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#KubeCon #CloudNativeCon

Improving Pod Disruption and Node Lifecycle

Lucy Sweet, Uber

Filip Krepinsky, Red Hat

Ryan Hallisey, NVIDIA



Node Lifecycle Working Group

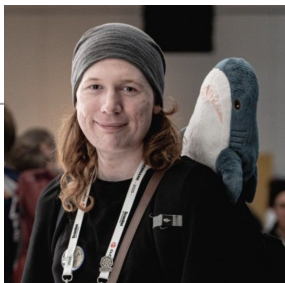


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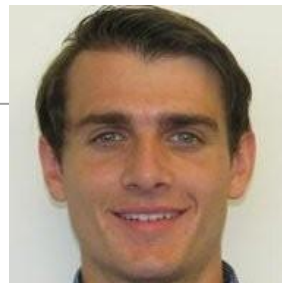
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Uber



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NVIDIA

Node Lifecycle Working Group

Core Mission

Providing holistic solutions for existing gaps in the lifecycles of disrupted Pods and Nodes.

Key Objectives:

- Node drain & maintenance
- Graceful node shutdown
- Pod eviction primitives
- Cloud provider integration

Key Initiatives

EvictionRequest API

A standardized interface for pod eviction with better observability.

Declarative Maintenance

Moving from imperative kubectl drain to declarative state management.

SLM & Readiness

Specialized Lifecycle & Readiness controllers.

Ecosystem

Collaborating across SIGs to ensure a unified node lifecycle experience.

Stakeholder SIGs:

Node

Apps

Scheduling

Autoscaling

Storage

Cloud Provider

Network

CLI

Cluster Lifecycle

Projects

- Eviction Request
- Specialized Lifecycle Management
- Graceful Node Shutdown

Termination Mechanisms



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- Node-pressure Eviction
- Kubelet Critical Pod Preemption
- Graceful Node Shutdown
- API-initiated Eviction
- Pod Preemption
- Taints and Tolerations
- Device Taints and Tolerations
- Garbage Collection
- Expected Pod Deletion or Eviction by application controller, autoscaler, descheduler etc.
- Pod Deletion by the User

State of API-Initiated Eviction



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- Imperative Eviction API

```
kubectl create -f - <<EOF --raw /api/v1/namespaces/default/pods/nginx/eviction
{"apiVersion": "policy/v1", "kind": "Eviction", "metadata": {"name": "nginx"}}
EOF
```

```
apiVersion: policy/v1
kind: PodDisruptionBudget
metadata:
  name: nginx
spec:
  minAvailable: 2
  selector:
    matchLabels:
      app: nginx
```

EvictionRequest API



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```
apiVersion: v1
kind: Pod
metadata:
  name: postgres
  labels:
    app: postgres
spec:
  evictionResponders:
    - name: kubecon.amsterdam.eu/migrator
  containers:
    - name: postgres
      image: postgres
```

```
apiVersion: coordination.k8s.io/v1alpha1
kind: EvictionRequest
metadata:
  name: 30576103-1097-46a9-be3a-4d5f01d8445f
spec:
  target:
    pod:
      uid: 30576103-1097-46a9-be3a-4d5f01d8445f
      name: nginx
  requesters:
    - name: "kubecon.amsterdam.eu/drainer"
      intent: Eviction
    - name: "kubecon.amsterdam.eu/rescheduler"
      intent: Eviction
```

EvictionRequest API

\$./demo

