KubeCon | CloudNativeCon

Europe 2022

WELCOME TO VALENCIA

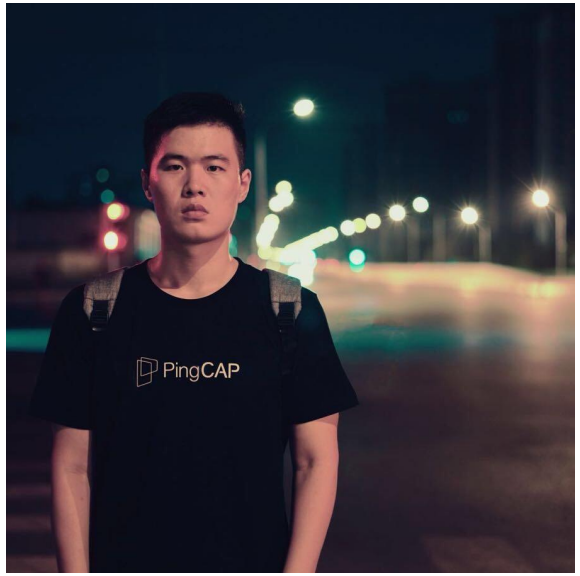
KubeCon CloudNativeCon Europe 2022

Make Cloud Chaos Engineering Easier - Deep Dive into Chaos Mesh

Cwen Yin
PingCAP

About Me

- Cwen(Chengwen) Yin
- Tech lead at PingCAP
- Maintainer and founder of Chaos Mesh



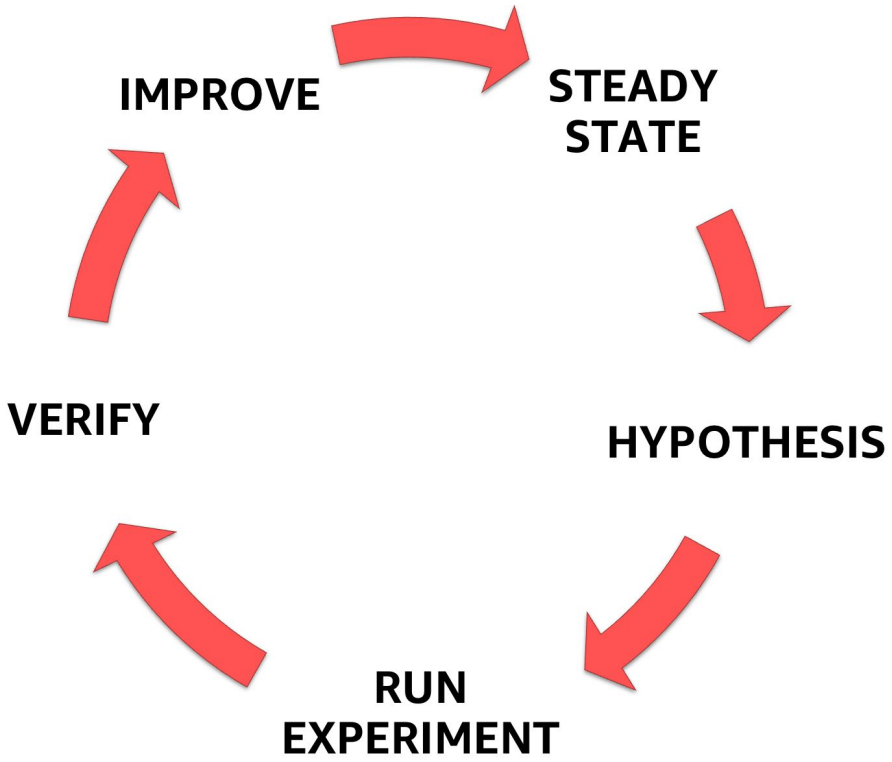
Testing a distributed system is difficult

- Distributed systems are more and more complex nowadays
  - Faults can happen anytime, anywhere, in any ways
- Writing tests and debugging is hard
  - Deterministic test is very hard and impossible to cover all faults

- No crash!!!
- No data loss!!!
- No wrong results!!!

