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Certified Kubernetes Security Specialist (CKS) Preparation Part 6 — Open Policy Agent (OPA)

Jonathan Mar 10 · 4 min read

If you have not yet checked the previous parts of this series, please go ahead and check Part1, Part2, Part3, Part4 and Part5.

In this article, I would focus on the preparation around **open policy agent (OPA)** in CKS certification exam. The whole article would be split into 3 parts, installation, testing and customization.

> *The Open Policy Agent (OPA, pronounced "oh-pa") is an open source, general-purpose policy engine that unifies policy enforcement across the stack. OPA provides a high-level declarative language that lets you specify policy as code and simple APIs to offload policy decision-making from your software. You can use OPA to enforce policies in microservices, Kubernetes, CI/CD pipelines, API gateways, and more.*

— Quoted from Open Policy Agent | Documentation

In my own definition, OPA is the yet another custom resource deployed in K8s environment to ensure the whole deployment and operation process are under strict security principles. OPA is written in Rego, a query language that is easy to read and write. For more information around Rego, please check out its official documentation here.

This article walks you through OPA installation, testing and customization. The installation is as simple as executing the one-liner,

```
kubectl apply -f https://raw.githubusercontent.com/open-policy-agent/gatekeeper/master/deploy/gatekeeper.yaml
```

After installation completes, we could verify by looking into the specific namespace.

```
- kubectl get ns
- kubectl get all -n gatekeeper-system
```

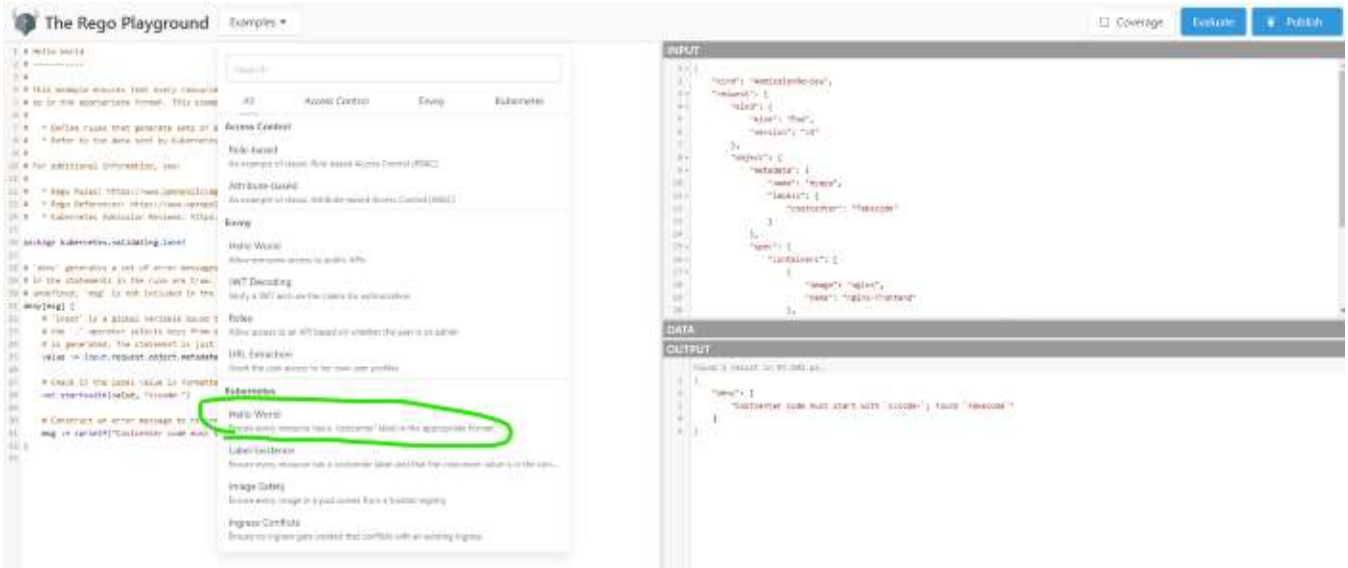
Also, we could check on the custom resource definitions (CRD) being created.

the specific details. For example, constraint template defines every resource needs a label and constraint defines resource “namespace” needs to have label “OPA”.

Testing

We could either directly go through our running environment to see how OPA works in practice or we could head over to the Rego playground to verify some of the OPA constraint logics and testify whether those fit our needs.

On the top left, there is a drop-down menu that gives you some pre-defined constraint templates when you are using OPA in different environment. In this case, we choose Kuberenetes’ constraint template example, “Hello World”. The constraint template is not “Hello World” but the fact that some resources within K8s require labels.



In the constraint itself (after clicking, the content would show on the left of the web browser), you could see the incoming request would be denied if the label of “costcenter” does not start with “cccode-”.

```
deny[msg] {
 # `input` is a global variable bound to the data sent to OPA by
Kubernetes. In Rego,
 # the `.` operator selects keys from objects. If a key is missing,
no error
```

```
# Check if the label value is formatted correctly.
 not startswith(value, "cccode-")

# Construct an error message to return to the user.
 msg := sprintf("Costcenter code must start with `cccode-`; found
`%v`", [value])
}
```

The result of not having “cccode-” in the beginning of label “costcenter” would result in the following deny message.

```
{
    "deny": [
        "Costcenter code must start with `cccode-`; found
`fakecode`"
    ]
}
```

Pretty straightforward, right? Let’s now take a look how it works in a real cluster. First things first, execute the one-liner to get constraint template installed.

```
kubectl apply -f https://raw.githubusercontent.com/open-policy-
agent/gatekeeper/master/demo/basic/templates/k8srequiredlabels_templ
ate.yaml
```

Ensure the constraint template is installed by executing

```
kubectl get crd
```

```
jonw@CKS-Master:~$ kubectl get crd
NAME                                                  CREATED AT
configs.config.gatekeeper.sh                          2021-03-08T21:23:15Z
constraintpodstatuses.status.gatekeeper.sh            2021-03-08T21:23:15Z
constrainttemplatepodstatuses.status.gatekeeper.sh    2021-03-08T21:23:15Z
constrainttemplates.templates.gatekeeper.sh           2021-03-08T21:23:15Z
k8srequiredlabels.constraints.gatekeeper.sh           2021-03-08T21:57:59Z
```

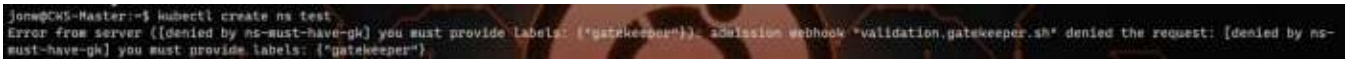
```
kubectl apply -f https://raw.githubusercontent.com/open-policy-agent/gatekeeper/master/demo/basic/constraints/all_ns_must_have_gatekeeper.yaml
```

Ensure the constraint is installed by executing

```
kubectl get k8srequiredlabels
```

Lastly, try to create a namespace without label “gatekeeper” and see what it would respond.

```
kubectl create ns test
```



Customization

Now, I believe all of you that have understood what is going on in the first 2 parts would be ready for some customizations in OPA, meaning you could create your own constraint templates and constraints. As this is thoroughly covered by Mohamed’s article, Create Your Own Constraint Step by Step, I would just briefly go through the key points.

- Ensure the JSON object is in the correct format for both constraint templates and constraints

Deploy in the actual running environment

That is it! Now all of you have some knowledge around what is OPA and how we could use it in the real-life situation. Happy learning!

Kubernetes Security Preparation Open Policy Agent Rego Constraints