WIGM and Why You Want an Operator

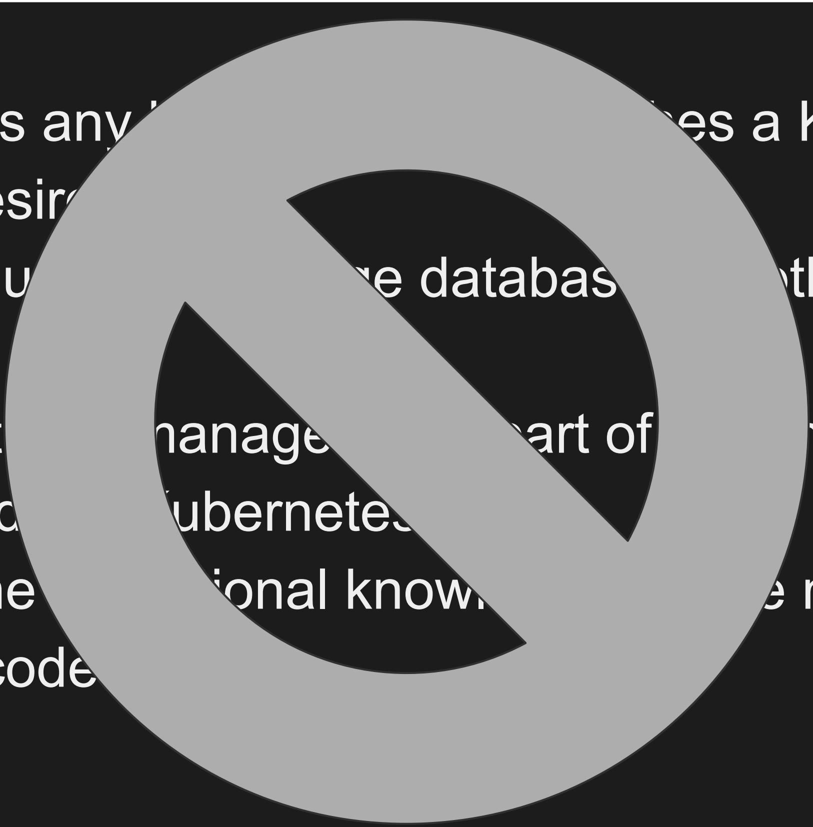
Carson Anderson

Weave

@carsonoid

@carson_ops

What is an Operator?



- An "Operator" is any ses a Kubernetes system and seeks a desir
- They are often u e databas ther software in Kubernetes
- They represent nanage art of naged service which runs insid ubernetes
- They take all the ional know e managed Software and put it into code

A management pattern

Why Use One?

A "Practical" Example

Wasteful

Individual

GIF

Mirror

What WIGM Does

- Download a GIF from a given URL
- Store the GIF locally
- Generate a web page to host the GIF with a given title
- Serve the web page

Management Goals

- Exceedingly easy to...
    - Host many instances with many configurations
    - Update configurations
    - Report on configurations
- No dedicated container images

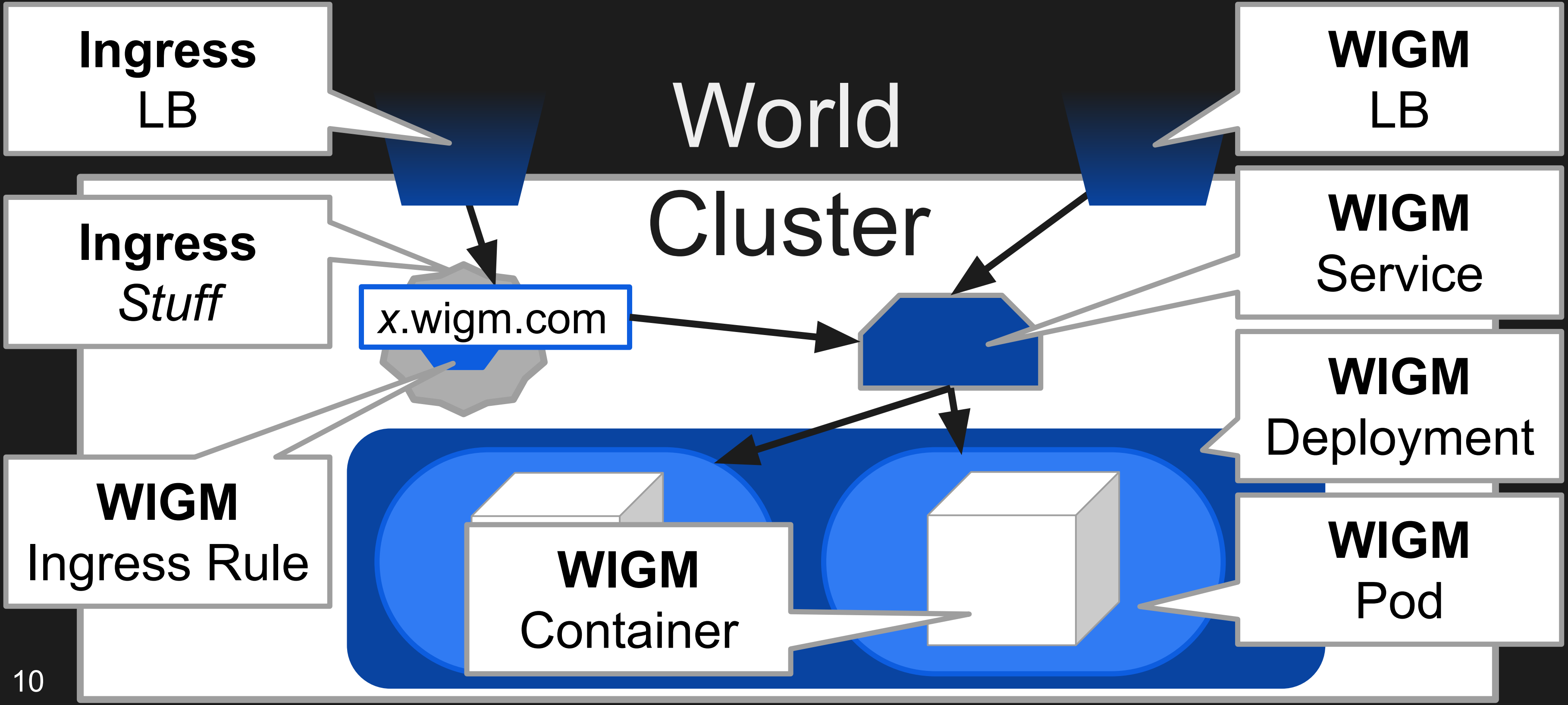
WIGM: Configuration

- **Name** - Kubernetes label value and resource name
- ENV variables:
  - **GIF_SOURCE_LINK** - Used to fetch original GIF
  - **GIF_TITLE** - Used as page title - HTML Friendly
- Access Decisions:
  - **Create** dedicated load balancer?
  - **Create** ingress rule?

