



# Advanced Cluster Management for Kubernetes

Alfred Bach  
PSA EMEA

Robust. Proven. Award winning.



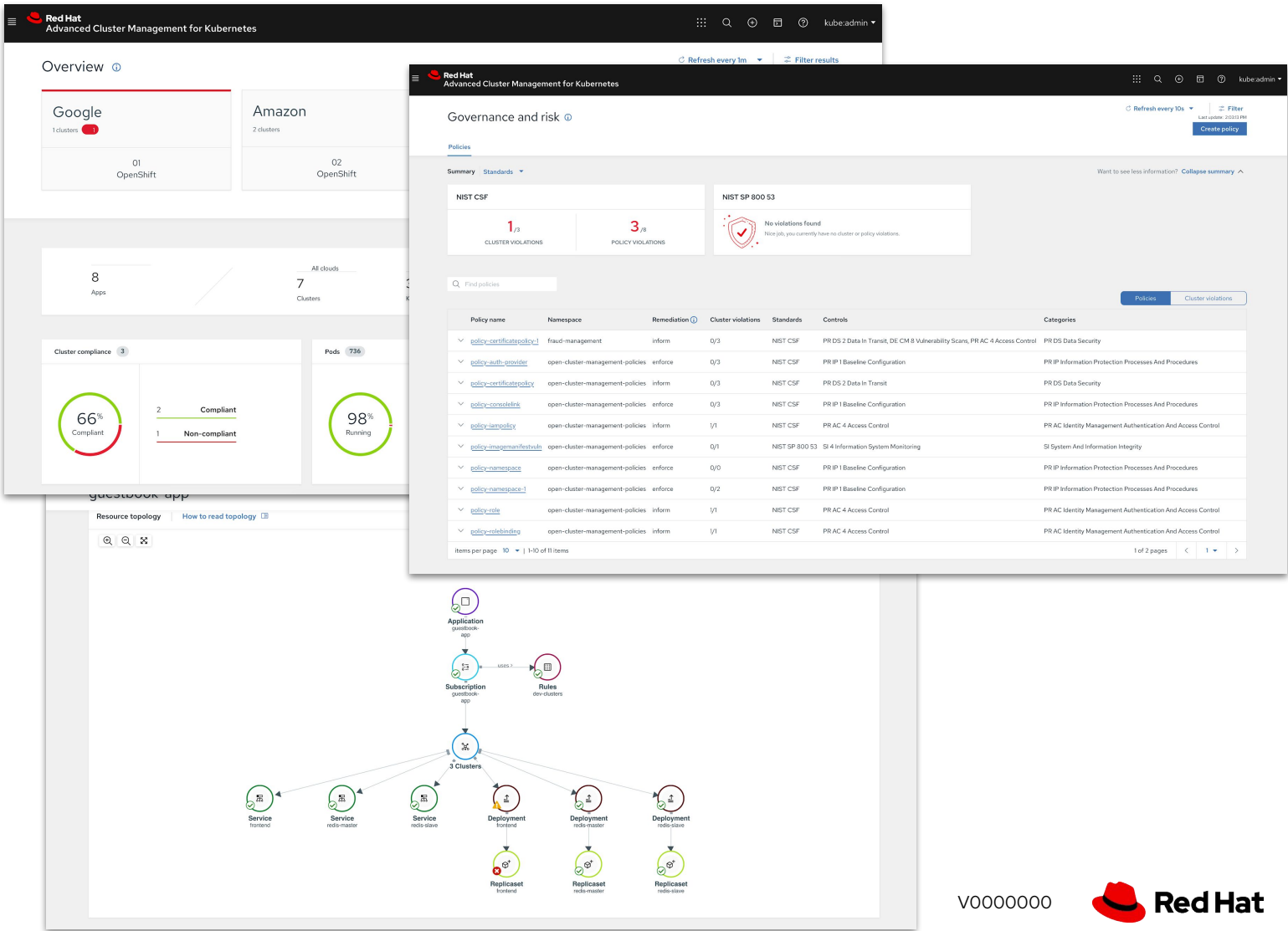
Multicloud lifecycle management



Policy driven governance, risk, and compliance



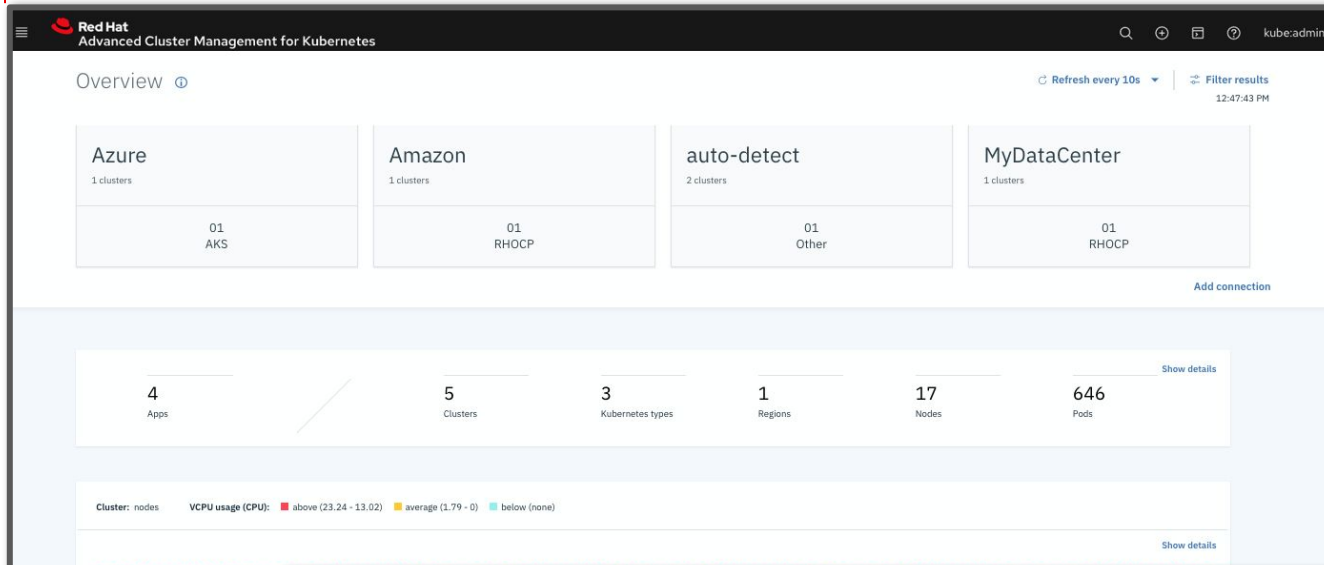
Advanced application lifecycle management



# Unified Multi-Cluster Management

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Single Pane for all your Kubernetes Clusters



