OWASP
Open Web Application
Security Project

Consequences of a Jailbroken iDevice

Part of the *Reverse Engineering and Code Modification Prevention* Umbrella

Agenda

- A Brief History of iOS Attacks
- iOS Security Basics
- Jailbreaking 101

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A BRIEF HISTORY OF IOS ATTACKS

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iPhone 2007

- Security… what's that?
  - Stripped-down OS
  - No privilege separation: All processes ran as root.
  - No code-signing enforcement
  - No DEP
  - No ASLR
  - No sandboxing
  - No app store

Libtiff Vulnerability (iOS 1.1.2)

Victim surf's malicious web site and attacker gets remote 'root' access to device

1. Get user's Safari Browser to view a malicious TIFF image;
2. Browser's *libtiff* library attempts to render image;
3. TIFF contains malicious input that renderer places into heap memory and executes

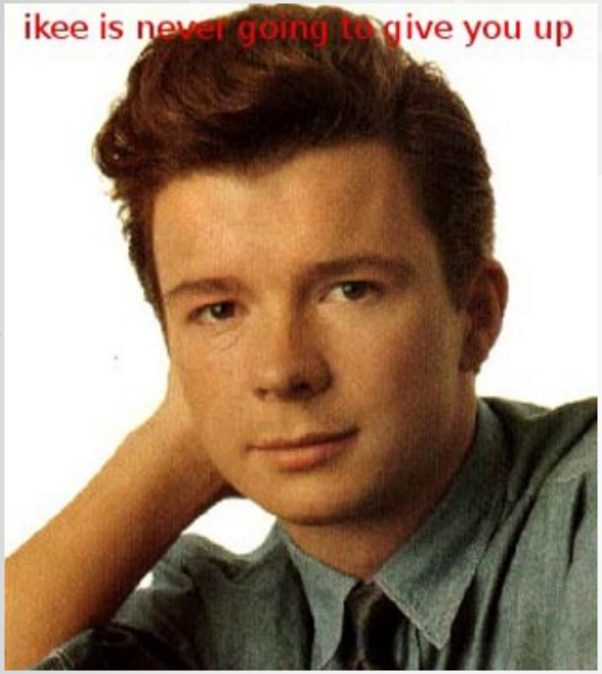
CommCentre Vulnerability (iOS 2)

Oh snap, I'm hacking into ur iPhone right now. LOLZ

An attacker can remotely eavesdrop on conversations, monitor user's location, or force victim's phone to join a botnet by sending an SMS to the victim.

1. Attacker sends victim malicious incoming SMS that contains code
2. CommCentre parses incoming SMS and buffer overflow occurs
3. CommCentre executes code as *root* user

Rick Astley is "Never Gonna Give You Up" *Ikee Worm* (iOS 2)

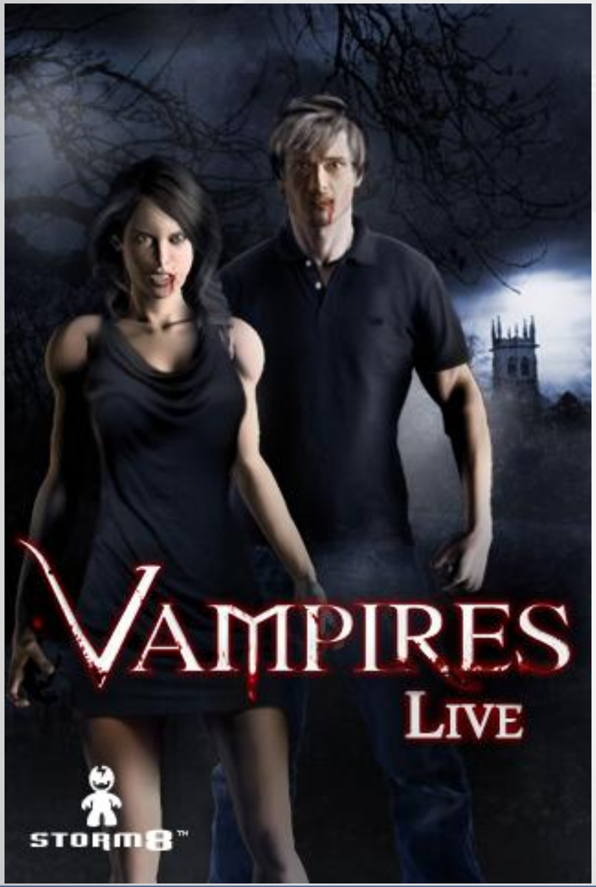


Jailbroken devices typically contained an SSH server with default root passwords...

