SUSE

23 NOVEMBER 2022

Using Kubernetes to manage your operating system

A technical deep-dive into Rancher Elemental

What to expect in this session

1. Why Elemental ?
2. Elemental basics
3. Elemental with Rancher
4. Elemental UI

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Introducing the speaker

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Long-time SUSE employee
Contributing to open source even longer
kkaempf @

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Marketing^wMotivation

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About Elemental

- Elemental[1] is
  - A solution offering by SUSE Rancher
  - An open source project
    - elemental-toolkit, elemental-cli
  - An operating system to deploy cluster nodes
    - “Elemental Teal” based on SLE Micro for Rancher
    - Image based
    - A/B update scheme

[1] https://rancher.github.io/elemental

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Linux ops vs. Kubernetes ops

- Linux
  - Needs package (rpm, deb, …) infrastructure
  - Needs OS people for administration
  - OS uptime is important
  - Needs synchronization with Kubernetes ops

- Kubernetes
  - Everything is hosted in OCI registries
  - Service uptime is important
  - OS is a Kubernetes resource
  - Kubernetes controlled updates

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Elemental – the basics

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From packages to OCI image to bootable ISO

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Containerizing the operating system

- Build the OS in Docker, Buildah, Kiwi, …
  - Apt-get, dnf, zypper, …
  - Grub2, kernel, dracut, systemd-*, bash, NetworkManager
  - Run dracut to create initrd
  - Is an OCI image
  - Can’t be booted or installed

Example: https://build.opensuse.org/package/show/home:kwk:osimage/slem4r_docker

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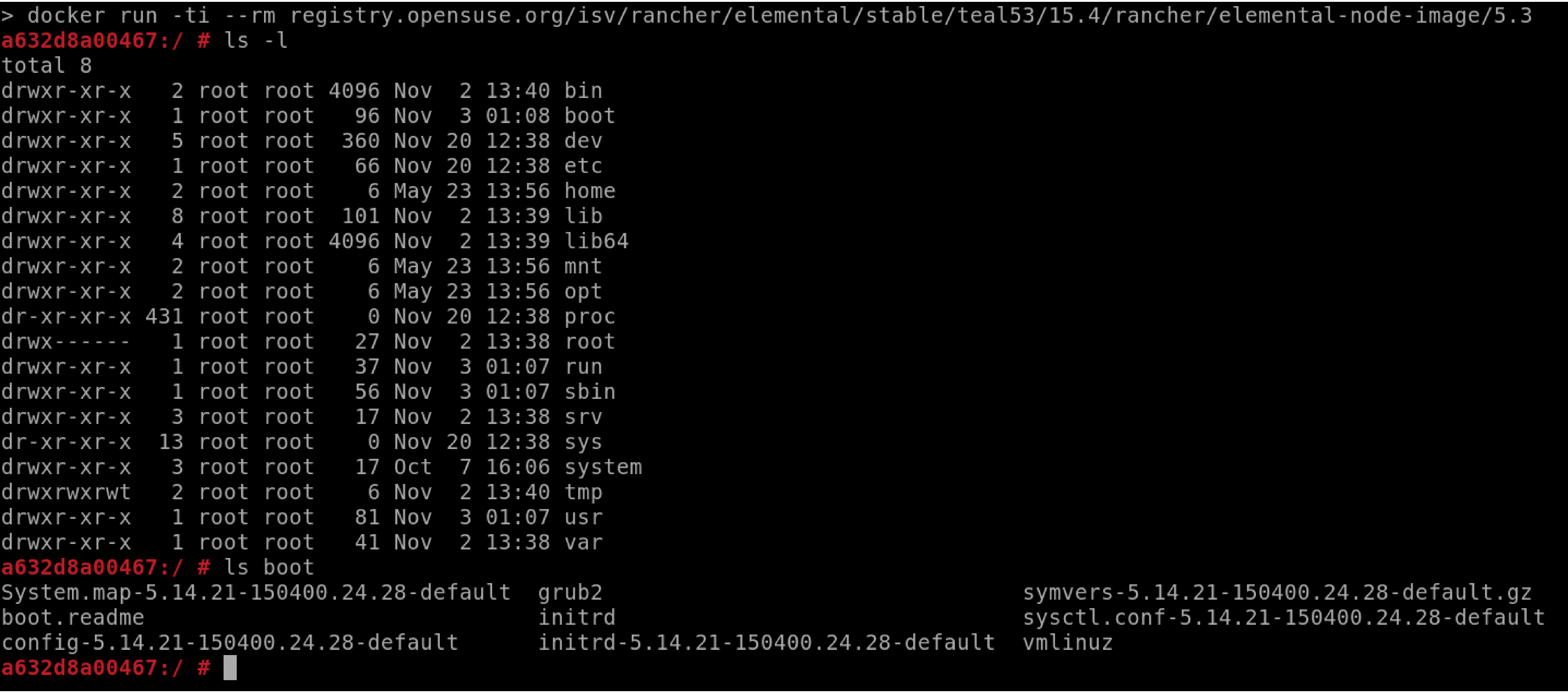

```
> docker run -ti --rm registry.opensuse.org/isv/rancher/elemental/stable/teal53/15.4/rancher/elemental-node-image/5.3
a632d8a00467:/ # ls -l
total 8
drwxr-xr-x   2 root root 4096 Nov  2 13:40 bin
drwxr-xr-x   1 root root   96 Nov  3 01:08 boot
drwxr-xr-x   5 root root  360 Nov 20 12:38 dev
drwxr-xr-x   1 root root   66 Nov 20 12:38 etc
drwxr-xr-x   2 root root    6 May 23 13:56 home
drwxr-xr-x   8 root root  101 Nov  2 13:39 lib
drwxr-xr-x   4 root root 4096 Nov  2 13:39 lib64
drwxr-xr-x   2 root root    6 May 23 13:56 mnt
drwxr-xr-x   2 root root    6 May 23 13:56 opt
dr-xr-xr-x 431 root root    0 Nov 20 12:38 proc
drwx------   1 root root   27 Nov  2 13:38 root
drwxr-xr-x   1 root root   37 Nov  3 01:07 run
drwxr-xr-x   1 root root   56 Nov  3 01:07 sbin
drwxr-xr-x   3 root root   17 Nov  2 13:38 srv
dr-xr-xr-x  13 root root    0 Nov 20 12:38 sys
drwxr-xr-x   3 root root   17 Oct  7 16:06 system
drwxrwxrwt   2 root root    6 Nov  2 13:40 tmp
drwxr-xr-x   1 root root   81 Nov  3 01:07 usr
drwxr-xr-x   1 root root   41 Nov  2 13:38 var
a632d8a00467:/ # ls boot
System.map-5.14.21-150400.24.28-default  grub2                                symvers-5.14.21-150400.24.28-default.gz
boot.readme                              initrd                               sysctl.conf-5.14.21-150400.24.28-default
config-5.14.21-150400.24.28-default      initrd-5.14.21-150400.24.28-default  vmlinuz
a632d8a00467:/ #
```

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Introducing elemental-cli

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elemental-cli [1]

- Command line tool
- Central 'orchestration' for all steps
  - ISO building
  - OCI image download
  - Upgrade
  - Initramfs setup
  - Systemd services

[1] https://github.com/rancher/elemental-cli

Making the OCI image bootable

- You can’t boot from an OCI images
  - Extract kernel and initrd
  - Grub2
  - Rootfs as image
  - Build ISO
    - `elemental build-iso`

https://download.opensuse.org/repositories/isv:/Rancher:/Elemental:/Stable:/Teal53/media/iso/elemental-teal.x86_64.iso

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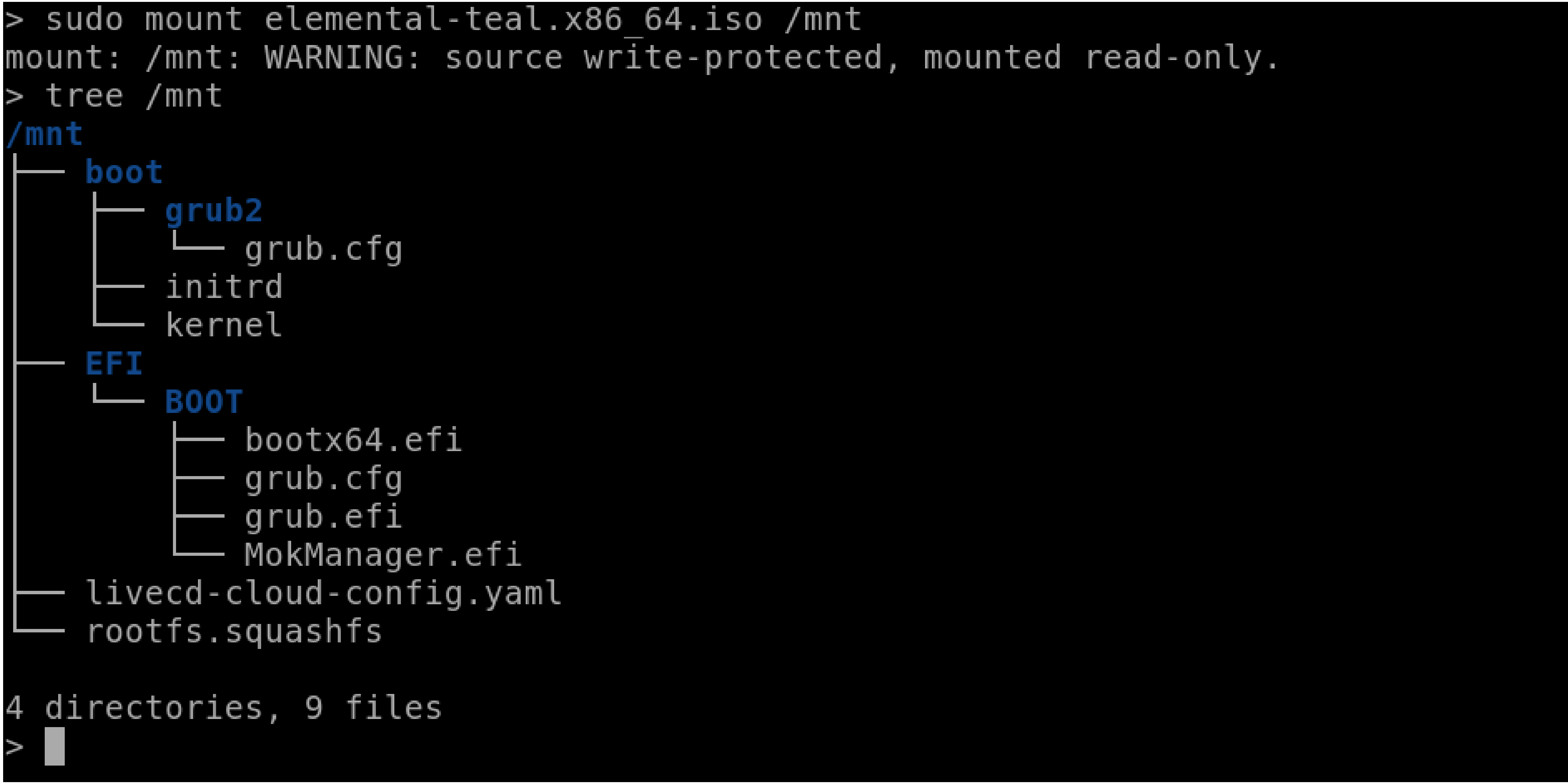

```
> sudo mount elemental-teal.x86_64.iso /mnt
mount: /mnt: WARNING: source write-protected, mounted read-only.
> tree /mnt
/mnt
├── boot
│   ├── grub2
│   │   └── grub.cfg
│   ├── initrd
│   └── kernel
├── EFI
│   └── BOOT
│       ├── bootx64.efi
│       ├── grub.cfg
│       ├── grub.efi
│       └── MokManager.efi
├── livecd-cloud-config.yaml
└── rootfs.squashfs

4 directories, 9 files
> 
```

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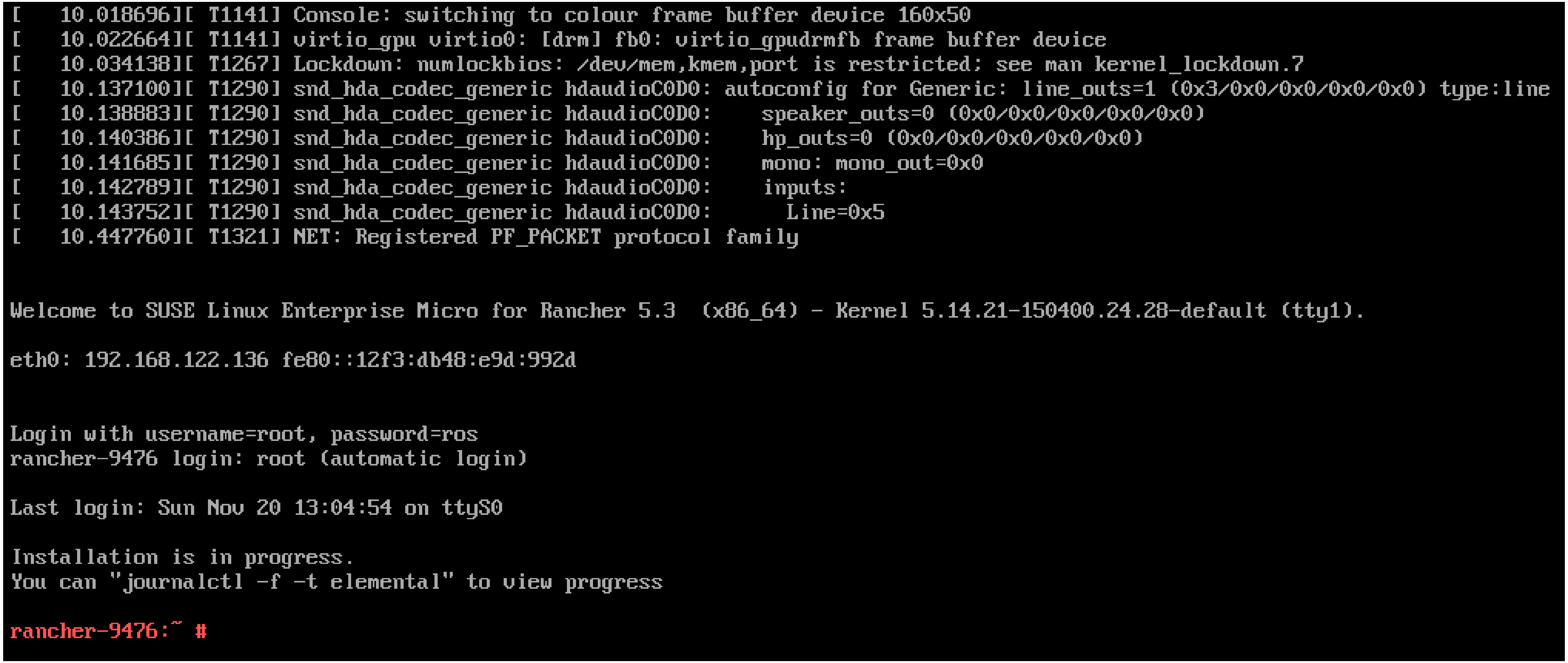

```
[   10.018696][ T1141] Console: switching to colour frame buffer device 160x50
[   10.022664][ T1141] virtio_gpu virtio0: [drm] fb0: virtio_gpudrmfb frame buffer device
[   10.034138][ T1267] Lockdown: numlockbios: /dev/mem,kmem,port is restricted; see man kernel_lockdown.7
[   10.137100][ T1290] snd_hda_codec_generic hdaudioC0D0: autoconfig for Generic: line_outs=1 (0x3/0x0/0x0/0x0/0x0) type:line
[   10.138883][ T1290] snd_hda_codec_generic hdaudioC0D0:    speaker_outs=0 (0x0/0x0/0x0/0x0/0x0)
[   10.140386][ T1290] snd_hda_codec_generic hdaudioC0D0:    hp_outs=0 (0x0/0x0/0x0/0x0/0x0)
[   10.141685][ T1290] snd_hda_codec_generic hdaudioC0D0:    mono: mono_out=0x0
[   10.142789][ T1290] snd_hda_codec_generic hdaudioC0D0:    inputs:
[   10.143752][ T1290] snd_hda_codec_generic hdaudioC0D0:      Line=0x5
[   10.447760][ T1321] NET: Registered PF_PACKET protocol family


Welcome to SUSE Linux Enterprise Micro for Rancher 5.3  (x86_64) - Kernel 5.14.21-150400.24.28-default (tty1).

eth0: 192.168.122.136 fe80::12f3:db48:e9d:992d


Login with username=root, password=ros
rancher-9476 login: root (automatic login)

Last login: Sun Nov 20 13:04:54 on ttyS0

Installation is in progress.
You can "journalctl -f -t elemental" to view progress

rancher-9476:~ #
```

