

What Is Fedora CoreOS?

All Things Open 2023



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Agenda

- Introduction to Fedora CoreOS
- Recent Developments
- How Fedora CoreOS is Being Used?
- Statistics
- Questions?



Introducing Fedora CoreOS



Fedora CoreOS: A top-level Fedora Edition

- Came from the **merging** of two communities:
 - CoreOS Inc's Container Linux
 - Project Atomic's Atomic Host
- Incorporates **Container Linux**
 - Philosophy
 - Provisioning Stack
 - Cloud Native Expertise
- Incorporates **Atomic Host**
 - Fedora Foundation
 - Update Stack
 - SELinux Enhanced Security



Components of Fedora CoreOS

- **Automatic updates**
 - No interaction for administrators
- **Automated provisioning**
 - All nodes start from **~same starting point**
 - Use Ignition to provision a node on **first boot**
- Strict **OS Versioning** with **Enhanced Security**
 - Operating System is the same that was shipped from Fedora
- Additional software runs in **containers**
 - Makes host updates more **reliable**
- Offers **Cloud Native** primitives anywhere Fedora CoreOS can run
 - Great for **clustered deployments**
 - Same tools available **everywhere**



Automatic Updates

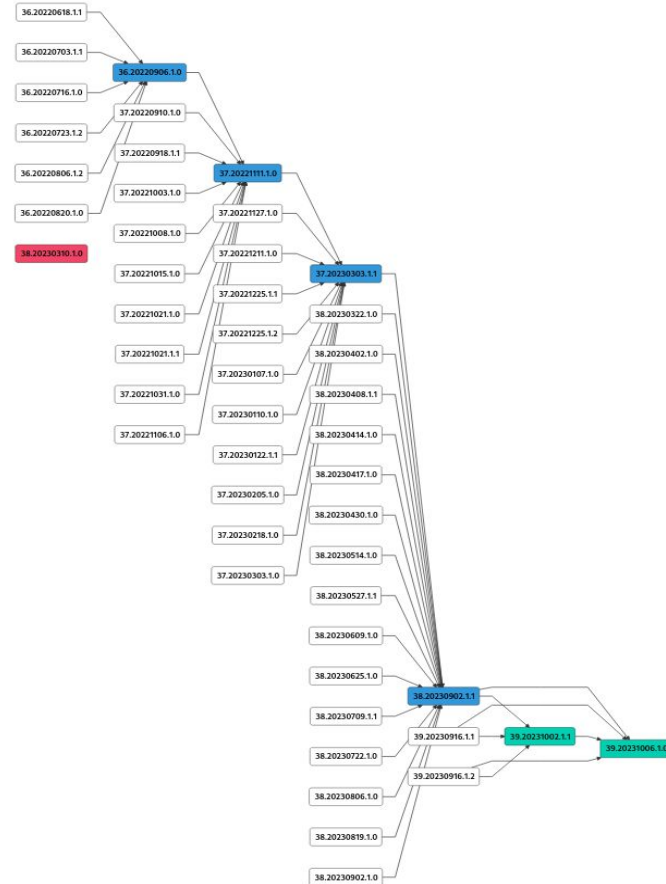
- FCOS features Automatic Updates by default
 - Automatic updates → Reliable updates
 - Managed upgrade rollouts over several days
 - Update Graph used to control upgrades
 - Several update streams to preview what's coming
 - Extensive tests in automated CI pipelines
 - For when things go wrong
 - rpm-ostree rollback can be used to go back