1. Worm spread between Jailbroken devices that used the same default passwords.
2. Later incarnations performed more malicious acts than simply changing wallpapers
3. Lock phone for ransom, stealing content, botnet enrollment

Storm 8 (2009)

- Affected games, “Vampires Live”, “Zombies Live”, and “Rockstars Live”



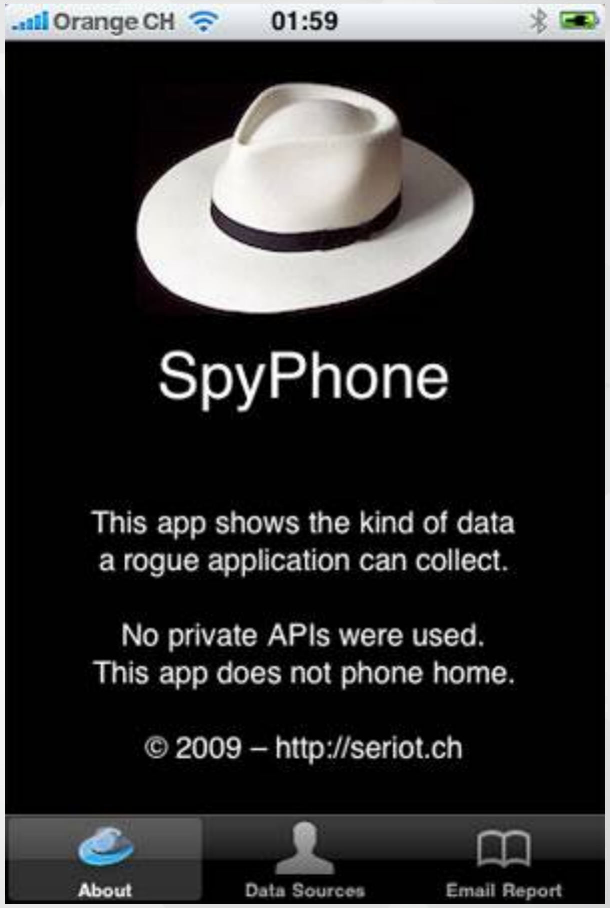
1. Apps collected cell phone numbers of the devices on which users were playing; 20 million downloads!
2. Uploaded data to Storm 8 servers
3. Resulted in class-action lawsuit; Storm8 claims it was a simple mistake…

SpyPhone (2010)

SpyPhone accesses every possible piece of information exposed through the sandbox

- Cell-phone number
- Read / write access to address book
- Safari / YouTube search terms
- E-mail account information
- Keyboard cache
- Geotagged photos
- GPS Information
- WiFi access point names

Even inside a 'safe' environment, a malicious app can extract a frightening amount of information



This app shows the kind of data a rogue application can collect.

No private APIs were used. This app does not phone home.

© 2009 – http://seriot.ch

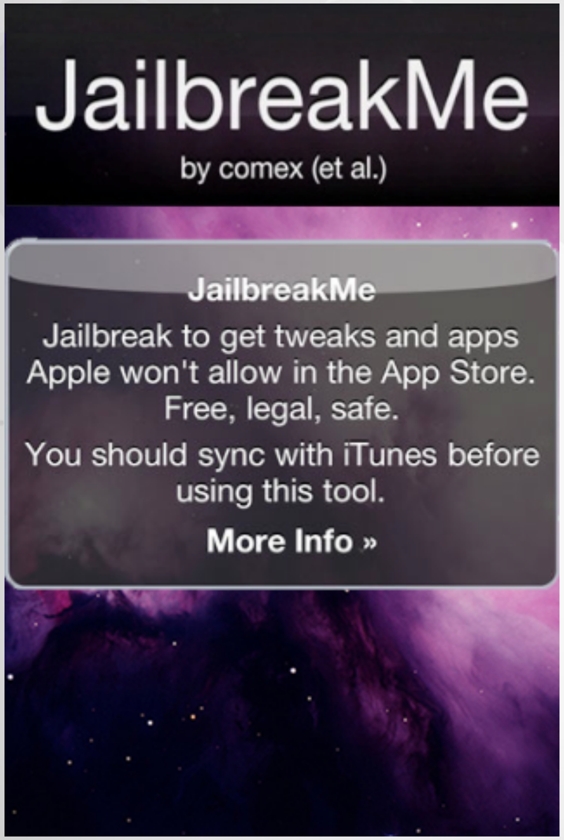
Pwn2Own (2010)

Annual competition in which contestants exploit mobile devices with unknown vulnerabilities for cash, their device, and a 'masters' jacket...

