

Linux
Plumbers
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Hermetic Builds with Bazel

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TL;DR: What?

```
$ BUILD_CONFIG=common/build.config.gki.aarch64 build/build.sh
```



```
$ bazel build //common:kernel_aarch64
```

<https://source.android.com/docs/setup/build/building-kernels#building-with-bazel>



Android Kernel Builds

"some document" -> "build.sh" -> Bazel (Kleaf)



Android Kernel Builds

- build.sh
 - build.config configuration
 - build
 - package
 - module builds
 - mixed builds
 - ...



Android Kernel Builds

- build.sh
 - lots of control via env variables
 - ever-growing shell script collection
 - difficult to maintain
 - hermeticity / reproducibility as hack
 - limited parallelism

```
#!/bin/bash
# Copyright (C) 2009 The Android Open Source Project
#
# This file contains the build system for the Android kernel.
#
# The build system is based on the GNU build system (make).
#
# The build system is designed to be used in a variety of
# environments. It is designed to be used in a variety of
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Bazel

- Scalable
- Built-in sandboxing for hermetic builds
- Fast incremental builds
- Build dependency analysis
- Parallelism
- Remote Build Execution (RBE)
- Future Android Platform build system



Kernel Builds with Bazel ([Kleaf](#))

- Consistent environment setup
- Hermetic toolchain (tools, compilers, etc.) enforced
- Wraps make defconfig and make steps
- Kbuild remains authoritative build system



Kernel Builds with Bazel

```
load("//build/kernel/kleaf:kernel.bzl",  
      "kernel_build", "kernel_module")
```

```
kernel_build(  
    name = "kernel",  
    outs = ["vmlinux"],  
    build_config = "common/build.config.gki.aarch64",  
    srcs = glob(["**"]),  
)
```

```
kernel_module(  
    name = "nfc",  
    srcs = glob(["**"]),  
    outs = ["nfc.ko"],  
    kernel_build = "//common:kernel",  
)
```

BUILD.bazel

- uses build.config (during migration)
- defines GKI kernel build
- kernel module against GKI

- consistent hermetic toolchain (enforced)
- sandboxed build



Kernel Builds with Bazel

```
kernel_build(name = "kernel", ...)
```

```
kernel_module(name = "nfc", ...)
```

```
$ bazel build nfc
```

- Builds "just enough" kernel
- Ensures limited visibility
 - kernel headers
 - scripts/
 - no other source files (.c)
- Enforces compatible toolchain
- Requires Kbuild makefiles (Kbuild, Makefile, Kconfig)



Driver Development Kit (DDK)

```
ddk_module(  
    name = "base",  
    srcs = [  
        "base.c",  
        "impl_base.h", // available for module local compilation  
    ],  
    hdrs = ["base.h"], // exported to other modules  
    kernel_build = "//common:kernel_aarch64",  
)
```

```
ddk_module(  
    name = "nfc",  
    srcs = [  
        "nfc.c", // can #include base.h and  
        "nfc.h", // use symbols exported from base  
    ],  
    kernel_build = "//common:kernel_aarch64",  
    deps = [":base"],  
)
```

- **Generates** Kbuild makefiles (Kbuild, Makefile, Kconfig)
- Ensures correct build dependencies
- Restricts source file visibility to declared inputs

DRAFT API



Useful Build Flags

`--lto={default,none,thin,full}`

LTO mode

`--use_prebuilt_gki=8728676`

Download prebuilt GKI from ci.android.com

`--config=local`

Local make cache (breaks sandbox)

`--config=fast`

`--config=local` and `--lto=thin`

`--config=release`

SCM versions, used on ci.android.com

`--kasan`

Enable KAsan

`--debug_print_scripts`

Print assembled scripts that get executed



Migrating to Kleaf

- build.sh deprecated
- automatic [command line migration](#)
- automatic [build.config migration](#)



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Questions?