KubeCon

North America 2017

Effective RBAC

Jordan Liggitt, *@liggitt, Red Hat*

RBAC Overview

Role-Based Access Control

“Can _____ _____ _____ ?”

subject verb object

RBAC Overview

Role-Based Access Control

"Can Bob educate dolphins ?"

subject verb object

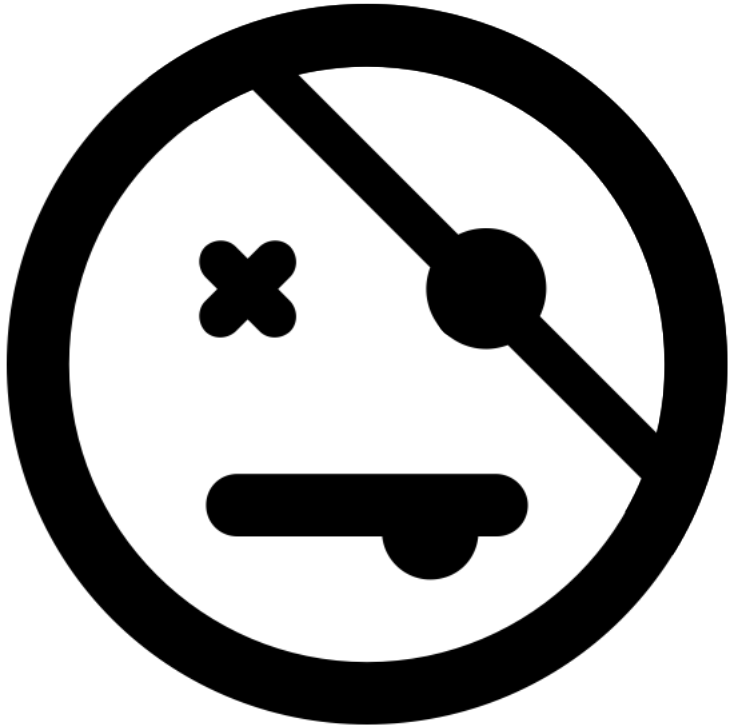
A Short Story

Bob

A Short Story

Bob

A Short Story



Bob

A Short Story

first mate of the green ship

help captain, train crew

A Short Story

role

first mate of the green ship

help captain, train crew

A Short Story

role → first mate of the green ship

permissions → help captain, train crew

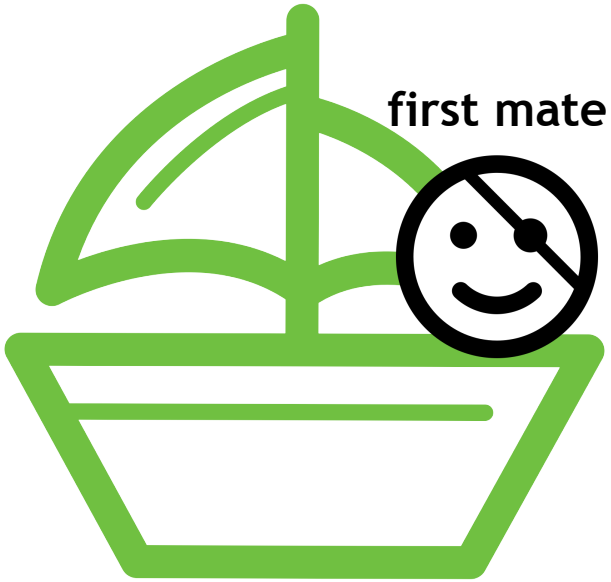
A Short Story

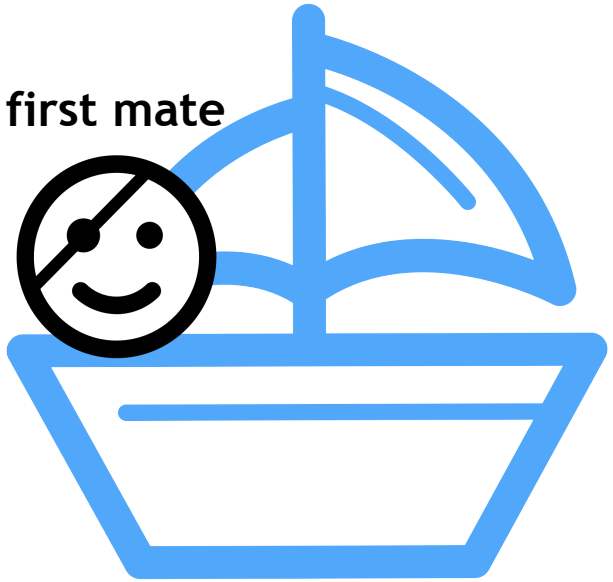
role → first mate of the green ship ← location

