Android on a non-mobile embedded system

a war story

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http://www.mind.be/content/Presentation_Android-non-mobile.odp

Does this look like an Android device?

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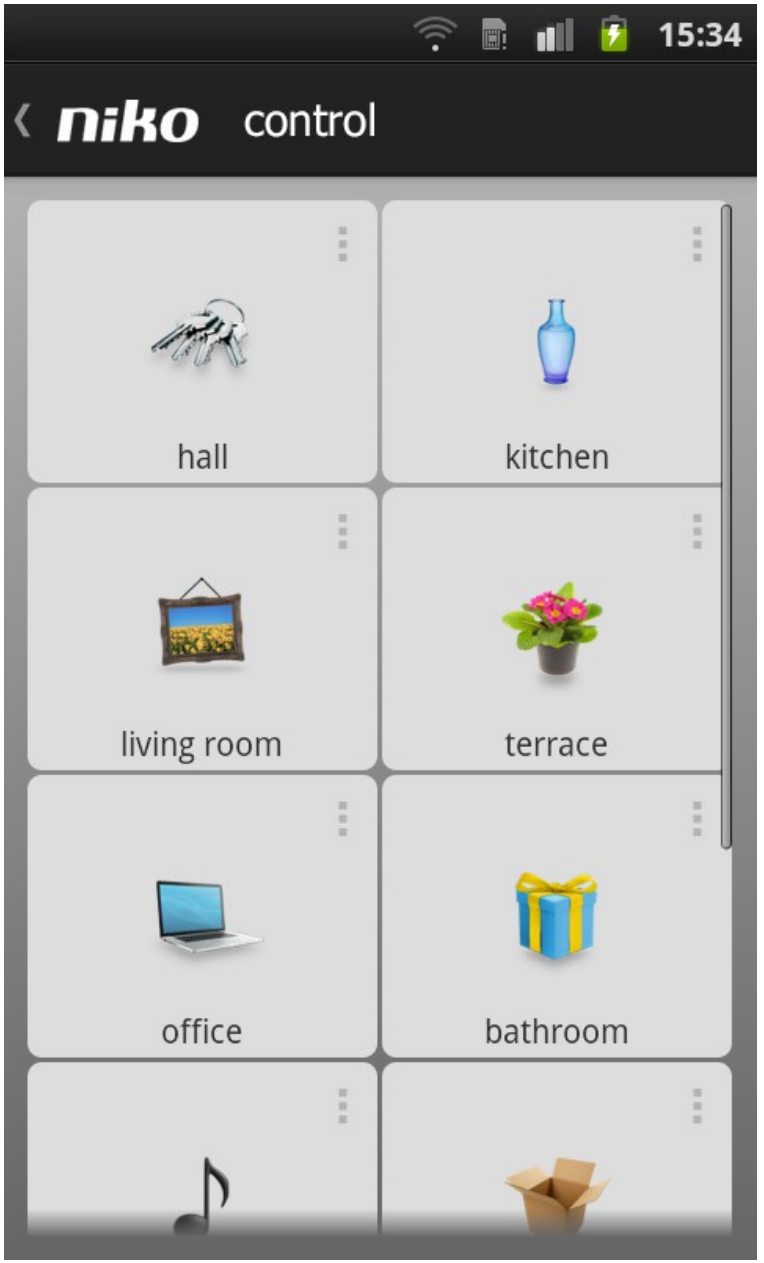

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Android on a non-mobile embedded system

- Benefits and limitations
  - Reduces time-to-market
  - Is somewhat familiar
  - Is sometimes supported on your device
  - But future is uncertain
- Lessons learned
  - Porting to your device is relatively easy
  - Size is a problem
  - You're on your own for updates

Background

- We come from a Linux world
  - Earlier generation based on Linux/Qt
  - Several products with Linux, various “distros”
  - Kernel customization for custom board
- We do a lot of outsourcing
  - To get things done quickly
  - Source code is always transferred to Niko
  - Incoming inspection of source code

