Desktop Linux
As easy as a smartphone – **Just in a Snap!**

An introduction into the universal packaging format

Till Kamppeter - Opportunity Open Source IIT Kanpur 2024

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

What the hell are Snaps?

- **App developers** provide apps as **source code**
  - Only **tech-savvy users** can use it directly
  - Or the devs need **goodwill of distro maintainers** to get their app packaged
  - Or they **package their app themselves**, 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** (Ubuntu Touch)?
- They have **learned** from it!
  ⇒ And now we have …

Snap!

By the way, **Snap got 10 years old!**

What the hell are Snaps?

Sandboxed packaging

- **Your app runs in a security shell isolated from the host system**
  - 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
- **OS-distribution-independent**
  - Package and test once, put into Snap Store, and users of any distro can use it.
  - All libraries and other dependencies come with your Snap

=> User experience as with smartphone apps

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
  - => **All-Snap operating system**, like Ubuntu Core Desktop
- **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 version released, app updates continue from upstream
- **Immutable distros, Immutable sub-systems, Immutable apps**
  - Ubuntu Core: **Immutable core**, all-Snap distro
  - Snaps are **immutable apps**

Snap packages

Snap Package Properties

- Compressed and **GPG-signed read-only squashfs images**
- Includes **metadata** in a ***.yaml** file
- Installed Snap has a **writable file system area** inside its confinement
- Come in **5 types** (app, OS core, gadget, kernel, desktop session)
- Support **transactional (atomic) updates** and **rollback**
- Can handle **binary diffs** for smaller download on upgrades
- Available on **multiple distros** and supported by default on all Ubuntu installs since Ubuntu 14.04 (**10 years!!**)

Snap Package Security

- **Read-only** file system image (squashfs)
- **GPG signed**
- **Confinement via:**
  - **AppArmor** (File system access rules)
  - **seccomp** (System call restrictions)
  - **Namespaces** (Separate resource spaces: PIDs, users, network, ...)
- **`snapd`** and **`snap-confine`** wrap around all executables in a snap, to ensure only the allowed writable dirs can be accessed

Snap Package Security

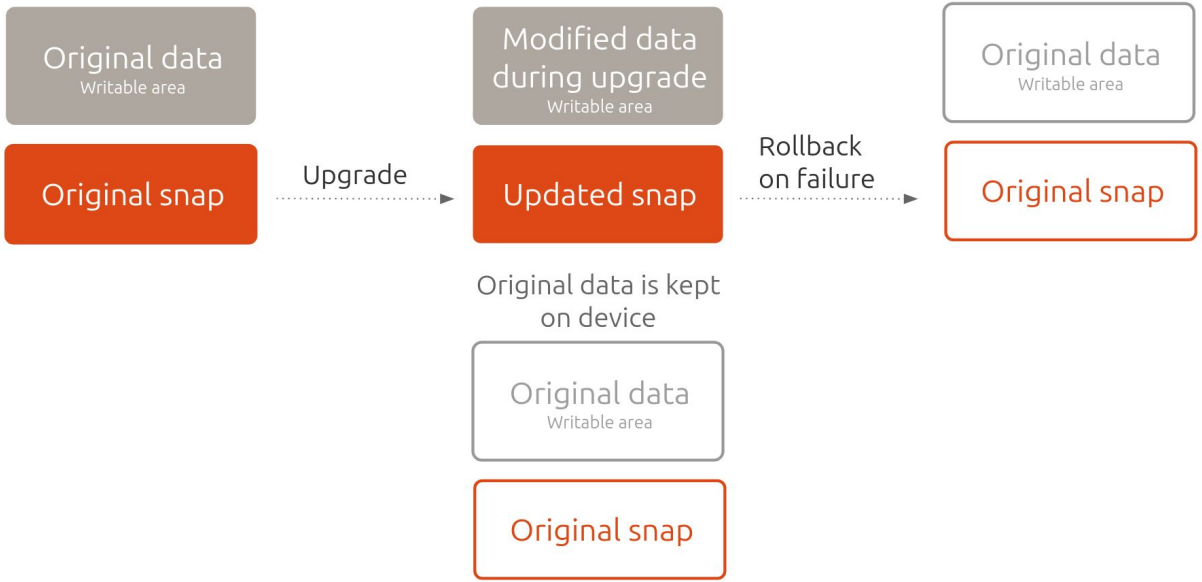
- **“root-safe”**
  - Applications can **run as root** but can not break out of the package confinement, **no need for specific user or group setup** to maintain security.
  - Example: **Daemon Snaps**
- **Storage-efficient**
  - Image stays compressed when mounted
  - **Core Snaps** and **content provider Snaps** hold common libraries and data files

