The Inner Workings of Mobile Cross-Platform Technologies

BLACK HAT ASIA
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ME?

Simon Roses Femerling

- Founder & CEO, VULNEX www.vulnex.com
- Blog: www.simonroses.com
-  @simonroses | @vulnexsl
- Former Microsoft, PwC, @Stake
- DARPA Cyber Fast Track award on software security project
- Black Hat, RSA, OWASP, SOURCE, AppSec, DeepSec, TECHNET

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TALK OBJECTIVES

- Existing mobile cross-platform tech
- Better or worst security?
- How and what to audit

AGENDA

1. Too Many Platforms
2. Cross-Platform Technologies
3. Auditing Apps
4. Conclusions

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1. Too Many Platforms

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1. MOBILE PLATFORM MADNESS

LEADERS	CONTENDERS
iOS, Android	BlackBerry, Windows Phone, Tizen, Firefox OS, Sailfish

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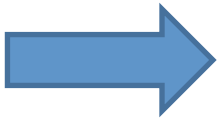
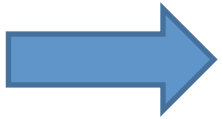
1. TRADITIONAL VS. CROSS-PLATFORM DEVELOPMENT



JAVA / XML



Objective-C

vs.

Cross-Platform	Dev Language	ANDROID	iPHONE	WINDOWS PHONE
Ximian (Mono)	.NET	YES	YES	YES
Corona SDK	LUA	YES	YES	
PhoneGap	HTML / CSS / JavaScript	YES	YES	YES
RhoMobile	JavaScript / HTML / CSS / Ruby	YES	YES	YES

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1. EXPANDING TOOLKIT

TRADITIONAL

- apktool
- Dex2jar
- JD-GUI
- IDA PRO
- Debugger

NEW

- .NET decompiler / disassemblers
- Ruby decompiler / disassemblers
- JavaScript static analysis
- Custom tools (parse smali and extract info)

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2. Cross-Platform Technologies

2. WE WILL EXPLORE

- Basic4android: http://www.basic4ppc.com/
- PhoneGap: http://phonegap.com/
- Corona SDK: http://coronalabs.com/
- RhoMobile: http://www.motorolasolutions.com/US-EN/Business+Product+and+Services/Software+and+Applications/RhoMobile+Suite
- MonoDroid: http://xamarin.com/android
- MonoTouch: http://xamarin.com/ios

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2. BASIC4ANDROID

- Writes Android & Desktop apps using BASIC
- Code gets translated from BASIC to Java, so no dependencies / native code
- Includes 33 Java libraries

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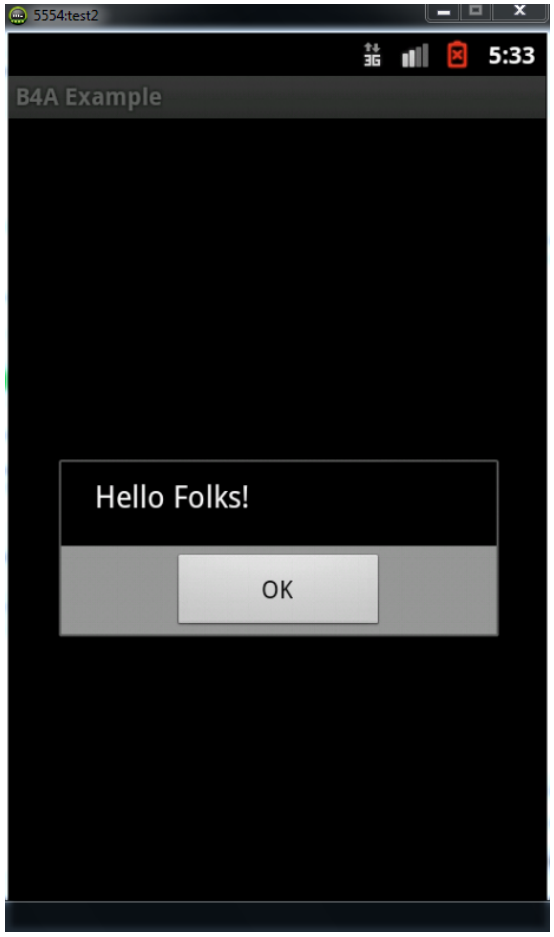
2. BASIC4ANDROID: EXAMPLE

```
Sub Activity_Create(FirstTime As Boolean)
    Msgbox("Hello Folks!", "")
End Sub
```

```
public static String _activity_create(boolean paramBoolean)
  throws Exception
{
  Common.Msgbox("Hello Folks!", "", mostCurrent.activityBA);
  return "";
}
```



