MapReduce Service

Getting Started

Issue 01

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Contents

1 Creating and Using a Hadoop Cluster for Offline Analysis.....1
2 Creating and Using a Kafka Cluster for Stream Processing.....9
3 Creating and Using an HBase Cluster for Offline Query.....17
4 Creating and Using a ClickHouse Cluster for Columnar Store.....24
5 Creating and Using an MRS Cluster Requiring Security Authentication.....31

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1 Creating and Using a Hadoop Cluster for Offline Analysis

Scenario

This topic describes how to create a Hadoop cluster for offline analysis and how to submit a wordcount job through the cluster client. A wordcount job is a classic Hadoop job that counts words in massive amounts of text.

The Hadoop cluster uses the open-source Hadoop ecosystem components, including YARN for cluster resource management, and Hive and Spark for offline large-scale distributed data storage and compute to provide massive data analysis and query capabilities.

Procedure

Before you start, complete operations described in **Preparations**. Then, follow these steps:

1. **Creating an MRS cluster**: Create a Hadoop analysis cluster of MRS 3.1.5.
2. **Installing the Cluster Client**: Download and install the MRS cluster client.
3. **Preparing Applications and Data**: Prepare the data files required for running the wordcount sample program on the MRS cluster client.
4. **Submitting a Job and Viewing the Result**: Submit a wordcount data analysis job on the cluster client and view the execution result.

Preparations

- You have prepared an IAM user who has the permission to create MRS clusters.

Step 1: Creating an MRS Cluster

Step 1 Go to the **Buy Cluster** page.

Step 2 Search for MapReduce Service in the service list and enter the MRS console.

Step 3 Click Buy Cluster. The **Quick Config** tab is displayed.

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Step 4 Configure the cluster as you need. In this example, a pay-per-use MRS 3.1.5 cluster will be created. For more details about how to configure the parameters, see **Quickly Creating a Cluster**.

Table 1-1 MRS cluster parameters

Parameter	Description	Example Value
Billing Mode	Billing mode of the cluster you want to create. MRS provides two billing modes: yearly/monthly and pay-per-use. Pay-per-use is a postpaid billing mode. You pay as you go and pay for what you use. The cluster usage is calculated by the second but billed every hour.	Pay-per-use
Region	Region where the MRS resources to be requested belong. MRS clusters in different regions cannot communicate with each other over an intranet. For lower network latency and quick resource access, select the nearest region.	Europe-Dublin
Cluster Name	Name of the MRS cluster you want to create.	mrs_demo
Cluster Type	A range of clusters that accommodate diverse big data demands. You can select a Custom cluster to run a wide range of analytics components supported by MRS.	Custom
Version Type	Service type of the MRS	Normal
Cluster Version	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version. You are advised to select the latest version.	MRS 3.1.5
Component	Cluster templates containing preset opensource components you will need for your business.	Hadoop Analysis Cluster
AZ	Available AZ associated with the cluster region.	AZ1
VPC	VPC where you want to create the cluster. You can click **View VPC** to view the name and ID. If no VPC is available, create one.	vpc-default
Subnet	Subnet where your cluster belongs. You can access the VPC management console to view the names and IDs of existing subnets in the VPC. If no subnet is created under the VPC, click **Create Subnet** to create one.	subnet-default

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Parameter	Description	Example Value
Cluster Node	Cluster node details.	Default value
Kerberos Authentication	Whether Kerberos authentication is enabled.	Disabled
Username	Username for logging in to the cluster management page and the ECS node.	root/admin
Password	User password for logging in to the cluster management page and the ECS node.	-
Confirm Password	Enter the user password again.	-
Enterprise Project	Enterprise project to which the cluster belongs.	default
Secure Communications	Select the check box to agree to use the access control rules.	Checked

Step 5 Click Buy Now. A page is displayed showing that the task has been submitted.

Step 6 Click **Back to Cluster List**. You can view the status of the newly created cluster on the **Active Clusters** page.

Wait for the cluster creation to complete. The initial status of the cluster is **Starting**. After the cluster is created, the cluster status becomes **Running**.

----End

Step 2: Installing the Cluster Client

You need to install a cluster client to connect to component services in the cluster, remotely access the client shell, and submit jobs.

The client can be installed on a node in or outside the cluster. This guide describes how to install the client on the Master1 node in the cluster.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

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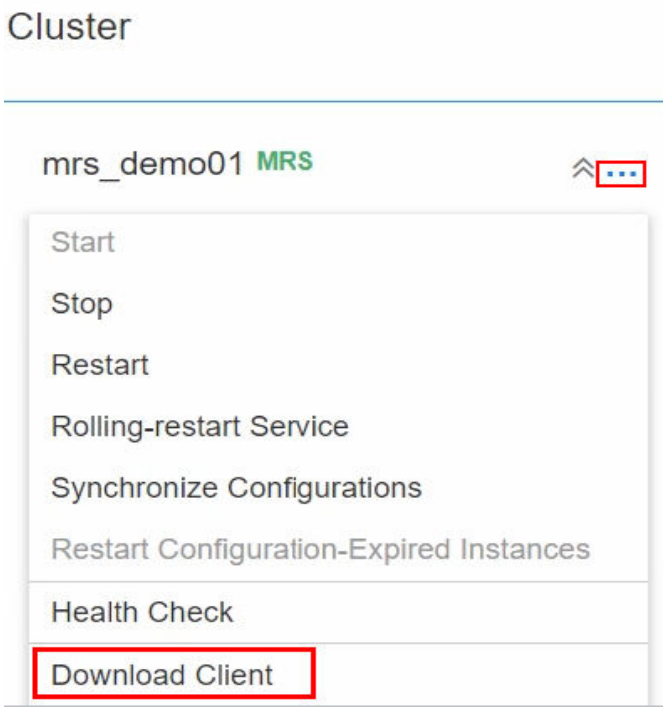
The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

Step 4 On the displayed **Homepage** page, click ··· next to the cluster name and click **Download Client** to download the cluster client.

Figure 1-1 Downloading a client



In the **Download Cluster Client** dialog box, set the following parameters:

- Set **Select Client Type** to **Complete Client**.
- For **Select Platform Type**, select the architecture of the node where the client is to be installed, for example, **x86_64**.

  To check the architecture of a node in the cluster, click **Hosts** on FusionInsight Manager navigation pane on the top and click the target node name to go to the basic information page.
- Retain the default path for **Save to Path**. The generated file will be saved in the **/tmp/FusionInsight-Client** directory on the active OMS node (usually the **Master1** node) of the cluster.

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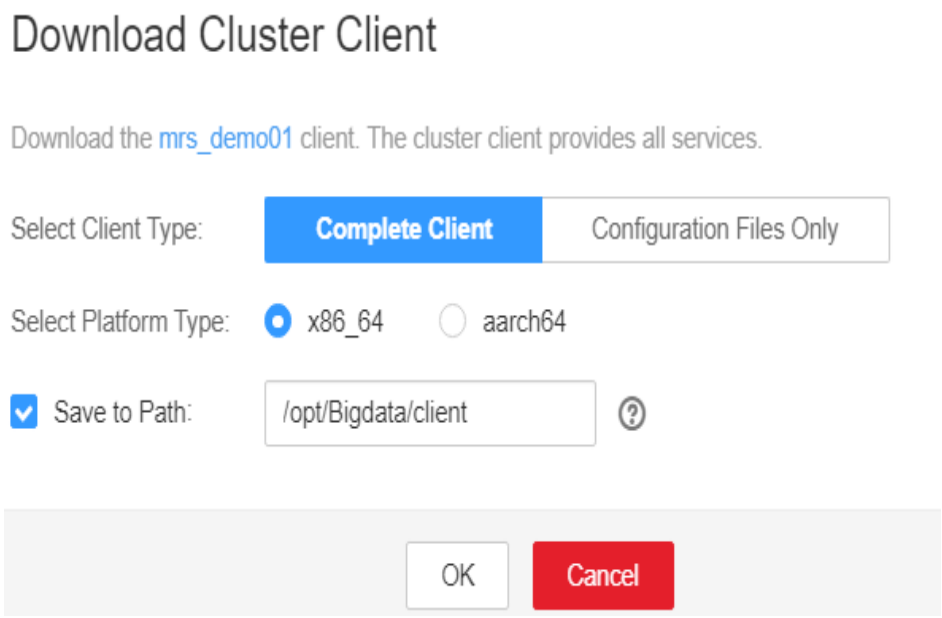
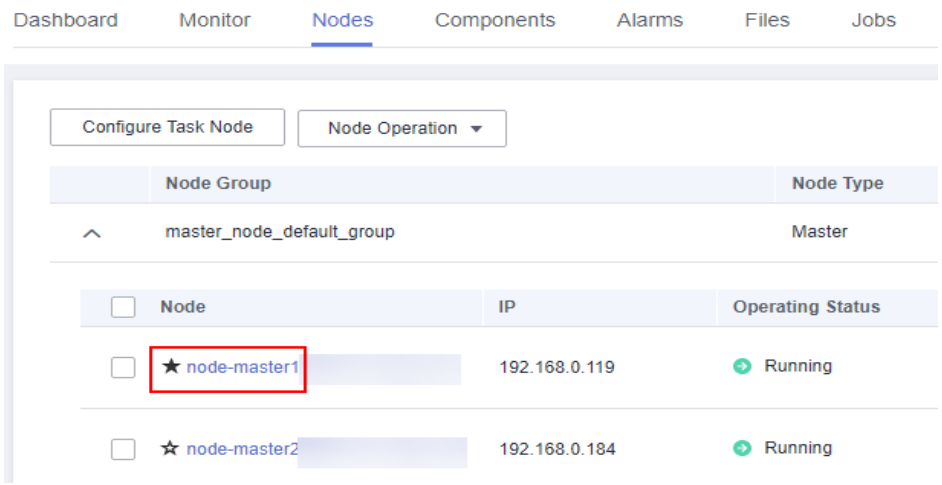
Figure 1-2 Downloading the cluster client



Click **OK** and wait until the client software is generated.

