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Beyond the Cluster: Harnessing the Power of Kubernetes Namespaces

Victor Varza & Adrian Aneci, Adobe Inc

Co-author - adobe/k8s-shredder, adobe/cluster-registry

Kubernetes Org Member

@email: aneci@adobe.com

@github: adriananeci

@linkedin: adrian-aneci

Co-author - adobe/k8s-shredder, adobe/cluster-registry

Organizer of KCD Romania, 25th of April 2024

@email: vvarza@adobe.com

@github: victorvarza

@linkedin: victorvarza

Agenda

Project Ethos

Kubernetes Namespaces

Capacity Management

Governance Policies

Multi-tenancy at Scale

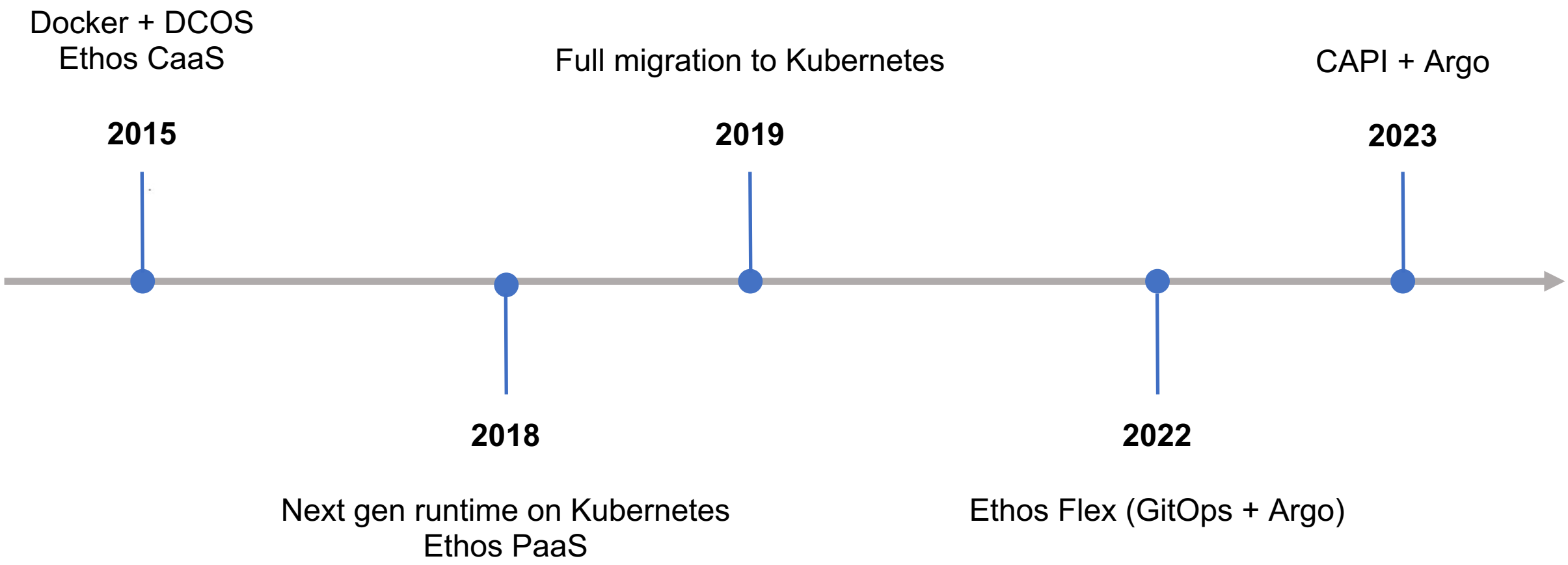
Non-disruptive Kubernetes Upgrades + Live Demo

Project Ethos

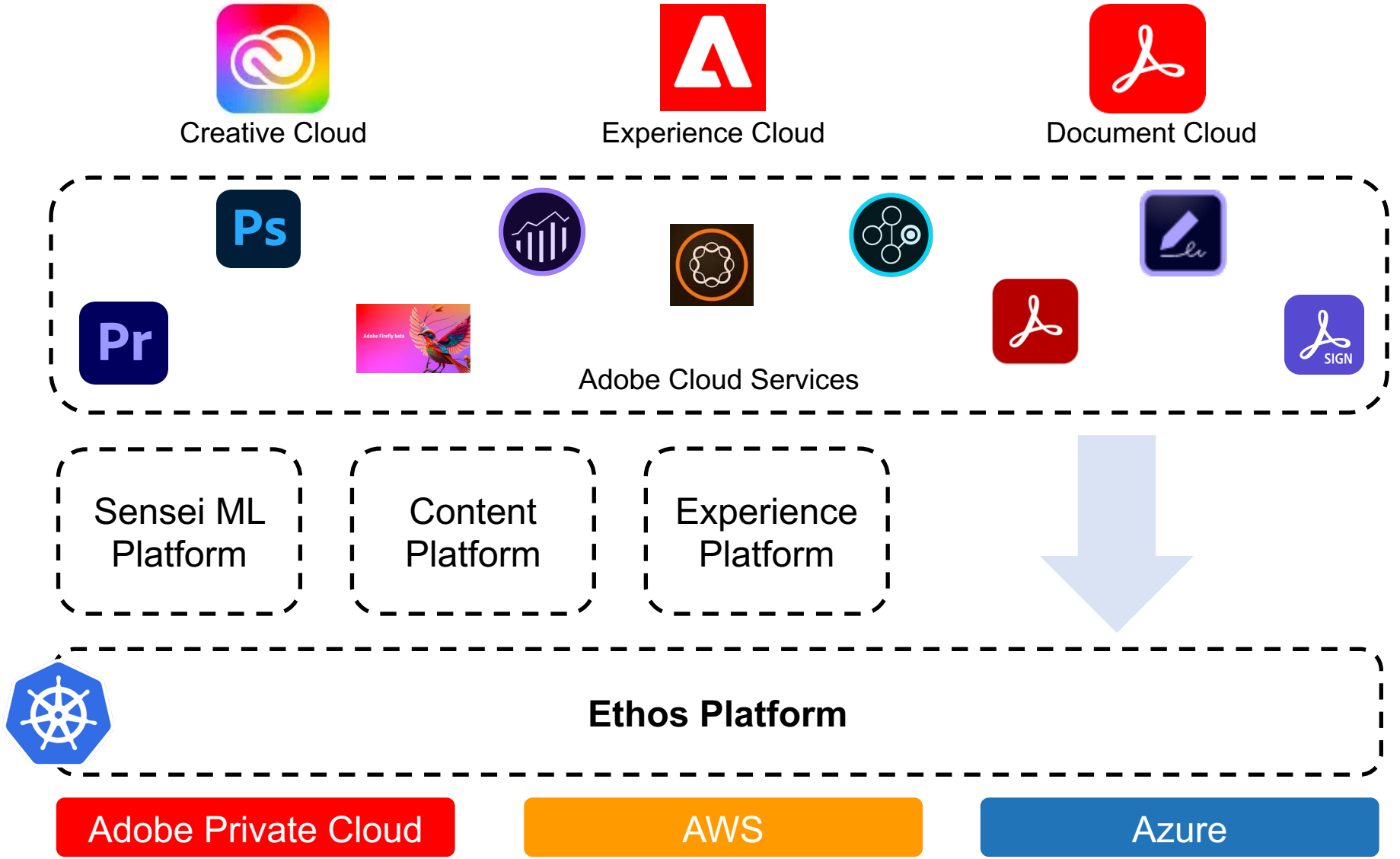
"It doesn't matter how good your engineering team is if they are not given something worthwhile to build."

