Kubernetes Operators in Java

What are Custom Resource Definitions and how to use them

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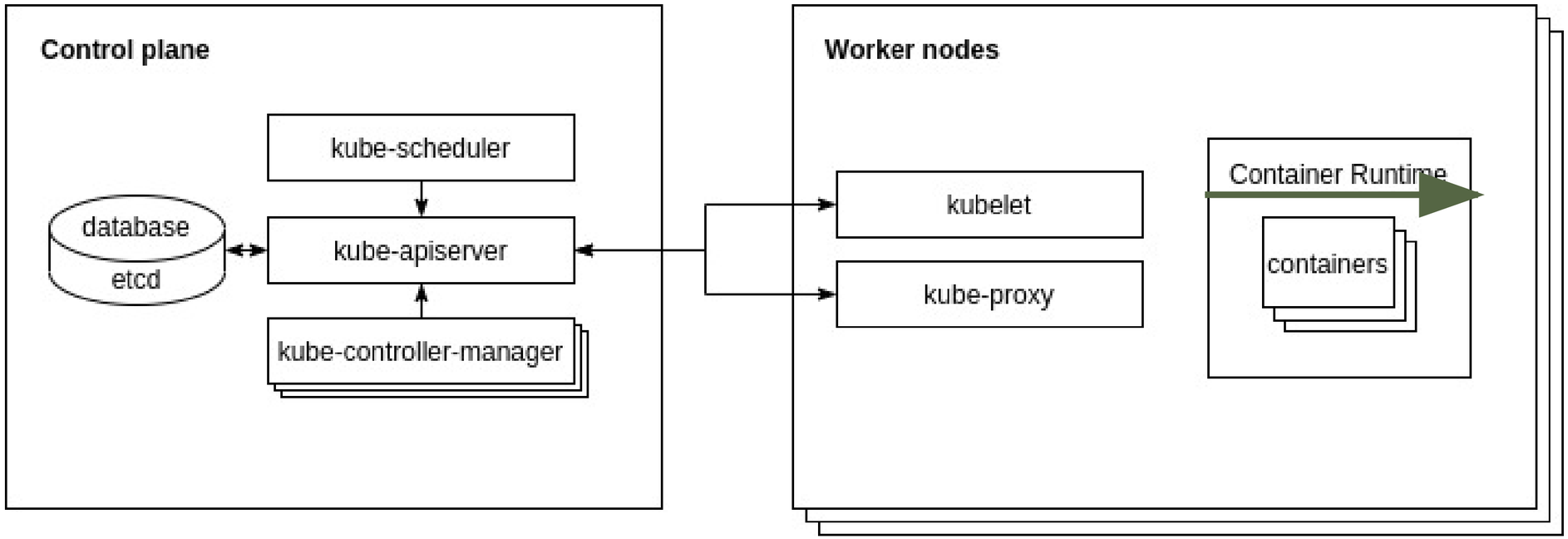
Kubernetes

System für deklaratives verwalten von Containern und Resourcen



Kubernetes

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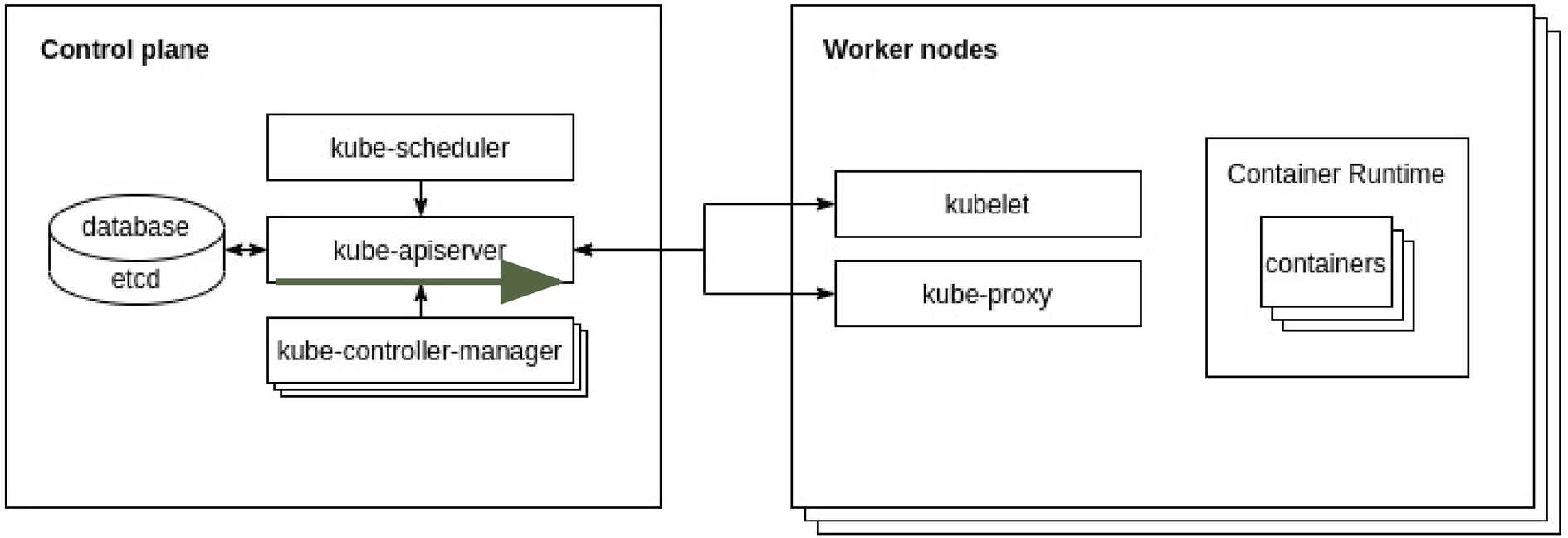

