



designwest

Embedded Android? Not so fast!

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These slides at <http://insymbols.com/misc/embedded-android-dw2013.pdf>

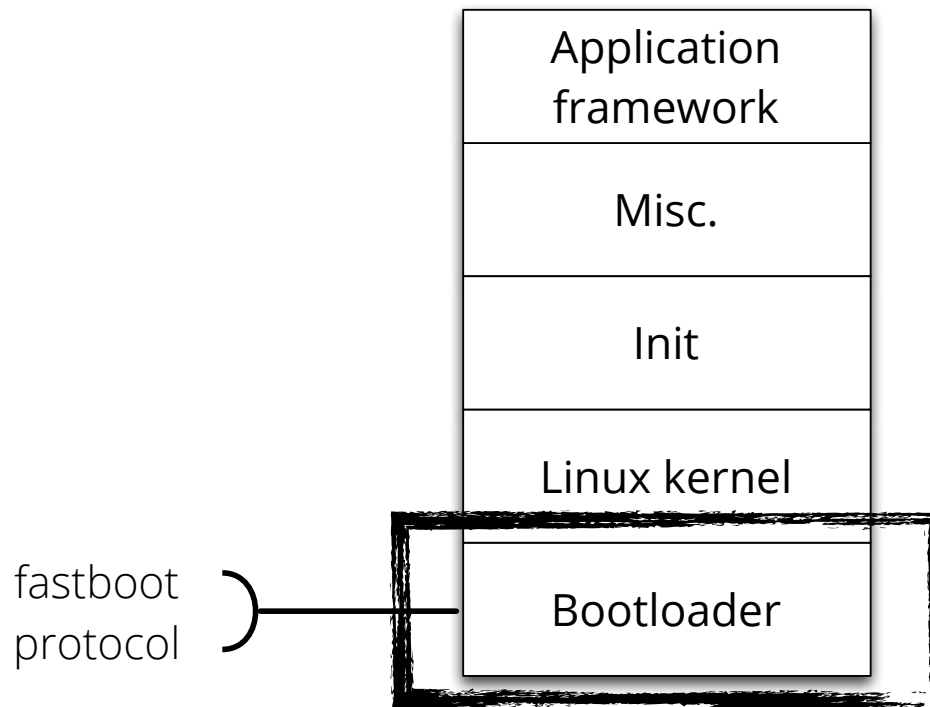
Contribute to discussion of Android's suitability for embedded work

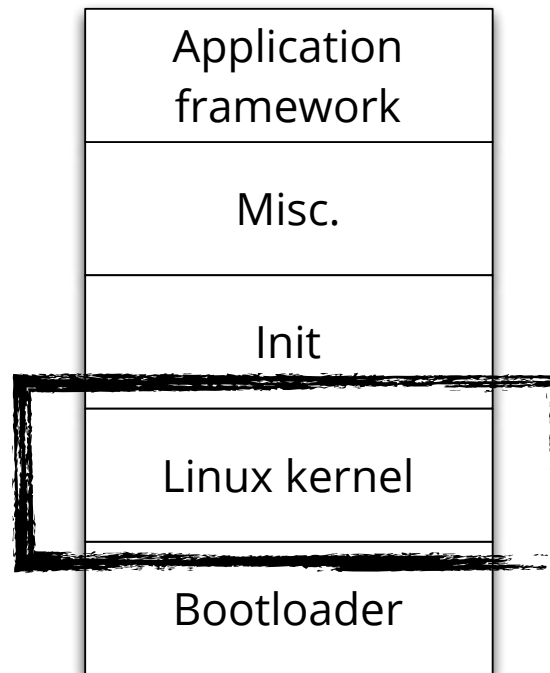
Demonstrate one way of using Android in an embedded system

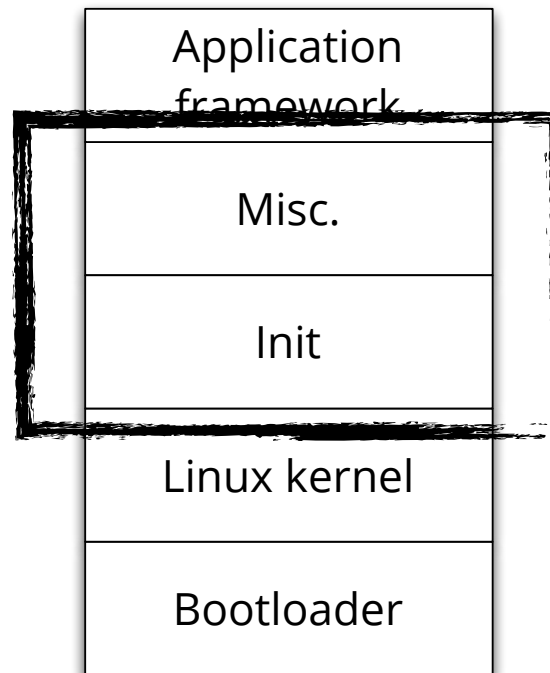
Q&A

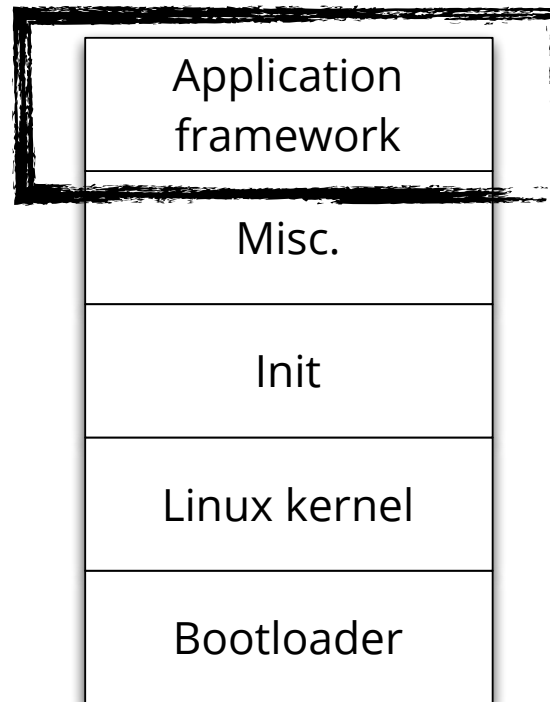
Application framework
Misc.
Init
Linux kernel
Bootloader











Enormously **successful**

Productive and enjoyable

environment for writing applications

Java has great tools


```
// mDataSource = new DriverDataSource(mBuffer, this);  
// mDataSource = new BackendDataSource(mBuffer, this);  
mDataSource.
```

```
mGrid.setOnC  
}
```

```
View.OnClickListener  
private bool
```

```
@Override  
public void  
if (mTog  
stop  
else
```

- equals(Object o) : boolean - Object
- getClass() : Class<?> - Object
- hashCode() : int - Object
- notify() : void - Object
- notifyAll() : void - Object
- start() : void - IDataSource
- stop() : void - IDataSource
- toString() : String - Object
- wait() : void - Object
- wait(long millis) : void - Object
- wait(long arg0, int arg1) : void - Object

public boolean equals (Object o)
Added in [API level 1](#)

Compares this instance with the sp
indicates if they are equal. In order
represent the same object as this in
class-specific comparison. The ger
this comparison should be reflexivi
transitive. Also, no object reference
equal to null.

