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Kubernetes 1.22 – What’s new?

Cloud Native Rosenheim Meetup, Oktober 2021

CLOUD NATIVE ROSENHEIM MEET UP

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Silver Application Development
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Silver Application Integration

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Who we are?

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Housekeeping

- this meetup will be streamed on YouTube!
- want to participate?
  - join our Meetup to get access to the Zoom meeting
    - https://www.meetup.com/CloudNative-Rosenheim-Meetup
  - we do also monitor the comments on YouTube

Cloud Native Rosenheim Meetup

- this is our first meetup as Cloud Native Rosenheim Meetup
- we are now a Cloud Native Community Groups member
  - join our Community: https://community.cncf.io/rosenheim
- also follow us on Twitter: @CloudNative_Ro

Agenda

- Kubernetes 1.22 Release
- new features – our pick
- API and feature removals

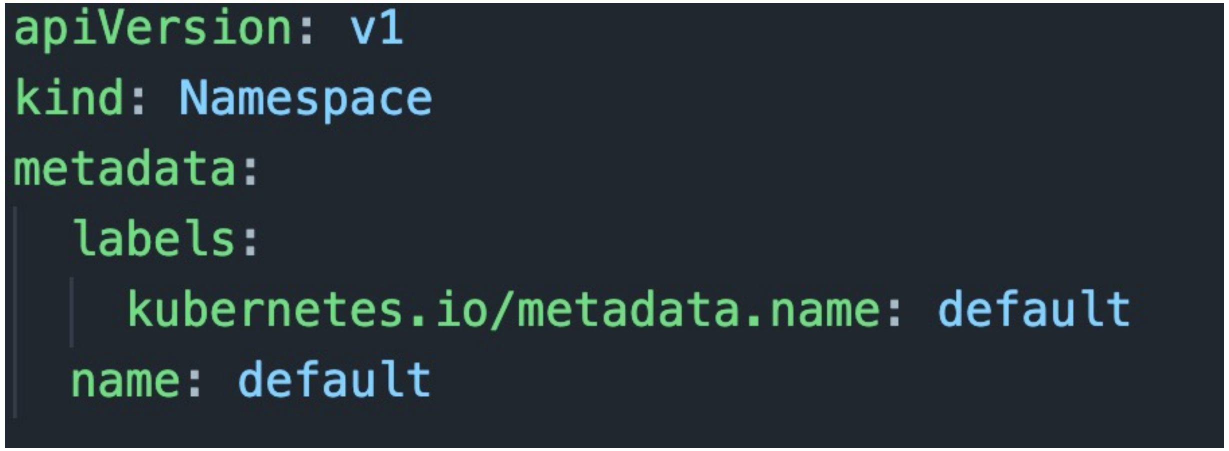
Kubernetes 1.22

- “Reaching New Peaks”
- got released on August 4
  - first longer-cycle release after the change from four to three yearly releases
- this release shifts to security first
- largest release ever with 53 enhancements
  - 13 have graduated to stable
  - 24 are moving to beta
  - 16 are entering alpha
  - 3 features have been deprecated

NEW FEATURES – OUR PICK

#1 Namespace labels

- graduating to Stable
- new label will be added to all namespaces where its value is the namespace name
- this label can be used with any namespace selector



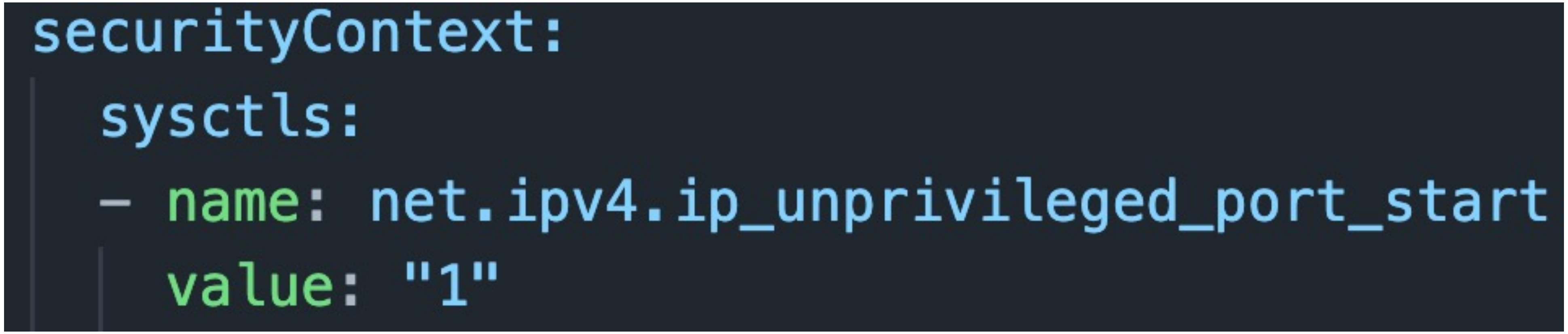
```yaml
apiVersion: v1
kind: Namespace
metadata:
  labels:
    kubernetes.io/metadata.name: default
  name: default
```

