Introduction to Bare Metal provisioning for Kubernetes

What's Metal³ ?

Metal3 (pronounced "metal-cubed") is an open source collection of tools to manage bare-metal infrastructure using Kubernetes and for Kubernetes

Maintained mainly by Ericsson + Red Hat, in collaboration with other companies and many independent contributors

Uses Ironic in containers as its hidden engine to manage bare metal nodes

Metal³ Features

- Node communication via **Redfish** and IPMI
- Installation methods PxeBoot or VirtualMedia
- Support for **UEFI** (including SecureBoot), and legacy BIOS
- Specific driver support for Dell, HP, and Fujitsu
- Secure communication between components using TLS
- RAID configuration
- Configurable automated cleaning
- Live ISO support
- Most recent additions:
  - Firmware version update
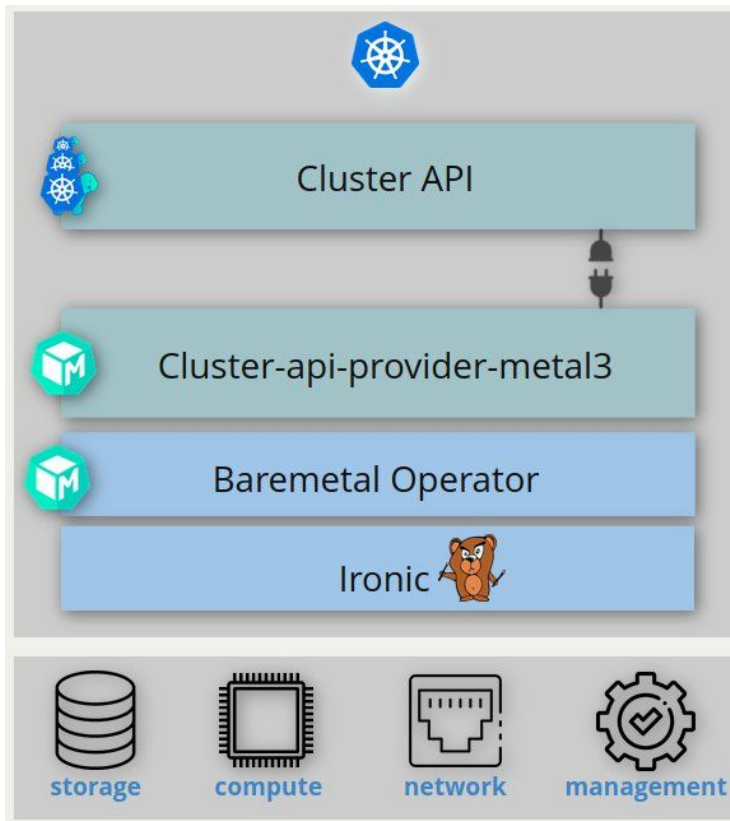 - Mount/Unmount of generic virtual media devices

Metal³ Components

Cluster Api Provider Metal³ (CAPM3)

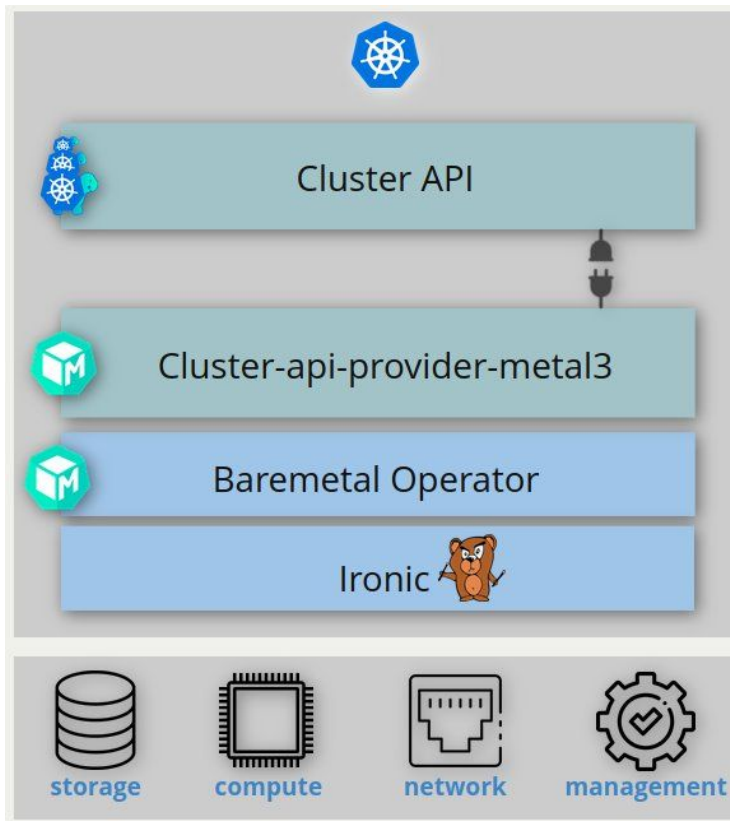Bare Metal Operator (BMO)