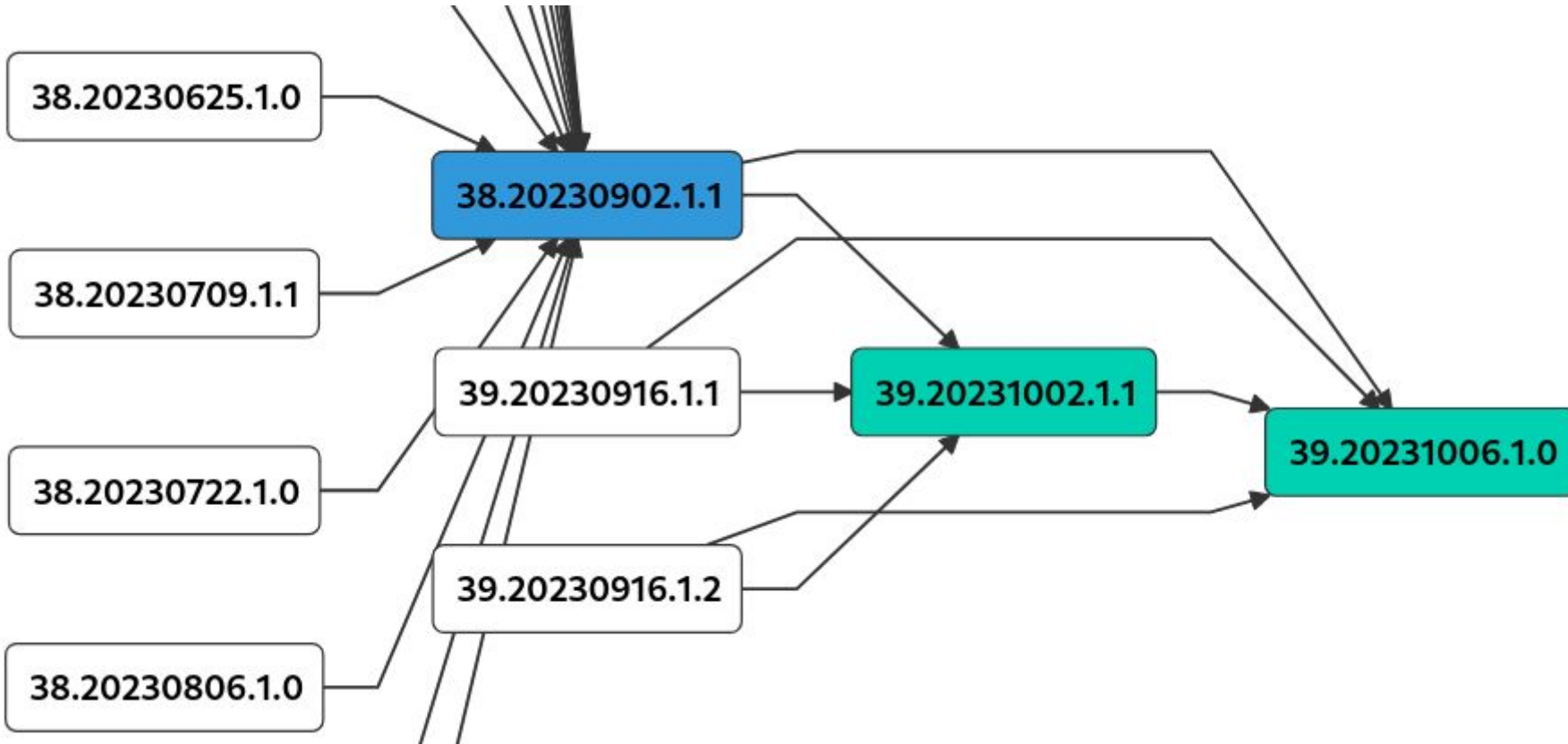
Automatic Updates: Update Graph



- Update Server manages an **Update Graph**
- Instructs clients on **safe path**
- Server side: [fedora-coreos-cincinnati](https://github.com/fedora-coreos/cincinnati)
- Client side: [zincati](https://github.com/fedora-coreos/zincati)



Automatic Updates: Update Graph



Automatic Updates: Update Streams



Download Fedora CoreOS

Fedora CoreOS is available across 3 different release streams

[Documentation](#)

[Release Notes](#)

[Community Support](#)



Stable

v 38.20230918.3.2

[JSON](#) — 5 days ago

The Stable stream is the most reliable version of Fedora CoreOS. Releases are battle-tested within the Testing stream before being promoted.

[Show Downloads](#)



Testing

v 38.20231002.2.2

[JSON](#) — 10 days ago

The Testing stream contains the next Stable release. Mix a few Testing machines into your cluster to catch any bugs specific to your hardware or configuration.

[Show Downloads](#)



Next

v 39.20231006.1.0

[JSON](#) — 5 days ago

The Next stream represents the future. It provides early access to new features and to the next major version of Fedora. Run a few Next machines in your cluster, or in staging, to help find problems.

[Show Downloads](#)

Automatic Updates: Update Streams

- Offered update streams with automatic updates
 - **next** - experimental features, Fedora major rebases
 - **testing** - preview of what's coming to stable
 - point in time snapshot of Fedora stable rpm content
 - **stable** - most reliable stream offered
 - promotion of testing stream after some bake time
- Goals
 - Publish new releases into update streams every two weeks
 - Find issues in next/testing streams before they hit stable