#2 Node Swap support

- graduating to Alpha
  - must be enabled via kubelet feature gate
- this enhancement enables Kubernetes workloads to use swap
- Java or Node apps could benefit
- note: global for the whole node, and cannot be configured per workload

#3 Unprivileged Ports

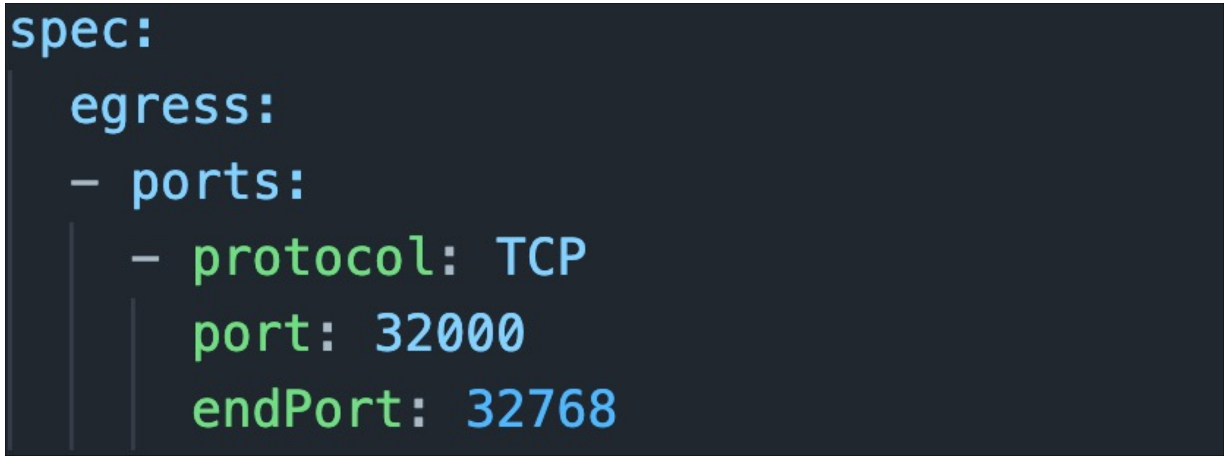
- marked as safe sysctl
- allows containers that are running as unprivileged users to bind low ports



```yaml
securityContext:
  sysctls:
  - name: net.ipv4.ip_unprivileged_port_start
    value: "1"
```

#4 Network Policy Endport

- graduating to Beta
- this enhancement will allow you to define all ports in a NetworkPolicy as a range



```
spec:
  egress:
  - ports:
    - protocol: TCP
      port: 32000
      endPort: 32768
```

#5 Rootless mode

- graduating to Alpha
- this enhancement enables Kubelet to run in a user namespace when the *KubeletInUserNamespace* feature gate is set
- kubeadm: this enhancement also enables to run the control plane as non-root via the *RootlessControlPlane* feature gate

#6 API server tracing

- graduating to Alpha
  - must be enabled via feature gate and --tracing-config-file flag
- this enhancement enables distributed tracing in the Kubernetes API Server
- uses OpenTelemetry format
- ETCD also supports distributed tracing (experimental)

