



# Containerizing your Database with MongoDB and OpenShift

December 2018

# TODAY'S AGENDA

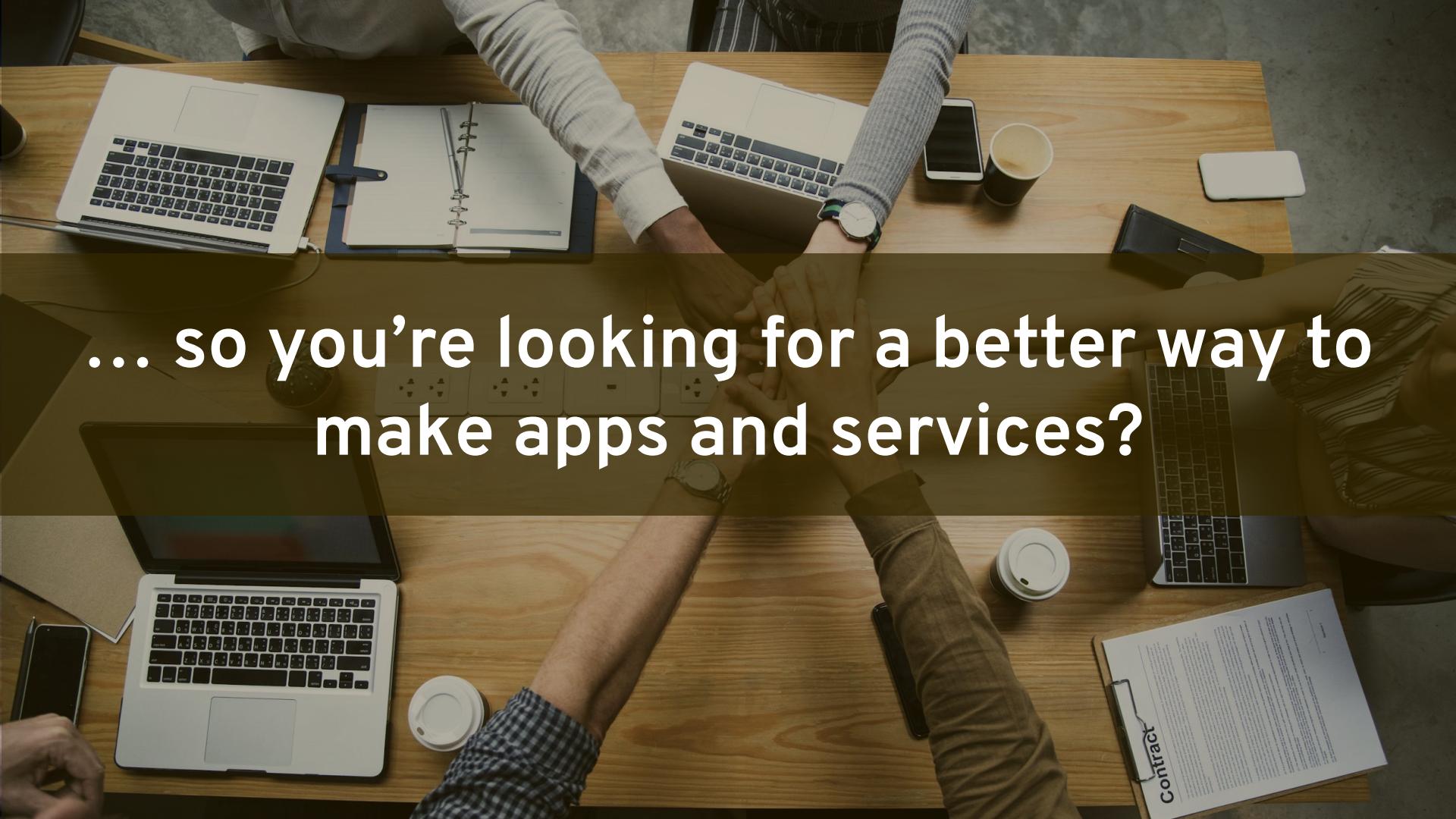
- Red Hat & MongoDB Intros

## Red Hat

- Introduction to Cloud Native App Delivery
- Containers and Container Platforms
- OpenShift + Operators Overview

## MongoDB

- Overview of MongoDB
- Running MongoDB Enterprise on Openshift
- Roadmap



... so you're looking for a better way to  
make apps and services?

# WHAT DO AGENCIES NEED?

## CHANGE FASTER

Increase the speed of change by **modernizing applications** to adapt to the markets and customers

## DEVELOP FASTER

Increase the speed of **developing new applications** to address new business opportunities

## DELIVER FASTER

Increase the speed of **app delivery** of existing and new applications to your customers

## INNOVATE FASTER

Increase the speed of **innovation** across the organization to the pace that your business demands

# YOUR DIFFERENTIATION DEPENDS ON YOUR ABILITY TO DELIVER AND INNOVATE

Cloud-native  
Applications

AI & Machine  
Learning

Blockchain

Internet of  
Things

Innovation  
Culture



CONTAINERS, KUBERNETES, MICROSERVICES & DEVOPS ARE KEY INGREDIENTS

# WHAT IS CLOUD-NATIVE APP DEV?

A MODERN APPROACH TO BUILDING AND RUNNING APPLICATIONS

Cloud-native  
Applications



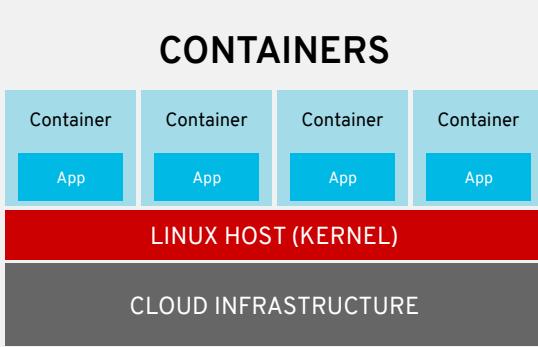
SERVICE-BASED AND API-DRIVEN USING CONTAINERS  
*KEY TO ENABLING DEVOPS*

# IT'S PART OF DIGITAL EVOLUTION

TRADITIONAL	CLOUD-NATIVE
Server-centric	Container-centric
Scale up vertically	Scale out horizontally
Tightly coupled monolith	Loosely coupled and service-based
Infrastructure-dependent	Portable across infrastructure
Waterfall, semi-agile, and long delivery	Agile and continuous delivery
Local IDEs & developer tools	Cloud-based, intelligent tools
Siloed dev from ops, QA, and security teams	DevSecOps, NoOps, and collaboration

# THE FUTURE IS IN CONTAINERS

## CONTAINER BENEFITS FOR MULTIPLE TEAMS



Package all app dependencies  
Integrated in Linux OS  
Fully Open Source  
Secure Isolation of Applications  
Eliminates need for VM Hypervisor  
Runs on Any Cloud Platform

