KCon

2019

美团

APT检测设备的扩展研究

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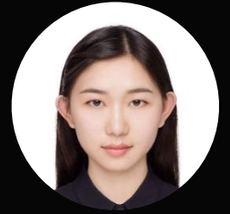
团队介绍

朱学文（Ju Zhu）
美团/高级安全研究员

9+年的安全研究经验
7+年主要从事高级威胁的研究，包括0Day、nDay和漏洞挖掘
一直致力于使用自动化系统来Hunt野外的高级威胁
多次获得CVE，且受到Google、Apple、Facebook等厂商的致谢
多次作为Speaker受邀参加BlackHat、CodeBlue、CSS等国内外的顶级安全会议



郭梦圆（Mabel Guo）
上海交通大学/美团实习安全研究员

上海交通大学在读硕士
研究生阶段致力于视频隐写/隐写分析研究
擅长iOS逆向以及虚拟化技术

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PART
01

业界主流APT检测设备的选型对比

业界主流APT检测设备的选型对比

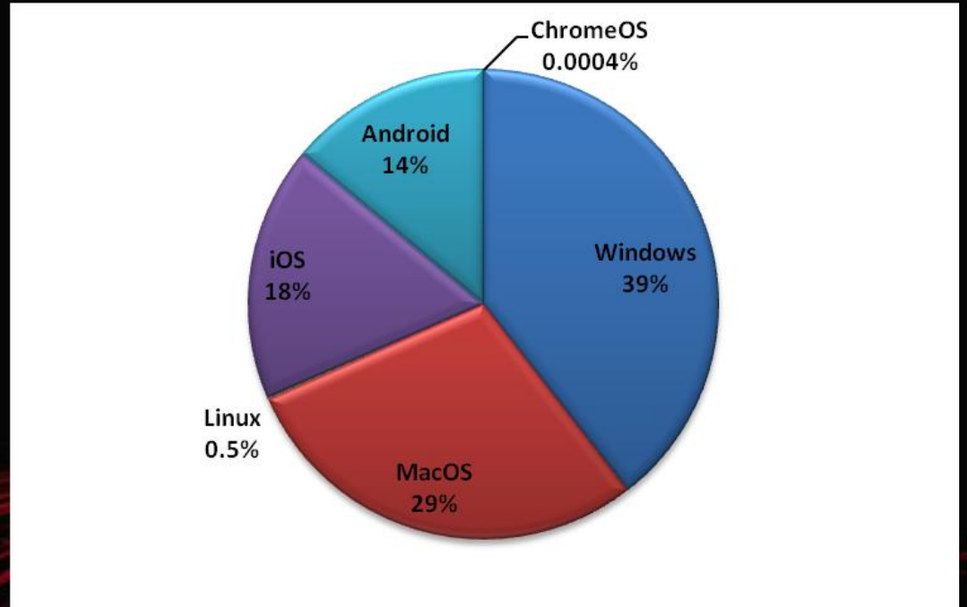
概述

平台支持性

文件类型支持性

内网接入设备类型统计

BYOD（Bring Your Own Device）



业界主流APT检测设备的选型对比

平台支持性

	Windows	MacOS	iOS	Android	其它
厂商1	✔	✘	✘	✘	✘
厂商2	✔	✘	✘	✘	✘
厂商3	✔	✘	✘	✔	✘

Win7、Win10、。。。　　32位、64位

自定义导入

业界主流APT检测设备的选型对比

文件类型支持性

	PE	Office	PDF	Mach-O	plist	APK
厂商1	✔	✔	✔	✘	✘	✘
厂商2	✔	✔	✘	✘	✘	✘
厂商3	✔	✔	✘	✔	✘	✔

Mach-O <- 静态分析

plist：iOS Ransomware（Death Profile）

PART
02

可参考的解决方案对比

可参考的解决方案对比

动态沙箱技术解决方案对比

MacOS

iOS、Android

动态沙箱技术解决方案对比

	MacOS	iOS	Android
可参考的动态沙箱	Darling 或 Cuckoo Sandbox	Corellium	Anbox 或 Cuckoo Droid
使用方式（云或本地）	本地	云	本地
开源？	是	否	是
实现成本	中	极高	中