The default implementation returns:

Press '^Space' to show Template Proposals

Press 'Tab' from propos

Problems @ Javadoc Declaration Console Call Hierarchy LogCat

Android

Form Widgets

TextView Large Medium Small

Button Small OFF

CheckBox RadioButton

CheckedTextView

Spinner

Sub Item



Text Fields

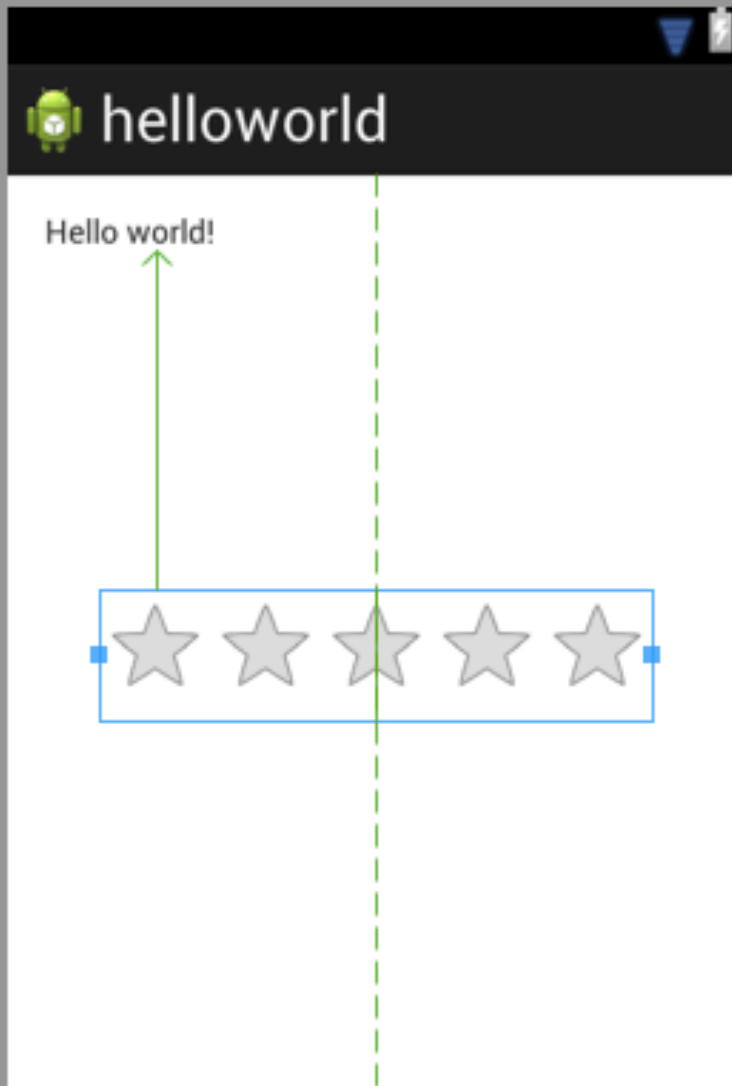
Layouts

Composite

Images & Media

Time & Date

Transitions



```
below: textView1  
centerHorizontal: true
```

Application framework excellent,
e.g., modularity of activities and intents

Users are familiar with Android GUIs

Framework services address common
needs: **network, power, audio,**
management

Hardware Requirements

Capable graphics (HW accelerated)

Sufficient storage (300 MiB?)

Kernel Requirements

Biggest Weakness

Android couples the operating system choice to the GUI choice

Issues with Android as OS

Software availability with build system

Software compatibility with libc

Software compatibility with libc

see `bionic/libc/CAVEATS`

not complete POSIX,
only what Android needs, e.g.:

no C++ exceptions

no locales or wide chars

missing functions like `getpwd()`

Issues with Android as OS

Package management

Field upgrades

Build system

SCM scheme

Issues with Android as OS

Limited and less-than-open community
of platform developers

You need to partition your solution in any case

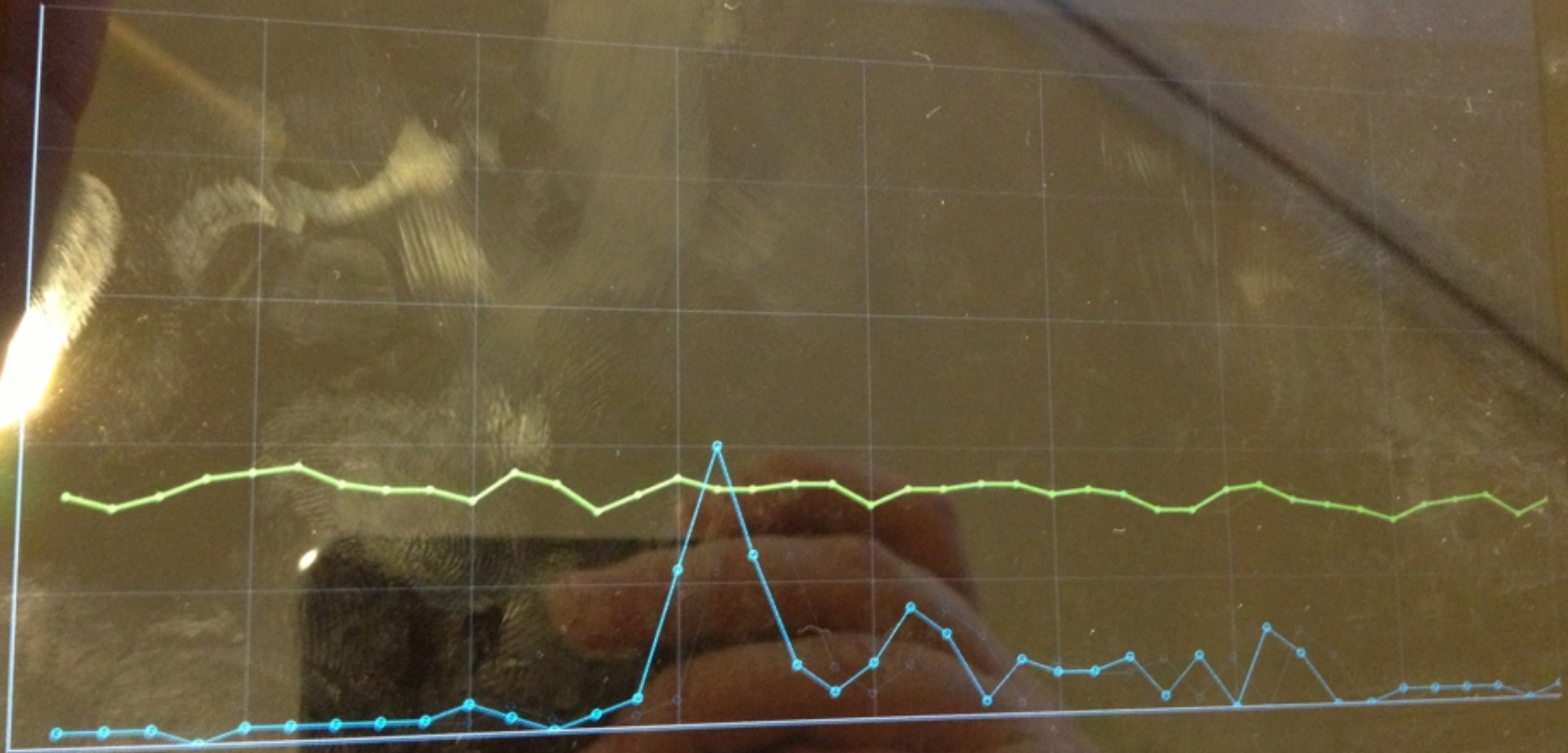
Running within Android framework is not suitable for some time-sensitive code