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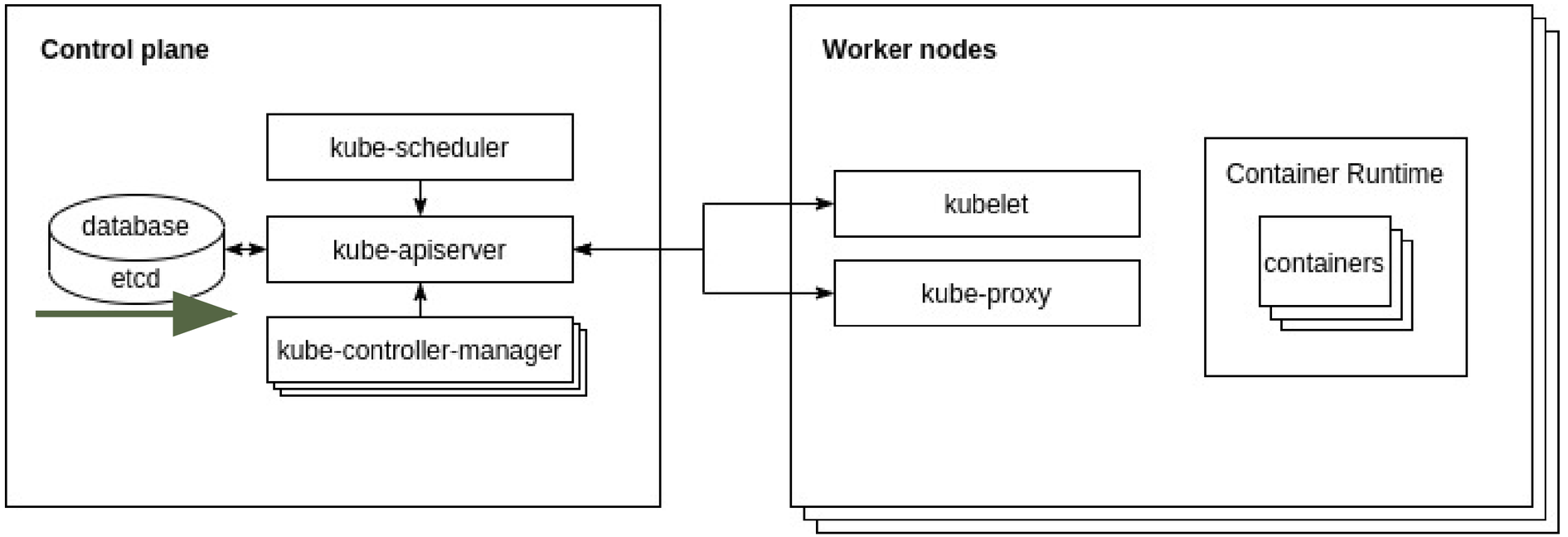

