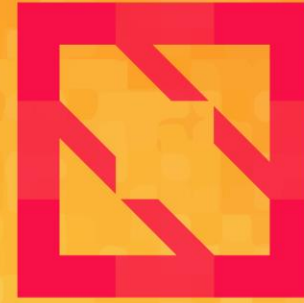




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Alkaid Compute

Cloud Lab, Futurewei Technologies



Agenda



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- Alkaid Overview
- Key Features
 - Multi Tenancy
 - Large Scalability
 - Unified VM/Container Stack

Alkaid Overview



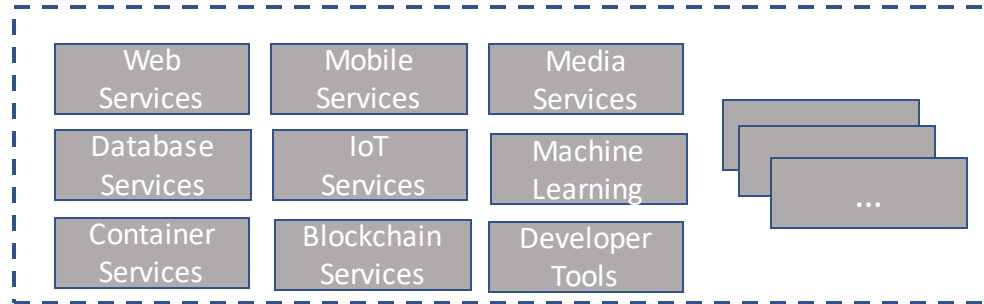
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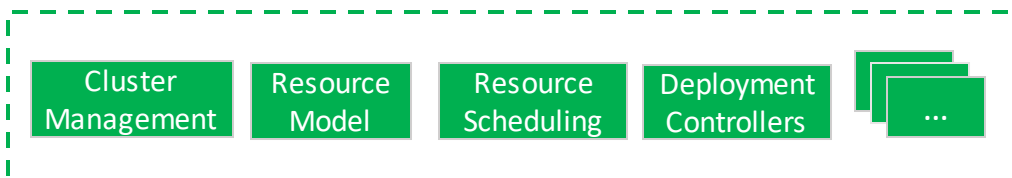
Cloud Applications & Services



Resource Requests &
Application Deployments



Alkaid



Physical Resources



Hard Multi-tenancy

Built-in hard multi-tenancy model, providing a strong isolation among tenant resources.



Cloud Scale

Designed to support 100K nodes per cluster. Partitioned and replicated storage, scheduler and controllers.



Unified Stack

One single unified stack for containers, VMs and bare metals, including API models, scheduling, runtime, etc.

Multi-Tenancy

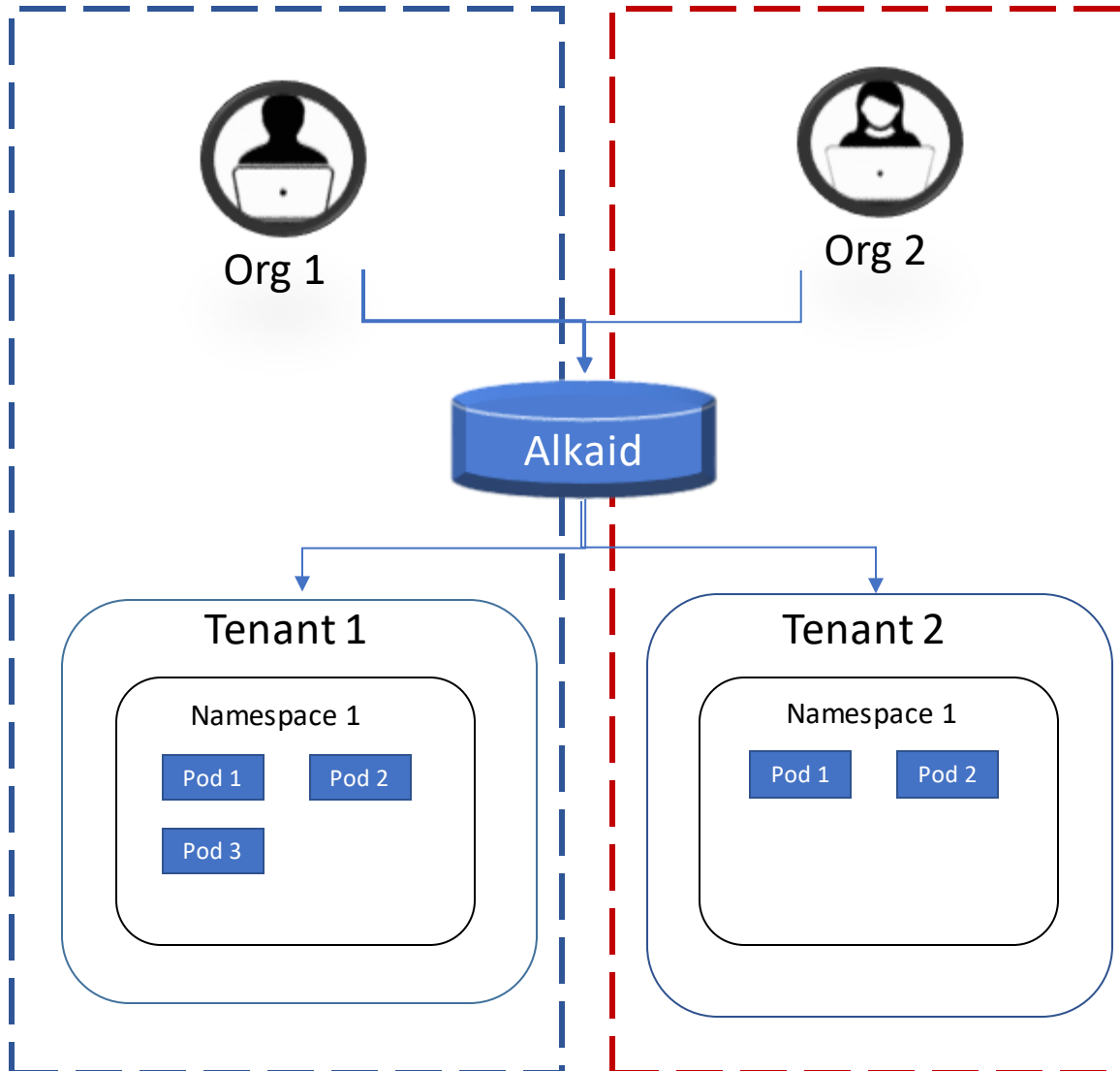


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Hard Multi-Tenancy

- Enable organizations/departments to safely share one infrastructure, without deploying/operating multiple clusters.
- Support per-tenant resource view, access control, quota, etc.
- Assume no trust among tenants; ready for strict scenarios like public cloud.