permissions → help captain, train crew

A Short Story

first mate: help captain, train crew

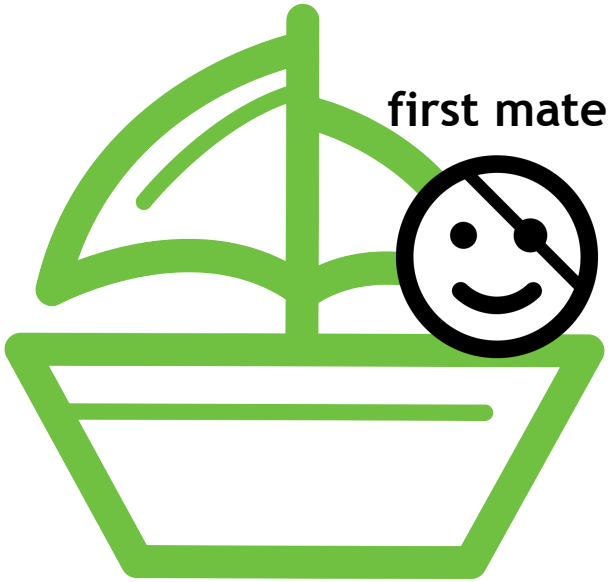


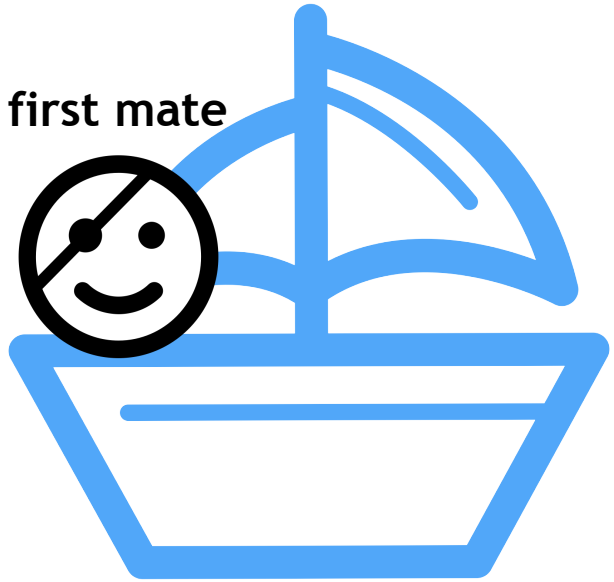


A Short Story

defined globally

first mate: help captain, train crew





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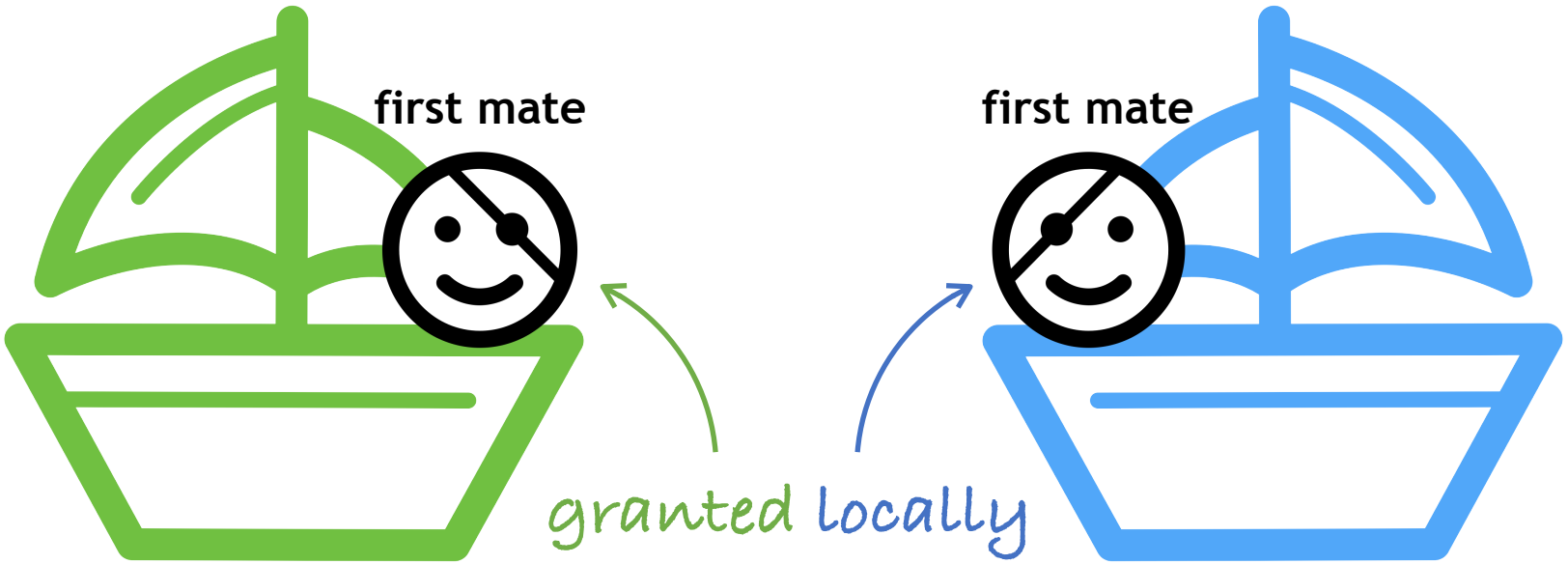
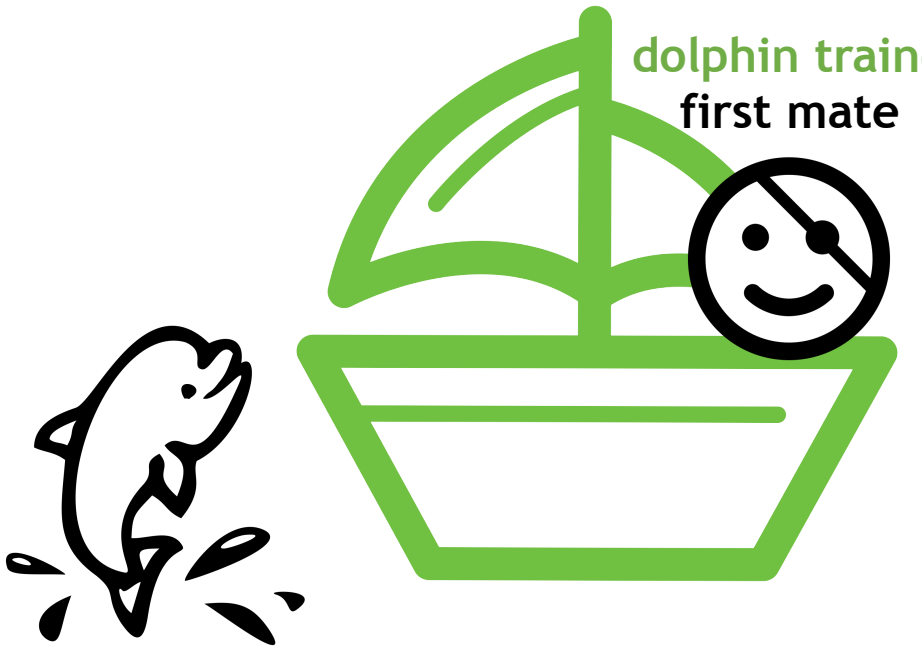


