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KubeVirt on Arm: Enhancing Virtualization Capabilities Within the Kubernetes Ecosystem

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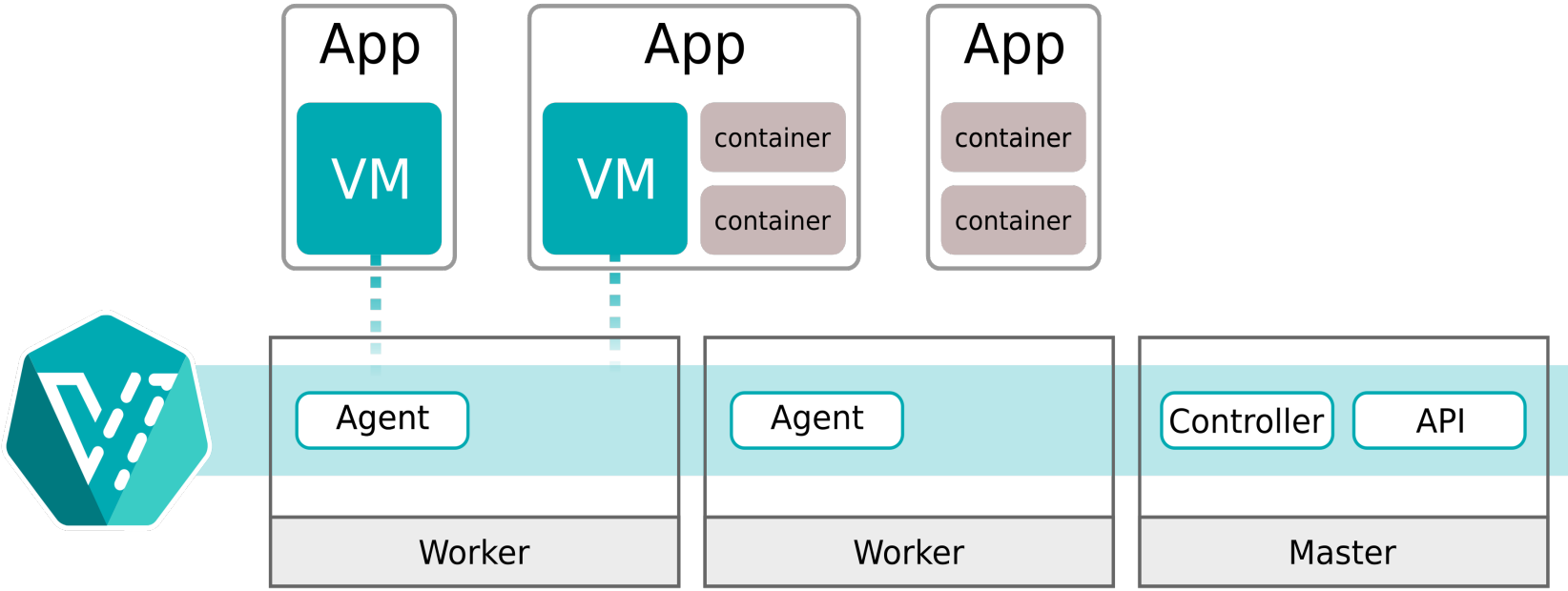
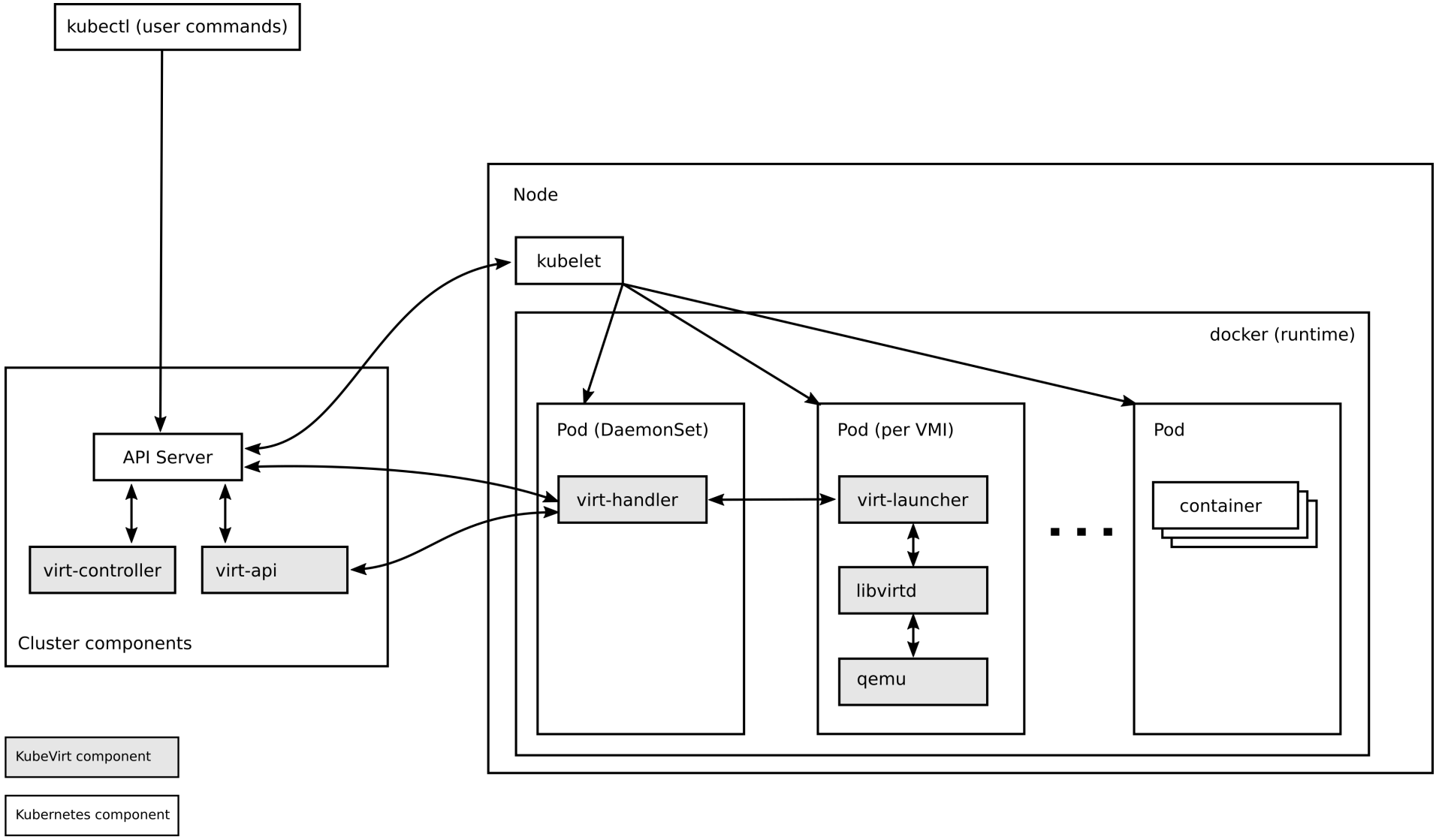
What is KubeVirt