Clusters											
Q Search											
Name	Namespace	Labels	Endpoint	Status	Nodes	Kubernetes Version	Storage	Memory	CPU		
exec2-iks	mcm-exec2-iks	cloud=IBM datacenter=dal13 environment=Dev name=exec2-iks region=US vendor=IKS	-	Offline	1	3.1.2-dev	-	33%	70%		
social-dev-1	mcm-social-dev-1	cloud=IBM datacenter=oregon environment=Dev name=social-dev-1 owner=marketing region=us-west vendor=ICP	<a href="#">launch</a>	Ready	1	3.1.2	v1.11.5+icp-ee	100%	62%	45%	
social-dev-2	mcm-social-dev-2	cloud=IBM datacenter=oregon environment=Dev name=social-dev-2 owner=marketing region=us-west vendor=ICP	<a href="#">launch</a>	Offline	1	3.1.2	v1.11.1+icp-ee	100%	48%	47%	
social-dev-gke	social-dev-gke	cloud=Google datacenter=us-central1-a environment=Dev name=social-dev-gke owner=marketing region=US vendor=GKE	-	Ready	1	3.1.2-dev	v1.11.7-gke.12	-	6%	22%	
social-prod-1	mcm-social-prod-1	cloud=IBM datacenter=oregon environment=Prod name=social-prod-1 owner=marketing region=us-west vendor=ICP	<a href="#">launch</a>	Ready	1	3.1.2	v1.11.1+icp-ee	100%	52%	34%	
social-prod-eks	social-prod-eks	cloud=AWS datacenter=us-east-1 environment=Prod name=social-prod-eks owner=marketing	-	Ready	1	3.1.2-dev	v1.11.8-eks-7c34c0	-	1%	10%	

- **Centrally** create, update and delete Kubernetes clusters **across multiple** private and public clouds
- Search, find and modify **any** kubernetes resource across the **entire** domain.
- **Quickly** troubleshoot and resolve issues across your **federated** domain

# Policy based Governance, Risk and Compliance

Don't wait for your security team to tap you on the shoulder

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The dashboard provides a comprehensive overview of policy violations and security findings. It includes a summary of violations by severity (3 Policy Violations, 1 Cluster Violation, 1 High Severity Finding, 1 Medium Severity Finding, and 1 Low Severity Finding). The 'Top violations' section lists specific policy violations like 'policy-cis', 'policy-grc', and 'policy-role'. The 'Top security findings' section shows a 'Policy violation finding' and a message about monitoring. The 'Most impacted controls' section includes a key for policy violations and security findings. A modal window displays the details of a 'compliancePolicy' named 'policy-prod', including its configuration and a table of object templates.

**compliancePolicy**

Type	Detail
Name	policy-prod
Message	-
Status	-
Enforcement	-
Exclude Namespaces	kube*
Include Namespaces	default

```
51 - - from:
52 -   - podSelector: {}
53 -   podSelector: {}
54 - matchLabels: null
55 - complianceType: musthave
56 - objectDefinition:
57 -   apiVersion: v1
58 -   kind: LimitRange
59 -   metadata:
60 -     name: mem-limit-range
61 -   spec:
62 -     limits:
63 -       - default:
64 -         memory: 512Mi
65 -         defaultRequest:
66 -           memory: 256Mi
67 -         type: Container
68 -     remediationAction: enforce
69
```

**Object Templates**

Name	Compliance Type	API version	Kind	Last Transition	Compliant
restricted-mcm	musthave	policy/v1beta1	PodSecurityPolicy	-	-
deny-from-other-namespaces	musthave	networking.k8s.io/v1	NetworkPolicy	-	-
mem-limit-range	musthave	v1	LimitRange	-	-

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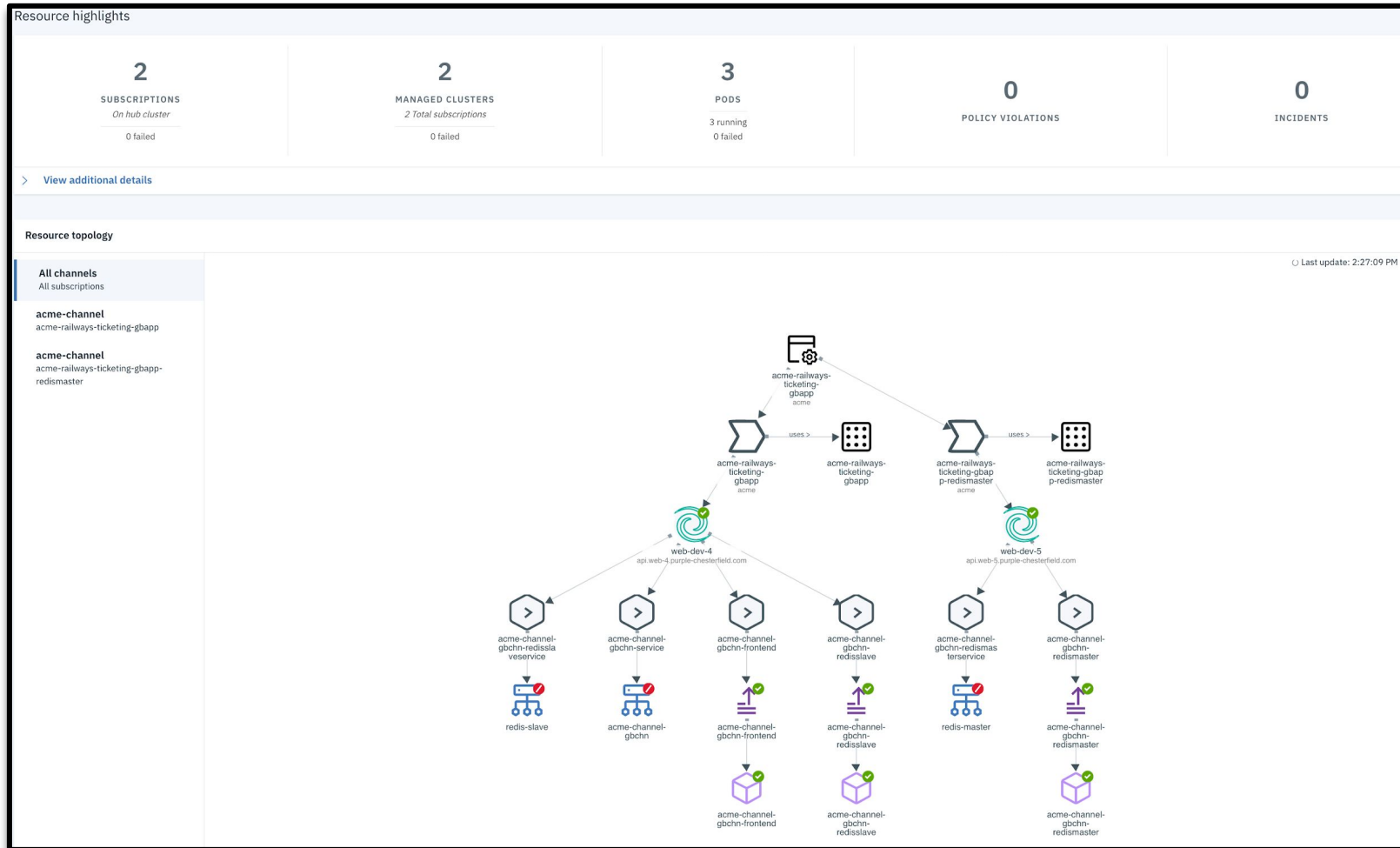
1 of 1 pages < 1 >

- **Centrally** set & enforce policies for security, applications, & infrastructure
- Quickly **visualize** detailed **auditing** on configuration of apps and clusters
- Built-in **CIS** compliance policies and audit checks
- **Immediate** visibility into your compliance posture based on **your** defined standards

# Advanced Application Lifecycle Management

Simplify your Application Lifecycle

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- **Easily** Deploy Applications at **Scale**
- Deploy Applications from **Multiple** Sources
- Quickly **visualize** application relationships **across** clusters and those that **span** clusters

# Benefits

## Red Hat OpenShift and Red Hat Advanced Cluster Management for Kubernetes



### Accelerate development to production

Self-service provisioning allows app dev teams to request clusters directly from a catalog removing central IT as a bottleneck.



