QA-Deployment with K8S

How to deploy multiple QA environments with the help of K8s (K3s)

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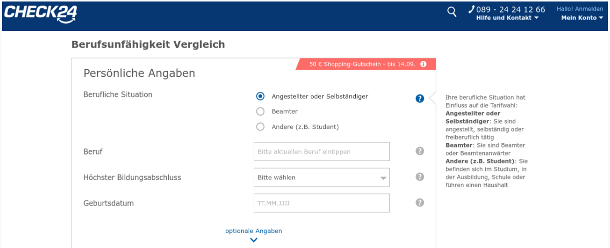
13. Februar 2021

CHECK24

BU-Product overview

- Comparison for disability insurances - 2 different products, separate desktop and mobile apps
- Backoffice apps
- Administration apps
- Node.js, Next.js, Docker (But not K8s)
- 6 Developers, 2 QA-Engineers, 4 Productmanagers



Berufsunfähigkeit Vergleich

Persönliche Angaben

Berufliche Situation
● Angestellter oder Selbständiger
○ Beamter
○ Andere (z.B. Student)

Beruf: Bitte aktuellen Beruf eintippen

Höchster Bildungsabschluss: Bitte wählen

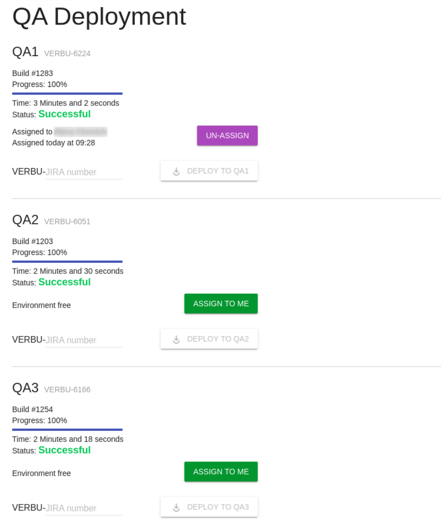
Geburtsdatum: TT.MM.JJJJ

Ihre berufliche Situation hat Einfluss auf die Tarifwahl:
Angestellter oder Selbständiger: Sie sind angestellt, selbständig oder freiberuflich tätig
Beamter: Sie sind Beamter oder Beamtenanwärter
Andere (z.B. Student): Sie befinden sich im Studium, in der Ausbildung, Schule oder führen einen Haushalt

What we had before

- 3 QA environments
- 3 cloned Bamboo plans for deployment
- 3 configuration files for each project with fixed host-urls (qa1, qa2, qa3)
- Docker-compose with 68 running containers on each host machine
- HAProxy for routing (no loadbalancing)
- Very difficult to add more QA environments (new VM, build-plan etc.)
- Hard to investigate when a feature was not deployed correctly
- Docker images tagged with **verbu-12345_latest**

How the UI was looking



QA Deployment

QA1 VERBU-6224

Build #1283
Progress: 100%

Time: 3 Minutes and 2 seconds
Status: **Successful**

Assigned to [redacted]
Assigned today at 09:28

VERBU-JIRA number

QA2 VERBU-6051

Build #1203
Progress: 100%

Time: 2 Minutes and 30 seconds
Status: **Successful**

Environment free

VERBU-JIRA number

QA3 VERBU-6166

Build #1254
Progress: 100%

Time: 2 Minutes and 18 seconds
Status: **Successful**

Environment free

VERBU-JIRA number

What was on our wishlist

- At least 6 parallel QA environments
- Easier scalable if necessary
- Only one config for all QA environments
- Better management and error investigation
- Stable URLs per feature-deployment

How about using Kubernetes (K8s)

What features from Kubernetes could help us

- Isolation between parallel deployments with using namespaces
- Dynamic generation of Urls with Ingress controller
- Restful API for deploying from external service
- Scalable cluster architecture