Step 5 Go back to the MRS console and click the cluster name in the cluster list. Go to the **Nodes** tab, click the name of the node that contains **master1**. In the upper right corner of the ECS details page, click **Remote Login** to log in to the **Master1** node.

Figure 1-3 Checking the Master1 node



Step 6 Log in to the **Master1** node as user **root**. The password is the one you set for the **root** user during cluster purchase.

Step 7 Switch to the directory where the client software package is stored and decompress the package.

cd /tmp/FusionInsight-Client/

tar -xvf FusionInsight_Cluster_1_Services_Client.tar

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tar -xvf FusionInsight_Cluster_1_Services_ClientConfig.tar

Step 8 Go to the directory where the installation package is stored and install the client.

cd FusionInsight_Cluster_1_Services_ClientConfig

Install the client to a specified directory. (If the directory exists, it must be empty.)

For example, if the client is installed in the **/opt/client** directory, run the following command:

./install.sh /opt/client

Wait until the client installation is complete.

```
...
... component client is installed successfully
...
```

----End

Step 3: Preparing Applications and Data

You can run the wordcount sample program preset in the cluster client on the created cluster, or develop a big data application and upload it to the cluster.

This topic uses the wordcount sample program on the MRS cluster client as an example. You need to prepare the data files required for running the wordcount sample program.

Step 1 Log in to the **Master1** node as user **root**.

Step 2 Prepare data files.

For example, the file names are **wordcount1.txt** and **wordcount2.txt**, and the content is as follows:

vi /opt/wordcount1.txt

```
hello word
hello wordcount
```

vi /opt/wordcount2.txt

```
hello mapreduce
hello hadoop
```

Step 3 Switch to the client installation directory, configure environment variables, and create an HDFS directory for storing sample data, for example, **/user/example/input**.

cd /opt/client

source bigdata_env

hdfs dfs -mkdir /user/example/input

Step 4 Upload the sample data to HDFS.

hdfs dfs -put /opt/wordcount1.txt /user/example/input

hdfs dfs -put /opt/wordcount2.txt /user/example/input

----End

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Step 4: Submitting a Job and Viewing the Result

Step 1 Log in to the client node (**Master1**) as user **root**.

Step 2 Submit a wordcount job, read source data for analysis, and output the execution result to the HDFS.

cd /opt/client

source bigdata_env

hadoop jar HDFS/hadoop/share/hadoop/mapreduce/hadoop-mapreduce-examples-3.3.1-*.jar wordcount "/user/example/input/*" "/user/example/output/"

```
...
  File Input Format Counters
    Bytes Read=56
  File Output Format Counters
    Bytes Written=48
```

NOTE

- **/user/example/output/** indicates the address for storing job output files on the HDFS. Set it to a directory that does not exist.
- The name of the **hadoop-mapreduce-examples-3.3.1-*.jar** file varies depending on the cluster client version. Use the actual name.

Step 3 Query job execution results.

1. Run the following command to view the job output file:

   hdfs dfs -ls /user/example/output/

   ```
   ...
   ... /user/example/output/_SUCCESS
   ... /user/example/output/part-r-0000
   ```

2. The output is saved in the HDFS file system. You can run a command to download the output to the local PC and view it.

   The following command is an example:

   hdfs dfs -get /user/example/output/part-r-00000 /opt

   cat /opt/part-r-00000

   The content of the **part-r-00000** file is as follows:

   ```
   hadoop    1
   hello    4
   mapreduce    1
   word    1
   wordcount    1
   ```

Step 4 View job run logs.

1. Log in to FusionInsight Manager of the target cluster as user **admin** and choose **Cluster** > **Services** > **Yarn**.
2. Click the **ResourceManager(xxx,Active)** link in the row where the **ResourceManager Web UI** is.
3. On the **All Applications** page, click the ID of the target job to view the job details.

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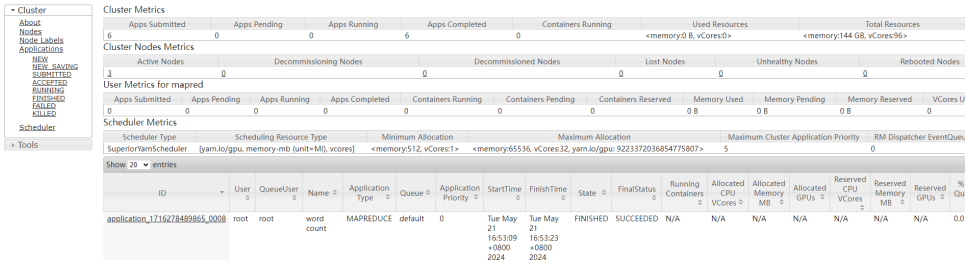
NOTE

On the **All Applications** page, you can confirm a task based on the task submission time and the user name that submits the task.

Figure 1-4 Checking job details



----End

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2 Creating and Using a Kafka Cluster for Stream Processing

Scenario

This topic helps you create a stream analysis cluster from scratch and generate and consume messages in a Kafka topic.

A Kafka cluster provides a message system with high throughput and scalability. It is widely used for log collection and monitoring data aggregation. Kafka is efficient in streaming data ingestion and real-time data processing and storage.

Procedure

Before you start, complete operations described in **Preparations**. Then, follow these steps:

1. **Creating an MRS Cluster**: Create a real-time analysis cluster of MRS 3.2.0-LTS.1.
2. **Installing the Cluster Client**: Download and install the MRS cluster client.
3. **Using the Kafka Client to Create a Topic**: Create a topic on the Kafka client.
4. **Managing Messages in a Kafka Topic**: Consume messages in a created topic on the Kafka client.

Preparations

- You have prepared an IAM user who has the permission to create MRS clusters.

Step 1: Creating an MRS Cluster

Step 1 Go to the **Buy Cluster** page.

Step 2 Search for MapReduce Service in the service list and enter the MRS console.

Step 3 Click Buy Cluster. The **Quick Config** tab is displayed.

Step 4 Configure the cluster as you need. In this example, a pay-per-use MRS 3.2.0-LTS.1 cluster will be created. For more details about how to configure the parameters, see **Quickly Creating a Cluster**.

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Table 2-1 MRS cluster parameters

Parameter	Description	Example Value
Billing Mode	Billing mode of the cluster you want to create. MRS provides two billing modes: yearly/monthly and pay-per-use. Pay-per-use is a postpaid billing mode. You pay as you go and pay for what you use. The cluster usage is calculated by the second but billed every hour.	Pay-per-use
Region	Region where the MRS resources to be requested belong. MRS clusters in different regions cannot communicate with each other over an intranet. For lower network latency and quick resource access, select the nearest region.	Europe-Dublin
Cluster Name	Name of the MRS cluster you want to create.	mrs_demo
Cluster Type	A range of clusters that accommodate diverse big data demands. You can select a Custom cluster to run a wide range of analytics components supported by MRS.	Custom
Version Type	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version. You are advised to select the latest version.	LTS
Cluster Version	Service type of the MRS	MRS 3.2.0-LTS.1
Component	Cluster templates containing preset opensource components you will need for your business.	Real-time analysis cluster
AZ	Available AZ associated with the cluster region.	AZ1
VPC	VPC where you want to create the cluster. You can click **View VPC** to view the name and ID. If no VPC is available, create one.	vpc-default
Subnet	Subnet where your cluster belongs. You can access the VPC management console to view the names and IDs of existing subnets in the VPC. If no subnet is created under the VPC, click **Create Subnet** to create one.	subnet-default
Cluster Node	Cluster node details.	Default value

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Parameter	Description	Example Value
Kerberos Authentication	Whether Kerberos authentication is enabled.	Disabled
Username	Username for logging in to the cluster management page and the ECS node.	root/admin
Password	User password for logging in to the cluster management page and the ECS node.	-
Confirm Password	Enter the user password again.	-
Enterprise Project	Enterprise project to which the cluster belongs.	default
Secure Communications	Select the check box to agree to use the access control rules.	Selected

Step 5 Click Buy Now. A page is displayed showing that the task has been submitted.

Step 6 Click **Back to Cluster List**. You can view the status of the newly created cluster on the **Active Clusters** page.

Wait for the cluster creation to complete. The initial status of the cluster is **Starting**. After the cluster is created, the cluster status becomes **Running**.

----End

Step 2: Installing the Cluster Client

You need to install a cluster client to connect to component services in the cluster and submit jobs.

You can install the client on a node in or outside the cluster. This topic installs the client on the **Master1** node as an example.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

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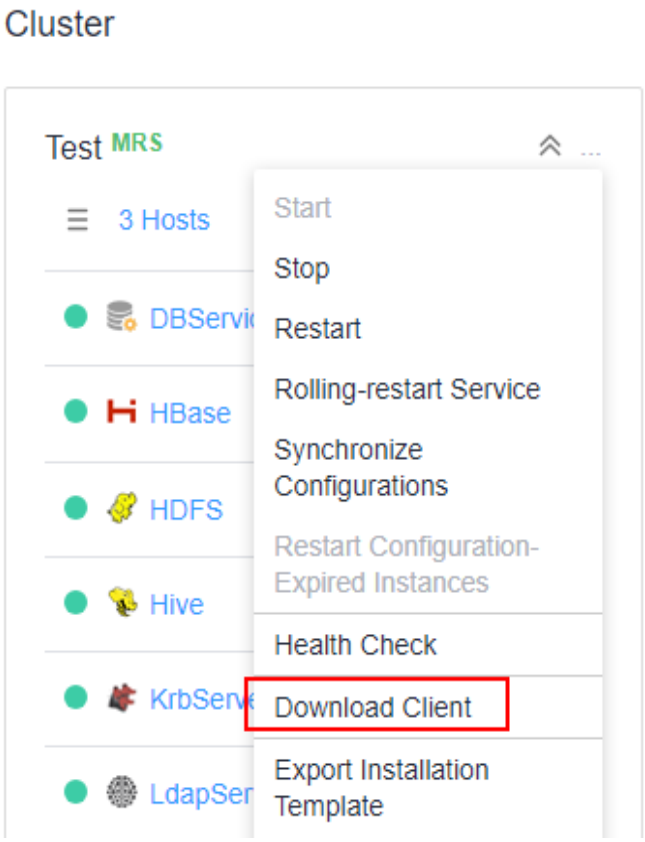
Step 4 On the displayed **Homepage** page, click ··· next to the cluster name and click **Download Client** to download the cluster client.

