iOS applications security testing cheat sheet

Oana Cornea

OWASP
The Open Web Application Security Project

About Me

- Oana Cornea

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Agenda

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- Introduction
- iOS security model
- iOS application assessment
- Wrap up - Mobile risks

The iOS security model

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- Device security
- Data Security
- Network Security
- Application Security

iOS application assessment

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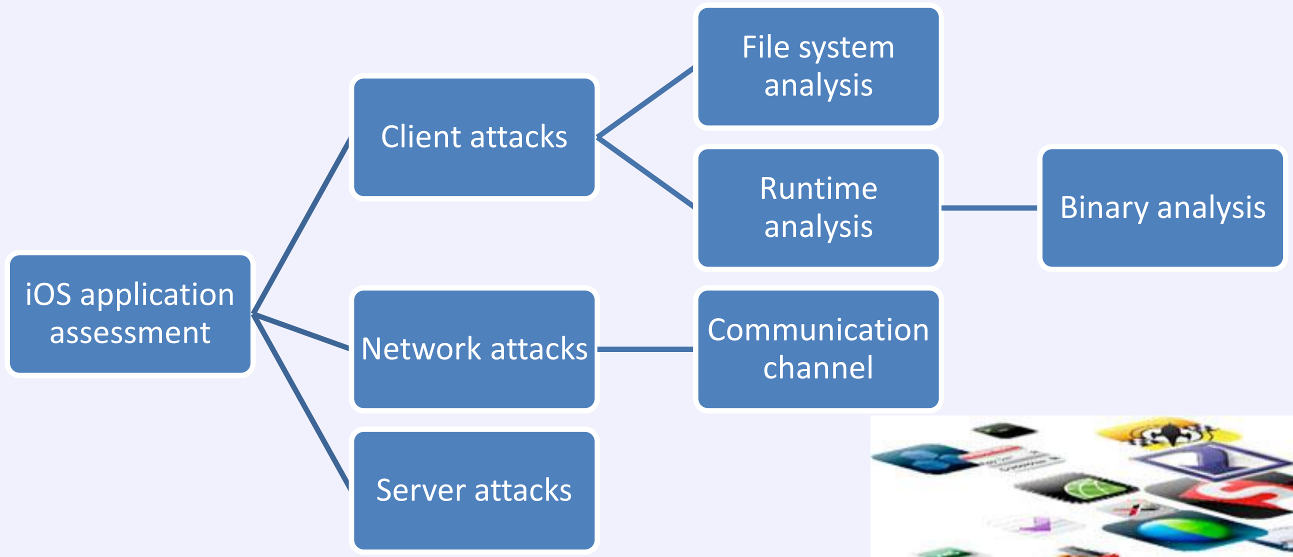