Marty Cagan - INSPIRED

Project Ethos



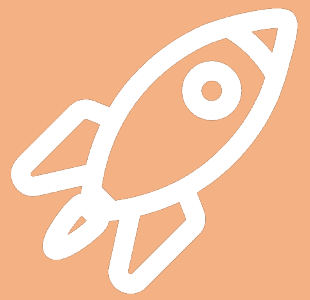
Ethos from 10k ft



Ethos in numbers

2.2 million containers

1.0 million pods



41k namespaces

330

K8s Clusters

AWS

Azure

APC

28 regions

> 35k compute nodes

2.9PB Memory

830k vCPUs

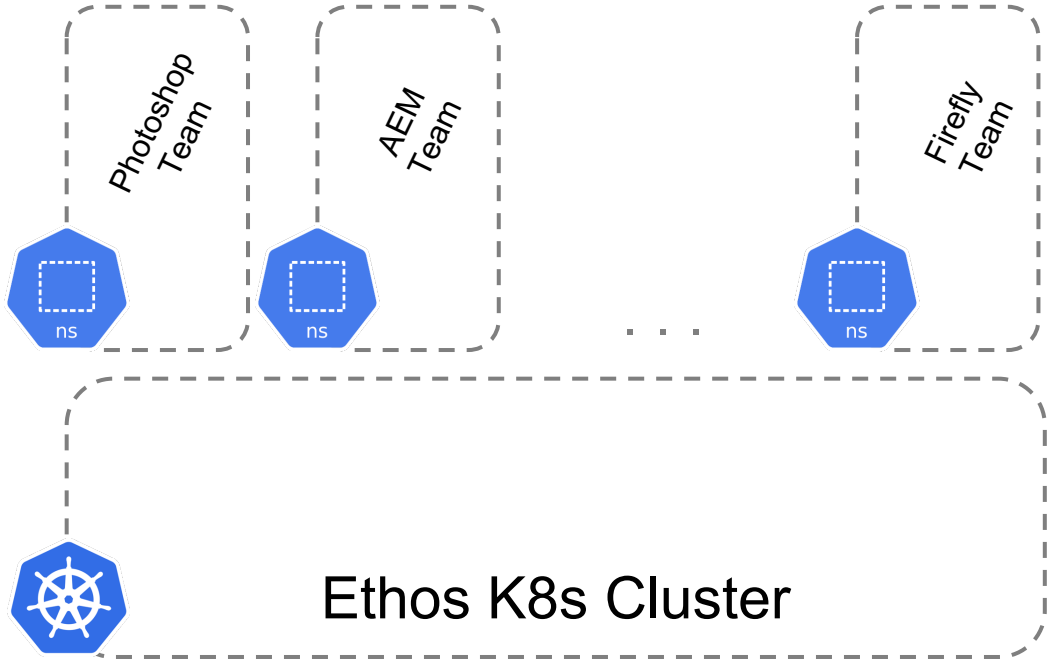
7.8k GPUs

Multi-tenancy @Adobe

Multi-tenancy = multiple different teams share multiple k8s clusters

> Shared Clusters

> Dedicated Clusters



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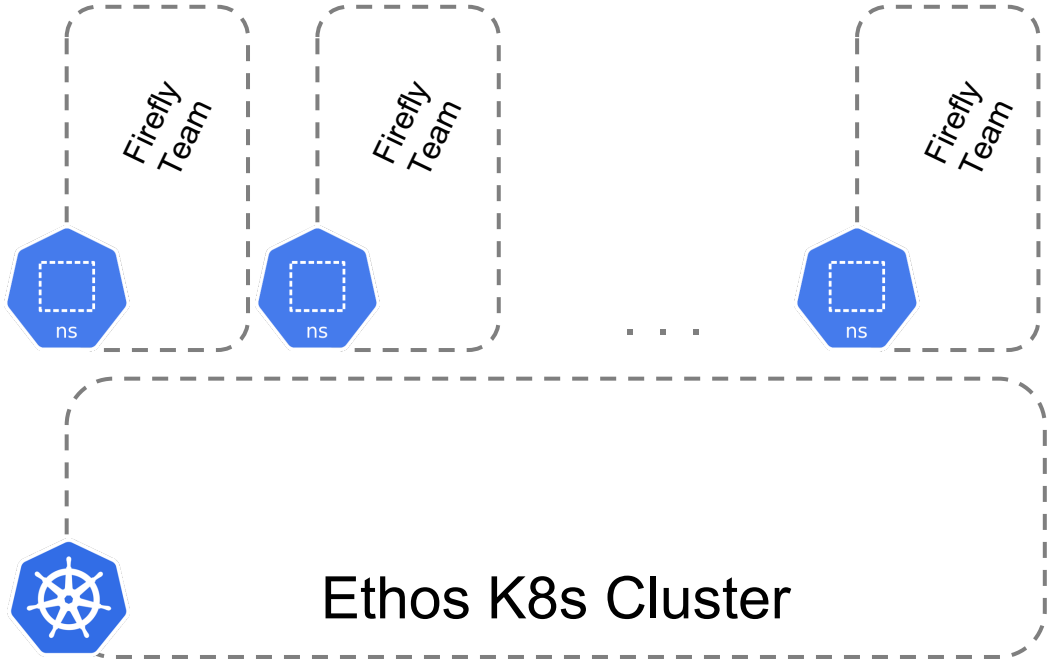
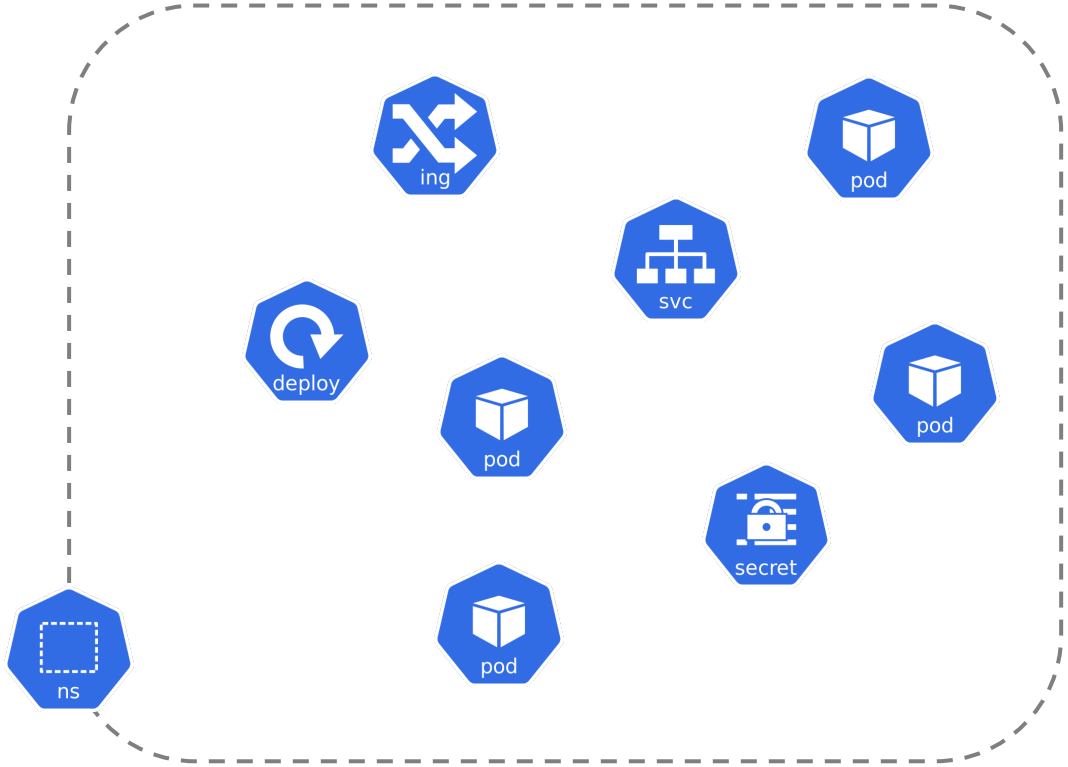


Kubernetes Namespaces

Developers ❤ namespaces
Unique namespace across the fleet
Compile a ns profile template



Namespace profile

Namespace
Rolebinding
Quota
LimitRange
Network Policies
Cilium Network Policies

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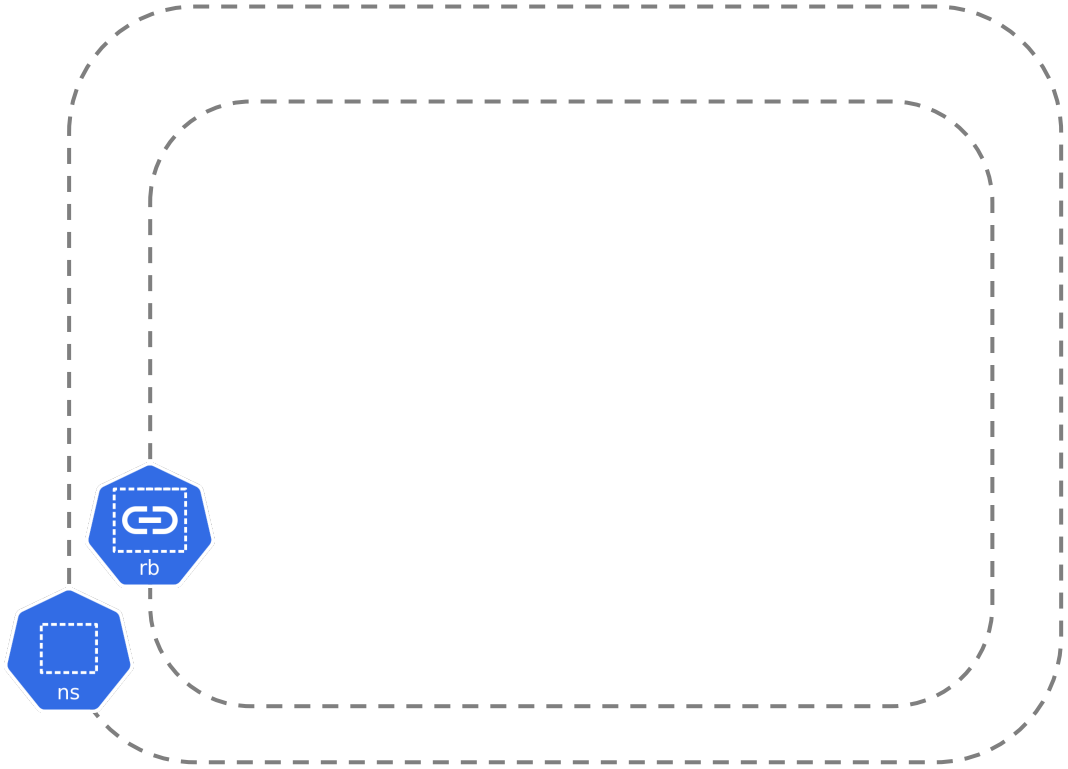

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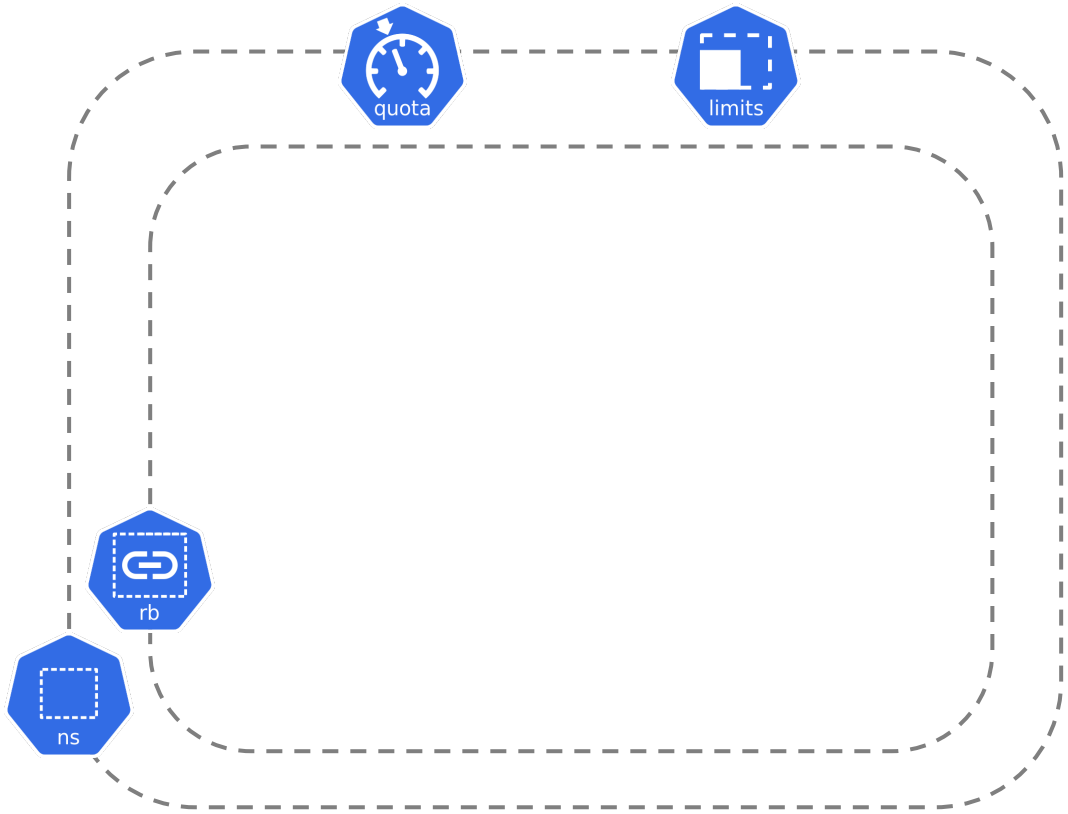

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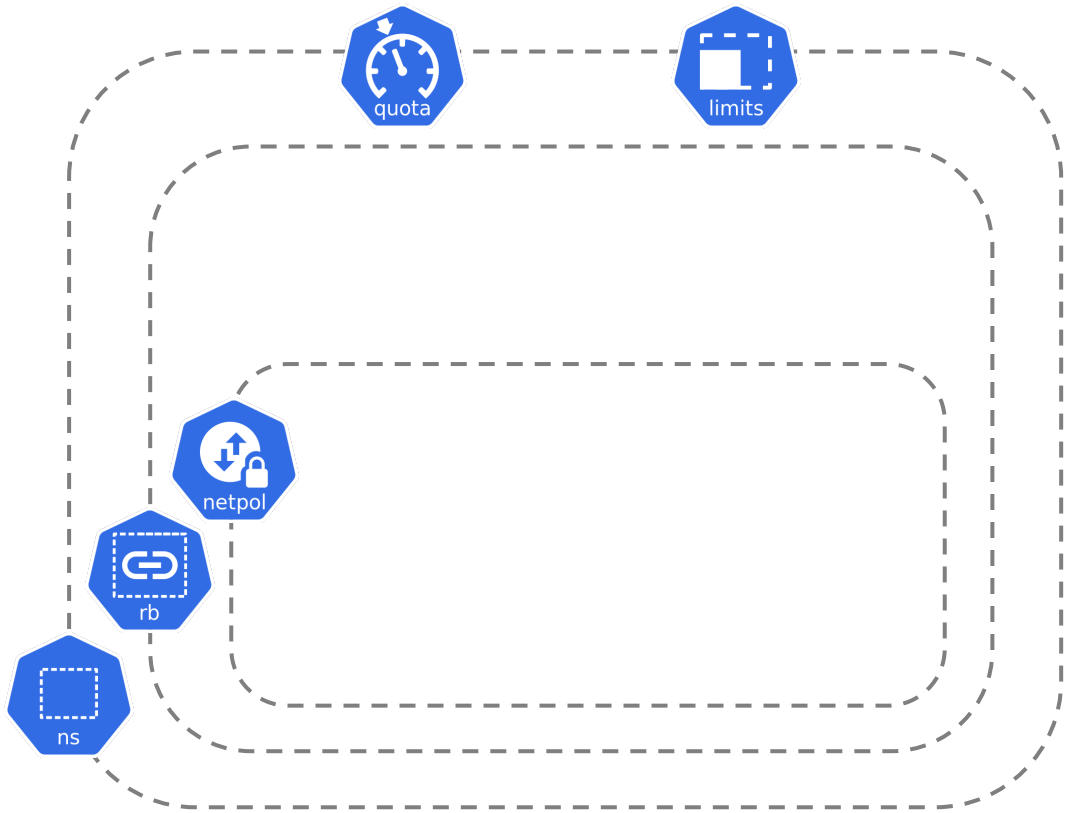

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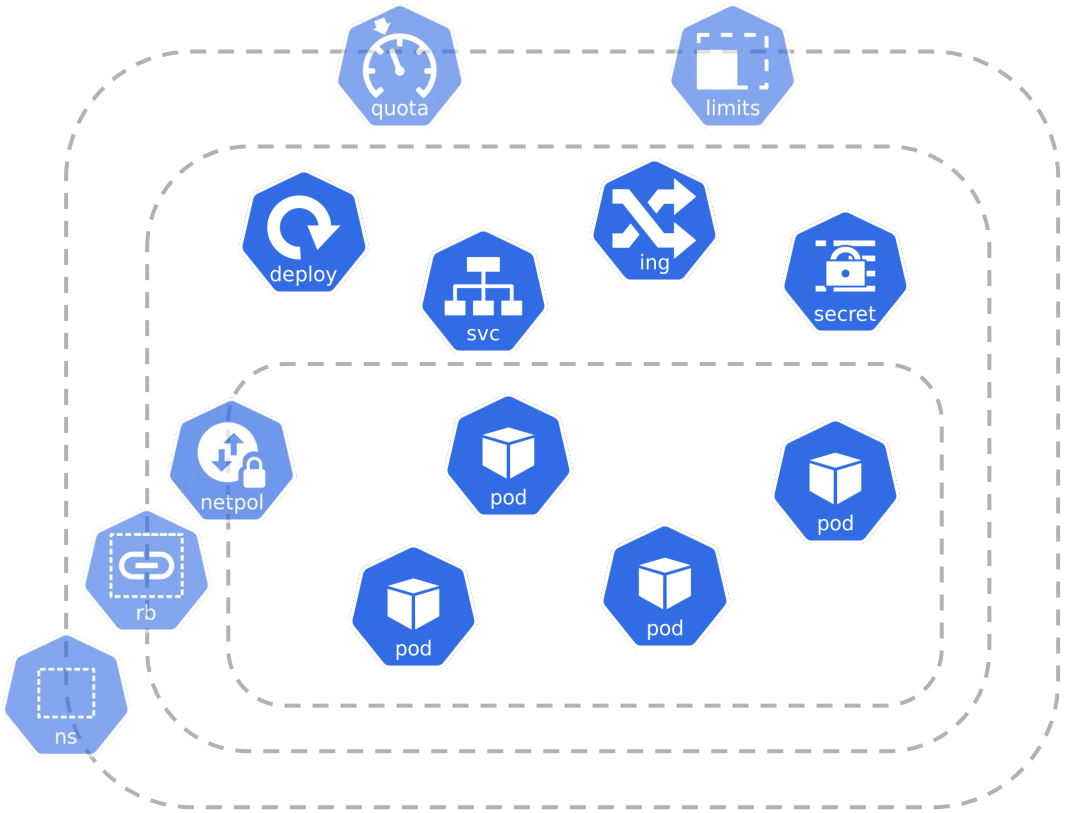


