Hortonworks DataFlow

Upgrade

(November 9, 2017)

docs.cloudera.com

Hortonworks DataFlow: Upgrade

Table of Contents

1. Upgrade NiFi

You can use this document upgrading from NiFi 0.x to NiFi 1.0.0, for both standalone and clustered NiFi instances. You can perform the NiFi upgrade process with minimal interruption to production dataflows.

1.1. Upgrade Overview

This section describes the changes made to NiFi 1.0.0. Because NiFi 1.0.0 is a major release, you should review this section carefully, and ensure that you understand the impact that these changes may have on your existing dataflows.

1.1.1. Minimum JRE/JDK Support

Java 8 is now the minimum JRE/JDK supported.

1.1.2. Kerberos System Properties

SPNEGO and service principals for Kerberos are now established via separate system properties.

New SPNEGO properties:

- nifi.kerberos.spnego.principal
- nifi.kerberos.spnego.keytab.location
- nifi.kerberos.spnego.authentication.expiration

New service properties:

- nifi.kerberos.service.principal
- nifi.kerberos.service.keytab.location

Removed properties:

- nifi.kerberos.keytab.location
- nifi.kerberos.authentication.expiration

1.1.3. DBCPConnectionPool Service

The Database Driver Jar Url property has been replaced by the Database Driver Location(s) property which accepts a comma-separated list of URLs or local files and folders containing the driver JAR.

Existing processors that reference this service will be invalid until you have configured the new Database Driver Location(s) property.

1.1.4. MonitorDiskUsage Reporting Task

This standard reporting task has been simplified to let you specify a logical name, a directory, and a threshold to monitor. Previously it was tightly coupled to the internal flow file and content repositories in a manner that did not align to the pluggable nature of those repositories.

The new approach gives the user total control over what they want MonitorDiskUsage to monitor.

1.1.5. Connection/Relationship Default Back Pressure Settings

In previous versions, no backpressure settings were supplied by default. In NiFi 1.0.0, new connections made have a default value set of 10,000 flow files and 1GB worth of data size.

1.1.6. Multi-Tenant Authorization Model

- Authority Provider model has been replaced by a Multi-tenant Authorization model. Access privileges are now defined by policies that can be applied system-wide or to individual components. Details can be found in Multi-tenant Authorization in *Hortonworks DataFlow Administration*.

- The system properties nifi.authority.provider.configuration.file and nifi.security.user.authority.provider have been replaced by nifi.authorizer.configuration.file and nifi.security.user.authorizer, respectively. Details on configuration can be found in Authorizer Configuration in *Hortonworks DataFlow Administration*.
- You can convert NiFi 0.7.0 authorized users and roles to the new authorization model. An existing `authorized-users.xml` file can be referenced in the `authorizers.xml` "Legacy Authorized Users File" property to automatically generate users and authorizations. Details on configuration can be found in Authorizers.xml Setup in *Hortonworks DataFlow Administration*.

1.1.7. HTTP(S) Site-to-Site

- HTTP(S) protocol is now supported in Site-to-Site as an underlying transport protocol.
- HTTP(S) protocol is enabled by default (nifi.remote.input.http.enabled=true). Configuration details can be found in Site-to-Site Properties in *Hortonworks DataFlow Administration*.

  Of note:

  - With both socket and HTTP protocols supported, nifi.remote.input.socket.host has been renamed to nifi.remote.input.host.
  - nifi.remote.input.secure is now set to false by default.

1.1.8. Zero-Master Clustering

Master/slave clustering model has been replaced by a Zero-Master Clustering paradigm. Each node in a NiFi cluster performs the same tasks on the data, but each operates on a different set of data. A DataFlow manager can now interact with the NiFi cluster through the UI of any node.

ZooKeeper elects a single node as the Cluster Coordinator and also handles failover. All cluster nodes report heartbeat and status information to the Cluster Coordinator, which is responsible for disconnecting and connecting nodes. Additionally, every cluster has one Primary Node, also elected by ZooKeeper.

Configuration details can be found in the Clustering Configuration, the Cluster Common Properties, the Cluster Node Properties, and the ZooKeeper Properties sections of *Hortonworks DataFlow Administration*.