```
apiVersion: coordination.k8s.io/v1alpha1
kind: EvictionRequest
metadata:
  name: 30576103-1097-46a9-be3a-4d5f01d8445f
spec:
status:
  conditions:
  - lastTransitionTime: "2026-03-25T11:14:45Z"
    message: ""
    reason: Succeeded
    status: "False"
    type: Failed
  - lastTransitionTime: "2026-03-25T11:15:17Z"
    message: Pod has reached terminal state
    reason: PodTerminal
    status: "True"
    type: Evicted
  observedGeneration: 1
  responders:|
  - completionTime: "2026-03-25T11:15:16Z"
    expectedCompletionTime: "2026-03-25T11:15:16Z"
    heartbeatTime: "2026-03-25T11:15:16Z"
    message: 'migrating'
    name: kubecon.amsterdam.eu/replicaset-migrator
    startTime: "2026-03-25T11:14:45Z"
  - name: imperative-eviction.k8s.io/evictor
  targetResponders:
  - name: kubecon.amsterdam.eu/replicaset-migrator
    state: Completed
  - name: imperative-eviction.k8s.io/evictor
    state: Inactive
```

EvictionRequest Ideas / RoadMap



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- New target types (PodGroup, Workload)
- Configurable Heartbeat Deadline
- Cancellation Policy
- Unification of Termination Mechanisms (long term goal)
- Eviction Types
- Preemption support
- Kubelet soft eviction support
- Integration and adoption in the Ecosystem (Workload controllers, drain, termination intent)
- Dynamic Responders

Lifecycle Management



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- Improve Lifecycle Management of the Node
 - Node Maintenance
 - Graceful Node Shutdown
- Declarative Node Maintenance [#4212](#)
- Kubectl cordon & kubectl drain
- Lots of tools
 - No standardized way to implement a solution

Ecosystem is Fragmented



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- aws-node-termination-handler
- karpenter
- cluster-autoscaler
- kured
- draino
- node-maintenance-operator
- maintenance-operator
- kubevirt
- Nvidia/pika
- strimzi/drain-cleaner
- pod-graceful-drain
- kubespray
- cluster-api
- And More ...

The Approach



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1. Observability
2. Meaningful States
 - a. e.g. Draining
3. Ecosystem Adoption

Specialized Lifecycle Management

- Create a standardized, declarative API for coordinating lifecycle management
 - <https://github.com/kubernetes/enhancements/pull/5769>



Kubelet Amnesia



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- <https://github.com/kubernetes/kubernetes/issues/122674>
- Kubelet “forgets” it is doing Graceful Node Shutdown



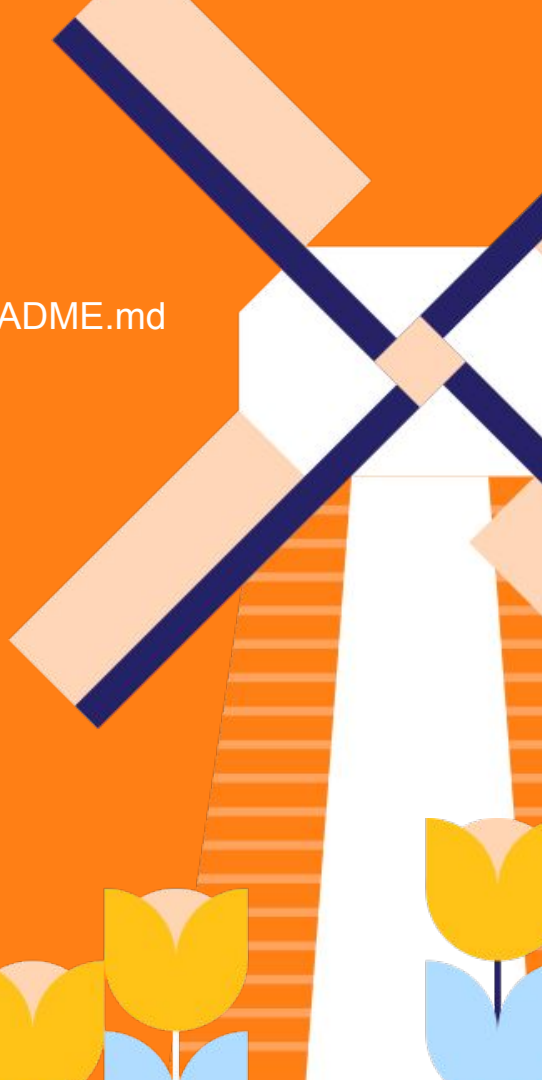
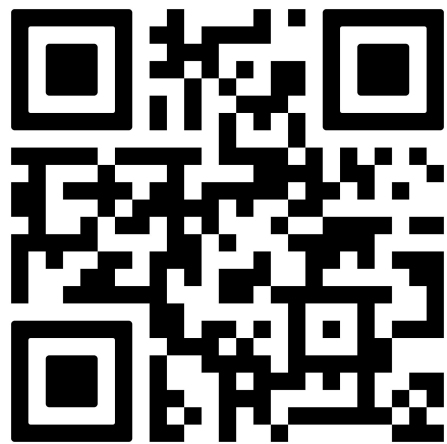
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- [Kubernetes Community Page](#)
- <https://github.com/kubernetes/community/blob/main/wg-node-lifecycle/README.md>
- Slack [#wg-node-lifecycle](#)
- (Join the Kubernetes slack for access)
- WG Node Lifecycle Weekly Meeting:
 - Mondays at 8:00 PT





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Thank you!

Questions?