Figure 2-1 Downloading the client



In the **Download Cluster Client** dialog box, set the following parameters:

- Set **Select Client Type** to **Complete Client**.
- Retain the default value for **Platform Type**, for example, **x86_64**.
- Retain the default path for **Save to Path**. The generated file will be saved in the **/tmp/FusionInsight-Client** directory on the active OMS node of the cluster.

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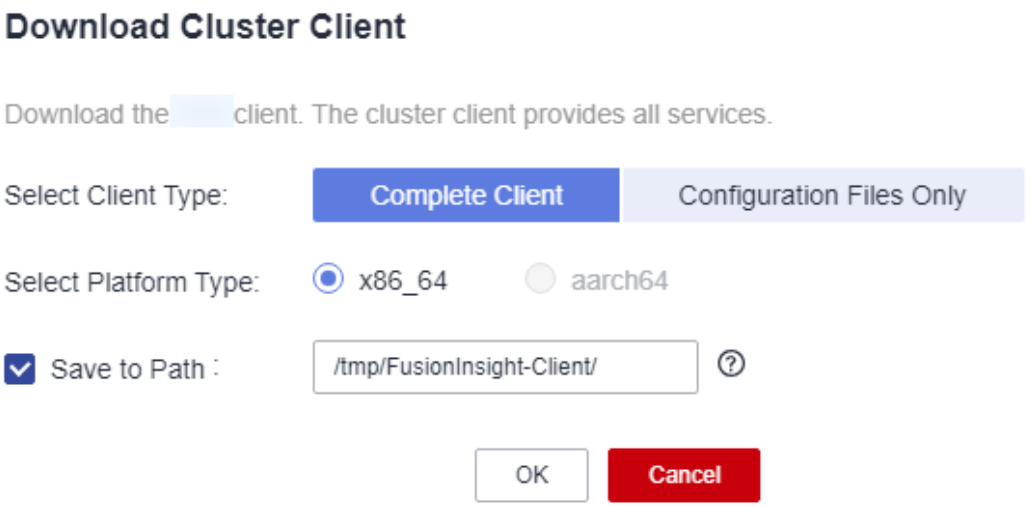
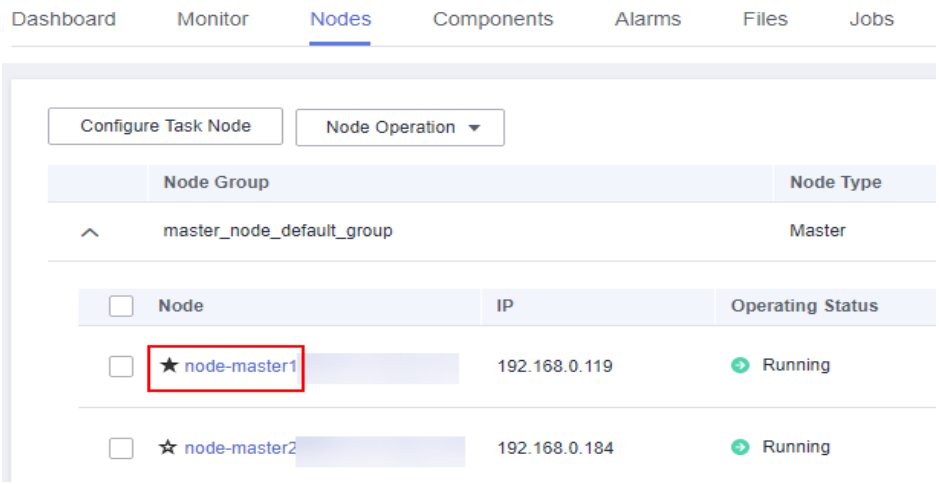
Figure 2-2 Downloading the cluster client



Click **OK** and wait until the client software is generated.

Step 5 Go back to the MRS console and click the cluster name in the cluster list. Go to the **Nodes** tab, click the name of the node that contains **master1**. In the upper right corner of the ECS details page, click **Remote Login** to log in to the **Master1** node.

Figure 2-3 Checking the Master1 node



Step 6 Log in to the **Master1** node as user **root**. The password is the one you set for the **root** user during cluster purchase.

Step 7 Switch to the directory where the client software package is stored and decompress the package.

cd /tmp/FusionInsight-Client/

tar -xvf FusionInsight_Cluster_1_Services_Client.tar

tar -xvf FusionInsight_Cluster_1_Services_ClientConfig.tar

Step 8 Go to the directory where the installation package is stored and install the client.

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cd FusionInsight_Cluster_1_Services_ClientConfig

Install the client to a specified directory (an absolute path), for example, **/opt/client**.

./install.sh /opt/client

```
...
... component client is installed successfully
...
```

NOTE

A client installation directory will be automatically created if it does not exist. If there is such directory, it must be empty. The specified client installation directory can contain only uppercase letters, lowercase letters, digits, and underscores (_), and cannot contain space.

----End

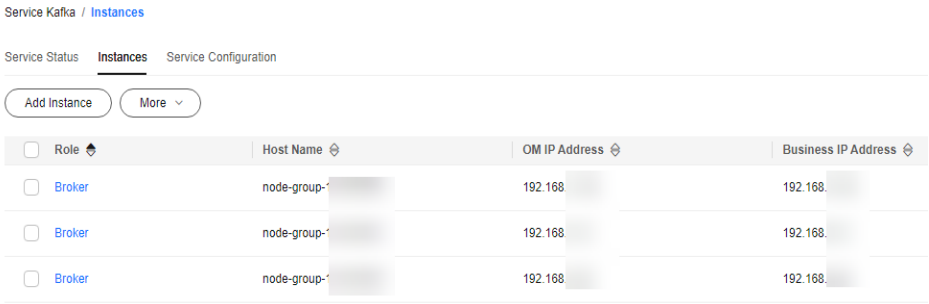
Step 3: Using the Kafka Client to Create a Topic

Step 1 In the cluster list, click the name of the target cluster. The dashboard tab is displayed.

Step 2 On the displayed page, click **Synchronize** next to **IAM User Sync**. In the displayed dialog box, select **All**, and click **Synchronize**. Wait until the synchronization task is complete.

Step 3 Go to the **Components** tab, click **ZooKeeper**, and then click the **Instances** tab. Check and record the IP address of a ZooKeeper quorumpeer role instance.

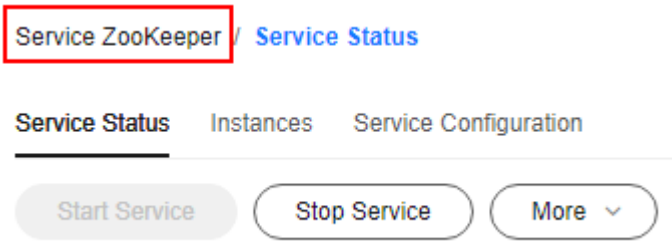
Figure 2-4 Checking IP addresses of ZooKeeper role instances



Step 4 Click **Service Configuration** and check the value of **clientPort**, which indicates the ZooKeeper client connection port.

Step 5 Click **Service ZooKeeper** to return to the component list.

Figure 2-5 Back to component list



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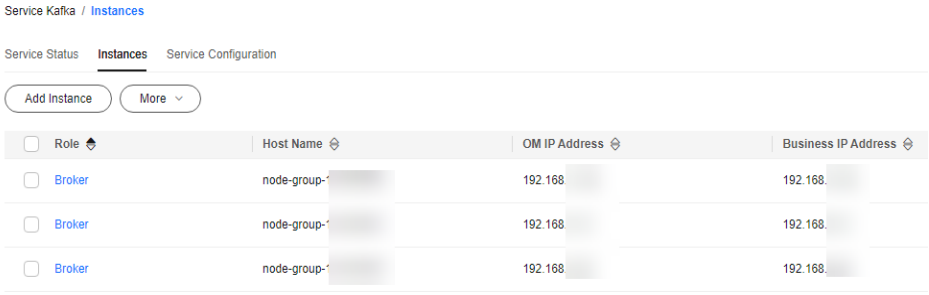
Step 6 Click **Kafka**, and then the **Instances** tab. Check and record the IP addresses of a Kafka Broker instance.

Figure 2-6 Checking the IP address of a broker instance



Step 7 Click **Service Configuration** and check the value of **port**, which indicates the port for connecting to Kafka Broker.

Step 8 Log in to the node (**Master1**) where the MRS client is located as user **root**.

Step 9 Switch to the client installation directory and configure environment variables.

cd /opt/client

source bigdata_env

Step 10 Create a Kafka topic.

kafka-topics.sh --create --zookeeper *IP address of ZooKeeper role instance*:*ZooKeeper client connection port* **/kafka --partitions 2 --replication-factor 2 --topic** *Topic name*

The following is an example:

kafka-topics.sh --create --zookeeper 192.168.21.234:2181/kafka --partitions 2 --replication-factor 2 --topic Topic1

If the following information is displayed, the topic is created:

```
Created topic Topic1.
```

----End

Step 4: Managing Messages in the Kafka Topic

Step 1 Log in to the node (**Master1**) where the MRS client is deployed as user **root**.

