KUBERNETES ON OPENSTACK

Cluster creation, management and service deployment

12.06.2023 I TIM KREUZER

WHAT TO EXPECT

Why you‘re here and what you will learn

- Kubernetes in 3 minutes
- Create a kubernetes cluster on OpenStack
- Manage your cluster – Browser and CLI
- Deploy services – the easy way
- Deploy services – the right way

KUBERNETES

In (nearly) 3 minutes

- „Kubernetes, also known as K8s, is an open source system for managing containerized applications across multiple hosts. It provides basic mechanisms for deployment, maintenance, and scaling of applications.”

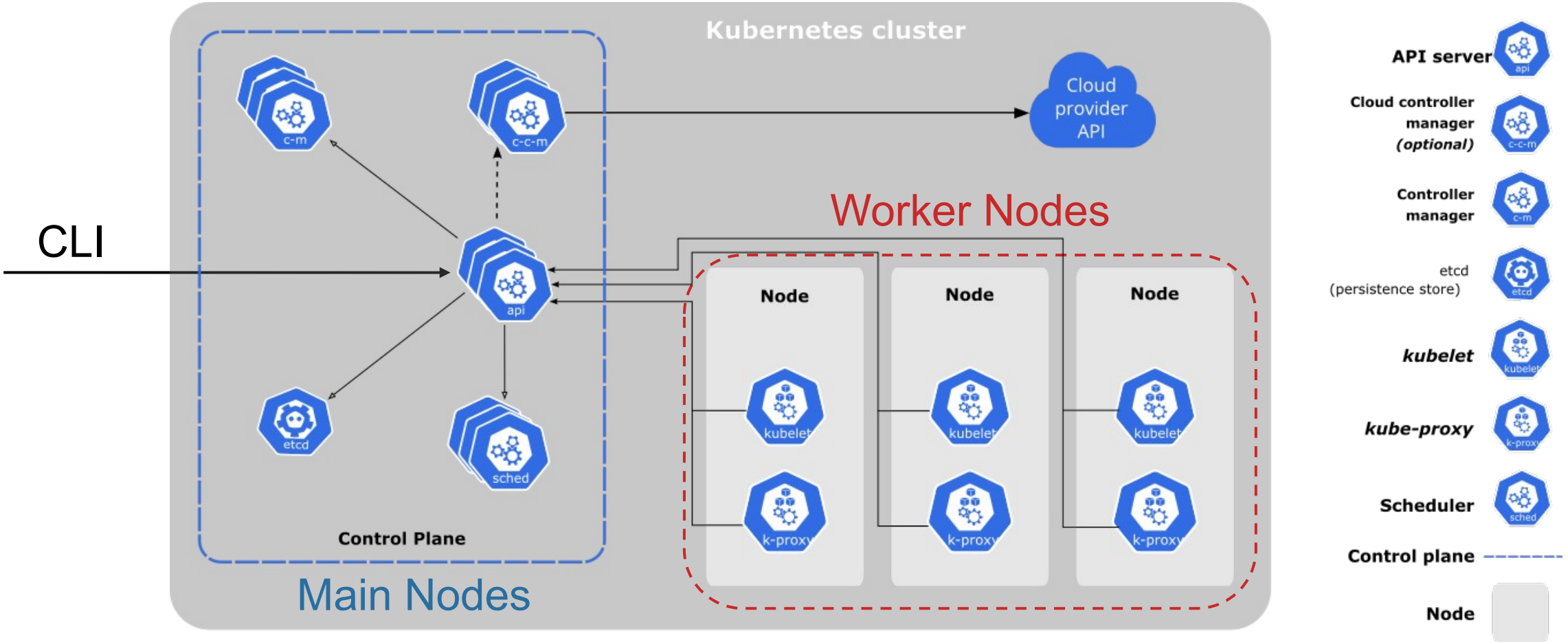
  github.com/kubernetes/kubernetes

- Features:
  - Load Balancing
  - Storage orchestration
  - Automated rollouts and rollbacks
  - Automated bin packing
  - Self-healing
  - Secret and configuration management