Automatic Updates: F39 Rebase

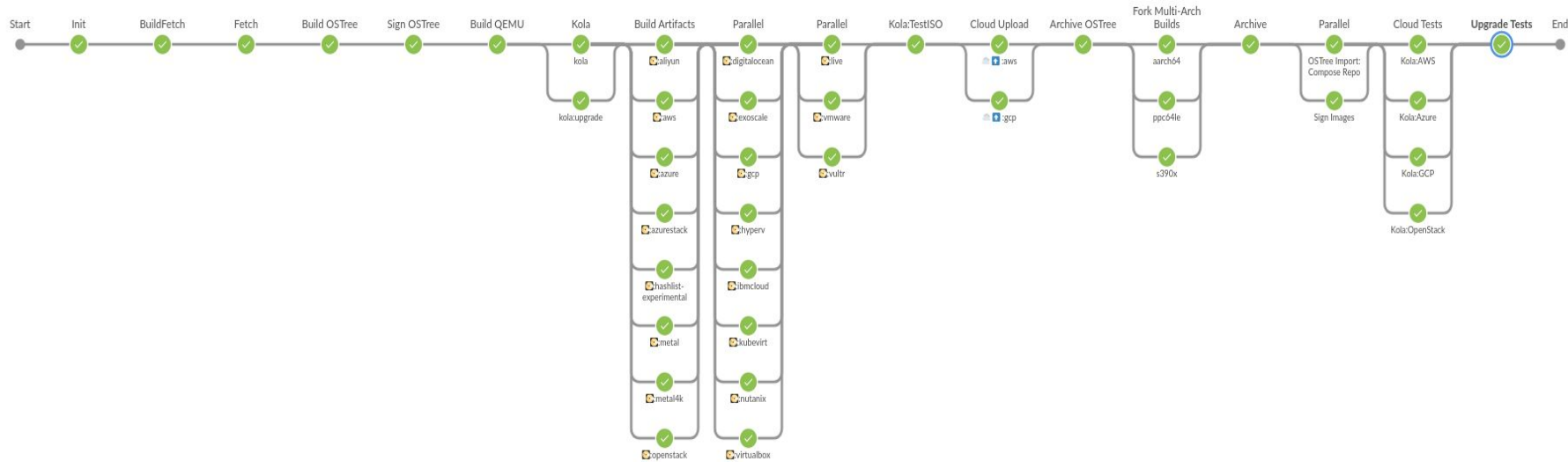
- Fedora Beta Release
 - The **next** stream is switched over to the new release.
- Fedora Final Freeze
 - The **next** stream switches to weekly releases to closely track GA content
- Fedora General Availability
 - Fedora CoreOS re-oriens its release schedule in the following way:
 - Week -1 (Fedora "Go" Decision):
 1. **next** release with final Fedora GA content
 - Week 0: (GA release):
 1. **testing** release promoted from previous **next**
 - Week 2:
 1. **stable** release promoted from previous **testing**
 2. now fully rebased to Fedora 39



Automatic Updates: Reliable Updates



None of this happens without passing tests!



Automatic Updates: Reliable Updates



None of this happens without passing tests!

✔	⚙️	kola-aws	13 hr - #325	4 days 0 hr - #312	1 hr 11 min
✔	⚙️	kola-azure	13 hr - #80	12 days - #57	45 min
✔	⚙️	kola-gcp	13 hr - #169	3 days 14 hr - #164	15 min
⋮	⚙️	kola-kubernetes	N/A	N/A	N/A
✔	☁️	kola-openstack	13 hr - #340	1 day 10 hr - #337	45 min



Automated Provisioning

- FCOS uses [Ignition](#) to automate provisioning
 - Any logic for machine lifetime is encoded in the config
 - Very easy to automatically re-provision nodes
 - Same starting point whether on bare metal or cloud
 - Use Ignition everywhere as opposed to kickstart for bare metal and cloud-init for cloud



Automated Provisioning: Ignition

- Declarative JSON documents provided via user data
- Can write files and systemd units, create users and groups, partition disks, create RAID arrays, set up LUKS encryption, format filesystems, etc..
- Runs exactly once, during the initramfs stage on first boot
- If provisioning fails, the boot fails (no half provisioned systems)
- Machine-friendly (JSON)



Automated Provisioning: Butane

- Tool to translate to Ignition spec
- Configs are Human friendly (YAML)
- Ignition semantics, plus sugar for common operations
- Transpiler catches common errors at build time
 - Validates created Ignition config



Automated Provisioning: Example Config

```
variant: fcos
version: 1.4.0
passwd:
  users:
    - name: core
      ssh_authorized_keys:
        - ssh-rsa AAAA...
storage:
  files:
    - path: /etc/containers/systemd/hello.container
      contents:
        inline: |
          [Unit]
          Description=Hello Service
          Wants=network-online.target
          After=network-online.target
          [Container]
          ContainerName=busybox1
          Image=docker.io/busybox
          Exec=/bin/sh -c "trap 'exit 0' INT TERM; while true; do echo Hello World; sleep 1;
          [Install]
          WantedBy=multi-user.target
```



OS Versioning & Security

- Fedora CoreOS uses RPM-OSTree technology
 - “Like git for your Operating System”
 - **38.20230918.3.2** - f2824f5
 - A single identifier tells you all software in that release
 - Uses read-only filesystem mounts
 - Prevents accidental OS corruption (rm -rf)
 - Prevents novice attacks from modifying system
- SELinux enforcing by default
 - Prevents compromised apps from gaining further access



Container Focused

- Software runs in containers
 - CLI:
 - podman
 - moby engine (docker)
 - Runtimes
 - containerd
 - crun, crun-wasm
 - not cri-o
 - depends on the kubernetes version



Cloud Native

- Great for clustered deployments
 - Burst nodes when demand increases
 - Ignition configs used to automate cluster join
 - Applications pulled from registry
 - Spin down nodes when no longer needed
- Using Ignition for provisioning
 - Across every platform/architecture
 - Unifies cloud provisioning with bare metal
 - Unifies provisioning across clouds
 - Cloud agents don't play a role
 - All platforms are now on the same playing field