### Increase application availability

Placement rules can allow quick deployment of clusters across distributed locations for availability, capacity, and security reasons.



### Reduce costs

Centralized management of clusters reduces operational cost, makes the environment consistent, and removes the need to manually manage individual clusters.



### Ease compliance

Policies can be written by the security team and enforced at each cluster, allowing environments to conform to your policy.

# Detailed Use Cases

# Multi-Cluster Lifecycle Management

## Overview

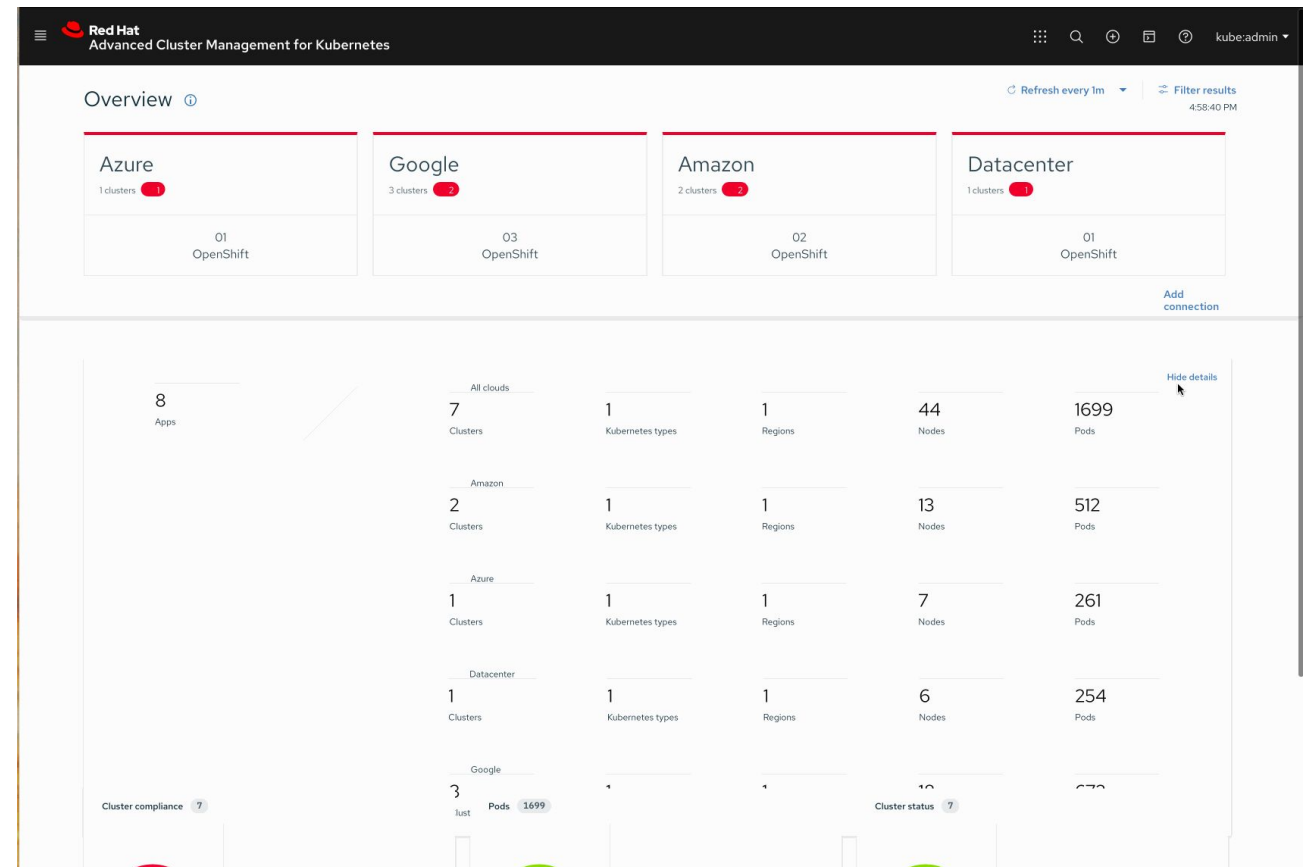
- Full Management of OCP Kubernetes
  - OpenShift 3.11, 4.1.x - 4.5.x
  - Public cloud hosted: OCP
- Public cloud managed kubernetes: EKS, AKS, GKE, IKS
  - Search, find and modify kubernetes resources.
- See high level summaries across all clusters
  - Misconfiguration
  - Pod status
  - Resource capacity
- Troubleshoot and resolve issues across the federated domain
  - See in dashboard or via a list/table form
  - Table shows custom tagging
  - Regions
  - Business Purpose
  - Version