Of note for your upgrade:

- NiFi Cluster Manager (NCM) configuration and properties are no longer relevant and have been removed.
- The following properties should be set on each node:
  - nifi.web.http.port=<node port>
  - nifi.cluster.is.node=true

- nifi.cluster.node.address=<fully qualified hostname of the node>
- nifi.cluster.node.protocol.port=<node protocol port>
- nifi.state.management.embedded.zookeeper.start=true
- nifi.state.management.provider.cluster=zk-provider
- nifi.state.management.embedded.zookeeper.properties=./conf/zookeeper.properties
- nifi.zookeeper.connect.string=<A comma-separated list of host:port pairs to connect to ZooKeeper. For example, my-zk-server1:2181,my-zk-server2:2181,my-zk-server3:2183>

- Coordinated dataflow selection across cluster nodes. During startup, a cluster coordinator is selected at random, and manages the distribution of the dataflow across all nodes. You should set the following to properties, to ensure that the cluster coordinator and other nodes have time to select the correct dataflow:
  - nifi.cluster.flow.election.max.wait.time=5 mins
  - nifi.cluster.flow.election.max.candidates=<number of NiFi nodes in the cluster>
- Embedded ZooKeeper setup
  - The zookeeper.properties file needs to be populated with a list of each node's embedded ZooKeeper server. The servers are specified in the form of server.1, server.2, to server.n. Each of these servers is configured as <hostname>:<quorum port>[:<leader election port>]. For example, server.1=nifi-node1-hostname:2888:3888.
  - The `zookeeper.properties` file has a property named dataDir which is set to ./state/zookeeper by default. For each node, create a file named myid and place it in this directory. The contents of this file should be the index of the server as specified by the server.<number>. Configuration details can be found in Embedded ZooKeeper Server in *Hortonworks DataFlow Administration*.
- State Management – In the state-management.xml file, set the "Connect String" property to the same list of ZooKeeper host:port pairs used for the nifi.zookeeper.connect.string property value.
- Secure Clustered Environment – The identities for each node must be specified in the authorizers.xml file. The authorization policies required for the nodes to communicate will then be created during startup. Details on configuration can be found in Authorizers.xml Setup in *Hortonworks DataFlow Administration*.

1.1.9. Secured ZooKeeper

- The username and password mechanism to provide ZooKeeper authentication is no longer supported. As a result, the "Username" and "Password" properties in the `state-management.xml` file have been removed.
- The "Access Control" property in the `state-management.xml` file is now set to "Open" by default. It should be changed to "CreatorOnly" when ZooKeeper is secured via Kerberos.

1.1.10. QueryDatabaseTable Processor

The 'SQL Pre-processing Strategy' property has been replaced by the 'Database Type' property. This property sets the type of database for generating database-specific code. Property values include 'Generic' (default) and 'Oracle' (for custom SQL clauses).

1.1.11. TailFile Processor

TailFile originally stored state in a local file, then state management was added in 0.5.0 to support reading in the local state and moving it into the state manager. In 1.0.0, the auto-migration from the old state mechanism has been removed.

If upgrading from a pre-0.5.0 version of NiFi, it is suggested to upgrade to a version greater than or equal to 0.5.0 first, then go to 1.0.0 to not lose state on existing TailFile processors.

1.1.12. LDAP referral strategy 'IGNORE' bug fix

Errors occurred if the Referral Strategy was set to 'IGNORE' due to a typo in the code to accept 'INGORE' instead. The `login-identity-providers.xml` file should now be configured with the intended value of 'IGNORE' for the Referral Strategy property.

1.2. Before you Begin

Before you begin, you can perform some tasks to ensure the efficiency and success of your upgrade process.

1.2.1. Optimizing your NiFi Directory Structure for Upgrade

When you install NiFi and perform the minimum configuration requirements by editing the `nifi.properties` file, your installation directory contains several files and directories. Assuming you have installed into an opt/ directory, the NiFi installation directory structure is similar to:

```
/
-->  opt/
  -->  nifi-current_version
       |--> LICENSE
       |--> NOTICE
       |--> README
       |--> bin/
       |--> conf/
       |--> docs/
       |--> lib/
       |--> work/
       |--> content_repository/
       |--> flowfile_repository/
       |--> logs/
       |--> provenance_repository/
```

To optmize the NiFi directory structure for upgrade:

1. Move the following directories out of the NiFi installation directory:

- Database repository
- All content repositories
- Flowfile repository
- NiFi log repository
- All provenance repositories

See the Hortonworks DataFlow Administration for information on options for creating these repositories to optimize performance and stability.

