Kubernetes: Kernels & Distros

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Where is Kubernetes today?

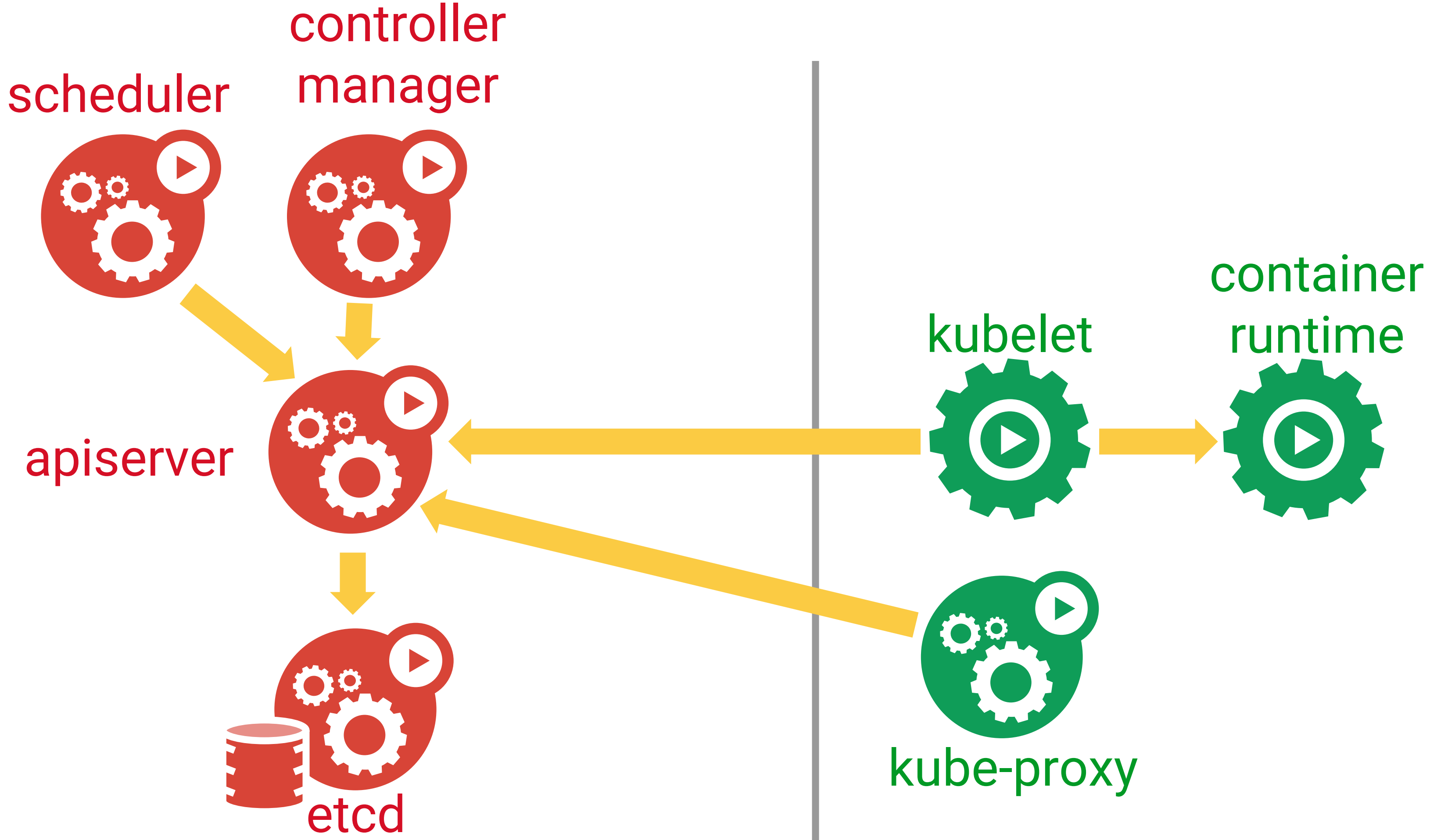
Kubernetes is ...