IT Operations



DevOps/SRE





# Multi-Cluster Lifecycle Management

## Creating & Importing Clusters

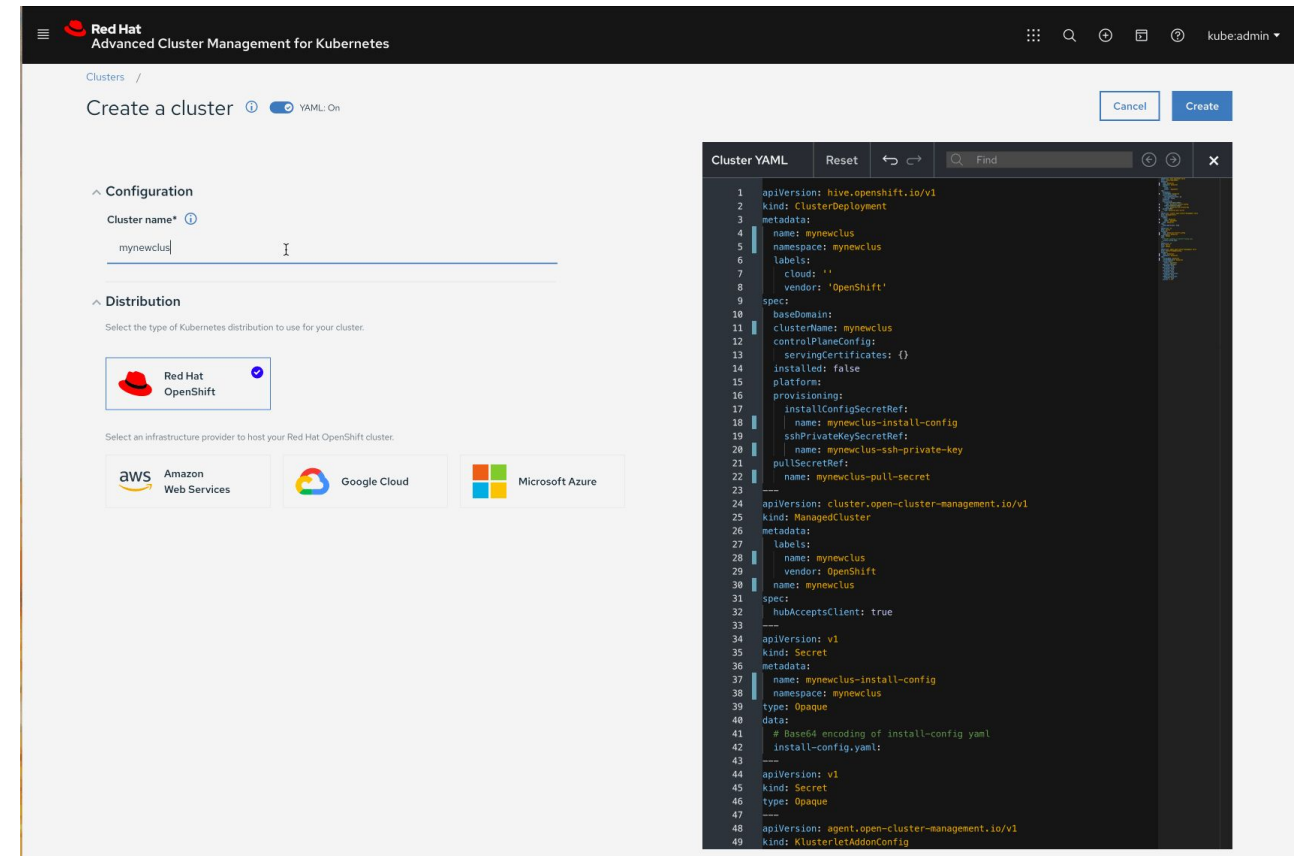
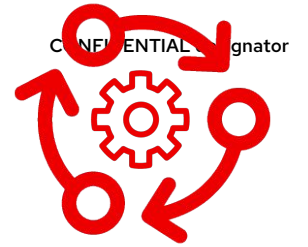
- **Create, Upgrade** and **Destroy** OCP clusters running on **Bare-metal** as well as public cloud
- Leverage Hive API for OCP cluster deployment
- Wizard or YAML based create cluster flow
- Launch to an OCP Console from ACM
- Access cluster login credentials and download kubeadmin configuration



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# Multi-Cluster Lifecycle Management

## Dynamic Search



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- Troubleshooting across clusters via relationships
- See all **unhealthy** pods
- See related application models to those pods
- See related Persistent Volumes
- See related secrets
- See related **\*any\*** kube resource object category

Red Hat Advanced Cluster Management for Kubernetes

Search

Unhealthy pods

kind:pod X status:Pending,Error,Failed,Terminating,ImagePullBackOff,CrashLoopBackOff,RunContainerError,ContainerCreating X

2 RELATED CLUSTER 2 RELATED SECRET 6 RELATED NODE 1 RELATED APPLICATION 2 RELATED DEPLOYMENT

2 RELATED REPLICASET 1 RELATED CHANNEL 2 RELATED SERVICE 3 RELATED SUBSCRIPTION

Pod (6)

Name	Namespace	Cluster	Status	Restarts	Host IP	Pod IP	Created	Labels
<a href="#">frontend-6cb7f8bd65-8lqz7</a>	guestbook-app	kilo-bravo	CrashLoopBackOff	35	10.0.135.156	10.129.2.79	3 hours ago	app=guestbook +2
<a href="#">frontend-6cb7f8bd65-fjw77</a>	guestbook-app	kilo-alpha	CrashLoopBackOff	35	10.0.167.117	10.129.2.161	3 hours ago	app=guestbook +2
<a href="#">frontend-6cb7f8bd65-rgqkx</a>	guestbook-app	kilo-alpha	CrashLoopBackOff	35	10.0.128.146	10.128.2.177	3 hours ago	app=guestbook +2
<a href="#">frontend-6cb7f8bd65-4grqm</a>	guestbook-app	kilo-alpha	CrashLoopBackOff	35	10.0.147.26	10.131.0.172	3 hours ago	app=guestbook +2
<a href="#">frontend-6cb7f8bd65-wpv2m</a>	guestbook-app	kilo-bravo	CrashLoopBackOff	35	10.0.154.41	10.131.0.92	3 hours ago	app=guestbook +2
<a href="#">frontend-6cb7f8bd65-kr7jc</a>	guestbook-app	kilo-bravo	CrashLoopBackOff	35	10.0.174.99	10.128.2.36	3 hours ago	app=guestbook +2

