Your app everywhere – **Just in a Snap!**

An **interactive** workshop

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UbuCon Asia 2024, Jaipur, India

CANONICAL ubuntu

Introduction

This workshop is based on
"Snapping like Hell(sworth)"
from the Ubuntu Summit 2022

Heather Ellsworth

Lucy Llewelyn

Thanks, Heather Ellsworth and Lucy Llewellyn, for your great work!

Introduction

Please download these slides!
You find them on the **Opportunity Open Source web site**, find this workshop on the **timetable**, open its **description page** and go to "**Presentation Materials**" (bottom).
https://events.canonical.com/event/47/contributions/397/
This way you can **browse the slides in your own pace** while setting up and doing the exercises.
And you can **copy and paste** command lines and example code.
You can click the numerous links.
You can also read the **advanced topics** which will not get necessarily presented here.
May the source (and these slides) always be with you!

Introduction

What you will learn

- What the hell are **Snaps**?
- Why package as Snap?
- How to package GNOME applications as Snaps (**snapping** applications)
- Building your application **from source** or packaging **binaries**
- Finding **dependencies**
- Using an **auxiliary Snap with all GNOME libraries**, to save storage

What you need to know

- Basic installing from source and from classic packages (DEB, RPM, …)
- Little code tweaks
- Shell scripting

Introduction

Why do I organize and host Snap workshops on conferences?
On the conferences there are many free software **app developers** and also **potential snappers** in the community.

- **Upstream should snap**: Free software projects snap their apps by themselves.
  - They know the ins and outs and the quirks of their own apps
  - They can most easily adapt their apps for snapping
  - The one a user could trust most is the creator of the app
- If upstream does not do it we need **volunteers in the community** for app snapping projects, like **snapcrafters**
  - Well-known projects like snapcrafters have a high degree of trustworthiness, too.

Your application everywhere, just in a Snap!

Setup

Setup

This is a **workshop**, interactive, so you will try everything on **your laptop**!
You need **Ubuntu 22.04** or later, **snapd**, **snapcraft**, and **LXD** installed, basic **development/compiling utilities**, activate Debian sources:

```
$ update-manager  (Settings -> Ubuntu Software -> Source code)
$ sudo apt install build-essential git
$  sudo apt build-dep gnome-text-editor (Gets all GNOME libraries and headers)
$ sudo snap install lxd
$  sudo lxd init  (Simply press <Enter> on each question)
$ sudo adduser `whoami` lxd
$ sudo ln -s /var/lib/snapd/snap /snap
$ sudo snap install --classic snapcraft
$ reboot
```

Setup

– – **OR** – – use our **virtual machine** image, on **any system**!

- We give you the file **workshop-ubuntu-23.04.qcow2** (5.7 GB) on a USB stick, please make a copy of it, so you can get back to the original state
- Or **download (well!) before the workshop starts** (let link open in browser): https://drive.google.com/file/d/1kkxZ8GE3_UtG7orl5v2d4x_T4FhMUcbb/view?usp=sharing
- Works with any software which supports ***.qcow2** images.
- Use **4 GB RAM**, **2 CPUs**, and **25 GB storage** if possible. 2 GB RAM and 1 CPU should also work.
- Check **BIOS settings** if hardware virtualization support is enabled.
- For example use **Virtual Machine Manager**, **GNOME Boxes**, or **qemu-system-x86_64**

Setup

Virtual Machine Manager

- `$ sudo apt install virt-manager`
- Choose connection "**QEMU/KVM**" and NOT "QEMU/KVM User session" so that you can transfer files via "scp" command
- Click button for creating a **new virtual machine**
- Choose "**Import existing disk image**"
- Operating system is **Ubuntu 23.04**
- Choose **4 GB RAM**, **2 CPUs**, **25 GB storage**
- Get the **VM's IP address** via "ip addr" command
- **Transfer files** via "scp" command on the host, user "ubuntu", password "ubuntu"

Setup

qemu-system-x86_64

- **Command line**:

```
$ qemu-system-x86_64 -smp 2 -m 4096 -machine accel=kvm \
 -display gtk,gl=on -net nic,model=virtio \
 -net user,hostfwd=tcp::8022-:22 -drive \
 file=IMAGE.qcow2,cache=none,format=qcow2,id=main,if=none \
 -device virtio-blk-pci,drive=main,bootindex=1 \
 -audiodev pa,id=ac97
```

- **Transfer files**, on host do (password: ubuntu):

```
$ scp -p 8022 FILE ubuntu@localhost:.
$ scp -p 8022 -r DIR ubuntu@localhost:.
```

