Android应用安全开发

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About Me

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议程

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- Android基础
- Android应用客户端安全
- Android应用通信安全
- Android应用服务端安全
- 总结

Android系统市场占有率巨大

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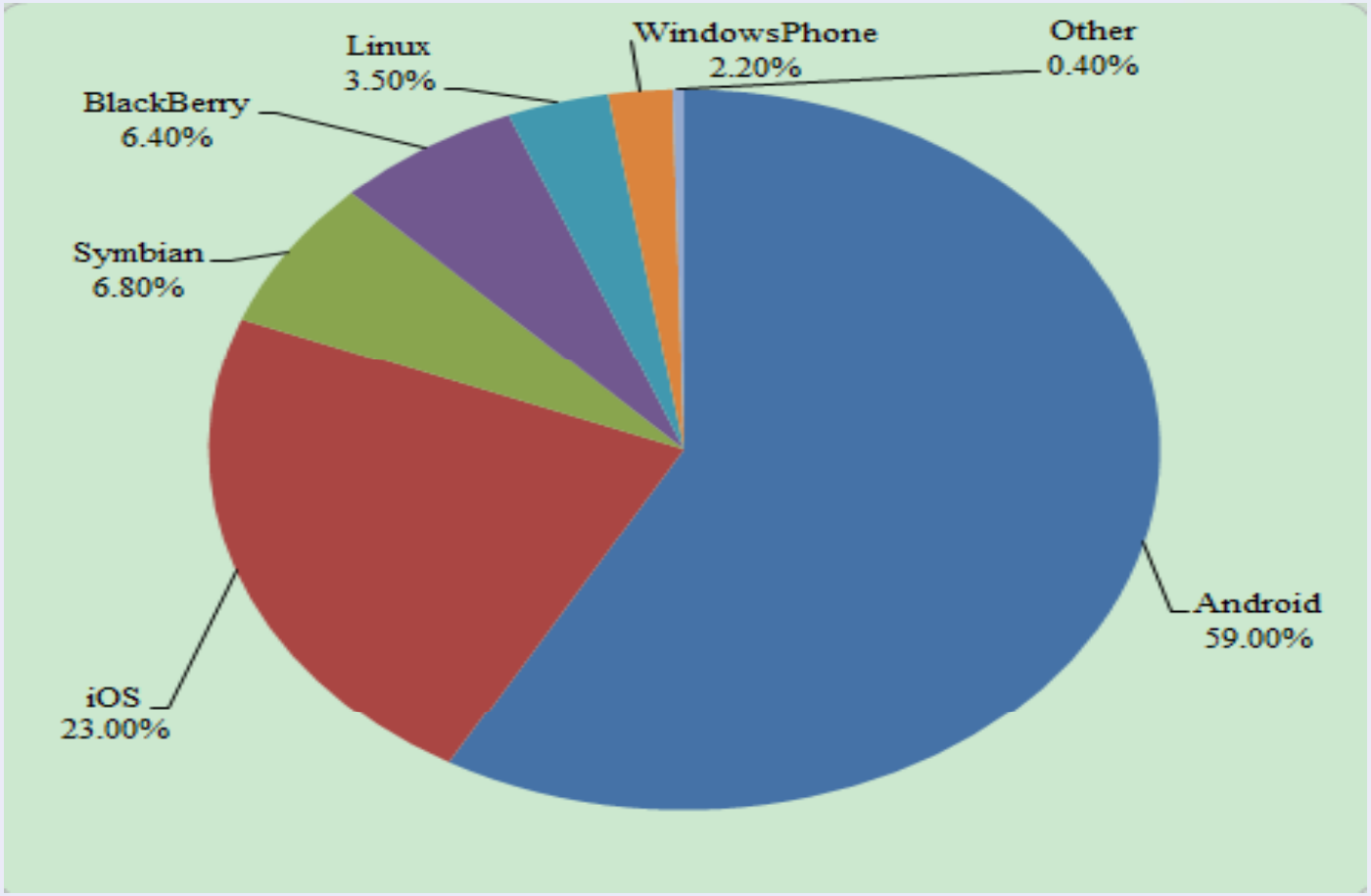