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elemental install

```
spec:
 config:
   cloud-config:
     users:
     - name: root
       passwd: root
   elemental:
     install:
       debug: true
       device: /dev/sda
       reboot: true
```

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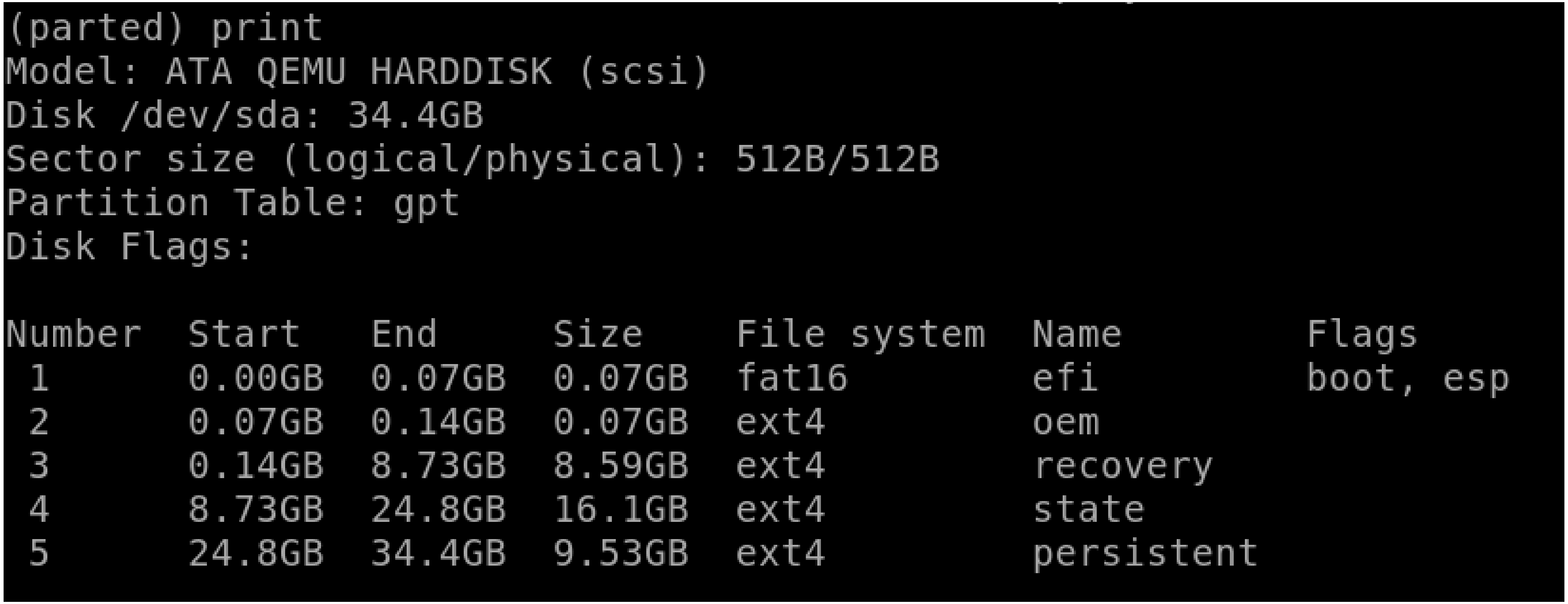
Partitioning

Separation of concerns



```
(parted) print
Model: ATA QEMU HARDDISK (scsi)
Disk /dev/sda: 34.4GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start   End     Size    File system  Name        Flags
 1      0.00GB  0.07GB  0.07GB  fat16        efi         boot, esp
 2      0.07GB  0.14GB  0.07GB  ext4         oem
 3      0.14GB  8.73GB  8.59GB  ext4         recovery
 4      8.73GB  24.8GB  16.1GB  ext4         state
 5      24.8GB  34.4GB  9.53GB  ext4         persistent
```

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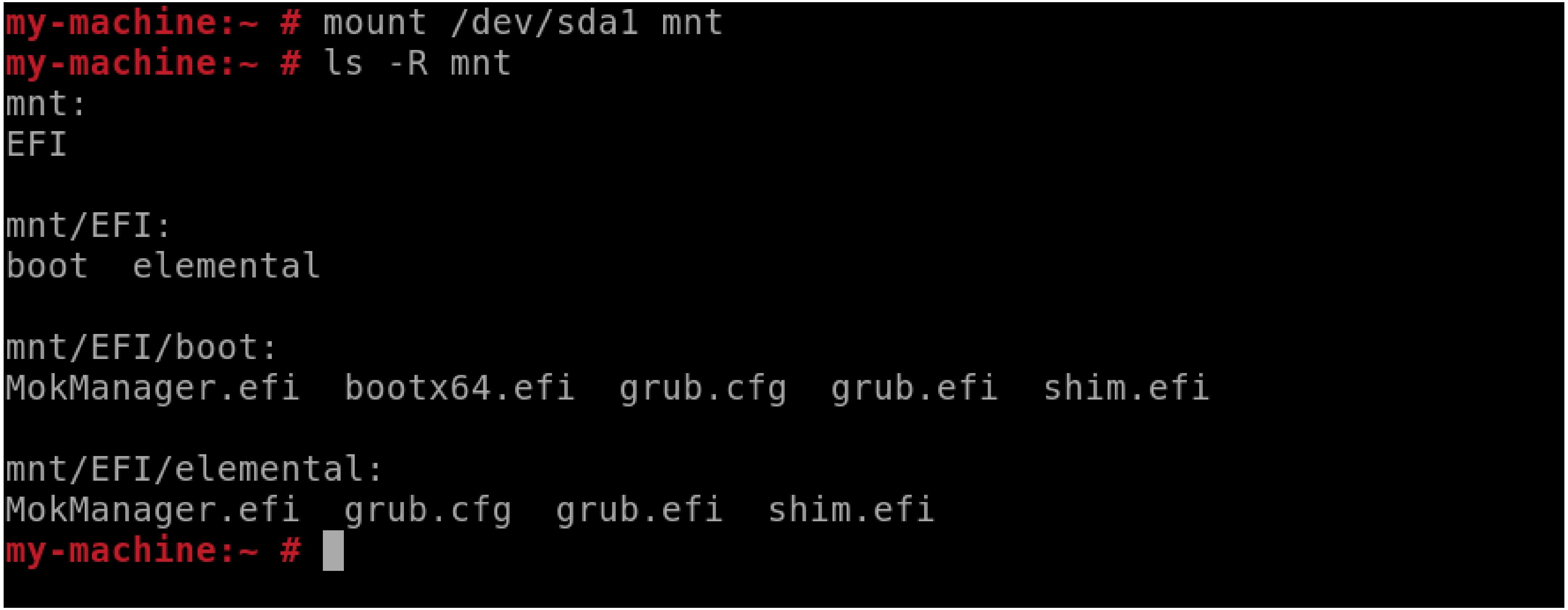
boot



```
my-machine:~ # mount /dev/sda1 mnt
my-machine:~ # ls -R mnt
mnt:
EFI

mnt/EFI:
boot  elemental

mnt/EFI/boot:
MokManager.efi  bootx64.efi  grub.cfg  grub.efi  shim.efi

mnt/EFI/elemental:
MokManager.efi  grub.cfg  grub.efi  shim.efi
my-machine:~ # 
```

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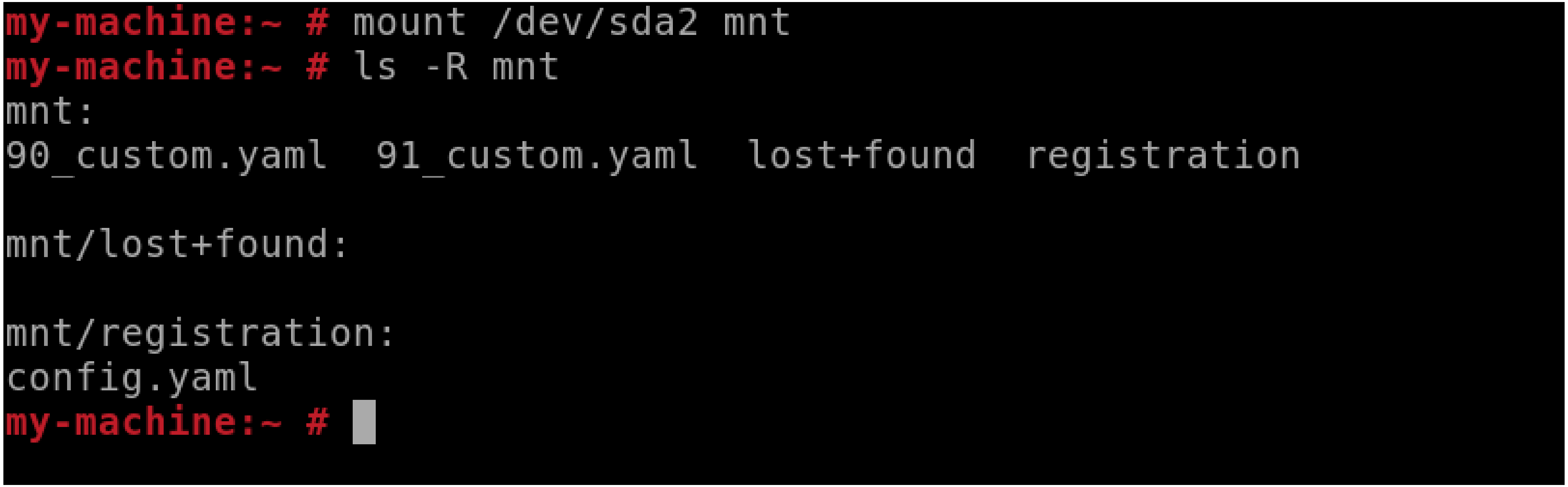
oem

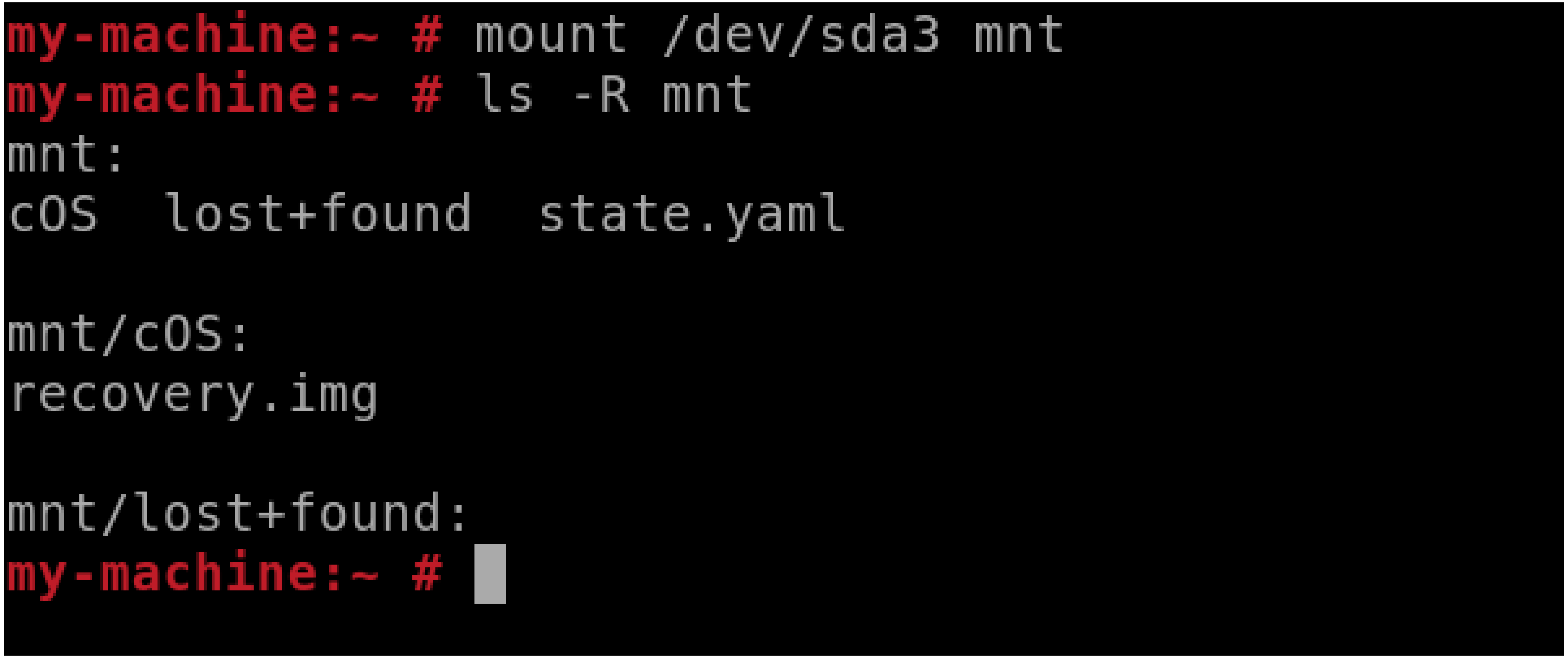


```
my-machine:~ # mount /dev/sda2 mnt
my-machine:~ # ls -R mnt
mnt:
90_custom.yaml  91_custom.yaml  lost+found  registration

mnt/lost+found:

mnt/registration:
config.yaml
my-machine:~ #
```

recovery



```
my-machine:~ # mount /dev/sda3 mnt
my-machine:~ # ls -R mnt
mnt:
cOS  lost+found  state.yaml

mnt/cOS:
recovery.img

mnt/lost+found:
my-machine:~ # 
```