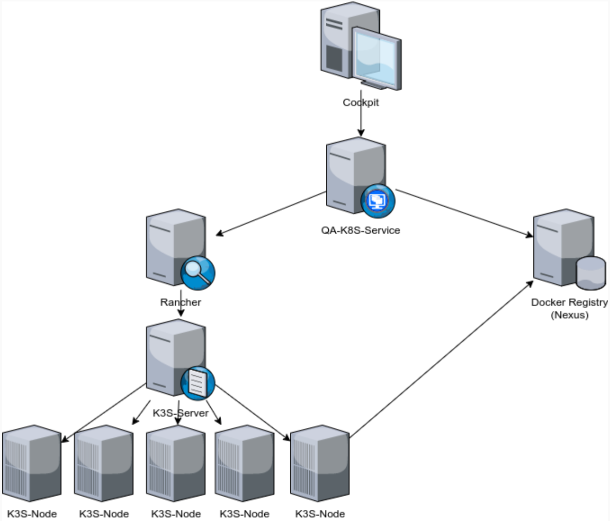
What comes from us

- Cockpit - provides a lot of functionalities for our daily workflows with Testing and Deployment
- QA-K8S-Service - Micro-Service with endpoints for creating, updating, and deleting qa-deployments

What external parts we're using

- Nexus Docker Registry
- K3s - Lightweight Kubernetes Distribution
- Rancher - Kubernetes Management Platform

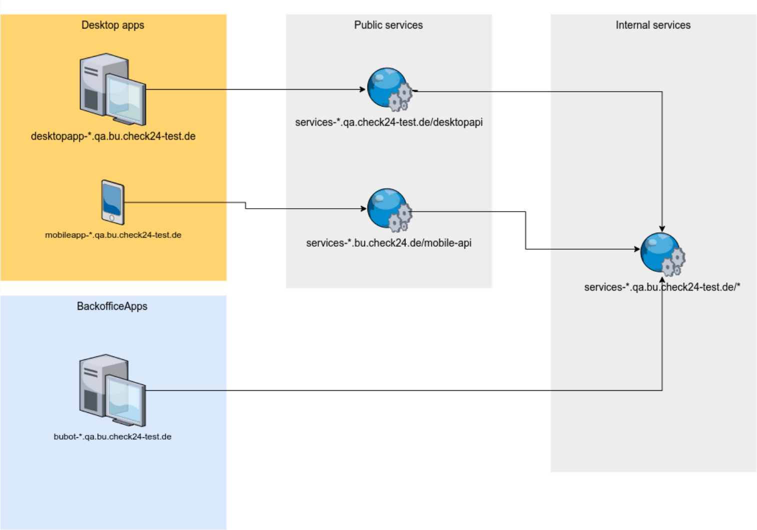
How is it working together



How we communicate with Kubernetes

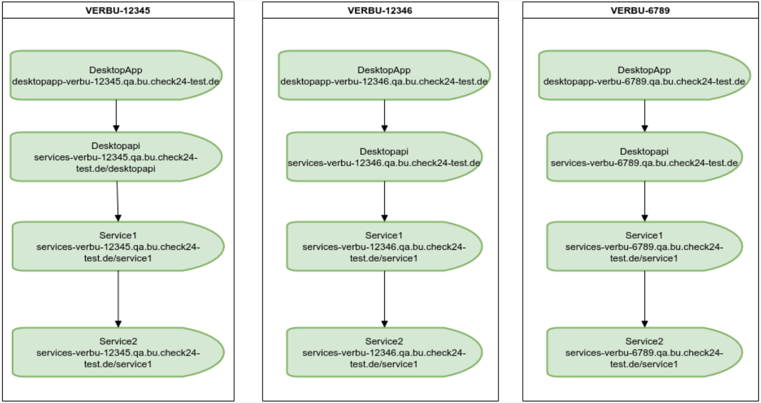
- Using officially-supported Kubernetes client libraries - Link
- Using REST api directly - Link
  - Tip: run `kubectl ... -v 8` to see the rest requests for each command
- Using Rancher api for extended features - Link

How services and apps are communicating with each other



Desktop apps
desktopapp-*.qa.bu.check24-test.de
mobileapp-*.qa.bu.check24-test.de
Public services
services-*.qa.check24-test.de/desktopapi
services-*.bu.check24.de/mobile-api
Internal services
services-*.qa.bu.check24-test.de/*
BackofficeApps
bubot-*.qa.bu.check24-test.de

How to deploy services and apps to QA (v1)



