IBM InfoSphere DataStage对接FusionInsight

适用场景

> IBM InfoSphere DataStage 11.5.0.2 ↔ FusionInsight HD V100R002C60U20

前提条件

- 已完成IBM InfoSphere DataStage 11.5.0.2的安装部署（本文部署在Centos7.2上）
- 已完成FusionInsight集群的部署，版本FusionInsight HD V100R002C60U20

准备工作

配置域名解析

- 使用`vi /etc/hosts`命令修改DataStage Server和Client的hosts文件，添加FI集群节点信息，如：

```
162.1.61.42 FusionInsight2
162.1.61.41 FusionInsight1
162.1.61.43 FusionInsight3
```

配置Kerberos认证

- 在FI管理界面创建DataStage对接用户，并赋予该用户所需权限，下载认证凭据

- 解压下载的tar文件，得到Kerberos配置文件krb5.conf和用户的keytab文件。
- 以root登录DataStage Server节点，将FI集群的krb5.conf文件复制到`/etc`目录。
- 将用户的user.keytab文件上传到DataStage Server节点的任意目录，如`/home/dsadm`。

安装FusionInsight客户端

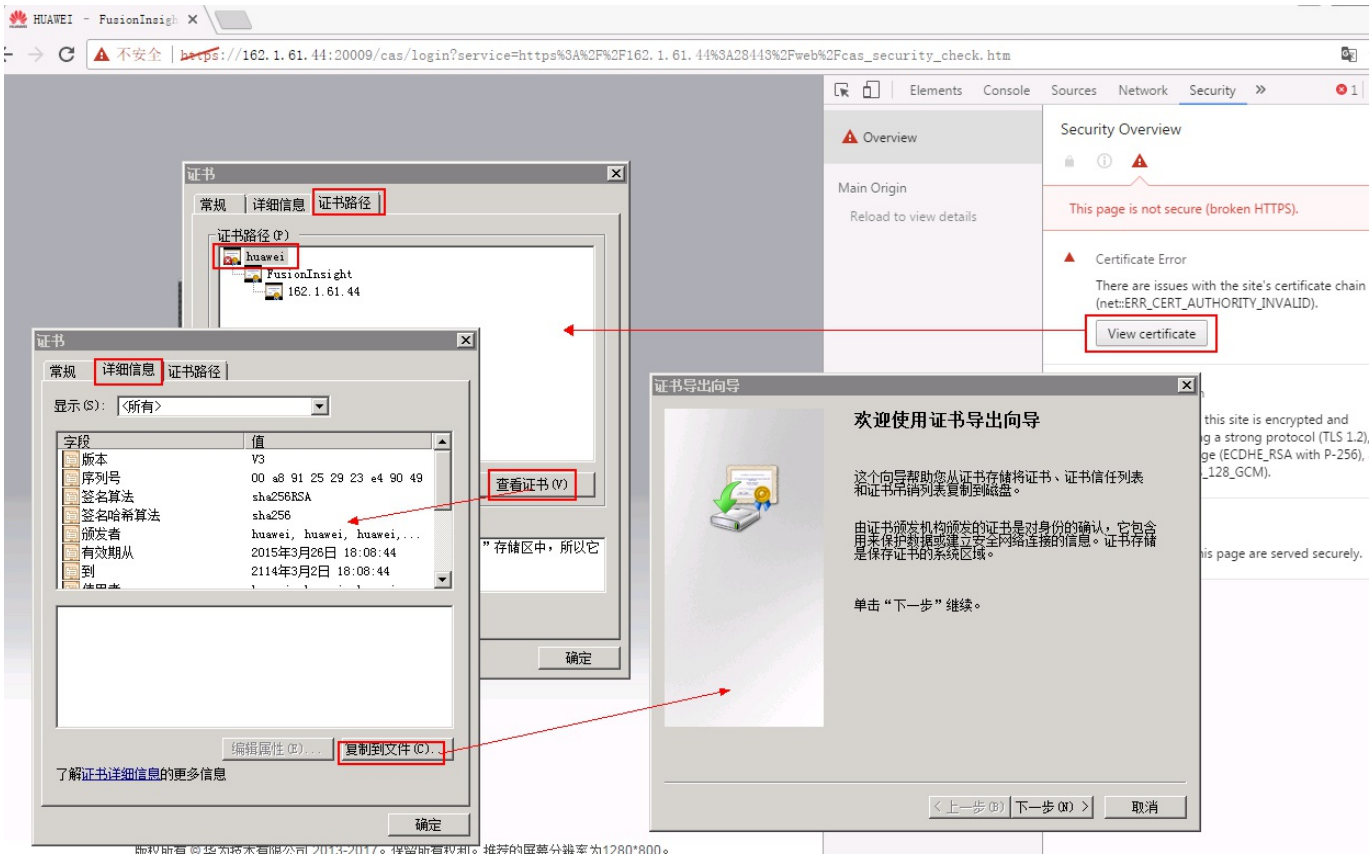
参考FI产品文档，在FI服务管理界面下载完整客户端，上传到DataStageServer，安装至自定义目录，如`/opt/ficlient`。

对接HDFS

导入FI集群的SSL证书

- 浏览器导出FI集群的根证书

  浏览器打开FI管理界面，查看证书，点击“证书路径”页签，选择根路径，查看根证书，在“详细信息”页签下，点击“复制到文件”，导出为cer格式



- 证书导入DataStage的keystore文件

  将导出的FI根证书fi-root-ca.cer上传到DataStage服务端，如`/home/dsadm`路径下，将证书导入到keystore文件，命令参考：

  ```
  /opt/IBM/InformationServer/jdk/bin/keytool -importcert -file /home/dsadm/fi-root-ca.cer -keystore /home/dsadm/iis-ds-truststore_ssl.jks -alias fi-root-ca.cer -storepass Huawei@123 -trustcacerts -noprompt
  chown dsadm:dstage /home/dsadm/iis-ds-truststore_ssl.jks
  ```

- 生成并保存加密后的keystore密码

  ```
  [root@datastage1502 dsadm]# /opt/IBM/InformationServer/ASBNode/bin/encrypt.sh
  Enter the text to encrypt:
  Enter the text again to confirm:
  {iisenc}SvtJ2f/uNTrvbuh26XDzag==
  [root@datastage1502 dsadm]#
  ```

  使用`vi /home/dsadm/authenticate.properties`命令新建配置文件，保存上一步骤生成的密文：

  ```
  password={iisenc}SvtJ2f/uNTrvbuh26XDzag==
  ```

  执行`chown dsadm:dstage /home/dsadm/ authenticate.properties`修改配置文件的属主

- 导出truststore环境变量

  使用`vi /opt/IBM/InformationServer/Server/DSEngine/dsenv`编辑DSEngine的环境变量，在最后添加

  ```
  export DS_TRUSTSTORE_LOCATION=/home/dsadm/iis-ds-truststore_ssl.jks
  export DS_TRUSTSTORE_PROPERTIES=/home/dsadm/authenticate.properties
  ```

- 重启DSEngine，参考命令

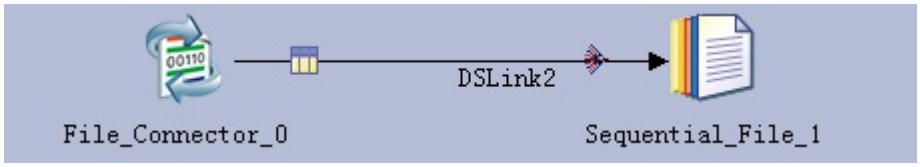
  ```
  su - dsadm
  cd $DSHOME
  bin/uv -admin -stop
  bin/uv -admin -start
  ```

读取HDFS文件

- 创建作业

新建并行作业，保存为hdfs2sf

添加File_Connector组件和Sequential File组件，以及File_Connector到Sequential File链接



- 参考下图修改配置

File_Connector_0 - File Connector

Stage | Output

Stage name: File_Connector_0

General | Properties | Advanced

Connection (Load Save)

File system	WebHDFS
Use custom URL	No
Use SSL (HTTPS)	Yes
Use Kerberos	Yes
Use keytab	Yes
Host *	fusioninsight1 NameNode主节点，主机名小写
Port	25003
Service principal	
User name *	test
Password	
Keytab *	/home/dsadm/user.keytab
Custom URL *	

Usage

File name *	/tmp/data.txt
Read mode	Read multiple files
Exclude files	
Reject mode	Continue
File name column	
File format	Comma-separated value (CSV)

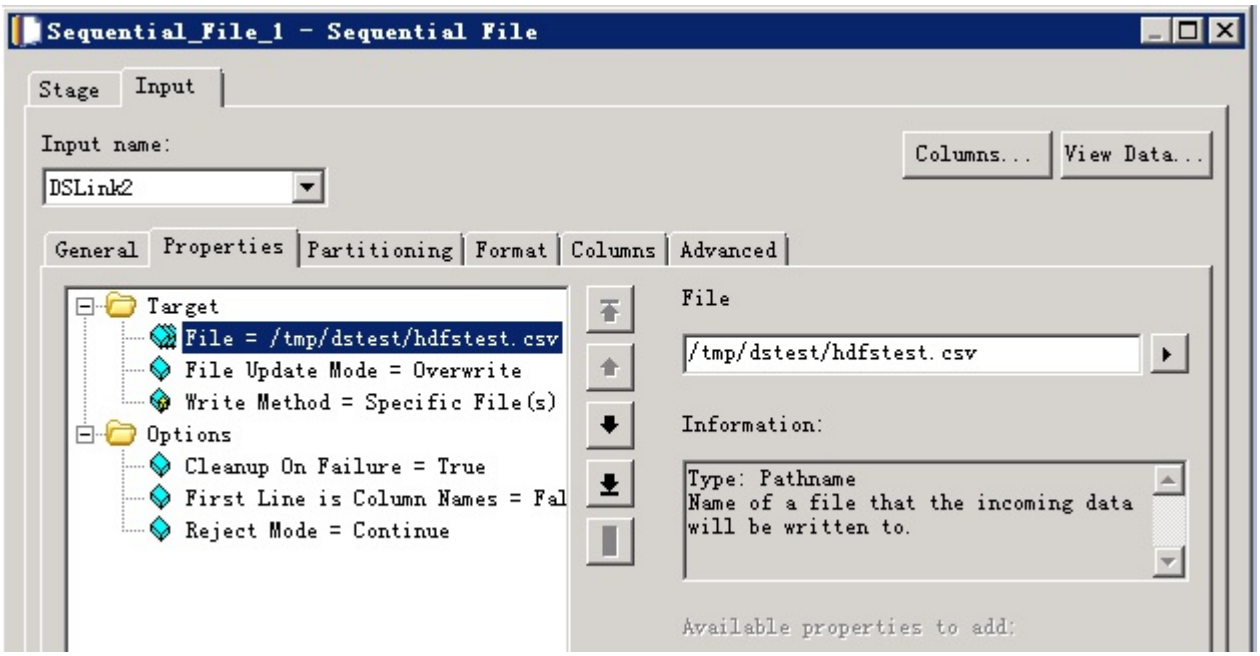
File_Connector_0 - File Connector

Stage | Output

Output name (downstream stage): DSLink2 (Sequential_File_1)

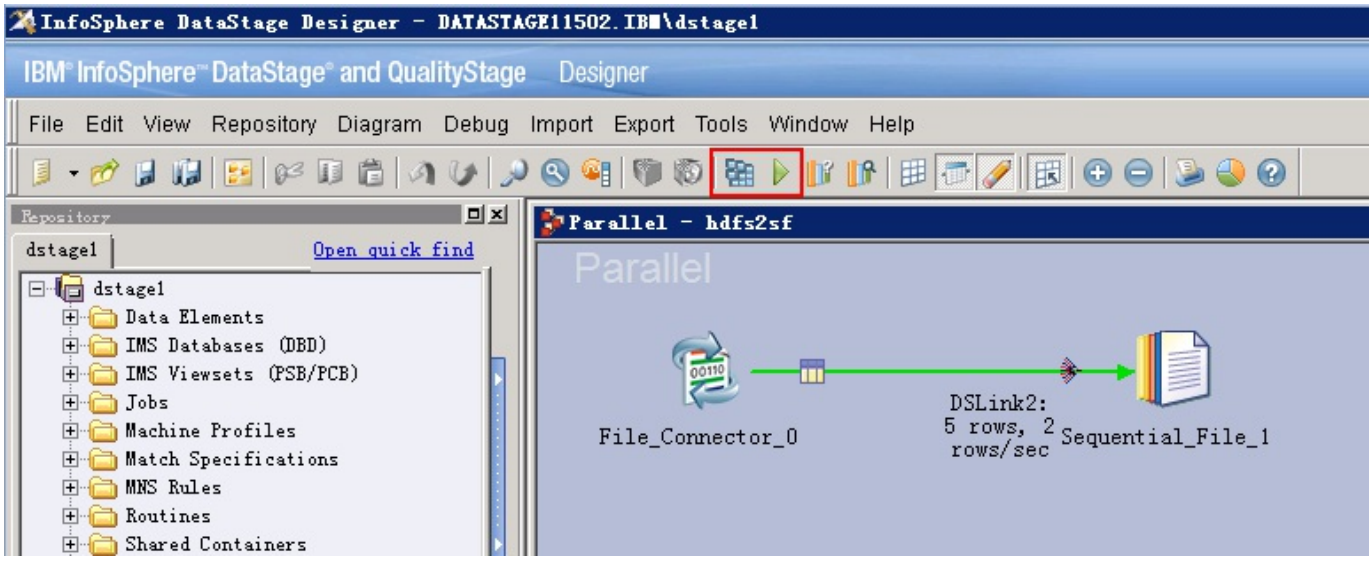
General | Properties | Link Ordering | Advanced | Columns

	Column name	Derivation	Key	SQL type	Extended	Length	Scale	Nullable	Data e
1	id			Integer		5		No	
2	name			VarChar		20		No	
3	usd_flag			VarChar		2		No	
4	salary			Double		8		No	
5	address			VarChar		30		No	
6	entrytime			VarChar		4		No	



- 编译运行

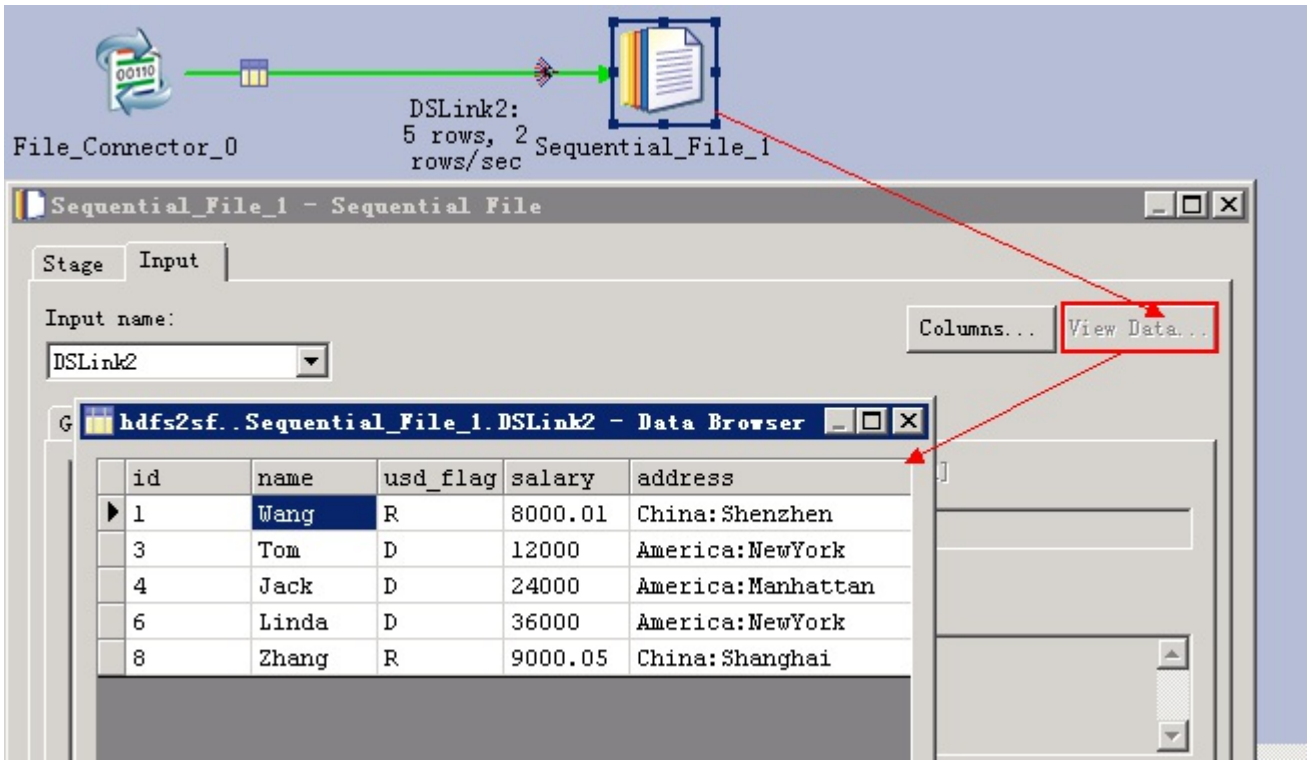
  保存配置后，编译，运行



在菜单 **Tools** -> **Run Director** 中打开Director客户端，查看作业日志

```
21:07:18    2017/7/6    Info        File_Connector_0,1: [JGSS_DBG_CRED]  main find keys for test@HADOOP.COM (...)
21:07:18    2017/7/6    Info        File_Connector_0,0: [JGSS_DBG_CTX]  main initSecContext input buffer: (len=108, offset=0) (...)
21:07:18    2017/7/6    Info        File_Connector_0,1: [JGSS_DBG_CTX]  main initSecContext input buffer: (len=108, offset=0) (...)
21:07:18    2017/7/6    Info        File_Connector_0,0: The file encoding was not specified. The default encoding of UTF-8 shall be assumed.
21:07:18    2017/7/6    Info        File_Connector_0,0: 3 rows were read from the /tmp/data.txt file.
21:07:18    2017/7/6    Info        File_Connector_0,1: The file encoding was not specified. The default encoding of UTF-8 shall be assumed.
21:07:18    2017/7/6    Info        File_Connector_0,1: 2 rows were read from the /tmp/data.txt file.
21:07:18    2017/7/6    Info        Sequential_File_1,0: Export complete; 5 records exported successfully, 0 rejected.
21:07:18    2017/7/6    Info        main_program: Step execution finished with status = OK.
21:07:18    2017/7/6    Info        main_program: Startup time, 0:01; production run time, 0:02.
21:07:18    2017/7/6    Info        Parallel job reports successful completion
21:07:18    2017/7/6    Control     Finished Job hdfs2sf.
```

- 查看读取的数据



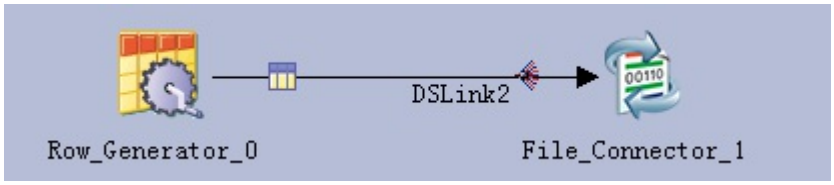

```
[root@datastage1502 tmp]# cd /tmp/dstest/
[root@datastage1502 dstest]# ll
total 4
-rw-rw-r-- 1 dsadm dstage 331 Jul  6 21:07 hdfstest.csv
[root@datastage1502 dstest]# cat hdfstest.csv
"1","Wang","R","8.000010000000000022E+03","China:Shenzhen","2014"
"3","Tom","D","1.20000200000000004E+04","America:NewYork","2014"
"4","Jack","D","2.400002999999999988E+04","America:Manhattan","2014"
"6","Linda","D","3.600004000000000009E+04","America:NewYork","2014"
"8","Zhang","R","9.000049999999999927E+03","China:Shanghai","2014"
```

