Deceiving Permissions - Rules for Android Malware Detection

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Session ID: MBS - 210
Session Classification: Advanced

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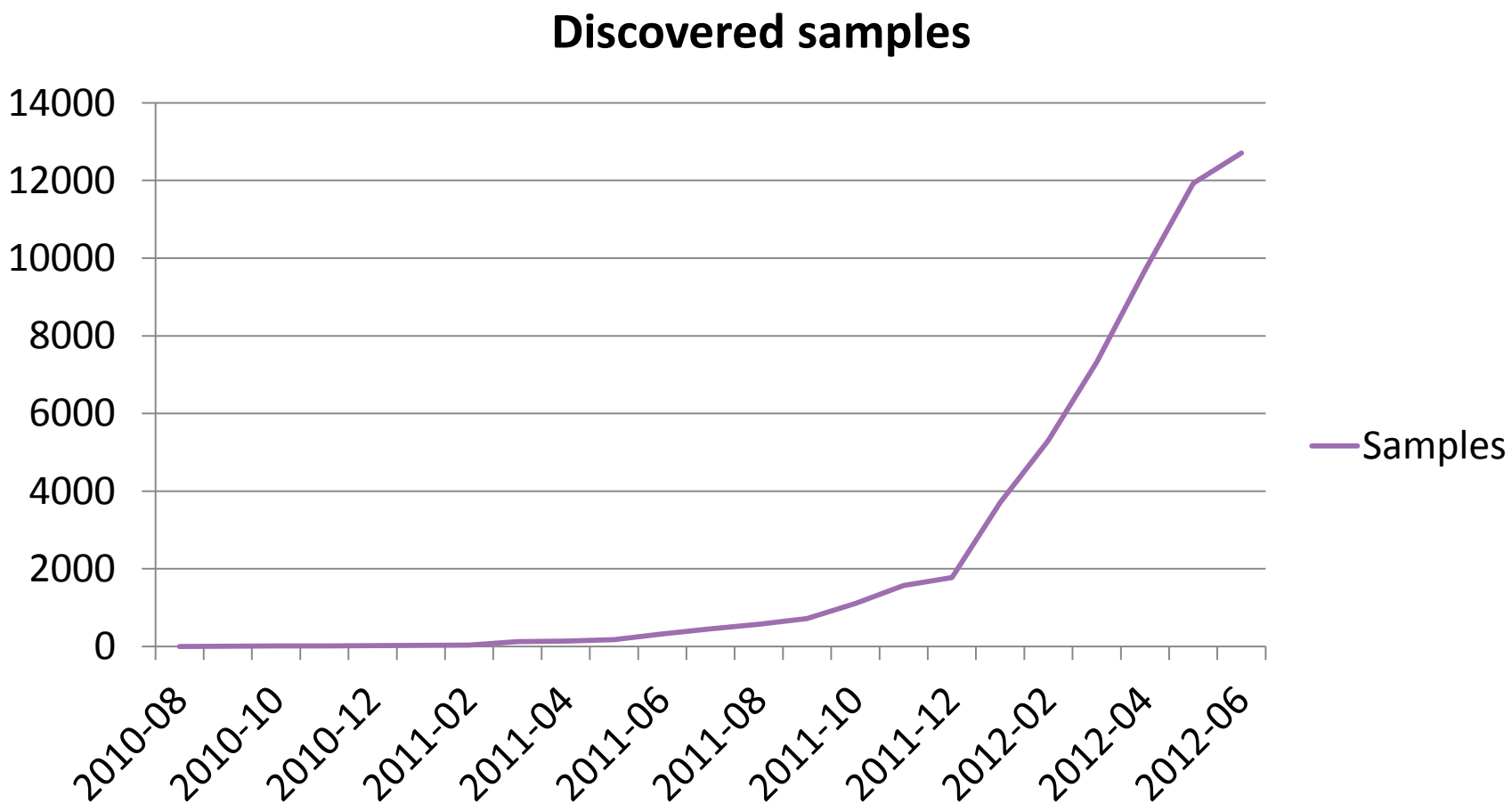
Deceiving Permissions