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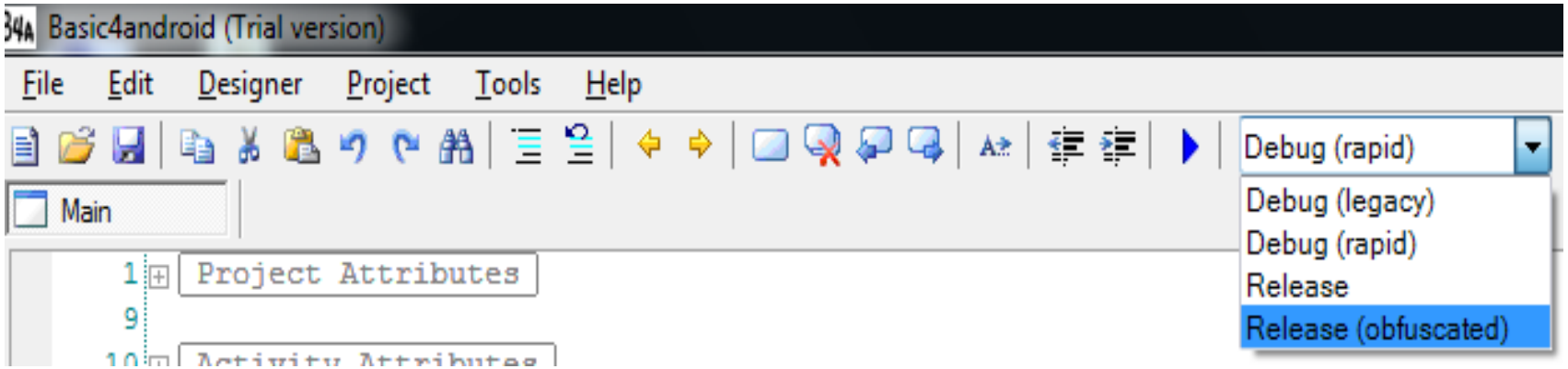
2. BASIC4ANDROID: PERMISSIONS DEFAULT

- By default 4 permissions:
  - android.permission.INTERNET
  - android.permission.BLUETOOTH
  - android.permission.WRITE_EXTERNAL_STORAGE
  - android.permission.BLUETOOTH_ADMIN

2. BASIC4ANDROID: KUDOS, OBFUSCATION



- Strings obfuscation
- Variables renaming

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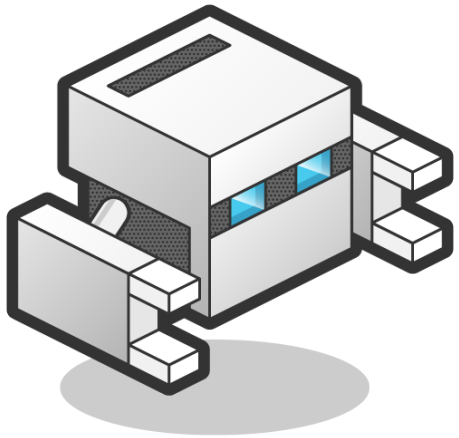
2. PHONEGAP

- Writes Apps using HTML / CSS & JavaScript
- Platforms: iOS, Android, Windows, Blackberry, bada, webOS
- Many Apps!



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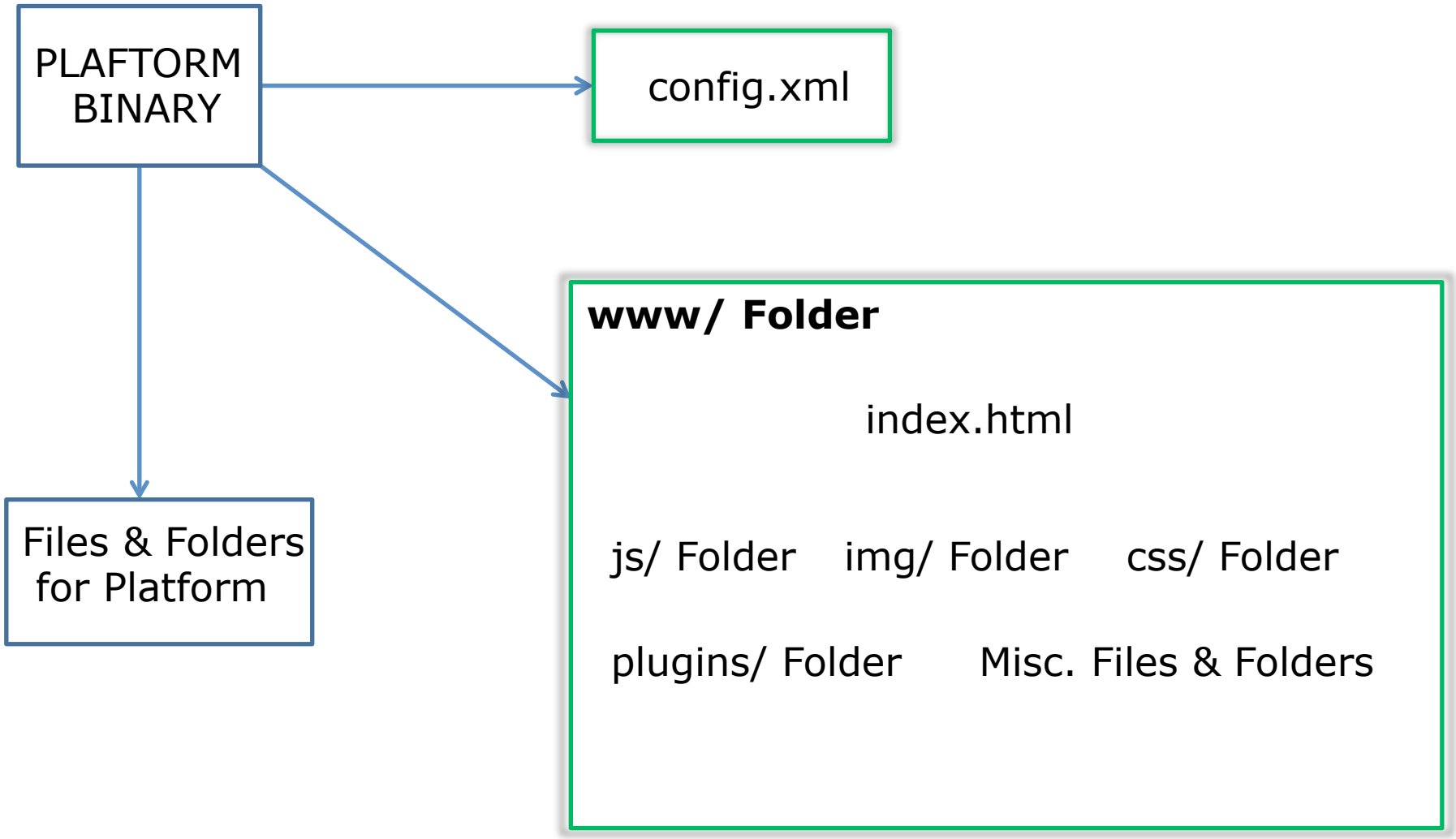
2. PHONEGAP APP STRUCTURE