WIGM: Outputs

- Kubernetes resources
    - Deployment
    - Service
    - Ingress rule (Optional)
- Dedicated Load balancer (Optional)

WIGM: Outputs Explained



WIGM Server

Pure Upstream NGINX

WIGM in Bash

Entrypoint for: nginx:1.5-alpine

```
## Expects: GIF_SOURCE_LINK, GIF_NAME
apk update && apk add curl

# go to data dir
cd /usr/share/nginx/html

# fetch original
curl -Lo wigm.gif "$GIF_SOURCE_LINK"

# write page using heredoc
cat > index.html <<EOF
<head>
  <title>WIGM: $GIF_TITLE</title>
</head>
<body>
  <h1>WIGM: $GIF_TITLE</h1>
  <img src="wigm.gif" />
</body>
EOF

# start nginx
exec nginx -g "daemon off;"
```

Management Tools

1. YAML
2. Helm
3. Operators
   - Metacontroller (Webhooks)
   - Operator SDK (Golang)

Evaluation Tasks

1. Release an instance of WIGM
    a. Create a LoadBalancer
    b. Disable Ingress
2. Update the GIF title
3. Enable ingress
4. Report Configuration
5. Delete

Evaluation Task Tracker

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

WIGM Via

YAML

YAML Code Structure

```
./wigm/yaml/
├── resources.yaml
└── releases
    ├── yaml1.yaml
    └── yaml2.yaml
```

YAML

resources.yaml Deployment Section

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wigm-host-NAME
  labels:
    app: wigm
    gif: NAME
spec:
  replicas: 2
  selector:
    matchLabels:
      app: wigm
      gif: NAME
  template:
    metadata:
      labels:
        app: wigm
        gif: NAME
    spec:
      [...]
```

YAML

resources.yaml Deployment Section (Continued)

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  [...]
spec:
  [...]
  template:
    [...]
    spec:
      containers:
      - name: gifhost
        image: nginx:1.15-alpine
        ports:
        - containerPort: 80
        env:
        - name: GIF_TITLE
          value: TITLE
        - name: GIF_SOURCE_LINK
          value: LINK
        command:
          [...]
```

YAML

resources.yaml Deployment Section (Continued)

```
[...]
  spec:
   containers:
   - name: gifhost
   [...]
    command:
    - sh
    - -exc
    - |

     # go to data dir
     [...]

     # fetch original
     [...]

     # write page using heredoc
     [...]

     # start nginx
     exec nginx -g "daemon off;"
```

YAML

resources.yaml Service Section

```yaml
---
kind: Service
apiVersion: v1
metadata:
  name: wigm-host-NAME
  labels:
    app: wigm
    gif: NAME
spec:
  selector:
    app: wigm
    gif: NAME
  # Uncomment line below to request
  # a cloud LB for the service
  # type: LoadBalancer
  ports:
  - protocol: TCP
    port: 80
    targetPort: 80
```

YAML

resources.yaml Ingress Section

```yaml
# Delete or comment to disable ingress
---
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: wigm-host-NAME
  labels:
    app: wigm
    gif: NAME
spec:
  rules:
  - host: NAME.wigm.carson-anderson.com
    http:
      paths:
      - path: /
        backend:
          serviceName: wigm-host-NAME
          servicePort: 80
```

YAML Evaluation

----CREATE----
Yes LoadBalancer
No Ingress

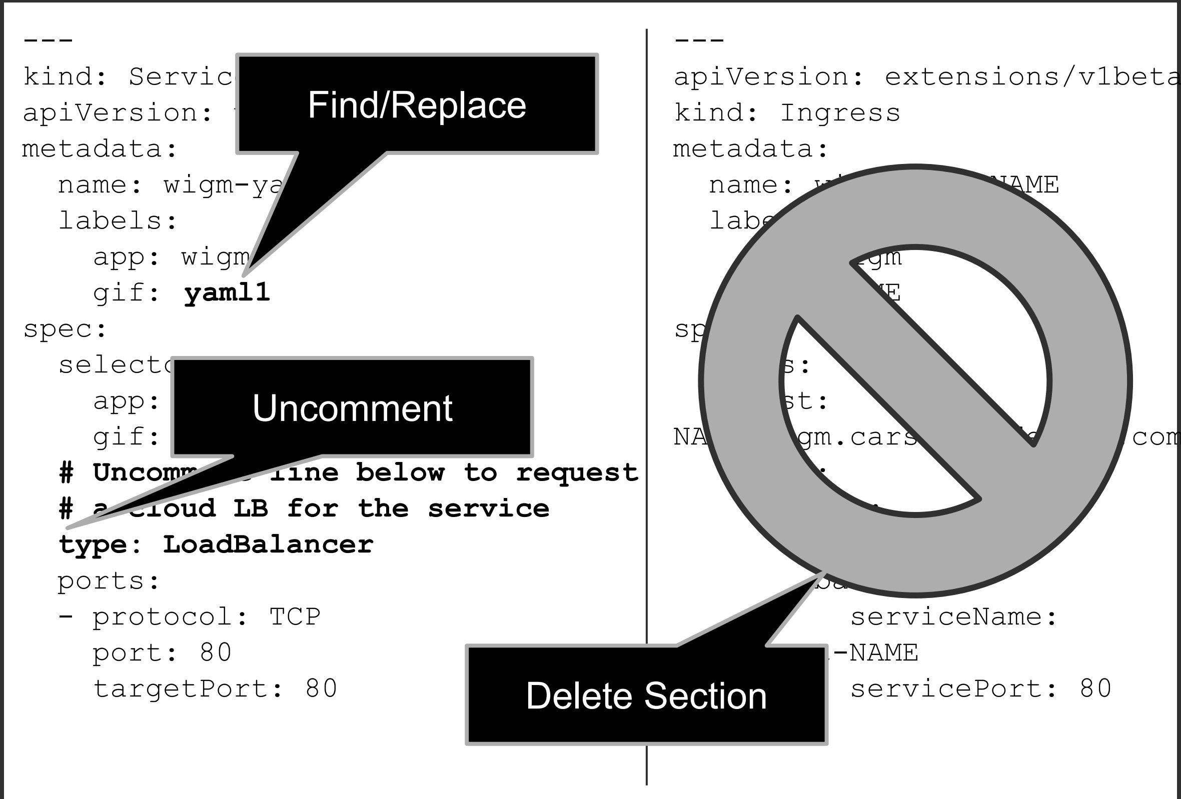
----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