- Overview and stats
- Finding detection rules
  - Process
  - Tools
  - Results

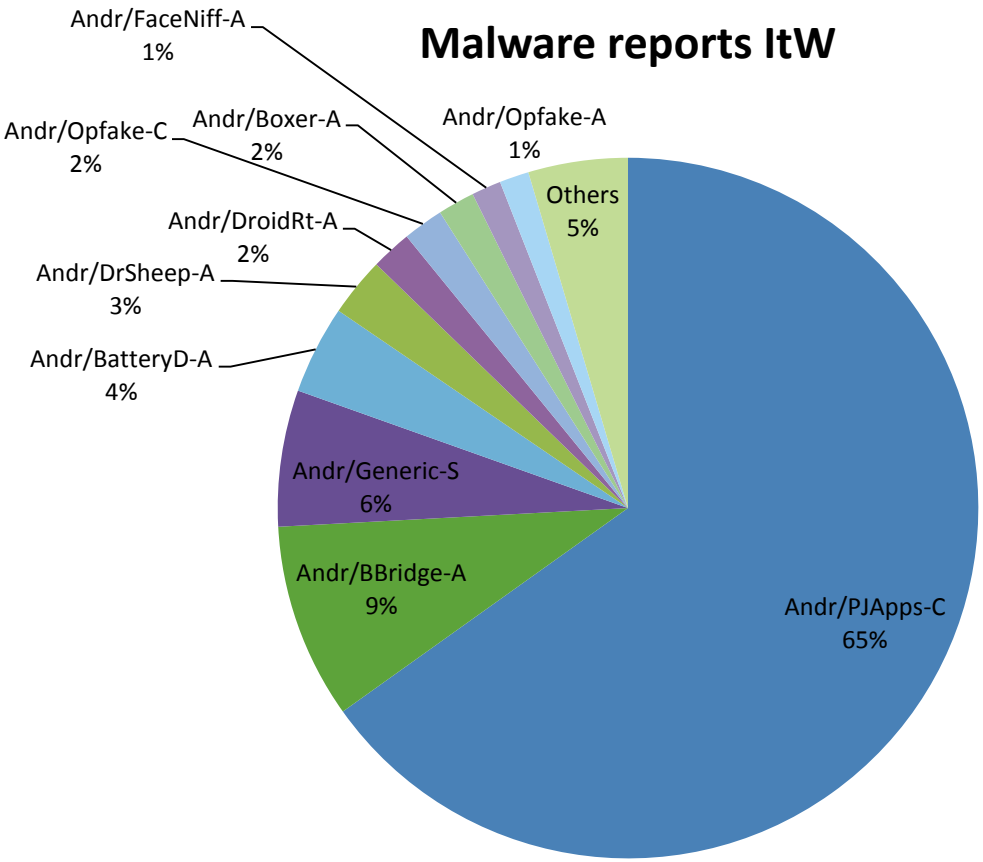
Android malware ecosystem

- Information stealers (Andr/SMSRep)
- SMS senders (Andr/AdSMS)
- Phishing (fake mobile banking software)
- Privilege escalation exploits (DroidDream)
- Zeus for Android (Zitmo)