### DEVELOPERS

- CLOUD-NATIVE APPS
- SIMPLIFY PACKAGING
- SIMPLIFY TESTING

### IT OPERATIONS

- CONSISTENT APP DEPLOYS
- AUTOMATED APP DEPLOYS
- IMPROVED APP PERFORMANCE
- MULTI-CLOUD CONSISTENCY

### BUSINESS LEADERS

- ENABLE DEVOPS CULTURE
- ENABLE HYBRID CLOUD
- REDUCE VM LICENSING COSTS
- ACCELERATE APP-DEV CYCLES

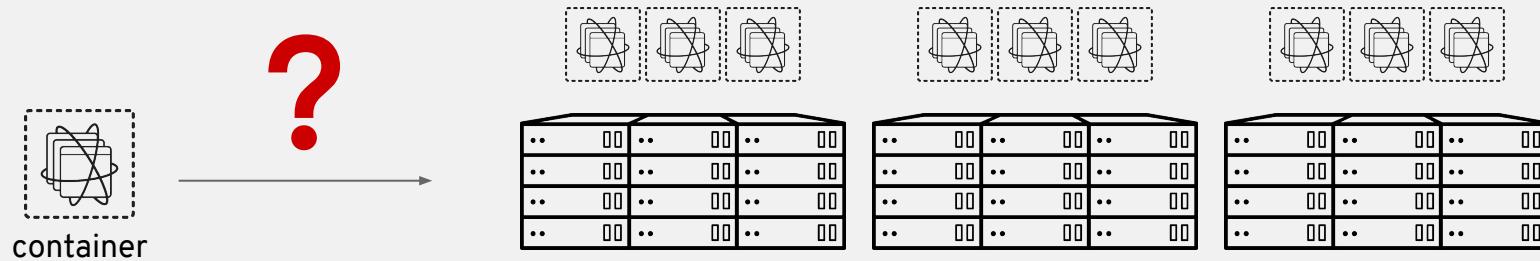


(most developers do)

**BUT SCALE BRINGS COMPLEXITY**



# DEVOPS WITH A SINGLE CONTAINER



Where do you store the container image?

In which host is the container deployed?

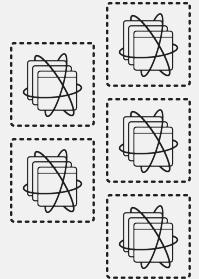
Which host has more capacity?

How does the container scale?

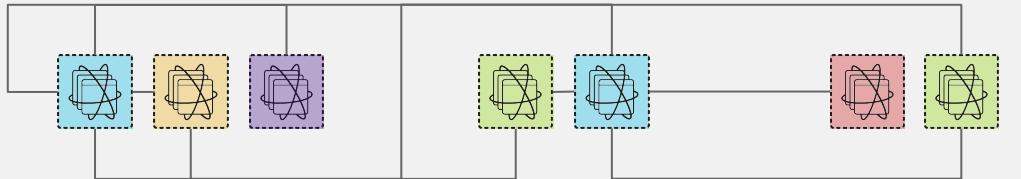
How is container health monitored?

What happens when a container crashes?

# DEVOPS WITH MANY CONTAINERS



multi-container  
services



Which containers are deployed together?

How do containers discover each other?

Which containers can access each other?

How to handle persistent storage?

How to limit access to certain containers?

How to deploy containers across many hosts?

# WE NEED MORE THAN JUST CONTAINERS

## Scheduling

Decide where to deploy containers

## Lifecycle and health

Keep containers running despite failures

## Discovery

Find other containers on the network

## Monitoring

Visibility into running containers

## Security

Control who can do what



## Scaling

Scale containers up and down

## Persistence

Survive data beyond container lifecycle

## Aggregation

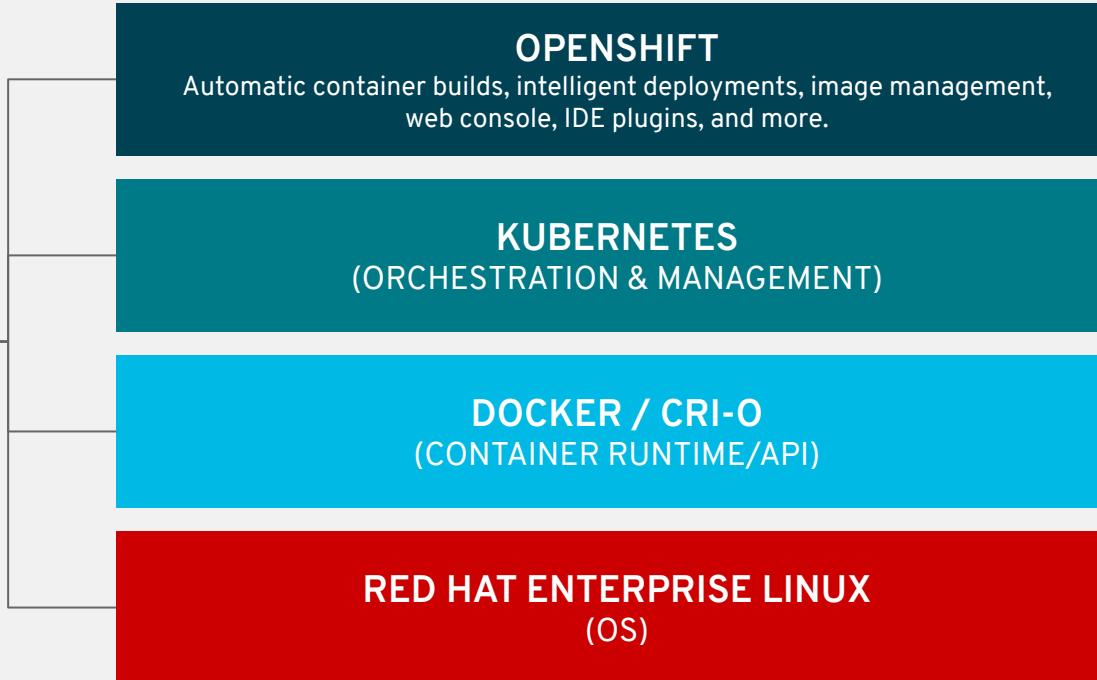
Compose apps from multiple containers

# OPENShift INCLUDES EVEN MORE

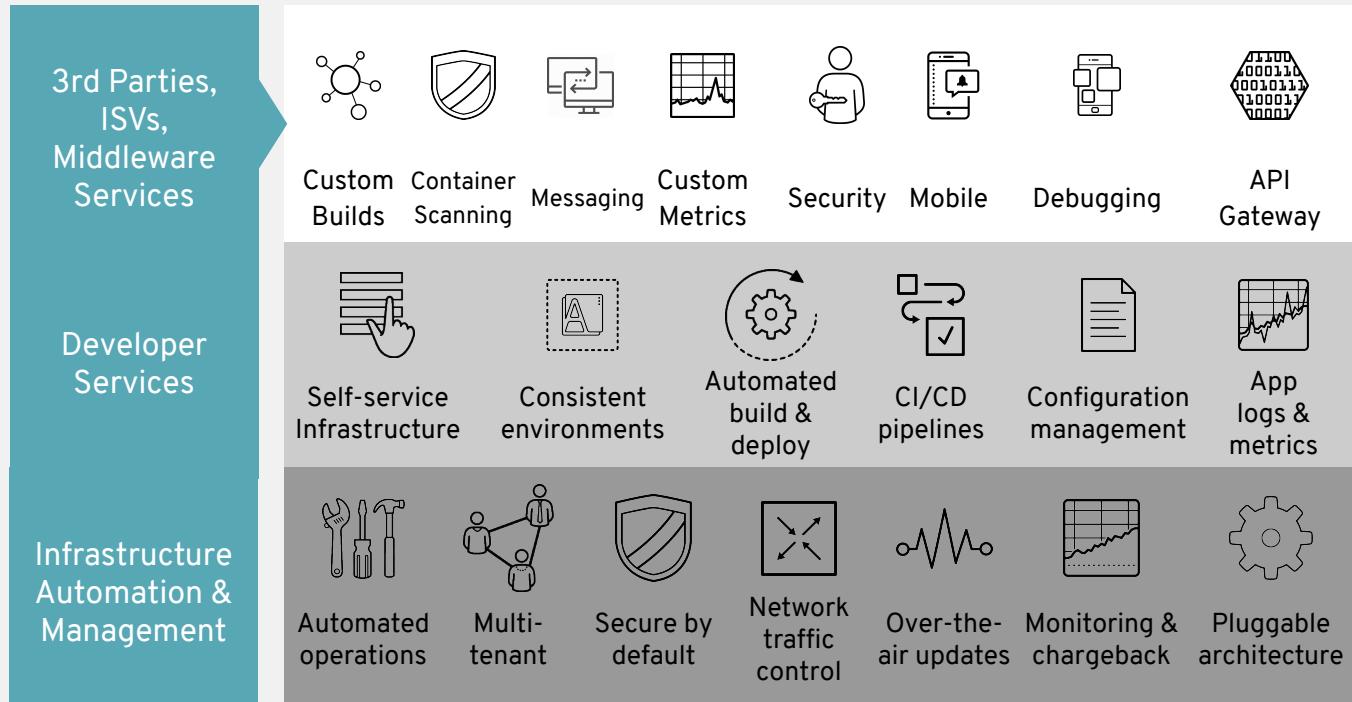
CONTAINERS, ORCHESTRATION, CLUSTER & APP SERVICES, MORE!



