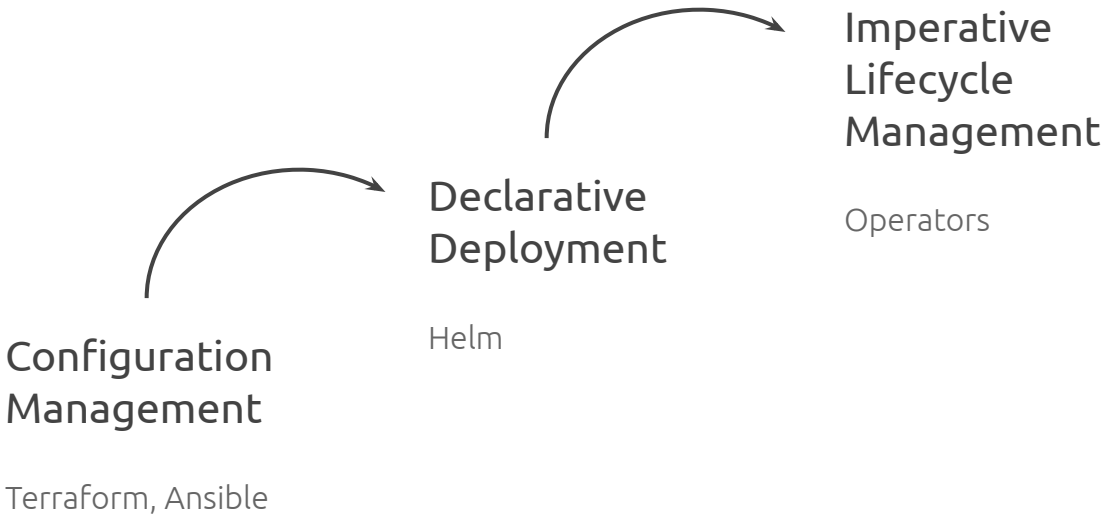
Understanding the VCA

Juju is a universal operator lifecycle manager

CANONICAL ubuntu

“How can we manage all these things?”



A ‘Kubernetes operator’ is a container which drives other containers.

Operators handle container lifecycle complexity

- ✓ install
- ✓ configure
- ✓ upgrade
- ✓ remove

“Automate all the detail of running this application on K8s”

An operator is ops code.

A charm is an operator package.

App domain knowledge, distilled into code

Application code is open source.

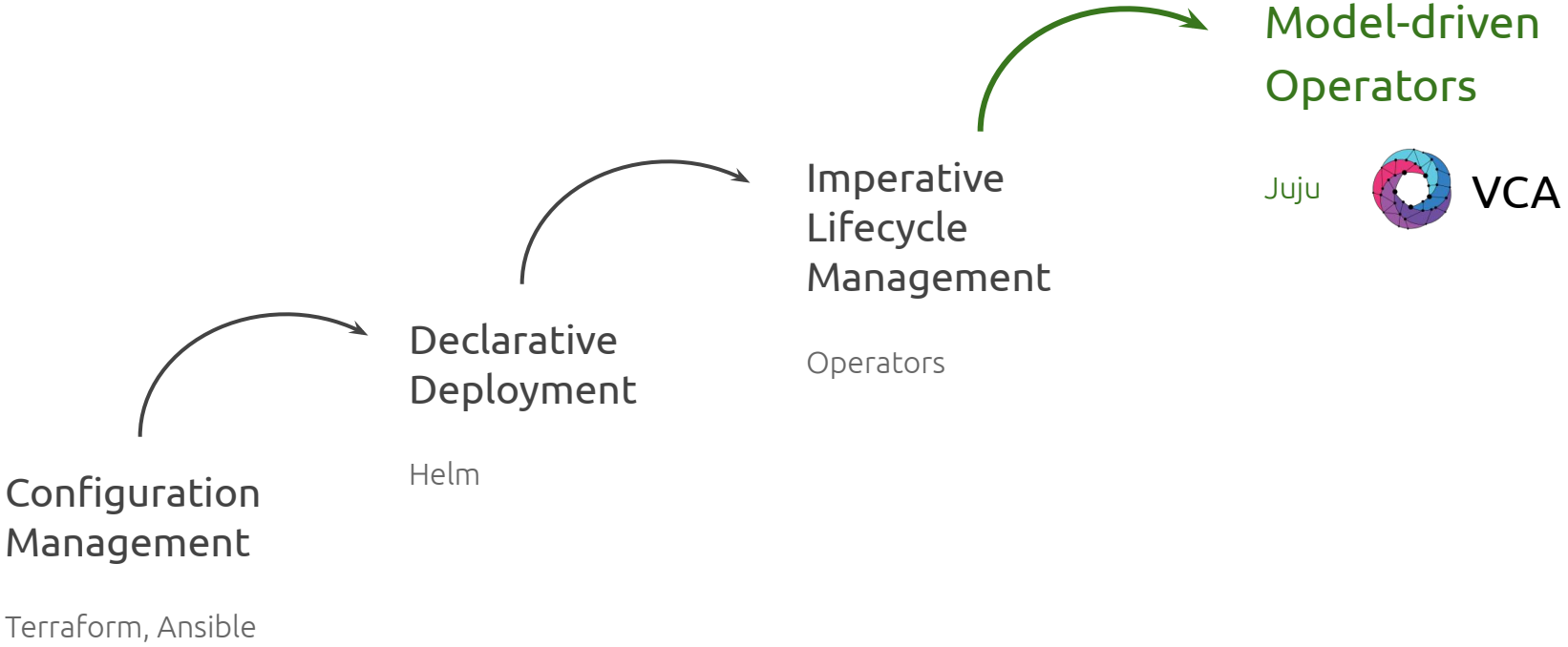
Why not share the operations code too?