Andriod整体构架

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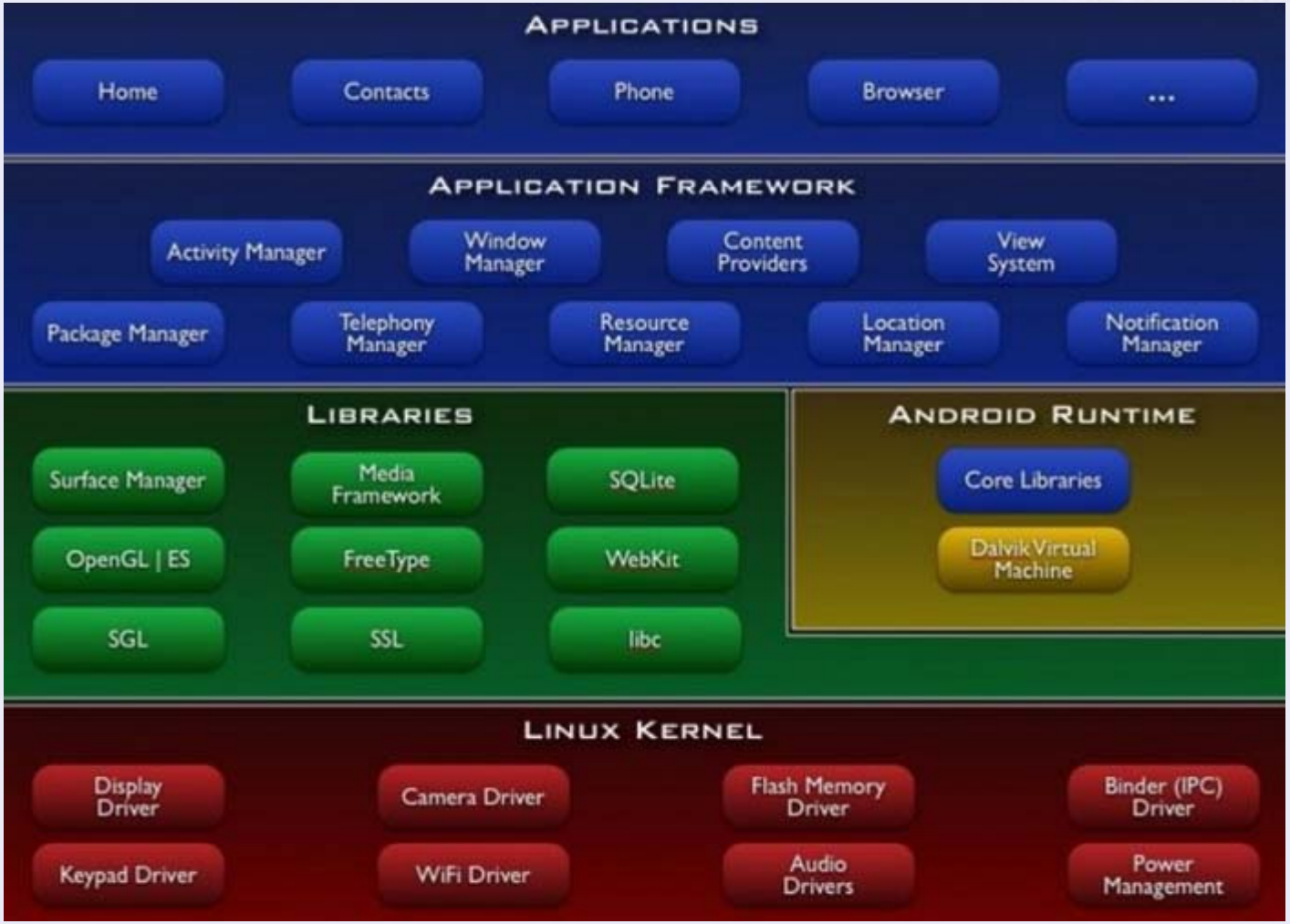

OWASP Mobile Top 10

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OWASP Mobile Top 10 Risks	
M1- Insecure Data Storage	M6- Improper Session Handling
M2- Weak Server Side Controls	M7- Security Decisions Via Untrusted Inputs
M3- Insufficient Transport Layer Protection	M8- Side Channel Data Leakage
M4- Client Side Injection	M9- Broken Cryptography
M5- Poor Authorization and Authentication	M10- Sensitive Information Disclosure

与传统Web应用相比

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- 手机上存的东西更隐私
- 手机直接关联运营商账号
- 手机更容易物理丢失
- 手机更多使用公用wifi上网
- Android系统的开放性
- Android机最大的乐趣-刷机（root）
- Android混乱的应用市场

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Android客户端安全

从AndroidManifest.xml说起

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- 每个Android程序中必须的文件
- 它位于整个项目的根目录
- 定义应用程序及其组件的结构和元数据
  - Permissions
  - Activities
  - Intents
  - Notifications
  - ContentProviders
  - 。。。

AndroidManifest.xml 实例

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```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.android.apis">

    <uses-permission android:name="android.permission.READ_CONTACTS" />
    <uses-permission android:name="android.permission.WRITE_CONTACTS" />
    <uses-permission android:name="android.permission.VIBRATE" />
    <uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION" />
    <uses-permission android:name="android.permission.INTERNET" />
    <uses-permission android:name="android.permission.SET_WALLPAPER" />

    <!-- We will request access to the camera, saying we require a camera
         of some sort but not one with autofocus capability. -->
    <uses-permission android:name="android.permission.CAMERA" />
    <uses-feature android:name="android.hardware.camera" />
    <uses-feature android:name="android.hardware.camera.autofocus" android:required="false" />

