TOWARDS BUILDING MODERN ANDROID AS A GUIX PACKAGE

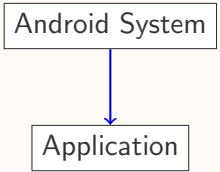
Julien Lepiller

Guix 10th anniversary
September 2022

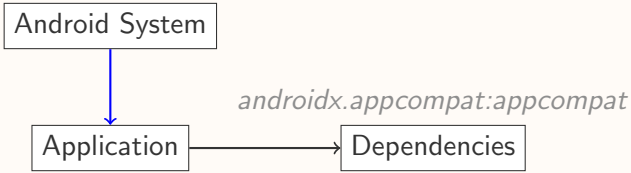
Introduction

Android System

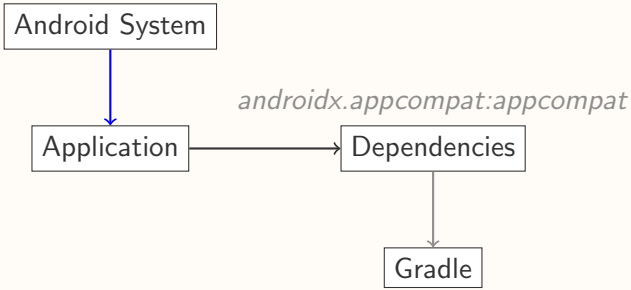
Introduction



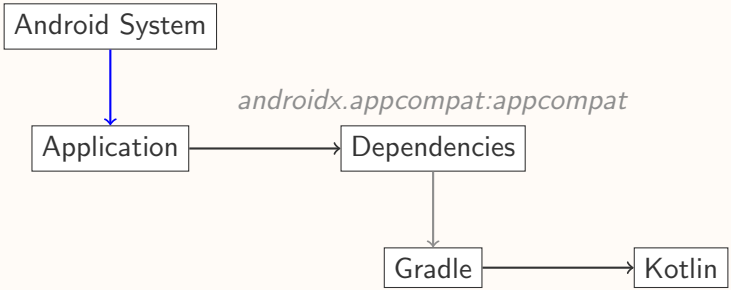
Introduction



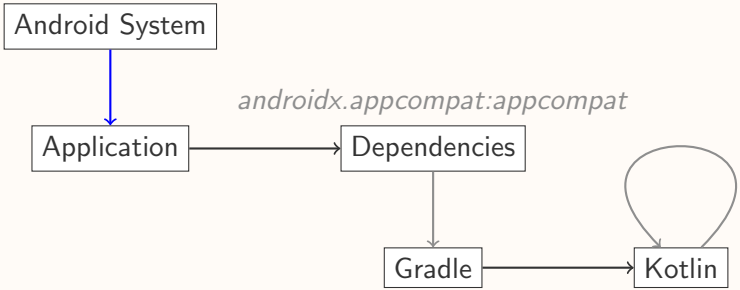
Introduction



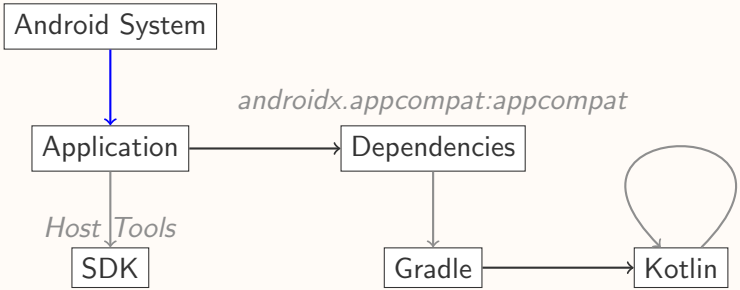
Introduction



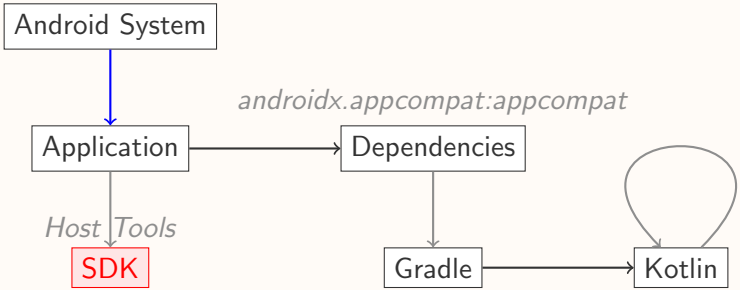
Introduction



Introduction



Introduction



Agenda

- **Getting Sources**
- Analyzing Blueprint Files
- Creating a Build System
- Current Status
- What's Next?