Chaos Engineering to the rescue

- Chaos engineering is about breaking things in a **controlled environment** and through **well-planned experiments** in order to **build confidence** in your application to withstand turbulent conditions.
- Chaos engineering is **NOT** about breaking things randomly **without a purpose**.



Why Chaos Mesh


```
$ kubectl get ns
tidb-cluster-1
tidb-cluster-2
tidb-cluster-3
nginx-ns-1
nginx-ns-2
app-ns-1
app-ns-2
...
$crontab -l
0 */2 * * * /usr/local/podkill -n tidb-cluster-1 -n tikv-1
0 */1 * * * /usr/local/podkill -n tidb-cluster-1 -n pd-1
0 */2 * * * /usr/local/network delay -v 20ms -n app-ns-1 -n
app-name
0 */2 * * * /usr/local/network delay -v 20ms -n app-ns-2 -n
app-name
...
```

On Kubernetes

- More application clusters (40+)
- More nodes on each cluster
- More target objects may fail, eg: Container / Pod / Network / Disk / System Clock / Kernel / etc

We need more Chaos experiments. However, **managing and scheduling many chaos experiments is a huge pain !**

In Docker

- The environment is different from the physical nodes
- Tools like tc / iptables / fuse / bcc can't be used directly
- Containers on the same node cannot affect each other

Chaos scope must be customizable and manageable for containers.

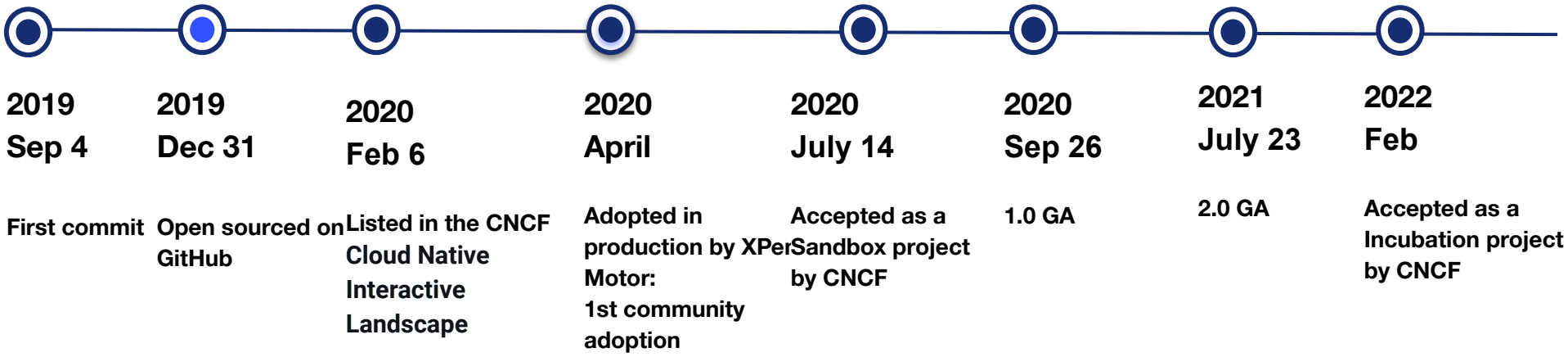
What is Chaos Mesh

What is Chaos Mesh

- A Cloud-Native Chaos Engineering platform on Kubernetes environments
- Started out as the internal platform to test TiDB
- Provides fault injection methods into the container, Pod, network, system I/O, kernel, etc.