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2. PHONEGAP: ASK FOR PERMISSIONS & YOU SHALL RECEIVE

- android.permission.VIBRATE
- android.permission.ACCESS_COARSE_LOCATION
- android.permission.ACCESS_FINE_LOCATION
- android.permission.ACCESS_LOCATION_EXTRA_COMMANDS
- android.permission.READ_PHONE_STATE
- android.permission.INTERNET
- android.permission.RECEIVE_SMS
- android.permission.RECORD_AUDIO
- android.permission.MODIFY_AUDIO_SETTINGS
- android.permission.READ_CONTACTS
- android.permission.WRITE_CONTACTS
- android.permission.WRITE_EXTERNAL_STORAGE
- android.permission.ACCESS_NETWORK_STATE
- android.permission.GET_ACCOUNTS
- android.permission.BROADCAST_STICKY

2. CORONA SDK

- Writes Apps using LUA
- Platforms: iOS, Android, Kindle Fire & NOOK
- Mostly games!

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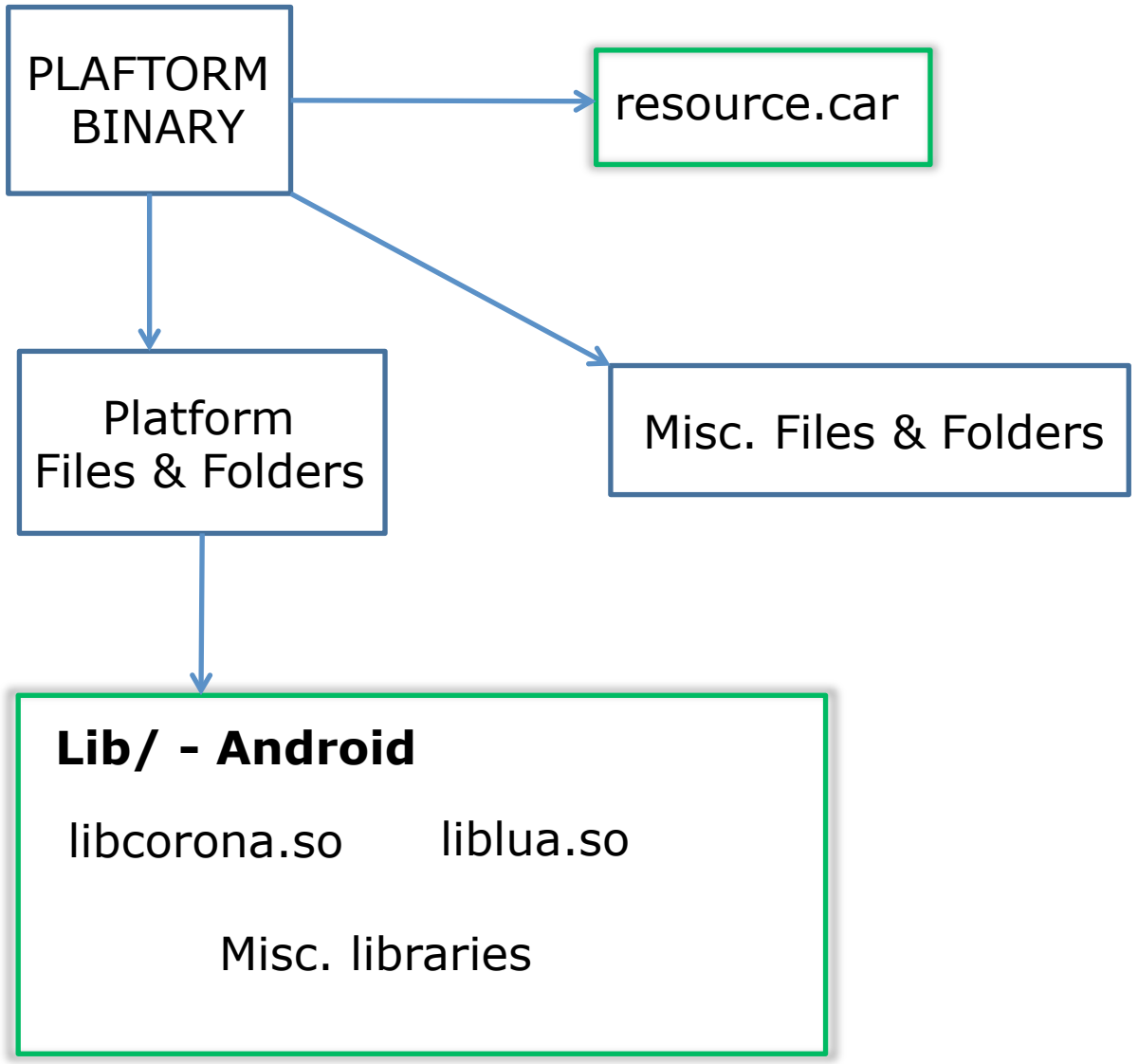
2. CORONA SDK APP STRUCTURE