- Winners of 2010 discovered vulnerabilities in MobileSafari of iPhone 3GS that allow remote execution of code;
- Their test code opened up the SMS database and sent the entire database's contents to a remote server;
- They won $15,000 and an iPhone 3GS

CAN SEC WEST

Jailbreakme.com ("Star") iOS 4.0.1


JailbreakMe

by comex (et al.)

JailbreakMe

Jailbreak to get tweaks and apps Apple won't allow in the App Store. Free, legal, safe.

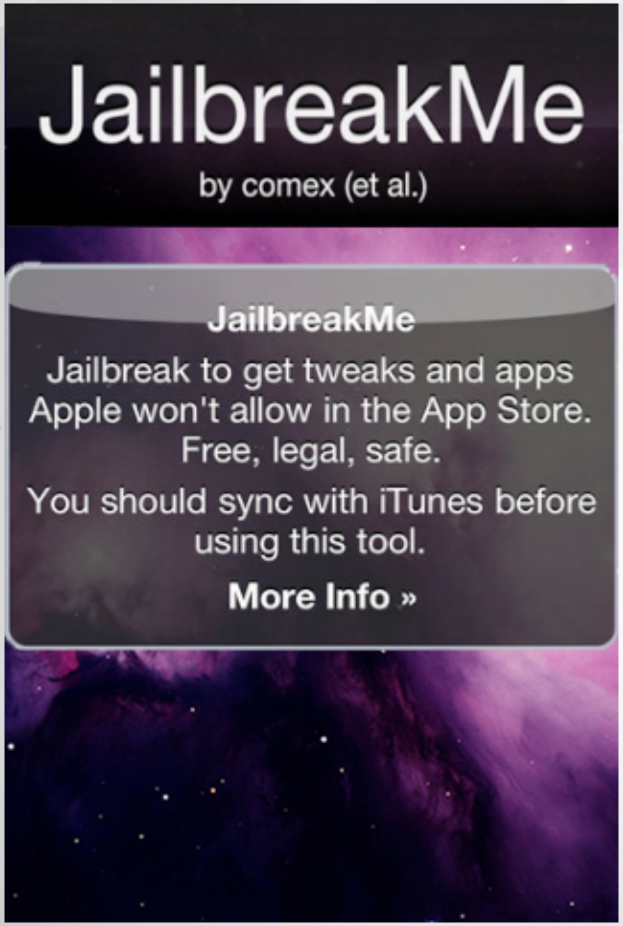
You should sync with iTunes before using this tool.

More Info »

Attacker can silently jailbreak victim's device by tricking victim into visiting a malicious web site

1. User visits malicious site;
2. Attacker exploits MobileSafari stack-overflow vulnerability in its font rendering code to execute foreign code within the browser;
3. Malicious payload exploited second vulnerability (integer overflow) that allowed privilege escalation to get increased access to device;
4. Attacker can now execute code within kernel space
5. Attacker disables code-signing
6. Attacker downloads remote libraries and silently jailbreaks device.

Jailbreakme.com (“Saffron”) – iOS 4.3.3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- Apple quickly patched iOS to mitigate ‘Star’ vulnerability. Apple also introduced ‘ASLR’ around the same time.
- Attacker achieved ‘drive-by’ Jailbreaking by exploiting critical vulnerabilities:

✔ Ability to execute foreign code

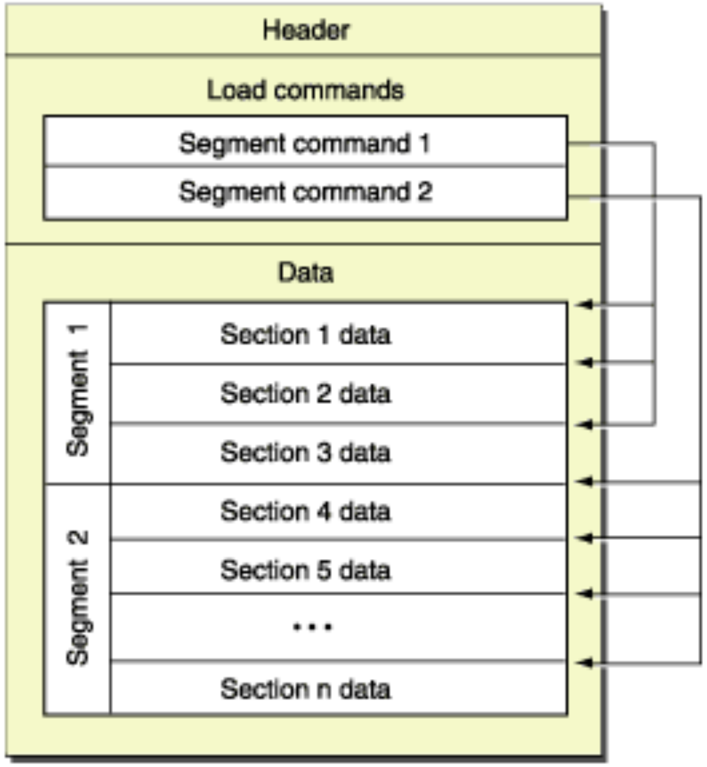
✔ Ability to raise privilege escalation to disable code signing (within kernel space)

✔ Ability to bypass ASLR

iOS Secutity Controls Strategy

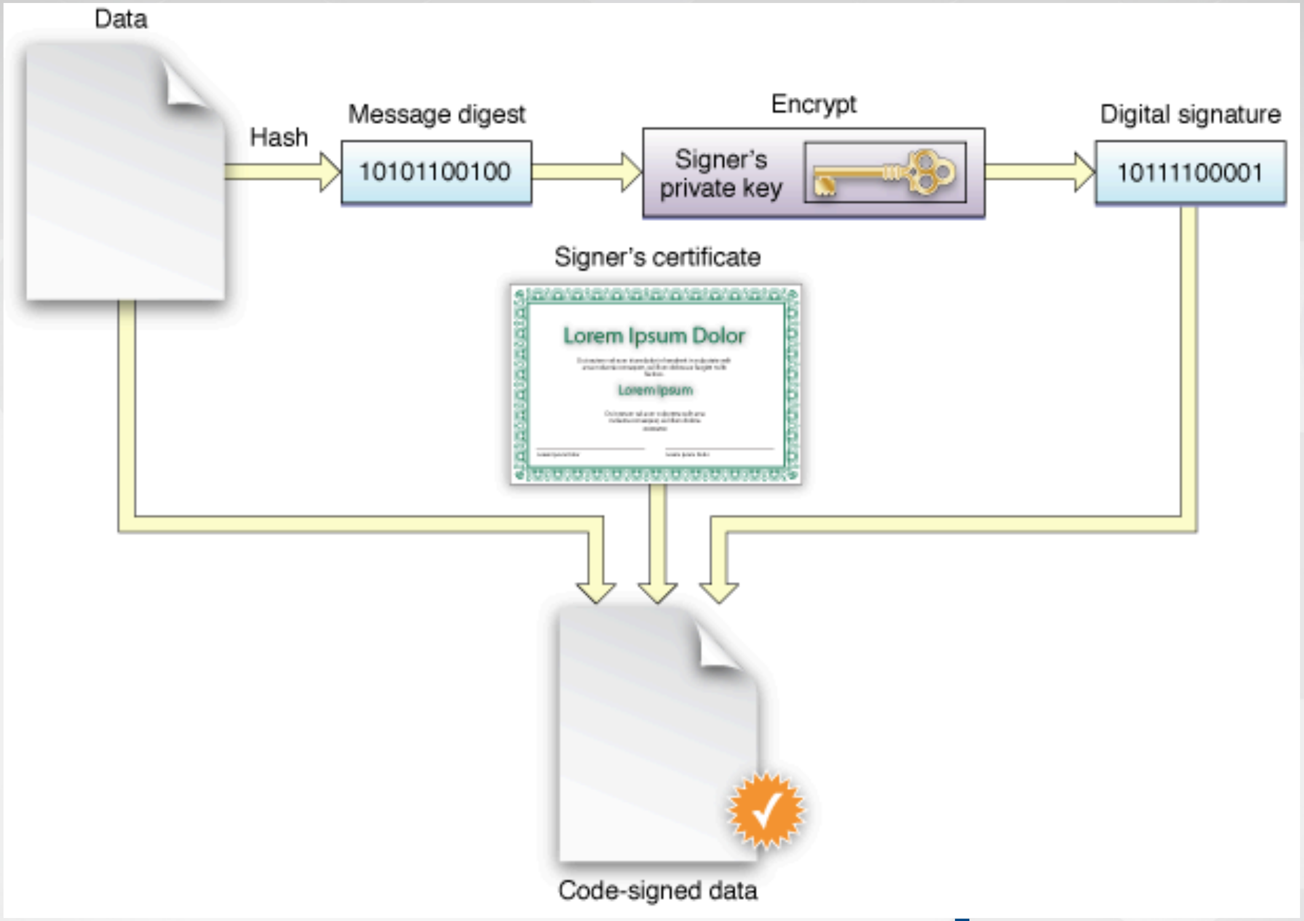
- Historical vulnerabilities illustrate the importance of particular security iPhone security controls:
  - – App Encryption
  - – Data Execution Prevention
  - – Code Signing
  - – Address Space Layout Randomization
  - – Sandboxing