Step 2 Switch to the client installation directory and configure environment variables.

cd /opt/client

source bigdata_env

Step 3 Generate a message in Topic1.

kafka-console-producer.sh --broker-list *IP address of the node where the Kafka Broker role is deployed*:*Broker connection port* **--topic** *Topic name* **--producer.config /opt/hadoopclient/Kafka/kafka/config/producer.properties**

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For the IP address and port number of the node where the Kafka Broker instance is deployed, see **Step 6** and **Step 7** in **Step 3: Using the Kafka Client to Create a Topic**.

The following is an example:

kafka-console-producer.sh --broker-list 192.168.21.21:9092 --topic Topic1 --producer.config /opt/client/Kafka/kafka/config/producer.properties

Step 4 Open a new client connection window.

cd /opt/client

source bigdata_env

Step 5 Consume messages in Topic1.

kafka-console-consumer.sh --topic *Topic name* **--bootstrap-server** *IP address of the node where the Kafka Broker role is deployed*:*Broker connection port* **--consumer.config /opt/client/Kafka/kafka/config/consumer.properties**

The following is an example:

kafka-console-consumer.sh --topic Topic1 --bootstrap-server 192.168.21.21:9092 --consumer.config /opt/client/Kafka/kafka/config/consumer.properties

Step 6 Enter some content in the command line that generates messages in **Step 3**. The content is used as the messages generated by the producer. Press **Enter** to send the message.

The following is an example:

```
>aaa
>bbb
>ccc
```

To stop generating messages, press **Ctrl+C** to exit.

Step 7 In the message consuming window of **Step 5**, check whether the messages are consumed.

```
aaa
bbb
ccc
```

----End

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3 Creating and Using an HBase Cluster for Offline Query

Scenario

This topic helps you create an HBase query cluster from scratch and describes how to create and query HBase tables through the cluster client.

An HBase cluster uses Hadoop and HBase components to provide a column-oriented distributed cloud storage system featuring enhanced reliability, great performance, and elastic scalability. It applies to the storage and distributed computing of massive amounts of data. You can use HBase to build a storage system capable of storing TB- or even PB-level data. With HBase, you can filter and analyze data with ease and get responses in milliseconds, rapidly mining data value.

Procedure

Before you start, complete operations described in **Preparations**. Then, follow these steps:

1. **Creating an MRS Cluster**: Create an HBase query cluster of MRS 3.2.0-LTS.1.
2. **Installing the Cluster Client**: Download and install the MRS cluster client.
3. **Creating a Table Using the HBase Client**: Create a table, insert table data, query the data, and delete the table on the HBase client.

Preparations

- You have prepared an IAM user who has the permission to create MRS clusters.

Step 1: Creating an MRS Cluster

Step 1 Go to the **Buy Cluster** page.

Step 2 Search for MapReduce Service in the service list and enter the MRS console.

Step 3 Click Buy Cluster. The **Quick Config** tab is displayed.

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Step 4 Configure the cluster as you need. In this example, a pay-per-use MRS 3.2.0-LTS.1 cluster will be created. For more details about how to configure the parameters, see **Quickly Creating a Cluster**.

Table 3-1 MRS cluster parameters

Parameter	Description	Example Value
Billing Mode	Billing mode of the cluster you want to create. MRS provides two billing modes: yearly/monthly and pay-per-use. Pay-per-use is a postpaid billing mode. You pay as you go and pay for what you use. The cluster usage is calculated by the second but billed every hour.	Pay-per-use
Region	Region where the MRS resources to be requested belong. MRS clusters in different regions cannot communicate with each other over an intranet. For lower network latency and quick resource access, select the nearest region.	Europe-Dublin
Cluster Name	Name of the MRS cluster you want to create.	mrs_demo
Cluster Type	A range of clusters that accommodate diverse big data demands. You can select a Custom cluster to run a wide range of analytics components supported by MRS.	Custom
Version Type	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version.	LTS
Cluster Version	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version. You are advised to select the latest version.	MRS 3.2.0-LTS.1
Component	Cluster templates containing preset opensource components you will need for your business.	HBase Query Cluster
AZ	Available AZ associated with the cluster region.	AZ1
VPC	VPC where you want to create the cluster. You can click **View VPC** to view the name and ID. If no VPC is available, create one.	vpc-default
Subnet	Subnet where your cluster belongs. You can access the VPC management console to view the names and IDs of existing subnets in the VPC. If no subnet is created under the VPC, click **Create Subnet** to create one.	subnet-default

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Parameter	Description	Example Value
Cluster Node	Cluster node details.	Default value
Kerberos Authentication	Whether Kerberos authentication is enabled.	Disabled
Username	Username for logging in to the cluster management page and the ECS node.	root/admin
Password	User password for logging in to the cluster management page and the ECS node.	-
Confirm Password	Enter the user password again.	-
Enterprise Project	Enterprise project to which the cluster belongs.	default
Secure Communications	Select the check box to agree to use the access control rules.	Selected

Step 5 Click Buy Now. A page is displayed showing that the task has been submitted.

Step 6 Click **Back to Cluster List**. You can view the status of the newly created cluster on the **Active Clusters** page.

Wait for the cluster creation to complete. The initial status of the cluster is **Starting**. After the cluster is created, the cluster status becomes **Running**.

----End

Step 2: Installing the Cluster Client

You need to install a cluster client to connect to component services in the cluster and submit jobs.

You can install the client on a node in or outside the cluster. This topic installs the client on the **Master1** node as an example.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

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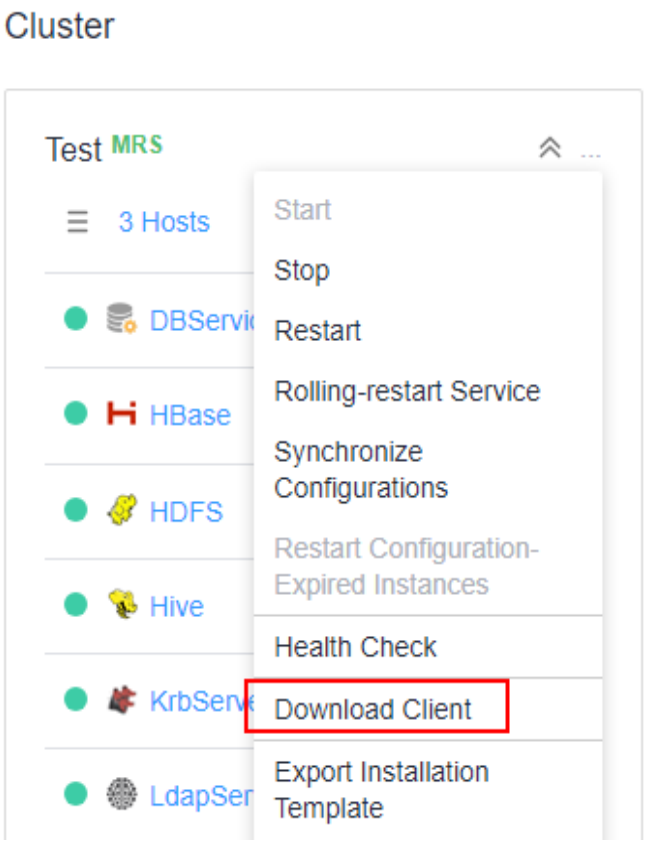
The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

Step 4 On the displayed **Homepage** page, click ··· next to the cluster name and click **Download Client** to download the cluster client.

Figure 3-1 Downloading the client



In the **Download Cluster Client** dialog box, set the following parameters:

- Set **Select Client Type** to **Complete Client**.
- Retain the default value for **Platform Type**, for example, **x86_64**.
- Retain the default path for **Save to Path**. The generated file will be saved in the **/tmp/FusionInsight-Client** directory on the active OMS node of the cluster.

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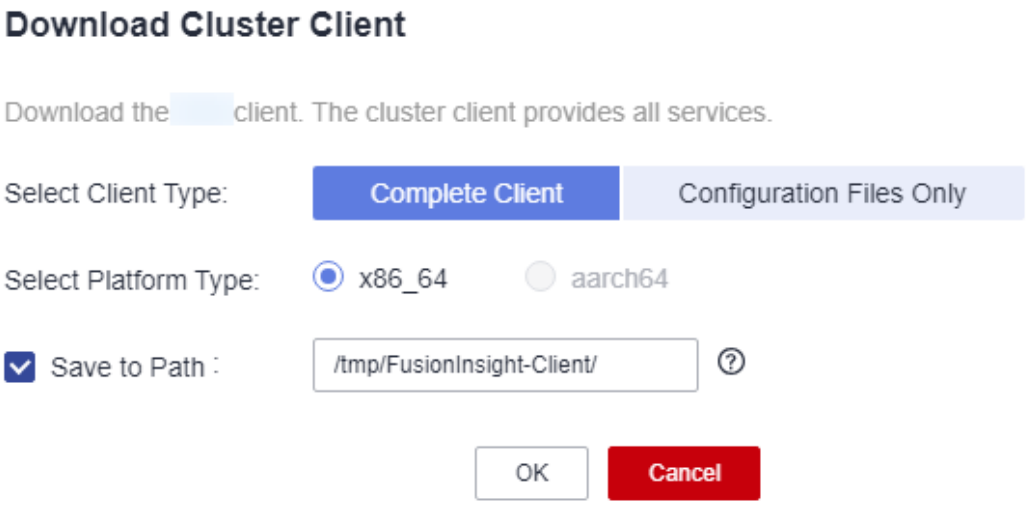
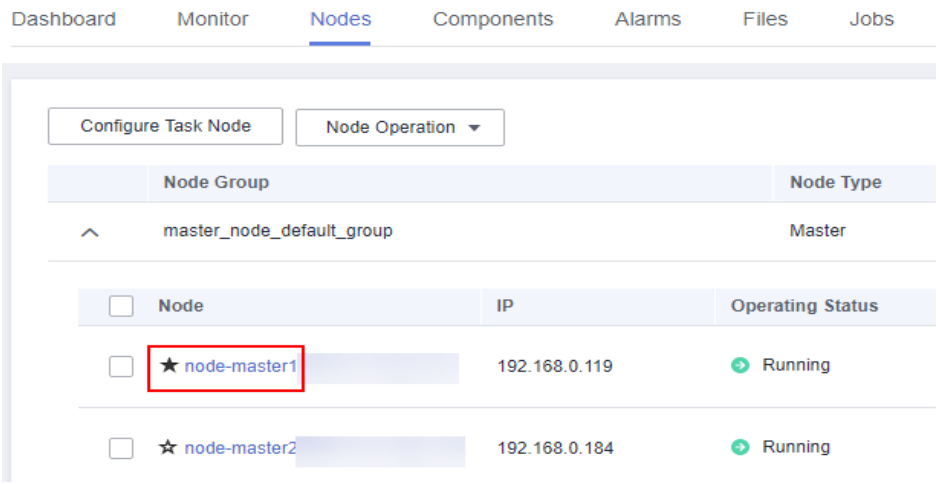
Figure 3-2 Downloading the cluster client



Click **OK** and wait until the client software is generated.