MacOS

阶梯式部署

Darling--大部分指标

Cuckoo Sandbox--剩下少部分

PART
03

iOS动态沙箱（蜜罐）

iOS动态沙箱（蜜罐）

总体架构流程

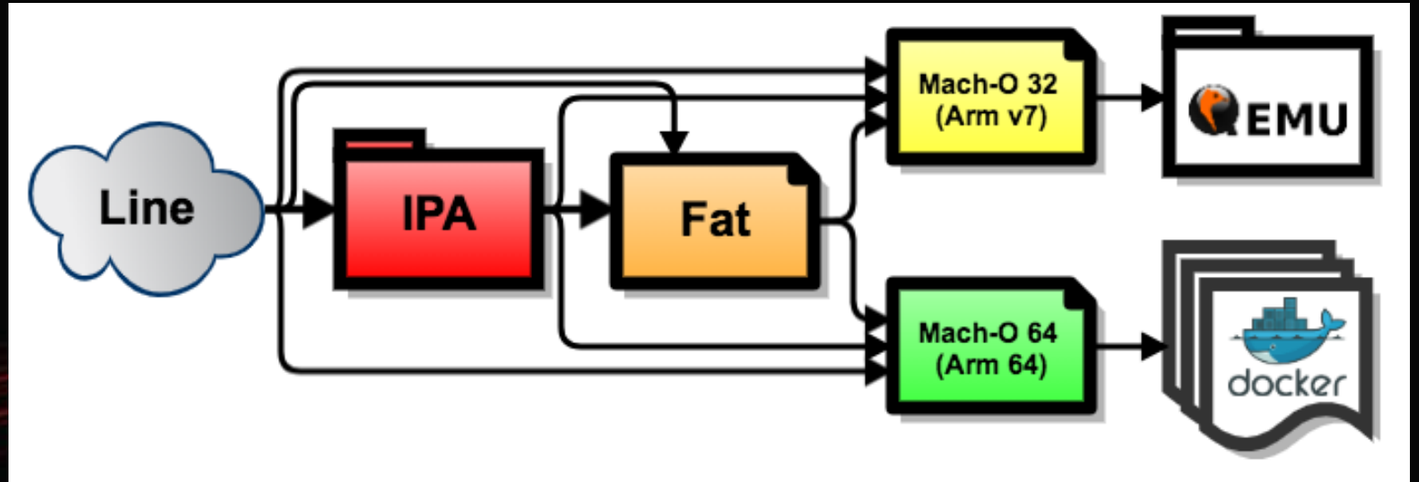
轻量级虚拟化设计

实现、部署

总体架构流程

针对Mach-O

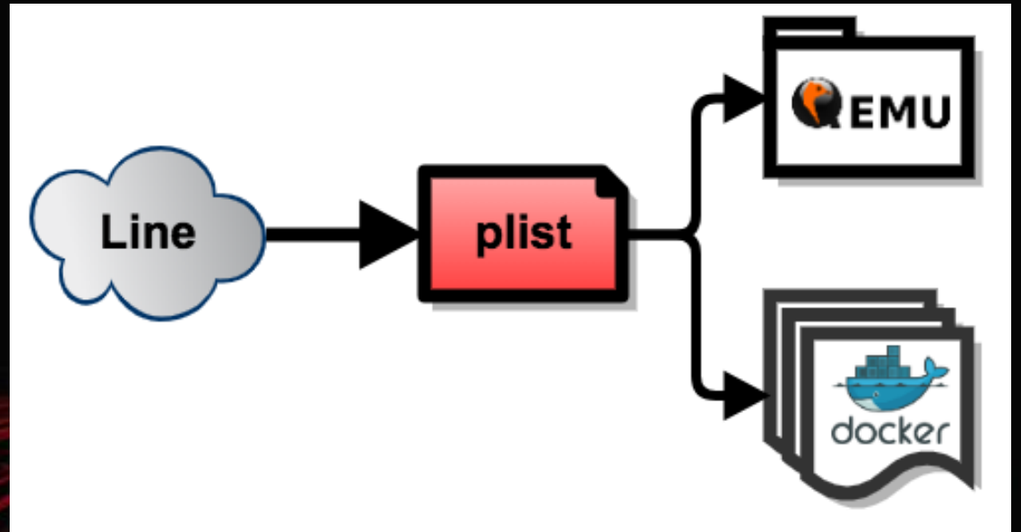
考虑攻击面（影响面）



总体架构流程

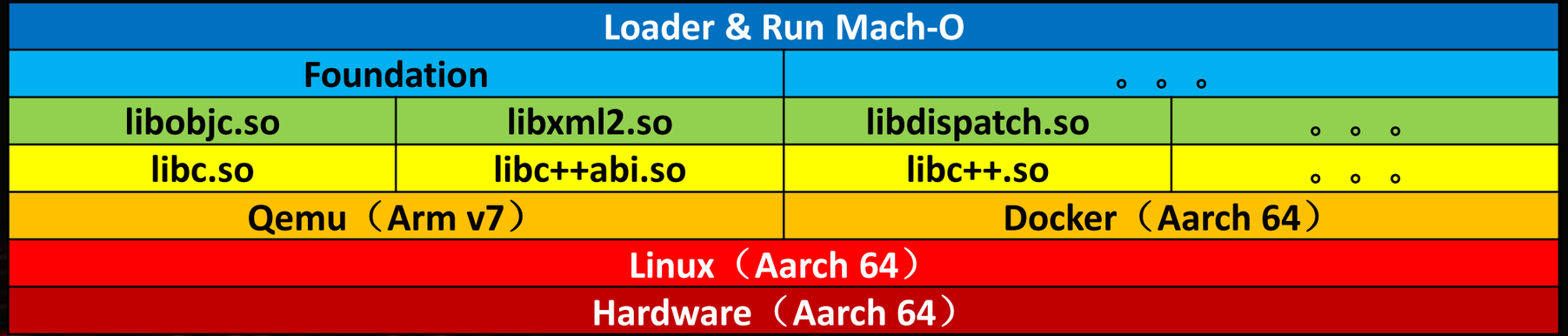
针对plist

类似Death Profile的攻击



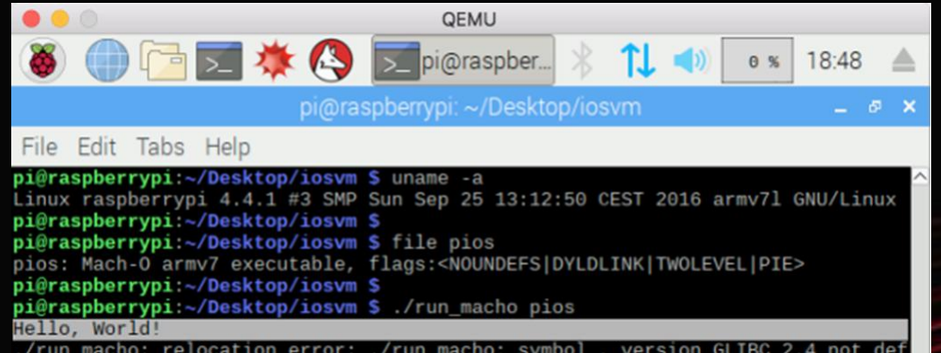
轻量级虚拟化设计

API重定向



轻量级虚拟化设计

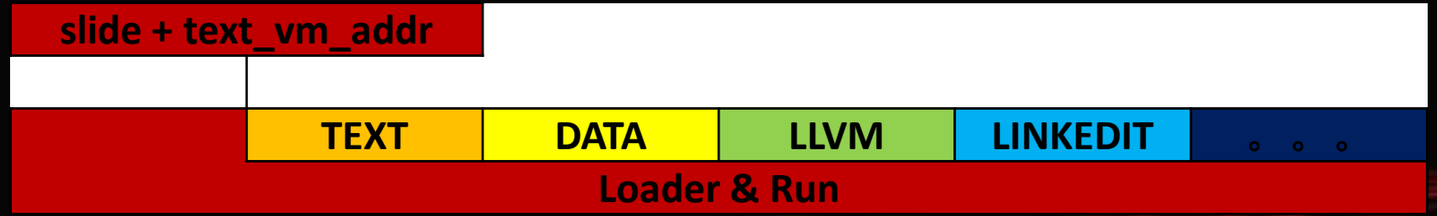
简单运行效果




```
[root@localhost ju]#
[root@localhost ju]# uname -a
Linux localhost.localdomain 4.14.36-6.1.hxt.aarch64 #1 SMP Tue Jul 17 07:01:42 UTC 2018 aarch64 aarch64 aarch64 GNU/Linux
[root@localhost ju]#
[root@localhost ju]# docker run iosvm-debian9 /usr/bin/file /root/ios64
/root/ios64: Mach-O 64-bit arm64 executable, flags:<NOUNDEFS|DYLDLINK|TWOLEVEL|PIE>
[root@localhost ju]#
[root@localhost ju]# docker run iosvm-debian9 /bin/run-macho /root/ios64
Hello World!
[root@localhost ju]#
[root@localhost ju]#
```