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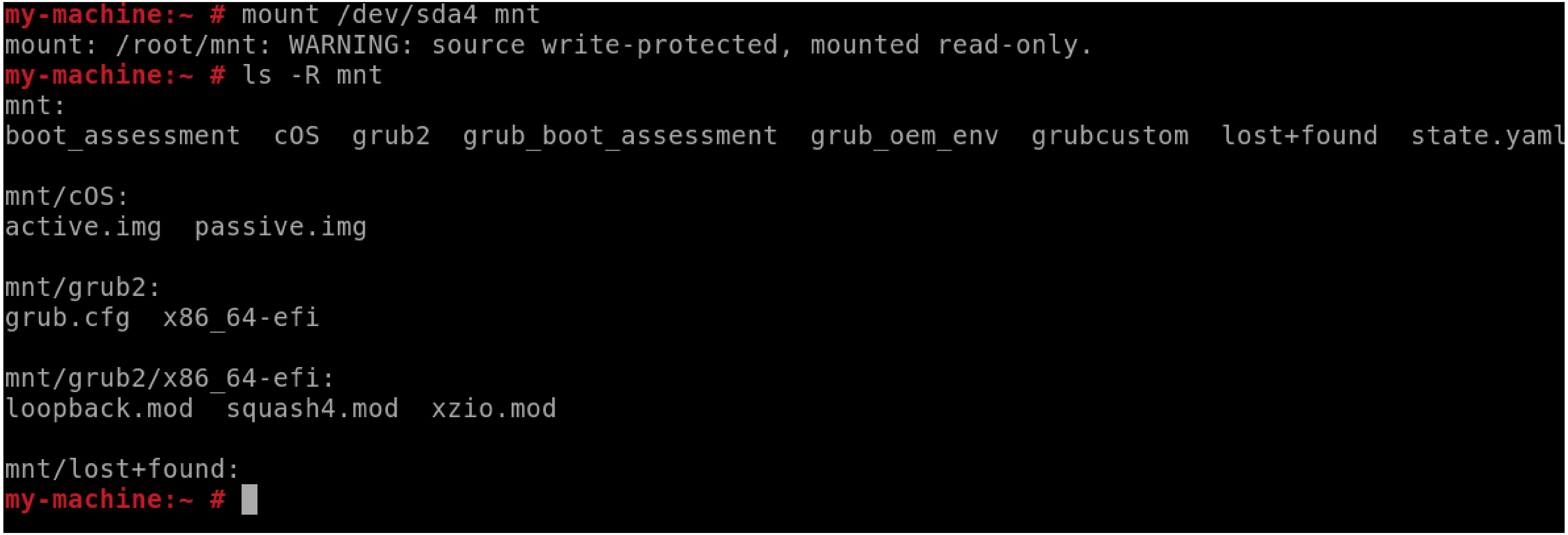
state



```
my-machine:~ # mount /dev/sda4 mnt
mount: /root/mnt: WARNING: source write-protected, mounted read-only.
my-machine:~ # ls -R mnt
mnt:
boot_assessment  cOS  grub2  grub_boot_assessment  grub_oem_env  grubcustom  lost+found  state.yaml

mnt/cOS:
active.img  passive.img

mnt/grub2:
grub.cfg  x86_64-efi

mnt/grub2/x86_64-efi:
loopback.mod  squash4.mod  xzio.mod

mnt/lost+found:
my-machine:~ # 
```

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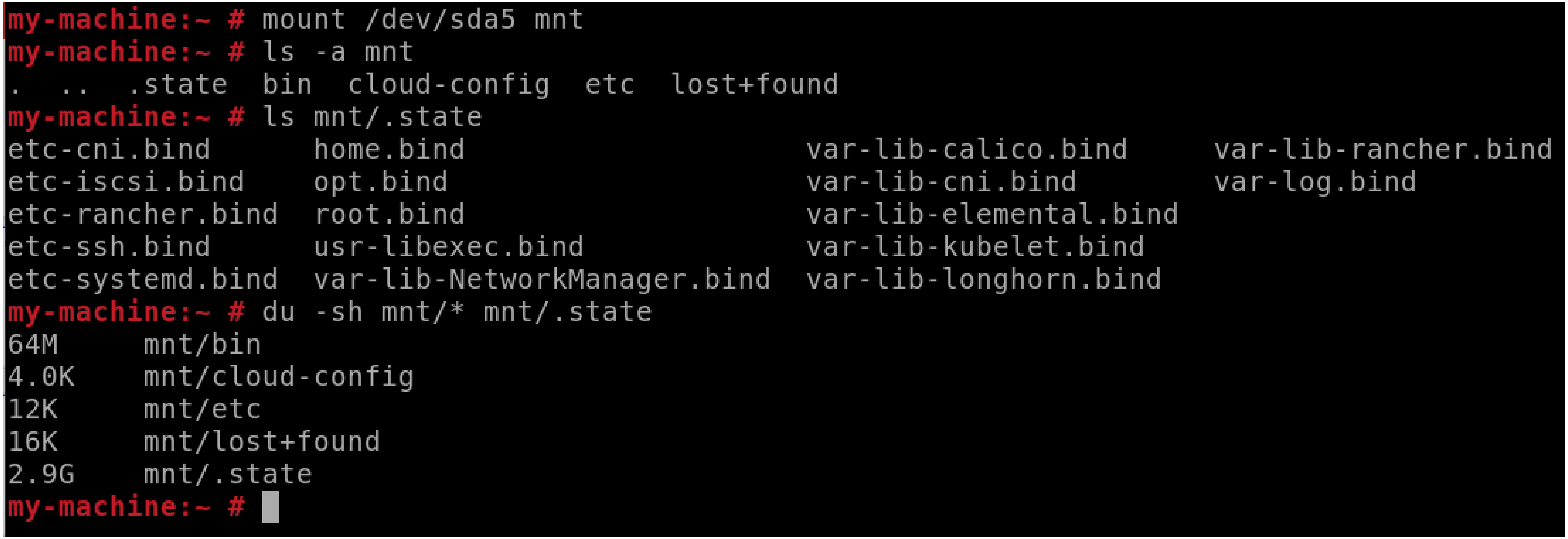
persistent



```
my-machine:~ # mount /dev/sda5 mnt
my-machine:~ # ls -a mnt
.  ..  .state  bin  cloud-config  etc  lost+found
my-machine:~ # ls mnt/.state
etc-cni.bind      home.bind                    var-lib-calico.bind     var-lib-rancher.bind
etc-iscsi.bind    opt.bind                     var-lib-cni.bind        var-log.bind
etc-rancher.bind  root.bind                    var-lib-elemental.bind
etc-ssh.bind      usr-libexec.bind             var-lib-kubelet.bind
etc-systemd.bind  var-lib-NetworkManager.bind  var-lib-longhorn.bind
my-machine:~ # du -sh mnt/* mnt/.state
64M     mnt/bin
4.0K    mnt/cloud-config
12K     mnt/etc
16K     mnt/lost+found
2.9G    mnt/.state
my-machine:~ # 
```

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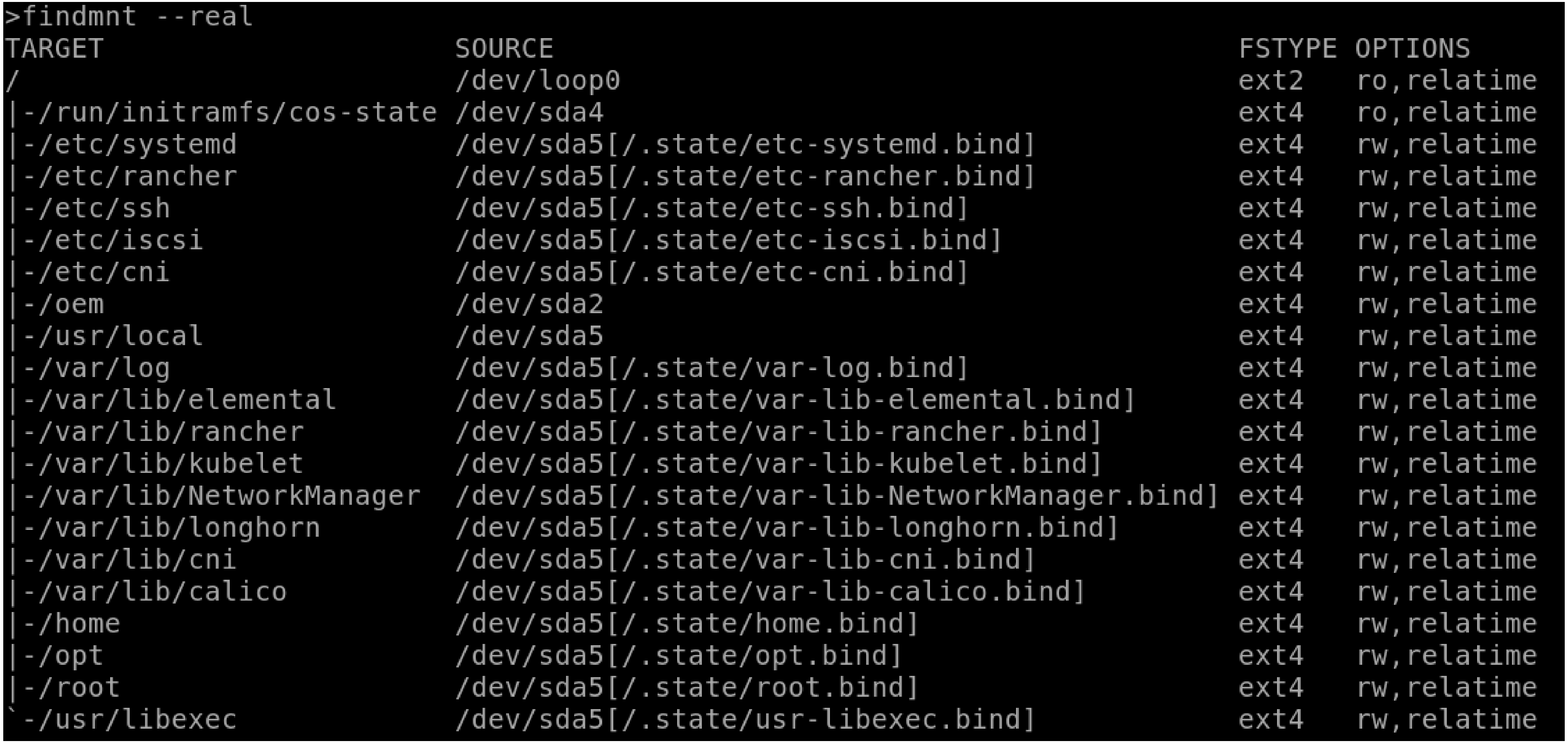
Bind mounts



```
>findmnt --real
TARGET                     SOURCE                                         FSTYPE OPTIONS
/                          /dev/loop0                                     ext2   ro,relatime
|-/run/initramfs/cos-state /dev/sda4                                      ext4   ro,relatime
|-/etc/systemd             /dev/sda5[/.state/etc-systemd.bind]            ext4   rw,relatime
|-/etc/rancher             /dev/sda5[/.state/etc-rancher.bind]            ext4   rw,relatime
|-/etc/ssh                 /dev/sda5[/.state/etc-ssh.bind]                ext4   rw,relatime
|-/etc/iscsi               /dev/sda5[/.state/etc-iscsi.bind]              ext4   rw,relatime
|-/etc/cni                 /dev/sda5[/.state/etc-cni.bind]                ext4   rw,relatime
|-/oem                     /dev/sda2                                      ext4   rw,relatime
|-/usr/local               /dev/sda5                                      ext4   rw,relatime
|-/var/log                 /dev/sda5[/.state/var-log.bind]                ext4   rw,relatime
|-/var/lib/elemental       /dev/sda5[/.state/var-lib-elemental.bind]      ext4   rw,relatime
|-/var/lib/rancher         /dev/sda5[/.state/var-lib-rancher.bind]        ext4   rw,relatime
|-/var/lib/kubelet         /dev/sda5[/.state/var-lib-kubelet.bind]        ext4   rw,relatime
|-/var/lib/NetworkManager  /dev/sda5[/.state/var-lib-NetworkManager.bind] ext4   rw,relatime
|-/var/lib/longhorn        /dev/sda5[/.state/var-lib-longhorn.bind]       ext4   rw,relatime
|-/var/lib/cni             /dev/sda5[/.state/var-lib-cni.bind]            ext4   rw,relatime
|-/var/lib/calico          /dev/sda5[/.state/var-lib-calico.bind]         ext4   rw,relatime
|-/home                    /dev/sda5[/.state/home.bind]                   ext4   rw,relatime
|-/opt                     /dev/sda5[/.state/opt.bind]                    ext4   rw,relatime
|-/root                    /dev/sda5[/.state/root.bind]                   ext4   rw,relatime
`-/usr/libexec             /dev/sda5[/.state/usr-libexec.bind]            ext4   rw,relatime
```

System bringup

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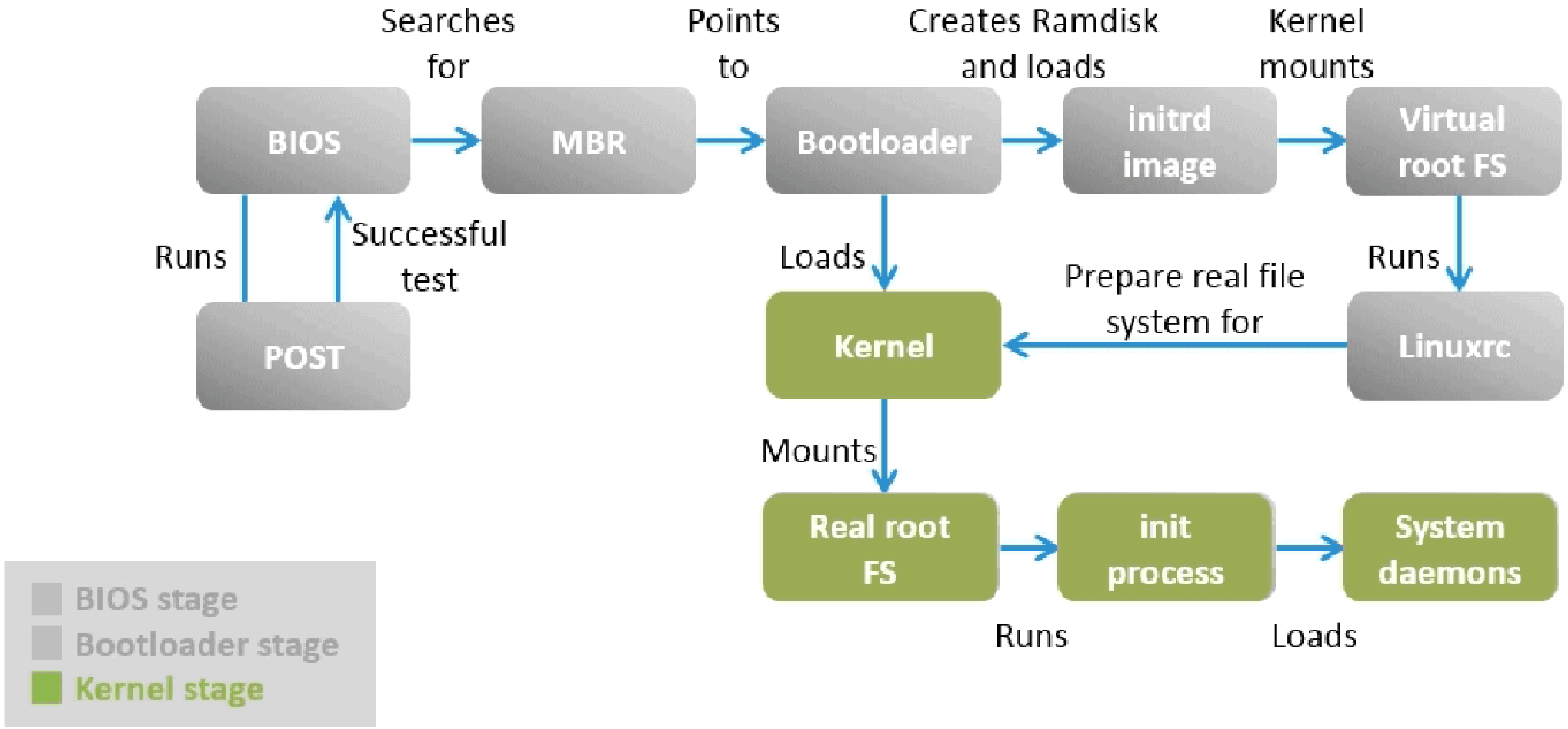
Linux boot process



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Source: https://www.golinuxcloud.com/linux-boot-process-explained-step-detail/

dracut

Build time

- Create initrd – saved on ISO

Run time

- Prepare rootfs
- Mount rootfs
- Handover to systemd

- Driven by modules
  - `man 7 dracut.modules`

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Elemental dracut modules

- `/usr/lib/dracut/modules.d/30cos-immutable-rootfs`

- Parse cmdline
  - Find `root=` parameter
- Find rootfs image
  - State partition
- Mount rootfs
- Overlay mount
  - e.g. `/etc/hostname`
- Bind mount
  - Persistent partition

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https://rancher.github.io/elemental-toolkit/docs/customizing/stages/