    <application android:name="ApiDemosApplication"
            android:label="@string/activity_sample_code"
            android:icon="@drawable/app_sample_code" >

        <!-- This is how we can request a library but still allow the app
             to be installed if it doesn't exist. -->
        <uses-library android:name="com.example.will.never.exist" android:required="false" />

        <activity android:name="ApiDemos">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.DEFAULT" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
```

Permission

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- 利用 Linux 已有的权限管理机制，为每一个 Application 分配不同的 uid 和 gid

- 在此基础上，对 Application 可以执行的某些具体操作进行权限细分和访问控制

Permission实例

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Normal

android.permission.VIBRATE
com.android.alarm.permission.SET_ALARM

Dangerous

android.permission.SEND_SMS
android.permission.CALL_PHONE

Signature

android.permission.FORCE_STOP_PACKAGES
android.permission.INJECT_EVENTS

SignatureOrSystem

android.permission.ACCESS_USB
android.permission.SET_TIME

滥用权限

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- android.permission.PROCESS_OUTGOING_CALLS
- android.permission.WAKE_LOCK,
- android.permission.READ_PHONE_STATE
- android.permission.INTERNET
- android.permission.RECEIVE_BOOT_COMPLETED
- android.permission.ACCESS_NETWORK_STATE
- android.permission.ACCESS_COARSE_LOCATION
- android.permission.ACCESS_FINE_LOCATION
- com.google.android.googleapps.permission.GOOGLE_AUTH
- com.google.android.googleapps.permission.GOOGLE_AUTH.OTHER_SERVICES
- android.permission.GET_ACCOUNTS

组件间调用

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- 四大组件
  - Activity
  - Service
  - Broadcast Receiver
  - Content Provider

- 如果配置不当，会被其他应用调用

- 为存储和获取数据提供统一的接口
- 可以在不同的应用程序之间共享数据
- ContentProvider提供的方法
  - query：查询
  - insert：插入
  - update：更新
  - delete：删除
  - getType：得到数据类型
  - onCreate：创建数据时调用的回调函数

滥用ContentProvider

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```
<provider android:name=".r[redacted]der" android:authorities="[redacted]tes" />
<provider android:name="[redacted]der" android:authorities="[redacted]ct" />
<provider android:name=".r[redacted]ovider" android:authorities="[redacted]review" />
<provider android:name=".d[redacted]ovider" android:authorities="d[redacted]" />
```

Content Provider Authority	Table Name
[redacted]	notes
[redacted]	user
[redacted]	rawnotes
[redacted]	note_tag_relations
[redacted]	words
[redacted]	counts
[redacted]	dicts

滥用ContentProvider

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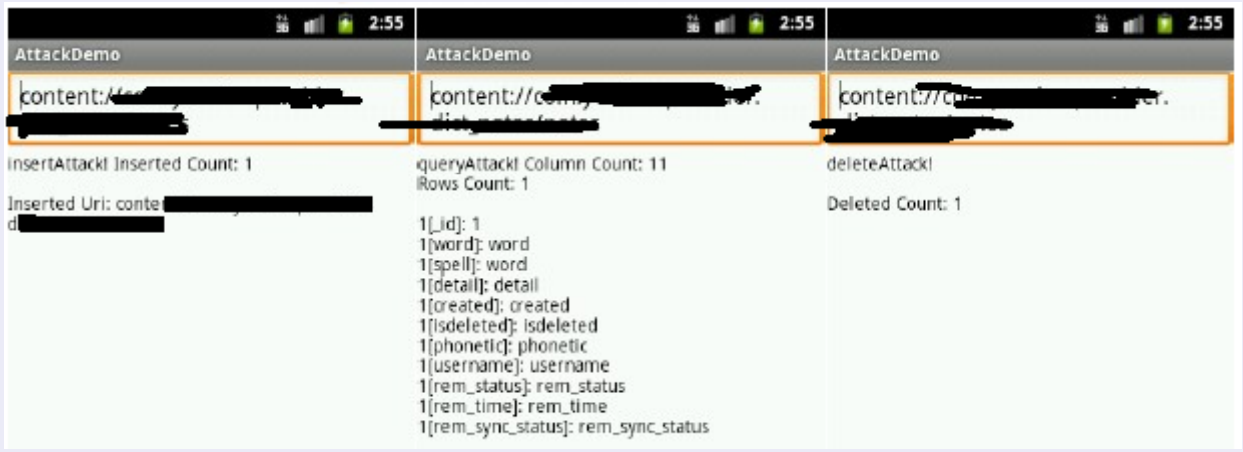