Segment数据映射到虚拟内存

VM Protection值 -> 虚拟内存VMP属性

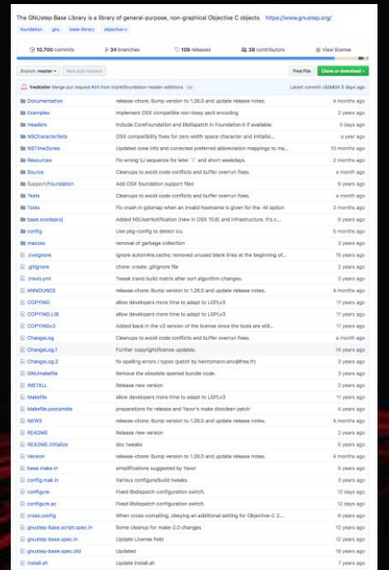


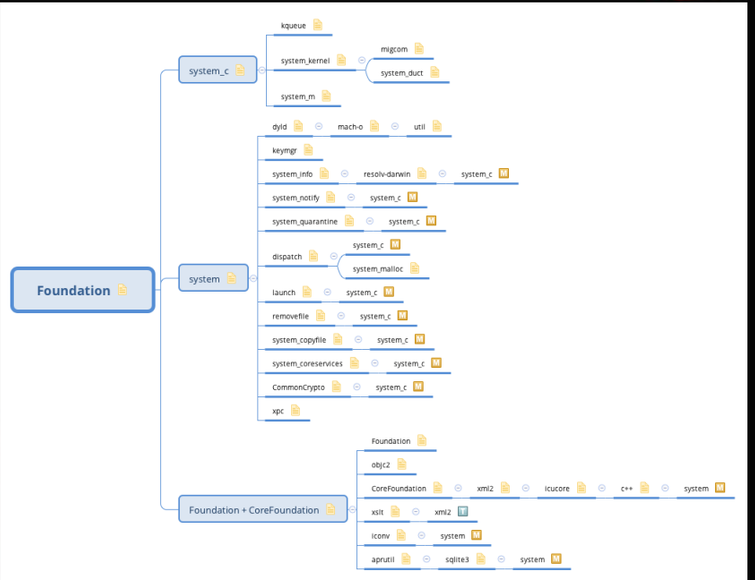
Segment名称	Segment信息	实际虚拟内存地址范围
TEXT	Segment Name __TEXT VM Address 4294967296 VM Size 32768 File Offset 0 File Size 32768 Maximum VM Protection 00000001 VM_PROT_READ 00000004 VM_PROT_EXECUTE	(slide + text_vm_addr) -> (slide + text_vm_addr + 0x8000)
DATA	Segment Name __DATA VM Address 4295000064 VM Size 16384 File Offset 32768 File Size 16384 Maximum VM Protection 00000001 VM_PROT_READ 00000002 VM_PROT_WRITE	(slide + text_vm_addr + 0x8000) -> (slide + text_vm_addr + 0xC000)
LLVM	Segment Name __LLVM VM Address 4295016448 VM Size 16384 File Offset 49152 File Size 16384 Maximum VM Protection 00000001 VM_PROT_READ 00000002 VM_PROT_WRITE	(slide + text_vm_addr + 0xC000) -> (slide + text_vm_addr + 0x10000)
LINKEDIT	Segment Name __LINKEDIT VM Address 4295032832 VM Size 32768 File Offset 65536 File Size 20496 Maximum VM Protection 00000001 VM_PROT_READ	(slide + text_vm_addr + 0x10000) -> (slide + text_vm_addr + 0x15010)