A Short Story

A Short Story

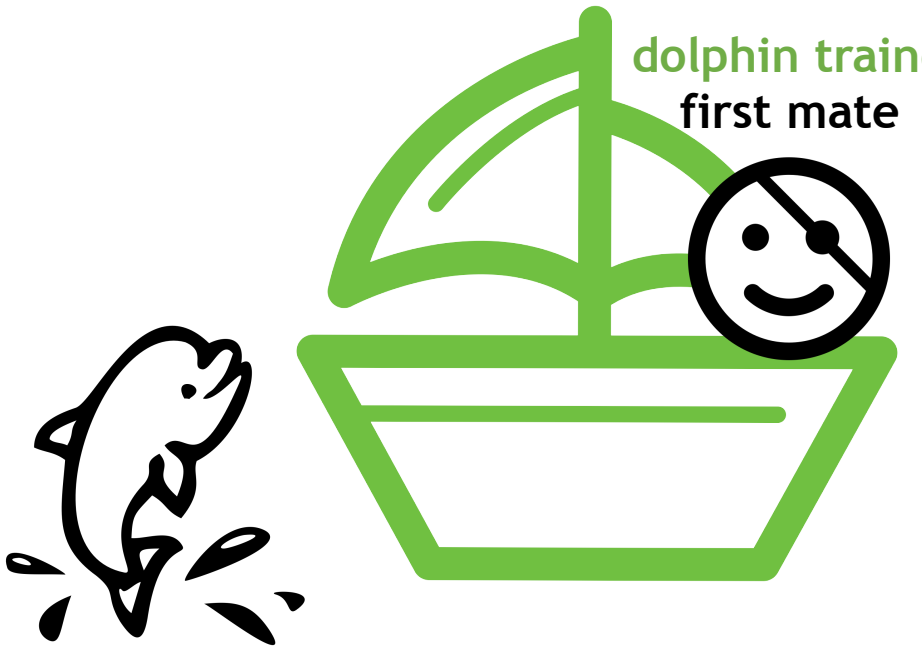
dolphin trainer: educate dolphins



A Short Story

defined locally

dolphin trainer: educate dolphins



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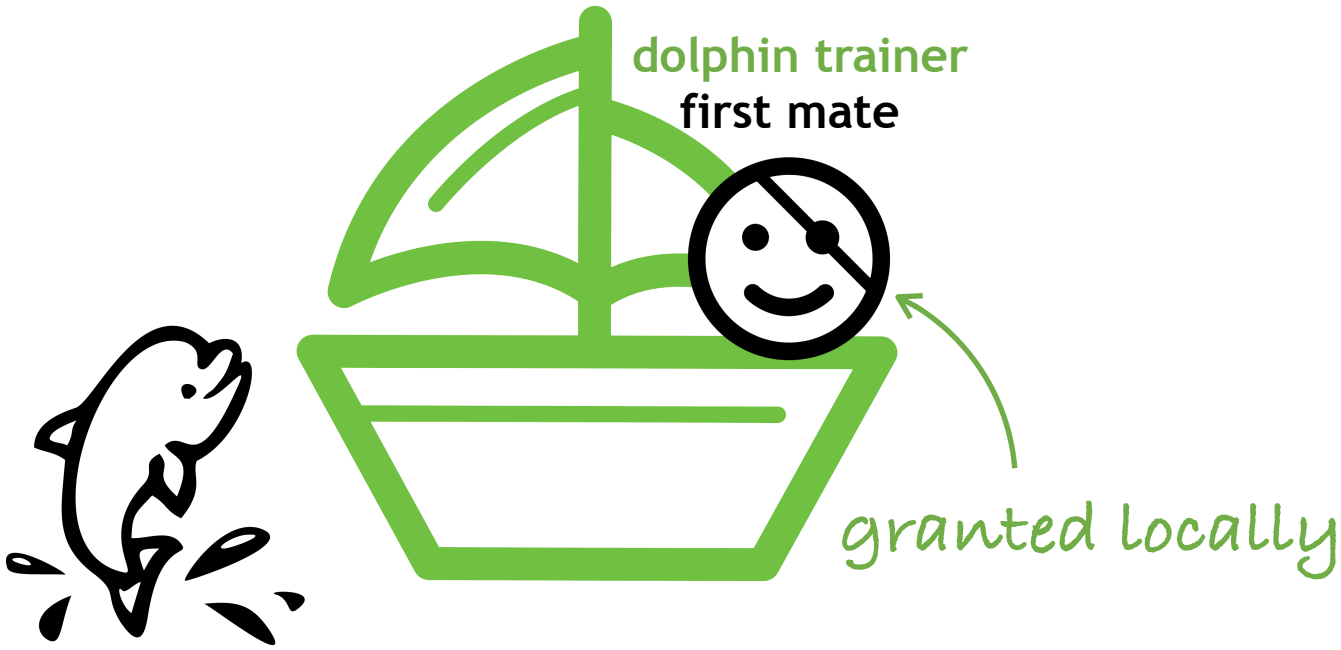
dolphin trainer: educate dolphins