Supported platforms and architectures



- Available for a plethora of **cloud/virt** platforms
 - Alibaba, AWS, Azure, DigitalOcean, Exoscale, GCP, Hyper-V, IBM Cloud, Kubevirt, Nutanix, OpenStack, Vultr, VMware, Libvirt/QEMU
 - Directly launchable on AWS & GCP
- Several options for **Bare Metal**
 - Live ISO (automated or interactive installations)
 - PXE (network) boot
 - Raw and 4K native disk images
- All Architectures Fedora Supports!
 - **x86_64, aarch64, ppc64le, s390x**



Recent Developments in Fedora CoreOS



Hyper-V Platform



The screenshot shows a Windows 10 desktop environment. A remote terminal window titled "dustyym on EC2AMAZ-C8E671V - Virtual Machine Connection" is open, displaying the following text:

```
Fedora CoreOS 38.20230720.20.1
Kernel 6.3.12-200.fc38.x86_64 on an x86_64 (tty1)

SSH host key: SHA256:tl7tA6B2SEEZouAFf+miru8Csr2ghSE8+10ARaDA/dI (ED25519)
SSH host key: SHA256:aDMB4Duu6bJUWaxRUL2QbJD1zer8Q1/9B/mzay0tUmA (ECDSA)
SSH host key: SHA256:pPuay393t7qHPK;SUs0i1ZugpzaMkHcazaVq3UgT3Vy (RSA)
Ignition: ran on 2023/07/21 15:40:20 UTC (this boot)
Ignition: user-provided config was applied
Ignition: wrote ssh authorized keys file for user: core
localhost login: core
Password:
C: Last failed login: Fri Jul 21 15:40:56 UTC 2023 on tty1
Th There were 2 failed login attempts since the last successful login.
C: Fedora CoreOS 38.20230720.20.1
Th [core@localhost ~]$
C: [core@localhost ~]$
Th [core@localhost ~]$
C:
C: b
op
C: v
v
D
07
07
07
07
07
C:
ad
C:
```

In the foreground, a small window titled "Administrator: Command Prom..." is open, showing system logs. The Windows taskbar at the bottom shows the search bar, task view, and system tray with the time 3:42 PM on 7/21/2023.

Kubevirt Platform



 **RED HAT** Quay.io

EXPLORE TUTORIAL PRICING

search



SIGN IN

← Repositories ↑...



fedora / fedora-coreos-kubevirt



Repository Tags

Compact

Expanded

Show Signatures



1 - 5 of 5



Filter Tags...

TAG

LAST MODIFIED ↓

SIZE

next



a day ago

N/A



testing



a day ago

N/A



stable



a day ago

N/A



KubeVirt Platform



Project: fedora-coreos-pipeline ▾

VirtualMachineInstances > VirtualMachineInstance details

VMI my-fcos Running Actions ▾

Details YAML Scheduling Events Console Network interfaces Disks

Guest login credentials >

VNC console ▾ Send key ▾

```
Fedora CoreOS 38.20230514.3.0
Kernel 6.2.15-300.fc38.x86_64 on an x86_64 (tty1)

SSH host key: SHA256:RXU/diQVceJoanQN14CqGYcKo+rczN9eck5P9WUBsPM (ECDSA)
SSH host key: SHA256:Hbd8F9IC/LhwNmk0JVnU2rXUq1PW_jA55m03JeMbCccs (ED25519)
SSH host key: SHA256:MYIuqyGBQH5wfmUnXbKJLOhbWfNAGHHNeL1TqdxAkIU (RSA)
emp1s0: 10.0.2.2 fe80::1c55:8521:e370:3fa
Ignition: ran on 2023/06/01 16:22:34 UTC (this boot)
Ignition: user-provided config was applied
Ignition: wrote ssh authorized keys file for user: core
my-fcos login: _
```



More Platform Enablement

- Added aarch64 Azure images
 - <https://github.com/coreos/fedora-coreos-pipeline/pull/694>
- Added aarch64 GCP Images
 - <https://github.com/coreos/fedora-coreos-tracker/issues/1377>
- Added SEV support for GCP images
 - <https://github.com/coreos/fedora-coreos-tracker/issues/1202>



Enhancing Composability

- Naming is hard
 - CoreOS Layering **or**
 - OSTree Native Containers **or**
 - Bootable Containers
- Fedora CoreOS is additionally offered as a container
- Customize Fedora CoreOS by performing a container build
 - FROM: quay.io/fedora/fedora-coreos:stable
- Makes individual derivation and distribution easier
 - Dockerfile & Container registry



Enhancing Composability: Example



```
# This is like https://tailscale.com/download/linux/fedora
# except it happens as part of a container build! You then need to do
# `tailscale up` via some other mechanism.
FROM quay.io/fedora/fedora-coreos:stable
RUN cd /etc/yum.repos.d/ && curl -LO https://pkgs.tailscale.com/stable/fedora/tailscale.repo && \
    rpm-ostree install tailscale && \
    systemctl enable tailscaled && \
    ostree container commit
```

- <https://github.com/coreos/coreos-layering-examples>

Enhancing Composability: Example

- `podman build -t myfcos:latest .`
- `podman push myfcos:latest quay.io/$USER/myfcos:latest`
- `rpm-ostree rebase --experimental \
ostree-unverified-registry:quay.io/$USER/myfcos:latest`



Enhancing Composability: Pros/Cons

- Rolling your own
 - As an end user:
 - Tweak things to suit your needs
 - Add configuration/Software
 - As a software integrator:
 - Can offer alternative stacks
 - Ublue, Podman Machine
- Downside
 - For Fedora CoreOS you now own your updates
 - Update Graph no longer consulted



How is Fedora CoreOS being used?



