Using a Service to Expose Your App

Learn about a Service in Kubernetes. Understand how labels and selectors relate to a Service. Expose an application outside a Kubernetes cluster.

Objectives

- Learn about a Service in Kubernetes
- Understand how labels and selectors relate to a Service
- Expose an application outside a Kubernetes cluster using a Service

Overview of Kubernetes Services

Kubernetes Pods are mortal. Pods have a lifecycle. When a worker node dies, the Pods running on the Node are also lost. A ReplicaSet might then dynamically drive the cluster back to the desired state via the creation of new Pods to keep your application running. As another example, consider an image-processing backend with 3 replicas. Those replicas are exchangeable; the front-end system should not care about backend replicas or even if a Pod is lost and recreated. That said, each Pod in a Kubernetes cluster has a unique IP address, even Pods on the same Node, so there needs to be a way of automatically reconciling changes among Pods so that your applications continue to function.

A Service in Kubernetes is an abstraction which defines a logical set of Pods and a policy by which to access them. Services enable a loose coupling between dependent Pods. A Service is defined using YAML or JSON, like all Kubernetes object manifests. The set of Pods targeted by a Service is usually determined by a *label selector* (see below for why you might want a Service without including a `selector` in the spec).

Although each Pod has a unique IP address, those IPs are not exposed outside the cluster without a Service. Services allow your applications to receive traffic. Services can be exposed in different ways by specifying a `type` in the `spec` of the Service:

- *ClusterIP* (default) - Exposes the Service on an internal IP in the cluster. This type makes the Service only reachable from within the cluster.
- *NodePort* - Exposes the Service on the same port of each selected Node in the cluster using NAT. Makes a Service accessible from outside the cluster using `<NodeIP>:<NodePort>` . Superset of ClusterIP.
- *LoadBalancer* - Creates an external load balancer in the current cloud (if supported) and assigns a fixed, external IP to the Service. Superset of NodePort.
- *ExternalName* - Maps the Service to the contents of the `externalName` field (e.g. `foo.bar.example.com`), by returning a `CNAME` record with its value. No proxying of any kind is set up. This type requires v1.7 or higher of `kube-dns` , or CoreDNS version 0.0.8 or higher.

More information about the different types of Services can be found in the Using Source IP tutorial. Also see Connecting Applications with Services.

Summary

- Exposing Pods to external traffic
- Load balancing traffic across multiple Pods
- Using labels

A Kubernetes Service is an abstraction layer which defines a logical set of Pods and enables external traffic exposure, load balancing and service discovery for those Pods.

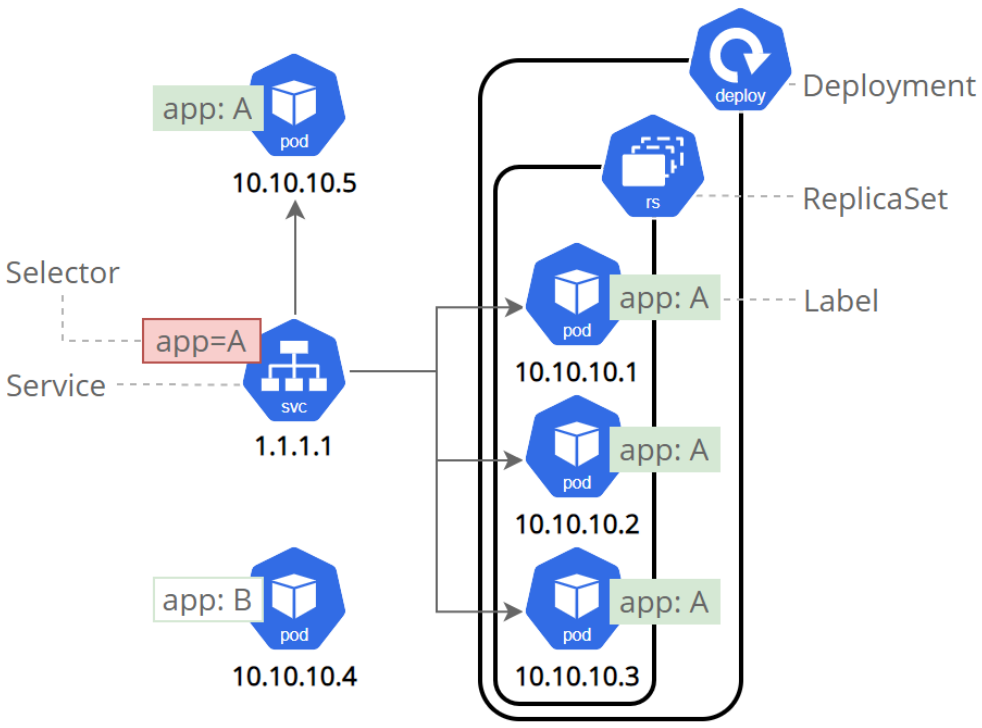
Additionally, note that there are some use cases with Services that involve not defining a `selector` in the spec. A Service created without `selector` will also not create the corresponding Endpoints object. This allows users to manually map a Service to specific endpoints. Another possibility why there may be no selector is you are strictly using `type: ExternalName`.