A Short Story

“Can Bob educate dolphins ?”

subject verb object

on the green ship

A Short Story

"Can Bob educate dolphins ?"

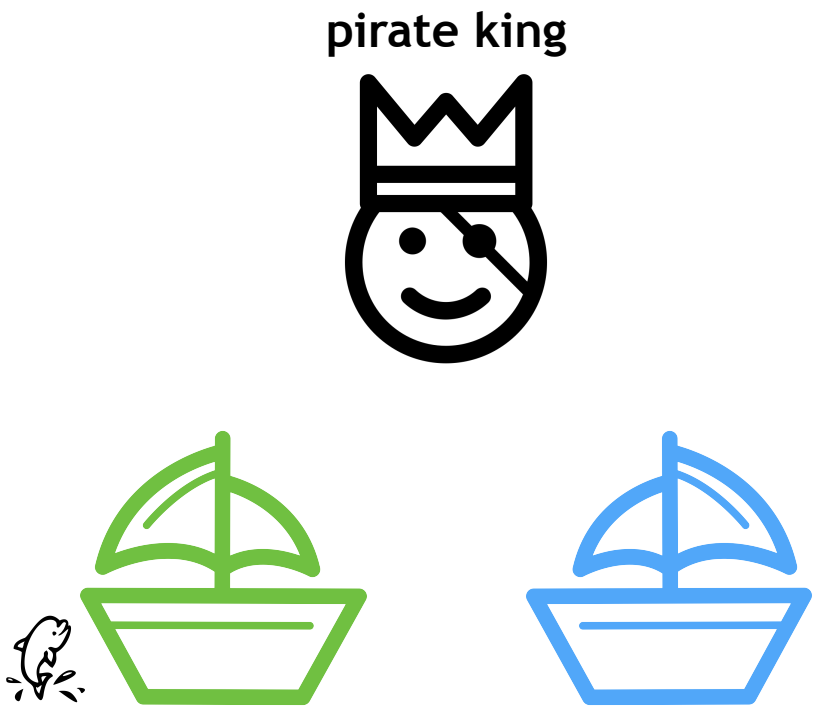
subject verb object

on the green ship

"Yes"