- A way to run Virtual Machines on Kubernetes
- This project is leaded by Red Hat
- Red Hat OpenShift Virtualization and SUSE Harvester is based on KubeVirt
- It had become an incubating project in CNCF in April 2022
- ARM submitted the first patch sets on May 4, 2020,



How It Works

- Virt-api
- Virt-controller
- Virt-operator
- Virt-handler
- Virt-launcher
  - Libvirtd
  - Qemu



Current Status – Cross Compiling

Some communities may not have Arm64 servers, so cross-build is necessary.

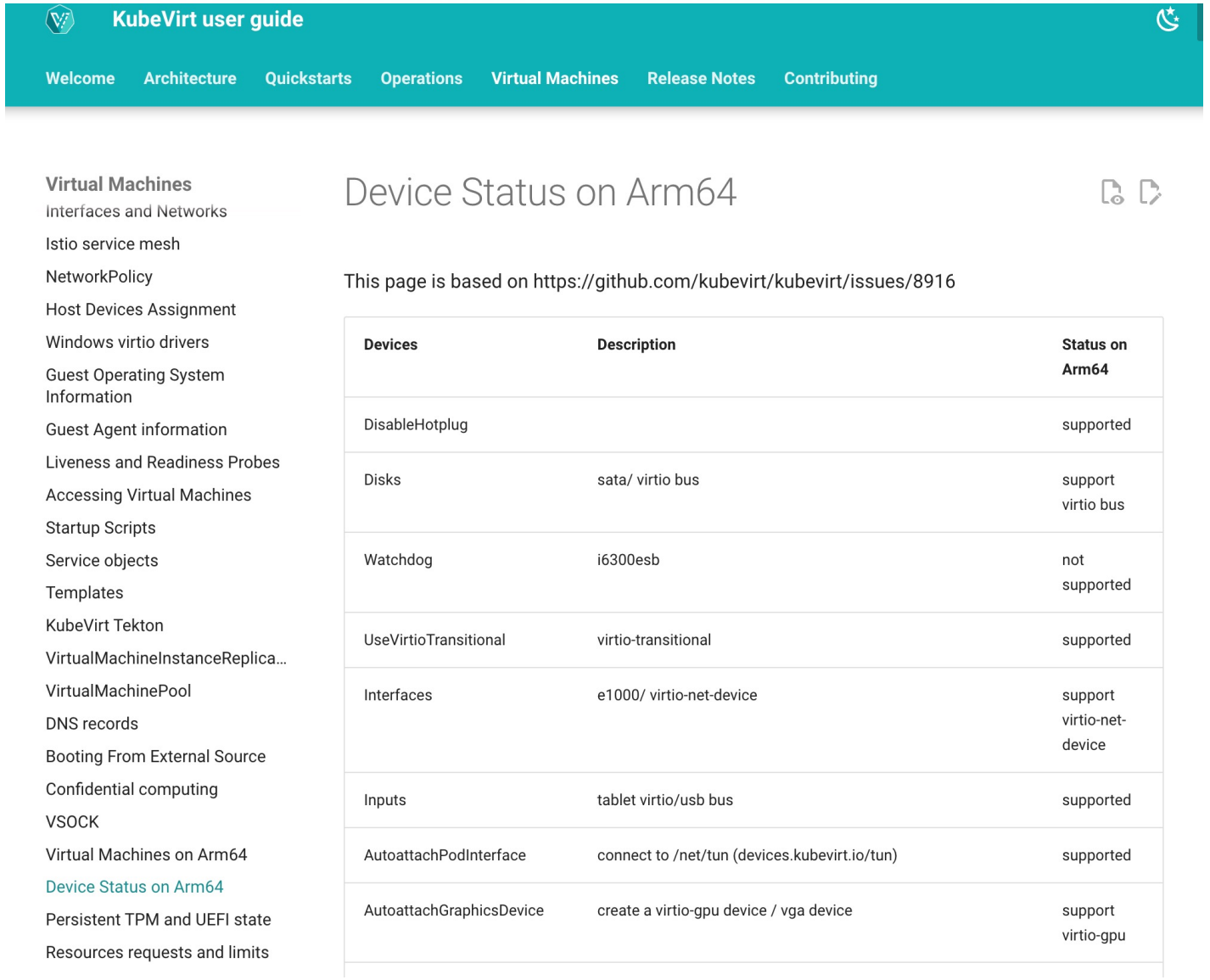
- Cross-build binary
- Cross-build container image
- Some tools or shell scripts may be needed to facilitate the cross-build process

KubeVirt

- Use Bazel to build binary and container image
  - Cross compile toolchain
    - aarch64-none-linux-gnu
  - Integrate the cross-compile toolchain into build tools
  - CPU arch-specific binary download
  - Cross-build container image
    - qemu-user-static
- Use qemu-img to build VM images
  - Auto download arch-specific rpm package

Current Status – Devices Support

- Boot Method
  - UEFI boot
- Use virtio device by default
  - Graphic Devices -- virtio-gpu
  - Disks – virtio bus
- Arch Specific modification in code level
  - `mutating-webhook`
  - `validating-webhook`