OPENSIFT



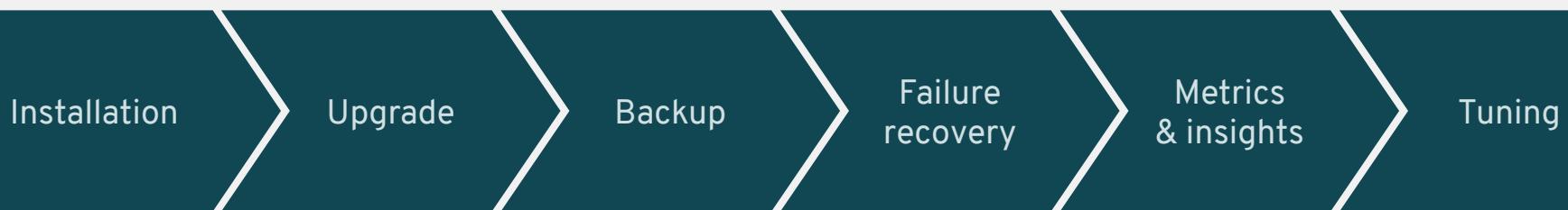
# DEVOPS VIEW OF OPENSHIFT



# AUTOMATED OPERATIONS

Operators codify operational knowledge and workflows to automate lifecycle management of containerized applications with Kubernetes

## AUTOMATED LIFECYCLE MANAGEMENT



And the Operator Framework is an open source toolkit to help you consume services on OpenShift in the same way that services are consumed on public clouds

For example, MongoDB

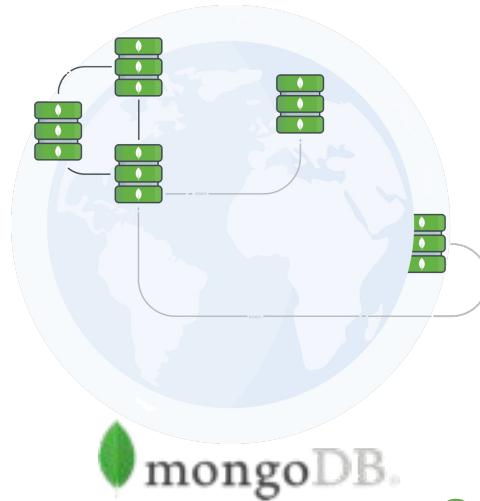
# THIS IS SO GREAT FOR APPS AND SERVICES!!!



## BUT... WHAT ABOUT DATABASES ???

# Summary: MongoDB UNIQUELY Delivers.....

**ACID transactional guarantees**  
of relational databases



**Developer productivity**  
of open source document  
databases

Freedom to **Run Anywhere**

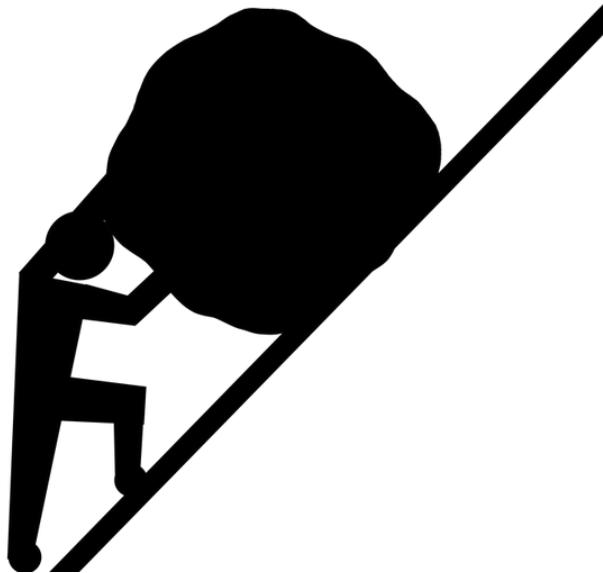
**Scale-out, data locality, and  
resilience of distributed systems**

# MongoDB Kubernetes Operator

An application that allows you to create and manage MongoDB deployments in Kubernetes cluster with the help of Ops Manager or Cloud Manager

- Quick, declarative definition of what MongoDB services you want
- Auto-healing, using Kubernetes reliability features
- Easy to scale up / scale down

# **Challenges running databases in containers**



## **Provisioning database deployments**

Complex sharded-cluster configuration

## **Managing/Monitoring/Alerts**

## **Advanced configurations**

AuthN/AuthZ

Encryption

TLS

## **Backups**

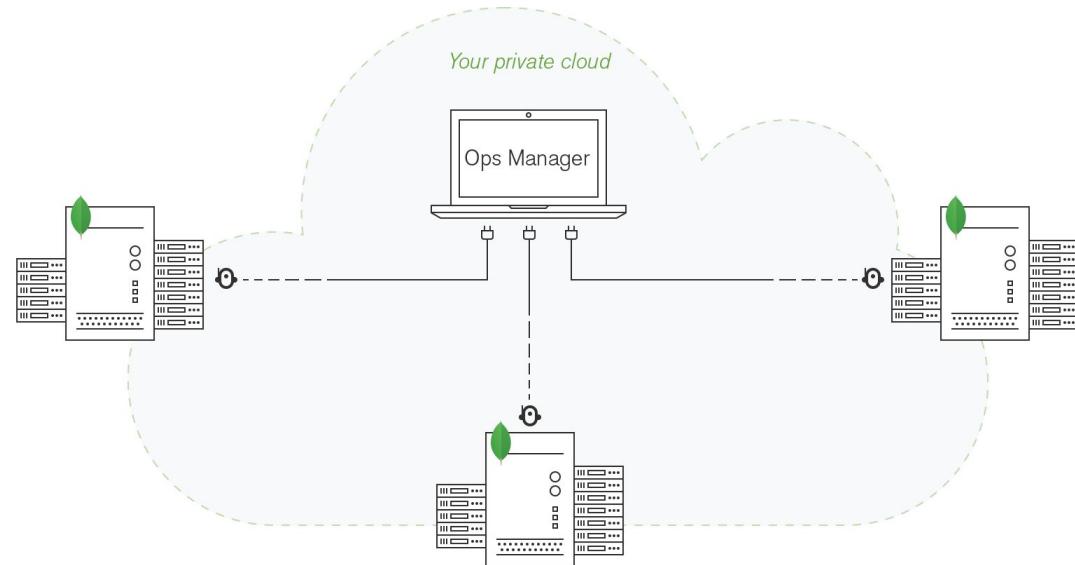
## **Enterprise-level support**

# What is MongoDB Ops Manager?



# Ops Manager - Monitoring, Automation and Backup

MongoDB Ops Manager makes it fast and easy  
for you to deploy, monitor, upgrade, back up  
and scale your MongoDB deployment