Step 5 Go back to the MRS console and click the cluster name in the cluster list. Go to the **Nodes** tab, click the name of the node that contains **master1**. In the upper right corner of the ECS details page, click **Remote Login** to log in to the **Master1** node.

Figure 3-3 Checking the Master1 node



Step 6 Log in to the **Master1** node as user **root**. The password is the one you set for the **root** user during cluster purchase.

Step 7 Switch to the directory where the client software package is stored and decompress the package.

cd /tmp/FusionInsight-Client/

tar -xvf FusionInsight_Cluster_1_Services_Client.tar

tar -xvf FusionInsight_Cluster_1_Services_ClientConfig.tar

Step 8 Go to the directory where the installation package is stored and install the client.

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cd FusionInsight_Cluster_1_Services_ClientConfig

Install the client to a specified directory (an absolute path), for example, **/opt/client**.

./install.sh /opt/client

```
...
... component client is installed successfully
...
```

NOTE

A client installation directory will be automatically created if it does not exist. If there is such directory, it must be empty. The specified client installation directory can contain only uppercase letters, lowercase letters, digits, and underscores (_), and cannot contain space.

----End

Step 3: Creating a Table Using the HBase Client

Step 1 Log in to the node (**Master1**) where the MRS client is deployed as user **root**.

Step 2 Switch to the client installation directory and configure environment variables.

cd /opt/client

source bigdata_env

Step 3 Access the HBase shell CLI.

hbase shell

Step 4 Create the **user_info** table on the HBase client.

1. Create the **user_info** table.
   create '*user_info*'**,{NAME => 'i'}**
2. Add data to the **user_info** table.
   put *'user_info','12005000201','i:name','A'*
   put *'user_info','12005000201','i:gender','Male'*
   put *'user_info','12005000201','i:age','19'*
   put *'user_info','12005000201','i:address','City A'*
   put *'user_info','12005000201','i:degree','master'*
   put *'user_info','12005000201','i:pose','manager'*

Step 5 Query the HBase table.

1. Query usernames and addresses by user ID.
   scan '*user_info*'**,**
   {STARTROW=>'*12005000201***',STOPROW=>'***12005000201***',COLUMNS=>['i:name','i:address']}**

   The query result is as follows:

   ```
   ROW                                   COLUMN
   +CELL
    12005000201                          column=i:address, timestamp=2021-10-30T10:21:42.196, value=City
   A
    12005000201                          column=i:name, timestamp=2021-10-30T10:21:18.594,
   value=A
   1 row(s)
   Took 0.0996 seconds
   ```

2. Query information by username.
   scan '*user_info*'**,{FILTER=>"SingleColumnValueFilter('i','name',=,'binary:***A***')"}**

   The query result is as follows:

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```
ROW                                  COLUMN
+CELL
 12005000201                         column=i:address, timestamp=2021-10-30T10:21:42.196, value=City
A
 12005000201                         column=i:age, timestamp=2021-10-30T10:21:30.777,
value=19
 12005000201                         column=i:degree, timestamp=2021-10-30T10:21:53.284,
value=master
 12005000201                         column=i:gender, timestamp=2021-10-30T10:21:18.711,
value=Male
 12005000201                         column=i:name, timestamp=2021-10-30T10:21:18.594,
value=A
 12005000201                         column=i:pose, timestamp=2021-10-30T10:22:07.152,
value=manager
1 row(s)
Took 0.2158 seconds
```

Step 6 Delete the HBase table.

1. Delete user data from the user information table.

   ```
   delete 'user_info','12005000201','i'
   ```

2. Delete the user information table.

   ```
   disable 'user_info'
   drop 'user_info'
   ```

----End

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4 Creating and Using a ClickHouse Cluster for Columnar Store

Scenario

This topic helps you create a ClickHouse cluster from scratch and create and query a ClickHouse table through the cluster client.

ClickHouse is an open-source columnar database oriented to online analysis and processing. It is independent of the Hadoop big data system and features ultimate compression rate and fast query performance.

Procedure

Before you start, complete operations described in **Preparations**. Then, follow these steps:

1. **Creating an MRS Cluster**: Create a ClickHouse cluster of MRS 3.2.0-LTS.1.
2. **Installing the Cluster Client**: Download and install the MRS cluster client.
3. **Creating a Table through the ClickHouse Client**: Create a table on the ClickHouse client and insert data into the table.

Preparations

- You have prepared an IAM user who has the permission to create MRS clusters.

Step 1: Creating an MRS Cluster

Step 1 Go to the **Buy Cluster** page.

Step 2 Search for MapReduce Service in the service list and enter the MRS console.

Step 3 Click Buy Cluster. The **Quick Config** tab is displayed.

Step 4 Configure the cluster as you need. In this example, a pay-per-use MRS 3.2.0-LTS.1 cluster will be created. For more details about how to configure the parameters, see **Quickly Creating a Cluster**.

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Table 4-1 MRS cluster parameters

Parameter	Description	Value
Billing Mode	Billing mode of the cluster you want to create. MRS provides two billing modes: yearly/monthly and pay-per-use. Pay-per-use is a postpaid billing mode. You pay as you go and pay for what you use. The cluster usage is calculated by the second but billed every hour.	Pay-per-use
Region	Region where the MRS resources to be requested belong. MRS clusters in different regions cannot communicate with each other over an intranet. For lower network latency and quick resource access, select the nearest region.	Europe-Dublin
Cluster Name	Name of the MRS cluster you want to create.	mrs_demo
Cluster Type	A range of clusters that accommodate diverse big data demands. You can select a Custom cluster to run a wide range of analytics components supported by MRS.	Custom
Version Type	Service type of the MRS	LTS
Cluster Version	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version. You are advised to select the latest version.	MRS 3.2.0-LTS.1
Component	Cluster templates containing preset opensource components you will need for your business.	ClickHouse Cluster
AZ	Available AZ associated with the cluster region.	AZ1
VPC	VPC where you want to create the cluster. You can click **View VPC** to view the name and ID. If no VPC is available, create one.	vpc-default
Subnet	Subnet where your cluster belongs. You can access the VPC management console to view the names and IDs of existing subnets in the VPC. If no subnet is created under the VPC, click **Create Subnet** to create one.	subnet-default
Cluster Node	Cluster node details.	Default value

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Parameter	Description	Value
Kerberos Authentication	Whether Kerberos authentication is enabled.	Disabled
Username	Username for logging in to the cluster management page and the ECS node.	root/admin
Password	User password for logging in to the cluster management page and the ECS node.	-
Confirm Password	Enter the user password again.	-
Enterprise Project	Enterprise project to which the cluster belongs.	default
Secure Communications	Select the check box to agree to use the access control rules.	Selected

Step 5 Click Buy Now. A page is displayed showing that the task has been submitted.

Step 6 Click **Back to Cluster List**. You can view the status of the newly created cluster on the **Active Clusters** page.

Wait for the cluster creation to complete. The initial status of the cluster is **Starting**. After the cluster is created, the cluster status becomes **Running**.

----End

Step 2: Installing the Cluster Client

You need to install a cluster client to connect to component services in the cluster and submit jobs.

You can install the client on a node in or outside the cluster. This topic installs the client on the **Master1** node as an example.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

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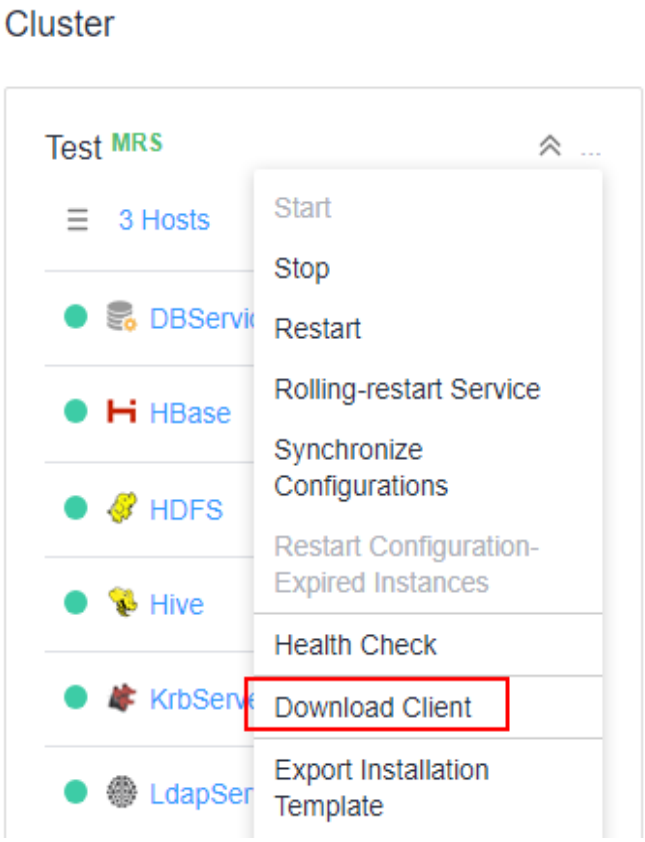
Step 4 On the displayed **Homepage** page, click ··· next to the cluster name and click **Download Client** to download the cluster client.

Figure 4-1 Downloading the client



In the **Download Cluster Client** dialog box, set the following parameters:

- Set **Select Client Type** to **Complete Client**.
- Retain the default value for **Platform Type**, for example, **x86_64**.
- Retain the default path for **Save to Path**. The generated file will be saved in the **/tmp/FusionInsight-Client** directory on the active OMS node of the cluster.

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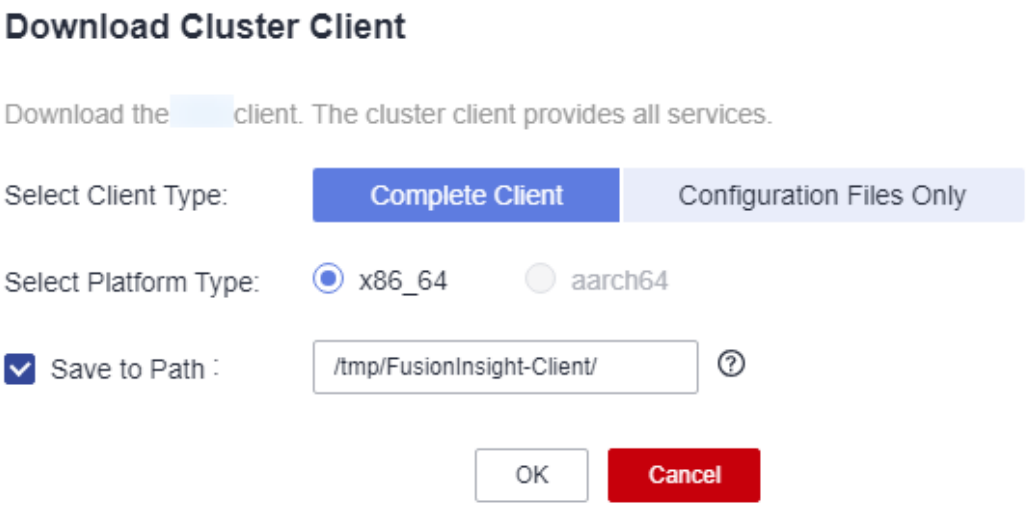
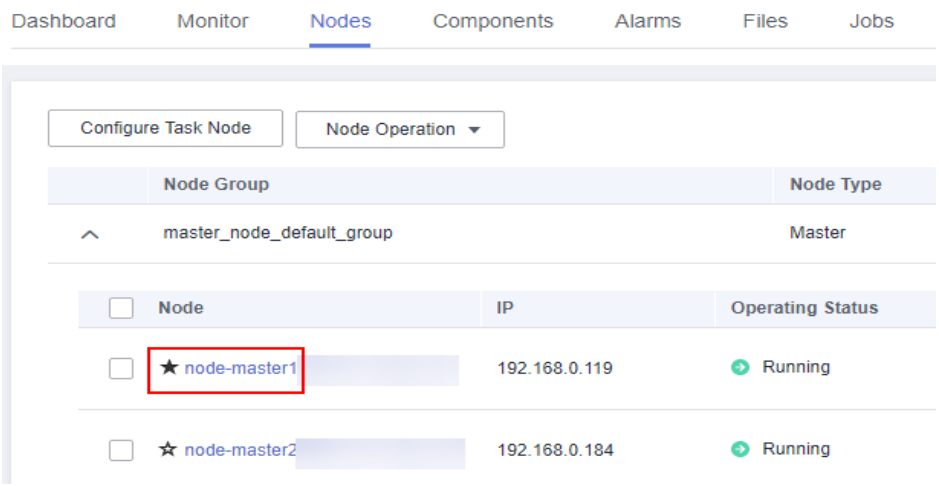
Figure 4-2 Downloading the cluster client



Click **OK** and wait until the client software is generated.

Step 5 Go back to the MRS console and click the cluster name in the cluster list. Go to the **Nodes** tab, click the name of the node that contains **master1**. In the upper right corner of the ECS details page, click **Remote Login** to log in to the **Master1** node.

Figure 4-3 Checking the Master1 node



Step 6 Log in to the **Master1** node as user **root**. The password is the one you set for the **root** user during cluster purchase.

Step 7 Switch to the directory where the client software package is stored and decompress the package.

cd /tmp/FusionInsight-Client/

tar -xvf FusionInsight_Cluster_1_Services_Client.tar

tar -xvf FusionInsight_Cluster_1_Services_ClientConfig.tar

Step 8 Go to the directory where the installation package is stored and install the client.

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cd FusionInsight_Cluster_1_Services_ClientConfig

Install the client to a specified directory (an absolute path), for example, **/opt/client**.

./install.sh /opt/client

