
Apache ShardingSphere ElasticJob document

Apache ShardingSphere

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Through the functions of flexible scheduling, resource management and job management, it creates a distributed scheduling solution suitable for Internet scenarios, and provides a diversified job ecosystem through open architecture design. It uses a unified job API for each project. Developers only need code one time and can deploy at will.

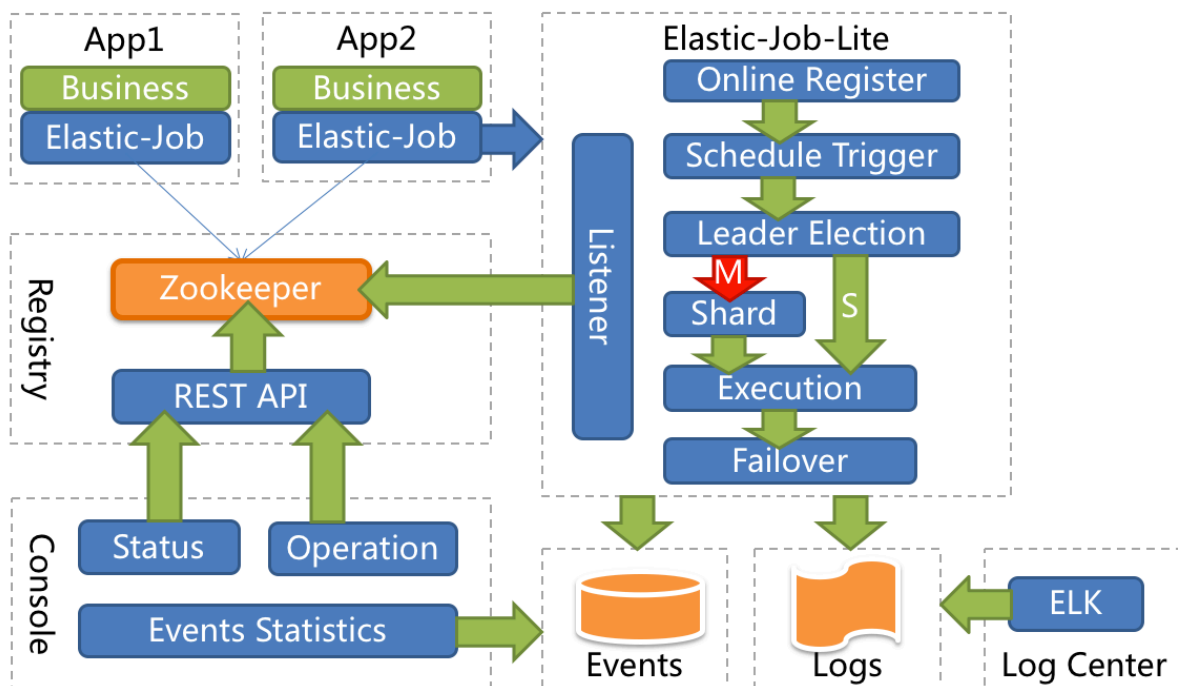
ElasticJob became an [Apache ShardingSphere](#) Sub project on May 28 2020.

Welcome communicate with community via [mail list](#).

Introduction

Using ElasticJob can make developers no longer worry about the non-functional requirements such as jobs scale out, so that they can focus more on business coding; At the same time, it can release operators too, so that they do not have to worry about jobs high availability and management, and can automatic operation by simply adding servers.

ElasticJob is a lightweight, decentralized solution that provides distributed task sharding services.



- Elastic Schedule
 - Support job sharding and high availability in distributed system
 - Scale out for throughput and efficiency improvement
 - Job processing capacity is flexible and scalable with the allocation of resources
- Resource Assign
 - Execute job on suitable time and assigned resources
 - Aggregation same job to same job executor
 - Append resources to newly assigned jobs dynamically
- Job Governance
 - Failover
 - Misfired
 - Self diagnose and recover when distribute environment unstable
- Job Dependency (TODO)
 - DAG based job dependency
 - DAG based job item dependency
- Job Open Ecosystem
 - Unify job api for extension
 - Support rich job type lib, such as dataflow, script, HTTP, file, big data
 - Focus business SDK, can work with Spring IOC
- Admin Console
 - Job administration
 - Job event trace query
 - Registry center management

Environment Required

3.1 Java

Java 8 or above required.

3.2 Maven

Maven 3.5.0 or above required.

3.3 ZooKeeper

ZooKeeper 3.6.0 or above required. [See details](#)

4.1 Import Maven Dependency

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-bootstrap</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

4.2 Develop Job

```
public class MyJob implements SimpleJob {

    @Override
    public void execute(ShardingContext context) {
        switch (context.getShardingItem()) {
            case 0:
                // do something by sharding item 0
                break;
            case 1:
                // do something by sharding item 1
                break;
            case 2:
                // do something by sharding item 2
                break;
            // case n: ...
        }
    }
}
```

4.3 Configure Job

```
JobConfiguration jobConfig = JobConfiguration.newBuilder("MyJob", 3).cron("0/5 * * * * ?").build();
```

4.4 Schedule Job

```
public class MyJobDemo {

    public static void main(String[] args) {
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createJobConfiguration()).schedule();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        CoordinatorRegistryCenter regCenter = new ZookeeperRegistryCenter(new
ZookeeperConfiguration("zk_host:2181", "my-job"));
        regCenter.init();
        return regCenter;
    }

    private static JobConfiguration createJobConfiguration() {
        // create job configuration
        // ...
    }
}
```

This chapter describes concepts and features about ElasticJob. Please refer to [User manual](#) for more details.

5.1 Schedule Model

ElasticJob is a thread-level scheduling framework for in-process. Through it, Job can be transparently combined with business application systems. It can be easily used in conjunction with Java frameworks such as Spring and Dubbo. Spring DI (Dependency Injection) Beans can be freely used in Job, such as data source connection pool and Dubbo remote service, etc., which is more convenient for business development.

5.2 Elastic Schedule

Elastic schedule is the most important feature in ElasticJob, which acts as a job processing system that enables the horizontal scaling of jobs by sharding, it's also the origin of the project name "ElasticJob".

5.2.1 Sharding

A concept in ElasticJob to split the job, enabling the job to be executed in distributed environment, where every single server only executes one of the slice that is assigned to it. ElasticJob is aware of the number of servers in an almost-real-time manner, with the increment/decrement number of the servers, it re-assigns the job slices to the distributed servers, maximizing the efficiency as the increment of resources.

To execute the job in distributed servers, a job will be divided into multiple individual job items, one or some of which will be executed by the distributed servers.

For example, if a job is divided into 4 slices, and there are two servers to execute the job, then each server is assigned 2 slices, undertaking 50% of the workload, as follows.



Sharding Item

ElasticJob doesn't directly provide the abilities to process the data, instead, it assigns the sharding items to the job servers, where the developers should process the sharding items and their business logic themselves. The sharding item is numeric type, in the range of $[0, \text{size}(\text{slices}) - 1]$.

Customized sharding options

Customized sharding options can build a relationship with the sharding items, converting the sharding items' numbers to more readable business codes.

For example, to horizontally split the databases according to the regions, database A stores data from Beijing, database B stores data from Shanghai and database C stores data from Guangzhou. If we configure only by the sharding items' numbers, the developers need the knowledge that 0 represents Beijing, 1 represents Shanghai and 2 represents Guangzhou. Customized sharding options make the codes more readable, if we have customized options $0=\text{Beijing}$, $1=\text{Shanghai}$, $2=\text{Guangzhou}$, we can simply use Beijing, Shanghai, Guangzhou in the codes.

5.2.2 Maximize the usage of resources

ElasticJob provides a flexible way to maximize the throughput of the jobs. When new job server joins, ElasticJob will be aware of it from the registry, and will re-shard in the next scheduling process, the new server will undertake some of the job slices, as follows.



Configuring a larger number of sharding items than the number of servers, or better, a multiplier of the number of servers, makes it more reasonably for the job to leverage the resources, and assign the sharding items dynamically.

For example, we have 10 sharding items and there are 3 servers, the number of sharding items are server A = 0,1,2,9; server B = 3,4,5; server C = 6,7,8. If the server C is down, then server A = 0,1,2,3,4 and B = 5,6,7,8,9, maximizing the throughput without losing any sharding item.

5.2.3 High Availability

When a server is down when executing a sharding item, the registry is also aware of that, and the sharding item will be transferred to another living server, thus achieve the goal of high availability. The unfinished job from a crashed server will be transferred and executed continuously, as follows.



Setting the total number of sharding items to 1 and more than 1 servers to execute the jobs makes the job run in the mode of 1 master and n slaves. Once the servers that are executing jobs are down, the idle servers will take over the jobs and execute them in the next scheduling, or better, if the failover option is enabled, the idle servers can take over the failed jobs immediately.

5.2.4 Implementation Principle

ElasticJob does not have a job scheduling center node, but the programs based on the deployment job framework trigger the scheduling when the corresponding time point is reached. The registration center is only used for job registration and monitoring information storage. The main job node is only used to handle functions such as sharding and cleaning.

Elastic Distributed Implementation

- The first server went online to trigger the main server election. Once the main server goes offline, the election is triggered again, and the election process is blocked. Only when the main server election is completed, other tasks will be performed.
- When a job server goes online, it will automatically register the server information to the registry, and automatically update the server status when it goes offline.
- The re-sharding flag will be updated when the master node is elected, the server goes offline, and the total number of shards changes.
- When a scheduled task is triggered, if it needs to be sharded again, it will be sharded by the main server. The sharding process is blocked, and the task can be executed after the sharding ends. If the main server goes offline during the sharding process, the master server will be elected first and then perform sharding.

- From the previous description, in order to maintain the stability of the job runtime, only the sharding status will be marked during the running process, and the sharding will not be re-sharded. Sharding can only occur before the next task is triggered.
- Each execution of sharding will sort instances by server IP to ensure that the sharding result will not produce large fluctuations.
- Realize the failover function, actively grab the unallocated shards after a certain server is executed, and actively search for available servers to perform tasks after a certain server goes offline.

Registry Data Structure

The registration center creates a job name node under the defined namespace to distinguish different jobs, so once a job is created, the job name cannot be modified. If the name is modified, it will be regarded as a new job. There are 5 data sub-nodes under the job name node, namely config, instances, sharding, servers and leader.

config node

Job configuration information, stored in YAML format.

instances node

Job running instance information, the child node is the primary key of the current job running instance. The primary key of the job running instance is composed of the IP address and PID of the job running server. The primary keys of the job running instance are all ephemeral nodes, which are registered when the job instance is online and automatically cleaned up when the job instance is offline. The registry monitors the changes of these nodes to coordinate the sharding and high availability of distributed jobs. You can write TRIGGER in the job running instance node to indicate that the instance will be executed once immediately.

sharding node

Job sharding information. The child node is the sharding item sequence number, starting from zero and ending with the total number of shards minus one. The child node of the sharding item sequence number stores detailed information. The child node under each shard is used to control and record the running status of the shard. Node details description:

Child node name	Ephemeral node	Description
instance	NO	The primary key of the job running instance that executes the shard
running	YES	The running state of the shard item. Only valid when monitorExecution is configured
fail over	YES	If the shard item is assigned to another job server by failover, this node value records the job server IP that executes the shard
mis fire	NO	Whether to restart the missed task
disabled	NO	Whether to disable this shard

servers node

Job server information, the child node is the IP address of the job server. You can write DISABLED in the IP address node to indicate that the server is disabled. Under the new cloud-native architecture, the servers node is greatly weakened, only including controlling whether the server can be disabled. In order to achieve the core of the job more purely, the server function may be deleted in the future, and the ability to control whether the server is disabled should be delegated to the automated deployment system.

leader node

The master node information of the job server is divided into three sub-nodes: election, sharding and failover. They are used for master node election, sharding and failover processing respectively.

The leader node is an internally used node. If you are not interested in the principle of the job framework, you don't need to pay attention to this node.

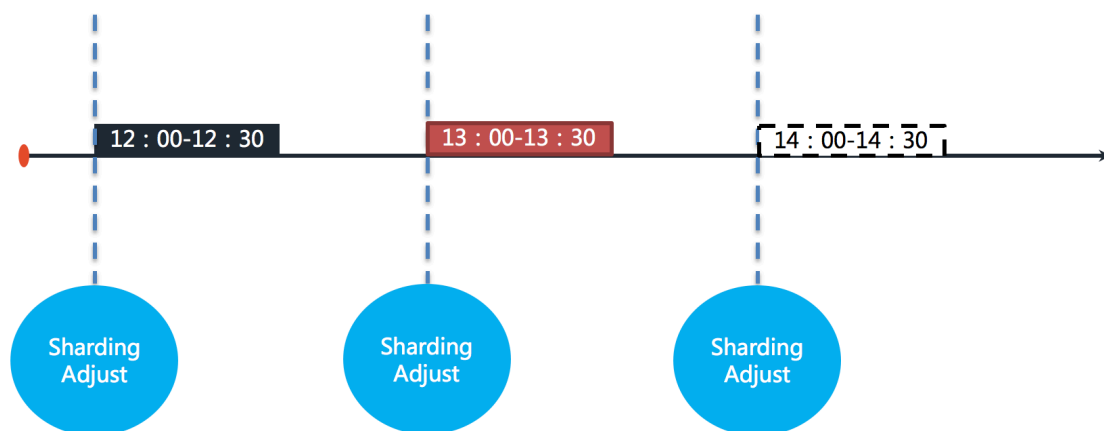
Child node name	Ephemeral node	Description
election:raw-latex:`instance`	YES	The IP address of the master node server. Once the node is deleted, a re-election will be triggered. All operations related to the master node will be blocked during the re-election process.
election:raw-latex: <i>latch</i>	NO	Distributed locks elected by the master node. Used for distributed locks of curator
sharding:raw-latex: <i>necessary</i>	NO	The flag for re-sharding. If the total number of shards changes, or the job server node goes online or offline or enabled/disabled, as well as the master node election, the re-sharded flag will be triggered. The master node is re-sharded without being interrupted in the middle. The sharding will not be triggered when the job is executed
sharding:raw-latex:`process`	YES	The node held by the master node during sharding. If there is this node, all job execution will be blocked until the sharding ends. The ephemeral node will be deleted when the master node sharding is over or the master node crashes
failover:raw-latex: <i>items</i> :raw-latex:`shard` <i>item</i>	NO	Once a job crashes, it will record to this node. When there is an idle job server, it will grab the job items that need to failover from this node
failover:raw-latex:`items` :raw-latex: <i>latch</i>	NO	Distributed locks used when allocating failover shard items. Used by curator distributed locks

5.3 Failover

ElasticJob will not re-shard during this execution, but wait for the next scheduling before starting the re-sharding process. When the server is down during job execution, failover allows the unfinished task to be compensated and executed on another job node.