Elemental systemd services

- `/usr/lib/systemd/system/cos-setup-*.service`
- Populate config files
  - Users
  - Network
  - …

Populating config files

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Cloud-init

https://cloud-init.io

Python

https://github.com/mudler/yip

Go

Copyr

elemental cloud-init

```
spec:
 config:
   cloud-config:
     users:
     - name: root
       passwd: root
   elemental:
     install:
       debug: true
       device: /dev/sda
       reboot: true
```

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https://rancher.github.io/elemental/cloud-config-reference

Summary

- Read-only rootfs image
- Partitions separate concerns
- Dracut to prepare rootfs
  - Bind mounts
  - Overlayfs (tmpfs)
- Systemd
- Yip (cloud-config)

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Elemental Teal

Rancher integration

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Kubernetes Custom Resources

- MachineRegistration
  - Describes class of machines (think: Cattle)
  - Spec.config.elemental.install
  - Spec.config.cloud-config

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elemental-operator

```
helm upgrade
  --create-namespace
  -n cattle-elemental-system
  --install elemental-operator
  oci://registry.opensuse.org/isv/rancher/elemental/stable/charts/elemental/elemental-operator
```

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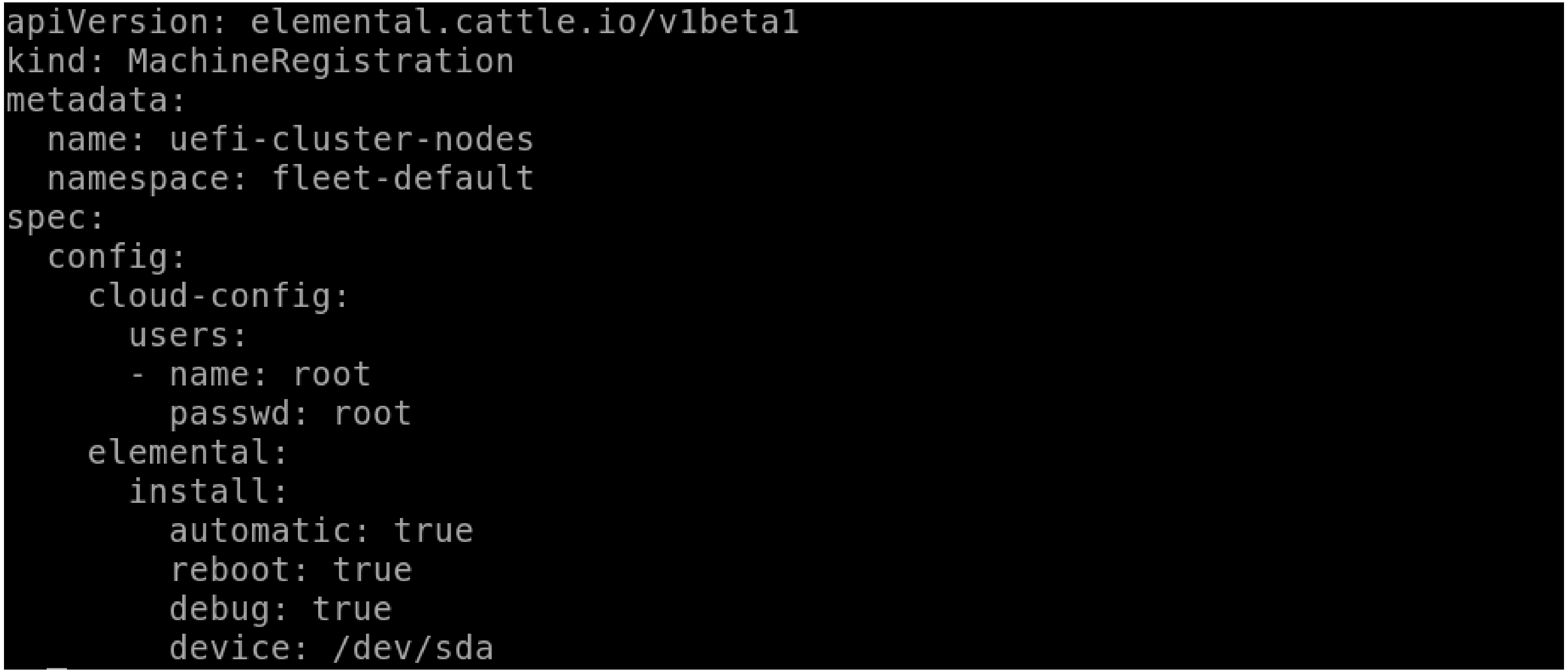
machineRegistration



```
apiVersion: elemental.cattle.io/v1beta1
kind: MachineRegistration
metadata:
  name: uefi-cluster-nodes
  namespace: fleet-default
spec:
  config:
    cloud-config:
      users:
      - name: root
        passwd: root
    elemental:
      install:
        automatic: true
        reboot: true
        debug: true
        device: /dev/sda
```

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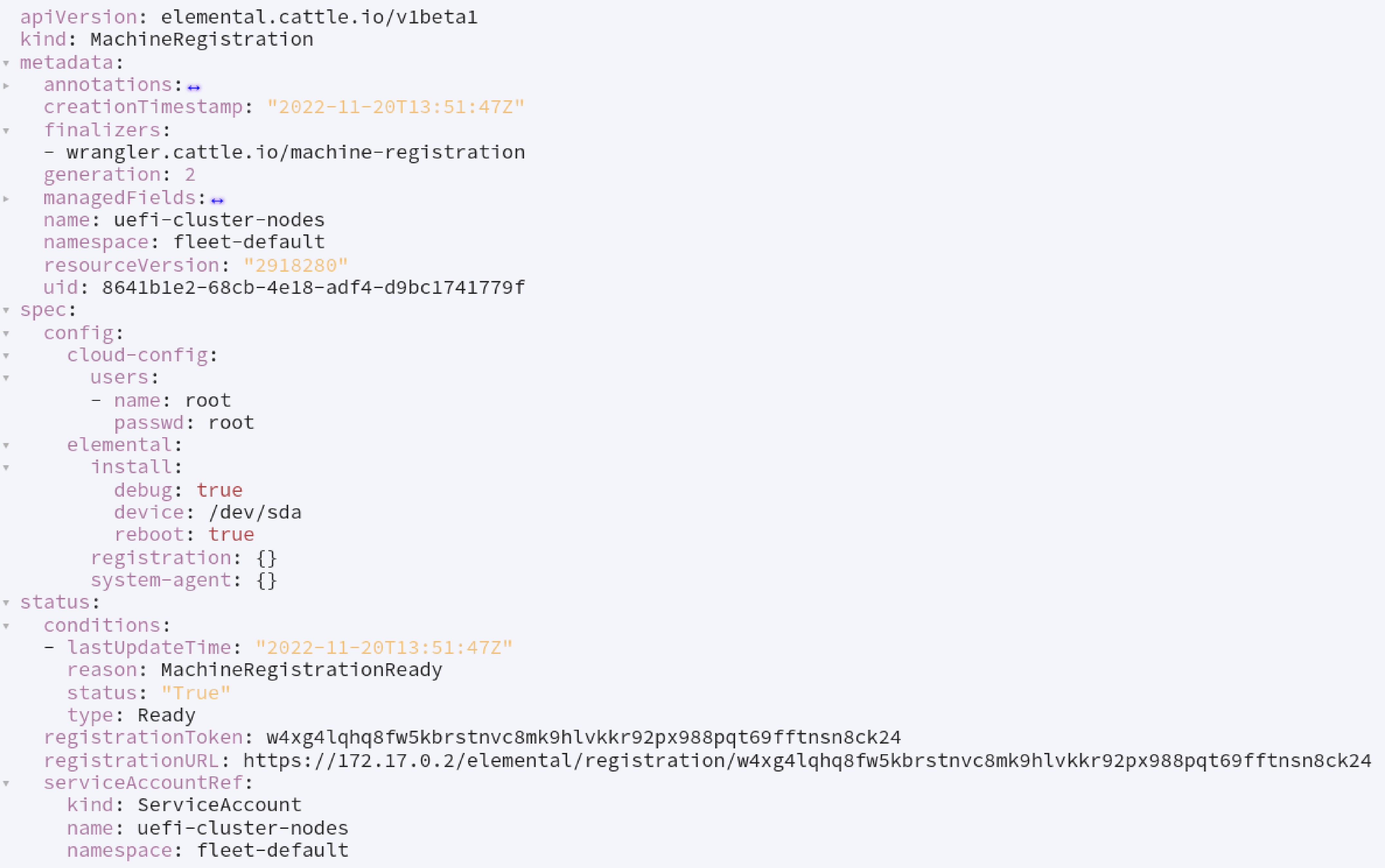
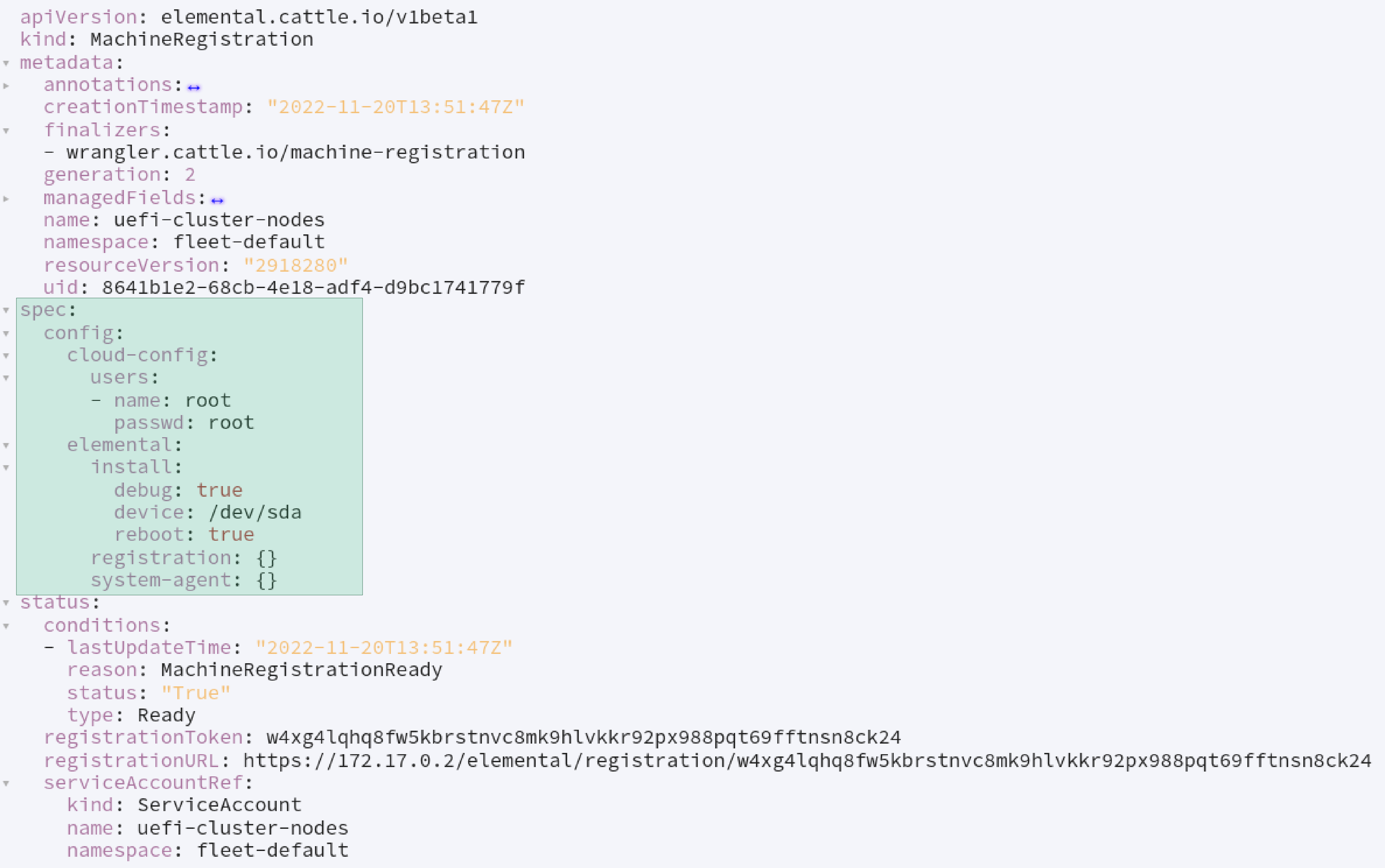
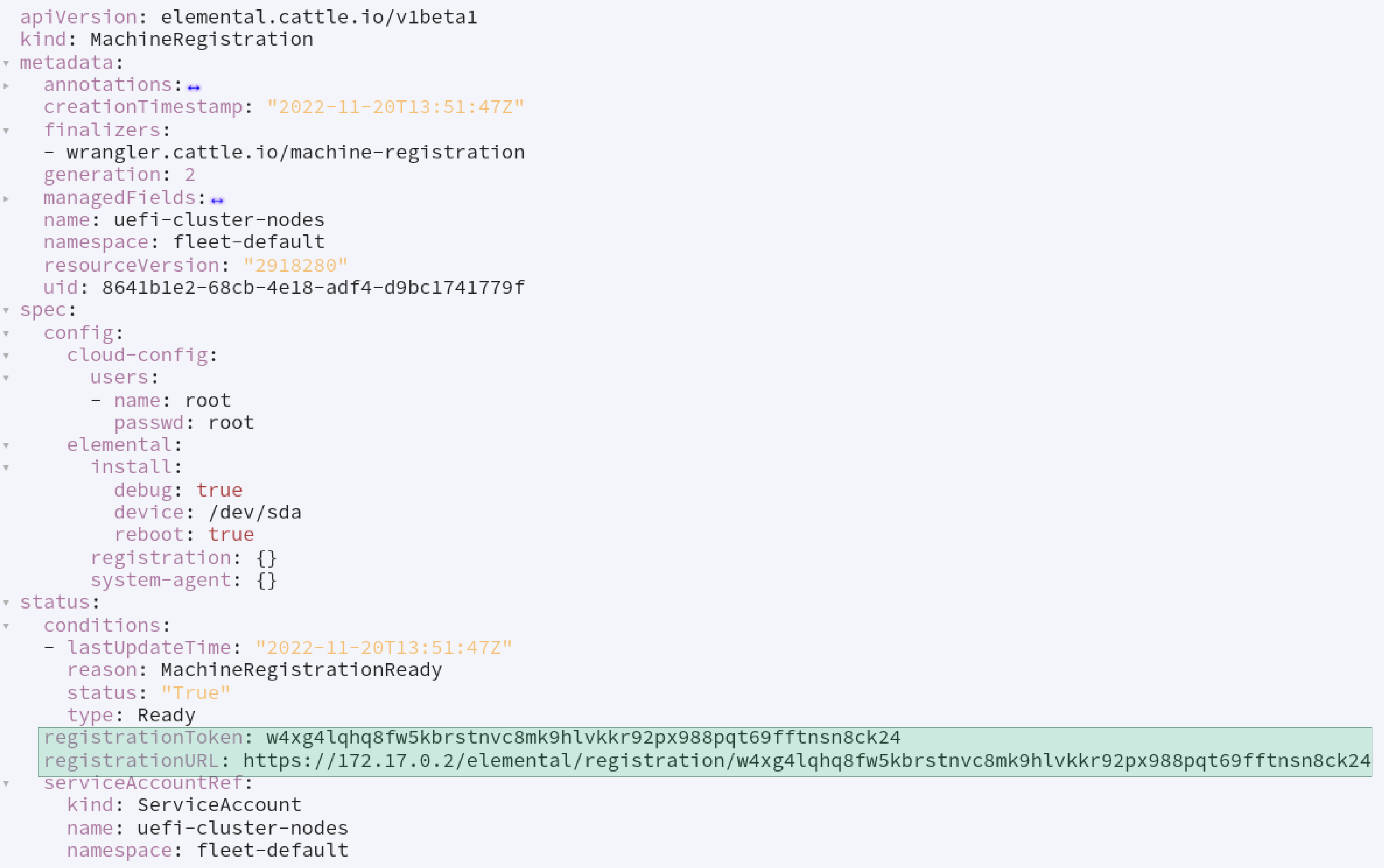


```
apiVersion: elemental.cattle.io/v1beta1
kind: MachineRegistration
metadata:
  annotations:↔
  creationTimestamp: "2022-11-20T13:51:47Z"
  finalizers:
  - wrangler.cattle.io/machine-registration
  generation: 2
  managedFields:↔
  name: uefi-cluster-nodes
  namespace: fleet-default
  resourceVersion: "2918280"
  uid: 8641b1e2-68cb-4e18-adf4-d9bc1741779f
spec:
  config:
    cloud-config:
      users:
      - name: root
        passwd: root
    elemental:
      install:
        debug: true
        device: /dev/sda
        reboot: true
      registration: {}
      system-agent: {}
status:
  conditions:
  - lastUpdateTime: "2022-11-20T13:51:47Z"
    reason: MachineRegistrationReady
    status: "True"
    type: Ready
  registrationToken: w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  registrationURL: https://172.17.0.2/elemental/registration/w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  serviceAccountRef:
    kind: ServiceAccount
    name: uefi-cluster-nodes
    namespace: fleet-default
```



```yaml
apiVersion: elemental.cattle.io/v1beta1
kind: MachineRegistration
metadata:
  annotations: ↔
  creationTimestamp: "2022-11-20T13:51:47Z"
  finalizers:
  - wrangler.cattle.io/machine-registration
  generation: 2
  managedFields: ↔
  name: uefi-cluster-nodes
  namespace: fleet-default
  resourceVersion: "2918280"
  uid: 8641b1e2-68cb-4e18-adf4-d9bc1741779f
spec:
  config:
    cloud-config:
      users:
      - name: root
        passwd: root
    elemental:
      install:
        debug: true
        device: /dev/sda
        reboot: true
      registration: {}
      system-agent: {}
status:
  conditions:
  - lastUpdateTime: "2022-11-20T13:51:47Z"
    reason: MachineRegistrationReady
    status: "True"
    type: Ready
  registrationToken: w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  registrationURL: https://172.17.0.2/elemental/registration/w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  serviceAccountRef:
    kind: ServiceAccount
    name: uefi-cluster-nodes
    namespace: fleet-default
```



```
apiVersion: elemental.cattle.io/v1beta1
kind: MachineRegistration
metadata:
  annotations:↔
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  finalizers:
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  generation: 2
  managedFields:↔
  name: uefi-cluster-nodes
  namespace: fleet-default
  resourceVersion: "2918280"
  uid: 8641b1e2-68cb-4e18-adf4-d9bc1741779f
spec:
  config:
    cloud-config:
      users:
      - name: root
        passwd: root
    elemental:
      install:
        debug: true
        device: /dev/sda
        reboot: true
      registration: {}
      system-agent: {}
status:
  conditions:
  - lastUpdateTime: "2022-11-20T13:51:47Z"
    reason: MachineRegistrationReady
    status: "True"
    type: Ready
  registrationToken: w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  registrationURL: https://172.17.0.2/elemental/registration/w4xg4lqhq8fw5kbrstnvc8mk9hlvkkr92px988pqt69fftnsn8ck24
  serviceAccountRef:
    kind: ServiceAccount
    name: uefi-cluster-nodes
    namespace: fleet-default
```