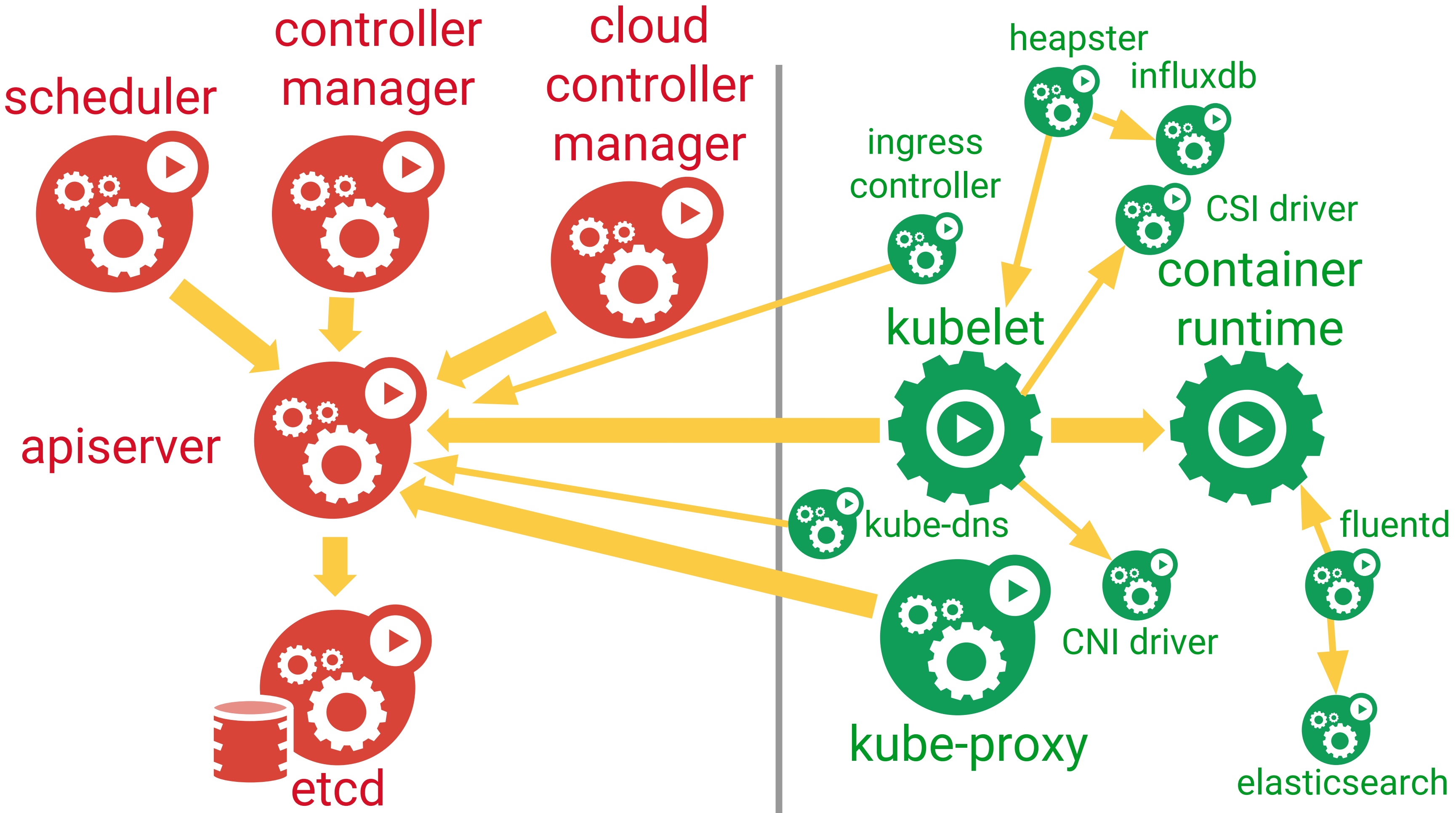
A fairly large project (~3M LOC)

Still growing

Not a monolithic program

A set of cooperating microservices


controller manager
scheduler
apiserver
etcd
kubelet
container runtime
kube-proxy


scheduler
controller manager
cloud controller manager
apiserver
etcd
heapster
influxdb
ingress controller
CSI driver
container runtime
kubelet
kube-dns
fluentd
CNI driver
kube-proxy
elasticsearch

Extensibility - Enabling out-of-tree

Drivers

- Network (CNI)
- Storage (flex, CSI)
- Device (e.g. GPU)
- Cloud providers

Container runtimes

Operators / controllers

Add-ons

- e.g. logging, monitoring

Some assembly required

Must Find Components!

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Must Find Components!

Download Components!

Version Skew!

Some assembly required

Must Find Components!

Download Components!

Unusable to most users

Version Skew!

Test Hell!