5.3.1 Concept

Failover is a temporary compensation execution mechanism for the currently executed job. When the next job is run, the current job allocation will be adjusted through resharing. For example, if the job is executed at an hourly interval, each execution will take 30 minutes. As shown below.



The figure shows that the jobs are executed at 12:00, 13:00 and 14:00 respectively. The current time point shown in the figure is the job execution at 13:00.

If one of the shard servers of the job goes down at 13:10, the remaining 20 minutes of the business that should be processed are not executed, and the next job can only be executed at 14:00. In other words, if failover is not turned on, there is a 50-minute idle period in this shard. As shown below.



After the failover is enabled, other ElasticJob servers can compensate for the execution of the sharding job after sensing the down job server. As shown below.



With sufficient resources, the job can still be executed completely at 13:30.

5.3.2 Execution mechanism

When the job execution node goes down, the failover process will be triggered. ElasticJob determines the execution timing of the failover according to the different conditions of the distributed job execution when it is triggered.

Notification execution

When other servers perceive that a failover job needs to be processed, and the job server has completed this task, it will pull the items to be failed over in real time and start compensation execution. Also called real-time execution.

Enquiry execution

After the execution of this task, the job service will inquire about the failover items to be executed from the registry, and if there are any, the compensation execution will start. Also called asynchronous execution.

5.3.3 Scenarios:

With the failover enabled, ElasticJob will monitor the execution status of each shard of the job and write it to the registry for other nodes to perceive.

In a job scenario that takes a long time to run and has a long interval, failover is an effective means to improve the real-time operation of the job; For short-interval jobs, a large number of network communications with the registry will be generated, which will affect the performance of the cluster; Moreover, short-interval jobs do not necessarily pay attention to the real-time performance of a single job. You

can use the re-shard of the next job execution to make all the items execute correctly. Therefore, it is not recommended to enable failover for short-interval jobs.

Another thing to note is that the idempotence of the job itself is a prerequisite to ensure the correctness of failover.

5.4 Misfire

ElasticJob does not allow jobs to be executed at the same time. When the execution time of a job exceeds its running interval, re-executing the missed task can ensure that the job continues to execute the overdue job after completing the last task.

5.4.1 Concept

The misfire function enables the overdue tasks to be executed immediately after the completion of the previous tasks. For example, if the job is executed at an hourly interval, each execution will take 30 minutes. As shown below.



The figure shows that the jobs are executed at 12:00, 13:00 and 14:00 respectively. The current time point shown in the figure is the job execution at 13:00.

If the job executed at 12:00 is finished at 13:10, then the job that should have been triggered by 13:00 missed the trigger time and needs to wait until the next job trigger at 14:00. As shown below.



After the misfire is enabled, ElasticJob will trigger the execution of the missed job immediately after the last job is executed. As shown below.



Missed jobs between 13:00 and 14:00 will be executed again.

5.4.2 Scenarios

In a job scenario that takes a long time to run and has a long interval, misfire is an effective means to improve the real-time operation of the job; For short-interval jobs that do not necessarily pay attention to the real-time performance of a single job, it is not necessary to turn on the misfire to re-execute.

5.5 Job Open Ecosystem

Flexible customized jobs is the most important design change in ElasticJob 3.x . The new version is based on the design concept of the Apache ShardingSphere pluggable architecture, and the new Job API was created. It is intended to enable developers to expand the types of jobs in a more convenient and isolated way, and create an ecosystem of ElasticJob jobs.

While ElasticJob provides functions such as elastic scaling and distributed management of jobs, it does not limit the types of jobs. It uses flexible job APIs to decouple jobs into job interfaces and actuator interfaces. Users can customize new job types, such as script execution, HTTP service execution, big data jobs, file jobs, etc. At present, ElasticJob has built-in simple jobs, data flow jobs, and script execution

jobs, and has completely opened up the extension interface. Developers can introduce new job types through SPI, and they can easily give back to the community.

5.5.1 Job interface

ElasticJob jobs can be divided into two types: `Class-based Jobs` and `Type-based Jobs`.

`Class-based Jobs` are directly used by developers, who need to implement the job interface to realize business logic. Typical representatives: `Simple type`, `Dataflow type`. `Type-based Jobs` only need to provide the type name, developers do not need to implement the job interface, but use it through external configuration. Typical representatives: `Script type`, `HTTP type` (Since 3.0.0-beta).

5.5.2 Actuator interface

It is used to execute user-defined job interfaces and weave into the ElasticJob ecosystem through Java's SPI mechanism.

ElasticJob is a lightweight, decentralized solution that provides distributed task sharding services.



The advantages of ElasticJob are no centralized design and less external dependence, which is suitable for business application with stable resource allocation.

6.1 Usage

This chapter will introduce the use of ElasticJob. Please refer to [Example](#) for more details.

6.1.1 Job API

ElasticJob can use for native Java, Spring Boot Starter and Spring namespace. This chapter will introduce how to use them.

Job Development

ElasticJob has two kinds of job types: Class-based job and Type-based job. Class-based jobs require developers to weave business logic by implementing interfaces; Type-based jobs don't need coding, just need to provide the corresponding configuration.

The method parameter `shardingContext` of the class-based job interface contains job configuration, slice and runtime information. Through methods such as `getShardingTotalCount()`, `getShardingItem()`, user can obtain the total number of shards, the serial number of the shards running on the job server, etc.

ElasticJob provides two class-based job types which are `Simple` and `Dataflow`; and also provides a type-based job which is `Script`. Users can extend job types by implementing the SPI interface.

Simple Job

It means simple implementation, without any encapsulation type. Need to implement `SimpleJob` interface. This interface only provides a single method for coverage, and this method will be executed periodically. It is similar to Quartz's native interface, but provides functions such as elastic scaling and slice.

```
public class MyElasticJob implements SimpleJob {

    @Override
    public void execute(ShardingContext context) {
        switch (context.getShardingItem()) {
            case 0:
                // do something by sharding item 0
                break;
            case 1:
                // do something by sharding item 1
                break;
            case 2:
                // do something by sharding item 2
                break;
            // case n: ...
        }
    }
}
```

```

    }
}

```

Dataflow Job

For processing data flow, need to implement DataflowJob interface. This interface provides two methods for coverage, which are used to fetch (fetchData) and process (processData) data.

```

public class MyElasticJob implements DataflowJob<Foo> {

    @Override
    public List<Foo> fetchData(ShardingContext context) {
        switch (context.getShardingItem()) {
            case 0:
                List<Foo> data = // get data from database by sharding item 0
                return data;
            case 1:
                List<Foo> data = // get data from database by sharding item 1
                return data;
            case 2:
                List<Foo> data = // get data from database by sharding item 2
                return data;
            // case n: ...
        }
    }

    @Override
    public void processData(ShardingContext shardingContext, List<Foo> data) {
        // process data
        // ...
    }
}

```

Streaming

Streaming can be enabled or disabled through the property `streaming.process`.

If streaming is enabled, the job will stop fetching data only when the return value of the `fetchData` method is null or the collection is empty, otherwise the job will continue to run; If streaming is disabled, the job will execute the `fetchData` and `processData` methods only once during each job execution, and then the job will be completed immediately.

If use the streaming job to process data, it is recommended to update its status after the `processData` method being executed, to avoid being fetched again by the method `fetchData`, so that the job never stops.

Script job

Support all types of scripts such as shell, python, perl. The script to be executed can be configured through the property `script.command.line`, without coding. The script path can contain parameters, after the parameters are passed, the job framework will automatically append the last parameter as the job runtime information.

The script example is as follows:

```
#!/bin/bash
echo sharding execution context is $*
```

When the job runs, it will output:

```
sharding execution context is {"jobName":"scriptElasticDemoJob","shardingTotalCount":10,"jobParameter":"","shardingItem":0,"shardingParameter":"A"}
```

HTTP job (Since 3.0.0-beta)

The http information to be requested can be configured through the properties of `http.url`, `http.method`, `http.data`, etc. Sharding information is transmitted in the form of Header, the key is `shardingContext`, and the value is in json format.

```
public class HttpJobMain {

    public static void main(String[] args) {

        new ScheduleJobBootstrap(regCenter, "HTTP", JobConfiguration.newBuilder(
            "javaHttpJob", 1)
            .setProperty(HttpJobProperties.URI_KEY, "http://xxx.com/execute")
            .setProperty(HttpJobProperties.METHOD_KEY, "POST")
            .setProperty(HttpJobProperties.DATA_KEY, "source=ejob")
            .cron("0/5 * * * * ?").shardingItemParameters("0=Beijing")).
            build()).schedule();
    }
}
```

```
@Controller
@Slf4j
public class HttpJobController {

    @RequestMapping(path = "/execute", method = RequestMethod.POST)
    public void execute(String source, @RequestHeader String shardingContext) {
        log.info("execute from source : {}, shardingContext : {}", source,
            shardingContext);
    }
}
```

When the job runs, it will output:

```
execute from source : ejob, shardingContext : {"jobName":"scriptElasticDemoJob",
"shardingTotalCount":3,"jobParameter":"","shardingItem":0,"shardingParameter":
"Beijing"}
```

Use Java API

Job configuration

ElasticJob uses the builder mode to create job configuration objects. The code example is as follows:

```
JobConfiguration jobConfig = JobConfiguration.newBuilder("myJob", 3).cron("0/5 * *
* * ?").shardingItemParameters("0=Beijing,1=Shanghai,2=Guangzhou").build();
```

Job start

ElasticJob scheduler is divided into two types: timed scheduling and one-time scheduling. Each scheduler needs three parameters: registry configuration, job object (or job type), and job configuration when it starts.

Timed scheduling

```
public class JobDemo {

    public static void main(String[] args) {
        // Class-based Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createJobConfiguration()).schedule();
        // Type-based Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), "MY_TYPE",
createJobConfiguration()).schedule();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        CoordinatorRegistryCenter regCenter = new ZookeeperRegistryCenter(new
ZookeeperConfiguration("zk_host:2181", "elastic-job-demo"));
        regCenter.init();
        return regCenter;
    }

    private static JobConfiguration createJobConfiguration() {
        // Create job configuration
        ...
    }
}
```

```

    }
}

```

One-Off scheduling

```

public class JobDemo {

    public static void main(String[] args) {
        OneOffJobBootstrap jobBootstrap = new
OneOffJobBootstrap(createRegistryCenter(), new MyJob(), createJobConfiguration());
        // One-time scheduling can be called multiple times
        jobBootstrap.execute();
        jobBootstrap.execute();
        jobBootstrap.execute();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        CoordinatorRegistryCenter regCenter = new ZookeeperRegistryCenter(new
ZookeeperConfiguration("zk_host:2181", "elastic-job-demo"));
        regCenter.init();
        return regCenter;
    }

    private static JobConfiguration createJobConfiguration() {
        // Create job configuration
        ...
    }
}

```

Job Dump

Using ElasticJob may meet some distributed problem which is not easy to observe.

Because of developer can not debug in production environment, ElasticJob provide dump command to export job runtime information for debugging.

Please refer to [Operation Manual](#) for more details.

The example below is how to configure spring namespace for open listener port to dump.

```

public class JobMain {

    public static void main(final String[] args) {
        SnapshotService snapshotService = new SnapshotService(regCenter, 9888).
listen();
    }
}

```

```
private static CoordinatorRegistryCenter createRegistryCenter() {
    // create registry center
}
}
```

Configuration error handler strategy

In the process of using ElasticJob, when the job is abnormal, the following error handling strategies can be used.

Error handler strategy name	Description	Built-in*	Default*	Extra config
Log Strategy	Log error and do not interrupt job	Yes	Yes	
Throw Strategy	Throw system exception and interrupt job	Yes		
Ignore Strategy	Ignore exception and do not interrupt job	Yes		
Email Notification Strategy	Send email message notification and do not interrupt job			Yes
Wechat Enterprise Notification Strategy	Send wechat message notification and do not interrupt job			Yes
Dingtalk Notification Strategy	Send dingtalk message notification and do not interrupt job			Yes

Log Strategy

```
public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
```

```

createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of log strategy
        return JobConfiguration.newBuilder("myScheduleJob", 3).cron("0/5 * * * * ?")
            .jobErrorHandlerType("LOG").build();
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of log strategy
        return JobConfiguration.newBuilder("myOneOffJob", 3).jobErrorHandlerType("LOG").build();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        // create registry center
        ...
    }
}

```

Throw Strategy

```

public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
            createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
            createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of throw strategy.
        return JobConfiguration.newBuilder("myScheduleJob", 3).cron("0/5 * * * * ?")
            .jobErrorHandlerType("THROW").build();
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of throw strategy
        return JobConfiguration.newBuilder("myOneOffJob", 3).jobErrorHandlerType("THROW").build();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {

```



```

        // create registry center
        ...
    }
}

```

Ignore Strategy

```

public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of ignore strategy.
        return JobConfiguration.newBuilder("myScheduleJob", 3).cron("0/5 * * * * ?
").jobErrorHandlerType("IGNORE").build();
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of ignore strategy.
        return JobConfiguration.newBuilder("myOneOffJob", 3).jobErrorHandlerType(
"IGNORE").build();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        // create registry center.
        ...
    }
}

```

Email Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```

<dependency>
    <groupId>org.apache.shardingsphere.elasticjob</groupId>
    <artifactId>elasticjob-error-handler-email</artifactId>

```

```
<version>${latest.release.version}</version>
</dependency>
```

```
public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of email notification
strategy.
        JobConfiguration jobConfig = JobConfiguration.newBuilder("myScheduleJob",
3).cron("0/5 * * * * ?").jobErrorHandlerType("EMAIL").build();
        setEmailProperties(jobConfig);
        return jobConfig;
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of email notification
strategy.
        JobConfiguration jobConfig = JobConfiguration.newBuilder("myOneOffJob", 3).
jobErrorHandlerType("EMAIL").build();
        setEmailProperties(jobConfig);
        return jobConfig;
    }

    private static void setEmailProperties(final JobConfiguration jobConfig) {
        // Set the mail configuration.
        jobConfig.getProps().setProperty(EmailPropertiesConstants.HOST, "host");
        jobConfig.getProps().setProperty(EmailPropertiesConstants.PORT, "465");
        jobConfig.getProps().setProperty(EmailPropertiesConstants.USERNAME,
"username");
        jobConfig.getProps().setProperty(EmailPropertiesConstants.PASSWORD,
"password");
        jobConfig.getProps().setProperty(EmailPropertiesConstants.FROM, "from@xxx.
xx");
        jobConfig.getProps().setProperty(EmailPropertiesConstants.TO, "to1@xxx.xx,
to1@xxx.xx");
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
```