A Short Story

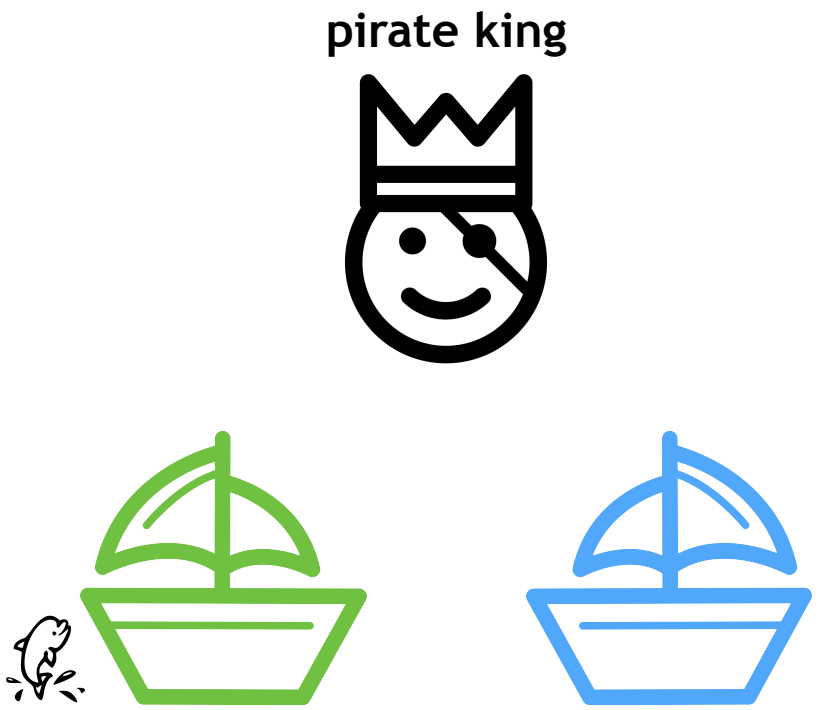
pirate king: command armada



A Short Story

defined globally

pirate king: command armada



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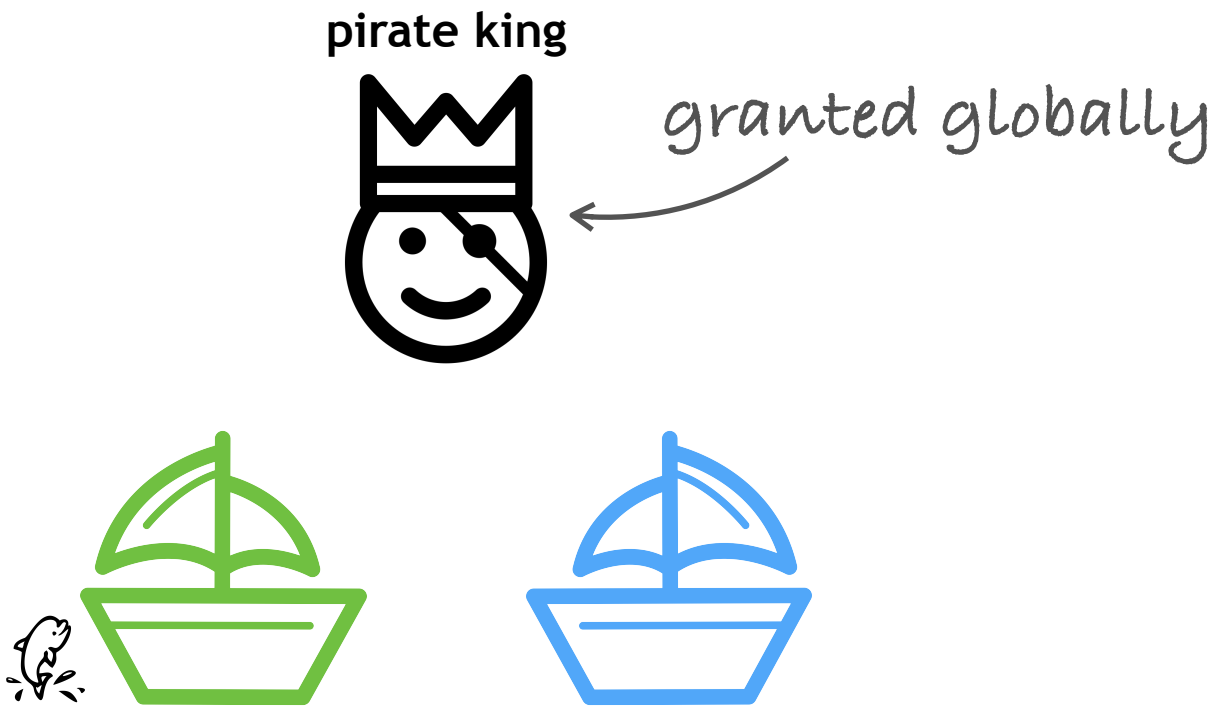
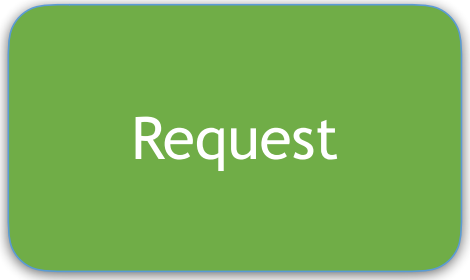


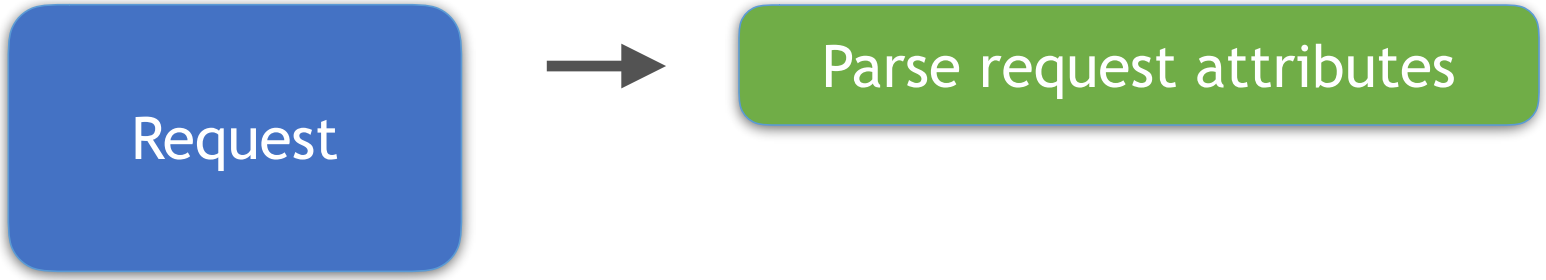
Request Handling




```
POST /apis/apps/v1/namespaces/ns1/deployments
Authorization: Bearer eyJhbGciOiJSUzI1NiI…
Content-Type: application/json
Accept: application/json

{"apiVersion":"v1","kind":"Deployment",…
```

Request Handling

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Verb	create
API group	apps
Namespace	ns1
Resource	deployments