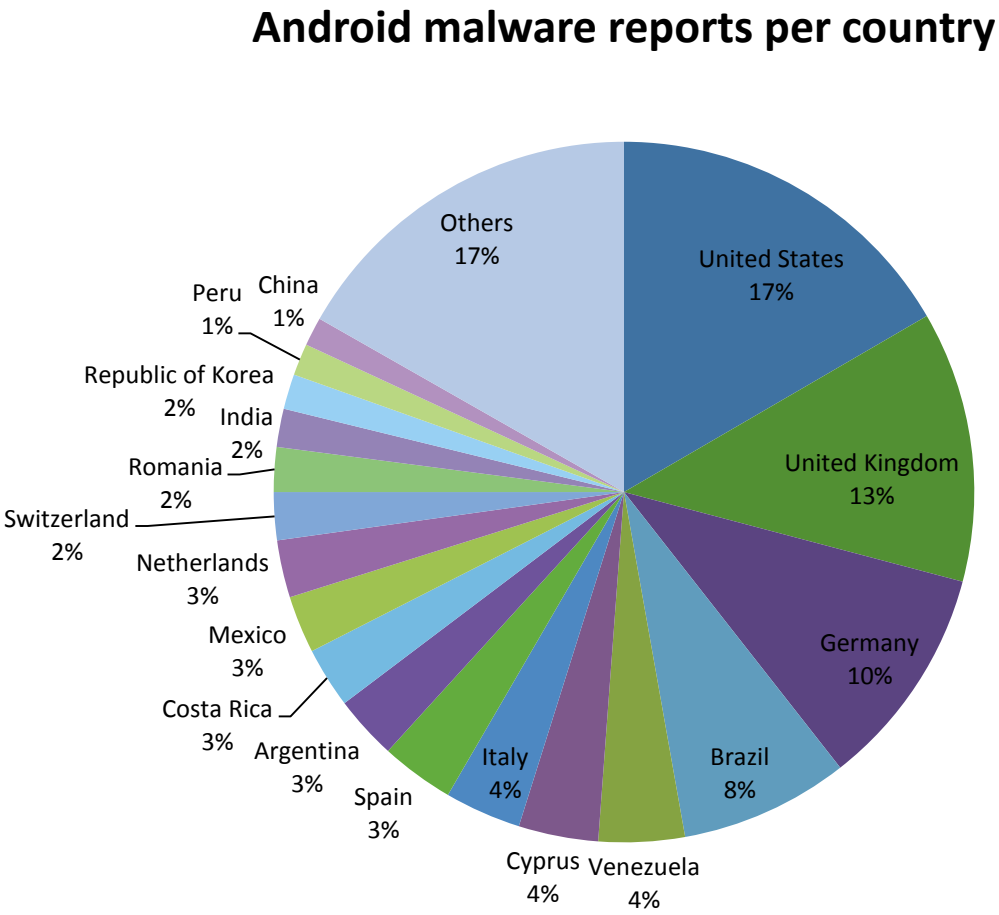
Android Malware



Android malware ItW



Android malware ItW



Andr/Boxer family

Andr/Boxer family

Witness

Andr/Boxer family

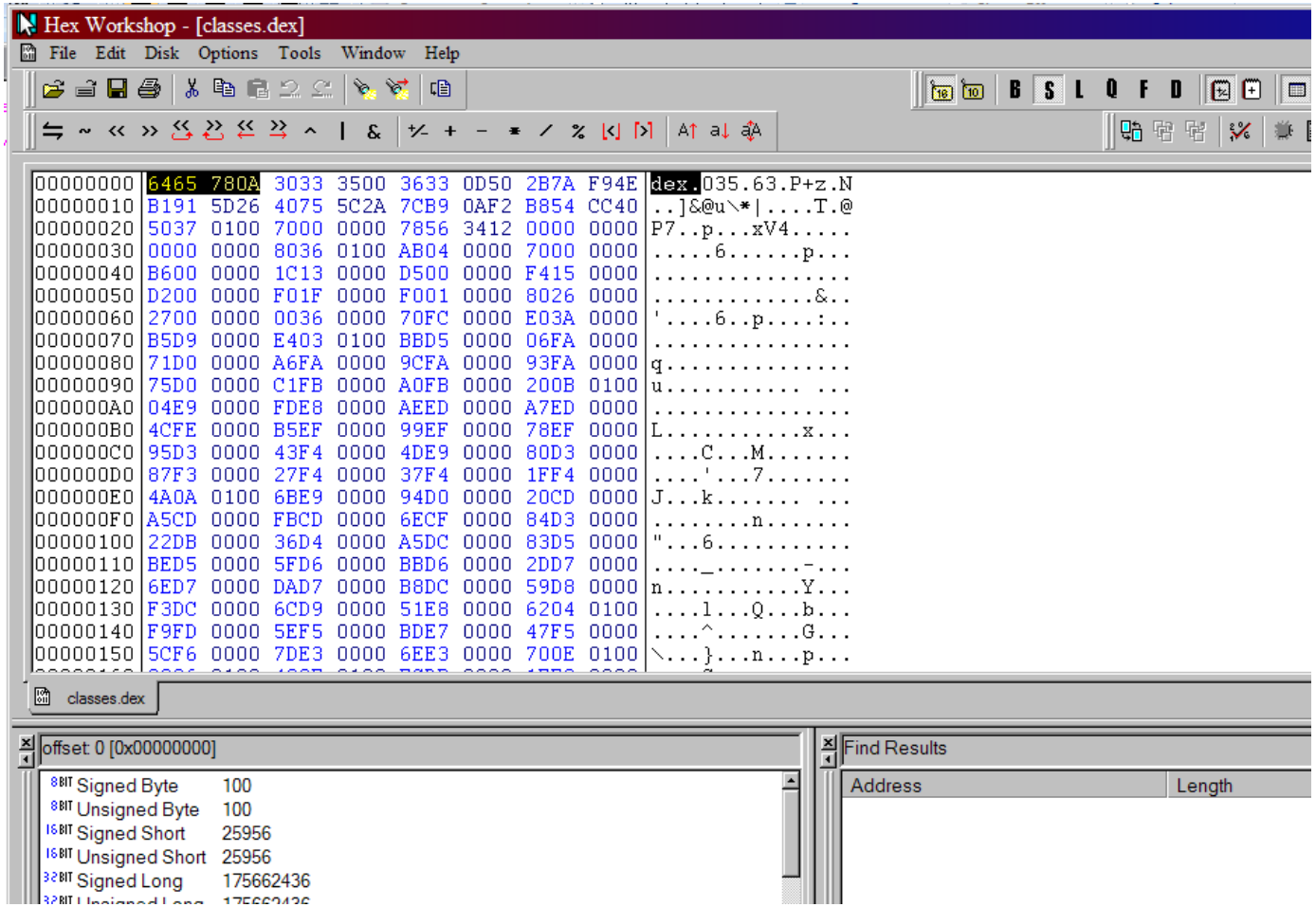
Witness

Android content detection