导入相关依赖库

模拟实现

（比如Foundation.framework）





运行

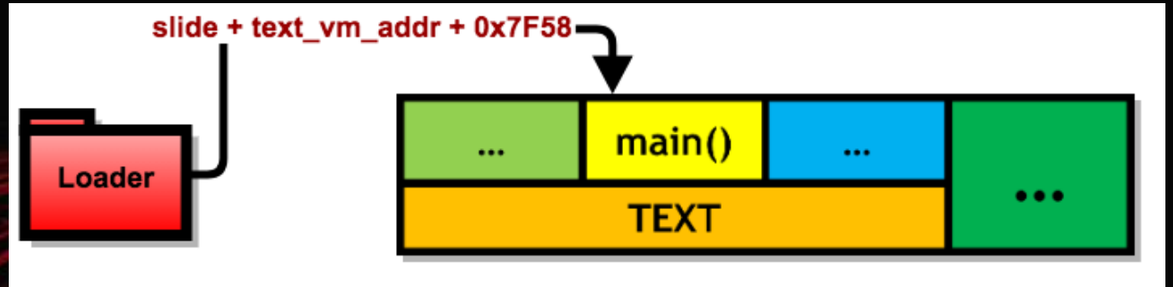
找到入口地址（比如main函数）

Load Commands--LC_MAIN

80000028	Command	LC_MAIN
00000018	Command Size	24
0000000000007F58	Entry Offset	32600
0000000000000000	Stacksize	0

绝对地址 = 入口地址

+ slide + text_vm_addr



地址（Rebase数据）修正

Lazy Symbol Pointer、CFString

	原数据（Pointer）		新数据（Pointer）
Lazy Symbol Pointer	0x100007F9C	->	slide + 0x100007F9C
CFString	0x100007FA8	->	slide + 0x100007FA8

Dynamic Loader Info	Description			
Rebase Info	__DATA	__la_symbol_ptr	0x100008010	Pointer
Opcodes	__DATA	__cfstring	0x100008028	Pointer
Actions				

Section64 (__DATA,__la_symbol_ptr)	Address	Data	Description	Value
Lazy Symbol Pointers	100008010	0000000100007F9C	Indirect Pointer	[0x100008010->_NSLog]

Section64 (__DATA,__cfstring)	Address	Data	Description	Value
ObjC CFStrings	100008018	0000000000000000	CFString Ptr	___CFConstantStringClassReference
	100008020	00000000000007C8		0x7C8
	100008028	0000000100007FA8	String	0x100007FA8:"Hello World!"