Figure 1 Mach-O file format basic structure



iOS Security Controls

App encryption

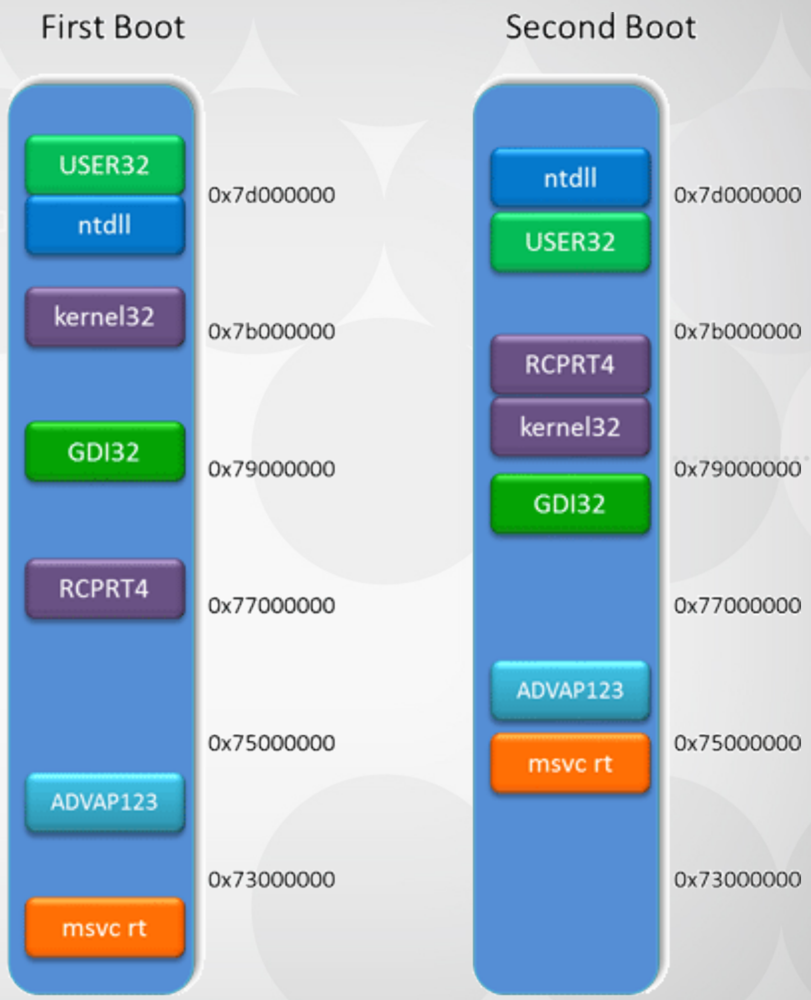


iOS Security Controls

Code signing

iOS Security Controls

- Code execution policies
  - ASLR
    - Address Space Layout Randomization
  - W^X Memory pages
    - No self-modifying code
  - Stack canaries