写入HDFS文件

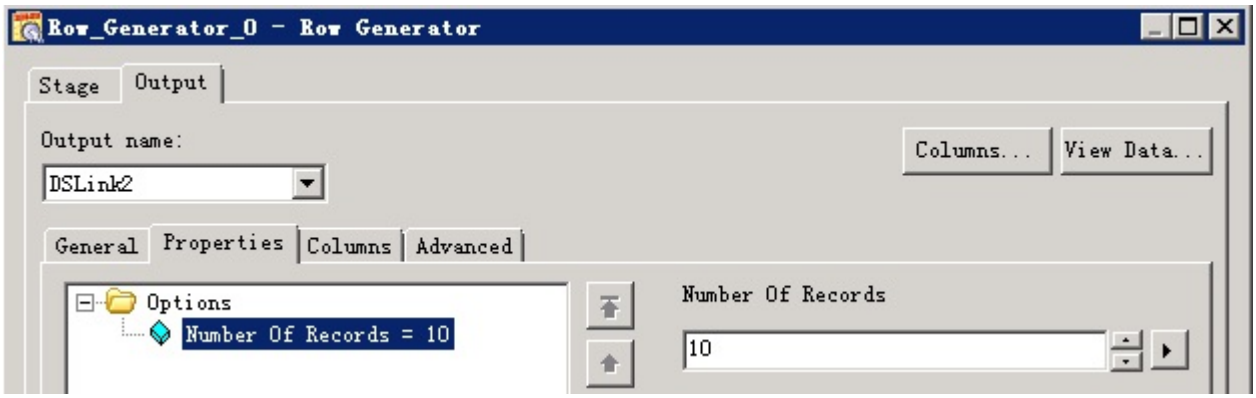
- 创建作业

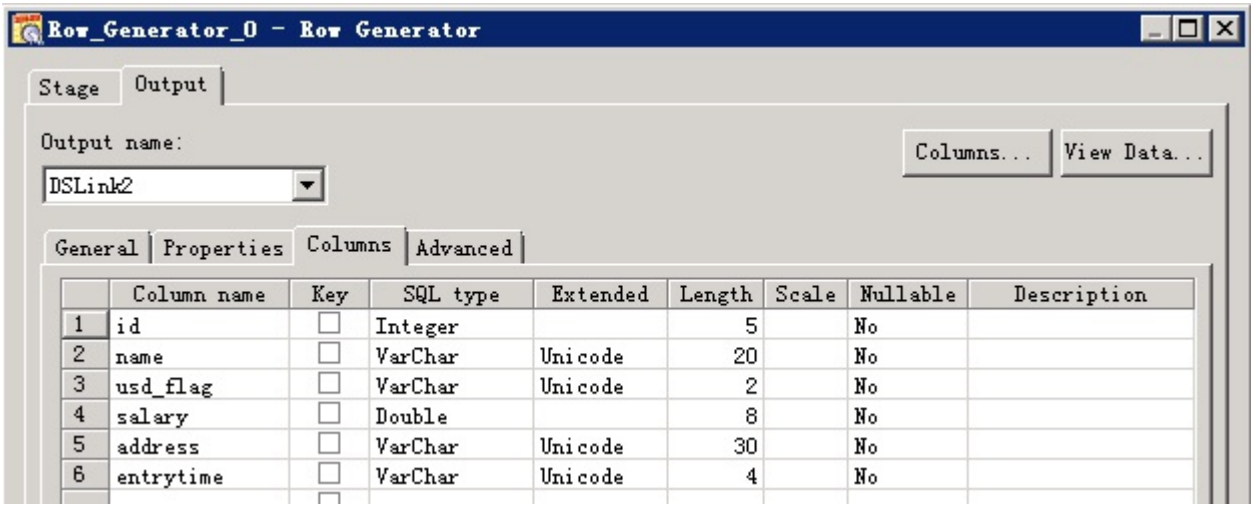
  新建并行作业，保存为hdfswrite

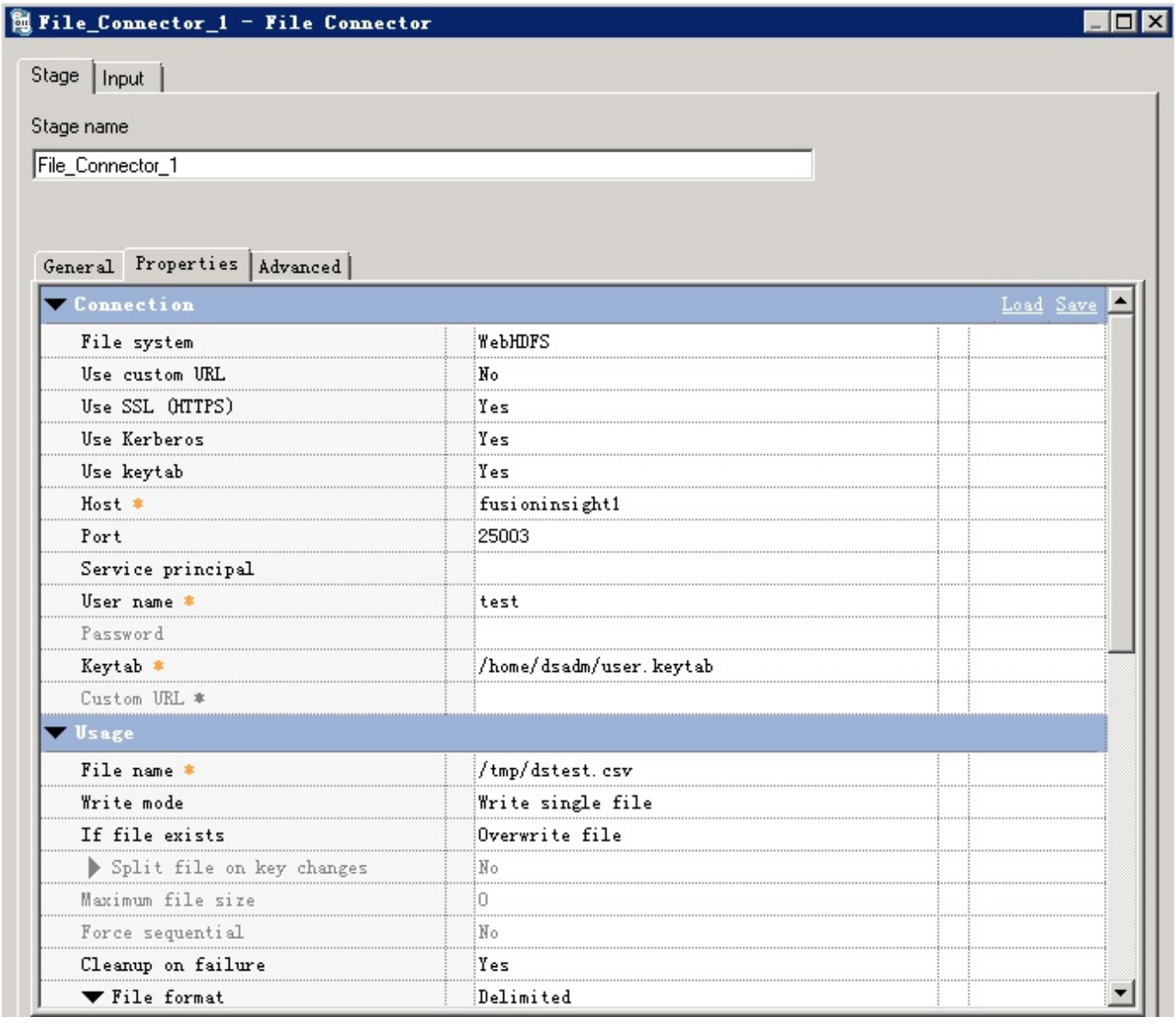
  添加Row Generator组件和File Connector组件，以及Row Generator到File Connector链接

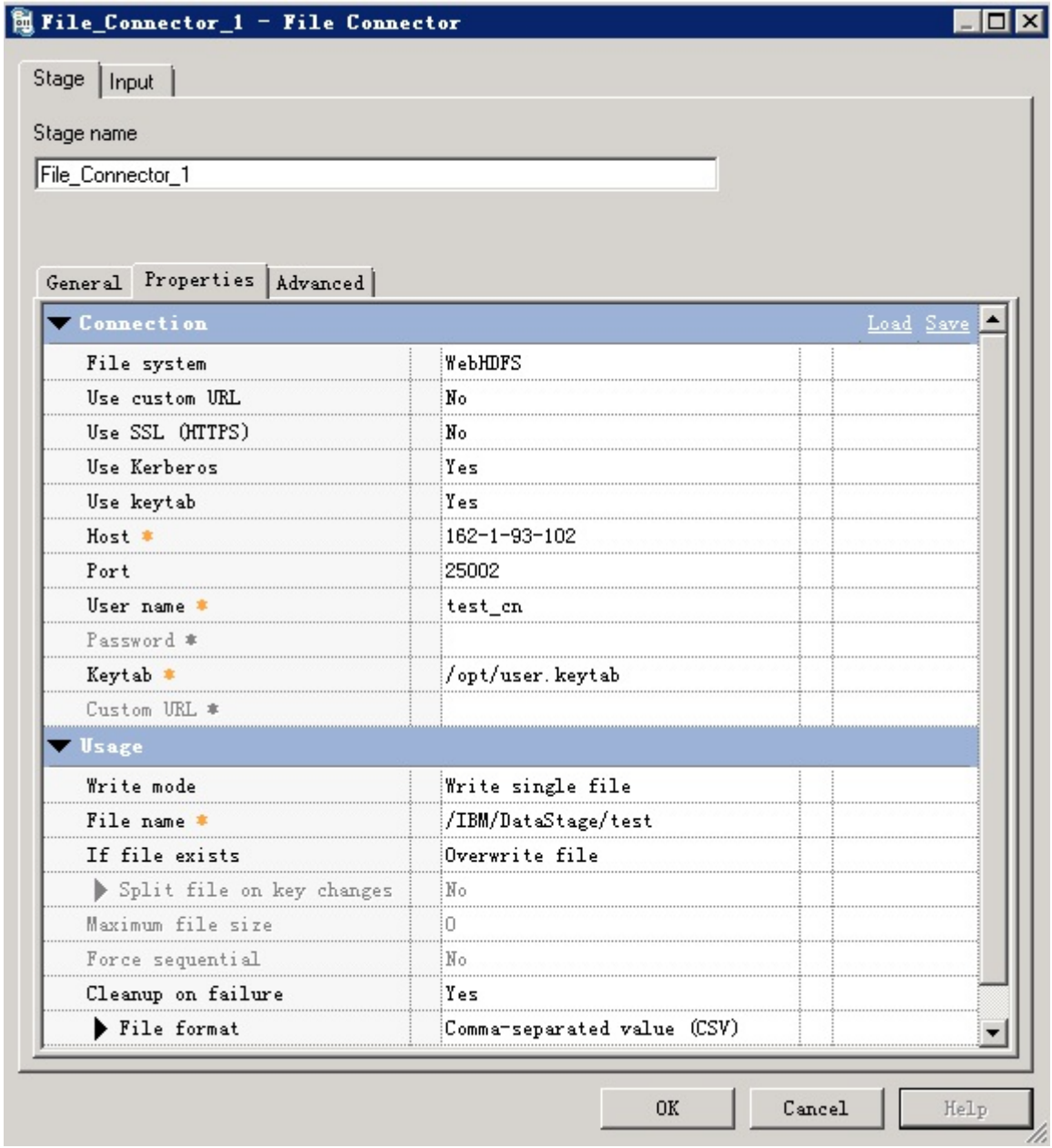


- 参考下图修改配置




Row_Generator_0 - Row Generator
Stage
Output
Output name:
DSLink2
Columns...
View Data...
General
Properties
Columns
Advanced
Column name
Key
SQL type
Extended
Length
Scale
Nullable
Description
1 id Integer 5 No
2 name VarChar Unicode 20 No
3 usd_flag VarChar Unicode 2 No
4 salary Double 8 No
5 address VarChar Unicode 30 No
6 entrytime VarChar Unicode 4 No


File_Connector_1 - File Connector
Stage
Input
Stage name
File_Connector_1
General
Properties
Advanced
Connection
Load
Save
File system
WebHDFS
Use custom URL
No
Use SSL (HTTPS)
Yes
Use Kerberos
Yes
Use keytab
Yes
Host *
fusioninsight1
Port
25003
Service principal
User name *
test
Password
Keytab *
/home/dsadm/user.keytab
Custom URL *
Usage
File name *
/tmp/dstest.csv
Write mode
Write single file
If file exists
Overwrite file
Split file on key changes
No
Maximum file size
0
Force sequential
No
Cleanup on failure
Yes
File format
Delimited



- 编译运行

  保存 — 编译 — 运行 ，查看作业日志：

```
21:33:32    2017/7/6    Info        File_Connector_1,0: Accessing file via WebHDFS file system.
21:33:33    2017/7/6    Info        File_Connector_1,0: IBMJGSSProvider Build-Level: -20160808 (...)
21:33:33    2017/7/6    Info        File_Connector_1,0: The /tmp/dstest.csv file, which contains 10 rows, was written.
21:33:33    2017/7/6    Info        main_program: Step execution finished with status = OK.
21:33:33    2017/7/6    Info        main_program: Startup time, 0:01; production run time, 0:02.
21:33:33    2017/7/6    Info        Parallel job reports successful completion
21:33:33    2017/7/6    Control     Finished Job hdfswrite.
```

- 查看写入数据

```
[root@datastage1502 dstest]# hdfs dfs -cat /tmp/dstest.csv
0,0000000000000000000,,0.0,,
1,11111,11,1.0,11111111111111111111,1111
2,2,22,2.0,222222222222222,2
3,33333333333333,33,3.0,333333333333333333333333333,33
4,4444444,44,4.0,444444,4
5,55555555555555,5,5.0,5555555555555,55
6,666666,,6.0,66666,
7,77777777,77,7.0,77777777777777777777777777777,7
8,88888888888888,8,8.0,8888888888888,888
9,999999,9,9.0,999999999999999999999,9
[root@datastage1502 dstest]#
```

对接Hive

使用Hive Connector

> 说明：Hive Connector官方认证过的Hive JDBC Driver只有DataDirect Hive Driver(IShive.jar)，用DataStage 11.5.0.2中自带的IShive.jar连接FusionInsight的hive时，会有thrift protocol报错，需要咨询IBM技术支持提供的最新的IShive.jar

设置JDBC Driver配置文件

- 在$DSHOME路径下创建isjdbc.config文件，CLASSPATH变量中添加DataDirect Hive Driver (IShive.jar)的路径，CLASS_NAMES变量中添加com.ibm.isf.jdbc.hive.HiveDriver，参考命令：

  ```
  su - dsadm
  cd $DSHOME
  vi isjdbc.config
  ```

  在isjdbc.config中添加如下信息:

  ```
  CLASSPATH=/opt/IBM/InformationServer/ASBNode/lib/java/IShive.jar
  CLASS_NAMES=com.ibm.isf.jdbc.hive.HiveDriver
  ```

- 配置Kerberos认证信息：

  在IShive.jar所在目录下创建JDBCDriverLogin.conf

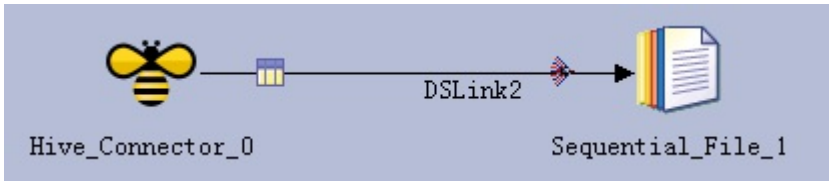
  ```
  cd /opt/IBM/InformationServer/ASBNode/lib/java/
  vi JDBCDriverLogin.conf
  ```

  文件内容如下：

  ```
  JDBC_DRIVER_test_cache{
        com.ibm.security.auth.module.Krb5LoginModule required
        credsType=initiator
        principal="test@HADOOP.COM"
        useCcache="FILE:/tmp/krb5cc_1004";
  };
  JDBC_DRIVER_test_keytab{
        com.ibm.security.auth.module.Krb5LoginModule required
        credsType=both
        principal="test@HADOOP.COM"
        useKeytab="/home/dsadm/user.keytab";
  };
  ```

读取Hive数据

- 创建作业

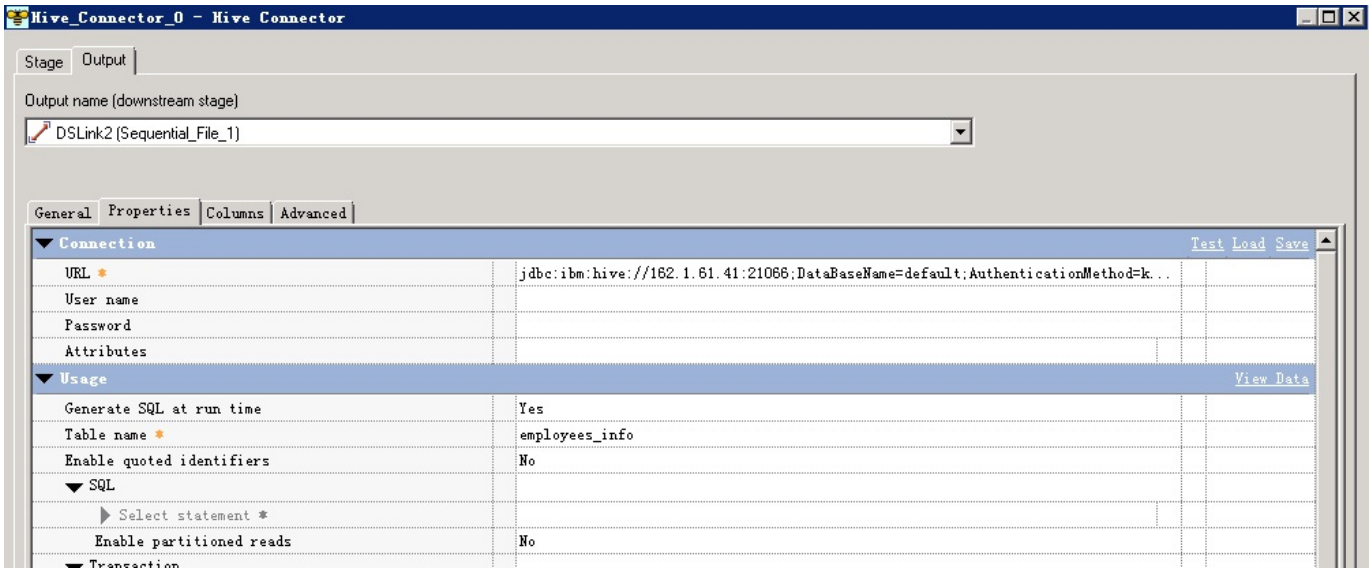
  

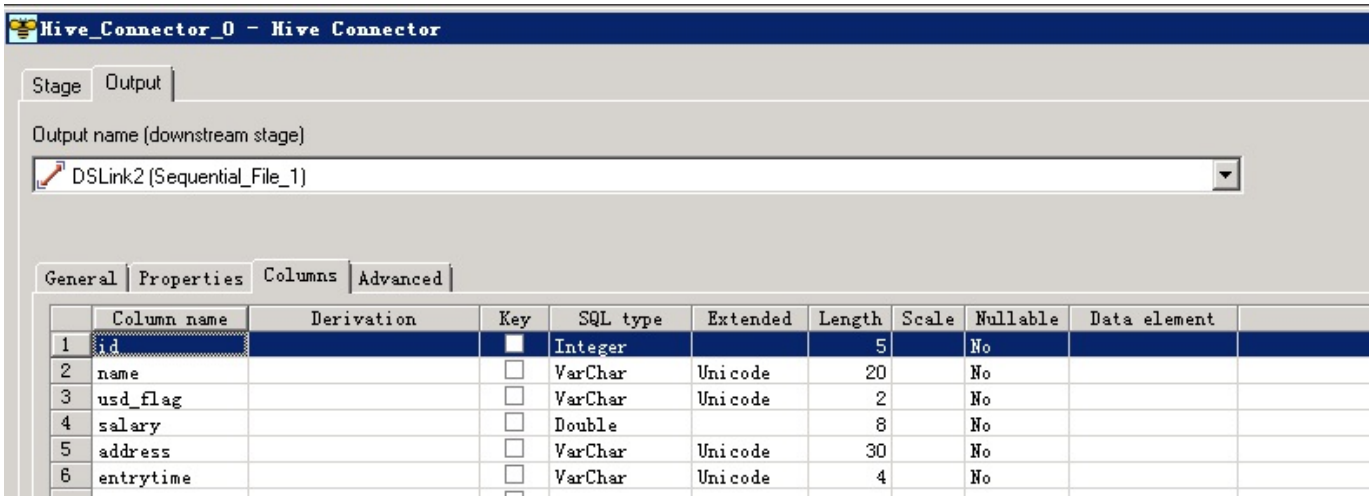
- 修改配置

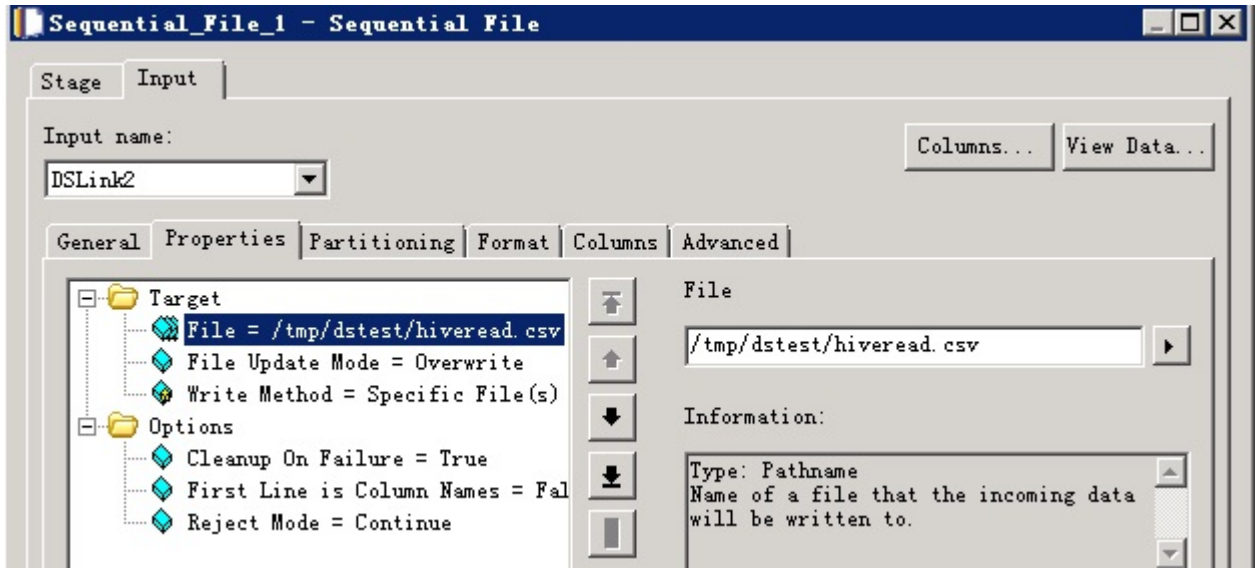
  URL参考如下进行配置：

  ```
  jdbc:ibm:hive://162.1.61.41:21066;DataBaseName=default;AuthenticationMethod=kerberos;ServicePrincipalName=hive/hadoop.hadoop.com@HADOOP.COM;loginConfigName=JDBC_DRIVER_test_keytab;
  ```

  其中JDBC_DRIVER_test_keytab为上一步指定的鉴权信息







- 编译运行

保存 — 编译 — 运行 ，查看作业日志：

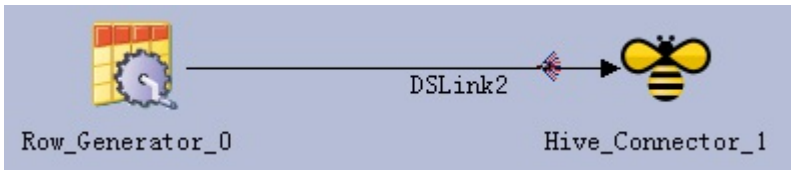
```
23:40:40    2017/7/6    Info        Hive_Connector_0,0: Number of rows fetched on the current node: 5.
23:40:40    2017/7/6    Info        Hive_Connector_0,0: [JGSS_DBG_WRAP]  main Krb5Context.wrap: set Flag Fields 0 SentByAccept
23:40:40    2017/7/6    Info        Hive_Connector_0,0: 32e0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
23:40:40    2017/7/6    Info        Hive_Connector_0,0: 29a0: 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  ................
23:40:41    2017/7/6    Info        Hive_Connector_0,0: The connector closed the connection to the data source. (...)
23:40:41    2017/7/6    Info        Hive_Connector_0: The connector closed the connection to the data source.
23:40:41    2017/7/6    Info        main_program: Step execution finished with status = OK.
23:40:41    2017/7/6    Info        main_program: Startup time, 0:31; production run time, 0:23.
23:40:41    2017/7/6    Info        Parallel job reports successful completion
23:40:41    2017/7/6    Control     Finished Job hive_read.
```

  - 查看读取的数据

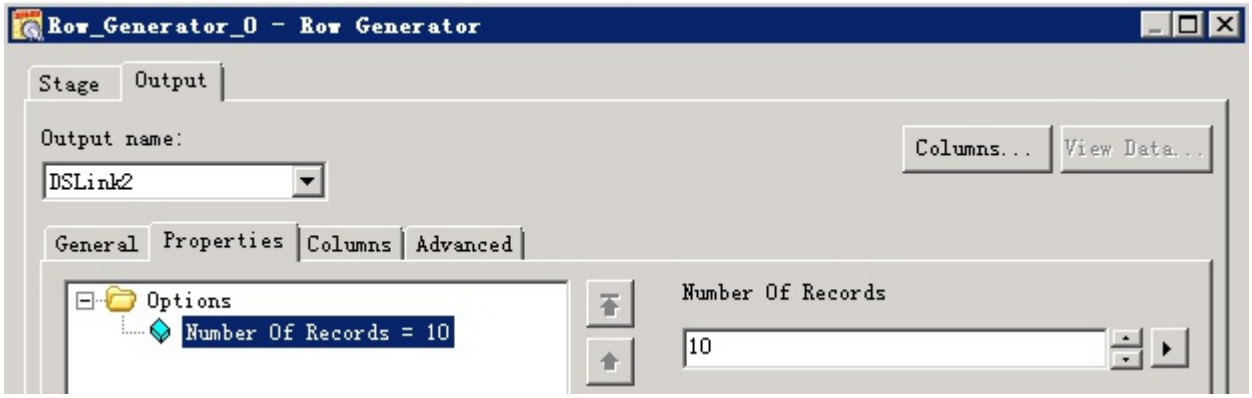
```
[root@datastage11502 dstest]# cat /tmp/dstest/hiveread.csv
"1","Wang","R","8.0000100000000022E+03","China:Shenzhen","2014"
"3","Tom","D","1.2000020000000004E+04","America:NewYork","2014"
"4","Jack","D","2.4000029999999988E+04","America:Manhattan","2014"
"6","Linda","D","3.6000040000000009E+04","America:NewYork","2014"
"8","Zhang","R","9.0000499999999927E+03","China:Shanghai","2014"
```