“I found nine operators of Cassandra but none of them seem very good and I don’t know which one to use”

Writing great operators is hard

- ✕ UX / CLI
- ✕ Configuration
- ✕ Component permutations
- ✕ Pod-based operator limitations
- ✕ Distributed systems

“How can we improve operators?”



A better way to build and use operators

- ✓ Model-driven operator lifecycle manager (OLM)
- ✓ Composition and integration of operators
- ✓ Standardised UX / CLI and configuration
- ✓ Parameterised async Day 2 operations
- ✓ Fine-grained sidecar workload control
- ✓ Python operator framework with Golang OLM
- ✓ Much, much less YAML, much simpler operator code

But first, a demo!

Kubeflow


modeldb-store
modeldb-ui
pytorch-operator
metadata-db
metadata-api
modeldb-backend
modeldb-db
dex-auth
metadata-envoy
metadata-grpc
metadata-ui
jupyter
jupyter-web
jupyter
jupyter-controller
oidc-gatekeeper
tf-job-operator
pipelines-viewer
ambassador
argo-ui
argo-controller
seldon-core
katib-db-manager
katib-controller
katib-ui
pipelines-ui
minio
kubeflow-dashboard
katib-db
metacontroller
pipelines-db
pipelines-api
kubeflow-profiles
pipelines-schedul...
pipelines-persist...
pipelines-visuali...

Different scenarios

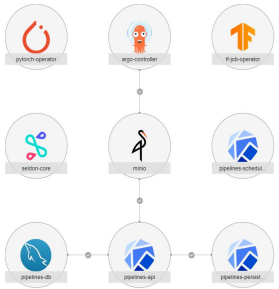
Edge Example

Data Scientist Example

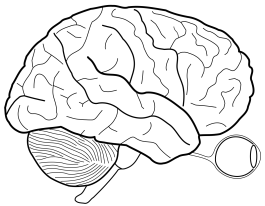
Enterprise Training Example

Much simpler YAML

Simpler YAML



```
---
bundle: kubernetes
applications:
  seldon-core:                { charm: seldon-core-15,                  scale: 1 }
  argo-controller:            { charm: argo-controller-14,              scale: 1 }
  pipelines-persistence:      { charm: pipelines-persistence-13,        scale: 1 }
  pipelines-scheduledworkflow: { charm: pipelines-scheduledworkflow-15, scale: 1 }
  tf-job-operator:            { charm: tf-job-operator-13,              scale: 1 }
  minio:                      { charm: minio-15,                        scale: 1 }
  pytorch-operator:           { charm: pytorch-operator-14,             scale: 1 }
  pipelines-db:               { charm: "cs:~charmed-osm/mariadb-k8s-34", scale: 1 }
  pipelines-api:              { charm: pipelines-api-14,                scale: 1 }
relations:
  - [ argo-controller, minio ]
  - [ pipelines-api, pipelines-db ]
  - [ pipelines-api, pipelines-persistence ]
  - [ "pipelines-api:minio", "minio:minio" ]
series: ~
description: ~
```

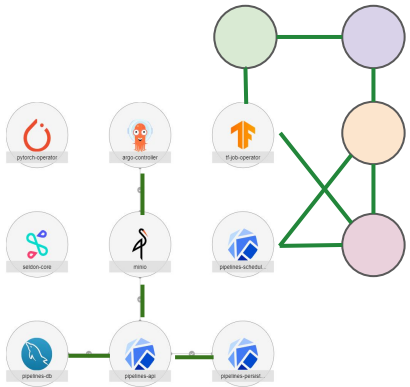



```
argo-controller-operator-233s32     argo-controller-34a643
seldon-core-operator-342de23        seldon-core-b3ac435
minio-operator-2342fe3              minio-23ac35
...                                 ...
```

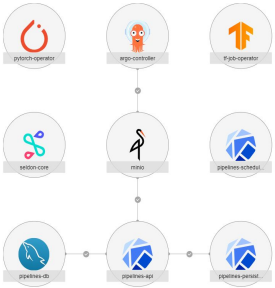
OLM

K8s

Real time dynamic integration



Automated integration in production

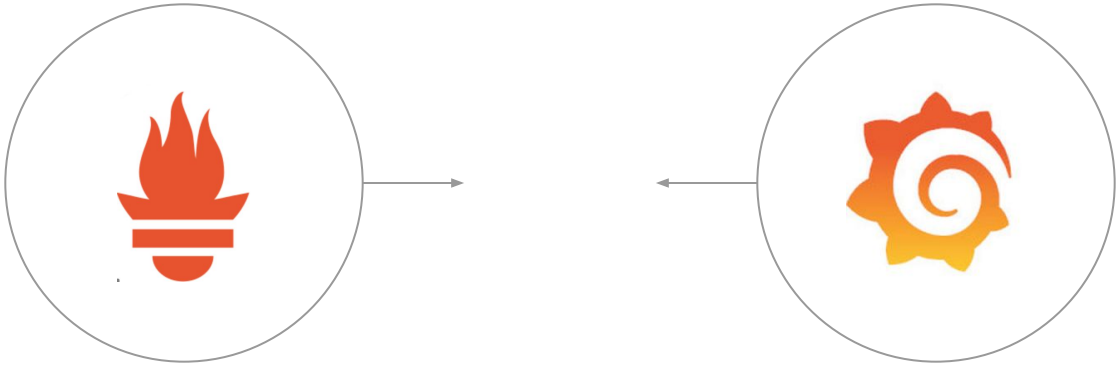


Declarative integration

Composition and integration

“Do one thing very well”

Composition and integration



“provide prometheus”

“require prometheus”

```
name: prometheus2
summary: Monitoring system and time...

...

provides:
  graf:
    interface: grafana-source
...
```

```
name: grafana
summary: Graph and Dashboard builder...

...

requires:
  grfn-src:
    interface: grafana-source
...
```

Composition and integration

“relate prometheus and grafana”