iOS application assessment

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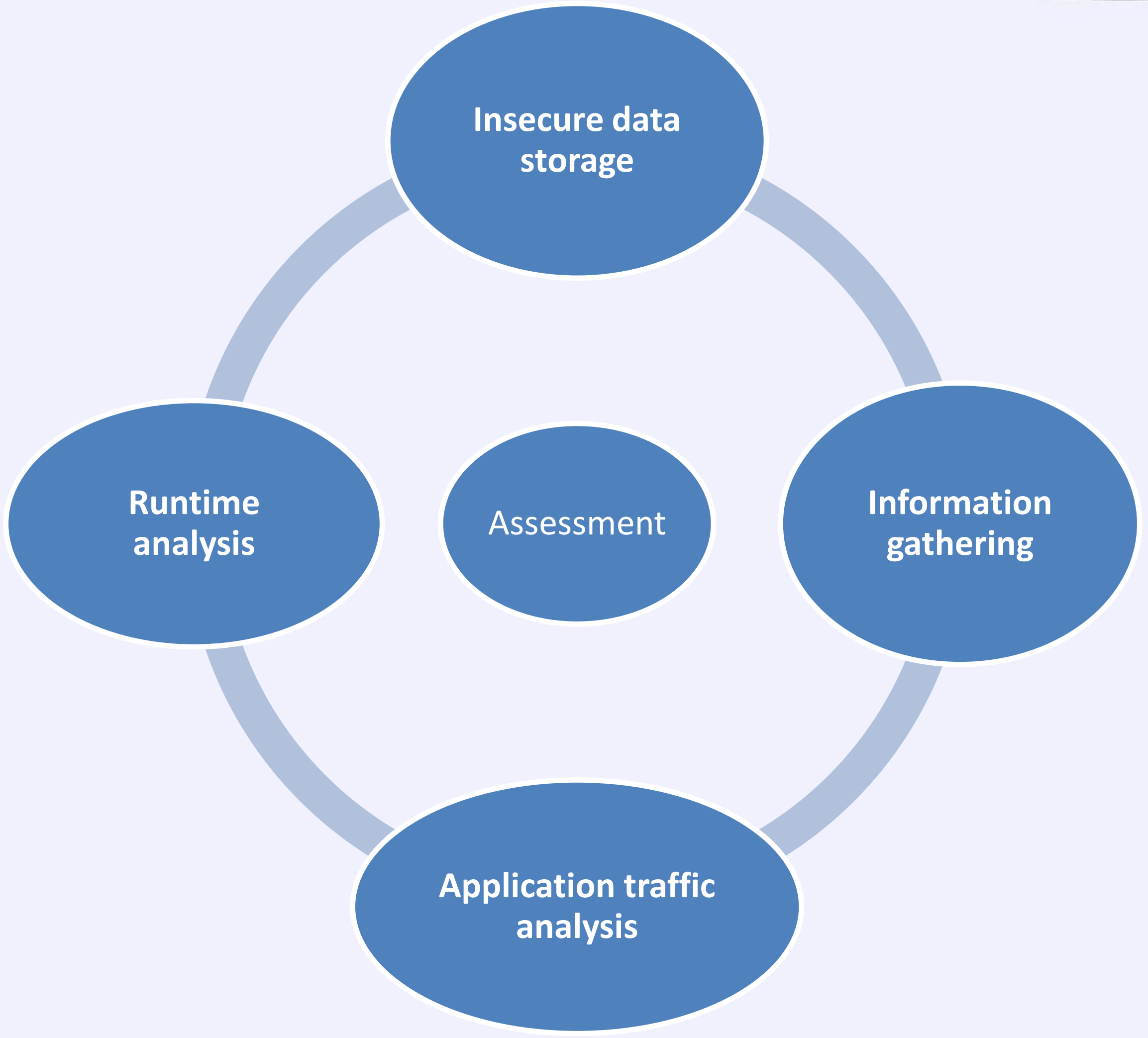
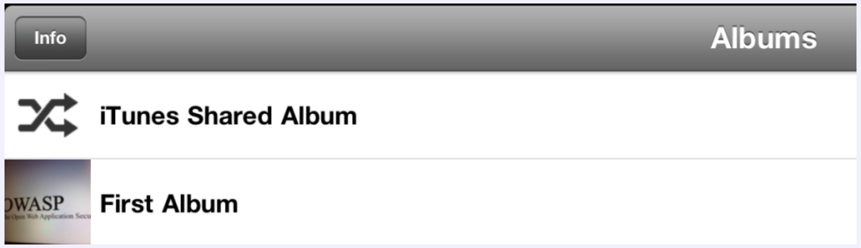
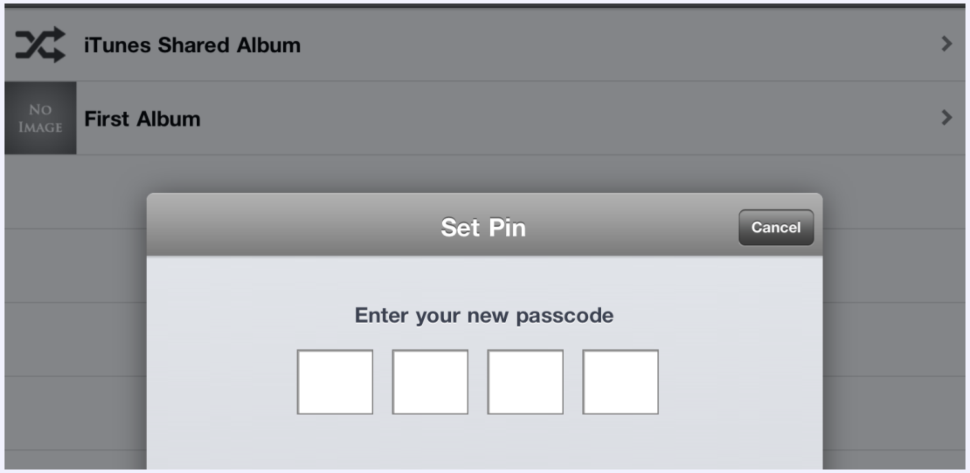


