Adding GNU/Hurd support to GNU Guix

Porting GNU Guix/GuixSD to a new platform

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What is distro bootstrapping?

Simply speaking

- Bootstrapping refers to the process of getting the distribution built “from nothing”.

But how does the first package gets built?

How is it usually done?

- Distros, like Debian or Arch Linux, use whatever is already present in the system.
- No clear notion of “bootstrap binaries”.
- Hard to track down the origins of a port (and reproduce it).

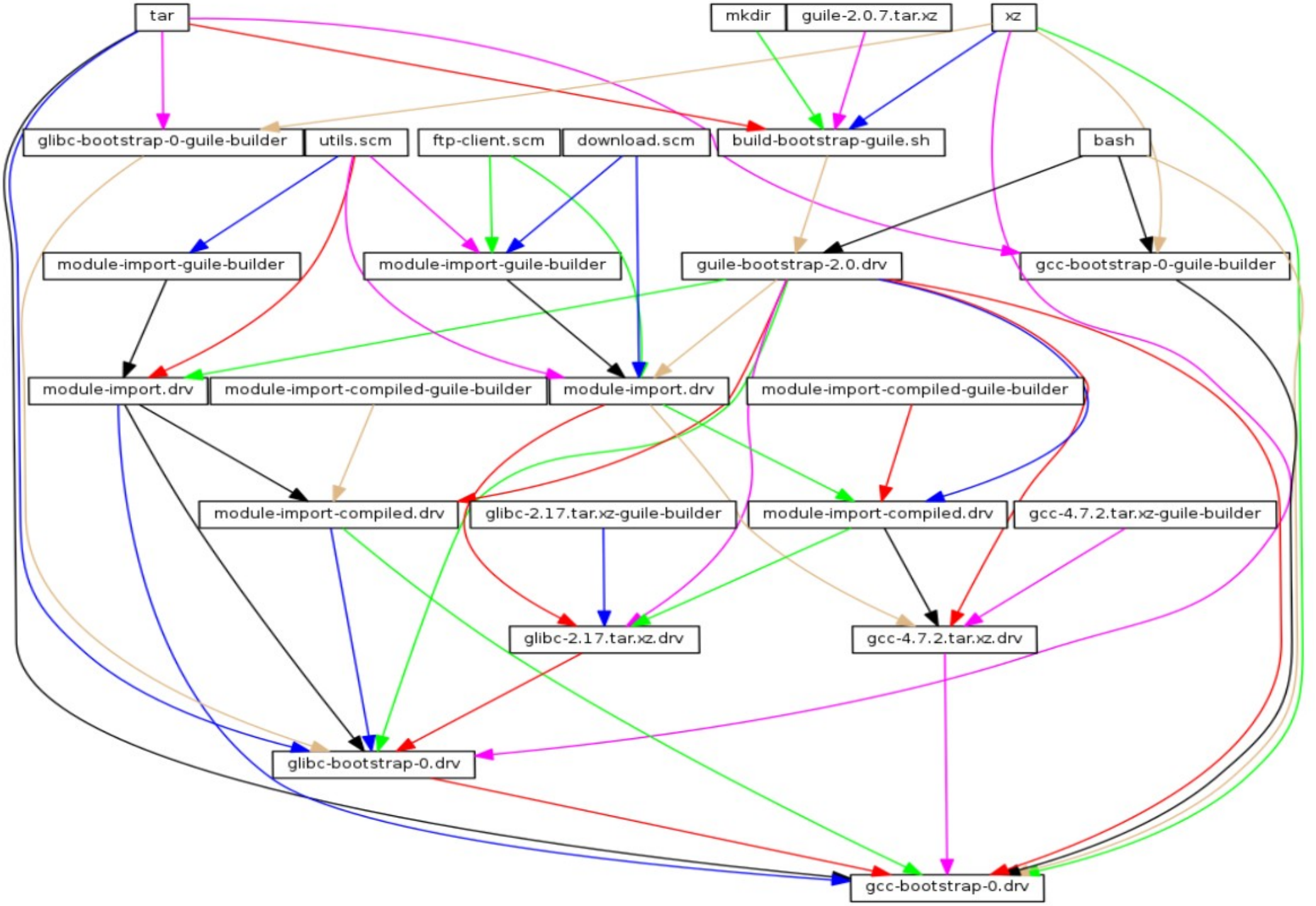

Guix

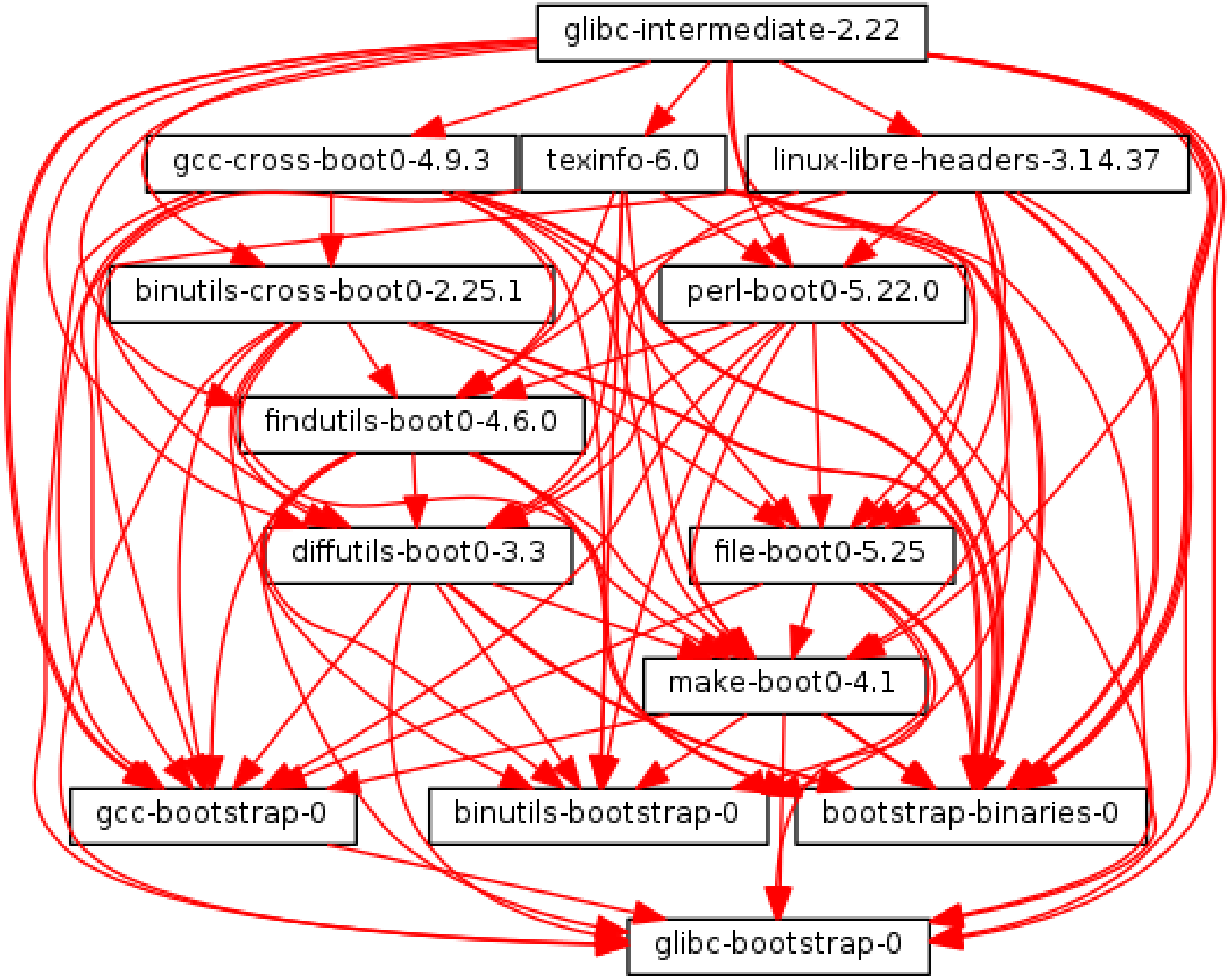
Bootstrapping Guix

Guix relies on a clearly defined set of pre-built binaries

- Guile
- GCC
- Binutils
- Libc
- Bootstrap binaries

Bootstrapping is complete when we have a full tool chain that does not depend on the pre-built bootstrap tools