2. Move static items that do not change from version to version out of the conf directory. These items include:
   - `flow.xml.gz`
   - `authorized-users.xml`
   - The templates directory

Note

NiFi 1.0.0 no longer contains `authorized-users.xml`. Instead, it contains `authorizations.xml` and `users.xml`. During upgrade, preserve `authorized-users.xml` so that NiFi 1.0.0 can use it to populate the values of the `authorizations.xml` and `users.xml` files.

A good directory structure that supports easy upgrading looks similar to:

```
/
|--> opt/
|    |--> nifi-current_version
|    |    |--> LICENSE
|    |    |--> NOTICE
|    |    |--> README
|    |    |--> bin/
|    |    |--> conf/
|    |    |--> docs/
|    |    |--> lib/
|    |    |--> work/
|    |
|    |--> Configuration_resources/
|    |    |--> authorized-users.xml
|    |    |--> flow.xml.gz
|    |    |--> templates/
|    |    |--> custom_lib/
|
|--> database_repository/
|--> content_repository_1/
|--> content_repository_N
|--> flowfile_repository/
|--> NiFi-logs/
|--> provenance_repository_1/
|--> provenance_repository_N/
```

Important

Upgrading from NiFi 0.x to 1.x converts your database, content, flowfile, log, and provenance repositories automatically. Once upgraded, you can not revert the repositories back to 0.x format.

1.2.2. Preserving your custom processors

If you have written customer processors, you can preserve them during the upgrade if you store them in one centralized location.

1. Create a second library directory, called custom_lib.
2. Move your custom processors to this new lib directory.
3. Add a new line to the `nifi.properties` file to specify this new lib directory:

```
nifi.nar.library.directory=./lib
nifi.nar.library.directory.custom=/opt/configuration_resources/custom_lib
```

1.2.3. Preserving customized NAR files

If you have customized any of the default NAR files, the upgrade to NiFi 1.0.0 overwrites these changes. To preserve the customization:

1. Identify and save the changes you have made to the default NAR files.
2. Perform your upgrade to NiFi 1.0.0.
3. Redo the changes you have made to the NAR files, in NiFi 1.0.0.
4. Start a dataflow.

1.3. Upgrading a single instance of NiFi

To upgrade to the NiFi 1.0.0, perform the following steps:

1. Download the latest NiFi release.
2. Install the new release in /opt. Your directory structure should look similar to:

```
/
|--> opt/
|    |--> nifi-current_version
|    |    |--> LICENSE
|    |    |--> NOTICE
|    |    |--> README
|    |    |--> bin/
|    |    |--> conf/
|    |    |--> docs/
|    |    |--> lib/
|    |    |--> work/
|    |
|    |--> nifi-1.0.0
|    |    |--> LICENSE
```

```
|     |     |--> NOTICE
|     |     |--> README
|     |     |--> bin/
|     |     |--> conf/
|     |     |--> docs/
|     |     |--> lib/
|     |     |--> work/
|     |
|     |--> Configuration_resources/
|     |     |--> authorized-users.xml
|     |     |--> flow.xml.gz
|     |     |--> templates/
|     |     |--> custom_lib/
|
|--> database_repository/
|--> content_repository_1/
|--> content_repository_N/
|--> flowfile_repository/
|--> NiFi-logs/
|--> provenance_repository_1/
|--> provenance_repository_N/
```

3. Save the `authorized-users.xml` from your older NiFi version, so that NiFi 1.0.0 can use it to populate the values of the `authorizations.xml` and `users.xml` files.

4. Using the values already configured in the following files inside the previous NiFi conf directory, update the corresponding lines in the same files under target NiFi directory (nifi-1.0.0):

   - `bootstrap.conf`
   - `logback.xml`
   - `nifi.properties`

Note

- Ensure that you make no typos when you are configuring the various paths to your existing repos and the path to the `flow.xml.gz` file in the `nifi.properties` file in the newer release.
- Ensure that you have the same Run As user configured in the `bootstrap.conf` file.
- If no new lines were added to these files, you can copy them directly from an older version to a newer. If you do copy the `nifi.properties` file, update the `nifi.version` number.

5. Verify that all file and directory ownerships for your target NiFi directory match what you set on the previous version.