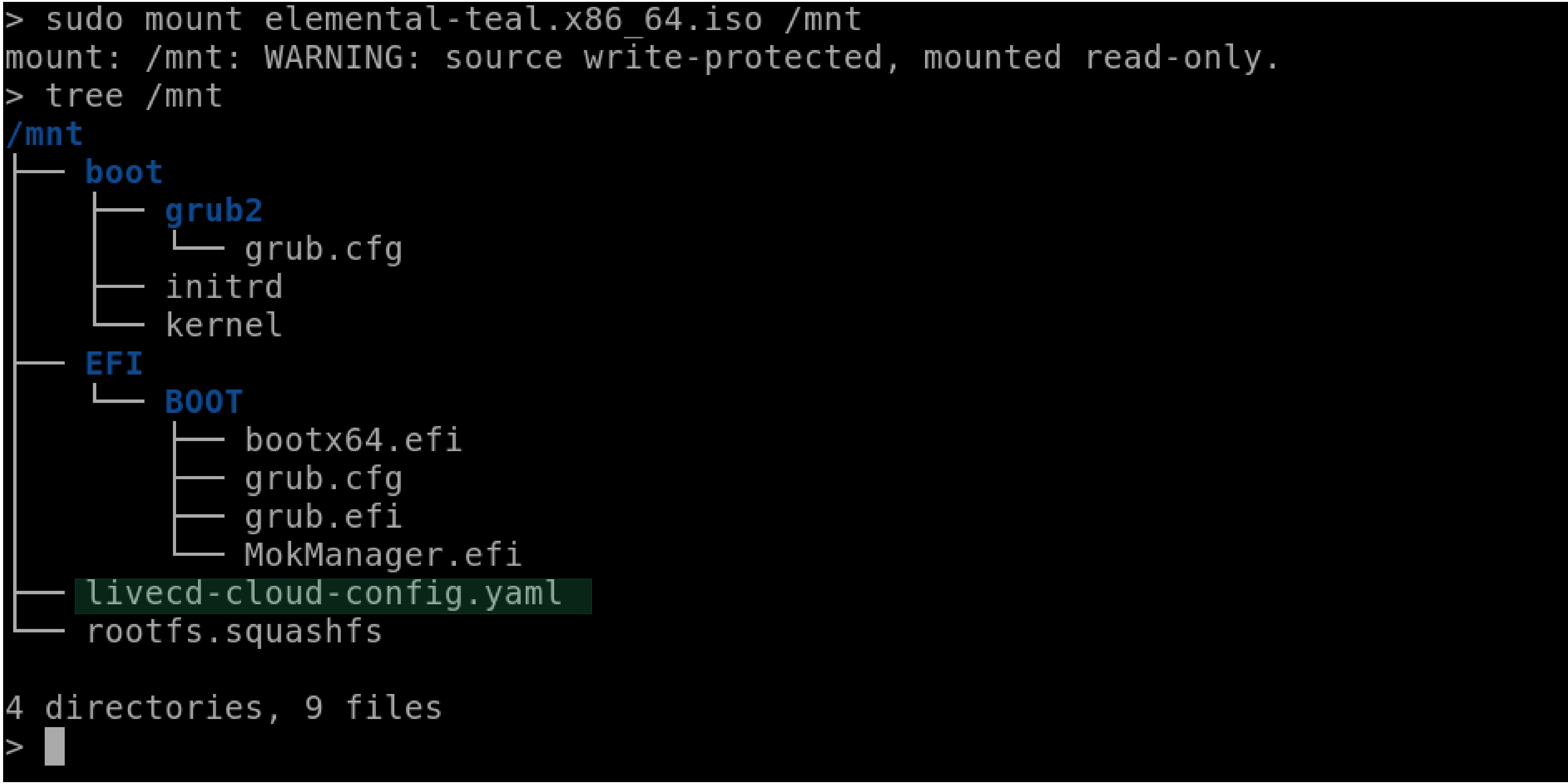

```
> sudo mount elemental-teal.x86_64.iso /mnt
mount: /mnt: WARNING: source write-protected, mounted read-only.
> tree /mnt
/mnt
├── boot
│   ├── grub2
│   │   └── grub.cfg
│   ├── initrd
│   └── kernel
├── EFI
│   └── BOOT
│       ├── bootx64.efi
│       ├── grub.cfg
│       ├── grub.efi
│       └── MokManager.efi
├── livecd-cloud-config.yaml
└── rootfs.squashfs

4 directories, 9 files
> 
```

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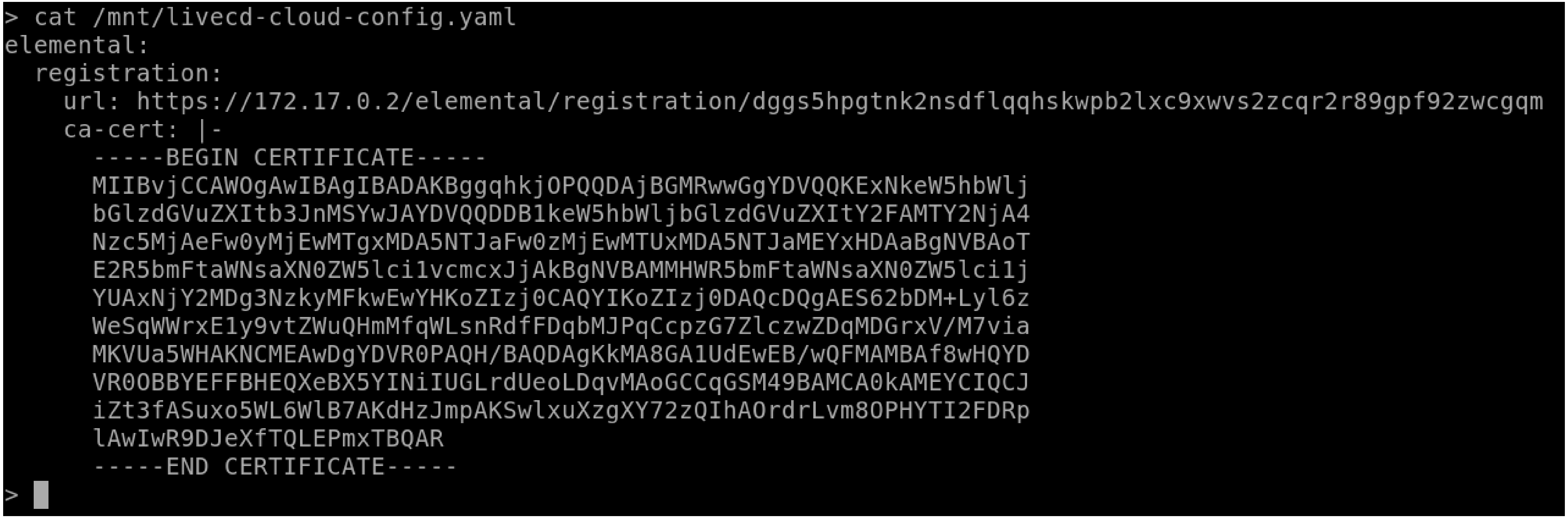

```
> cat /mnt/livecd-cloud-config.yaml
elemental:
  registration:
    url: https://172.17.0.2/elemental/registration/dggs5hpgtnk2nsdflqqhskwpb2lxc9xwvs2zcqr2r89gpf92zwcgqm
    ca-cert: |-
      -----BEGIN CERTIFICATE-----
      MIIBvjCCAWOgAwIBAgIBADAKBggqhkjOPQQDAjBGMRwwGgYDVQQKExNkeW5hbWlj
      bGlzdGVuZXItb3JnMSYwJAYDVQQDDB1keW5hbWljbGlzdGVuZXItY2FAMTY2NjA4
      Nzc5MjAeFw0yMjEwMTgxMDA5NTJaFw0zMjEwMTUxMDA5NTJaMEYxHDAaBgNVBAoT
      E2R5bmFtaWNsaXN0ZW5lci1vcmcxJjAkBgNVBAMMHWR5bmFtaWNsaXN0ZW5lci1j
      YUAxNjY2MDg3NzkyMFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAES62bDM+Lyl6z
      WeSqWWrxE1y9vtZWuQHmMfqWLsnRdfFDqbMJPqCcpzG7ZlczwZDqMDGrxV/M7via
      MKVUa5WHAKNCMEAwDgYDVR0PAQH/BAQDAgKkMA8GA1UdEwEB/wQFMAMBAf8wHQYD
      VR0OBBYEFFBHEQXeBX5YINiIUGLrdUeoLDqvMAoGCCqGSM49BAMCA0kAMEYCIQCJ
      iZt3fASuxo5WL6WlB7AKdHzJmpAKSwlxuXzgXY72zQIhAOrdrLvm8OPHYTI2FDRp
      lAwIwR9DJeXfTQLEPmxTBQAR
      -----END CERTIFICATE-----
> 
```

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Phoning home

- Connecting to the management cluster
  - Cluster: elemental-operator
  - Machine: elemental-register
- Guarantee uniqueness
  - TPM 2.0 hash
- Secure device onboarding

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Registration flow

`kubectl apply -f machineRegistration.yaml`

Elemental operator: `registrationToken registrationURL`

ISO: `livecd-cloud-config.yaml`

`elemental-register`

Elemental operator: `machineInventory`

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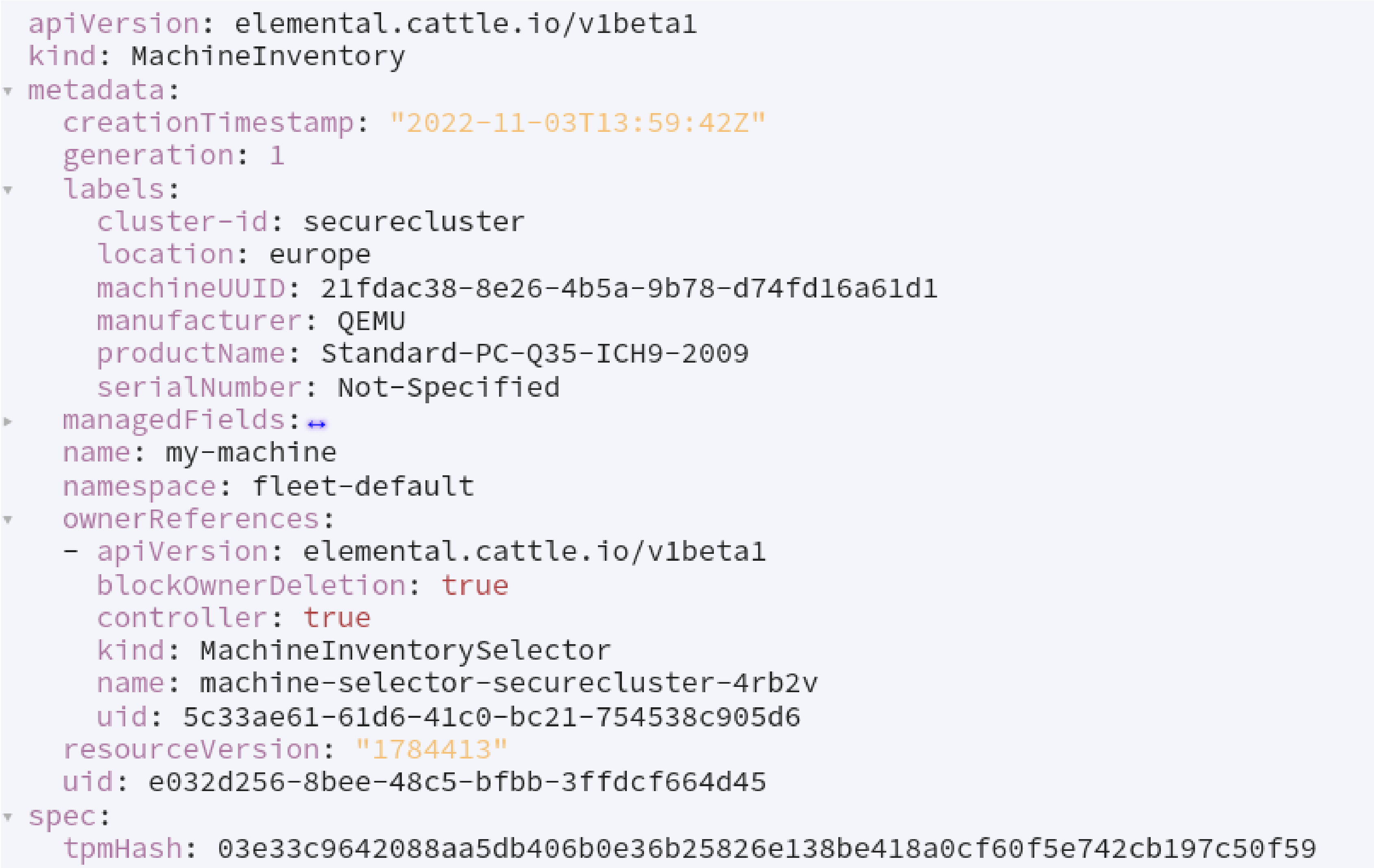
machineInventory



```yaml
apiVersion: elemental.cattle.io/v1beta1
kind: MachineInventory
metadata:
  creationTimestamp: "2022-11-03T13:59:42Z"
  generation: 1
  labels:
    cluster-id: securecluster
    location: europe
    machineUUID: 21fdac38-8e26-4b5a-9b78-d74fd16a61d1
    manufacturer: QEMU
    productName: Standard-PC-Q35-ICH9-2009
    serialNumber: Not-Specified
  managedFields:↔
  name: my-machine
  namespace: fleet-default
  ownerReferences:
  - apiVersion: elemental.cattle.io/v1beta1
    blockOwnerDeletion: true
    controller: true
    kind: MachineInventorySelector
    name: machine-selector-securecluster-4rb2v
    uid: 5c33ae61-61d6-41c0-bc21-754538c905d6
  resourceVersion: "1784413"
  uid: e032d256-8bee-48c5-bfbb-3ffdcf664d45
spec:
  tpmHash: 03e33c9642088aa5db406b0e36b25826e138be418a0cf60f5e742cb197c50f59
```