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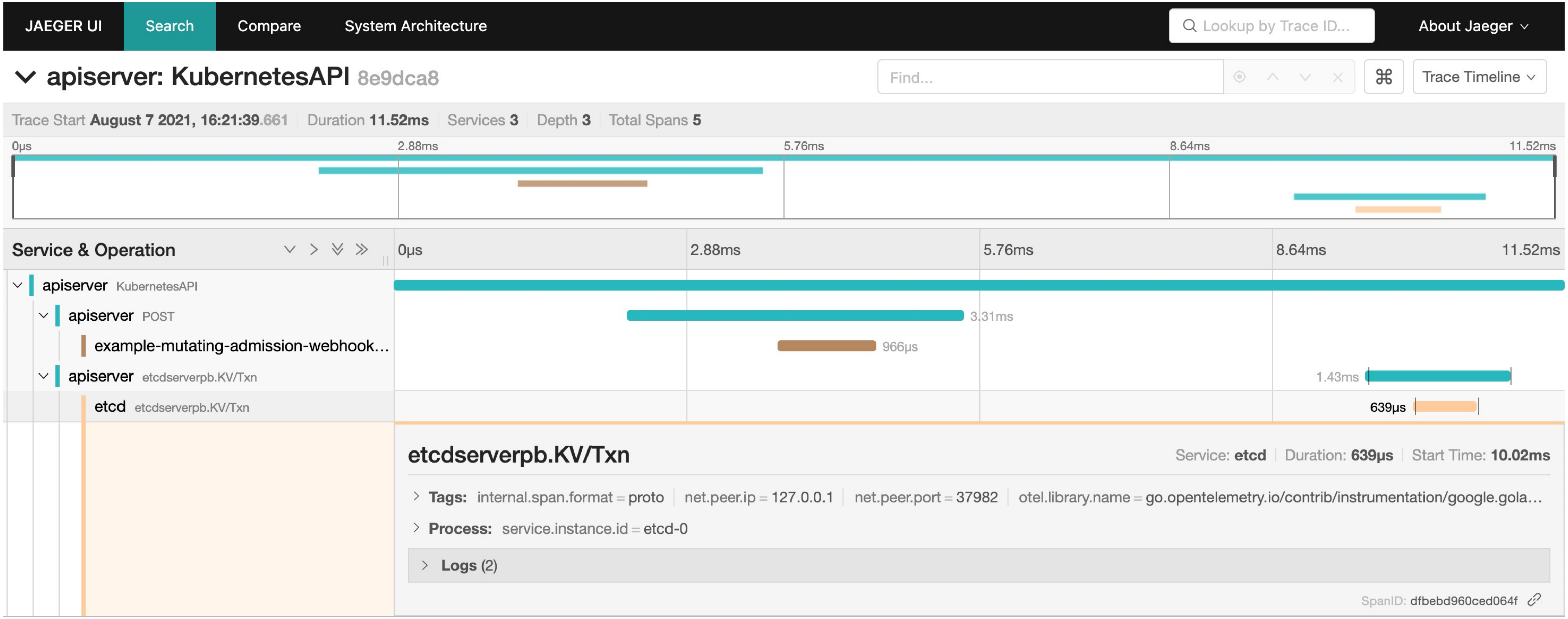
#6 API server tracing



apiserver: KubernetesAPI 8e9dca8

Trace Start **August 7 2021, 16:21:39**.661 | Duration **11.52ms** | Services **3** | Depth **3** | Total Spans **5**

Service & Operation	Duration
apiserver KubernetesAPI	
apiserver POST	3.31ms
example-mutating-admission-webhook...	966μs
apiserver etcdserverpb.KV/Txn	1.43ms
etcd etcdserverpb.KV/Txn	639μs

etcdserverpb.KV/Txn

Service: **etcd** | Duration: **639μs** | Start Time: **10.02ms**

Tags: internal.span.format = proto | net.peer.ip = 127.0.0.1 | net.peer.port = 37982 | otel.library.name = go.opentelemetry.io/contrib/instrumentation/google.gola...

Process: service.instance.id = etcd-0

Logs (2)

SpanID: dfbebd960ced064f

#7 Pod Security Admission Control

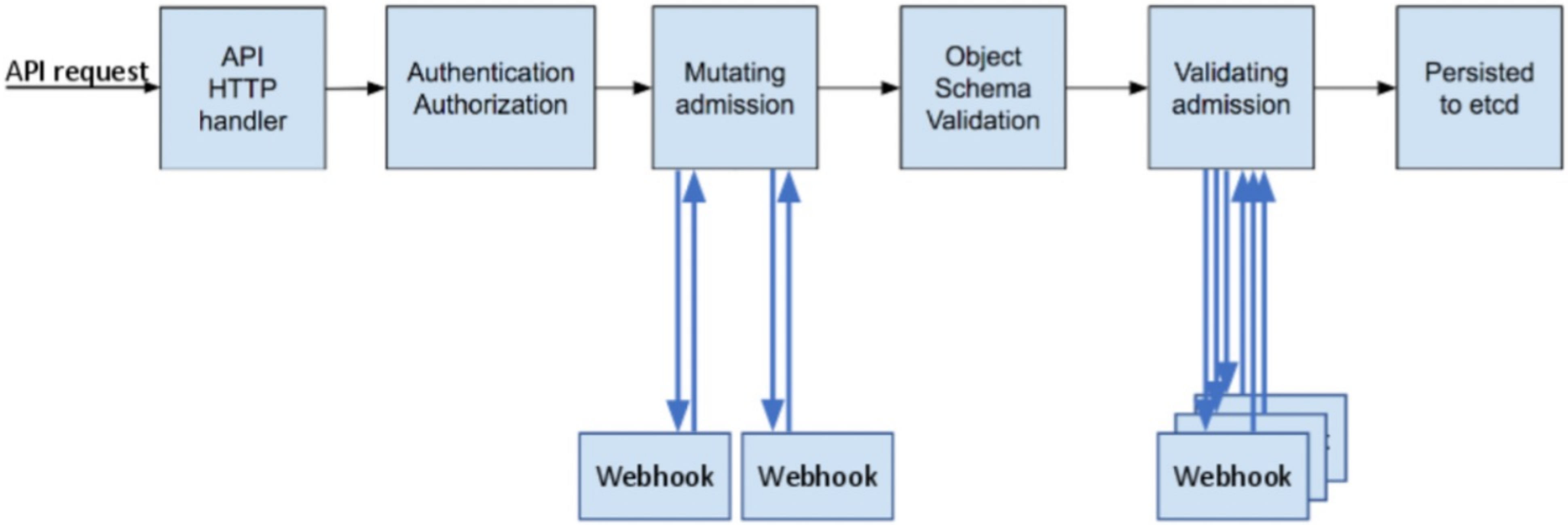
- graduating to Alpha
  - must be explicitly enabled via feature gates on the cluster components
- offers a built-in *Pod Security* admission controller as a successor to PodSecurityPolicies
- but what exactly is admission control?