tar
mkdir
guile-2.0.7.tar.xz
xz
glibc-bootstrap-0-guile-builder
utils.scm
ftp-client.scm
download.scm
build-bootstrap-guile.sh
bash
module-import-guile-builder
module-import-guile-builder
guile-bootstrap-2.0.drv
gcc-bootstrap-0-guile-builder
module-import.drv
module-import-compiled-guile-builder
module-import.drv
module-import-compiled-guile-builder
module-import-compiled.drv
glibc-2.17.tar.xz-guile-builder
module-import-compiled.drv
gcc-4.7.2.tar.xz-guile-builder
glibc-2.17.tar.xz.drv
gcc-4.7.2.tar.xz.drv
glibc-bootstrap-0.drv
gcc-bootstrap-0.drv


glibc-intermediate-2.22
gcc-cross-boot0-4.9.3
texinfo-6.0
linux-libre-headers-3.14.37
binutils-cross-boot0-2.25.1
perl-boot0-5.22.0
findutils-boot0-4.6.0
diffutils-boot0-3.3
file-boot0-5.25
make-boot0-4.1
gcc-bootstrap-0
binutils-bootstrap-0
bootstrap-binaries-0
glibc-bootstrap-0

Porting to a new Platform

1) Cross-build the bootstrap binaries:

```
guix build –-target=i585-pc-gnu bootstrap-tarballs
```

2) “Inject” the bootstrap binaries in the package DAG for that platform.