Test application





Information gathering

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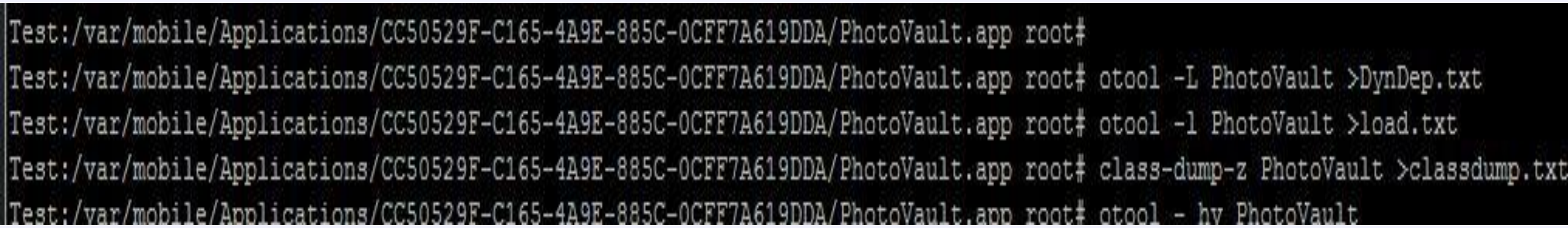
- Observe application behavior
- Determine the application’s data states (at rest, in transit or on display) and sensitivity – in this case the sensitive photos are protected by a PIN.
- Identify
  - access methods
  - what frameworks are in use
  - server side APIs that are in use
  - what protocols are in use
  - other applications or services with which the application interacts

Information gathering



```
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root#
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# otool -L PhotoVault >DynDep.txt
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# otool -l PhotoVault >load.txt
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# class-dump-z PhotoVault >classdump.txt
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# otool - hv PhotoVault
```

- List the dynamic dependencies
- Dump the load commands for the application.
- Class dump

Application traffic analysis

- Intercept the traffic and analyze the requests and responses using a proxy: Burp, Charles, Mallory

Runtime analysis

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- Disassemble the application (gdb)
- Analyze file system interaction
- Analyze the application with a debugger (gdb): inspecting objects in memory and calling functions and methods; replacing variables and methods at runtime.

Runtime analysis

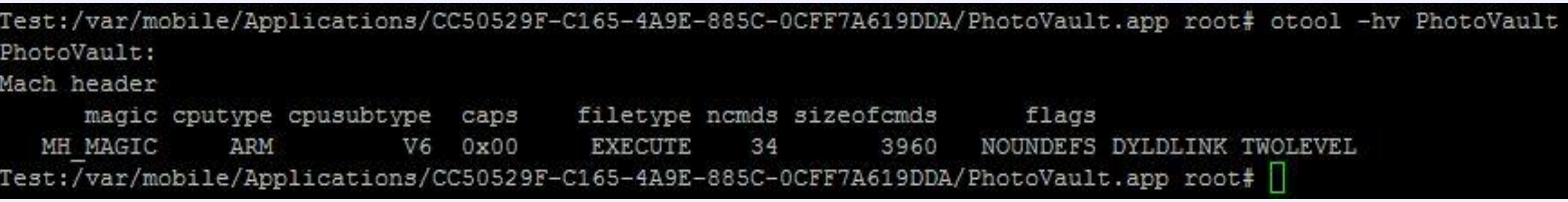
- Runtime analysis protecting features:
  - Locate the PIE (Position Independent Executable)

    Check this using the command: *otool –hv <app name>*
  - Stack smashing protection - specify the –fstack-protector-all compiler flag.