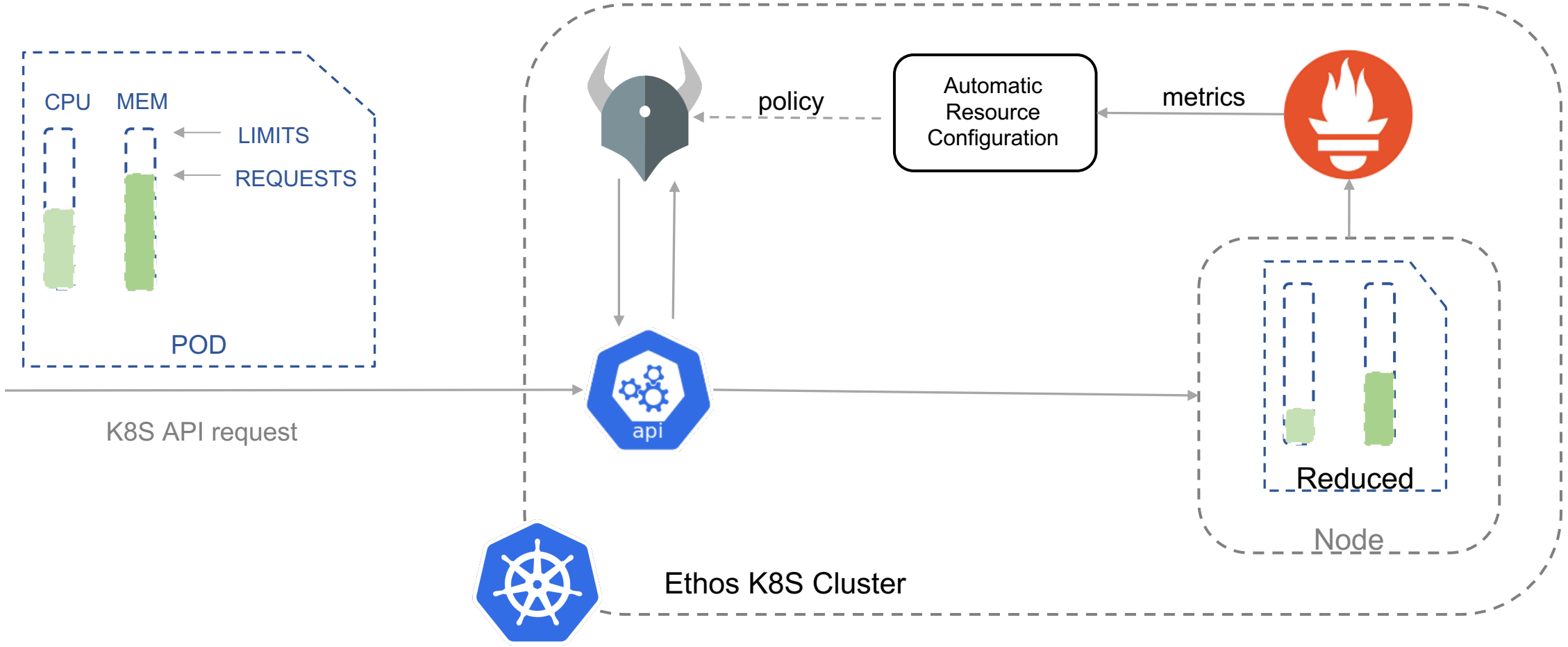
Capacity management

Capacity issues = higher costs

Three levels:

- ✓ Pod - Automatic Resource Configuration
- ✓ Namespace – Baseline Quota Unit
- ✓ Cluster – Capacity Alerts

Capacity management



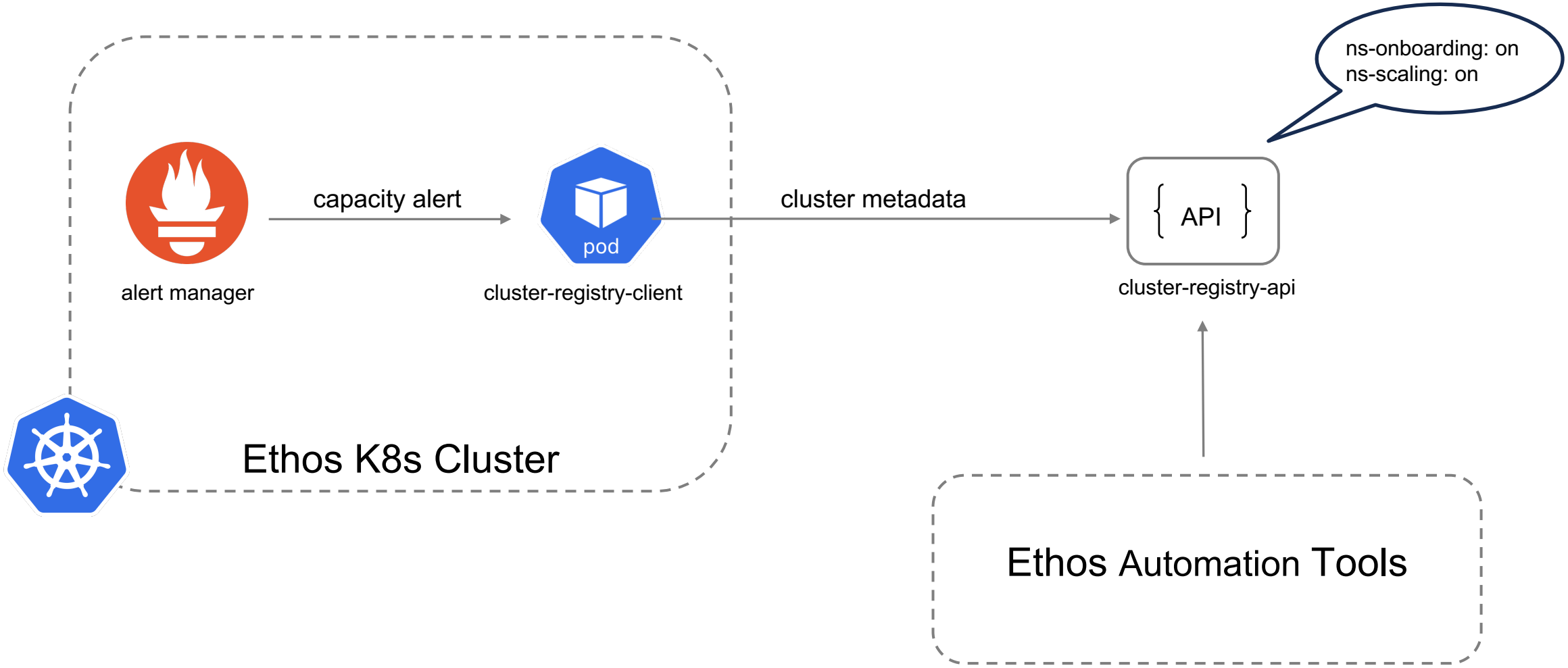
Capacity management

1 Baseline Quota Unit (BQU) = 16 vCPUs
32 GiB of RAM
30 PODs (Running)
…

Resource	Used	Hard
count/ciliumnetworkpolicies.cilium.io	0	30
count/configmaps	0	15
count/ingresses.networking.k8s.io	0	0
count/ingressroutes.contour.heptio.com	0	5
count/networkpolicies.extensions	0	10
count/networkpolicies.networking.k8s.io	7	10
count/pods	0	300
count/secrets	1	15
count/serviceaccounts	1	15
count/services	0	10
limits.cpu	**0**	**16**
limits.memory	**0**	**32Gi**
persistentvolumeclaims	0	5
pods	**0**	**30**
services.loadbalancers	0	0
services.nodeports	0	0

Capacity management

https://github.com/adobe/cluster-registry



Governance policies

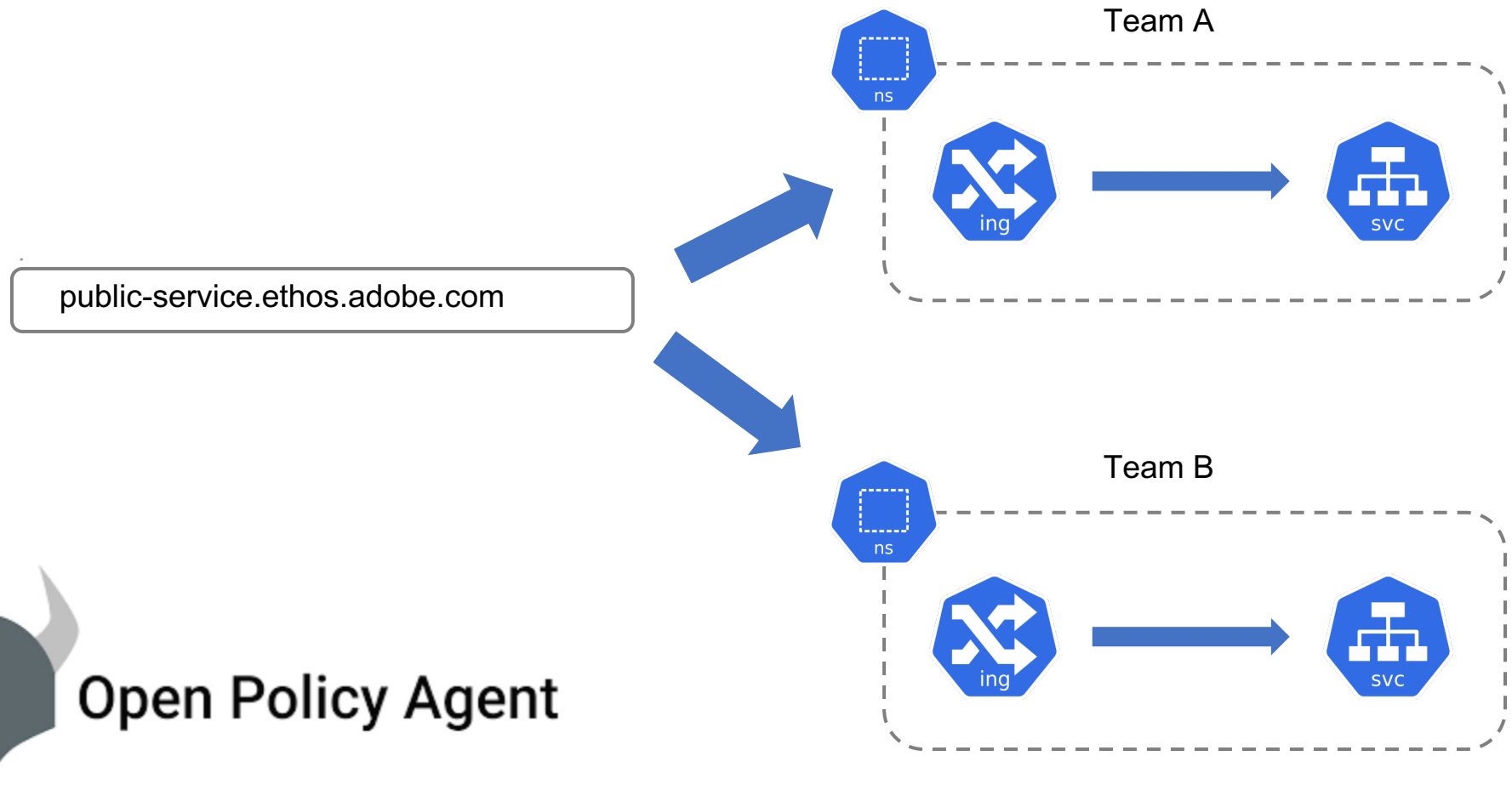
Business is governed by a set of rules => so does a multi-tenant k8s cluster.

Why are these policies mandatory?

