

# Universal Packages

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# Introduction

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# What are packages?

A **package** is an archive containing a collection of executable files or source code, along with metadata, which represent a computer program.

# What is a package format?

A **package format** is an organizational structure for delivering packages to users.

# Why do we need package formats?

- They provide a common way to bundle executables, libraries, assets, etc. for deployment on user machines.
- They provide metadata about programs for use in package managers.
- It would suck if we had to go find the source code for every single program we want to use and compile from source.<sup>1</sup>

<sup>1</sup>Actually, some package formats do require compilation from source (for example some AUR packages) but at least it helps automate this process.

## A bit of history

- 1994 `dpkg` — the package format behind `apt` and `apt-get`. Used by Debian-based systems.
- 1997 `RPM` — the package format behind `yum` and `dnf`. Used by RHEL-like systems.
- 2002 `pacman` — the package manager for Arch Linux. It just uses tar files.
- 2004 `klik/PortableLinuxApps` (2011)/`AppImage` (2013) — a package format built to be Linux-distro agnostic.
- 2006 `nix` — a purely functional package format. Primarily used by NixOS.
- June 2016 `snapt` — the Canonical-backed universal package format is ported to a wide range of Linux distros.
- June 2016 `Flatpak` — the Red Hat-backed universal package format becomes generally available.

# Universal Package Formats

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## Common objectives

- Linux distro agnosticism
- Solve the “dependency hell”
- Create a “single” deployment target for all of Linux



# ApplImage

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## Why is ApplImage cool?

- **ApplImage does not require installation.** The ApplImage file is just its compressed image that is mounted with FUSE when it runs.
- **ApplImage does not require root permission.** The application is run as the user and the base system is left untouched.
- **The ApplImage itself is executable.** Just `chmod +x the .AppImage` file and run.
- **Linus says so**

*"This is just very cool."*

*~ Linus Torvalds*

## How does ApplImage work?

Application developers use the `appimagetool` converts an `AppDir` into a self-mounting filesystem image.

ApplImages can be integrated with the system via menu entries, icons, MIME types, etc. The `appimaged` daemon handles this registering and unregistering process.

# How to create an AppImage

Create an AppDir with the following files (totally copied from their documentation):

- The files of the original application.
- A `.desktop` file that tells `appimagetool` about the name of the application, and the icon it should use.
- A PNG, SVG or an XPM icon with the name given in the `.desktop` file with the `Icon` entry.
- An `AppRun` file, which is used to start up the application inside the filesystem. Once the AppImage ELF has mounted the filesystem, it invokes this file. In the `AppRun` file, you can run some initialization procedures (such as setting environment variables), and then start up the real application.
- Optionally, you should also add AppStream metadata in `usr/share/metainfo`.

# Live Demo: Running an ApplImage

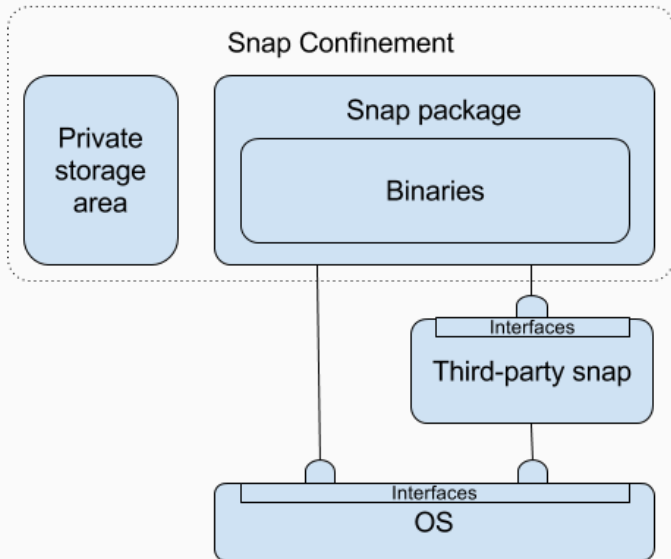
# Snaps & snapd

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# Why are Snaps cool?

- **Snaps are squashFS filesystems.** They contain your app code and a `snap.yaml` file with metadata.
- **Snaps are self-contained.** The necessary libraries and runtimes are bundled in the snap. This allows you to have different library versions in your application than exist on your base system.
- **Snaps can have different levels confinement.**
  - `strict` is the default policy. The snap has read and/or write rights only in its own install space and selected areas.
  - `devmode` is for development of Snaps.
  - `classic` confinement behaves as a traditionally packaged application, with full access to the system.
- **Snaps can communicate with one another via *interfaces*.**

# How do Snaps work?





# How to create a Snap

- Make your application.
- Make a `snapcraft.yaml` with a bunch of stuff.
  - name
  - version
  - summary
  - description
  - grade
  - confinement
  - ...
- Run `snapcraft`.

