View v) {
        String sn = RegActivity.this.edit_sn.getText().toString().trim();
        if (sn == null || sn.length() == 0) {
          Toast.makeText(RegActivity.this, "您的输入为空", 0).show();
          return;
        }
        ((MyApp) RegActivity.this.getApplication()).saveSN(sn);
        new Builder(RegActivity.this).setTitle("回复").setMessage("您的注册码已保存").setPositiveButton("好吧", new DialogInterface.OnClickListener() {
          public void onClick(DialogInterface dialog, int which) {
            Process.killProcess(Process.myPid());
          }
        }).show();
      }
    });
```


4.查看到了三个native方法

```
package com.gdufs.xman;

import android.app.Application;
import android.util.Log;

public class MyApp extends Application {
  public static int m = 0;

  public native void initSN();

  public native void saveSN(String str);

  public native void work();

  static {
    System.loadLibrary("myjni");
  }

  public void onCreate() {
    initSN();
    Log.d("com.gdufs.xman m=", String.valueOf(m));
    super.onCreate();
  }
}
```


5.先查看 initSN方法只有在 本类的onCreate初始化，在JADX中搜索MyApp的类初始化的地方

查找用例： com.gdufs.xman.MyApp

节点	代码
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	MyApp myApp = (MyApp) getApplication();
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	MyApp myApp = (MyApp) MainActivity.this.getApplication();
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	int m = MyApp.m;

节点	代码
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	MyApp myApp = (MyApp) getApplication();
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	if (MyApp.m == 0) {
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	MyApp myApp = (MyApp) MainActivity.this.getApplication();
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	((MyApp) MainActivity.this.getApplication()).work();
com.gdufs.xman.MyApp	public class MyApp extends Application {
com.gdufs.xman.RegActivity.onCreate(Bundle) : void	((MyApp) RegActivity.this.getApplication()).saveSN(sn);

6.发现关键的判断值 MyApp.m(图1)，搜索引用发现没有赋值的地方(图2)，那么说明有可能是SO里面，加上APP初始化就进行判断，说明MyApp.m赋值的initSN方法