- safeguarding teams against inter-team collisions
- protecting cluster stability

Governance policies

FQDN Conflicts day



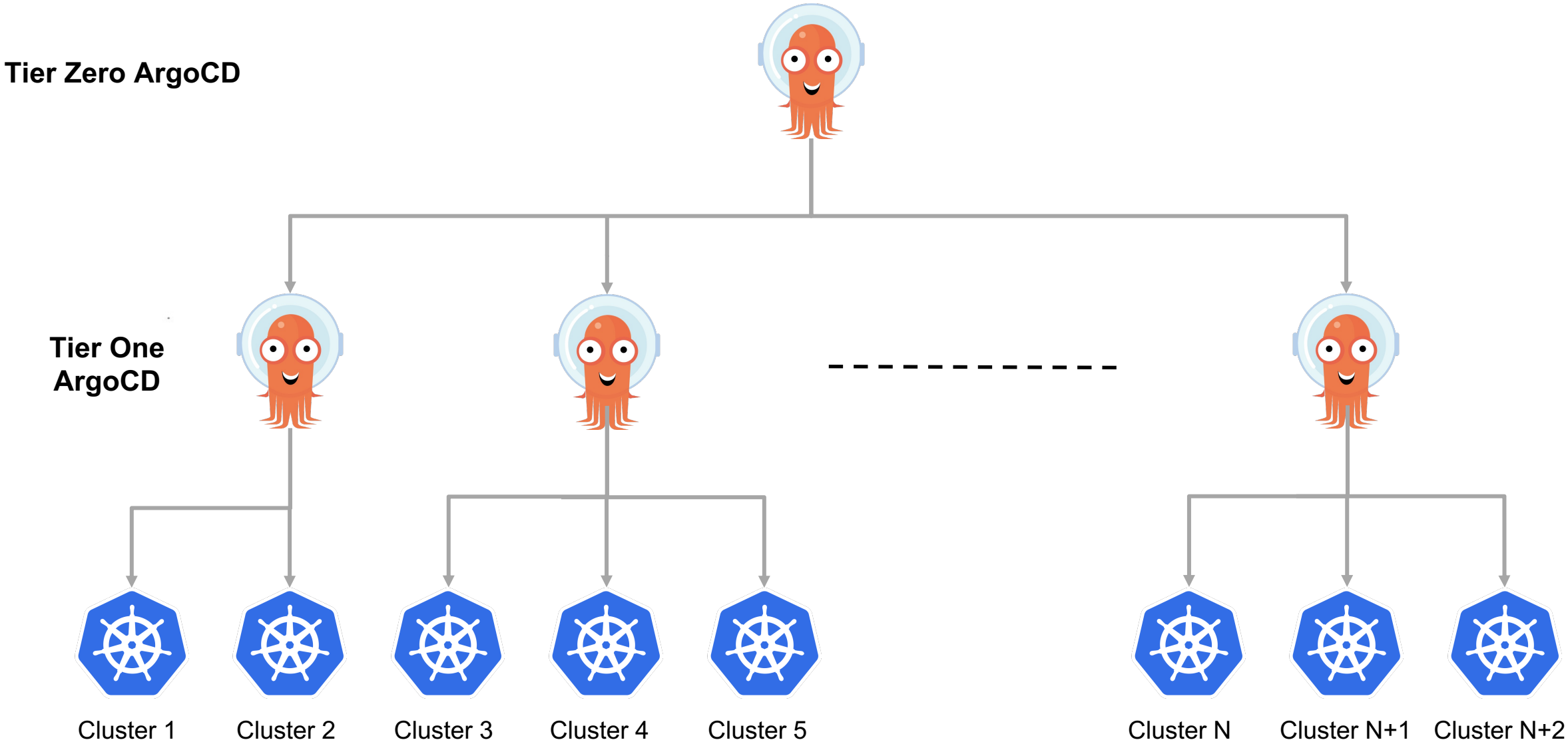
Governance policies

Other example policies:

- Control Plane Toleration
- CronJob History
- Default Ingress Class
- Namespace Limit
- External IP Services

```
# Deny any Service which defines spec.externalIPs
# https://github.com/kubernetes/kubernetes/issues/97076
violation[msg]{
      input.request.kind.kind = "Service"
      isCreateOrUpdate
      input.request.object.spec.externalIPs
      msg = sprintf("External IP Services are not
permitted due to CVE-2020-8554", [])
}
```

Multi-tenancy at scale



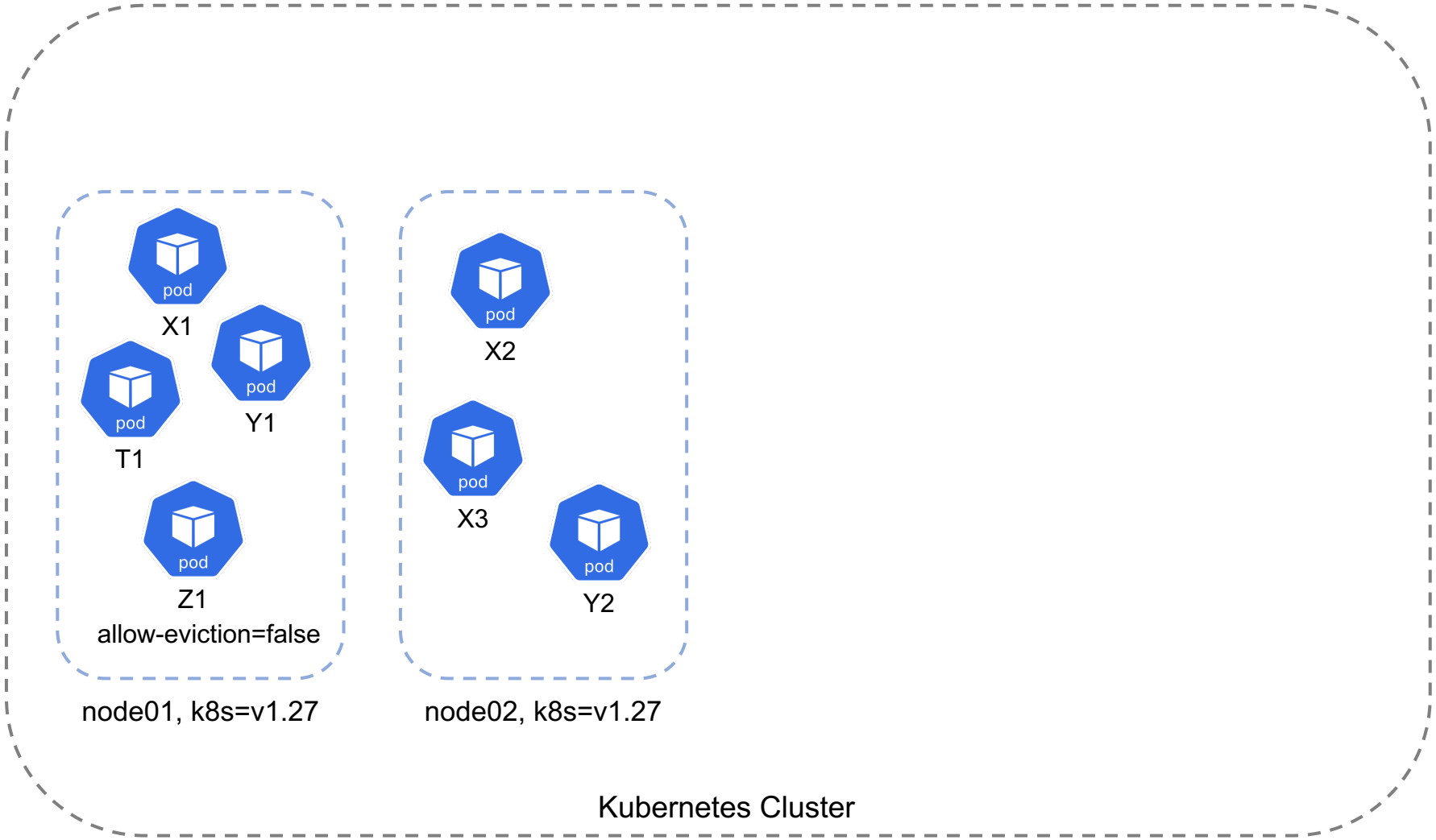
Non disrupting cluster upgrades

Disruptions:
- Voluntary
- Involuntary

Pod Disruption Budget (PDB)
- contract between the cluster administrator and the developer

https://github.com/adobe/k8s-shredder

Non disrupting cluster upgrades



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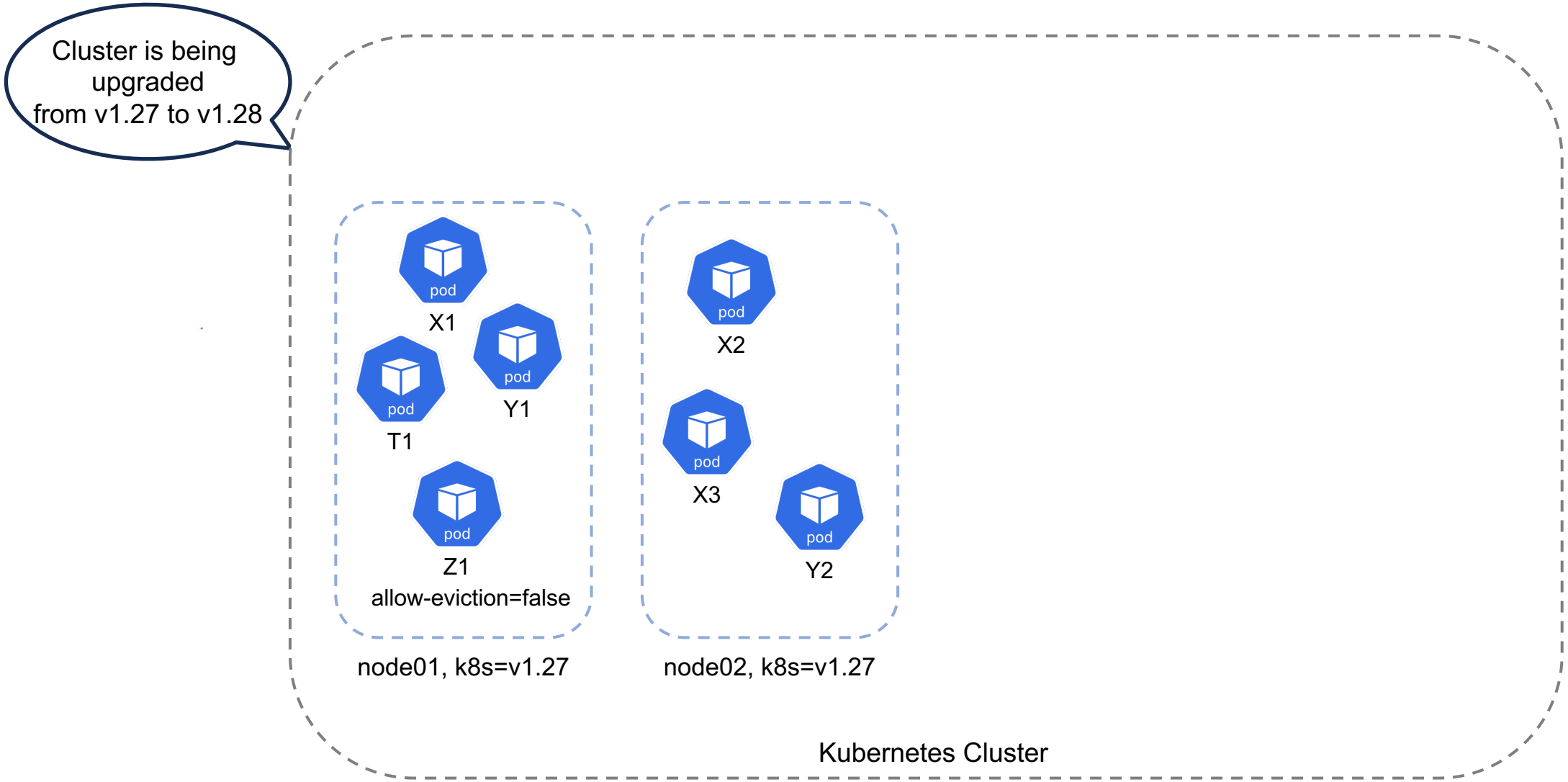