Can run code outside of framework, but not well-supported, and library challenges remain



Jumpstart™ Oscilloscope

8:30



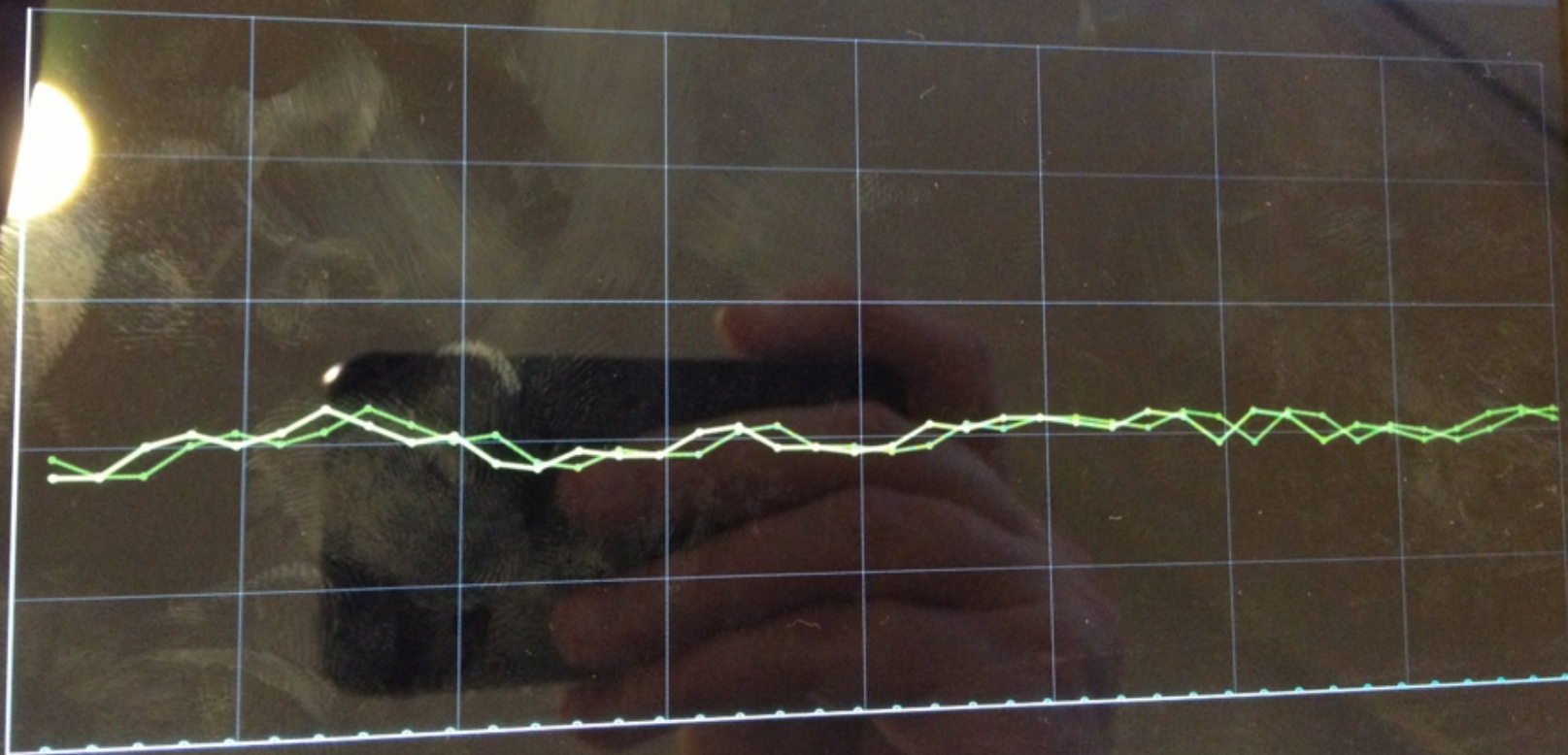
CH1 1 Volt/div Jitter 10 ms/div





Jumpstart™ Oscilloscope

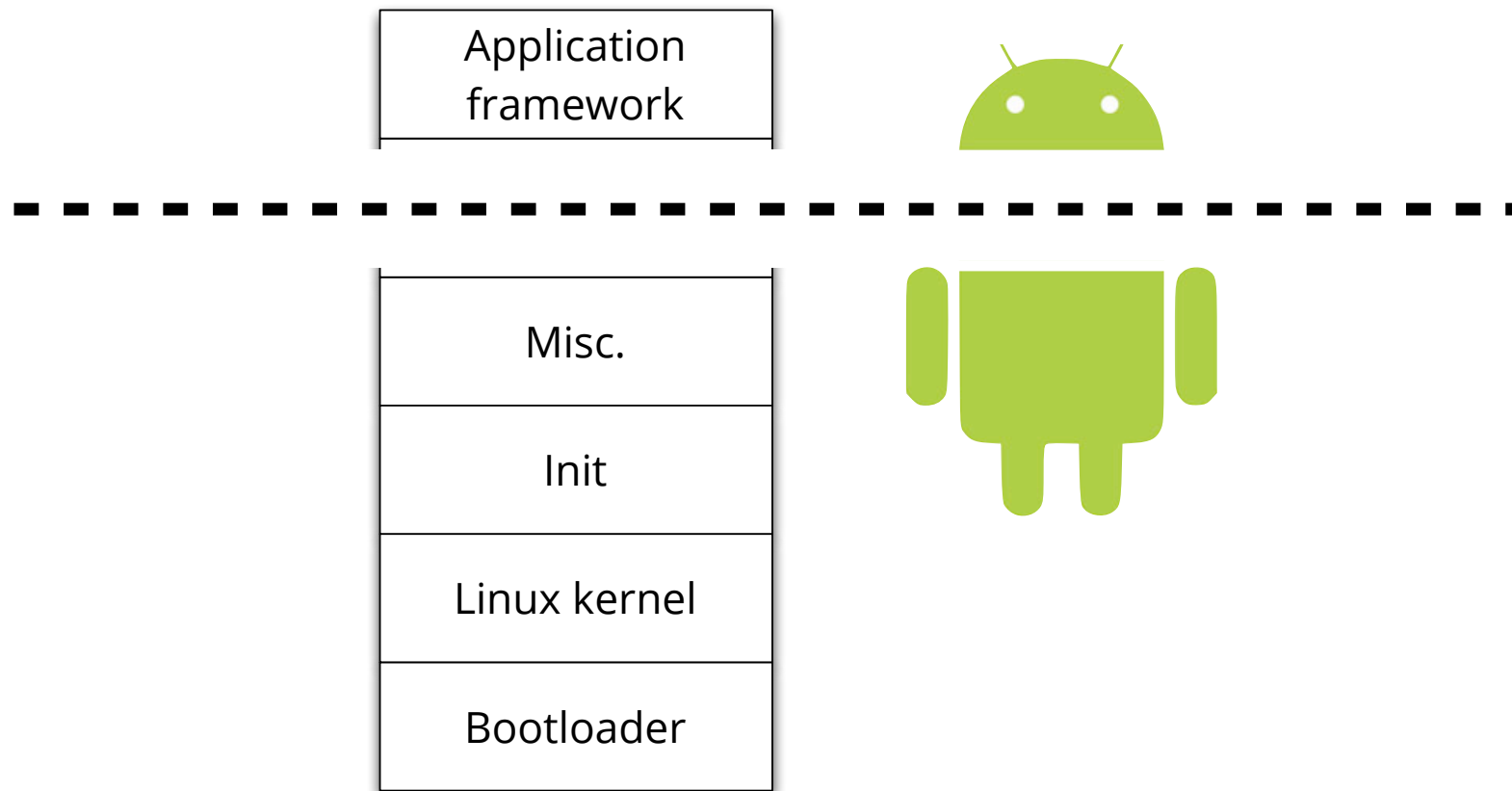
8:33



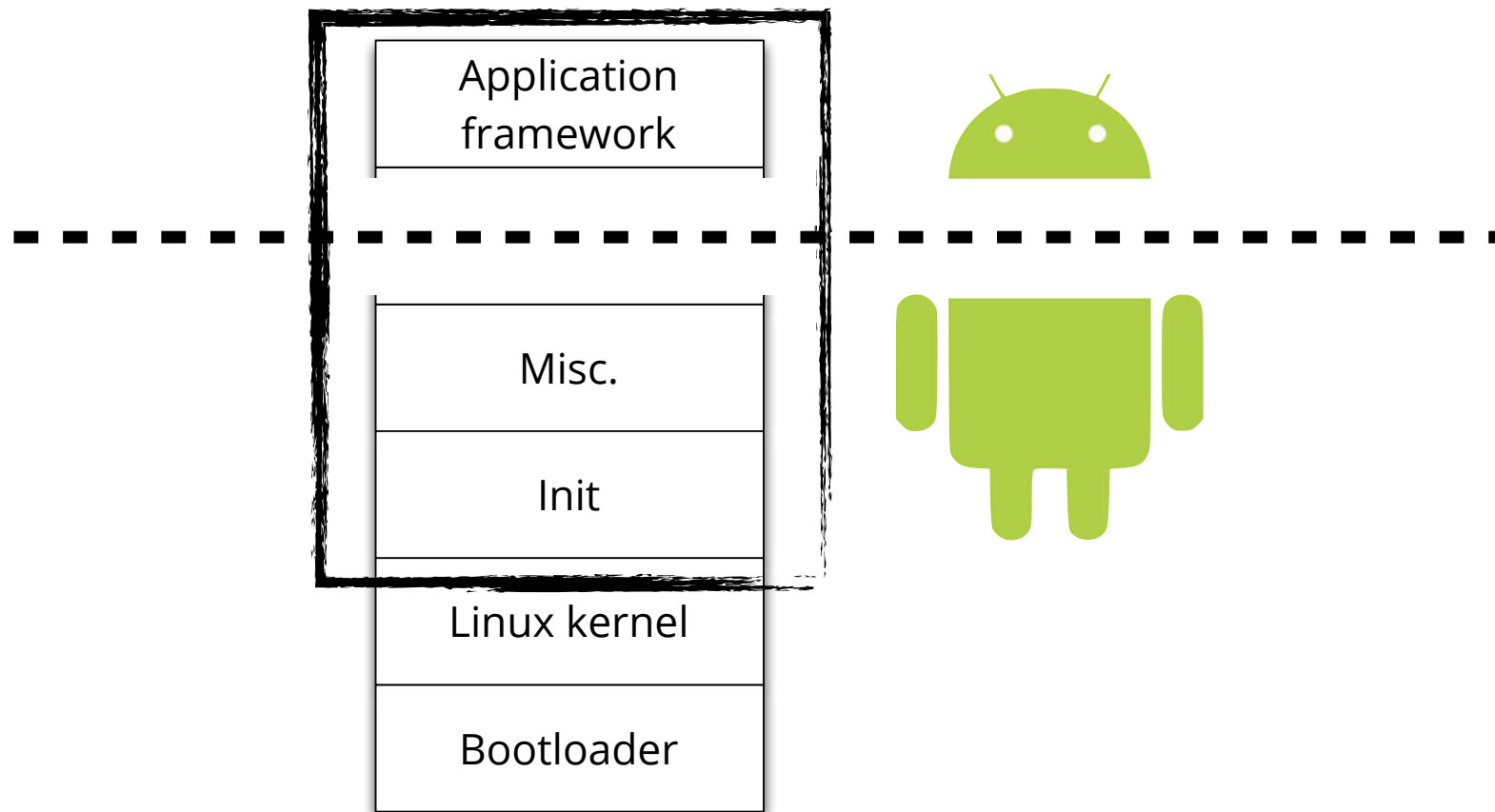
CH1 1 Volt/div Jitter 10 ms/div