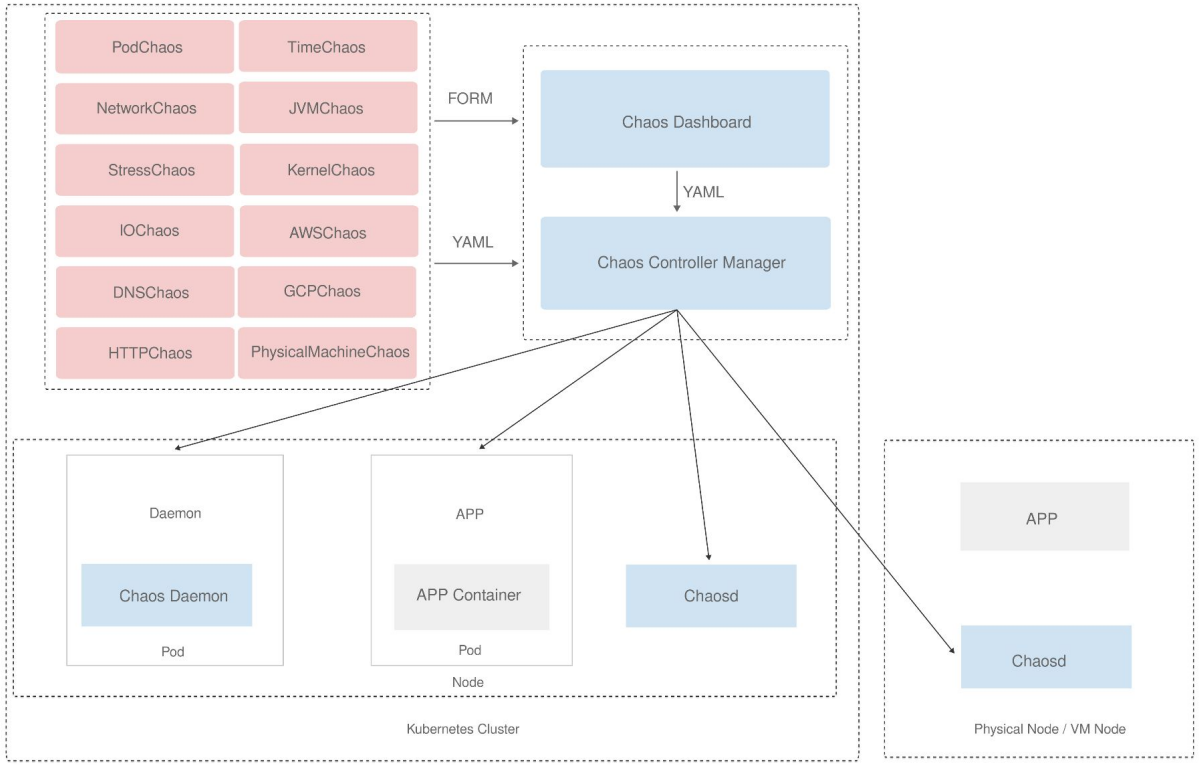
Chaos Mesh's Mission

- Make Chaos Engineering easy



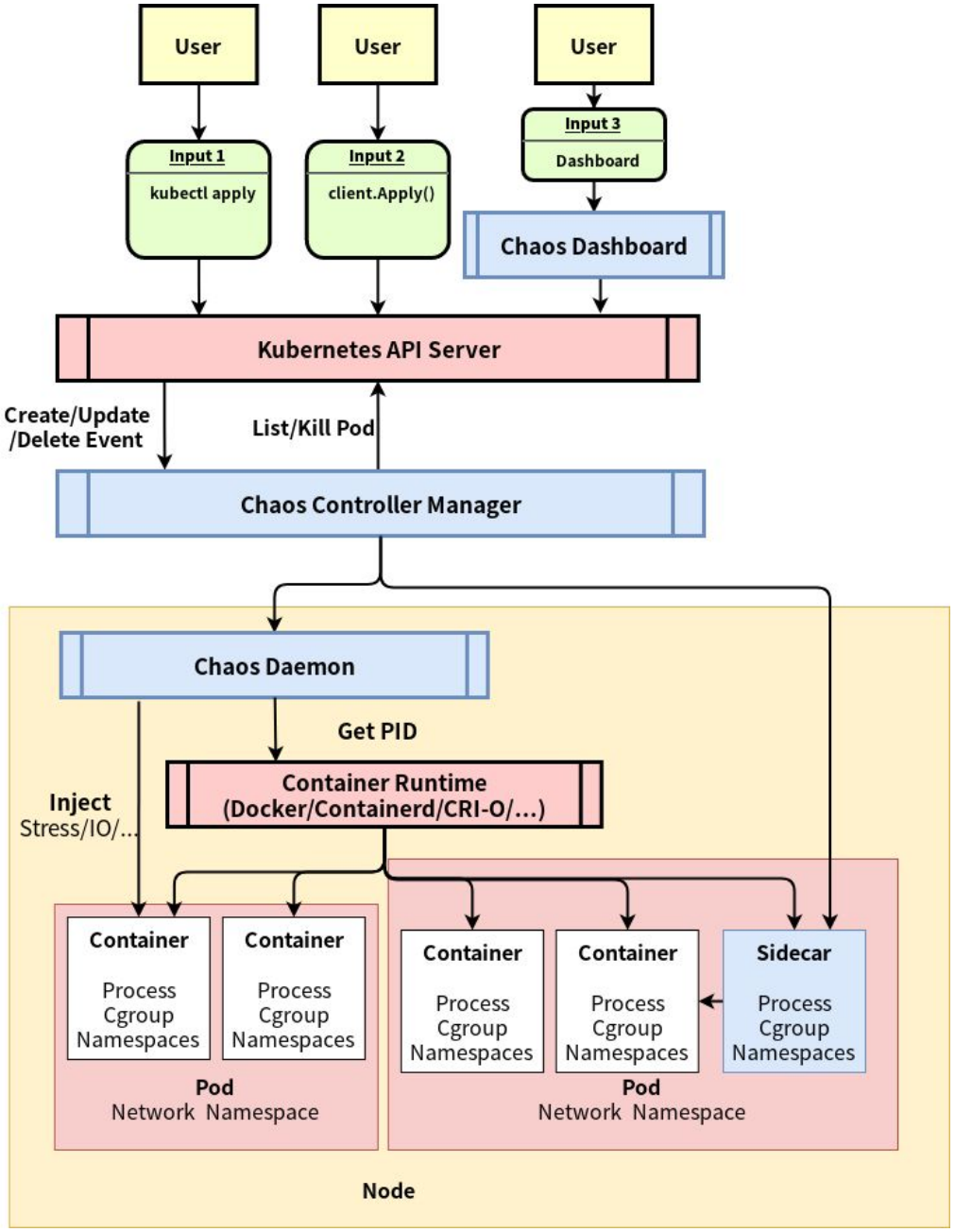
Deep into Chaos Mesh

Architecture



- Chaos Dashboard
  - Manage and monitor chaos experiment
- Chaos Controller Manager
  - Schedule and control component
  - Workflow engine
- Chaos Daemon
  - Executive component on kubernetes node
- Chaosd
  - Executive component on non-kubernetes node