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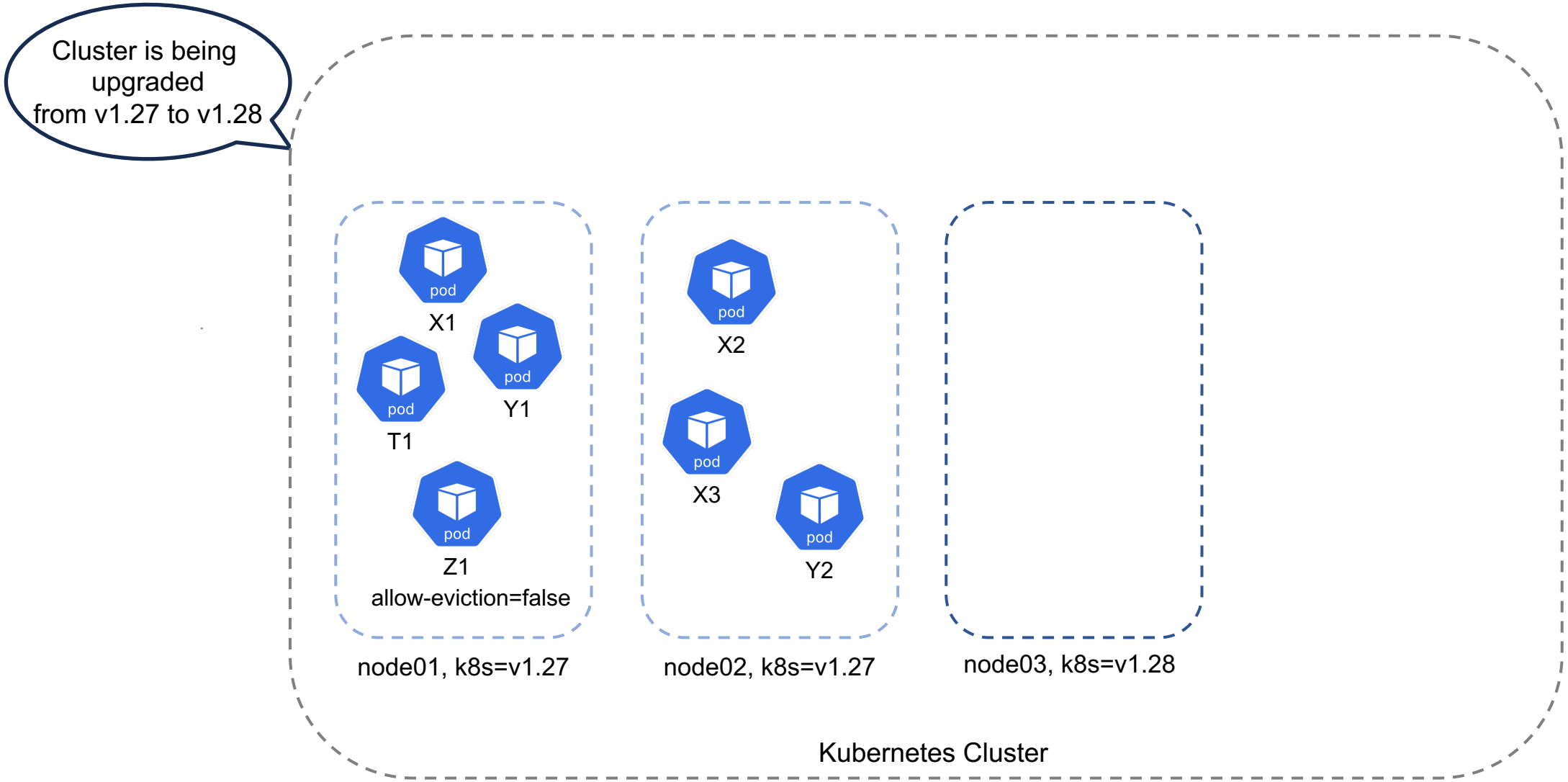

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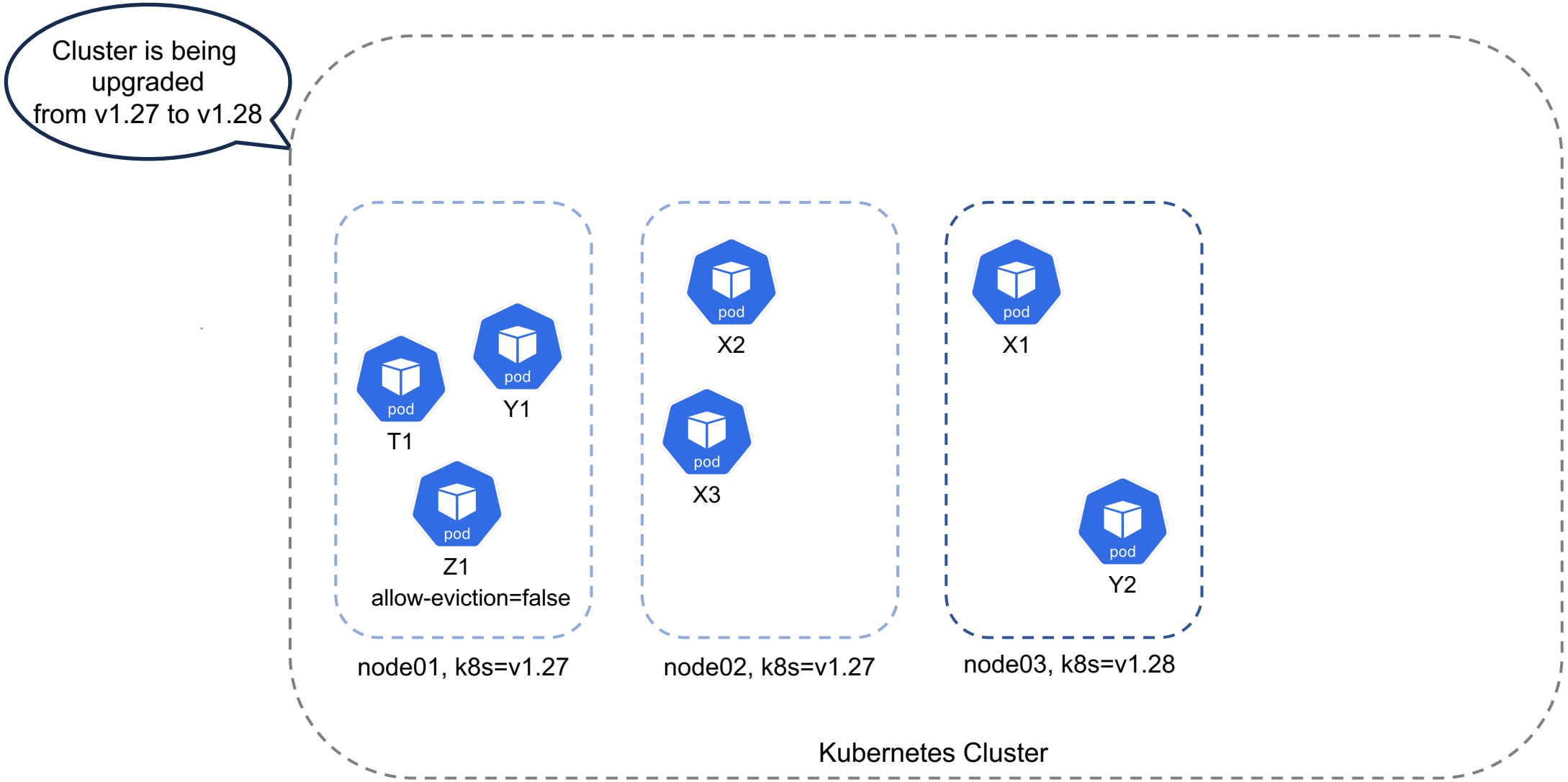

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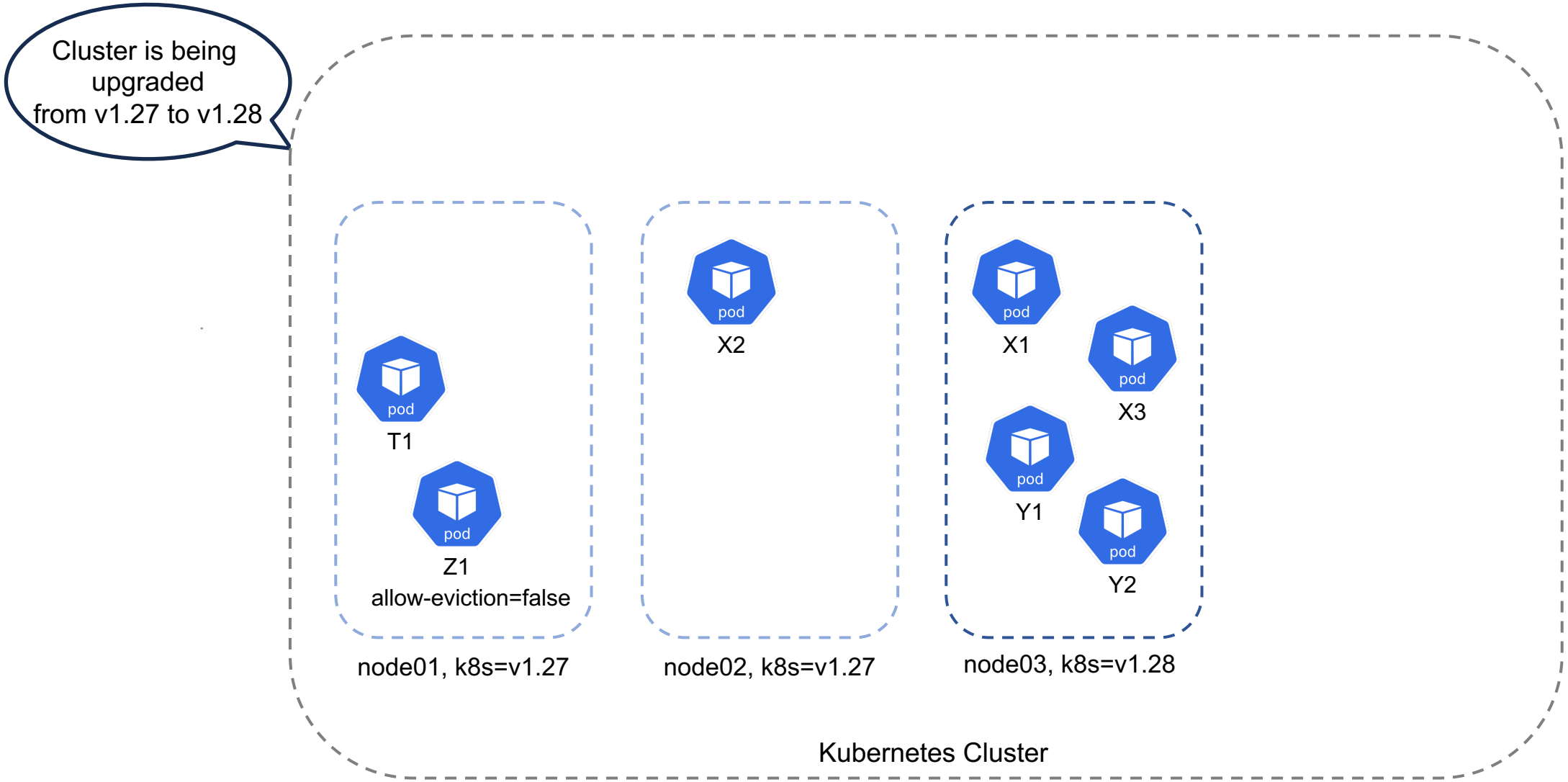

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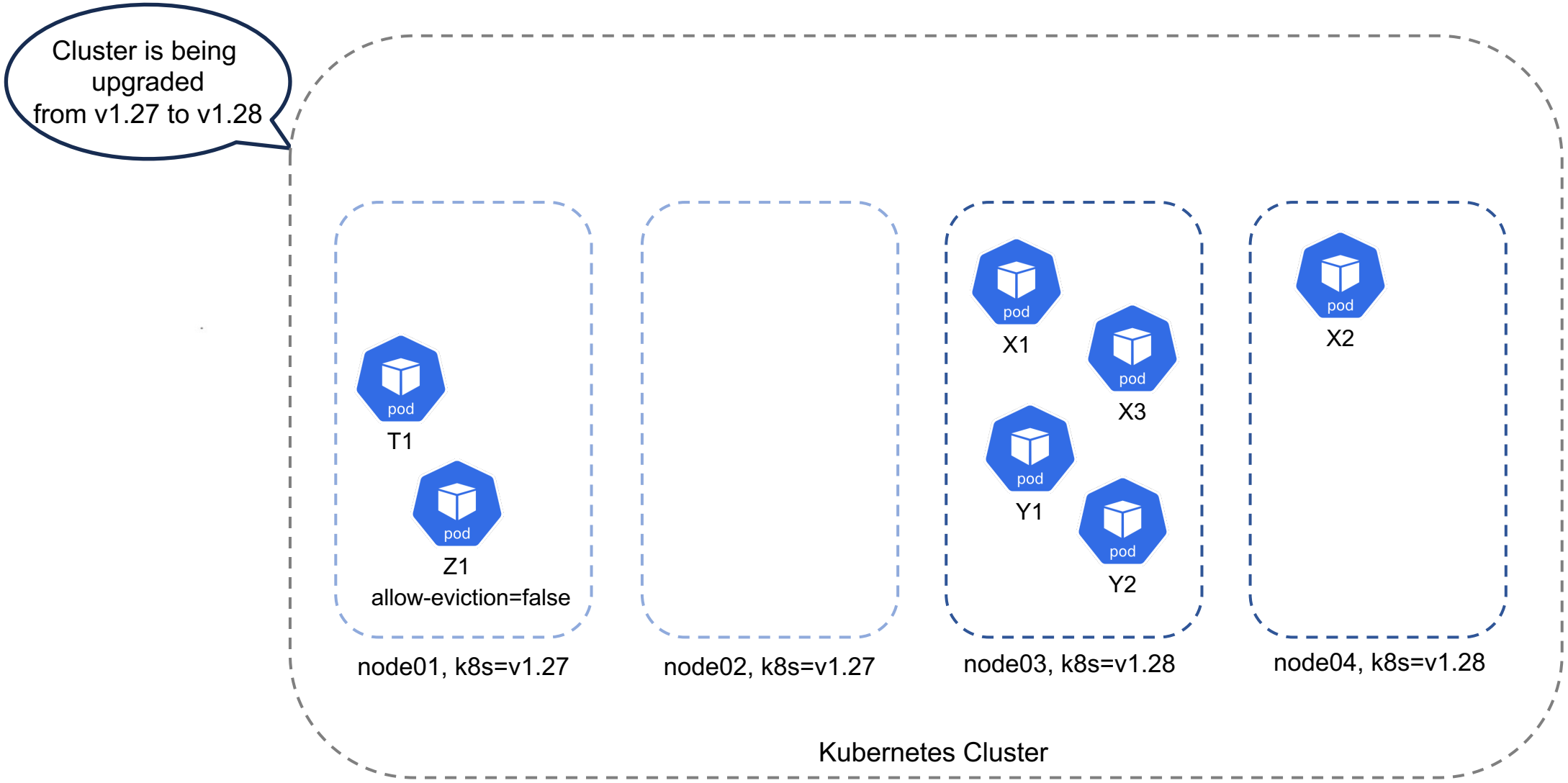