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Rancher cluster provisioning

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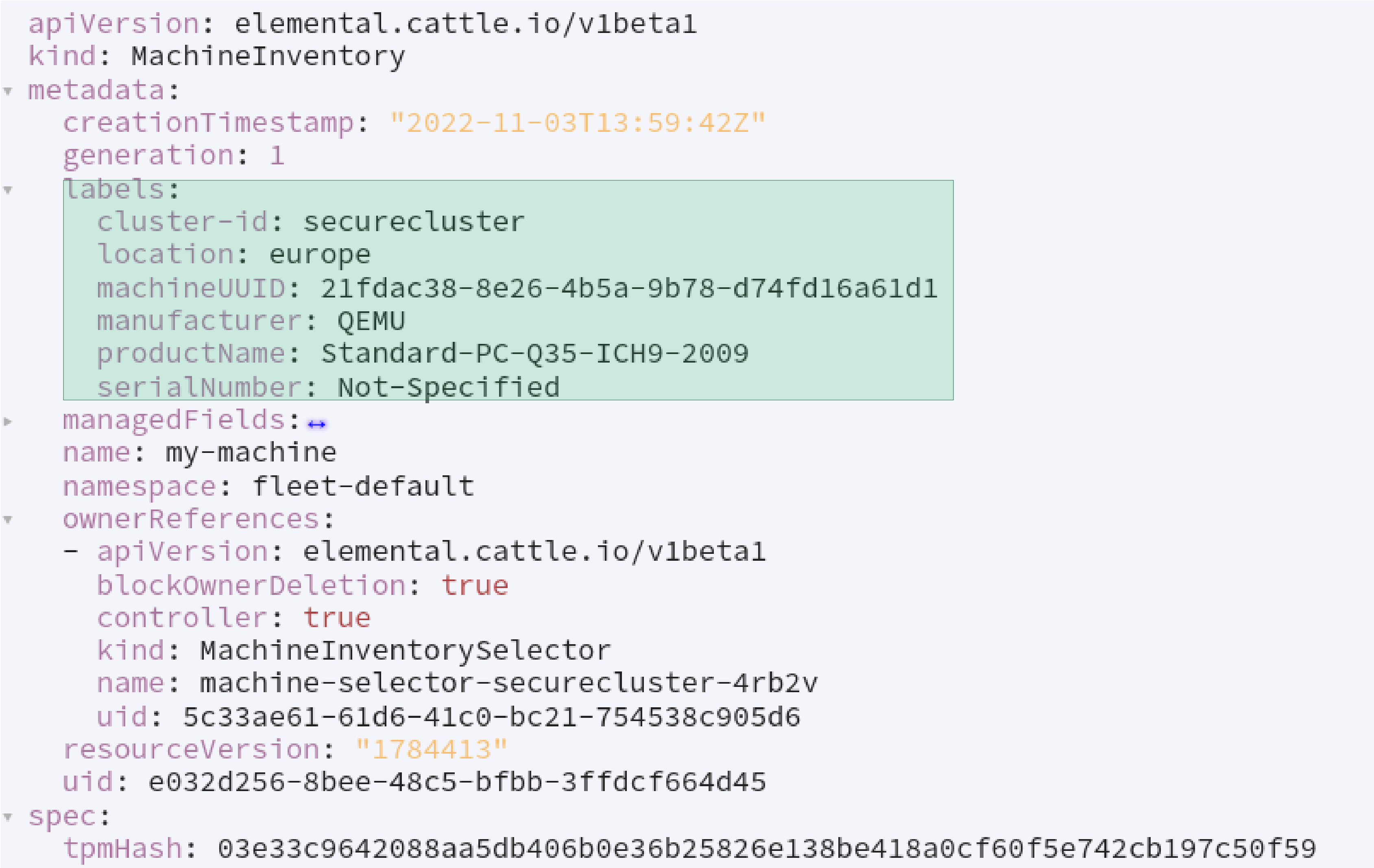
Labels control everything



```yaml
apiVersion: elemental.cattle.io/v1beta1
kind: MachineInventory
metadata:
  creationTimestamp: "2022-11-03T13:59:42Z"
  generation: 1
  labels:
    cluster-id: securecluster
    location: europe
    machineUUID: 21fdac38-8e26-4b5a-9b78-d74fd16a61d1
    manufacturer: QEMU
    productName: Standard-PC-Q35-ICH9-2009
    serialNumber: Not-Specified
  managedFields:↔
  name: my-machine
  namespace: fleet-default
  ownerReferences:
  - apiVersion: elemental.cattle.io/v1beta1
    blockOwnerDeletion: true
    controller: true
    kind: MachineInventorySelector
    name: machine-selector-securecluster-4rb2v
    uid: 5c33ae61-61d6-41c0-bc21-754538c905d6
  resourceVersion: "1784413"
  uid: e032d256-8bee-48c5-bfbb-3ffdcf664d45
spec:
  tpmHash: 03e33c9642088aa5db406b0e36b25826e138be418a0cf60f5e742cb197c50f59
```

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Allow machine to join cluster

```
kubectl label
  MachineInventory my-machine
  -n fleet-default
  cluster-id=securecluster
```

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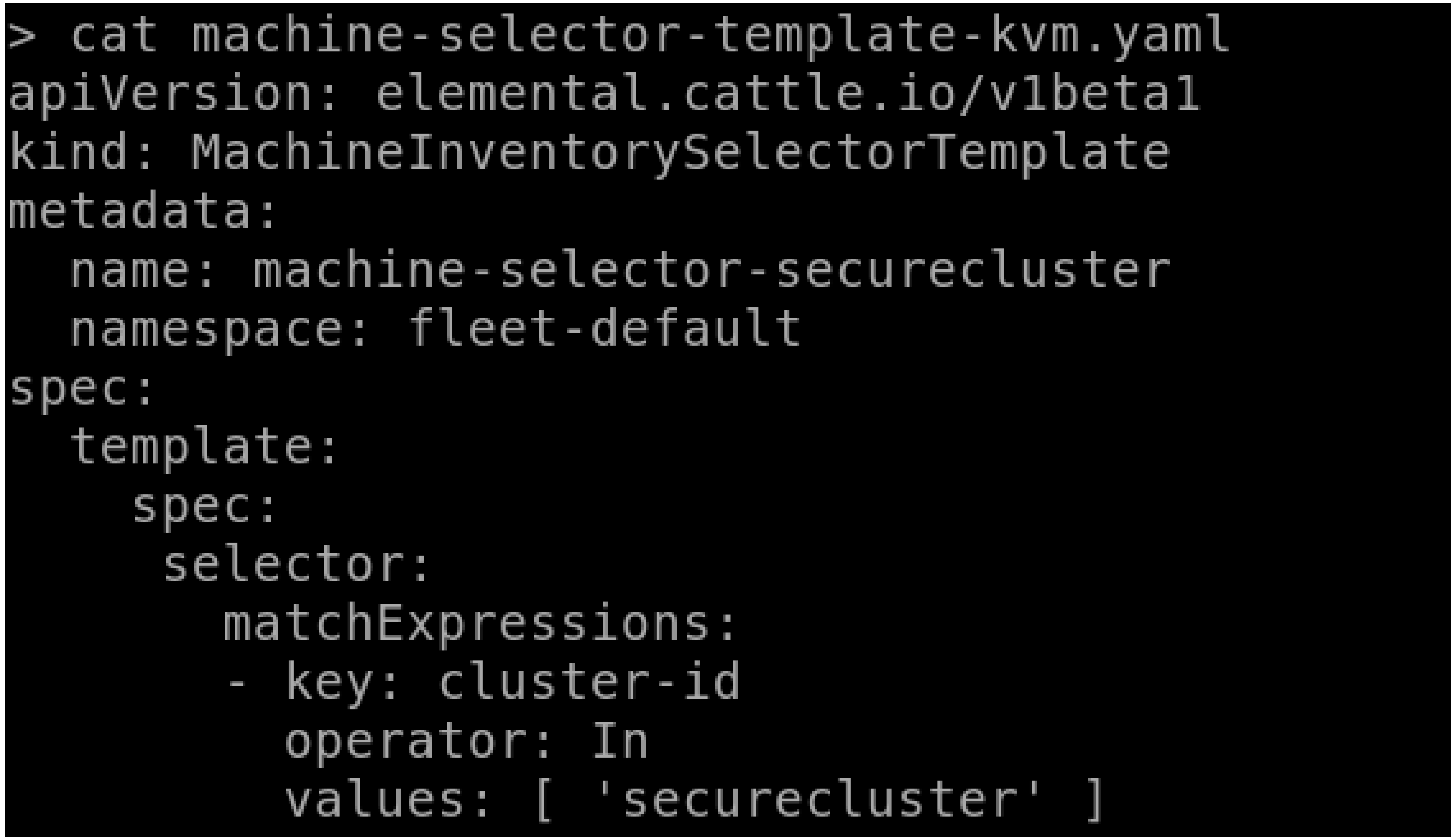
Help cluster to find machines



```
> cat machine-selector-template-kvm.yaml
apiVersion: elemental.cattle.io/v1beta1
kind: MachineInventorySelectorTemplate
metadata:
  name: machine-selector-securecluster
  namespace: fleet-default
spec:
  template:
    spec:
     selector:
       matchExpressions:
       - key: cluster-id
         operator: In
         values: [ 'securecluster' ]
```

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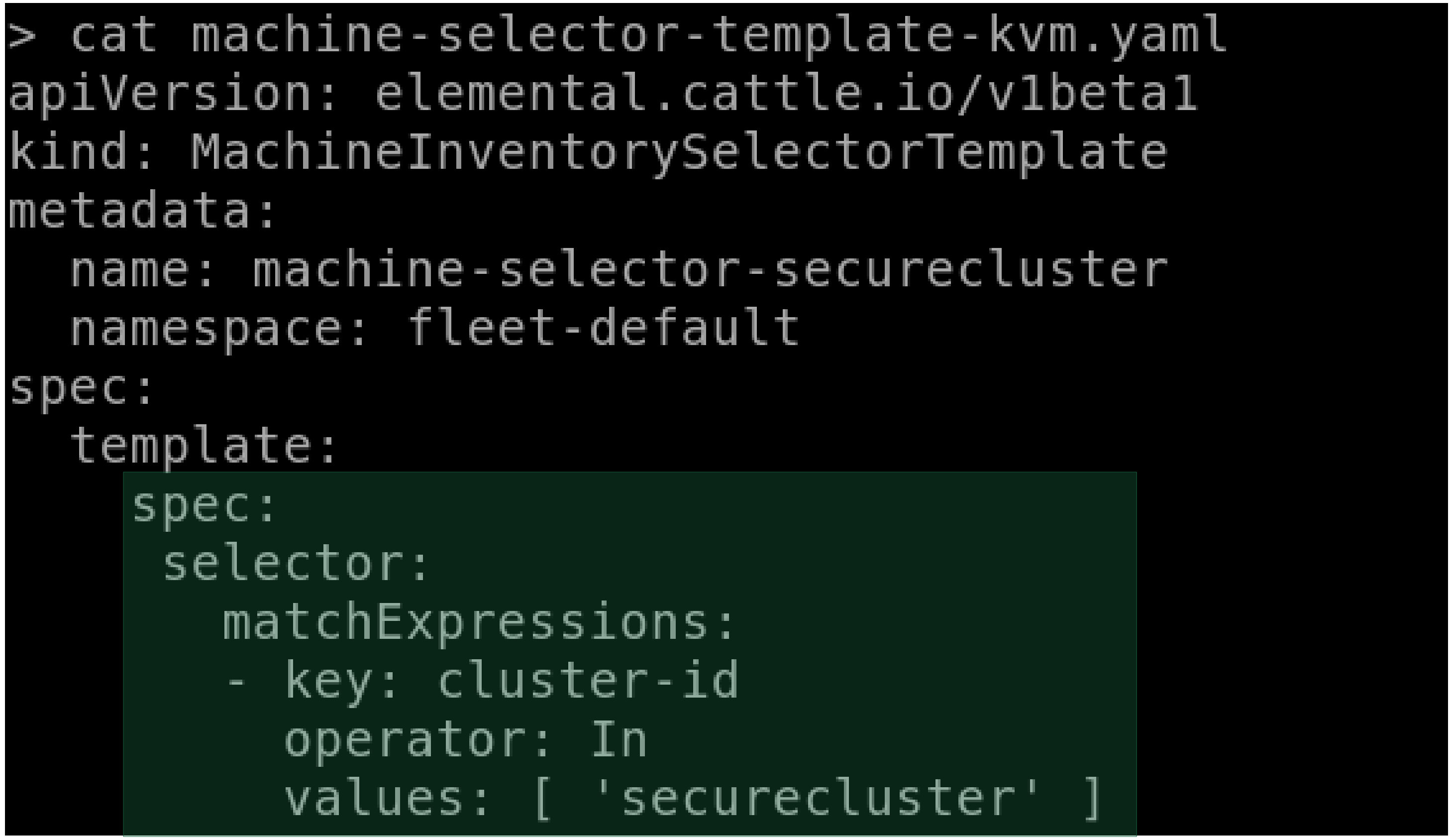
Help cluster to find machines



```
> cat machine-selector-template-kvm.yaml
apiVersion: elemental.cattle.io/v1beta1
kind: MachineInventorySelectorTemplate
metadata:
  name: machine-selector-securecluster
  namespace: fleet-default
spec:
  template:
    spec:
     selector:
       matchExpressions:
       - key: cluster-id
         operator: In
         values: [ 'securecluster' ]
```