Architecture



CustomResourceDefinitions

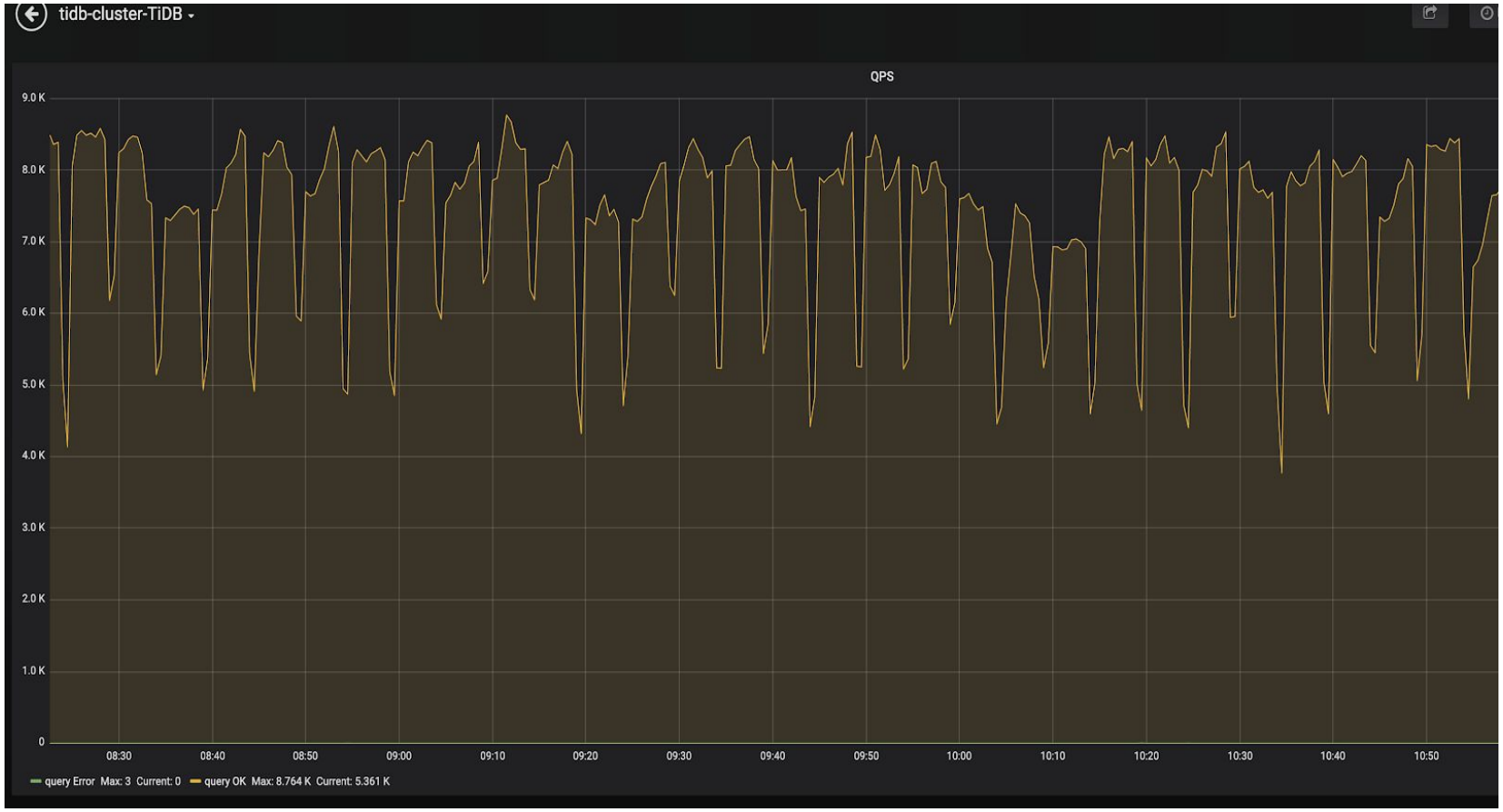
- PodChaos
- NetworkChaos
- IOChaos
- TimeChaos
- StressChaos
- KernelChaos
- JVMChaos
- DNSChaos
- Workflow
- PhysicalMachineChaos
- ...

```yaml
apiVersion: chaos-mesh.org/v1alpha1
kind: PodChaos
metadata:
 name: pod-kill-example
spec:
 action: pod-kill
 mode: one
 selector:
   labelSelectors:
     "app.kubernetes.io/component": "tikv"
```

```yaml
apiVersion: chaos-mesh.org/v1alpha1
kind: Schedule
metadata:
 name: schedule-pod-kill-example
spec:
 schedule: "@every 5m"
 type: "PodChaos"
 historyLimit: 5
 concurrencyPolicy: Forbid
 podChaos:
   action: "pod-kill"
   mode: one
   selector:
     labelSelectors:
       "app.kubernetes.io/component": "tikv"
```