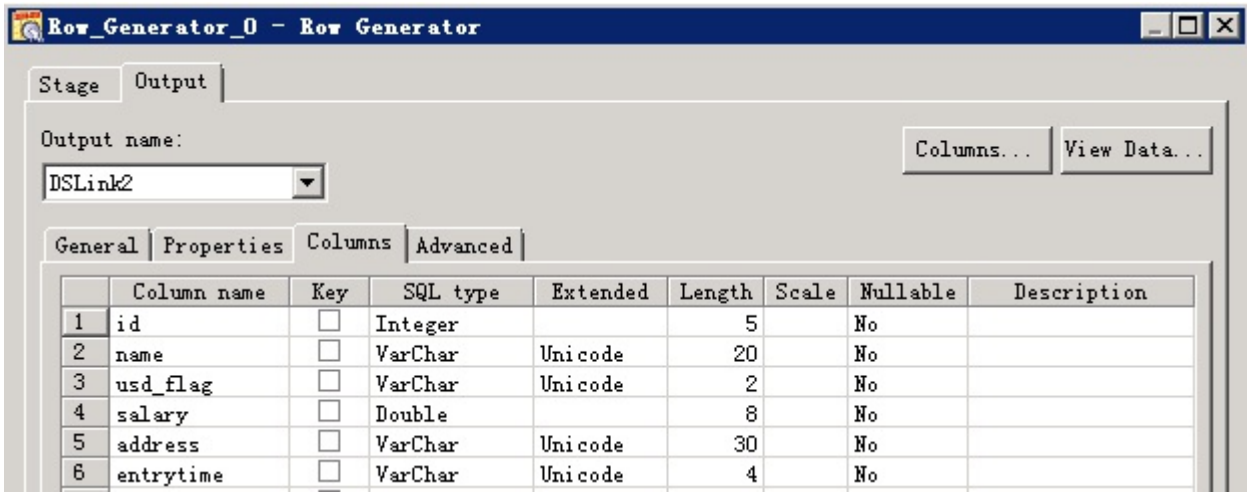
数据写入Hive表

- 创建作业

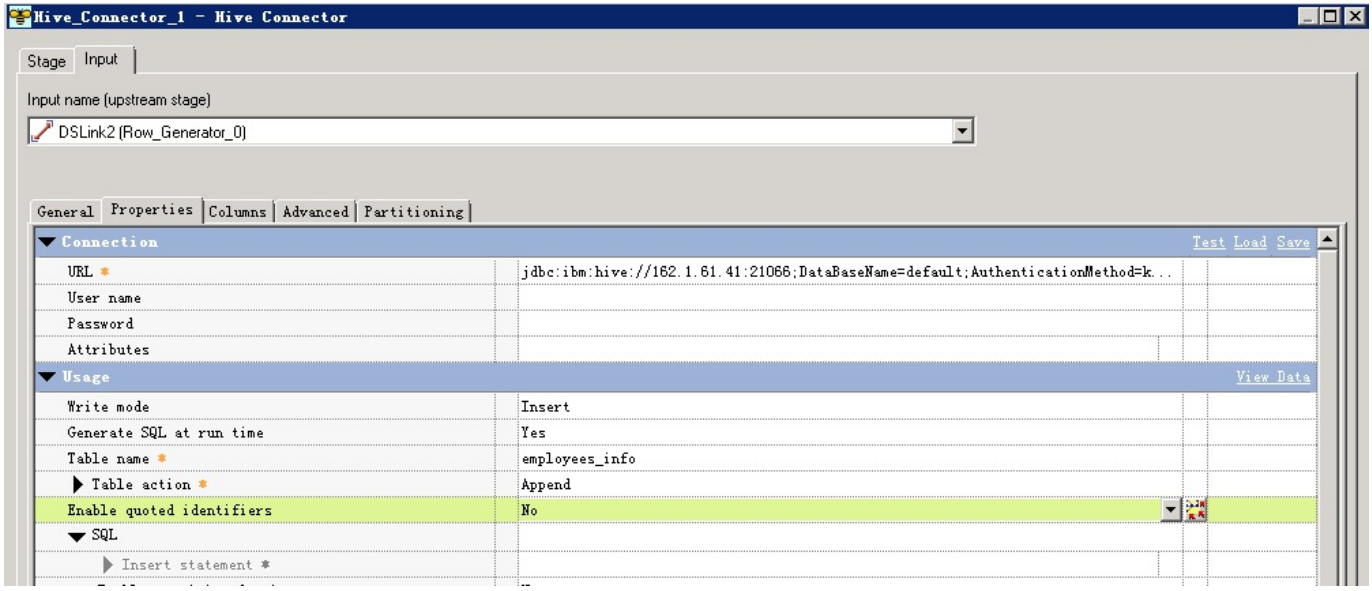


- 修改配置





	Column name	Key	SQL type	Extended	Length	Scale	Nullable	Description
1	id		Integer		5		No	
2	name		VarChar	Unicode	20		No	
3	usd_flag		VarChar	Unicode	2		No	
4	salary		Double		8		No	
5	address		VarChar	Unicode	30		No	
6	entrytime		VarChar	Unicode	4		No	



- 编译运行

保存 — 编译 — 运行 ，查看作业日志，写入10条数据，用时2'11"

```
23:51:00    2017/7/6    Info        Hive_Connector_1,0: The connector closed the connection to the data source. (...)
23:51:00    2017/7/6    Info        Hive_Connector_1: The connector closed the connection to the data source.
23:51:00    2017/7/6    Info        main_program: Step execution finished with status = OK.
23:51:00    2017/7/6    Info        main_program: Startup time, 0:52; production run time, 2:11.
23:51:00    2017/7/6    Info        Parallel job reports successful completion
23:51:00    2017/7/6    Control     Finished Job hive_write.
```

- 查看Hive表数据：

```
0: jdbc:hive2://162.1.61.42:21066/> select * from employees_info;
+-------------------------+---------------------------+-----------------------------+-------------------------+-----------------------------------+-----------------------------+--+
| employees_info.id       | employees_info.name       | employees_info.usd_flag     | employees_info.salary   |    employees_info.address         | employees_info.entrytime    |
+-------------------------+---------------------------+-----------------------------+-------------------------+-----------------------------------+-----------------------------+--+
| 1                       | 11111                     | 11                          | 1.0                     | 11111111111111111111              | 1111                        |
| 3                       | 33333333333333            | 33                          | 3.0                     | 333333333333333333333333          | 33                          |
| 5                       | 55555555555555            | 5                           | 5.0                     | 5555555555555                     | 55                          |
| 7                       | 77777777                  | 77                          | 7.0                     | 77777777777777777777777777        | 7                           |
| 9                       | 999999                    | 9                           | 9.0                     | 99999999999999999999              | 9                           |
| 0                       | 0000000000000000000       |                             | 0.0                     |                                   |                             |
| 2                       | 2                         | 22                          | 2.0                     | 222222222222222                   | 2                           |
| 4                       | 4444444                   | 44                          | 4.0                     | 444444                            | 4                           |
| 6                       | 666666                    |                             | 6.0                     | 66666                             |                             |
| 8                       | 88888888888888            | 8                           | 8.0                     | 8888888888888                     | 888                         |
| 1                       | Wang                      | R                           | 8000.01                 | China:Shenzhen                    | 2014                        |
| 3                       | Tom                       | D                           | 12000.02                | America:NewYork                   | 2014                        |
| 4                       | Jack                      | D                           | 24000.03                | America:Manhattan                 | 2014                        |
| 6                       | Linda                     | D                           | 36000.04                | America:NewYork                   | 2014                        |
| 8                       | Zhang                     | R                           | 9000.05                 | China:Shanghai                    | 2014                        |
+-------------------------+---------------------------+-----------------------------+-------------------------+-----------------------------------+-----------------------------+--+
15 rows selected (0.488 seconds)
```

> Hive Connector向Hive表写数据使用Insert语句，每插入一条数据会起一个MR任务，效率特别低，不推荐使用这种方式。可以将数据直接写入HDFS文件。

使用JDBC Connector

如果要使用FusionInsight的Hive JDBC驱动， 用isjdbc.config文件CLASSPATH中添加jdbc驱动和依赖包的方式，在运行作业时会有如下报错，此时需要用导出CLASSPATH环境变量的方式加载

```
JDBC_Connector_0: The connector encountered a Java exception:
java.sql.SQLException: Create jdbc client failed.
        at org.apache.hive.jdbc.HiveConnection.<init>(HiveConnection.java:191)
        at org.apache.hive.jdbc.HiveDriver.connect(HiveDriver.java:105)
        at com.ibm.is.cc.jdbc.CC_JDBCConnection.openConnection(CC_JDBCConnection.java:1027)
        at com.ibm.is.cc.jdbc.CC_JDBCConnection.connect(CC_JDBCConnection.java:838)
Caused by: java.lang.RuntimeException: Illegal Hadoop Version: Unknown (expected A.B.* format)
        at org.apache.hadoop.hive.shims.ShimLoader.getMajorVersion(ShimLoader.java:167)
        at org.apache.hadoop.hive.shims.ShimLoader.loadShims(ShimLoader.java:139)
        at org.apache.hadoop.hive.shims.ShimLoader.getHadoopThriftAuthBridge(ShimLoader.java:125)
        at org.apache.hive.service.auth.KerberosSaslHelper.getKerberosTransport(KerberosSaslHelper.java:55)
        at org.apache.hive.jdbc.HiveConnection.createBinaryTransport(HiveConnection.java:507)
        at org.apache.hive.jdbc.HiveConnection.openTransport(HiveConnection.java:258)
        at org.apache.hive.jdbc.HiveConnection.createClient(HiveConnection.java:214)
        at org.apache.hive.jdbc.HiveConnection.access$000(HiveConnection.java:112)
        at org.apache.hive.jdbc.HiveConnection$1.run(HiveConnection.java:185)
        at org.apache.hive.jdbc.HiveConnection$1.run(HiveConnection.java:182)
        at java.security.AccessController.doPrivileged(AccessController.java:488)
        at javax.security.auth.Subject.doAs(Subject.java:572)
        at org.apache.hadoop.security.UserGroupInformation.doAs(UserGroupInformation.java:1738)
        at org.apache.hive.jdbc.HiveConnection.<init>(HiveConnection.java:182)
        ... 3 more
```

而且只能用JDBC Connector，不能用Hive Connector，否则会有如下报错

```
java.sql.SQLException: Method not supported
        at org.apache.hive.jdbc.HiveConnection.commit(HiveConnection.java:827)
        at com.ibm.is.cc.hive.HiveConnection.commitDirect
(HiveConnection.java:578)
        at com.ibm.is.cc.hive.HiveAdapter.preRun(HiveAdapter.java:776)
```

设置CLASSPATH环境变量

- Hive jdbc驱动包及依赖包位于Hive客户端lib目录下 `/opt/ficlient/Hive/Beeline/lib` ，若未安装客户端，也可单独上传这些jar包到任意目录。
- 设置CLASSPATH环境变量，添加上述jar包的完整路径，参考命令：

```
su - dsadm
vi $DSHOME/dsenv
```

- 文件最后添加相关的jar包（具体路径根据实际环境调整）

```
export CLASSPATH=/opt/ficlient/Hive/Beeline/lib/commons-cli-1.2.jar:/opt/ficlient/Hive/Beeline/lib/commons-collections-
```

```
3.2.1.jar:/opt/ficlient/Hive/Beeline/lib/commons-configuration-1.6.jar:/opt/ficlient/Hive/Beeline/lib/commons-lang-
2.6.jar:/opt/ficlient/Hive/Beeline/lib/commons-logging-1.1.3.jar:/opt/ficlient/Hive/Beeline/lib/curator-client-
2.7.1.jar:/opt/ficlient/Hive/Beeline/lib/curator-framework-2.7.1.jar:/opt/ficlient/Hive/Beeline/lib/curator-recipes-
2.7.1.jar:/opt/ficlient/Hive/Beeline/lib/guava-14.0.1.jar:/opt/ficlient/Hive/Beeline/lib/hadoop-auth-
2.7.2.jar:/opt/ficlient/Hive/Beeline/lib/hadoop-common-2.7.2.jar:/opt/ficlient/Hive/Beeline/lib/hadoop-mapreduce-client-core-
2.7.2.jar:/opt/ficlient/Hive/Beeline/lib/hive-beeline-1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-cli-
1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-common-1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-exec-
1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-jdbc-1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-metastore-
1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-serde-1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-service-
1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-shims-0.23-1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/hive-shims-common-
1.3.0.jar:/opt/ficlient/Hive/Beeline/lib/httpclient-4.5.2.jar:/opt/ficlient/Hive/Beeline/lib/httpcore-
4.4.jar:/opt/ficlient/Hive/Beeline/lib/jline-2.12.jar:/opt/ficlient/Hive/Beeline/lib/libfb303-
0.9.3.jar:/opt/ficlient/Hive/Beeline/lib/libthrift-0.9.3.jar:/opt/ficlient/Hive/Beeline/lib/log4j-
1.2.17.jar:/opt/ficlient/Hive/Beeline/lib/slf4j-api-1.7.5.jar:/opt/ficlient/Hive/Beeline/lib/slf4j-log4j12-
1.7.5.jar:/opt/ficlient/Hive/Beeline/lib/super-csv-2.2.0.jar:/opt/ficlient/Hive/Beeline/lib/xercesImpl-
2.9.1.jar:/opt/ficlient/Hive/Beeline/lib/zookeeper-3.5.1.jar
```

- 导入环境变量

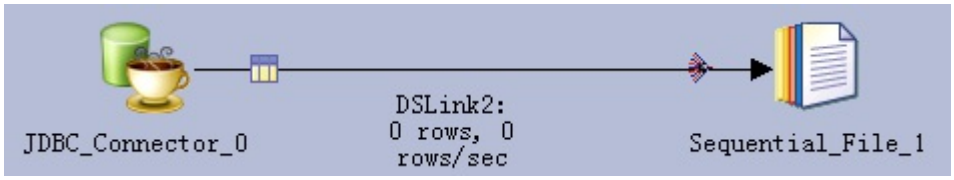
```
source $DSHOME/dsenv
```

- 重启DSEngine

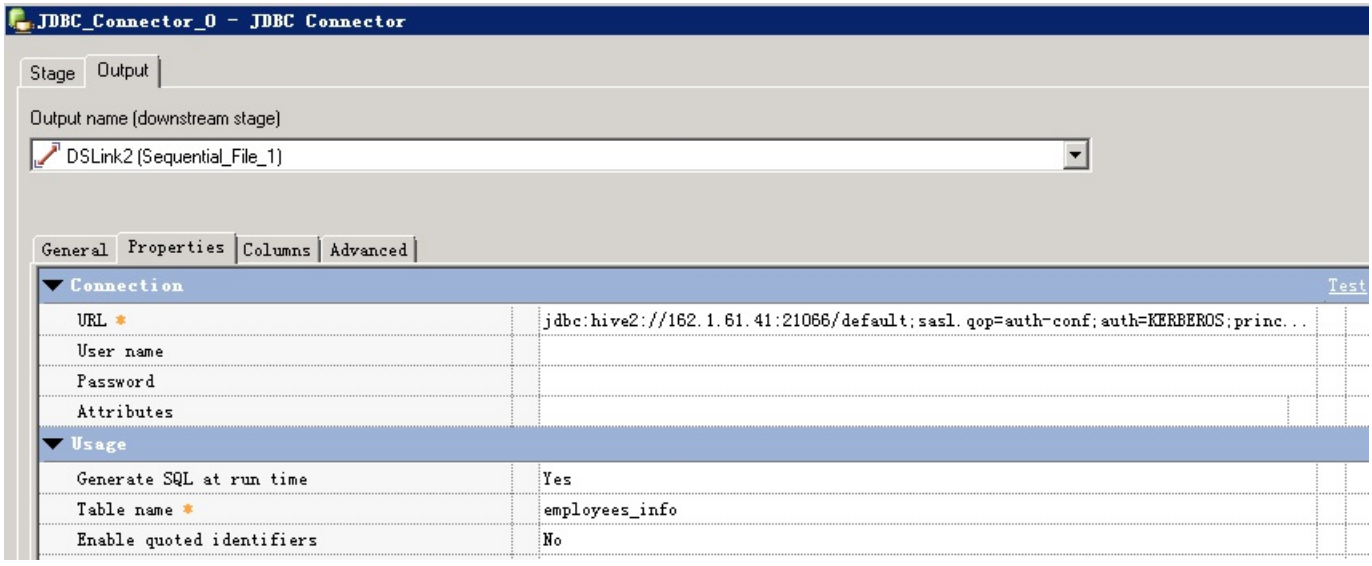
```
cd $DSHOME
bin/uv -admin -stop
bin/uv -admin -start
```

读取Hive数据

- 创建作业

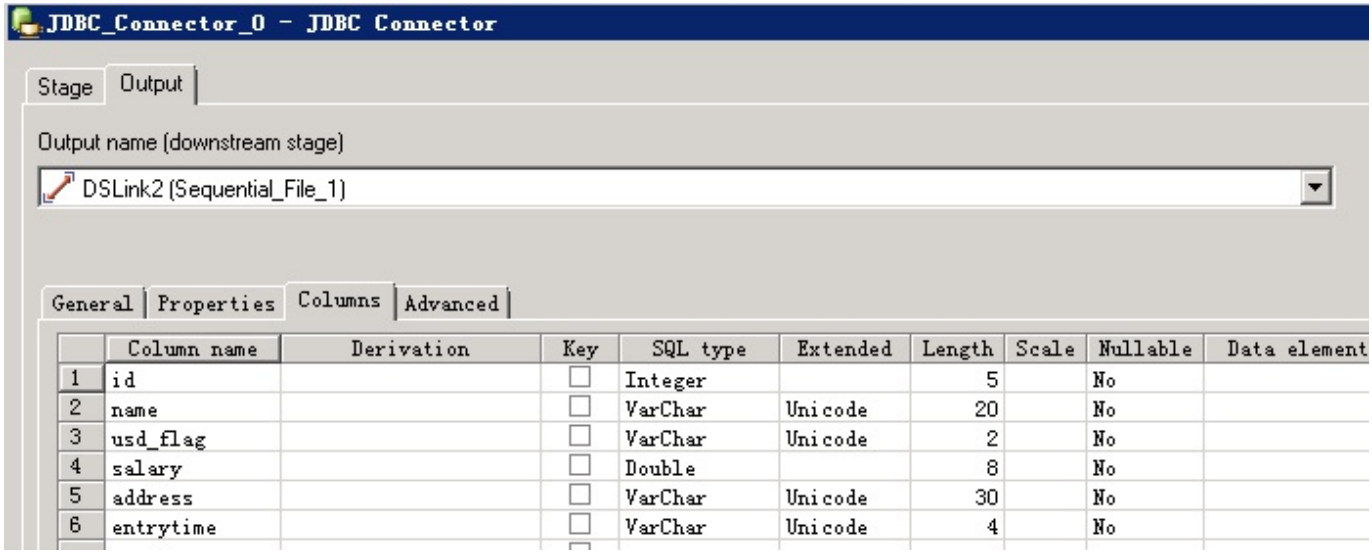


- 修改配置

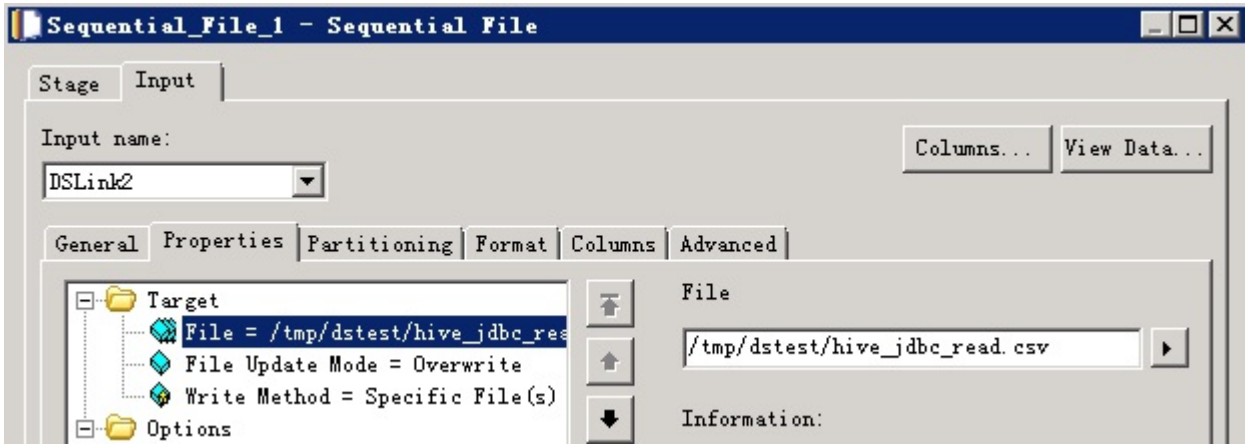


其中URL为：

```
jdbc:hive2://162.1.61.41:21066/default;sasl.qop=auth-
conf;auth=KERBEROS;principal=hive/hadoop.hadoop.com@HADOOP.COM;user.principal=test@HADOOP.COM;user.keytab=/home/dsadm/user.keytab;
```



	Column name	Derivation	Key	SQL type	Extended	Length	Scale	Nullable	Data element
1	id			Integer		5		No	
2	name			VarChar	Unicode	20		No	
3	usd_flag			VarChar	Unicode	2		No	
4	salary			Double		8		No	
5	address			VarChar	Unicode	30		No	
6	entrytime			VarChar	Unicode	4		No	



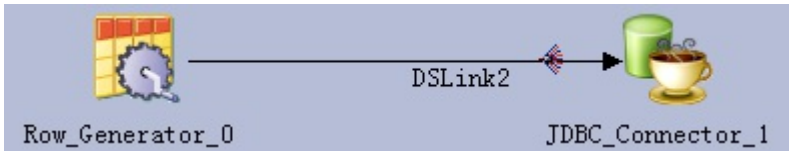
- 编译运行

```
23:03:57    2017/7/7    Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
23:03:57    2017/7/7    Info        Sequential_File_1,0: Export complete; 5 records exported successfully, 0 rejected. (...)
23:03:57    2017/7/7    Info        JDBC_Connector_0: The connector closed the connection to the data source.
23:03:57    2017/7/7    Info        main_program: Step execution finished with status = OK.
23:03:57    2017/7/7    Info        main_program: Startup time, 0:03; production run time, 0:02.
23:03:57    2017/7/7    Info        Parallel job reports successful completion
23:03:57    2017/7/7    Control     Finished Job hive_jdbc_connector.
```