- Copy resources.yml
- Paste to release folder
- Find/Replace
  - NAME -> yaml1
  - TITLE -> yaml1
  - LINK -> https://…
- Uncomment LB Line
- Delete Ingress YAML
- "kubectl create -f …"



```
---
kind: Servic
apiVersion: 
metadata:
  name: wigm-ya
  labels:
    app: wigm
    gif: yaml1
spec:
  selecto
    app:
    gif:
  # Uncomm    line below to request
  # a cloud LB for the service
  type: LoadBalancer
  ports:
  - protocol: TCP
    port: 80
    targetPort: 80
```

```
---
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: w          NAME
  labe
      gm
      E
sp
    s:
    st:
NA     gm.cars          com

      ba
          serviceName:
         -NAME
          servicePort: 80
```

Find/Replace

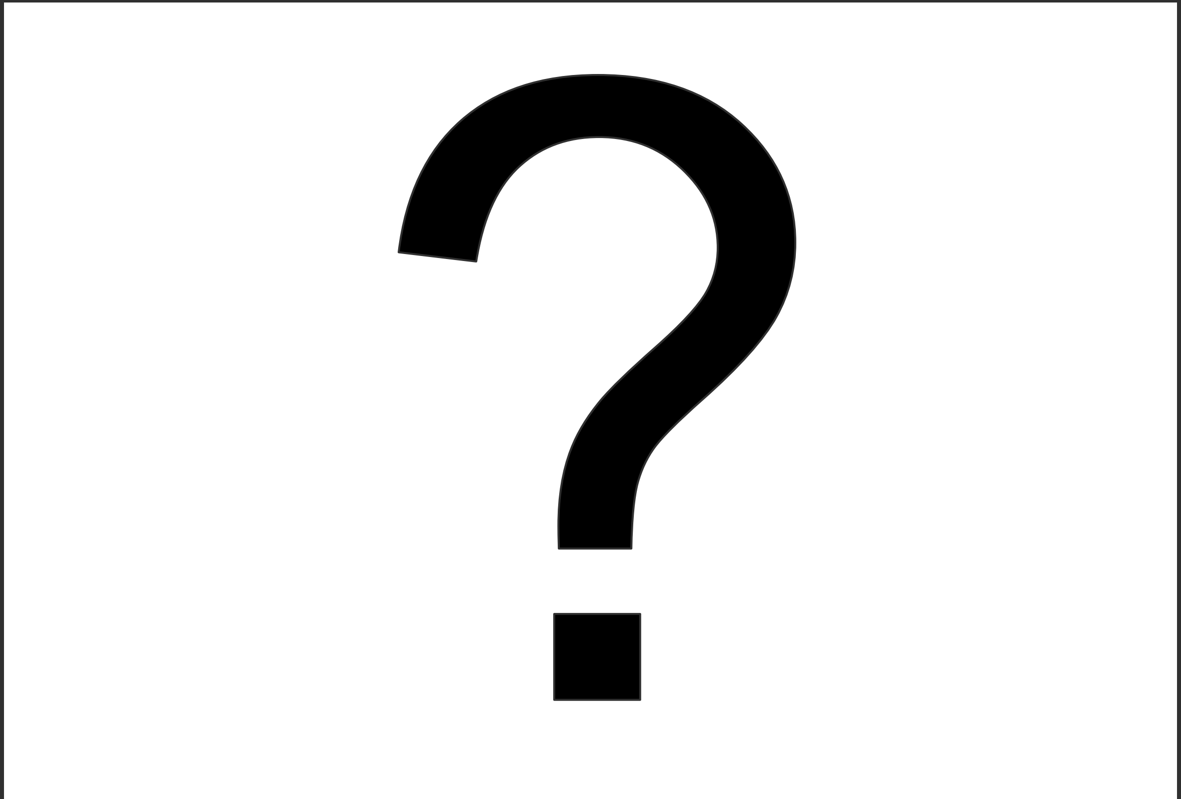
Uncomment

Delete Section

- Edit YAML
- "kubectl apply"

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wigm-host-yamlrelease
  labels:
    app: wigm
    gif: yamlrelease
spec:
  [...]
    spec:
     [...]

       env:
        - name: GIF_TITLE
          value: "This is YAML!"
        - name: GIF_SOURCE_LINK
          value: https://media.giphy.com/media/JloRBVCgTP6RW/giphy.gif
```

- Uhh...
- Copy...
- That thing...



----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

```
$ kubectl get -f releases/yaml1.yaml


NAME                               READY    UP-TO-DATE    AVAILABLE    AGE
deployment.apps/wigm-host-yaml1    2/2      2             0            7s

NAME                       TYPE         CLUSTER-IP       EXTERNAL-IP    PORT(S)    AGE
service/wigm-host-yaml1    ClusterIP    10.43.140.191    <none>         80/TCP     7s

NAME                                  HOSTS                                 ADDRESS    PORTS    AGE
ingress.extensions/wigm-host-yaml1    yaml1.wigm.carson-anderson.com                   80       7s
```

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

```
$ kubectl delete -f releases/yaml1.yaml

deployment.apps "wigm-host-yaml1" deleted
service "wigm-host-yaml1" deleted
ingress.extensions "wigm-host-yaml1" deleted
```

Summary

WIGM Via YAML

WIGM Via

Helm

Helm Code Structure

```
./wigm/helm/
├── Chart.yaml
├── values.yaml
├── templates
│   ├── deployment.yaml
│   ├── ingress.yaml
│   └── service.yaml
└── releases
    ├── helm1.yaml
    └── helm1.yaml
```

Helm

values.yaml

```yaml
# Default values for wigm.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

gif:
  title: "" # Defaults to helm stack name
  link: "" # Required!

