Altinity

ClickHouse on Kubernetes!

Intro to the Kubernetes ClickHouse Operator

Altinity Engineering Team

Altinity Background

- Premier provider of software and services for ClickHouse
- Incorporated in UK with distributed team in US/Canada/Europe
- Main US/Europe sponsor of ClickHouse community
- Offerings:
  - 24x7 support for ClickHouse deployments
  - Software (Kubernetes, cluster manager, tools & utilities)
  - POCs/Training

What is ClickHouse?

Understands SQL

Runs on bare metal to cloud

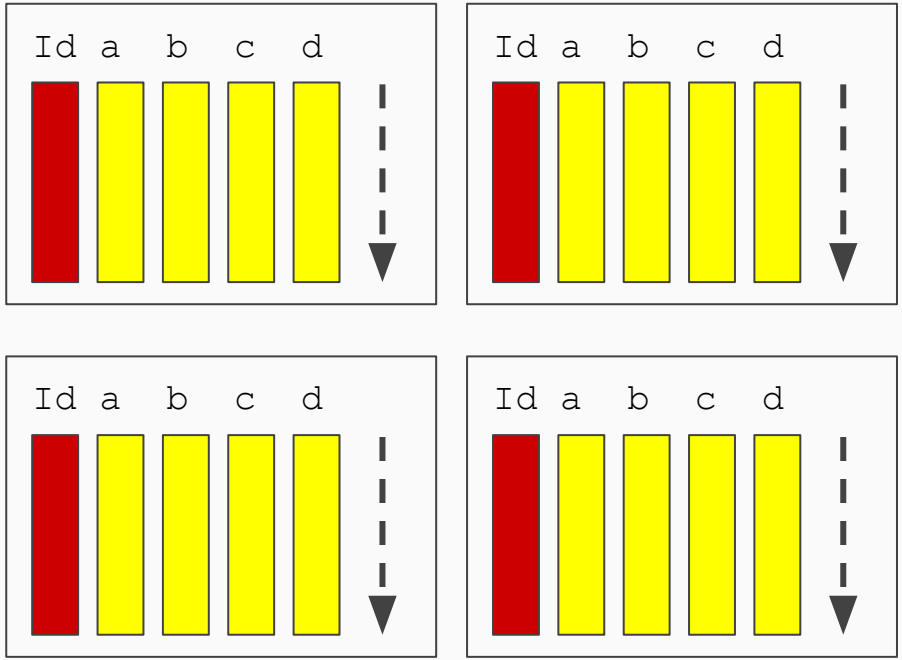
Simple to install

Stores data in columns

Scales to many petabytes

Is Open source (Apache 2.0)

Is WAY fast!



What is Kubernetes?

“Kubernetes is the new Linux”