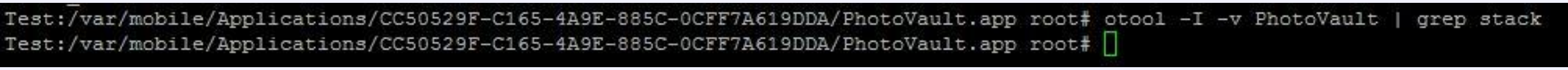
    Check this using: *otool –I –v <app name> | grep stack* .

    If the application was compiled with the stack smashing protection two undefined symbols will be present: "___stack_chk_fail" and "___stack_chk_guard".

Runtime analysis



```
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# otool -hv PhotoVault
PhotoVault:
Mach header
      magic cputype cpusubtype  caps    filetype ncmds sizeofcmds      flags
   MH_MAGIC     ARM         V6  0x00     EXECUTE    34       3960   NOUNDEFS DYLDLINK TWOLEVEL
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root#
```



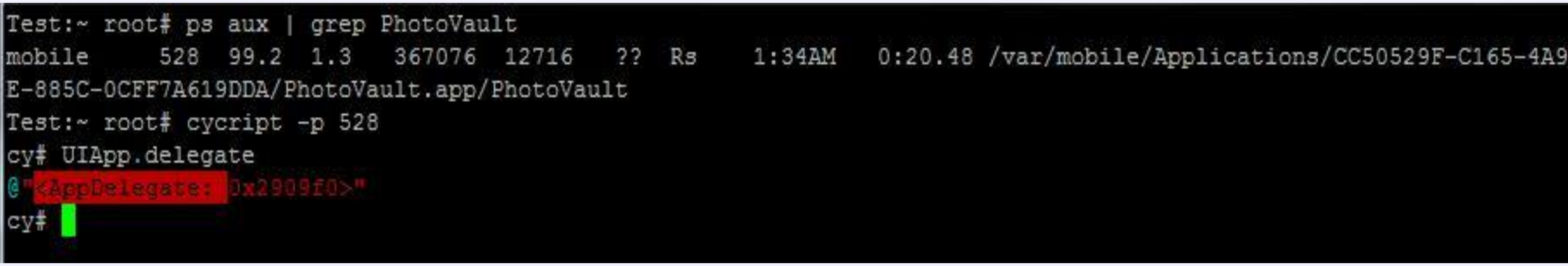
```
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root# otool -I -v PhotoVault | grep stack
Test:/var/mobile/Applications/CC50529F-C165-4A9E-885C-0CFF7A619DDA/PhotoVault.app root#
```

Runtime analysis

- Abusing the runtime with Cycript
- Abusing the runtime library – disassembling and debugging