Ironic containerized components:

- Ironic API
- Ironic Inspector
- Ironic Python Agent
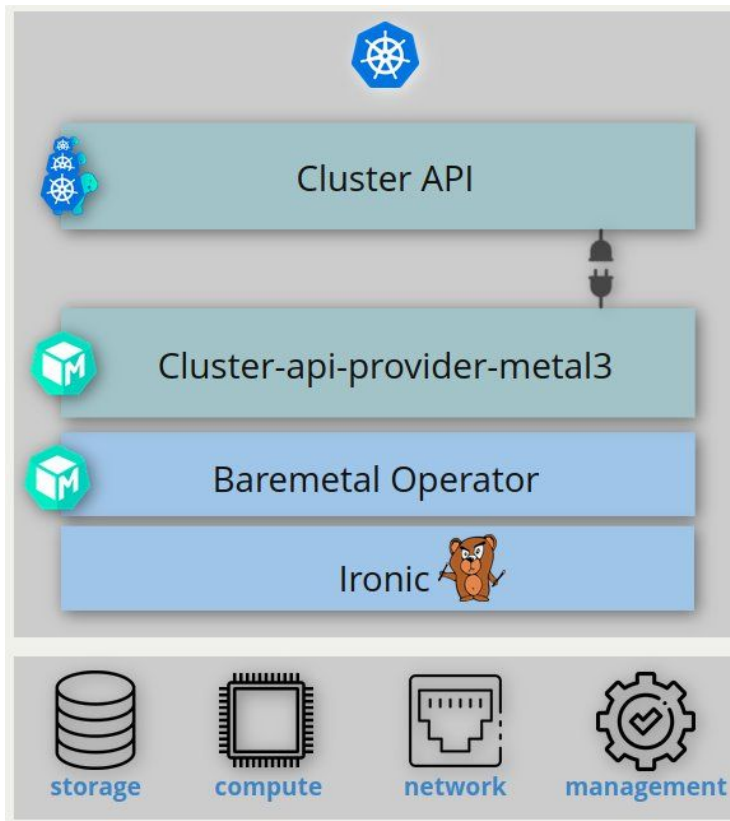
Metal³ Components

Cluster Api Provider Metal³ (CAPM3)

Provider of Kubernetes Cluster API that allows to deploy a Cluster API based cluster on bare metal using Metal³

Metal³ Components

Bare Metal Operator (BMO)

- Provides an interface to Ironic API using BareMetalHost (BMH) Custom Resources (CR) in Kubernetes
- Communicates with Ironic to provide instructions on which operations to execute on nodes