```

        // create registry center.
        ...
    }
}

```

Wechat Enterprise Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```

<dependency>
    <groupId>org.apache.shardingsphere.elasticjob</groupId>
    <artifactId>elasticjob-error-handler-wechat</artifactId>
    <version>${latest.release.version}</version>
</dependency>

```

```

public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs.
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs.
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of wechat enterprise
notification strategy.
        JobConfiguration jobConfig = JobConfiguration.newBuilder("myScheduleJob",
3).cron("0/5 * * * * ?").jobErrorHandlerType("WECHAT").build();
        setWechatProperties(jobConfig);
        return jobConfig;
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of wechat enterprise
notification strategy.
        JobConfiguration jobConfig = JobConfiguration.newBuilder("myOneOffJob", 3).
jobErrorHandlerType("WECHAT").build();
        setWechatProperties(jobConfig);
        return jobConfig;
    }
}

```

```
private static void setWechatProperties(final JobConfiguration jobConfig) {
    // Set the configuration for the enterprise wechat.
    jobConfig.getProps().setProperty(WechatPropertiesConstants.WEBHOOK, "you_
webhook");
}

private static CoordinatorRegistryCenter createRegistryCenter() {
    // create registry center.
    ...
}
}
```

Dingtalk Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-dingtalk</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

```
public class JobDemo {

    public static void main(String[] args) {
        // Scheduling Jobs.
        new ScheduleJobBootstrap(createRegistryCenter(), new MyJob(),
createScheduleJobConfiguration()).schedule();
        // One-time Scheduling Jobs.
        new OneOffJobBootstrap(createRegistryCenter(), new MyJob(),
createOneOffJobConfiguration()).execute();
    }

    private static JobConfiguration createScheduleJobConfiguration() {
        // Create scheduling job configuration, and the use of dingtalk
notification strategy.
        JobConfiguration jobConfig = JobConfiguration.newBuilder("myScheduleJob",
3).cron("0/5 * * * * ?").jobErrorHandlerType("DINGTALK").build();
        setDingtalkProperties(jobConfig);
        return jobConfig;
    }

    private static JobConfiguration createOneOffJobConfiguration() {
        // Create one-time job configuration, and the use of dingtalk notification
}
```

```

strategy.
    JobConfiguration jobConfig = JobConfiguration.newBuilder("myOneOffJob", 3).
jobErrorHandlerType("DINGTALK").build();
    setDingtalkProperties(jobConfig);
    return jobConfig;
}

private static void setDingtalkProperties(final JobConfiguration jobConfig) {
    // Set the configuration of the dingtalk.
    jobConfig.getProps().setProperty(DingtalkPropertiesConstants.WEBHOOK, "you_
webhook");
    jobConfig.getProps().setProperty(DingtalkPropertiesConstants.KEYWORD, "you_
keyword");
    jobConfig.getProps().setProperty(DingtalkPropertiesConstants.SECRET, "you_
secret");
}

private static CoordinatorRegistryCenter createRegistryCenter() {
    // create registry center.
    ...
}
}

```

Use Spring Boot Starter

ElasticJob provides a customized Spring Boot Starter, which can be used in conjunction with Spring Boot. Developers are free from configuring CoordinatorRegistryCenter, JobBootstrap by using ElasticJob Spring Boot Starter. What developers need to solve distributed scheduling problem are job implementations with a little configuration.

The following content is only demonstrated through Spring Boot 3. The relevant content may still be valid on Spring Boot 2, but since Spring Boot 2 has ended maintenance, no availability assumptions are made for Spring Boot 2.

Job configuration

Implements ElasticJob

Job implementation is similar to other usage of ElasticJob. The difference is that jobs will be registered into the Spring IoC container.

Thread-Safety Issue

Bean is singleton by default. Consider setting Bean Scope to prototype if the instance of ElasticJob would be used by more than a JobBootstrap.

```
@Component
public class SpringBootDataflowJob implements DataflowJob<Foo> {

    @Override
    public List<Foo> fetchData(final ShardingContext shardingContext) {
        // fetch data
    }

    @Override
    public void processData(final ShardingContext shardingContext, final List<Foo>
data) {
        // process data
    }
}
```

Configure CoordinateRegistryCenter and Jobs

Configure the Zookeeper which will be used by ElasticJob via configuration files.

elasticjob.jobs is a Map. Using key as job name. Specific job type and configuration in value. The Starter will create instances of OneOffJobBootstrap or ScheduleJobBootstrap and register them into the Spring IoC container automatically.

Configuration reference:

```
elasticjob:
  regCenter:
    serverLists: localhost:6181
    namespace: elasticjob-springboot
  jobs:
    dataflowJob:
      elasticJobClass: org.apache.shardingsphere.elasticjob.dataflow.job.
DataflowJob
      cron: 0/5 * * * * ?
      shardingTotalCount: 3
      shardingItemParameters: 0=Beijing,1=Shanghai,2=Guangzhou
    scriptJob:
      elasticJobType: SCRIPT
      cron: 0/10 * * * * ?
      shardingTotalCount: 3
      props:
        script.command.line: "echo SCRIPT Job: "
```

Job Start

Schedule Job

Just start Spring Boot Starter directly. The schedule jobs will startup when the Spring Boot Application is started.

One-off Job

When to execute OneOffJob is up to you. Developers can inject the OneOffJobBootstrap bean into where they plan to invoke. Trigger the job by invoking `execute()` method manually.

Users should not use annotations such as `jakarta.annotation.Resource` which partially violate Spring Boot best practices to inject Spring beans that define one-time tasks.

The bean name of OneOffJobBootstrap is specified by property “`jobBootstrapBeanName`”, Please refer to [Spring Boot Starter Configuration](#).

```
elasticjob:
  jobs:
    myOneOffJob:
      elasticJobType: SCRIPT
      jobBootstrapBeanName: myOneOffJobBean
      shardingTotalCount: 9
      props:
        script.command.line: "echo Manual SCRIPT Job: "
```

```
import org.apache.shardingsphere.elasticjob.bootstrap.type.OneOffJobBootstrap;
import org.springframework.beans.factory.ObjectProvider;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;

import java.util.Objects;

@RestController
public class OneOffJobController {
    // 通过 "@Autowired" 注入
    @Autowired
    @Qualifier("myOneOffJobBean")
    private ObjectProvider<OneOffJobBootstrap> myOneOffJobProvider;

    @GetMapping("/execute2")
    public String executeOneOffJob2() {
        OneOffJobBootstrap myOneOffJob = myOneOffJobProvider.getIfAvailable();
        Objects.requireNonNull(myOneOffJob);
        myOneOffJob.execute();
    }
}
```

```
        return "{\"msg\":\"OK\"}";
    }
}
```

Configuration error handler strategy

In the process of using ElasticJob, when the job is abnormal, the following error handling strategies can be used.

Error handler strategy name	Description	Built-in*	Default*	Extra config*
Log Strategy	Log error and do not interrupt job	Yes	Yes	
Throw Strategy	Throw system exception and interrupt job	Yes		
Ignore Strategy	Ignore exception and do not interrupt job	Yes		
Email Notification Strategy	Send email message notification and do not interrupt job			Yes
Wechat Enterprise Notification Strategy	Send wechat message notification and do not interrupt job			Yes
Dingtalk Notification Strategy	Send dingtalk message notification and do not interrupt job			Yes

Log Strategy

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: LOG
```


Throw Strategy

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: THROW
```

Ignore Strategy

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: IGNORE
```

Email Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-email</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: EMAIL
  props:
    email:
      host: host
      port: 465
      username: username
      password: password
      useSsl: true
      subject: ElasticJob error message
      from: from@xxx.xx
      to: to1@xxx.xx,to2@xxx.xx
```

```
cc: cc@xxx.xx
bcc: bcc@xxx.xx
debug: false
```

Wechat Enterprise Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-wechat</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: WECHAT
  props:
    wechat:
      webhook: you_webhook
      connectTimeout: 3000
      readTimeout: 5000
```

Dingtalk Notification Strategy

Please refer to [here](#) for more details.

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-dingtalk</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

```
elasticjob:
  regCenter:
    ...
  jobs:
    ...
  jobErrorHandlerType: DINGTALK
```

```

props:
  dingtalk:
    webhook: you_webhook
    keyword: you_keyword
    secret: you_secret
    connectTimeout: 3000
    readTimeout: 5000

```

Use Spring Namespace

ElasticJob provides a custom Spring namespace, which can be used with the Spring. Through the way of DI (Dependency Injection), developers can easily use data sources and other objects that managed by the Spring container in their jobs, and use placeholders to get values from property files.

Job Configuration

```

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:elasticjob="http://shardingsphere.apache.org/schema/elasticjob"
  xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.
xsd
    http://shardingsphere.apache.org/schema/elasticjob
    http://shardingsphere.apache.org/schema/elasticjob/
elasticjob.xsd
    ">
  <!-- Configure registry center for job -->
  <elasticjob:zookeeper id="regCenter" server-lists="yourhost:2181" namespace=
"my-job" base-sleep-time-milliseconds="1000" max-sleep-time-milliseconds="3000"
max-retries="3" />

  <!-- Configure job java bean -->
  <bean id="myJob" class="xxx.MyJob">
    <property name="fooService" ref="xxx.FooService" />
  </bean>

  <!-- Configure job scheduler base on java bean -->
  <elasticjob:job id="${myJob.id}" job-ref="myJob" registry-center-ref="regCenter
" sharding-total-count="${myJob.shardingTotalCount}" cron="${myJob.cron}" />

  <!-- Configure job scheduler base on type -->
  <elasticjob:job id="${myScriptJob.id}" job-type="SCRIPT" registry-center-ref=
"regCenter" sharding-total-count="${myScriptJob.shardingTotalCount}" cron="$
{myScriptJob.cron}">
    <props>

```

```

        <prop key="script.command.line">${myScriptJob.scriptCommandLine}</prop>
    </props>
</elasticjob:job>
</beans>

```

Job Start

Schedule Job

If the Spring container start, the XML that configures the Spring namespace will be loaded, and the job will be automatically started.

One-off Job

When to execute OneOffJob is up to you. Developers can inject the OneOffJobBootstrap bean into where they plan to invoke. Trigger the job by invoking `execute()` method manually.

```

<bean id="oneOffJob" class="org.apache.shardingsphere.elasticjob.kernel.example.
job.simple.SpringSimpleJob"/>
<elasticjob:job id="oneOffJobBean" job-ref="oneOffJob" ... />

```

```

public final class SpringMain {
    public static void main(final String[] args) {
        ClassPathXmlApplicationContext context = new
ClassPathXmlApplicationContext("classpath:META-INF/application-context.xml");
        OneOffJobBootstrap oneOffJobBootstrap = context.getBean("oneOffJobBean",
OneOffJobBootstrap.class);
        oneOffJobBootstrap.execute();
    }
}

```

Job Dump

Using ElasticJob may meet some distributed problem which is not easy to observe.

Because of developer can not debug in production environment, ElasticJob provide dump command to export job runtime information for debugging.

Please refer to [Operation Manual](#) for more details.

The example below is how to configure SnapshotService for open listener port to dump.

```

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:elasticjob="http://shardingsphere.apache.org/schema/elasticjob"

```

```

        xsi:schemaLocation="http://www.springframework.org/schema/beans
                           http://www.springframework.org/schema/beans/spring-
beans.xsd
                           http://shardingsphere.apache.org/schema/elasticjob
                           http://shardingsphere.apache.org/schema/elasticjob/
elasticjob.xsd
        ">
        <!--Create registry center -->
        <elasticjob:zookeeper id="regCenter" server-lists="yourhost:2181" namespace=
"dd-job" base-sleep-time-milliseconds="1000" max-sleep-time-milliseconds="3000"
max-retries="3" />

        <!--Configure the task snapshot export service -->
        <elasticjob:snapshot id="jobSnapshot" registry-center-ref="regCenter" dump-
port="9999" />
</beans>

```

Configuration error handler strategy

In the process of using ElasticJob, when the job is abnormal, the following error handling strategies can be used.

Error handler strategy name	Description	Built-in*	Default*	Extra config
Log Strategy	Log error and do not interrupt job	Yes	Yes	
Throw Strategy	Throw system exception and interrupt job	Yes		
Ignore Strategy	Ignore exception and do not interrupt job	Yes		
Email Notification Strategy	Send email message notification and do not interrupt job			Yes
Wechat Enterprise Notification Strategy	Send wechat message notification and do not interrupt job			Yes
Dingtalk Notification Strategy	Send dingtalk message notification and do not interrupt job			Yes

The following example shows how to configure the error-handling policy through the Spring namespace.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:elasticjob="http://shardingsphere.apache.org/schema/elasticjob"
       xsi:schemaLocation="http://www.springframework.org/schema/beans
                           http://www.springframework.org/schema/beans/spring-
beans.xsd
                           http://shardingsphere.apache.org/schema/elasticjob
                           http://shardingsphere.apache.org/schema/elasticjob/
elasticjob.xsd"
       ">
  <!-- Log Strategy -->
  <elasticjob:job ... job-error-handler-type="LOG" />

  <!-- Throw Strategy -->
  <elasticjob:job ... job-error-handler-type="THROW" />

  <!-- Ignore Strategy -->
  <elasticjob:job ... job-error-handler-type="IGNORE" />

  <!-- Email Notification Strategy -->
  <elasticjob:job ... job-error-handler-type="EMAIL">
    <props>
      <prop key="email.host">${host}</prop>
      <prop key="email.port">${port}</prop>
      <prop key="email.username">${username}</prop>
      <prop key="email.password">${password}</prop>
      <prop key="email.useSsl">${useSsl}</prop>
      <prop key="email.subject">${subject}</prop>
      <prop key="email.from">${from}</prop>
      <prop key="email.to">${to}</prop>
      <prop key="email.cc">${cc}</prop>
      <prop key="email.bcc">${bcc}</prop>
      <prop key="email.debug">${debug}</prop>
    </props>
  </elasticjob:job>

  <!-- Wechat Enterprise Notification Strategy -->
  <elasticjob:job ... job-error-handler-type="WECHAT">
    <props>
      <prop key="wechat.webhook">${webhook}</prop>
      <prop key="wechat.connectTimeoutMilliseconds">${
{connectTimeoutMilliseconds}</prop>
      <prop key="wechat.readTimeoutMilliseconds">${readTimeoutMilliseconds}</
prop>
    </props>
```

```

</elasticjob:job>

<!-- Dingtalk Notification Strategy -->
<elasticjob:job ... job-error-handler-type="DINGTALK">
    <props>
        <prop key="dingtalk.webhook">${webhook}</prop>
        <prop key="dingtalk.keyword">${keyword}</prop>
        <prop key="dingtalk.secret">${secret}</prop>
        <prop key="dingtalk.connectTimeoutMilliseconds">${
{connectTimeoutMilliseconds}</prop>
        <prop key="dingtalk.readTimeoutMilliseconds">${readTimeoutMilliseconds}
</prop>
    </props>
</elasticjob:job>
</beans>

```

6.1.2 Job Listener

ElasticJob provides job listeners, which are used to perform monitoring methods before and after task execution. Listeners are divided into regular listeners executed by each job node and distributed listeners executed by only a single node in a distributed scenario. This chapter will introduce how to use them in detail.