  kubernetes.io/docs/concepts/overview/

KUBERNETES

Architecture



kubernetes.io/docs/concepts/overview/components/

KUBERNETES

Resources

ConfigMap

Deployment

Service

- LoadBalancer
- NodePort
- ClusterIP

Pod

StorageClass

DaemonSet

StatefulSet

Secret

PersistentVolume

IngressClass

PersistentVolumeClaim

Ingress

KUBERNETES

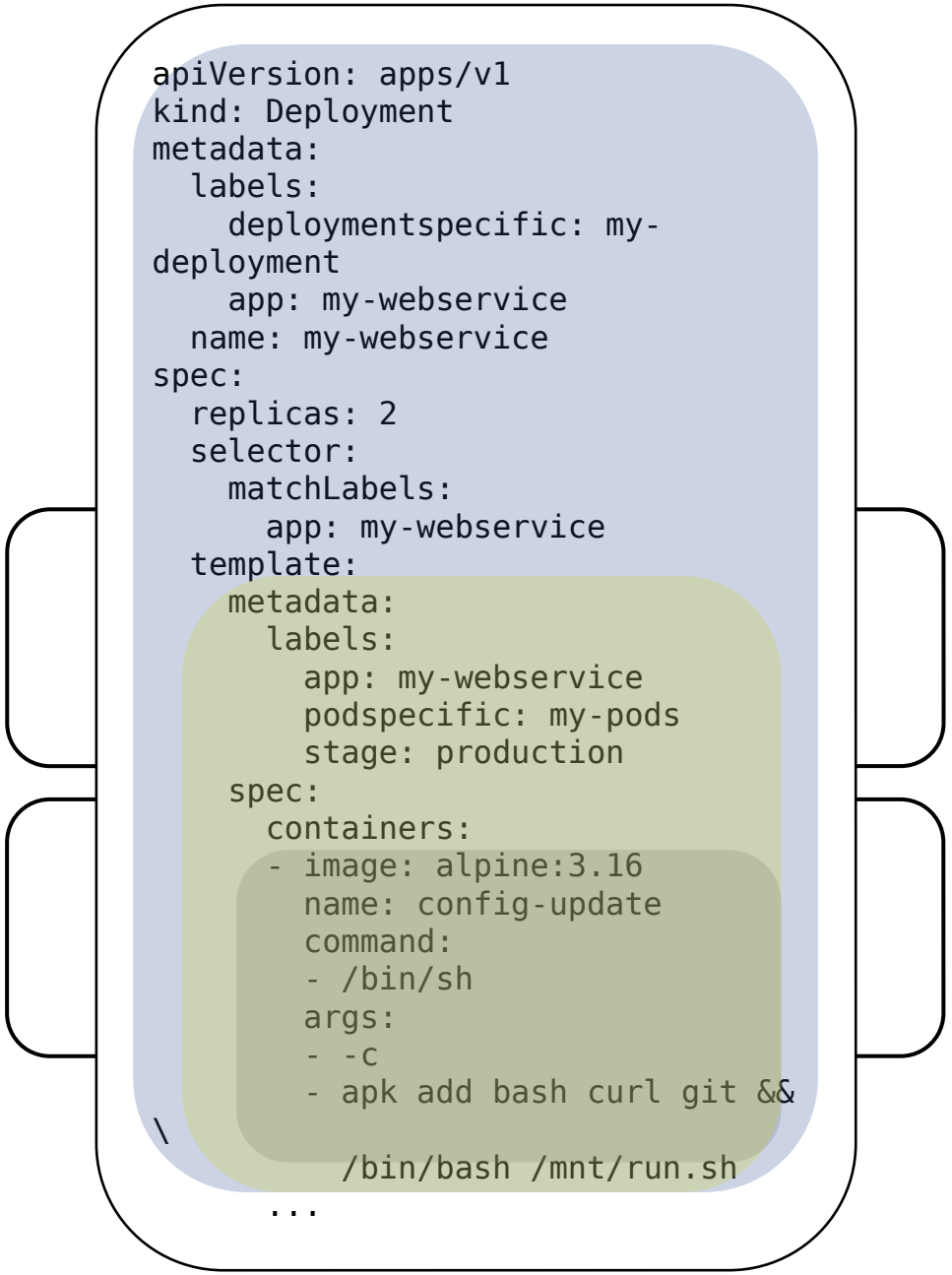
Resources - Deployment

Node / VM

Deployment

Pod

Container



```
apiVersion: apps/v1
kind: Deployment
metadata:
  labels:
    deploymentspecific: my-
deployment
    app: my-webservice
  name: my-webservice
spec:
  replicas: 2
  selector:
    matchLabels:
      app: my-webservice
  template:
    metadata:
      labels:
        app: my-webservice
        podspecific: my-pods
        stage: production
    spec:
      containers:
      - image: alpine:3.16
        name: config-update
        command:
        - /bin/sh
        args:
        - -c
        - apk add bash curl git &&
\
          /bin/bash /mnt/run.sh
      ...
```