KubeVirt user guide

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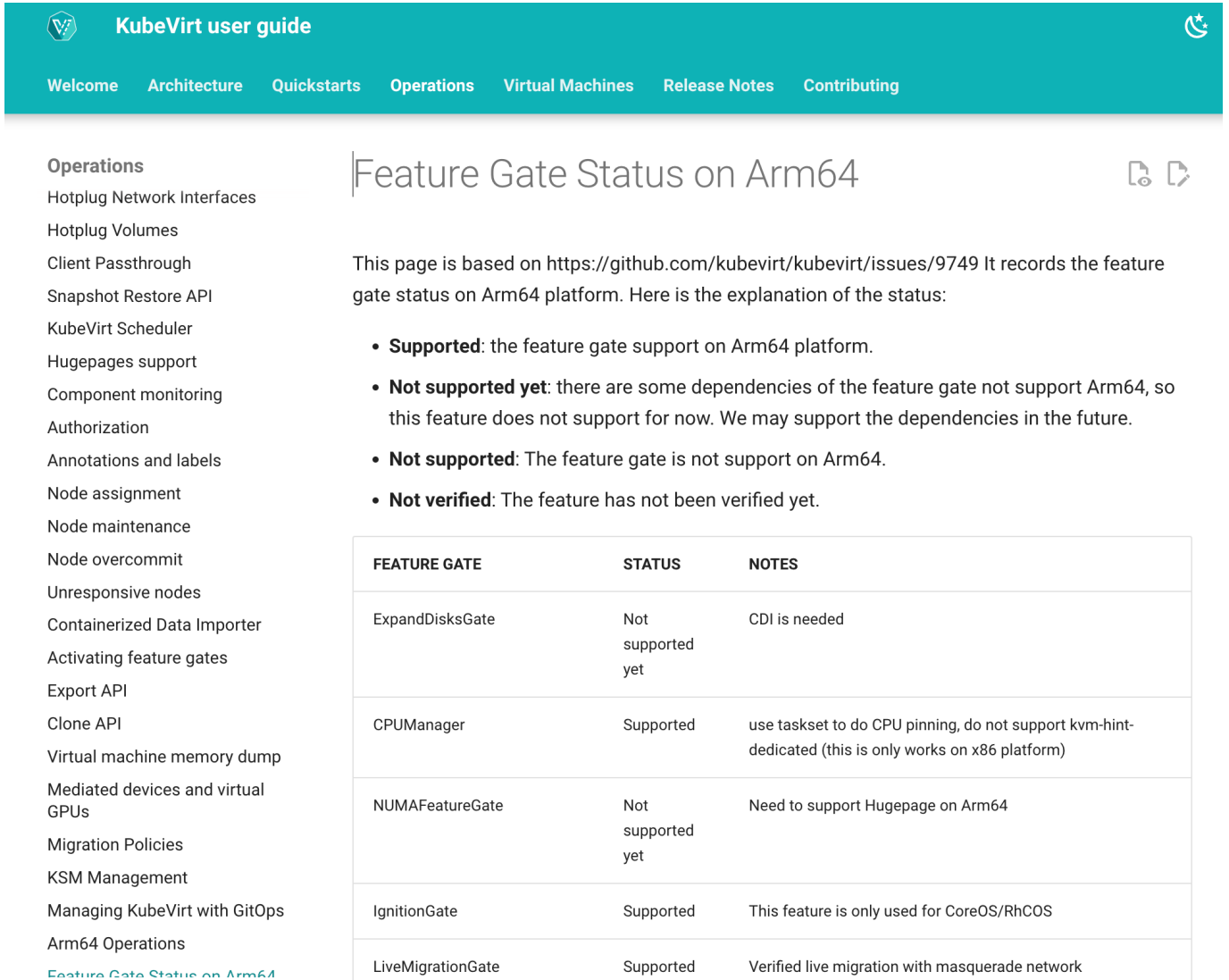
Device Status on Arm64

This page is based on https://github.com/kubevirt/kubevirt/issues/8916

Devices	Description	Status on Arm64
DisableHotplug		supported
Disks	sata/ virtio bus	support virtio bus
Watchdog	i6300esb	not supported
UseVirtioTransitional	virtio-transitional	supported
Interfaces	e1000/ virtio-net-device	support virtio-net-device
Inputs	tablet virtio/usb bus	supported
AutoattachPodInterface	connect to /net/tun (devices.kubevirt.io/tun)	supported
AutoattachGraphicsDevice	create a virtio-gpu device / vga device	support virtio-gpu

Current Status – Features Support

- The Supported Features
  - CPUManager
  - LiveMigrationGate
  - SidecarGate
  - SnapshotGate
  - VSOCKGate
  - …
- The Unsupported Features
  - Unverified
    - GPUGate
  - Dependence not support Arm64
    - HotplugNetworkIfacesGate
  - Feature not support
    - WorkloadEncryptionSEV



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Operations

- Hotplug Network Interfaces
- Hotplug Volumes
- Client Passthrough
- Snapshot Restore API
- KubeVirt Scheduler
- Hugepages support
- Component monitoring
- Authorization
- Annotations and labels
- Node assignment
- Node maintenance
- Node overcommit
- Unresponsive nodes
- Containerized Data Importer
- Activating feature gates
- Export API
- Clone API
- Virtual machine memory dump
- Mediated devices and virtual GPUs
- Migration Policies
- KSM Management
- Managing KubeVirt with GitOps
- Arm64 Operations
- Feature Gate Status on Arm64

Feature Gate Status on Arm64

This page is based on https://github.com/kubevirt/kubevirt/issues/9749 It records the feature gate status on Arm64 platform. Here is the explanation of the status:

- **Supported**: the feature gate support on Arm64 platform.
- **Not supported yet**: there are some dependencies of the feature gate not support Arm64, so this feature does not support for now. We may support the dependencies in the future.
- **Not supported**: The feature gate is not support on Arm64.
- **Not verified**: The feature has not been verified yet.