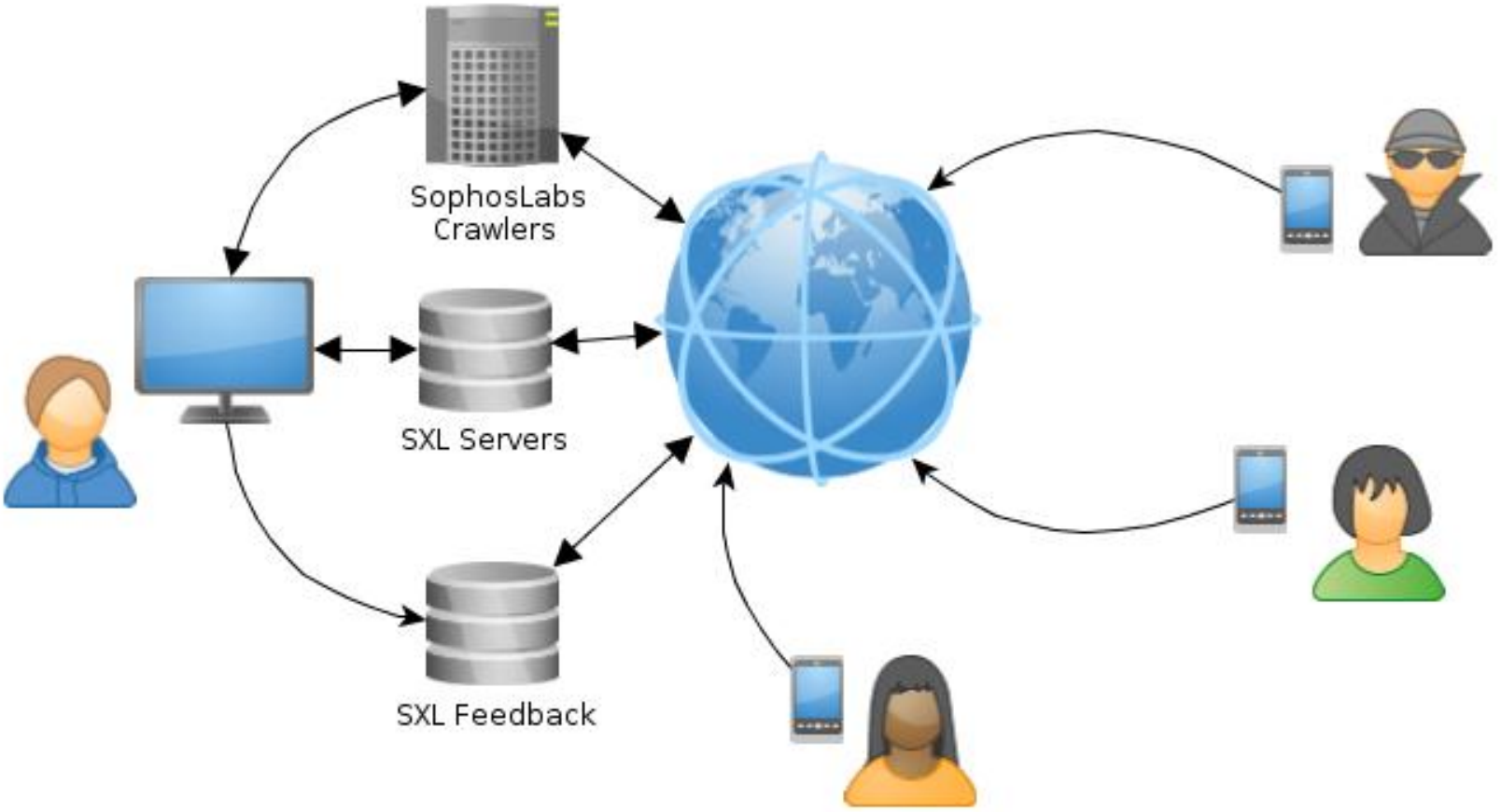
- APK = JAR = ZIP
- Signing mandatory
  - Self-certified certificates norm
- Classes.dex (Dalvik)
- AndroidManifest.xml
- Native ELF files
  - .so (shared objects)
  - command line