6. Stop the older NiFi version.

Note

You can stop NiFi while files still exist in your dataflows.

7. Before you start the upgraded NiFi nodes, add the location of your `authorized-users.xml` file to `authorizations.xml`, if you want to map your previous authorized users to the new NiFi authentication model.

```
<authorizer>
<identifier>file-provider</identifier>
<class>org.apache.nifi.authorization.FileAuthorizer</class>
<property name="Authorizations File">./conf/authorizations.xml</property>
<property name="Users File">./conf/users.xml</property>
<property name="Initial Admin Identity"></property>
<property name="Legacy Authorized Users File"></property>
```

8. Start your upgraded NiFi version and immediately tail the app log.

   - Use the app log to verify that the new NiFi has fully started and begins processing data.
   - If it fails to start, you can restart the previous NiFi version while you investigate the cause.
   - NiFi is commonly configured to run as a service. Make sure that any path or links for that service are updated to point at the newly installed version's executables now.
   - Once you have verified that the new version has started, is processing data, and can be accessed via the UI, you can delete the older version.

1.4. Upgrading a NiFi cluster

The NiFi software configuration described in this procedure applies to both standalone and cluster node instances of NiFi software.

1. Download the latest NiFi release.

2. Install the new release in /opt. Your directory structure should look similar to:

```
/
|--> opt/
|    |--> nifi-current_version
|    |    |--> LICENSE
|    |    |--> NOTICE
|    |    |--> README
|    |    |--> bin/
|    |    |--> conf/
|    |    |--> docs/
|    |    |--> lib/
|    |    |--> work/
|    |
|    |--> nifi-1.0.0
|    |    |--> LICENSE
|    |    |--> NOTICE
|    |    |--> README
|    |    |--> bin/
|    |    |--> conf/
|    |    |--> docs/
|    |    |--> lib/
```

```
|    |    |--> work/
|    |
|    |--> Configuration_resources/
|    |    |--> authorized-users.xml
|    |    |--> flow.xml.gz
|    |    |--> templates/
|    |    |--> custom_lib/
|
|--> database_repository/
|--> content_repository_1/
|--> content_repository_N/
|--> flowfile_repository/
|--> NiFi-logs/
|--> provenance_repository_1/
|--> provenance_repository_N/
```

3. Save the `authorized-users.xml` from your older NiFi version, so that NiFi 1.0.0 can use it to populate the values of the `authorizations.xml` and `users.xml` files.

4. Using the values already configured in the following files inside the previous NiFi conf directory, update the corresponding lines in the same files under target NiFi directory (nifi-1.0.0):

   - `bootstrap.conf`
   - `logback.xml`
   - `nifi.properties`

   

   Note

   - Ensure that you make no typos when you are configuring the various paths to your existing repos and the path to the `flow.xml.gz` file in the `nifi.properties` file in the newer release.
   - Ensure that you have the same Run As user configured in the `bootstrap.conf` file.
   - If no new lines were added to these files, you can copy them directly from an older version to a newer. If you do copy the `nifi.properties` file, update the `nifi.version` number.

5. Verify that all file and directory ownerships for your target NiFi directory match what you set on the previous version.

6. Stop the NCM and all nodes running the previous NiFi version.

   

   Note

   - NiFi 1.0.0 implements zero-master clustering and there is no NCM in NiFi 1.0.0.
   - It is important to stop everything. You cannot upgrade and restart one node at a time. You could end up with mismatched versions of NiFi connected to your cluster NCM.

- It is OK to stop your NiFi cluster while files still exist in your dataflows.

7. Before you start the upgraded NiFi nodes, add the location of your `authorized-users.xml` file to `authorizations.xml`, if you want to map your previous authorized users to the new NiFi authentication model.

```
<authorizer>
<identifier>file-provider</identifier>
<class>org.apache.nifi.authorization.FileAuthorizer</class>
<property name="Authorizations File">./conf/authorizations.xml</property>
<property name="Users File">./conf/users.xml</property>
<property name="Initial Admin Identity"></property>
<property name="Legacy Authorized Users File"></property>
```

8. To support NiFi's new zero-master clustering model, ensure that the following properties are set on each node in your cluster:

   - nifi.web.http.port=<node port>
   - nifi.cluster.is.node=true
   - nifi.cluster.node.address=<fully qualified hostname of the node>
   - nifi.cluster.node.protocol.port=<node protocol port>
   - nifi.state.management.embedded.zookeeper.start=true
   - nifi.state.management.provider.cluster=zk-provider
   - nifi.state.management.embedded.zookeeper.properties=./conf/zookeeper.properties
   - nifi.zookeeper.connect.string=<A comma-separated list of host:port pairs to connect to ZooKeeper. For example, my-zk-server1:2181,my-zk-server2:2181,my-zk-server3:2183>

   Configuration details can be found in the Clustering Configuration, the Cluster Common Properties, the Cluster Node Properties, and the ZooKeeper Properties sections of *Hortonworks DataFlow Administration*.