C1: update config
C2: webservice
C3: serve static files

KUBERNETES

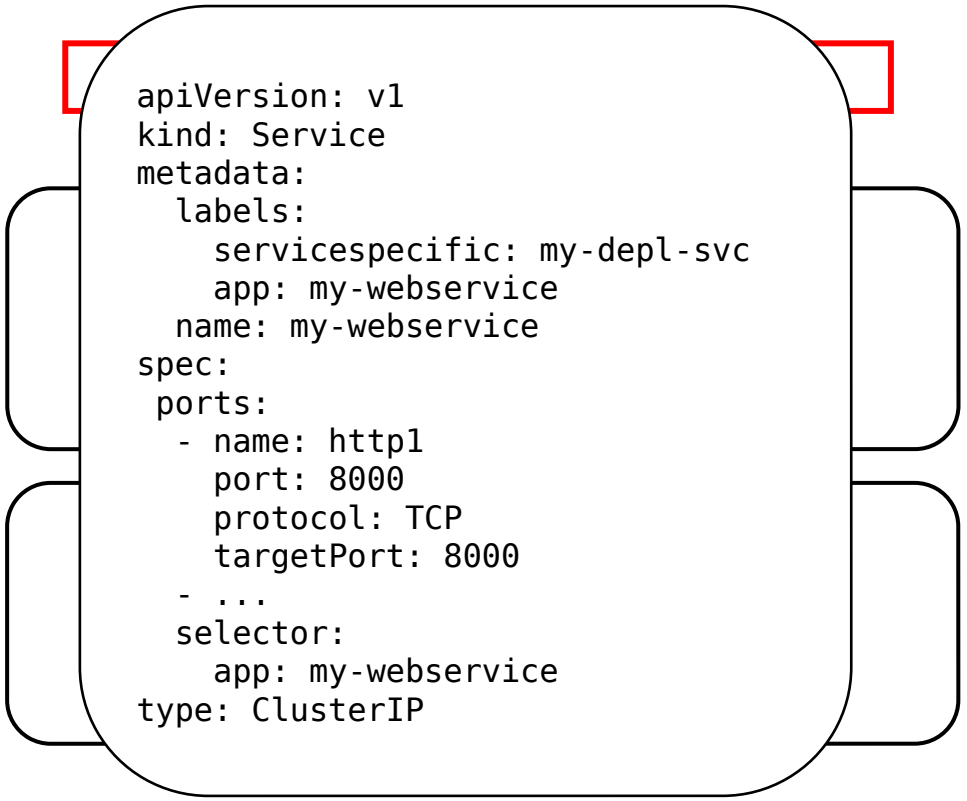
Resources - Service

Node / VM

Deployment

Pod

Container



```
apiVersion: v1
kind: Service
metadata:
  labels:
    servicespecific: my-depl-svc
    app: my-webservice
  name: my-webservice
spec:
 ports:
  - name: http1
    port: 8000
    protocol: TCP
    targetPort: 8000
  - ...
  selector:
    app: my-webservice
type: ClusterIP
```