#7 Pod Security Admission Control

- Admission control:
  - software which is compiled into the kube-apiserver binary
  - intercepts requests to the Kubernetes API server prior to persistence of the object, but after the request is authenticated and authorized
  - Kubernetes supports 37 different admission controllers
    - special controllers:
      - MutatingAdmissionWebhook
      - ValidatingAdmissionWebhook
  - Admission controllers may be "validating", "mutating", or both

#7 Pod Security Admission Control

- Admission control phases:



Admission Controller Phases

#7 PodSecurityPolicy Throwback

- PodSecurityPolicy admission controller which must be enabled via the API Server Flag "--enable-admission-plugins=PodSecurityPolicy"
- target user or pod's serviceaccount; must be authorized via RBAC to use the configured PodSecurityPolicy
- PodSecurityPolicy API and admission controller are deprecated since v1.21 and will be removed from Kubernetes in v1.25

#7 Pod Security Admission Control

- Pod Security Standards
  - define three different *policies* to broadly cover the security spectrum: Privileged, Baseline & Restricted
- enforcement
  - the enforcement can be done at three levels: enforce, audit & warn
  - <enforcement>-version: can be "latest" or specific like *"v1.22"*
- configurable via namespace labels
  or AdmissionConfiguration

#7 Demo Pod Security Admission Control

#7 Pod Security Admission Control

- conclusion: The PSP replacement is less complex than its predecessor but not quite as flexible
- alternatives in the CNCF:
  - Open Policy Agent
  - Kyverno
  - Kubewarden

#8 SeccompDefault

- graduating to Alpha - must be explicitly enabled via kubelet feature gate and turned on via kubelet configuration (or command line)
- with this feature you can enable seccomp to all workloads or to workloads on a specific node, rather than configure it per workload
- but what exactly is seccomp?

#8 Seccomp basics

- secure computing mode: seccomp
- is a Linux kernel mechanism that lets you restrict the system calls a process can use
- reduces the chance that a Linux kernel vulnerability will be exploited
- all container runtimes ship with a default seccomp profile (sane defaults)
- Kubernetes will explicitly set the seccomp profile to *Unconfined* which disables seccomp filtering

#8 SeccompDefault

- the new feature just changes the default seccomp profile from *Unconfined* to *RuntimeDefault*
- profiles:
  - Unconfined: seccomp will not be enabled, which is also the default
  - RuntimeDefault: the container runtimes default profile will be used
  - Localhost: a node local profile will be applied

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#9 Ephemeral Containers

- Alpha feature since v1.16
- what`s new?
  - API changes in v1.22
- eequires
  - kubectl v1.22 since earlier versions use the old API
  - containerd v1.5
  - must be enabled via feature gate in Api-Server, Controller-Manager, Scheduler & Kubelet
  - currently not supported with cri-o
    - https://github.com/cri-o/cri-o/issues/4790