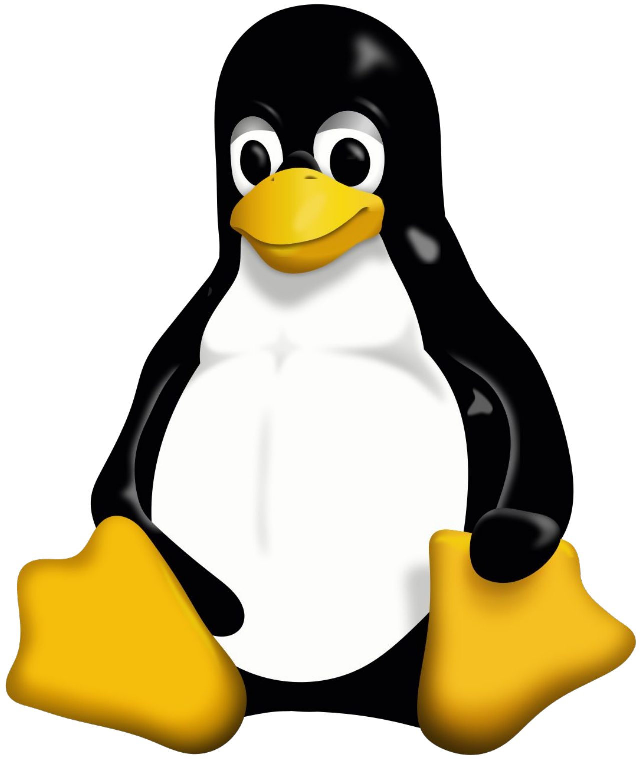
Comparative analysis

Linux is many projects

Decentralized & layered:

- Installers
- Kernel
- Bootup
- Shells
- Tools
- Programming Languages
- GUIs

Roughly “kernel” & “distro”



The kernel - Not useful alone

One big program

Lives in its own git repo
- No tools, add-ons, etc.

Releases fairly frequently
- 8-10 weeks

Has only X.Y versions
- Bugs in X.Y get fixed in X.Y+1
- X.Y.Z patch releases managed by community

Distributions

Everything else is developed separately

DIY systems are not tenable

ca. 1992, the concept of "Linux distros" emerged

EVERYONE uses a distro

Distributions

Distros serve different needs

Most users don't care about kernel version, just distro version

Generally release slowly

- Quarters to years

Emphasize their differences

- Technical & opinions

Distributions

Distro Value Add

- Platform support (drivers & extensions)
- Packaging & component lifecycle
- Support, security, & testing
- Simple installation

Kubernetes: Kernel or Distribution?

Is Kubernetes a kernel or a distro?

Releases quarterly

Includes enough to run *most* clouds

- But not all of them
- May not be true in the future

Contains a bunch of drivers

- But not all of them
- May not be true in the future

Is Kubernetes a kernel or a distro?

Integrates some 3rd party add-ons

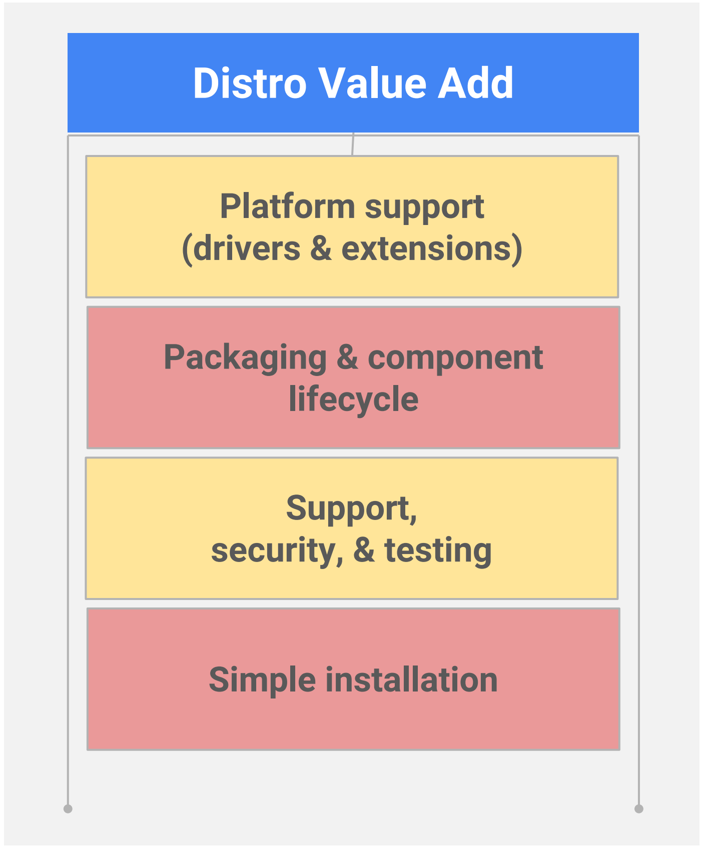
- But not many
- Does not usually carry patches