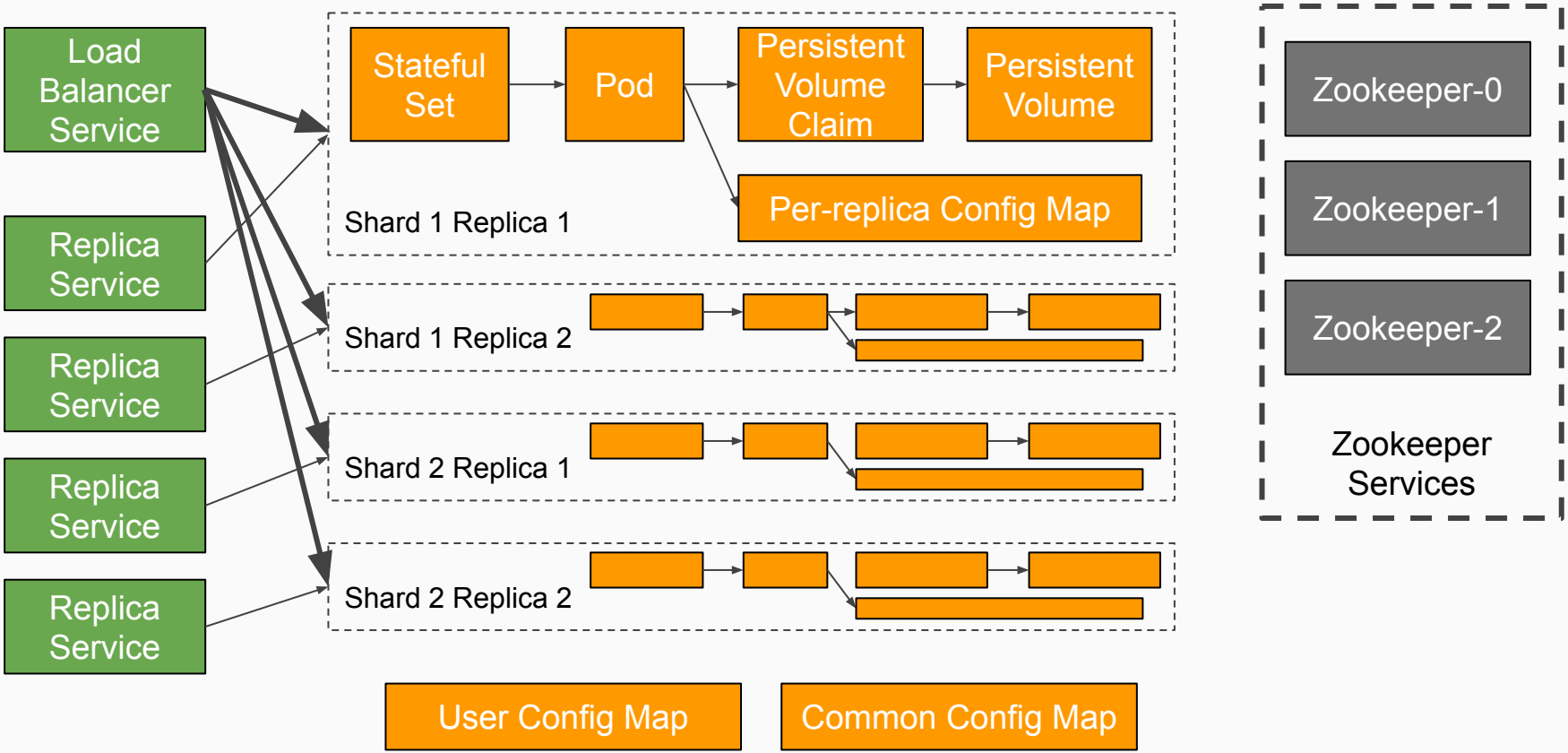
Actually it’s an open-source platform to:

- manage container-based systems
- build distributed applications declaratively
- allocate machine resources efficiently
- automate application deployment