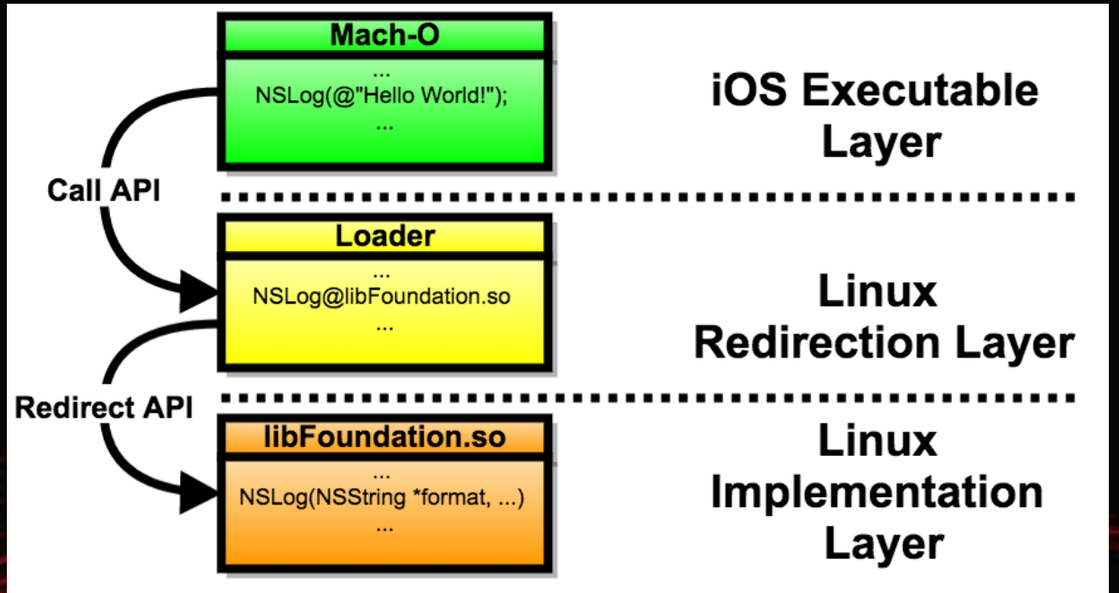
地址（API）重定向

Lazy Symbol Pointer数据 <- 模拟实现函数地址

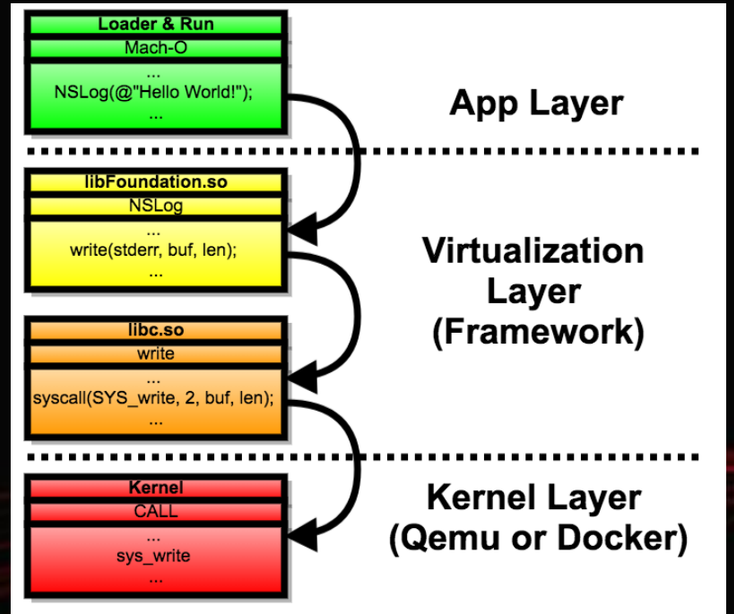
Section64 (__DATA,__la_symbol_ptr)	Address	Data	Description	Value
Lazy Symbol Pointers	100008010	0000000100007F9C	Indirect Pointer	[0x100008010->_NSLog]

	原地址		新地址
NSLog	slide + 0x100007F9C	->	NSLog@libFoundation.so

API重定向流程


Mach-O
...
NSLog(@"Hello World!");
...
iOS Executable Layer
Call API
Loader
...
NSLog@libFoundation.so
...
Linux Redirection Layer
Redirect API
libFoundation.so
...
NSLog(NSString *format, ...)
...
Linux Implementation Layer