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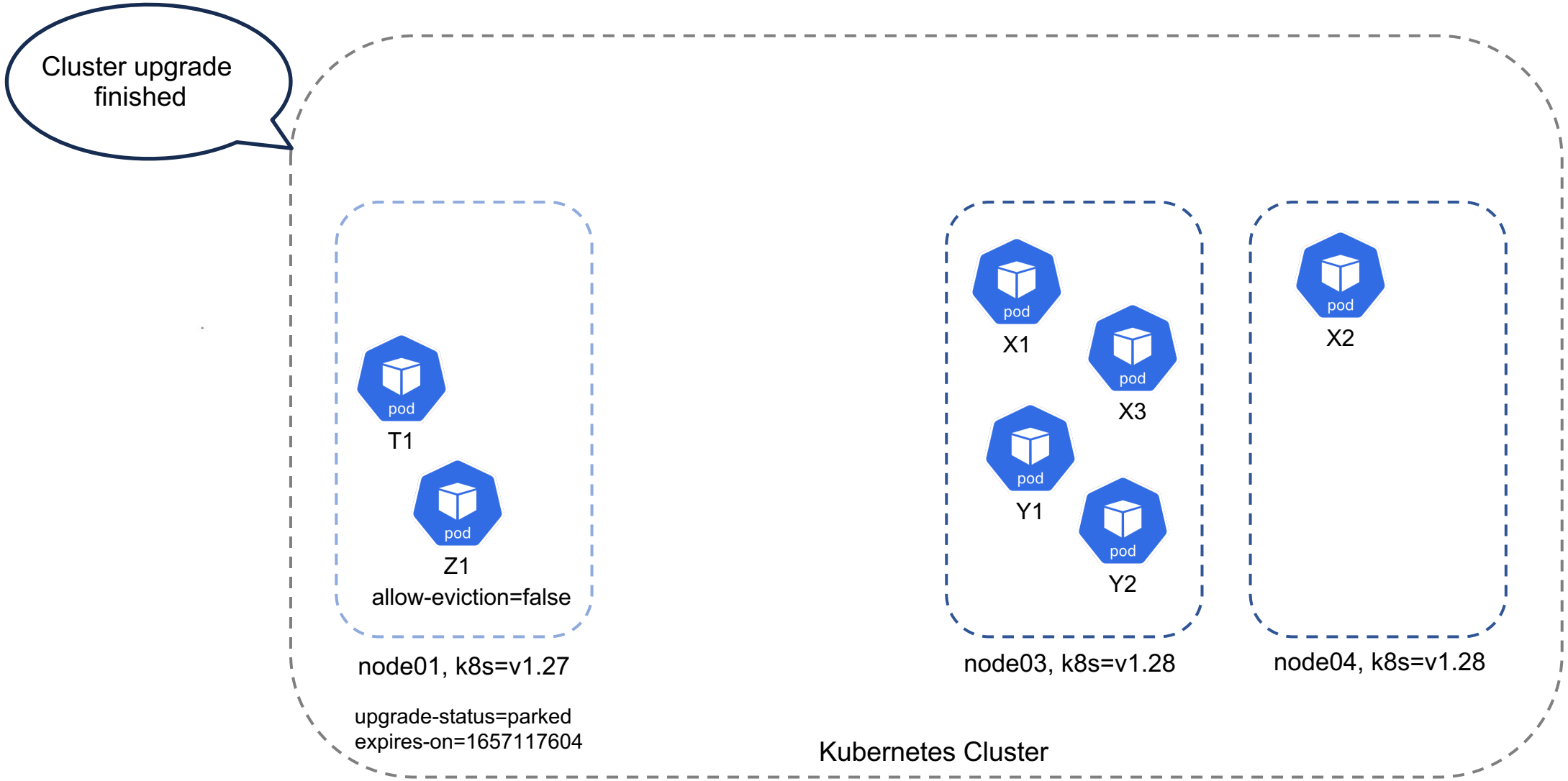

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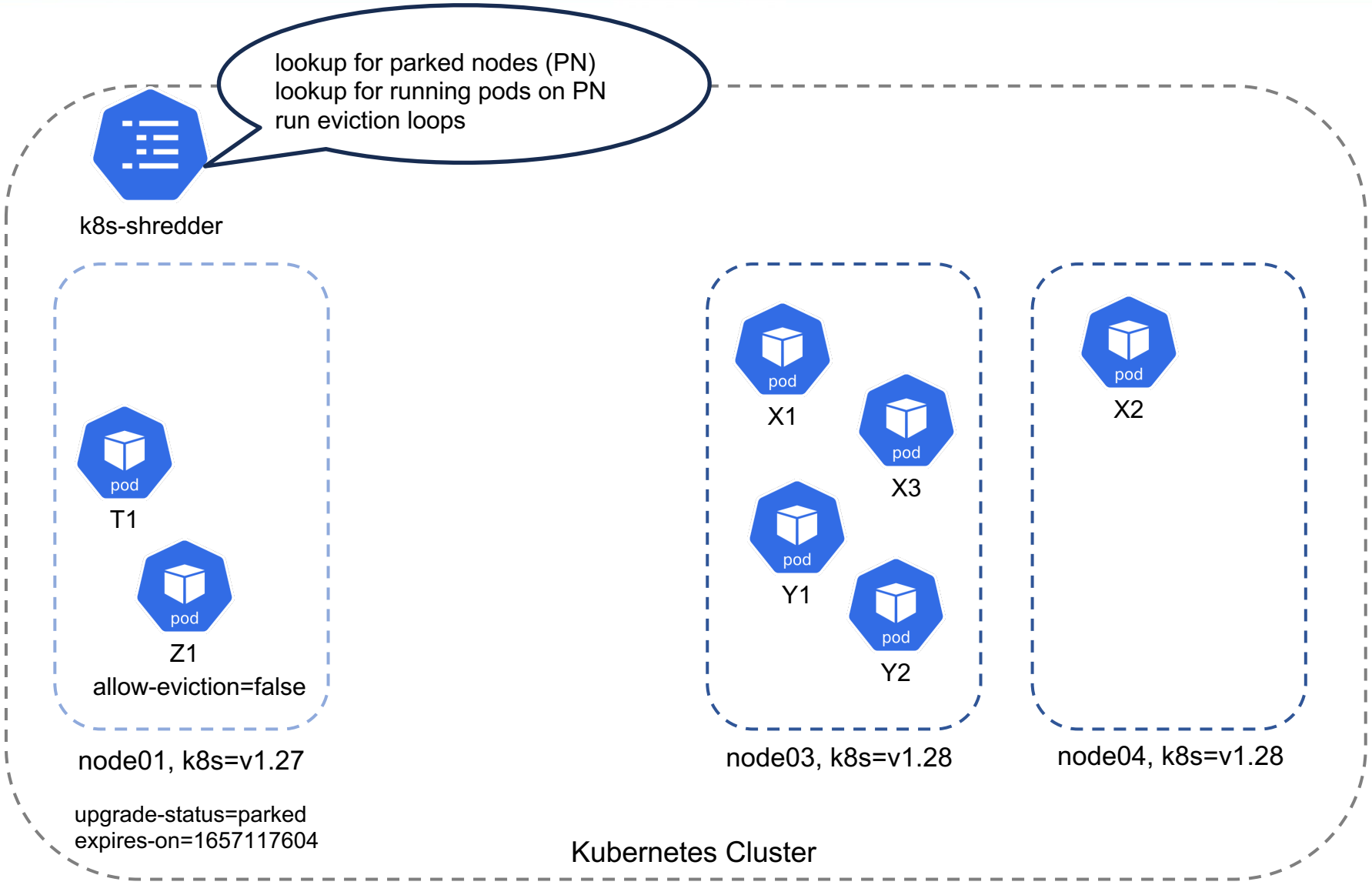

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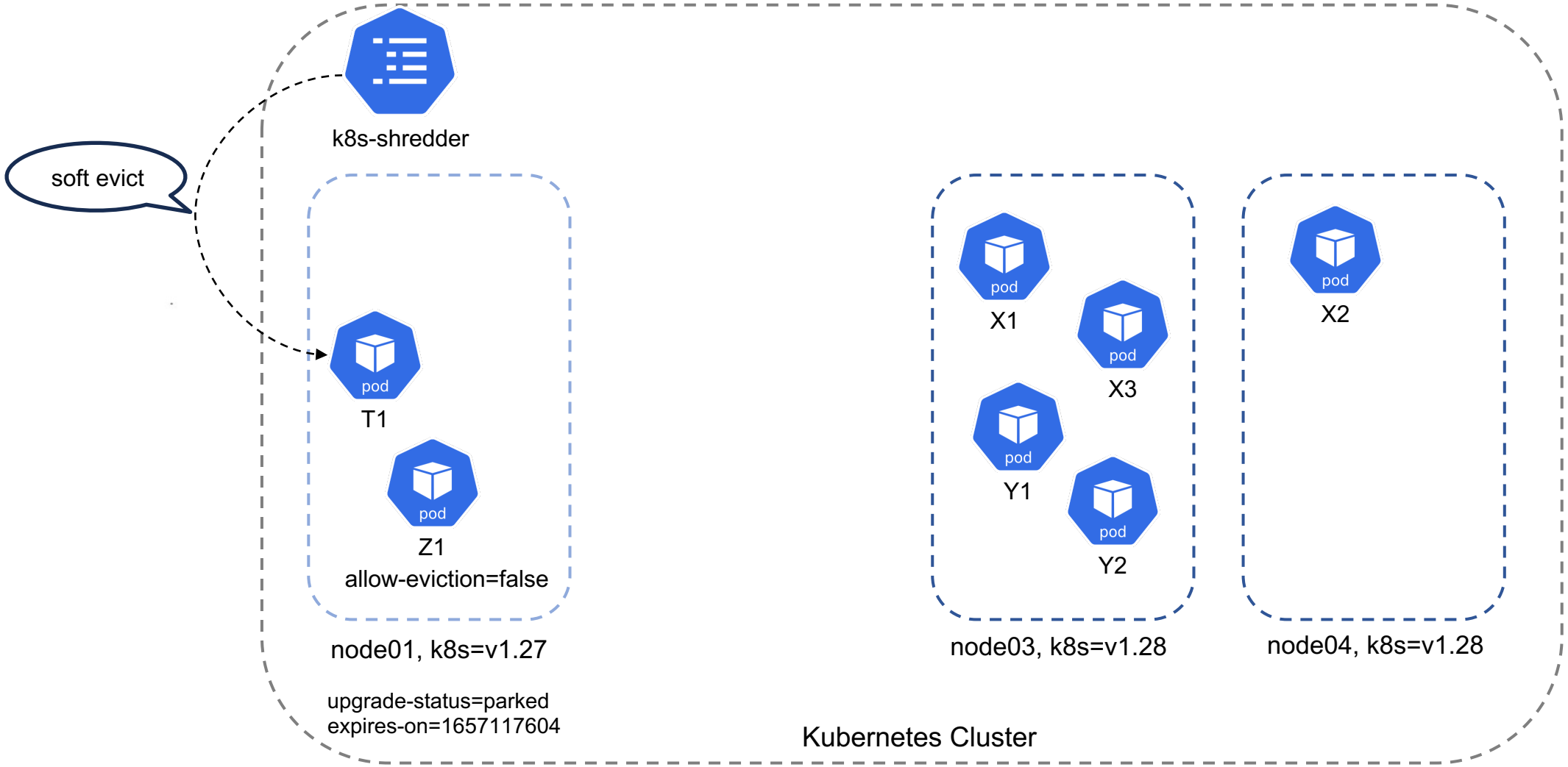