FEATURE GATE	STATUS	NOTES
ExpandDisksGate	Not supported yet	CDI is needed
CPUManager	Supported	use taskset to do CPU pinning, do not support kvm-hint-dedicated (this is only works on x86 platform)
NUMAFeatureGate	Not supported yet	Need to support Hugepage on Arm64
IgnitionGate	Supported	This feature is only used for CoreOS/RhCOS
LiveMigrationGate	Supported	Verified live migration with masquerade network

Current Status – Hybrid Cluster Support

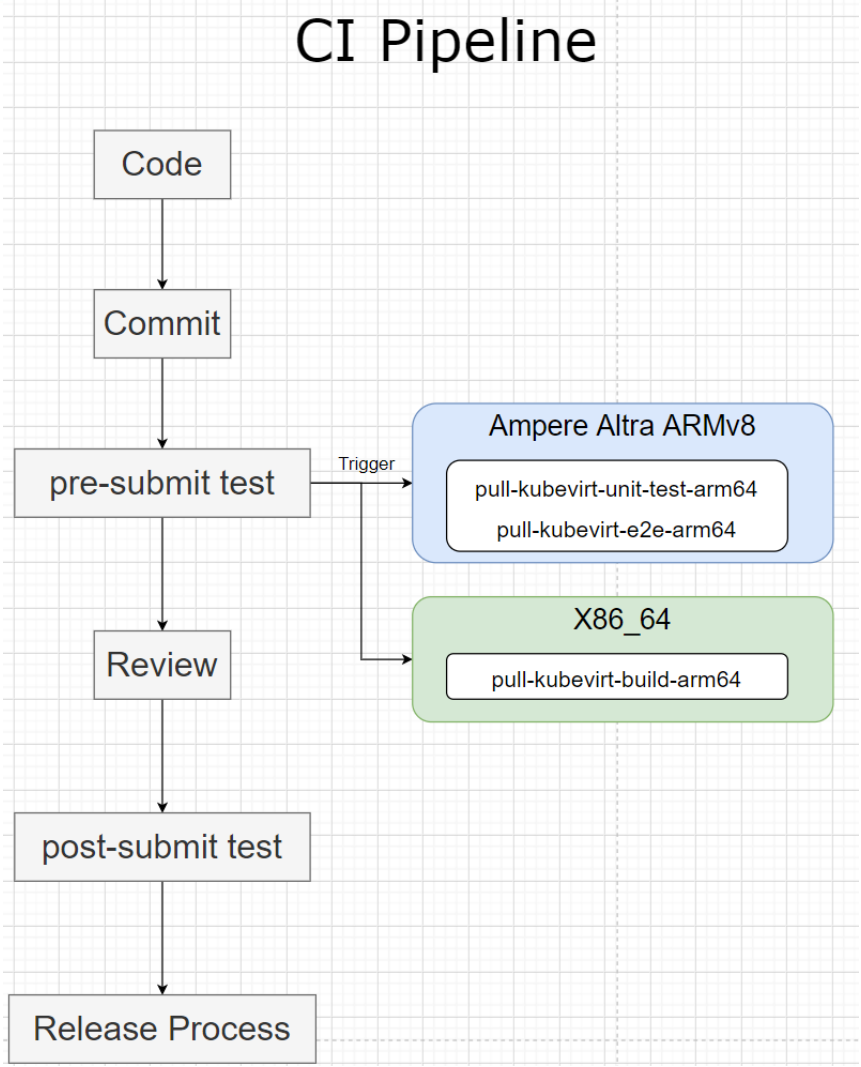
- Make it possible to manage both X86 and ARM-based workloads in one cluster.
  - Open the FeatureGate: MultiArchitecture
  - Select desired Cluster
  - Add Architecture in VMI configuration
  - E.g.

```
spec:
  nodeSelector:
    kubernetes.io/arch: arm64
  architecture: arm64
```