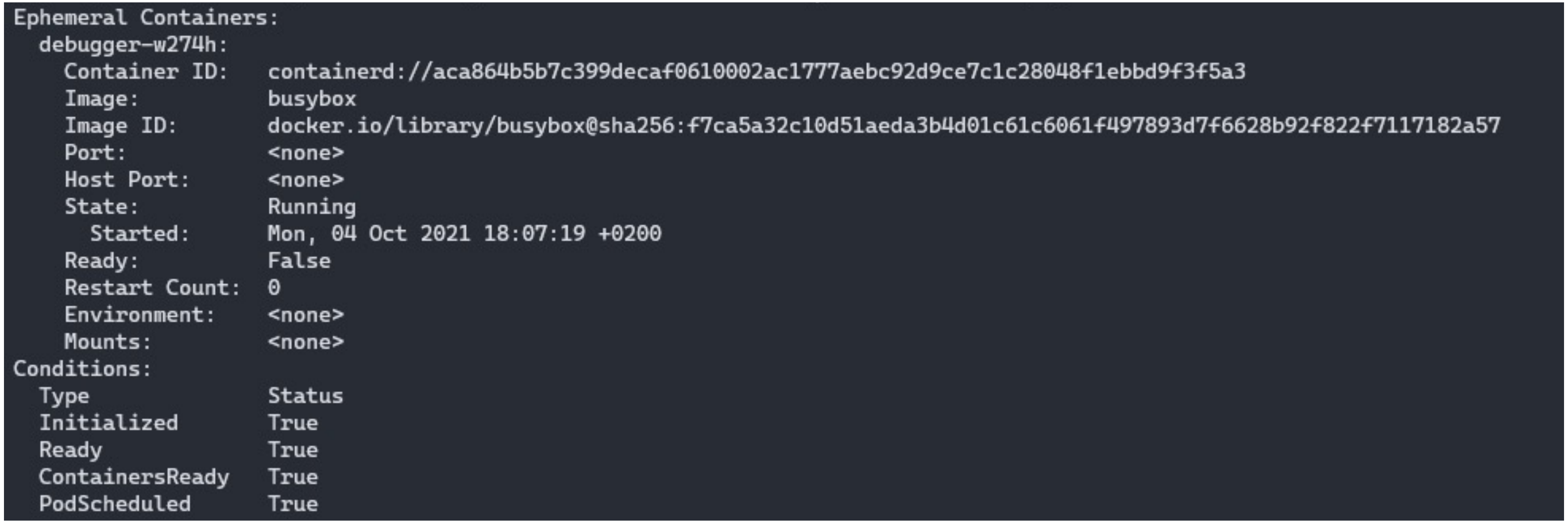
#9 Ephemeral Containers

- what are they used for?

- assumptions
  - Container images should be lightweight as possible
  - Containers running inside of pods only contain application code and required dependencies

- the pod running your application crashes!
  - No shell
  - No debugging tools
    - = no troubleshooting

#9 Demo Ephemeral Containers



```
Ephemeral Containers:
  debugger-w274h:
    Container ID:   containerd://aca864b5b7c399decaf0610002ac1777aebc92d9ce7c1c28048f1ebbd9f3f5a3
    Image:          busybox
    Image ID:       docker.io/library/busybox@sha256:f7ca5a32c10d51aeda3b4d01c61c6061f497893d7f6628b92f822f7117182a57
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Mon, 04 Oct 2021 18:07:19 +0200
    Ready:          False
    Restart Count:  0
    Environment:    <none>
    Mounts:         <none>
Conditions:
  Type              Status
  Initialized       True
  Ready             True
  ContainersReady   True
  PodScheduled      True
```

API AND FEATURE REMOVALS

API and feature removals

- this release removes (not deprecates) APIs and features
  - this happened the last time with 1.16
  - and will also happen with 1.25
- you will need to update your manifests prior the upgrade
- some API groups allow to retrieve or update existing objects with older API versions

Kubernetes Deprecation Policy

- there are 3 API tracks with different policies!
- GA (generally available, stable), e.g. v1
  - 12 months or 3 releases (whichever is longer)
- Beta (pre-release), e.g. v1beta1
  - 9 months or 3 releases (whichever is longer)
- Alpha (experimental), e.g. v1alpha1
  - 0 releases