Effects: pod kill

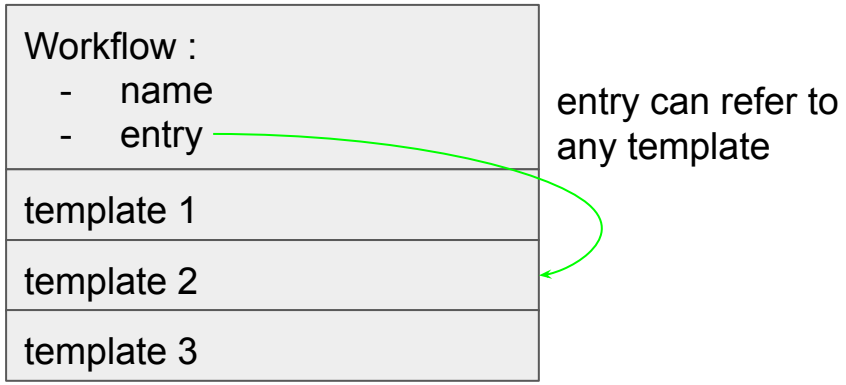
Kill a random pod every 5 minutes (sysbench - Point Select)



Workflow Engine

- Three parts of the a workflow
  - Workflow Name
  - Entry, the entry of the whole workflow
  - Template array
- Five different types of templates
  - Serial
  - Parallel
  - Chaos
  - Suspend
  - Task
- Serial, Parallel, Task allow other nodes to be referenced as child nodes

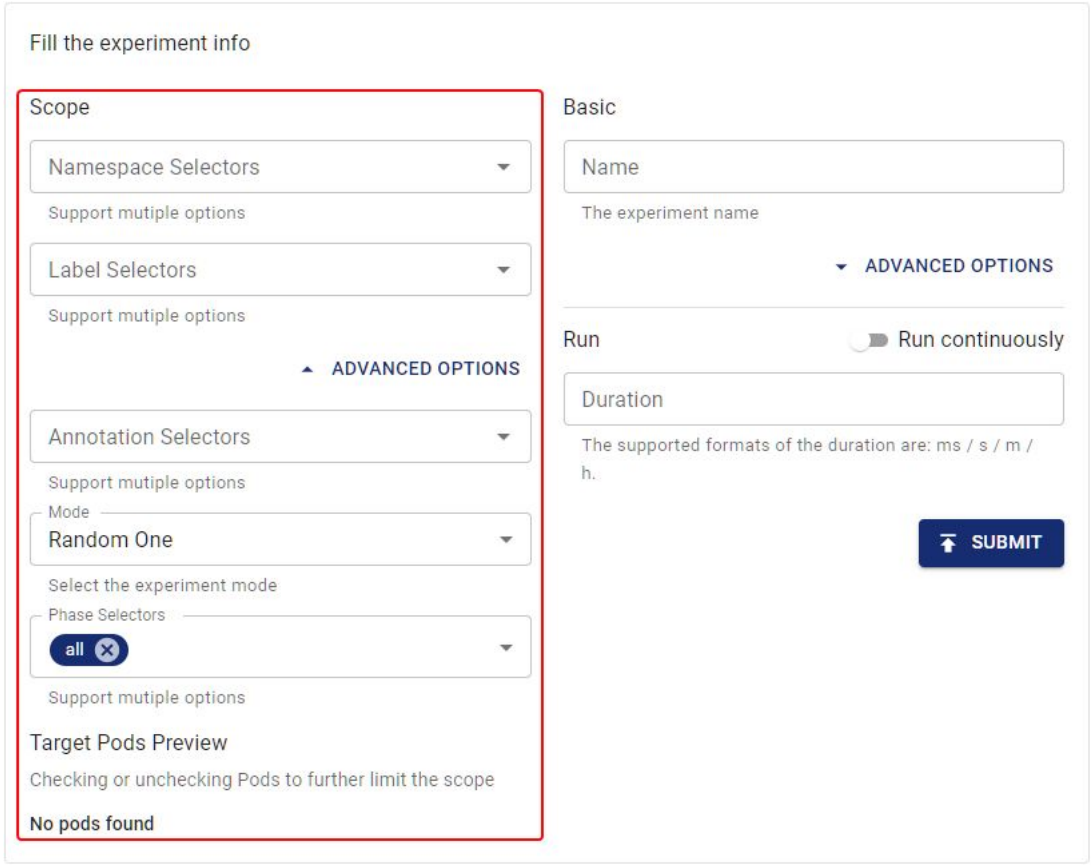
```
apiVersion: chaos-mesh.org/v1alpha1
kind: Workflow
metadata:
  name: <name-of-workflow>
spec:
  entry: <refs-to-name-of-one-template>
  templates:
  - name: <name>
    templateType: <type>
  - name: <name>
    templateType: <type>
  ...
```