Kubernetes

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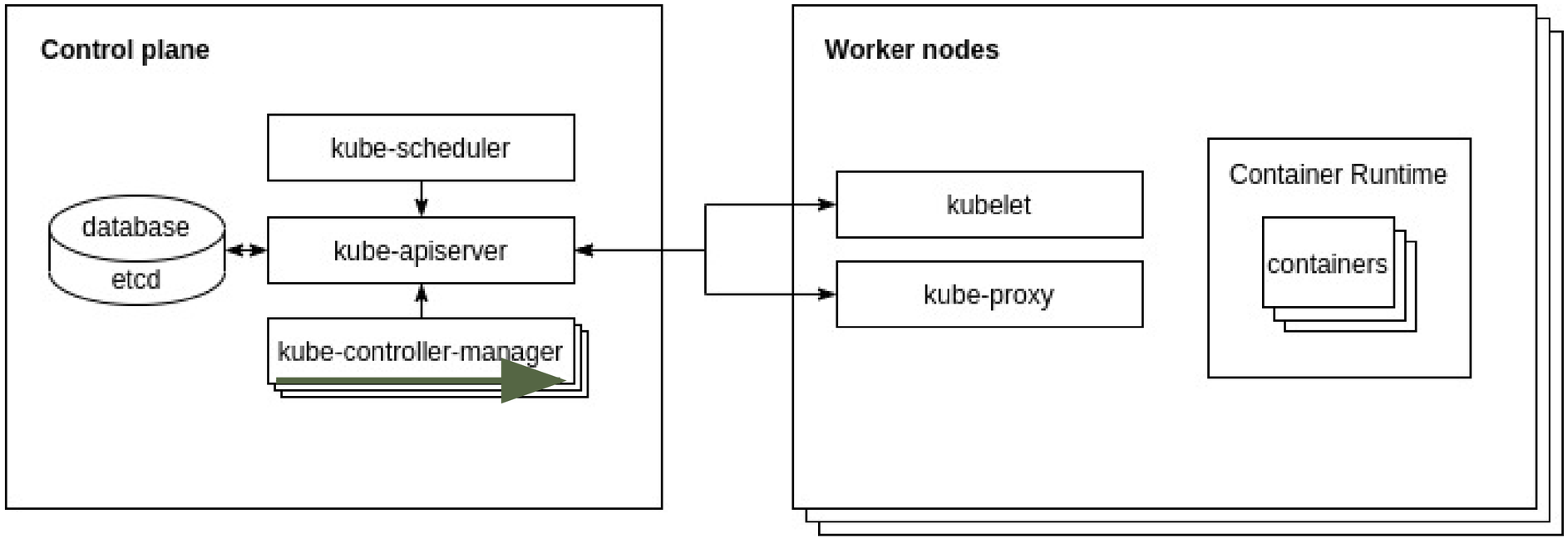

Kubernetes

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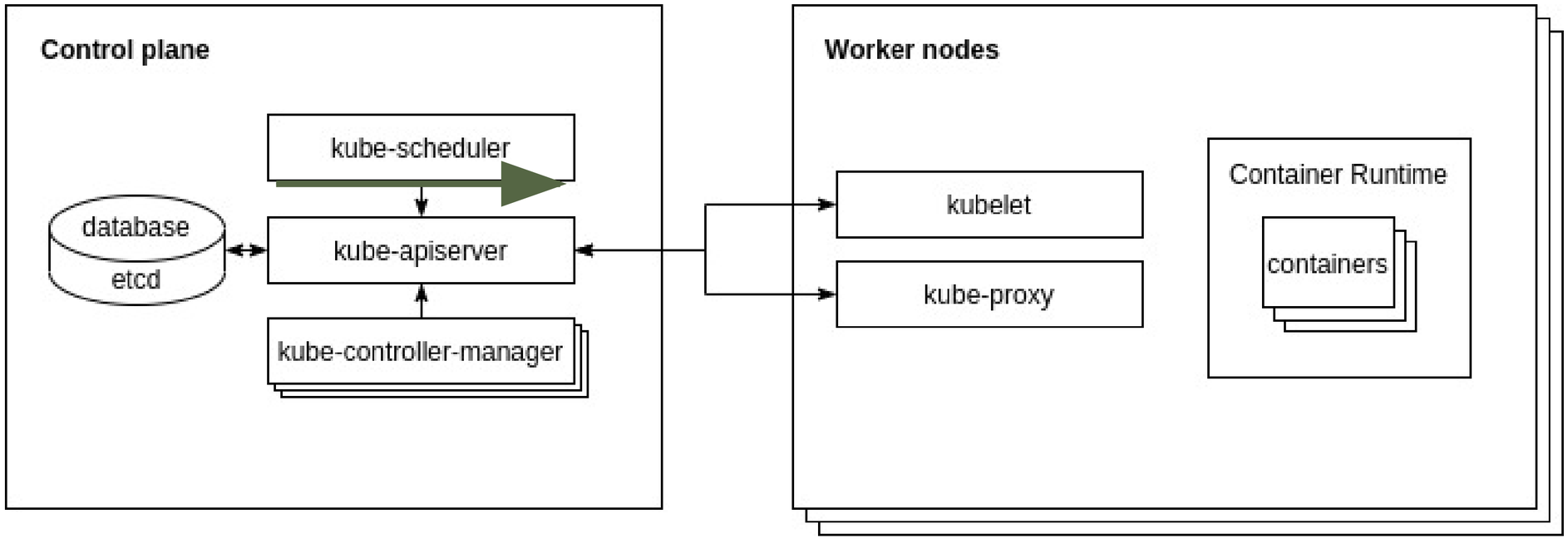
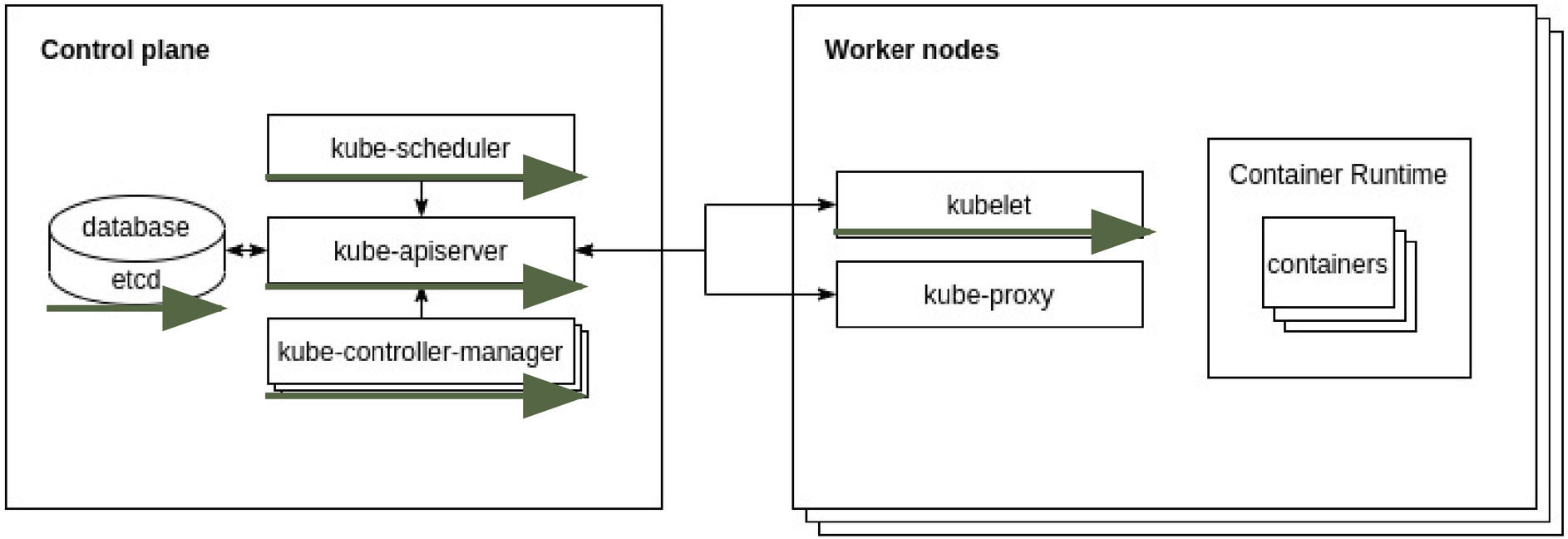