Current Status – CI/CD pipeline support

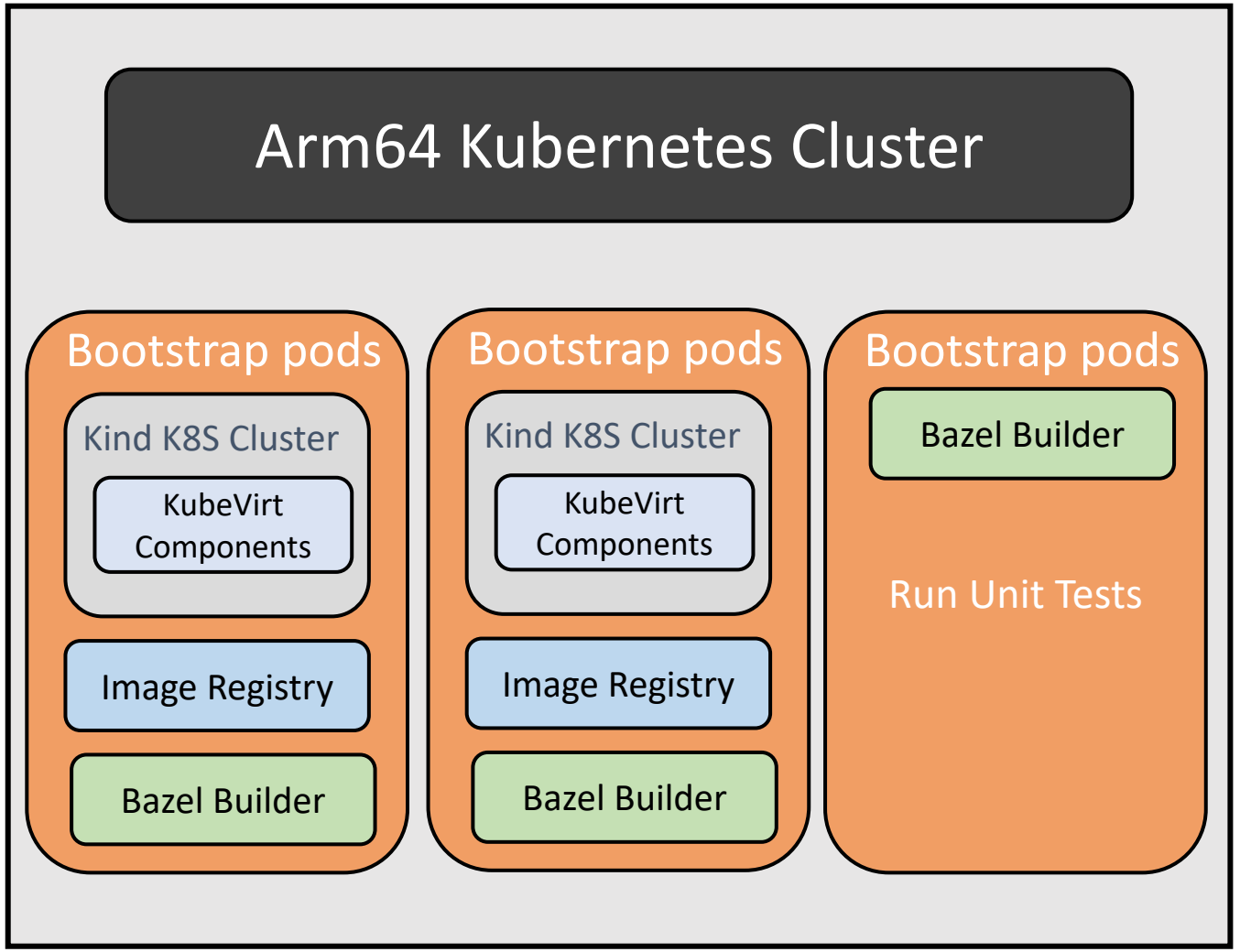
- Run test in nested containerize environment
  - Bootstrap pods
  - Kind K8S cluster
  - Image registry
  - Bazel builder

- Pros
  - Faster
    - Native build
    - Local image registry
  - Isolated K8S cluster
  - Parallel testing is possible



Development Env Setup

- Use container in container environment to setup development Env.
- Demo Video:



Future Plans

- CDI
  - A cross compile patch has merged. CI tests are needed.
- Performance Monitor
  - Use Perf to monitor the performance of VM

Booth No. S10

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