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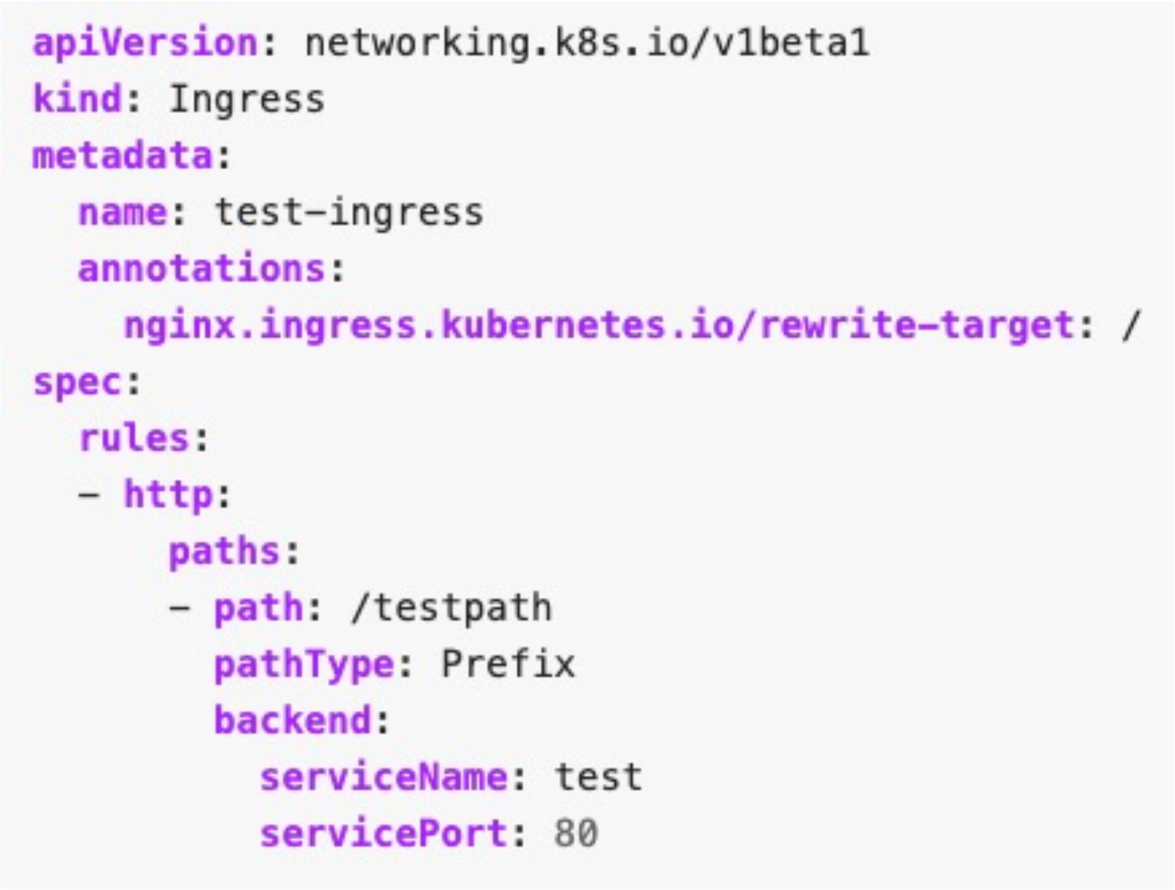
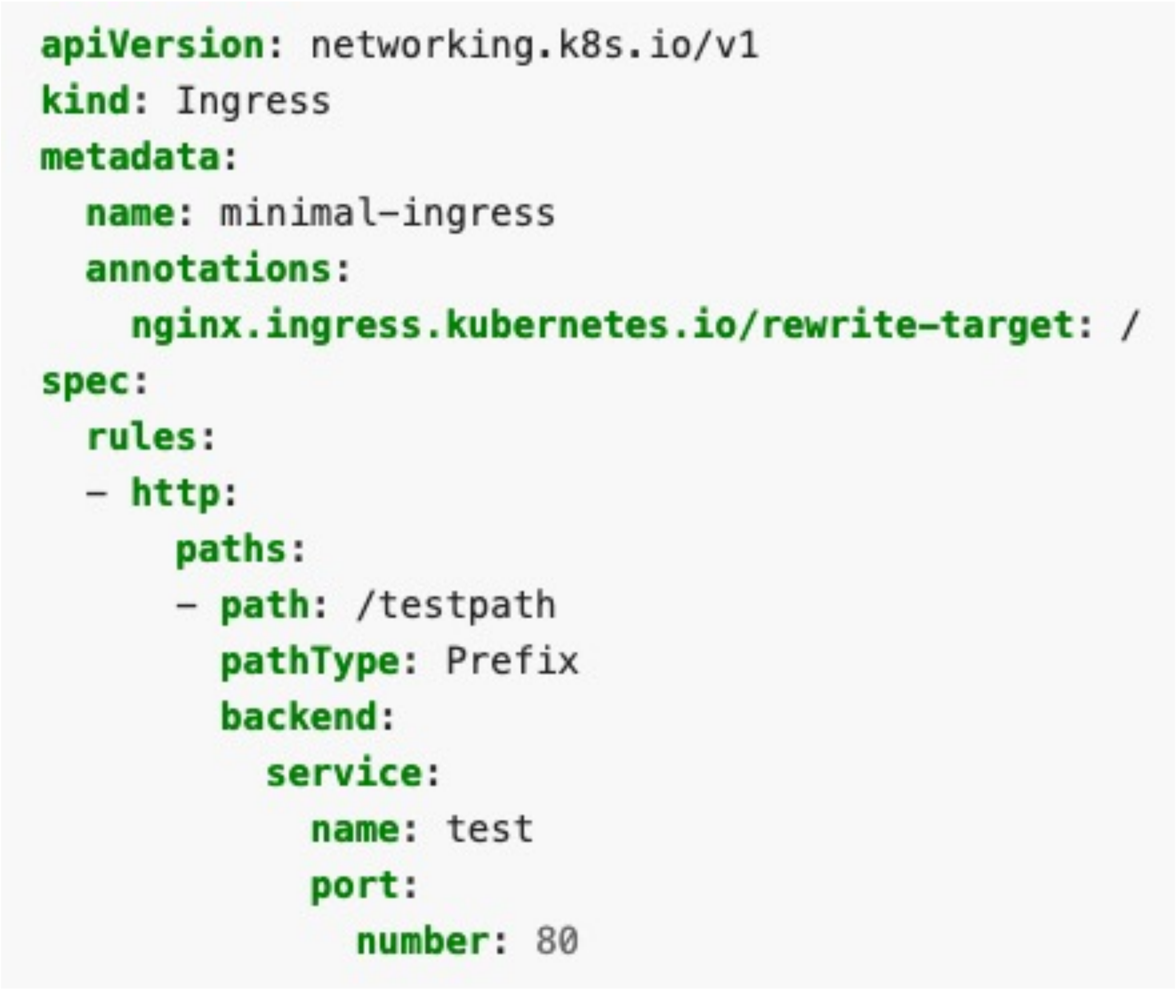
Ingress & IngressClass