Services and Labels

A Service routes traffic across a set of Pods. Services are the abstraction that allows pods to die and replicate in Kubernetes without impacting your application. Discovery and routing among dependent Pods (such as the frontend and backend components in an application) are handled by Kubernetes Services.

Services match a set of Pods using labels and selectors, a grouping primitive that allows logical operation on objects in Kubernetes. Labels are key/value pairs attached to objects and can be used in any number of ways:

- Designate objects for development, test, and production
- Embed version tags
- Classify an object using tags



Labels can be attached to objects at creation time or later on. They can be modified at any time. Let's expose our application now using a Service and apply some labels.

Create a new Service

Let’s verify that our application is running. We’ll use the `kubectl get` command and look for existing Pods:

```
kubectl get pods
```

If no Pods are running then it means the objects from the previous tutorials were cleaned up. In this case, go back and recreate the deployment from the Using kubectl to create a Deployment tutorial. Please wait a couple of seconds and list the Pods again. You can continue once you see the one Pod running.

Next, let’s list the current Services from our cluster:

```
kubectl get services
```

We have a Service called `kubernetes` that is created by default when minikube starts the cluster. To create a new service and expose it to external traffic we'll use the expose command with NodePort as parameter.

```
kubectl expose deployment/kubernetes-bootcamp --type="NodePort" --port 8080
```

Let's run again the `get services` subcommand:

```
kubectl get services
```

We have now a running Service called kubernetes-bootcamp. Here we see that the Service received a unique cluster-IP, an internal port and an external-IP (the IP of the Node).

To find out what port was opened externally (for the `type: NodePort` Service) we'll run the `describe service` subcommand:

```
kubectl describe services/kubernetes-bootcamp
```

Create an environment variable called `NODE_PORT` that has the value of the Node port assigned:

```
export NODE_PORT="$(kubectl get services/kubernetes-bootcamp -o go-template='{{(index
.spec.ports 0).nodePort}}')"
echo "NODE_PORT=$NODE_PORT"
```

Now we can test that the app is exposed outside of the cluster using `curl` , the IP address of the Node and the externally exposed port:

```
curl http://"$(minikube ip):$NODE_PORT"
```

> **Note:**
> If you're running minikube with Docker Desktop as the container driver, a minikube tunnel is needed. This is because containers inside Docker Desktop are isolated from your host computer.
>
> In a separate terminal window, execute:
> ```
> minikube service kubernetes-bootcamp --url
> ```
>
> The output looks like this:
>
> ```
> http://127.0.0.1:51082
> !  Because you are using a Docker driver on darwin, the terminal needs to be open
> to run it.
> ```
>
> Then use the given URL to access the app:
> ```
> curl 127.0.0.1:51082
> ```

And we get a response from the server. The Service is exposed.

Step 2: Using labels

The Deployment created automatically a label for our Pod. With the `describe deployment` subcommand you can see the name (the *key*) of that label:

```
kubectl describe deployment
```

Let's use this label to query our list of Pods. We'll use the `kubectl get pods` command with `-l` as a parameter, followed by the label values:

```
kubectl get pods -l app=kubernetes-bootcamp
```

You can do the same to list the existing Services:

```
kubectl get services -l app=kubernetes-bootcamp
```

Get the name of the Pod and store it in the `POD_NAME` environment variable:

```
export POD_NAME="$(kubectl get pods -o go-template --template '{{range .items}}
{{.metadata.name}}{{"\n"}}{{end}}')"
echo "Name of the Pod: $POD_NAME"
```

To apply a new label we use the `label` subcommand followed by the object type, object name and the new label:

```
kubectl label pods "$POD_NAME" version=v1
```

This will apply a new label to our Pod (we pinned the application version to the Pod), and we can check it with the describe pod command:

```
kubectl describe pods "$POD_NAME"
```

We see here that the label is attached now to our Pod. And we can query now the list of pods using the new label:

```
kubectl get pods -l version=v1
```

And we see the Pod.

Deleting a service

To delete Services you can use the `delete service` subcommand. Labels can be used also here:

```
kubectl delete service -l app=kubernetes-bootcamp
```

Confirm that the Service is gone:

```
kubectl get services
```

This confirms that our Service was removed. To confirm that route is not exposed anymore you can `curl` the previously exposed IP and port:

```
curl http://"$(minikube ip):$NODE_PORT"
```

This proves that the application is not reachable anymore from outside of the cluster. You can confirm that the app is still running with a `curl` from inside the pod:

```
kubectl exec -ti $POD_NAME -- curl http://localhost:8080
```

> We see here that the application is up. This is because the Deployment is managing the application. To shut down the application, you would need to delete the Deployment as well.

Once you're ready, move on to Running Multiple Instances of Your App.

Feedback

Was this page helpful?

Yes No

Last modified September 25, 2023 at 12:30 AM PST: Fix sytle guide pending feedback (da8f6e9a23)