service:
  create_cloud_lb: false

ingress:
  enabled: true
```

Helm

templates/ deployment.yaml

```
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wigm-host-{{ .Release.Name }}
  labels:
    app: wigm
    gif: {{ .Release.Name }}
spec:
    [...]
    spec:
      containers:
      - name: gifhost
        [...]
        env:
       - name: GIF_TITLE
          {{- if .Values.gif.title}}
          value: {{ .Values.gif.title| quote  }}
          {{- else }}
          value: {{ .Release.Name }}
          {{- end }}
        - name: GIF_SOURCE_LINK
          value: {{ .Values.gif.link }}
```

Helm

templates/
service.yaml

```
---
kind: Service
apiVersion: v1
metadata:
  name: wigm-host-{{ .Release.Name }}
  labels:
    app: wigm
    gif: {{ .Release.Name }}
spec:
  selector:
    app: wigm
    gif: {{ .Release.Name }}
  {{ if .Values.service.create_cloud_lb }}
  type: LoadBalancer
  {{ end }}
  ports:
  - protocol: TCP
    port: 80
    targetPort: 80
```

Helm

templates/ ingress.yaml

```
{{ if .Values.ingress.enabled }}
---
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: wigm-host-{{ .Release.Name }}
  labels:
    app: wigm
    gif: {{ .Release.Name }}
spec:
  rules:
  - host: {{ .Release.Name }}.wigm.carson-anderson.com
    http:
      paths:
      - path: /
        backend:
          serviceName: wigm-host-{{ .Release.Name }}
          servicePort: 80
{{ end }}
```

Helm Evaluation

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

- Create Values File

```
cat > releases/helm1.yaml <<EOF
gif:
  title: "helm1"
  link:  "https://media.giphy.com/media/wa6hNG157vUA25ncAu/giphy.gif"

service:
  create_cloud_lb: true

ingress:
  enabled: false
EOF
```

- Run Helm Install

```
helm install \
  -n helm1 \
  -f releases/helm1.yaml .
```

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

- Edit Values File

```
cat > releases/helm1.yaml <<EOF
gif:
  title: "Helm is better!"
  link:  "https://media.giphy.com/media/wa6hNG157vUA25ncAu/giphy.gif"

service:
  create_cloud_lb: true

ingress:
  enabled: false
EOF
```

- Run Helm Upgrade

```
helm upgrade \
  helm1 \
  -f releases/helm1.yaml .
```

```
----CREATE----
Yes LoadBalancer
No  Ingress
```

```
----UPDATE----
Change Title
```

```
----UPDATE----
Enable Ingress
```

```
----REPORT----
```

```
----DELETE----
```

- Edit Values File

```
cat > releases/helm1.yaml <<EOF
gif:
  title: "Helm is better!"
  link: "https://media.giphy.com/media/wa6hNG157vUA25ncAu/giphy.gif"

service:
  create_cloud_lb: true

ingress:
  enabled: true
EOF
```

- Run Helm Upgrade

```
helm upgrade \
  helm1 \
  -f releases/helm1.yaml .
```

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

```
$ helm status helm1

LAST DEPLOYED: Thu Oct 31 01:09:59 2019
NAMESPACE: default
STATUS: DEPLOYED

RESOURCES:
==> v1/Deployment
NAME            READY  UP-TO-DATE  AVAILABLE  AGE
wigm-host-helm1  2/2    2           2          23s

==> v1/Pod(related)
NAME                              READY  STATUS   RESTARTS  AGE
wigm-host-helm1-56b595bc57-mwgj5  1/1    Running  0         23s
wigm-host-helm1-56b595bc57-wvf6f  1/1    Running  0         23s

==> v1/Service
NAME            TYPE          CLUSTER-IP   EXTERNAL-IP  PORT(S)       AGE
wigm-host-helm1  LoadBalancer  10.43.7.140  <pending>    80:32043/TCP  23s
```

```
$ helm delete --purge helm1

release "helm1" deleted
```

Summary

WIGM Via Helm

WIGM Via

Any Operator

Operators

Custom Resources

```yaml
apiVersion: wigm.carson-anderson.com/v1
kind: WigmGif
metadata:
  name: operators
spec:
  gif:
    title: "Deploying With Operators"
    link: https://m.../giphy.gif

  service:
    create_cloud_lb: true

  ingress:
    enabled: true
```

Operators

Custom Resource Definition

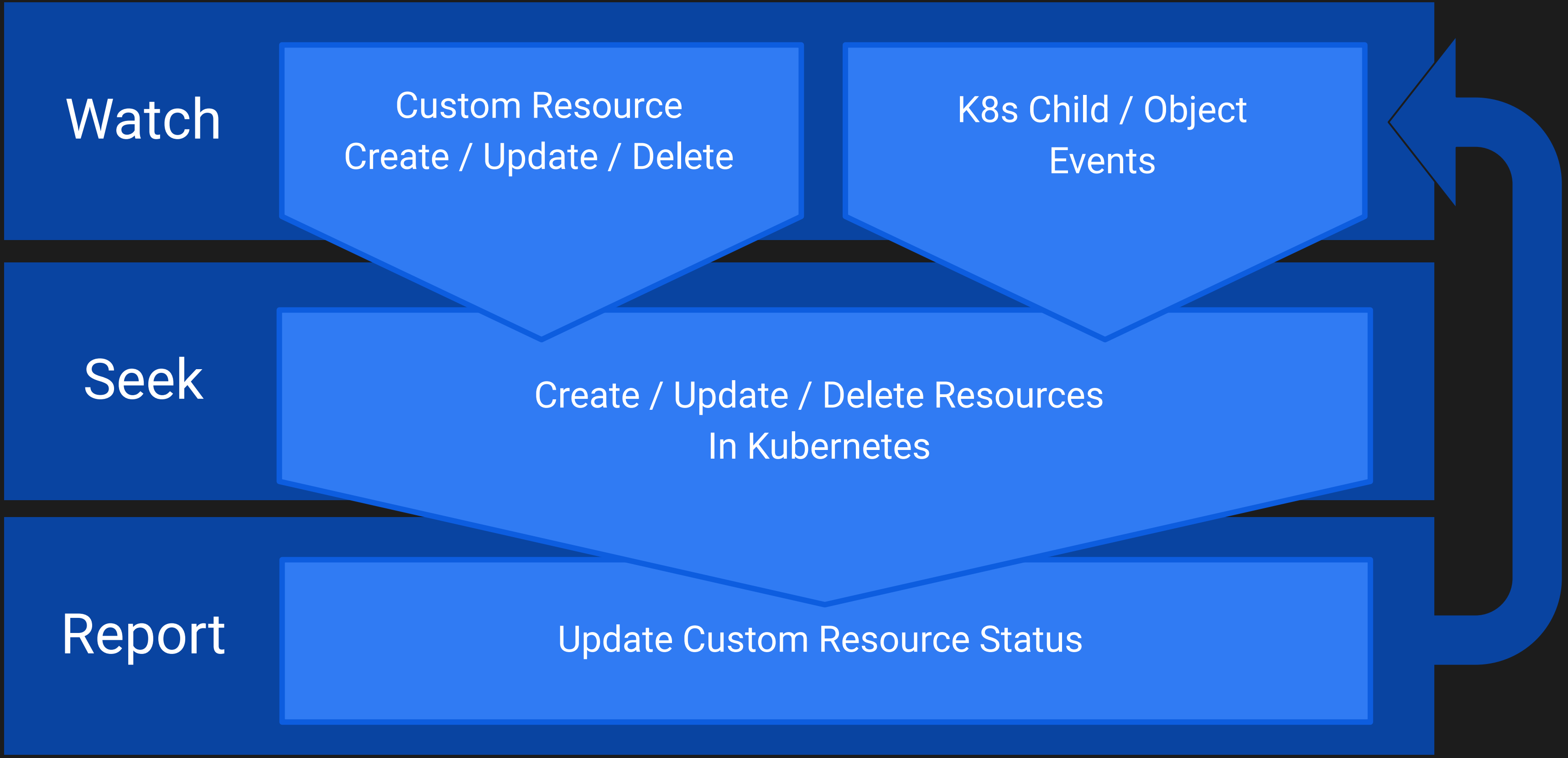
```
apiVersion: apiextensions.k8s.io/v1beta1
kind: CustomResourceDefinition
metadata:
  name: wigmgifs.wigm.carson-anderson.com
spec:
  group: wigm.carson-anderson.com
  names:
    kind: WigmGif
    listKind: WigmGifList
    plural: wigmgifs
    singular: wigmgif
  scope: Namespaced
  version: v1
  subresources:
    status: {}
  additionalPrinterColumns:
  [...]
```

Operators

CRD Continued