Key Changes:

- A new API object: **tenant**
- All API objects have a new field **Tenant** in its **ObjectMeta** section
- A new resource URL scheme: ***tenants/{tenant}/namespaces/{namespace}/{objectTypes}/{objectName}***
- Tenant-aware Client-Go library, scheduler, controllers, agent and CLI tools.

Demo: Multi-Tenancy



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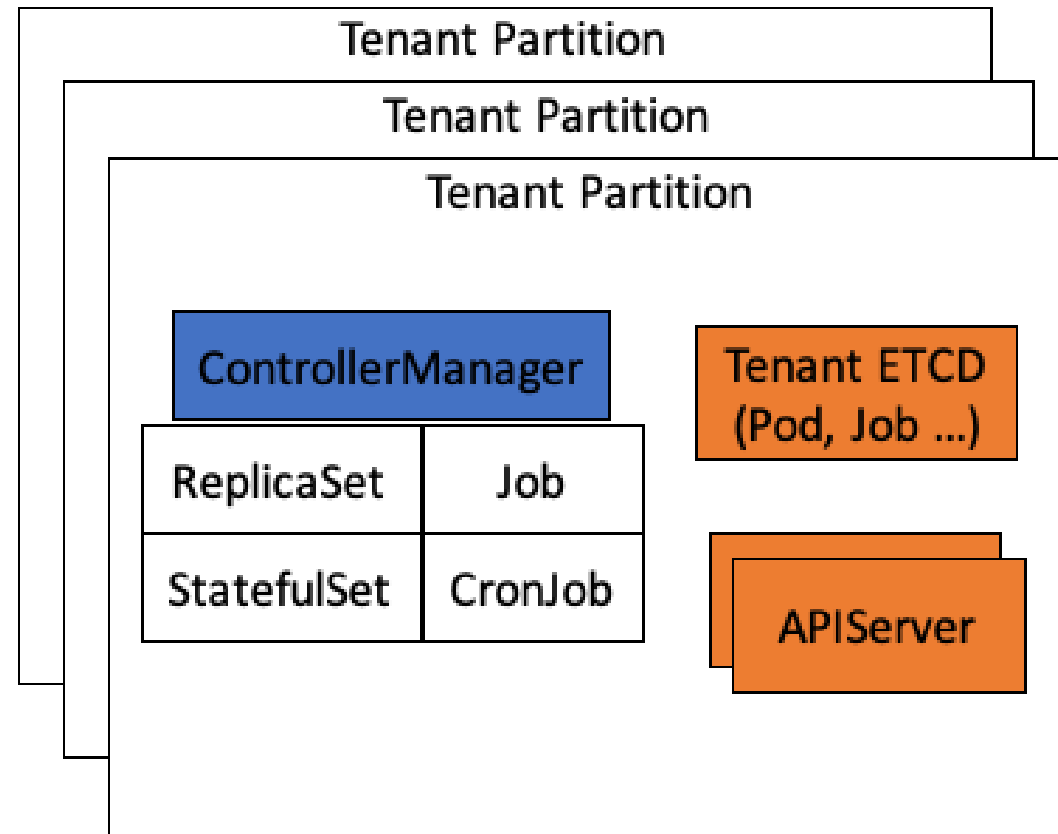
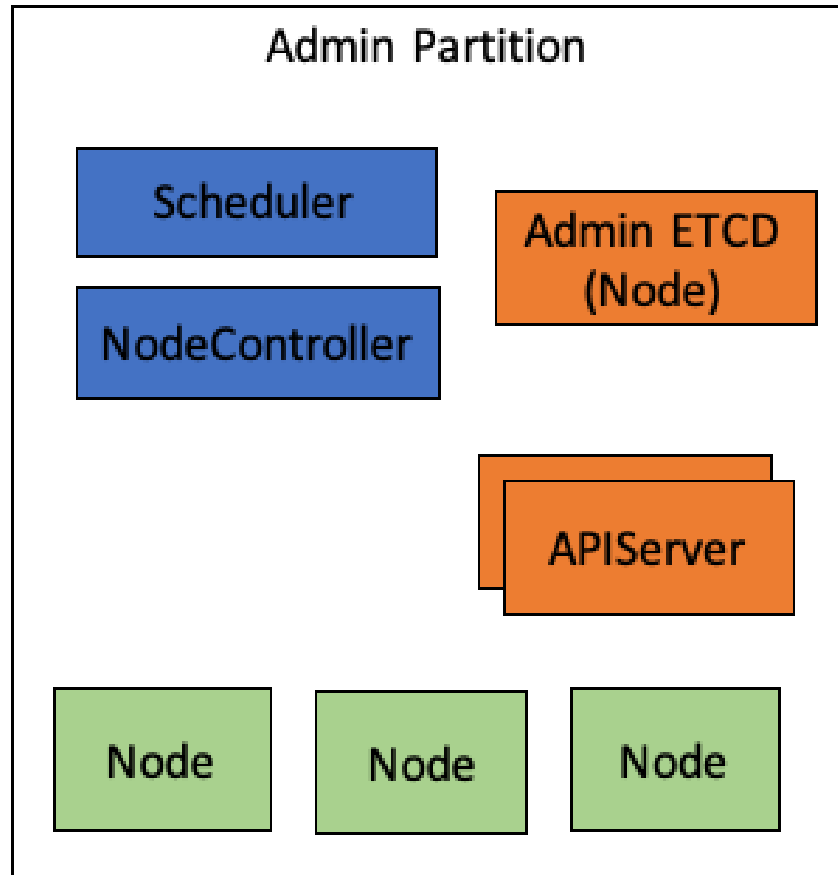


