Pentesting iPhone Applications

Video available @

http://securitylearn.wordpress.com

Agenda

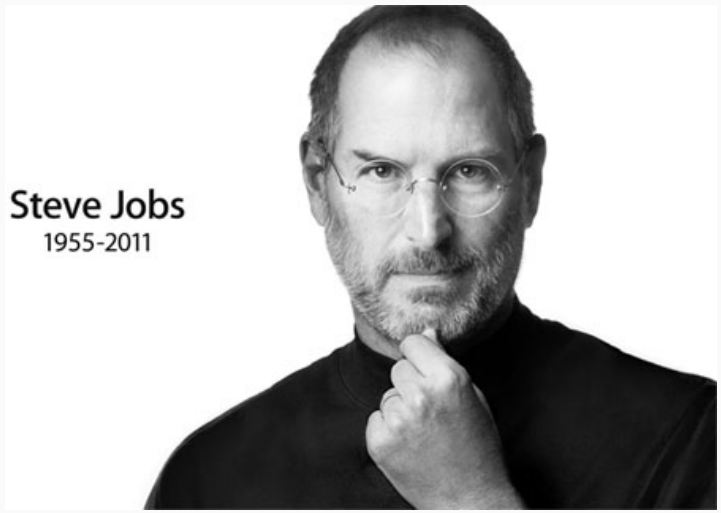
- iPhone App Basics
  - App development
  - App distribution
- Pentesting iPhone Apps
  - Methodology
  - Areas of focus
- Major Mobile Threats

Who am I

< 1 Development	• Framework for functional testing tools
5+ Information Security	• Web application hacking, Network assessments, Reverse engineering, Mobile application hacking…
Other Activities	• OWASP Hyderabad Contributor • Blogging - Securitylearn.wordpress.com

iPhone App Basics

- iPhone released in 2007
  - 110 million sales till March 2011
- Browser based Applications
  - HTML + CSS + JavaScript
- Native iOS Applications
  - Objective C & Cocoa Touch API
    - Super set of C, Compiles into native code (ARM)
- App Store
  - Centralized mechanism to distribute software
  - Only Apple signed application are available
  - Designed to protect the Apps from piracy & No malware



Why to build iPhone Application?

- New business
- Good way to launch new services
- Urgency for clients
- Users want them
- Quick to develop
- Fame and Fortune
  - Angry Birds cost $140k to develop and made $70 million in profits

    Source: mildtech.net

iPhone Application Distribution

Distributed as .ipa files

- iOS Simulator
- Device testing
- Ad-Hoc Distribution
- In-House Distribution
- Over The Air Distribution
- App Store Distribution
  - Apps have to obey Apple Review guidelines

Pentesting of iPhone Applications

- Areas of focus include
  - Network communication
  - Privacy Issues
  - Application Data Storage
  - Reverse Engineering
  - URL Schemes
  - Push Notifications

- Overlap between iPhone security and iPhone App security

JailBreaking

- iPhone does not allow unsigned applications
- Jailbreak gives a full access to the device
- Allows to install Apps which are not authorized (via Cydia)
- Can put your phone at increased risk to some security vulnerabilities
- **Tools:** PwnageTool, redsn0w, Sn0wbreeze, Greenpois0n, jailbreakMe…

- JailBreaking makes our work easy

Useful Cydia Apps

- Openssh : SSH to phone
- Adv-cmds : process commands like ps, kill…
- Sqlite3 : Sqlite database client
- GNU Debugger: Reverse engineering
- Syslogd : To view iPhone logs
- Tcpdump: capture traffic on phone
- com.ericasadun.utlities: plutil (view plist files)
- Darwin tools: Strings command
- Odcctools: otool, nm …

SSH to iPhone

- Install Open SSH from Cydia
- On workstation install SSH Client
- iPhone has two users by default
  - Root and mobile (password is 'alpine')
- Connect to the phone as a root user via SSH
  - SSH over WIFI

    > ssh root@iPhoneIP

    > password: alpine

  - SSH over USB

    > ./itunnel_mux --lport 1234

    > ssh –p 1234 root@127.0.0.1

    > password: alpine

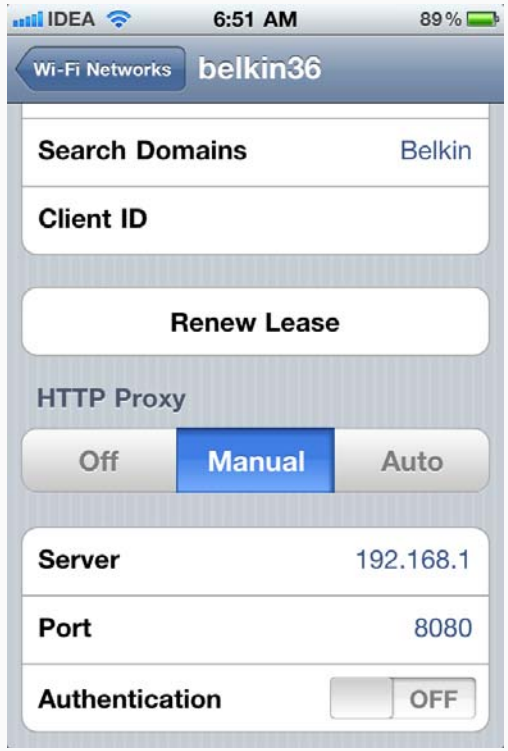
SSH Clients		
Type	**Windows**	**OS X**
Console	Putty	SSH client
GUI	WinSCP	Cyberduck