Service

KUBERNETES

Resources - Ingress

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: webservice-ingress
spec:
  ingressClassName: nginx
  rules:
  - host: myws.fz-juelich.de
    http:
      paths:
      - backend:
          service:
            name: my-webservice
            port:
              number: 8000
        path: /
        pathType: Prefix
  - ...
  tls:
  - hosts:
    - myws.fz-juelich.de
    secretName: myws-certs
```

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OPENSTACK

Create a K8s cluster

rancher.com

RANCHER

Create a K8s cluster

- Multi-Cluster Management
- „Kubernetes-as-a-service“
- Integrated support for
  - Prometheus
  - Grafana
  - Fleet
- Including OpenStack driver

RANCHER

Create a K8s cluster

- OpenStack requirements:
  - Application credentials
  - SSH-Keypair
  - Network / Subnet
  - Security group for subnet
  - One „proxy“ VM

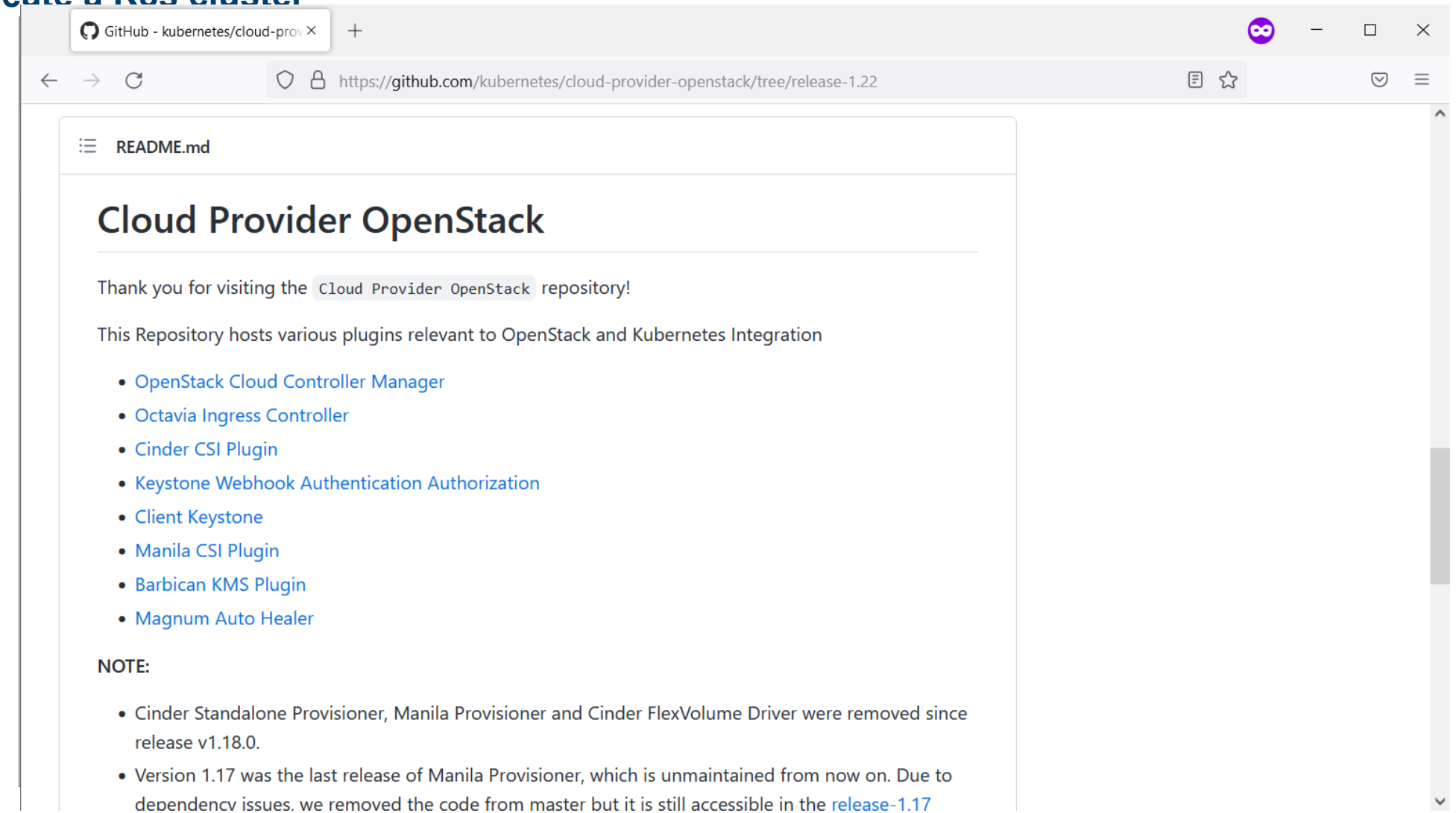
RANCHER

Create a K8s cluster

- „Proxy“ VM:
  - Add Floating IP
  - Accessible for administrators (134.94.0.0/16)
  - Install docker
  - `docker run -d --restart=unless-stopped --net=host --privileged rancher/rancher:v2.6`
- Customization:
  - Persistent Rancher storage (`-v ...:/var/lib/rancher`)
  - Certificate for rancher webservice (`-v ...:/etc/rancher/ssl/`)
  - Install nfs server for your services

RANCHER

Create a K8s cluster



PLUGINS

Connect Kubernetes and OpenStack

- Cloud Controller Manager
  - Manage load balancers

- Cinder CSI Plugin
  - Use cinder volumes as persistent storage

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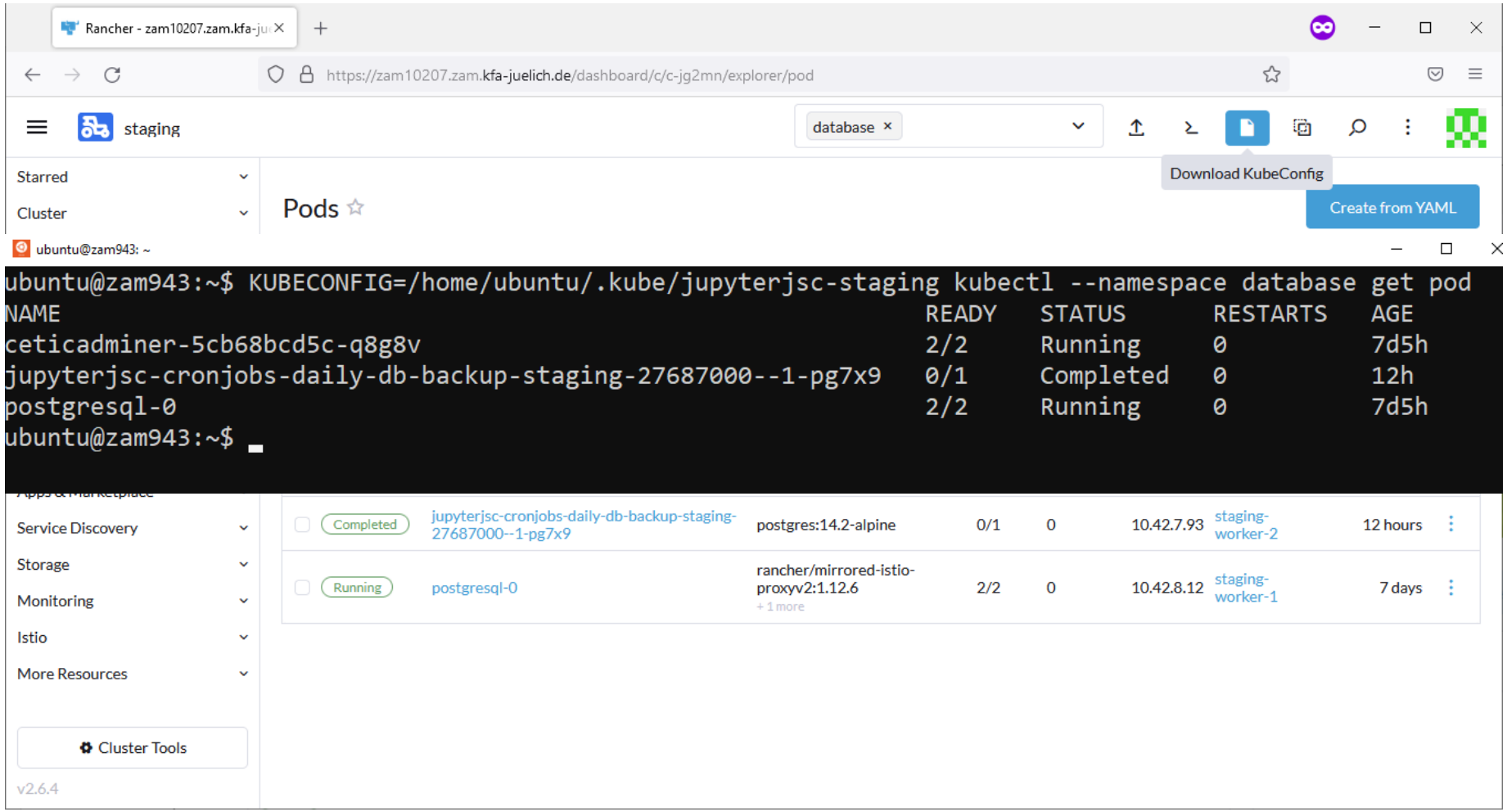
