Distributing software on Linux

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About me

- Work for Canonical
  - Ubuntu Core
  - Snapd
  - Snaps' core runtime
- GNOME foundation member
  - GNOME OS
  - Freedestkop SDK, the main Flatpak runtime
- My opinion. I do not represent Canonical or GNOME here.

Issue statement

- A developer wants to provide an (hopefully open source) application to Linux users.
- Nowadays, not all Linux users can build from source code.
- Linux as in Linux+GNU+FreeDesktop
- Focus on the C world. Everything else depends on it.

Distribute software, the old way

1. Release a source archive

2. Hope every distribution will make packages of it

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Linux API

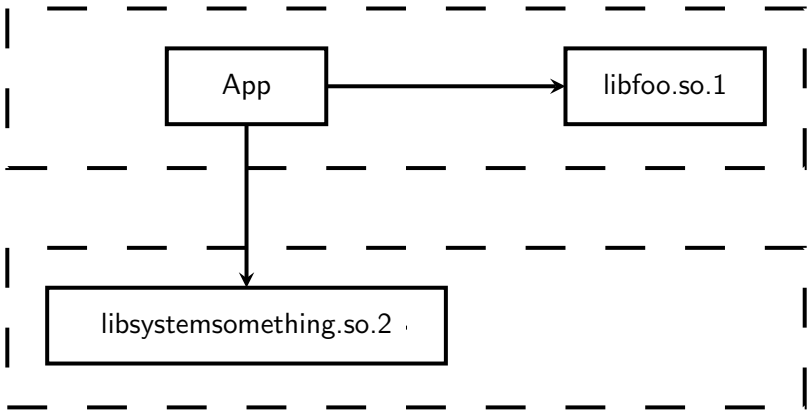
- system calls (Linux kernel)
- devices through ioctl (Linux kernel)
- file systems (procfs, sysfs, cgroups) (Linux kernel)
- sockets (AF_NETLINK, Linux kernel)
- C API
  - virtual system calls (Linux kernel)
  - system shared libraries
- IPC: dbus, varlink, wayland, etc.

About shared libraries

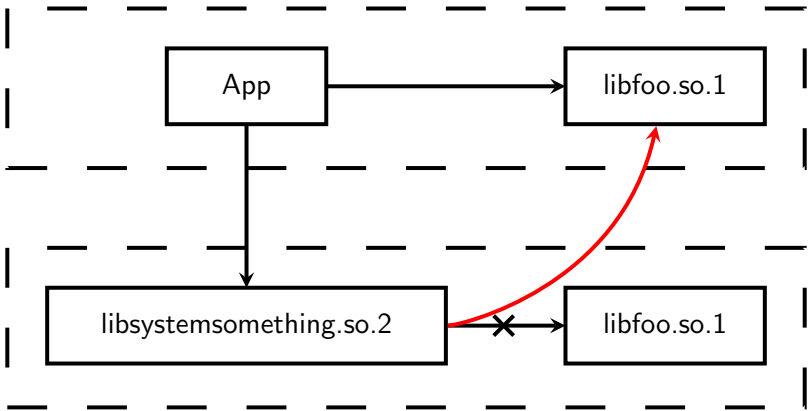
- PT_INTERP (e.g. /lib64/ld-linux-x86-64.so.2) (only on executable)
- Multiple DT_NEEDED
- Dynamic symbols table
- Relocation tables (to relocate the GOT)
- DT_SONAME, ABI "major" version (only on libraries)
- Symbol version tables (with definitions and requirements)

Shared library ABI versioning

System libraries, application libraries?



System libraries, application libraries?



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Packages

The good

- Dependencies install shared libraries
- Dependencies know about ABI versions

The bad (for third party)

- A package built on Ubuntu 24.04 might not work on 22.04
- A stale dependency can break upgrades
- A bad dependency can break your OS
- Not user friendly to install third party packages

Special mentions

- Ubuntu's Personal Package Archives (PPA)
- openSUSE's Open Build Service
- Nix

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Doing it yourself

- Interpreter (ld−linux.so) is absolute path
- Glibc need to match interpreter (new libc with old ld-linux.so does not work)
- shared libraries backends for Vulkan, OpenGL, EGL, libdrm need updates every time a new GPU is released
- openssl, gnutls, nss need updated CA certificates
- security fixes
- Glibc's Name Service Switch is plugin based. Needed for DNS, user/group query, etc.

Open Container Initiative and Docker

- Good for microservices
- Docker has a popular registry
- Not practical for desktop applications
- One blob, so need updates
- Not usually installed by default

Systemd portable services

- No default “store”
- Good for services only
- Can split base from application

Flatpak

- Desktop applications
- Installed by default on Fedora, Endless, Mint, Elementary, GNOME OS...
- Default store `flathub.org`
- `https://docs.flatpak.org/en/latest/`

Snap

- Installed by default on Ubuntu
- Can do system and user services
- Can do desktop applications
- `https://snapcraft.io/docs/snapcraft-tutorials`

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What to use

Maximize your audience: try to use most of them. It is less that there are distros.

Services OCI and Snap

Desktop Flatpak and Snap