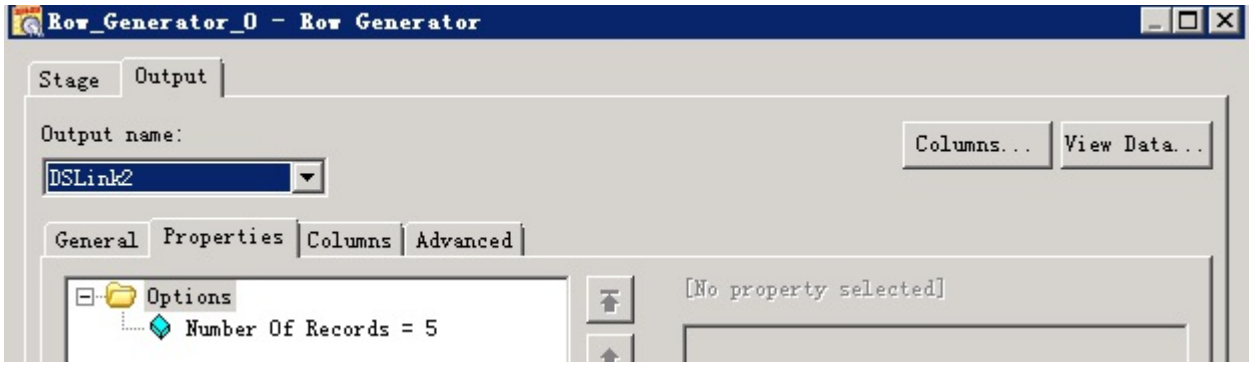
```
[root@datastage1502 dstest]# cat hive_jdbc_read.csv
"1","Linda","D","3.60000400000000009E+04","America:NewYork","2014"
"3","Tom","D","1.20000200000000004E+04","America:NewYork","2014"
"4","Jack","D","2.40000299999999988E+04","America:Manhattan","2014"
"6","Wang","R","8.00001000000000022E+03","China:Shenzhen","2014"
"8","Zhang","R","9.00004999999999927E+03","China:Shanghai","2014"
```

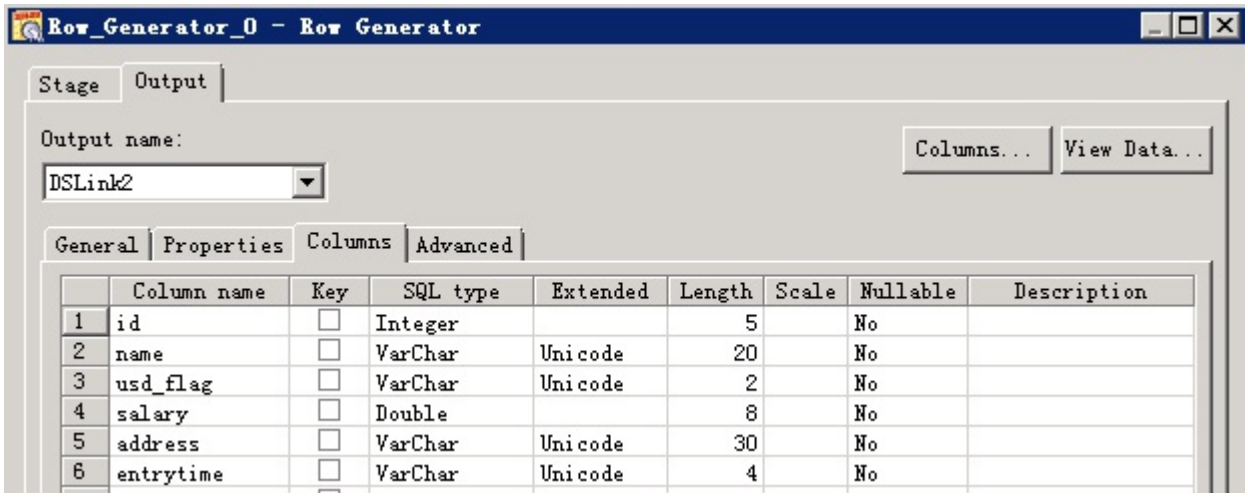
数据写入Hive表

- 创建作业

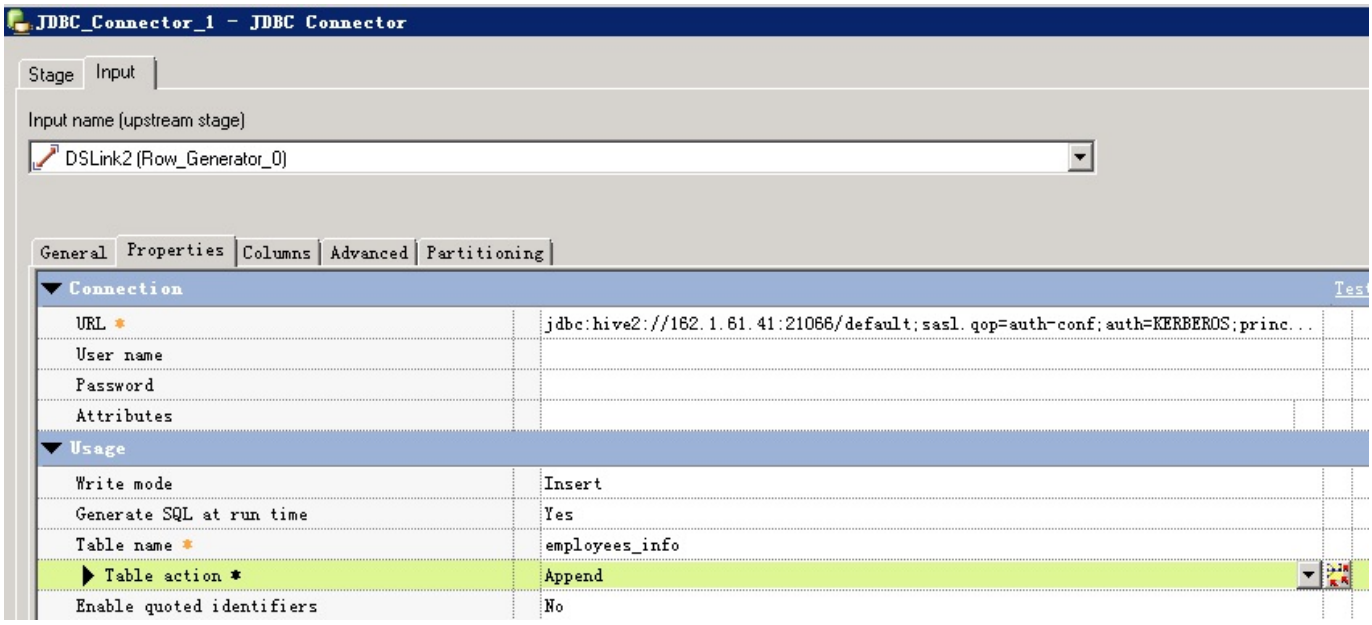


- 修改配置





	Column name	Key	SQL type	Extended	Length	Scale	Nullable	Description
1	id		Integer		5		No	
2	name		VarChar	Unicode	20		No	
3	usd_flag		VarChar	Unicode	2		No	
4	salary		Double		8		No	
5	address		VarChar	Unicode	30		No	
6	entrytime		VarChar	Unicode	4		No	



- 编译运行

写入5条数据，用时1'49"

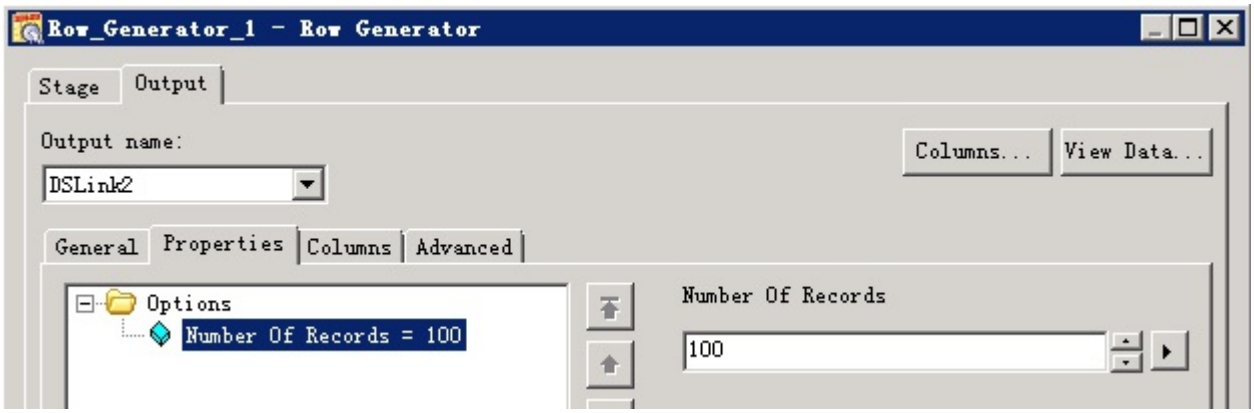
```
23:15:59    2017/7/7    Info       JDBC_Connector_1: The connector closed the connection to the data source.
23:15:59    2017/7/7    Info       main_program: Step execution finished with status = OK.
23:15:59    2017/7/7    Info       main_program: Startup time, 0:02; production run time, 1:49.
23:15:59    2017/7/7    Info       Parallel job reports successful completion
23:15:59    2017/7/7    Control    Finished Job hive_jdbc_write.
```

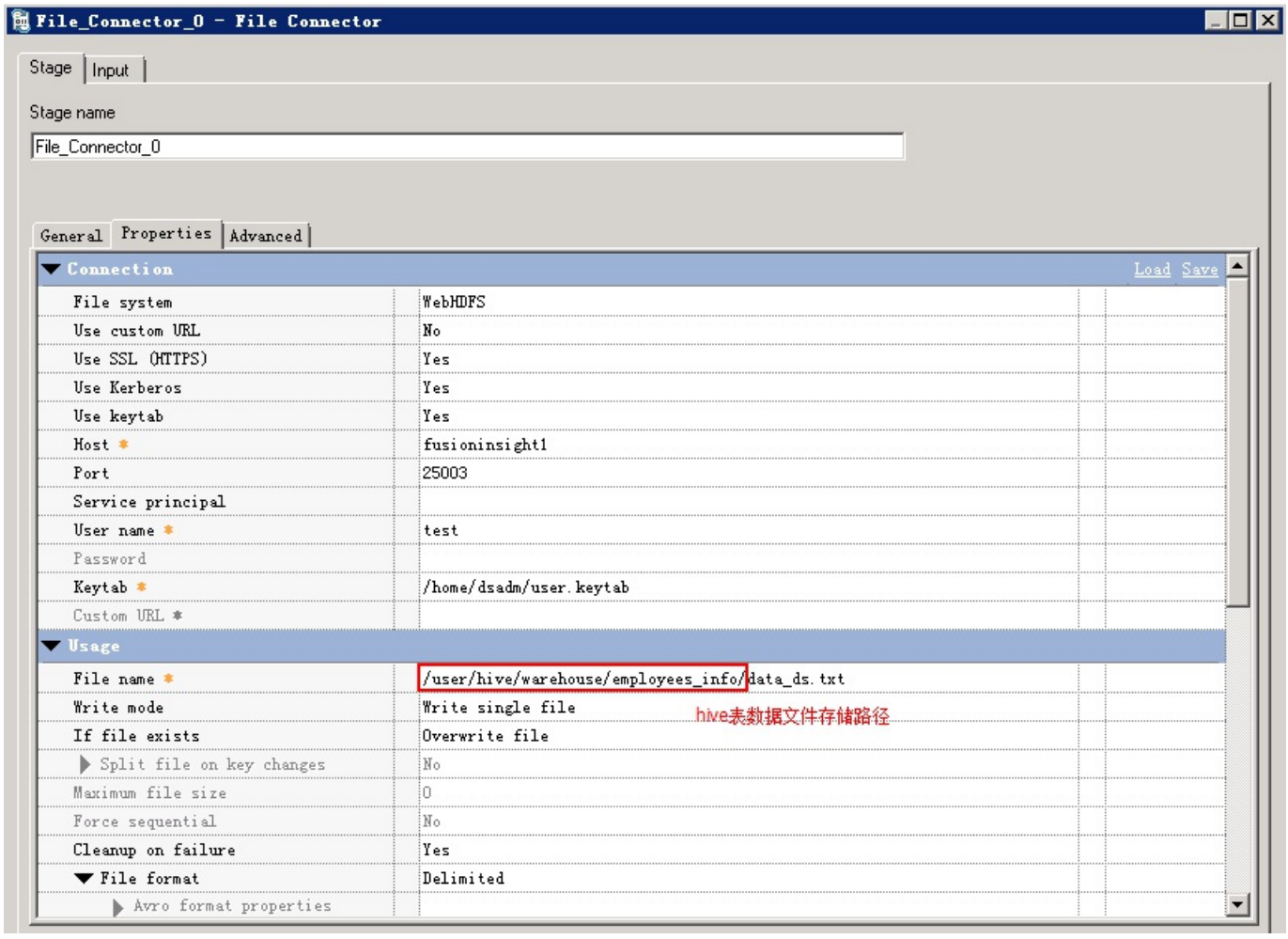
```
0: jdbc:hive2://162.1.61.41:21066/> select * from employees_info;
+----------------------+------------------------+---------------------------+-------------------------+-------------------------------+-----------------------------+--+
| employees_info.id    | employees_info.name    | employees_info.usd_flag   | employees_info.salary   |   employees_info.address      | employees_info.entrytime    |
+----------------------+------------------------+---------------------------+-------------------------+-------------------------------+-----------------------------+--+
| 1                    | 11111                  | 11                        | 1.0                     | 11111111111111111111          | 1111                        |
| 0                    | 000000000000000000     |                           | 0.0                     |                               |                             |
| 3                    | 33333333333333         | 33                        | 3.0                     | 333333333333333333333333      | 33                          |
| 2                    | 2                      | 22                        | 2.0                     | 222222222222222               | 2                           |
| 4                    | 4444444                | 44                        | 4.0                     | 444444                        | 4                           |
| 1                    | Linda                  | D                         | 36000.04                | America:NewYork               | 2014                        |
| 3                    | Tom                    | D                         | 12000.02                | America:NewYork               | 2014                        |
| 4                    | Jack                   | D                         | 24000.03                | America:Manhattan             | 2014                        |
| 6                    | Wang                   | R                         | 8000.01                 | China:Shenzhen                | 2014                        |
| 8                    | Zhang                  | R                         | 9000.05                 | China:Shanghai                | 2014                        |
+----------------------+------------------------+---------------------------+-------------------------+-------------------------------+-----------------------------+--+
10 rows selected (0.228 seconds)
```

数据导入Hive表的HDFS文件

- 创建作业

- 修改配置





- 编译运行

```
0:16:07     2017/7/7     Info        File_Connector_0,0: Accessing file via WebHDFS file system.
0:16:08     2017/7/7     Info        File_Connector_0,0: IBMJGSSProvider Build-Level: -20160808 (...)
0:16:08     2017/7/7     Info        File_Connector_0,0: The /user/hive/warehouse/employees_info/data_ds.txt file, which contains 100 rows, was written.
0:16:08     2017/7/7     Info        main_program: Step execution finished with status = OK.
0:16:08     2017/7/7     Info        main_program: Startup time, 0:03; production run time, 0:02.
0:16:08     2017/7/7     Info        Parallel job reports successful completion
0:16:08     2017/7/7     Control     Finished Job hive_write_hdfs.
```

- 查看写入数据

```
[root@datastage11502 ~]# hdfs dfs -ls /user/hive/warehouse/employees_info
Found 4 items
-rwxrwx---+  3 test hive        223 2017-07-06 23:50 /user/hive/warehouse/employees_info/000000_0
-rwxrwx---+  3 test hive        146 2017-07-06 23:51 /user/hive/warehouse/employees_info/000000_0_copy_1499356264319
-rwxrwx---+  3 test hive        194 2017-06-20 11:42 /user/hive/warehouse/employees_info/data.txt
-rwxr-x---+  3 test hive       2934 2017-07-07 00:16 /user/hive/warehouse/employees_info/data_ds.txt
[root@datastage11502 ~]# hdfs dfs -cat /user/hive/warehouse/employees_info/data_ds.txt
0,aa,a,0.0,aaaaaaaaaaaaaaaaaaa,
1,b,b,1.0,bbbbb,bbbb
2,cccc,c,2.0,c,c
3,dddddddddd,d,3.0,ddddddddddddd,dd
4,eeee,e,4.0,eeeeeee,e
5,ffff,f,5.0,fffffffffffff,ff
6,,g,6.0,gggggg,
7,hhhhhhhhh,h,7.0,hhhhhhhh,h
8,iiiiiii,i,8.0,iiiiiiiiiiiii,iii
9,jjjjjjjj,j,9.0,jjjjjj,j
10,kkkkkkkkkk,k,10.0,kkkkkkkkkkkkkkkkkk,kkkk
11,,l,11.0,,ll
12,mmmmm,m,12.0,mmmmmmmmmmmmmmmmmmmm,mmm
13,nnnnnnnn,n,13.0,,
14,ooo,o,14.0,ooooooooo,ooo
```

hive表数据增量100

```
0: jdbc:hive2://162.1.61.42:21066/> select * from employees_info limit 10;
+---------------------+----------------------+--------------------------+------------------------+-----------------------------+----------------------------+--+
| employees_info.id   | employees_info.name  | employees_info.usd_flag  | employees_info.salary  |   employees_info.address    | employees_info.entrytime   |
+---------------------+----------------------+--------------------------+------------------------+-----------------------------+----------------------------+--+
| 1                   | 11111                | 11                       | 1.0                    | 1111111111111111111111      | 1111                       |
| 3                   | 33333333333333       | 33                       | 3.0                    | 3333333333333333333333333   | 33                         |
| 5                   | 55555555555555       | 5                        | 5.0                    | 5555555555555               | 55                         |
| 7                   | 77777777             | 77                       | 7.0                    | 777777777777777777777777777 | 7                          |
| 9                   | 999999               | 9                        | 9.0                    | 99999999999999999999        | 9                          |
| 0                   | 0000000000000000000  |                          | 0.0                    |                             |                            |
| 2                   | 2                    | 22                       | 2.0                    | 222222222222222             | 2                          |
| 4                   | 4444444              | 44                       | 4.0                    | 444444                      | 4                          |
| 6                   | 666666               |                          | 6.0                    | 66666                       |                            |
| 8                   | 88888888888888       | 8                        | 8.0                    | 8888888888888               | 888                        |
+---------------------+----------------------+--------------------------+------------------------+-----------------------------+----------------------------+--+
10 rows selected (0.34 seconds)
0: jdbc:hive2://162.1.61.42:21066/> select count(*) from employees_info;
INFO  : Number of reduce tasks determined at compile time: 1
INFO  : In order to change the average load for a reducer (in bytes):
INFO  :   set hive.exec.reducers.bytes.per.reducer=<number>
INFO  : In order to limit the maximum number of reducers:
INFO  :   set hive.exec.reducers.max=<number>
INFO  : In order to set a constant number of reducers:
INFO  :   set mapreduce.job.reduces=<number>
INFO  : number of splits:1
INFO  : Submitting tokens for job: job_1498704716735_0035
INFO  : Kind: HDFS_DELEGATION_TOKEN, Service: ha-hdfs:hacluster
INFO  : Kind: HIVE_DELEGATION_TOKEN, Service: HiveServer2ImpersonationToken
INFO  : The url to track the job: https://fusioninsight1:26001/proxy/application_1498704716735_0035/
INFO  : Starting Job = job_1498704716735_0035, Tracking URL = https://fusioninsight1:26001/proxy/application_1498704716735_0035/
INFO  : Kill Command = /opt/huawei/Bigdata/FusionInsight_V100R002C60U20/FusionInsight-Hive-1.3.0/hive-1.3.0/bin/..//../hadoop/bin/hadoop job  -kill job_1498704
INFO  : Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 1
INFO  : 2017-07-07 00:22:41,092 Stage-1 map = 0%,  reduce = 0%
INFO  : 2017-07-07 00:22:48,590 Stage-1 map = 100%,  reduce = 0%, Cumulative CPU 1.93 sec
INFO  : 2017-07-07 00:22:54,009 Stage-1 map = 100%,  reduce = 100%, Cumulative CPU 3.93 sec
INFO  : MapReduce Total cumulative CPU time: 3 seconds 930 msec
INFO  : Ended Job = job_1498704716735_0035
+------+--+
| _c0  |
+------+--+
| 115  |
+------+--+
1 row selected (23.059 seconds)
```