Andriod应用反编译

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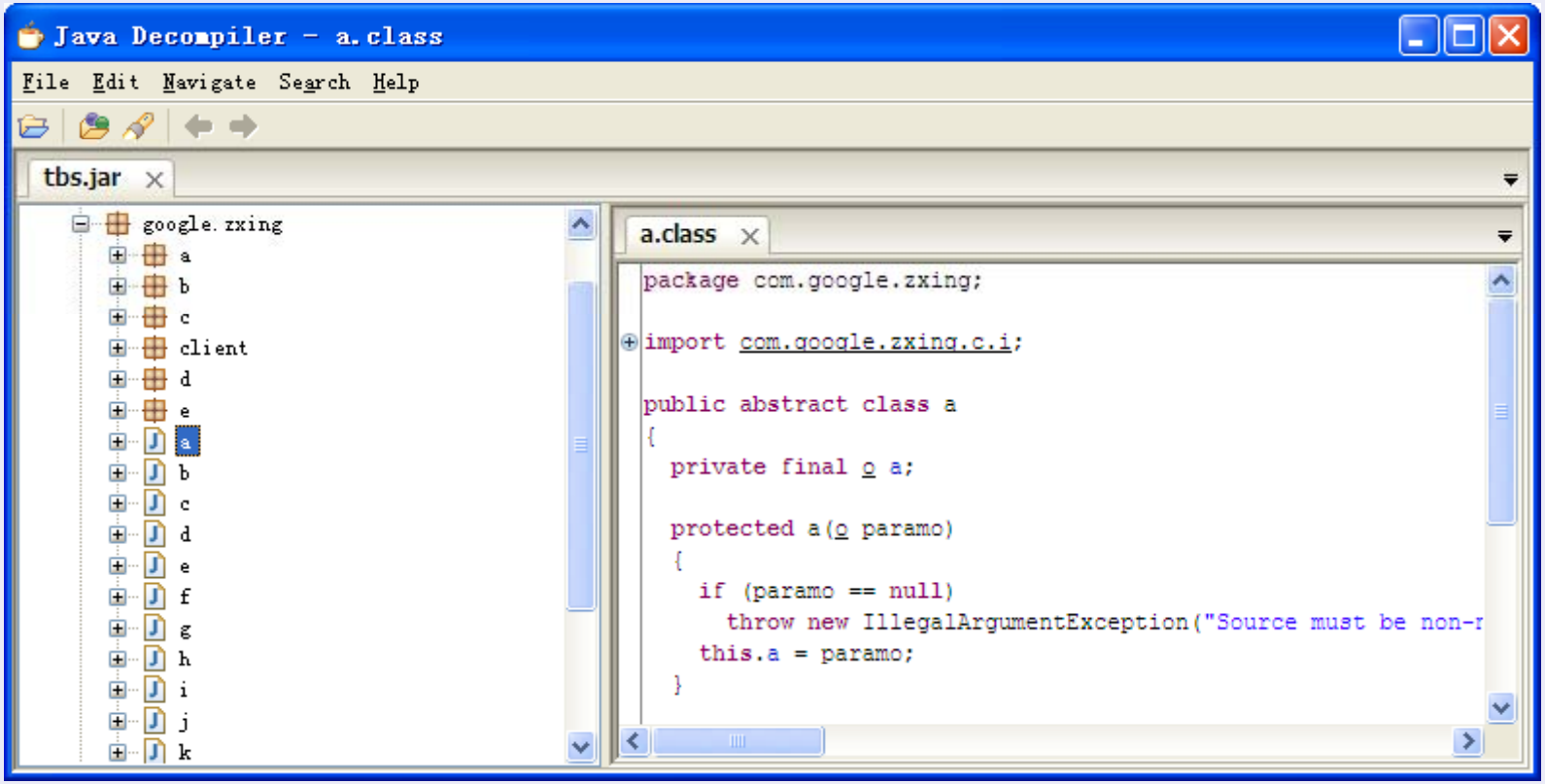
- Andriod 应用程序使用java开发，可通过反编译的方式获取对应的源码
- APK包其实就是个ZIP包，用WinRAR解开获得classes.dex
- 使用dex2jar将程序转换成jar文件
- 使用jad对jar文件进行反编译

反编译实例


Java Decompiler - a.class
File Edit Navigate Search Help
tbs.jar
google.zxing
a
b
c
client
d
e
a
b
c
d
e
f
g
h
i
j
k
a.class
package com.google.zxing;
import com.google.zxing.c.i;
public abstract class a
{
private final o a;
protected a(o paramo)
{
if (paramo == null)
throw new IllegalArgumentException("Source must be non-r
this.a = paramo;
}

对策

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- ProGuard 是一个免费的 Java类文件的压缩，优化，混肴器
- 新建了一个Android工程之后，一个proguard.cfg文件会在工程的根目录下自动创建
- 文件定义了混淆器是怎样优化和混淆你的代码

