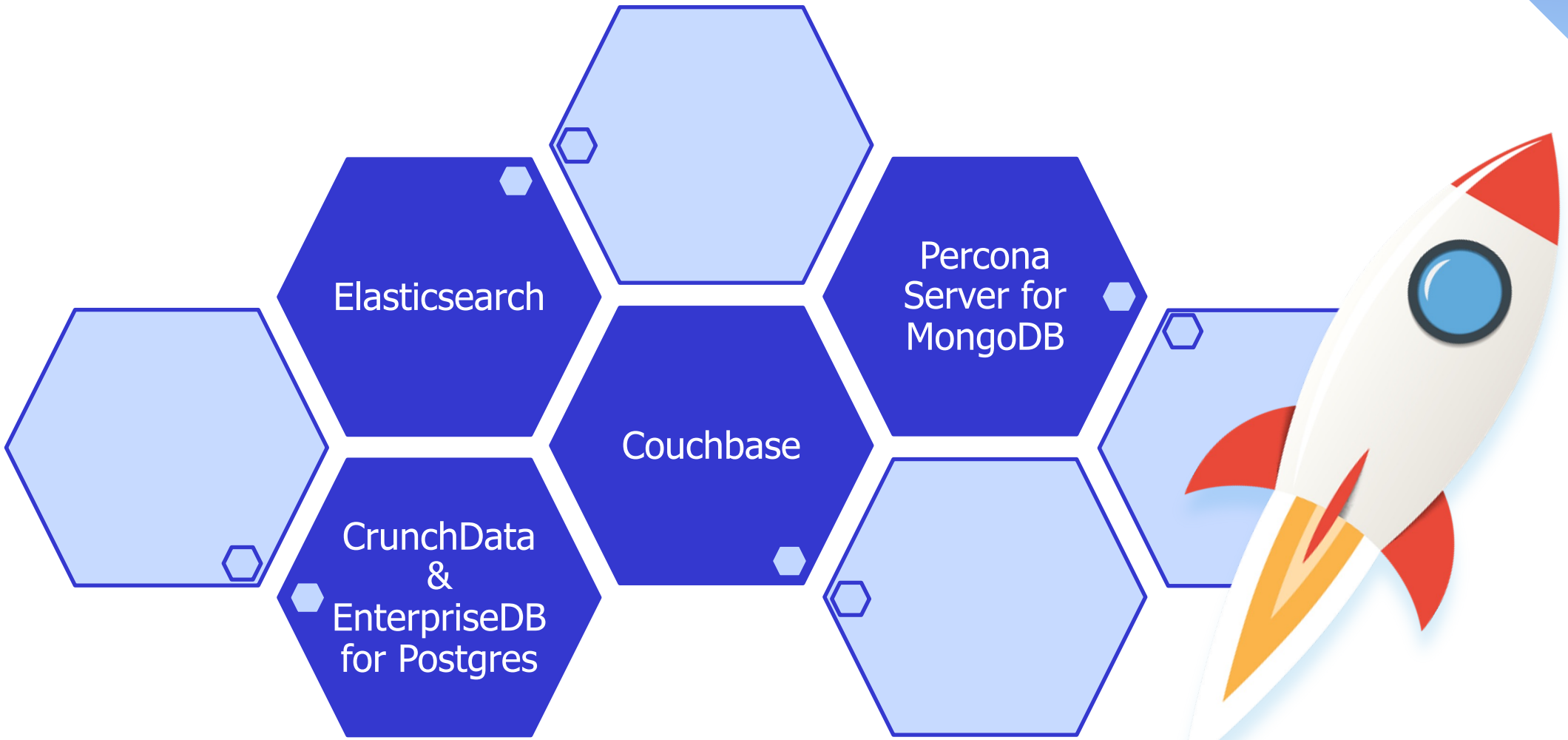
But What About Operators?

Operators

Accelerating Stateful Workloads on K8s



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What is an Operator?

An operator is a Kubernetes controller that **understands 2 domains: Kubernetes and something else**. By combining knowledge of both domains, it can automate tasks that usually require a human operator that understands both domains.