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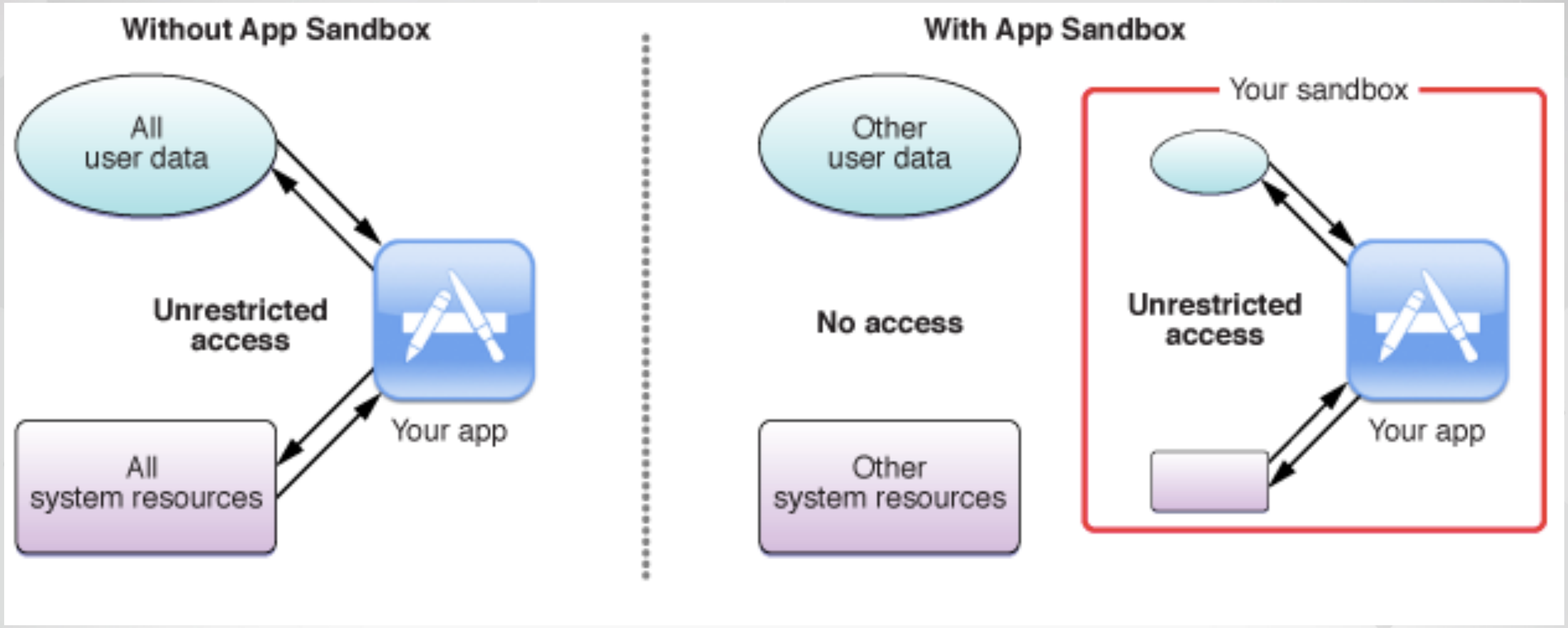


iOS Security Controls

Sandboxing

Circumventing iOS Controls

- Jailbreaking
  - Remove iOS controls
  - Gain root access
  - Custom kernel
  - Privilege escalation

Jailbreaking Motivation

- Jailbreaking removes critical security controls from the iOS and allows an attacker to return to these earlier vulnerabilities we've already seen...