How is Fedora CoreOS being used?

**By Podman
Machine/Desktop**

Podman Machine/Desktop



podman desktop

[Documentation](#) [Core Values](#) [Features](#) [Downloads](#) [Extend](#) [Blog](#)

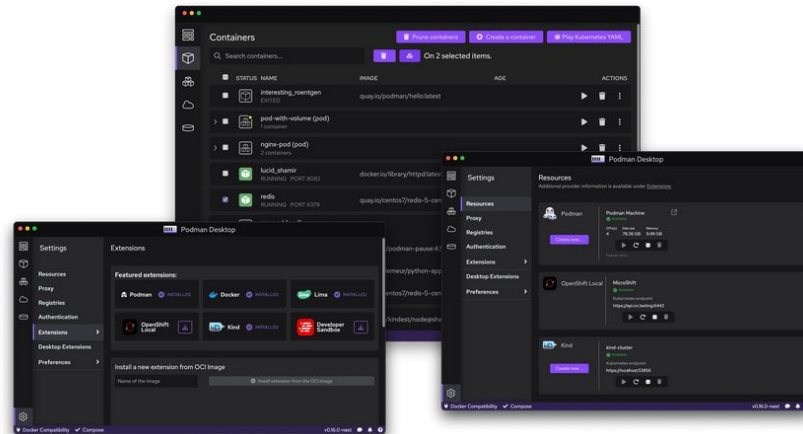
Containers and Kubernetes for application developers

Podman Desktop is an open source graphical tool enabling you to seamlessly work with containers and Kubernetes from your local environment.

Download Now

For Linux (*browser-detected*)

[Other downloads](#)



How is Fedora CoreOS being used?

By Kubernetes Distributions



Typhoon

Typhoon

Typhoon is a minimal and free Kubernetes distribution.

- Minimal, stable base Kubernetes distribution
- Declarative infrastructure and configuration
- **Free** (freedom and cost) and privacy-respecting
- Practical for labs, datacenters, and clouds

Typhoon distributes upstream Kubernetes, architectural conventions, and cluster addons, much like a GNU/Linux distribution provides the Linux kernel and userspace components.

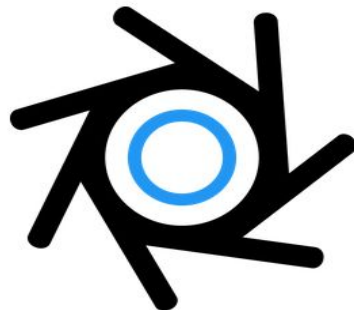
Features

- Kubernetes v1.28.2 (upstream)
- Single or multi-master, [Calico](#) or [Cilium](#) or [flannel](#) networking
- On-cluster etcd with TLS, [RBAC](#)-enabled, [network policy](#), SELinux enforcing
- Advanced features like [worker pools](#), [preemptible](#) workers, and [snippets](#) customization
- Ready for Ingress, Prometheus, Grafana, CSI, or other [addons](#)

Modules

Typhoon provides a Terraform Module for each supported operating system and platform.

Typhoon is available for [Fedora CoreOS](#).



OKD

The logo for OKD, featuring a red circle followed by the lowercase letters 'okd' in white. The background of the logo area is a dark gray rectangle with a pattern of faint, light gray hexagons.

The Community Distribution of Kubernetes that powers
Red Hat OpenShift



How is Fedora CoreOS being used?

By Universities





PRECISION DENTAL MEDICINE

Columbia University Irving Medical Center
College of Dental Medicine

 fedora COREOS

 COLUMBIA

COLLEGE OF
DENTAL MEDICINE



Columbia University



- From The Presentation by Marc Pusey - used to:
 - process data coming from “connected” dental chairs
 - Data is used to analyze dental students/technicians
 - Quality of Work, Work Habits (i.e. posture), etc
 - Overlay information on video streams of the procedures
 - In data science education to run Jupyter notebook models
 - Students getting hands on with Open Source/FCOS
- Recording link: <https://www.youtube.com/watch?v=coh55lyUc1M>



How is Fedora CoreOS being used?