DEX format /'dex'0A

Classes.dex



Mobile Security - ecosystem



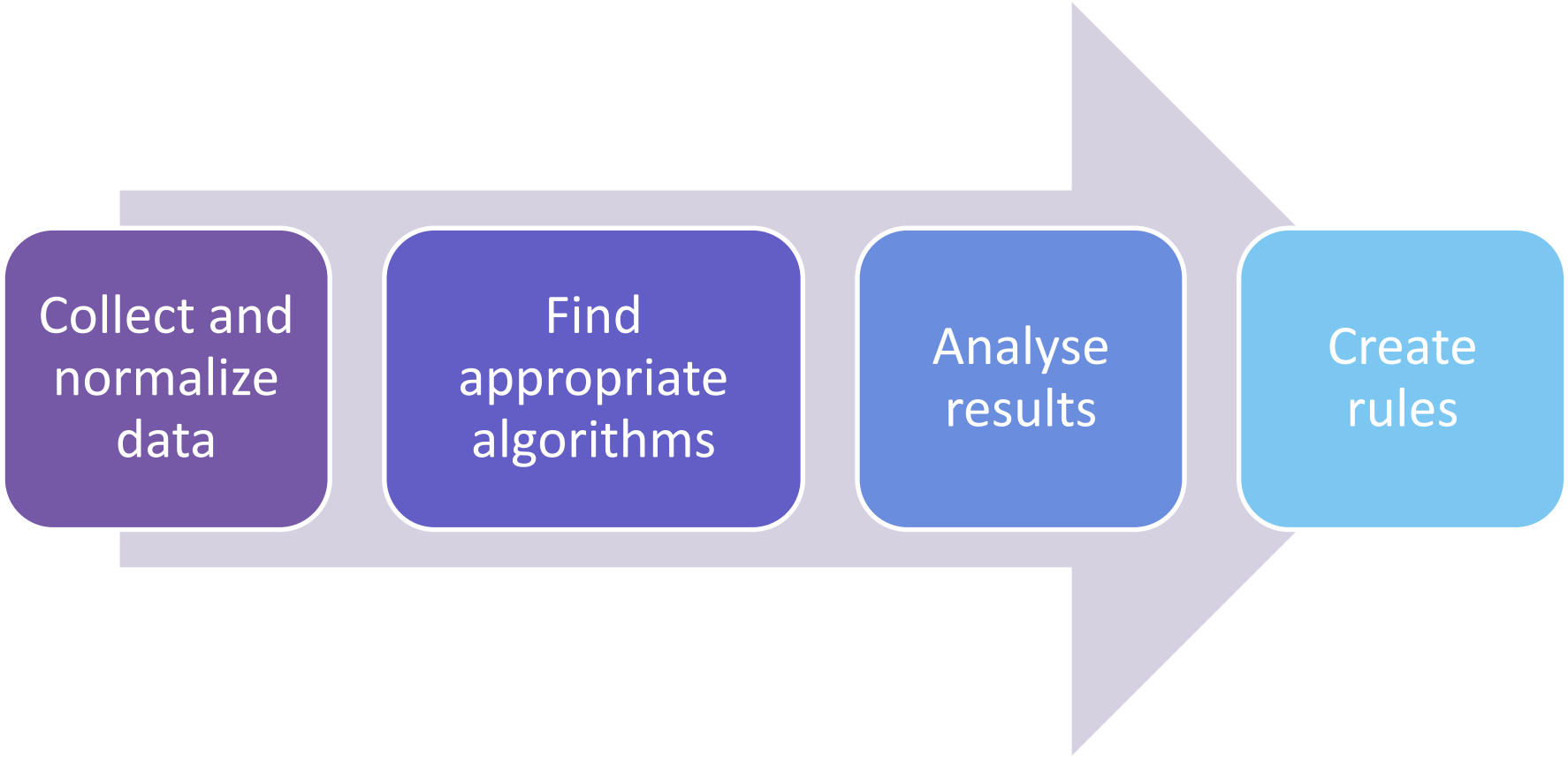
Finding rules

- Cloud lookups
  - Package name
  - Permissions bitmap
  - Certificate information
- Test set 7k APK files

Mining for attributes

- Data mining
  - Classification
  - Clustering
  - Attribute evaluation (125 attributes)
  - Find attribute combinations for suspicious APK detections
  - WEKA toolkit

Data mining process



Data extraction

- Tools
  - Apktool (decode Android manifest)
  - Aapt (permissions)
  - Keytool (certificate information)
  - Dexdump (class names)
  - Perl (for creating ARFF or C4.5 file format)

Classification and clustering

- Classification
  - Decision trees
  - Multilayer perceptron (neural network)
  - PART
  - k-NN
  - Voting
- Clustering
  - k-Means (finding k is a bit tricky)
  - EM

Decision rule example

android.permission.SEND_SMS = true AND

android.permission.AUTHENTICATE_ACCOUNTS = false AND

android.permission.USE_CREDENTIALS = false AND

android.permission.ACCESS_LOCATION_EXTRA_COMMANDS = false AND

android.permission.CHANGE_WIFI_STATE = false AND

android.permission.BLUETOOTH_ADMIN = false AND

android.permission.RECORD_AUDIO = false AND

android.permission.DEVICE_POWER = false AND

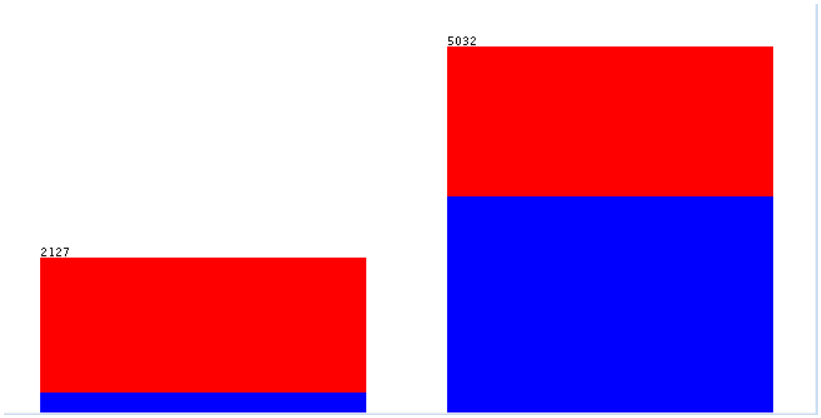
android.permission.CHANGE_NETWORK_STATE = false AND

android.permission.CHANGE_CONFIGURATION = true: malware (974.0)