Request Handling


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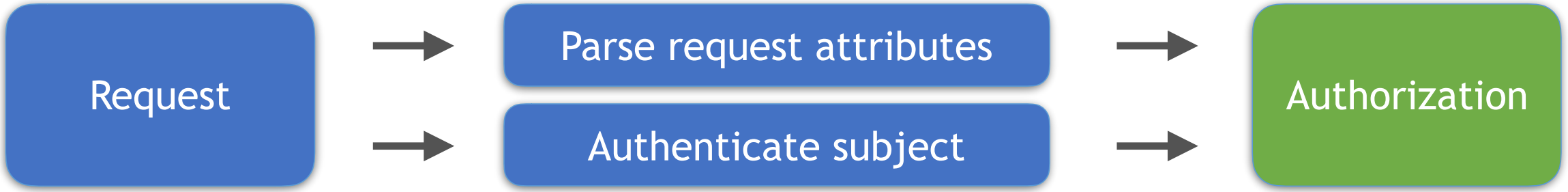
{"apiVersion":"v1","kind":"Deployment",…
```

Verb	create
API group	apps
Namespace	ns1
Resource	deployments

Username	bob
Groups	system:authenticated

Request Handling



Can bob in group system:authenticated
create
apps deployments in namespace ns1?

RBAC Overview

deployer in namespace ns1

create apps deployments

RBAC Overview

role

deployer in namespace ns1

create apps deployments

RBAC Overview

role

deployer in namespace ns1

permissions

create apps deployments

RBAC Overview

role → deployer in namespace ns1 ← location

permissions → create apps deployments

RBAC Overview

```
kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
    name: deployer
    namespace: ns1
```

RBAC Overview

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kind: Role
apiVersion: rbac.authorization.k8s.io/v1
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rules:
- verbs: ["create"]
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```

```
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
    name: bob-deployer
    namespace: ns1
```

RBAC Overview

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    namespace: ns1

roleRef:
    kind: Role
    apiGroup: rbac.authorization.k8s.io
    name: deployer
```

RBAC Overview

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subjects:
- kind: User
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RBAC Overview

defined locally

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RBAC Overview

defined globally

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```

RBAC Overview

Define permissions in a ClusterRole object…

- … if the resources are cluster-scoped
- … if you want to reference the role from multiple namespaces
- … if you want to give cluster-wide access

```
kubectl get pods ––all–namespaces
```

RBAC Overview

Define permissions in a Role object…

- … if the resources are namespaced and
  you only want to reference the role from one namespace

RBAC Overview

Grant a ClusterRole with a ClusterRoleBinding object…

- … if the resources are cluster-scoped
- … if you want to give cluster-wide access

```
kubectl get pods --all-namespaces
```

RBAC Overview

Grant a ClusterRole or Role with a RoleBinding object…

- … if the resources are namespaced and
  you want to limit access to a particular namespace

Cluster Setup

1 step process:

Use a distribution or installer that sets up RBAC for you

Cluster Setup

```
kube-apiserver --authorization-mode=RBAC
```

Cluster Setup

- Default roles
- Default role bindings to `system:…` user names

https://kubernetes.io/docs/admin/authorization/rbac/#default-roles-and-role-bindings

Cluster Setup

Bootstrap superuser

- Set up a credential with the `system:masters` group
- Use for setup, delegation, “break glass in case of emergency”

Cluster Setup

Control plane components

- kube-scheduler
  - create a credential for `system:kube-scheduler`
- kube-controller-manager
  - create a credential for `system:kube-controller-manager`
  - run with `--use-service-account-credentials` for control loops
- kube-proxy
  - create a credential for `system:kube-proxy`

Cluster Setup

Kubelets

- Enable Node authorization mode and NodeRestriction admission plugin

```
kube-apiserver --authorization-mode=Node,RBAC \
  --admission-control=…,NodeRestriction,…
```

- Create a credential per node
  - username "`system:node:<nodeName>`"
  - group "`system:nodes`"
  - Node TLS bootstrapping sets up well-formed credentials

Cluster Setup

Add-ons

- Many already include RBAC role definitions
- For those that don't, grant roles to their service accounts

Applying Policies

General purpose default ClusterRoles:

- cluster-admin: superuser
- admin, edit, view: namespaced user roles

https://kubernetes.io/docs/admin/authorization/rbac/#user-facing-roles

Applying Policies

Best: Grant a role to an application-specific service account

```
kubectl create rolebinding my-service-account-binding \
  --clusterrole=view \
  --serviceaccount=my-namespace:my-service-account \
  --namespace=my-namespace
```

Applying Policies

OK: Grant a role to the “default” service account in a namespace

```
kubectl create rolebinding default-service-account-binding \
  --clusterrole=view \
  --serviceaccount=my-namespace:default \
  --namespace=my-namespace
```

Applying Policies

OK: Grant a role to all service accounts in a namespace

```
kubectl create rolebinding all-service-accounts-binding \
  --clusterrole=view \
  --group=system:serviceaccounts:my-namespace \
  --namespace=my-namespace
```

Applying Policies

Less than ideal: run as superuser

```
kubectl create clusterrolebinding my-superuser-binding \
  --clusterrole=cluster-admin \
  --serviceaccount=my-namespace:my-service-account
```

Building Custom Roles

Option 1:

- Know every API call an app makes
- Enjoy hand-editing RBAC YAML

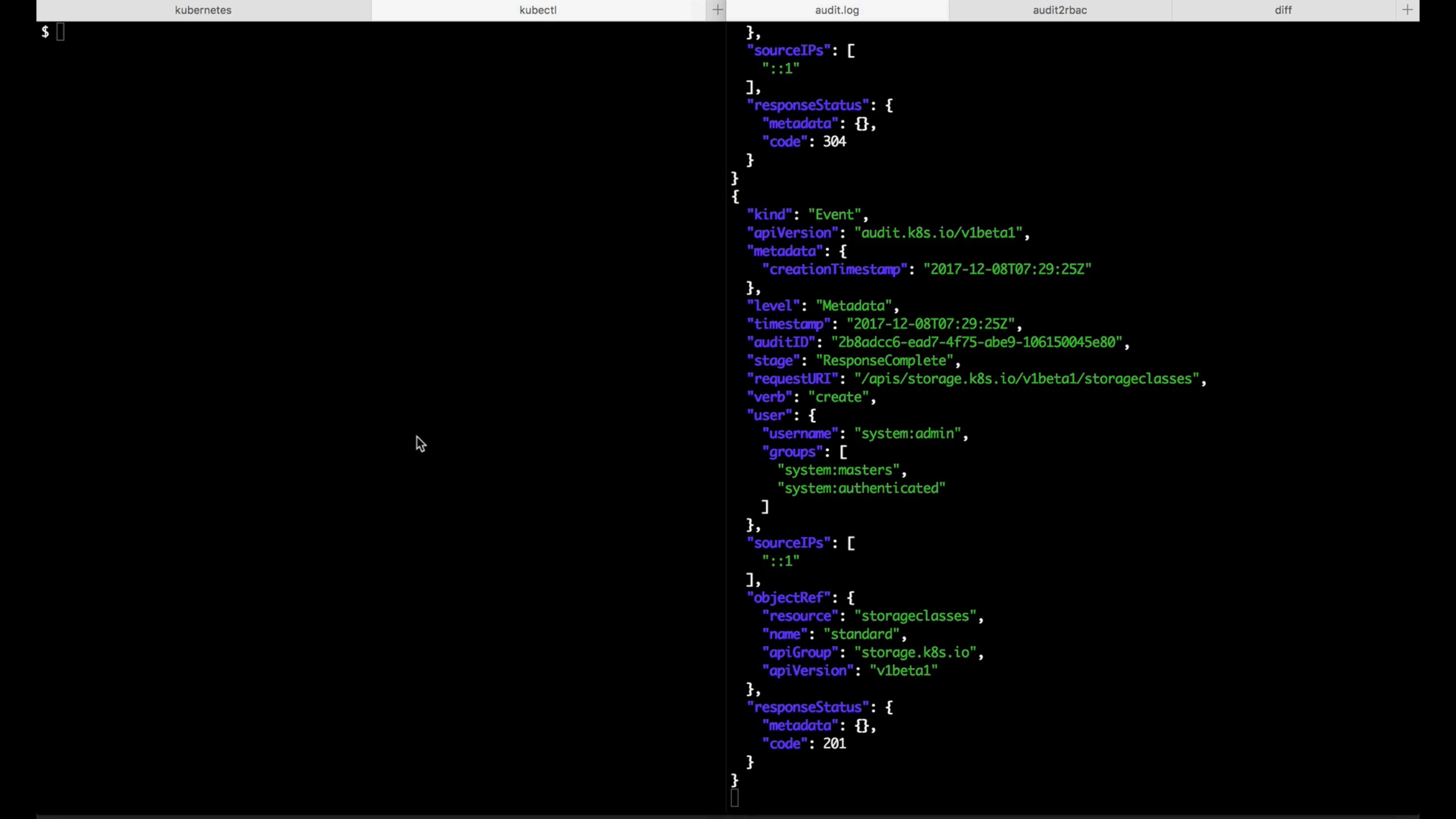
Building Custom Roles

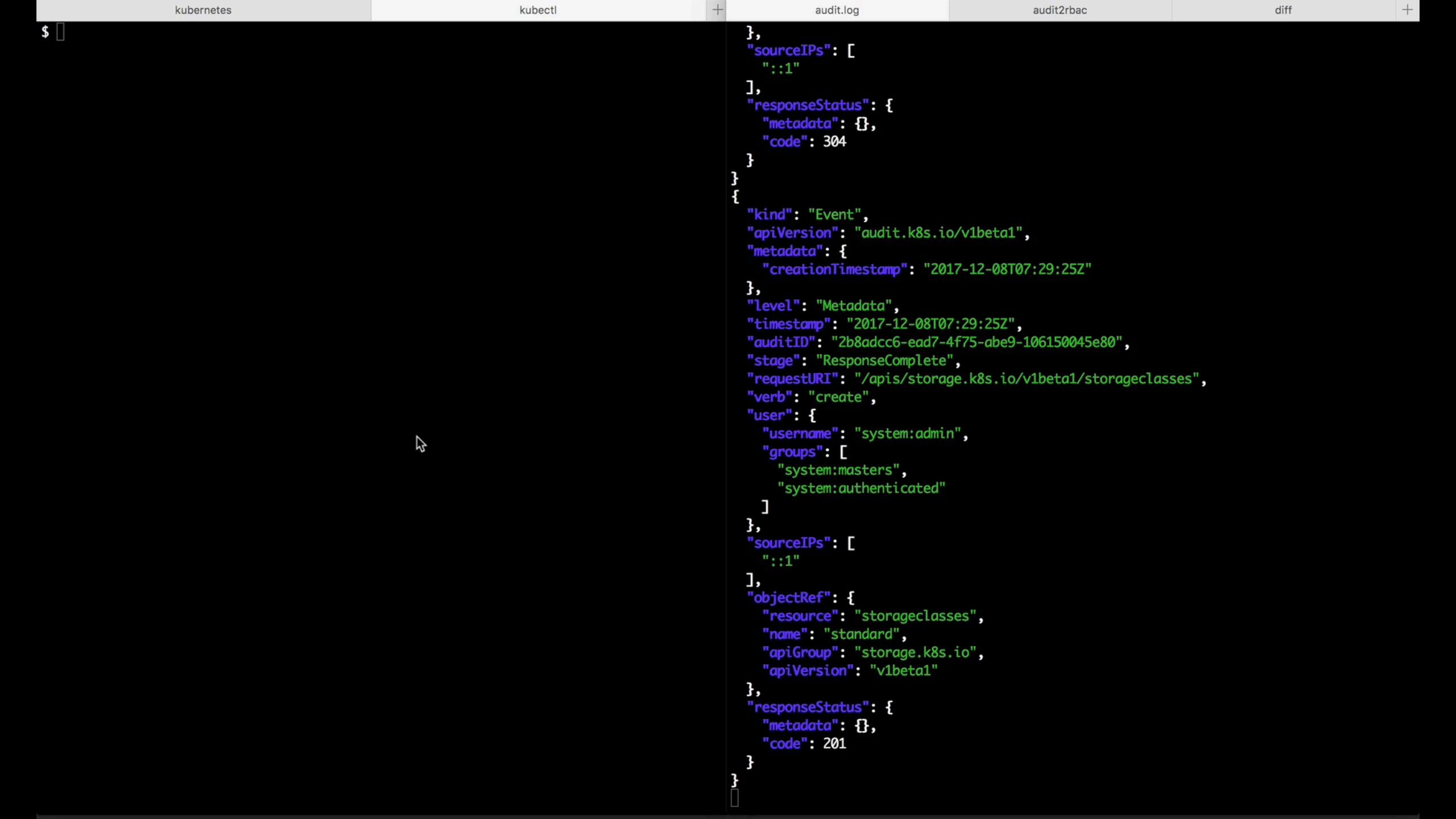
Option 2:

1. Enable audit logs
   - https://kubernetes.io/docs/tasks/debug-application-cluster/audit/
2. Run application with a dedicated service account
3. Capture audit logs for that service account
4. Generate a role (or set of roles) that allow the requests

Building Custom Roles

Demo


kubernetes
kubectl
audit.log
audit2rbac
diff
$
},
"sourceIPs": [
"::1"
],
"responseStatus": {
"metadata": {},
"code": 304
}
}
{
"kind": "Event",
"apiVersion": "audit.k8s.io/v1beta1",
"metadata": {
"creationTimestamp": "2017-12-08T07:29:25Z"
},
"level": "Metadata",
"timestamp": "2017-12-08T07:29:25Z",
"auditID": "2b8adcc6-ead7-4f75-abe9-106150045e80",
"stage": "ResponseComplete",
"requestURI": "/apis/storage.k8s.io/v1beta1/storageclasses",
"verb": "create",
"user": {
"username": "system:admin",
"groups": [
"system:masters",
"system:authenticated"
]
},
"sourceIPs": [
"::1"
],
"objectRef": {
"resource": "storageclasses",
"name": "standard",
"apiGroup": "storage.k8s.io",
"apiVersion": "v1beta1"
},
"responseStatus": {
"metadata": {},
"code": 201
}
}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"stage": "ResponseComplete",
"requestURI": "/apis/storage.k8s.io/v1beta1/storageclasses",
"verb": "create",