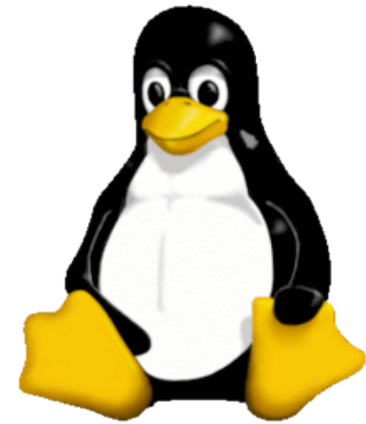
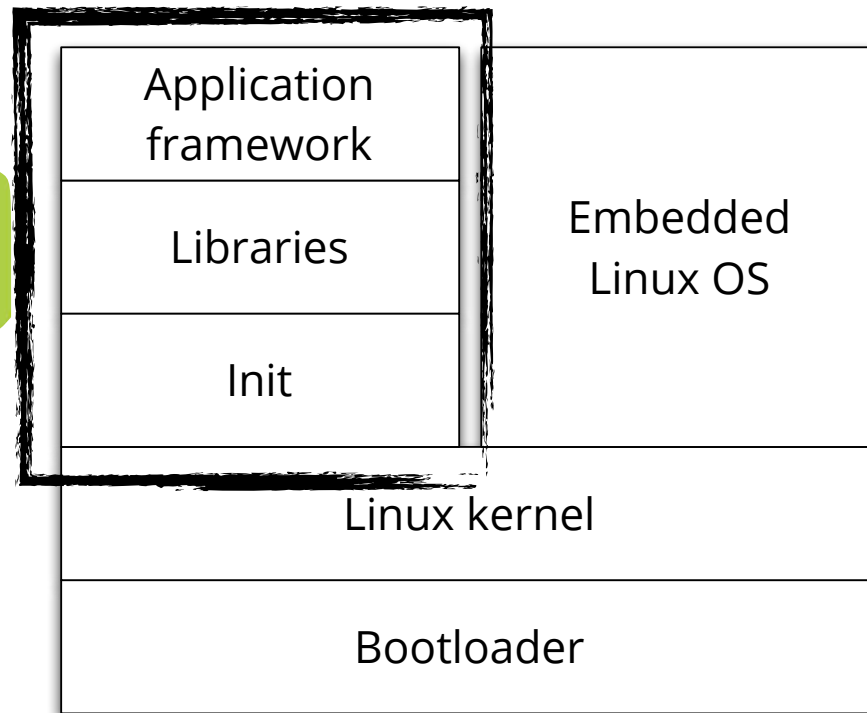
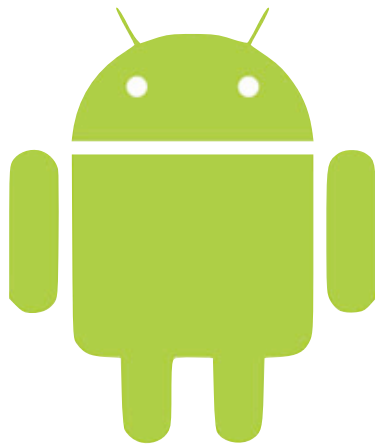
Ideally we could just use the application framework



but Android is architected and delivered as a **tightly-coupled** combination



forcing us to keep it intact and put other software alongside it



Why, again?