Setup

Your Virtual Machine

- It is **Ubuntu Desktop 23.04**
- User: **ubuntu**
- Password: **ubuntu**
- Preceed command with **sudo** to run it as root, password **ubuntu**
- Transfer files from your host with **scp**
  - Get the IP address via "ip addr" command
  - Or change host name ("**ubuntu**") via **GNOME Control Center**, section "**About**"
- **All the needed tools are already installed**
- Editors installed: **gnome-text-editor**, **vim**, **emacs**, **nano**
- Install any additional package you need
- Mentioned **GIT repositories** in **examples/**, do exercises in **exercises/**

Setup

Update your Virtual Machine

- Get a snapcraft which supports core24:
  `sudo snap refresh snapcraft`
- Get the updated core24-based examples.
  Go into each of the example GIT repositories and do
  `git pull`
- Options: General system update
  `sudo apt update`
  `sudo apt dist-upgrade`
  `sudo apt autoremove`

Your application everywhere, just in a Snap!

What the hell are Snaps? And why should I use them?

What the hell are Snaps?

- You are developer of an **application**?
- Already thought about how it **gets distributed** to end users?
  ⇒ **This could turn people away from Linux!**
- You provide the **source code**
  - Only **tech-savvy users** can use it directly
  - You need **goodwill of distro maintainers** to package your app
  - Distro version released ⇒ No update of your app in this distro version ⇒ User always has to update to **newest distro version**
- **You package** your app, for 10+ distros and have to test on 10+ distros
- **That is a nightmare! Isn't it?**

What the hell are Snaps?

- You have a **smartphone**? There it is much easier: **Google Play Store**, **App Store**
- And remember that Canonical developed a **smartphone OS**?
- They have **learned** from it!

⇒ And now we have …

Snap!

What the hell are Snaps?

- A method of **OS-distribution-independent packaging**
  - **You package and test once**, put your **Snap** into the **Snap Store**, and users of **any distro** (Ubuntu, Debian, SUSE, Red Hat, Windows, …) can use it.
  - **All libraries and other dependencies** come with your Snap
  - **User experience as with smartphone apps**
- Your app runs in a **security shell** (AppArmor, seccomp, namespaces), isolated from the host system
  - So-called **sandboxed packaging**
  - Communication to outside only via **well-defined interfaces**
  - **Snap Store has control**, has to explicitly permit "dangerous" interfaces
  - This way we can **trust third-party apps**
  - We are not dependent any more on distro maintainers for secure packages

What the hell are Snaps?

- **Don't fear the daemons, we snap them, too!**
  - Snap is universal, not only desktop apps but also daemons, system utilities, sub-systems, drivers, operating system cores, kernels, … can get snapped
- **Packaging moves from distros to upstream**
  - 10+ distros, each packaging XXX, inventing the wheel 10+ times
  - So let upstream, XXX.org, snap it, distros take the Snap
  - Distro devs concentrate on distro core or contribute to upstream code
  - Distro version released, app updates continue from upstream
- **Immutable distros, Immutable sub-systems, Immutable apps**
  - Ubuntu Core/Ubuntu Core Desktop: Immutable, all-Snap distro
  - Snaps are immutable apps (or immutable sub-systems, like the CUPS Snap)
  - Not that immutable, many system components, like printing stack or GPU drivers in separate Snaps

Your application everywhere, just in a Snap!

Example #1:

Hello World!

Example #1: Hello World! – What are we doing?

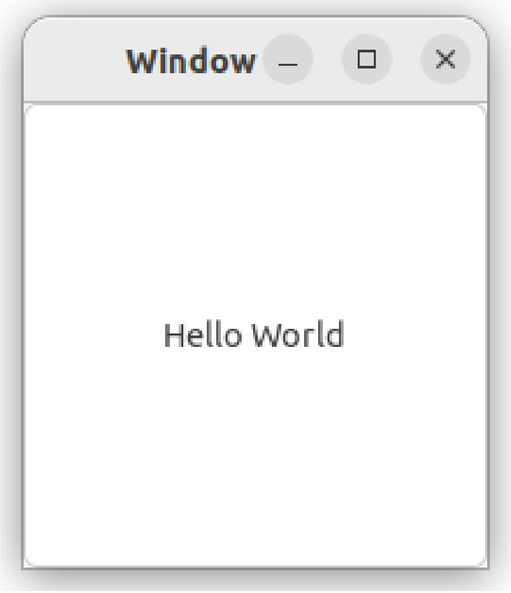
- **What to expect**
  - Use **GNOME's Gtk Hello World** example as an **example C program with GUI**
  - Step-by-step process creating snapcraft.yaml
  - Iterative build
- **Key concepts**
  - Basic metadata, apps, parts
  - How to include build dependencies (build-packages:)
  - How to include runtime dependencies (stage-packages:)
  - "dump" plugin
  - Local source (source in same repository as snapping)
  - "Manual" building (override-build:)
  - build and test

Example #1: Hello World! – Make the app!