Andriod应用数据库

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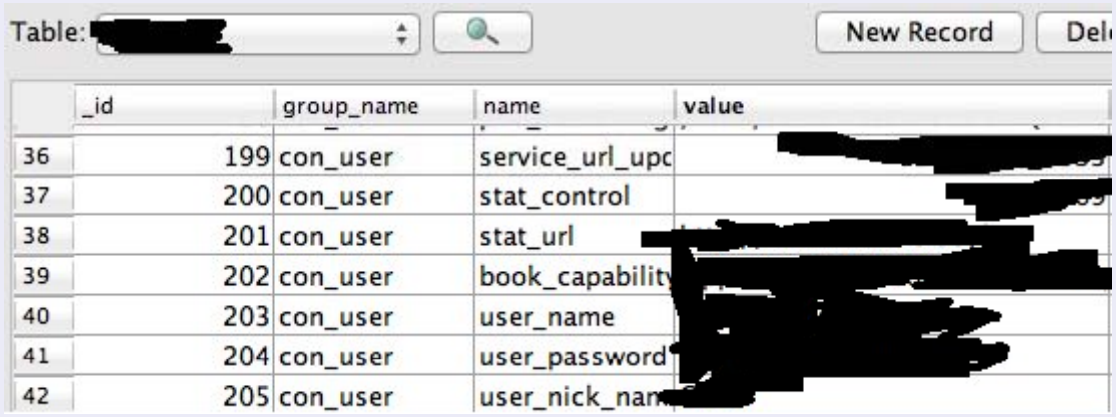
- Android使用开源的、与操作系统无关的SQL数据库SQLite
- 可以使用sqlite3查询sqlite数据库中的内容
- 同样可能受到SQLi攻击

对策

- 对于敏感数据要加密



- 预防SQLi

Android存储系统

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- SD卡作为手机的扩展存储设备，在手机中充当硬盘角色，可以让我们手机存放更多的数据以及多媒体等大体积文件

- 内部存储 RAM，就是我们常说的真正意义上的内存

对SDCard进行读写操作

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- 只需要在AndroidManifest.xml中声明

```
<uses-permission
    android:name="android.permission.WRITE_EXTERNAL_STORAGE"/>
```

- 我们存放在SD卡中数据很可能被其他恶意程序读取或者篡改

对RAM进行读写操作

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- 存放在RAM中数据，被root之后也可以读取篡改
- 国内大部分机器都root了
- Android 2.2/2.3有大量可提权到root的漏洞

本地敏感信息保存实例

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```
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
<map>
<string name="[redacted]_password">[redacted]</string>
<boolean name="[redacted]d_open" value="true" />
<string name="login_username">[redacted]</string>
<boolean name="first_open_app" value="false" />
<boolean name="is_pushing" value="true" />
<boolean name="show_guide" value="false" />
```

对策

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- Encode vs. Serializable vs. Encrypt
- 加密之后的密钥存放？？
  - 算法密钥都在本地
- 对保存在客户端的敏感信息加密
  - 对于SD卡上的敏感信息一定要加密
  - 加密用的密钥放到RAM中

- Android底层是Linux和C
- 如果使用native本地库，那么可能存在缓冲区溢出
- 如果使用标准SDK库，那么把心放回肚子里

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Android应用通信安全

Android手机信道

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- SMS
- Socket
- HTTP
- Bluetooth

主要威胁

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- 明文密码
- 明文会话id
- 其他敏感信息
- 手机信道更加危险

未加密的通信

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```
⊞ Ethernet II, Src: HonHaiPr_58:f7:50 (44:37:e6:58:f7:50), Dst: Cisco_aa:78:bf (00:13:19:aa:78:bf)
⊞ Internet Protocol Version 4, Src: 192.168.161.237 (192.168.161.237), Dst: [redacted]
⊞ Transmission Control Protocol, Src Port: 59658 (59658), Dst Port: http (80), Seq: 1, Ack: 1, Len: 251
⊟ Hypertext Transfer Protocol
  ⊞ POST /[redacted] HTTP/1.0\r\n
    [redacted]\n
    Content[redacted]application/x-www-form-urlencoded\r\n
  ⊞ Content-Length:116\r\n
    \r\n
    [Full request URI: [redacted]]
⊟ Line-based text data: application/x-www-form-urlencoded
    &username=[redacted]&password=[redacted]&product=[redacted]&time
⊞ Hypertext Transfer Protocol
```

```
0000 [redacted]  ....X.D7 .X.P..E.
0010 [redacted]  .#Q.@...  .......
0020 [redacted]  S. 7..S2.P.
0030 [redacted]  .....PO ST[redacted]
0040 [redacted]
0050 [redacted]
0060 [redacted]  ent-Type
0070 [redacted]  : applic ation/x-
0080 [redacted]  www-form -urlenco
0090 [redacted]  ded..Con tent-Len
00a0 [redacted]  gth:116. ...&user
00b0 [redacted]  name=[redacted]m& password
00c0 [redacted]  =0[redacted]
00d0 [redacted]
00e0 [redacted]  &produc t=[redacted]
00f0 [redacted]  &pass type=0&s
0100 [redacted]  id=&fid= 0&time=.
0110 [redacted]
0120 [redacted]
0130 [redacted]
```