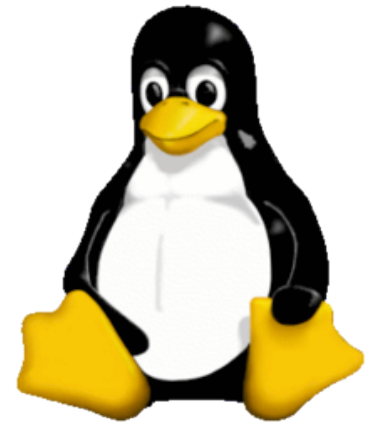
extra software

libraries

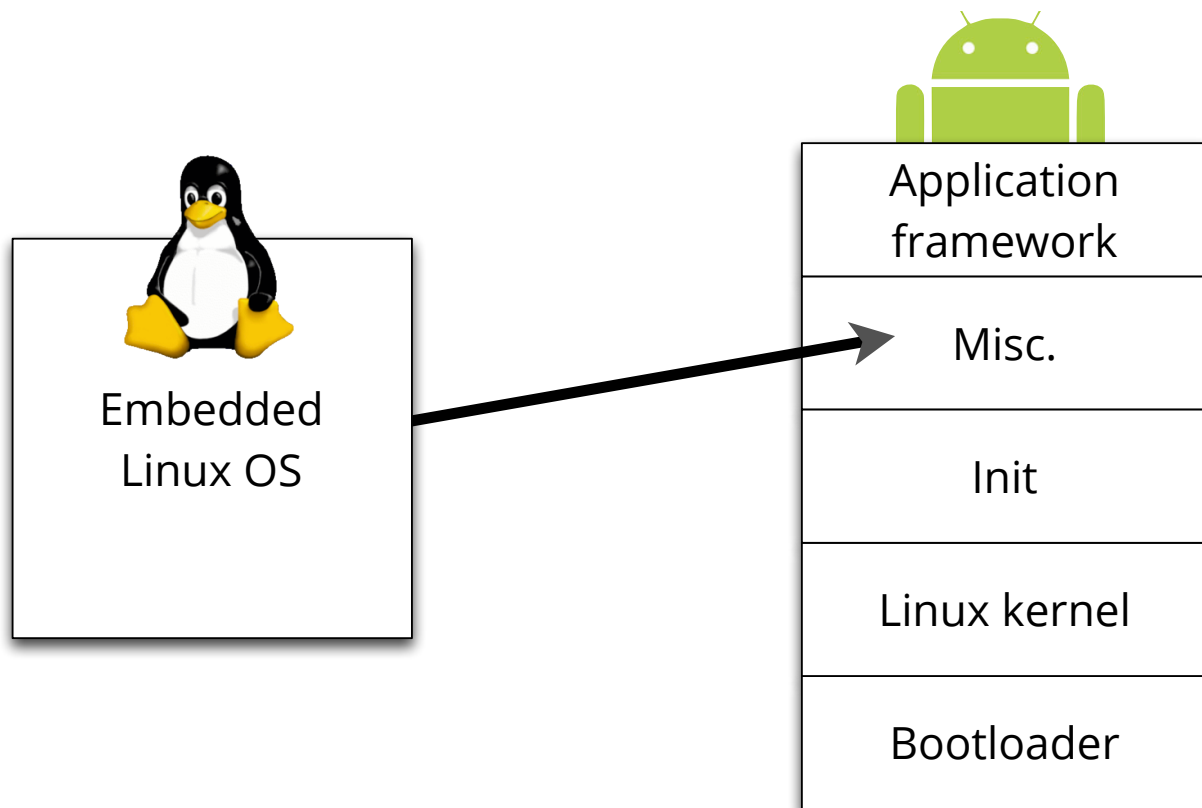
package
management

tools

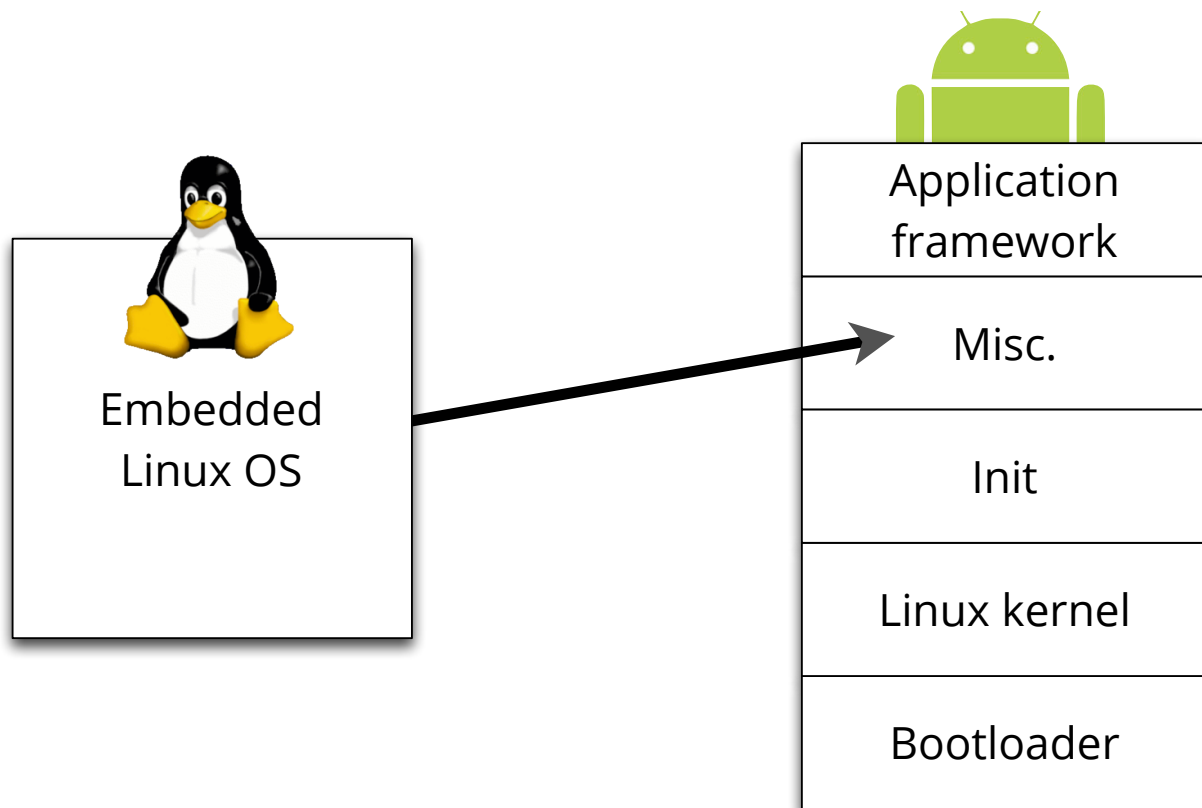
Embedded
Linux OS



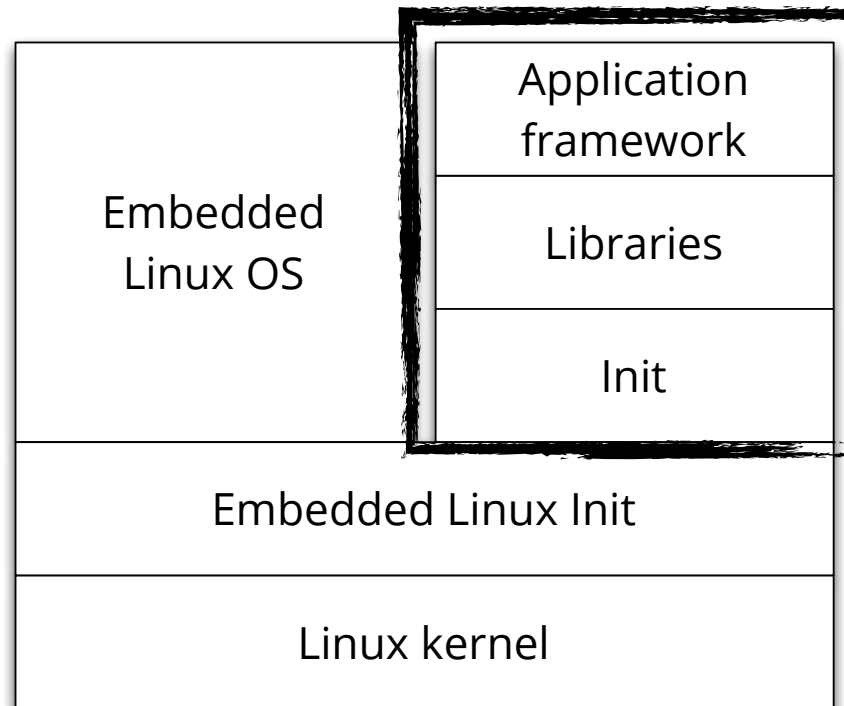