**By Fedora/Red Hat for
Release Engineering**



Within Fedora: Helper Services



- The [Archive Repo Manager](#)
 - Watches Bodhi, stores updates in an Archive Repo
 - uses FUSE, so we run the service in a VM
 - needs extra configuration inside kubernetes
 - We use FCOS for the VM
 - Easy to provision from scratch ([Butane/Ignition](#))
 - Automatically updates itself



Within OpenShift/RHCOS

- The Fedora CoreOS Build pipeline runs on OpenShift
 - Offered by Fedora Infrastructure
- RHEL based RHCOS is the foundation of OpenShift
 - downstream of Fedora CoreOS



Multi-Arch Builders

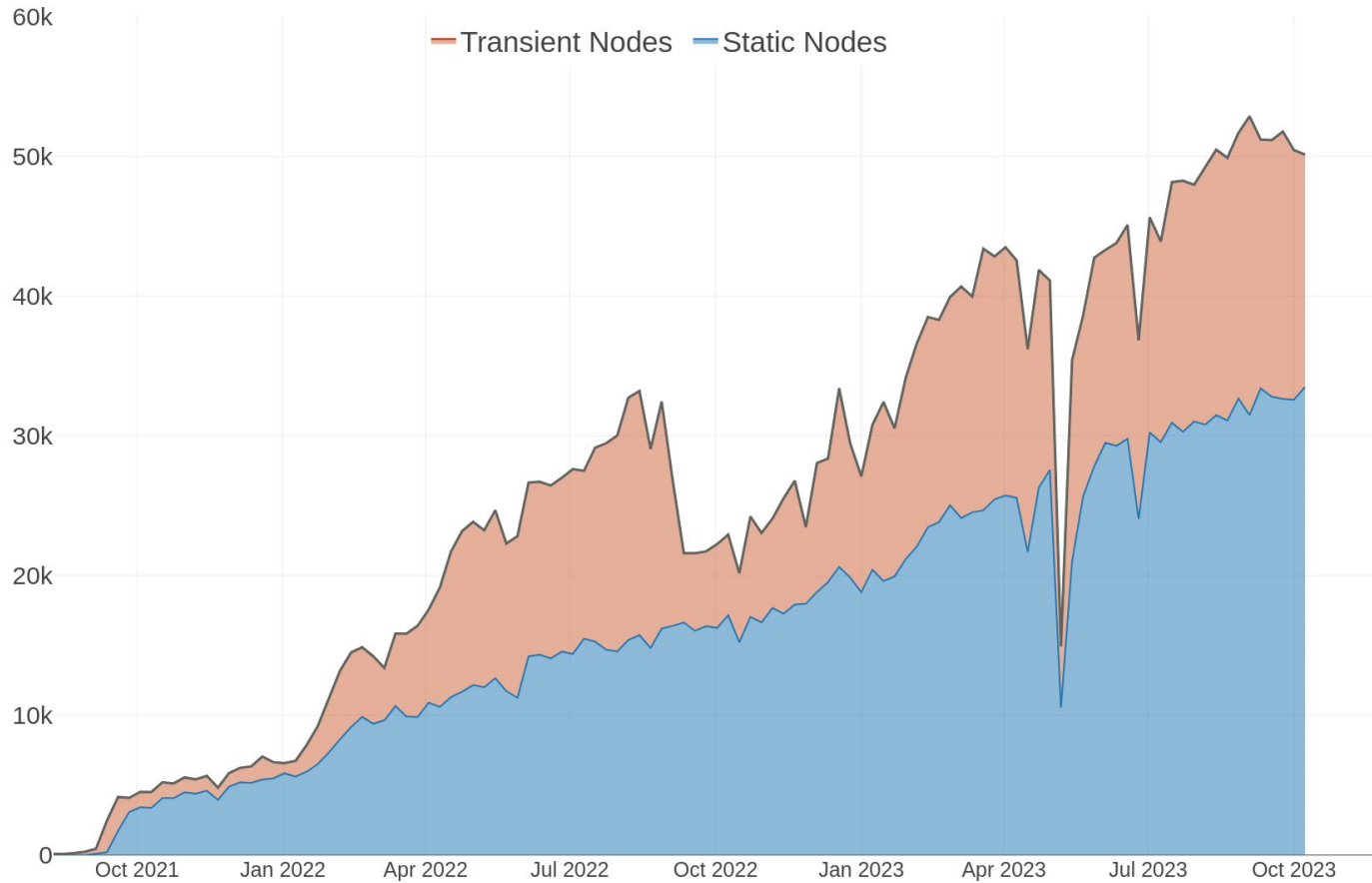
- Fedora Infra OpenShift is x86_64 only
- Need to do native aarch64, ppc64le, s390x builds
- 🖱️ Use Fedora CoreOS
 - Jenkins from x86_64 pipeline
 - Talks to FCOS aarch64, ppc64le, s390x builders
 - Uses `podman -remote` for the builds
 - Automatically update on a schedule
 - Easy to [provision](#) via Ignition/Butane