完整运行流程

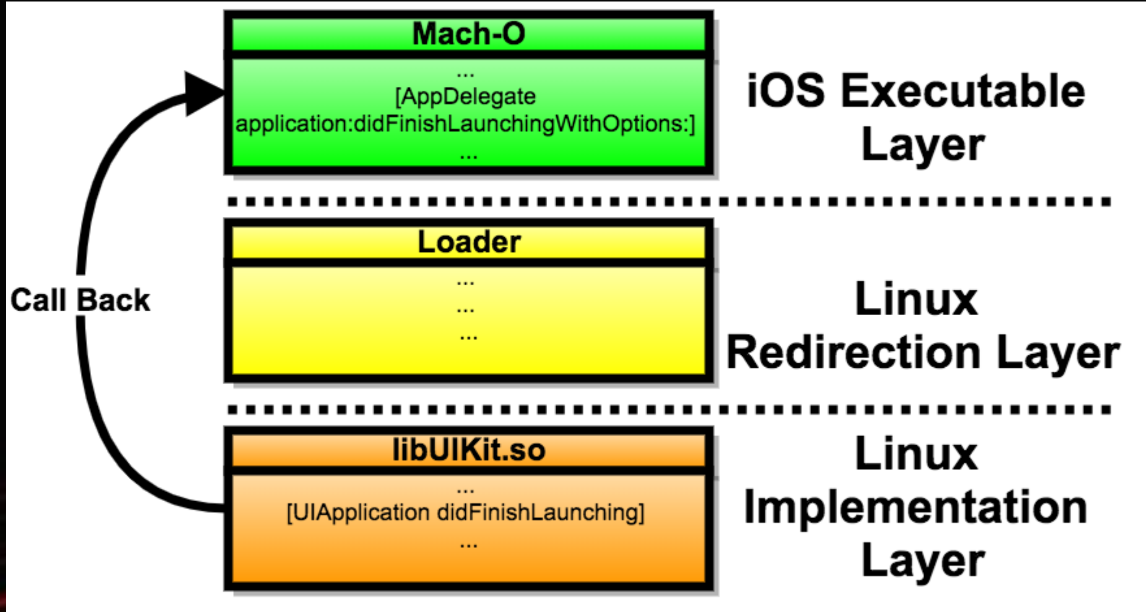


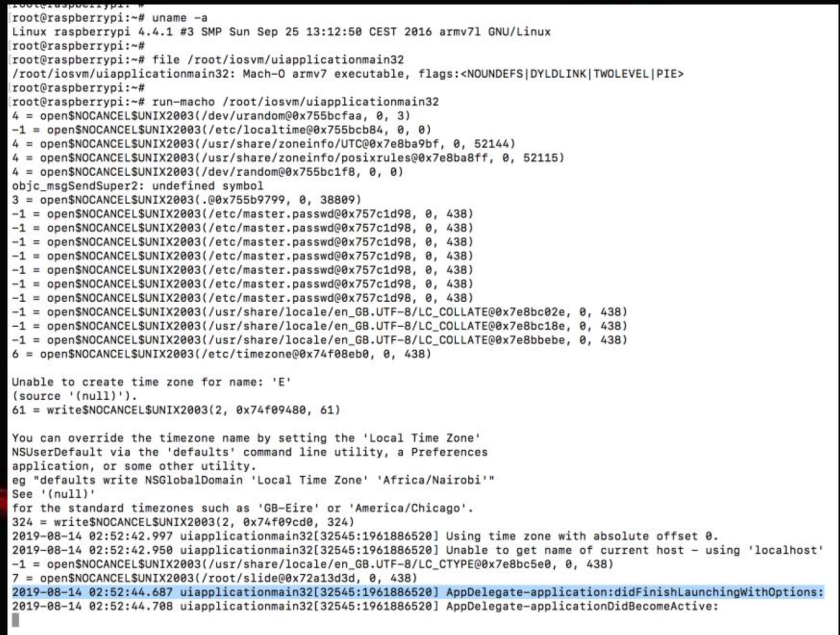

```
root@raspberrypi:~#
root@raspberrypi:~# uname -a
Linux raspberrypi 4.4.1 #3 SMP Sun Sep 25 13:12:50 CEST 2016 armv7l GNU/Linux
root@raspberrypi:~#
root@raspberrypi:~# file /root/iosvm/nslog32
/root/iosvm/nslog32: Mach-O armv7 executable, flags:<NOUNDEFS|DYLDLINK|TWOLEVEL|PIE>
root@raspberrypi:~#
root@raspberrypi:~# run-macho /root/iosvm/nslog32
4 = open$NOCANCEL$UNIX2003(/dev/urandom@0x755dbfa2, 0, 3)
-1 = open$NOCANCEL$UNIX2003(/etc/localtime@0x755dbb7c, 0, 0)
4 = open$NOCANCEL$UNIX2003(/usr/share/zoneinfo/UTC@0x7ef279cf, 0, 48040)
4 = open$NOCANCEL$UNIX2003(/usr/share/zoneinfo/posixrules@0x7ef2790f, 0, 48011)
4 = open$NOCANCEL$UNIX2003(/dev/random@0x755db1f0, 0, 0)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757e0d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757e0d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757e0d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757e0d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757e0d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7ef2959e, 0, 438)
3 = open$NOCANCEL$UNIX2003(.@0x755d8791, 0, 34705)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7ef296fe, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7ef2942e, 0, 438)
3 = open$NOCANCEL$UNIX2003(/etc/timezone@0x74f081b0, 0, 438)

Unable to create time zone for name: 'E'
(source '(null)').
61 = write$NOCANCEL$UNIX2003(2, 0x74f08780, 61)

You can override the timezone name by setting the 'Local Time Zone'
NSUserDefault via the 'defaults' command line utility, a Preferences
application, or some other utility.
eg "defaults write NSGlobalDomain 'Local Time Zone' 'Africa/Nairobi'"
See '(null)'
for the standard timezones such as 'GB-Eire' or 'America/Chicago'.
324 = write$NOCANCEL$UNIX2003(2, 0x74f08f90, 324)
2019-05-20 11:10:52.883 nslog32[5736:1961886520] Using time zone with absolute offset 0.
2019-05-20 11:10:52.824 nslog32[5736:1961886520] Hello World!
root@raspberrypi:~#
```