After the job dependency (DAG) function is developed, the job listener function may be considered to be deleted.

Listener Development

Common Listener

If the job processes the files of the job server and deletes the files after the processing is completed, consider using each node to perform the cleaning task. This type of task is simple to implement, and there is no need to consider whether the global distributed task is completed. You should try to use this type of listener.

```

public class MyJobListener implements ElasticJobListener {

    @Override
    public void beforeJobExecuted(ShardingContexts shardingContexts) {
        // do something ...
    }

    @Override
    public void afterJobExecuted(ShardingContexts shardingContexts) {
        // do something ...
    }
}

```

```

@Override
public String getType() {
    return "simpleJobListener";
}
}

```

Distributed Listener

If the job processes database data, only one node needs to complete the data cleaning task after the processing is completed. This type of task is complicated to process and needs to synchronize the status of the job in a distributed environment. Timeout settings are provided to avoid deadlocks caused by job out of sync. It should be used with caution.

```

public class MyDistributeOnceJobListener extends
AbstractDistributeOnceElasticJobListener {

    public TestDistributeOnceElasticJobListener(long startTimeoutMills, long
completeTimeoutMills) {
        super(startTimeoutMills, completeTimeoutMills);
    }

    @Override
    public void doBeforeJobExecutedAtLastStarted(ShardingContexts shardingContexts)
    {
        // do something ...
    }

    @Override
    public void doAfterJobExecutedAtLastCompleted(ShardingContexts
shardingContexts) {
        // do something ...
    }

    @Override
    public String getType() {
        return "distributeOnceJobListener";
    }
}

```


Add SPI implementation

Put `JobListener` implementation to module `infra-common`, `resources/META-INF/services/org.apache.shardingsphere.elasticjob.infra.listener.ElasticJobListener`

Use Java API

Common Listener

```
public class JobMain {

    public static void main(String[] args) {
        new ScheduleJobBootstrap(createRegistryCenter(), createJobConfiguration()).
            schedule();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        CoordinatorRegistryCenter regCenter = new ZookeeperRegistryCenter(new
            ZookeeperConfiguration("zk_host:2181", "elastic-job-demo"));
        regCenter.init();
        return regCenter;
    }

    private static JobConfiguration createJobConfiguration() {
        JobConfiguration jobConfiguration = JobConfiguration.newBuilder("test", 2)
            .jobListenerTypes("simpleListener",
                "distributedListener").build();
    }
}
```

Distributed Listener

```
public class JobMain {

    public static void main(String[] args) {
        new ScheduleJobBootstrap(createRegistryCenter(), createJobConfiguration()).
            schedule();
    }

    private static CoordinatorRegistryCenter createRegistryCenter() {
        CoordinatorRegistryCenter regCenter = new ZookeeperRegistryCenter(new
            ZookeeperConfiguration("zk_host:2181", "elastic-job-demo"));
        regCenter.init();
        return regCenter;
    }
}
```

```

private static JobConfiguration createJobConfiguration() {
    JobConfiguration jobConfiguration = JobConfiguration.newBuilder("test", 2)
        .jobListenerTypes("simpleListener",
            "distributeListener").build();
}
}

```

Use Spring Namespace

Listener configuration

```

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:elasticjob="http://shardingsphere.apache.org/schema/elasticjob"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.
xsd
        http://shardingsphere.apache.org/schema/elasticjob
        http://shardingsphere.apache.org/schema/elasticjob/
elasticjob.xsd
        ">
    <!-- Configuration job registration center -->
    <elasticjob:zookeeper id="regCenter" server-lists="yourhost:2181" namespace=
"my-job" base-sleep-time-milliseconds="1000" max-sleep-time-milliseconds="3000"
max-retries="3" />

    <!-- Configuration Job Bean -->
    <bean id="myJob" class="xxx.MyJob" />

    <elasticjob:job id="${myJob.id}" job-ref="myJob" registry-center-ref="regCenter
" sharding-total-count="3" cron="0/1 * * * * ?" job-listener-types=
"simpleJobListener,distributeOnceJobListener">
    </elasticjob:job>
</beans>

```

Job start

The xml that configures the Spring namespace is started through Spring, and the job will be automatically loaded.

6.1.3 Tracing

ElasticJob provides a tracing function, which can handle important events in the scheduling process through event subscription for query, statistics and monitor. Now, the event subscription based on relation database is provided to record events, and developers can also extend it through SPI.

Use Java API

ElasticJob currently provides `TracingConfiguration` based on database in the configuration. Developers can also extend it through SPI.

```
// init DataSource
DataSource dataSource = ...;
// define tracing configuration based on relation database
TracingConfiguration tracingConfig = new TracingConfiguration<>("RDB",
dataSource);
// init registry center
CoordinatorRegistryCenter regCenter = ...;
// init job configuration
JobConfiguration jobConfig = ...;
jobConfig.getExtraConfigurations().add(tracingConfig);
new ScheduleJobBootstrap(regCenter, jobConfig).schedule();
```

Use Spring Boot Starter

ElasticJob Spring Boot Starter has already integrated `TracingConfiguration` configuration. What developers need to do is register a bean of `DataSource` into the Spring IoC Container and set the type of data source. Then the Starter will create an instance of `TracingConfiguration` and register it into the container.

Import Maven Dependency

Import `spring-boot-starter-jdbc` for `DataSource` register or create a bean of `DataSource` manually.

```
<dependency>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-starter-jdbc</artifactId>
  <version>${springboot.version}</version>
</dependency>
```

Configuration

```
spring:
  datasource:
    url: jdbc:h2:mem:job_event_storage
    driver-class-name: org.h2.Driver
    username: sa
    password:

elasticjob:
  tracing:
    type: RDB
```

Job Start

TracingConfiguration will be registered into the IoC container imperceptibly after setting tracing type to RDB. If elasticjob-spring-boot-starter was imported, developers need to do nothing else. The instances of JobBootstrap will use the TracingConfiguration automatically.

Use Spring Namespace

Import Maven Dependency

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-spring-namespace</artifactId>
  <version>${elasticjob.latest.version}</version>
</dependency>
```

Configuration

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:elasticjob="http://shardingsphere.apache.org/schema/elasticjob"
  xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.
xsd
    http://shardingsphere.apache.org/schema/elasticjob
    http://shardingsphere.apache.org/schema/elasticjob/
elasticjob.xsd
    ">
  <!-- Configure registry center for job -->
  <elasticjob:zookeeper id="regCenter" server-lists="yourhost:2181" namespace=
```

```
"my-job" base-sleep-time-milliseconds="1000" max-sleep-time-milliseconds="3000"
max-retries="3" />

<!-- Configure job java bean -->
<bean id="myJob" class="xxx.MyJob" />

<!-- Configure DataSource -->
<bean id="tracingDataSource" class="com.zaxxer.hikari.HikariDataSource"
destroy-method="close">
    <property name="driverClassName" value="${driver.class.name}" />
    <property name="jdbcUrl" value="${url}" />
    <property name="username" value="${username}" />
    <property name="password" value="${password}" />
</bean>
<!-- Configure event tracing -->
<elasticjob:rdb-tracing id="elasticJobTrace" data-source-ref=
"elasticJobTracingDataSource" />

<!-- Configure job -->
<elasticjob:job id="${myJob.id}" job-ref="myJob" registry-center-ref="regCenter
" tracing-ref="elasticJobTrace" sharding-total-count="3" cron="0/1 * * * * ?" />
</beans>
```

Job Start

If the Spring container start, the XML that configures the Spring namespace will be loaded, and the job will be automatically started.

Table Structure

The database which is the value of the event tracing property `event_trace_rdb_url` will automatically create two tables `JOB_EXECUTION_LOG` and `JOB_STATUS_TRACE_LOG` and several indexes.

JOB_EXECUTION_LOG Columns

Column name	Column type	Required	Describe
id	VARCHAR(40)	Yes	Primary key
job_name	VARCHAR(100)	Yes	Job name
task_id	VARCHAR(1000)	Yes	Task name, create new tasks every time the job runs.
hostname	VARCHAR(255)	Yes	Hostname
ip	VARCHAR(50)	Yes	IP
sharding_item	INT	Yes	Sharding item
execution_source	VARCHAR(20)	Yes	Source of job execution. The value options are NORMAL_TRIGGER, MISFIRE, FAILOVER.
failure_cause	VARCHAR(2000)	No	The reason for execution failure
is_success	BIT	Yes	Execute successfully or not
start_time	TIME STAMP	Yes	Job start time
complete_time	TIME STAMP	No	Job end time

JOB_EXECUTION_LOG records the execution history of each job. There are two steps:

1. When the job is executed, program will create one record in the JOB_EXECUTION_LOG, and all fields except failure_cause and complete_time are not empty.
2. When the job completes execution, program will update the record, update the columns of is_success, complete_time and failure_cause(if the job execution fails).

JOB_STATUS_TRACE_LOG Columns

Column name	Column type	Required	Describe
id	VARCHAR (40)	Yes	Primary key
job_name	VARCHAR (100)	Yes	Job name
original_task_id	VARCHAR (100)	Yes	Original task name
task_id	VARCHAR (100)	Yes	Task name
slave_id	VARCHAR (100)	Yes	Server's name of executing the job. The value is server's IP.
execution_type	VARCHAR (20)	Yes	Type of job execution, the value options are NORMAL_TRIGGER, MISFIRE, FAILOVER.
sharding_item	VARCHAR (255)	Yes	Collection of sharding item, multiple sharding items are separated by commas.
state	VARCHAR (20)	Yes	State of job execution, the value options are TASK_STAGING, TASK_RUNNING, TASK_FINISHED, TASK_KILLED, TASK_LOST, TASK_FAILED, TASK_ERROR.
message	VARCHAR (200)	Yes	Message
creation_time	TIMESTAMP	Yes	Create time

JOB_STATUS_TRACE_LOG record the job status changes. Through the task_id of each job, user can query the life cycle and running track of the job status change.

6.1.4 Operation API

ElasticJob provides a Java API, which can control the life cycle of jobs in a distributed environment by directly operating the registry.

The module is still in incubation.

Configuration API

Class name: `org.apache.shardingsphere.elasticjob.lifecycle.api.JobConfigurationAPI`

Get job configuration

Method signature: `YamlJobConfiguration getJobConfiguration(String jobName)`

- **Parameters:**
 - `jobName` —Job name
- **Returns:** Job configuration object

Update job configuration

Method signature: `void updateJobConfiguration(YamlJobConfiguration yamlJobConfiguration)`

- **Parameters:**
 - `jobConfiguration` —Job configuration object

Remove job configuration

Method signature: `void removeJobConfiguration(String jobName)`

- **Parameters:**
 - `jobName` —Job name

Operation API

Class name: `org.apache.shardingsphere.elasticjob.lifecycle.api.JobOperateAPI`

Trigger job execution

The job will only trigger execution if it does not conflict with the currently running job, and this flag will be automatically cleared after it is started.

Method signature: `void trigger(Optional jobName, Optional serverIp)`

- **Parameters:**

- `jobName` —Job name
- `serverIp` —IP address of the job server

Disable job

Disabling a job will cause other distributed jobs to trigger resharding.

Method signature: `void disable(Optional jobName, Optional serverIp)`

- **Parameters:**

- `jobName` —Job name
- `serverIp` —job server IP address

Enable job

Method signature: `void enable(Optional jobName, Optional serverIp)`

- **Parameters:**

- `jobName` —Job name
- `serverIp` —job server IP address

Shutdown scheduling job

Method signature: `void shutdown(Optional jobName, Optional serverIp)`

- **Parameters:**

- `jobName` —Job name
- `serverIp` —IP address of the job server

Remove job

Method signature: `void remove(Optional jobName, Optional serverIp)`

- **Parameters:**

- `jobName` —Job name
- `serverIp` —IP address of the job server

Operate sharding API

Class `ShardingOperateAPI` name: `org.apache.shardingsphere.elasticjob.lifecycle.api.`

Disable job sharding

Method signature: `void disable(String jobName, String item)`

- **Parameters:**

- `jobName` —Job name
- `item` —Job sharding item

Enable job sharding

Method signature: `void enable(String jobName, String item)`

- **Parameters:**

- `jobName` —Job name
- `item` —Job sharding item

Job statistics API

Class `JobStatisticsAPI` name: `org.apache.shardingsphere.elasticjob.lifecycle.api.`

Get the total count of jobs

Method signature: `int getJobsTotalCount()`

- **Returns:** the total count of jobs

Get brief job information

Method signature: `JobBriefInfo getJobBriefInfo(String jobName)`

- **Parameters:**
 - `jobName` —Job name
- **Returns:** The brief job information

Get brief information about all jobs.

Method signature: `Collection getAllJobsBriefInfo()`

- **Returns:** Brief collection of all job information

Get brief information of all jobs under this IP

Method signature: `Collection getJobsBriefInfo(String ip)`

- **Parameters:**
 - `ip` —server IP
- **Returns:** Brief collection of job information

Job server status display API

Class `org.apache.shardingsphere.elasticjob.lifecycle.api.ServerStatisticsAPI`

Total count of job servers

Method signature: `int getServersTotalCount()`

- **Returns:** Get the total count of job servers

Get brief information about all job servers

Method signature: `Collection getAllServersBriefInfo()`

- **Returns:** Brief collection of job information

Job sharding status display API

Class name: `org.apache.shardingsphere.elasticjob.lifecycle.api.ShardingStatisticsAPI`

Get job sharding information collection

Method signature: `Collection getShardingInfo(String jobName)`

- **Parameters:**
 - `jobName` —Job name
- **Returns:** The collection of job sharding information

6.2 Configuration

Through which developers can quickly and clearly understand the functions provided by ElasticJob.

This chapter is a configuration manual for ElasticJob, which can also be referred to as a dictionary if necessary.