RANCHER

Manage your Cluster



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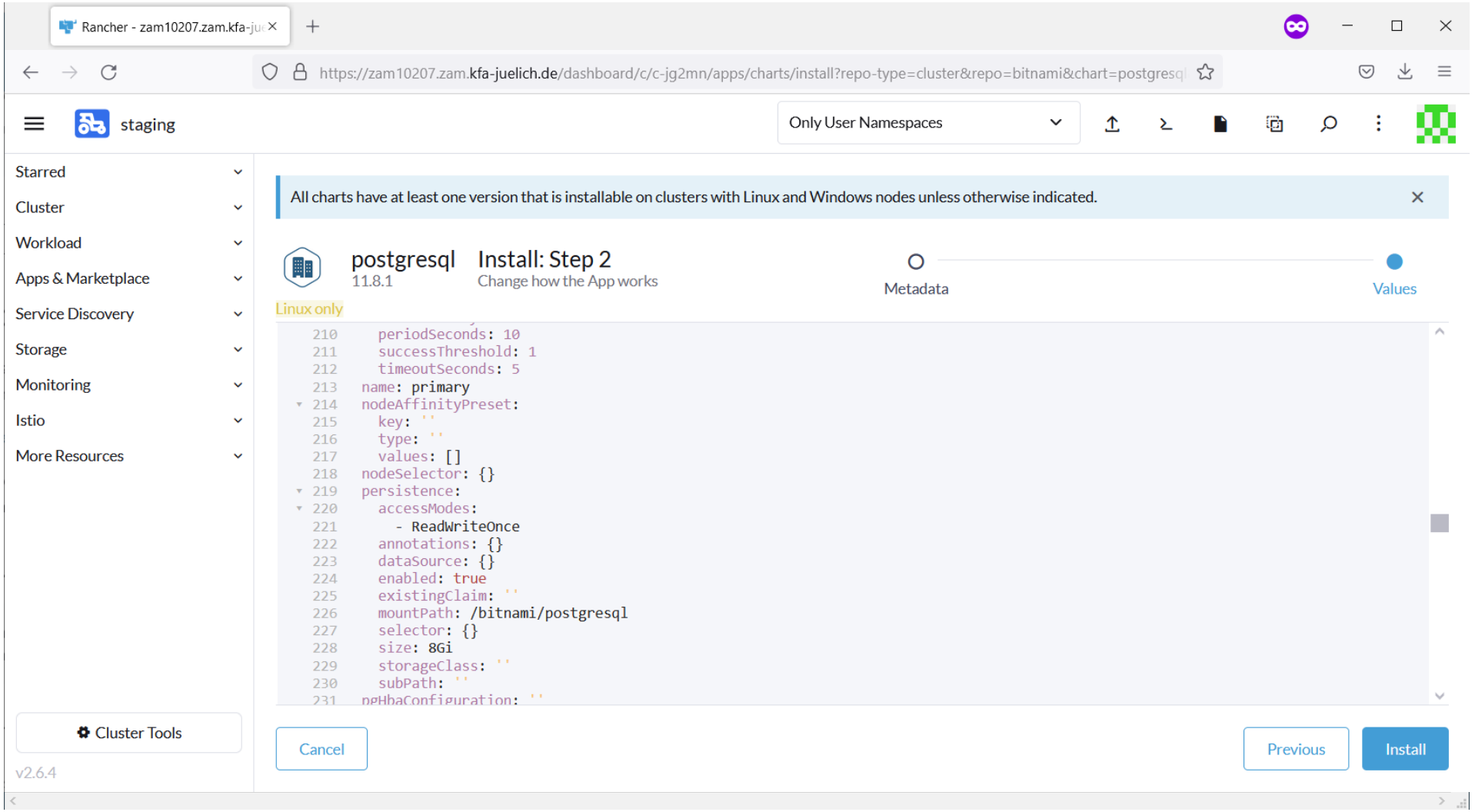
INSTALL SERVICES

Helm Charts

- Debian: apt – Fedora: yum – Kubernetes: helm
- Public repositories hosting thousands of charts
  - Listed at artifacthub.io
  - Used directly as git repository
- Versioning, rollouts, rollbacks
- Templates / parameters to fit your needs
- Create your own Helm charts

INSTALL SERVICES

Helm Charts



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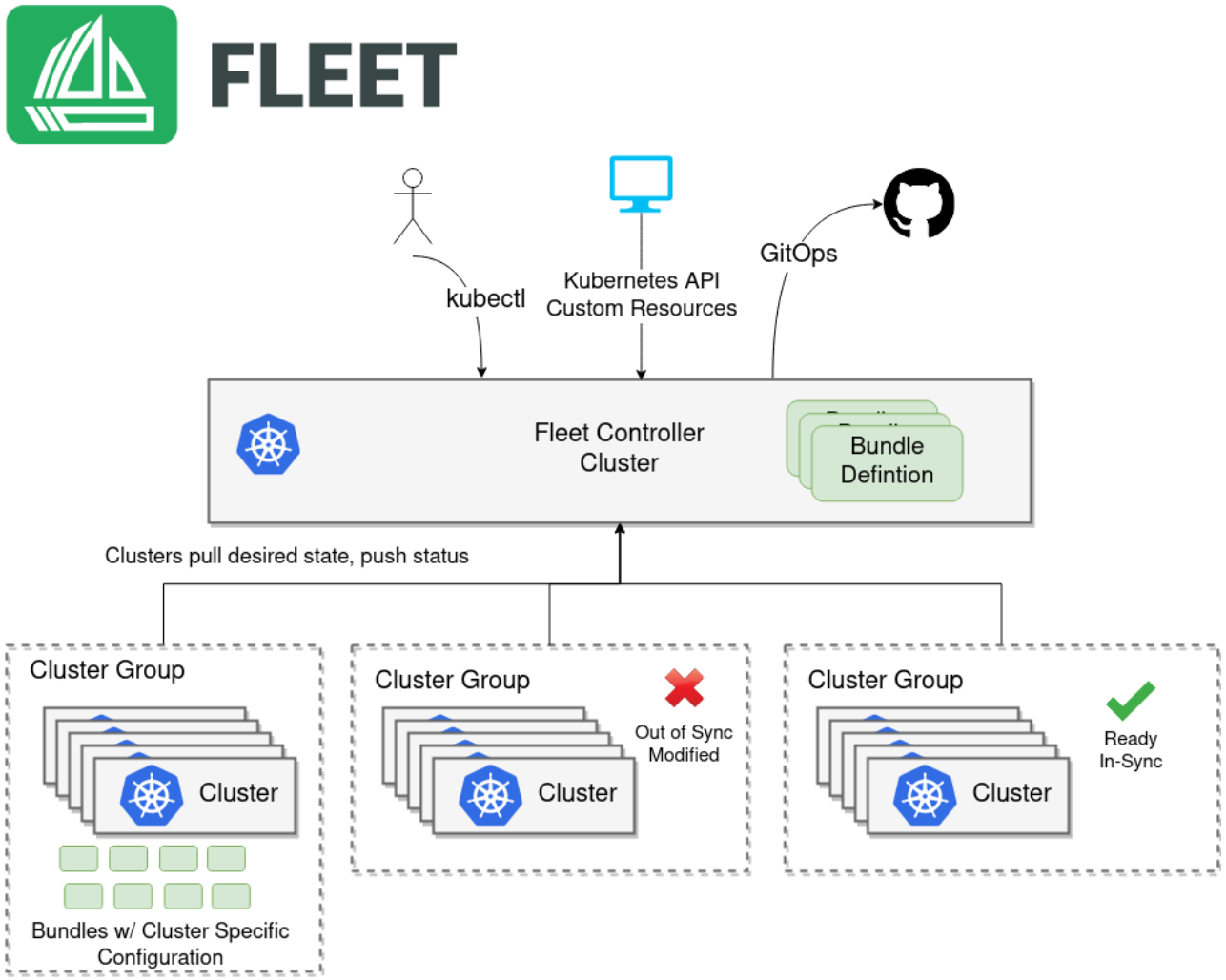
FLEET

Continuous Delivery

- Container management and deployment engine
- A Rancher project
- Integrated UI in Rancher
- GitOps – get desired cluster state from git
- Scalability – Manage up to a million clusters - or just one