```yaml
apiVersion: apiextensions.k8s.io/v1beta1
kind: CustomResourceDefinition
metadata:
  name: wigmgifs.wigm.carson-anderson.com
spec:
  [...]
  additionalPrinterColumns:
  - name: Title
    type: string
    description: The title of the gif
    JSONPath: .spec.gif.title
  - name: DeploymentOK
    type: boolean
    description: Is the deployment created
    JSONPath: .status.deployment.created
  [...]
```

Operator Principles



Operator code structure

```
./wigm/operators/
└── releases/
    ├── operator1.yaml
    └── operator2.yaml
```

Operator Evaluation

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

- Create Custom Resource file
- kubectl apply

OR

- API POST

```
cat > releases/operator1.yaml <<EOF
apiVersion: wigm.carson-anderson.com/v1
kind: WigmGif
metadata:
  name: operator1
spec:
  gif:
    title: operators
    link: https://media.giphy.com/[...]/giphy.gif

service:
  create_cloud_lb: true

ingress:
  enabled: false
EOF

kubectl apply -f \
  releases/operator1.yaml
```

----CREATE----
Yes LoadBalancer
No Ingress

----UPDATE----
Change Title

----UPDATE----
Enable Ingress

----REPORT----

----DELETE----

- Update resource file
- kubectl apply …

OR

- Kubectl edit …

OR

- kubectl patch …

OR

- API PATCH

```
cat > releases/operator1.yaml <<EOF
apiVersion: wigm.carson-anderson.com/v1
kind: WigmGif
metadata:
  name: operators
spec:
  gif:
    title: "Operators are awesome!"
    link: https://media.giphy.com/[...]/giphy.gif

service:
  create_cloud_lb: true

ingress:
  enabled: false
EOF

kubectl apply -f \
  releases/operator1.yaml
```

- Update resource file
- kubectl apply …

OR

- Kubectl edit …

OR

- kubectl patch …

OR

- API PATCH

```
cat > releases/operator1.yaml <<EOF
apiVersion: wigm.carson-anderson.com/v1
kind: WigmGif
metadata:
  name: operators
spec:
  gif:
    title: "Operators are awesome!"
    link: https://media.giphy.com/[...]/giphy.gif

service:
  create_cloud_lb: true

ingress:
  enabled: true
EOF

kubectl apply -f \
  releases/operator1.yaml
```

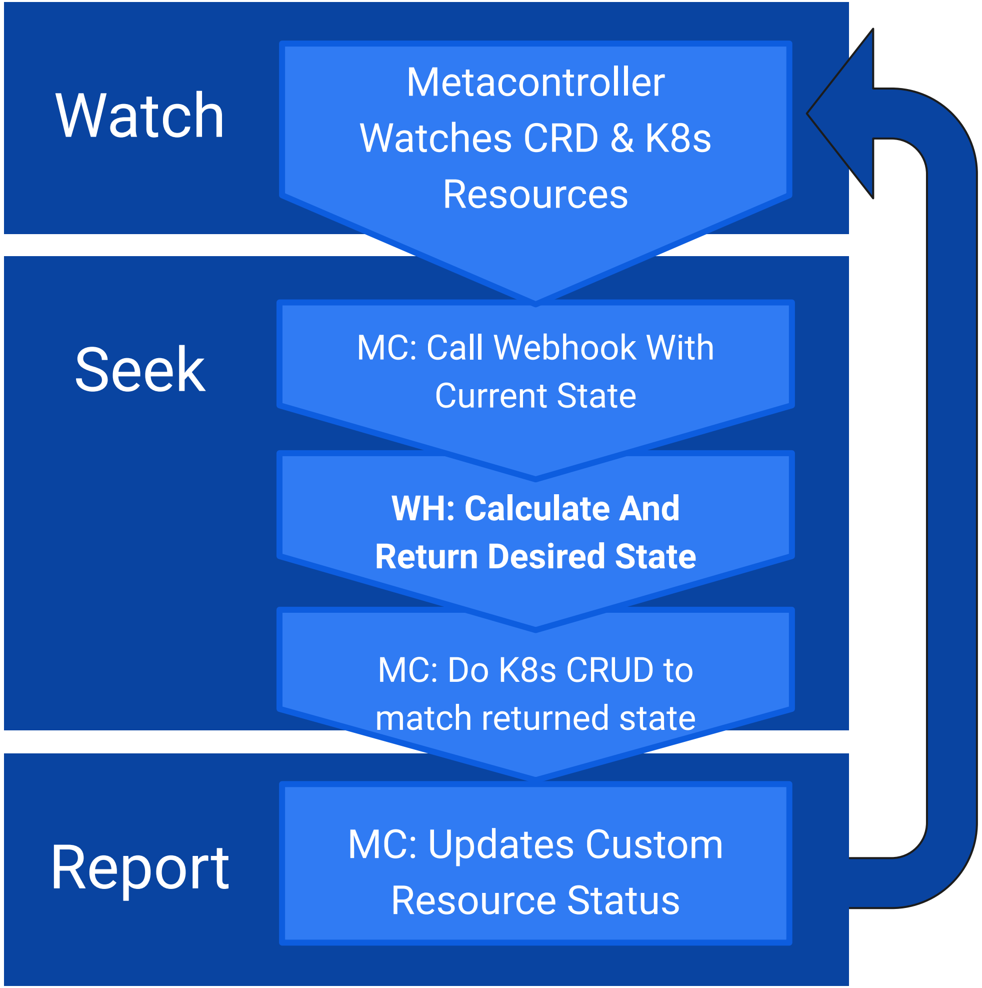
```
$ kubectl get wigmgif operator1