X.Y.Z releases and medium-term support

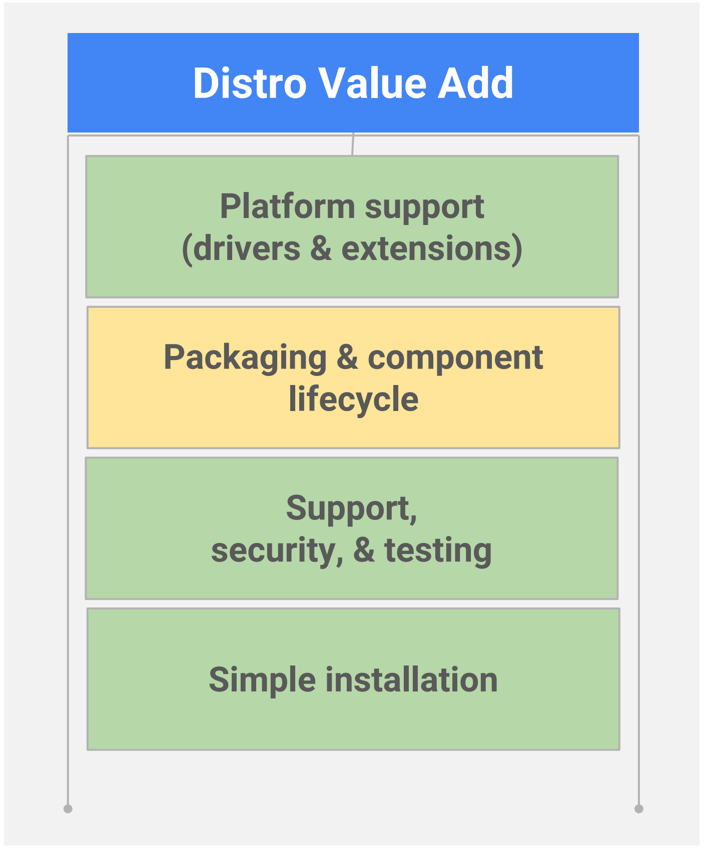
Lives in a small number of git repos

- Highly coupled components

Kubernetes upstream as a distro


Distro Value Add
Platform support (drivers & extensions)
Packaging & component lifecycle
Support, security, & testing
Simple installation

Other Kubernetes distros


Distro Value Add
Platform support (drivers & extensions)
Packaging & component lifecycle
Support, security, & testing
Simple installation

There are ALREADY more than 30 Kubernetes distributions!

- Clouds
- Enterprise vendors
- Higher level platforms
- Bespoke

Fragmentation risk: conformance

certified

kubernetes

* conformance program

Distros were inevitable.

Distros were inevitable.

How do we want to organize our project and community?

Option #1: Ignore it

Others *will* make distros

- No coordination or consistency
- We will have no say

Result:

- Fragmentation & politicization
- Many options, confusing UX
- Over time, converge on 3-4 distros?

Option #2: One distro to rule them all

Needs *huge* non-eng effort

Major distraction from k8s

Others will *still* do their own

- Opinions

Result: Probably failure, see option #1

Option 3: Find the middle-ground

Formalize what we already do

Focus on correctness and stability

Others will still do their own

- But hopefully based on ours?

Result:

- Clean up our thinking / processes
- Define tools, standards, etc.
- Derived distros benefit from staying close

Concrete Ideas

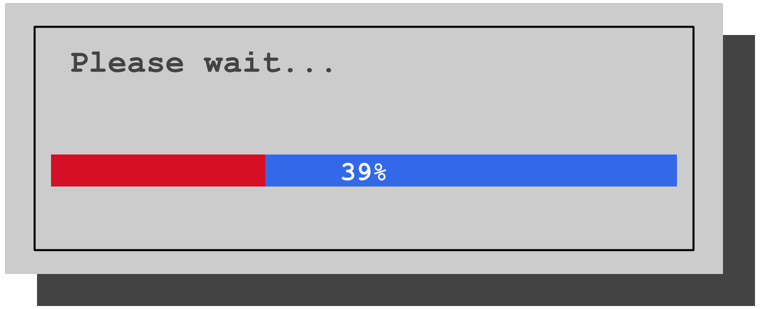
Installers

Pick ONE installer and make it great

- Which one? Contentious!