VERBU-12345

DesktopApp
desktopapp-verbu-12345.qa.bu.check24-test.de

Desktopapi
services-verbu-12345.qa.bu.check24-test.de/desktopapi

Service1
services-verbu-12345.qa.bu.check24-test.de/service1

Service2
services-verbu-12345.qa.bu.check24-test.de/service1

VERBU-12346

DesktopApp
desktopapp-verbu-12346.qa.bu.check24-test.de

Desktopapi
services-verbu-12346.qa.bu.check24-test.de

Service1
services-verbu-12346.qa.bu.check24-test.de/service1

Service2
services-verbu-12346.qa.bu.check24-test.de/service1

VERBU-6789

DesktopApp
desktopapp-verbu-6789.qa.bu.check24-test.de

Desktopapi
services-verbu-6789.qa.bu.check24-test.de

Service1
services-verbu-6789.qa.bu.check24-test.de/service1

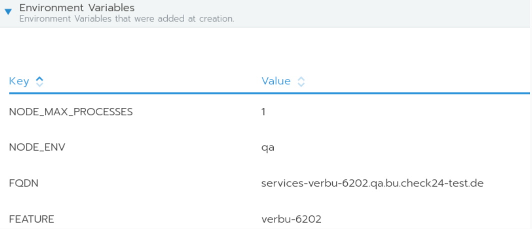
Service2
services-verbu-6789.qa.bu.check24-test.de/service1

What problems we had to solve

- Dynamic creation of urls
- Waiting for depending services (NSQ)
- Find the right limits
- Rewriting urls
- Updating deployments

Dynamic creation of urls

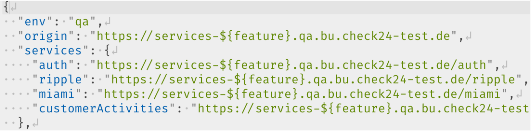
Set feature as environment variable



Environment Variables
Environment Variables that were added at creation.

Key	Value
NODE_MAX_PROCESSES	1
NODE_ENV	qa
FQDN	services-verbu-6202.qa.bu.check24-test.de
FEATURE	verbu-6202

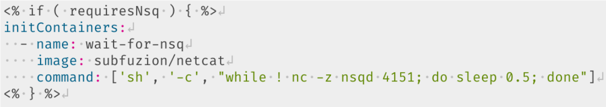
- Use placeholders in config files
- Replace placeholder with feature env when service is starting



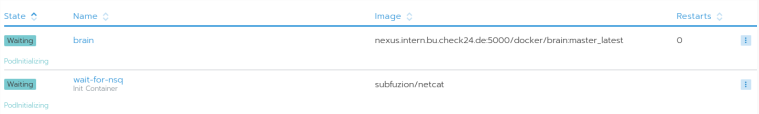
```
{
  "env": "qa",
  "origin": "https://services-${feature}.qa.bu.check24-test.de",
  "services": {
    "auth": "https://services-${feature}.qa.bu.check24-test.de/auth",
    "ripple": "https://services-${feature}.qa.bu.check24-test.de/ripple",
    "miami": "https://services-${feature}.qa.bu.check24-test.de/miami",
    "customerActivities": "https://services-${feature}.qa.bu.check24-test
  },
```

Waiting for dependent services

- Some of the services require a running NSQ service



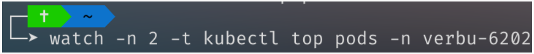
```
<% if ( requiresNsq ) { %>
initContainers:
  - name: wait-for-nsq
    image: subfuzion/netcat
    command: ['sh', '-c', "while ! nc -z nsqd 4151; do sleep 0.5; done"]
<% } %>
```