# Ops Manager - Monitoring

mongoDB Ops Manager 4.0.3.50208.20181003T0835Z OK All Clusters

Please set your time zone Admin James ▾

CONTEXT: mdbedemo01 ORGANIZATION 0 > MDBDEMO01 > MY-REPLICA-SET3-0.MY-REPLICA-SET3-SVC.JBO.SVC.CLUSTER.LOCAL:27017

VERSION 4.0.3 DATA SIZE 229 B

PROJECT ACTIVE Deployment

- Alerts 0
- Backup
- Users & Teams
- Settings
- Docs
- Support

Overview Real Time Status Hardware DB Stats Profiler Performance Advisor More ▾

GRANULARITY Auto ZOOM 1 hour CURRENT DISPLAY 11/04/2018 08:31pm to 11/04/2018 09:31pm AT 10 SECONDS GRANULARITY

### Opcounters

command The average rate of commands performed per second over the selected sample period

query The average rate of queries performed per second over the selected sample period

update The average rate of updates performed per second over the selected sample period

delete The average rate of deletes performed per second over the selected sample period

getmore The average rate of getMores performed per second on any cursor over the selected sample period. On a primary,

2018/11/04 20:53:18: COMMAND: 7/S QUERY: 1.5/S UPDATE: 0/S DELETE: 0/S GETMORE: 0.6/S INSERT: 0/S



# Ops Manager - Automation

 mongoDB Ops Manager      James ▾

DEPLOYMENT > CREATE NEW SHARDED CLUSTER

## Create New Sharded Cluster

### Sharded Cluster Configuration

A sharded cluster consists of shards, config servers, and one or more mongos routing processes. Deploy your sharded cluster quickly by giving it a unique name and path. Additional configurations are optional. [Learn more \(\\* = Required\)](#).

Cluster Name *	<input type="text" value="myCluster"/>	Config Server Replica Set Name *	<input type="text" value="configRS"/>
Shard Name Prefix *	<input type="text" value="myShard"/>		

### CLUSTER SETTINGS

Process Name	Version	Data Directory *	Log File *
▼ myCluster	4.0.3	e.g. /data	e.g. /data/mongodb.log
▶ myShard_0	4.0.3	e.g. /data	e.g. /data/mongodb.log
▶ myShard_1	4.0.3	e.g. /data	e.g. /data/mongodb.log



# Ops Manager - Backup

mongoDB Ops Manager    4.0.3.50208.20181003T0835Z    OK    All Clusters

**CONTEXT**    mdbedemo01    **PROJECT** ACTIVE

ORGANIZATION 0 > MDBEDEMO01

## Backup

Overview    Restore History    More ▾

Name	Status	Last Snapshot	Last Oplog Slice	Options
my-replica-set3	<span>STOP</span>	<span>RESTORE OR DOWNLOAD</span>	11/04/18 - 09:40 PM	11/04/18 - 09:57 PM

**my-replica-set3**

**RESTORE**    Ops Manager Docs

Snapshot: 11/04/18 - 09:40 PM (UTC)

2. Do you want to restore this snapshot to a MongoDB replica set or download a copy of your data?

You can DOWNLOAD your snapshots for archival or other purposes or you can RESTORE your snapshots directly into an existing MongoDB cluster that you control.

**DOWNLOAD**    **CHOOSE CLUSTER TO RESTORE TO**

**BACK**

Disk space required is 145.23 KB.

- Point-In-Time Recovery
- Continuous, Incremental Backups
- Queryable backups



# Cloud Manager

mongoDB Cloud Manager    STANDARD    OK    All Clusters

CONTEXT: MDBE TALK > MDBEDEMO01

## Deployment

Add New ...

PROJECT ACTIVE Deployment

Alerts 0    Backup    Users & Teams    Settings    Docs    Support

VIEW: TOPOLOGY LIST Search...

**jbomongodb17.local:29000**  
Version 4.0.3  
DATA METRICS MODIFY ...  
TYPE Standalone AUTH Disabled  
DATABASE SIZE 59 B  
BI CONNECTOR CT 0 Connectors  
SSL Disabled