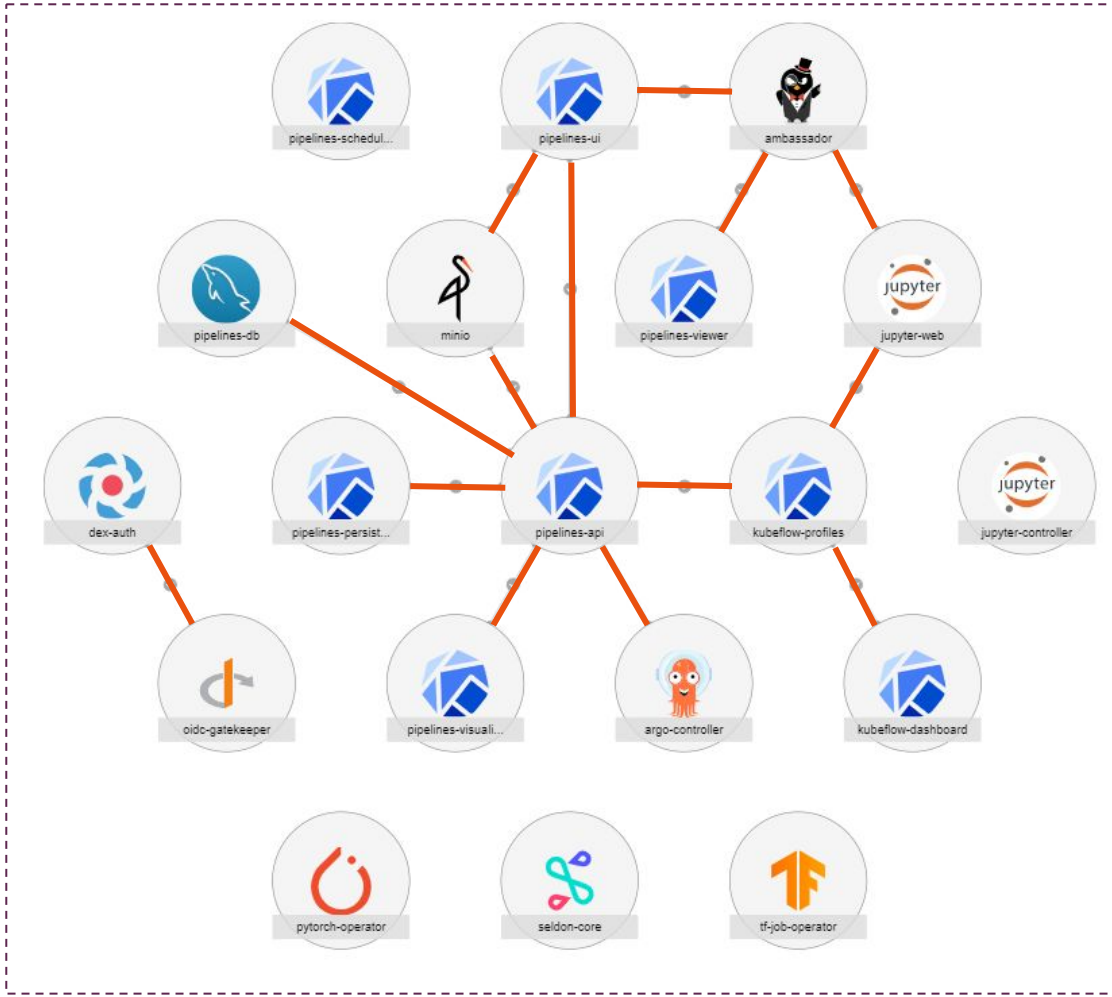
Small, composable operator

We model integration explicitly

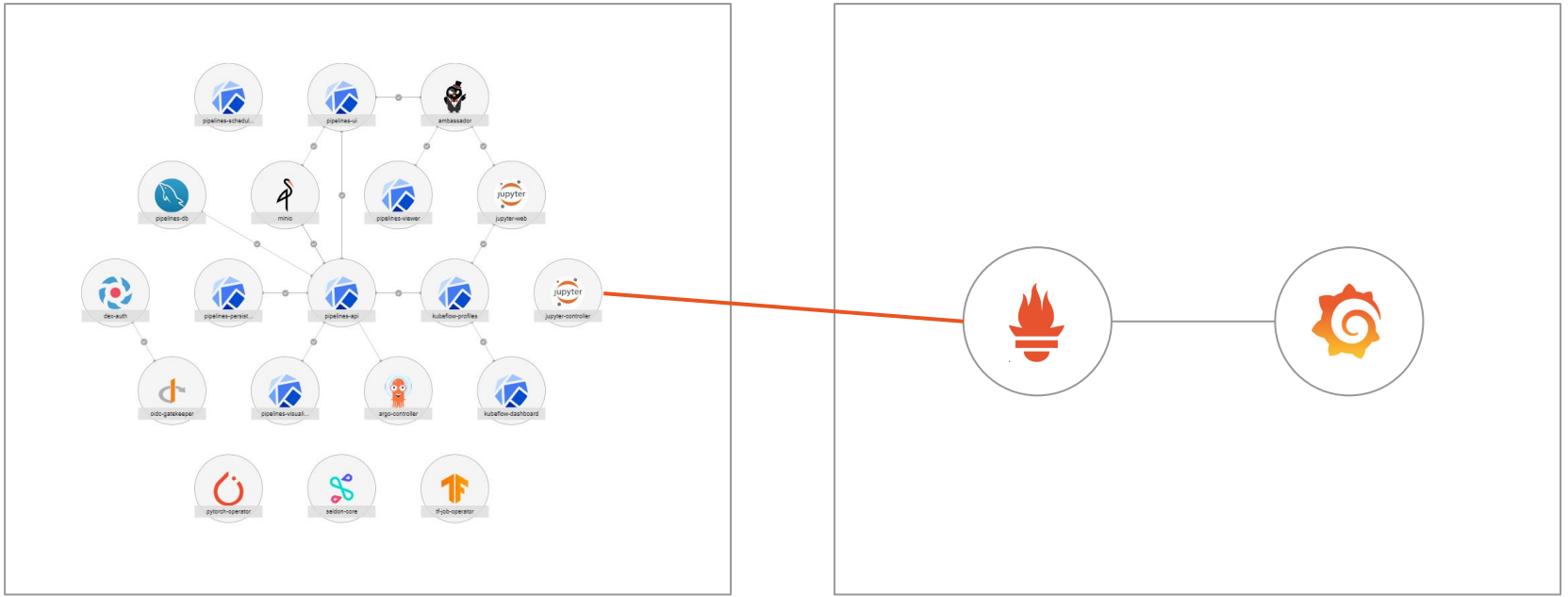
~~Complexity~~

Composition

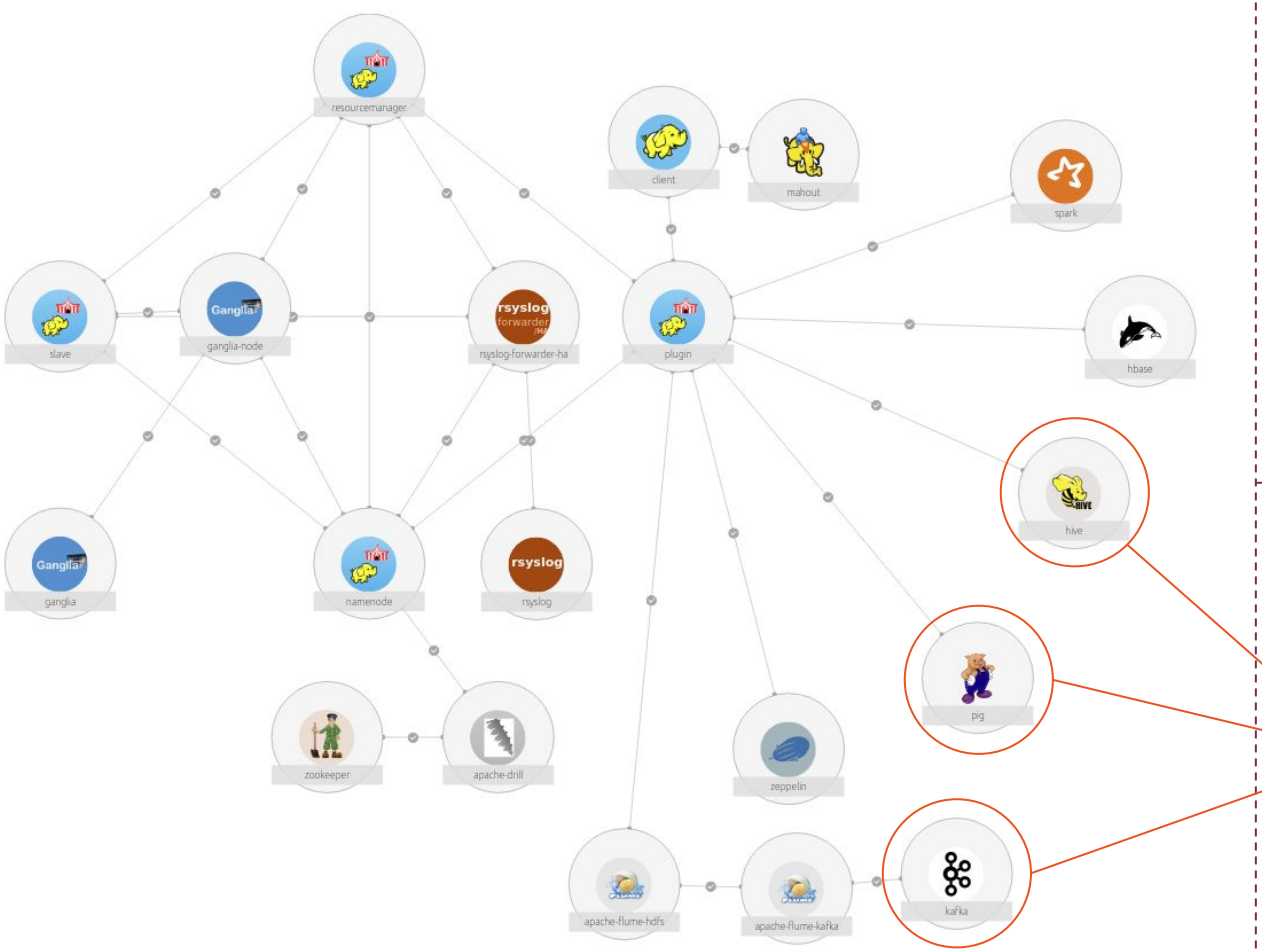
Model



Multi cloud integration



The model



Juju

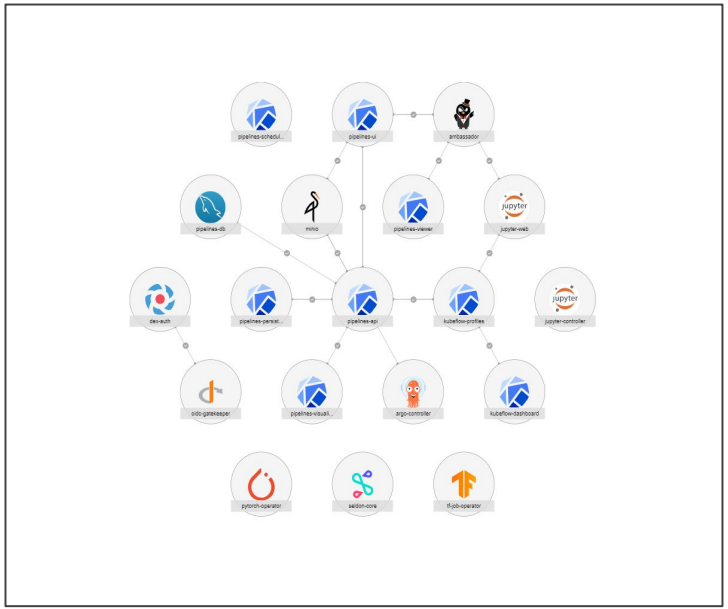
Operator Lifecycle Manager

Model

Charms

Operator packages