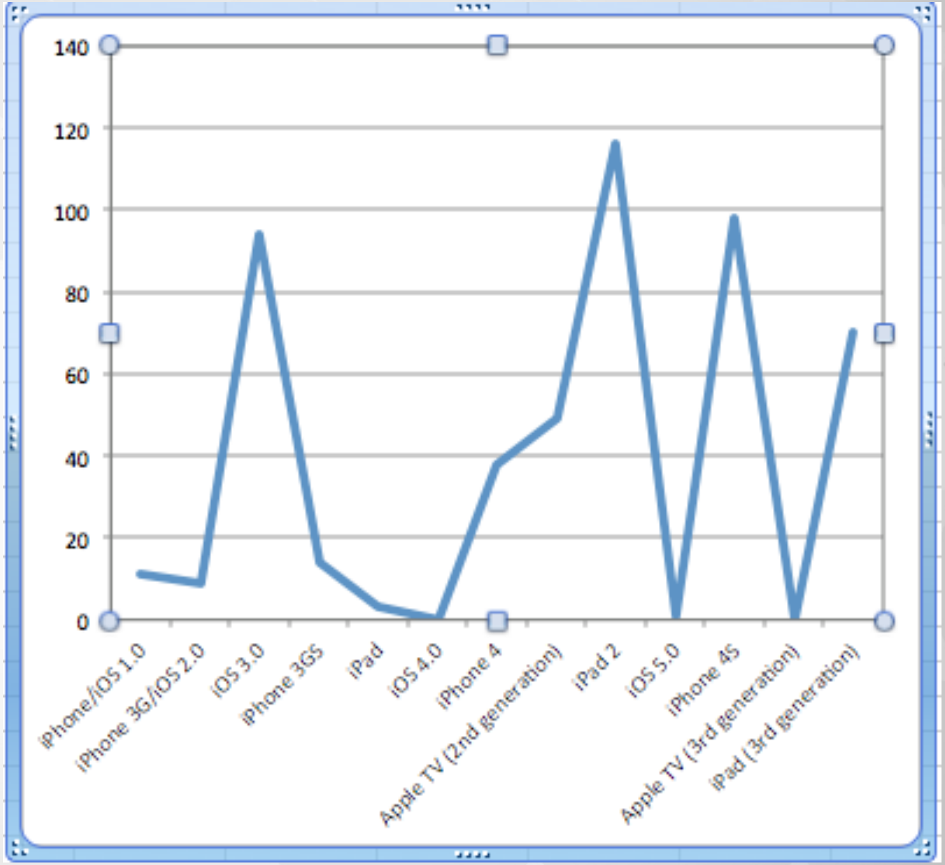
- Why jailbreak?!
  - Adding features
  - Carrier independence
  - OS customization
  - Security auditing
  - Piracy
  - Espionage/Forensics

Jailbreak History

- iPhone 1.0 (released June 29th 2007)
  Broken July 10th 2007
- 4.3.2
  redsnow 0.9.11x (Broken April 2011)
- 4.3.3
  jailbreakme.com remote jailbreak (Broken July 2011)
- 5.1.1
  absinthe 2.0.x (Broken May 2012)
- 6.1
  evasion (Broken Jan 30 2013)
- 7.0
  evasion (Broken December 22 2013)