- How to make the hello world: https://www.gtk.org/docs/getting-started/hello-world
- If you are not using our virtual machine, grab the source code from the site and put it into ~/exercises/hello-world-gtk/src/hello-world-gtk.c
- Build and run the app:

```
$ cd ~/exercises/hello-world-gtk/src
$ gcc $(pkg-config --cflags gtk4) -o hello-world-gtk \
    hello-world-gtk.c $(pkg-config --libs gtk4)
$ ./hello-world-gtk
```

- Now you know what we will snap …



Example #1: Hello World! – Let's snap it!

- We have the **source** and **know how to make the binary**
- Remove the binary, we do not need it in the Snap, it can actually break the Snap:

  ```
  $ rm hello-world-gtk
  ```
- `Using your favorite editor, create ~/exercises/hello-world-gtk/snapcraft.yaml`
  This is the instruction file for the Snap build
- Ok what do we need?
  - **metadata**: Name, version, summary, description, base, confinement
  - **apps**: List of apps that will be built
  - **parts**: The stuff that builds the apps

(Quick grab: https://github.com/tillkamppeter/hello-world-gtk)

Example #1: Hello World! – Metadata

- Enter these lines into your snapcraft.yaml file:

```
name: hello-world-gtk
version: '0.1'
summary: Gtk Hello World example
description: A simple Gtk example
base: core24
confinement: strict
```

- Recommended metadata: https://snapcraft.io/docs/adding-global-metadata
- Complete list of metadata keys/values: https://snapcraft.io/docs/snapcraft-top-level-metadata

(Quick grab: https://github.com/tillkamppeter/hello-world-gtk)

Example #1: Hello World! – Apps

- Add these lines to your snapcraft.yaml file:

```
apps:
  hello-world-gtk:
    command: src/hello-world-gtk
    plugs:
      - x11
      - wayland
```

(Quick grab: https://github.com/tillkamppeter/hello-world-gtk)

Example #1: Hello World! – Parts

- Add these lines to your snapcraft.yaml file:

```
parts:
  hello-world-gtk:
    plugin: dump
    source: .
    override-build: |
      set -eux
      cd src
      gcc $(pkg-config --cflags gtk4) -o hello-world-gtk \
      hello-world-gtk.c $(pkg-config --libs gtk4)
      cd ..
      craftctl default
    build-packages:
      - pkgconf
      - libgtk-4-dev
    stage-packages:
      - libgtk-4-1
```

- For a complete list of parts keys/values: https://snapcraft.io/docs/adding-parts

(Quick grab: https://github.com/tillkamppeter/hello-world-gtk)

Example #1: Hello World! – Build it!

- Build command: “snapcraft” with options
  - --verbostiy = verbosity level of the build
  - --debug = in case of failure, drop us into the build environment
- Output of build process:

```
$ snapcraft --verbosity debug --debug

Starting Snapcraft 8.3.2
Logging execution to
  '/home/ubuntu/.local/state/snapcraft/log/snapcraft-20230729-145410.515361.log'
Running on amd64 for amd64
Launching instance…
[...]
Creating snap package…
Packed hello-world-gtk_0.1_amd64.snap
$
```

(Quick grab: https://github.com/tillkamppeter/hello-world-gtk)

Example #1: Hello World! - Install and run it!

- Command: “snap install” with options
  - --dangerous = If not installed from store, circumvent store signature

```
$ sudo snap install hello-world-gtk_0.1_amd64.snap --dangerous
hello-world-gtk 0.1 installed

$ snap run hello-world-gtk
(hello-world-gtk:109667): Gtk-WARNING **: 14:50:30.500: Locale not supported by C library.
      Using the fallback 'C' locale.
Gsk-Message: 14:50:30.710: Failed to realize renderer of type 'GskGLRenderer' for surface
'GdkX11Toplevel': libEGL not available
(hello-world-gtk:109667): Gtk-CRITICAL **: 14:50:30.759: Unable to connect to the
accessibility bus
at 'unix:path=/run/user/1000/at-spi/bus_1,guid=65774ea9c81c70feb5c5007163669b8e': Could not
connect: Permission denied
Gdk-Message: 14:50:30.760: Failed to get file transfer portal: Could not connect:
Permission denied
```

Example #1: Hello World! – Important Remark

- You probably have seen that **we have compiled the source before snapping** and, instead of including that binary, **let the Snap build process compile it again**.
- This is very important for **sandboxed packaging**.
- Our virtual machine is **Ubuntu 23.04**, so our manually compiled executable is based on the libraries of this distribution
- The executables encapsulated in the Snaps get their libraries from a base distro, in our case **Ubuntu 24.04** (base: core24 in snapcraft.yaml), also the `stage-packages:` are from this distro version.
- The binary built under Ubuntu 23.04 does not necessarily work under 24.04, making the Snap fail.