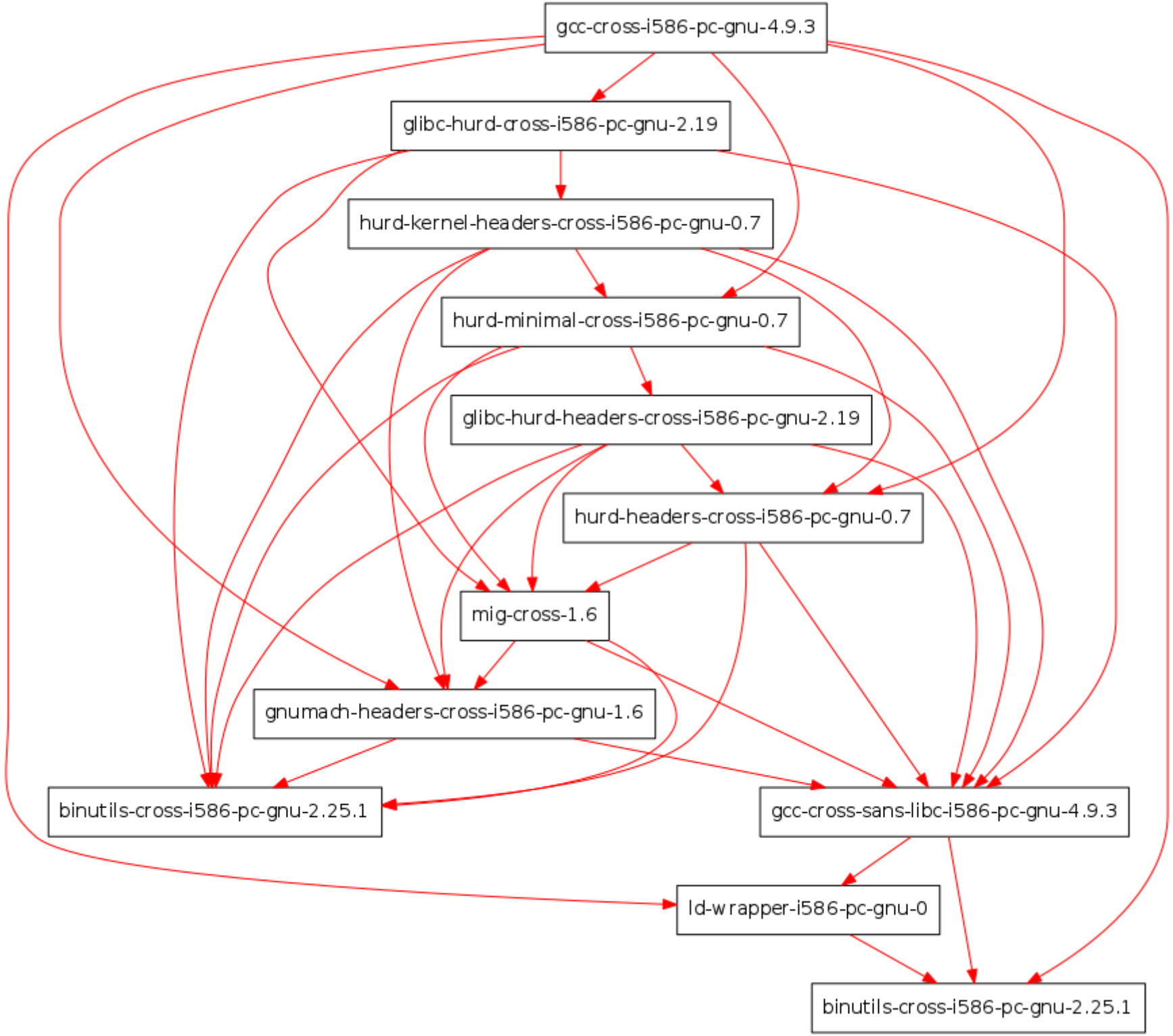
```
(gnu packages bootstrap)
```

3) Build Guix on a running OS of that platform!!

It wasn't so easy..