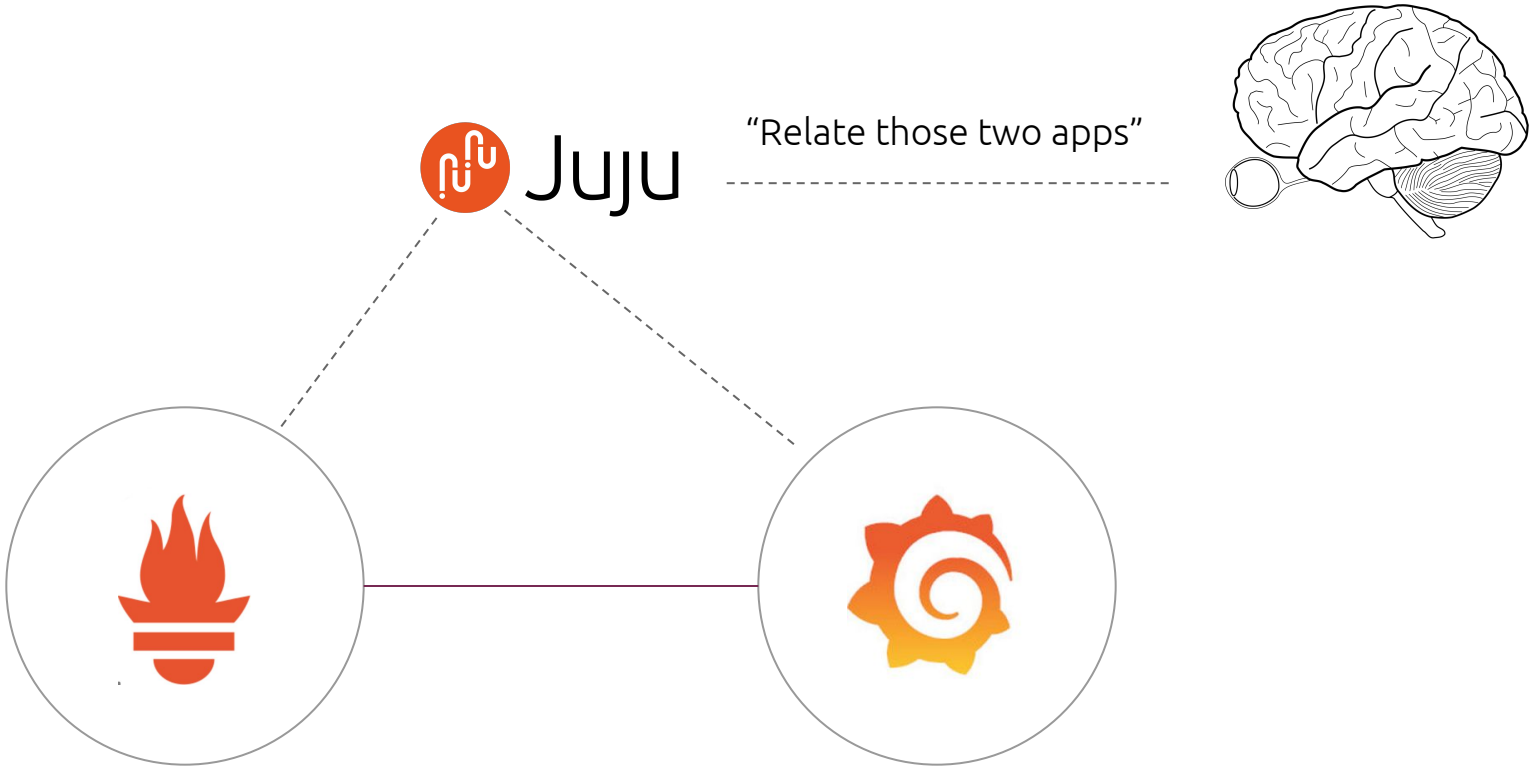
Model-driven operators



- ✓ RBAC on model permissions
- ✓ Capacity and scale
- ✓ Network attachments
- ✓ Storage classes
- ✓ Architecture & operations
- ✓ Integration
- ✓ Placement

How do operators communicate?

Juju is an Operator Lifecycle Manager (OLM)



Consistent UX and CLI for all operators

```
juju deploy prometheus grafana