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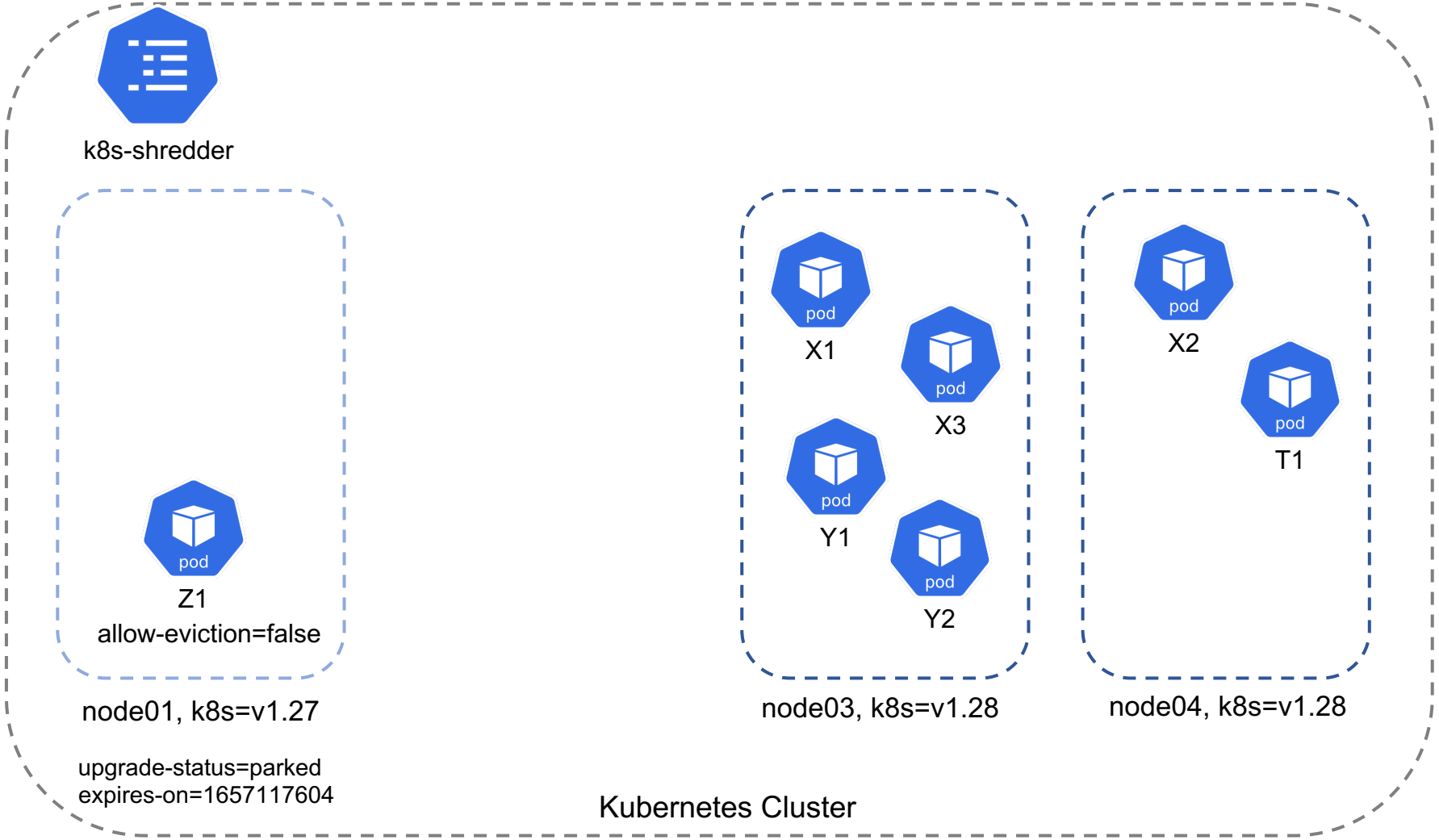

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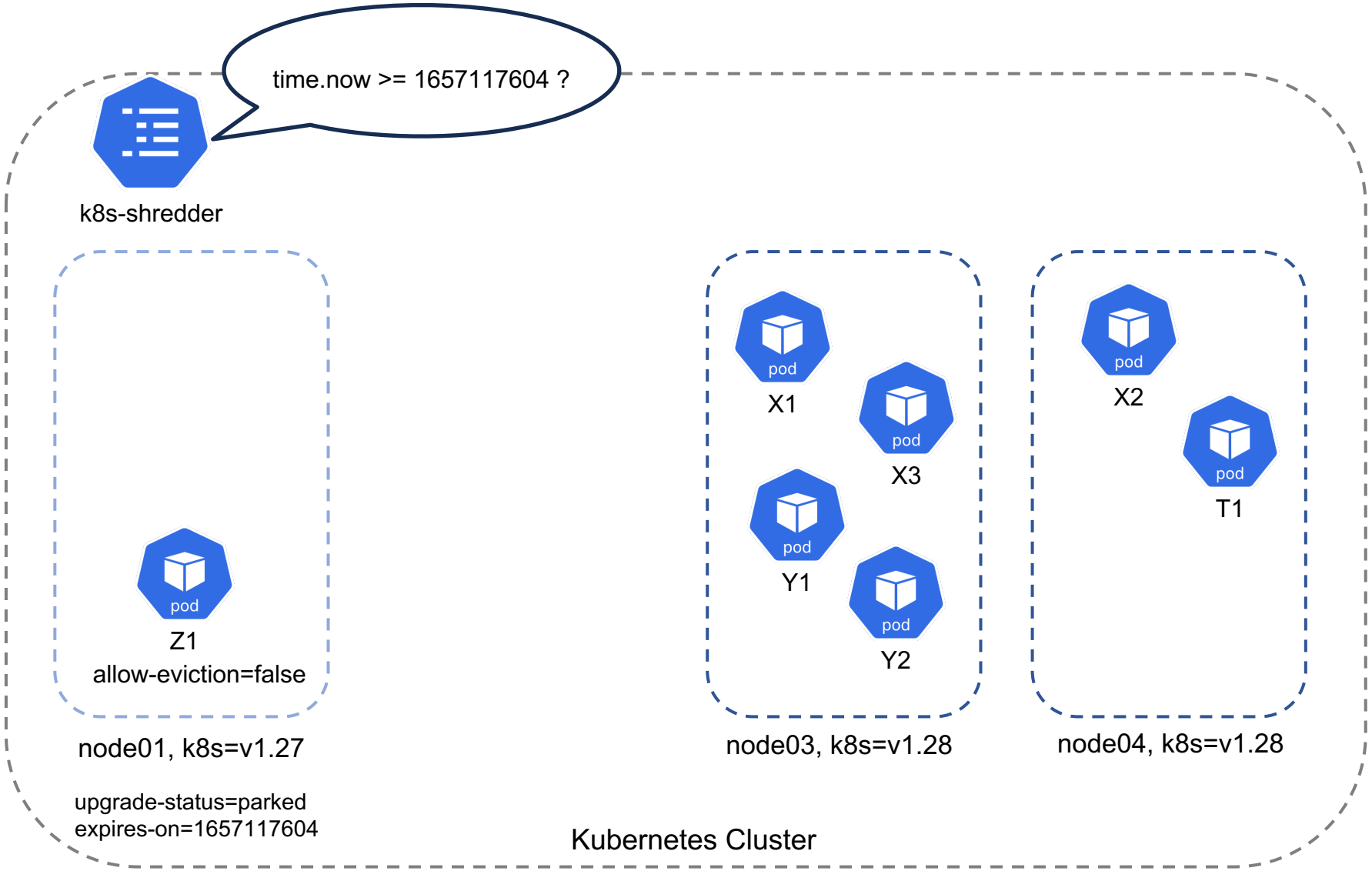

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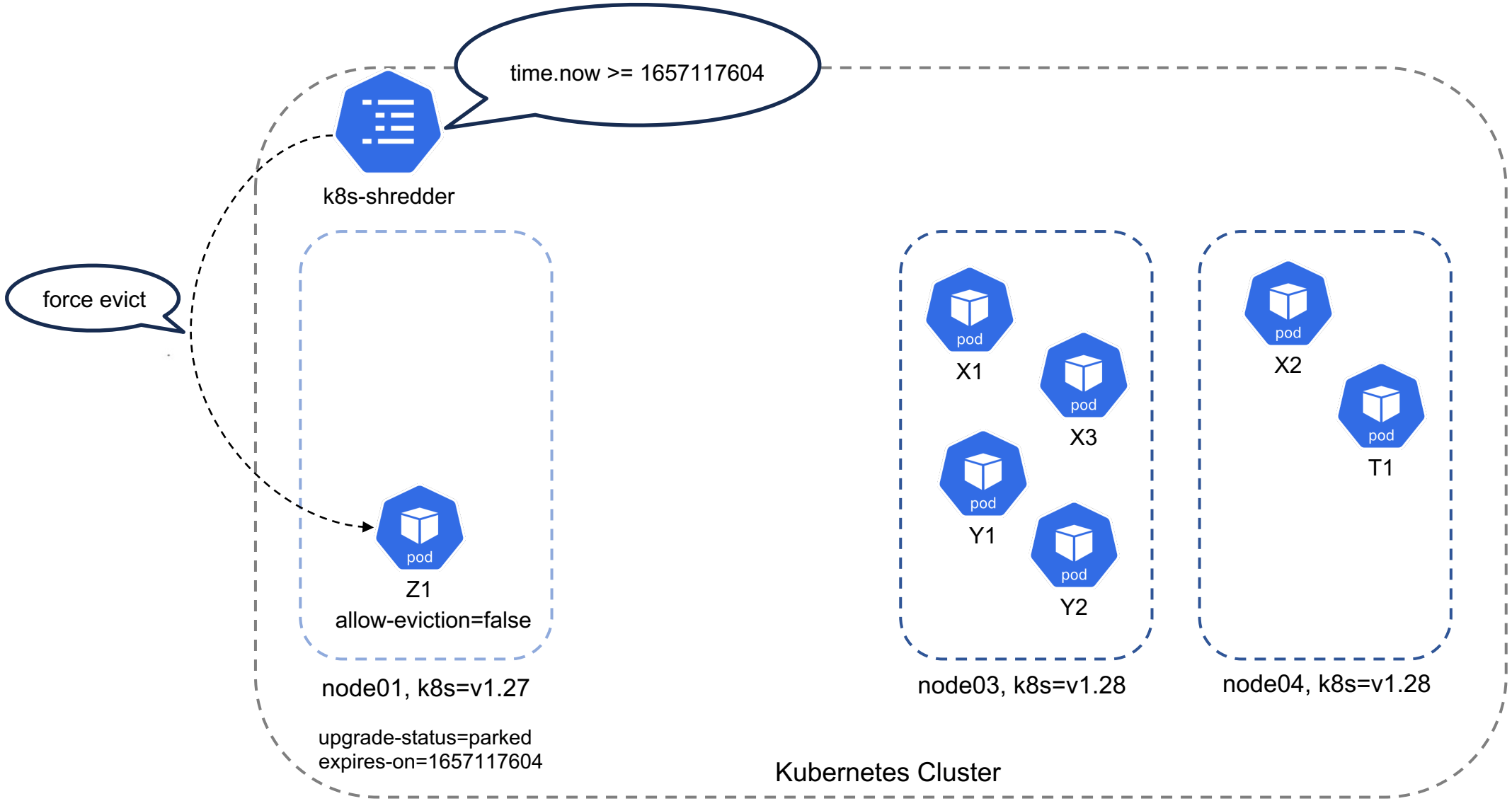