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2. CORONA SDK DEFAULT PERMISSIONS

- It’s a start!
  - android.permission.INTERNET

2. RHOMOBILE

- Writes Apps using Ruby & HTML / JS / CSS
- Platforms: iOS, Android, Windows Phone and Windows Desktop
- Limited set of Apps but improving

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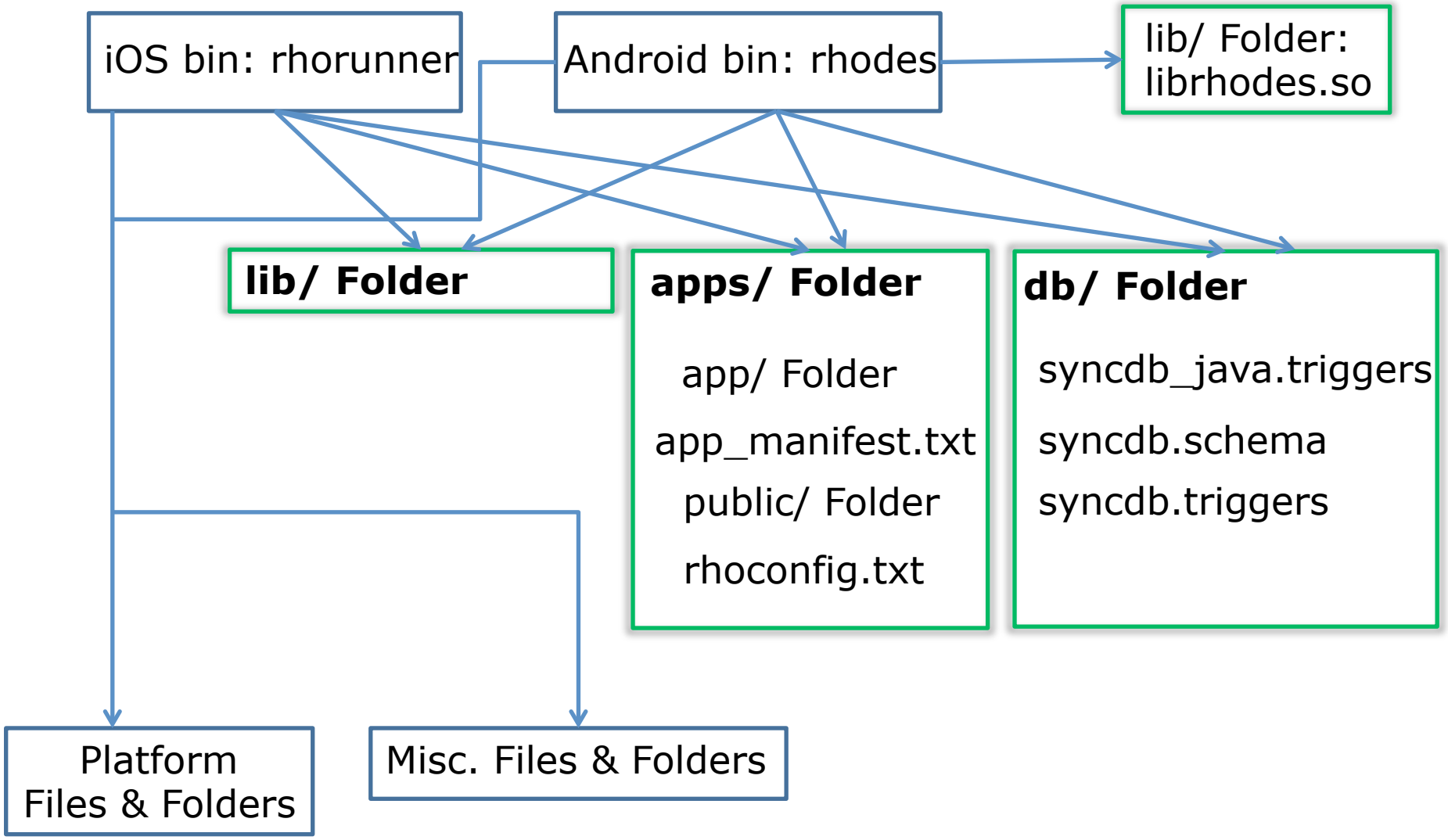
2. RHOMOBILE APP STRUCTURE