Network Communication

- Mobile application pentesting isn't really all that different
  - It involves network communication
- Communication mechanism
  - Clear text transmission (http)
  - Encrypted transmission (https)
  - Use of Custom or Proprietary protocols

Clear text Transmission

- It's 2011. Still Apps run on http
- More possible MITM attacks because of WIFI
  - Firesheep
- To analyze HTTP traffic
  - Enable manual proxy in iPhone (settings - > WIFI - > manual)



SSL Communication

- HTTPS is required for sensitive data transmission
- In SSL communication,
  - Apps may fail to validate SSL cert
    - *allowsAnyHTTPSCertificateForHost*
  - Apps which are validating the cert will not allow MITM
    - *similar to modern browsers like Google chrome, IE 8…*
  - To capture the traffic, load your proxy (burp) CA Cert to iPhone
  - Same applicable to other protocols which works on Cert

DEMO

Custom Protocols

- Identify the communication protocol
  - On SSH Terminal:
    > tcpdump -w traffic.pcap
  - Load the .pcap in wireshark and analyze
- May not respect iPhone proxy settings
- DNS Spoofing techniques to MITM

  - Once you capture the traffic it is a typical web application pentesting in which attacks are done on the application server

-Authentication, Authorization, Session management, weak ciphers….

Privacy Issues

- Every iPhone has an unique device identifier called UDID
- Apps may collect the device UDID
- With UDID
  - Possible to observe the user browsing patterns
  - Feasible to locate user Geo location
  - More possible attacks are documented in “Eric Smith: iPhone-Applications-Privacy-Issues.pdf”
- One such application is
  - Openfient : mobile social gaming network http://corte.si/posts/security/openfeint-udid-deanonymization/
- Observe the network traffic to find out UDID transmission

Application Data Storage

- 76 percent of mobile Apps store user data on phone
- 10 percent Apps store passwords in clear text
  Source: viaforensics.com/appwatchdog

- Apps store information on phone
  - For better performance
  - Offline access

- Data storage locations
  - Plist files
  - Keychain
  - Logs
  - Screenshots
  - Home directory

Application Directory Structure

- Application run in a sandbox (seatbelt) with 'mobile' privileges
- Each application gets a private area of the file system

SubDirectory	Description
Appname.app	Contains the application code and static data
Documents	Data that may be shared with desktop through iTunes
Library	Application support files
Library/Preferences/	App specific preferences
Library/Caches/	Data that should persist across successive launches of the application but not needed to be backed up
tmp	Temporary files that do not need to persist across successive launches of the application

Plist files

- Property list files
  - often used to store user's properties of an App
  - /var/mobile/Applications/[appid]/Documents/Preferences
- Key value pairs are stored in binary format
- Easily extracted and modified with property list editor, plutil
- Look for usernames , passwords, cookies…
- Apps may take Authentication/Authorization decisions
  - Ex: admin=1, timeout=10

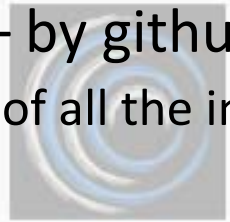
- Do not store clear text data in plist files

Keychain

- SQLite database for sensitive data storage
- Four tables: genp, inet, cert, keys
- Located at: /var/Keychains/keychain-2.db
- Keychain data is encrypted
  - Uses hardware encryption key
  - Uses user passcode for encryption
    - Depends on accessibility constant of keychain entry
  - Can not be moved to other device
- Idea is, developers can leverage keychains to have the OS to store information securely
  - Not any more

Keychain

- Accessible to all the applications
- Application can only access it's key chain items
  - On a JailBroken device It can be bypassed
- Keychain Dumper Tool – by github
  - Displays keychain entries of all the installed applications



- Use data protection API while storing data in keychain
- Use kSecAttrAccessibleWhenUnlocked accessibility constant
  - If phone is lost & user sets a passcode, it is difficult to retrieve protected contents in keychain
  - Keychain data is encrypted with User Passcode

Error Logs

- Apps may write sensitive data in logs
  - Debugging (NSLog calls)
  - Trouble shooting
  - Requests & Responses
  - /private/var/log/syslog