Your application everywhere, just in a Snap!

Example #2:

tldr python client

Example #2: Tldr Python Client - A CLI app!

- Example for **an actual CLI application**
- This example snap uses python as the plugin for the main part, because, the project is based on python, and they also use the python build system
- In this example, you'll learn how an app is snapped, when it needs to have internet connection

Example #2: Tldr Python Client - A CLI app!

Metadata in ~/tldr-python-client/snap/snapcraft.yaml (https://github.com/tldr-pages/tldr-python-client):

```
name: tldr
base: core24
version: '3.3.0'
summary: tldr python client
description: Python command-line client for tldr pages.

grade: stable
confinement: strict

platforms:
  amd64:
  arm64:
  armhf:
  ppc64el:
  s390x:
```

Example #2: Tldr Python Client - A CLI app!

Apps entry in ~/tldr-python-client/snap/snapcraft.yaml (https://github.com/tldr-pages/tldr-python-client):

```
apps:
  tldr:
    command: bin/tldr
    environment:
      PYTHONPATH: $SNAP/lib/python3.12/site-packages:$PYTHONPATH
    plugs:
      - network
      - home
```

Example #2: Tldr Python Client – Build the app!

Build the app from source

- **The way for "official" Snaps** (especially if you are upstream).
- No (binary) Debian packages of the app involved.
- Get **official upstream source**, ideally directly from its **GIT repository** using release tags
  - When hosting the snap manifest on GitHub, we can auto-update the Snap on new upstream versions using the Snapcrafters CI: https://github.com/snapcrafters/.github/wiki/Adding-our-automation-to-a-snap
- **Snapcraft plugins support common build systems**:
  - autotools, meson, make, cmake, flutter, rust, go, …
  - To know about all the plugins: https://snapcraft.io/docs/supported-plugins
  - You only specify build configuration parameters, all commands are called automatically.

```
meson-parameters:
  - --prefix=/usr
  - --buildtype=release
```

Your application everywhere, just in a Snap!

Example #3:

yt-dlp in a snap!

Example #3: Yt-DLP - A CLI app using FFMpeg!

- Example for **a CLI application with a content snap**
- This example snap uses python as the plugin for the main part, because, the project is based on python, and they also use the python build system
- In this example, you'll learn how an app is snapped, when it needs to have internet connection, and access to ffmpeg libraries

Example #3: Yt-DLP - A CLI app using FFMpeg!

Metadata in snap-yt-dlp/snap/snapcraft.yaml (https://github.com/soumyadghosh/snap-yt-dlp):

```
name: yt-dlp
title: YT-DLP
summary: A fork of youtube-dl with additional features and patches
description: |
      Based on youtube-dl 2021.06.06 commit/379f52a and
      youtube-dlc 2020.11.11-3 commit/98e248f, youtube-dl offers all the
      features and patches of youtube-dlc in addition to the latest youtube-dl
adopt-info: yt-dlp
grade: stable
confinement: strict
base: core24
platforms:
  amd64:
  arm64:
  armhf:
```

Example #3: Yt-DLP - A CLI app using FFMpeg!

Apps entry in ~/tldr-python-client/snap/snapcraft.yaml (https://github.com/soumyadghosh/snap-yt-dlp):

```
apps:
  yt-dlp:
    command: usr/bin/yt-dlp
    plugs: [home, network, network-bind, removable-media]
    environment:
      PYTHONPATH: ${SNAP}/usr/lib/python3/dist-packages:${PYTHONPATH}
      LD_LIBRARY_PATH: ${SNAP}/ffmpeg-platform/usr/lib/
${CRAFT_ARCH_TRIPLET_BUILD_FOR}:${LD_LIBRARY_PATH}
      PATH: ${SNAP}/ffmpeg-platform/usr/bin:${PATH}
      REQUESTS_CA_BUNDLE: /etc/ssl/certs/ca-certificates.crt
```

Example #3: Yt-DLP - A CLI app using FFMpeg!

Plugs entry in ~/tldr-python-client/snap/snapcraft.yaml (https://github.com/soumyadghosh/snap-yt-dlp):

This is the place, where we give our snap access to the shared content snap,

```
plugs:
  ffmpeg-2404:
    interface: content
    target: ffmpeg-platform
    default-provider: ffmpeg-2404
```

Your application everywhere, just in a Snap!