ElasticJob has provided 3 kinds of configuration methods for different situations.

6.2.1 Registry Center Configuration

Configuration

Name	Data Type	Default Value	Description
<code>serverLists</code>	String		ZooKeeper server IP list
<code>namespace</code>	String		ZooKeeper namespace
<code>baseSleepTimeMilliseconds</code>	int	1000	The initial value of milliseconds for the retry interval
<code>maxSleepTimeMilliseconds</code>	String	3000	The maximum value of milliseconds for the retry interval
<code>maxRetries</code>	String	3	Maximum number of retries
<code>sessionTimeoutMilliseconds</code>	int	60000	Session timeout in milliseconds
<code>connectionTimeoutMilliseconds</code>	int	15000	Connection timeout in milliseconds
<code>digest</code>	String	no need	Permission token to connect to ZooKeeper

Core Configuration Description

serverLists:

Include IP and port, multiple addresses are separated by commas, such as: host1:2181,host2:2181

6.2.2 Job Configuration

Configuration

Name	Data Type	Default Value	Description
jobName	String		Job name
shardingTotalCount	int		Sharding total count
cron	String		CRON expression, control the job trigger time
timeZone	String		time zone of CRON
shardingItemParameters	String		Sharding item parameters
jobParameter	String		Job parameter
monitorExecution	boolean	true	Monitor job execution status
failover	boolean	false	Enable or disable job failover
misfire	boolean	true	Enable or disable the missed task to re-execute
maxTimeDiffSeconds	int	1 (no check)	The maximum value for time difference between server and registry center in seconds
reconcileIntervalMinutes	int	10	Service scheduling interval in minutes for repairing job server inconsistent state
jobShardingStrategyType	String	AVG_LOCATION	Job sharding strategy type
jobExecutorThreadPoolSizeProvider	String	CPU	Job thread pool handler type
jobErrorHandlerType	String		Job error handler type
description	String		Job description
props	Properties		Job properties
disabled	boolean	false	Enable or disable start the job
overwrite	boolean	false	Enable or disable local configuration override registry center configuration

Core Configuration Description

shardingItemParameters:

The sequence numbers and parameters of the Sharding items are separated by equal sign, and multiple key-value pairs are separated by commas. The Sharding sequence number starts from 0 and can't be greater than or equal to the total number of job fragments. For example: 0=a, 1=b, 2=c

jobParameter:

With this parameter, user can pass parameters for the business method of job scheduling, which is used to implement the job with parameters. For example: Amount of data acquired each time, Primary key of the job instance read from the database, etc.

monitorExecution:

When the execution time and interval of each job are very short, it is recommended not to monitor the running status of the job to improve efficiency. There is no need to monitor because it is a transient state. User can add data accumulation monitoring by self. And there is no guarantee that the data will be selected repeatedly, idempotency should be achieved in the job. If the job execution time and interval time are longer, it is recommended to monitor the job status, and it can guarantee that the data will not be selected repeatedly.

maxTimeDiffSeconds:

If the time error exceeds the configured seconds, an exception will be thrown when the job starts.

reconcileIntervalMinutes:

In a distributed system, due to network, clock and other reasons, ZooKeeper may be inconsistent with the actual running job. This inconsistency cannot be completely avoided through positive verification. It is necessary to start another thread to periodically calibrate the consistency between the registry center and the job status, that is, to maintain the final consistency of ElasticJob.

Less than 1 means no repair is performed.

jobShardingStrategyType:

For details, see [Job Sharding Strategy](#).

jobExecutorThreadPoolSizeProviderType:

For details, see [Thread Pool Strategy](#).

jobErrorHandlerType:

For details, see [Error Handler Strategy](#).

props:

For details, see [Job Properties](#).

disabled:

It can be used for deployment, forbid jobs to start, and then start them uniformly after the deployment is completed.

overwrite:

If the value is true, local configuration override registry center configuration every time the job is started.

6.2.3 Job Listener Configuration

Common Listener Configuration

Configuration: no

Distributed Listener Configuration

Configuration

Name	Data Type	Default Value	Description
started-timeout-milliseconds	unsigned long	Long.MAX_VALUE	The timeout in milliseconds before the last job is executed
completed-timeout-milliseconds	unsigned long	Long.MAX_VALUE	The timeout in milliseconds after the last job is executed

6.2.4 Event Tracing Configuration

Configuration

Name	Data Type	Default Value	Description
type	String		The type of event tracing storage adapter
storage	Generics Type		The object of event tracing storage adapter

6.2.5 Java API

Registry Center Configuration

The component which is used to register and coordinate the distributed behavior of jobs, currently only supports ZooKeeper.

Class name: `org.apache.shardingsphere.elasticjob.reg.zookeeper.ZookeeperConfiguration`

Configuration:

Name	Constructor injection
serverLists	Yes
namespace	Yes
baseSleepTimeMilliseconds	No
maxSleepTimeMilliseconds	No
maxRetries	No
sessionTimeoutMilliseconds	No
connectionTimeoutMilliseconds	No
digest	No

Job Configuration

Class name: `org.apache.shardingsphere.elasticjob.api.JobConfiguration`

Configuration:

Name	Constructor injection
jobName	Yes
shardingTotalCount	Yes
cron	No
timeZone	No
shardingItemParameters	No
jobParameter	No
monitorExecution	No
failover	No
misfire	No
maxTimeDiffSeconds	No
reconcileIntervalMinutes	No
jobShardingStrategyType	No
jobExecutorThreadPoolSizeProvider	No
jobErrorHandlerType	No
jobListenerTypes	No
description	No
props	No
disabled	No
overwrite	No

6.2.6 Spring Boot Starter

To use the Spring boot, user need to add the dependency of the `elasticjob-spring-boot-starter` module in the `pom.xml` file.

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-spring-boot-starter</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

Registry Center Configuration

Prefix: `elasticjob.reg-center`

Configuration:

Property name	Required
<code>server-lists</code>	Yes
<code>namespace</code>	Yes
<code>base-sleep-time-milliseconds</code>	No
<code>max-sleep-time-milliseconds</code>	No
<code>max-retries</code>	No
<code>session-timeout-milliseconds</code>	No
<code>connection-timeout-milliseconds</code>	No
<code>digest</code>	No

Reference:

YAML

```
elasticjob:
  regCenter:
    serverLists: localhost:6181
    namespace: elasticjob-springboot
```

Properties

```
elasticjob.reg-center.namespace=elasticjob-springboot
elasticjob.reg-center.server-lists=localhost:6181
```

Job Configuration

Prefix: elasticjob.jobs

Configuration:

Property name	Required
elasticJobClass / elasticJobType	Yes
cron	No
timeZone	No
jobBootstrapBeanName	No
sharding-total-count	Yes
sharding-item-parameters	No
job-parameter	No
monitor-execution	No
failover	No
misfire	No
max-time-diff-seconds	No
reconcile-interval-minutes	No
job-sharding-strategy-type	No
job-executor-service-handler-type	No
job-error-handler-type	No
job-listener-types	No
description	No
props	No
disabled	No
overwrite	No

“elasticJobClass” and “elasticJobType” are mutually exclusive.

If cron was configured, the job will be created as a ScheduleJobBootstrap. The Starter will start scheduling when application is ready. Otherwise, the job will be created as a OneOffJobBootstrap with a name specified by “jobBootstrapBeanName” . It requires manual injection and execution.

Reference:

YAML

```
elasticjob:
  jobs:
    simpleJob:
      elasticJobClass: org.apache.shardingsphere.elasticjob.kernel.example.job.
SpringBootSimpleJob
      cron: 0/5 * * * * ?
      timeZone: GMT+08:00
      shardingTotalCount: 3
      shardingItemParameters: 0=Beijing,1=Shanghai,2=Guangzhou
    scriptJob:
```

```

elasticJobType: SCRIPT
cron: 0/10 * * * * ?
shardingTotalCount: 3
props:
  script.command.line: "echo SCRIPT Job: "
manualScriptJob:
  elasticJobType: SCRIPT
  jobBootstrapBeanName: manualScriptJobBean
  shardingTotalCount: 9
  props:
    script.command.line: "echo Manual SCRIPT Job: "

```

Properties

```

elasticjob.jobs.simpleJob.elastic-job-class=org.apache.shardingsphere.elasticjob.
kernel.example.job.SpringBootSimpleJob
elasticjob.jobs.simpleJob.cron=0/5 * * * * ?
elasticjob.jobs.simpleJob.timeZone=GMT+08:00
elasticjob.jobs.simpleJob.sharding-total-count=3
elasticjob.jobs.simpleJob.sharding-item-parameters=0=Beijing,1=Shanghai,2=Guangzhou
elasticjob.jobs.scriptJob.elastic-job-type=SCRIPT
elasticjob.jobs.scriptJob.cron=0/5 * * * * ?
elasticjob.jobs.scriptJob.sharding-total-count=3
elasticjob.jobs.scriptJob.props.script.command.line=echo SCRIPT Job:
elasticjob.jobs.manualScriptJob.elastic-job-type=SCRIPT
elasticjob.jobs.manualScriptJob.job-bootstrap-bean-name=manualScriptJobBean
elasticjob.jobs.manualScriptJob.sharding-total-count=3
elasticjob.jobs.manualScriptJob.props.script.command.line=echo Manual SCRIPT Job:

```

Event Trace Configuration

Prefix: elasticjob.tracing

Property name	Options	Required	Description
type	RDB	No	
includeJobNames		No	allow list of job
excludeJobNames		No	block list of job

“includeJobNames” and “excludeJobNames” are mutually exclusive.

Load all Job When “includeJobNames” and “excludeJobNames” are null.

RDB is the only supported type at present. If Spring IoC container contained a bean of DataSource and RDB was set in configuration, an instance of TracingConfiguration will be created automatically.

Reference:

YAML

```
elasticjob:
  tracing:
    type: RDB
    excludeJobNames: [ job-name-1, job-name-2 ]
```

Properties

```
elasticjob.tracing.type=RDB
elasticjob.tracing.excludeJobNames=[ job-name ]
```

Dump Job Info Configuration

Prefix: elasticjob.dump

Property name	Default value	Required
enabled	true	No
port		Yes

Designate a port as dump port in configurations. The Spring Boot Starter will enable dumping automatically. If the port for job dump was missing, dump won't be enabled.

Reference:

YAML

```
elasticjob:
  dump:
    port: 9888
```

Properties

```
elasticjob.dump.port=9888
```

6.2.7 Spring Namespace

To use the Spring namespace, user need to add the dependency of the elasticjob-spring module in the pom.xml file.

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-spring-namespace</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

Spring namespace: <http://shardingsphere.apache.org/schema/elasticjob/elasticjob.xsd>

Registry Center Configuration

<elasticjob:zookeeper />

Configuration:

Name	Required
id	Yes
server-lists	Yes
namespace	Yes
base-sleep-time-milliseconds	No
max-sleep-time-milliseconds	No
max-retries	No
session-timeout-milliseconds	No
connection-timeout-milliseconds	No
digest	No

Job Configuration

<elasticjob:job />

Configuration:

Name	Required
id	Yes
class	No
job-ref	No
registry-center-ref	Yes
tracing-ref	No
cron	Yes
timeZone	No
sharding-total-count	Yes
sharding-item-parameters	No
job-parameter	No
monitor-execution	No
failover	No
misfire	No
max-time-diff-seconds	No
reconcile-interval-minutes	No
job-sharding-strategy-type	No
job-executor-service-handler-type	No
job-error-handler-type	No
description	No
props	No
disabled	No
overwrite	No

Event Tracing Configuration

<elasticjob:rdb-tracing />

Configuration:

Name	Data Type	Re quired	Default Value	Description
id	S tring	Yes		The bean' s identify of the event tracing
data-so urce-ref	DataS ource	No		The bean' s name of the event tracing Data-Source

Job Dump Configuration

<elasticjob:snapshot />

Configuration:

Name	Data Type	Required	Default Value	Description
id	String	Yes		The identify of the monitoring service in the Spring container
registry-center-ref	String	Yes		Registry center bean's reference, need to the statement of the reg:zookeeper
dump-port	String	Yes		Job dump portusage: echo "dump@jobName" nc 127.0.0.1 9888

6.2.8 Built-in Strategy

Introduction

ElasticJob allows developers to implement strategies via SPI; At the same time, ElasticJob also provides a couple of built-in strategies for simplify developers.

Usage

The built-in strategies are configured by type. This chapter distinguishes and lists all the built-in strategies of ElasticJob according to its functions for developers' reference.

Job Sharding Strategy

Average Allocation Strategy

Type: AVG_ALLOCATION

Sharding or average by sharding item.

If the job server number and sharding count cannot be divided, the redundant sharding item that cannot be divided will be added to the server with small sequence number in turn.

For example: 1. If there are 3 job servers and the total sharding count is 9, each job server is divided into: 1=[0,1,2], 2=[3,4,5], 3=[6,7,8]; 2. If there are 3 job servers and the total sharding count is 8, each job server is divided into: 1=[0,1,6], 2=[2,3,7], 3=[4,5]; 3. If there are 3 job servers and the total sharding count is 10, each job server is divided into: 1=[0,1,2,9], 2=[3,4,5], 3=[6,7,8].

Odevity Strategy

Type: ODEVITY

Sharding for hash with job name to determine IP asc or desc.

IP address asc if job name' hashCode is odd; IP address desc if job name' hashCode is even. Used to average assign to job server.

For example: 1. If there are 3 job servers with 2 sharding item, and the hash value of job name is odd, then each server is divided into: 1 = [0], 2 = [1], 3 = []; 2. If there are 3 job servers with 2 sharding item, and the hash value of job name is even, then each server is divided into: 3 = [0], 2 = [1], 1 = [].

Round Robin Strategy

Type: ROUND_ROBIN

Sharding for round robin by name job.

Thread Pool Strategy

CPU Resource Strategy

Type: CPU

Use CPU available processors * 2 to create thread pool.

Single Thread Strategy

Type: SINGLE_THREAD

Use single thread to execute job.

Error Handler Strategy

Log Strategy

Type: LOG

Built-in: Yes

Log error and do not interrupt job.

Throw Strategy

Type: THROW

Built-in: Yes

Throw system exception and interrupt job.

Ignore Strategy

Type: IGNORE

Built-in: Yes

Ignore exception and do not interrupt job.

Email Notification Strategy

Type: EMAIL

Built-in: No

Send email message notification and do not interrupt job.