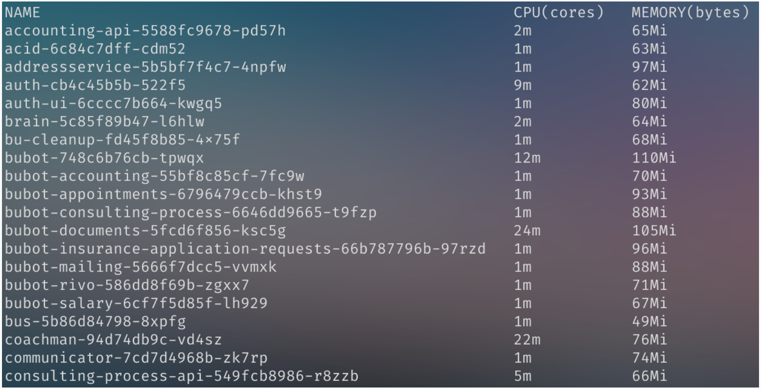
State	Name	Image	Restarts	
Waiting PodInitializing	brain	nexus.intern.bu.check24.de:5000/docker/brain:master_latest	0	⋮
Waiting PodInitializing	wait-for-nsq Init Container	subfuzion/netcat		⋮

Finding the right limits

- Observe a deployment to learn what resources are required



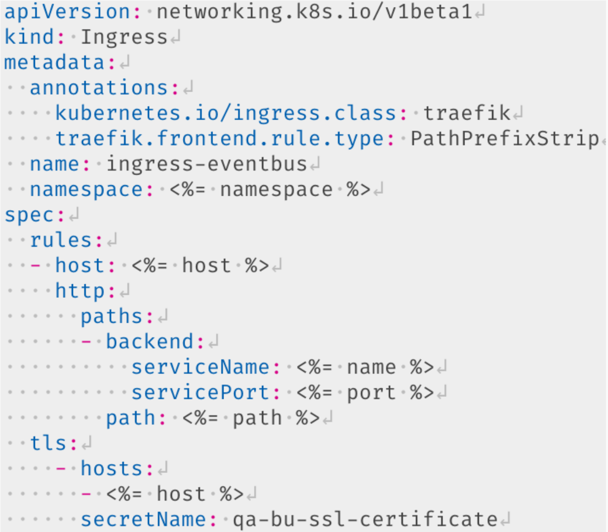
```
  †  ~
└─➤ watch -n 2 -t kubectl top pods -n verbu-6202
```



```
NAME                                                CPU(cores)   MEMORY(bytes)
accounting-api-5588fc9678-pd57h                     2m           65Mi
acid-6c84c7dff-cdm52                                1m           63Mi
addressservice-5b5bf7f4c7-4npfw                     1m           97Mi
auth-cb4c45b5b-522f5                                9m           62Mi
auth-ui-6cccc7b664-kwgq5                            1m           80Mi
brain-5c85f89b47-l6hlw                              2m           64Mi
bu-cleanup-fd45f8b85-4x75f                          1m           68Mi
bubot-748c6b76cb-tpwqx                              12m          110Mi
bubot-accounting-55bf8c85cf-7fc9w                   1m           70Mi
bubot-appointments-6796479ccb-khst9                 1m           93Mi
bubot-consulting-process-6646dd9665-t9fzp           1m           88Mi
bubot-documents-5fcd6f856-ksc5g                     24m          105Mi
bubot-insurance-application-requests-66b787796b-97rzd  1m        96Mi
bubot-mailing-5666f7dcc5-vvmxk                      1m           88Mi
bubot-rivo-586dd8f69b-zgxx7                         1m           71Mi
bubot-salary-6cf7f5d85f-lh929                       1m           67Mi
bus-5b86d84798-8xpfg                                1m           49Mi
coachman-94d74db9c-vd4sz                            22m          76Mi
communicator-7cd7d4968b-zk7rp                       1m           74Mi
consulting-process-api-549fcb8986-r8zzb             5m           66Mi
```

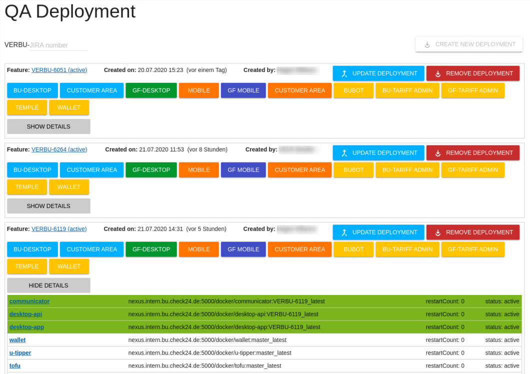
Rewriting of urls

- Remove `/eventbus` from the url before forwarding to NSQ service



```yaml
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  annotations:
    kubernetes.io/ingress.class: traefik
    traefik.frontend.rule.type: PathPrefixStrip
  name: ingress-eventbus
  namespace: <%= namespace %>
spec:
  rules:
  - host: <%= host %>
    http:
      paths:
      - backend:
          serviceName: <%= name %>
          servicePort: <%= port %>
        path: <%= path %>
  tls:
    - hosts:
      - <%= host %>
      secretName: qa-bu-ssl-certificate
```

Mission completed?