How? Some suggest injecting pre-built Embedded OS into Android build process



Backwards—this leaves Android in charge of build process, package management, etc.



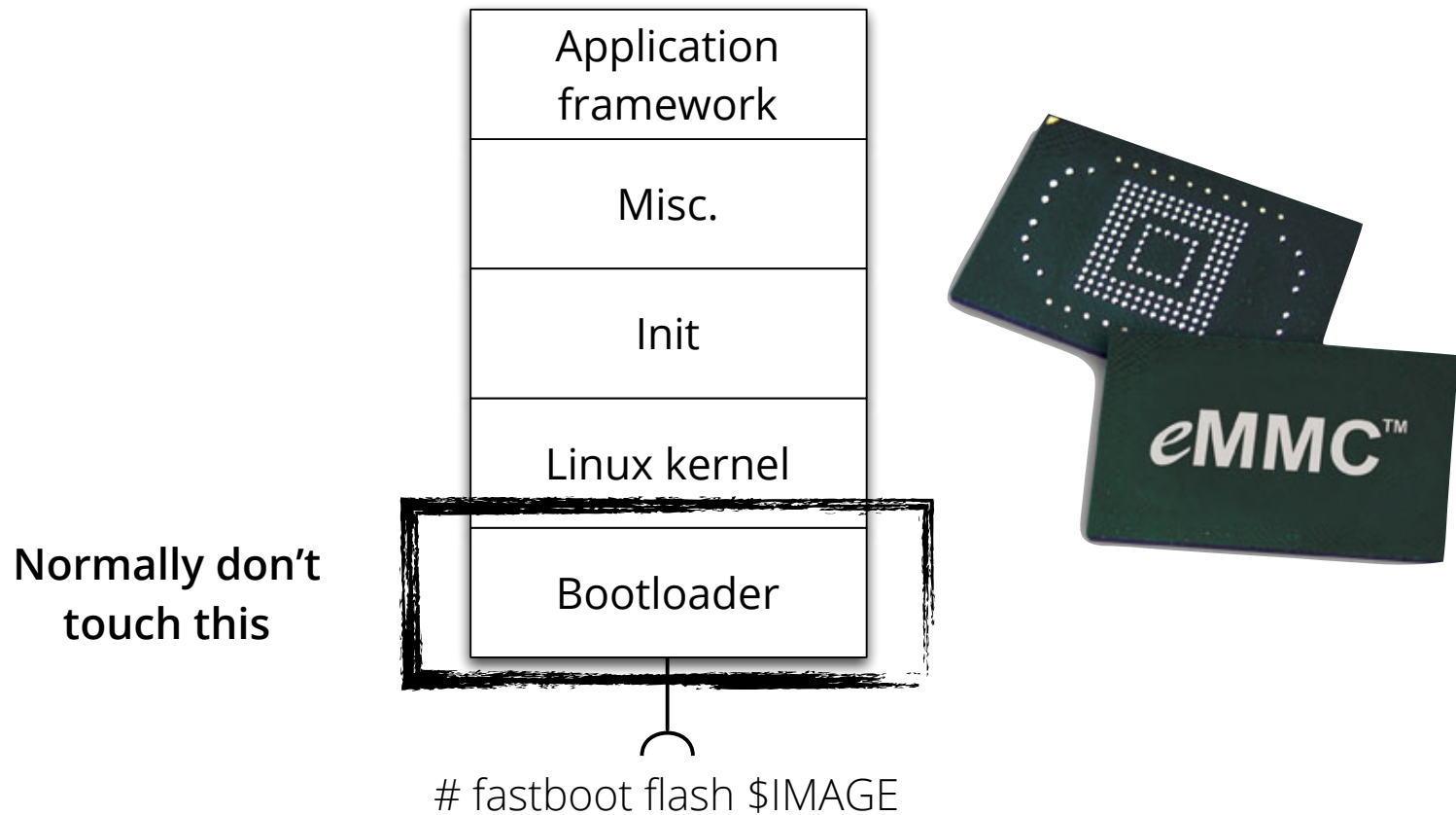
Proposal: treat Android as package within the Embedded Linux OS