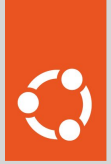
Interfaces: Safe vs. Dangerous

- Snapped app **completely encapsulated** (AppArmor, seccomp, namespaces)
- Cannot communicate with host system or with other Snaps
- Communication is only possible via **well-defined interfaces**: "network", "cups", "dbus", …
- **“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

Updating Snaps

- Transactional (atomic) updates
- Current version and its writable area saved, for rollback
- Automatic rollback and reboot after kernel panic or boot failure

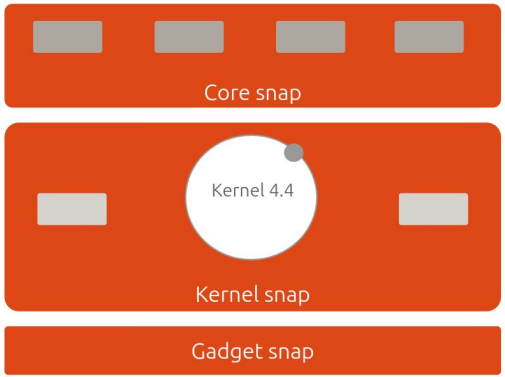




Ubuntu Core – All-Snap OS

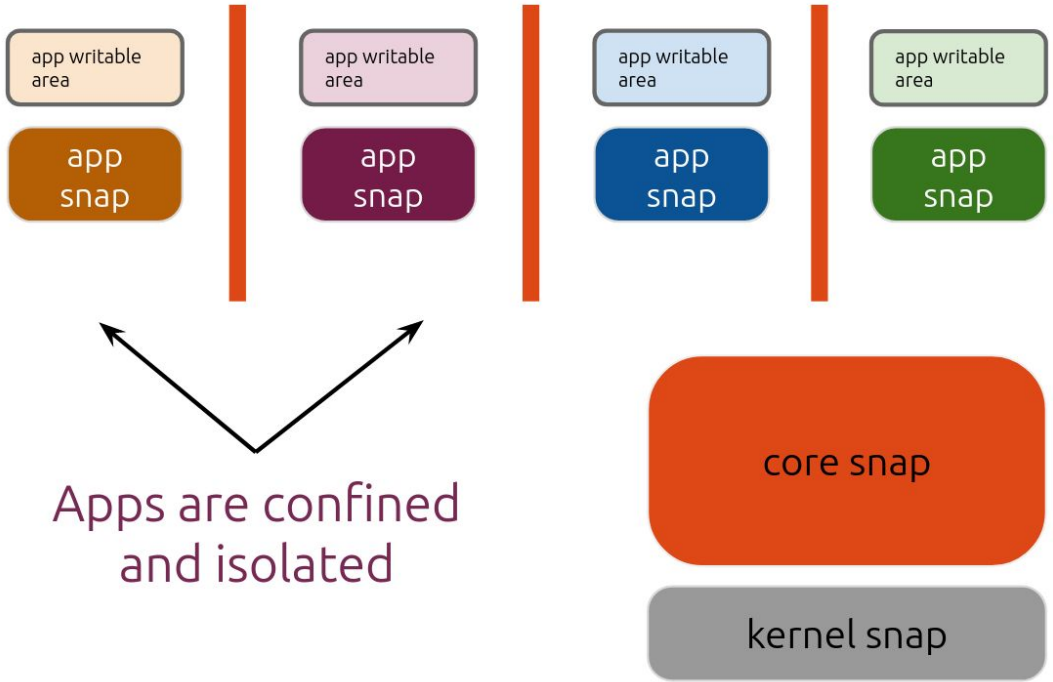
Ubuntu Core Operating System

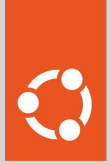
- **Originally created for IoT …**
- **The all-Snap Ubuntu Core OS consists of**
  - **Gadget** Snap
    - Bootloader, partitioning, hardware specifics …
  - **Kernel** Snap
  - **Core** Snap
    - Minimum base operating system
    - core, core18, core20, …, core24, … based on Ubuntu LTS
- **Comes in one image but Snaps separately updateable**
- **Applications added as Snaps**



No interdependencies between Snaps

- Every Snap can be **independently** updated (and rolled back)