Pod Resource

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: example-webserver
  namespace: example-namespace
spec:
  containers:
  - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
```

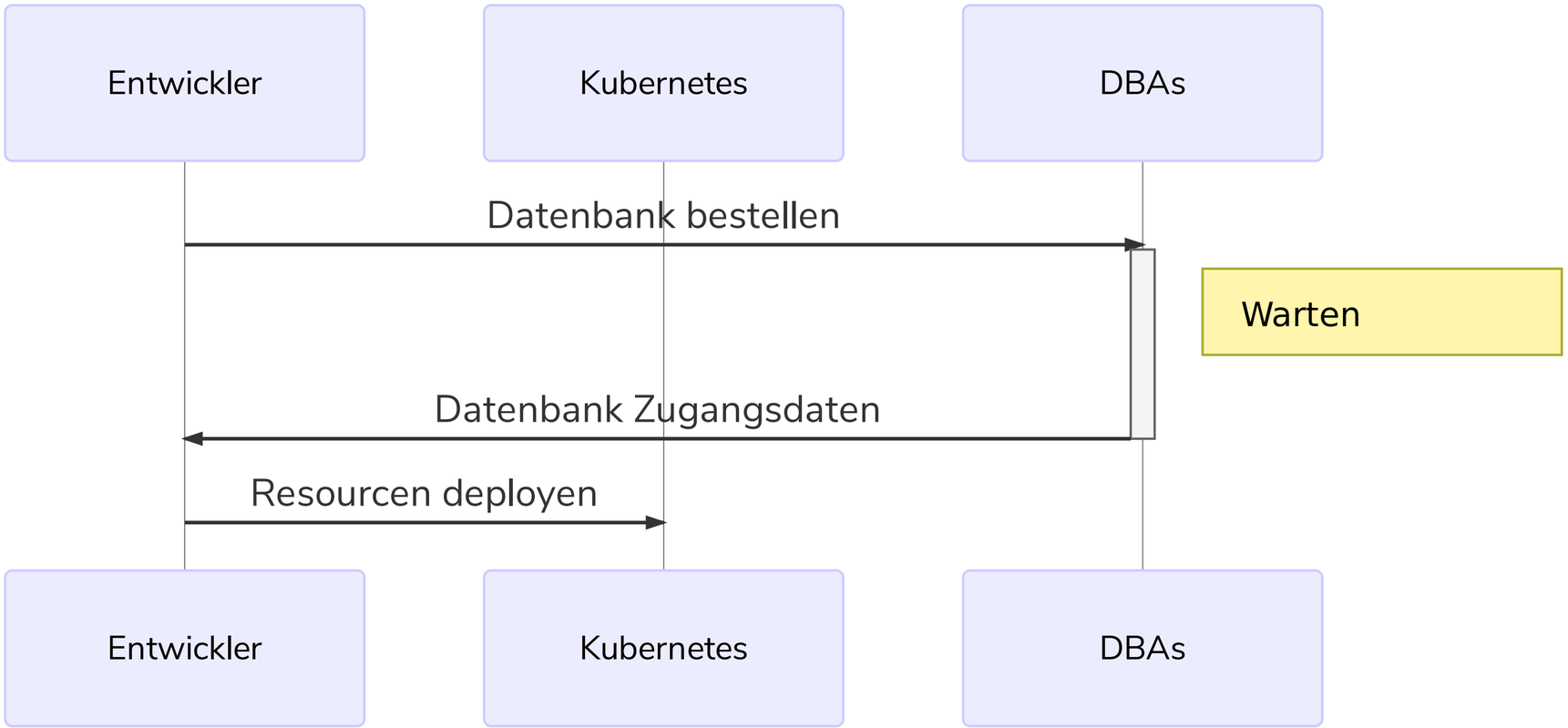
```
kubectl apply --file pod.yaml
```

Pod Resource

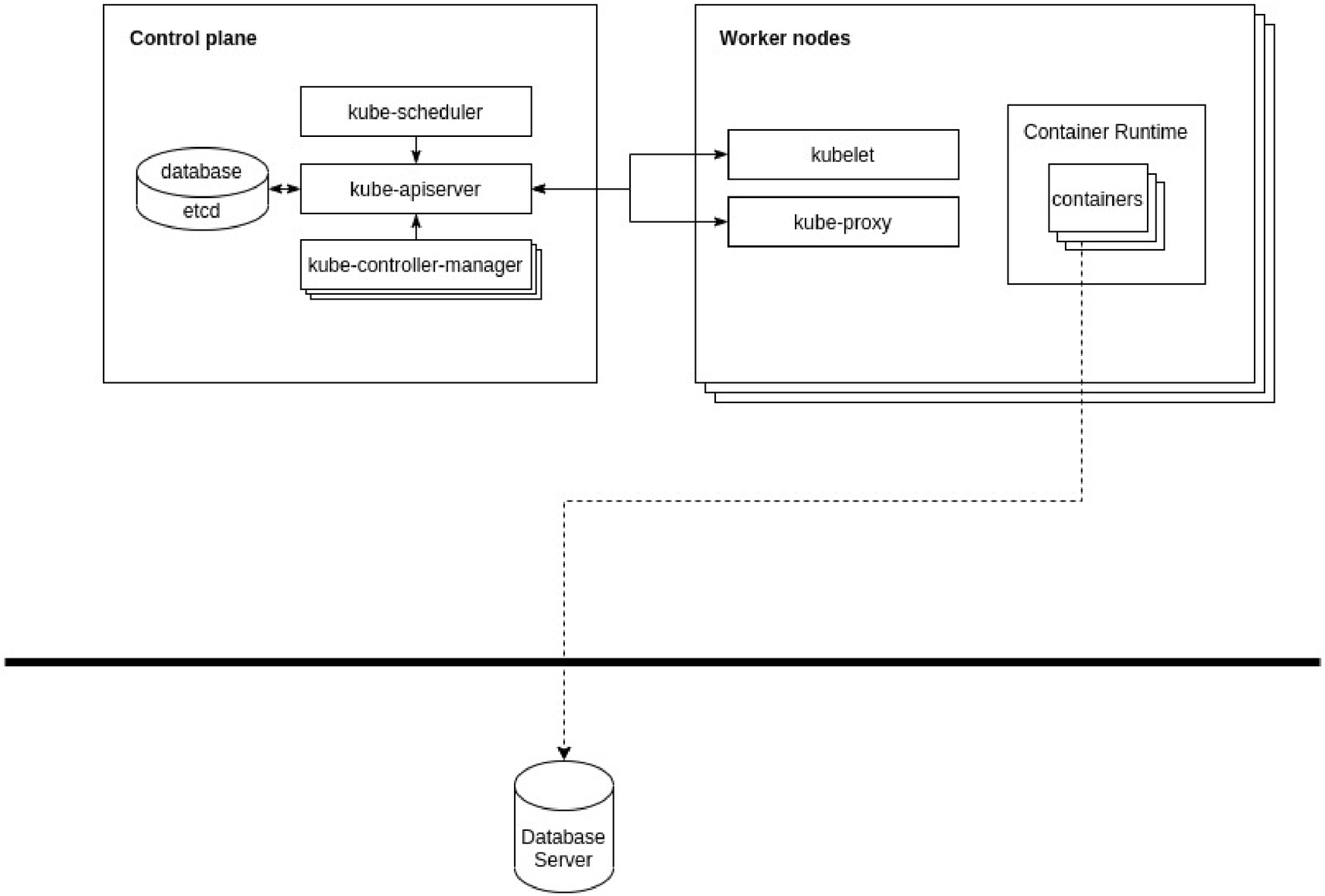


Use Case - IST

Entwickler will eine Applikation deployen die eine zentrale Datenbank braucht

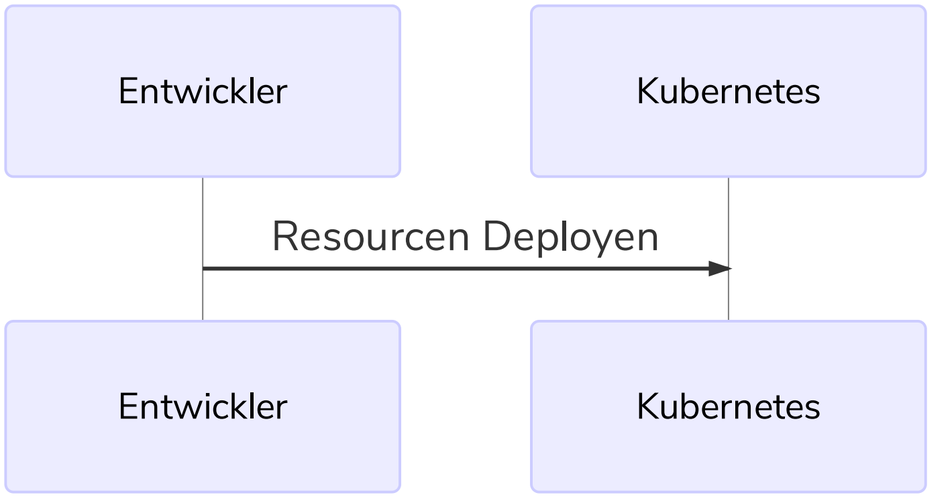


Use Case - IST


Control plane
kube-scheduler
database
etcd
kube-apiserver
kube-controller-manager
Worker nodes
kubelet
kube-proxy