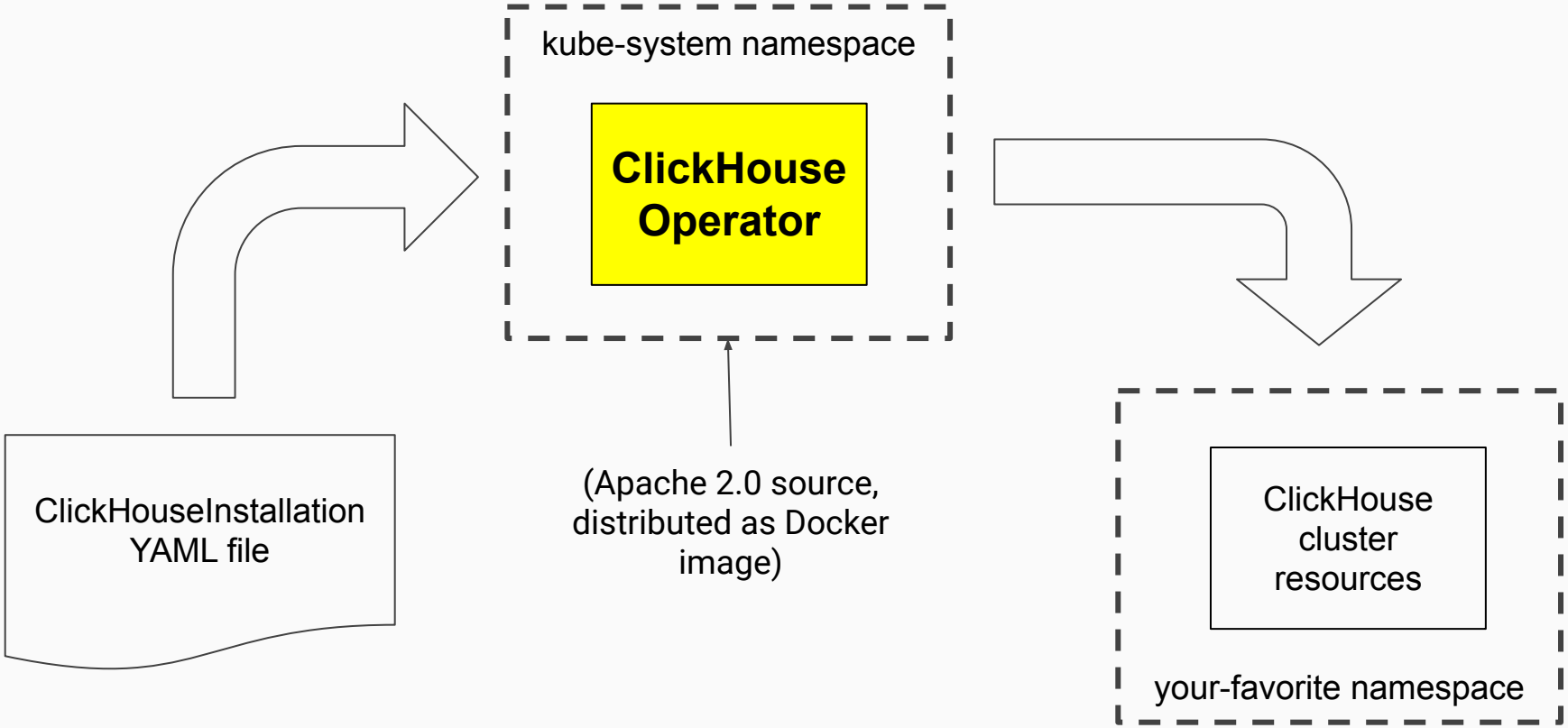
Why run ClickHouse on Kubernetes?

1. Other applications are already there
2. Portability
3. Bring up data warehouses quickly
4. Easier to manage than deployment on hosts

What does ClickHouse look like on Kubernetes?



The ClickHouse operator turns complex data warehouse configuration into a single easy-to-manage resource



Installing and removing the ClickHouse operator

[Optional] Get sample files from github repo:

```
git clone https://github.com/Altinity/clickhouse-operator
```

Install the operator:

```
kubectl apply -f clickhouse-operator-install.yaml
```

Remove the operator:

```
kubectl delete -f clickhouse-operator-install.yaml
```

Let’s start with a single-node cluster

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "demo-01"
spec:
  configuration:
    clusters:
    - name: "demo-01"
      layout:
        type: Standard
        shardsCount: 1
        replicasCount: 1
```

WARNING: This installation lacks persistent storage

See examples in later slides for storage definition

Next let’s add a shard

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "demo-01"
spec:
  configuration:
    clusters:
    - name: "demo-01"
        layout:
          type: Standard
          shardsCount: 2
          replicasCount: 1
```

How to access your ClickHouse data warehouse on Kubernetes

Connect from within Kubernetes using service DNS name

```
# Use load balancer
clickhouse-client --host clickhouse-demo-01.test
# Connect to specific node
clickhouse-client --host chi-a82946-2946-0-0.test
```

Connect from outside Kubernetes using Ingress or Nodeport

```
# Kops deployment on AWS configures external ingress.
clickhouse-client --host $AWS_ELB_HOST_NAME
```

Replication requires Zookeeper to be enabled

Install minimal Zookeeper in separate namespace.

```
kubectl create ns zoons
kubectl apply -f zookeeper-1-node.yaml -n zoons
watch kubectl -n zoons get all
```