Or define a manifest format that installers consume?

- Think kernel config process and result



```
Please wait...

39%
```

Add-ons

Formalize “add-ons”

- Central repository
- Ownership
- Management mechanism
- Tooling
  - `kubectl apt-get update`?

Start with `cluster/addons/...`

- How to track upstreams?

Manage the kernel

Bound and extract "the kernel"

- Still multiple binaries
- No installer, add-ons, cloud providers

Manage it as a single component

Release it tick-tock style

- Features vs. stability

Kernel != distro

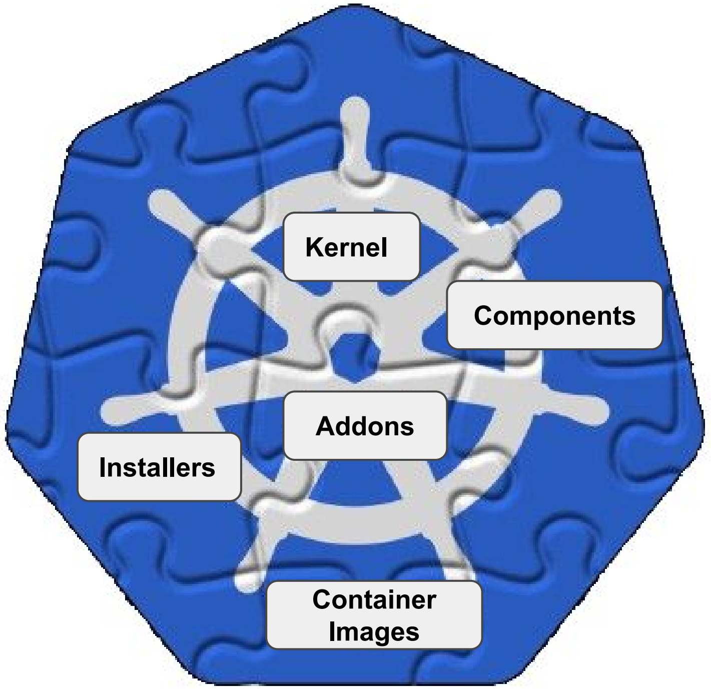
Manage the distro

Fork all code into our space

- Only ship things we control
- Carry patches IFF needed

Push everything to one repository

- No hunting all over the internet



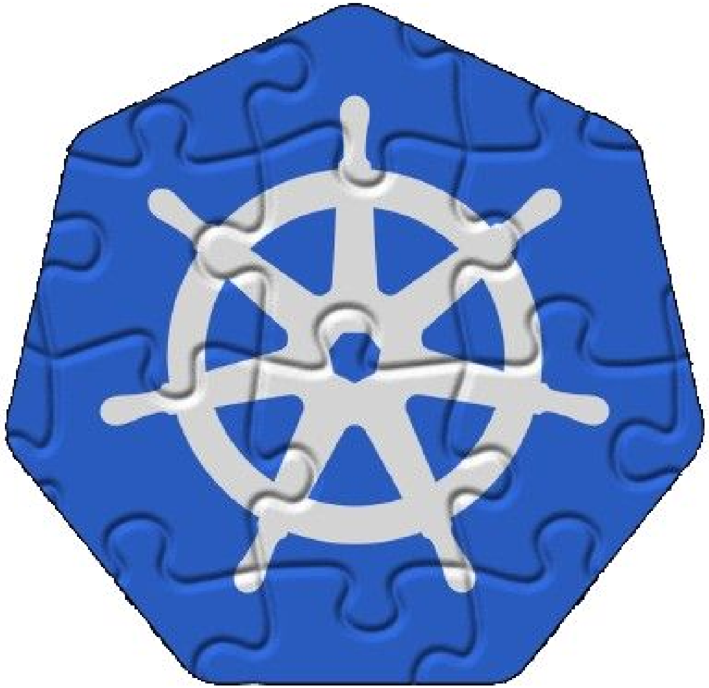
Manage the distro

Distinguish component version from package version

- e.g. 1.2.3-4 = “4th build of 1.2.3”

Release distro every 6-12 months

Base deprecation policies on distro releases



A new role - Distro Hero!

These are just some ideas

To pull this off, we need a **community**

- Different skills
- Different focus

https://commons.wikimedia.org/wiki/File:Placeholder_couple_superhero.png