```
3  public void onCreate(Bundle savedInstanceState) {
     String str2;
4    super.onCreate(savedInstanceState);
5    setContentView(R.layout.activity_main);
6    String str1 = "Xman";
7    Log.d("com.gdufs.xman m=", str1);
9    MyApp myApp = (MyApp) getApplication();
9    int m = MyApp.m;
0    if (m == 0) {
1      str2 = "未注册";
2    } else if (m == 1) {
3      str2 = "已注册";
     } else {
5      str2 = "已混乱";
     }
8    setTitle(str1 + str2);
9    this.btn1 = (Button) findViewById(R.id.button1);
4    this.btn1.setOnClickListener(new OnClickListener() {
3      public void onClick(View v) {
4        MyApp myApp = (MyApp) MainActivity.this.getApplication();
5        if (MyApp.m == 0) {
6          MainActivity.this.doRegister();
1          return;
         }
8        ((MyApp) MainActivity.this.getApplication()).work();
9        Toast.makeText(MainActivity.this.getApplicationContext(), MainActivity.workString, 0).show();
       }
     });
   }
```

关键值

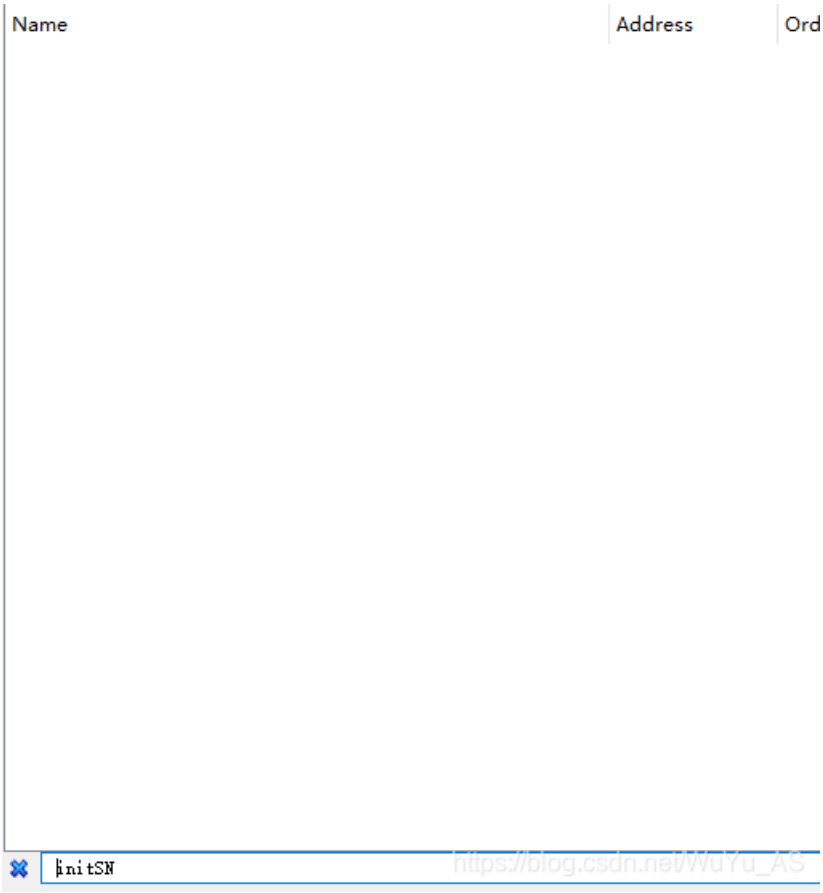
图1

查找用例： com.gdufs.xman.MyApp.m : int

节点	代码
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	int m = MyApp.m;
com.gdufs.xman.MainActivity.onCreate(Bundle) : void	if (MyApp.m == 0) {
com.gdufs.xman.MyApp	public static int m = 0;
com.gdufs.xman.MyApp.onCreate() : void	Log.d("com.gdufs.xman m=", String.valueOf(m));

图2

7.打开IDA，导入SO，打开导出表搜索 initSN 发现并没有，说明是在JNI_OnLoad里进行动态注册



8.查看JNI_OnLoad，并且导入jni.h文件，查看off_5004

```
jint JNI_OnLoad(JavaVM *vm, void *reserved)
{
  if ( !(*vm)->GetEnv(vm, &g_env, 65542) )
  {
    _android_log_print(2, "com.gdufs.xman", "JNI_OnLoad()");
    native_class = (*g_env)->FindClass(g_env, "com/gdufs/xman/MyApp");
    if ( !(*g_env)->RegisterNatives(g_env, native_class, off_5004, 3) )
    {
      _android_log_print(2, "com.gdufs.xman", "RegisterNatives() --> nativeMethod() ok");
      return 65542;
    }
    _android_log_print(6, "com.gdufs.xman", "RegisterNatives() --> nativeMethod() failed");
  }
  return -1;
}
```

```
.data:00005003                 DCB    0
.data:00005004 off_5004        DCD aInitsn             ; DATA XREF: JNI_OnLoad+32↑o
.data:00005004                                         ; JNI_OnLoad+38↑o ...
.data:00005004                                         ; "initSN"
.data:00005008                 DCD aV                  ; "()V"
.data:0000500C                 DCD n1+1
.data:00005010                 DCD aSavesn             ; "saveSN"
.data:00005014                 DCD aLjavaLangStrin     ; "(Ljava/lang/String;)V"
.data:00005018                 DCD n2+1
.data:0000501C                 DCD aWork               ; "work"
.data:00005020                 DCD aV                  ; "()V"
.data:00005024                 DCD n3+1
```

9.先查看n1,简单读取"/sdcard/reg.dat"文件(由于文件是放在SD卡里所以需要给APP存储权限就可以了)，读取文件内的字符串，然后和"EoPAoY62@EIRD"进行比较