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1 of 1 pages

# Multi-Cluster Lifecycle Management

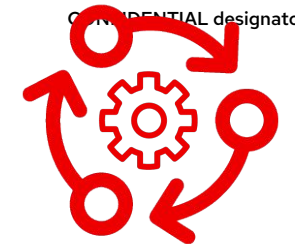
## Visual Web Terminal **Tech-Preview**



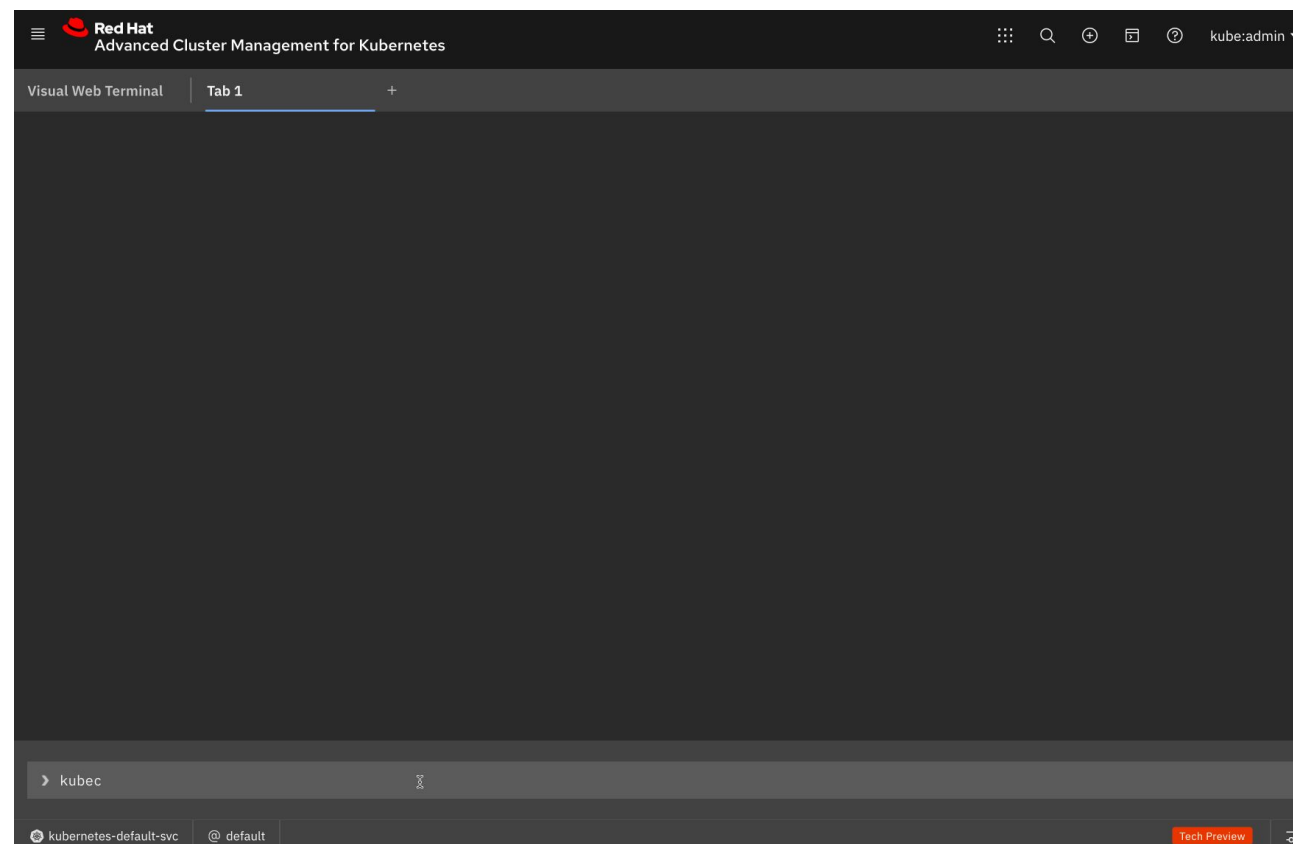
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- Interactive terminal combines command input with visual output
- One **Terminal** for **all**
- Works with **helm**, **kubect****l**, **oc**, **istioct****l**
- Single interface for multi-cluster
- Drive ops directly from dashboards
- Bash commands allow for grep



# Policy Driven Governance Risk and Compliance

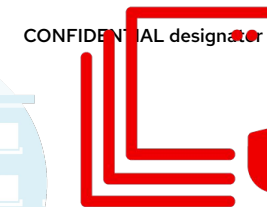
## Architecture Overview



Security Ops

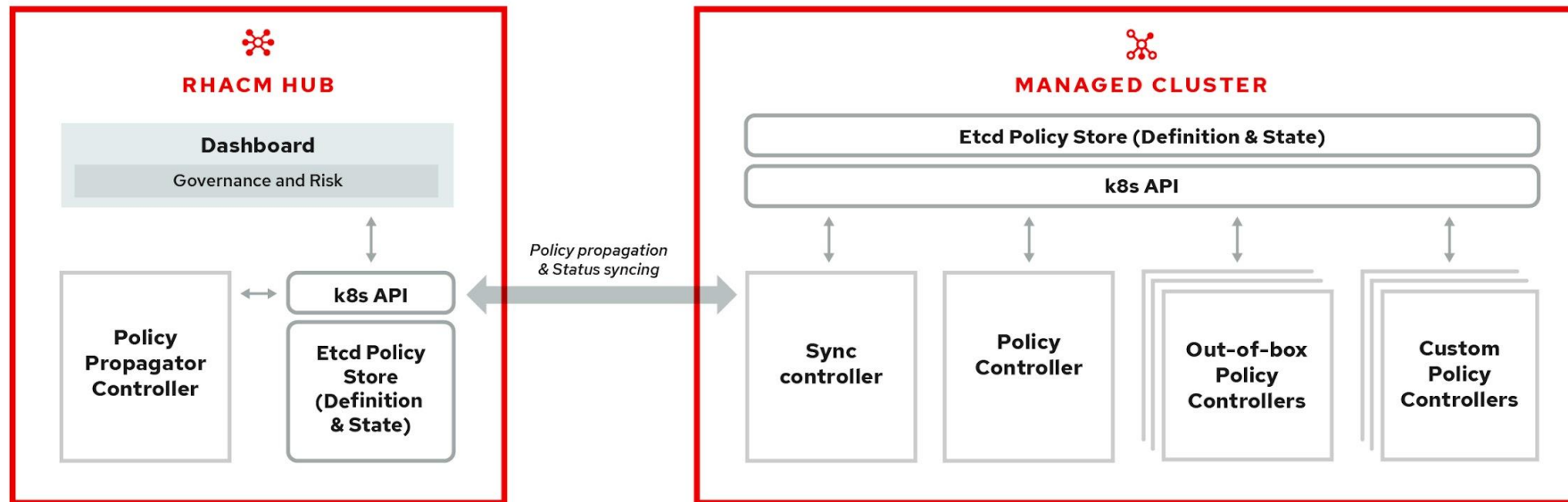


IT Operations



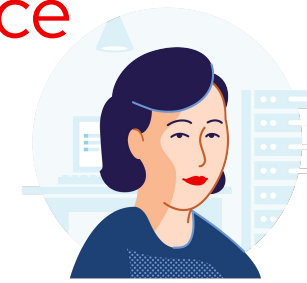
### Managed Cluster and GRC Controllers

- Driven by Kubernetes CRDs and controllers
- Governance capability for managed clusters covering both security and configuration aspects.
- Out of box policies and an extensible policy framework



# Policy based Governance, Risk and Compliance

Don't wait for your security team to tap you on the shoulder



Security Ops



IT Operations



- Set and enforce policies for security, applications, & infrastructure
- Deep visibility for auditing configuration of apps and clusters
- Unique policy capabilities around CIS compliance
- Categorize violations based on your standards for immediate visibility into your compliance posture

The screenshot displays the Red Hat Advanced Cluster Management for Kubernetes console. The main heading is 'Create policy' with a 'YAML: On' toggle. The form includes fields for 'Name' (policy-grc), 'Namespace' (policy.open-cluster-management.io/standards), 'Specifications' (Begin typing to search for template to select), 'Cluster binding' (Begin typing to search for cluster label to select), 'Standards' (Begin typing to search for label to select), 'Categories' (Begin typing to search for label to select), and 'Controls' (Begin typing to search for label to select). A 'Policy YAML' editor is open on the right, showing the following YAML content:

```
1 apiVersion: policy.open-cluster-management.io/v1
2 kind: Policy
3 metadata:
4   name: policy-grc
5   namespace:
6   annotations:
7     policy.open-cluster-management.io/standards:
8     policy.open-cluster-management.io/categories:
9     policy.open-cluster-management.io/controls:
10 spec:
11   remediationAction: inform
12   disabled: false
13 ---
14 apiVersion: policy.open-cluster-management.io/v1
15 kind: PlacementBinding
16 metadata:
17   name: binding-policy-grc
18   namespace:
19   placementRef:
20     name: placement-policy-grc
21     kind: PlacementRule
22     apiGroup: apps.open-cluster-management.io
23 subjects:
24   - name: policy-grc
25     kind: Policy
26     apiGroup: policy.open-cluster-management.io
27 ---
28 apiVersion: apps.open-cluster-management.io/v1
29 kind: PlacementRule
30 metadata:
31   name: placement-policy-grc
32   namespace:
33 spec:
34   clusterConditions:
35     - status: "True"
36       type: ManagedClusterConditionAvailable
37   clusterSelector:
38     matchExpressions:
```