9. Set the following NiFi properties to ensure that the cluster coordinator and other nodes have time to select the correct dataflow:

   - nifi.cluster.flow.election.max.wait.time=5 mins
   - nifi.cluster.flow.election.max.candidates=<number of NiFi nodes in the cluster>

10. Start the upgraded NiFi nodes.

Note

Check the `nifi-app.log` for errors and for any nodes that fail to join the upgraded cluster.

11. If you configured NiFi to run as a service, ensure that any path or links for that service are updated to point at the newly installed version executables.

12. Configure the `state-management.xml` and `zookeeper.properties` file on every node with the following information:

    - Specify whether you want to use an embedded or external ZooKeeper server.
    - If you are using an embedded server, identify the nodes on which you want to run the Zookper server. For these nodes, be sure to also edit the state management porition of the `nifi.properties` file.

    See the Hortonworks DataFlow Administration for additional information on state management and using the ZooKeeper server.

13. If you want to start using LDAP user authentication, configure the `login-identity-providers.xml` file, and update the `nifi.properties` file.

14. If you want to setup NiFi JVM lifecycle event notifications, configure the `bootstrap-notification.services.xml` file and update the relevant settings in the `bootstrap.conf` file.

15. Once you have verified that the new version has started, is processing data, and can be accessed via the UI, you can delete the older version.

2. Upgrade Kafka

2.1. Upgrade Apache Kafka

Upgrade each Apache Kafka node, one at a time.

You can stop each Kafka broker and upgrade the component without downtime if you have enough replication for your topic.

You can stop one Kafka broker at a time, upgrade the Kafka binaries to HDP 2.6, and start the broker, before stopping the next broker.

Note

If you are willing to accept downtime, you can take all of the brokers down, update the code, and restart all of the brokers. By default, the brokers start with the new protocol.

You can bump the protocol version and restart, at any time after the brokers are upgraded.

1. Shut down the current Kafka daemon, switch to the new version, and start the daemon:

```
su - kafka -c "/usr/hdf/current/kafka-broker/bin/kafka stop"
hdf-select set kafka-broker 2.5.4.0-2633
su - kafka -c "usr/hdf/current/kafka-broker/bin/kafka start"
```

2. To verify that the Kafka daemon joined the cluster, create a topic and submit it to Kafka. Send a test message for that topic, and then validate that it was received by a consumer.

3. If the upgrade process fails, follow the steps in "Downgrading Kafka" to return to your previous version of Kafka.

2.1.1. Downgrading Kafka

Downgrade each Kafka node one at a time. You can stop each Kafka broker and upgrade the component without downtime if you have enough replication for your topic.

1. Shut down the current Kafka daemon, switch to the previous version, and start the daemon:

```
su - kafka -c "/usr/hdp/current/kafka-broker/bin/kafka stop"
hdp-select set kafka-broker 2.6.0.0-2041
su - kafka -c "/usr/hdp/current/kafka-broker/bin/kafka start"
```

```
su - kafka -c "/usr/hdf/current/kafka-broker/bin/kafka stop"
hdf-select set kafka-broker 2.6.0.0-2041
su - kafka -c "/usr/hdf/current/kafka-broker/bin/kafka start"
```

2. To verify that the Kafka daemon joined the cluster, create a topic and submit it to Kafka. Send a test message for that topic, and then validate that it was received by a consumer.

3. Upgrade Storm

3.1. Configure and Start Apache Storm

Note

The su commands in this section use "zookeeper" to represent the ZooKeeper Service user. If you are using another name for your ZooKeeper Service user, you need to substitute your ZooKeeper Service user name for "zookeeper" in each of the su commands.