Selectors

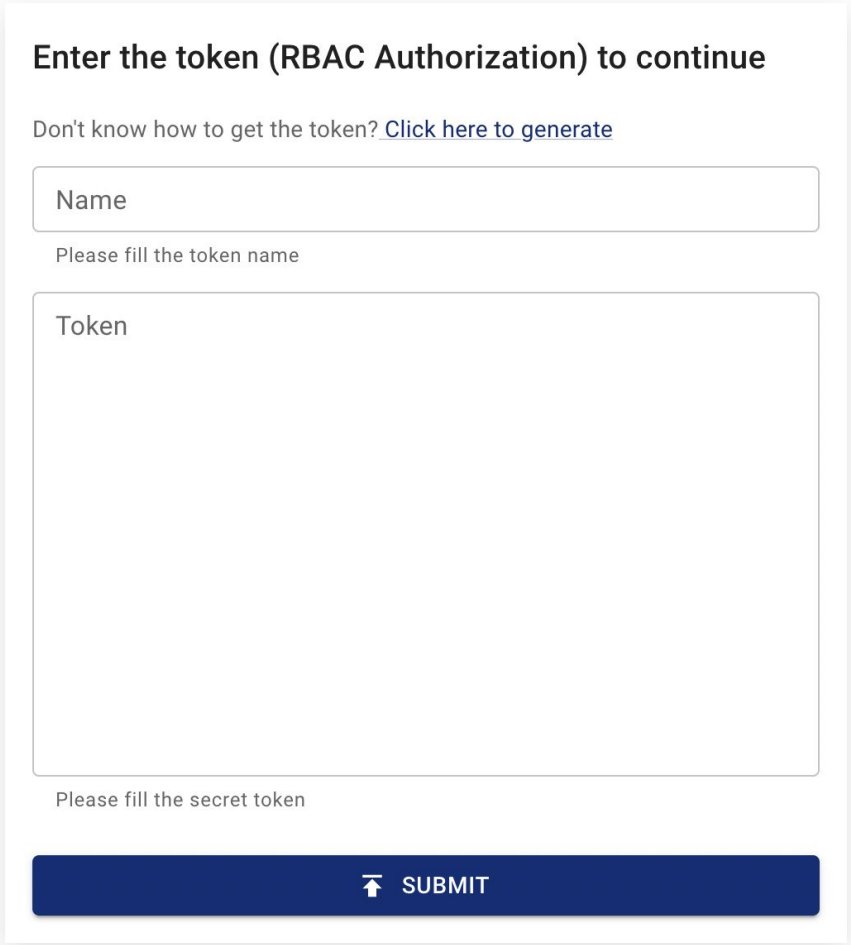
- Namespace selectors
- Label selectors
- Expression selectors
- Annotation selectors
- Field selectors
- PodPhase selectors
- Node selectors
- Node list
- Pod list