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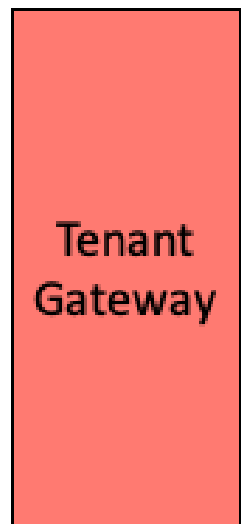
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```
Futurewei@KubeCon2019$# Here we are showing how multi-tenancy works.  
Futurewei@KubeCon2019$# First, we create two tenants.  
Futurewei@KubeCon2019$# A new type of resource, tenant, is defined, as shown in the follow yaml files.  
Futurewei@KubeCon2019$
```

Scalability Architecture Option 1



End User
(Kubectl, UI etc)



- Shard tenant data
- Scheduler has global view of all nodes in cluster

Scalability Architecture Option 2

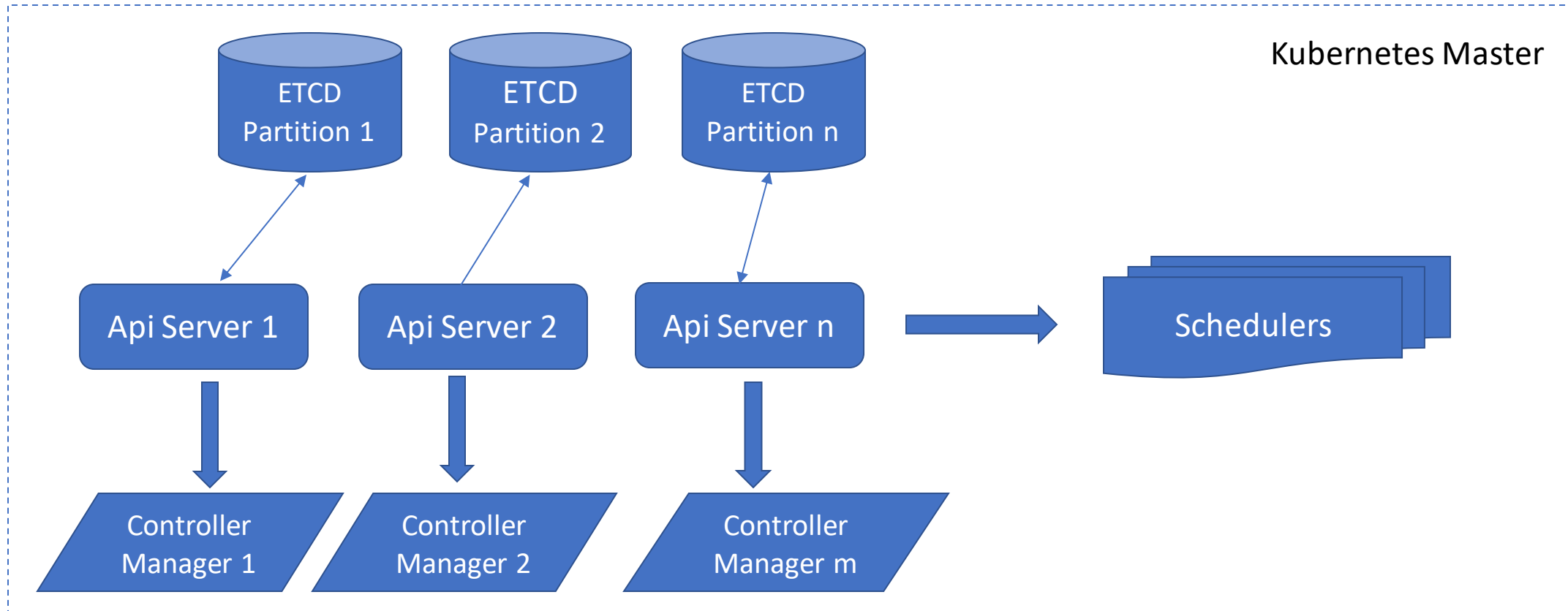


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- Allow list/watch by range of field value (demo?)
- Support multiple controller instances with the same type (demo?)
 - Add hash key to metadata
 - Split workloads by hash key and assign to a single controller instance based on hash key range

Scalability Performance Test Output



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- ReplicaSet controller (POC)
 - Latency
 - Throughput

Two Stacks in Today's Data Center

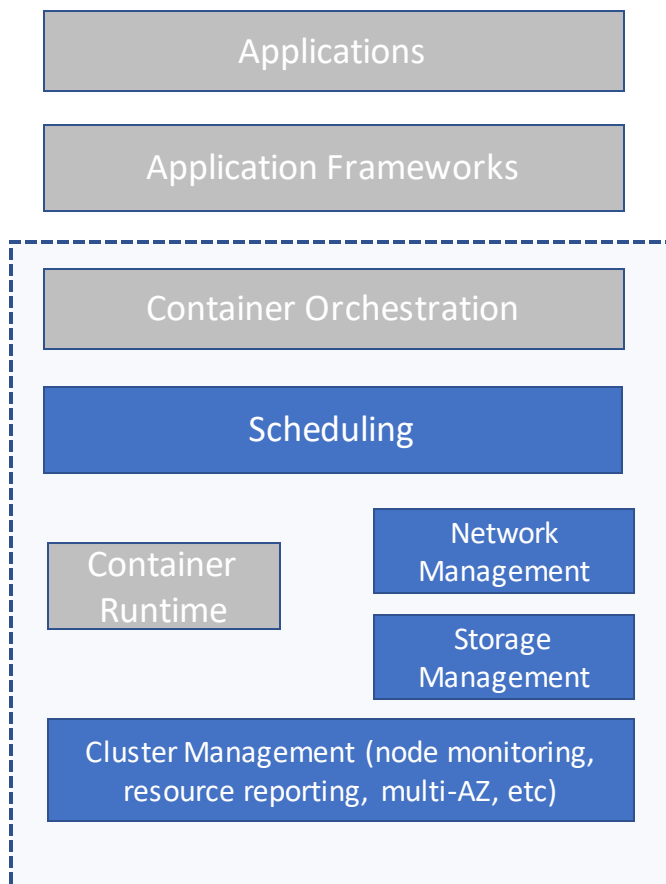


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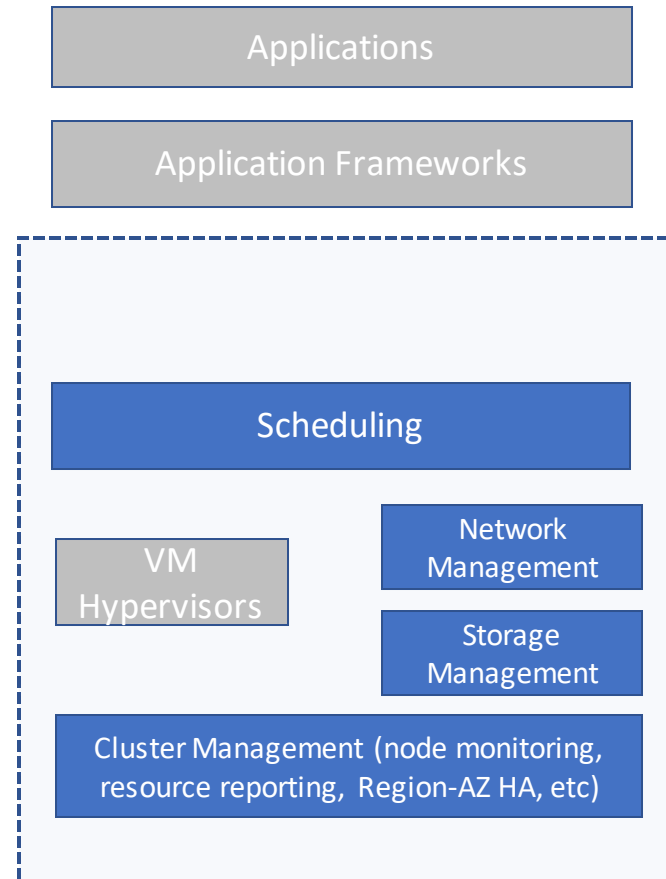


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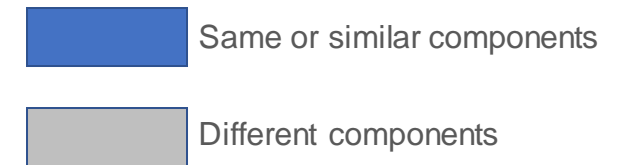