Apache Storm is fairly independent of changes to the HDP cluster:

1. Deactivate all running topologies.
2. Delete all states under zookeeper:

```
/usr/hdf/current/zookeeper-client/bin/zkCli.sh (optionally in secure
 environment specify -server zk.server:port)
```

3. `rmr /storm`
4. Delete all states under the storm-local directory:

```
rm -rf <value of stormlocal.dir>
```

5. Stop Storm Services on the storm node.
6. Update the following configs in `storm.yaml`:
   - `storm.thrift.transport=org.apache.storm.security.auth.SimpleTransportPlugin`
   - `storm.messaging.transport=org.apache.storm.messaging.netty.Context`
   - `nimbus.topology=org.apache.storm.nimbus.DefaultTopologyValidator`
   - `topology.spout.wait.strategy=org.apache.storm.spout.SleepSpoutWaitStrategy`
   - `topology.kryo.factory=org.apache.storm.serialization.DefaultKryoFactory`
   - `topology.tuple.serializer=org.apache.storm.serialization.types.ListDelegate`
   - `nimbus.authorizer=org.apache.storm.security.suth.authorizer.SimpleACLAuthor` (applicable only in a secure cluster)
   - `drpc.authorizer=org.apache.storm.security.auth.authorizer.DRPCSimpleACLAuth` (applicable only in a secure cluster)
   - `ui.filter=org.apache.storm.secuity.auth.KerberosPrincipalToLocal` (applicable only in a secure cluster)
7. Stop ZooKeeper Services on the storm node.

```
su -zookeeper -c "export ZOOCFGDIR=/etc/zookeeper/conf ; export ZOOCFG=zoo.
cfg ;source /etc/zookeeper/conf/zookeeper-env.sh ; /usr/lib/zookeeper/bin/
zkServer.sh stop"
```

8. Remove Storm and zookeeper from the storm node and install the HDP 2.6.0 version:
   - For **RHEL/CentOS/Oracle Linux**:

     ```
     yum erase storm

     yum erase zookeeper

     yum install storm

     yum install zookeeper
     ```

   - For **SLES**:

     ```
     zypper rm storm

     zypper rm zookeeper

     zypper install storm

     zypper install zookeeper
     ```

   - For **Ubuntu/Debian**:

     ```
     apt-get remove storm --purge

     apt-get remove zookeeper --purge

     apt-get install storm

     apt-get install zookeeper
     ```

9. Replace your configuration after upgrading. Copy `/etc/storm/conf` from the template to the conf directory .
10. Replace your ZooKeeper configuration after upgrading. Replace the ZooKeeper template configuration in `/etc/zookeeper/conf`.
11. Ensure ZooKeeper is running. On the storm node, run the following command:

    ```
    su - zookeeper -c "source /etc/zookeeper/conf/zookeeper-env.sh; export
     ZOOCFGDIR=/etc/zookeeper/conf; /usr/hdf/current/zookeeper-server/bin/
    zkServer.sh start >> $ZOO_LOG_DIR/zoo.out\"
    ```

    where

    - $ZOO_LOG_DIR is the directory where ZooKeeper server logs are stored. For example, /var/log/zookeeper.

12. Start nimbus, then supervisor/ui/drpc/logviewer:

    `/usr/hdf/current/storm-nimbus/bin/storm nimbus`.

13. Start Storm, using a process controller, such as supervisor:

```
su - storm /usr/hdf/current/storm-supervisor/bin/storm
supervisor
```

You can use the same command syntax to start Storm using nimbus/ui and logviewer.

```
su - storm /usr/hdf/current/storm-supervisor/bin/storm nimbus
su - storm /usr/hdf/current/storm-supervisor/bin/storm ui
su - storm /usr/hdf/current/storm-supervisor/bin/storm logviewer
su - storm /usr/hdf/current/storm-supervisor/bin/storm drpc
```

4. Upgrade ZooKeeper

4.1. Configure and Start Apache ZooKeeper

1. Replace your configuration after upgrading on all the ZooKeeper nodes. Replace the ZooKeeper template configuration in `/etc/zookeeper/conf`.

2. Start ZooKeeper.

   On all ZooKeeper server host machines, run the following command to start ZooKeeper and the ZKFC:

   ```
   su - zookeeper -c "/usr/hdf/current/zookeeper-server/bin/zookeeper-server
    start"
   ```

4.2. Introduction

Some content....