Android
benefits and limitations

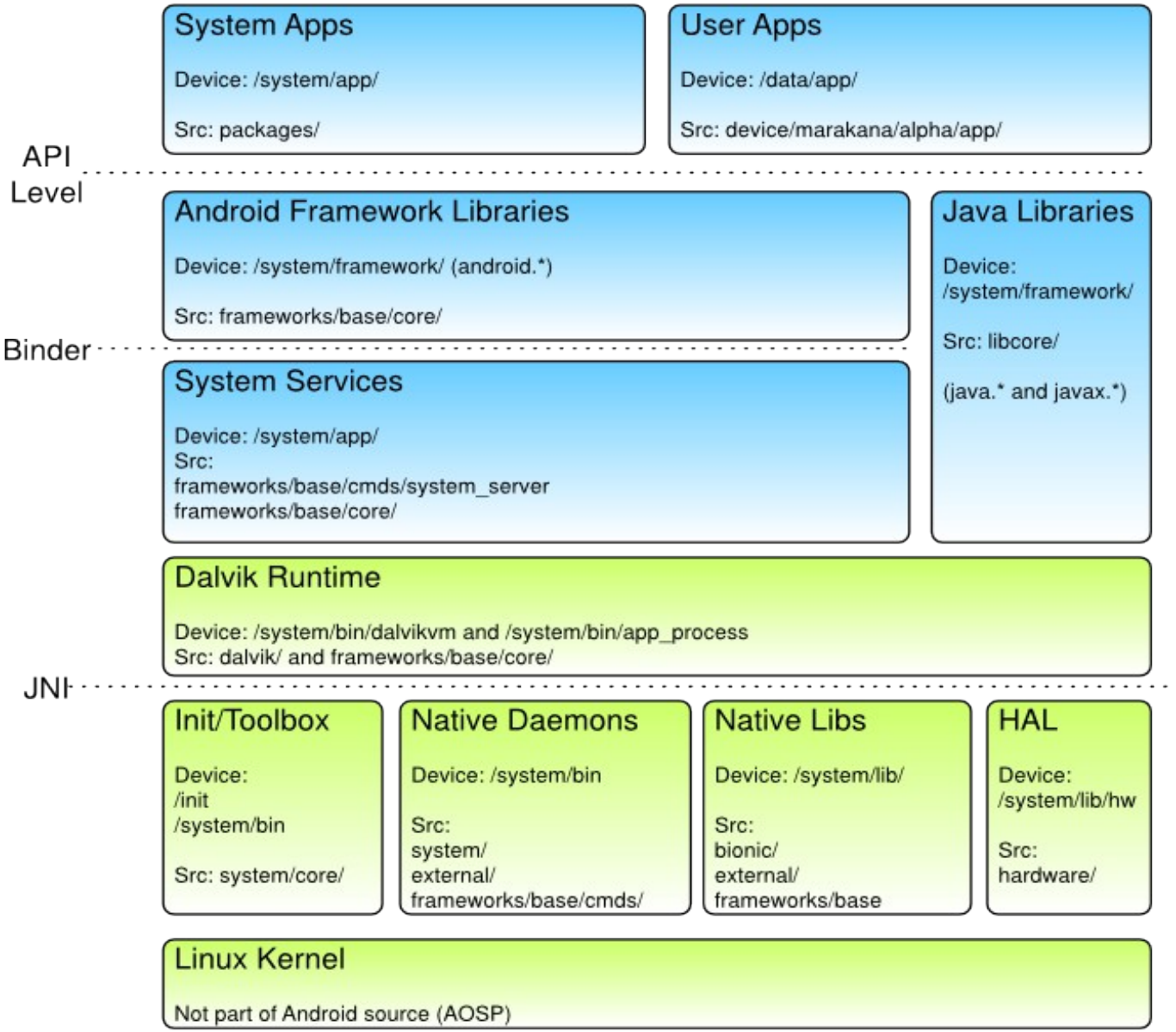
Android reduces time to market

- Smartphone/tablet app can be reused
- UI work can easily be outsourced
  - Many app developers out there
  - UI designers know Android
- App has shorter release cycle
  - Reuse testing of smartphone/tablet app
    Just add another device to the pool
  - Good test frameworks exist
  - App is a smaller part ⇒ less risk

Android is (somewhat) familiar

- It's still a Linux kernel
  – but with many adaptations
- It still uses many traditional libs and daemons
  – but with many adaptations
- Source is based on *make* and *git*
  – but used in an unfamiliar way (*lunch*, *repo*)
- It doesn't follow Filesystem Hierarchy Standard
- It doesn't use glibc, but bionic – not POSIX!