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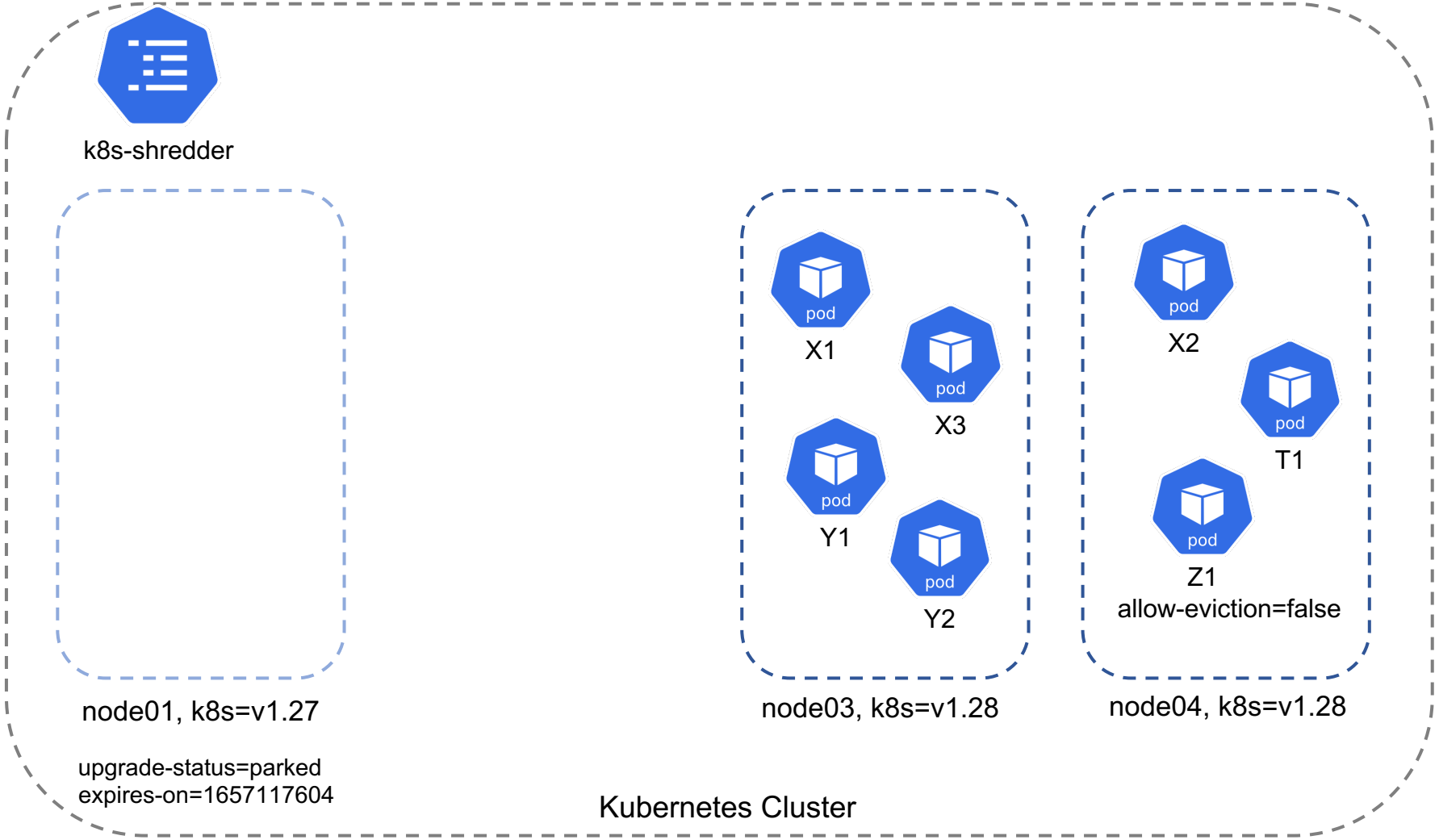

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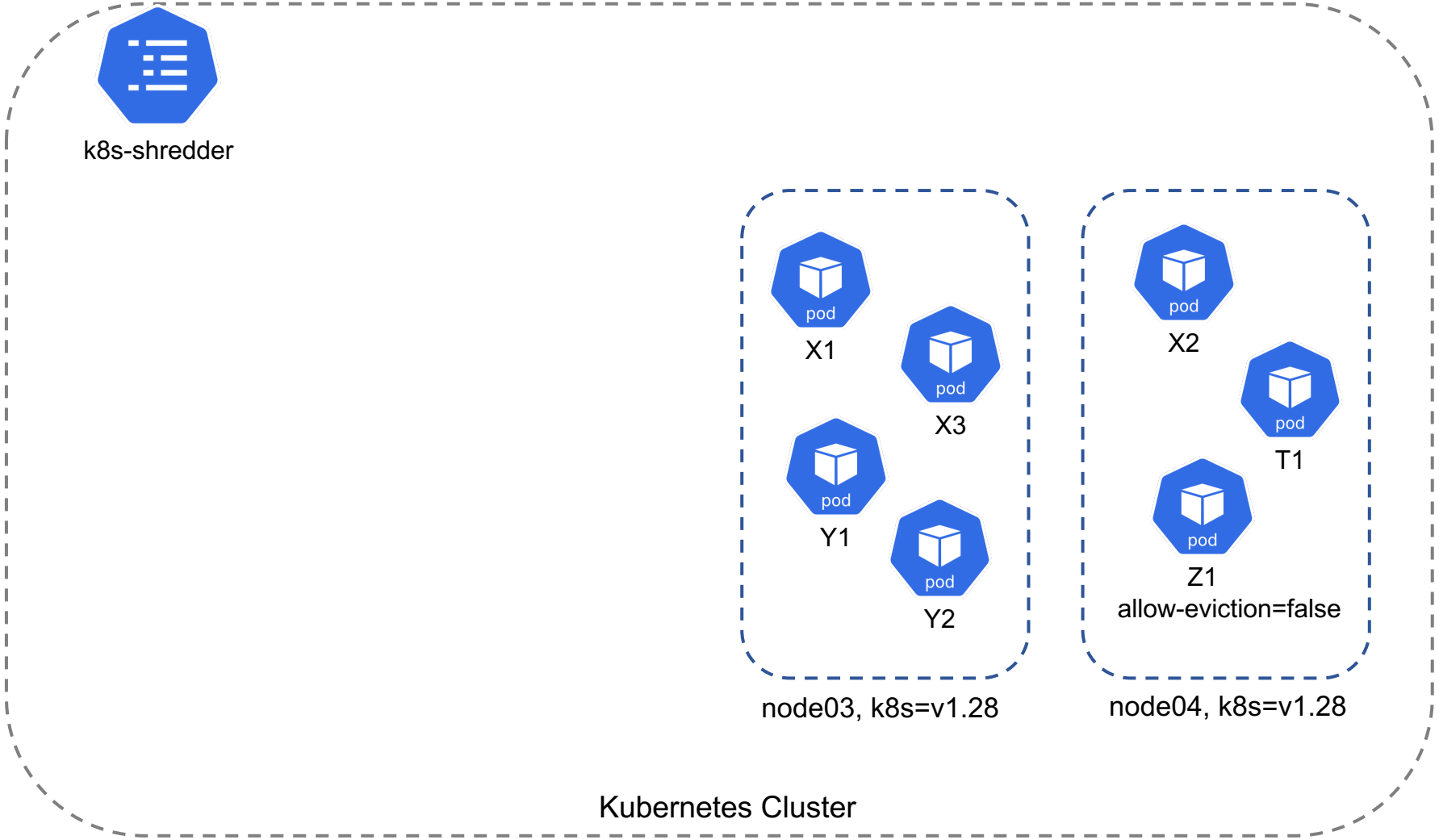

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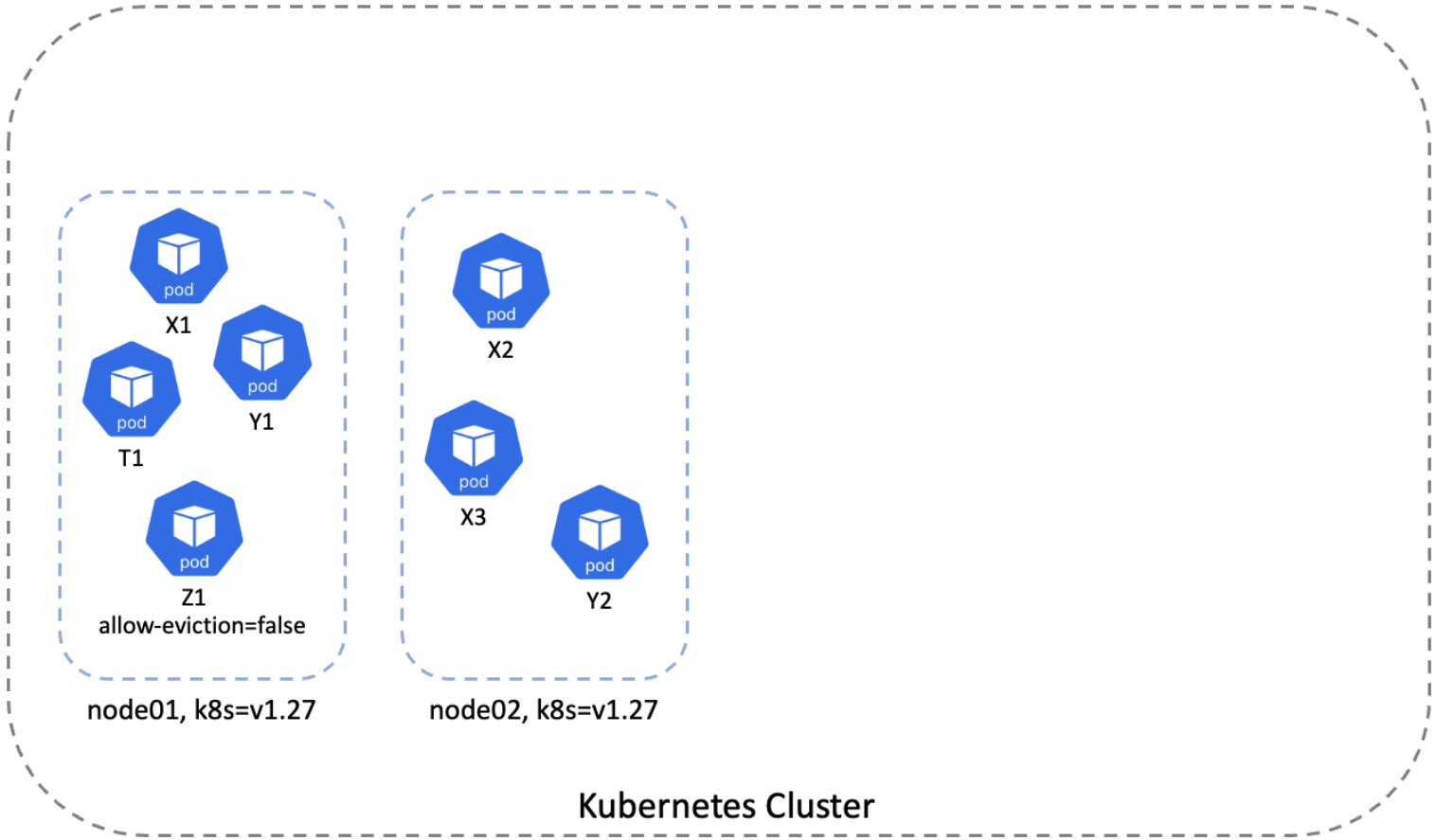

Non disrupting cluster upgrades

Conclusion

There is no silver bullet while building a multi-tenant developer platform

Every company is different and has its own needs and vision regarding multi-tenancy

Namespaces are a viable solution for building the boundaries around multi-tenancy

Challenges while working at scale are different compared to small or medium size platforms.

Thank you!

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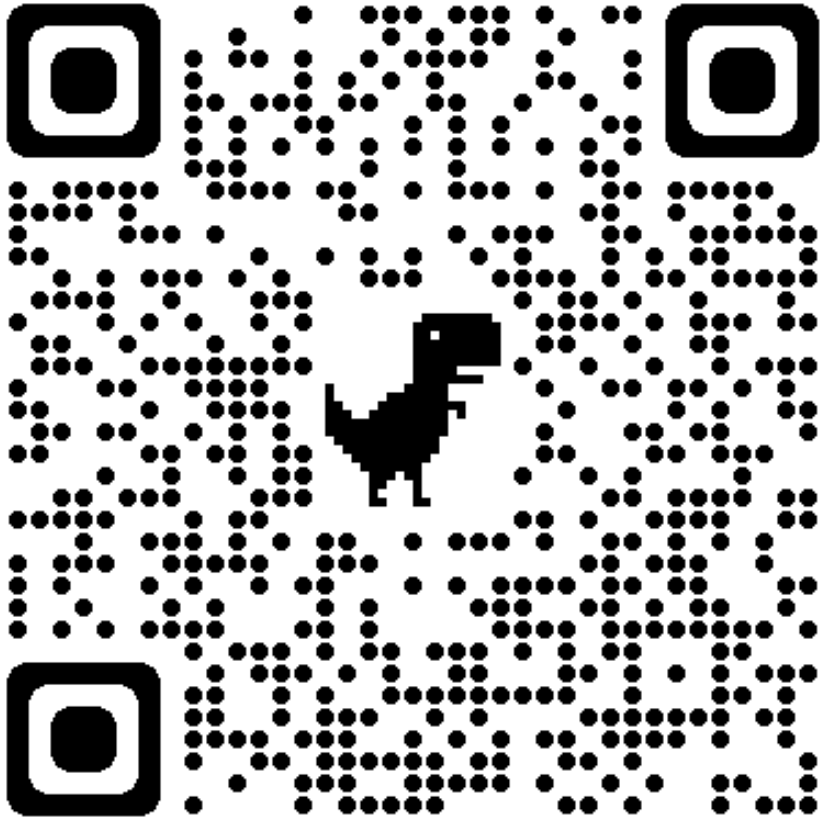

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