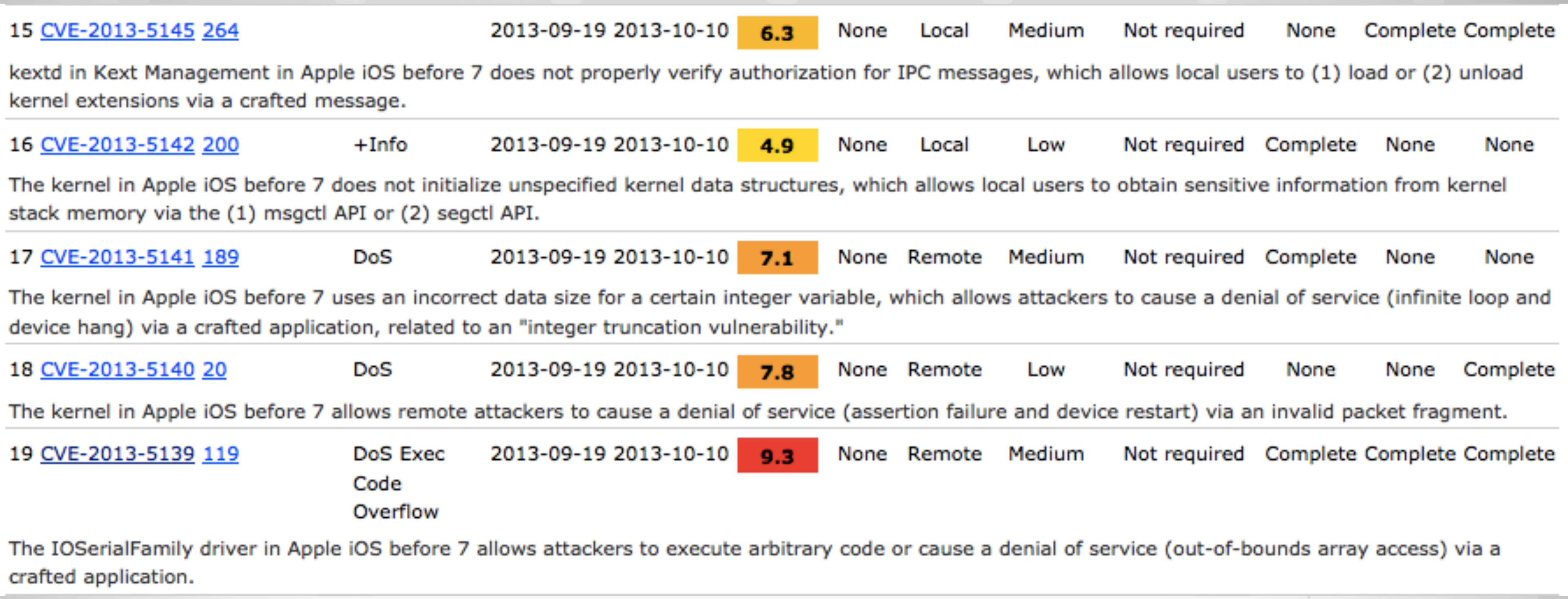
Jailbreak History

- Time to jailbreak increases when:
  - New OS versions
  - New hardware versions
- Apple continually patches known exploits



Ramifications of Jailbreaking

- If a device is Jailbroken, all bets are off...
  - Application encryption is not enforced
  - Code-signing is disabled
  - Arbitrary remote code execution is possible
  - Exploitation of other applications on the device is entirely possible
- The attack is really limited by the imagination of the attacker



15	CVE-2013-5145	264		2013-09-19	2013-10-10	6.3	None	Local	Medium	Not required	None	Complete	Complete
kextd in Kext Management in Apple iOS before 7 does not properly verify authorization for IPC messages, which allows local users to (1) load or (2) unload kernel extensions via a crafted message.													
16	CVE-2013-5142	200	+Info	2013-09-19	2013-10-10	4.9	None	Local	Low	Not required	Complete	None	None
The kernel in Apple iOS before 7 does not initialize unspecified kernel data structures, which allows local users to obtain sensitive information from kernel stack memory via the (1) msgctl API or (2) segctl API.													
17	CVE-2013-5141	189	DoS	2013-09-19	2013-10-10	7.1	None	Remote	Medium	Not required	Complete	None	None
The kernel in Apple iOS before 7 uses an incorrect data size for a certain integer variable, which allows attackers to cause a denial of service (infinite loop and device hang) via a crafted application, related to an "integer truncation vulnerability."													
18	CVE-2013-5140	20	DoS	2013-09-19	2013-10-10	7.8	None	Remote	Low	Not required	None	None	Complete
The kernel in Apple iOS before 7 allows remote attackers to cause a denial of service (assertion failure and device restart) via an invalid packet fragment.													
19	CVE-2013-5139	119	DoS Exec Code Overflow	2013-09-19	2013-10-10	9.3	None	Remote	Medium	Not required	Complete	Complete	Complete
The IOSerialFamily driver in Apple iOS before 7 allows attackers to execute arbitrary code or cause a denial of service (out-of-bounds array access) via a crafted application.													

Ramifications of Non-Jailbreaking

Even if you are running on a non-Jailbroken device, there are plenty of remote-execution vulnerabilities out there...

Ramifications of Non-Jailbreaking

- SpyPhone illustrates the problems of running things on a non-Jailbroken device:
  - AppStore approval process is not transparent or rigorous;
  - Sandboxing is far too permissive and allows access to all sorts of things apps shouldn't have access to;
  - Information disclosure to third-parties is probably the greatest risk a user will face

- iOS Security controls are not bug-free
  - Check out the CVE iOS Security Vulnerabilities database to see the latest and greatest security exploits

Conclusions

- Jailbreaking teaches us a lot about the pitfalls of iOS security
- There are plenty of bad things that can happen in non-jailbroken environments
- Jailbreaking is not going away anytime soon
- In your code, always test for the presence of a jailbroken environment. There's a lot of risk in these environments
- Follow *xcon* for more information about how to reliably detect jailbroken environments