



# Kubernetes 1.31 Feature Guide

## Overview

Kubernetes 1.31 delivers notable enhancements across networking, storage and security. AppArmor profiles are now stable, offering a native way to confine container capabilities <sup>1</sup>. Ingress connectivity is improved through kube-proxy changes that reduce downtime and traffic drops during topology changes <sup>1</sup>. Persistent volume claims can now report transition times, making storage lifecycle management observable <sup>2</sup>. Beta features introduce a new **NFTables backend** and support multiple service CIDRs, while alpha features expand dynamic resource allocation and device health reporting.

## Key Enhancements and How to Use Them

### 1. AppArmor Support (GA)

AppArmor allows defining security profiles that limit system calls and capabilities for containers. To enable it:

```
apiVersion: v1
kind: Pod
metadata:
  name: secure-app
  annotations:
    container.apparmor.security.beta.kubernetes.io/secure-container:
      localhost/docker-default
spec:
  containers:
    - name: secure-container
      image: myimage
```

- **Benefits:** Hardens workloads by restricting kernel operations. - **Pitfalls:** Profiles must be present on each node; mismatch leads to the runtime falling back to unconfined profile.

### 2. Improved Ingress Connectivity

Kube-proxy enhancements reduce downtime during upgrades and topology changes. No configuration change is required; ensure your nodes run Kubernetes 1.31 and verify that `Conntrack` timeouts and `iptables` timeouts are tuned appropriately.

### 3. Persistent Volume Transition Time

Kubernetes now records timestamps when a persistent volume claim (PVC) transitions between phases. Use `kubectl describe pvc` to view these events. This helps diagnose slow binding or provisioning issues.

## 4. Multiple Service CIDRs (Beta)

Define multiple `serviceCIDR` ranges in `kube-proxy` configuration to expand service IP space without downtime <sup>3</sup>:

```
apiVersion: kubeproxy.config.k8s.io/v1beta1
kind: KubeProxyConfiguration
mode: "iptables"
serviceCIDR:
  - "10.96.0.0/16"
  - "10.97.0.0/16"
```

- **Benefits:** Allows dynamic scaling of service IPs and integration with Gateway API. - **Pitfalls:** Only available in beta; must enable the `ServiceIPStaticSubnets` feature gate.

## 5. NFTables Backend (Beta)

A new networking backend based on NFTables offers potentially faster rule processing and easier management. To enable: 1. Set `mode: nft` in the `KubeProxyConfiguration`. 2. Enable the feature gate: `KubeProxyIPTablesCleanup`. - **Caveats:** As a beta feature, it may not be suited for production clusters.

## 6. Deprecations

- **cgroup v1:** Now in maintenance mode; plan to migrate to cgroup v2.
- **CephFS volume plugin:** Removed. Use the CSI driver instead.

## Migration Tips

- Review cluster configuration for deprecated features and enable feature gates for beta/alpha capabilities.
- Test AppArmor profiles in staging before applying to production.
- Monitor PVC transition times to identify storage bottlenecks.

## Success Metrics

- Reduced downtime during upgrades.
- Improved security posture through AppArmor enforcement.
- Better capacity planning using multiple service CIDRs.

## Sources

- Sysdig overview of Kubernetes 1.31 features <sup>1</sup> <sup>2</sup>.
- Additional details on multiple service CIDR allocator <sup>3</sup>.

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<sup>1</sup> <sup>2</sup> Kubernetes 1.31 Release: Key Features, Enhancements, and Deprecations  
<https://cloudfleet.ai/blog/cloud-native-how-to/2024-08-kubernetes-1-31-release/>

- 3 Kubernetes 1.31 – What's new? | Sysdig  
<https://www.sysdig.com/blog/whats-new-kubernetes-1-31>