加密的通信

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```
GET /[redacted]in=154831009&sess_id=bzwYsYNBIL7AtCURdaU63gali3jamESZ&data=45D4C8FAE3F7D4AC96C63B45F4CD19302AE52C644785EAFCE79B49A85BE1708879315C7528AD77EC HTTP/1.1
返回数据
{ "err": 0, "uin": 154831009, "isdna": 1, "setdir": 0, "have_mobile": 1, "mobile_mask": "152******12", "ques_appear": 1, "qqtoken_appear": 0, "tkn_usable": 1, "mobile_appear": 1, "mobile_sms_pref

GET [redacted]in=154831009&sess_id=bzwYsYNBIL7AtCURdaU63gali3jamESZ HTTP/1.1
返回数据
{ "err": 0, "uin": 154831009, "info": "" }
```

HTTPS的证书验证

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- 大量自签名证书
- 系统设置，信任所有证书
- 绝大部分应用没有验证客户端

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- 中间人攻击

```
public  SSLHttpClient (File keyStoreFile, String keyStorePass) throws Exception {
    initHttpClient();
    KeyStore keyStore = KeyStore.getInstance(KeyStore.getDefaultType());
    keyStore.load(new FileInputStream(keyStoreFile), keyStorePass.toCharArray());// 导入证书密钥库