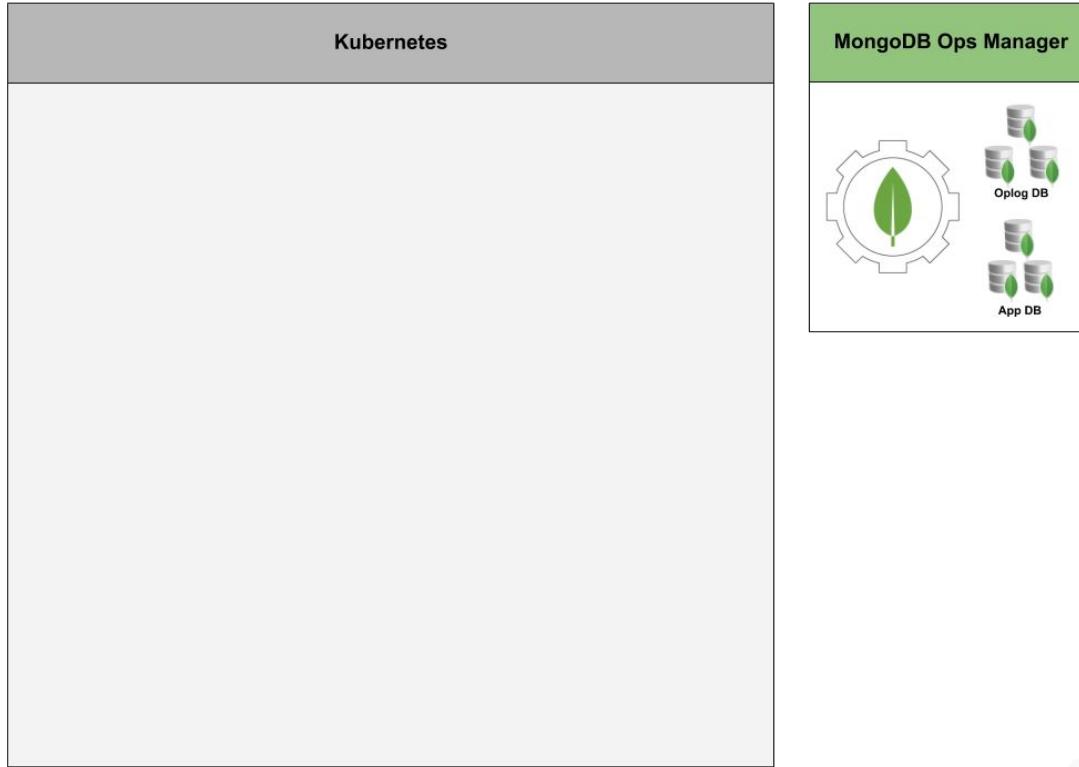
**Operations**  
R: 757.4 W: 376.0  
  
Last 6 Hours

**Disk Usage**  
100.0 B  
0.0 B  
Last 30 Days

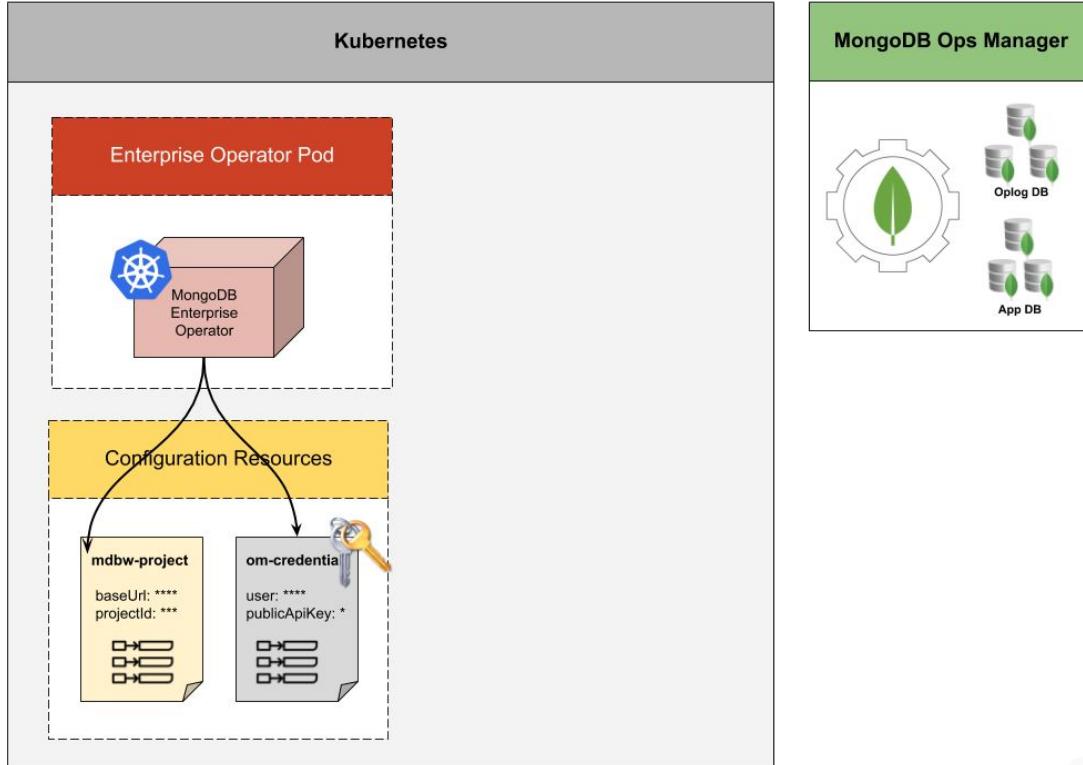
**Connections**  
7  
  
Last 6 Hours

**Disk IOPS**  
116.0  
  
Last 6 Hours

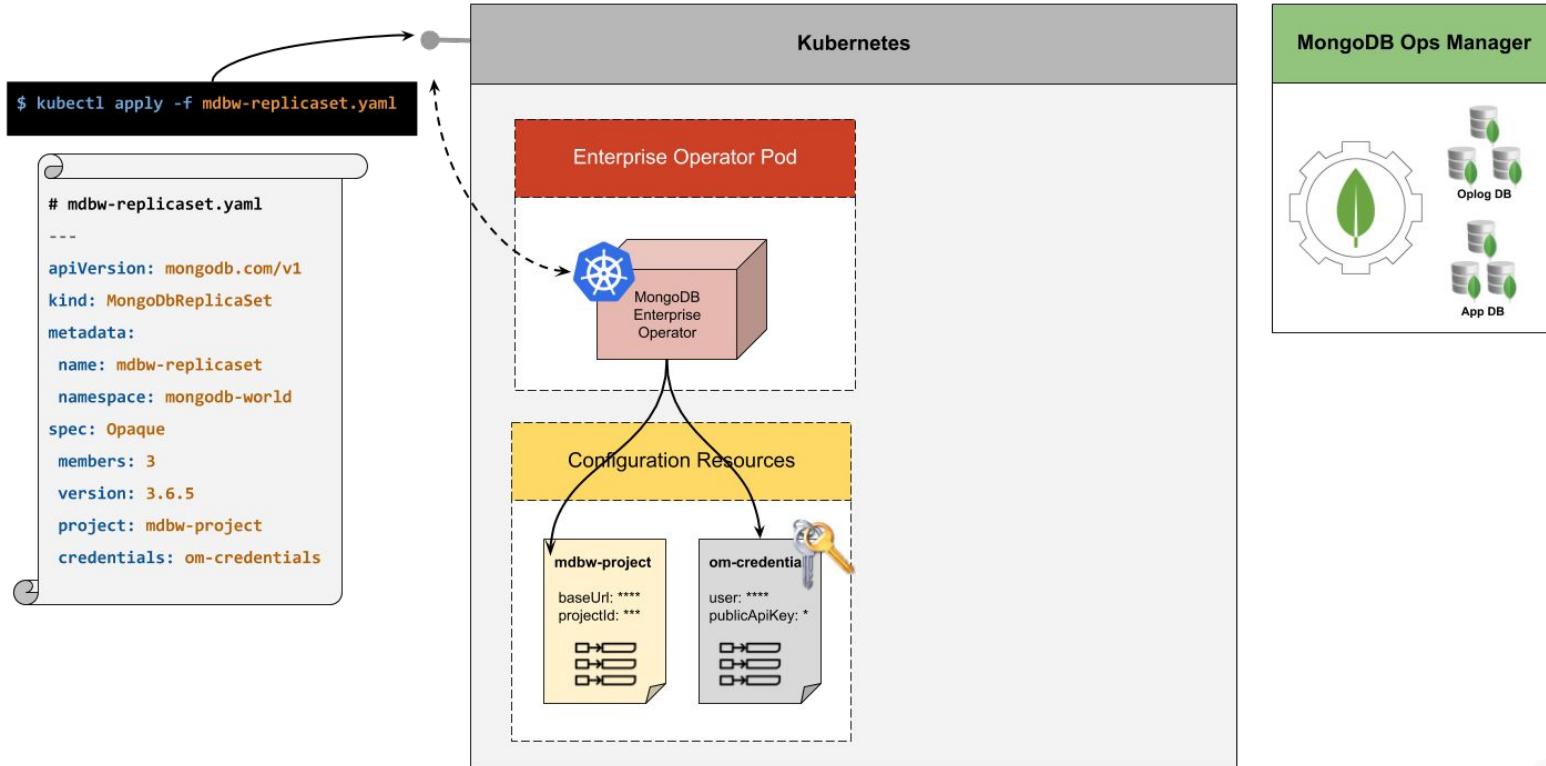
# Architecture (1)