NAME         TITLE                    DEPLOYMENTOK    SERVICEOK    SERVICETYPE     INGRESSENABLED

operator1    Operators are great!     true            true         LoadBalancer    true

$ kubectl get wigmgifs -ocustom-columns=
  NAME:.metadata.name,\
  DEPLOYMENT:.status.deployment.created,\
  SERVICE:.status.service.created,\
  SVCTYPE:.status.service.type,\
  INGRESS:.status.ingress.created


# OR API GET
```

```
$ kubectl delete wigmgif operator1

wigmgif.wigm.carson-anderson.com "operator1" deleted




# OR API DELETE
```

WIGM Via Metacontroller

Operators

Metacontroller



Watch

Metacontroller Watches CRD & K8s Resources

Seek

MC: Call Webhook With Current State

WH: Calculate And Return Desired State

MC: Do K8s CRUD to match returned state

Report

MC: Updates Custom Resource Status

Metacontroller Setup

- Write the webhook sync function
- Install Metacontroller into cluster
- Run a webhook server in cluster
- Register webhook with metacontroller
  - CompositeController custom resource

Metacontroller Code Structure

```
./wigm/operators/with-metacontroller/
├── controller-metaconfig.yaml
├── controller-deploy.yaml
└── controller.py
```

Operators

Metacontroller controller.py sync

```
[...]
def sync(self, parent, children):
  name = parent["metadata"]["name"]

  # default status
  status = {
  [...]
  }

  # Generate the desired child objects
  children = [
    self.get_deployment(parent, name),
    self.get_service(parent, name),
  ]

  [...]

  return {"status": status, "children": children}
```

Take in current state

Calculate desired state

Return progress and desired state

Operators

Metacontroller
controller.py
get_deployment

```
def get_deployment(self, parent, name):
   giftitle = parent["spec"]["gif"].get("title", name)
   giflink = parent["spec"]["gif"]["link"]

   deployment = {
     "apiVersion": "apps/v1",
     "kind": "Deployment",
     "metadata": {
       "name": "wigm-host-%s"%(name),
       "labels": { "app": "wigm",
                   "gif": name }
     },
     "spec": {
       [...]
         "spec": {
           "containers": [
             {
              [...]
               "env": [
                 { "name": "GIF_TITLE",
                   "value": giftitle },
                 { "name": "GIF_SOURCE_LINK",
                   "value": giflink
                 }
               [...]
   return deployment
```

Operators

Metacontroller
Code sample

```
def get_service(self, parent, name):
    service = {
      "kind": "Service",
      "apiVersion": "v1",
      "metadata": {
        "name": "wigm-host-%s"%(name),
        "labels": {
          "app": "wigm",
          "gif": name
        }
      },

    # conditionally set service ki
    if parent["spec"].get(
          "service", {}).get("create_cloud_lb"):
      service["spec"]["type"] = "LoadBalancer"

    return service
```

String building

Business decisions in code

Operators

Metacontroller controller.py get_ingress

```
# if parent["spec"].get("ingress", {}).get("enabled",):
#   children.append(
#    self.get_ingress(parent, name)
#   )

---

def get_ingress(self, parent, name):
    ingress = {
      "apiVersion": "extensions/v1beta1",
      "kind": "Ingress",
      "metadata": {
        "name": "wigm-host-%s"%(name),
       [...]
      },
      "spec": {
        "rules": [
          {
           "host": "%s.wigm.carson-anderson.com"%(name),
           [...]
    }