Container Runtime
containers
Database
Server

Use Case - SOLL

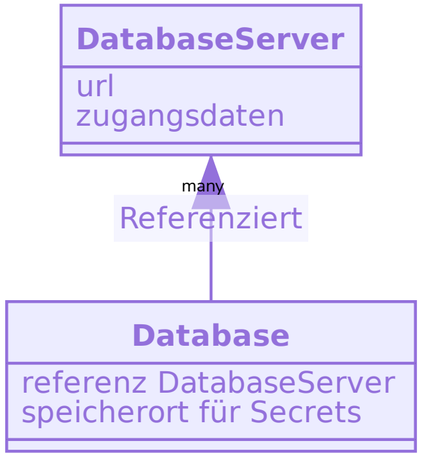
Entwickler will eine Applikation deployen die eine zentrale Datenbank braucht



Use Case - 2 neue Resourcen

- **DatabaseServer Custom Resource**: von Infrastruktur einmalig erstellt und beinhaltet Zugangsdaten zur Datenbank

- **Database Custom Resource**: von Entwickler erstellt und referenziert auf ein **DatabaseServer**. Anhand dieser Resource sollen Datenbanken und User erstellt werden. Die Zugangsdaten sollen dann als kubernetes Resource zur Verfügung gestellt werden.



Use Case - DatabaseServer