    SSLSocketFactory socketFactory = new SSLSocketFactory("TLS", null, null, keyStore, new SecureRandom(),
            SSLSocketFactory.ALLOW_ALL_HOSTNAME_VERIFIER);
    Scheme sch = new Scheme("https", 443, socketFactory);
    httpClient.getConnectionManager().getSchemeRegistry().register(sch);
}
```

对策

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- 使用安全的信道传输敏感信息
- 重载verification函数，hardcode强制验证证书的发行者
- 对客户端同样需要验证

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Android应用服务端安全

关于sessionid

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- 唯一编号(IMEI，IMSI)，实际上并不唯一
- 任意程序可以读取上传
- 不适合当做认证凭证使用

跟常规Web APP一样

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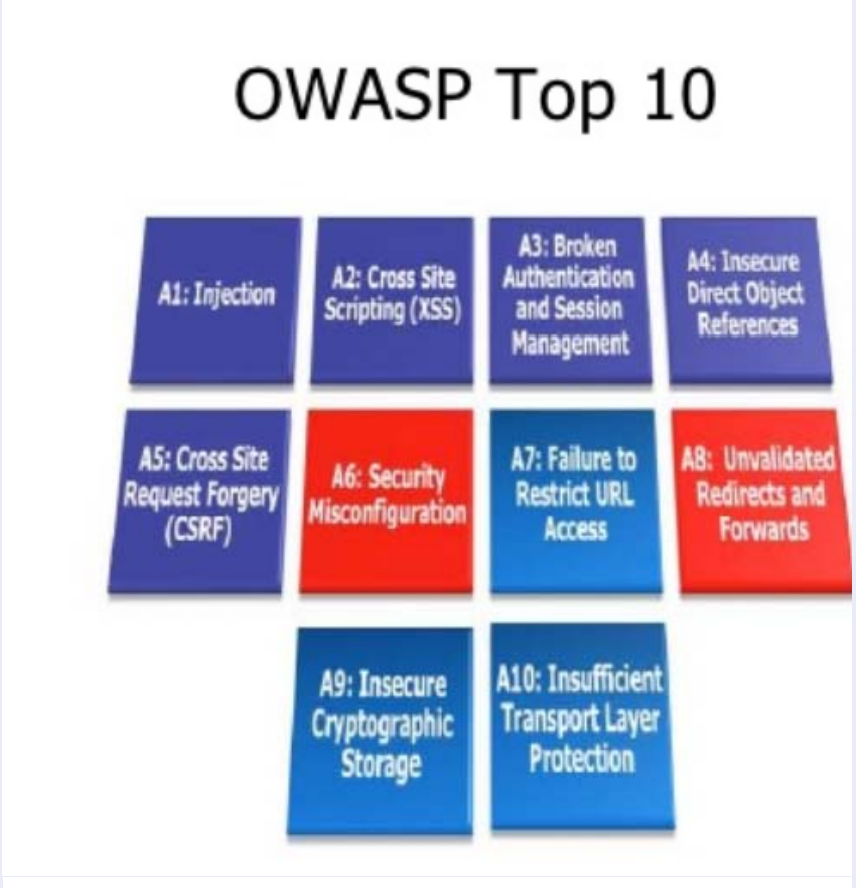

走HTTP的应用

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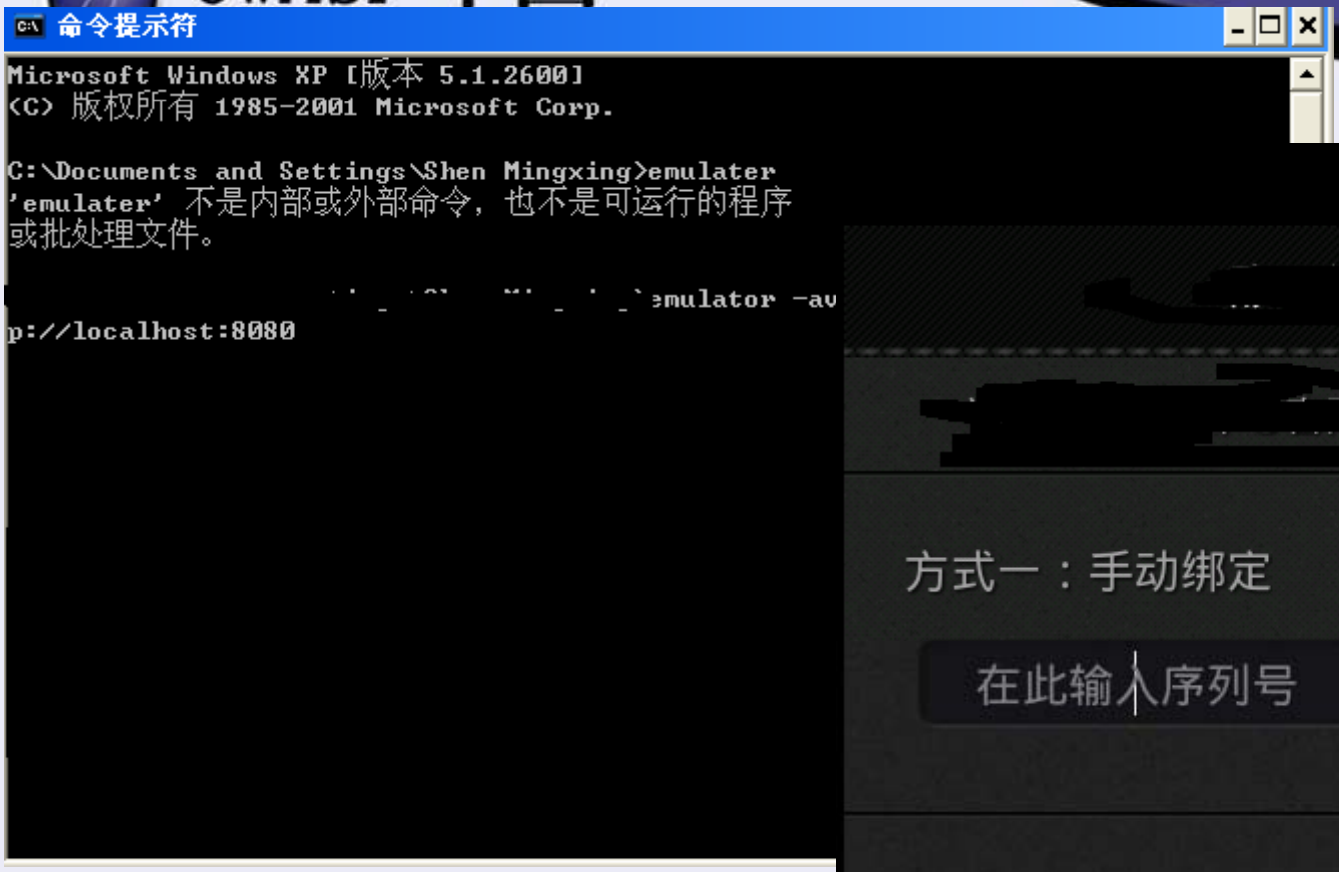

走HTTP的应用– burp zap …

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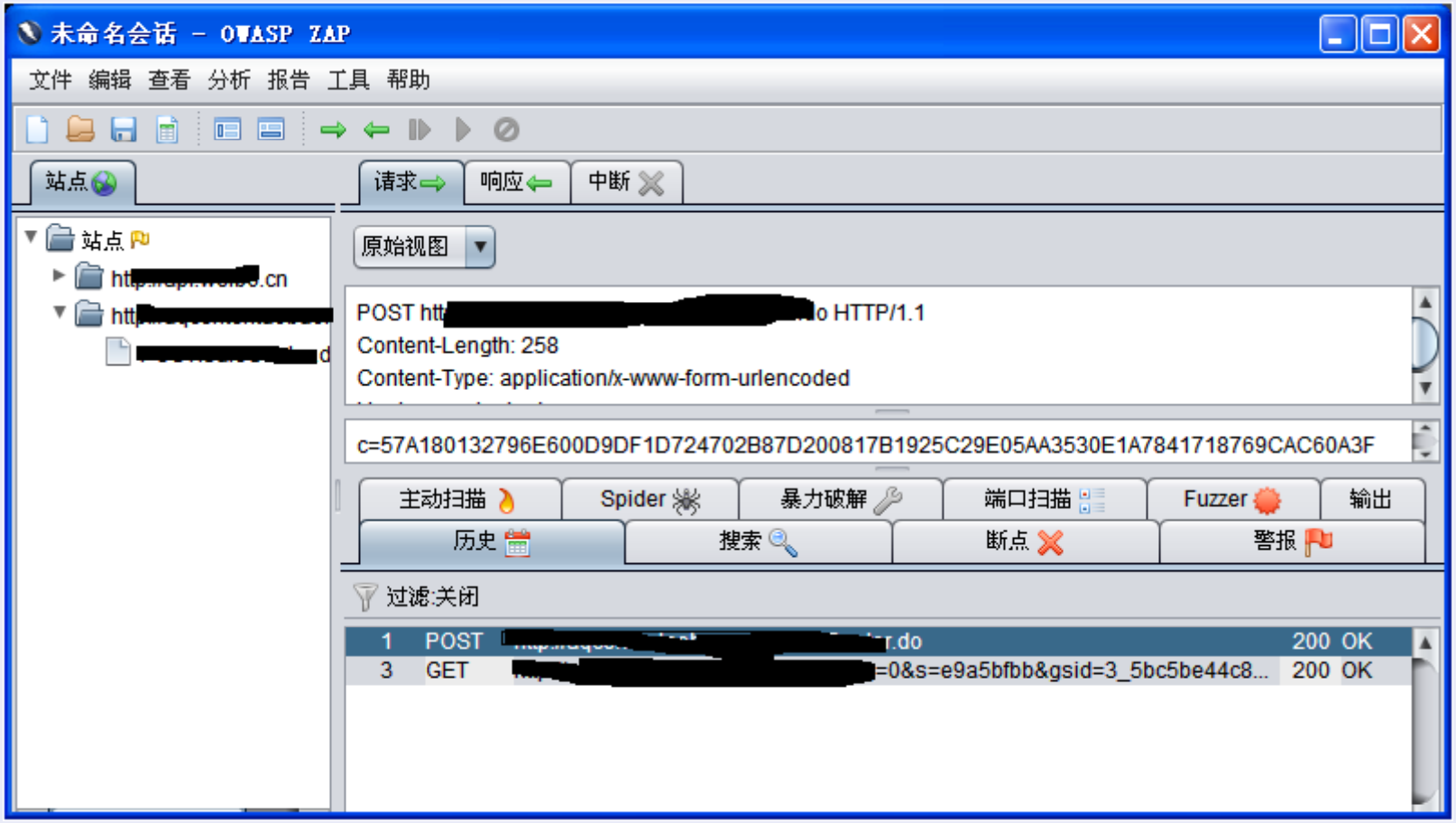

走 Socket的应用 - Mallory

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Mallory

Streams

	Dir	Len	Source	Dest	tatu
0	c2s	37	10.0.0.10:62310	68.229.93.156:26637	U