# Policy based Governance, Risk and Compliance

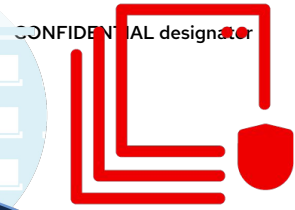
Don't wait for your security team to tap you on the shoulder



Security Ops



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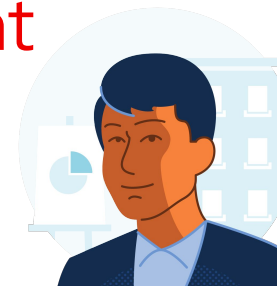
- Standard Policies out of the box
  - FISMA
  - HIPAA
  - NIST
  - PCI
- Leverage Different Categories to Represent more standards (if Needed)
- Use Labels to enforce policies against clusters
- Use **inform** to view policy violations
- Use **enforce** to view violations and automatically remediate

The screenshot shows the Red Hat Advanced Cluster Management for Kubernetes console. The main form is titled "Create policy" and includes fields for Name, Namespace, Specifications, Cluster binding, Standards, Categories, and Controls. The "Policy YAML" editor on the right shows the following content:

```
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8     policy.open-cluster-management.io/categories:
9     policy.open-cluster-management.io/controls:
10 spec:
11   remediationAction: inform
12   disabled: false
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14 apiVersion: policy.open-cluster-management.io/v1
15 kind: PlacementBinding
16 metadata:
17   name: binding-policy-grc
18   namespace:
19 placementRef:
20   name: placement-policy-grc
21   kind: PlacementRule
22   apiGroup: apps.open-cluster-management.io
23 subjects:
24   - name: policy-grc
25     kind: Policy
26     apiGroup: policy.open-cluster-management.io
27
28 apiVersion: apps.open-cluster-management.io/v1
29 kind: PlacementRule
30 metadata:
31   name: placement-policy-grc
32   namespace:
33 spec:
34   clusterConditions:
35     - status: "True"
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37   clusterSelector:
38     matchExpressions:
```

# Advanced Application Lifecycle Management

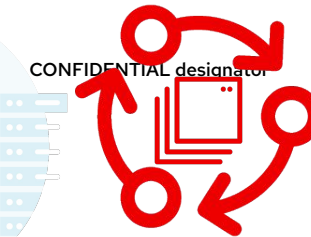
## Simplify your Application Lifecycle



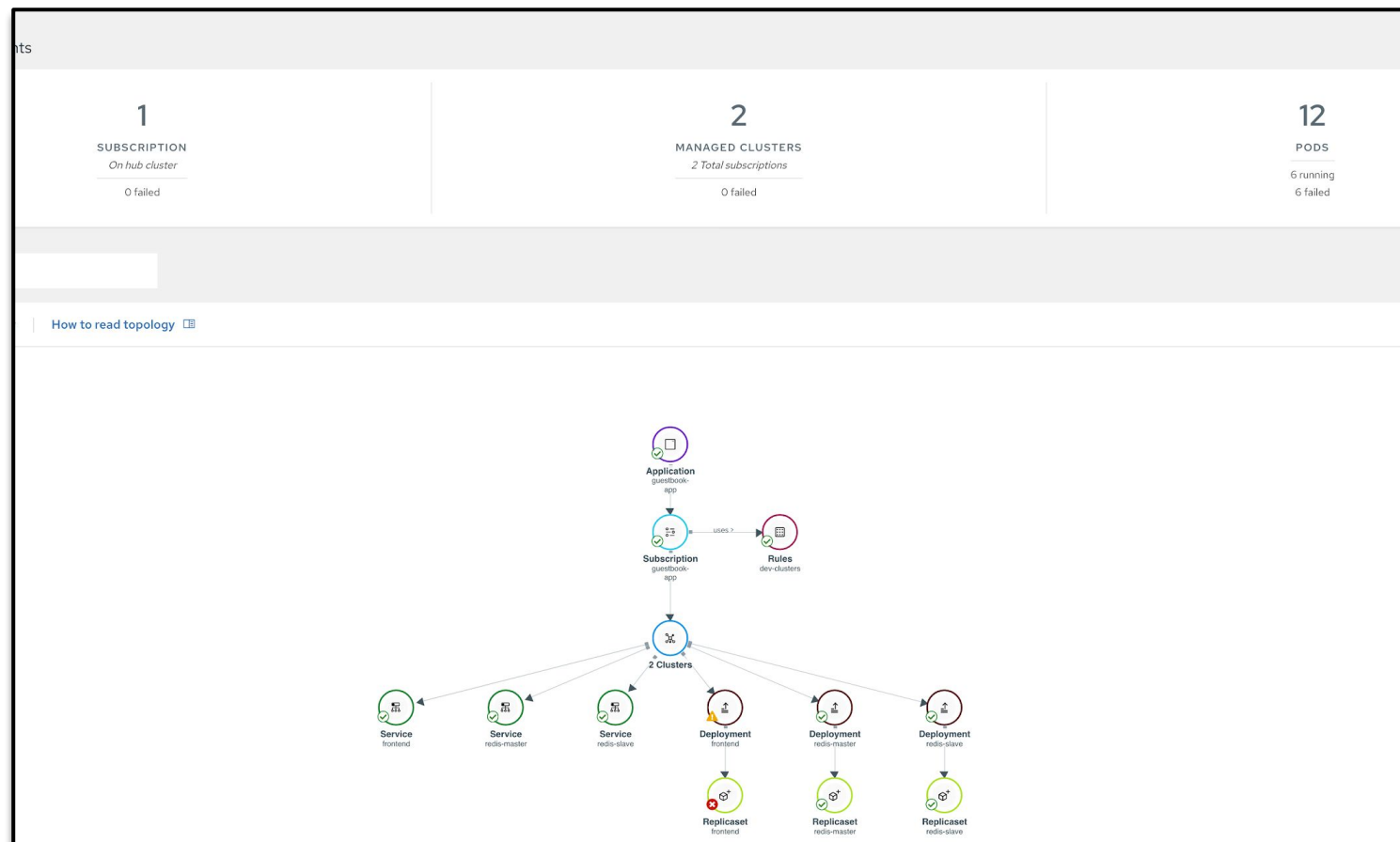
IT Operations



DevOps/SRE



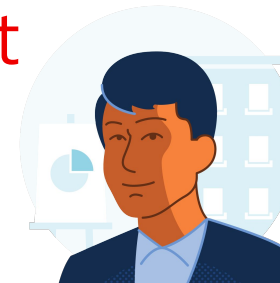
- Deploy Applications at Scale
- Deploy Applications from Multiple Sources and Clusters
- Quickly Visualize Application Relationships
- Using the subscription & channel model, the latest application revisions are delivered to appropriate clusters, automatically.