Jimmy Zelinskie, Former OpenShift Principal Product Manager

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Example Operator manifest using *Percona Operator for MongoDB*

```yaml
apiVersion: psmdb.percona.com/v1
kind: PerconaServerMongoDB
metadata:
  name: my-cluster-name
  finalizers:
    - delete-psmdb-pods-in-order
spec:
  crVersion: 1.13.0
  allowUnsafeConfigurations: false
  replsets:
  - name: rs0
    size: 3
    expose:
      enabled: false
      exposeType: ClusterIP
    resources:
      limits:
        cpu: "300m"
        memory: "0.5G"
      requests:
        cpu: "300m"
        memory: "0.5G"
    volumeSpec:
      persistentVolumeClaim:
        resources:
          requests:
            storage: 3Gi
  sharding:
    enabled: true
    configsvrReplSet:
      size: 3
.......
```

1x Cluster

3x Percona Server Replicas

Each with its own PVC

3x Config Server Replicas

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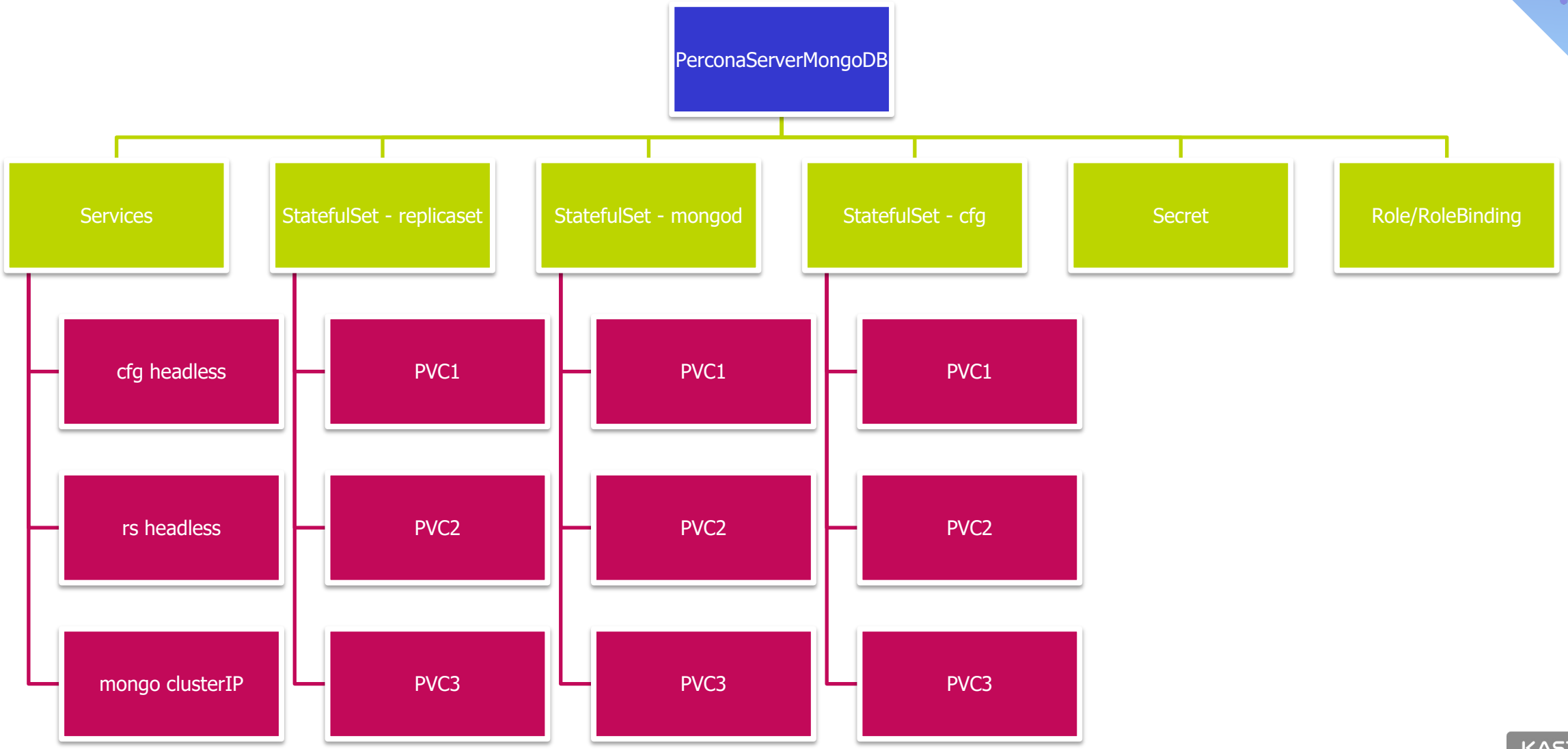
Derived Resources