```
int __fastcall n1(int a1)
{
  FILE *fpointer; // r0
  FILE *fpointer_1; // r4
  int v4; // r0
  int fileSize; // r7
  void *v6; // r5
  int v8; // r0
  int v9; // r1

  fpointer = fopen("/sdcard/reg.dat", "r+");
  fpointer_1 = fpointer;
  if ( !fpointer )
  {
    v4 = a1;
    return setValue(v4, 0);
  }
  fseek(fpointer, 0, 2);
  fileSize = ftell(fpointer_1);
  v6 = malloc(fileSize + 1);
  if ( !v6 )
  {
    fclose(fpointer_1);
    v4 = a1;
    return setValue(v4, 0);
  }
  fseek(fpointer_1, 0, 0);
  fread(v6, fileSize, 1u, fpointer_1);
  *(v6 + fileSize) = 0;
  if ( !strcmp(v6, "EoPAoY62@ElRD") )
  {
    v8 = a1;
    v9 = 1;
  }
  else
  {
    v8 = a1;
    v9 = 0;
  }
  setValue(v8, v9);
  return j_fclose(fpointer_1);
}
```


10.会将结果通过setValue设置到 MyApp.m，那么就找到了关键的key"EoPAoY62@ElRD"

```
int __fastcall setValue(JNIEnv *a1, int a2)
{
  jclass v4; // r5
  jfieldID v5; // r0

  v4 = (*a1)->FindClass(a1, "com/gdufs/xman/MyApp");
  v5 = (*a1)->GetStaticFieldID(a1, v4, "m", "I");
  return ((*a1)->SetStaticIntField)(a1, v4, v5, a2);
}
```

11.查看动态注册里的n2(JAVA层saveSN)，分为三部分：

1.初始化 加密用的字符串；

2.将明文和从table中取出的字符进行异或；

3.写入/sdcard/reg.dat文件

```
int __fastcall n2(JNIEnv *env, jobject obj, jstring content)
{
  FILE *fpointer; // r7
  _DWORD *table_1; // r4
  const char *v8; // r3
  int v9; // r0
  int v10; // r1
  _WORD *v11; // r5
  JNIEnv *v12; // r0
  int table_index; // r4
  JNIEnv v14; // r3
  signed int index; // r6
  const char *content_char; // r9
  char *content_char_1; // r5
  signed int content_char_len; // r10
  char table_item; // r2
  char content_char_item; // r3
  _BYTE table[56]; // [sp+0h] [bp-38h] BYREF