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-email</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

Configuration:

Name	Description	Required	Default Value
email.host	Email server host address	Yes	.
email.port	Email server port	Yes	.
email.username	Email server username	Yes	.
email.password	Email server password	Yes	.
email.useSsl	Whether to enable SSL encrypted transmission	No	true
email.subject	Email Subject	No	ElasticJob error message
email.from	Sender email address	Yes	.
email.to	Recipient's email address	Yes	.
email.cc	Carbon copy email address	No	null
email.bcc	Blind carbon copy email address	No	null
email.debug	Whether to enable debug mode	No	false

Wechat Enterprise Notification Strategy

Type: WECHAT

Built-in: No

Send wechat message notification and do not interrupt job

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-wechat</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

Configuration:

Name	Description	Required	Default Value
wechat.webhook	The webhook address of the wechat robot	Yes	.
wechat.connectTimeoutMilliseconds	The timeout period for establishing a connection with the wechat server	No	3000 milliseconds
wechat.readTimeoutMilliseconds	The timeout period for reading available resources from the wechat server	No	5000 milliseconds

Dingtalk Notification Strategy

Type: DINGTALK

Built-in: No

Send dingtalk message notification and do not interrupt job

Maven POM:

```
<dependency>
  <groupId>org.apache.shardingsphere.elasticjob</groupId>
  <artifactId>elasticjob-error-handler-dingtalk</artifactId>
  <version>${latest.release.version}</version>
</dependency>
```

Configuration:

Name	Description	Required	Default Value
dingtalk.webhook	The webhook address of the dingtalk robot	Yes	.
dingtalk.keyword	Custom keywords	No	null
dingtalk.secret	Secret for dingtalk robot	No	null
dingtalk.connectTimeoutMilliseconds	The timeout period for establishing a connection with the dingtalk server	No	3000 milliseconds
dingtalk.readTimeoutMilliseconds	The timeout period for reading available resources from the dingtalk server	No	5000 milliseconds

6.2.9 Job Properties

Introduction

ElasticJob provide customized configurations for different types of jobs through the way of attribute configuration.

Job Type

Simple Job

Interface name: `org.apache.shardingsphere.elasticjob.simple.job.SimpleJob`

Configuration: no

Dataflow Job

Interface name: `org.apache.shardingsphere.elasticjob.dataflow.job.DataflowJob`

Configuration:

<i>Name</i>	<i>Data Type</i>	<i>Description</i>	<i>Default Value</i>
streaming.process	boolean	Enable or disable Streaming	false

Script Job

Type: SCRIPT

Configuration:

<i>Name</i>	<i>Data Type</i>	<i>Description</i>	<i>Default Value</i>
script.command.line	String	Script content or path	.

HTTP Job

Type: HTTP

Configuration:

Name	Data Type	Description	Default Value
http.uri	String	http request uri	.
http.method	String	http request method	.
http.data	String	http request data	.
http.connect.timeout.milliseconds	String	http connect timeout	3000
http.read.timeout.milliseconds	String	http read timeout	5000
http.content.type	String	http content type	.

6.2.10 GraalVM Native Image

Background information

ElasticJob has been verified for availability under GraalVM Native Image.

To build a GraalVM Native Image with the Maven dependency `org.apache.shardingsphere.elasticjob:elasticjob-bootstrap:${elasticjob.version}`, you need to use GraalVM Native Build Tools.

GraalVM Native Build Tools provides Maven Plugin and Gradle Plugin to simplify the long-winded shell commands of GraalVM CE's `native-image` command line tool.

ElasticJob requires the following or higher versions of GraalVM CE to build the GraalVM Native Image. Users can quickly switch JDKs through SDKMAN!. This also applies to downstream distributions of GraalVM CE such as <https://sdkman.io/jdks#graal>, <https://sdkman.io/jdks#nik> and <https://sdkman.io/jdks#mandrel>.

- GraalVM CE For JDK 22.0.2, corresponding to `22.0.2-graalce` of SDKMAN!

Users can still use old versions of GraalVM CE such as `21.0.2-graalce` on SDKMAN! to build ElasticJob's GraalVM Native Image product. ElasticJob does not set CI for GraalVM CE versions that have stopped maintenance.

Using ElasticJob's Java API

Maven Ecosystem

Users need to actively use the GraalVM Reachability Metadata Central Repository. The following configuration is for reference. To configure additional Maven Profiles for the project, refer to the documentation of GraalVM Native Build Tools.

```
<project>
  <dependencies>
    <dependency>
      <groupId>org.apache.shardingsphere.elasticjob</groupId>
      <artifactId>elasticjob-bootstrap</artifactId>
      <version>${elasticjob.version}</version>
      <scope>test</scope>
    </dependency>
  </dependencies>

  <build>
    <plugins>
      <plugin>
        <groupId>org.graalvm.buildtools</groupId>
        <artifactId>native-maven-plugin</artifactId>
        <version>0.10.2</version>
        <extensions>true</extensions>
        <executions>
          <execution>
            <id>build-native</id>
            <goals>
              <goal>compile-no-fork</goal>
            </goals>
            <phase>package</phase>
          </execution>
          <execution>
            <id>test-native</id>
            <goals>
              <goal>test</goal>
            </goals>
            <phase>test</phase>
          </execution>
        </executions>
      </plugin>
    </plugins>
  </build>
</project>
```

Gradle Ecosystem

Users need to actively use the GraalVM Reachability Metadata Central Repository. The following configuration is for reference. To configure additional Gradle Tasks for the project, refer to the documentation of GraalVM Native Build Tools. Due to the limitations of <https://github.com/gradle/gradle/issues/17559>, users need to introduce the Metadata Repository JSON file in the form of Maven dependencies. Refer to <https://github.com/graalvm/native-build-tools/issues/572>.

```
plugins {
    id 'org.graalvm.buildtools.native' version '0.10.2'
}

dependencies {
    implementation 'org.apache.shardingsphere.elasticjob:elasticjob-bootstrap:${elasticjob.version}'
    implementation(group: 'org.graalvm.buildtools', name: 'graalvm-reachability-metadata', version: '0.10.2', classifier: 'repository', ext: 'zip')
}

graalvmNative {
    metadataRepository {
        enabled.set(false)
    }
}
```

For build tools such as sbt that are not supported by GraalVM Native Build Tools

Such requirements require opening additional issues at <https://github.com/graalvm/native-build-tools> and providing plugin implementations for the corresponding build tools.

Usage restrictions

1. Users still need to configure GraalVM Reachability Metadata in separate files in the `src/main/resources/META-INF/native-image` folder or the `src/test/resources/META-INF/native-image` folder. Users can quickly collect GraalVM Reachability Metadata through the GraalVM Tracing Agent of GraalVM Native Build Tools.
2. For `org.apache.shardingsphere.elasticjob.bootstrap.type.ScheduleJobBootstrap` with `elasticJobType` as `SCRIPT` under Linux, if `script.command.line` is set to the relative path of a `.sh` file in the private project's classpath under the GraalVM Native Image when building the GraalVM Native Image, then the `.sh` file must at least have the POSIX file permission of `rw-r-xr-x` set in advance. This is because `com.oracle.svm.core.jdk.resources.NativeImageResourceFileSystem` obviously does not support `java.nio.file.attribute.PosixFileAttributeView`. Long story short, users should avoid including logic like the following in their jobs,


```
import java.io.IOException;
import java.net.URL;
import java.nio.file.Files;
import java.nio.file.Path;
import java.nio.file.Paths;
import java.nio.file.attribute.PosixFilePermissions;

public class ExampleUtils {
    public void setPosixFilePermissions() throws IOException {
        URL resource = ExampleUtils.class.getResource("/script/demo.sh");
        assert resource != null;
        Path path = Paths.get(resource.getPath());
        Files.setPosixFilePermissions(path, PosixFilePermissions.fromString("rwxr-xr-x"));
    }
}
```

3. WeCom Notification Policy, DingTalk Notification Policy, and Email Notification Policy are not yet available under GraalVM Native Image.
4. The Spring namespace integration module `org.apache.shardingsphere.elasticjob:elasticjob-spring-namespace` of ElasticJob is not yet available under GraalVM Native Image.
5. The Spring Boot Starter integration module `org.apache.shardingsphere.elasticjob:elasticjob-spring-boot-starter` for ElasticJob is not yet available under GraalVM Native Image.

Contribute GraalVM Reachability Metadata

ElasticJob's usability verification under GraalVM Native Image is done by the Maven Plugin subproject of GraalVM Native Build Tools.

Unit test coverage under GraalVM Native Image is tested by running unit tests under JVM, tagging unit tests with `junit-platform-unique-ids*`, and then building GraalVM Native Image for `nativeTest`. Contributors are requested not to use test libraries such as `io.kotest:kotest-runner-junit5-jvm:5.5.4` that failed to discover tests in `test listener` mode.

ElasticJob defines the `elasticjob-test-native` Maven Module to provide a small subset of unit tests for native Test, which avoids the use of third-party libraries such as Mockito that cannot be used under native Test.

ElasticJob defines the `nativeTestInElasticJob` Maven profile to execute `nativeTest` for the `elasticjob-test-native` module.

Assuming the contributor is on a fresh Ubuntu 22.04.4 LTS instance, he can use SDKMAN! to manage JDK and toolchains with the following bash command, and execute `nativeTest` for the `elasticjob-test-native` submodule.

Contributors must install Docker Engine to execute the testcontainers-java related unit tests.

```
sudo apt install unzip zip curl sed -y
curl -s "https://get.sdkman.io" | bash
source "$HOME/.sdkman/bin/sdkman-init.sh"
sdk install java 22.0.2-graalce
sdk use java 22.0.2-graalce
sudo apt-get install build-essential zlib1g-dev -y

git clone git@github.com:apache/shardingsphere-elasticjob.git
cd ./shardingsphere-elasticjob/
./mvnw -PnativeTestInElasticJob -T1C -e clean test
```

When contributors find that GraalVM Reachability Metadata for third-party libraries not related to ElasticJob is missing, they should open a new issue at <https://github.com/oracle/graalvm-reachability-metadata>, and submit a PR with missing GraalVM Reachability Metadata for dependent third-party libraries. ElasticJob proactively hosts GraalVM Reachability Metadata for some third-party libraries in the elasticjob-reachability-metadata submodule.

If nativeTest fails, generate preliminary GraalVM Reachability Metadata for unit tests, and manually adjust the contents of the META-INF/native-image/org.apache.shardingsphere.elasticjob/elasticjob-reachability-metadata/ folder in the classpath of the elasticjob-reachability-metadata submodule to fix nativeTest. If necessary, use the org.junit.jupiter.api.condition.DisabledInNativeImage annotation or the org.graalvm.nativeimage.imagecode.System Property to shield some unit tests from running under the GraalVM Native Image.

ElasticJob defines the generateMetadata Maven Profile to execute unit tests with the GraalVM Tracing Agent under the GraalVM JIT Compiler, and generates or overwrites the existing GraalVM Reachability Metadata file in the META-INF/native-image/org.apache.shardingsphere.elasticjob/generated-reachability-metadata/ folder in the classpath of the elasticjob-reachability-metadata submodule. This process can be easily handled by the following bash command. Contributors may still need to manually adjust specific JSON entries and adjust the filter chain of the Maven Profile and GraalVM Tracing Agent as appropriate. For the elasticjob-reachability-metadata submodule, manually added, deleted, and modified JSON entries should be located in the META-INF/native-image/org.apache.shardingsphere.elasticjob/elasticjob-reachability-metadata/ folder, while the entries in META-INF/native-image/org.apache.shardingsphere.elasticjob/generated-reachability-metadata/ should only be generated by the generateMetadata Maven Profile.

The following command is just an example of generating Conditional GraalVM Reachability Metadata for elasticjob-test-native. The generated GraalVM Reachability Metadata is located in the elasticjob-reachability-metadata submodule.

For GraalVM Reachability Metadata used independently by test classes and test files, contributors should place it in the classpath of the shardingsphere-test-native submodule under META-INF/native-image/elasticjob-test-native-test-metadata/.

```
git clone git@github.com:apache/shardingsphere.git
cd ./shardingsphere/
./mvnw -PgenerateMetadata -DskipNativeTests -e -T1C clean test native:metadata-copy
```

6.3 Operation

This chapter is an operation manual for ElasticJob.

6.3.1 Deploy Guide

Application deployment

1. Start the ZooKeeper of the ElasticJob designated registry.
2. Run the jar file containing ElasticJob and business code. It is not limited to the startup mode of jar or war.
3. When the job server is configured with multiple network cards, the network card address can be specified by setting the system variable `elasticjob.preferred.network.interface` or specify network addresses by setting the system variable `elasticjob.preferred.network.ip`. ElasticJob obtains the first non-loopback available IPV4 address in the network card list by default.

Operation and maintenance platform and RESTful API deployment (optional)

1. Unzip `elasticjob-console-${version}.tar.gz` and execute `bin\start.sh`.
2. Open the browser and visit `http://localhost:8899/` to access the console. 8899 is the default port number. You can customize the port number by entering `-p` through the startup script.
3. The method of accessing RESTful API is the same as the console.
4. `elasticjob-console-${version}.tar.gz` can be obtained by compiling `mvn install`.

6.3.2 Dump Job Information

Using ElasticJob may meet some distributed problem which is not easy to observe.

Because of developer cannot debug in production environment, ElasticJob provide dump command to export job runtime information for debugging.

For security reason, the information dumped had already mask sensitive information, it instead of real IP address to `ip1`, `ip2` ...

Open Listener Port

To open listener port using Java, refer to [Java API job information export configuration](#). To open listener port using Spring Boot Starter, refer to [Spring Boot Starter job information export configuration](#). To open listener port using Spring Namespace, refer to [Spring namespace job information export configuration](#).

Execute Dump

Dump to stdout

```
echo "dump@jobName" | nc <job server IP address> 9888
```

```
[chris:elastic-job]echo "dump" | nc localhost 9888
/simpleElasticJob/servers |
/simpleElasticJob/servers/ip1 |
/simpleElasticJob/servers/ip1/status | READY
/simpleElasticJob/servers/ip1/sharding | 0,1,2,3,4,5,6,7,8,9
/simpleElasticJob/servers/ip1/hostname | localhost
/simpleElasticJob/leader |
/simpleElasticJob/leader/sharding |
/simpleElasticJob/leader/execution |
/simpleElasticJob/leader/election |
/simpleElasticJob/leader/election/latch |
/simpleElasticJob/leader/election/host | ip1
/simpleElasticJob/config |
/simpleElasticJob/config/shardingTotalCount | 10
/simpleElasticJob/config/shardingItemParameters | 0=A,1=B,2=C,3=D,4=E,5=F,6=G,7=H,8=I,9=J
/simpleElasticJob/config/processCountIntervalSeconds | 300
/simpleElasticJob/config/monitorPort | 9888
/simpleElasticJob/config/monitorExecution | false
/simpleElasticJob/config/misfire | true
/simpleElasticJob/config/maxTimeDiffSeconds | -1
/simpleElasticJob/config/jobShardingStrategyClass |
/simpleElasticJob/config/jobParameter |
/simpleElasticJob/config/jobClass | com.dangdang.example.elasticjob.spring.job.SimpleJobDemo
/simpleElasticJob/config/fetchDataCount | 1
/simpleElasticJob/config/failover | true
/simpleElasticJob/config/description | 只运行一次的作业示例
/simpleElasticJob/config/cron | 0/5 * * * * ?
/simpleElasticJob/config/concurrentDataProcessThreadCount | 1
```

Dump to file

```
echo "dump@jobName" | nc <job server IP address> 9888 > job_debug.txt
```

6.3.3 Execution Monitor

By monitoring several key nodes in the zookeeper registry of ElasticJob, the job running status monitoring function can be completed.