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Container stack such as Kubernetes



VM stack such as OpenStack Nova



- Having two separate stacks brings difficulty to development, operation and resource planning.
- It also hurts resource utilization by having separate resource pools.

One Converged Stack with Alkaid

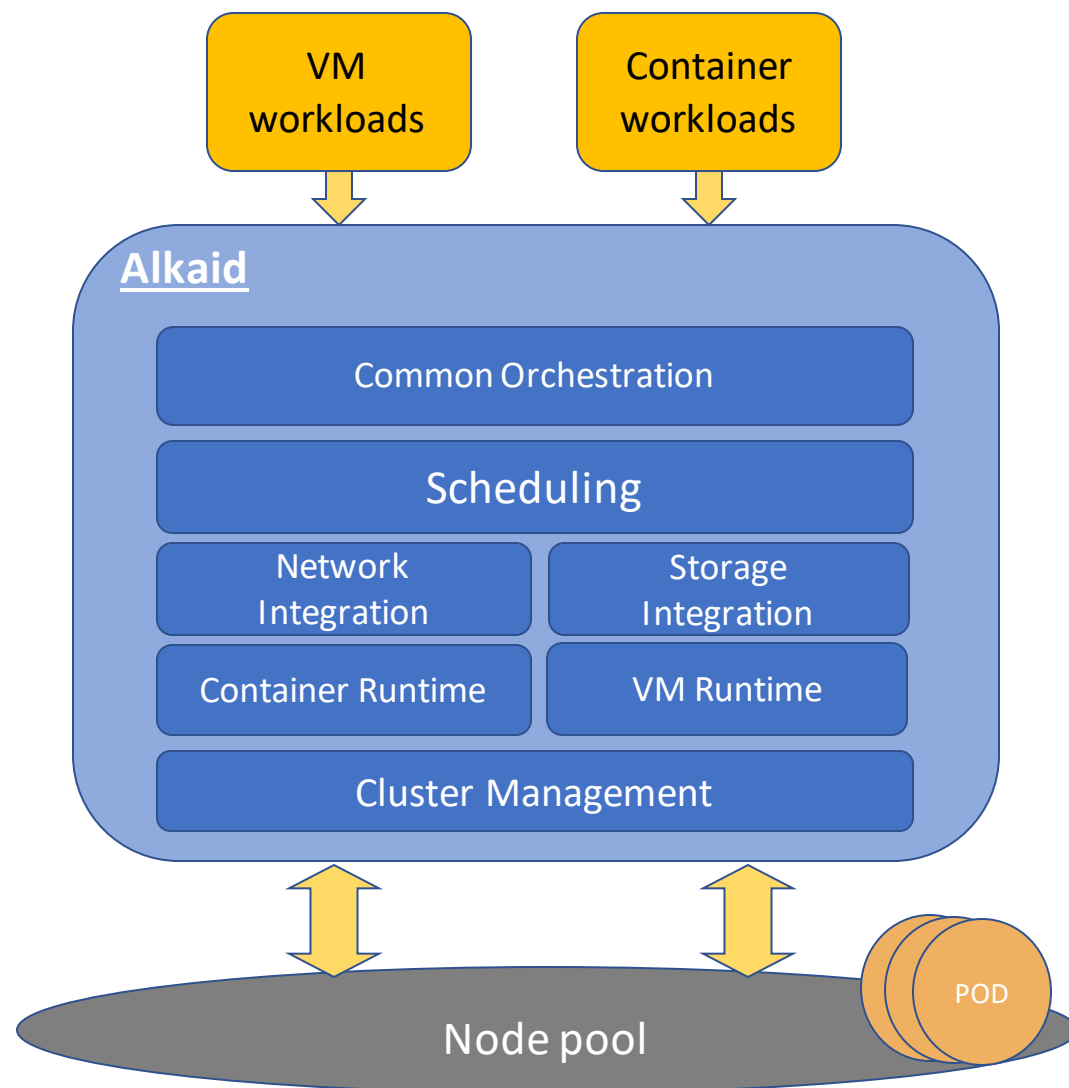


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Different Options to Support VM in K8S

Addon-based Approach	Native Approach
VM defined as CRD	Single API object hierarchy
Additional controllers and agents	No additional components
Additional tools	Single tool chain
No changes to Kubernetes	Fundamental changes inside K8s
Other offerings	Alkaid

Native VM Support in Alkaid



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```
apiVersion: v1
kind: Pod
metadata:
  name: vm1
spec:
  virtualMachine:
    name: vm
    image: download.cirros-cloud.net/0.3.5/cirros-0.3.5-x86_64-disk.img
    resources:
      requests:
        cpu: "1"
        memory: "1Gi"
```

```
apiVersion: v1
kind: Pod
metadata:
  name: container1
spec:
  containers:
    - name: container1
      image: ubuntu
      command: ["/bin/bash", "-ec", "while ;; do echo '.'; sleep 5 ; done"]
      resources:
        requests:
          cpu: "1"
          memory: "1Gi"
```