```yaml
apiVersion: autodba.sircremefresh.dev/v1alpha1
kind: ClusterDatabaseServer
metadata:
  name: database-server-prd
spec:
  host: 'instance.database-prd'
  port: '5432'
  authSecretRef:
    name: 'database-server-secret'
  databaseType: 'PostgreSQL'
```

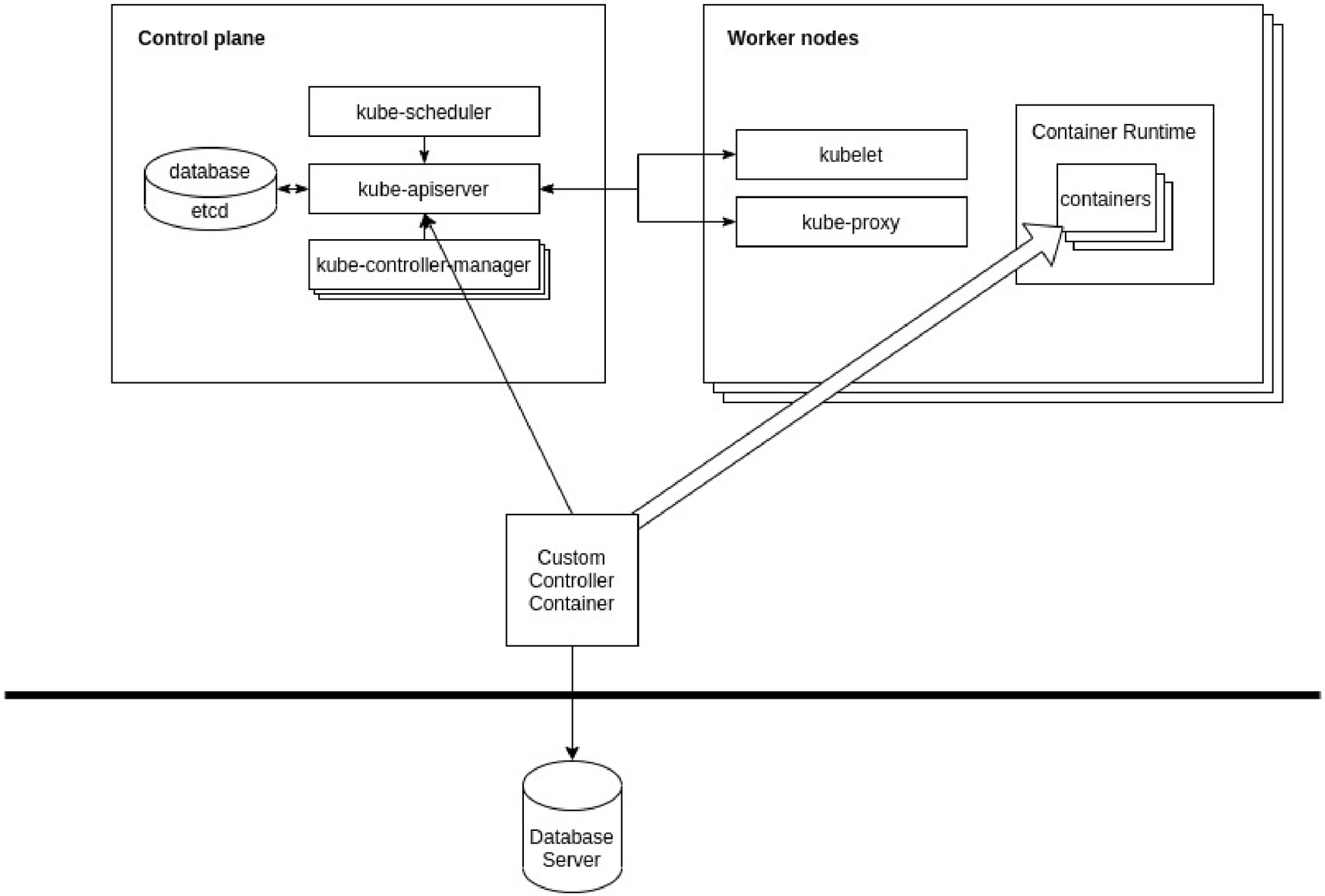
Use Case - Database