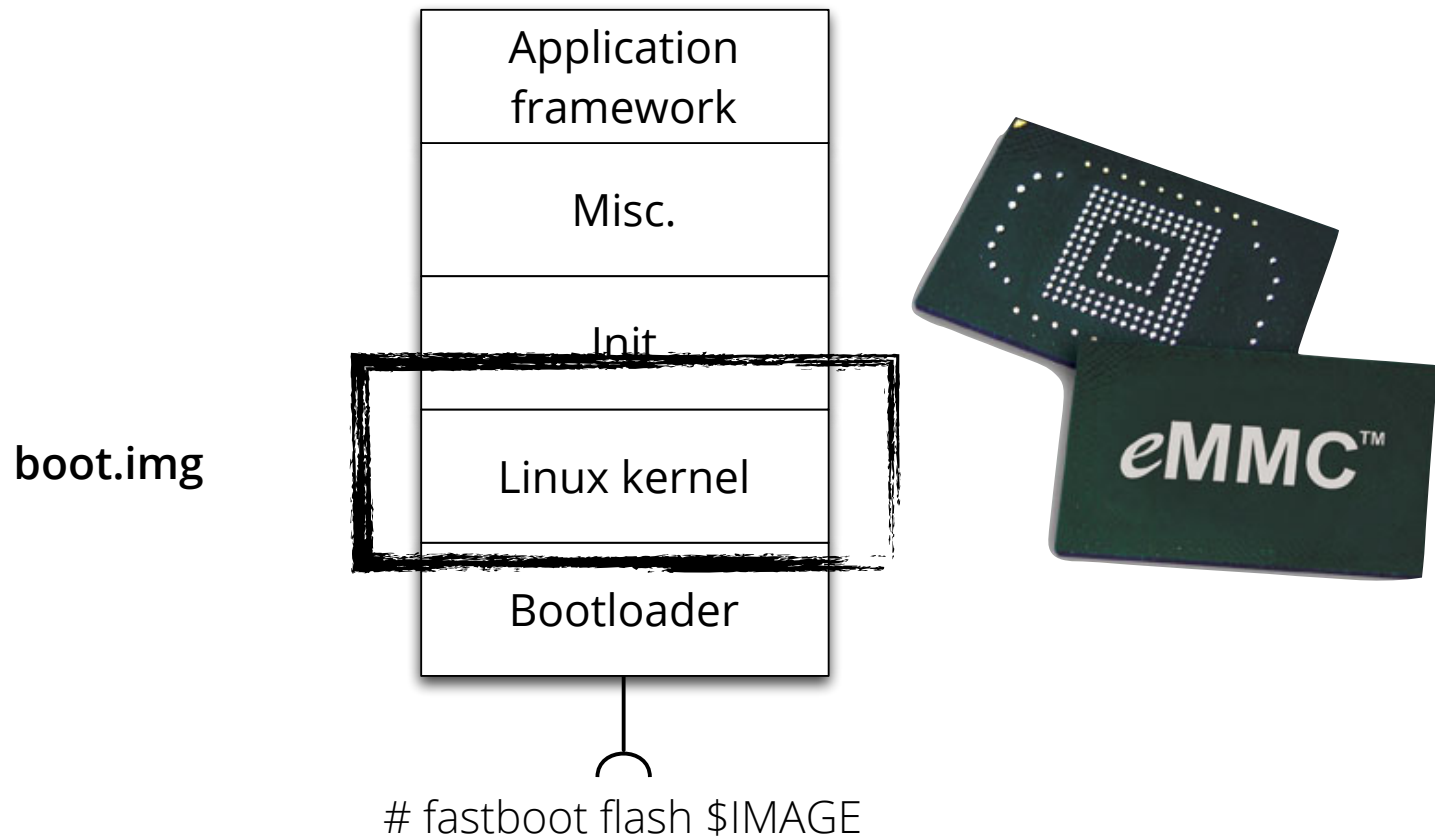
Demonstration of this concept applied to the Nexus 7



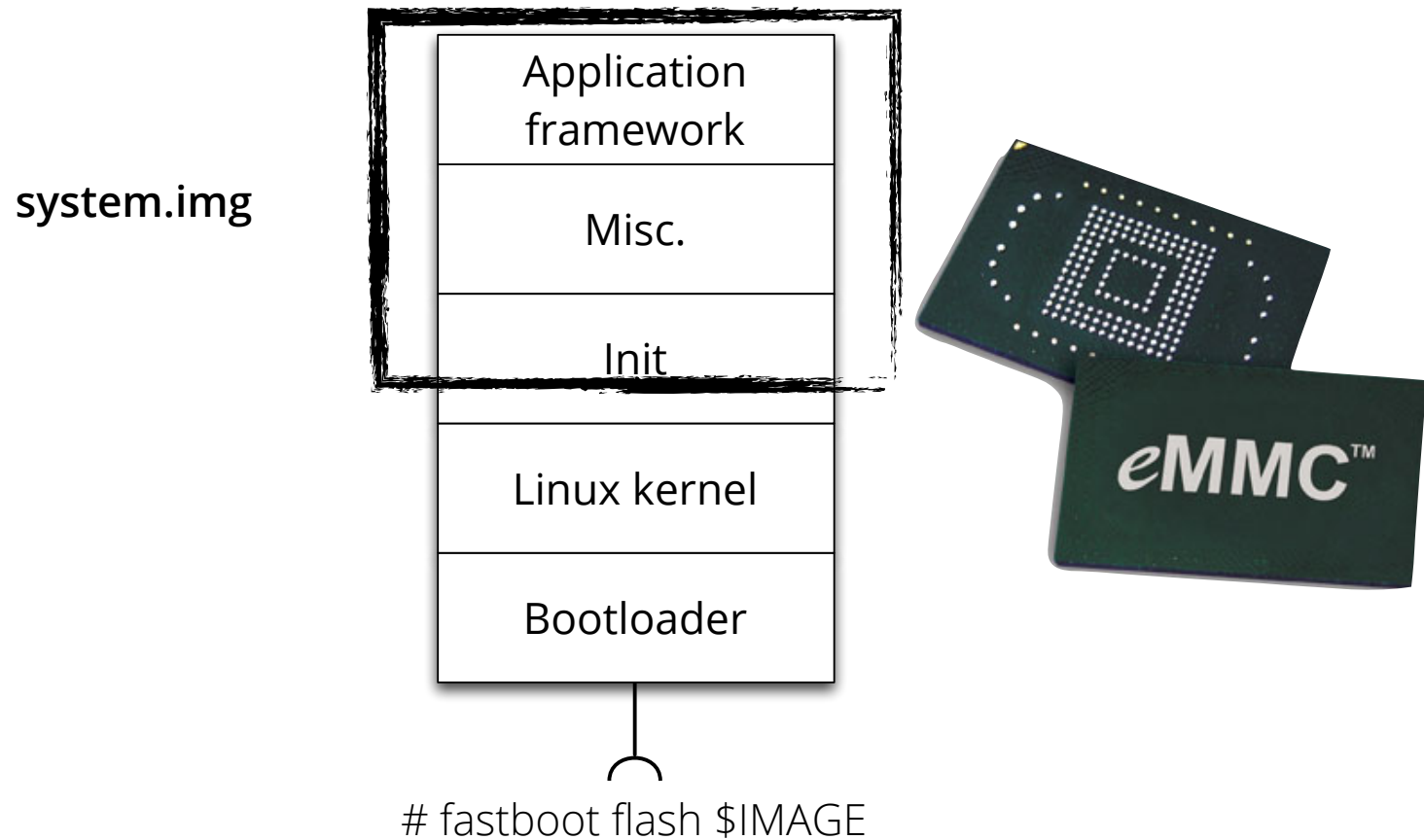
How Android device storage is partitioned