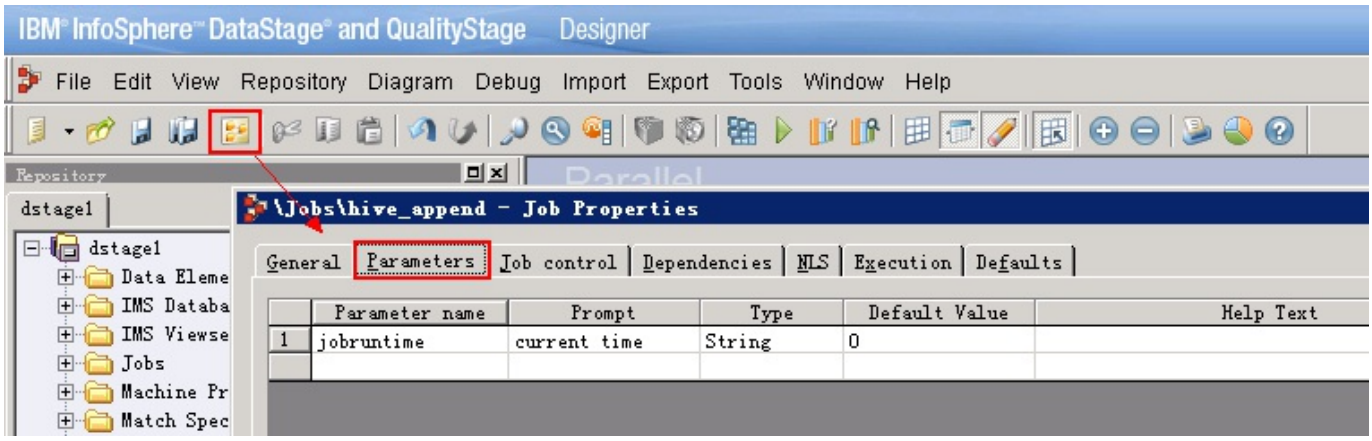
增量数据定期自动导入Hive表的HDFS文件

增量数据可以新增HDFS文件的方式导入hive，如果要定期自动化执行，导入的文件名中需要包含可变参数进行设置和区分，然后以命令或脚本方式运行作业，给该参数赋值。

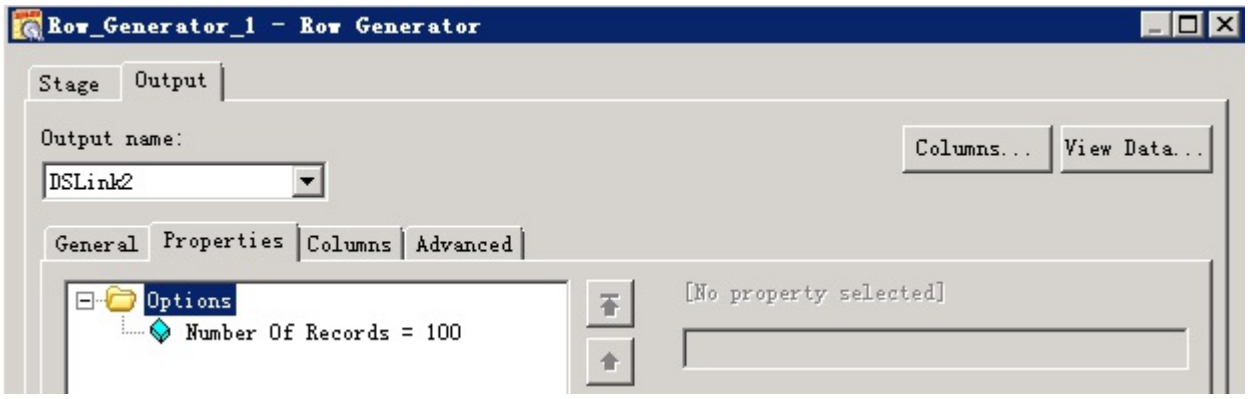
- 创建作业

- 设置作业参数

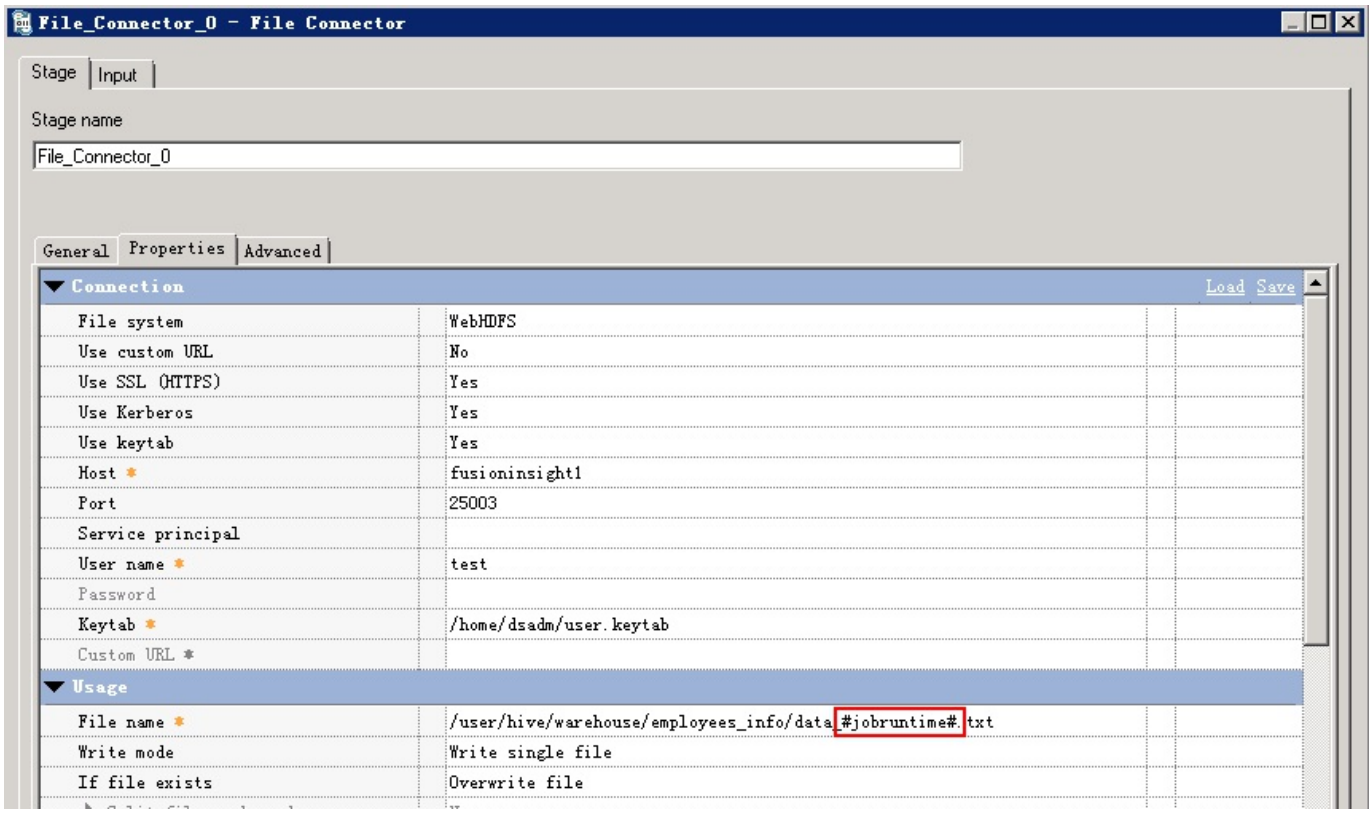
点击“job properties”按钮，设置参数如下



- 修改配置



File Connector配置导出文件的名称，以"#"引用设置的参数



- dsjob命令运行作业

保存编译作业，在DataStage Server上执行dsjob -run命令，格式为：

```
dsjob -run [-mode <NORMAL | RESET | VALIDATE>] -param = -jobstatus PROJECT_NAME JOB_NAME
```

命令参考:

```
su - dsadm
cd $DSHOME/bin
```

```
./dsjob -run -param jobruntime=`date +'%Y-%m-%d-%H-%M-%S'` -jobstatus dstage1 hive_append
```

```
[dsadm@datastage11502 bin]$ ./dsjob -run -param jobruntime=`date +'%Y-%m-%d-%H-%M-%S'` -jobstatus dstage1 hive_append
Waiting for job...
Finished waiting for job
Job Status      :  (1)

Status code = 1
[dsadm@datastage11502 bin]$ ./dsjob -run -param jobruntime=`date +'%Y-%m-%d-%H-%M-%S'` -jobstatus dstage1 hive_append
Waiting for job...
Finished waiting for job
Job Status      :  (1)

Status code = 1
[dsadm@datastage11502 bin]$
```

- 查看HDFS文件：

```
[root@datastage11502 ~]# hdfs dfs -ls /user/hive/warehouse/employees_info
Found 6 items
-rwxrwx---+  3 test hive        223 2017-07-06 23:50 /user/hive/warehouse/employees_info/000000_0
-rwxrwx---+  3 test hive        146 2017-07-06 23:51 /user/hive/warehouse/employees_info/000000_0_copy_1499356264319
-rwxrwx---+  3 test hive        194 2017-06-20 11:42 /user/hive/warehouse/employees_info/data.txt
-rwxr-x---+  3 test hive       2934 2017-07-07 00:50 /user/hive/warehouse/employees_info/data_2017-07-07-00-50-03.txt
-rwxr-x---+  3 test hive       2934 2017-07-07 00:51 /user/hive/warehouse/employees_info/data_2017-07-07-00-51-32.txt
-rwxr-x---+  3 test hive       2934 2017-07-07 00:16 /user/hive/warehouse/employees_info/data_ds.txt
[root@datastage11502 ~]#
```

- 查看Hive数据增量为200条

```
0: jdbc:hive2://162.1.61.42:21066/> select count(*) from employees_info;
INFO  : Number of reduce tasks determined at compile time: 1
INFO  : In order to change the average load for a reducer (in bytes):
INFO  :   set hive.exec.reducers.bytes.per.reducer=<number>
INFO  : In order to limit the maximum number of reducers:
INFO  :   set hive.exec.reducers.max=<number>
INFO  : In order to set a constant number of reducers:
INFO  :   set mapreduce.job.reduces=<number>
INFO  : number of splits:1
INFO  : Submitting tokens for job: job_1498704716735_0036
INFO  : Kind: HDFS_DELEGATION_TOKEN, Service: ha-hdfs:hacluster
INFO  : Kind: HIVE_DELEGATION_TOKEN, Service: HiveServer2ImpersonationToken
INFO  : The url to track the job: https://FusionInsight1:26001/proxy/application_1498704716735_0036/
INFO  : Starting Job = job_1498704716735_0036, Tracking URL = https://FusionInsight1:26001/proxy/application_1498704716735_0036/
INFO  : Kill Command = /opt/huawei/Bigdata/FusionInsight_V100R002C60U20/FusionInsight-Hive-1.3.0/hive-1.3.0/bin/..//../hadoop/bin/
INFO  : Hadoop job information for Stage-1: number of mappers: 1; number of reducers: 1
INFO  : 2017-07-07 00:54:12,877 Stage-1 map = 0%,  reduce = 0%
INFO  : 2017-07-07 00:54:20,343 Stage-1 map = 100%,  reduce = 0%, Cumulative CPU 2.15 sec
INFO  : 2017-07-07 00:54:26,752 Stage-1 map = 100%,  reduce = 100%, Cumulative CPU 4.22 sec
INFO  : MapReduce Total cumulative CPU time: 4 seconds 220 msec
INFO  : Ended Job = job_1498704716735_0036
+------+--+
| _c0  |
+------+--+
| 315  |
+------+--+
1 row selected (23.953 seconds)
```

对接SparkSQL

与使用FI Hive JDBC驱动类似，可以用SparkSQL JDBC驱动连接Hive，同样需要导出CLASSPATH环境变量来加载驱动包及依赖包。

> SparkSQL jdbc不支持insert into语句，只能用来读hive数据，不能插入数据到hive表。

设置CLASSPATH环境变量

- SparkSQL jdbc驱动包及依赖包位于Spark客户端lib目录下`/opt/ficlient/Spark/spark/lib/`，若未安装客户端，也可单独上传所需jar包到任意目录。
- 设置CLASSPATH环境变量，添加上述jar包的完整路径，以及spark客户端配置文件路径（SparkSQL jdbc连接hive时需要读取hive-site.xml中的配置）：

```
su - dsadm
vi $DSHOME/dsenv
```

配置如下内容：

```
export CLASSPATH= /opt/ficlient/Spark/spark/lib/commons-collections-3.2.2.jar:/opt/ficlient/Spark/spark/lib/commons-configuration-1.6.jar:/opt/ficlient/Spark/spark/lib/commons-lang-2.6.jar:/opt/ficlient/Spark/spark/lib/commons-logging-1.1.3.jar:/opt/ficlient/Spark/spark/lib/curator-client-2.7.1.jar:/opt/ficlient/Spark/spark/lib/curator-framework-2.7.1.jar:/opt/ficlient/Spark/spark/lib/guava-12.0.1.jar:/opt/ficlient/Spark/spark/lib/hadoop-auth-
```

```
2.7.2.jar:/opt/ficlient/Spark/spark/lib/hadoop-common-2.7.2.jar:/opt/ficlient/Spark/spark/lib/hadoop-mapreduce-client-core-
2.7.2.jar:/opt/ficlient/Spark/spark/lib/hive-common-1.2.1.spark.jar:/opt/ficlient/Spark/spark/lib/hive-exec-
1.2.1.spark.jar:/opt/ficlient/Spark/spark/lib/hive-jdbc-1.2.1.spark.jar:/opt/ficlient/Spark/spark/lib/hive-metastore-
1.2.1.spark.jar:/opt/ficlient/Spark/spark/lib/hive-service-1.2.1.spark.jar:/opt/ficlient/Spark/spark/lib/htrace-core-3.1.0-
incubating.jar:/opt/ficlient/Spark/spark/lib/httpclient-4.5.2.jar:/opt/ficlient/Spark/spark/lib/httpcore-
4.4.4.jar:/opt/ficlient/Spark/spark/lib/libthrift-0.9.3.jar:/opt/ficlient/Spark/spark/lib/log4j-
1.2.17.jar:/opt/ficlient/Spark/spark/lib/slf4j-api-1.7.10.jar:/opt/ficlient/Spark/spark/lib/slf4j-log4j12-
1.7.10.jar:/opt/ficlient/Spark/spark/lib/xercesImpl-2.9.1.jar:/opt/ficlient/Spark/spark/lib/zookeeper-
3.5.1.jar:/opt/ficlient/Spark/spark/conf
```

- 导入环境变量

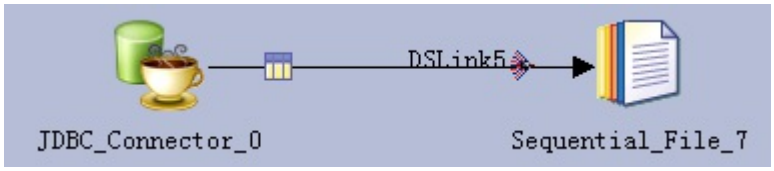
```
source $DSHOME/dsenv
```

- 重启DSEngine

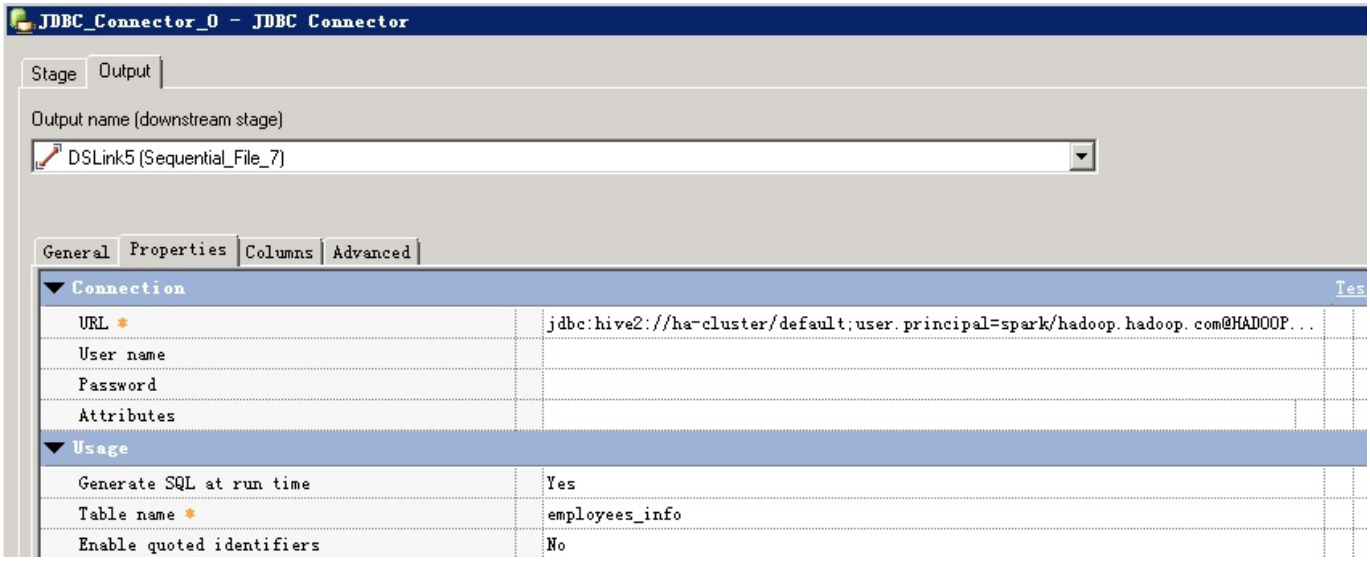
```
cd $DSHOME
bin/uv -admin -stop
bin/uv -admin -start
```

读取Hive表数据

- 创建作业

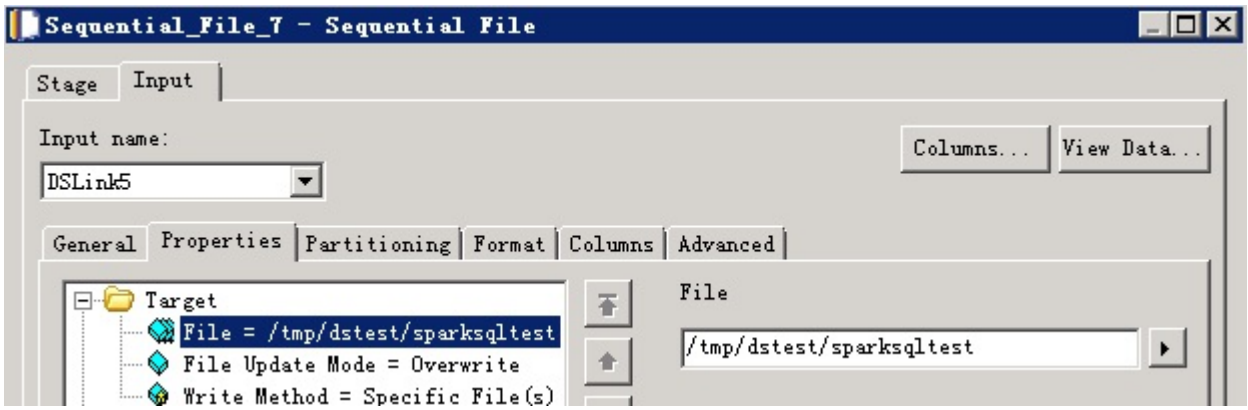


- 修改配置



URL参考：

```
jdbc:hive2://ha-cluster/default;user.principal=spark/hadoop.hadoop.com@HADOOP.COM;saslQop=auth-
conf;auth=KERBEROS;principal=spark/hadoop.hadoop.com@HADOOP.COM;user.principal=test@HADOOP.COM;user.keytab=/home/dsadm/user.keytab
;
```



- 编译运行

```
23:51:44    2017/7/7    Info        JDBC_Connector_0,0: Number of rows fetched on the current node: 10.
23:51:44    2017/7/7    Info        JDBC_Connector_0,0: [JGSS_DBG_WRAP]  main Krb5Context.wrap: set Flag Fields 0 SentByAccep
23:51:44    2017/7/7    Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
23:51:44    2017/7/7    Info        Sequential_File_7,0: Export complete; 10 records exported successfully, 0 rejected.  (...)
23:51:44    2017/7/7    Info        JDBC_Connector_0: The connector closed the connection to the data source.
23:51:44    2017/7/7    Info        main_program: Step execution finished with status = OK.
23:51:44    2017/7/7    Info        main_program: Startup time, 0:13; production run time, 0:04.
23:51:44    2017/7/7    Info        Parallel job reports successful completion
23:51:44    2017/7/7    Control     Finished Job sparkjdbctest1.
```

```
[root@datastage1502 dstest]# cat sparksqltest
"1","11111","11","1.00000000000000000E+00","11111111111111111111","1111"
"0","00000000000000000","","0.00000000000000000E+00","",""
"3","33333333333333","33","3.00000000000000000E+00","333333333333333333333333","33"
"2","2","22","2.00000000000000000E+00","222222222222222","2"
"4","4444444","44","4.00000000000000000E+00","444444","4"
"1","Linda","D","3.60000400000000009E+04","America:NewYork","2014"
"3","Tom","D","1.20000200000000004E+04","America:NewYork","2014"
"4","Jack","D","2.40000299999999988E+04","America:Manhattan","2014"
"6","Wang","R","8.00001000000000022E+03","China:Shenzhen","2014"
"8","Zhang","R","9.00004999999999927E+03","China:Shanghai","2014"
```

对接Phoenix

使用Phoenix以JDBC方式访问HBase表，也需要导出CLASSPATH环境变量来加载驱动包及依赖包。

设置CLASSPATH环境变量

- Phoenix相关的jar包位于HBase客户端lib目录下`/opt/ficlient/HBase/hbase/lib`，若未安装客户端，也可单独上传所需jar包到任意目录。
- 设置CLASSPATH环境变量，添加上述jar包的完整路径，以及HBase客户端配置文件路径（phoenix连接时需要读取hbase-site.xml中的配置）：

```
su - dsadm
vi $DSHOME/dsenv
```

配置如下内容：

```
export CLASSPATH=
/opt/ficlient/HBase/hbase/lib/commons-cli-1.2.jar:/opt/ficlient/HBase/hbase/lib/commons-codec-
1.9.jar:/opt/ficlient/HBase/hbase/lib/commons-collections-3.2.2.jar:/opt/ficlient/HBase/hbase/lib/commons-configuration-
1.6.jar:/opt/ficlient/HBase/hbase/lib/commons-io-2.4.jar:/opt/ficlient/HBase/hbase/lib/commons-lang-
2.6.jar:/opt/ficlient/HBase/hbase/lib/commons-logging-1.2.jar:/opt/ficlient/HBase/hbase/lib/dynalogger-
V100R002C30.jar:/opt/ficlient/HBase/hbase/lib/gson-2.2.4.jar:/opt/ficlient/HBase/hbase/lib/guava-
12.0.1.jar:/opt/ficlient/HBase/hbase/lib/hadoop-auth-2.7.2.jar:/opt/ficlient/HBase/hbase/lib/hadoop-common-
2.7.2.jar:/opt/ficlient/HBase/hbase/lib/hadoop-hdfs-2.7.2.jar:/opt/ficlient/HBase/hbase/lib/hadoop-hdfs-client-
2.7.2.jar:/opt/ficlient/HBase/hbase/lib/hbase-client-1.0.2.jar:/opt/ficlient/HBase/hbase/lib/hbase-common-
1.0.2.jar:/opt/ficlient/HBase/hbase/lib/hbaseFileStream-1.0.jar:/opt/ficlient/HBase/hbase/lib/hbase-protocol-
1.0.2.jar:/opt/ficlient/HBase/hbase/lib/hbase-secondaryindex-1.0.2.jar:/opt/ficlient/HBase/hbase/lib/hbase-server-
1.0.2.jar:/opt/ficlient/HBase/hbase/lib/htrace-core-3.1.0-incubating.jar:/opt/ficlient/HBase/hbase/lib/httpclient-
4.5.2.jar:/opt/ficlient/HBase/hbase/lib/httpcore-4.4.4.jar:/opt/ficlient/HBase/hbase/lib/httpmime-
4.3.6.jar:/opt/ficlient/HBase/hbase/lib/jackson-core-asl-1.9.13.jar:/opt/ficlient/HBase/hbase/lib/jackson-mapper-asl-
1.9.13.jar:/opt/ficlient/HBase/hbase/lib/log4j-1.2.17.jar:/opt/ficlient/HBase/hbase/lib/luna-
0.1.jar:/opt/ficlient/HBase/hbase/lib/netty-3.2.4.Final.jar:/opt/ficlient/HBase/hbase/lib/netty-all-
4.0.23.Final.jar:/opt/ficlient/HBase/hbase/lib/noggit-0.6.jar:/opt/ficlient/HBase/hbase/lib/phoenix-core-4.4.0-HBase-
1.0.jar:/opt/ficlient/HBase/hbase/lib/protobuf-java-2.5.0.jar:/opt/ficlient/HBase/hbase/lib/slf4j-api-
1.7.7.jar:/opt/ficlient/HBase/hbase/lib/slf4j-log4j12-1.7.7.jar:/opt/ficlient/HBase/hbase/lib/solr-solrj-
5.3.1.jar:/opt/ficlient/HBase/hbase/lib/zookeeper-3.5.1.jar:/opt/ficlient/HBase/hbase/conf
```

- 导入环境变量

```
source $DSHOME/dsenv
```

- 重启DSEngine

```
cd $DSHOME
bin/uv -admin -stop
bin/uv -admin -start
```

创建jaas配置文件

- Phoenix连接需要查询zookeeper ， zookeeper的Kerberos认证需要指定jaas配置文件

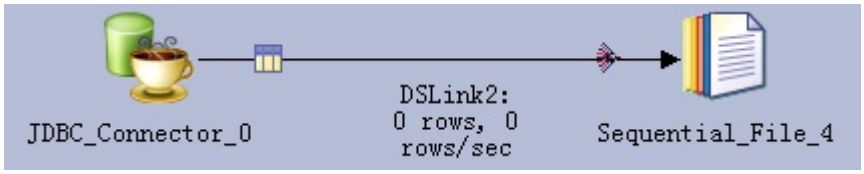
```
su - admin
vi /home/dsadm/jaas.conf
```