Ubuntu Core Desktop

Ubuntu Core Desktop – Building Blocks

- **Easy to maintain** for end users, like a **smartphone**
- **Boot Base** = Core Snap
- **Additional Bases:** Extra Core Snaps needed for Apps using other coreXX base Snap
- **Ubuntu Desktop Session Snap:** Wayland, Desktop environment (GNOME, later KDE and others)
- All building blocks **independently updateable** and **exchangeable**

Ubuntu Core Desktop

- **Principally as Ubuntu Core**, but image comes with
  - **Desktop Session Snap**
  - Common **Applications**
- Everything **easily** exchangeable: Other desktop, gaming kernel, …
- **Development work done in LXD containers**, with GUI frontend **Workshops**

Ubuntu Core Desktop – TODO

- **Still to be done for a first release**
  - Gaming: **Nvidia driver** support
  - Productivity: **Printer setup tools** for all-IPP and Printer Application support
  - Productivity: **Scanner Applications**
  - **Development**: IDE support, GUI DEBs, classic Snaps
  - **TPM full disk encryption**
  - **Remote management** via Canonical Landscape
  - **Active Directory** login
  - **Distro infrastructure**: ISOs, testing, stable release tracks, documentation

Ubuntu Core Desktop

- **Advantages**
  - **Stability:** Read-only system files, atomic updates, no dependency conflicts
  - **Security:** Secure boot, read-only system files, encapsulation
  - **Composability:** Defined modules which do not affect each other
  - **Manageability:** Defined modules, atomic updates, single package format
  - **Privacy:** Encapsulated apps with well-defined permissions

Thank you! Questions?

The Making of …

snapcraft – Let's go snapping …

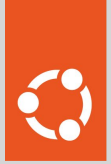
- **snapcraft** creates Snaps, orchestrating disparate components and building systems into one cohesive **distributable package**
- It can **re-use DEB packages** from Ubuntu (of the Ubuntu LTS release the Core Snap used is based on).
- It’s **extensible** and **new plugins** to leverage different technologies are being developed all the time. A few examples of its plugins are Java, Python, Catkin (ROS), Go, CMake, qmake, make, autotools, etc.

snapcraft – Let's go snapping …

- **Single `snapcraft.yaml` file** that describes everything
- Defines apps, build process, build dependencies, runtime dependencies, interfaces
- Fully supported and integrated in **Launchpad**
- GitHub build service provided via https://build.snapcraft.io/
- **Detailed documentation** and tutorials at https://snapcraft.io/

ubuntu-image – Assemble your all-Snap OS

- The **magic tool** putting everything together
- Using a signed “assertion” file to define which Snaps end up inside the image
- Reads `gadget.yaml` to create **partitioning**
- Can build full disk images (i.e. SD card) or multi-partition images (i.e. to dd single img files to specific eMMC partitions on a pre-partitioned flash device)
- Available as a Snap! (`snap install ubuntu-image ...`)
- **Detailed documentation** at: https://docs.ubuntu.com/core/en/guides/build-device/image-building



Want to know more?

More info/links

- **Snap Store** and **home page** of Snap: https://snapcraft.io
- **Discuss** your questions in the forums: https://forum.snapcraft.io/
- **Documentation**: https://snapcraft.io/docs
- Want to **learn snapping**? – Workshops! https://forum.snapcraft.io/t/40263
- Let the **important people talk about Snap**: https://www.youtube.com/watch?v=ido6kGmSHWI

More info/links

- Learn about **immutable OS** distributions:
  https://ubuntu.com/blog/ubuntu-core-an-immutable-linux-desktop
- **Ubuntu Core Desktop – Introduction**
  https://discourse.ubuntu.com/t/ubuntu-core-desktop-deep-dive/
- **Ubuntu Core Desktop – GitHub**
  https://github.com/canonical/ubuntu-core-desktop/
- **Ubuntu Core Desktop – Installation HOWTO**
  https://www.omgubuntu.co.uk/2023/06/try-ubuntu-snap-desktop
- **Ubuntu Core Desktop – Talk on Ubuntu Summit 2023**
  https://www.youtube.com/watch?v=ahWrhnjjYDk

More info/links

- 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
- Want to watch some **snappy videos**? Here we go:
  - https://www.youtube.com/watch?v=TfB6QwR2GYg
  - https://www.youtube.com/watch?v=ido6kGmSHWI
  - https://www.youtube.com/watch?v=m5QKJH9tDjQ