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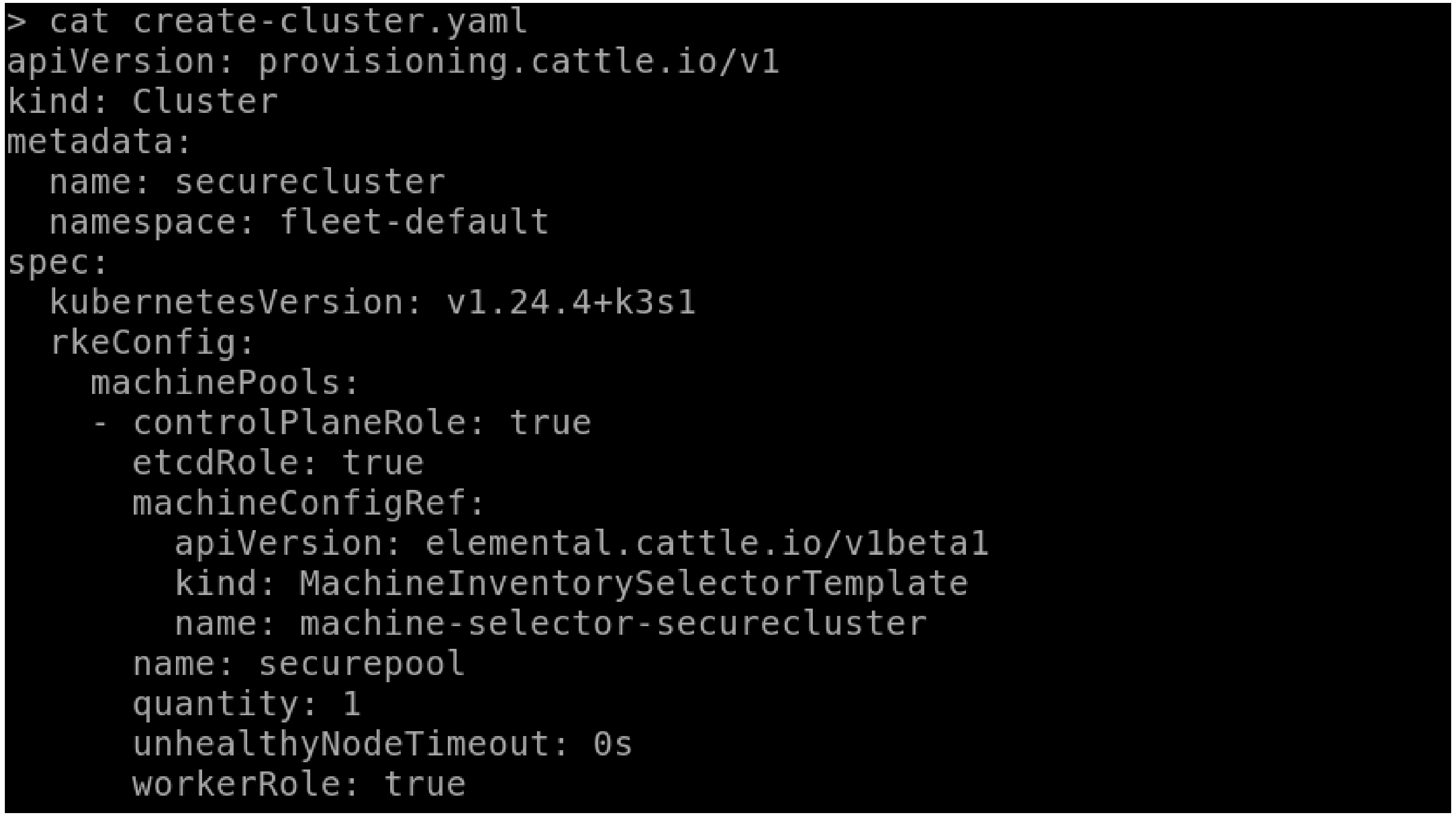
Cluster creation



```
> cat create-cluster.yaml
apiVersion: provisioning.cattle.io/v1
kind: Cluster
metadata:
  name: securecluster
  namespace: fleet-default
spec:
  kubernetesVersion: v1.24.4+k3s1
  rkeConfig:
    machinePools:
    - controlPlaneRole: true
      etcdRole: true
      machineConfigRef:
        apiVersion: elemental.cattle.io/v1beta1
        kind: MachineInventorySelectorTemplate
        name: machine-selector-securecluster
      name: securepool
      quantity: 1
      unhealthyNodeTimeout: 0s
      workerRole: true
```

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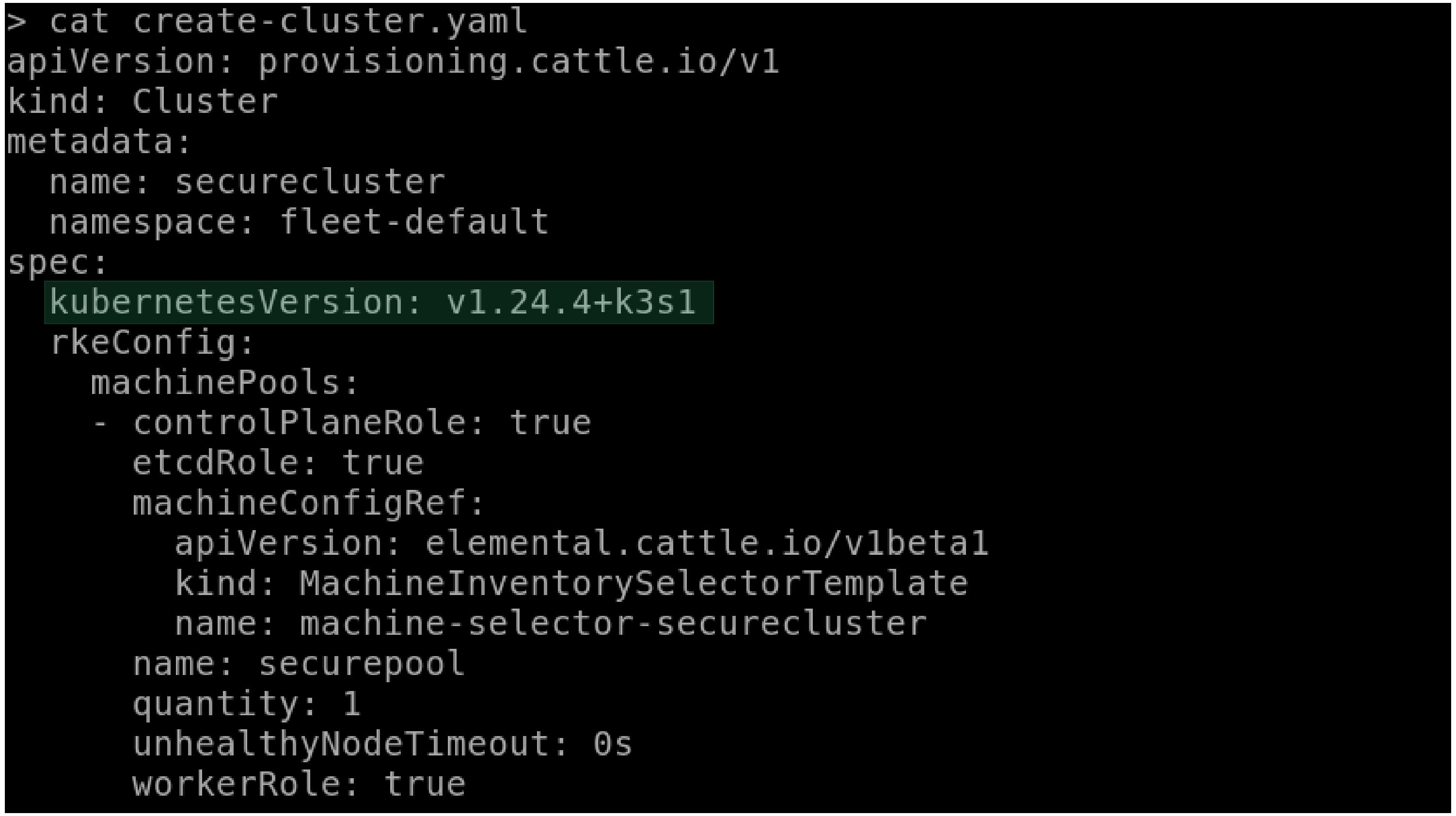
Kubernetes version



```
> cat create-cluster.yaml
apiVersion: provisioning.cattle.io/v1
kind: Cluster
metadata:
  name: securecluster
  namespace: fleet-default
spec:
  kubernetesVersion: v1.24.4+k3s1
  rkeConfig:
    machinePools:
    - controlPlaneRole: true
      etcdRole: true
      machineConfigRef:
        apiVersion: elemental.cattle.io/v1beta1
        kind: MachineInventorySelectorTemplate
        name: machine-selector-securecluster
      name: securepool
      quantity: 1
      unhealthyNodeTimeout: 0s
      workerRole: true
```

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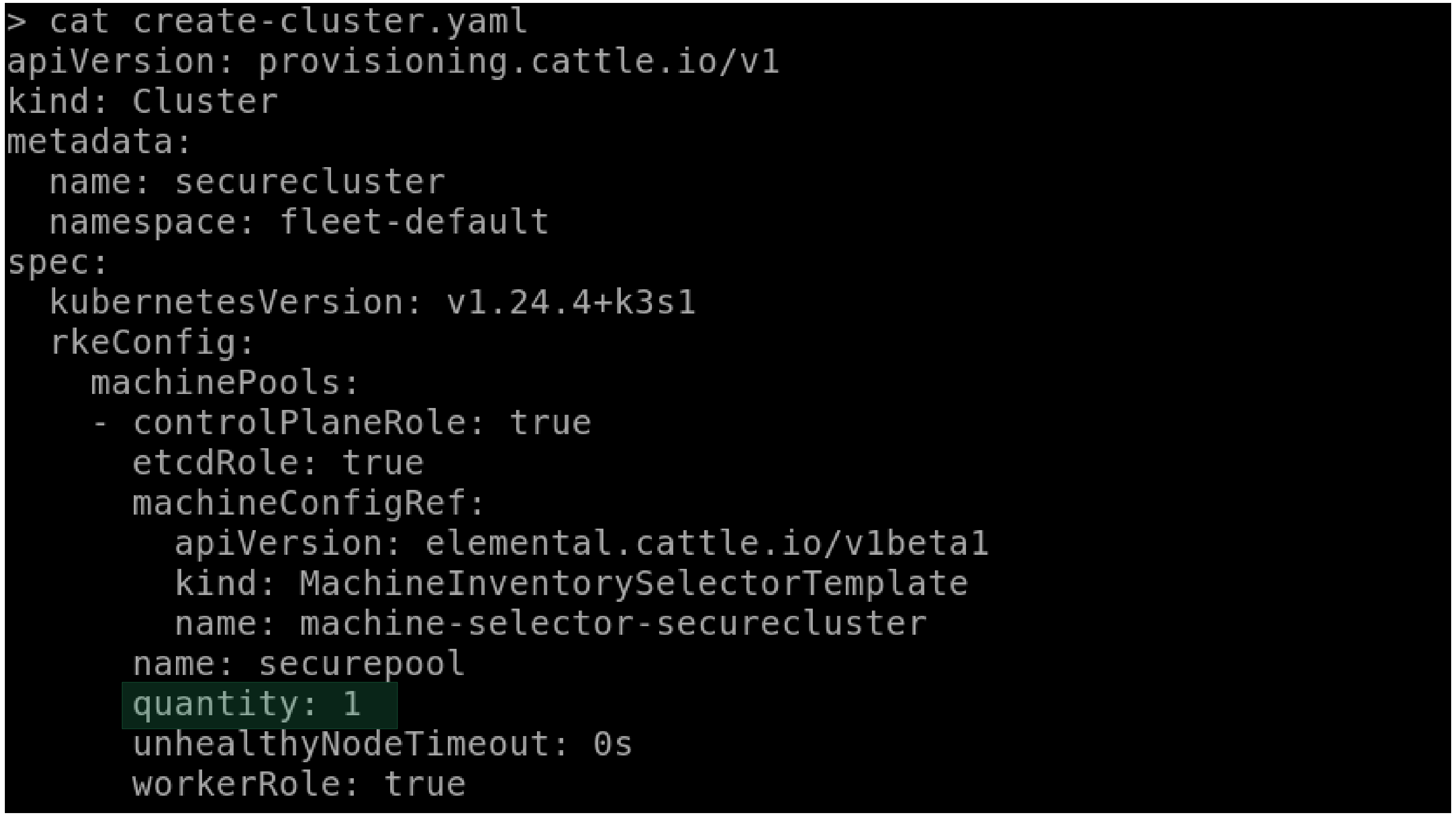
Number of nodes



```
> cat create-cluster.yaml
apiVersion: provisioning.cattle.io/v1
kind: Cluster
metadata:
  name: securecluster
  namespace: fleet-default
spec:
  kubernetesVersion: v1.24.4+k3s1
  rkeConfig:
    machinePools:
    - controlPlaneRole: true
      etcdRole: true
      machineConfigRef:
        apiVersion: elemental.cattle.io/v1beta1
        kind: MachineInventorySelectorTemplate
        name: machine-selector-securecluster
      name: securepool
      quantity: 1
      unhealthyNodeTimeout: 0s
      workerRole: true
```

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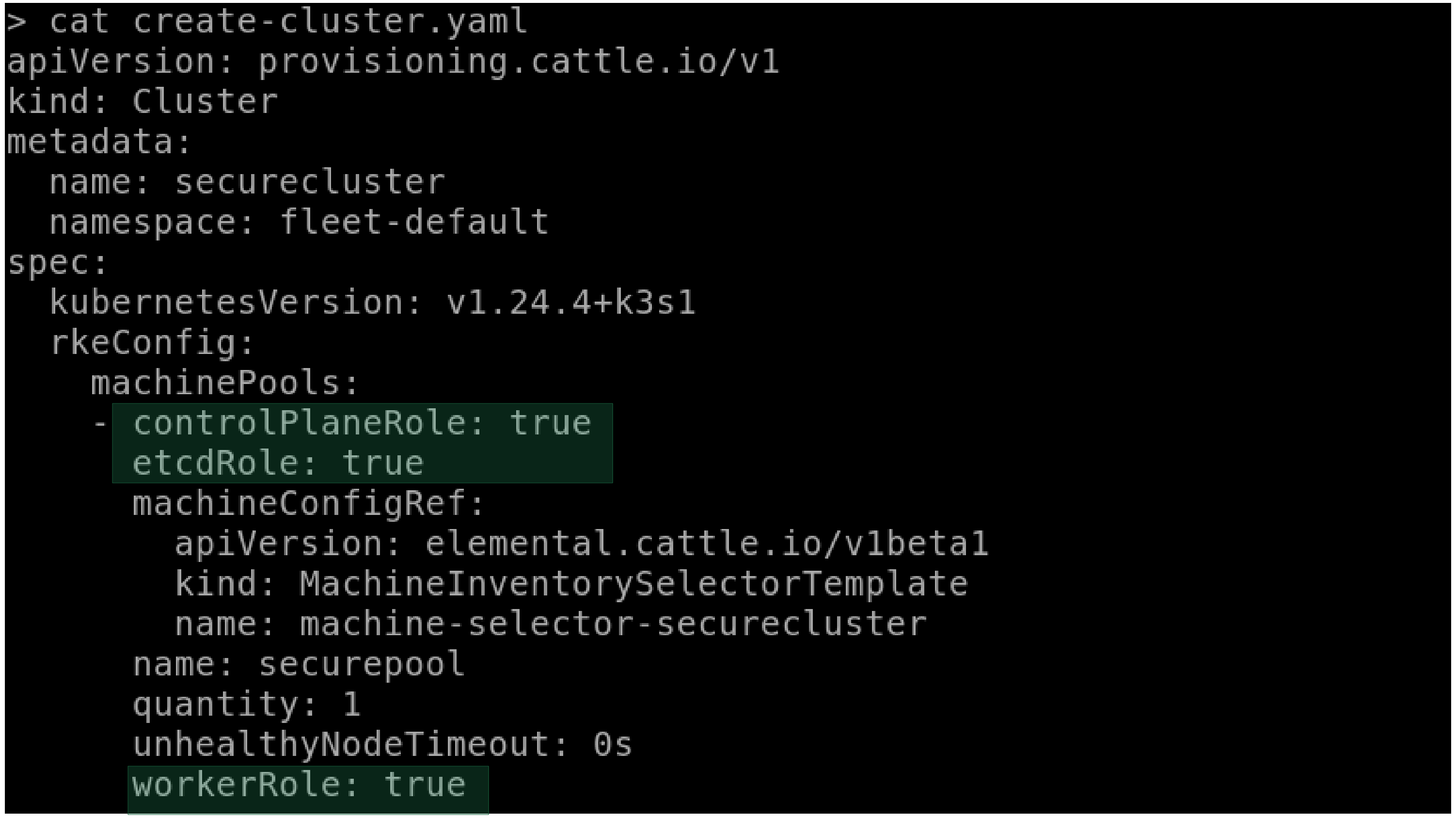
Node roles



```
> cat create-cluster.yaml
apiVersion: provisioning.cattle.io/v1
kind: Cluster
metadata:
  name: securecluster
  namespace: fleet-default
spec:
  kubernetesVersion: v1.24.4+k3s1
  rkeConfig:
    machinePools:
    - controlPlaneRole: true
      etcdRole: true
      machineConfigRef:
        apiVersion: elemental.cattle.io/v1beta1
        kind: MachineInventorySelectorTemplate
        name: machine-selector-securecluster
      name: securepool
      quantity: 1
      unhealthyNodeTimeout: 0s
      workerRole: true
```