- networking.k8s.io/v1 (available since v1.19)
- removals
  - extensions/v1beta1
  - networking.k8s.io/v1beta1
- no notable changes for IngressClass
- notable changes for Ingress
  - many fields are renamed/moves
  - pathType is now required

Ingress



```yaml
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: test-ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  rules:
  - http:
      paths:
      - path: /testpath
        pathType: Prefix
        backend:
          serviceName: test
          servicePort: 80
```



```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: minimal-ingress
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  rules:
  - http:
      paths:
      - path: /testpath
        pathType: Prefix
        backend:
          service:
            name: test
            port:
              number: 80
```

Ingress – things to verify

- verify whether you Ingress implementation supports v1
- also migrate your kubernetes.io/ingress.class annotation to the spec.ingressClassName field
- in general: Review all existing Ingress manifests

CustomResourceDefintion

- apiextensions.k8s.io/v1 (available since v1.16)
- removals
  - apiextensions.k8s.io/v1beta1
- notable changes
  - spec.scope no longer defaults to Namespaced
  - multiple fields have been restructured/moved
    - mostly related to the new spec.versions field
- verify whether your third-party tools support v1!

Webhook resources

- relates to MutatingWebhookConfiguration and ValidatingWebhookConfiguration
- admissionregistration.k8s.io/v1 (available since v1.16)
- removals
  - admissionregistration.k8s.io/v1beta1
- notable changes
  - multiple default values have changed
  - webhooks[*].name needs to be unique
- review your third-party tools!

Further removals #1

- SubjectAccessReview: authorization.k8s.io/v1beta1
  - relates to LocalSubjectAccessReview, SelfSubjectAccessReview, SubjectAccessReview
  - authorization.k8s.io/v1 (available since v1.6)
  - notable changes
    - spec.group was renamed to spec.groups
- CertificateSigningRequest: certificates.k8s.io/v1beta1
  - certificates.k8s.io/v1 (available since v1.19)
  - notable changes
    - some/new fields are required now

Further removals #2 (no notable changes)

- RBAC resources: rbac.authorization.k8s.io/v1beta1
  - relates to ClusterRole, ClusterRoleBinding, Role, and RoleBinding
  - rbac.authorization.k8s.io/v1 (available since v1.8)
- Storage resources: storage.k8s.io/v1beta1
  - relates to CSIDriver, CSINode, StorageClass, VolumeAttachment
  - storage.k8s.io/v1 (available since v1.6 to v 1.19)

Further removals #3 (no notable changes)