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2. RHOMOBILE SECURITY

- Developers must declare permissions (11 perms available)
- Security Token: restricts access to App
- JavaScript & CSS Obfuscation

2. MONODROID

- Writes Apps using C# and .NET (Android)
- Platforms: iOS, Android, Windows Phone & MacOS
- Becoming popular

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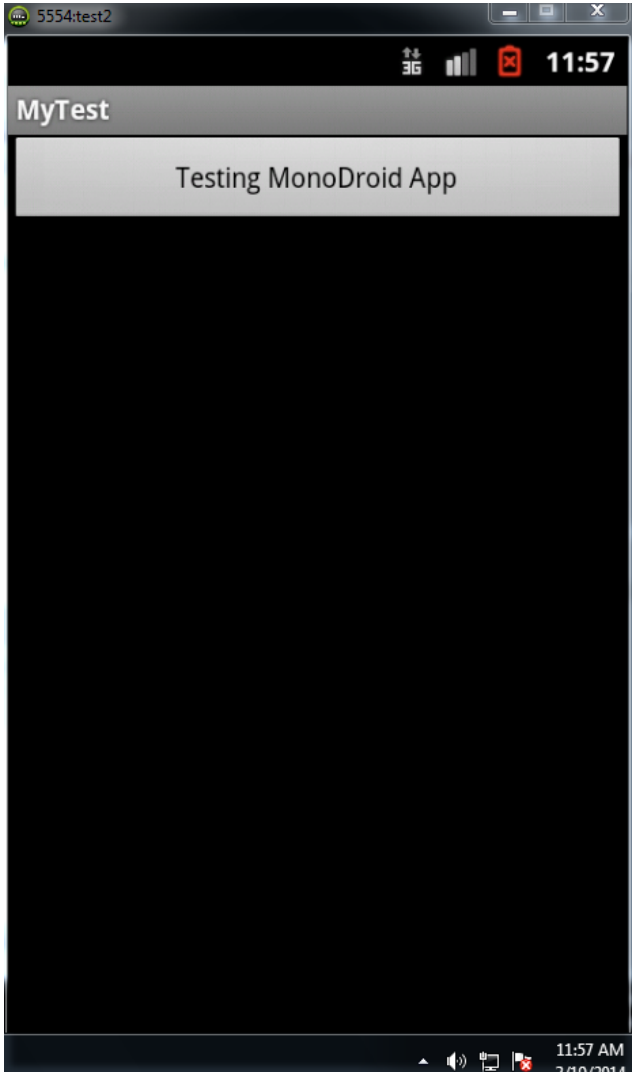
2. MONODROID EXAMPLE

```
using System;
using Android.App;
using Android.Content;
using Android.Runtime;
using Android.Views;
using Android.Widget;
using Android.OS;

namespace MyTest
{
    [Activity (Label = "MyTest", MainLauncher = true)]
    public class MainActivity : Activity
    {
        int count = 1;

        protected override void OnCreate (Bundle bundle)
        {
            base.OnCreate (bundle);

            // Set our view from the "main" layout resource
            SetContentView (Resource.Layout.Main);

            // Get our button from the layout resource,
            // and attach an event to it
            Button button = FindViewById<Button> (Resource.Id.myButton);

            button.Click += delegate {
                button.Text = string.Format ("{0} clicks!", count++);
            };
        }
    }
}
```