Metal³ Components

Ironic

- Communicates with the nodes BMCs (Baseboard Management Controllers)
- Provides nodes hardware information (storage, compute, networking) via inspection
- Provision and manage the nodes (pxeboot, virtual media)
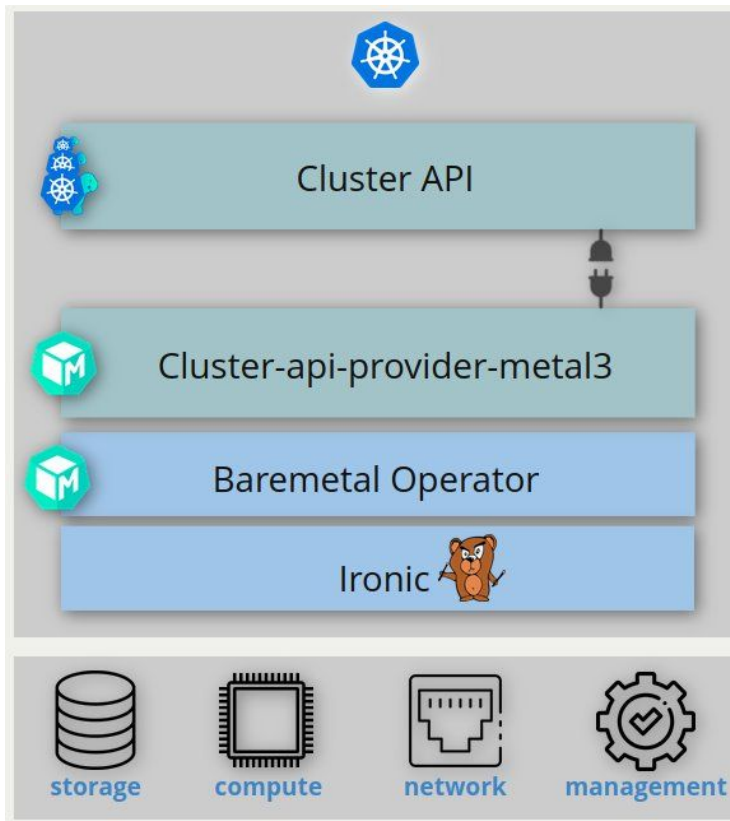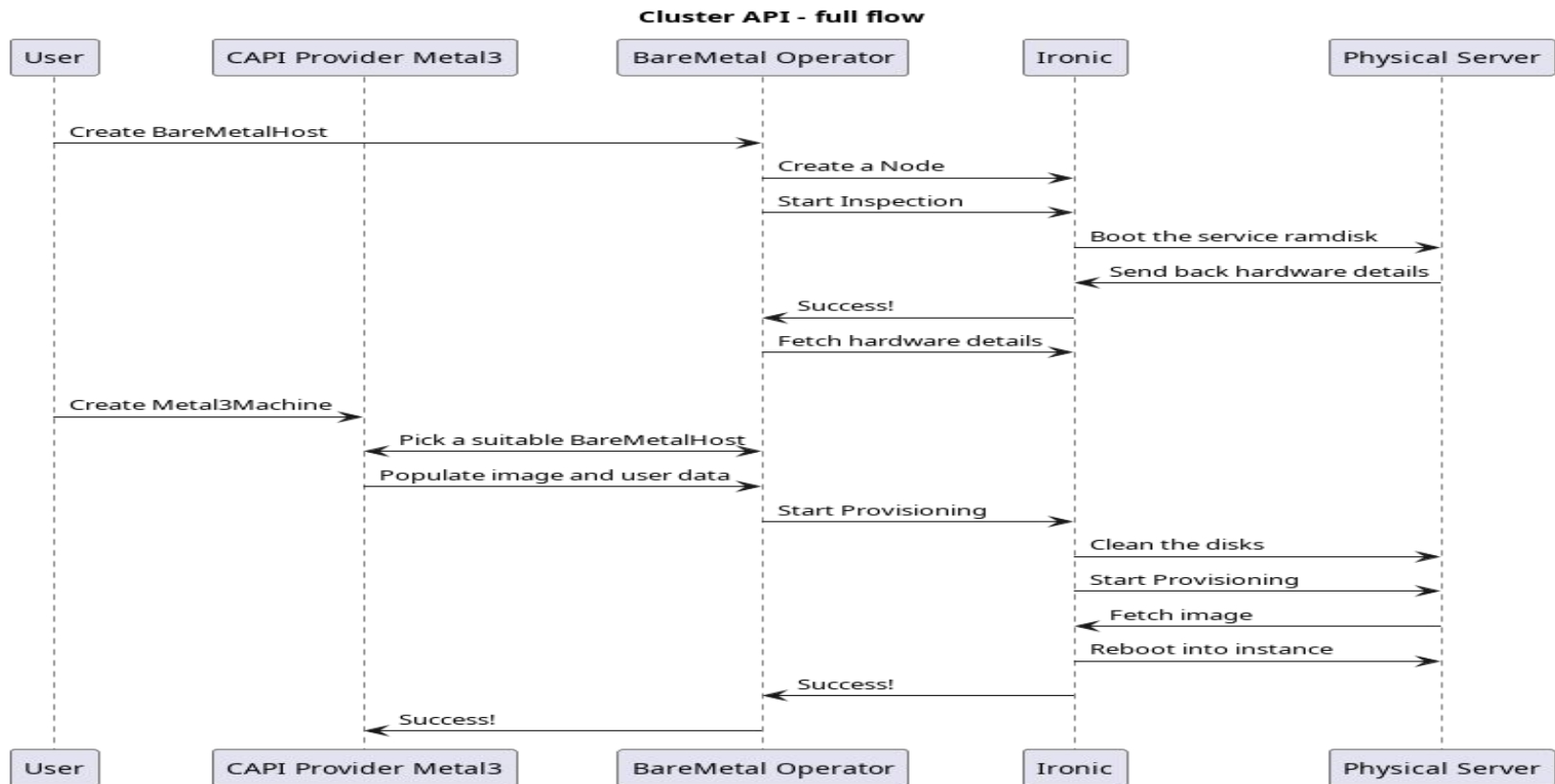
Bare Metal Management