juju config prometheus foo=322 bar=isolated
juju relate prometheus grafana
juju scale prometheus 3
```

```
juju deploy kubeflow-pipelines istio
juju config kubeflow-pipelines driver=cuda angio=done
juju relate istio kubeflow-pipelines
juju scale kubeflow-pipelines 3
```

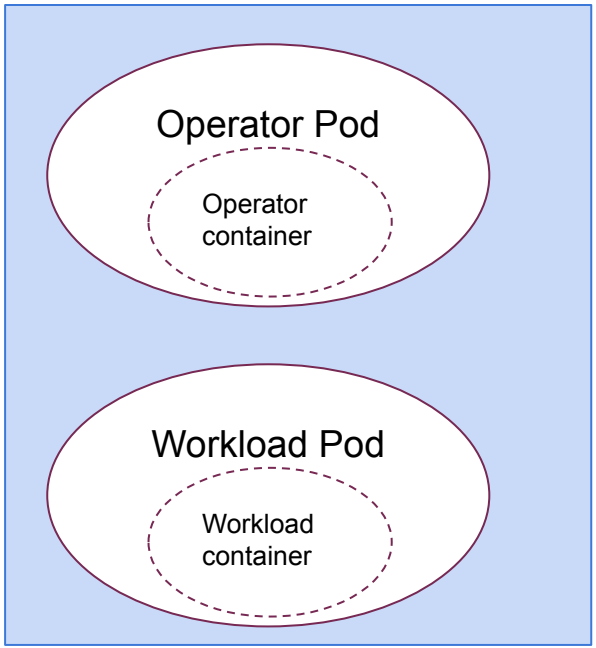
```
deploy
config
relate
scale
day 2
```