文件内容如下：

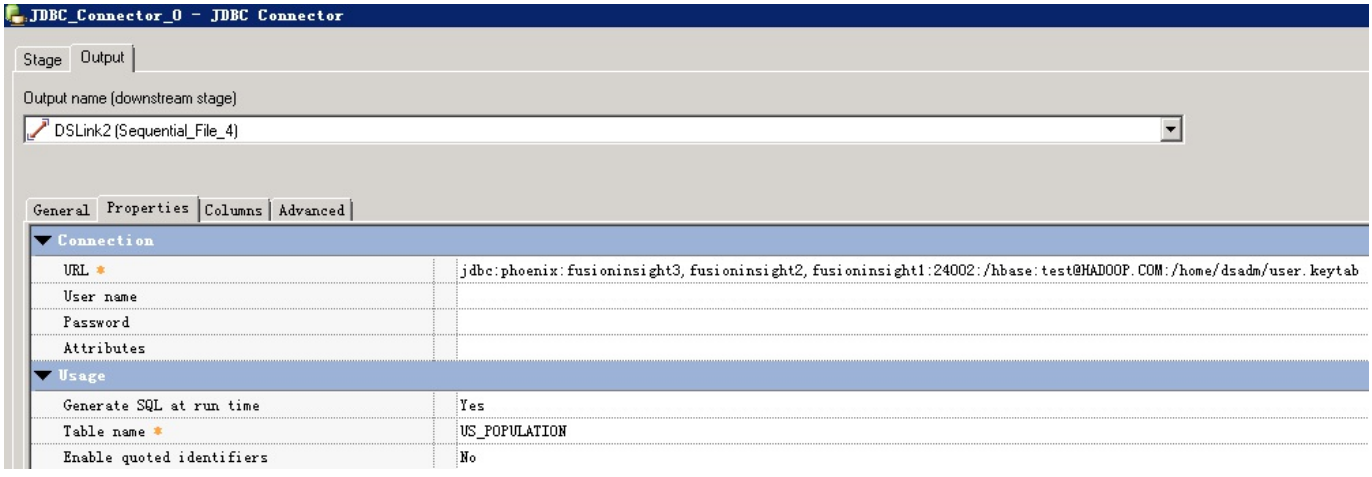
```
Client {
    com.ibm.security.auth.module.Krb5LoginModule required
    credsType=both
    principal="test@HADOOP.COM"
    useKeytab="/home/dsadm/user.keytab";
};
```

读取Phoenix表数据

- 创建作业

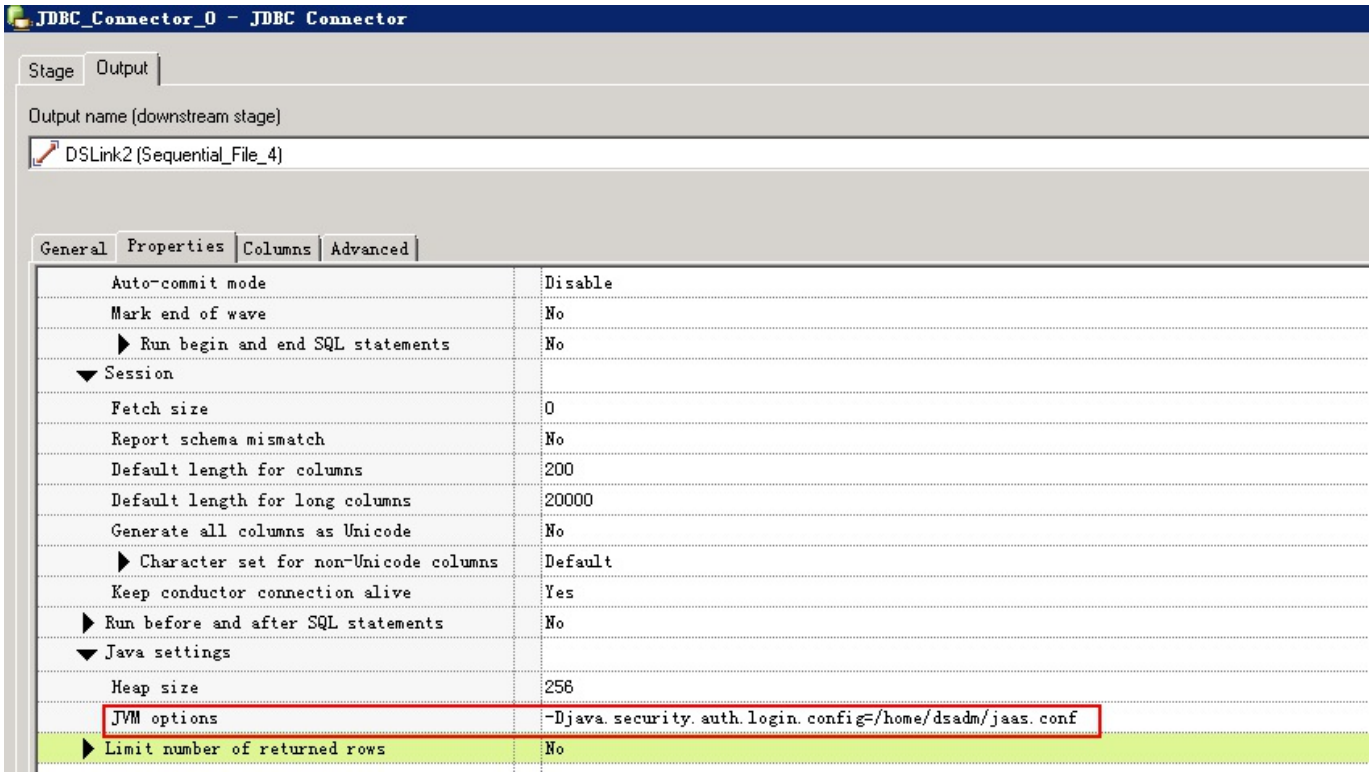


- 修改配置

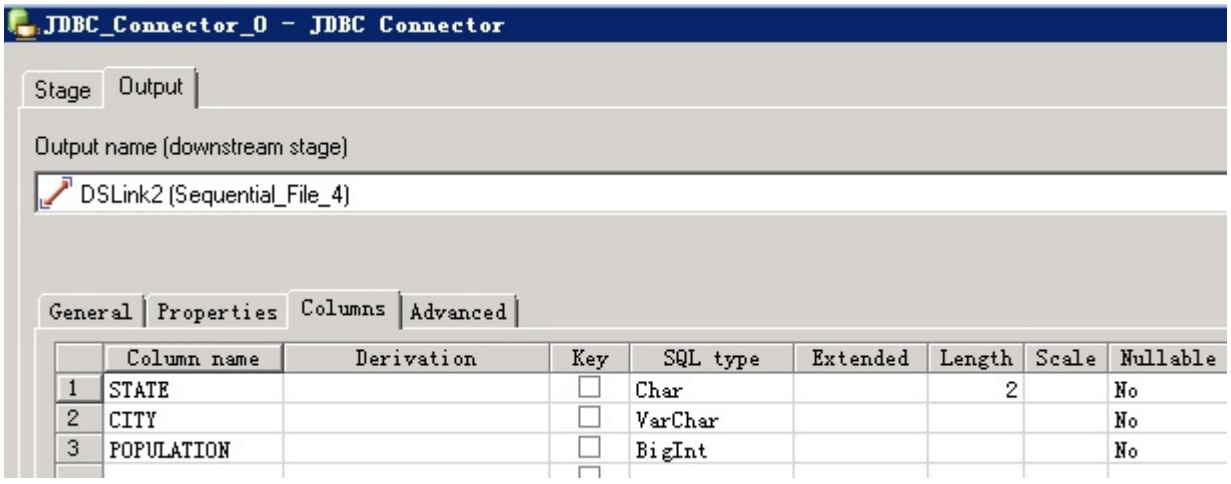


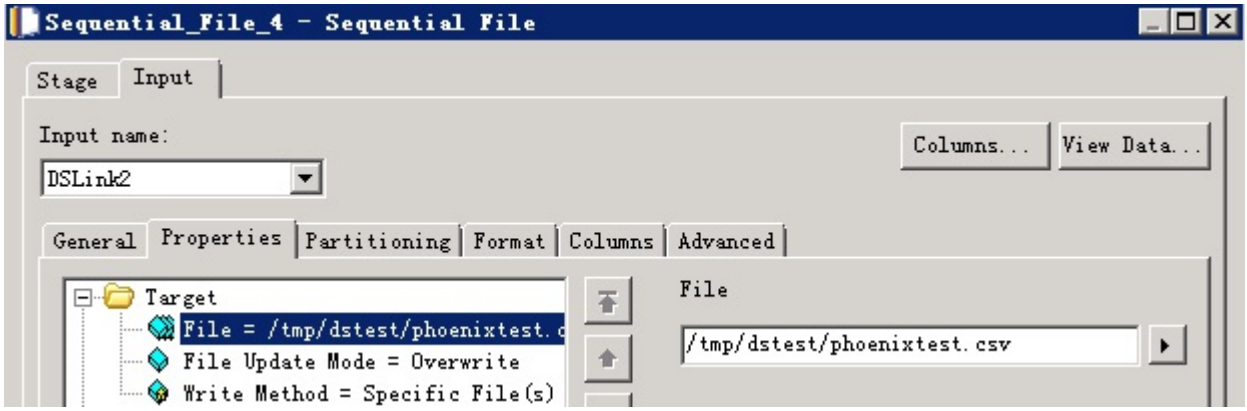
- URL参考：

```
jdbc:phoenix:fusioninsight3,fusioninsight2,fusioninsight1:24002:/hbase:test@HADOOP.COM:/home/dsadm/user.keytab
```



- 配置JVM options为 `-Djava.security.auth.login.config=/home/dsadm/jaas.conf`





- 编译运行

```
1:47:06     2017/7/8     Info        JDBC_Connector_0,0: Number of rows fetched on the current node: 10.
1:47:06     2017/7/8     Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
1:47:06     2017/7/8     Info        Sequential_File_4,0: Export complete; 10 records exported successfully, 0 rejected.
1:47:06     2017/7/8     Info        JDBC_Connector_0: The connector closed the connection to the data source.
1:47:06     2017/7/8     Info        main_program: Step execution finished with status = OK.
1:47:06     2017/7/8     Info        main_program: Startup time, 0:03; production run time, 0:05.
1:47:06     2017/7/8     Info        Parallel job reports successful completion
1:47:06     2017/7/8     Control     Finished Job phoenixtest.
```

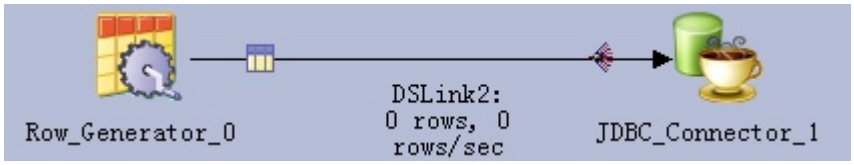
```
[root@datastage11502 dstest]# cat phoenixtest.csv
"CA","Los Angeles","3844829"
"CA","San Diego","1255540"
"CA","San Jose","912332"
"TX","Dallas","1213825"
"AZ","Phoenix","1461575"
"TX","Houston","2016582"
"PA","Philadelphia","1463281"
"IL","Chicago","2842518"
"NY","New York","8143197"
"TX","San Antonio","1256509"
```

写入Phoenix表数据

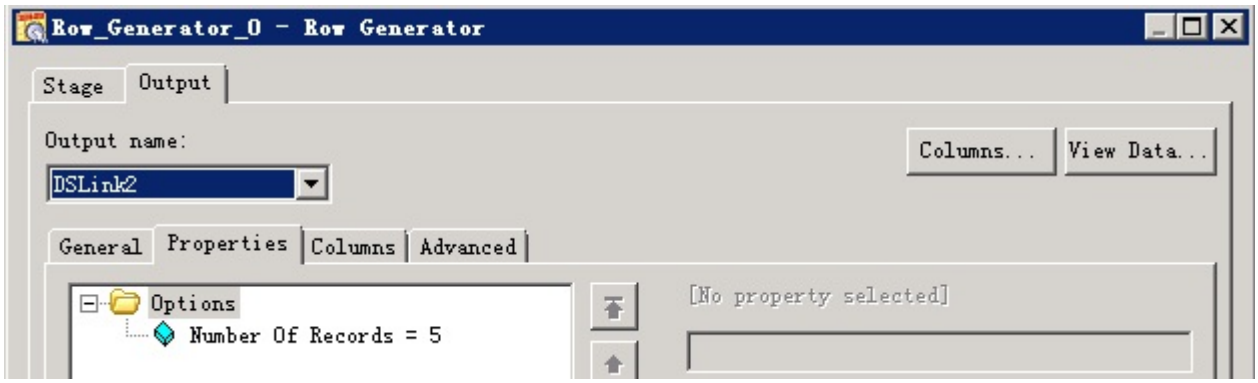
Phoenix插入语句是upsert into，不支持Insert into 语句，所以不能用JDBC Connector在运行时自动生成SQL语句，需要自己填写，否则会报错：

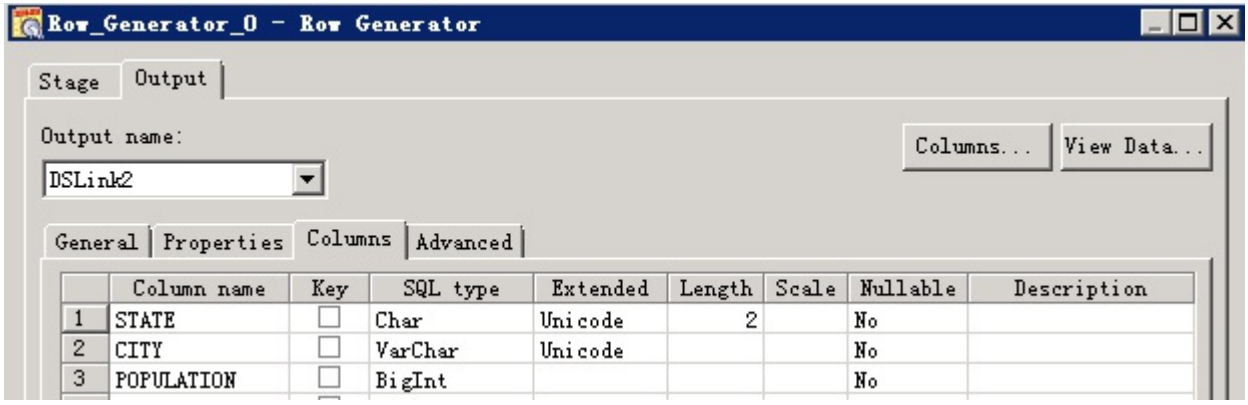
```
main_program: Fatal Error: The connector failed to prepare the statement: INSERT INTO us_population (STATE, CITY, POPULATION) VALUES (?, ?, ?). The reported error is: org.apache.phoenix.exception.PhoenixParserException: ERROR 601 (42P00): Syntax error. Encountered "INSERT" at line 1, column 1..
```

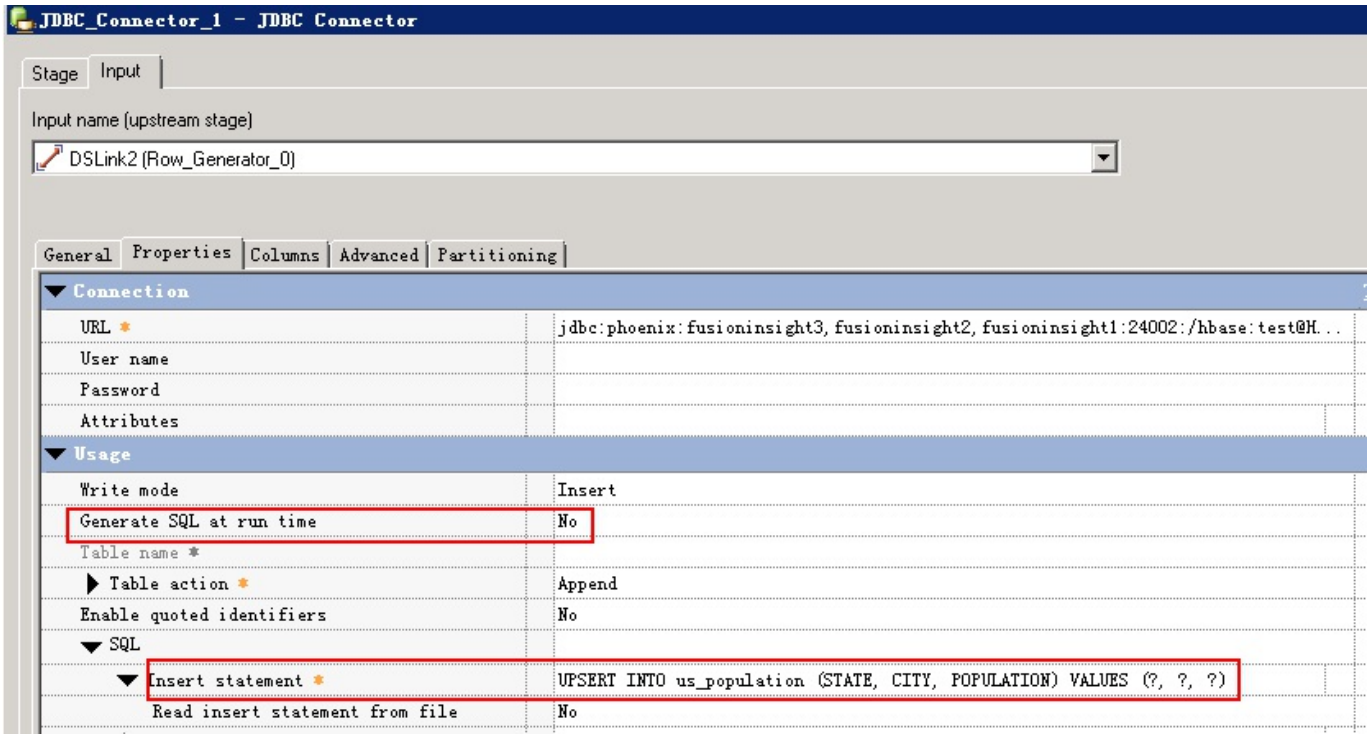
- 创建作业

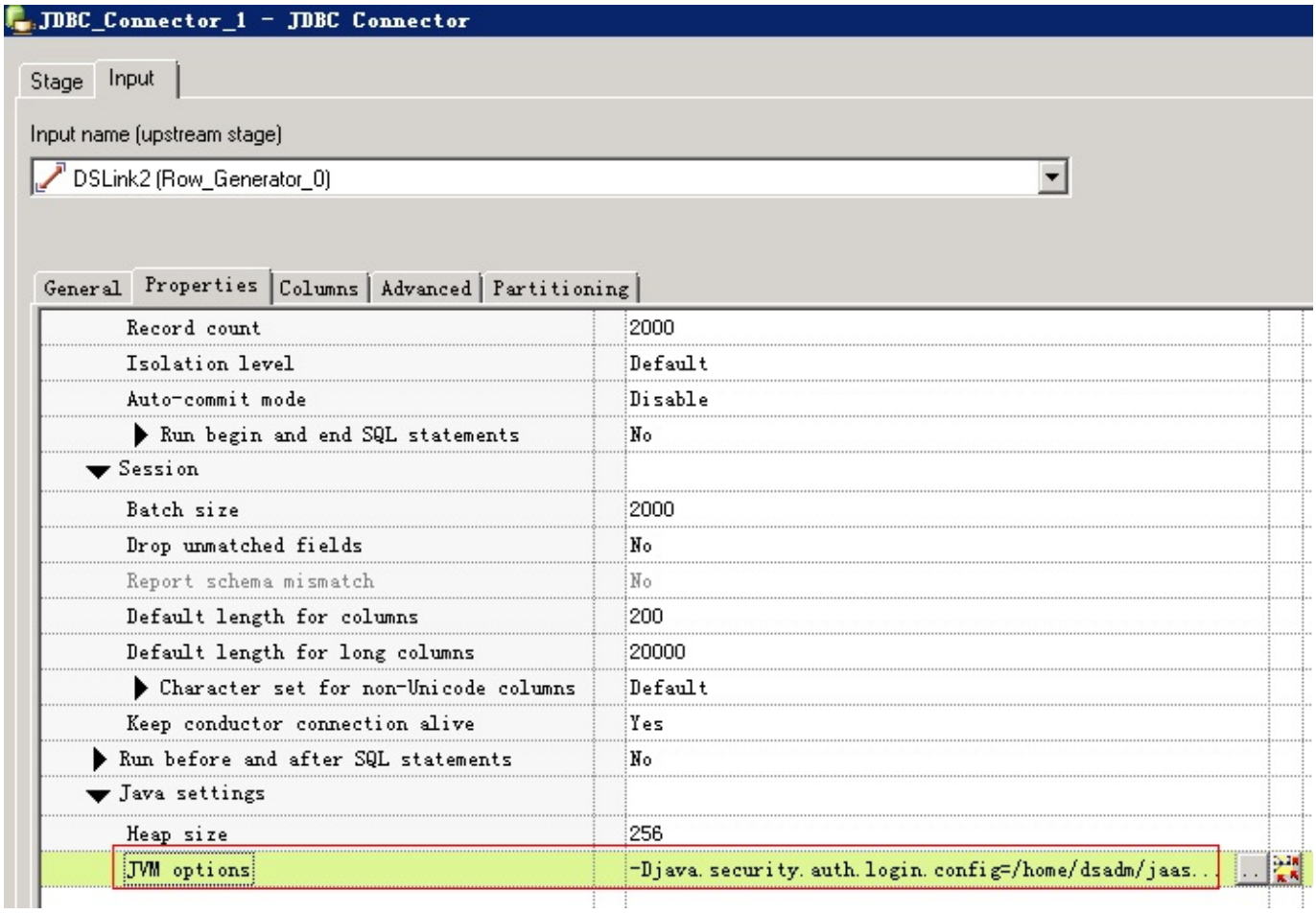


- 修改配置









- 编译运行

```
Info        JDBC_Connector_1,1: The connector established connection to the data source.
Info        JDBC_Connector_1,1: The character set encoding for the non-Unicode character values on the link is UTF-8. The maximum number of bytes per character in this
Info        JDBC_Connector_1,1: The connector will run the following statement on the data source: UPSERT INTO us_population (STATE, CITY, POPULATION) VALUES (?, ?, ?)
Warning     JDBC_Connector_1,1: 2017-07-10 14:19:27,914 INFO  [hconnection-0x8dcfceb8-shared--pool2-t9] ipc.AbstractRpcClient: RPC Server Kerberos principal name for se
Info        JDBC_Connector_1,1: [JGSS_DBG_CRED]  hconnection-0x8dcfceb8-shared--pool2-t9 MN not found; creating one (...)
Info        JDBC_Connector_1,0: Number of rows inserted on the current node: 3.
Info        JDBC_Connector_1,0: The connector closed the connection to the data source.
Info        JDBC_Connector_1,1: Number of rows inserted on the current node: 2.
Info        JDBC_Connector_1,1: The connector closed the connection to the data source.
Info        JDBC_Connector_1: The connector closed the connection to the data source.
Info        main_program: Step execution finished with status = OK.
Info        main_program: Startup time, 0:05; production run time, 0:04.
Info        Parallel job reports successful completion
Control     Finished Job phoenix write.
```

```
0: jdbc:phoenix> select * from US_POPULATION;
+--------+----------------------------------------------------------------------------------------------------+-------------+
| STATE  |                                                CITY                                                | POPULATION  |
+--------+----------------------------------------------------------------------------------------------------+-------------+
| CA     | Los Angeles                                                                                        | 3844829     |
| 33     | 33333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333 | 3           |
| CA     | San Jose                                                                                           | 912332      |
| TX     | Dallas                                                                                             | 1213825     |
| AZ     | Phoenix                                                                                            | 1461575     |
| 00     | 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000 | 0           |
| CA     | San Diego                                                                                          | 1255540     |
| IL     | Chicago                                                                                            | 2842518     |
| NY     | New York                                                                                           | 8143197     |
| 11     | 11111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111 | 1           |
| PA     | Philadelphia                                                                                       | 1463281     |
| 22     | 22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222 | 2           |
| TX     | San Antonio                                                                                        | 1256509     |
| 44     | 44444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444 | 4           |
| TX     | Houston                                                                                            | 2016582     |
+--------+----------------------------------------------------------------------------------------------------+-------------+
15 rows selected (0.093 seconds)
```