Created by the Operator



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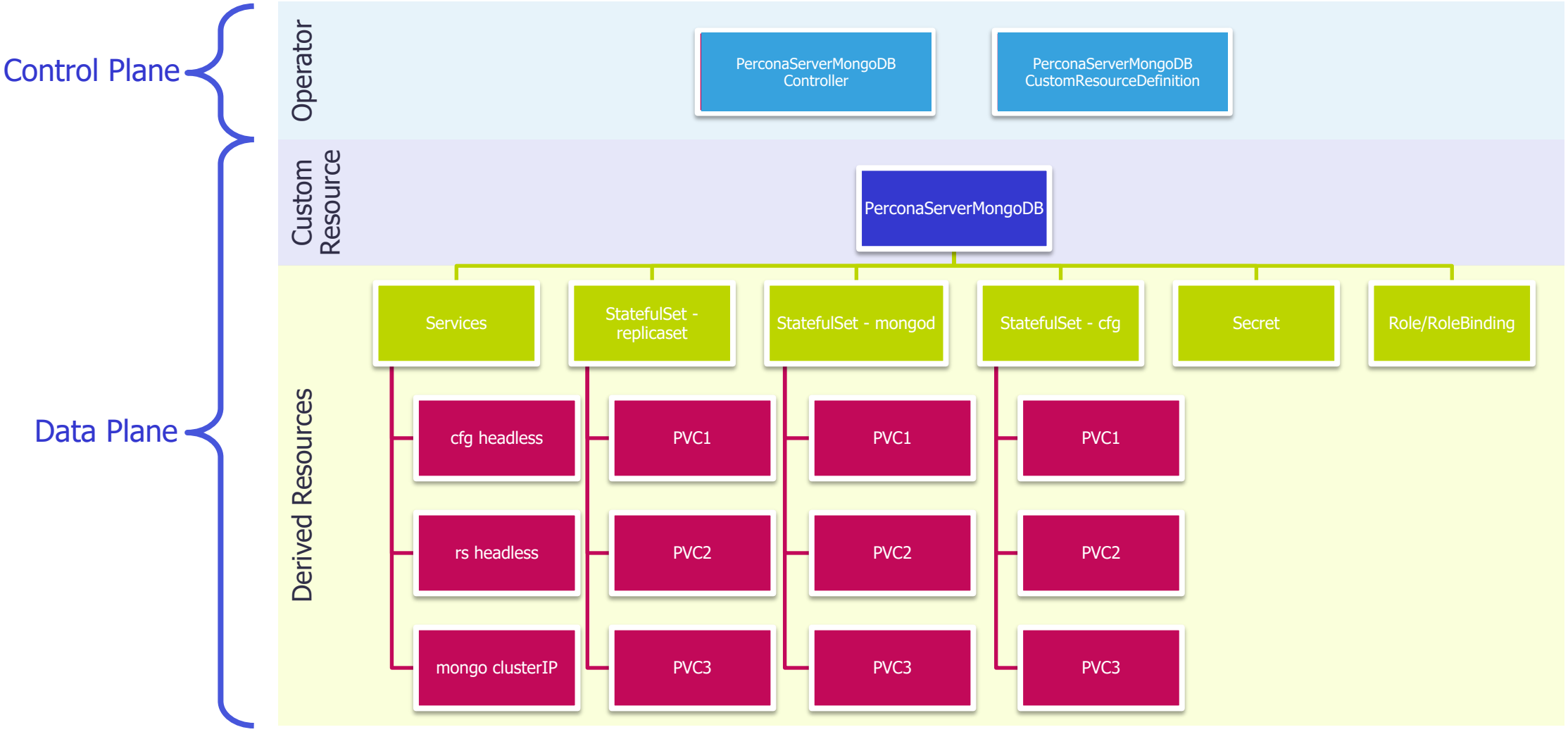
Operator Dichotomy

Control v. Data



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"My Operator does backup for me…"

Leverage it!

- More Operators are providing built-in protection logic
- Data service backup does not protect your complete app
- Use Blueprints to work *with* the Operator, not *against* it!

```yaml
apiVersion: psmdb.percona.com/v1
kind: PerconaServerMongoDBBackup
metadata:
  name: backup1
spec:
  clusterName: my-cluster-name
  storageName: s3-us-west
```

```yaml
apiVersion: psmdb.percona.com/v1
kind: PerconaServerMongoDBRestore
metadata:
  name: restore1
spec:
  clusterName: my-cluster-name
  backupName: backup1
```