Consistent application operations


deploy
config
relate
scale
day 2
Consistent application operations
storage
network
permissions
compute
Consistent business execution

Fine-grained workload control by operators

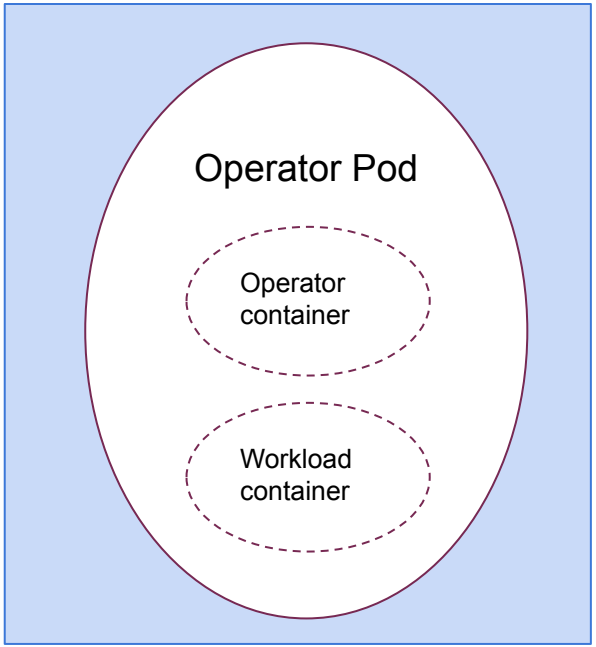
Traditional K8s operator in separate pod



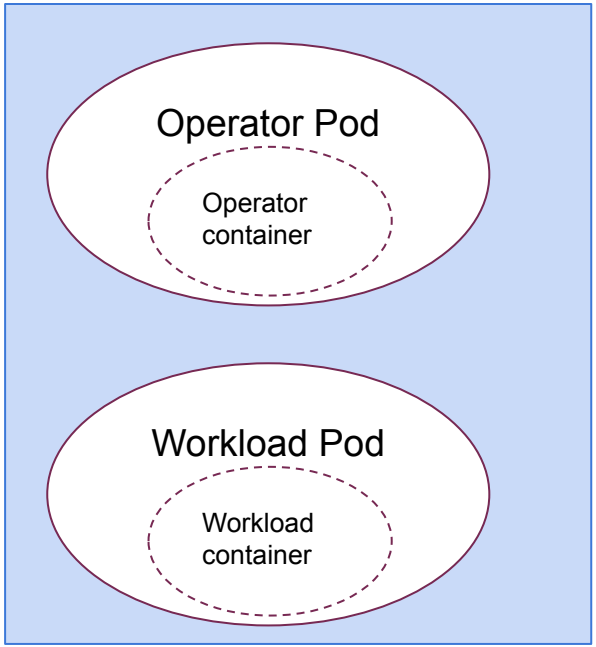
- On different machines
- No IPC or local comms
- No file sharing
- No separate state per unit

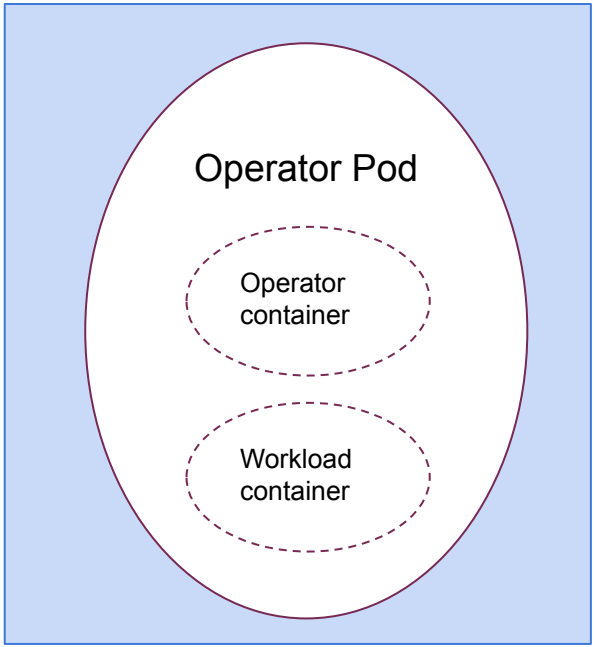
Fine-grained control with sidecar placement

- Always co-located on host
- Can use SHM or UNIX sockets
- Can share files with workload
- Operator scales too
- Better control, debugging