```
...
... component client is installed successfully
...
```

NOTE

A client installation directory will be automatically created if it does not exist. If there is such directory, it must be empty. The specified client installation directory can contain only uppercase letters, lowercase letters, digits, and underscores (_), and cannot contain space.

----End

Step 3: Creating a Table Through the ClickHouse Client

Step 1 Log in to the node (**Master1**) where the MRS client is deployed as user **root**.

Step 2 Switch to the client installation directory and configure environment variables.

cd /opt/client

source bigdata_env

Step 3 Run the **clickhouse client** command to connect to the ClickHouse server.

clickhouse client --host *IP address of the ClickHouseServer instance* **--port** *9000* **--user** *Username* **--password**

NOTE

- To obtain the IP address of the ClickHouseServer instance, log in to FusionInsight Manager of the cluster and choose **Cluster** > **Services** > **ClickHouse** > **Instances**.
- Clusters with Kerberos authentication disabled use non-SSL connections by default. The default connection port is 9000. To view the port number, log in to FusionInsight Manager of the cluster, choose **Cluster** > **Services** > **ClickHouse** > **Configurations**, and search for **tcp_port**.
- If the **--user** and **--password** parameters are not specified, the **default** user is used for logging in to the ClickHouse client by default. If you want to specify the username and password, run the **create user** SQL statement on the ClickHouse client to create a ClickHouse user.

Step 4 Create the **test001** database.

```
create database test001 on cluster default_cluster;
```

Step 5 Create the replication table **test010**.

```
CREATE TABLE test001.test010 on cluster default_cluster
(
`EventDate` DateTime,
`CounterID` UInt32,
`UserID` UInt32,
`ver` UInt16
)
ENGINE = ReplicatedReplacingMergeTree('/clickhouse/tables/{shard}/test3', '{replica}', ver)
ORDER BY (CounterID, EventDate, intHash32(UserID));
```

Step 6 Create a replication table **test010** and insert data into the table.

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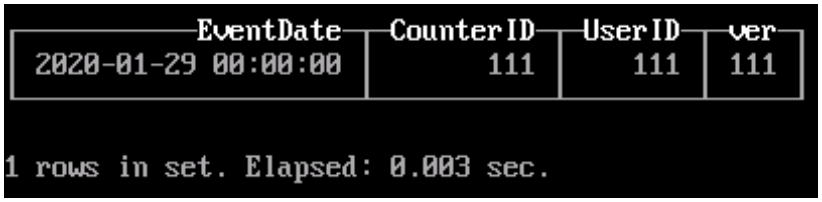
```
insert into test001.test010 values('2020-01-29',111,111,111);
```

Step 7 View data in the **test010** table.

```
select * from test001.test010;
```

Figure 4-4 Viewing data in the **test010** table.



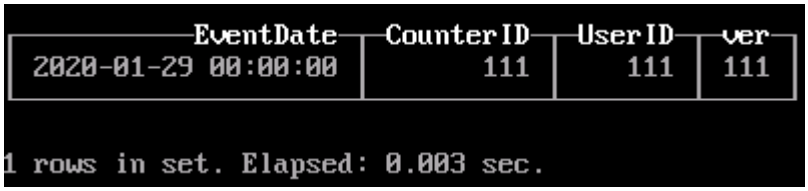
Step 8 Create a distributed table **test001.test010_dir** and insert data into the table.

```
create table test001.test010_dir ON CLUSTER default_cluster as test001.test010 ENGINE = Distributed(default_cluster, test001, test010, rand());
insert into test001.test010_dir values('2020-01-29',111,111,111);
```

Step 9 Query the distributed table.

```
select * from test001.test010_dir;
```

Figure 4-5 Viewing data in the **test010_dir** table



Step 10 Delete the created database table.