QA Deployment

VERBU-JIRA number

Feature: VERBU-6051 (active) **Created on:** 20.07.2020 15:23 (vor einem Tag) **Created by:** [redacted]

Feature: VERBU-6264 (active) **Created on:** 21.07.2020 11:53 (vor 8 Stunden) **Created by:** [redacted]

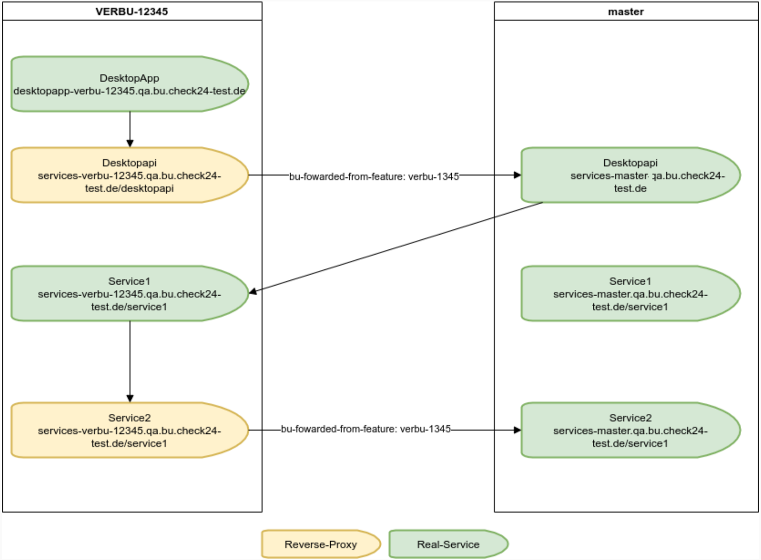
Feature: VERBU-6119 (active) **Created on:** 21.07.2020 14:31 (vor 5 Stunden) **Created by:** [redacted]

communicator	nexus.intern.bu.check24.de:5000/docker/communicator:VERBU-6119_latest	restartCount: 0	status: active
desktop-api	nexus.intern.bu.check24.de:5000/docker/desktop-api:VERBU-6119_latest	restartCount: 0	status: active
desktop-app	nexus.intern.bu.check24.de:5000/docker/desktop-app:VERBU-6119_latest	restartCount: 0	status: active
wallet	nexus.intern.bu.check24.de:5000/docker/wallet:master_latest	restartCount: 0	status: active
u-tipper	nexus.intern.bu.check24.de:5000/docker/u-tipper:master_latest	restartCount: 0	status: active
tofu	nexus.intern.bu.check24.de:5000/docker/tofu:master_latest	restartCount: 0	status: active

- Now we could deploy 5 parallel deployments (the 6th became instable)
- But each deployment requires ∼70 PODs to deploy
- Creation but also deletion was slow
- Updating was faster but manual trigger required

How about using a ServiceMesh, like Istio?

How to deploy services and apps to QA (v2)