APIs

- A pod contains one VM, or one or more containers
- Action object to support VM life-cycle

Scheduler

- Unified scheduling by a common representation of VM and container resources

Controllers

- Reuse existing controllers like job controllers, RS controllers, etc

Agent

- Handle the VM object in sync loop
- Support multiple CRI endpoints for containers and VMs
- Extend CRI to add methods for VM
- A VM CRI runtime server

VM Pod: Built-in Multi Runtime

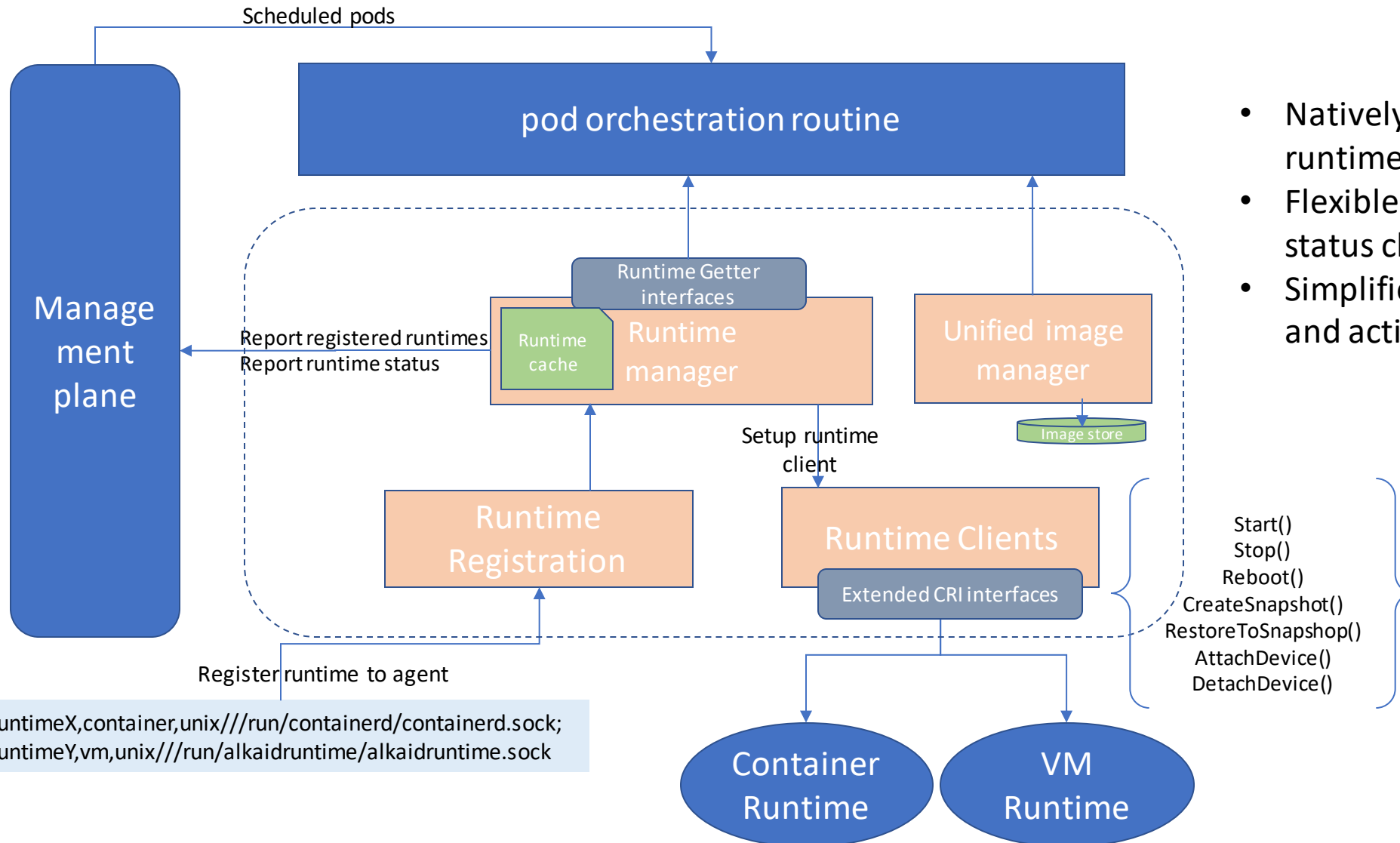


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- Natively supports VM and container runtime services
- Flexible runtime registration and status check/reports
- Simplified workload orchestration and actions flows