Note ZK node DNS name: **zookeeper-0.zookeepers.zoons**

You can also install using helm *or* use external ZK cluster

After inserting a ‘zookeepers’ clause we can add replicas

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "demo-01"
spec:
  configuration:
    zookeeper:
      nodes:
        - host: zookeeper-0.zookeepers.zoons
          port: 2181
    clusters:
    - name: "demo-01"
      layout:
        type: Standard
        shardsCount: 2
        replicasCount: 2
```

TIP: Confirm the DNS name of Zookeeper from with a pod

NOTE: Non-replicated tables do not replicate automatically when replicas are added

We can add and modify users with the ‘users’ clause

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "demo-01"
spec:
  configuration:
    users:
      demo/default: secret
      demo/password: demo
      demo/profile: default
      demo/quota: default
      demo/networks/ip: "::/0"
  clusters:
    - name: "demo-01"
      layout:
        type: Standard
        shardsCount: 2
        replicasCount: 1
```

TIP: User and profile changes take a few minutes to propagate. Confirm changes using clickhouse-client

To make storage persistent and set properties add an explicit volume claim template with class and size

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "storage"
spec:
  defaults:
    deployment:
      volumeClaimTemplate: storage-vc-template
  templates:
     volumeClaimTemplates:
     - name: storage-vc-template
       persistentVolumeClaim:
         metadata:
           name: USE_DEFAULT_NAME
         spec:
           storageClassName: default
           accessModes:
           - ReadWriteOnce
           resources:
             requests:
               storage: 2Gi
  configuration:
```

TIP: Check syntax carefully as errors may result in failures to allocate or mount volumes

TIP: Confirm storage by ‘kubectl exec’ into pod; run ‘df -h’ to confirm mount

storageClassName can be used to set the proper class of storage as well as disable dynamic provisioning

Use kubectl to find available storage classes:

```
kubectl describe StorageClass
```

Bind to default storage:

```
spec:
  storageClassName: default
```

Bind to gp2 type

```
spec:
  storageClassName: gp2
```

Disable dynamic provisioning and use static PVs:

```
spec:
  storageClassName: ''
```

Set the ClickHouse version using a podTemplate

```
apiVersion: "clickhouse.altinity.com/v1"
kind: "ClickHouseInstallation"
metadata:
  name: "demo-02"
spec:
  defaults:
    deployment:
      podTemplate: clickhouse-stable
      volumeClaimTemplate: storage-vc-template
  templates:
    podTemplates:
    - name: clickhouse-stable
      containers:
      - name: clickhouse
        image: yandex/clickhouse-server:18.16.1
    volumeClaimTemplates:
# Etc.
```

TIP: Always specify the image version fully; do not use ‘latest’ tag

More pod template tricks: controlling resources

```
spec:
  defaults:
    deployment:
      podTemplate: clickhouse-stable
      volumeClaimTemplate: storage-vc-template
  templates:
    podTemplates:
    - name: clickhouse-stable
      containers:
      - name: clickhouse
        image: yandex/clickhouse-server:18.16.1
          resources:
            requests:
              memory: "512Mi"
              cpu: "500m"
            limits:
              memory: "512Mi"
```

Advice, encouragement, and caveats

- Clickhouse operator is in beta
- Operator does not always detect errors in manifest files
- Error logging is limited, will be improved shortly
- Connectivity is a work in progress
- It’s a great way to explore cluster configurations

Please explore the operator and log issues on Github!!!

Partial roadmap for the operator and other Altinity projects

- Make operator status more transparent
- Default configuration templates
- ClickHouse health checks
- Predefined Grafana monitoring dashboards

Coming soon:

- **Altinity Cluster Manager**
- **Storage management starting with backup/restore**

More information on Altinity ClickHouse Operator...

ClickHouse Operator Github Project:
https://github.com/Altinity/clickhouse-operator

Altinity Blog -- https://www.altinity.com/blog

Webinars like this one!

Questions?

Thank you!

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