对接Fiber

对接Fiber需要先安装FI客户端

修改JDBC Driver配置文件

- 修改$DSHOME路径的isjdbc.config文件，CLASSPATH变量中添加Fiber jdbc driver及依赖包的路径，CLASS_NAMES变量中添加com.huawei.fiber.FiberDriver,org.apache.hive.jdbc.HiveDriver, org.apache.phoenix.jdbc.PhoenixDriver

  参考命令：

  ```
  su - dsadm
  cd $DSHOME
  vi isjdbc.config
  ```

  配置如下：

  ```
  CLASSPATH=/opt/IBM/InformationServer/ASBNode/lib/java/IShive.jar;/opt/mppdb/jdbc/gsjdbc4.jar;/opt/Progress/DataDirect/JDBC\_60/lib/mongodb.jar;/opt/ficlient/Fiber/lib/commons-cli-1.2.jar;/opt/ficlient/Fiber/lib/commons-logging-1.1.3.jar;/opt/ficlient/Fiber/lib/fiber-jdbc-1.0.jar;/opt/ficlient/Fiber/lib/hadoop-common-2.7.2.jar;/opt/ficlient/Fiber/lib/hive-beeline-1.2.1.spark.jar;/opt/ficlient/Fiber/lib/hive-common-1.2.1.spark.jar;/opt/ficlient/Fiber/lib/hive-jdbc-1.2.1.spark.jar;/opt/ficlient/Fiber/lib/jline-2.12.jar;/opt/ficlient/Fiber/lib/log4j-1.2.17.jar;/opt/ficlient/Fiber/lib/slf4j-api-1.7.10.jar;/opt/ficlient/Fiber/lib/slf4j-log4j12-1.7.10.jar;/opt/ficlient/Fiber/lib/super-csv-2.2.0.jar;

  CLASS_NAMES=com.ibm.isf.jdbc.hive.HiveDriver;org.postgresql.Driver;com.ddtek.jdbc.mongodb.MongoDBDriver;com.huawei.fiber.FiberDriver;org.apache.hive.jdbc.HiveDriver;org.apache.phoenix.jdbc.PhoenixDriver
  ```

修改Fiber配置文件

- DataStage使用IBM jdk，需要新建Fiber配置文件给DataStage使用

  ```
  cd /opt/ficlient/Fiber/conf
  cp fiber.xml fiber_ibm.xml
  ```

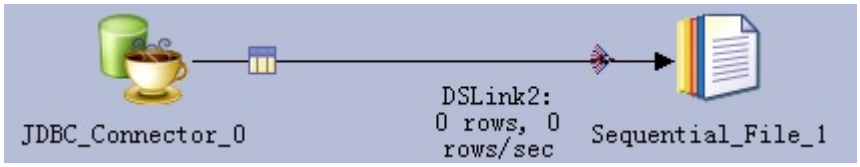
- 修改fiber_ibm.xml中phoenix,hive,spark各driver的以下两个参数：
  - java.security.auth.login.config 修改为 /home/dsadm/jaas.conf
  - zookeeper.kinit 修改为 /opt/IBM/InformationServer/jdk/jre/bin/kinit
- 文件/home/dsadm/jaas.conf的内容如下：

  ```
  Client {
      com.ibm.security.auth.module.Krb5LoginModule required
      credsType=both
      principal="test@HADOOP.COM"
      useKeytab="/home/dsadm/user.keytab";
  };
  ```

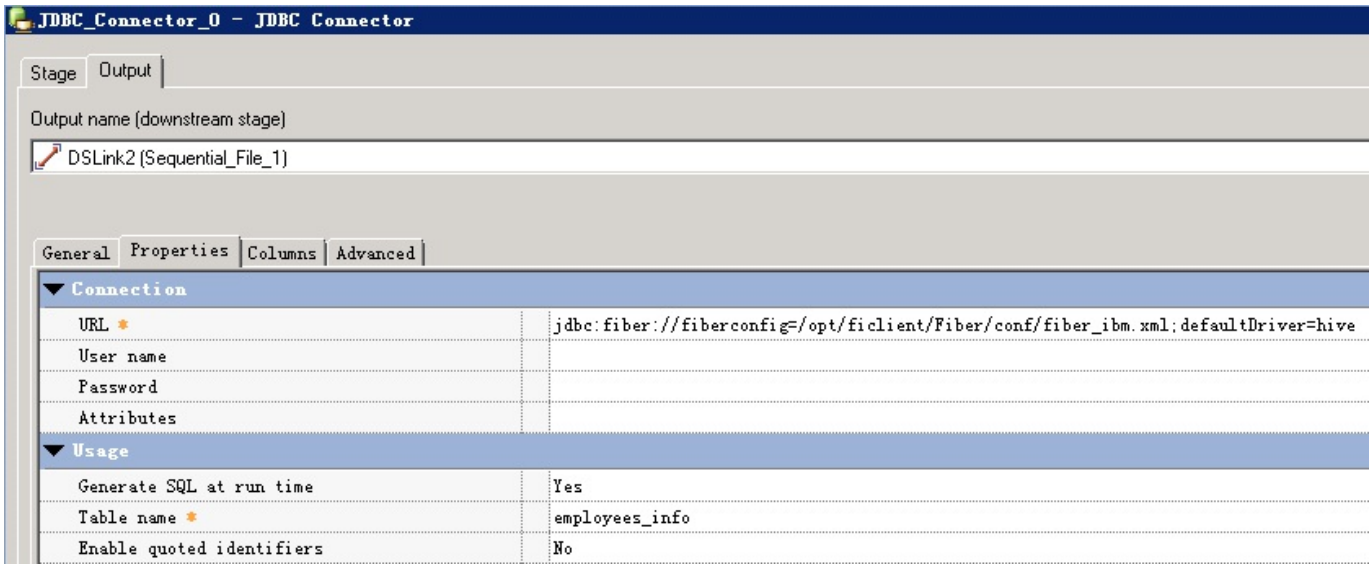
- 其它配置项参考FI产品文档Fiber客户端配置指导修改。

使用Hive Driver读取数据

- 创建作业

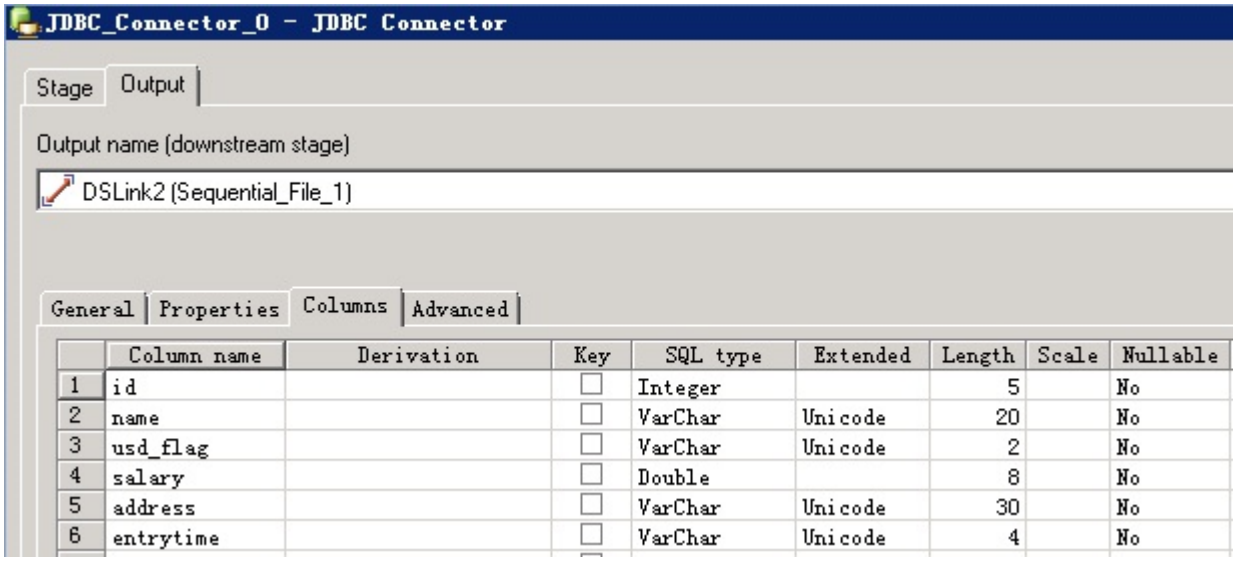


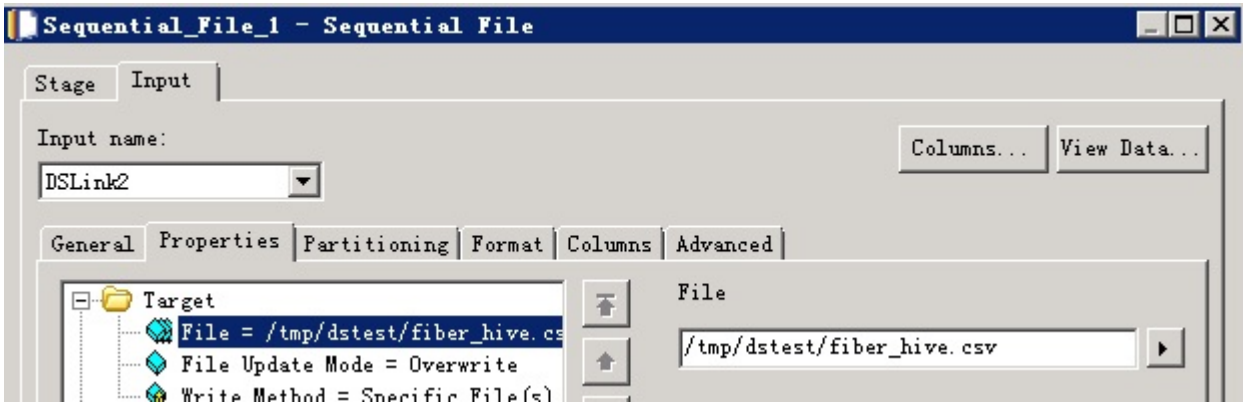
- 修改配置



URL参考：

```
jdbc:fiber://fiberconfig=/opt/ficlient/Fiber/conf/fiber_ibm.xml;defaultDriver=hive
```





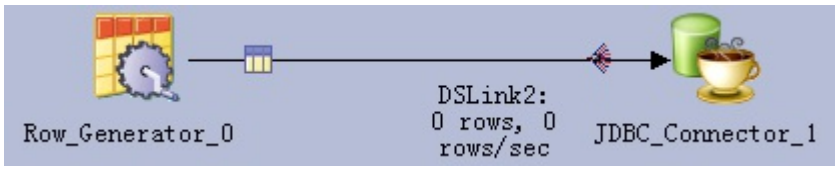
- 编译运行

```
12:14:58    2017/7/8    Info        JDBC_Connector_0,0: Number of rows fetched on the current node: 10.
12:14:58    2017/7/8    Info        JDBC_Connector_0,0: [JGSS_DBG_WRAP]  main Krb5Context.wrap: set Flag Fields 0 SentB
12:14:58    2017/7/8    Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
12:14:58    2017/7/8    Info        Sequential_File_1,0: Export complete; 10 records exported successfully, 0 rejected.
12:14:58    2017/7/8    Info        JDBC_Connector_0: The connector closed the connection to the data source.
12:14:58    2017/7/8    Info        main_program: Step execution finished with status = OK.
12:14:58    2017/7/8    Info        main_program: Startup time, 0:04; production run time, 0:02.
12:14:58    2017/7/8    Info        Parallel job reports successful completion
12:14:58    2017/7/8    Control     Finished Job fiber_hive_read.
```

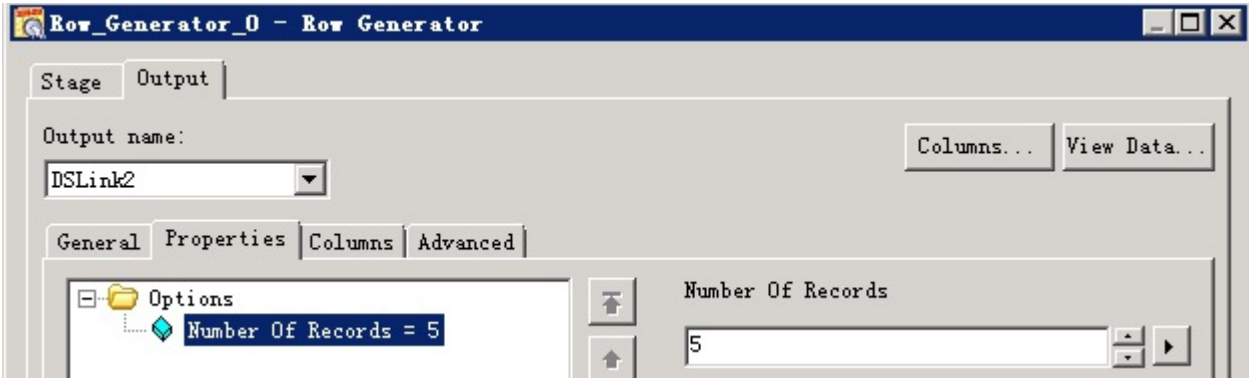
```
[root@datastage1502 dstest]# cat fiber_hive.csv
"1","11111","11","1.00000000000000000E+00","11111111111111111111","1111"
"0","000000000000000000","","0.00000000000000000E+00","",""
"3","33333333333333","33","3.00000000000000000E+00","333333333333333333333333","33"
"2","2","22","2.00000000000000000E+00","222222222222222","2"
"4","4444444","44","4.00000000000000000E+00","444444","4"
"1","Linda","D","3.600004000000000009E+04","America:NewYork","2014"
"3","Tom","D","1.200002000000000004E+04","America:NewYork","2014"
"4","Jack","D","2.400002999999999988E+04","America:Manhattan","2014"
"6","Wang","R","8.000010000000000022E+03","China:Shenzhen","2014"
"8","Zhang","R","9.000049999999999927E+03","China:Shanghai","2014"
```

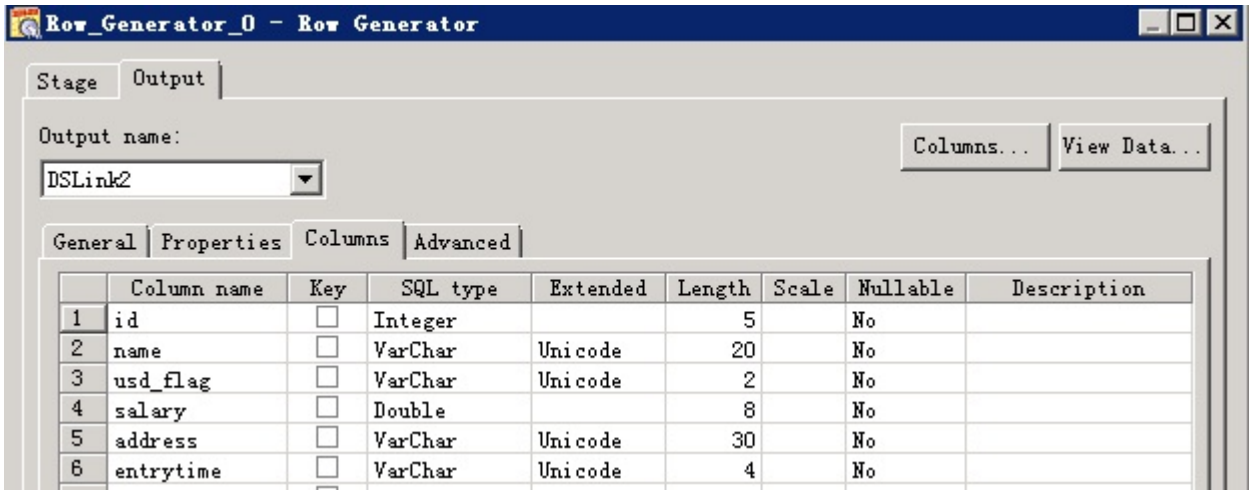
使用Hive Driver写入数据

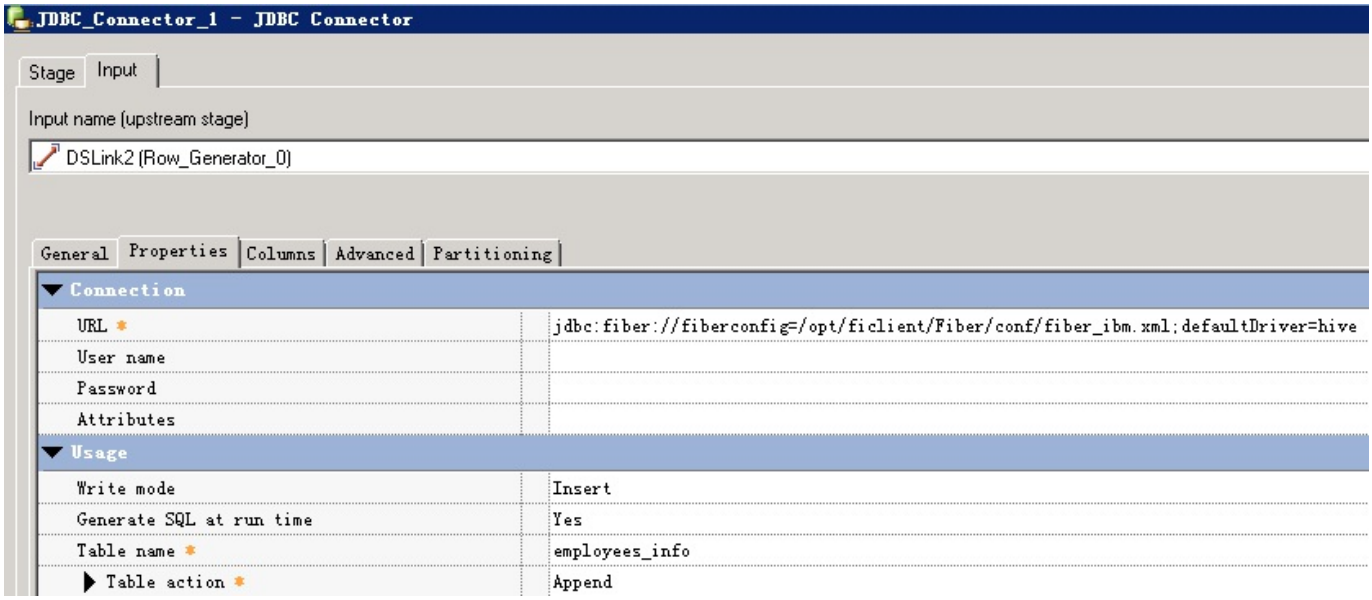
- 创建作业



- 修改配置





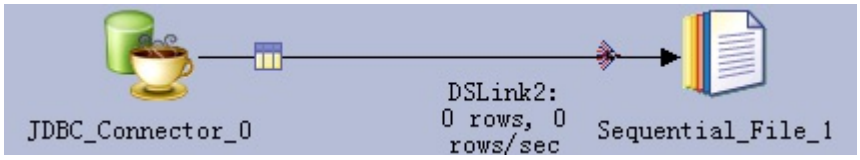


- 编译运行

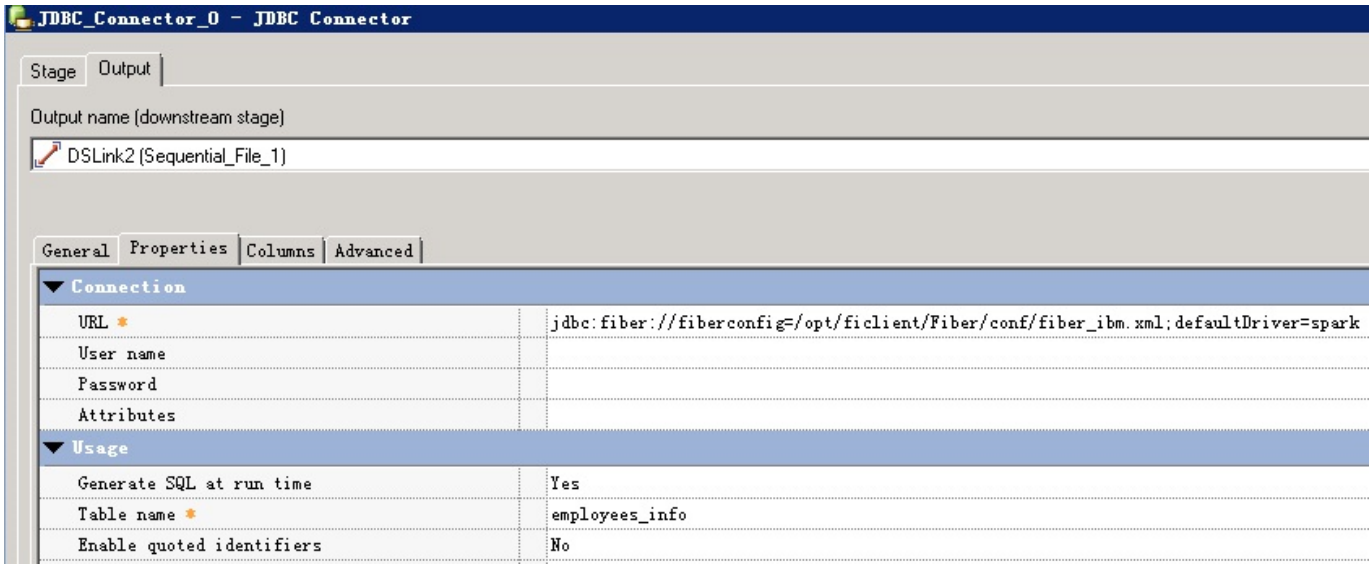
```
12:23:45    2017/7/8    Info       JDBC_Connector_1,1: Number of rows inserted on the current node: 2.
12:23:45    2017/7/8    Info       JDBC_Connector_1,1: [JGSS_DBG_MARSH]  main 0000: 80 01 00 01 00 00 00 0c  43 6c 6f 7
12:23:48    2017/7/8    Info       JDBC_Connector_1,1: The connector closed the connection to the data source.
12:24:06    2017/7/8    Info       JDBC_Connector_1,0: [JGSS_DBG_WRAP]  main GSSContextImpl.unwrap buffer (len=113, off
12:24:06    2017/7/8    Info       JDBC_Connector_1,0: Number of rows inserted on the current node: 3.
12:24:06    2017/7/8    Info       JDBC_Connector_1,0: [KRB_DBG_CRYP] AES128EType:main:   AES128>>> AESencrypt result:
12:24:06    2017/7/8    Info       JDBC_Connector_1,0: The connector closed the connection to the data source. (...)
12:24:06    2017/7/8    Info       JDBC_Connector_1: The connector closed the connection to the data source.
12:24:06    2017/7/8    Info       main_program: Step execution finished with status = OK.
12:24:06    2017/7/8    Info       main_program: Startup time, 0:02; production run time, 1:52.
12:24:06    2017/7/8    Info       Parallel job reports successful completion
12:24:06    2017/7/8    Control    Finished Job fiber_hive_write.
```