Example #4:

GNOME Text Editor

Example #4: GNOME Text Editor – A GNOME app!

- Example for **an actual GNOME application**
- "extensions: [gnome]" in "apps:" entry: This includes the **GNOME snapcraft extension**, saves work and resources
  - Adding **GNOME**, **GTK**, and **desktop** resources
  - Adding all needed plugs: "x11", "wayland", "desktop", "gsettings", …
  - Connects to the **GNOME content provider Snaps** which provide **all libraries**, **icons**, **themes**, … –> **Shared resources save storage space!**
  - A **snapcraft extension** is for snapcraft.yaml like a ***.inc** for **C** files.
- "desktop: FILE.desktop" in "apps:" entry: ***.desktop for launcher icon**
- D-Bus (session bus) slot for GtkApplication registration
- "layout:": To assure that auxiliary directories of the app can get accessed

Example #4: GNOME Text Editor – A GNOME app!

- Metadata in ~/examples/gnome-text-editor-workshop-examples/local-deb/snapcraft.yaml (https://github.com/tillkamppeter/gnome-text-editor-workshop-examples):

```
name: gnome-text-editor

base: core24

grade: stable

confinement: strict

Summary: GNOME's Text Editor

Description: bla bla …

version: "46.3"

slots:

  # for GtkApplication registration

  gnome-text-editor:

    interface: dbus

    bus: session

    name: org.gnome.TextEditor

layout:

  /usr/share/gnome-text-editor:
```

Example #4: GNOME Text Editor – A GNOME app!

- Apps entry in ~/examples/gnome-text-editor-workshop-examples/local-deb/snapcraft.yaml (https://github.com/tillkamppeter/gnome-text-editor-workshop-examples):

```
apps:

  gnome-text-editor:

    extensions: [gnome]

    command: usr/bin/gnome-text-editor

    desktop: usr/share/applications/org.gnome.TextEditor.desktop

    environment:

      GTK_USE_PORTAL: "1"

      GDK_DEBUG: "portals

    plugs:

      - home

      - removable-media

      - mount-observe

      - cups
```

Example #4: GNOME Text Editor – A GNOME app!

There are several methods to get hold on the app for snapping it (~/examples/gnome-text-editor-workshop-examples/, https://github.com/tillkamppeter/gnome-text-editor-workshop-examples):

- local-deb/: **Local binary Debian package**, no compiling or source needed, can for example be a **proprietary package to install on Ubuntu Core**.
  To try, get the deb for your core distro (like core24 → 24.04) from https://launchpad.net/ubuntu/+source/gnome-text-editor

```
parts:
  gnome-text-editor:
    plugin: dump
    source: gnome-text-editor_46.3-0ubuntu2_amd64.deb
    source-type: deb
```

  We must take care of (non-GNOME) dependencies, via stage-packages: (or adding them in additional parts)

Example #4: GNOME Text Editor – A GNOME app!

- stage-packages/: **App which is in Ubuntu as Debian package**, simply **pulled in as a dependency**, always for the correct architecture, but note that the **dependencies of the staged packages are also staged** (and the GNOME ones are not needed, they are in the content provider Snap).

```
parts:
  gnome-text-editor:
    plugin: nil
    source: .
    stage-packages:
      - gnome-text-editor
```

  To do it correctly we will have to **remove unwished files**, so this method is better for simple command line utilities.
- The 2 previous methods were for quick-&-dirty snapping, let's do the real thing …

Example #4: GNOME Text Editor – A GNOME app!

- snap/: Build the app **from source**
  - **The way for "official" Snaps** (especially if you are upstream).
  - No (binary) Debian packages of the app involved.
  - Get **official upstream source**, ideally directly from its **GIT repository** using release tags
    - When hosting the snapping on GitHub we can auto-update the Snap on new upstream versions: https://ubuntu.com/blog/improving-snap-maintenance-with-automation
  - **Snapcraft plugins support common build systems**:
    - autotools, make, cmake, flutter, rust, go, … Usually **meson** for **GNOME apps**
    - You only specify build configuration parameters, all commands are called automatically.