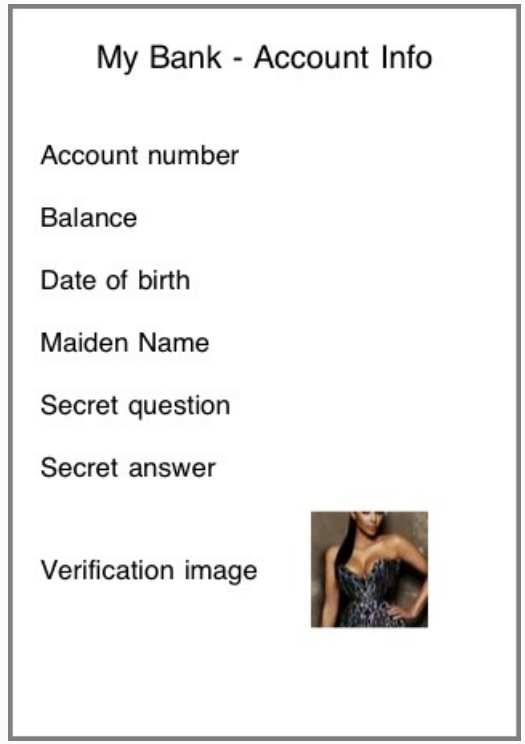
- To view iPhone logs
  - Console App (from AppStore)
  - Sync to iTunes
    - Mac OS X : ~/Library/Logs/CrashReporter/MobileDevice/<DEVICE_NAME>
    - Windows XP:
      C:\Documents and Settings\<USERNAME>\Application Data\Apple computer\Logs\CrashReporter/<DEVICE_NAME>

Screenshot

- Home button shrinks your application with a nice effect
- iOS takes screen shots of the application to create that effect
- Sensitive data may get cached
  - App directory/Library/Caches/Snapshots

- Solution
  - Remove sensitive data or change the screen before the applicationDidEnterBackground() function returns
  - Instead of hiding or removing sensitive data you can also prevent back- grounding altogether by setting the "Application does not run in background" property in the application's Info.plist file

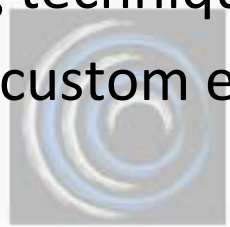
Screenshot



Copied From SANS website

Home directory

- Apps can store data in application home directory
- Custom encryption mechanism can be used to store files
- Use Reverse engineering techniques to find encryption key
- Write tools to break the custom encryption



Reverse Engineering

- Apps downloaded from AppStore are encrypted
  - Fairplay DRM (AES)
- On a JailBroken device, we can decrypt Apps easily
  - Craculous : decrypts Apps on device
  - Installous : installs decrypted Apps on device
- Self distributed Apps are not encrypted
- Hex Rays decompiler & Run time debugger (gdb)
- Look for Hard coded passwords and encryption keys
- Buffer Overflows
  - iOS 4.3 introduced ASLR support
    - Apps must be compiled with PIE (position independent executable) for full support

URL Scheme

- Protocol Handlers - mailto:, tel:
- Browser to App interaction
- View Info.plist for supported schemes

  > plutil Facebook.app/Info.plist

  CFBundleURLName = "com.facebook";

  CFBundleURLSchemes = (**fbauth, fb**);
- Parameters are supplied to the application

  Mailto:securitylearn.wordpress@gmail.com

  twitter://post?message=visit%20maniacdev.com

  – Bad Input crash Apps

URL Scheme

- Decrypt the App to find parameters

  > strings Facebook.app/Facebook | grep 'fb:'

  fb://online#offline

  fb://birthdays/(initWithMonth:)/(year:)

  fb://userset

  fb://nearby

  fb://place/(initWithPageId:)

  – http://wiki.akosma.com/IPhone_URL_Schemes

- Remote attacks

  – URL Scheme allows to edit or delete data without user permission

  Ex: Skype URL Handler Dial Arbitrary Number

  <iframe src="skype://14085555555?call"></iframe>

Push Notifications

- App vendors use this service to push notifications to the user's device even when the app is in a frozen state
  - Instant Messenger alerts the user when a new message is received even though the user is using another app
- Device token unique to ios instance is required
- Push notification data can be read by Apple
  - Do not send Confidential data in notifications
- Do not allow push notifications to modify App data

Major mobile Threats

- Easy to lose phones
  - Device is protected with passcode
  - Sensitive files on the device are encrypted
  - What's the threat?
- Data encryption in mobile is only available after boot up
  - Boot Rom exploits
    - all files on the device can be copied with in 10 minutes
  - Passcode brute force
    - 4 digit passcode can be brute forced with in 20 minutes
- Mobile App Risks
  - Veracode Top 10
  - OWASP Top 10

References

- BlackHat 2011 - DaiZovi_iOS_Security
- Fraunhofer iOS Device encryption security
- GitHub – Keychain Dumper

Thank You

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