Getting Sources

Official instructions (simplified):

```
# Get sources
repo init -u https://android.googlesource.com/platform/manifest
repo sync
# then build android
source build/envsetup.sh
lunch aosp_arm-eng
m
```

The Manifest

```
...
<project path="device/ti/beagle_x15-kernel"
    name="device/ti/beagle-x15-kernel"
    groups="device,beagle_x15,pdk"
    clone-depth="1" />
<project path="system/libziparchive"
    name="platform/system/libziparchive"
    groups="pdk" />
<project path="prebuilts/abi-dumps/ndk"
    name="platform/prebuilts/abi-dumps/ndk"
    groups="pdk-fs" clone-depth="1" />
...
```

Manifest Parsing

```
(use-modules (sxml simple))
```

- Shallow clone of each project
- Exclude prebuilts


28 GB later ...

Repository Hierarchy

- Lots of repositories
- Each may contain multiple projects / packages / targets
- Vendored dependencies
- Different types: host, target, C, java, etc.

SDK Build System: Blueprint and Soong

Blueprint

- Meta build system
- Defines syntax, basic rule handling with defaults
- Defines basic rules for Go, so it can build itself
- Nice bootstrap included :)

Soong

- Build system for Android
- Based on blueprint
- Defines additional rule types for Android
  - Java
  - C/C++
  - Go
  - Scripting
  - etc.

Soong failures (for Guix purposes)

- Refuses to run arbitrary binary for reproducibility reasons
- Runs blessed prebuilt binaries for “reproducibility”
- Assumes it is in a directory with all of Android sources
  - Only looks for dependencies in intermediate result directory
  - Install to intermediate result directory
- hard-coded targets in the build directory

Agenda

- Getting Sources
- **Analyzing Blueprint Files**
- Creating a Build System
- Current Status
- What's Next?

Blueprint Files

The goal is to build the SDK host tools (adb, etc.). They use Blueprint:

```
cc_binary_host {
    name: "adb",
    stl: "libc++_static",
    defaults: ["adb_defaults"],
    srcs: [
        "client/adb_client.cpp",
        "client/bugreport.cpp",
        ...]
}
```

PEG Parser

Apparently I cannot spend a year without writing a PEG parser (2018: opam, 2019: maven stuff, 2021: blueprint, 2022: gettext)

```
(use-modules (ice-9 peg))

(define-peg-pattern keyval all
  (and var-name (* SP) COLON (* SP) keyval-val))
(define-peg-pattern var-name body
  (+ (or "_" (range #\a #\z) (range #\A #\Z)
         (range #\0 #\9))))
(define-peg-pattern keyval-val body
  (or boolean integer strings-list string-all map-pat var-name))
```

Transform to a Guile Structure

```
cc_library {
  name: "foo"
  srcs: ["foo.c"]
}
cc_binary {
  name: "bar"
  srcs: ["bar.cc"]
  shared_libs: ["foo"]
}
```

- **type**: module type, `cc_library`, `cc_binary`
- **name**: module name, `foo`, `bar`
- **keys**: alist, `((srcs . ("bar.cc")) (shared-libs . ("foo")))`
- **defaults**: default modules list
- **file**: file-name the module comes from