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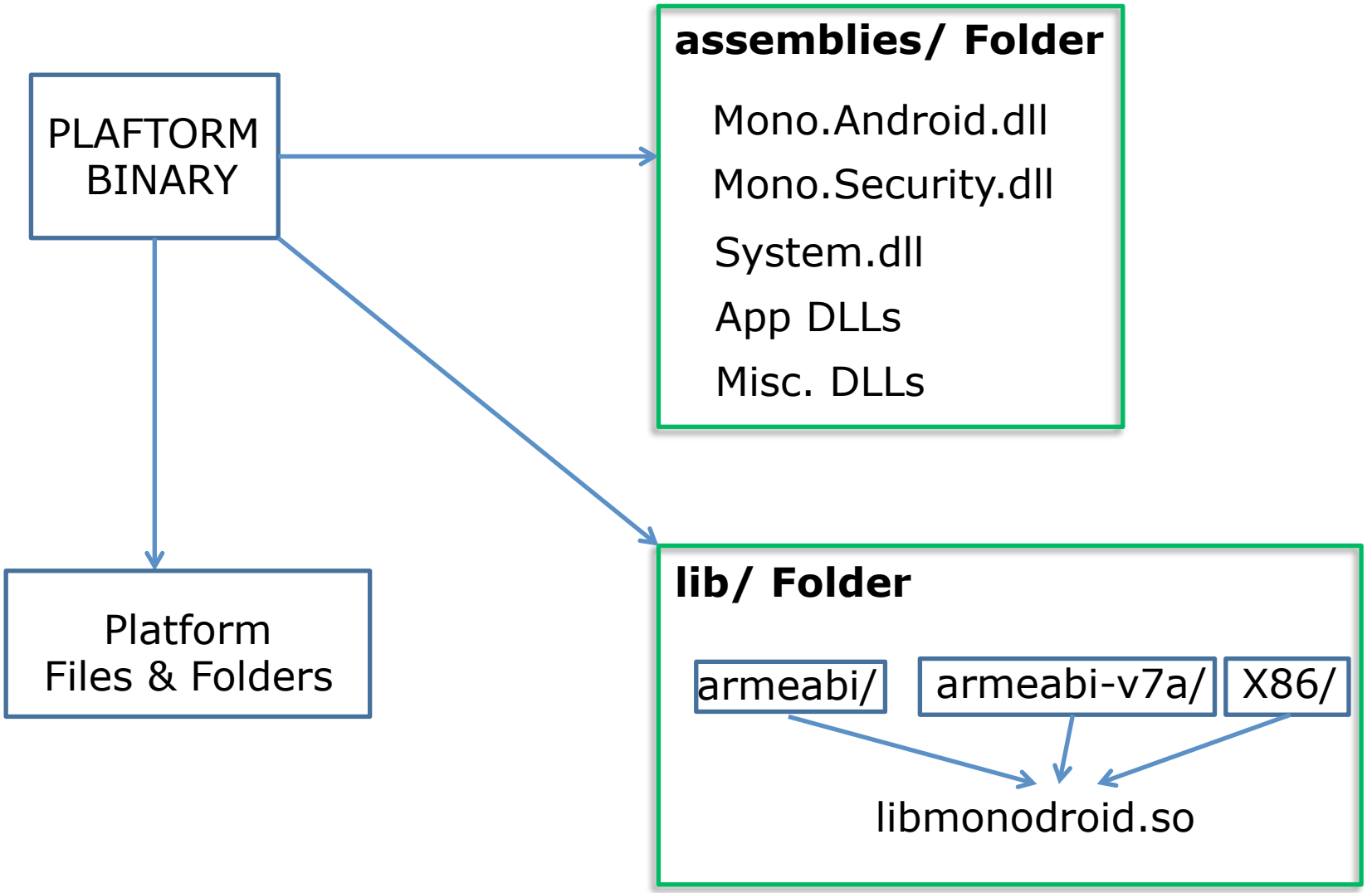
2. MONODROID APP STRUCTURE



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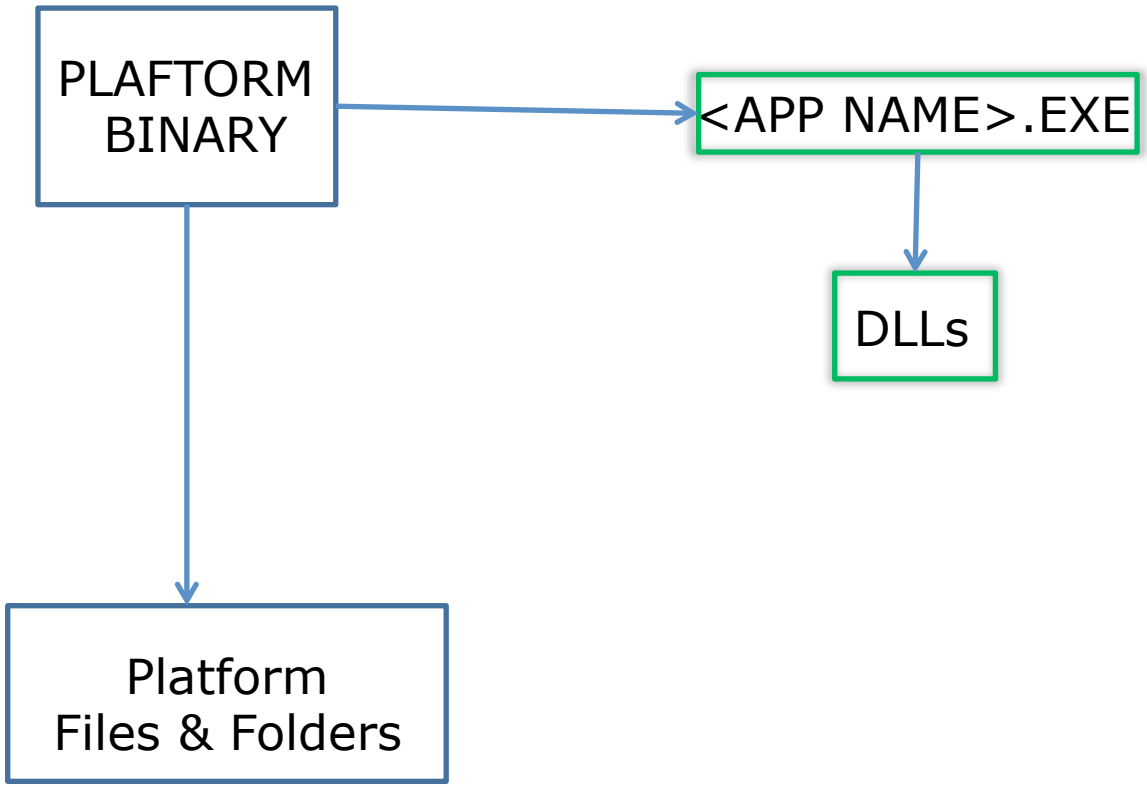
2. MONOTOUCH