Steps

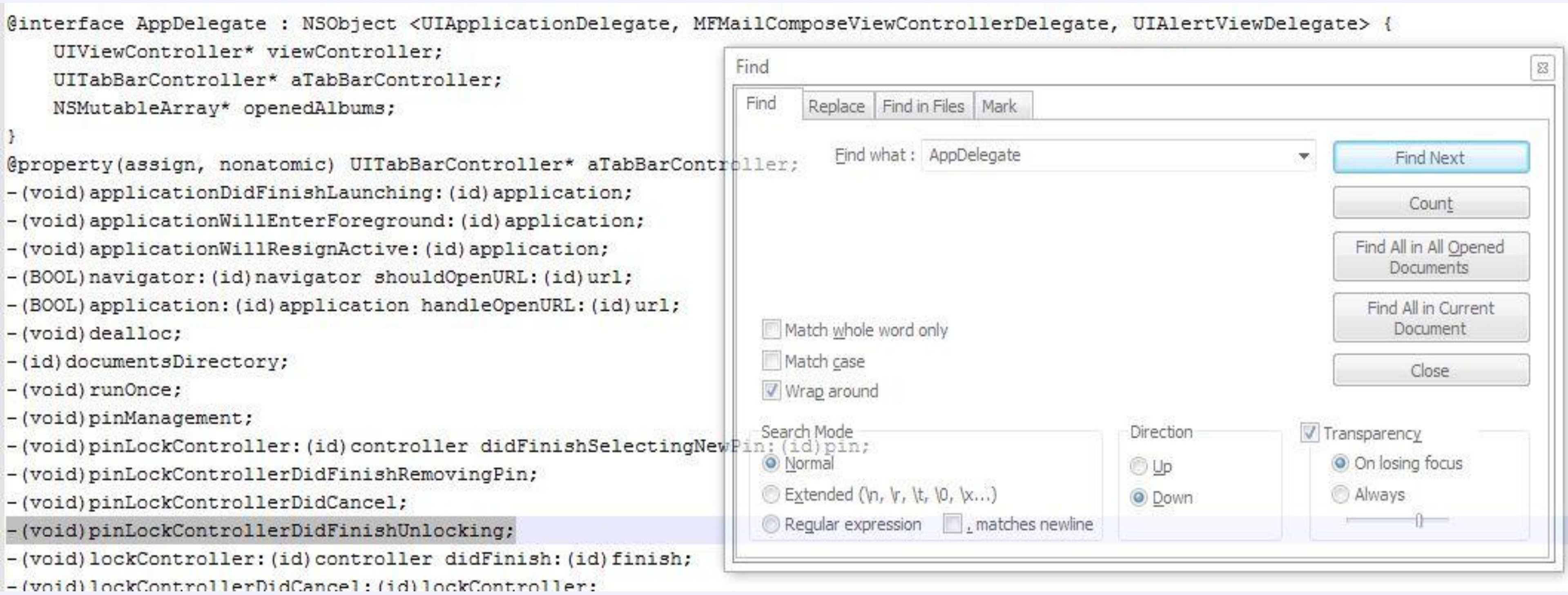
- Hook into the application process using *cycript –p [PID]* command.
- Grab the application delegate instance using *UIApp.delegate* command.



```
Test:~ root# ps aux | grep PhotoVault
mobile     528  99.2  1.3   367076  12716   ??  Rs    1:34AM   0:20.48 /var/mobile/Applications/CC50529F-C165-4A9
E-885C-0CFF7A619DDA/PhotoVault.app/PhotoVault
Test:~ root# cycript -p 528
cy# UIApp.delegate
@"<AppDelegate: 0x2909f0>"
cy# 
```

Steps

Search the class dump for AppDelegate and look for its interface.



```
@interface AppDelegate : NSObject <UIApplicationDelegate, MFMailComposeViewControllerDelegate, UIAlertViewDelegate> {
    UIViewController* viewController;
    UITabBarController* aTabBarController;
    NSMutableArray* openedAlbums;
}
@property(assign, nonatomic) UITabBarController* aTabBarController;
-(void)applicationDidFinishLaunching:(id)application;
-(void)applicationWillEnterForeground:(id)application;
-(void)applicationWillResignActive:(id)application;
-(BOOL)navigator:(id)navigator shouldOpenURL:(id)url;
-(BOOL)application:(id)application handleOpenURL:(id)url;
-(void)dealloc;
-(id)documentsDirectory;
-(void)runOnce;
-(void)pinManagement;
-(void)pinLockController:(id)controller didFinishSelectingNewPin:(id)pin;
-(void)pinLockControllerDidFinishRemovingPin;
-(void)pinLockControllerDidCancel;
-(void)pinLockControllerDidFinishUnlocking;
-(void)lockController:(id)controller didFinish:(id)finish;
-(void)lockControllerDidCancel:(id)lockController;
```