  fpointer = fopen("/sdcard/reg.dat", "w+");
  if ( !fpointer )
    return j___android_log_print(3, "com.gdufs.xman", byte_2DCA);
  table_1 = table;
  v8 = "W3_arE_whO_we_ARE";
  do
  {
    v9 = *v8;
    v8 += 8;
    v10 = *(v8 - 1);
    *table_1 = v9;
    table_1[1] = v10;
    v11 = table_1 + 2;
    table_1 += 2;
  }
  while ( v8 != "E" );
  v12 = env;
  table_index = 2016;
  *v11 = *v8;
  v14 = *env;
  index = 0;
  content_char = v14->GetStringUTFChars(v12, content, 0);
  content_char_1 = content_char;
  content_char_len = strlen(content_char);
  while ( index < content_char_len )
  {
    if ( index % 3 == 1 )
    {
      table_index = (table_index + 5) % 16;
      table_item = table[table_index + 1];
    }
    else if ( index % 3 == 2 )
    {
      table_index = (table_index + 7) % 15;
      table_item = table[table_index + 2];
    }
    else
    {
      table_index = (table_index + 3) % 13;
      table_item = table[table_index + 3];
    }
    content_char_item = *content_char_1;
    ++index;
    *content_char_1++ = content_char_item ^ table_item;
  }
  fputs(content_char, fpointer);
  return j_fclose(fpointer);
}
```

初始化 加密用的字符串

加密算法，最后使用的是异或

写入文件

12第一部分：.初始化 加密用的字符串，从伪代码中明显是固定的，加上也没有反调试，所以直接IDA，动态调试(下断点的地方 如图1)

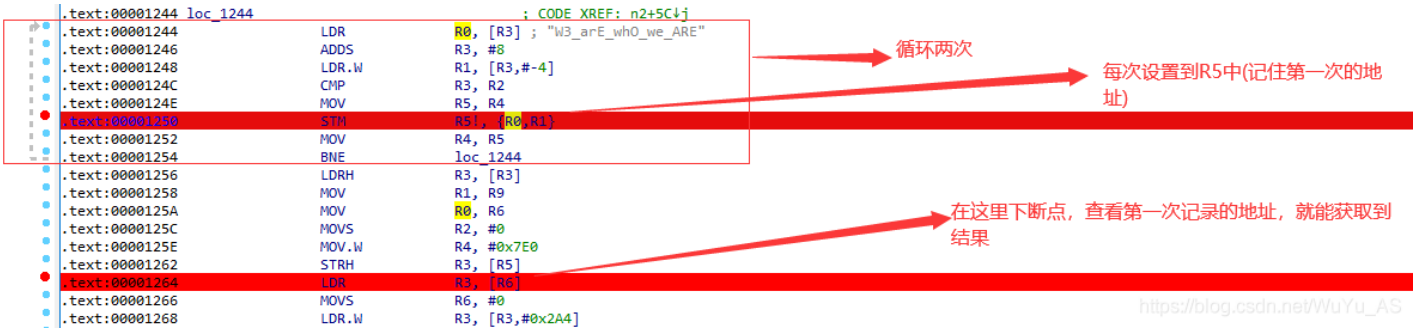


图1

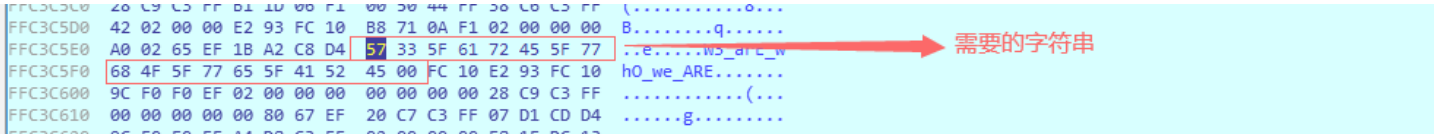


图2

13.第二部分：加密算法很简单，实现的JAVA代码

```
public static String myEncrpt_CTF(String input){
    char[]table={0x57,0x33,0x5F,0x61,0x72,0x45,0x5F,0x77,0x68,0x4F,0x5F,0x77,0x65,0x5F,0x41,0x52,0x45,0x00};
    char[]result=new char[input.length() ];
    int table_index=2016;
    char table_item=0;
    for (int i = 0; i <input.length() ; i++) {
        if(i%3==1){
            table_index=(table_index+5)%16;
            table_item=table[table_index+1];
        }else if(i%3==2){
            table_index=(table_index+7)%15;
            table_item=table[table_index+2];
        }else{
            table_index=(table_index+3)%13;
            table_item=table[table_index+3];
        }
        result[i]= (char) (input.charAt(i)^table_item);
    }

    return new String(result);
}
```

14.因为table_item的生成和明文没有任何关系，加上最后是异或，说明了传入密文，返回的就是明文

```
System.out.println(myEncrpt_CTF("EoPAoY62@ElRD"));
201608Am!2333
```

15.输入正确的flag,重新进入app,按照指定的格式xman{201608Am!2333}! 提交就好了，不过这是很久以前的比赛APP，所以当成成功的标志就好了