Live Demo: Running a Snap

**flatpak**

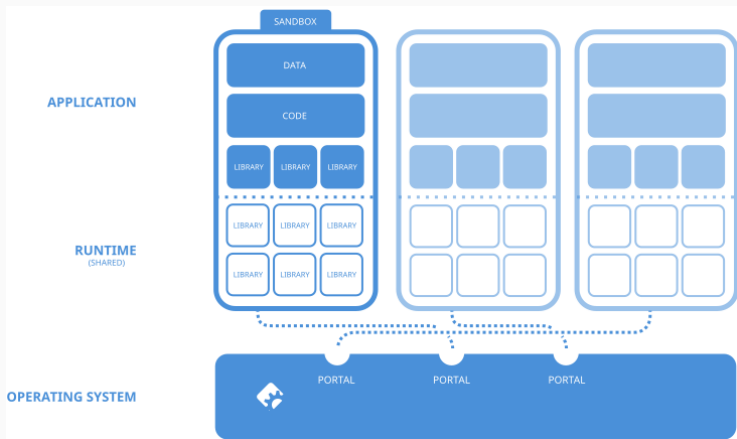
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- Flatpak is a system for building, distributing and running sandboxed desktop applications on Linux.  
(<https://github.com/flatpak/flatpak>)

# Why is flatpak cool?

- Flatpak includes a system of runtimes that allow developers to build their application against a stable base.
- Runtimes allow deduplication of dependencies between packages
- Flatpak makes use of bubblewrap for sandboxing
- Flatpak supports a system of Appstream metadata to allow packages to show up nicely in various package managers

# flatpak Overview



- `org.freedesktop.Platform`
  - D-Bus
  - GLib
  - PulseAudio
  - X11
  - Wayland
- `org.gnome.Platform` (based on freedesktop)
  - GStreamer
  - PyGObject
  - Vala
  - GVFS
  - other stuff to make Gnome work...

- org.kde.Platform
  - Qt Frameworks
  - KDE Frameworks



- All processes run as the user with no capabilities
- All processes run in a transient systemd user scope with the name `flatpak-$appid-$pid`
- `/` is a private tmpfs not visible anywhere else. This is `pivot_root`:ed into so it is the new and all other mounts from the host are unmounted from the namespace.

# How to build a flatpak package

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- Install the flatpak-builder package
- See <https://flatpak.org/getting.html> for instructions

- Add the repository hosting your runtime
- `$ flatpak remote-add --if-not-exists flathub https://flathub.org/repo/flathub.flatpakrepo`
- Install the runtime and corresponding SDK
- `$ flatpak install flathub org.freedesktop.Platform//1.6`  
`org.freedesktop.Sdk//1.6`

**nix**

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# Comparison

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## Advantages of each of these universal package formats

- AppImage is great for portable, self-contained applications.
- Snaps are good for deploying single applications.
- Flatpak is good for distributing a set of applications. For example Gnome development builds are in a Flatpak repository.

**Love to Hate Them**

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# Proprietary enterprise applications are coming to Linux

Currently, when enterprises want to make a cross-platform application, they see this:

macOS .dmg

Windows .exe

Linux .deb and .rpm and PKGBUILD and ..., then deal with the dependency hell<sup>2</sup>

However, when companies like Canonical come in and say “just target snaps”, all of a sudden, it may tip the scale at enterprises for them to start targeting Linux. If they create a snap, then they capture all of the Linux market, not just the subset that uses a particular format.

<sup>2</sup>Yes, you have to deal with dependency hell on other platforms too, but every platform has a different type of dependency hell. Coming to Linux is an expensive prospect for many enterprises.

# Pros and cons

## Pros

- More application availability.
- More abstraction! No more dealing with a bunch of different packaging formats.

## Cons

- The applications are going to be crap. Bloated, Electron, enterprise crap.
- More abstraction! Not much improvement on ease of deployment in comparison to deploying to `.deb`.

**Questions?**

# Resources

AppImage <https://appimage.org/>

Snapcraft <https://snapcraft.io/>

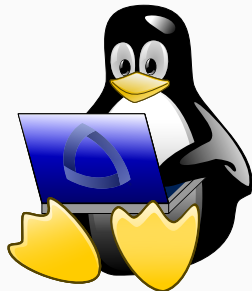
Flatpak <https://flatpak.org/>

Nix <https://nixos.org/nix/>

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