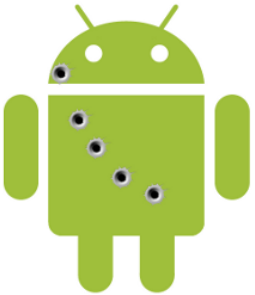
Attributes

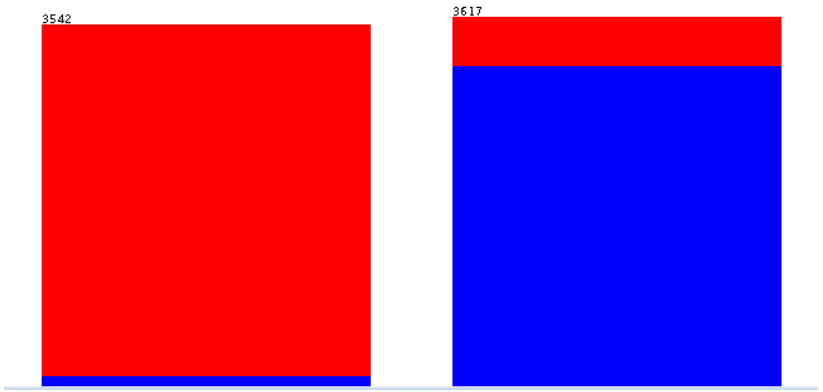
- Attribute evaluation
  - Single
  - Combination