- Writes Apps using C# and .NET (iOS)
- Platforms: iOS, Android, Windows Phone & MacOS
- Same as MonoDroid

2. MONOTOUCH APP STRUCTURE



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3. Auditing Apps

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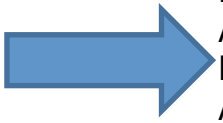
3. FINGERPRINT BASIC4ANDROID

- Apktool or unzip apk
  - Search Folder: “anywheresoftware”
- All b4a Apps contain this folder

3. BASIC4ANDROID REVERSING

- If App was published in debug mode, we can recover BASIC code!

```
.method public static _activity_create(Z)Ljava/lang/String;
    …

    .line 226
    const/16 v0, 0x18

    sput v0, Lanywheresoftware/b4a/BA;->debugLineNum:I

    const-string v0, "Sub Activity_Create(FirstTime As Boolean)"

    sput-object v0, Lanywheresoftware/b4a/BA;->debugLine:Ljava/lang/String;

    .line 227
    const/high16 v0, 0x80

    invoke-static {v0}, Lanywheresoftware/b4a/debug/Debug;->ShouldStop(I)V

    .line 228
    const/16 v0, 0x19

    sput v0, Lanywheresoftware/b4a/BA;->debugLineNum:I

    const-string v0, "If fbLogin.AccessToken = \"\" Then"

    sput-object v0, Lanywheresoftware/b4a/BA;->debugLine:Ljava/lang/String;

    .line 229
    const/high16 v0, 0x100
```



```
Sub Activity_Create(FirstTime As Boolean)
        If fbLogin.AccessToken = \"\" Then
        StartActivity(fbLogin)
        Activity.Color = Colors.RGB(40,40,40)
        lstHeader.SingleLineLayout.Label.TextColor
        = Colors.RGB(230,230,230)
        lstHeader.Color = Colors.RGB(40,40,40)
        lstHeader.Enabled = False"
        Activity.AddView(lstHeader,0,0,100%x,50dip)
        lblLine.Color = Colors.RGB(47,134,165)"
        Activity.AddView(lblLine,0,50dip,100%x,3)
        If File.Exists(File.DirDefaultExternal,\"date.txt\") Then
```

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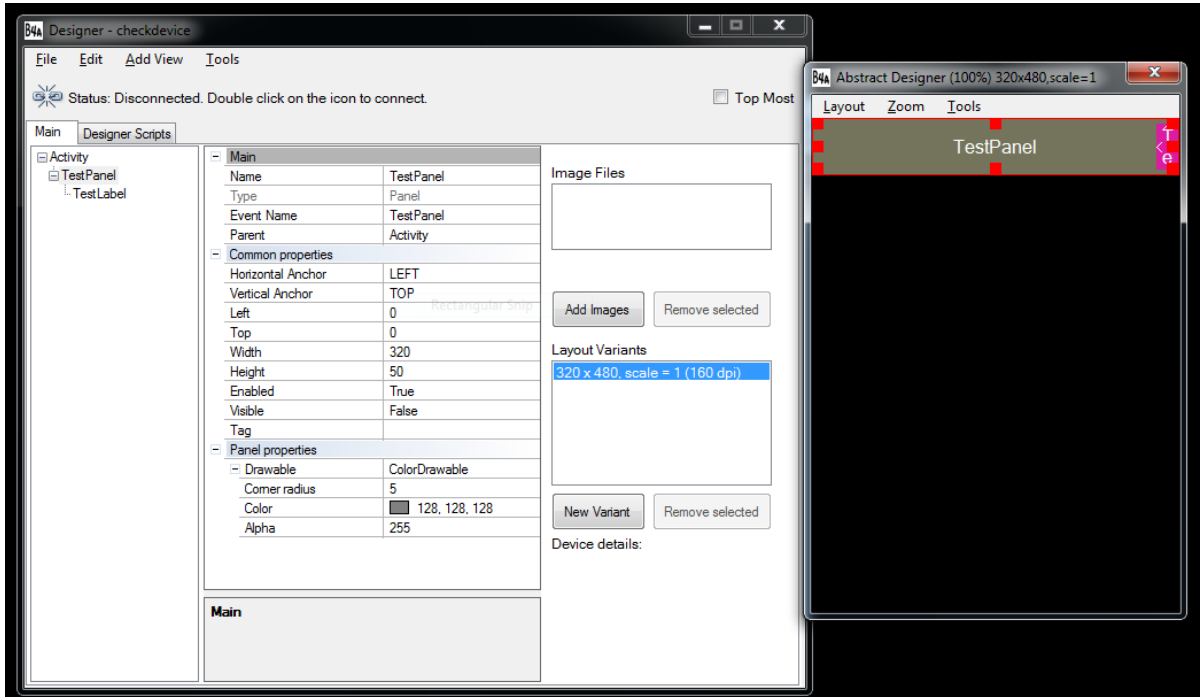
3. BASIC4ANDROID BAL FILES