    return ingress
```

Operators

Metacontroller Configuration:

CompositeController

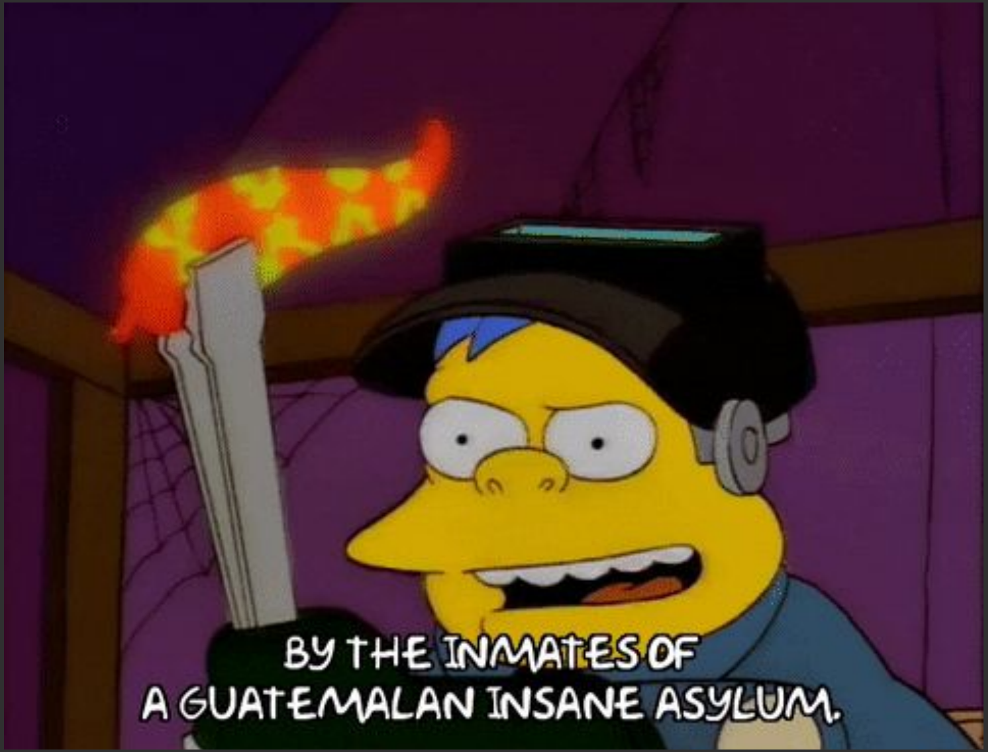
```
apiVersion: metacontroller.k8s.io/v1alpha1
kind: CompositeController
metadata:
  name: wigm-controller
spec:
  generateSelector: true
  parentResource:
    apiVersion: wigm.carson-anderson.com/v1
    resource: wigmgifs
  childResources:
  - apiVersion: apps/v1
    resource: deployments
    updateStrategy:
      method: InPlace
  - apiVersion: v1
    resource: services
    updateStrategy:
      method: InPlace
  - apiVersion: extensions/v1beta1
    resource: ingresses
    updateStrategy:
      method: InPlace
  hooks:
    sync:
      webhook:
        url: http://wigm-controller.wigm/sync
```

Summary

WIGM Via Operator (Metacontroller)

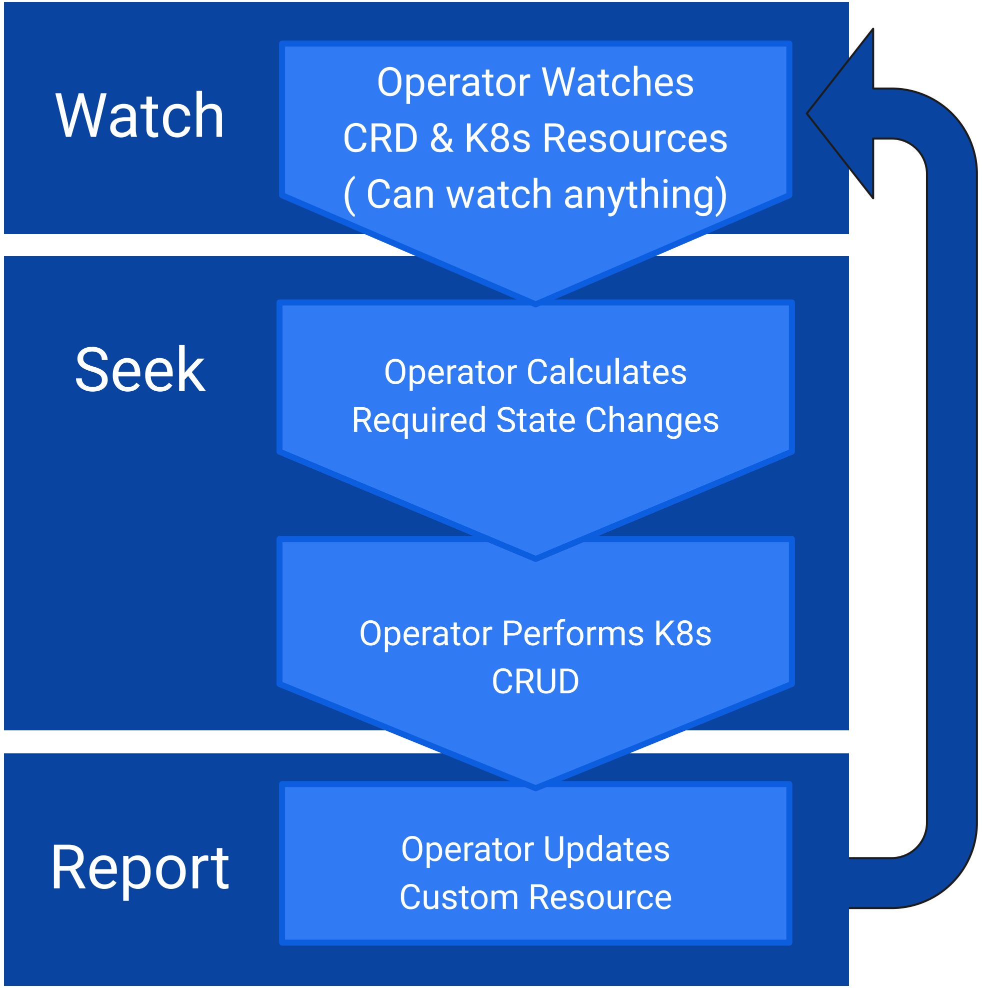
WIGM Via

Operator-SDK
(Golang)



Operators

Operator SDK



Watch

Operator Watches CRD & K8s Resources (Can watch anything)

Seek

Operator Calculates Required State Changes

Operator Performs K8s CRUD

Report

Operator Updates Custom Resource

Operator-SDK Setup

- Generate boilerplate
- Generate and update custom types
  - WigmGif
- Generate and update reconciler
- Build and run controller binary

Operators

Operator SDK Generate Boilerplate

```
# Generate boilerplate controller
operator-sdk new wigm

# Go to controller root
cd wigm
```

Operator-SDK Deploy Files

```
./wigm/operators/with-operator-sdk/
└── deploy
    ├── operator.yaml
    ├── role_binding.yaml
    ├── role.yaml
    └── service_account.yaml
```

Operators

Operator SDK
Generate
Types

```
# Generate boilerplate CRD and API Spec
operator-sdk add api \
--api-version=wigm.carson-anderson.com/v1 \
--kind=WigmGif
```

Operator-SDK Deploy Files

```
./wigm/operators/with-operator-sdk/
└── deploy
    ├── crds
    │   └── wigm_v1_wigmgif_crd.yaml
    ├── operator.yaml
    ├── role_binding.yaml
    ├── role.yaml
    └── service_account.yaml
```

Operator-SDK Types Files

```
./wigm/operators/with-operator-sdk/
└── pkg
    └── apis
        └── wigm
            └── v1
                └── wigmgif_types.go
```

Operators

Operator SDK
Edit Types

```
# File ./pkg/apis/wigm/v1/wigmgif_types.go
[...]
// WigmGifSpec defines the desired state of
WigmGif
type WigmGifSpec struct {
 Gif      GifProperties [...]
 Service *ServiceProperties [...]
 Ingess  *IngressProperties [...]
}

type GifProperties struct {
 Title string `json:"title,omitempty"`
 Link string `json:"link"`
}

type ServiceProperties struct {
 CreateCloudLB bool `json:"create_cloud_lb"`
}

type IngressProperties struct {
 Enabled bool `json:"enabled"`
}
```

Operators

Ex: Power of Embedded Types