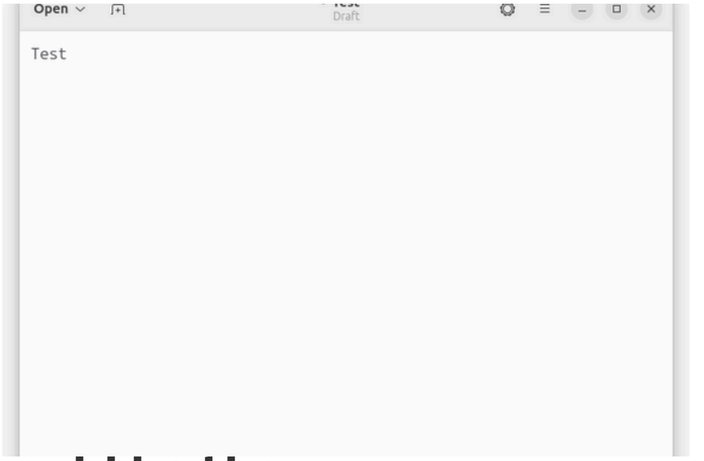
```
meson-parameters:
  - --prefix=/usr
  - --buildtype=release
```

Example #4: GNOME Text Editor – A GNOME app!

- **Extract upstream version number, summary, and description** and use it for the Snap (from GIT, from code, from AppStream XML file, …)
  - `At top level: "adopt-info: gnome-text-editor"`
  - `In gnome-text-editor part: "parse-info: <XML file>"`
  - In gnome-text-editor app: "common-id: <App ID from XML file>"
  - `In gnome-text-editor part scriptlet: "craftctl set version=..."`
- **`Provide each app's icon`** as `$SNAP/meta/gui/icons/hicolor/scalable/apps/NAME.svg`
  and refer to it using "Icon=NAME" in the *.desktop file
- **Caching of icon theme directories**: If caches for them are created with gtk-update-icon-cache, less system calls and disk seeks. In override-prime: find directories with index.theme file

Example #4: GNOME Text Editor – A GNOME app!

- **Build the Snap** with the usual
  `$ snapcraft pack -v --debug`
- Make sure that there is **no classically installed GNOME Text Editor** running
  `$ ps aux | grep gnome-text-editor`
  Close any still running instance.
- **Start your snapped GNOME Text Editor** via
  `$ snap run gnome-text-editor`
  or
  `$ /snap/bin/gnome-text-editor`
  Both commands override the $PATH priority of /usr/bin
- If you click "**Activities**" in the upper left and **search**, the **second result should be the Snap**
- **All versions here generally work** but spill different amounts of warnings into the terminal



Example #4: GNOME Text Editor – A GNOME app!

- When building the Snap you get a warning that a needed library is missing, add a part to stage all missing libraries:

```
libraries:
  after: [ gnome-text-editor ]
  plugin: nil
  stage-packages:
    - libeditorconfig0
  prime:
    - usr/lib/*/libeditorconfig.so.*
```

Your application everywhere, just in a Snap!

Example #3:

GNOME Calculator

Example #3: GNOME Calculator – Stepping it up!

- Have a look at another example

  https://github.com/ubuntu/gnome-calculator.git
- Many things are similar to GNOME Text Editor, but there is also
  - **Summary and description are static**, not taken from AppStream XML
  - Calculator **does not print**, so we do not plug “cups”
  - `Instead of using "layout:" we use "--prefix=/snap/gnome-calculator/current/usr" and "organize:"`
  - In "override-build:" We patch out the **documentation building** in meson.build, documentation **does not make sense in a Snap**
  - "cleanup:" part: **Core Snap** and **GNOME content provider Snaps** contain a lot of files of which we get **duplicates** by build-packages and stage-packages and their dependencies. Remove them systematically (Check linter in build process!!).

Your application everywhere, just in a Snap!

Your Turn!
Let's snap **Your** app!

Your application everywhere, just in a Snap!

Get the **perfect snapper** – More info/Links

More info/links:

- **Example Snaps** used here:
  - https://github.com/ubuntu/gnome-text-editor
  - https://github.com/ubuntu/gnome-calculator
  - https://github.com/OpenPrinting/ghostscript-printer-app
- More Snap magic, not only for daemons, in my "**Daemon Snapper's workshop**" (links to slides and exercises/examples):
  - https://events.canonical.com/event/2/contributions/42/
- Workshop **GNOME app Snap example from Olivier Tilloy**, each commit in this GIT repository is one step of the snapcraft.yaml development:
  - https://git.launchpad.net/~osomon/+git/secrets-snap/log/?h=main
- Want to snap something cute? **Qt/KDE** apps? Jesús' talk from Akademy 2023:
  - https://github.com/jssotomdz/qt-snaps

More info/links:

- GitHub workflow to **auto-update your Snap on each upstream release**:
  - https://ubuntu.com/blog/improving-snap-maintenance-with-automation
- Ubuntu blogs from Oliver Smith about **optimizing performance of Snaps**:
  - https://ubuntu.com/blog/how-are-we-improving-firefox-snap-performance-part-1
  - https://ubuntu.com/blog/how-are-we-improving-firefox-snap-performance-part-2
  - https://ubuntu.com/blog/improving-firefox-snap-performance-part-3
  - https://ubuntu.com/blog/firefox-snap-updates-and-upgrades
- And to know why we all are snapping like hell (**all-Snap Desktop**):
  - https://ubuntu.com/blog/ubuntu-core-an-immutable-linux-desktop
- Want to watch some **snappy videos**? Here we go:
  - https://www.youtube.com/watch?v=TfB6QwR2GYg
  - https://www.youtube.com/watch?v=ido6kGmSHWI

More info/links:

- And at **OpenPrinting** we are also snappy:
  - http://www.openprinting.org/
  - https://openprinting.github.io/about-us/
  - https://openprinting.github.io/news/
  - https://snapcraft.io/publisher/openprinting
  - https://github.com/OpenPrinting

Your application everywhere, just in a Snap!

Advanced Topics

Your application everywhere, just in a Snap!

Finding Dependencies

Finding Dependencies

A Snap needs to include all dependencies of the application: Libraries, fonts, icons, utilities, … There are several ways to find them:

- **Desktop apps**: Use **snapcraft extensions** to cover most: "gnome", "kde-neon", "flutter-...", …
- Have a look at **classic Debian (or RPM) packages**. Overtake their dependencies for the Snap
- Investigate executables (and libraries) with the "ldd" command
- Read **upstream source documentation**
- Check the **linter** output in the end of the Snap build

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The GNOME extension and library/resource Snaps

The GNOME extension and library/resource Snaps

- With "extensions: [gnome]" in an "apps:" entry we include the **GNOME snapcraft extension**
- A **snapcraft extension** is for snapcraft.yaml like a ***.inc** for **C** files
- **Saves a lot of work for the snapper**, to not have to repeat GNOME-specific stuff and update it separately in each Snap
  - Adds **GNOME**, **GTK**, and **desktop** resources
  - Adds all **needed plugs**: "x11", "wayland", "desktop", "gsettings", …
  - Connects to the **GNOME content provider Snaps** which provide **all libraries**, **icons**, **themes**, …
- **Content provider Snaps** contain files to be shared between other Snaps, typically libraries, icons, themes for **GUI apps** for **GNOME**, **KDE**, **Flutter**, …
  - **Snaps bringing all their dependencies get huge! Sharing helps.**

The GNOME extension and library/resource Snaps

- **TODO: More snapcraft extensions:**
  - **CUPS**: Do both plug "cups" and add the content-provider blob to install the CUPS Snap by a simple "extension: [cups]". See snapcraft.yaml of the GNOME Text Editor
  - **Printer Applications**: A lot of repetition in the snapcraft.yaml and a lot of work to apply updates in each of them … Imagine simply having parts to build a classic CUPS driver plus an "extension: [retro-printer-app]" and that's it … See https://github.com/OpenPrinting/ps-printer-app

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App from source or binary?

Apps from source or binary?

With the GNOME Text Editor we have seen that one can build Snaps from **binary files** or **compile the source**, what to use?

- **Source code**, usually from **upstream project (is that you?)**
  - **Free software/open-source** only
  - **Security**: Auditable, choice of more secure compiler options, quick fixes
  - **Adaptable** to Snap file system and encapsulation
  - **More frequent updates**
    - Does not depend on goodwill of distro packagers, low frequency of Ubuntu LTS, …
    - Immediately grab upstream releases, even development snapshots
    - GIT-based update-automation: https://ubuntu.com/blog/improving-snap-maintenance-with-automation
    - Especially important for hardware enablement (drivers)

Apps from source or binary?

- **Binary files**
  - Allows snapping **proprietary**, **closed-source** software
    - **Do not put into the Snap Store without permission!**
    - For private use, like **running the software on Ubuntu Core**
  - Quick addition of software pieces as "stage-packages:"
    - **Update only every 2 years with Ubuntu LTS**
    - Pulls in all the package's dependencies, can be good, but also bad (desktop apps with content provider Snap).
  - **Less/no knowledge in compiling/patching/coding needed**
  - **Not adaptable**, for file system paths, system users, chown, … **So snapping could get tricky**

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Patching the code

Patching the code

- Why do we need to **modify (patch) the upstream code**?
  - Complex applications often get **tricky to snap**
  - **Upstream's design** did not take Snap into account
  - Upstream **does not always accept the changes**, or it takes time until the next release
  - Even **classic Debian/RPM** packaging often needs patches
- **Examples** for patching needs
  - Directory and file **locations used are hard-coded**, no options, config, …
  - A snapped service (with a slot) has to determine **what the client Snap plugs**, to accept/deny inquiry
  - Application does **operations which are not allowed under confinement** (like chown/chmod) but are also not needed under confinement