Receive_boot_completed

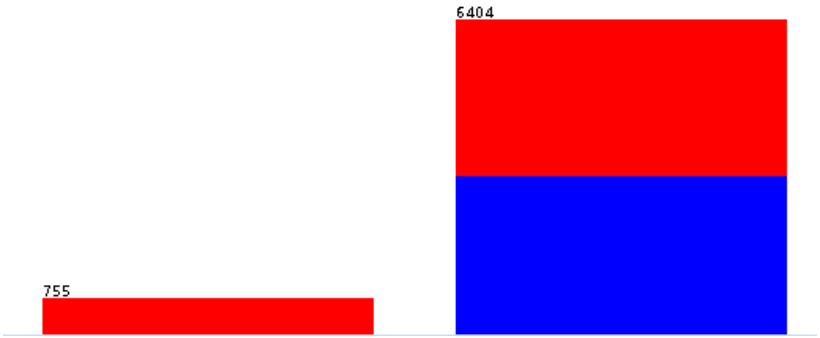


Send_sms





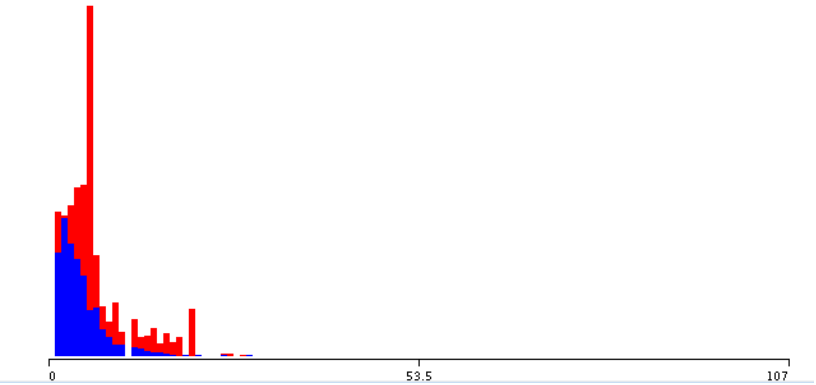
Install_packages



True

False

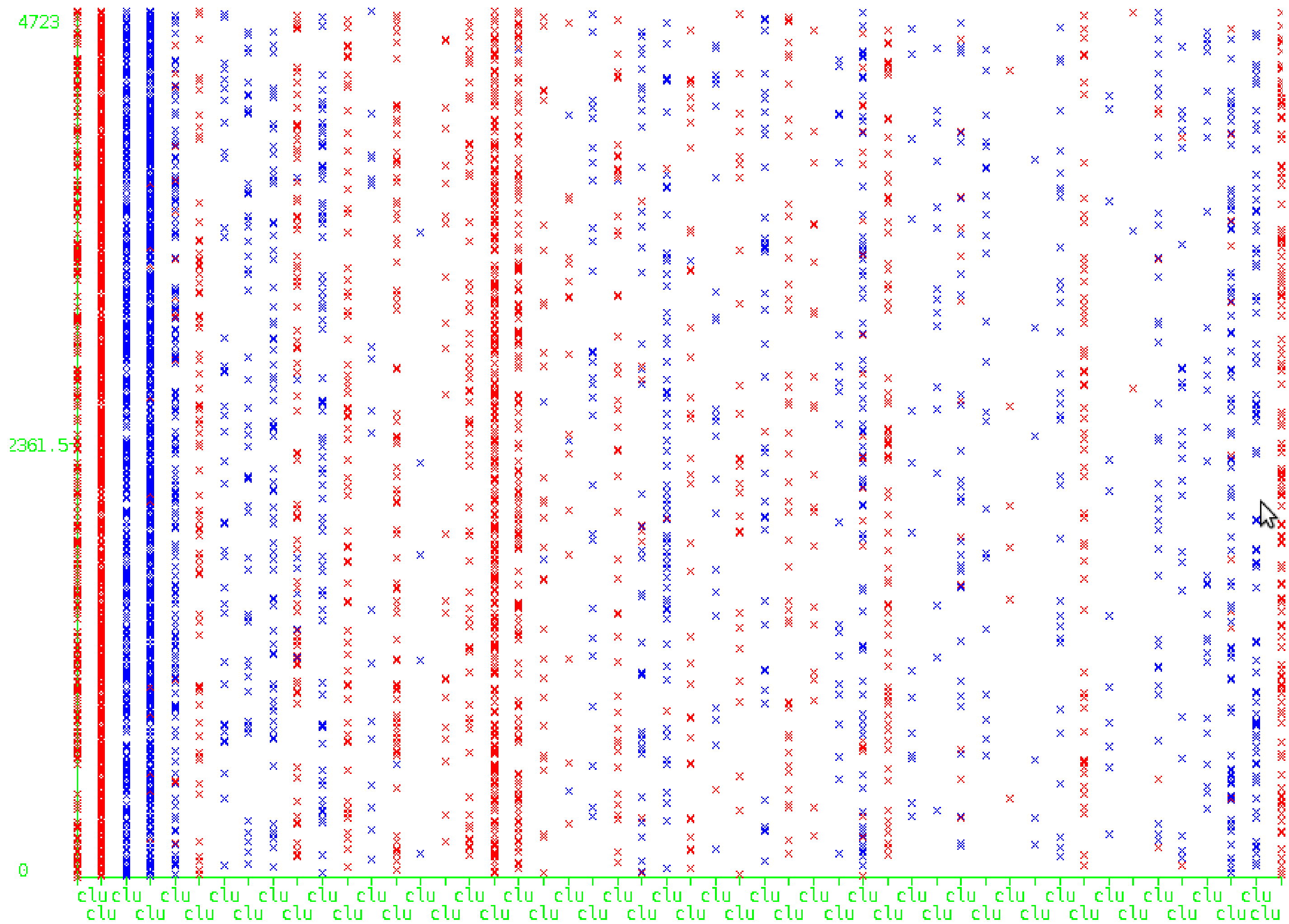
Number of permissions



Top attributes - IG

0.61300345	android.permission.SEND_SMS
0.26650618	permission number
0.25418388	android.permission.RECEIVE_SMS
0.20317289	android.permission.CHANGE_CONFIGURATION
0.14376634	android.permission.RECEIVE_BOOT_COMPLETED
0.13039788	android.permission.READ_PHONE_STATE
0.11595942	android.permission.READ_SMS
0.08563974	android.permission.INSTALL_PACKAGES
0.0616352	android.permission.RECEIVE_WAP_PUSH
0.05807259	android.permission.WRITE_SMS
0.05672391	android.permission.ACCESS_NETWORK_STATE
0.04802936	com.android.browser.permission.READ_HISTORY_BOOKMARKS

Cluster assignments



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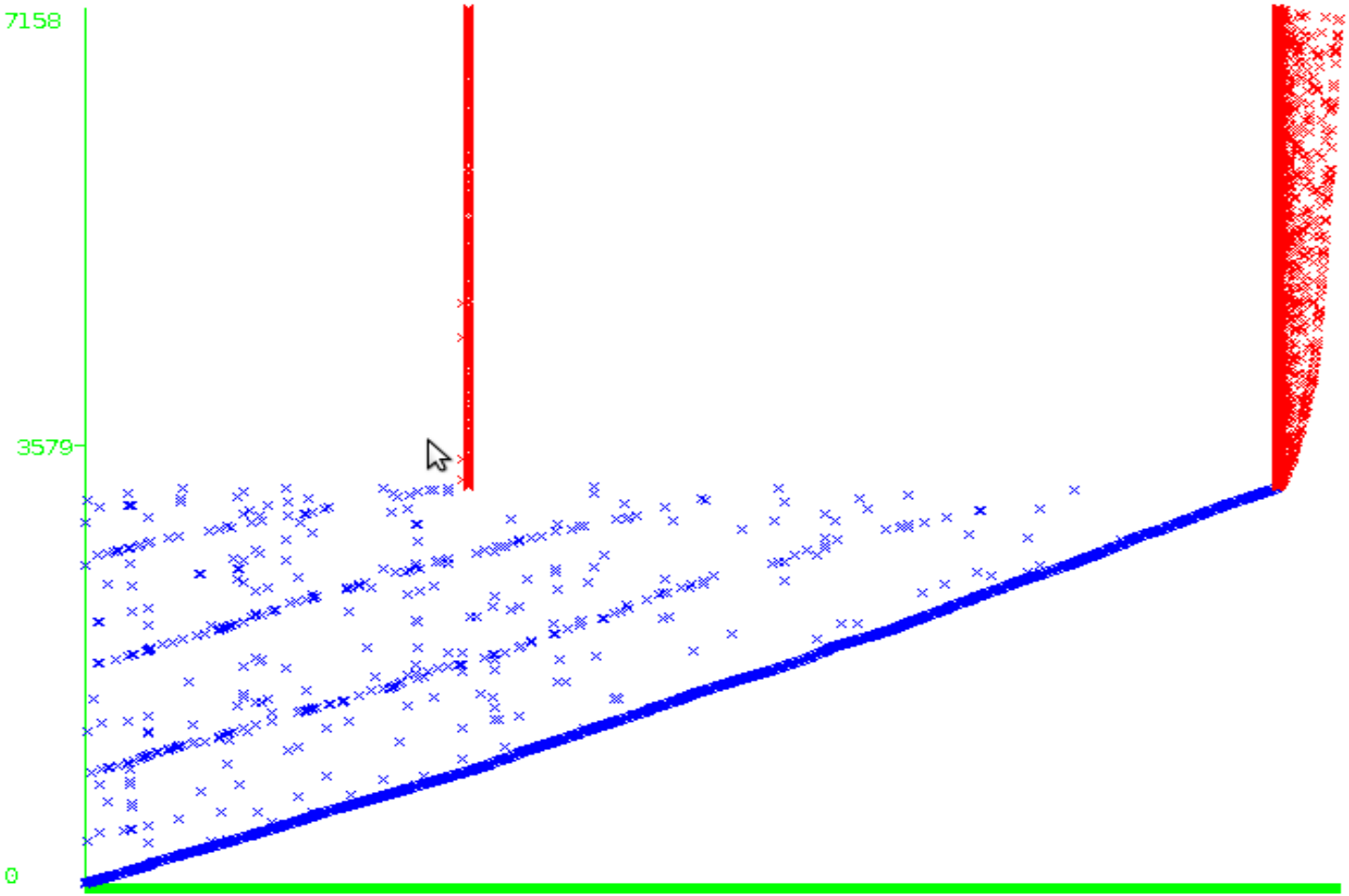
Andr/Boxer-A cluster