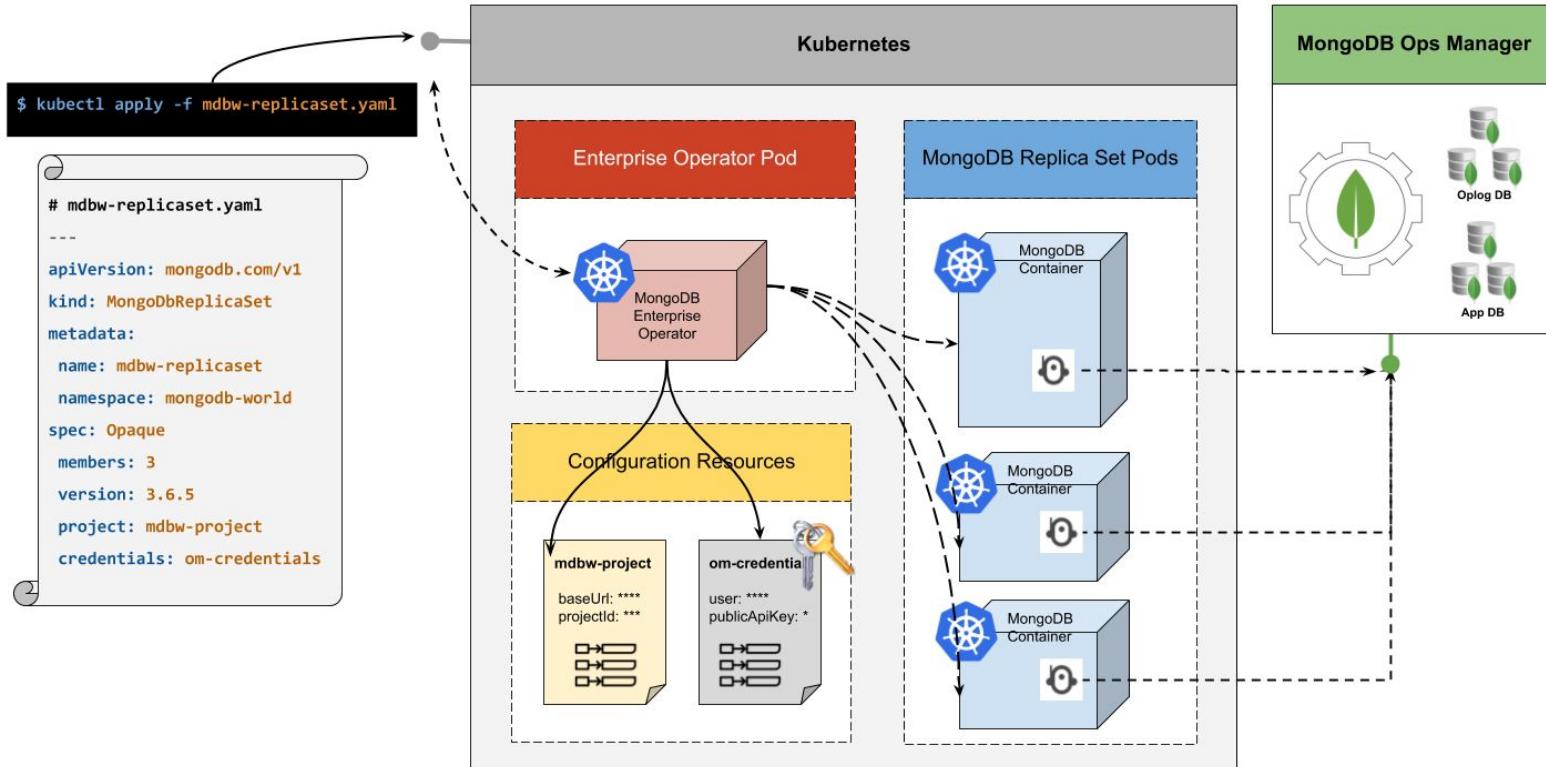
# Architecture (2)



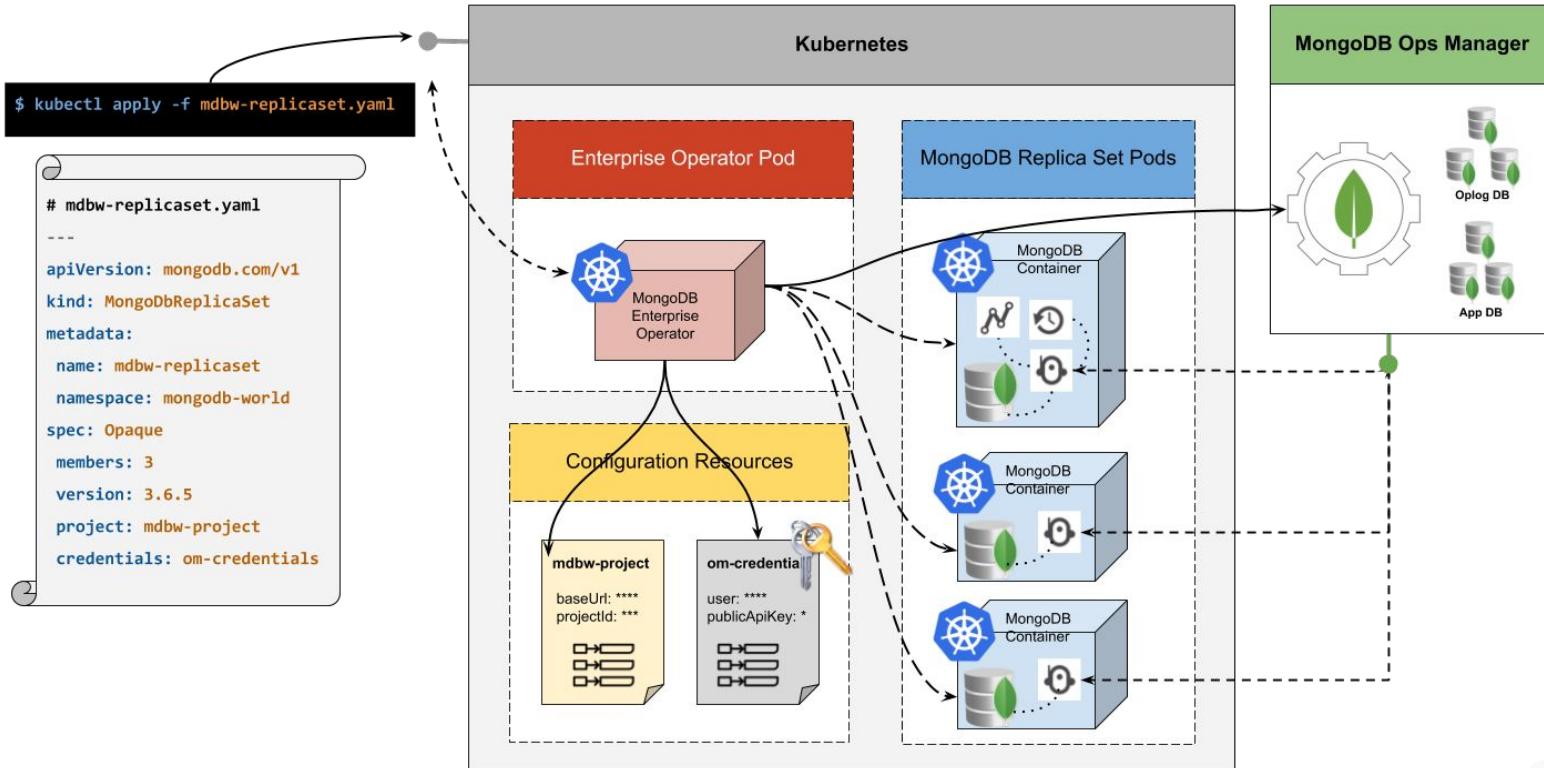
# Architecture (3)