Both are supported





Golang and Python

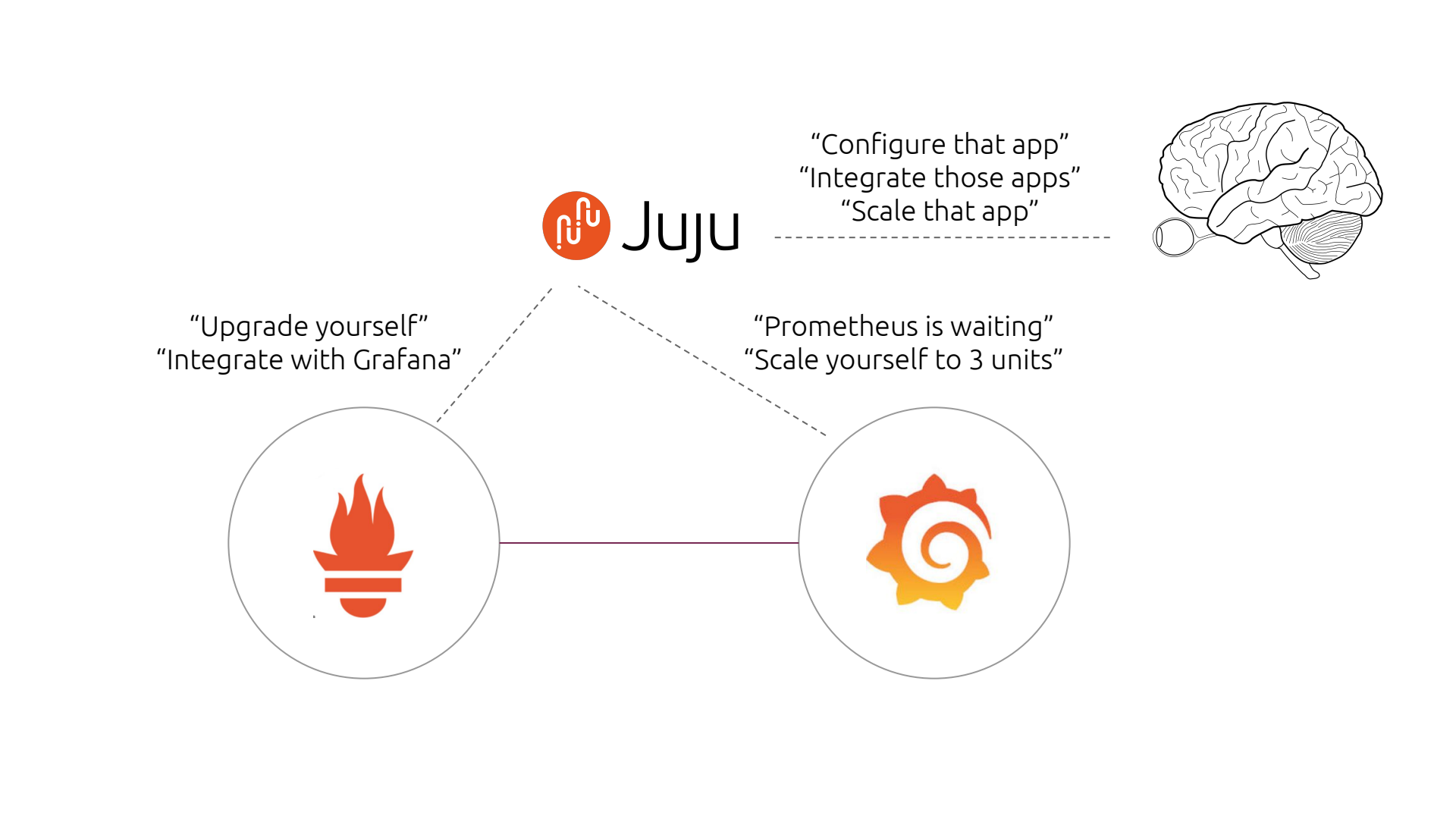
OLM in Golang

- Highly concurrent
- Events and messaging
- Multi model multi app
- Performance critical
- Highly available

Charms in Python

- Simpler collaboration
- Integration code only
- Serialized event handling
- Control plane for one app
- Community-centric

The Juju OLM distributes events to operators


Juju
“Configure that app”
“Integrate those apps”
“Scale that app”
“Upgrade yourself”
“Integrate with Grafana”
“Prometheus is waiting”
“Scale yourself to 3 units”

Python operator framework
is a clean event handling loop

```
class MyCharm(CharmBase):

    def __init__(self, *args):
        super().__init__(*args)
        self.framework.observe(self.on.config_changed, self)

    def on_config_changed(self, event):
        url = self.model.config[“url”]
        # ...
```

You can also charm traditional apps

Solve for both infrastructure and apps

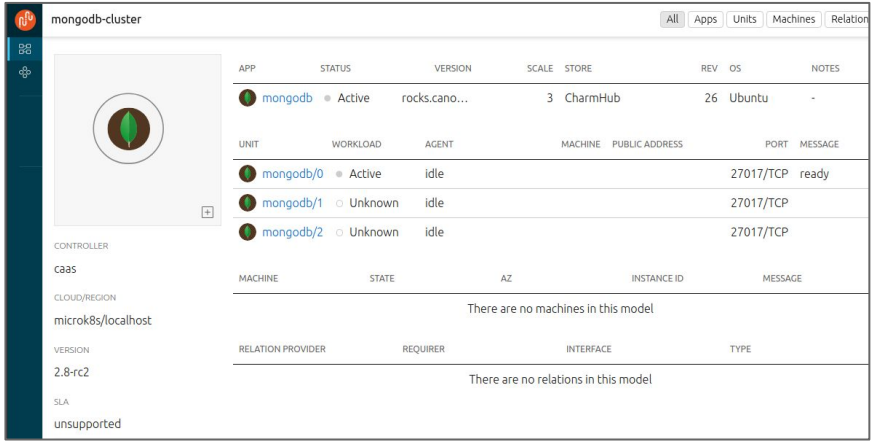
On machines

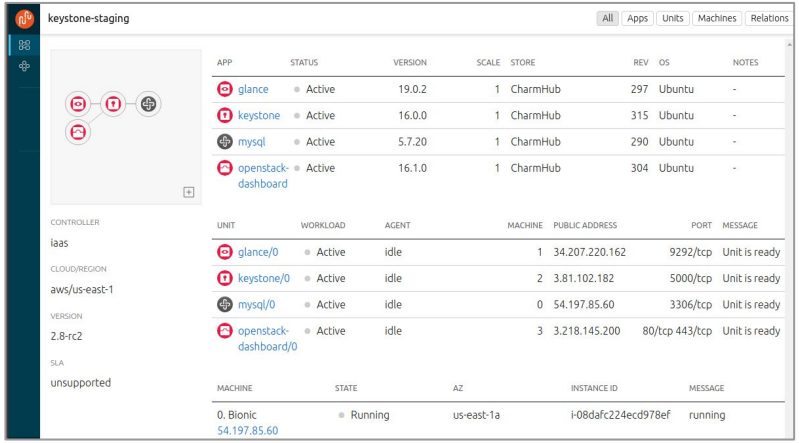
The scripts work locally
to that machine