回调流程


Mach-O
...
[AppDelegate
application:didFinishLaunchingWithOptions:]
...
iOS Executable
Layer
Loader
...
...
...
Linux
Redirection Layer
libUIKit.so
...
[UIApplication didFinishLaunching]
...
Linux
Implementation
Layer
Call Back


root@raspberrypi:~# uname -a
Linux raspberrypi 4.4.1 #3 SMP Sun Sep 25 13:12:50 CEST 2016 armv7l GNU/Linux
root@raspberrypi:~#
root@raspberrypi:~# file /root/iosvm/uiapplicationmain32
/root/iosvm/uiapplicationmain32: Mach-O armv7 executable, flags:<NOUNDEFS|DYLDLINK|TWOLEVEL|PIE>
root@raspberrypi:~#
root@raspberrypi:~# run-macho /root/iosvm/uiapplicationmain32
4 = open$NOCANCEL$UNIX2003(/dev/urandom@0x755bcfaa, 0, 3)
-1 = open$NOCANCEL$UNIX2003(/etc/localtime@0x755bcb84, 0, 0)
4 = open$NOCANCEL$UNIX2003(/usr/share/zoneinfo/UTC@0x7e8ba9bf, 0, 52144)
4 = open$NOCANCEL$UNIX2003(/usr/share/zoneinfo/posixrules@0x7e8ba8ff, 0, 52115)
4 = open$NOCANCEL$UNIX2003(/dev/random@0x755bc1f8, 0, 0)
objc_msgSendSuper2: undefined symbol
3 = open$NOCANCEL$UNIX2003(.@0x755b9799, 0, 38809)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/etc/master.passwd@0x757c1d98, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7e8bc02e, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7e8bc18e, 0, 438)
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_COLLATE@0x7e8bbebe, 0, 438)
6 = open$NOCANCEL$UNIX2003(/etc/timezone@0x74f08eb0, 0, 438)
Unable to create time zone for name: 'E'
(source '(null)').
61 = write$NOCANCEL$UNIX2003(2, 0x74f09480, 61)
You can override the timezone name by setting the 'Local Time Zone'
NSUserDefault via the 'defaults' command line utility, a Preferences
application, or some other utility.
eg "defaults write NSGlobalDomain 'Local Time Zone' 'Africa/Nairobi'"
See '(null)'
for the standard timezones such as 'GB-Eire' or 'America/Chicago'.
324 = write$NOCANCEL$UNIX2003(2, 0x74f09cd0, 324)
2019-08-14 02:52:42.997 uiapplicationmain32[32545:1961886520] Using time zone with absolute offset 0.
2019-08-14 02:52:42.950 uiapplicationmain32[32545:1961886520] Unable to get name of current host - using 'localhost'
-1 = open$NOCANCEL$UNIX2003(/usr/share/locale/en_GB.UTF-8/LC_CTYPE@0x7e8bc5e0, 0, 438)
7 = open$NOCANCEL$UNIX2003(/root/slide@0x72a13d3d, 0, 438)
2019-08-14 02:52:44.687 uiapplicationmain32[32545:1961886520] AppDelegate-application:didFinishLaunchingWithOptions:
2019-08-14 02:52:44.708 uiapplicationmain32[32545:1961886520] AppDelegate-applicationDidBecomeActive:

部署

更好适配

ODM（Original Design Manufacturer）

PART
04

一些实践

谢谢观看

演讲人：朱学文（Ju Zhu）