```
drop database test001 on cluster default_cluster no delay;
```

----End

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5 Creating and Using an MRS Cluster Requiring Security Authentication

Scenario

This topic helps you create a Hadoop analysis cluster that requires Kerberos authentication and submit a wordcount job through the cluster client. A wordcount job is a classic Hadoop job that counts words in massive amounts of text.

The Hadoop cluster uses many open-source Hadoop ecosystem components, including YARN for cluster resource management and Hive and Spark for offline large-scale distributed data storage and compute to provide massive data analysis and query capabilities.

Procedure

Before you start, complete operations described in **Preparations**. Then, follow these steps:

1. **Creating an MRS Cluster**: Create a Hadoop analysis cluster of MRS 3.2.0-LTS.1 that requires Kerberos authentication.
2. **Creating a Cluster User**: Create a role that has the permission to submit the wordcount job and bind the role to a user on FusionInsight Manager.
3. **Installing the Cluster Client**: Download and install the MRS cluster client.
4. **Preparing Applications and Data**: Prepare the data files required for running the wordcount sample program on the MRS cluster client.
5. **Submitting a Job and Viewing the Result**: Submit a wordcount data analysis job on the cluster client and view the execution result.

Preparations

- You have prepared an IAM user who has the permission to create MRS clusters.

Step 1: Creating an MRS Cluster

Step 1 Go to the **Buy Cluster** page.

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Step 2 Search for MapReduce Service in the service list and enter the MRS console.

Step 3 Click Buy Cluster. The **Quick Config** tab is displayed.

Step 4 Configure the cluster as you need. In this example, a pay-per-use MRS 3.2.0-LTS.1 cluster will be created. For more details about how to configure the parameters, see **Quickly Creating a Cluster**.

Table 5-1 MRS cluster parameters

Parameter	Description	Example Value
Billing Mode	Billing mode of the cluster you want to create. MRS provides two billing modes: yearly/monthly and pay-per-use. Pay-per-use is a postpaid billing mode. You pay as you go and pay for what you use. The cluster usage is calculated by the second but billed every hour.	Pay-per-use
Region	Region where the MRS resources to be requested belong. MRS clusters in different regions cannot communicate with each other over an intranet. For lower network latency and quick resource access, select the nearest region.	Europe-Dublin
Cluster Name	Name of the MRS cluster you want to create.	mrs_demo
Cluster Type	A range of clusters that accommodate diverse big data demands. You can select a Custom cluster to run a wide range of analytics components supported by MRS.	Custom
Version Type	Service type of the MRS	Normal
Cluster Version	Version of the MRS cluster. Supported open-source components and their functions vary depending on the cluster version. You are advised to select the latest version.	MRS 3.2.0-LTS.1
Component	Cluster templates containing preset opensource components you will need for your business.	Hadoop Analysis Cluster
AZ	Available AZ associated with the cluster region.	AZ1
VPC	VPC where you want to create the cluster. You can click **View VPC** to view the name and ID. If no VPC is available, create one.	vpc-default

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Parameter	Description	Example Value
Subnet	Subnet where your cluster belongs. You can access the VPC management console to view the names and IDs of existing subnets in the VPC. If no subnet is created under the VPC, click **Create Subnet** to create one.	subnet-default
Cluster Node	Cluster node details.	Default value
Kerberos Authentication	Whether Kerberos authentication is enabled.	Enabled
Username	Username for logging in to the cluster management page and the ECS node.	root/admin
Password	User password for logging in to the cluster management page and the ECS node.	-
Confirm Password	Enter the user password again.	-
Enterprise Project	Enterprise project to which the cluster belongs.	default
Secure Communications	Select the check box to agree to use the access control rules.	Selected

Step 5 Click Buy Now. A page is displayed showing that the task has been submitted.

Step 6 Click **Back to Cluster List**. You can view the status of the newly created cluster on the **Active Clusters** page.

Wait for the cluster creation to complete. The initial status of the cluster is **Starting**. After the cluster is created, the cluster status becomes **Running**.

----End

Step 2: Creating a Cluster User

For clusters with Kerberos authentication enabled, perform the following steps to create a user and grant permissions to the user to execute programs.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

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Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

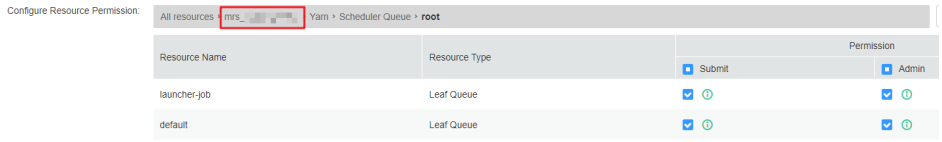
The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

Step 4 Click **System** in the navigation pane on the top, and click **Permission** > **Role**.

Step 5 Click **Create Role** and set the following parameters. For details, see **Creating a Role**.

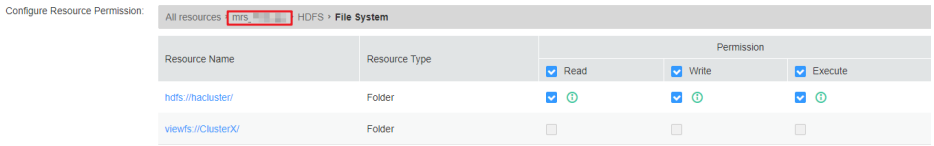
- Enter a role name, for example, **mrrole**.
- For **Configure Resource Permission**, select the cluster to be operated, choose **Yarn** > **Scheduler Queue** > **root**, and select **Submit** and **Admin** in the **Permission** column. Click the name of the target cluster in the path and then configure other permissions.

Figure 5-1 Configuring resource permissions for YARN



- Choose **HDFS** > **File System** > **hdfs://hacluster/**. Locate the row that contains **user**, select **Read**, **Write**, and **Execute** in the **Permission** column, and click **OK**.

Figure 5-2 Configuring resource permissions for HDFS



Step 6 Click **User** in the navigation pane on the left, and then click **Create** on the displayed page. Set the following parameters. For details, see **Creating a User**.

- Enter a username, for example, **test**.
- Set **User Type** to **Human-Machine**.
- Enter the password in **Password** and enter it again in **Confirm Password**.
- Bind **Manager_viewer** to the **mrrole** role created in **Step 5** to grant permissions.

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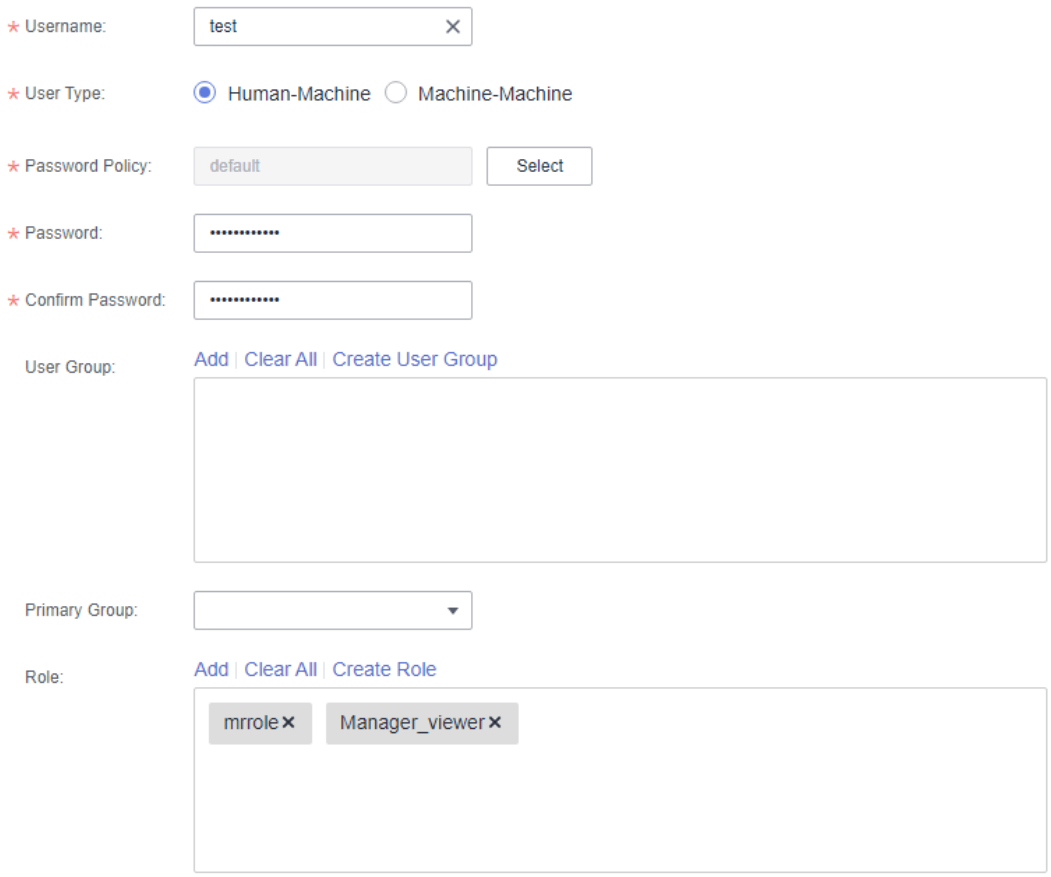
Figure 5-3 Creating a user



Step 7 Click **OK**.

----End

Step 3: Installing the Cluster Client

You need to install a cluster client to connect to component services in the cluster and submit jobs.

You can install the clients on a node in or outside the cluster. This topic installs the client on the **Master1** node as an example.

Step 1 Click the MRS cluster name in the cluster list to go to the dashboard page.

Step 2 Click **Access Manager** next to **MRS Manager**. In the displayed dialog box, select **EIP** and configure the EIP information.

For the first access, click **Manage EIPs** to purchase an EIP on the EIP console. Go back to the **Access MRS Manager** dialog box, refresh the EIP list, and select the EIP.

Step 3 Select the confirmation check box and click **OK** to log in to the FusionInsight Manager of the cluster.

The username for logging in to FusionInsight Manager is **admin**, and the password is the one configured during cluster purchase.

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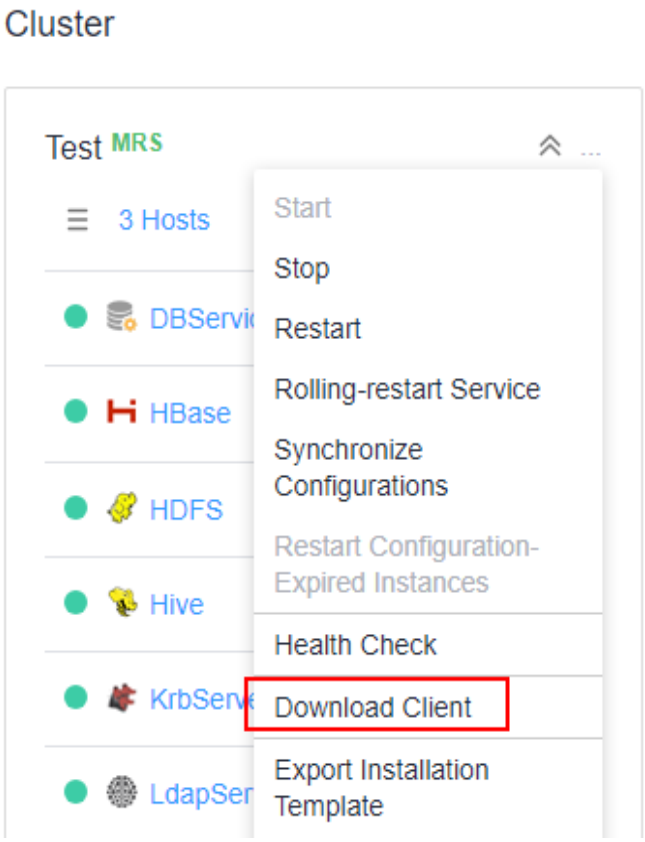
Step 4 On the displayed **Homepage** page, click ··· next to the cluster name and click **Download Client** to download the cluster client.

Figure 5-4 Downloading the client



In the **Download Cluster Client** dialog box, set the following parameters:

- Set **Select Client Type** to **Complete Client**.
- Retain the default value for **Platform Type**, for example, **x86_64**.
- Retain the default path for **Save to Path**. The generated file will be saved in the **/tmp/FusionInsight-Client** directory on the active OMS node of the cluster.

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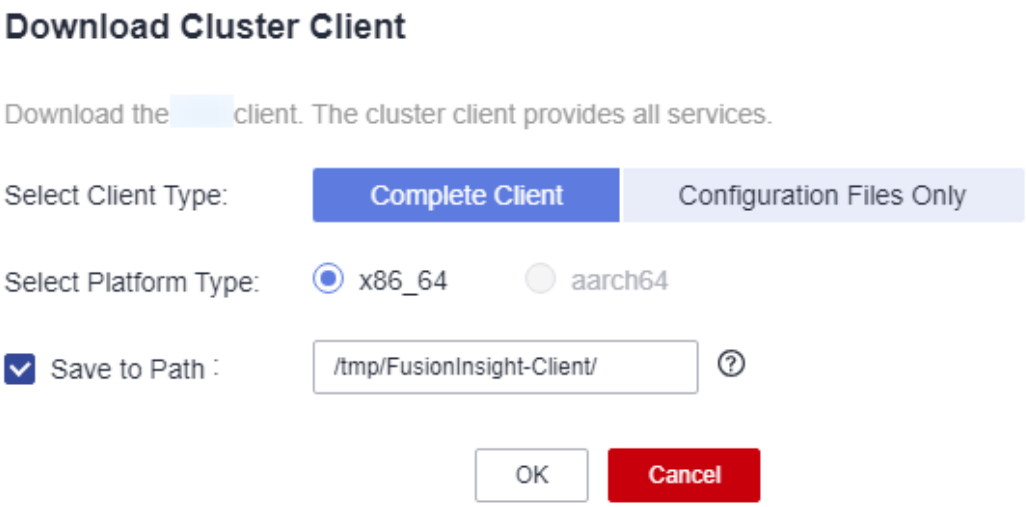
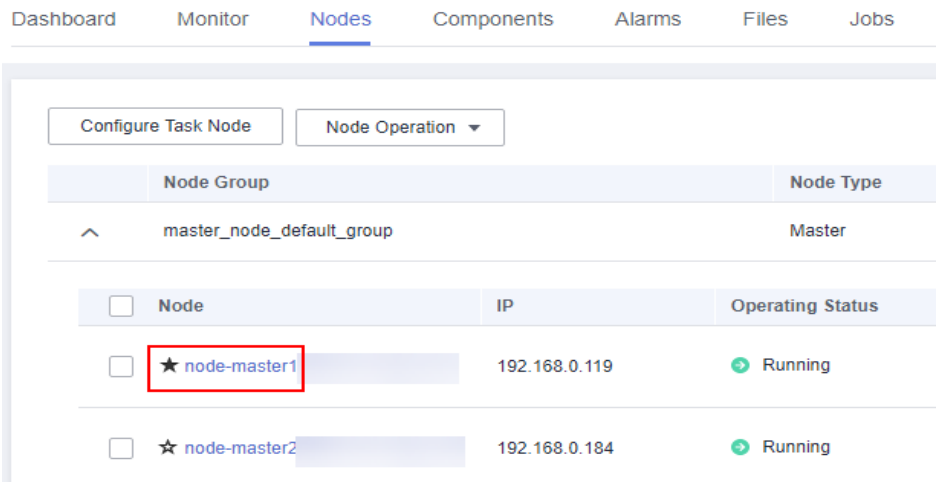
Figure 5-5 Downloading the cluster client



Click **OK** and wait until the client software is generated.

Step 5 Go back to the MRS console and click the cluster name in the cluster list. Go to the **Nodes** tab, click the name of the node that contains **master1**. In the upper right corner of the ECS details page, click **Remote Login** to log in to the **Master1** node.

Figure 5-6 Checking the Master1 node



Step 6 Log in to the **Master1** node as user **root**. The password is the one you set for the **root** user during cluster purchase.

Step 7 Switch to the directory where the client software package is stored and decompress the package.

cd /tmp/FusionInsight-Client/

tar -xvf FusionInsight_Cluster_1_Services_Client.tar

tar -xvf FusionInsight_Cluster_1_Services_ClientConfig.tar

Step 8 Go to the directory where the installation package is stored and install the client.

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cd FusionInsight_Cluster_1_Services_ClientConfig

Install the client to a specified directory (an absolute path), for example, **/opt/client**.

./install.sh /opt/client