```
# File ./pkg/apis/wigm/v1/wigmgif_types.go
import (
  corev1 "k8s.io/api/core/v1"
)
[...]
// WigmGifSpec defines the desired state of
WigmGif
type WigmGifSpec struct {
 Gif GifProperties [...]
 Service *ServiceProperties [...]
 Resources *corev1.ResourceRequirements
}

type GifProperties struct {
 Title string `json:"title,omitempty"`
 Link string `json:"link"`
}

type ServiceProperties struct {
 CreateCloudLB bool `json:"create_cloud_lb"`
}
```

Operators

Generate Reconciler

```
# Generate boilerplate controller
operator-sdk add controller \
--api-version=wigm.carson-anderson.com/v1 \
--kind=WigmGif
```

Operator-SDK Controller Files

```
./wigm/operators/with-operator-sdk/
└── pkg
    └── controller
        └── wigmgif
            └── wigmgif_controller.go
```

Operators

WigmGIF Controller Psudocode

```
controller = NewController()

controller.Watch(WigmGifs)
controller.Watch(Child Deployments)
controller.Watch(Child Services)
controller.Watch(Child Ingresses)

for wigmggif in controller.Changes() {
  controller.SyncDeployment(wigmggif)
  if error {
    handleError()
  }
  controller.SyncService(wigmggif)
  if error {
    handleError()
  }
  controller.SyncIngress(wigmggif)
  if error {
    handleError()
  }
}
```

Graceful error handling

Graceful error handling

Graceful error handling

Operators

WigmGIF Controller

```
# /pkg/controller/wigmgif/wigmgif_controller.go

func add(mgr manager.Manager, r reconcile.Reconciler)
error {
    // Create a new controller
    c, err := controller.New("wigmgif-controller", mgr,
controller.Options{Reconciler: r})
    if err != nil {
        return err
    }

    // Watch for changes to primary resource WigmGif
    err = c.Watch(&source.Kind{ Type: &wigmv1.WigmGif{}},
&handler.EnqueueRequestForObject{})
    if err != nil {
        return err
    }

    // Watch for changes to child deployments and
requeue the owner WigmGif
    err = c.Watch(&source.Kind{Type:
&appsv1.Deployment{}}, &handler.EnqueueRequestForOwner{
        IsController: true,
        OwnerType:    &wigmv1.WigmGif{},
    })
    [...]
```

Operators

WigmGIF Controller Syncs

```
func (r *ReconcileWigmGif) Reconcile(request reconcile.Request)
(reconcile.Result, error) {

[...]

// Sync the deployment, updating status in the passed instance
      if r, err := r.syncDeployment(instance); err != nil ||
r.Requeue == true {
            return r, err
      }

      // Sync the service, updating status in the passed instance
      if r, err := r.syncService(instance); err != nil ||
r.Requeue == true {
            return r, err
      }

      // Sync the ingress, updating status in the passed instance
      if r, err := r.syncIngress(instance); err != nil ||
r.Requeue == true {
            return r, err
      }

      // update the status
      if err := r.client.Status().Update(context.TODO(),
instance); err != nil
[...]
```

Operators

Golang Operator Reconciler Code Sample

```
func newDeploymentForWG(wg *wigmv1.WigmGif)
*appsv1.Deployment {
        name := wg.GetName()

        giflink := wg.Spec.Gif.Link
        giftitle := name
        if wg.Spec.Gif.Title != "" {
                giftitle = wg.Spec.Gif.Name
        }

        labels := map[string]string{
                "app": "wigm",
                "gif": name,
        }

        deployment := &appsv1.Deployment{
                ObjectMeta: metav1.ObjectMeta{
                        Name:       "wigm-host-" + name,
                        Namespace: wg.GetNamespace(),
                        Labels:    labels,
                },
                Spec: appsv1.DeploymentSpec{
                        [...]
                        Containers: []corev1.Container{{
                                Name:  "gifhost",
                                Image: "nginx:1.15-alpine",
                                Env: []corev1.EnvVar{{
                                        Name:  "GIF_NAME",
                                        Value: gifname,},
                [...]
```

Struct fields

Strictly Typed

String building

Side Note: Structify Demo!

structify.carsonoid.net

Operators

WigmGIF Controller Get Service

```
func newServiceForWG(wg *wigmv1.WigmGif) *corev1.Service
{
       [...]

     if (
          wg.Spec.Service != nil &&
          wg.Spec.Service.CreateCloudLB
          ) {
         service.Spec.Type = corev1.ServiceTypeLoadBalancer
     }

       [...]
}
```

Operators

Ex: Golang Fake Client Testing

```
func TestWigmGifBasicCreate(t *testing.T) {

// Create a fake client to mock API calls.
cl := fake.NewFakeClient(objs...)

// Run Reconciler
res, err := r.Reconcile(req)

// Get Result
err = cl.Get(context.TODO(),
  types.NamespacedName{
  Name: expectedDeployment.GetName(),
  Namespace: expectedDeployment.GetNamespace()},
  foundDeployment)

// Validate
if err != nil {
  t.Errorf(
    "Error getting expected deployment: %s", err
  )
}

}
```

Same Reconcile Function as the Controller

Summary and Demo

WIGM Via Operator (Operator-SDK)

The Evolution WIGM

YAML

HELM

Operators

Management Pattern Comparison

	Develop Speed	Portability	Release Creation	Release Updates	Testability	Automatic State Seek	Performance
YAML	🟩	🟥	🟥 Manual	🟥 Manual	🟥 Manual	⬛	⬛
Helm	🟩	🟨 Req. local copy of the templates and values	🟩	🟨 Manually Applied	🟨	⬛	⬛
Operator: Metacontroller	🟨 Webhook Redeploy	🟩 Supports any K8s API tool or Code	🟨	🟨	🟨	🟨 Batched	🟨
Operator: operator-sdk	🟥 Golang Learning Curve	🟩 Supports any K8s API tool or Code	🟩	🟩	🟩	🟩	🟩

More of Me

github.com/carsonoid/talk-wigm-and-operators

K3s (demos): github.com/rancher/k3s

@carsonoid

@carson_ops

kube-decon.carson-anderson.com

dynamic-kubernetes.carson-anderson.com

salt-decon.carson.anderson.com