VM Pod: State Management

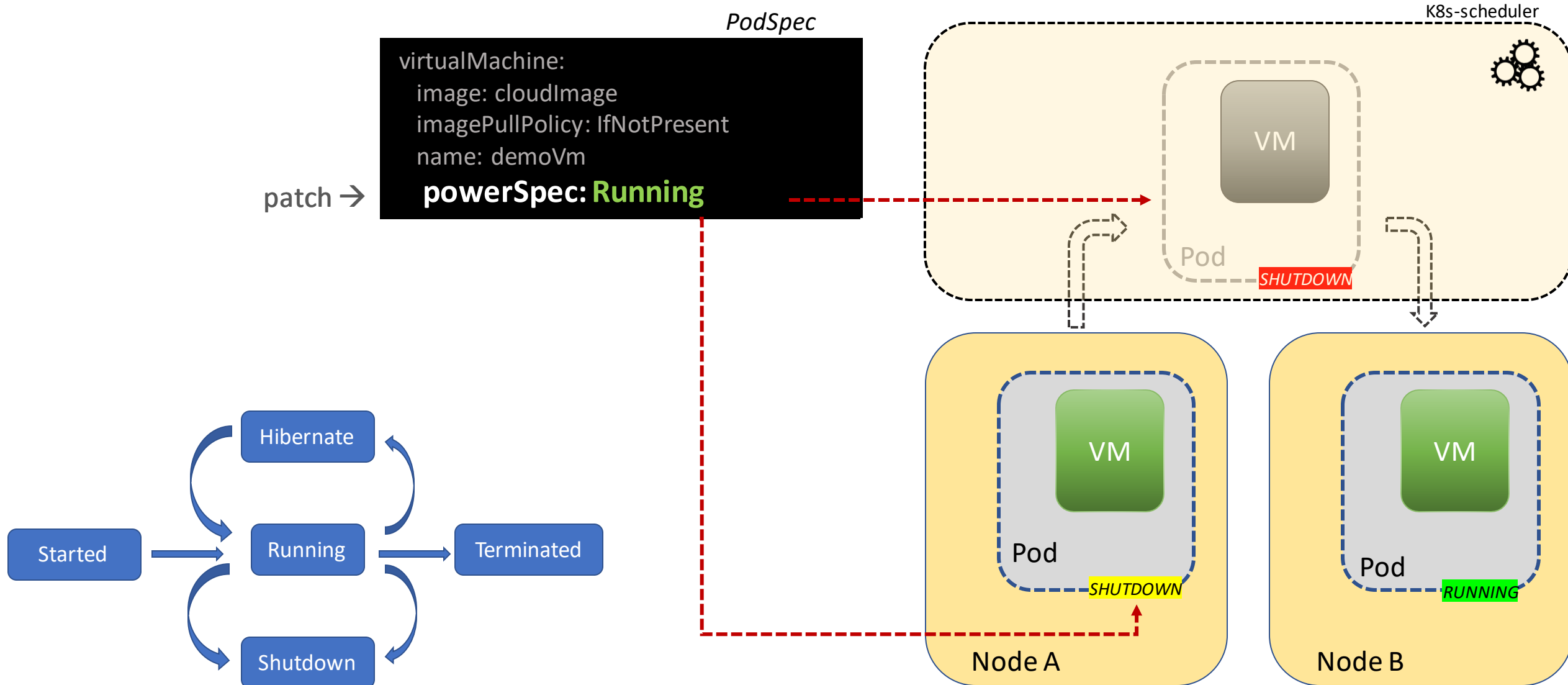


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Demo: Start and Stop VM

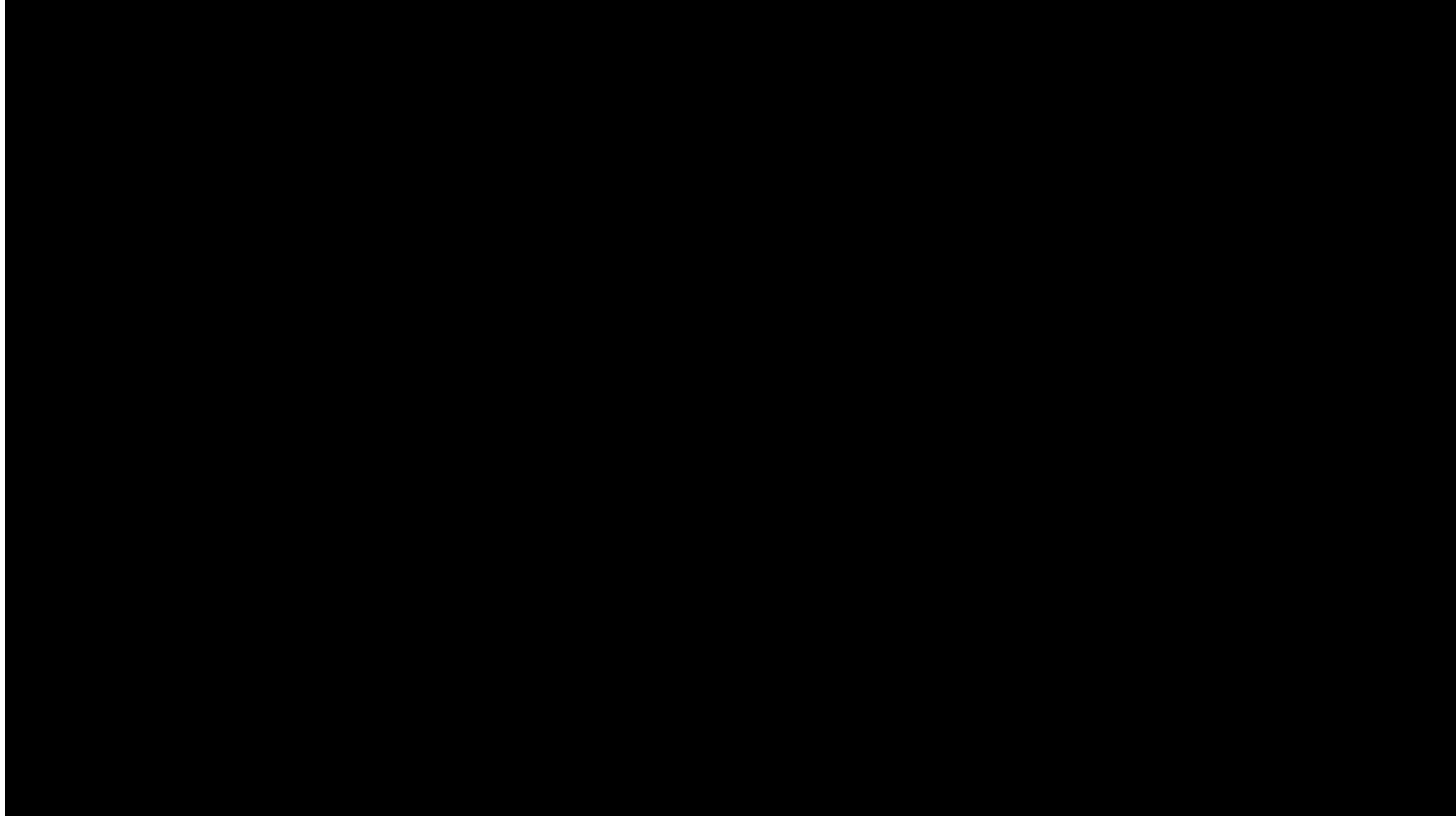


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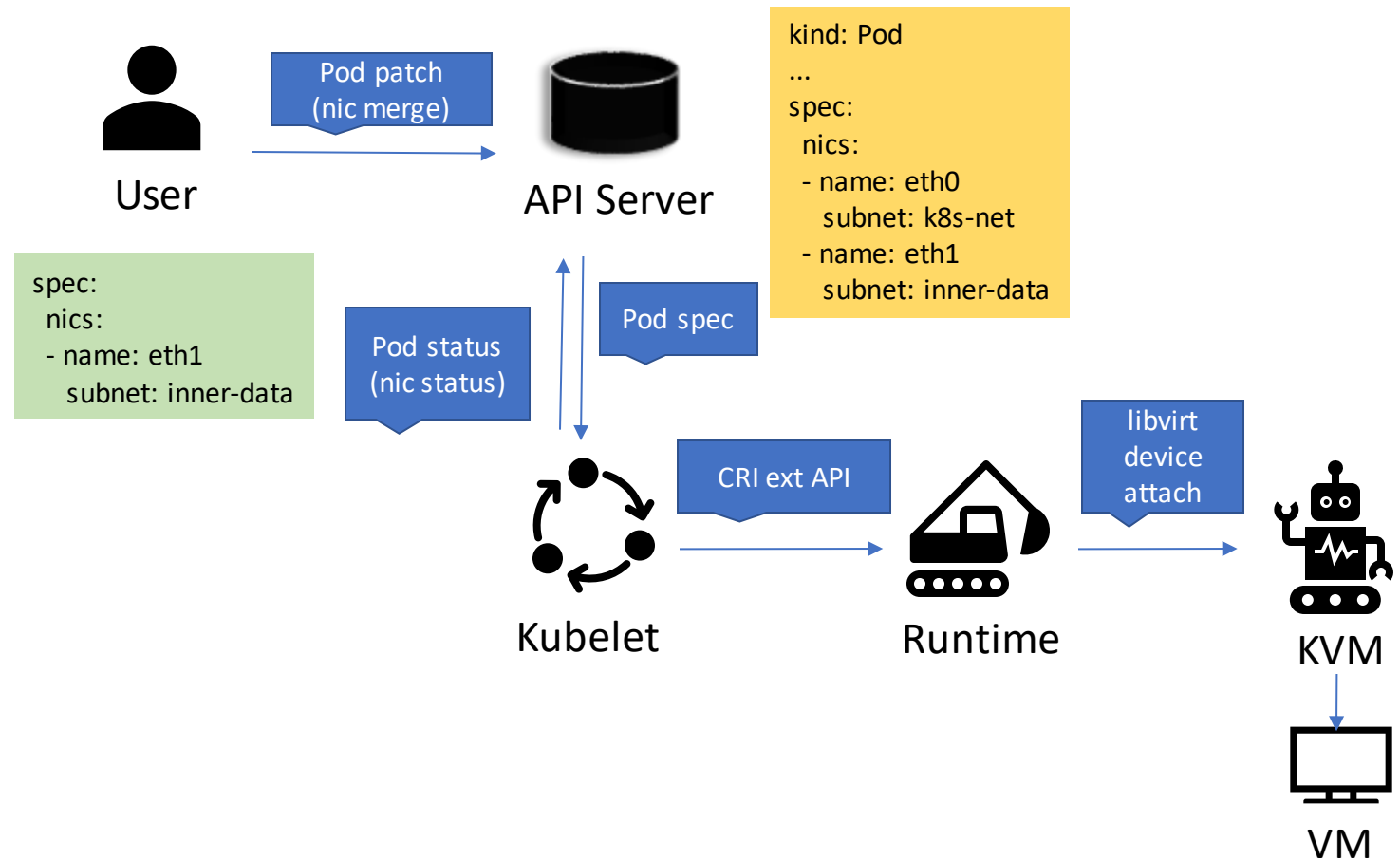


VM Pod: Configuration Management



- user changes the desired VM resources in pod spec;
- system reconciles to ensure actual resources eventually in line with the desired;
- system reports the actual resources as part of pod status.