VERBU-12345

DesktopApp
desktopapp-verbu-12345.qa.bu.check24-test.de

Desktopapi
services-verbu-12345.qa.bu.check24-test.de/desktopapi

Service1
services-verbu-12345.qa.bu.check24-test.de/service1

Service2
services-verbu-12345.qa.bu.check24-test.de/service1

bu-fowarded-from-feature: verbu-1345

bu-fowarded-from-feature: verbu-1345

master

Desktopapi
services-master. qa.bu.check24-test.de

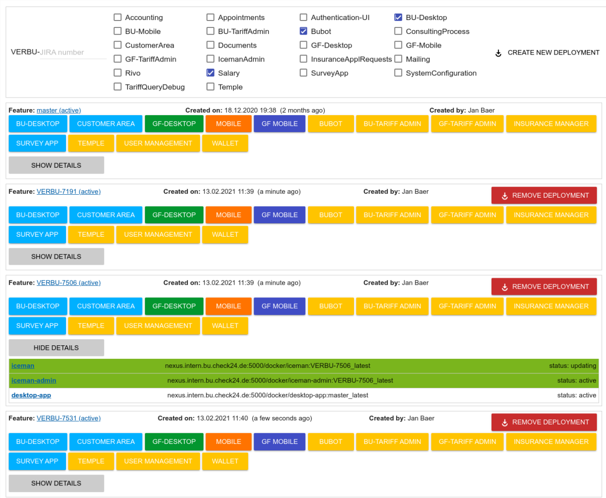
Service1
services-master.qa.bu.check24-test.de/service1

Service2
services-master.qa.bu.check24-test.de/service1

Reverse-Proxy

Real-Service

How is it looking now?



VERBU-JIRA number

☐ Accounting
☐ BU-Mobile
☐ CustomerArea
☐ GF-TariffAdmin
☐ Rivo
☐ TariffQueryDebug

☐ Appointments
☐ BU-TariffAdmin
☐ Documents
☐ IcemanAdmin
☑ Salary
☐ Temple

☐ Authentication-UI
☑ Bubot
☐ GF-Desktop
☐ InsuranceApplRequests
☐ SurveyApp

☑ BU-Desktop
☐ ConsultingProcess
☐ GF-Mobile
☐ Mailing
☐ SystemConfiguration

Feature: master (active) **Created on:** 18.12.2020 19:38 (2 months ago) **Created by:** Jan Baer

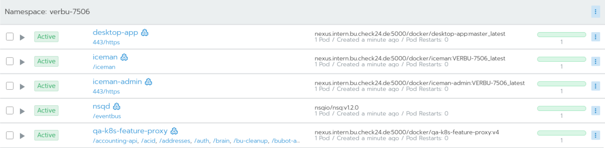
Feature: VERBU-7191 (active) **Created on:** 13.02.2021 11:39 (a minute ago) **Created by:** Jan Baer

Feature: VERBU-7506 (active) **Created on:** 13.02.2021 11:39 (a minute ago) **Created by:** Jan Baer

iceman	nexus.intern.bu.check24.de:5000/docker/iceman:VERBU-7506_latest	status: updating
iceman-admin	nexus.intern.bu.check24.de:5000/docker/iceman-admin:VERBU-7506_latest	status: active
desktop-app	nexus.intern.bu.check24.de:5000/docker/desktop-app:master_latest	status: active

Feature: VERBU-7531 (active) **Created on:** 13.02.2021 11:40 (a few seconds ago) **Created by:** Jan Baer

What is running internally



Namespace: verbu-7506

□	▶	Active	desktop-app 443/https	nexus.intern.bu.check24.de:5000/docker/desktop-app:master_latest 1 Pod / Created a minute ago / Pod Restarts: 0	1	⋮
□	▶	Active	iceman /iceman	nexus.intern.bu.check24.de:5000/docker/iceman:VERBU-7506_latest 1 Pod / Created a minute ago / Pod Restarts: 0	1	⋮
□	▶	Active	iceman-admin 443/https	nexus.intern.bu.check24.de:5000/docker/iceman-admin:VERBU-7506_latest 1 Pod / Created a minute ago / Pod Restarts: 0	1	⋮
□	▶	Active	nsqd /eventbus	nsqio/nsq:v1.2.0 1 Pod / Created a minute ago / Pod Restarts: 0	1	⋮
□	▶	Active	qa-k8s-feature-proxy /accounting-api, /acid, /addresses, /auth, /brain, /bu-cleanup, /bubot-a...	nexus.intern.bu.check24.de:5000/docker/qa-k8s-feature-proxy:v4 1 Pod / Created a minute ago / Pod Restarts: 0	1	⋮

How is it improving the deployment?

- Much faster deployment because of deploying only a few services and apps
- Faster cleanup of existing deployments
- Using much less resources per deployment
- More parallel deployments are possible
- Bonus: Automatic updating of deployments from Bamboo

Questions?