Find what : AppDelegate

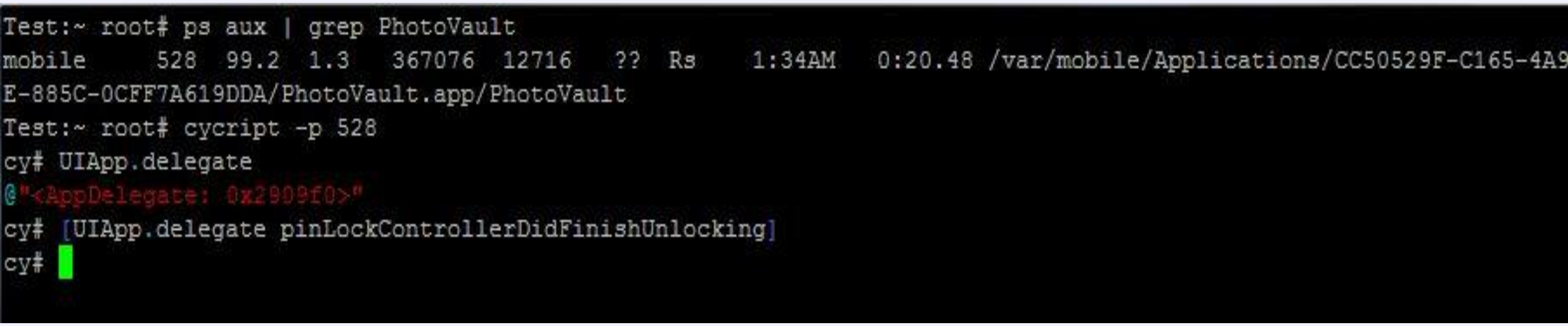
[ ] Match whole word only
[ ] Match case
[✓] Wrap around

Search Mode: [✓ Normal] Extended (\n, \r, \t, \0, \x...) Regular expression [ ] . matches newline

Direction: Up [✓ Down]