```
...
... component client is installed successfully
...
```

NOTE

A client installation directory will be automatically created if it does not exist. If there is such directory, it must be empty. The specified client installation directory can contain only uppercase letters, lowercase letters, digits, and underscores (_), and cannot contain space.

----End

Step 4: Preparing Applications and Data

You can run the wordcount sample program preset in the cluster client on the created cluster, or develop a big data application and upload it to the cluster. This topic uses the wordcount sample program preset in the cluster client as an example. You need to prepare the data files required for running the wordcount sample program.

Step 1 Log in to the **Master1** node as user **root**.

Step 2 Prepare data files.

There is no format requirement. For example, the file names are **wordcount1.txt** and **wordcount2.txt**, and the content is as follows:

vi /opt/wordcount1.txt

```
hello word
hello wordcount
```

vi /opt/wordcount2.txt

```
hello mapreduce
hello hadoop
```

Step 3 Switch to the client installation directory, configure environment variables, and create an HDFS directory for storing sample data, for example, **/user/example/input**.

cd /opt/client

source bigdata_env

kinit test (**test** is the username created in **Step 6**. Change the password upon first login.)

hdfs dfs -mkdir /user/example

hdfs dfs -mkdir /user/example/input

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NOTE

The **test** user created in **Step 6** has only the read, write, and execute permissions on the **/user** directory. If the **input** directory is created in a directory other than **/user**, an error message is displayed, indicating that the permission is required. The following is an example:

hdfs dfs -mkdir /hbase/input

The following error message is displayed:

```
mkdir: Permission denied: user=test, access=EXECUTE, inode="/hbase":hbase:hadoop:drwxrwx--T
```

Step 4 Upload the sample data to HDFS.

hdfs dfs -put /opt/wordcount1.txt /user/example/input

hdfs dfs -put /opt/wordcount2.txt /user/example/input

----End

Step 5: Submitting a Job and Viewing the Result

Step 1 Log in to the client node (**Master1**) as user **root**.

Step 2 Submit the wordcount job, read source data for analysis, and output the execution result to the HDFS.

cd /opt/client

source bigdata_env

kinit test

hadoop jar HDFS/hadoop/share/hadoop/mapreduce/hadoop-mapreduce-examples-3.3.1-*.jar wordcount "/user/example/input/*" "/user/example/output/"

```
...
    File Input Format Counters
        Bytes Read=56
    File Output Format Counters
        Bytes Written=48
```

NOTE

- **/user/example/output/** indicates the address for storing job output files on the HDFS. Set it to a directory that does not exist.
- The name of the **hadoop-mapreduce-examples-3.3.1-*.jar** file varies depending on the cluster client version. Use the actual name.

Step 3 Query job execution results.

1. View the job output file.

   hdfs dfs -ls /user/example/output/

   ```
   ...
   ... /user/example/output/_SUCCESS
   ... /user/example/output/part-r-0000
   ```

2. Save the output in the HDFS file system. You can run a command to download the output to the local PC and view it.

   The following is an example:

   hdfs dfs -get /user/example/output/part-r-00000 /opt

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cat /opt/part-r-00000

The content of the **part-r-00000** file is as follows:

```
hadoop    1
hello    4
mapreduce    1
word    1
wordcount    1
```

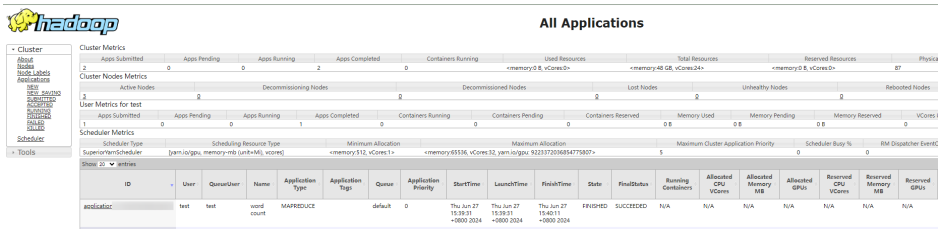
Step 4 View job run logs.

1. Log in to FusionInsight Manager of the cluster as user **test** created in **Step 6** and choose **Cluster** > **Services** > **Yarn**.
2. Click the **ResourceManager(xxx,Active)** link in the row where **ResourceManager Web UI** is.
3. On the **All Applications** page, click the ID of the target job to view the job details.

   NOTE

   On the **All Applications** page, you can confirm a task based on the task submission time and the user name that submits the task.

Figure 5-7 Viewing job details



----End

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