```yaml
apiVersion: autodba.sircremefresh.dev/v1alpha1
kind: Database
metadata:
  namespace: voting-prd
  name: voting-database
spec:
  secretName: 'voting-db-secret'
  serverRef:
    name: 'database-server-prd'
```

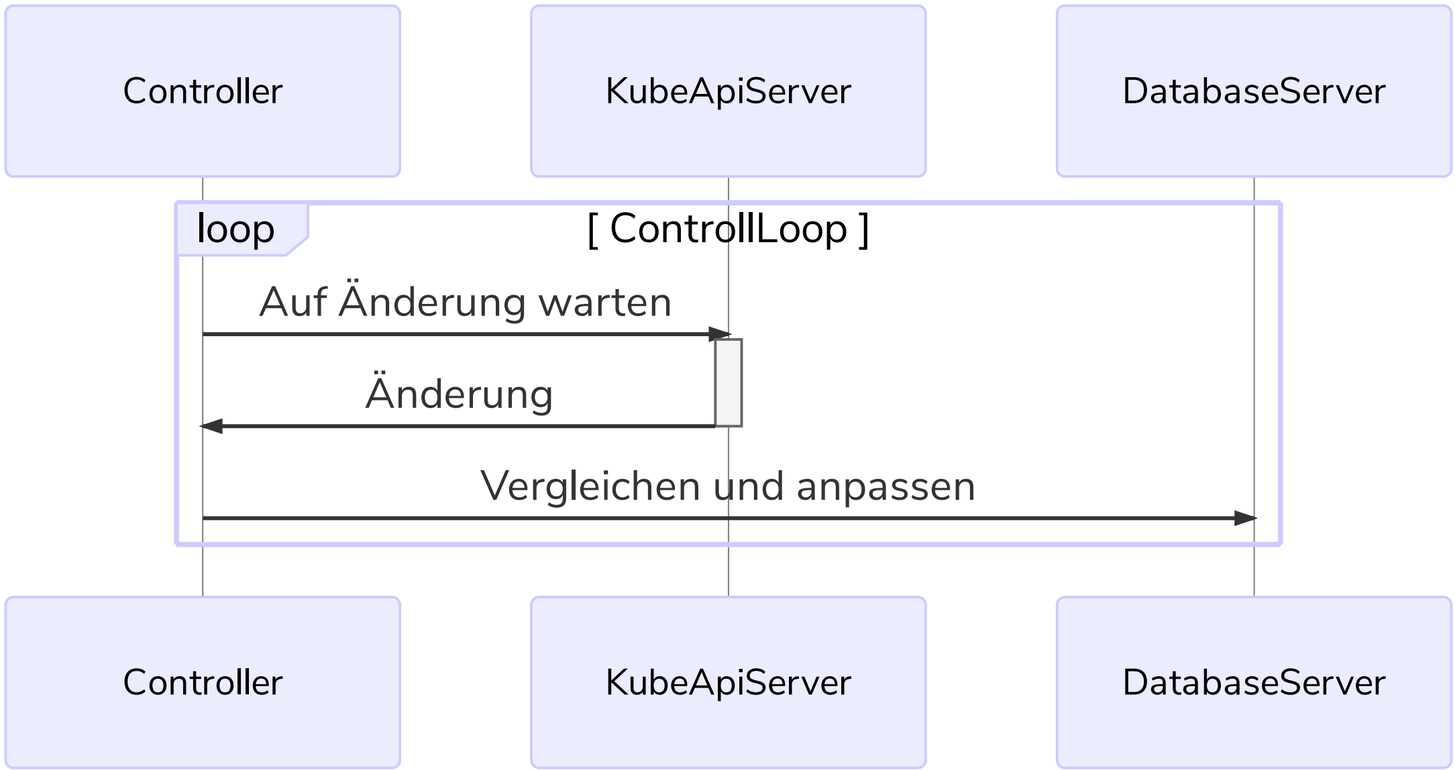
Custom Resource