Final Form

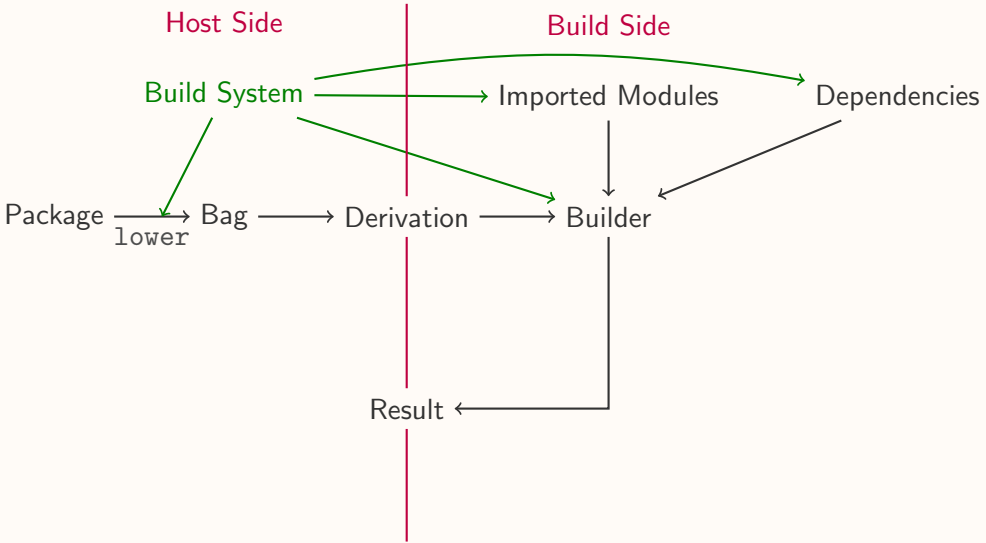
```
(define-module-record-type cc make-cc cc?
  (srcs cc-scrs (default '()))
  (shared-libs cc-shared-libs (default '()))
  ...)
```

- Structure for each family of types
- Defines all possible keys
- Fill in keys from defaults, then current module

Agenda

- Getting Sources
- Analyzing Blueprint Files
- **Creating a Build System**
- Current Status
- What's Next?

Sketch


Host Side
Build Side
Build System
Imported Modules
Dependencies
Package
lower
Bag
Derivation
Builder
Result

Default Phases

Generate abstract *Makefile* rules from the specified blueprint module

- **out** files created
- **deps** files required
- **cmd** command to generate output files
- **source?** whether it generates sources
- **dependencies** external dependencies (for importer)

Run `make`, `make install`.

Writing Build Phases

- Phases are run on the build side
  - All go to `(android build)` separate modules
  - `(android build soong-build-system)`: phases top-level
  - `(android build blueprint)`: blueprint parsing
  - `(android build soong cc)`: CC and Art targets specific code
  - `(android build soong java)`: Java targets specific code

Writing Build Phases

```
(use-modules ((guix build gnu-build-system) #:prefix gnu:))
(define %standard-phases
  (modify-phases gnu:%standard-phases
    (delete 'bootstrap)
    (add-before 'configure 'reset-include-path reset-include-path)
    (replace 'configure configure)
    (delete 'check)))
```

Show me the code

Let's look at the code of `(android build-system soong)`

Agenda

- Getting Sources
- Analyzing Blueprint Files
- Creating a Build System
- **Current Status**
- What's Next?

Guix Android Channel

```
(cons* (channel
        (name 'guix-android)
        (url "https://framagit.org/tyreunom/guix-android.git")
        (introduction
          (make-channel-introduction
            "d031d039b1e5473b030fa0f272f693b469d0ac0e"
            (openpgp-fingerprint
              "1EFB 0909 1F17 D28C CBF9  B13A 53D4 57B2 D636 EE82"))))
       %default-channels)
```

Importer

```
,use (android import repo)
(define manifest (get-manifest))
(define root (fetch-manifest-repositories manifest)); 28GB
(define bp-files (get-all-bp-files root)); find-files, ~1-2 minutes
(define bp-maps (get-bp-maps bp-files)); ~5 minutes on HDD
(import-recursively manifest root bp-maps '("adb" "fastboot")
                    "sources.scm" "packages.scm")
```

Packages and Experiments

- aapt, aapt2, **adb**, aidl, apksigner, dexdump, dmtracedump, dx, etc1tool, **fastboot**, hprof-conv, libaapt2_jni, sqlite3, split-select, zipalign
- Soong build system for cc, genrule, java and protobuf
- Cross-compilation ready
- Experimenting a Kotlin bootstrap (failure after 20-ish versions)
- Sbt bootstrap (from Scala binary)

Agenda

- Getting Sources
- Analyzing Blueprint Files
- Creating a Build System
- Current Status
- **What's Next?**

What's Next?

- `gradle-build-system`
- Build Android libraries
- Build Android system
- Contribute back clang cross-compiler
- Contribute back soong build system and importer