What is K3s?

K3s is a fully compliant Kubernetes distribution with the following enhancements:

- Packaged as a single binary. (less than 100 MB.)
- Lightweight storage backend based on sqlite3 as the default storage mechanism. etcd3, MySQL, Postgres also still available.
- Wrapped in simple launcher that handles a lot of the complexity of TLS and options.
- Secure by default with reasonable defaults for lightweight environments.

What is K3s?

- Simple but powerful “batteries-included” features have been added, such as: a local storage provider, a service load balancer, a Helm controller, and the Traefik ingress controller.
- Operation of all Kubernetes control plane components is encapsulated in a single binary and process. This allows K3s to automate and manage complex cluster operations like distributing certificates.
- External dependencies have been minimized (just a modern kernel and cgroup mounts needed).

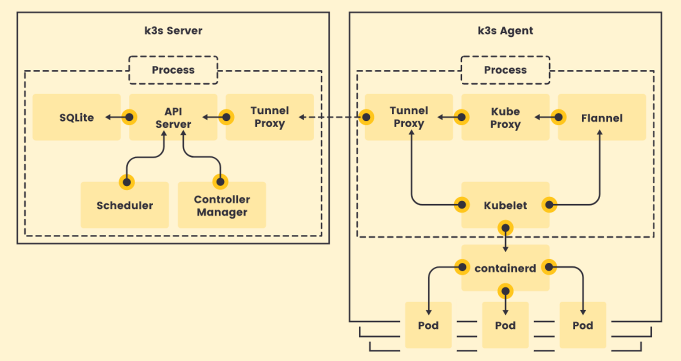
What's included in K3s

- Containerd
- Flannel
- CoreDNS
- CNI
- Host utilities (iptables, socat, etc)
- Ingress controller (traefik)
- Embedded service loadbalancer
- Embedded network policy controller

How to use K3s

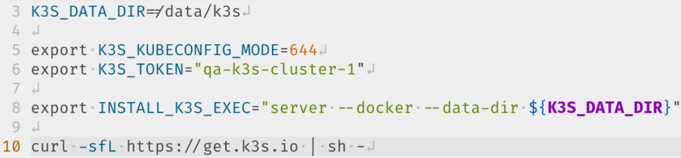
- Uses per default Containerd as container-engine
- Can use alternatively Docker, but it's not required
- Run's as a Server and a Node on the same machine
- But also as Server(s) and Node(s) on separate machines
- You need at least one Server and one Node
- For high availability K3s supports a cluster of multiple servers

The architecture of K3s



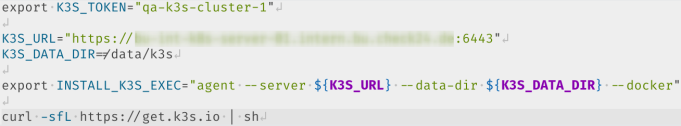
Install K3s is very easy

Install the server



```
K3S_DATA_DIR=/data/k3s

export K3S_KUBECONFIG_MODE=644
export K3S_TOKEN="qa-k3s-cluster-1"

export INSTALL_K3S_EXEC="server --docker --data-dir ${K3S_DATA_DIR}"

curl -sfL https://get.k3s.io | sh -
```

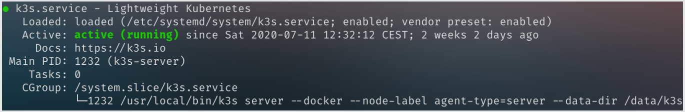
Install the agent



```
export K3S_TOKEN="qa-k3s-cluster-1"

K3S_URL="https://[redacted]:6443"
K3S_DATA_DIR=/data/k3s

export INSTALL_K3S_EXEC="agent --server ${K3S_URL} --data-dir ${K3S_DATA_DIR} --docker"

curl -sfL https://get.k3s.io | sh
```

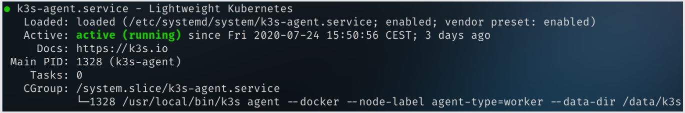
K3s will be installed as Systemd service