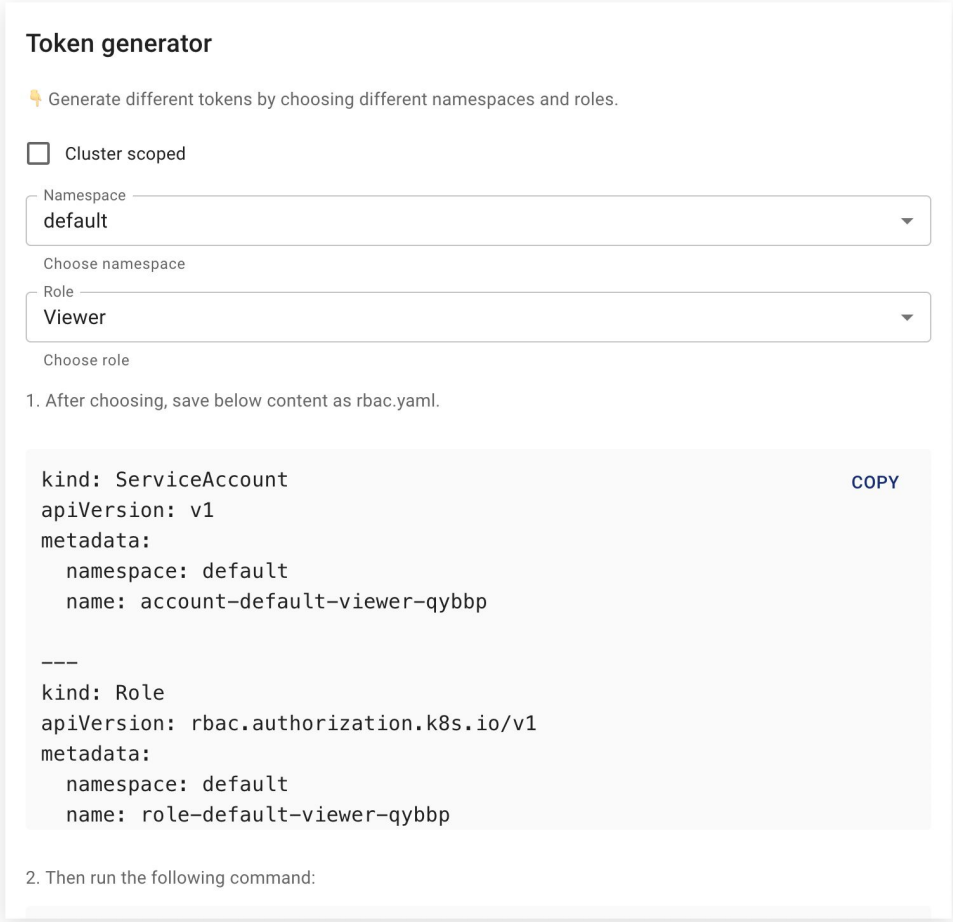
```
selector:
 labelSelectors:
   'app.kubernetes.io/component': 'tikv'
```



Authorization

- Authorization mechanism based on Kubernetes RBAC permission policies.





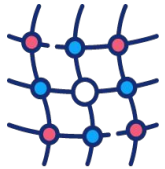
Demo

What is Next?

Future plans

- Ease of use
  - More comprehensive status inspection mechanism and reports
  - Improve Observability via event logs and metrics
- Security
  - A new component to force recovery chaos experiments, and avoid experiments going out of control
- Support running chaos experiment on multiple kubernetes clusters
- Provide a plugin approach to extend complex chaos types, such as RabbitMQChaos, RedisChaos, …
- Build a hub for users sharing their own chaos workflow and chaos types
- Provide more tutorials & plugins to make integrating with ecological tools easier

Follow & communicate with us



chaos-mesh.org

CNCF - #project-chaos-mesh

github.com/chaos-mesh

@chaos_mesh

Channel: Chaos Mesh

Thanks!!