"user": {
"username": "system:admin",
"groups": [
"system:masters",
"system:authenticated"
]
},
"sourceIPs": [
"::1"
],
"objectRef": {
"resource": "storageclasses",
"name": "standard",
"apiGroup": "storage.k8s.io",
"apiVersion": "v1beta1"
},
"responseStatus": {
"metadata": {},
"code": 201
}
}

Building Custom Roles

Demo

Building Custom Roles

audit2rbac - https://github.com/liggitt/audit2rbac

- verb expansion
  - list → get+list+watch, update → patch+update
- multi-name inference
  - multiple names → any name
- multi-namespace inference
  - multiple namespaces → any namespace

Aggregated Roles

- Aggregated roles (new in 1.9)
- Easily contribute to default admin/edit/view cluster roles
- Label your ClusterRoles:
  - rbac.authorization.k8s.io/aggregate-to-admin="true"
  - rbac.authorization.k8s.io/aggregate-to-edit="true"
  - rbac.authorization.k8s.io/aggregate-to-view="true"

Aggregated Roles

```
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
    name: myco.acme.com:catset-admin
    labels:
        rbac.authorization.k8s.io/aggregate-to-admin="true"
        rbac.authorization.k8s.io/aggregate-to-edit="true"

rules:
- verbs: ["get","list","watch","create","update","patch","delete"]
    apiGroups: ["myco.acme.com"]
    resources: ["catsets"]
```

KubeCon

North America 2017

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http://bit.ly/effective-rbac