Monitoring job server alive

Listen for the existence of node `job_name:raw-latex:instances:raw-latex:\job_instance_id`. This node is a temporary node. If the job server is offline, the node will be deleted.

6.3.4 Console

Unzip `elasticjob-console-${version}.tar.gz` and execute `bin\start.sh`. Open the browser and visit `http://localhost:8899/` to access the console. 8899 is the default port number. You can customize the port number by entering `-p` through the startup script.

Log in

The console provides two types of accounts: administrator and guest. The administrator has all operation rights, and the visitors only have the viewing rights. The default administrator user name and password are `root/root`, and the guest user name and password are `guest/guest`. You can modify the administrator and guest user names and passwords through `conf\application.properties`.

```
auth.root_username=root
auth.root_password=root
auth.guest_username=guest
auth.guest_password=guest
```

Login with Casdoor

The console have integrated [Casdoor](#). We can choose it for SSO.

Step1: Deploy Casdoor

Casdoor code in GitHub: <https://github.com/casdoor/casdoor>

Here a example for development mode. [More](#)

Backend

```
go run main.go
```

Frontend


```
cd web
yarn install
yarn start
```

Step2:Configure Casdoor

Name: ShardingSphere

Display name: ShardingSphere

Logo: URL: https://cdn.casbin.org/img/casdoor-logo_1185x256.png

Preview: 

Home: /

Description:




Organization: ShardingSphere

Client ID: 3ed79fa530645fbd3653

Client secret: 54633c82b7796a4332c6976864c616bc3b05556


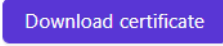
Cert: cert-built-in

Redirect URLs:

Redirect URL	Action
http://localhost:8080	  

RedirectURLs is depend on what url you need redirect.The selected data will use in next.

2.On the certificate editing page, you can see your Certificate

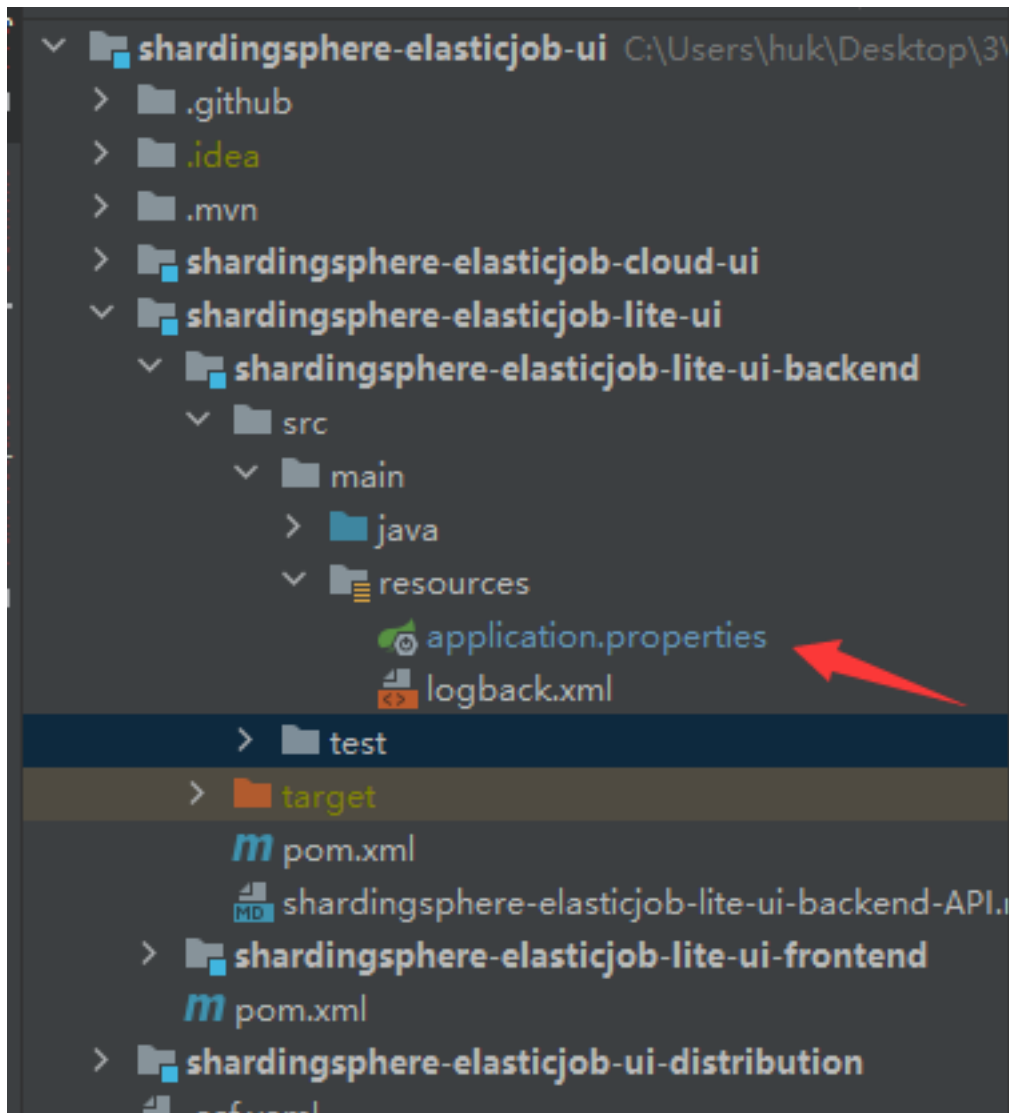
Certificate:  

Private

```
-----BEGIN CERTIFICATE-----
MIIE+TCCAUGAwIBAgIDAeJAMA0GCSqGSIb3DQEBCwUAMDYxHTAbBgNVBAoTFENh
c2Rvb3I3IjYw5pemF0aW9uMRUwEwYDVQQDEwxDYXNkb29yIENicnQwHhcNMjEx
MDE1MDgxMTUyWWhcNDE1MDgxMTUyWjA2MR0wGwYDVQQKEwRDXNkb29yIE9y
Z2FuaXphdGlvbjEVMBMGA1UEAxMMQ2FzZG9vciBDZXJ0MIIICjANBgkqhkiG9w0B
AQEFAAOCAg8AMIICCGKCAgEAsInpb5E1/ym0f1RfDSSE8IR7y+lw+RjI74e5ej
rq4b8zMYk7HeHCyZr/hmNEwEVXnhXu1P0mBeQ5ypp/QGo8vgEmjAETNmzkl1NjOQ
CjCYwUrasO/f/Mnl1C0j13vx6mV1kHZjSrKsMhYY1vaxTEP3+VB8Hjg3MHFWrb07
uvFMCJe5W8+0rKErZCKTR8+9VB3janeBz//zQePFVh79bFZate/hLirPK0Go9P1g
OvwloC1A3sarHTP4Qm/LQRt0rHqZFybdySpyWAQvhNaDFE7mTstRSBb/wUjNCUBD
PTSLVJC04WII5f6Nkfx0Z7KvmbPstSj+btvcqsvRAGtvdsB9h62Kptjs1Yn7GAuo
l3qt/4zoKbiURYxkQJXlwwCQsEftUuk5ew5zuPSIDRL0LByQTLbx0JqLAFNfW3g/
pzSDjgd/60d6HTmbvZni4SmjdyFhXCdb1Kn7N+xTojnfaNkwep2REV+RMc0fx4Gu
hRsnLsmkmUDeylZ9aBL9oj11YEQfM2JZEQ+RVtUx+wB4y8K/tD1bcY+IfnG5rBpw
IDpS262boq4SR5vb3Z7bB0w4ZxvOfJ/1VLoRftjPbLif0bhfr/AeZMHpIKOXvfz4
yE+hqzi68wdF0VR9xYc/RbSAf7323OsjYnjEglnUtRohnRgCpjlK/Mt2Kt84Kb0
wn8CAwEAAAMQMA4wDAYDVR0TAQH/BAIwADANBgkqhkiG9w0BAQsFAAOCAgEAn2If
DKKLX+F1vKRO/5gJ+Plr8P5NkuQkmwH97b8CS2gS1phDyNglc4/Lsdzuf4Awe6ve
C06IVdWSlis8UPUPdjmT2uMPSNjwLxG3QsrinMURNwFILTfRem/heJe0Zgur9J1M
8haawdSdJjH2RgmFoDeE2r8NVRfhhR8KnCO1ddTJKuS1N0/irHz21W4jt4rxzCvI
2nR42Fybap3O/g2JXMhNNR0wZmNjgpf7XVENCSuFO1jTywLaqjuXCg54IL7XVLG
omKNNNcc8h1FCeKj/nnbGMhodnFWKDTsJcbNmOPNH06ixzqMy/Hqc+mWYv7maAG
Jtevs3qgMZ8F9Qzr3HpUc6R3ZYYWDY/xxPisuKftOPZgtH979XC4mdf0WPnOBLqL
2DJ1za8mjiGJolvb7XNVKcUfDXYw85ZTZQ5b9cll4e+6bmyWqQltlwt+Ati/uFEV
XzCj70B4IALX6xau1kLEpV9O1GERizYRz5P9NJNA7KoO5AVMp9w0DQkt+LbXnZE
HHnWKy8xHQKZF9sR7YBPGLs/Ac6tviv5Ua15OgJ/8dLRZ/veyFfGo2yZsl+hKVU5
nCCJHBcAyFnm1hdvdeH33jDBjNB6ciotJZrf/3VYalWSalADosHagMWfXuWP+h
8XKXmzlXuHbTMQYtZPDgspS5aK+S4Q9wb8RRAYo=
-----END CERTIFICATE-----
```

Step3:Configure application in ShardingSphere

First we need find the application.properties we need configure



Second we need copy the data in Casdoor application and paste them into application.


```

casdoor.endpoint=http://localhost:7001
casdoor.client-id=3ed79fa530645fbd3653
casdoor.client-secret=54633c82b7796a4332c6976864c6c16bc3b05556
casdoor.certificate=\
-----BEGIN CERTIFICATE-----\n\
MIE+TCCAuGgAwIBAgIDAeJAMA0GCSqGSIb3DQEBwUAMDYxHTAbBgNVBAoTFENh\n\
c2Rvb3IgT3JnYW5pemF0aW9uMRUwEwYDVQQDEwxDYXNkb29yIENlcjQwHhcNMjEx\n\
MDE1MDgxMTUyWhcNNDE1MDgxMTUyWjA2MR0wGwYDVQQKEwR0YXNkb29yIE9y\n\
Z2FuaXphdGlvbjEVMBMGA1UEAxMMQ2FzZG9vcjB0ZXJ0MIICIjANBgkqhkiG9w0B\n\
AQEFAAOCAG8AMIICCGKCAgEAsInpb5E1/ym0f1RfSDSSE8IR7y+Lw+RJjI74e5ej\n\
rq4b8zMYk7HeHCyZr/hmNEwEVXnhXu1P0mBeQ5ypp/QGo8vgEmjAETNmzkI1Nj0Q\n\
CjCYwUras0/f/MnI1C0j13vx6mV1kHZjSrKsMhYY1vaxTEP3+VB8Hjg3MHFWrb07\n\
uvFMCJe5W8+0rKERZCKTR8+9VB3janeBz//zQePFVh79bFZate/hLirPK0Go9P1g\n\
0vwIoC1A3sarHTP4Qm/LQRt0rHqZFybdySpyWAQvNaDFE7mTstRSBb/wUjNCUBD\n\
PTSLVjC04WLLSf6Nkfx0Z7KvmbPstSj+btvcgsvRAGtvdsB9h62Kptjs1Yn7GAuo\n\
I3qt/4zoKb1URYxkQJXIvwCQSEftUuk5ew5zuPSLDRLoLByQTLbx0JqLAFNFW3g/\n\
pzSDjgd/60d6HTnvbZni4SmjdyFhXCdb1Kn7N+xTojnfANkweP2REV+RMcfx4Gu\n\
hRsnLsmkmUDeYIZ9aBL9oj11YEQfM2JZEq+RVtUx+wB4y8K/tD1bcY+IfnG5rBpw\n\
IDpS262boq4SRsVb3Z7bB0w4Zxv0fJ/1VLoRfttjPbLIfohhfr/AeZMHpIK0Xvfz4\n\
yE+hqzj68wDF0VR9xYc/RbSAf73230sjYnjJEGInUtRohnRgCpjIk/Mt2Kt84Kb0\n\
wn8CAwEAAMQMA4wDAYDVR0TAQH/BAIwADANBgkqhkiG9w0BAQsFAAOCAGeAn2lf\n\
DKKLX+F1vKR0/5gJ+Plr8P5NKuQkmwH97b8CS2gS1phDyNgIc4/LSdzuf4Awe6ve\n\
C06lVdWSIis8UPUPdjmT2uMPSNjwLxG3QsrImMURNwFLLTfRem/heJe0Zgur9J1M\n\
8awdSdJjH2RgmFoDeE2r8NVRfhhR8Knc01ddTJKuS1N0/irHz21W4jt4rxzCvL\n\
2nR42FybaP30/g2JXMhNNR0wZmNjgPsF7XVENCsUf01jTywLagjuXCg54IL7XVLG\n\
omKNNcc8h1FCeKj/nnbGMhodnFWKDTsJcbNmcOPNH06ixzqMy/Hqc+mWYv7maAG\n\
Jtevs3qgMZ8F9Qzr3HpUc6R3ZYWDY/xxPisuKft0PZgtH979XC4mdf0WPn0BLqL\n\
2DJ1zaBmji6JoLvb7XNVKcUfDXyw85ZTZQ5b9cLI4e+6bmyWqQItlwt+Ati/uFEV\n\
Xzcj70B4LALX6xau1kLEpV901GERizYRz5P9NJA7Ko05AVMp9w0DQkt+LbXnZE\n\
HHnWKy8xHQKZF9sR7YBPGLs/Ac6tvi5Ua150gJ/8dLRZ/veyFf6o2yZsI+hKVU5\n\
nCCJHBCAyFnm1hdvduEdH33jDBjNB6ciotJZrf/3VYaIWSaLADosHAgMWfXuWP+h\n\
8XKXmzlxuHbTMQYtZPDgspS5aK+S4Q9wb8RRAYo=\n\
-----END CERTIFICATE-----
casdoor.organization-name=ShardingSphere
casdoor.application-name=ShardingSphere

```

Now we can use it

Function list

- Login security control
- Registration center, event tracking data source management
- Quickly modify job settings
- View job and server dimension status
- Operational job disable/enable, stop and delete life cycle
- Event tracking query

Design concept

The operation and maintenance platform has no direct relationship with ElasticJob. It displays the job status by reading the job registration center data, or updating the registration center data to modify the global configuration.