Cluster : cluster60
certificate : c67f8fc63e25c1f2d3d3623210d126bc96afee69
package : ru-2emskdev-2eandrinst
android.permission.CHANGE_CONFIGURATION : true
android.permission.INTERNET : true
android.permission.READ_PHONE_STATE : true
android.permission.RECEIVE_BOOT_COMPLETED : true
android.permission.RECEIVE_SMS : true
android.permission.SEND_SMS : true
permnum : 6.0
class : malware

APK certificate clusters



Top certificates

Certsha1	Count	Detected	Possible Certtificate names
38918a453d07199354f8b19af05ec6562ced5788	6036	0	["com.android","com.google"]
24bb24c05e47e0aefa68a58a766179d9b613a600	4354	0	["com.google"]
0eb79878d3551cbe6ecf0e711e688951b44d7337	4312	0	["android.tts","app.batterymonitor","app.batterymonitor2","com.android","com.broadcom"]
61ed377e85d386a8dfee6b864bd85b0bfaa5af81	3754	1995	["au.com","biz.mtoy","chaire1.mm","cmp.netsentry","cn.jingling"]
9ca5170f381919dfe0446fcdab18b19a143b3163	3574	0	["android.tts","com.android","com.broadcom","com.cisco","com.google"]
5cb0136d4f218b1d7a489024972f8aa4720f5e67	1966	1966	["com.depositmobi","com.soft","com.software","com.some","net.install"]
c67f8fc63e25c1f2d3d3623210d126bc96afee69	1487	1487	["com.android","com.bratolubzet","com.maestrodeoid","com.manufacturatinkov","com.satismangroup"]
c3169c61b106efa253f56dfe542392f7bd80ee2d	1476	0	["com.android","com.arcsoft","com.samsung","com.sec","com.smlds"]
66da9177253113474f6b3043b89e0667902cf115	1451	0	["com.rovio"]
b599462d81daaeb2081e6129e75a54ef0aedbf03	1439	0	["com.android","com.hu1","com.samsung","com.sec"]
9741a0f330dc2e8619b76a2597f308c37dbe30a2	1350	0	["com.android","com.arcsoft","com.lifevibes","com.samsung","com.sec"]
184ab55237bb822a4175b62155ff209b822b785e	1193	1193	["ahv7teix.ohshooc8","aichoor9.cai6ood0","aig0.ohdu","android.app","cai7real.mah5lure"]
8a3c4b262d721acd49a4bf97d5213199c86fa2b9	1163	0	["com.facebook"]
330df1d4f77968c397ff53d444089bb46dc330f1	1111	0	["com.android","com.sonyericsson","com.svox"]
69726e79fdb776e41111cb4b99e3b6a9d1abec3c	1033	0	["com.android","com.htc","com.rosedata","com.sdgtl","com.svox"]
d5ca82cbddd3985279b074ea53ba9a30688935be	972	0	["com.adobe"]
59a3683b5b6101178204a75b90fea6098229c844	910	0	["com.android","com.htc"]
ba141746d704b96ed4dbc24d02d44bb2a3908512	906	0	["com.android","com.hu1","com.samsung","com.sec","om.samsung"]
5f206863fdfd884ee45873b7688828880d221301	893	0	["com.glu"]
80d0156e14efa9b2be949acc1791720cc58cb6e3	870	0	["android.tts","com.android","com.aricent","com.google","com.sonyericsson"]

Conclusion

- Android malware numbers exponentially increasing
- Increased complexity (obfuscation, polymorphism)
- Single permissions and combinations are (not) good alone
- Certificate reputation significant
- More attributes to be added in future research