Server



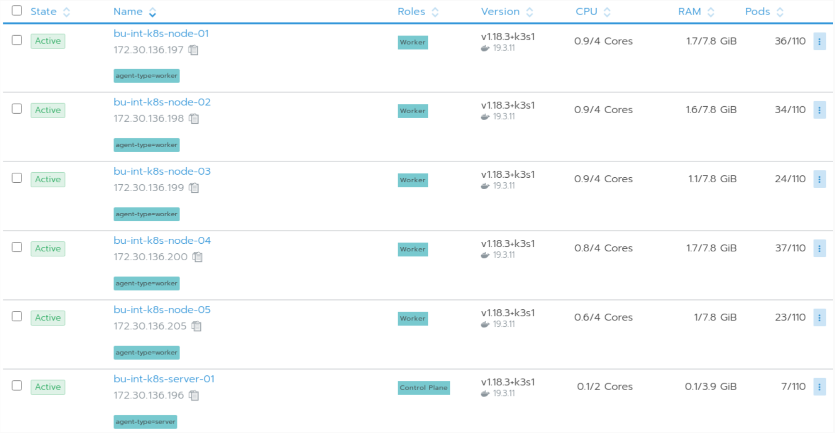
```
● k3s.service - Lightweight Kubernetes
   Loaded: loaded (/etc/systemd/system/k3s.service; enabled; vendor preset: enabled)
   Active: active (running) since Sat 2020-07-11 12:32:12 CEST; 2 weeks 2 days ago
     Docs: https://k3s.io
 Main PID: 1232 (k3s-server)
    Tasks: 0
   CGroup: /system.slice/k3s.service
           └─1232 /usr/local/bin/k3s server --docker --node-label agent-type=server --data-dir /data/k3s
```

Agent



```
● k3s-agent.service - Lightweight Kubernetes
   Loaded: loaded (/etc/systemd/system/k3s-agent.service; enabled; vendor preset: enabled)
   Active: active (running) since Fri 2020-07-24 15:50:56 CEST; 3 days ago
     Docs: https://k3s.io
 Main PID: 1328 (k3s-agent)
    Tasks: 0
   CGroup: /system.slice/k3s-agent.service
           └─1328 /usr/local/bin/k3s agent --docker --node-label agent-type=worker --data-dir /data/k3s
```

The whole K3s cluster



□	State	Name	Roles	Version	CPU	RAM	Pods	
□	Active	bu-int-k8s-node-01 172.30.136.197 agent-type=worker	Worker	v1.18.3+k3s1 19.3.11	0.9/4 Cores	1.7/7.8 GiB	36/110	⋮
□	Active	bu-int-k8s-node-02 172.30.136.198 agent-type=worker	Worker	v1.18.3+k3s1 19.3.11	0.9/4 Cores	1.6/7.8 GiB	34/110	⋮
□	Active	bu-int-k8s-node-03 172.30.136.199 agent-type=worker	Worker	v1.18.3+k3s1 19.3.11	0.9/4 Cores	1.1/7.8 GiB	24/110	⋮
□	Active	bu-int-k8s-node-04 172.30.136.200 agent-type=worker	Worker	v1.18.3+k3s1 19.3.11	0.8/4 Cores	1.7/7.8 GiB	37/110	⋮
□	Active	bu-int-k8s-node-05 172.30.136.205 agent-type=worker	Worker	v1.18.3+k3s1 19.3.11	0.6/4 Cores	1/7.8 GiB	23/110	⋮
□	Active	bu-int-k8s-server-01 172.30.136.196 agent-type=server	Control Plane	v1.18.3+k3s1 19.3.11	0.1/2 Cores	0.1/3.9 GiB	7/110	⋮

What’s is the role of Rancher

- Makes the access to the cluster easier. (UserManagement, AccessToken)
- Provides additional REST endpoints for creating namespaces and querying workloads
- Can configure monitoring with Prometheus and Grafana
- Works fine together with K3s because it’s from the same company
- Easy version upgrades for the K3s cluster with the system-upgrade-controller
- Easier access to container logs and analyzing deployment problems

Questions?

Thank you!