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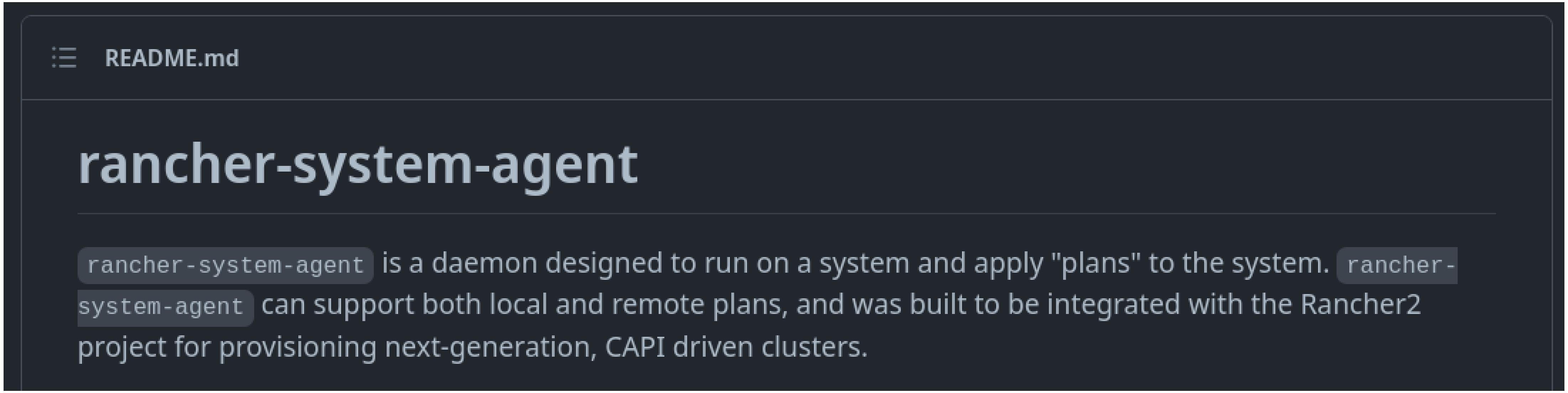
Rancher System Agent

https://github.com/rancher/system-agent



README.md

rancher-system-agent

`rancher-system-agent` is a daemon designed to run on a system and apply "plans" to the system. `rancher-system-agent` can support both local and remote plans, and was built to be integrated with the Rancher2 project for provisioning next-generation, CAPI driven clusters.

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Plans

A plan is just **a container image** which is executed in the host context without any container engine, but **which carries the binaries within a folder** which can be accessed during execution

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Plans

- Containerd
- K3s / Rke2
- …

https://github.com/rancher-sandbox/elemental-example-plan

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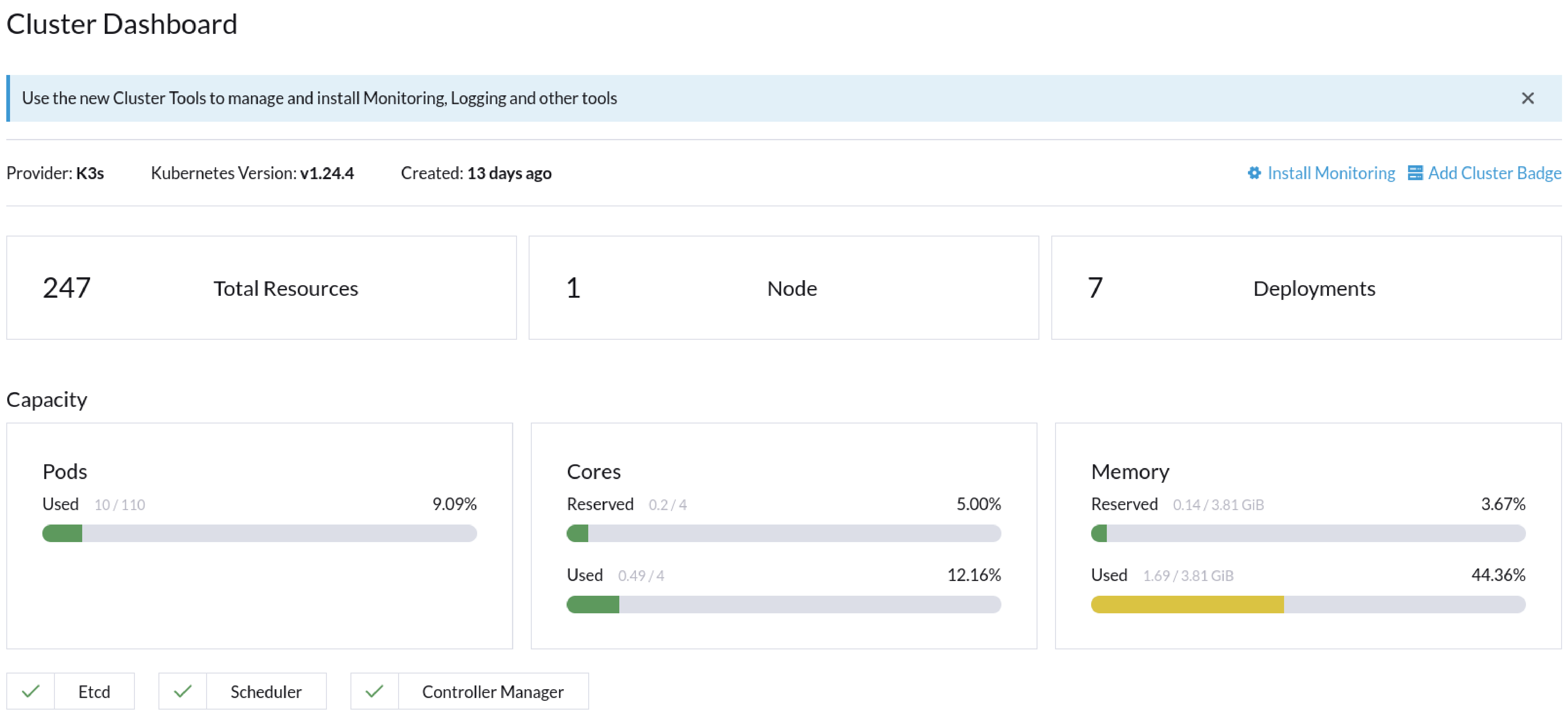

Cluster Dashboard

Use the new Cluster Tools to manage and install Monitoring, Logging and other tools ✕

Provider: **K3s** Kubernetes Version: **v1.24.4** Created: **13 days ago**

247	Total Resources
1	Node
7	Deployments

Capacity

Pods

Used 10 / 110 9.09%

Cores

Reserved 0.2 / 4 5.00%

Used 0.49 / 4 12.16%

Memory

Reserved 0.14 / 3.81 GiB 3.67%

Used 1.69 / 3.81 GiB 44.36%

✓ Etcd ✓ Scheduler ✓ Controller Manager

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Elemental UI

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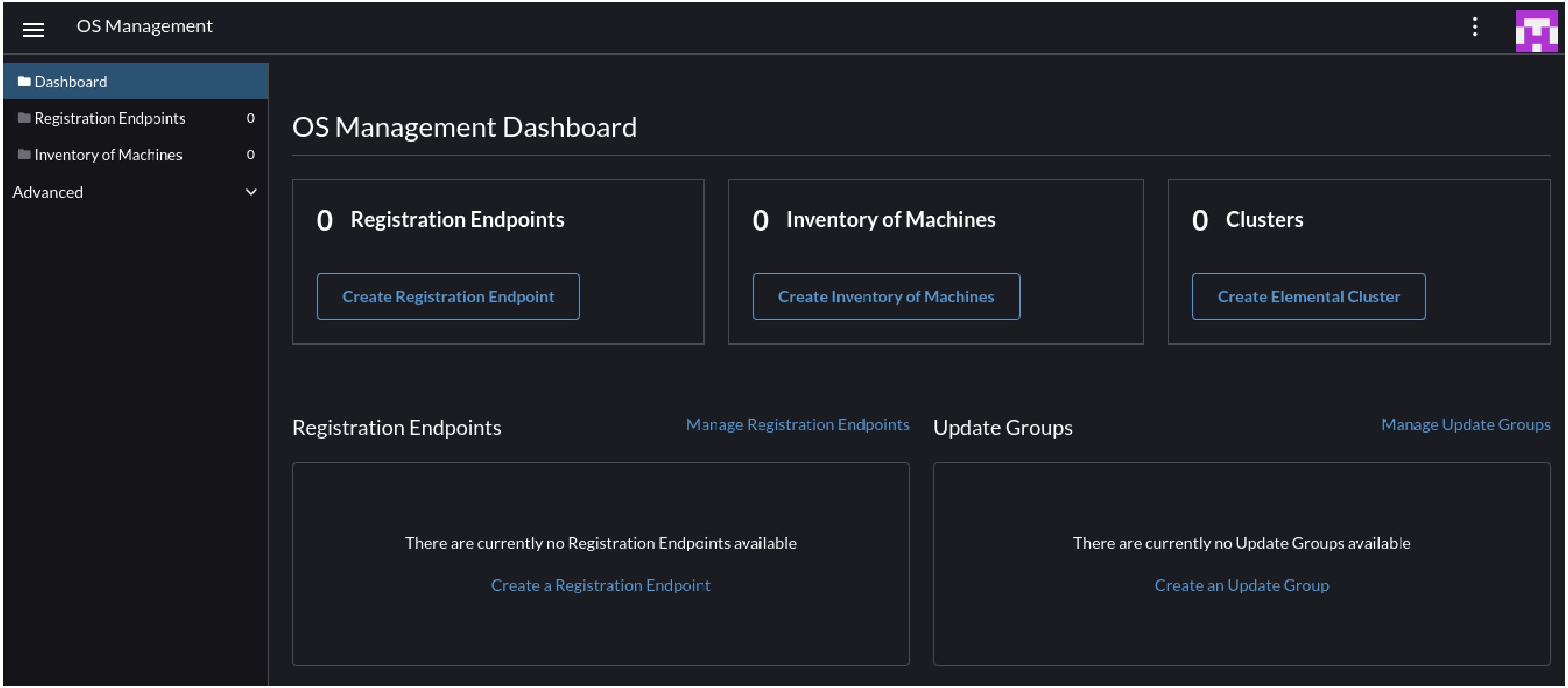

OS Management

OS Management Dashboard

0 Registration Endpoints

0 Inventory of Machines

0 Clusters

Registration Endpoints

There are currently no Registration Endpoints available

Update Groups

There are currently no Update Groups available

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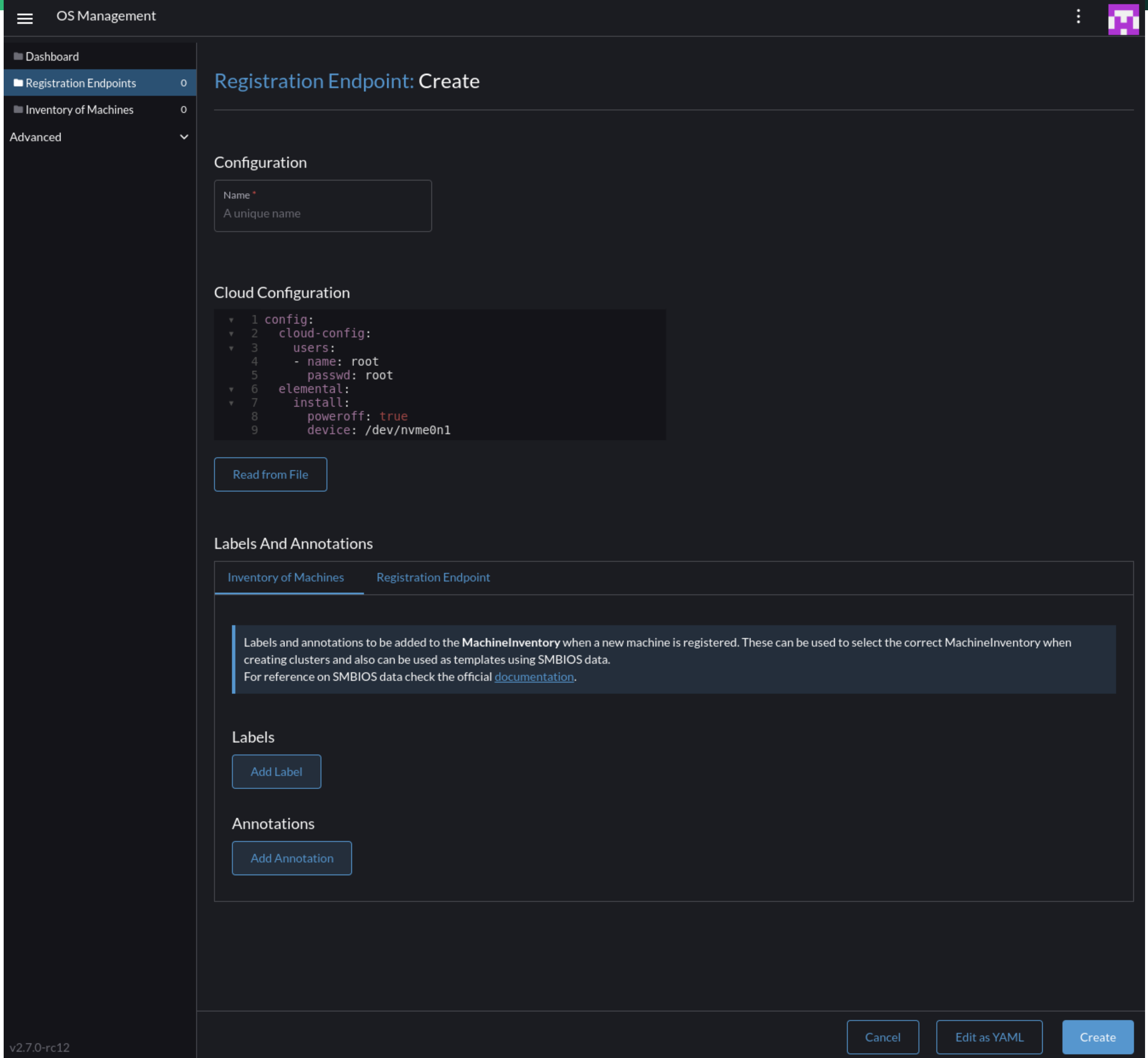

Registration Endpoint: Create

Configuration

Name *
A unique name

Cloud Configuration

```
config:
  cloud-config:
    users:
      - name: root
        passwd: root
  elemental:
    install:
      poweroff: true
      device: /dev/nvme0n1
```

Labels And Annotations

Labels and annotations to be added to the **MachineInventory** when a new machine is registered. These can be used to select the correct MachineInventory when creating clusters and also can be used as templates using SMBIOS data.
For reference on SMBIOS data check the official documentation.

Labels

Annotations

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Thank you

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