# Architecture (4)

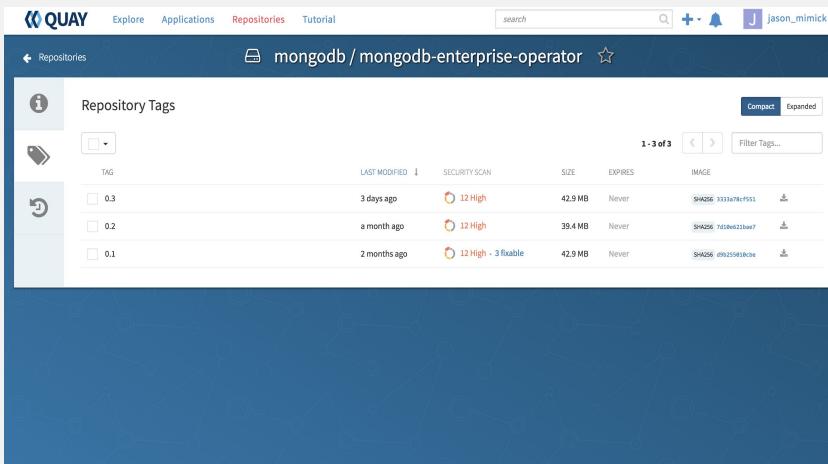


# Architecture (5)

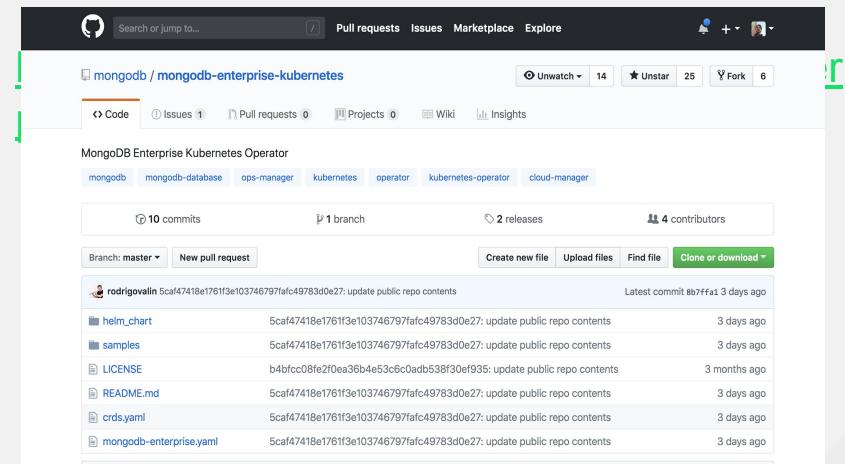


# Getting the operator

Official container  
images hosted on



Public GitHub  
repository



# DEMO: Hands on with the MongoDB Kubernetes Operator



# Getting Started with the MongoDB Operator

## Step 1: Install

crds.yaml

mongodb-enterprise.yaml

## Step 2: Configure

Cloud/Ops Manager

ConfigMap

Secret

## Step 3: Provision

Create replica set

# Spin up k8s & install operator

<https://docs.opsmanager.mongodb.com/current/tutorial/install-k8s-operator/>

```
# Start cluster
minishift start --openshift-version 3.11.0
oc create project mongodb          # project~namespace

git clone https://github.com/mongodb/mongodb-enterprise-kubernetes

# Install CRDS & operator
oc create -f ./crds.yaml
oc create -f ./mongodb-enterprise.yaml

# set default namespace (op creates & installs to 'mongodb')
oc config set-context $(kubectl config current-context)\ --namespace=mongodb
# See all operator stuff
oc get all --selector=app=mongodb-enterprise-operator
```

# Configuration - Connection to Ops Manager

```
---  
apiVersion: v1  
kind: ConfigMap  
metadata:  
  name: dot-local  
data:  
  projectId:  
    5b76d1750bd66b7ea136427f  
  baseUrl:  
    https://cloud.mongodb.com/
```

```
---  
apiVersion: v1  
kind: Secret  
metadata:  
  name: opsmgr-credentials  
stringData:  
  user: jason.mimick  
  publicKey:  
    02b9674b-e912-4bf5-bec3-43687  
    832a6cd
```

# Create Secret & ConfigMap

```
oc create -f opsmgr-credentials.yaml
```

```
oc create -f dot-local-opsmgr-project.yaml
```

```
oc get configmaps,secrets
```

# Deploying a Replica Set

```
apiVersion: mongodb.com/v1
kind: MongoDBReplicaSet
metadata:
  name: my-replica-set
  namespace: mongodb
spec:
  members: 3
  version: 4.0.0
  project: <name of ConfigMap>
  credentials: <name of Secret>
```

```
oc create -f my-replica-set.yaml
```

```
oc get all --selector=app=my-replica-set-svc
```

NAME	READY	STATUS	RESTARTS	AGE
pod/chicago-rs1-0	1/1	Running	12	13h
pod/chicago-rs1-1	1/1	Running	12	13h
pod/chicago-rs1-2	1/1	Running	12	13h

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP
PORT(S)	AGE		
service/chicago-rs1-svc	ClusterIP	None	<none>
27017/TCP	13h		
service/chicago-rs1-svc-external	NodePort	10.102.95.40	<none>
27017:30780/TCP	13h		

NAME	DESIRED	CURRENT	AGE
statefulset.apps/chicago-rs1	3	3	13h

```
:w
```

# Persistent Storage - DB right?

```
apiVersion: mongodb.com/v1
kind: MongoDBReplicaSet
metadata:
  name: chicago-rs1
  namespace: mongodb
spec:
  members: 3
  version: 4.0.0
  project: dotlocal-chicago
  credentials: opsmgr-credentials
podSpec:
  storage: 5G
  storageClass: managed-premium
```

# Persistent Storage - What's

KIND	NAME	STATUS
StorageClass	default	<none>
StorageClass	managed-premium	<none>
PersistentVolume	pvc-2428e963-b5ff-11e8-bef4-0a58acf12f3	Bound
PersistentVolume	pvc-877ac893-b5ff-11e8-bef4-0a58acf12f3	Bound
PersistentVolume	pvc-c8993a87-b5ff-11e8-bef4-0a58acf12f3	Bound
PersistentVolumeClaim	data-chicago-rs1-0	Bound
PersistentVolumeClaim	data-chicago-rs1-1	Bound
PersistentVolumeClaim	data-chicago-rs1-2	Bound

# Node Affinity & Anti-Affinity

```
...  
podSpec:  
...  
  nodeAffinity:  
    requiredDuringSchedulingIgnoredDuringExecution:  
      nodeSelectorTerms:  
        - matchExpressions:  
          - key: mood  
            operator: In  
            values:  
              - happy
```

# Node Affinity & Anti-Affinity

```
$ kubectl describe node my-nodes-{0,1,2} | grep -E "^\w+Name:|mood|^mongodb"
```

Name:

*aks-nodepool1-21637950-0*

**mood=happy**

mongodb

chicago-rs1-2

mongodb

chicago-rs1-happy-nodes-0

mongodb

chicago-rs1-happy-nodes-2

mongodb

mongodb-enterprise-operator-57bdc5c59f-1q6gt

Name:

*aks-nodepool1-21637950-1*

**mood=happy**

mongodb

chicago-rs1-0

mongodb

chicago-rs1-happy-nodes-1

Name:

*aks-nodepool1-21637950-2*

**mood=content**

mongodb

chicago-rs1-1

# Roadmap

## Additional Features

Release Plans

Beta now - target Q2 2019 for  
GA

<https://docs.opsmanager.mongodb.com/current/reference/known-issues-k8s-beta/>

OpenShift 3.11

SSL/TLS

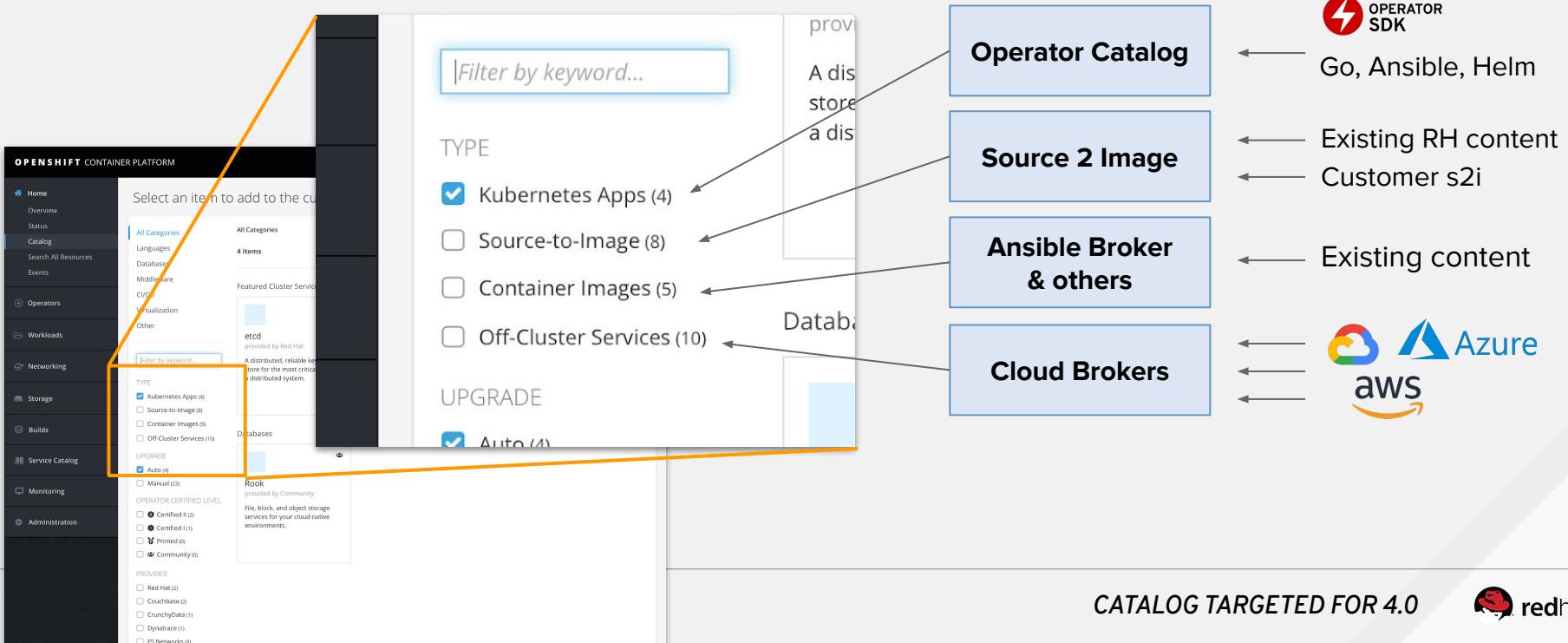
Authentication

Enabling Backups

Running Ops Manager inside  
Kubernetes

# ROADMAP: OPENSHIFT 4 COMING IN 2019

- Redesigned catalog brings this all together for Operators
- Certified operators will be available for users to provision and consume
- CoreOS integrations, Istio, Mobile, Registry w. Quay, more!



# Community Resources

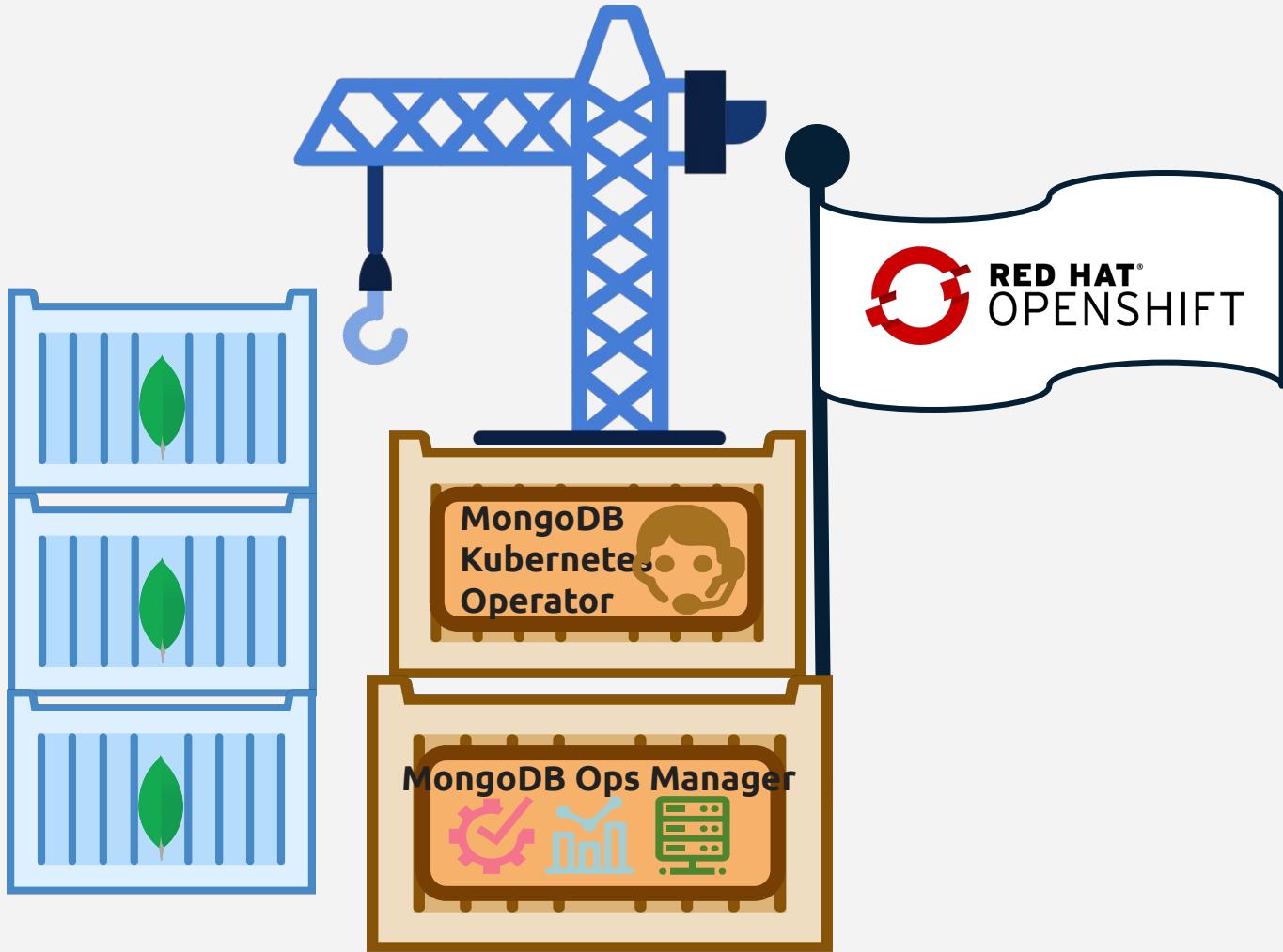
Where to get involved and learn more

Github:

<https://github.com/mongodb/mongodb-enterprise-kubernetes>

Slack: <https://launchpass.com/mongo-db>  
[#enterprise-kubernetes](#)

Talk to me!



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OpenShift

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Building  
Applications On  
OpenShift

START COURSE

Subsystems,  
Components, and  
Internals

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OpenShift  
Playgrounds

START COURSE

Service Mesh  
workshop with Istio

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Serverless scenarios  
with OpenShift  
Cloud Functions

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Interactive Learning Scenarios provide you with a pre-configured OpenShift instance, accessible from your browser without any downloads or configuration.