1	c2s	102	10.0.0.10:62288	128.164.182.1:52976	U
2	c2s	38	10.0.0.10:62359	68.231.246.203:28137	U
3	c2s	58	10.0.0.10:62323	72.218.20.98:25744	S
4	c2s	29	10.0.0.10:62537	70.161.137.216:20134	U
5	c2s	62	10.0.0.10:62473	64.131.188.122:11560	U
6	c2s	35	10.0.0.10:62515	144.118.228.248:34603	U
7	c2s	30	10.0.0.10:62790	70.72.76.23:55019	U
8	c2s	30	10.0.0.10:62789	174.59.121.35:29103	U
9	c2s	30	10.0.0.10:62765	69.143.229.182:22479	U
10	c2s	57	10.0.0.10:62895	109.87.76.182:27477	U
11	c2s	85	10.0.0.10:62898	68.174.69.91:55625	U
12	c2s	56	10.0.0.10:62906	109.86.51.82:36823	U
13	c2s	106	10.0.0.10:62876	87.53.96.68:16652	U

Actions: Intercept Send Drop

Text Hex

Save Hex Changes

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	21	e3	5e	2c	d2	e8	7b	d7	e1	d3	a9	f9	0c	ec	06	46	!.^,..{.....F
2	d8	2f	e8	74	f6	7d	29	fd	9d	1c	34	e3	34	aa	01	bf	./.t.})...4.4...
3	5c	40	3a	ae	a9	11	6c	8b	95	a5	ba	5d	e3	50	60	b3	\@:...l....].P`.
4	42	15	f7	b2	e1	17	11	8c	06	b1							B.....

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Thanks!

Q & A