- Cluster specific configuration possible

FLEET

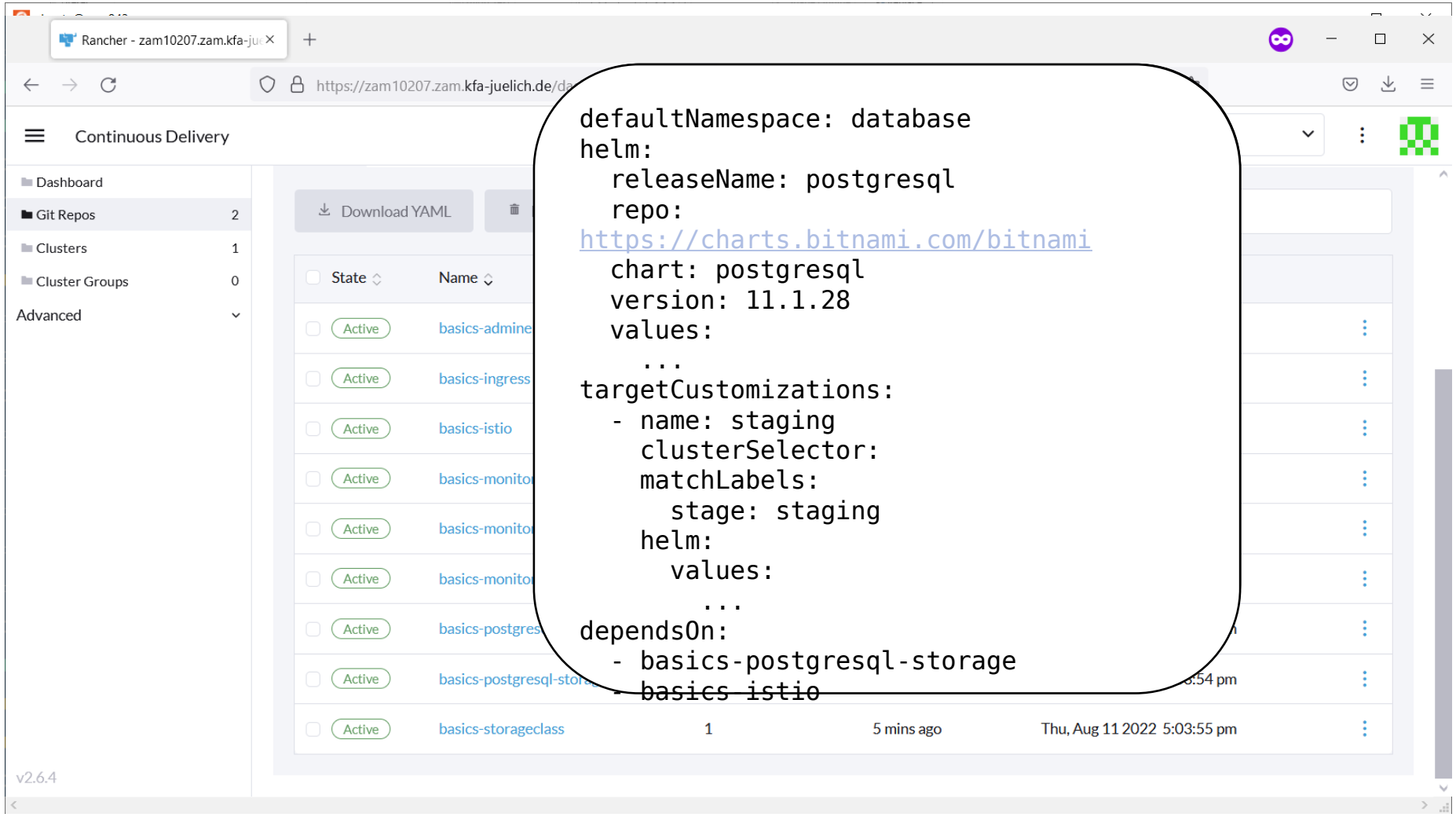
Continuous Delivery



fleet.rancher.io

FLEET

Continuous Delivery



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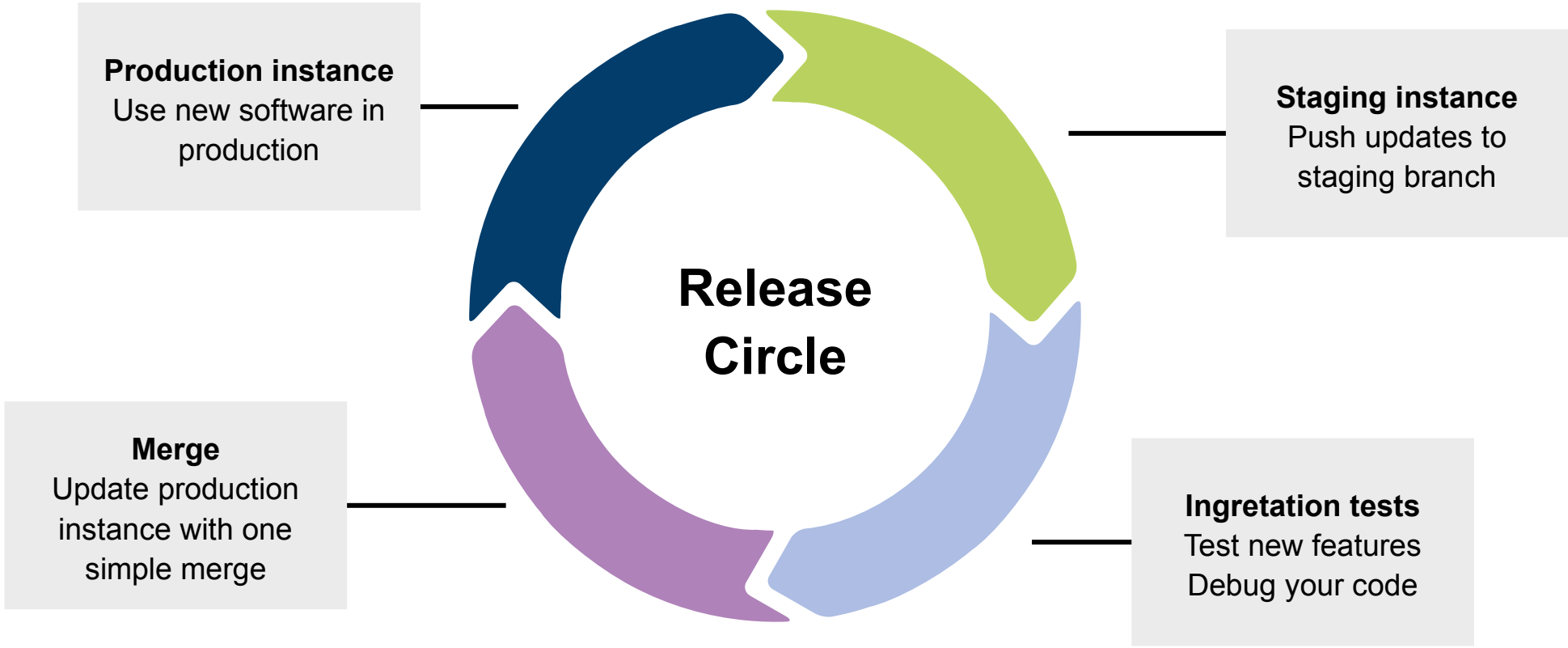
Continuous Delivery



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APPENDIX

Make life easier

- Monitoring with Prometheus & Grafana
- CLI – Manage multiple clusters in one terminal
- Local cluster with K3s
- How To Kubernetes – starting point

APPENDIX

Monitoring

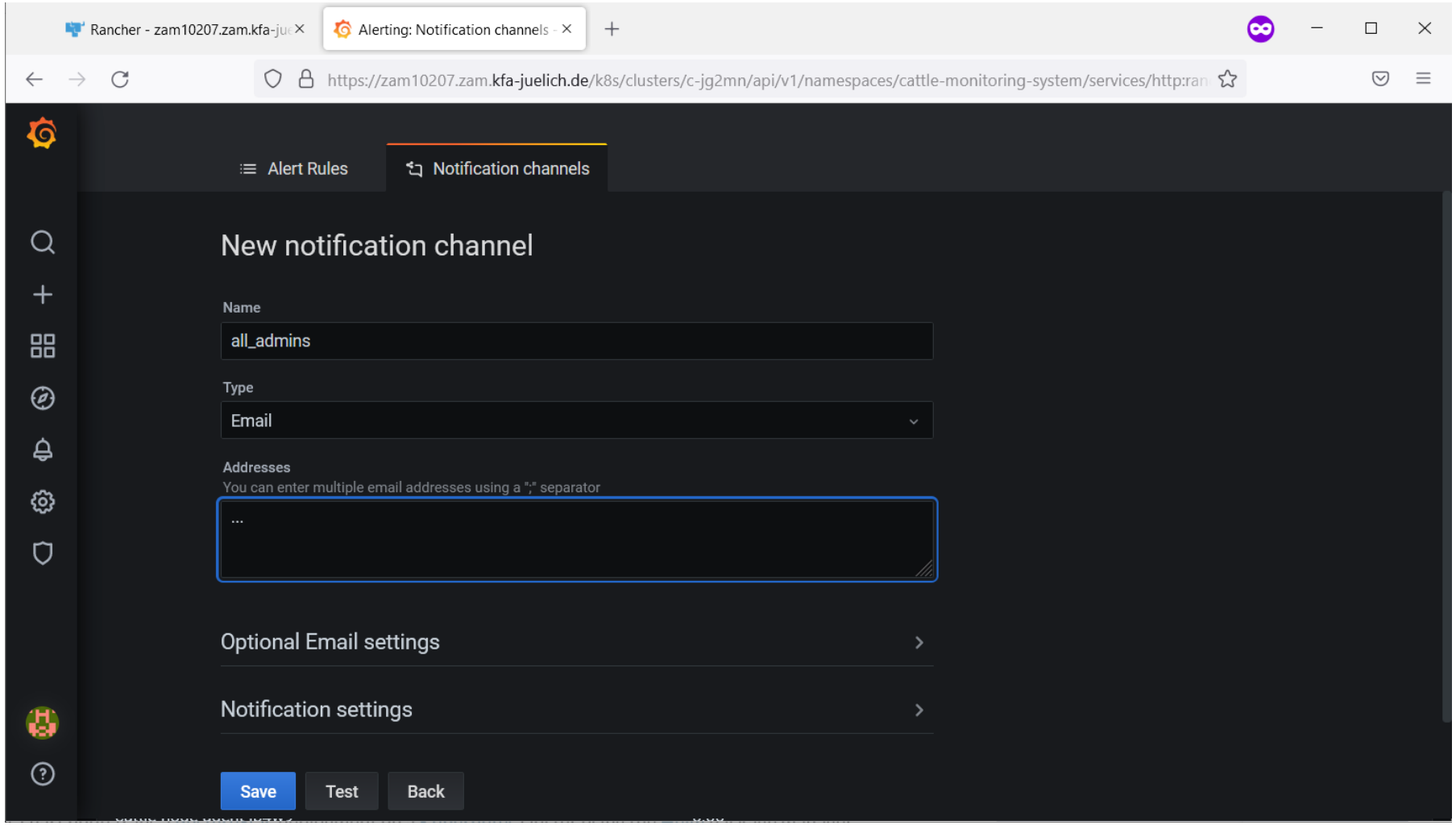
- Install Rancher monitoring app
- Integrated in Rancher UI
- More than 40 dashboards by default
- Add mail configuration to monitor chart
- Add Grafana alerts to monitor your services
- Default username/password: admin/prom-operator

values.yaml:

```
grafana.ini:
   smtp:
     enabled: true
     from_address: your-svc@fz-
juelich.de
     from_name: Your Service
     host: mail.fz-juelich.de:25
```

APPENDIX

Monitoring



JÜLICH Forschungszentrum

APPENDIX

Make life easier

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APPENDIX

CLI

- Install kubectl: https://kubernetes.io/docs/tasks/tools/install-kubectl-linux/
- Set env variable `KUBECONFIG` to your current cluster configuration
- Bash completion: https://kubernetes.io/docs/tasks/tools/included/optional-kubectl-configs-bash-linux/
- Aliases are your friend (but enemies of bash completion)

```
ubuntu@zam943:~$ alias skj
alias skj='KUBECONFIG=/home/ubuntu/.kube/jupyterjsc-staging kubectl -n jupyterjsc'
ubuntu@zam943:~$ alias pkj
alias pkj='KUBECONFIG=/home/ubuntu/.kube/jupyterjsc-production kubectl -n jupyterjsc'
ubuntu@zam943:~$ alias jkcms
alias jkcms='KUBECONFIG=/home/ubuntu/.kube/jupyterjsc-jusufcloud kubectl -n cattle-monitoring-system'
```

- Another way: Everything in one config file. `kubectl config` to switch between clusters

APPENDIX

Make life easier

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K3S

Lightweight Kubernetes

- Built for IoT, CI & Edge computing
- <50Mb binary
- Great for development & first local tests
- K3d
  - Another Rancher project
  - Lightweight wrapper to run k3s
  - One Node in K8s == One Container in K3s
  - K3s cluster with n main and m workers -> n+m+1 container on your machine
  - Cluster started and ready within 3 minutes

APPENDIX

Make life easier

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KUBERNETES

How To

- https://kubernetes.io/docs/tutorials/
- https://www.youtube.com/playlist?list=PLy7NrYWoggjwPggqtFsI_zMAwvG0SqYCb
  - Short videos (10-15 min) for multiple Kubernetes topics