On Kubernetes

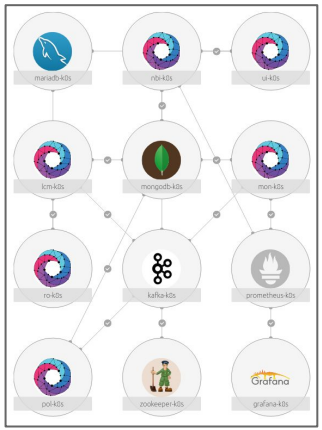
The scripts in one container
act on other containers

Model driven operations - Machine & Kubernetes

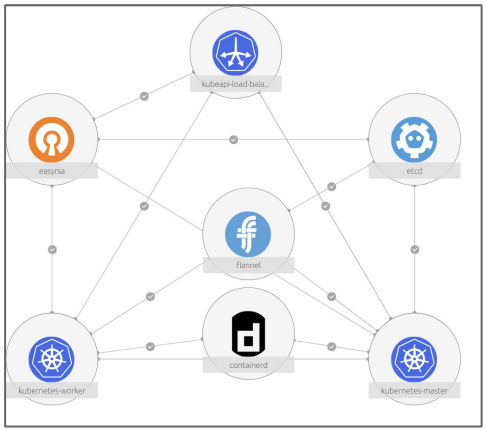




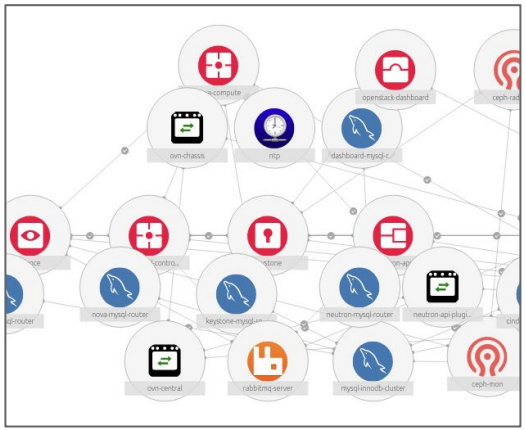
Universal operators



Kubernetes

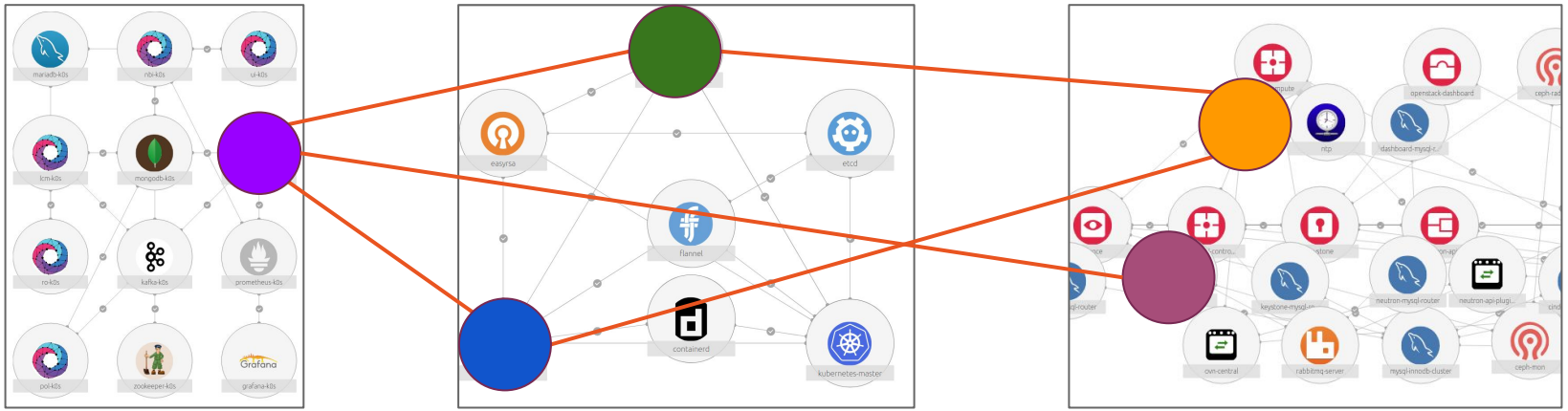


VM / Cloud



Bare metal

Integration across generations



Kubernetes

VM / Cloud

Bare metal

The Open Operator Collection

Universal operators for Linux, Windows and Kubernetes apps

Read our manifesto

FILTERS

Categories

- AI/ML
- Big Data
- Database
- Cloud
- Containers
- Logging and Tracing
- Monitoring
- Networking
- Security
- Storage

Useful links

What is an operator?

How do I publish here?

Glossary

15 FEATURED

Platforms All

Prometheus

charmcraft

Prometheus for Kubernetes clusters

Discourse

discourse-charmers

Discourse bundled for Juju-k8s deployment

Elasticsearch

charmcraft

Elasticsearch is the distributed search and analytics engine.

Mattermost

mattermost-charmers

Mattermost charm

Grafana

charmcraft

Data vizualization for the charmed LMA stack

Graylog

charmcraft

Graylog log management system

Wordpress

charmcraft

WordPress is a full featured web blogging tool, this charm deploys it.

AlertManager

charmcraft

Alert management for charmed LMA stack

Cassandra

narindergupta

Distributed storage system for structured data

MongoDB

charmcraft

An open-source document database, and the leading NoSQL database

Reusable, composable operators

- Easier to write operators
- Easier to deploy operators
- Easier to share operators
- Easier to integrate operators

https://charmhub.io/

Thank you. Questions?