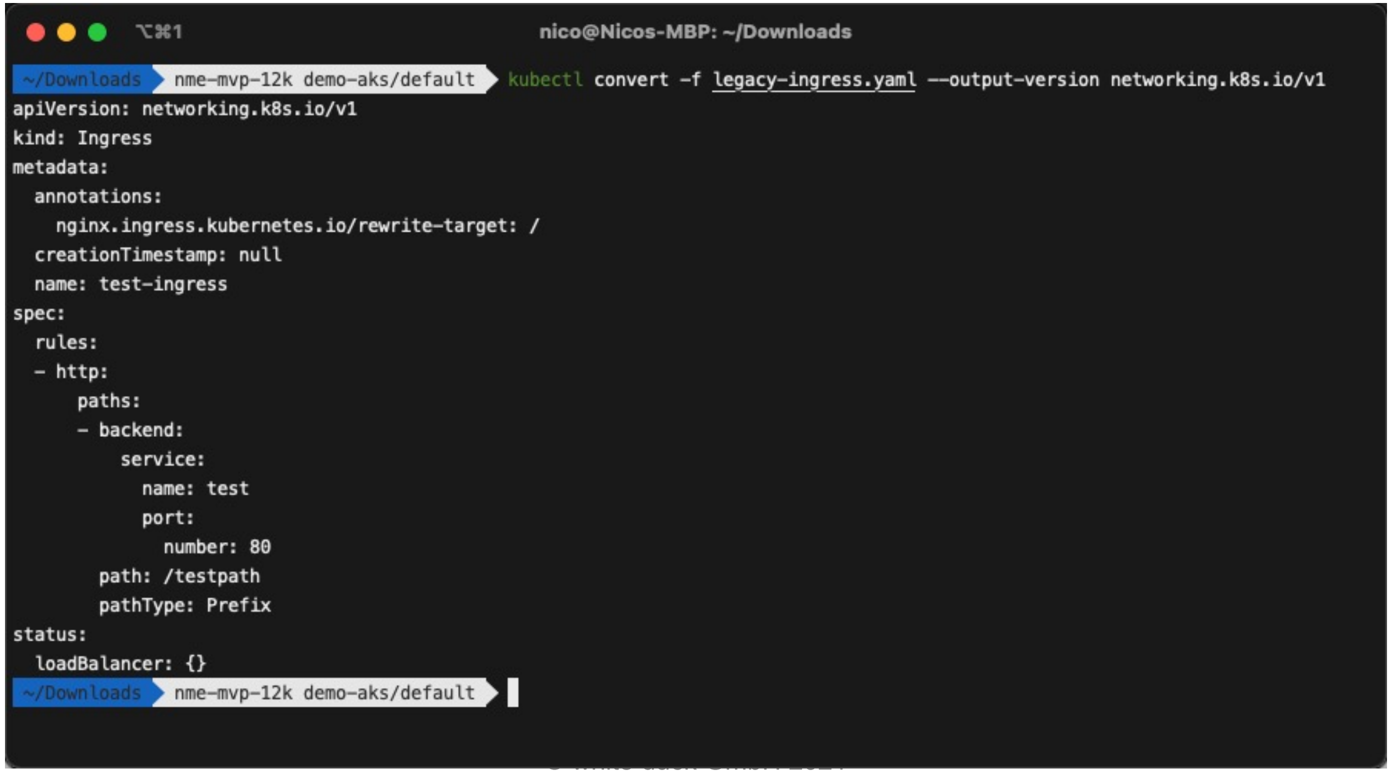
- PriorityClass: scheduling.k8s.io/v1beta1
  - scheduling.k8s.io/v1 (available since v1.14)
- APIService: apiregistration.k8s.io/v1beta1
  - apiregistration.k8s.io/v1 (available since v1.10)
- Lease: coordination.k8s.io/v1beta1
  - coordination.k8s.io/v1 (available since v1.14)

Demo: Verify your API versions

- you can verify your API versions manually, via CI/CD and in-cluster
- tools to use manually & CI/CD
  - https://github.com/doitintl/kube-no-trouble
  - https://github.com/FairwindsOps/pluto
  - https://github.com/yannh/kubeconform
- tools to use in-cluster
  - https://kyverno.io/policies/best-practices/check_deprecated_apis/
- kubectl API warnings (stable since 1.22)

Demo: kubectl convert

- a plugin for kubectl
- helps you upgrading your manifests



```
~/Downloads  nme-mvp-12k demo-aks/default  kubectl convert -f legacy-ingress.yaml --output-version networking.k8s.io/v1
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
  creationTimestamp: null
  name: test-ingress
spec:
  rules:
  - http:
      paths:
      - backend:
          service:
            name: test
            port:
              number: 80
        path: /testpath
        pathType: Prefix
status:
  loadBalancer: {}
~/Downloads  nme-mvp-12k demo-aks/default 
```

Links

- https://github.com/whiteducksoftware/cloud-native-rosenheim-meetup
- https://kubernetes.io/blog/2021/08/04/kubernetes-1-22-release-announcement
- https://kubernetes.io/blog/2021/07/14/upcoming-changes-in-kubernetes-1-22
- https://sysdig.com/blog/kubernetes-1-22-whats-new
- https://blog.aquasec.com/kubernetes-version-1.22-security-features
- https://kubernetes.io/docs/reference/using-api/deprecation-guide
- https://kubernetes.io/docs/reference/using-api/deprecation-policy
- https://kubernetes.io/docs/concepts/security/pod-security-admission/
- https://kubernetes.io/blog/2021/09/03/api-server-tracing/
- https://kubernetes.io/docs/reference/command-line-tools-reference/feature-gates
- https://www.downloadkubernetes.com/ (kubectl convert)

Questions?

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