Example: NIC Hot Plug Message Flow



VM resources	Op to support
CPU number	Update
memory	Update
network interface	Hot plug
disk storage	Hot plug

VM Pod Configuration Management



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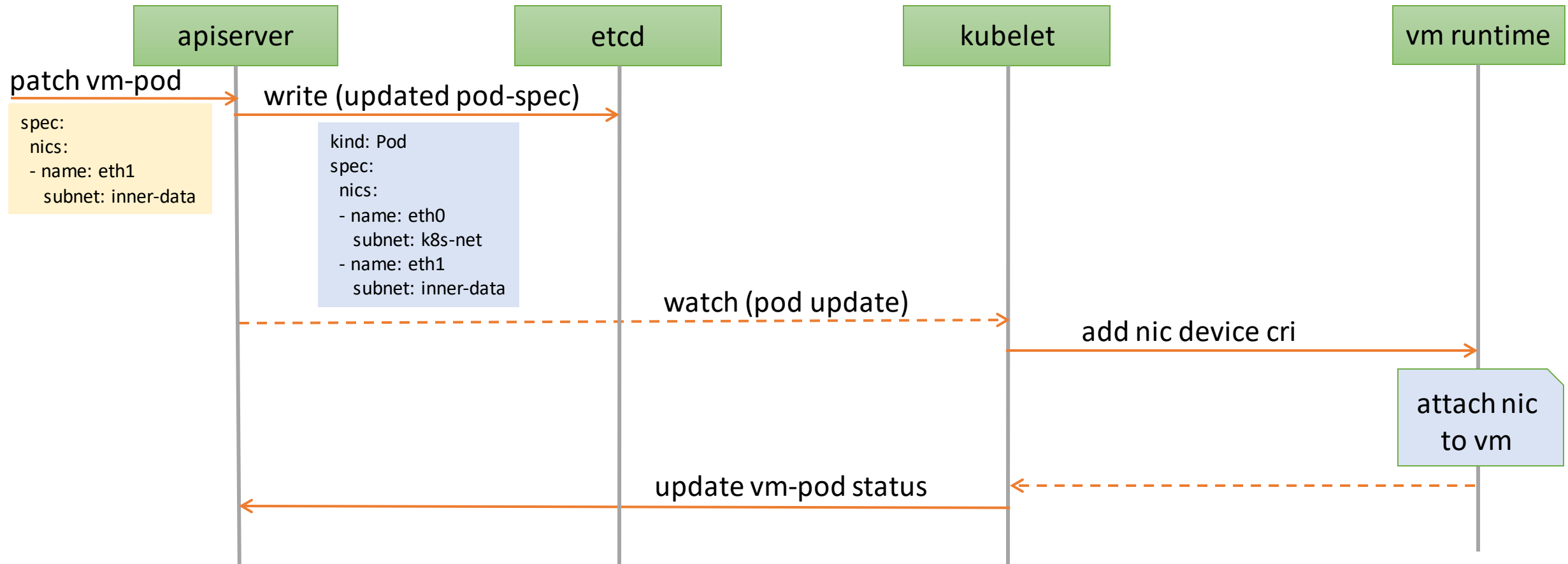


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- K8s user changes the desired VM resources by PATCHing Pod Spec of a running VM Pod
- System reconciles to ensure actual resources eventually match desired resources
- Supports updating VM CPU/memory resources, and NIC/storage hot-plug

Example: NIC Hot Plug Workflow



VM Pod: Action Framework



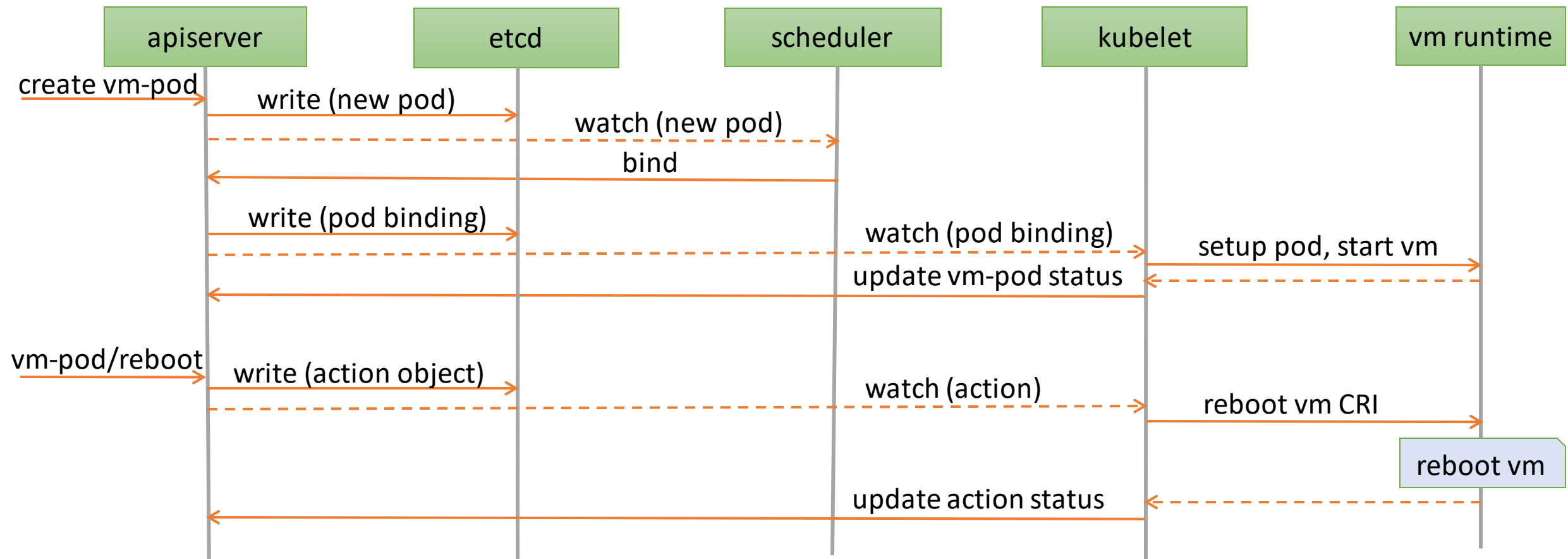
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- Allows user to perform operations on VM Pod
 - Examples: Reboot a VM, Take a VM snapshot, ...
- User specifies desired Action by POSTing to pods/action subresource
- Agent responsible for Action watches for actions, implements it, and updates status



Demo: Snapshot and Restore a VM



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```
root@fw0000360:~/KCNA_Demo#  
root@fw0000360:~/KCNA_Demo#
```




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The End