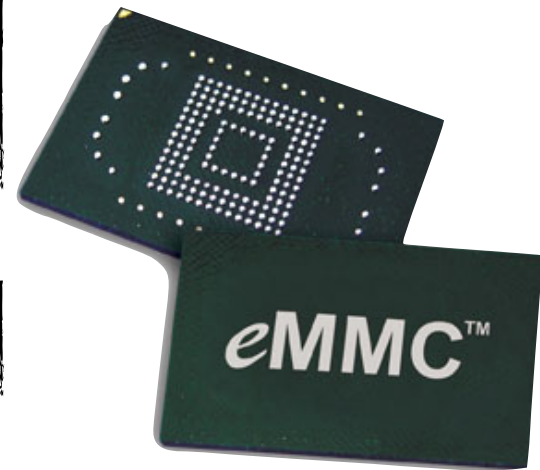
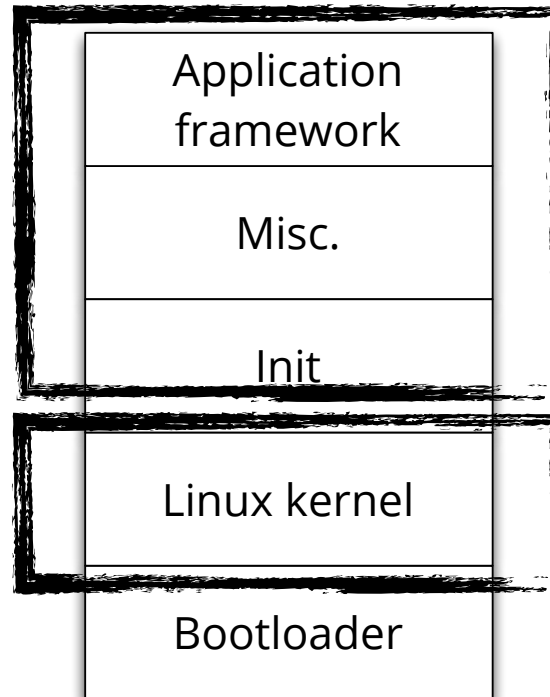
How Android device storage is partitioned



How Android device storage is partitioned



New kernel, new system image (now in userdata partition)



fastboot flash \$IMAGE

Nexus 7 **kernel** source:

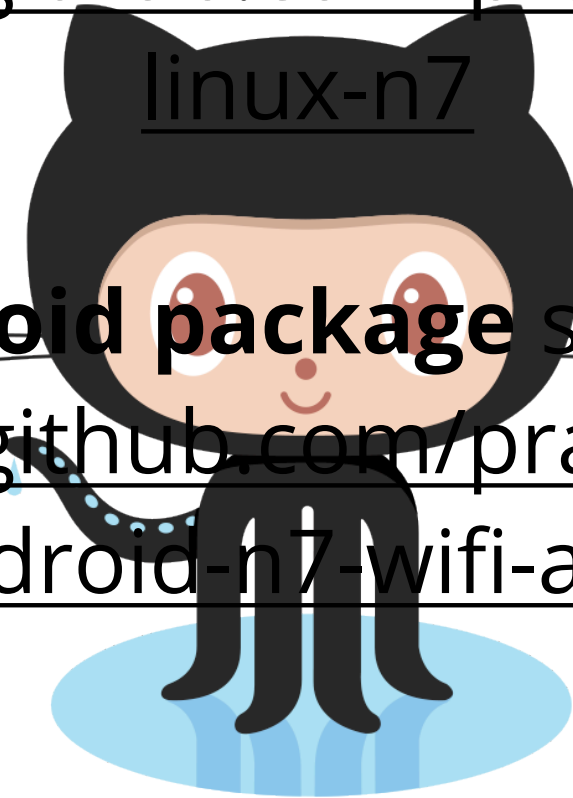
<https://github.com/pragmatux/>

[linux-n7](https://github.com/pragmatux/linux-n7)

Android package source:

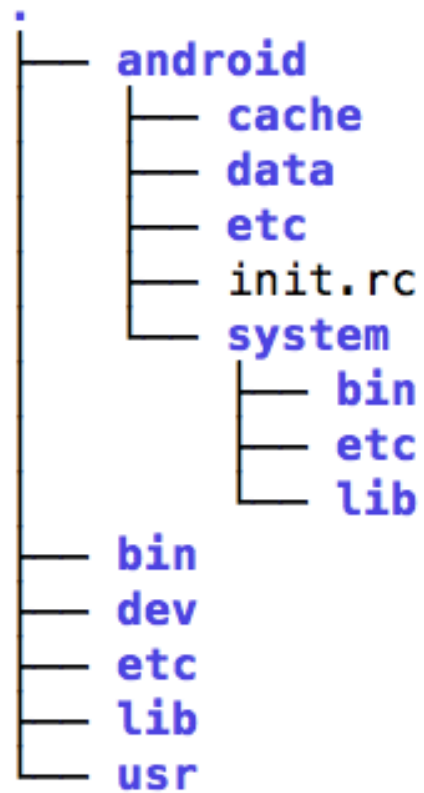
<https://github.com/pragmatux/>

[android-n7-wifi-aosp](https://github.com/pragmatux/android-n7-wifi-aosp)

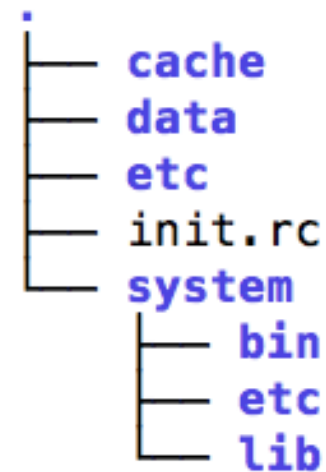


Android filesystem in chroot

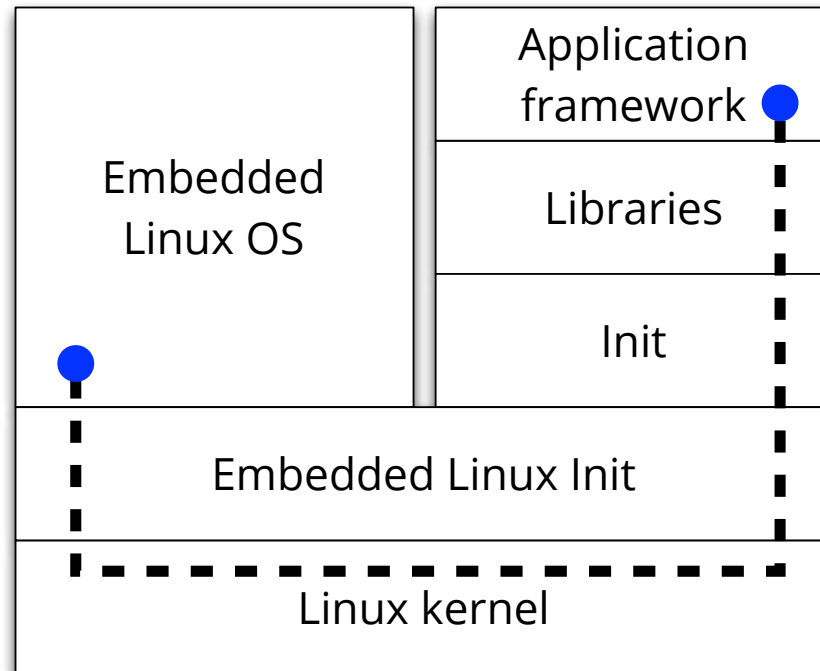
Embedded OS



Android



Communication via kernel still works as always



Demos

Console

Android managed by systemd

APK delivered by .deb package

Android activity plus native daemon



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