Android is (somewhat) familiar



Custom programs can be reused if...

- You can port them to bionic
  or you install glibc on the system
- You can adapt paths to /system/...
  or you chroot into an FHS tree
- You can package it in *lunch*/*repo*

  (yet another build/package system)
- Hopefully you don't need to run the same code on stock Linux...

Many chip and board vendors provide Android

- Branches off AOSP (https://android.googlesource.com/platform)
- AOSP itself contains some boards
  - Actually only one at the moment: Pandaboard
- SoC vendor forks
  - TI OMAP, Freescale i.MX, …
- Board vendor forks
  - e.g. Phytec, Variscite, Inforce, Adeneo, …
- Community-driven forks
  - Android-x86, rowboat (Gumstix), ...

Is Android future-proof? Kernel lags behind

- Freescale i.MX Android kernel:
  - is at 3.0.15, not 3.0.99
  - > 2000 patches between v3.0.15 and imx_3.0.15_android
- TI DM37x Android kernel:
  - TI provides 2.6.32-based kernel
  - android.googlesource.com is at 3.0.58, not 3.0.99
  - > 3000 patches between v3.0.58 and android-omap-3.0

Is Android future-proof? Board vendors don't provide updates

- Board vendors typically provide only a few versions e.g. Gingerbread, Jellybean
- Usually no more updates after move to new Android version
  - Theoretically not much of a problem since older apps mostly run on newer Android
  - However, porting customizations can be a lot of effort

⇒ you're on your own if you want long-term support

Is Android future proof? Community forks vary

- Tracking AOSP is not trivial!
- E.g. android-x86: only 4.0-r1 considered stable
  - Not yet supported by AMD
  - Graphics and codec acceleration may not be available

Lessons learned

Adding BSP is easy

- Just edit arch/arm/mach-xxx/board-yyy as usual; same for display
- Exporting to middleware (app space) is more difficult
  - especially sensors, HW acceleration for multimedia
- See e.g.
  - Porting Android presentation at ELC-E 2012

    http://elinux.org/images/f/ff/Porting_Android_4.0_to_a_Custom_Board.pdf
  - Embedded Android training

    http://www.opersys.com/training/embedded-android
- But all this is typically already provided by the vendor

Basic customizations are very easy

- Custom bootsplash is foreseen in *bootable*
- Define required services in *device_name.mk*
- Replace *Launcher* with custom app
- Remove SystemUI, lock screen, unneeded apps and services

  But it's easy to break dependencies, so test carefully
- Customizing standard apps is more work

The Ethernet problem

See Adding Ethernet Connectivity at ELC-E 2012
http://elinux.org/images/9/98/Dive_Into_Android_Networking-_Adding_Ethernet_Connectivity.pdf

- Ethernet works fine on the Linux side
- But it's not visible in Connectivity Manager
  so apps don't detect that it's available
- Android-x86 has Ethernet Connectivity Manager
  but it doesn't work perfectly

Size matters

- AOSP is provided as git trees, not tarballs
- Full clone takes about a day
- Impossible to integrate in our svn-based workflow
- Build from scratch takes too long for a nightly build
- In the end, we shifted this responsibility to the board vendor

App store doesn't come for free

- AOSP doesn't contain Google Play
  or other Google products
  Agreement with Google is required
- So you cannot use Google Play to
  - push updates
  - sell features by installing apps
- Google Play server-side isn't open source
  But FDroid (from Replicant) is open source
  git://gitorious.org/f-droid/fdroidserver.git
- Relatively easy for an app to update itself

Update daemon app

- Service with permission to install packages: `android.permission.INSTALL_PACKAGES`
- Polls your company URL for presence of new .apk
- Downloads .apk
- Installs it with local package manager: `pm install -r foo.apk`

OS updates: roll your own

- AOSP has *bootable*, but chip vendors usually ship U-Boot
- Update is normally initiated by the user
  Failsafe remote update is not foreseen at all
- On the other hand, it's U-Boot + Linux userspace, so not so different from other embedded systems

Conclusion: Android can save a lot of time

- If you can reuse a smartphone app (or vice versa)
- If it is already ported to your platform

  but doesn't cost more time than porting Linux
- If you don't need standard Linux tools/daemons
- Once you have the platform you can quickly respond to market and functional changes.