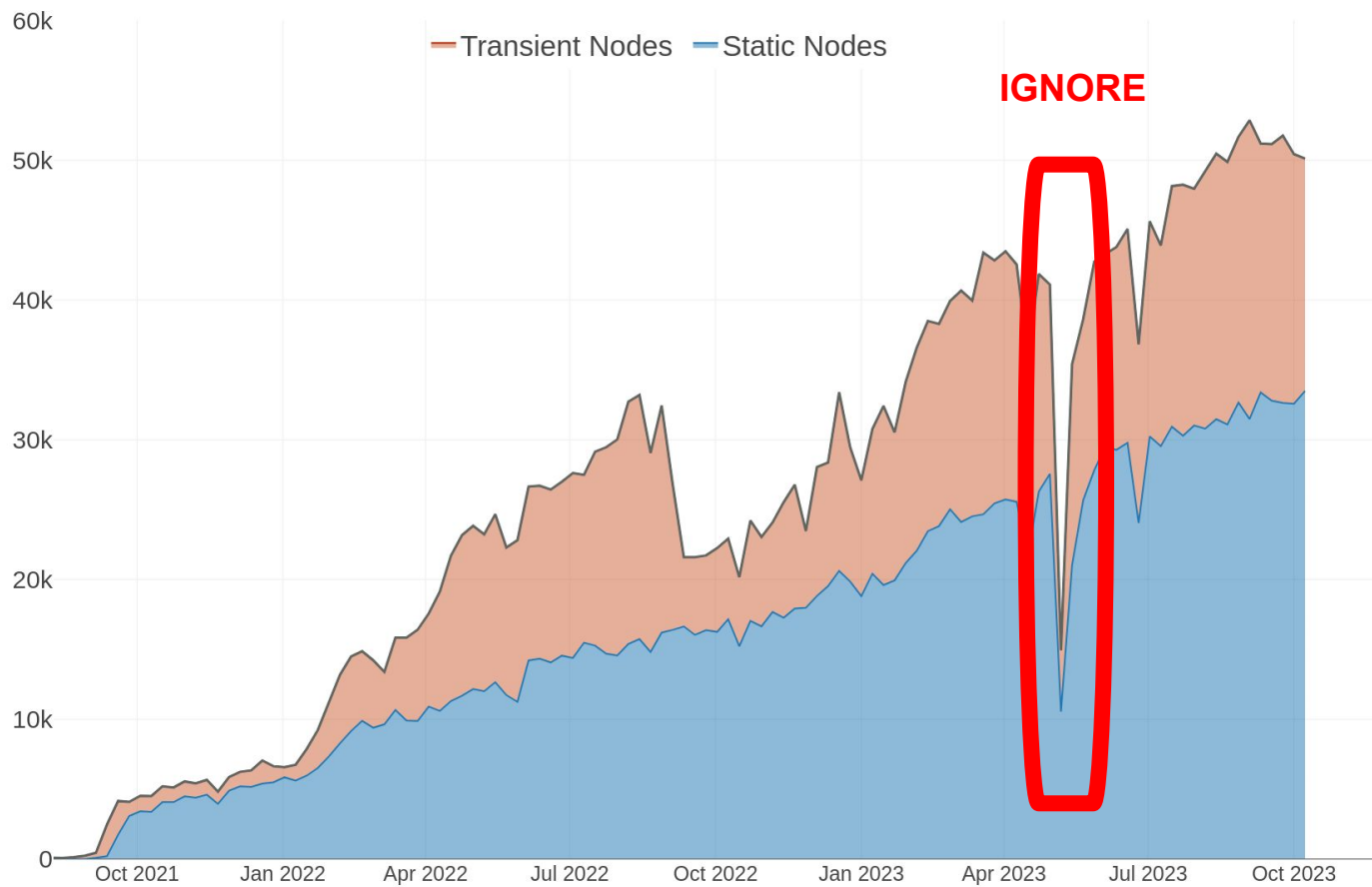
Statistics



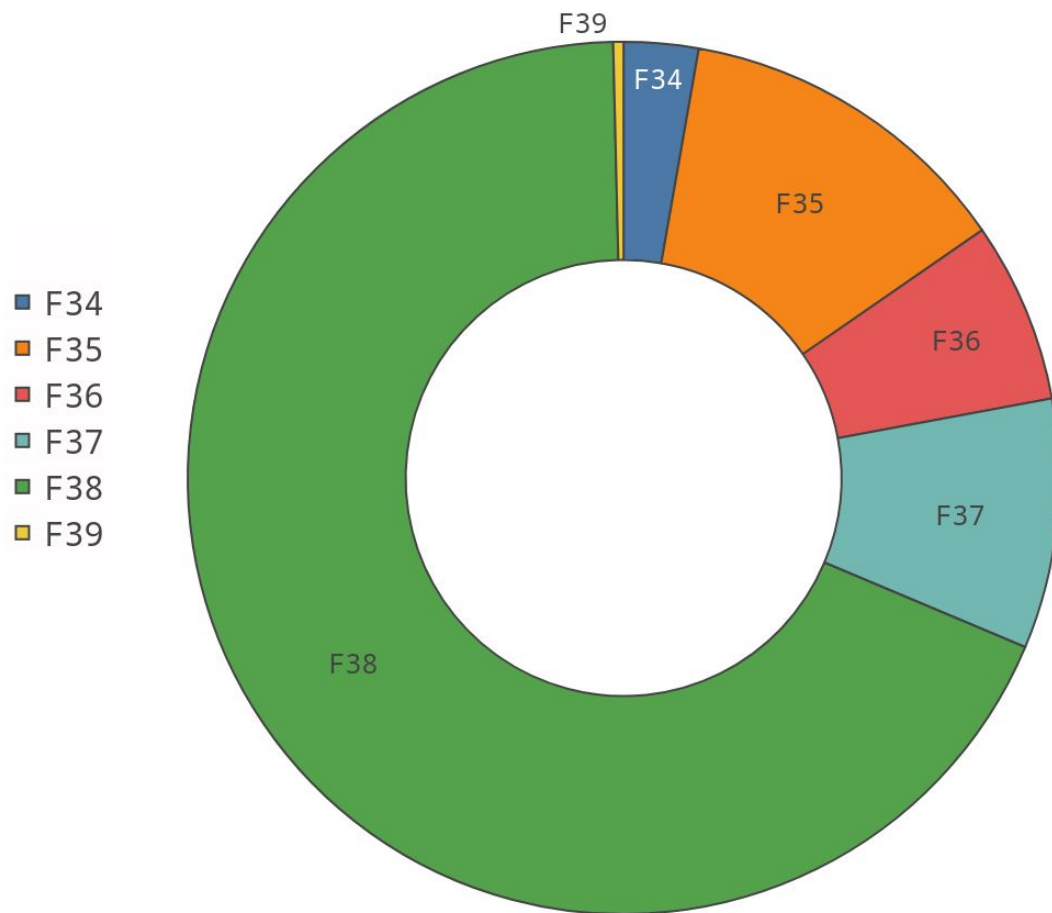
Stats: All Nodes



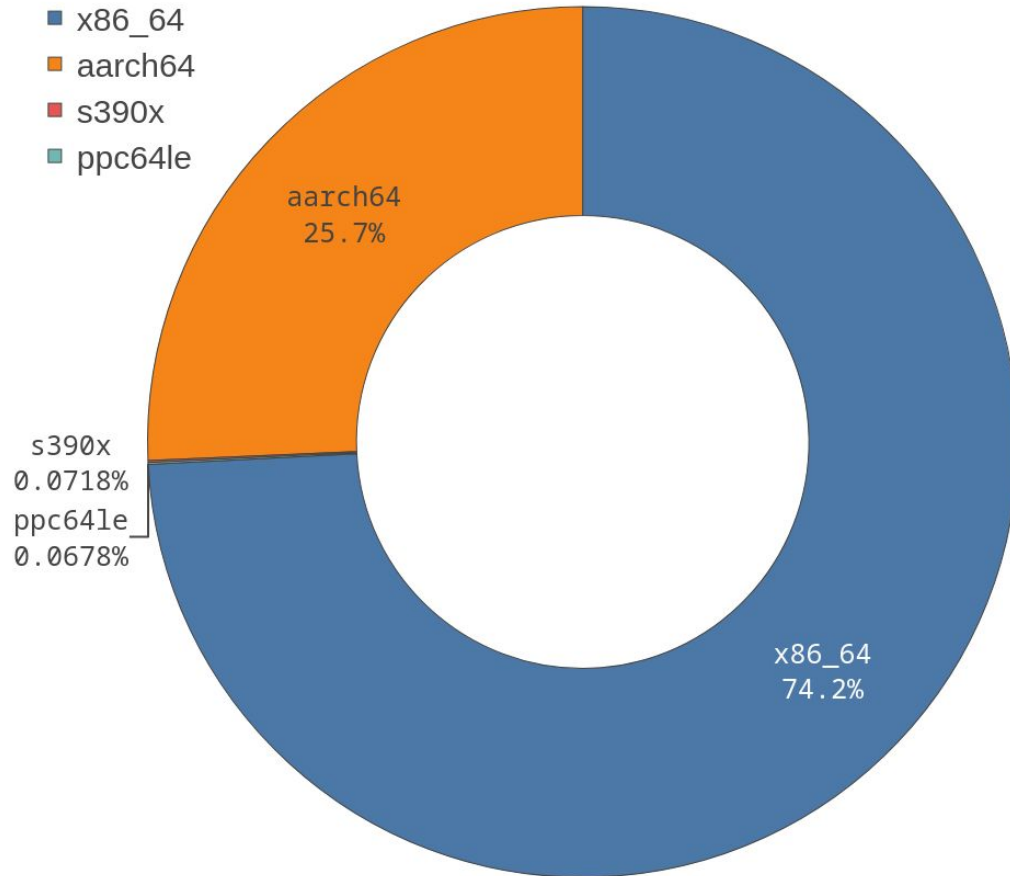
Stats: All Nodes



Stats: by Fedora Release (2023/10)



Stats: by Architecture (2023/10)



Community Community Community!



Get involved!

- Web: <https://fedoraproject.org/coreos/>
- Issues: <https://github.com/coreos/fedora-coreos-tracker/issues>
- Forum: <https://discussion.fedoraproject.org/tag/coreos>
- Mailing list: coreos@lists.fedoraproject.org
- Matrix: **#coreos:fedoraproject.org**



Questions?