Patching the code

- In snapcraft.yaml (only relevant lines, patch is in snap/local/ of your project repository):

```
parts:
  my-application:
    override-build: |
      patch -p1 < $CRAFT_PROJECT_DIR/snap/local/log.patch
      craftctl default
```

Patching the code

- Alternative: **Command-line editing** with "sed" or "perl":
- In snapcraft.yaml (only relevant lines):

```
parts:
  my-application:
    override-build: |
      sed -i.bak -e 's|Icon=@app_id@$|Icon=app.icon|g' \
        app.desktop.in.in
      perl -p -i -e 's/chown lp.lp file//' script.sh
      craftctl default
```

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Interfaces: Safe vs. Dangerous

Interfaces: Safe vs. Dangerous

- Snapped applications are **completely encapsulated** (AppArmor, seccomp, namespaces)
- By default, they cannot communicate with the host system or with other Snaps
- Communication is possible via **well-defined interfaces**: "network", "cups", "dbus", …
- A "**plug**" has to be connected with a "**slot**" of the system or of another Snap in order to communicate
  - **“Safe” interfaces**
    - Ex.: “cups” which allows listing available printers and printing
    - **are auto-connected** when installing from Snap Store
  - **“Dangerous” interfaces**
    - Ex.: “cups-control” which allows creating/removing printers, delete all jobs …
    - **need manual connection** or **permission** from Snap Store team for auto-connection

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Cleaning up …

Cleaning up …

- Snaps containing all the app's dependencies **can get very large**
- So we should take care not to pack too much
- **We should not include (or remove):**
  - **Header files of libraries** (*.inc), pkgconfig files (*.pc), static libraries (*.a), *.la, lintian
  - **Development utilities**
  - **Man pages** and other **documentation**, **examples**
  - `/var`
  - Library binaries which are **reported unused** by the linter
  - Files which the desktop's/GUI toolkit's content provider Snap already contains
  - Parts of the upstream package we do not need in this Snap (if we need libcups of the CUPS package, remove cupsd)

Cleaning up …

- How to remove/clean up:
  - "Negative" entries in "prime:"

```
prime:
  - -usr/include
  - -usr/lib/pkgconfig
  - -usr/share/fonts
  - -usr/share/man
  - -usr/share/doc
  - -usr/share/doc-base
  - -usr/share/lintian
```

Use this especially if the linter tells you at the end of the build that you have unused libraries.

Cleaning up …

- **Do not build the whole source code** (via "override-build:") or build ("./configure") parameters
- **Skip "make install", manually copy selected files** (via "override-build:")

```
override-build: |
      set -eux
      ./configure --sysconfdir=/var/snap/...
      cd cups
      make
      cd ..
      cd filter

  make rastertoepson
      cd ..

  mkdir -p $CRAFT_PART_INSTALL/usr/lib

  cp cups/libcups*.a $CRAFT_PART_INSTALL/usr/lib/

  cp -P cups/libcups*.so* $CRAFT_PART_INSTALL/usr/lib/
      [...]
      mkdir -p $CRAFT_PART_INSTALL/usr/lib/ghostscript-printer-app/filter
      cp filter/rastertoepson $CRAFT_PART_INSTALL/usr/lib/ghostscript-printer-app/filter

  #craftctl default  # DO NOT do the default action here!!
```

Cleaning up …

- **Build from source instead of pulling it as "stage-packages:"**, then adapt/customize
  - The Ghostscript Printer Application Snap contains many printer drivers which Debian provides as "printer-driver-..." Debian packages
  - The packages depend on CUPS (the daemon), Ghostscript, QPDF, and a lot of other things
  - As we have the CUPS daemon in the CUPS Snap and build the other dependencies by ourselves from source for newer versions (than Ubuntu LTS) and updates, we avoid "stage-packages:" here and build from source
  - But we use the source of Debian's packaging repos to get it with Debian's patches

Cleaning up …

- **"cleanup:" part applied in the very end of Snap build**
  - Spot duplicate files (here libraries), especially also duplicates with the content provider Snaps for the dektops/GUIs

```
cleanup:
  after: [gnome-calculator]
  plugin: nil
  build-snaps: [core24, gtk-common-themes, gnome-46-2404]
  override-prime: |
    set -eux
    for snap in "core24" "gtk-common-themes" "gnome-46-2404"; do
      cd "/snap/$snap/current" && \
        find . -type f,l -name *.so.* \
          -exec rm -f "$CRAFT_PRIME/{}" \;
    done
```