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```
6    backup:
7      outputArtifacts:
8        cloudObjects:
9          keyValue:
10           psmdbbackup: 'backup-{{ toDate "2006-01-02T15:04:05.999999999Z07:00" .Time | date "2006-01-02t15-04-05z07-00" }}'
11           namespace: "{{ .Object.metadata.namespace }}"
12     phases:
13     - func: KubeOps
14       name: createBackupCR
15       args:
16         operation: create
17         namespace: "{{ .Object.metadata.namespace }}"
18         spec: |-
19           apiVersion: psmdb.percona.com/v1
20           kind: PerconaServerMongoDBBackup
21           metadata:
22             finalizers:
23             - delete-backup
24             name: backup-{{ toDate "2006-01-02T15:04:05.999999999Z07:00" .Time | date "2006-01-02t15-04-05z07-00" }}
25           spec:
26             clusterName: {{ .Object.metadata.name }}
27             storageName: my-s3-storage
28     - func: Wait
29       name: waitBackupReady
30       args:
31         timeout: 360s
32         conditions:
33           anyOf:
34             - condition: '{{ if  eq "{ $.status.state }" "ready" }}true{{ else }}false{{ end }}'
35               objectReference:
36                 apiVersion: v1
37                 group: psmdb.percona.com
38                 resource: perconaservermongodbbackups
39                 name: 'backup-{{ toDate "2006-01-02T15:04:05.999999999Z07:00" .Time | date "2006-01-02t15-04-05z07-00" }}'
40                 namespace: "{{ .Object.metadata.namespace}}"
```

Blueprint "backup" action

Kanister Function

Create Operator-controlled Backup CR

Store generated Backup CR name in RestorePoint

Kanister Function

Wait for new Backup CR to reach "Ready" state

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```
55    restore:
56      inputArtifactNames:
57      - cloudObjects
58      phases:
59      - func: Wait
60        name: waitMongoDBClusterReady
61        args:
62          timeout: 300s
63          conditions:
64            anyOf:
65              - condition: '{{ if  eq "{ $.status.state }" "ready" }}true{{ else }}false{{ end }}'
66                objectReference:
67                  apiVersion: v1
68                  group: psmdb.percona.com
69                  resource: perconaservermongodbs
70                  name: "{{ .Object.metadata.name}}"
71                  namespace: "{{ .Object.metadata.namespace}}"
72      - func: KubeOps
73        name: createRestoreFromBackup
74        args:
75          operation: create
76          namespace: "{{ .Object.metadata.namespace }}"
77          spec: |-
78            apiVersion: psmdb.percona.com/v1
79            kind: PerconaServerMongoDBRestore
80            metadata:
81              name: restore-{{ toDate "2006-01-02T15:04:05.999999999Z07:00" .Time | date "2006-01-02t15-04-05z07-00" }}
82            spec:
83              clusterName: {{ .Object.metadata.name }}
84              backupName: {{ .ArtifactsIn.cloudObjects.KeyValue.psmdbbackup }}
85              {{- if .Options }}
86              {{- if .Options.pitr }}
87              pitr:
88                type: date
89                date: {{ .Options.pitr }}
90              {{- end }}
91              {{- end }}
92      - func: Wait
93        name: waitRestoreReady
94        args:
95          timeout: 720s
96          conditions:
97            anyOf:
98              - condition: '{{ if  eq "{ $.status.state }" "ready" }}true{{ else }}false{{ end }}'
99                objectReference:
100                 apiVersion: v1
101                 group: psmdb.percona.com
102                 resource: perconaservermongodbrestores
103                 name: 'restore-{{ toDate "2006-01-02T15:04:05.999999999Z07:00" .Time | date "2006-01-02t15-04-05z07-00" }}'
104                 namespace: "{{ .Object.metadata.namespace}}"
```

Blueprint "restore" action

Reference output of "backup" action

Wait for new MongoDB cluster CR to be "Ready"

Create Operator-controlled Restore resource

Using Backup CR name stored in RestorePoint

Wait for Restore CR to be "Ready"

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```
41    delete:
42      inputArtifactNames:
43      - cloudObjects
44      phases:
45      - func: KubeOps
46        name: deleteBackupCR
47        args:
48          operation: delete
49          objectReference:
50            apiVersion: v1
51            group: psmdb.percona.com
52            resource: perconaservermongodbbackups
53            name: '{{ .ArtifactsIn.cloudObjects.KeyValue.psmdbbackup }}'
54            namespace: '{{ .ArtifactsIn.cloudObjects.KeyValue.namespace }}'
```

Blueprint "delete" action

Reference output of "backup" action

Delete Backup CR

Using Backup CR name stored in RestorePoint

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Should I include the Derived Resources in my Policy?

If you're using a Blueprint:

- No need to backup derived resources
- Excluding them can save time & storage
- Leverage label-based Exclude Filters as part of your K10 Policy:
  - Ex. `app.kubernetes.io/managed-by=percona-server-mongodb-operator`

If you're NOT using a Blueprint:

- Derived resources MUST be protected by K10 Policy
- Validate with Operator author that restore via derived resources is supported (and if additional transforms are required)

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Should I backup the Operator itself (aka Control Plane)?

You can, but it doesn't mean you should:

- Yes, operators are CRDs, and Kasten K10 protects CRDs
- Need to ensure Control Plane restore is complete before attempting to restore CRs controlled by the Operator
- OpenShift Operators have additional APIs to manage Operator packaging and deployment – just reinstall!
- Recommended approach:
  1. Reinstall Operator (typically via cluster deployment IaC)
  2. Restore apps including Operator-controlled CRs via K10

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