The console can only control whether the job itself is running, but it cannot control the start of the job process, because the console and the job server are completely separated, and the console cannot control the job server.

Unsupported item

- Add assignment

The job will be automatically added the first time it runs. ElasticJob is started as a jar and has no job distribution function.

ElasticJob provides dozens of SPI based extensions. it is very convenient to customize the functions for developers.

This chapter lists all SPI extensions of ElasticJob. If there is no special requirement, users can use the built-in implementation provided by ElasticJob; advanced users can refer to the interfaces for customized implementation.

ElasticJob community welcomes developers to feed back their implementations to the [open-source community](#), so that more users can benefit from it.

7.1 Job Sharding Strategy

Job Sharding Strategy, used to sharding job to distributed tasks.

<i>SPI Name</i>	<i>Description</i>
JobShardingStrategy	Job sharding strategy

<i>Implementation Class</i>	<i>Description</i>
AverageAllocationJobShardingStrategy	Sharding or average by sharding item
OrderSortByNameJobShardingStrategy	Sharding for hash with job name to determine IP asc or desc
RotateServerByNameJobShardingStrategy	Sharding for round robin by name job

7.2 Thread Pool Strategy

Thread pool strategy, used to create thread pool for job execution.

<i>SPI Name</i>	<i>Description</i>
JobExecutorThreadPoolSizeProvider	Job executor thread pool size provider

<i>Implementation Class</i>	<i>Description</i>
CPUUsageJobExecutorThreadPoolSizeProvider	Use CPU available processors * 2 to create thread pool
SingleThreadJobExecutorThreadPoolSizeProvider	Use single thread to execute job

7.3 Error Handler

Error handler strategy, used to handle error when exception occur during job execution.

<i>SPI Name</i>	<i>Description</i>
JobErrorHandler	Job error handler

<i>Implementation Class</i>	<i>Description</i>
LogJobErrorHandler	Log error and do not interrupt job
ThrowJobErrorHandler	Throw system exception and interrupt job
IgnoreJobErrorHandler	Ignore exception and do not interrupt job
EmailJobErrorHandler	Send email message notification and do not interrupt job
WechatJobErrorHandler	Send wechat message notification and do not interrupt job
DingtalkJobErrorHandler	Send dingtalk message notification and do not interrupt job

7.4 Job Class Name Provider

Job class name provider, used to provide job class name in different contain environments.

<i>SPI Name</i>	<i>Description</i>
JobClassNameProvider	Job class name provider

<i>Implementation Class</i>	<i>Description</i>
DefaultJobClassNameProvider	Job class name provider in standard environment
SpringProxyJobClassNameProvider	Job class name provider in Spring container environment

7.5 Roadmap

- ☒ Unified Job Config API
 - ☒ Core Config
 - ☒ Type Config
 - ☒ Root Config
- ☒ Job Types
 - ☒ Simple
 - ☒ Dataflow
 - ☒ Script
 - ☒ Http (Since 3.0.0-beta)
- ☒ Event Trace
 - ☒ Event Publisher
 - ☒ Database Event Listener
 - ☐ Other Event Listener
- ☐ Unified Schedule API
- ☐ Unified Resource API
- ☒ Distributed Features
 - ☒ High Availability
 - ☒ Elastic scale in/out
 - ☒ Failover
 - ☒ Misfire
 - ☒ Idempotency
 - ☒ Reconcile
- ☒ Registry Center
 - ☒ ZooKeeper
 - ☐ Other Registry Center Supported
- ☒ Lifecycle Management
 - ☒ Add/Remove
 - ☒ Pause/Resume
 - ☒ Disable/Enable
 - ☒ Shutdown
 - ☒ Restful API

- ☒ Web Console
- ☒ Job Dependency
 - ☒ Listener
 - ☐ DAG
- ☒ Spring Integrate
 - ☒ Namespace
 - ☒ Bean Injection
 - ☒ Spring Boot Starter (Since 3.0.0-alpha)

8.1 Latest Releases

ElasticJob is released as source code tarballs with corresponding binary tarballs for convenience. The downloads are distributed via mirror sites and should be checked for tampering using GPG or SHA-512.

8.1.1 ElasticJob - Version: 3.0.4 (Release Date: Oct 18, 2023)

- Source Codes: [[SRC](#)] [[ASC](#)] [[SHA512](#)]
- ElasticJob Binary Distribution: [[TAR](#)] [[ASC](#)] [[SHA512](#)]

8.1.2 ElasticJob-UI - Version: 3.0.2 (Release Date: Oct 31, 2022)

- Source Codes: [[SRC](#)] [[ASC](#)] [[SHA512](#)]
- ElasticJob-UI Binary Distribution: [[TAR](#)] [[ASC](#)] [[SHA512](#)]

8.2 All Releases

Find all releases in the [Archive repository](#).

8.3 Verify the Releases

PGP signatures [KEYS](#)

It is essential that you verify the integrity of the downloaded files using the PGP or SHA signatures. The PGP signatures can be verified using GPG or PGP. Please download the [KEYS](#) as well as the [asc](#) signature files for relevant distribution. It is recommended to get these files from the main distribution directory and not from the mirrors.

```
gpg -i KEYS
```

or

```
pgpk -a KEYS
```

or

```
gpg -ka KEYS
```

To verify the binaries/sources you can download the relevant asc files for it from main distribution directory and follow the below guide.

```
gpg --verify apache-shardingsphere-*****.asc apache-shardingsphere-elasticjob-  
*****
```

or

```
pgpv apache-shardingsphere-elasticjob-*****.asc
```

or

```
gpg apache-shardingsphere-elasticjob-*****.asc
```

9.1 Register

Welcome to register by company + homepage + use case(optional), your support is important to us.

Please register [here](#) with company + homepage + use case(optional).

9.2 Who are using ElasticJob?

Total: 83 companies.

9.2.1 E-commerce

DangDang

Three Squirrels

BESSKY

HAI ZOL

Xiu

homedo

AVIC B2B ONLINE TRADING OLATRORM

GShopper

ChunBo

HuiNong

DaZong

YangSC

DG-Mail

Nex Poster

JD

9.2.2 Financial Industry

Best Pay

WX XISHANG BANK

ppdai

YinSheng E-Pay

ZhongAn Tech

JinCaiHuLian

Lianlian Pay

SR online

IcInfo

LaoCaiBao

NiuCard

JieDaiBao

JinHui365

91 Tech Group

9.2.3 Digitalization and Cloud Services

YunJia cloud

Joyowo

Tree Bear

南方电网深圳数研院

9.2.4 Transportation

JUNEYAO AIR

CaoCao

Tuhu

ShouQi

iTrip

MaiHaoche

TTPai

DiDi

9.2.5 Logistics

YR Express

HaoYunHu

DeKun

9.2.6 Real Estate

ZIroom

UCommune

LianJia

9.2.7 E-education

IBeiLiao

IQiHang

Will Class

Think Town

GSX

Qidian

9.2.8 E-entertainment

MiguFun

motie

squirrel

9.2.9 News

FangJia

IFeng

Taoguba

FanHaoYue

SOHU

9.2.10 Communication

MeiZu

OnePlus

9.2.11 Internet of Things

Lenovo

Neoway

Gizwits

YY Cloud

G7

ShenzhenGuangliansaixun Co., LTD.

Guangzhou shang mai network technology co. LTD

9.2.12 Software Development Services

ultrapower

DuiBa Group

Cig

Yeahmobi

LeiMing

ZhongChuang Technology

DeepDraw

WeiLaiXinFeng

Guangzhou Zhongruan

PubLink

9.2.13 Health Care

H&H Global

Glory

YIBAO

SYTown

9.2.14 Retail

YH

9.2.15 AI

DeepBlue

10.1 Why do some compiling errors appear?

Answer:

ElasticJob uses lombok to enable minimal coding. For more details about using and installment, please refer to the official website of [lombok](#).

10.2 Does ElasticJob support dynamically adding jobs?

Answer:

For the concept of dynamically adding job, everyone has a different understanding.

ElasticJob is provided in jar package, which is started by developers or operation. When the job is started, it will automatically register job information to the registry center, and the registry center will perform distributed coordination, so there is no need to manually add job information in the registry center. However, registry center has no affiliation with the job server, can't control the distribution of single-point jobs to other job machines, and also can't start the job of remote server. ElasticJob doesn't support ssh secret management and other functions.

In summary, ElasticJob has supported basic dynamically adding jobs, but it can't be fully automated.

10.3 Why is the job configuration modified in the code or Spring XML file, but the registry center is not updated?

Answer:

ElasticJob adopts a decentralized design. If the configuration of each client is inconsistent and is not controlled, the configuration of the client which is last started will be the final configuration of the registry center.

ElasticJob proposes the concept of `overwrite`, which can be configured through `JobConfiguration` or `Spring` namespace. `overwrite=true` indicates that the client's configuration is allowed to override the registry center, and on the contrary is not allowed. If there is no configuration of related jobs in the registry center, regardless of whether the property of `overwrite` is configured, the client's configuration will be still written into the registry center.

10.4 What happens if the job can't communicate with the registry center?

Answer:

In order to ensure the consistency of the job in the distributed system, once the job can't communicate with the registry center, the job will stop immediately, but the job's process will not exit. The purpose of this is to prevent the assignment of the shards executed by the node that has lost contact with the registry center to another node when the job is re-sharded, causing the same shard to be executed on both nodes at the same time. When the node resumes contact with the registry center, it will participate in the sharding and resume execution of the newly shard.

10.5 What are the usage restrictions of ElasticJob?

Answer:

- After the job start successfully, modifying the job name is regarded as a new job, and the original job is discarded.
- It will be triggered re-sharding if the server changes, or if the sharding item is modified; re-sharding will cause the running streaming job to stop after the job is executed, and this job will return to normal after the re-sharding is finished.
- Enable `monitorExecution` to realize the function of distributed job idempotence (that is, the same shard will not be run on different job servers), but `monitorExecution` has a greater impact on the performance of jobs executed in a short period of time (such as second-level triggers). It is recommended to turn it off and realize idempotence by yourself.

10.6 What should you do if you suspect that ElasticJob has a problem in a distributed environment, but it cannot be reproduced and cannot be debugged in the online environment?

Answer:

Distributed problems are very difficult to debug and reproduce. For this reason, ElasticJob provides the `dump` command.

If you suspect a problem in some scenarios, you can refer to the [dump](#) document to submit the job runtime information to the community. ElasticJob has filtered sensitive information such as IP, and the dump file can be safely transmitted on the Internet.

10.7 Why can't the Console page display normally?

Answer:

Make sure that the Web Console's version is consistent with ElasticJob, otherwise it will become unavailable.

10.8 Why is the job state shard to be adjusted in the Console?

Answer:

Shard to be adjusted indicates the state when the job has started but has not yet obtained the shard.

10.9 Why is there a task scheduling delay in the first startup?

Answer:

ElasticJob will obtain the local IP when performing task scheduling, and it may be slow to obtain the IP for the first time. Try to set `-Djava.net.preferIPv4Stack=true`.

10.10 In Windows env, run ShardingSphere-ElasticJob-UI, could not find or load main class org.apache.shardingsphere.elasticjob.kernel.ui.Bootstrap. Why?

Answer:

Some decompression tools may truncate the file name when decompressing the ShardingSphere-ElasticJob-UI binary package, resulting in some classes not being found

Open cmd.exe and execute the following command:

```
tar zxvf apache-shardingsphere-elasticjob-${RELEASE.VERSION}-lite-ui-bin.tar.gz
```

10.11 Unable to startup Cloud Scheduler. Continuously output “Elastic job: IP:PORT has leadership”

Answer:

Cloud Scheduler required Mesos native library. Specify Mesos native library path by property `-Djava.library.path`.

For instance, Mesos native libraries are under `/usr/local/lib`, so the property `-Djava.library.path=/usr/local/lib` need to be set to start the Cloud Scheduler.

About Apache Mesos, please refer to [Apache Mesos](#).

10.12 Unable to obtain a suitable IP in the case of multiple network interfaces

Answer:

You may specify interface by system property `elasticjob.preferred.network.interface` or specify IP by system property `elasticjob.preferred.network.ip`.

For example

1. specify the interface `eno1`: `-Delasticjob.preferred.network.interface=eno1`.
2. specify network addresses, `192.168.0.100`: `-Delasticjob.preferred.network.ip=192.168.0.100`.
3. specify network addresses for regular expressions, `192.168.*`: `-Delasticjob.preferred.network.ip=192.168.*`.

10.13 During the zk authorization upgrade process, there was a false death of the instance during the rolling deployment process, and even if the historical version was rolled back, there was still false death.

Answer:

During the rolling deployment process, competitive election leaders will be triggered, and instances with passwords will encrypt the zk directory, making instances without passwords inaccessible, ultimately leading to overall election blocking.

For example

Through the logs, it can be found that an `-102` exception will be thrown:


```
xxxx-07-27 22:33:55.224 [DEBUG] [localhost-startStop-1-EventThread] [] [] [] - o.a.
c.f.r.c.TreeCache : processResult: CuratorEventImpl{type=GET_DATA, resultCode=-102,
path='/xxx/leader/election/latch/_c_bcccdcc-1134-4e0a-bb52-59a13836434a-latch-
0000000047', name='null', children=null, context=null, stat=null, data=null,
watchedEvent=null, aclList=null}
```

1. If you encounter the issue of returning to the historical version and still pretending to be dead during the upgrade process, it is recommended to delete all job directories on zk and restart the historical version afterwards.
2. Calculate a reasonable job execution gap, such as when the job will not trigger from 21:00 to 21:30 in the evening. During this period, first stop all instances, and then deploy all versions with passwords online.

11

Blog

TODO