# Advanced Application Lifecycle Management

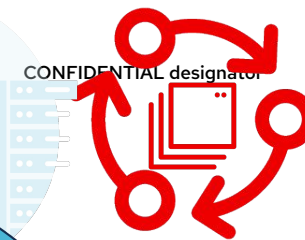
## Subscriptions Bring Enterprise to Kubernetes



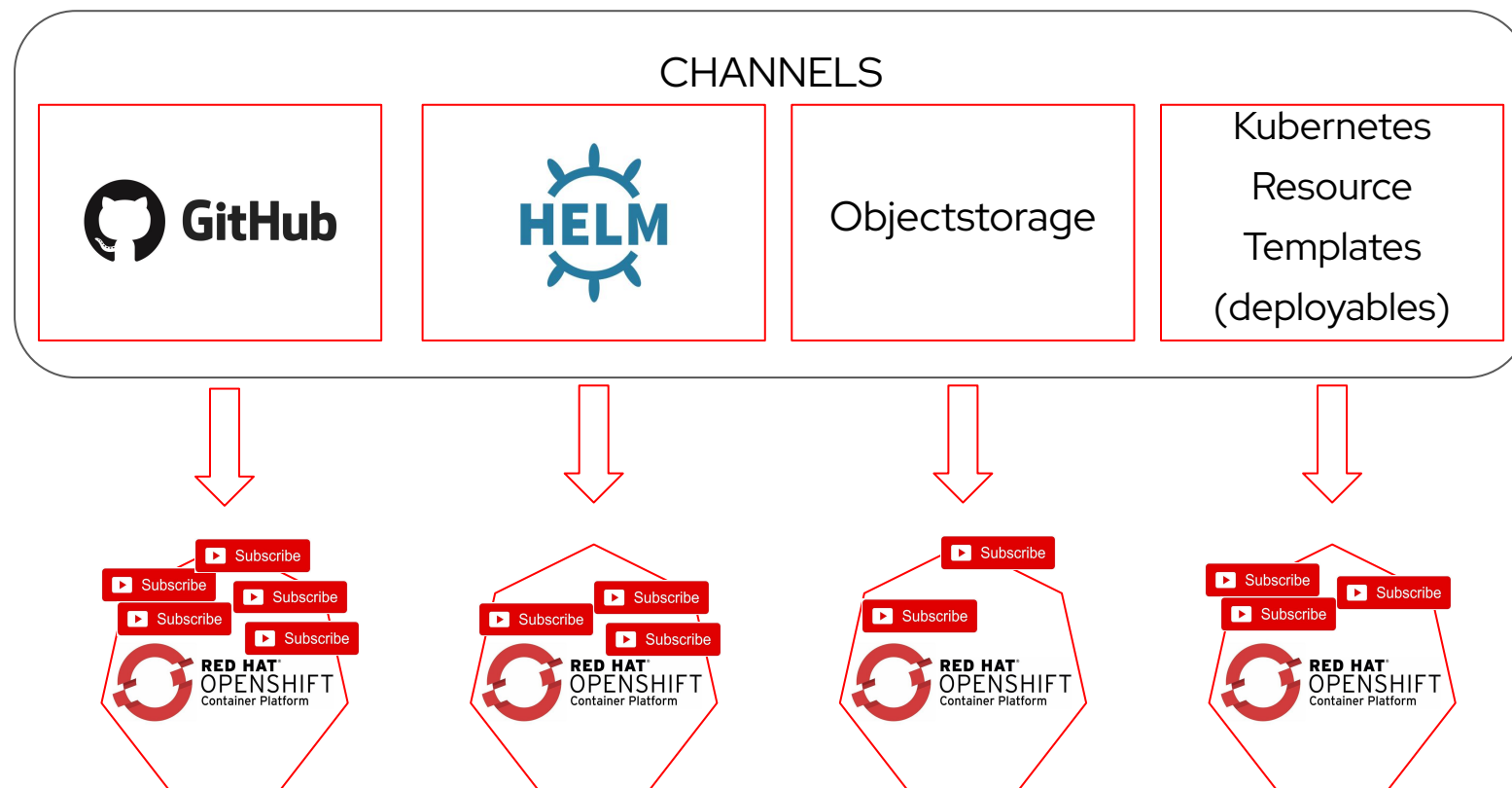
IT Operations



DevOps/SRE



- Extending the best of Enterprise into a desired state methodology
- Time Windows: New releases during your maintenance windows
- Rolling Updates: Control the rate and load on your growing infrastructure





# Advanced Application Lifecycle Management

## GitOps as the source of truth

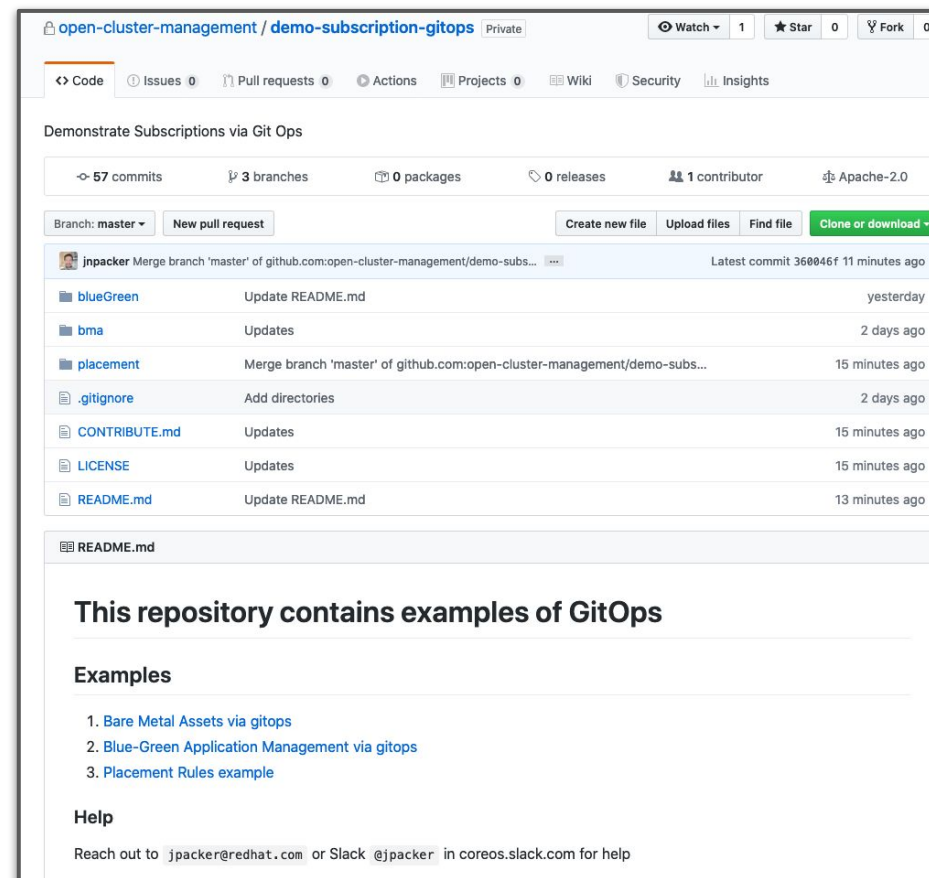
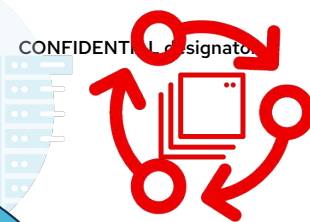
- Create, modify & delete, just as you would any source code. Git becomes your source of truth controlling your data center.
- Have a record of who, what & when for every change precipitated in your environments
- Through code Reviews & Approvals, take full control of all changes to your data center(s)
- Restore your environment, via the Git commit history (system of record)