Quick steps:

- Base k8s management cluster
- Install and configure BMO and Ironic
- Define hosts (BareMetalHosts) as Kubernetes manifests
- Change the BMH definition in Kubernetes to manage the hosts, being able to update values like user data, ip addresses, and so on

```yaml
apiVersion: metal3.io/v1alpha1
kind: BareMetalHost
metadata:
  name: node-0
  namespace: metal3
spec:
  bmc:
    address: ipmi://192.168.111.1:6230
    credentialsName: node-0-bmc-secret
  bootMACAddress: 00:5a:91:3f:9a:bd
  image:
    checksum: http://172.22.0.1/images/CENTOS_9_NODE_IMAGE_K8S_v1.29.0.qcow2.sha256sum
    url: http://172.22.0.1/images/CENTOS_9_NODE_IMAGE_K8S_v1.29.0.qcow2
  networkData:
    name: test1-workers-tbwnz-networkdata
    namespace: metal3
  online: true
  userData:
    name: test1-workers-vd4gj
    namespace: metal3
status:
  hardware:
    cpu:
      arch: x86_64
      count: 2
    hostname: node-0
    nics:
    - ip: 172.22.0.73
      mac: 00:5a:91:3f:9a:bd
      name: enp1s0
    ramMebibytes: 4096
    storage:
    - hctl: "0:0:0:0"
      name: /dev/sda
      serialNumber: drive-scsi0-0-0-0
      sizeBytes: 53687091200
      type: HDD
```

Metal³ Workflow

Cluster API - full flow

Development Setup

Recommended requirements:

Bare Metal host, 16 GB RAM, 8 CPUs

- Minikube to instantiate an ephemeral Kubernetes management cluster
- Ironic tools to emulate bare metal nodes
  - Sushy-tools (redfish)
  - VirtualBMC (IPMI)
- All bootstrap configuration in a single file

https://book.metal3.io/developer_environment/tryit

What's happening in Metal³

Inspector merge into ironic

- Partially completed
- Uses an "inspector agent" integrated in ironic
- Inspector service will go away eventually

Ironic-standalone-operator https://github.com/metal3-io/ironic-standalone-operator

- A new way to operate Ironic in Metal³
- Setup and management of ironic instances

Community Info

Weekly meeting every wednesday
https://docs.google.com/document/d/1IkElh-ffWY3DaNX3aFcAxGbttdEY_symo7WA
GmzkWhU

Metal3 website: https://metal3.io/

Github: https://github.com/metal3-io

Slack: #cluster-api-baremetal at Kubernetes

Thank you!

My contacts:

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