- BAL files contain UI elements

- Open then in b4a designer



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3. FINGERPRINT PHONEGAP

- Look for www/ folder
- All app code is HTML & JavaScript ☺

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3. PHONEGAP REVIEW

- What permissions?
- Config.xml
  - What plugins are being used?
  - <access origin="*" /> ¿?
- JavaScript code
  - Sensitive information?
  - Use of Eval()
  - Cross Site Scripting is back: WebView, Plugins, etc.
  - Use of clear text channels?
- PhoneGap Security Wiki: https://github.com/phonegap/phonegap/wiki/Platform-Security

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3. FINGERPRINT CORONA SDK

- File: resource.car

- Lib/ Folder:
  - liblua.so
  - Libcorona.so

3. FINGERPRINT RHOMOBILE

- iOS
  - File: rhorunner
  - Apps/ folder:
    - rhoconfig.txt file
    - Folders: app, lib and public
  - Lib/ folder:
    - Files *.iseq
- Android
  - Lib/ Folder:
    - Librhodes.so
  - Apps/ folder:
    - rhoconfig.txt file
    - Folders: app and public

3. RHOMOBILE RHOCONFIG.TXT

```
# startup page for your application
start_path = '/app'

# path to the options page (in this case handled by javascript)
options_path = '/app/Settings'

# location of bundle url (i.e. from rhohub.com); used by desktop win32 simulator
rhobundle_zip_url = ''

# optional password to access bundle (usually not required); used by desktop win32 simulator
rhobundle_zip_pwd = nil

# Rhodes log properties
# log level
# 0-trace, 1-info(app level), 2-warnings, 3-errors
# for production set to 3
MinSeverity  = 1

# enable copy log messages to standard output, useful for debugging
LogToOutput = 1

# '*' means all categories, otherwise list them : Cat1, Cat2
LogCategories = *

# what categories to exclude
ExcludeLogCategories =

# max log file size in Bytes, set 0 to unlimited size; when limit is reached, log wraps to beginning of file
MaxLogFileSize=50000
```

- App start page
- Any passwords?
- Is HTTP Server for debugging enabled?
- Where are logs going?
- Any URLs ?

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3. FINGERPRINT MONODROID & MONOTOUCH

- iOS
  - <App Name>.exe
  - Mono DLLs
  - Xamarin DLLs
  - App DLLs

- Android
  - lib/ folder
    - (armeabi, armeabe-v7a, x86) folders
      - libmonodroid.so
  - assemblies folder
    - Mono DLLs
    - Xamarin DLLs
    - App DLLs

3. NOTHING LIKE THE WTF LOG

```
using ...
namespace Hyena
{
    public enum LogPriority
    {
        Verbose,
        Debug,
        Info,
        Warning,
        Error,
        Assert,
        Wtf
    }
}
```

- Save to disk error msg in JSON format

  or

- Sends error msg to server using HTTP

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3. NO OBFUSCATION!!

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3. USUAL SUSPECTS!

- Clear Text Communication (OWASP M3)
- Weak Crypto (OWASP M6)
- Use of insecure 3 party libs: HELLO VULNA!
- Sensitive info to SD (OWASP M2)
- App Logic exposed
- Insecure passwords (OWASP M2)
- JavaScript Injection (OWASP M7)
- Sensitive info in config files (OWASP M2)

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3. WHERE TO LOOK FOR BUGS

- Native code
  - app
  - libraries
- Cross-Platform App
  - app
  - libraries
  - config files

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4. Conclusions

3. SOME APP CASE STUDIES MISSING?

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4. CROSS-PLATFORM MOBILE SECURITY RECAP

- Depending on the tech a bit more hard to reverse
- Suffers the same bugs as native apps
- Not offering much additional security

4. Q&A

- Thanks!
-  @simonroses | @vulnexsl
- www.vulnex.com

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