```yaml
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  name: databases.autodba.sircremefresh.dev
spec:
  group: autodba.sircremefresh.dev
  names:
    kind: Database
    listKind: DatabaseList
    plural: databases
    singular: database
  scope: Namespaced
  versions:
    - name: v1alpha1
      schema:
        openAPIV3Schema:
          ...
```

Custom Controller



Custom Controller



Impl - Library

fabric8

Impl - Database

```
@Version("v1alpha1")
@Group("autodba.sircremefresh.dev")
@Kind("Database")
@Plural("databases")
@Singular("database")
public class Database extends CustomResource<DatabaseSpec, DatabaseStatus> implements Namespaced {
}

public class DatabaseSpec {
    private String secretName;
    private DatabaseServerRef serverRef;
}
```

Impl - Events

```
var databaseInformer =
  informerFactory.sharedIndexInformerForCustomResource(Database.class, DatabaseList.class, RESYNC_PERIOD_MILLIS);

databaseInformer.addEventHandler(new ResourceEventHandler<>() {
...
            @Override
            public void onUpdate(Database oldDatabase, Database newDatabase) {
                logger.info("Database {} updated", Cache.metaNamespaceKeyFunc(newDatabase));
                enqueueDatabase(newDatabase);
            }
...
        });
```

Impl - WorkQueue

```
public void run() {
...
  while (!Thread.currentThread().isInterrupted()) {
    String key = workQueue.take();
...
    String namespace = key.split("/")[0];
    String name = key.split("/")[1];
    Database database = databaseLister
        .namespace(namespace)
        .get(name);
...
    databaseReconciler.reconcile(database, databaseServer, secret);
...
    }
}
```

Impl - Secret

```
var secret = new SecretBuilder()
    .withNewMetadata()
    .withName(secretName)
...
    .endMetadata()
    .addToStringData(DATABASE_KEY, databaseKey)
    .addToStringData(USERNAME_KEY, databaseKey)
    .addToStringData(PASSWORD_KEY, password)
    .addToStringData(HOST_KEY, databaseServer.getSpec().getHost())
    .addToStringData(PORT_KEY, databaseServer.getSpec().getPort())
    .addToStringData(URL_KEY, getDatabaseUrl(databaseServer, databaseKey, password))
    .build();

client.secrets().createOrReplace(secret);
```