[✓] Transparency: [✓ On losing focus] Always

Steps



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Test:~ root# ps aux | grep PhotoVault
mobile      528  99.2  1.3   367076  12716   ??  Rs    1:34AM   0:20.48 /var/mobile/Applications/CC50529F-C165-4A9
E-885C-0CFF7A619DDA/PhotoVault.app/PhotoVault
Test:~ root# cycript -p 528
cy# UIApp.delegate
@"<AppDelegate: 0x2909f0>"
cy# [UIApp.delegate pinLockControllerDidFinishUnlocking]
cy# 
```

Insecure data storage

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- Log files
- Data storage in application folder
- SqlLite database
- Property list files
- File caching
- Keyboard cache
- Cookies.binarycookies
- iOS keychain
- Sensitive information in snapshots

Wrap up - Mobile risks

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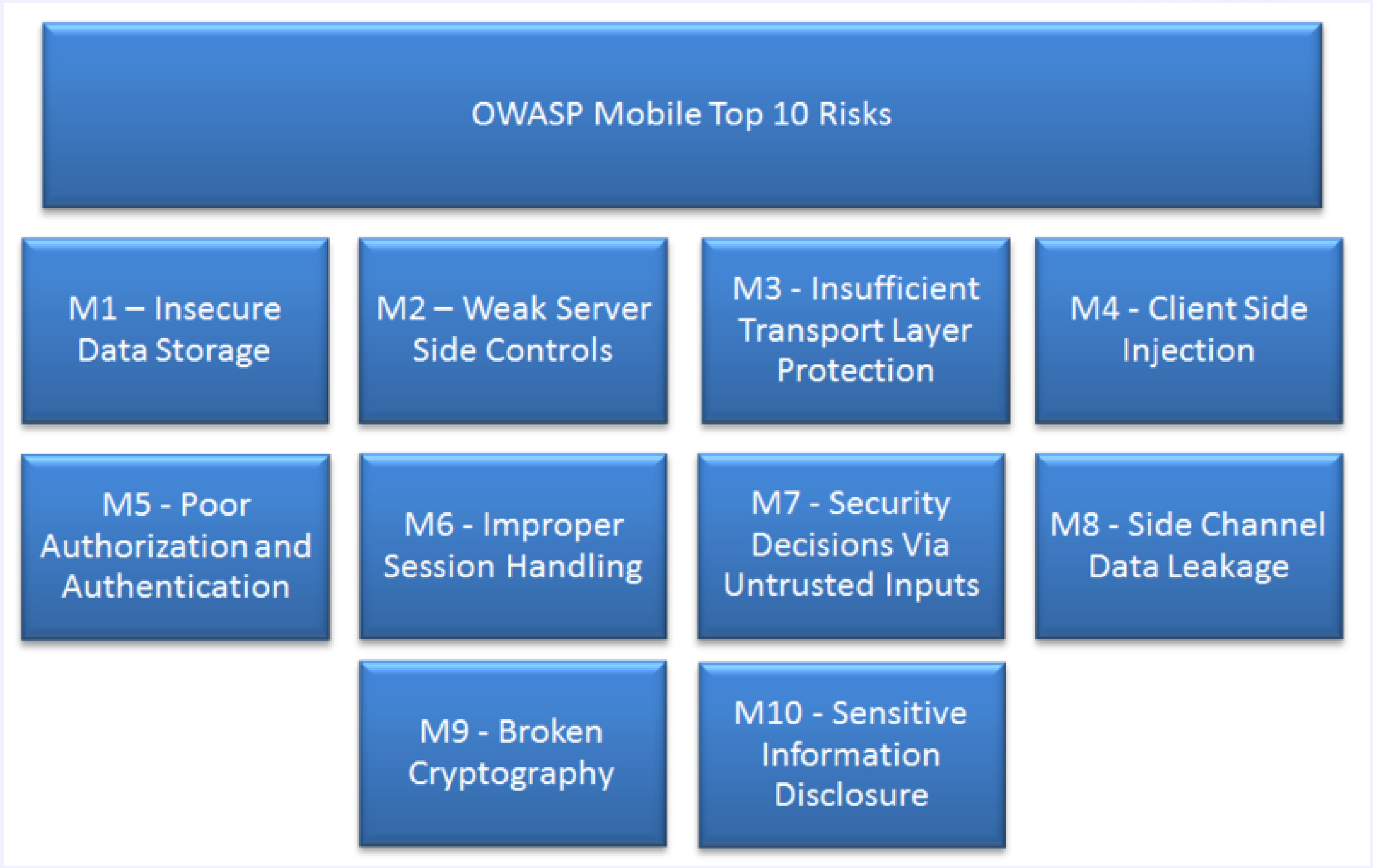

OWASP Mobile Top 10 Risks

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

Wrap up - Mobile risks

- Insecure data storage
  - Avoid storing sensitive data on the device because any data stored locally could be compromised.
- Weak server side controls
  - Harden servers against malicious attacks
- Insufficient server side protection
  - Secure the communication

Wrap up - Mobile risks

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- Client side injection
  - Implement proper input validation
- Poor authorization and authentication
  - Avoid query string for sensitive data, institute local session timeout
- Improper session handling
  - Review the session management mechanism

Wrap up - Mobile risks

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- **Security decisions via untrusted inputs**
- The combination of input validation, output escaping, and authorization controls can be used against these weaknesses.

- **Side channel data leakage**
- Avoid crash logs, debug logs and caching app data.

- **Broken cryptography**
- Take advantage of what your platform already provides

- **Sensitive information disclosure**
- Anything that must truly remain private should not reside on the mobile device; keep private information (e.g., algorithms, proprietary information) on the server.

OWASP resources

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- iGoat
- MobiSec
- iMas
- Mobile Testing Guide

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Thank you!

- https://www.owasp.org/index.php/IOS_Application_Security_Testing_Cheat_Sheet
- https://www.owasp.org/index.php/OWASP_Mobile_Security_Project