IT Operations



DevOps/SRE



<https://github.com/open-cluster-management/demo-subscription-gitops>

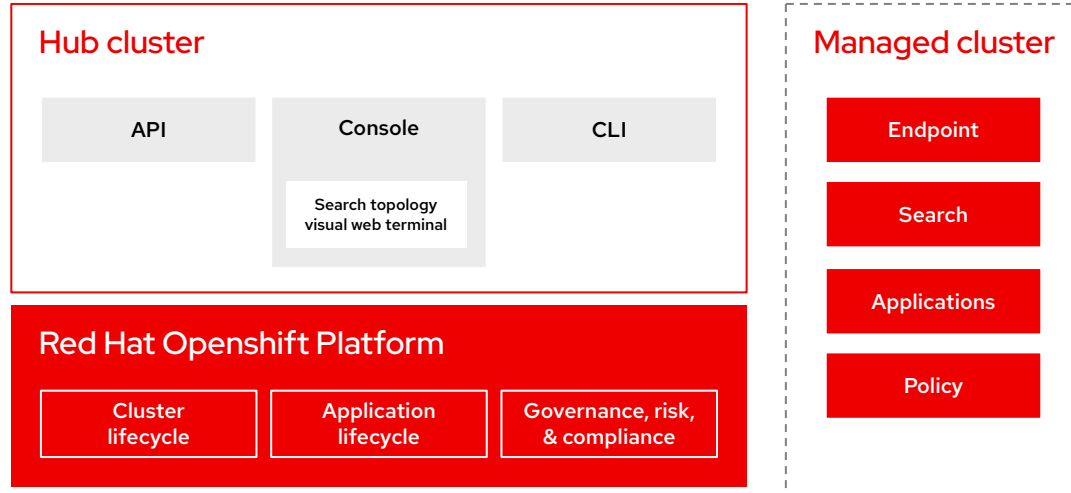
# Architecture

## Red Hat Advanced Cluster Management For Kubernetes

# Architecture overview



IT Operations



## Hub architecture and components

Red Hat Advanced Cluster Management uses the multicluster-hub operator and runs in the open-cluster-management namespace

## Managed cluster architecture and components

Red Hat Advanced Cluster Management managed clusters use the multicluster-endpoint operator which runs in the multicluster-endpoint namespace

# Installation

## Advanced Cluster Management For Kubernetes

# Installation and Foundation

## Operator Install for Hub



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### Hub Cluster

- Operator based installation
- Available on OperatorHub
- Requires OCP 4.3.x ->

### Full Management of OCP clusters

- OpenShift 3.11, 4.1.x ->
- Public cloud hosted: OCP

### Limited Support for Public cloud managed Kubernetes

- EKS, AKS, GKE, IKS

### High Availability

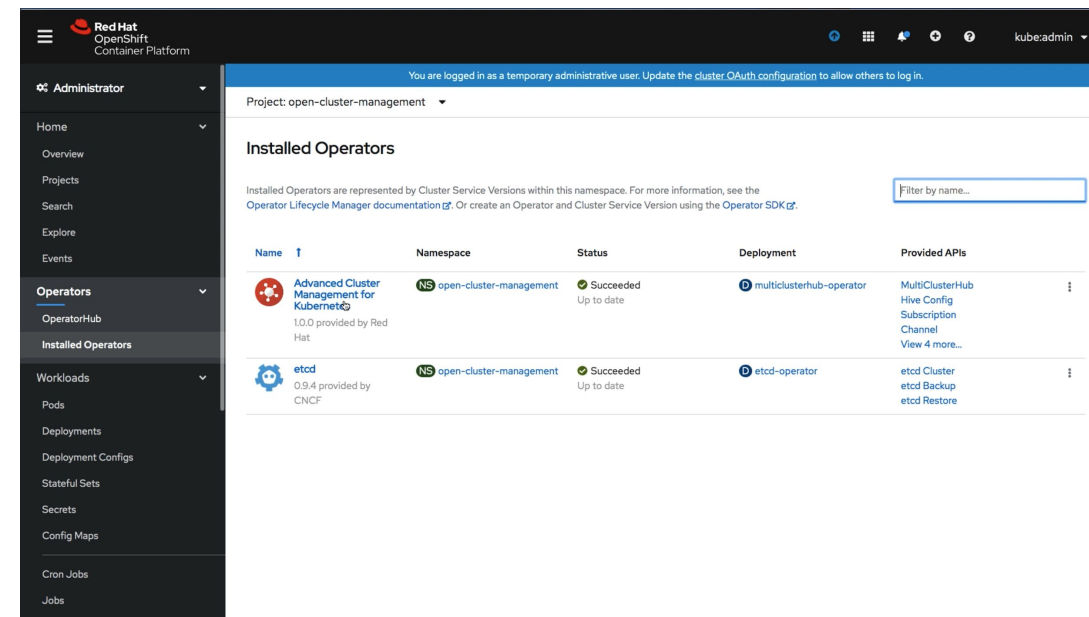
- Supports OCP Availability Zone
- Limitation for Search component based on RedisGraph

### Resource Requirements

- **Test:** 3 master, 3 workers, 6 v CPU and 16GB RAM
- **Production:** 3 masters, 3 workers, 16vCPU and 24GB RAM\*

\* Production requirements vary based on number of clusters in the management domain and types of workloads being run.

\* vCPU/RAM Numbers are per node.



# Installation and foundation

## Operator install for managed cluster

**IT Operations**

## Managed cluster

The multicluster-endpoint operator controls the deployment of components on the managed cluster.

### List of included components:

- ▶ Application manager
- ▶ Connection manager
- ▶ Work manager
- ▶ Policy controller
- ▶ Search collector
- ▶ Service registry
- ▶ IAM policy controller
- ▶ Certificate policy controller
- ▶ CIS policy controller

# Thank you

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