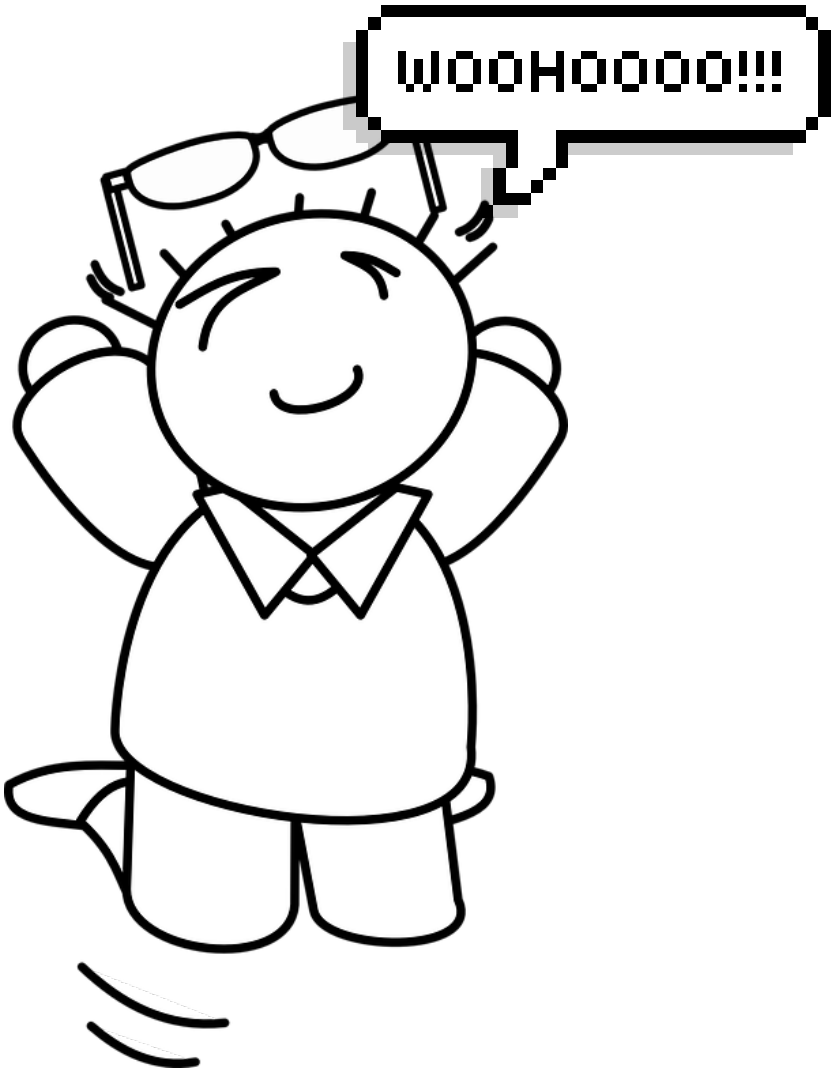
What's special about the Hurd

- The Hurd is a collection of servers that run on top of the Mach microkernel.
- These servers implement features that are normally implemented by the kernel.
- Through glibc the same standard interfaces known from other UNIX-like systems are provided.


gcc-cross-i586-pc-gnu-4.9.3
glibc-hurd-cross-i586-pc-gnu-2.19
hurd-kernel-headers-cross-i586-pc-gnu-0.7
hurd-minimal-cross-i586-pc-gnu-0.7
glibc-hurd-headers-cross-i586-pc-gnu-2.19
hurd-headers-cross-i586-pc-gnu-0.7
mig-cross-1.6
gnumach-headers-cross-i586-pc-gnu-1.6
binutils-cross-i586-pc-gnu-2.25.1
gcc-cross-sans-libc-i586-pc-gnu-4.9.3
ld-wrapper-i586-pc-gnu-0
binutils-cross-i586-pc-gnu-2.25.1

Building the bootstrap binaries.

- `PATH_MAX missing (acl, patch, sed, tar, etc..).`
- Binaries for i686-gnu failed to run on a Hurd system. i586-gnu work.
- Linux assumptions in Guix (cross-toolchain).
- Problems with building Hurdish Glibc.


WOOHOOOO!!!

Using the binaries on the new platform

1. Update `(gnu packages bootstrap)` with information on the new binaries and where to download them.
2. Add rules to the `gnu-system.am` file on how to handle the binaries.
3. Clone Guix on the new platform.
4. Run `./configure –-with-courage && make && make install`
5. Begin building!

It works!!

Using Guix on GNU/Hurd

guix-daemon → `pivot_root()`, `mount()`, `MS_BIND`

1. Hurd utils, settrans → libhurdutil library, settrans().
2. mount() → nixMount() wrapper.
3. MS_BIND → firmlink
4. pivot_root() → fakeroot

Building GuixSD from GNU/Hurd

On Debian/Hurd:

```
guix system disk-image config.scm
```

- Linux assumptions `(ex. gnu/build, gnu/system).`
- On Linux `guix system` cannot build for Hurd.
- Package build failures. Patches needed.

Current status

- Cross-build to GNU/Hurd with just:

```
guix build --target=i586-pc-gnu foo
```

- 50+ patches on Guix proper.
- Branch ‘master’ can be used on a running GNU/Hurd system.

```
guix build foo
```

- Currently testing guix-daemon patches.
- GNU/Hurd cross-compilation on Hydra.

Work in progress

- Finish libhurdutil library.
- Finish nix/utils/calls.(hh.cc).
- Make Guix's build system kernel agnostic.
- Package Hurd libraries.

Roadmap

- Port GuixSD
  - Isolate Linuxisms
  - Package missing dependencies.
- Port container-style features in guix-daemon
  - Sub-hurds instead of Linux name spaces

Thanks for mentoring, suggestions, code, debugging and patience..

- Ludovic Courtès, Justus Winter, Samuel Thibault my GSoC mentors for their valuable help, guidance, patience and trust!
- Everyone from Guix and Hurd for helping me in so many ways! :-)
- Extra thanks to Rene Saavedra for testing, reporting and patching Guix on Hurd non-stop!
- This work was part of my GSoC 2015 and 2016 projects so I would like to thank everyone from FSF for taking care of everything for the GNU Project participation.

Credits

- GNU Guix logo, GFDL, http://gnu.org/s/guix/graphics
- comic speech bubble, http://wigflip.com/ds/
- cartoon person, https://pixabay.com/en/specman-man-cartoon-person-jumping-161928/