使用Spark Driver读取数据

- 创建作业

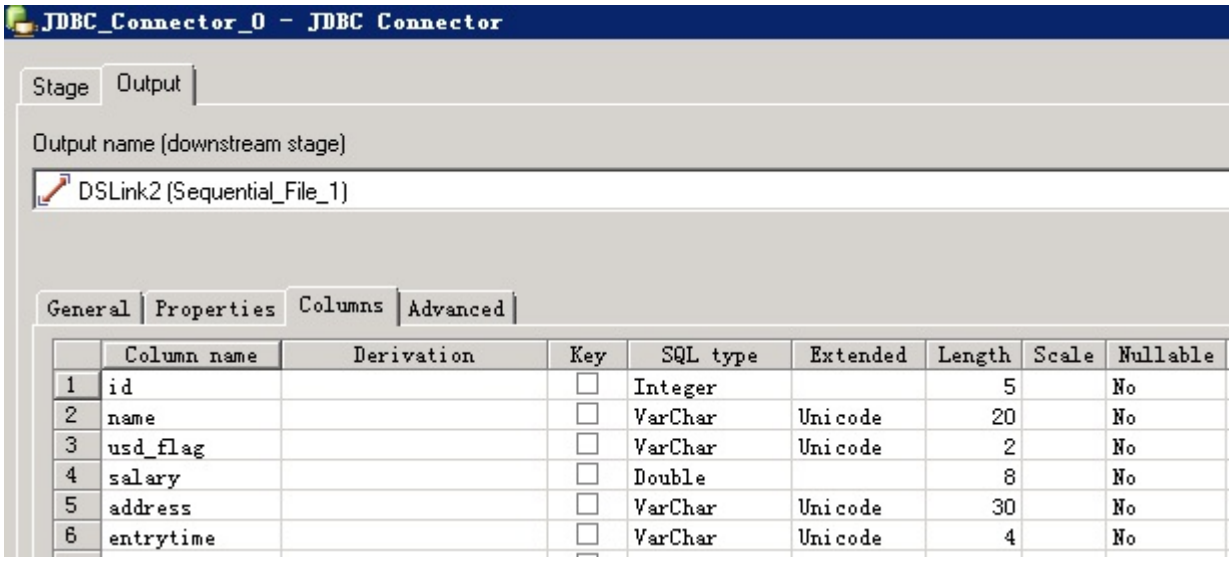


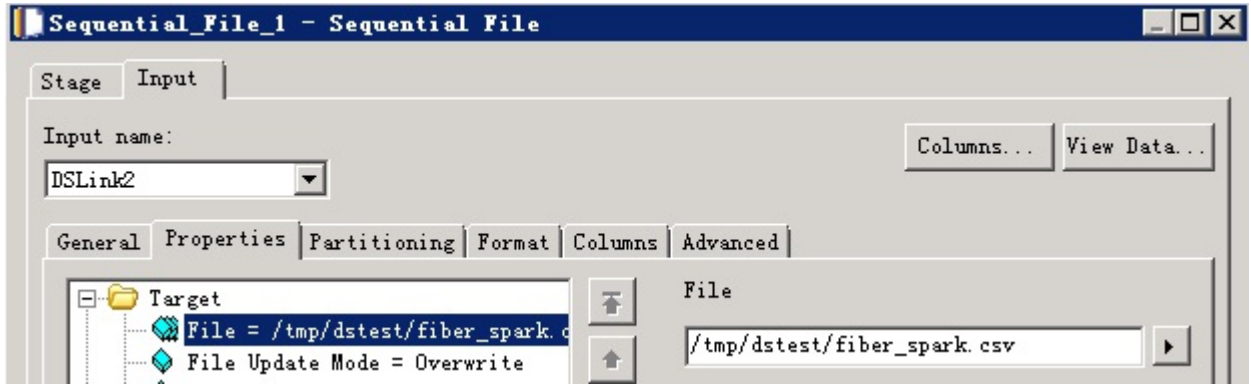
- 修改配置



URL参考：

```
jdbc:fiber://fiberconfig=/opt/ficlient/Fiber/conf/fiber_ibm.xml;defaultDriver=spark
```





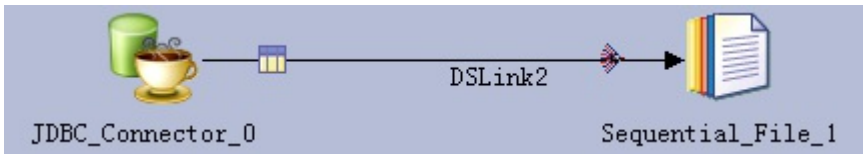
- 编译运行

```
12:29:43    2017/7/8    Info        JDBC_Connector_0,0: Number of rows fetched on the current node: 15.
12:29:43    2017/7/8    Info        JDBC_Connector_0,0: [JGSS_DBG_WRAP]  main Krb5Context.wrap: set Flag Fields 0 SentBy
12:29:43    2017/7/8    Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
12:29:43    2017/7/8    Info        Sequential_File_1,0: Export complete; 15 records exported successfully, 0 rejected.
12:29:43    2017/7/8    Info        JDBC_Connector_0: The connector closed the connection to the data source.
12:29:43    2017/7/8    Info        main_program: Step execution finished with status = OK.
12:29:43    2017/7/8    Info        main_program: Startup time, 0:15; production run time, 0:06.
12:29:43    2017/7/8    Info        Parallel job reports successful completion
12:29:43    2017/7/8    Control     Finished Job fiber_spark_read.
```

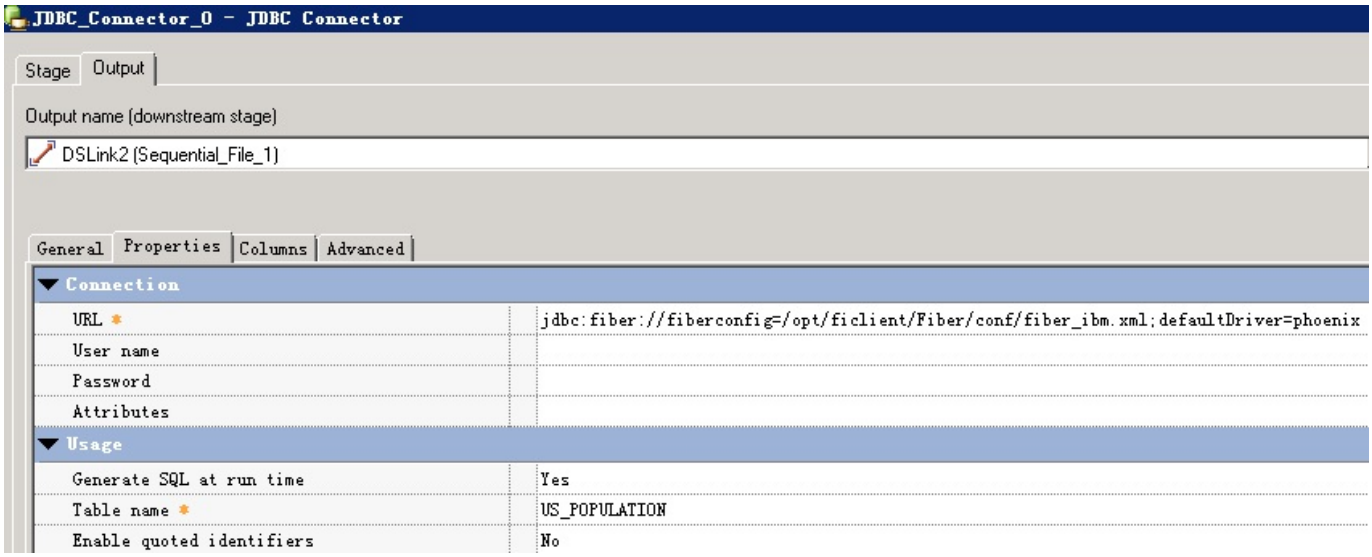
```
[root@datastage11502 dstest]# cat fiber_spark.csv
"1","11111","11","1.0000000000000000E+00","11111111111111111111","1111"
"0","00000000000000000","","0.0000000000000000E+00","",""
"3","33333333333333","33","3.0000000000000000E+00","333333333333333333333333","33"
"2","2","22","2.0000000000000000E+00","222222222222222","2"
"4","4444444","44","4.0000000000000000E+00","444444","4"
"0","00000000000000000","","0.0000000000000000E+00","",""
"1","11111","11","1.0000000000000000E+00","11111111111111111111","1111"
"2","2","22","2.0000000000000000E+00","222222222222222","2"
"3","33333333333333","33","3.0000000000000000E+00","333333333333333333333333","33"
"4","4444444","44","4.0000000000000000E+00","444444","4"
"1","Linda","D","3.600004000000009E+04","America:NewYork","2014"
"3","Tom","D","1.200002000000004E+04","America:NewYork","2014"
"4","Jack","D","2.400002999999999988E+04","America:Manhattan","2014"
"6","Wang","R","8.00001000000000022E+03","China:Shenzhen","2014"
"8","Zhang","R","9.00004999999999927E+03","China:Shanghai","2014"
```

使用Phoenix Driver读取数据

- 创建作业

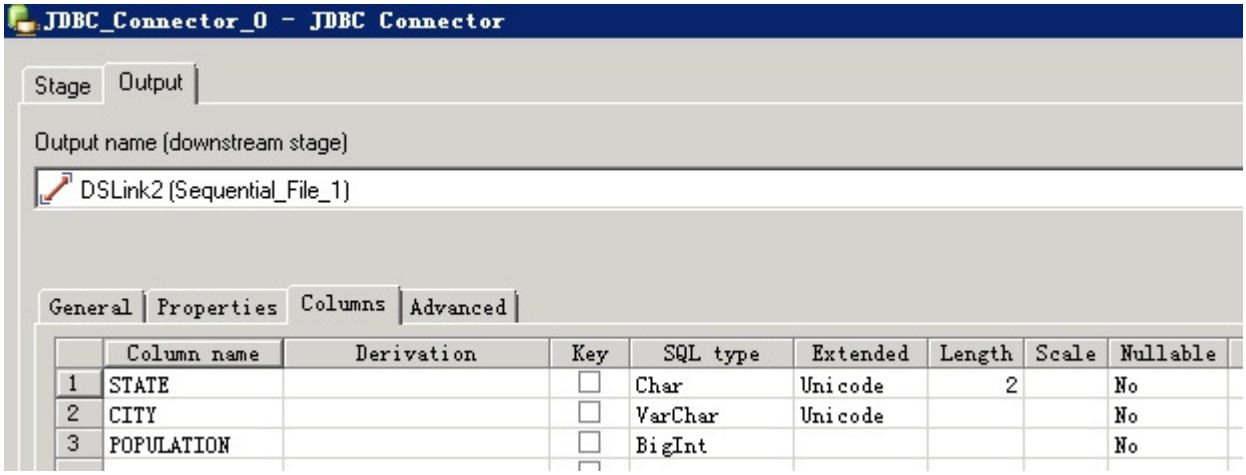


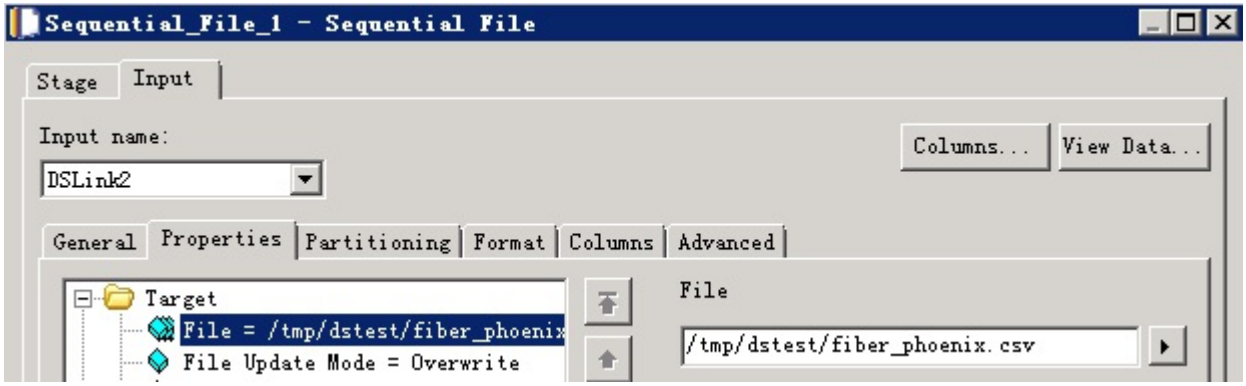
- 修改配置



URL参考：

```
jdbc:fiber://fiberconfig=/opt/ficlient/Fiber/conf/fiber_ibm.xml;defaultDriver=phoenix
```





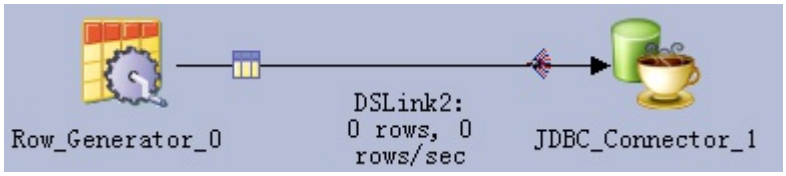
- 编译运行

  目前未能读取到数据，“The connector could not determine the value for the fetch size.”，问题正在确认中

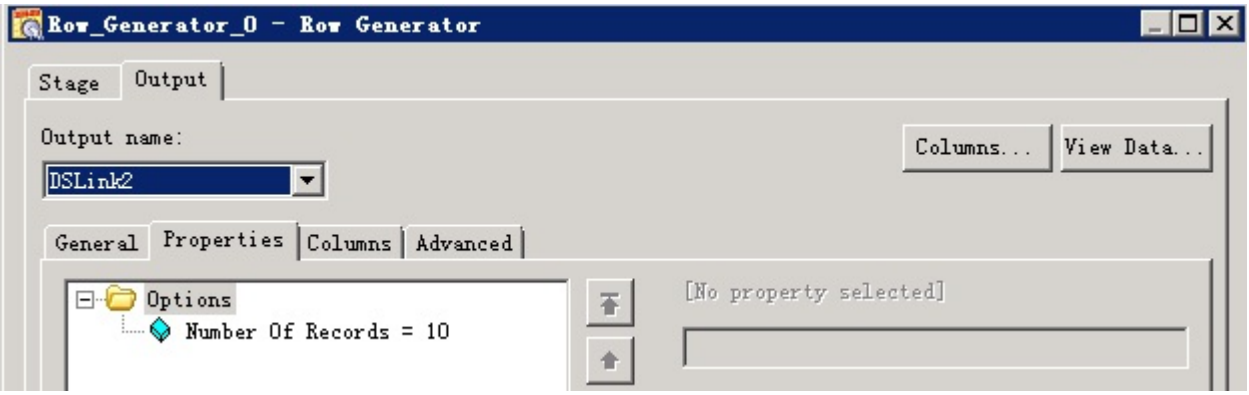
```
12:40:46  2017/7/8  Info     JDBC_Connector_0,0: The connector will run the following statement on the data source:
12:40:46  2017/7/8  Info     JDBC_Connector_0,0: The connector could not determine the value for the fetch size.
12:40:46  2017/7/8  Info     JDBC_Connector_0,0: Number of rows fetched on the current node: 0.
12:40:46  2017/7/8  Info     JDBC_Connector_0,0: The connector closed the connection to the data source.
12:40:46  2017/7/8  Info     Sequential_File_1,0: Export complete; 0 records exported successfully, 0 rejected.
12:40:46  2017/7/8  Info     JDBC_Connector_0: The connector closed the connection to the data source.
12:40:46  2017/7/8  Info     main_program: Step execution finished with status = OK.
12:40:46  2017/7/8  Info     main_program: Startup time, 0:05; production run time, 0:04.
12:40:46  2017/7/8  Info     Parallel job reports successful completion
12:40:46  2017/7/8  Control  Finished Job fiber_phoenix_read.
```

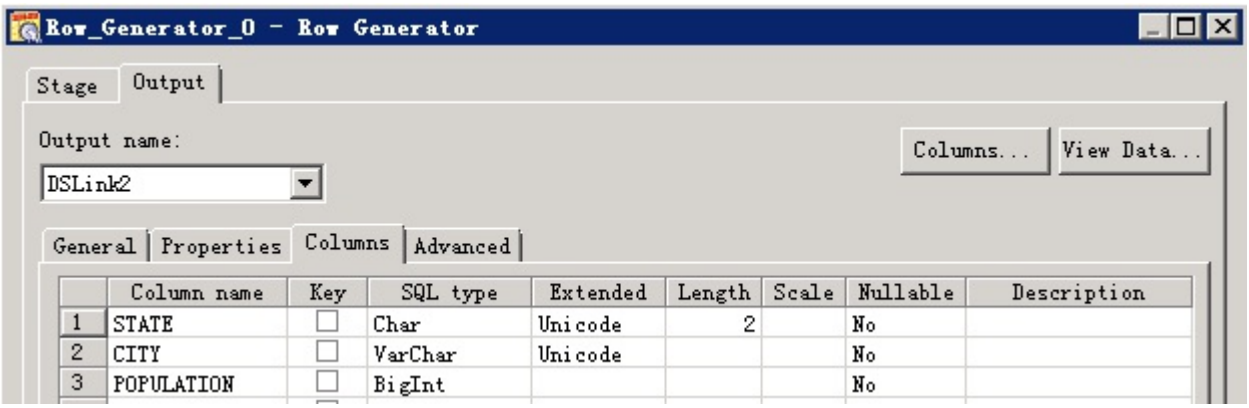
使用Phoenix Driver写入数据

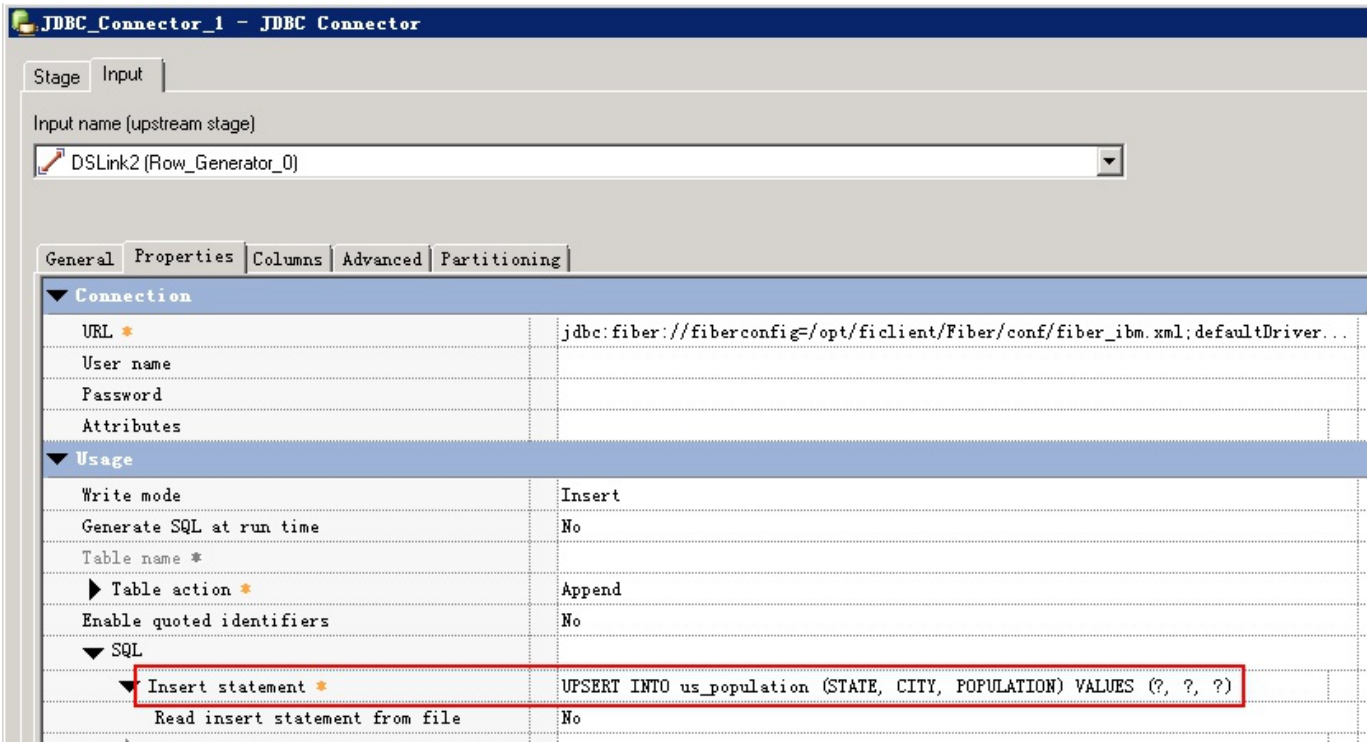
- 创建作业



- 修改配置







URL参考：

```
jdbc:fiber://fiberconfig=/opt/ficlient/Fiber/conf/fiber_ibm.xml;defaultDriver=phoenix
```

- 编译运行

  写入数据0行，问题正在确认中

```
JDBC_Connector_1,1: Number of rows inserted on the current node: 0.
JDBC_Connector_1,1: The connector closed the connection to the data source.
JDBC_Connector_1,0: The character set encoding for the non-Unicode character values on the link is UTF-8. The maximum number of bytes per character in this
JDBC_Connector_1,0: The connector will run the following statement on the data source: UPSERT INTO us_population (STATE, CITY, POPULATION) VALUES (?, ?, ?)
JDBC_Connector_1,0: Number of rows inserted on the current node: 0.
JDBC_Connector_1,0: The connector closed the connection to the data source.
JDBC_Connector_1: The connector closed the connection to the data source.
main_program: Step execution finished with status = OK.
main_program: Startup time, 0:05; production run time, 0:05.
Parallel job reports successful completion
Finished Job fiber_phoenix_write.
```

对接Kafka

说明：kafka Connector不支持发送或者消费integer, float, double, numeric, decimal等数值类型的字段，需要转换成char, varchar, longvarchar等类型，否则会有如下报错：

```
main_program: APT_PMsectionLeader(2, node2), player 2 - Unexpected termination by Unix signal 9(SIGKILL).
```

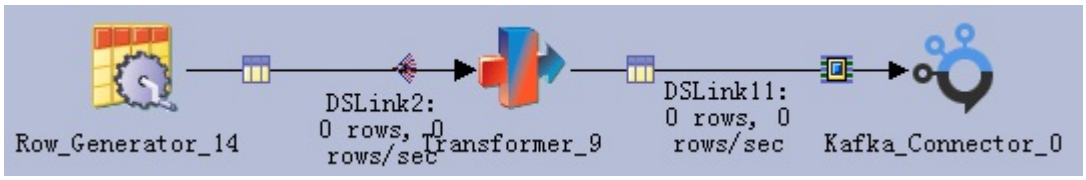
安装kafka客户端

- kafka Connector需要配置Kafka client Classpath，可以在DataStage节点安装kafka客户端来获取kafka-client jar包。安装步骤参考FusionInsight产品文档。
- Kafka Client Classpath 需要提供kafka-client, log4j, slf4j-api 三个jar包的路径，如：

```
/opt/ficlient/Kafka/kafka/libs/kafka-clients-0.10.0.0.jar;/opt/ficlient/Kafka/kafka/libs/log4j-
1.2.17.jar;/opt/ficlient/Kafka/kafka/libs/slf4j-api-1.7.21.jar
```

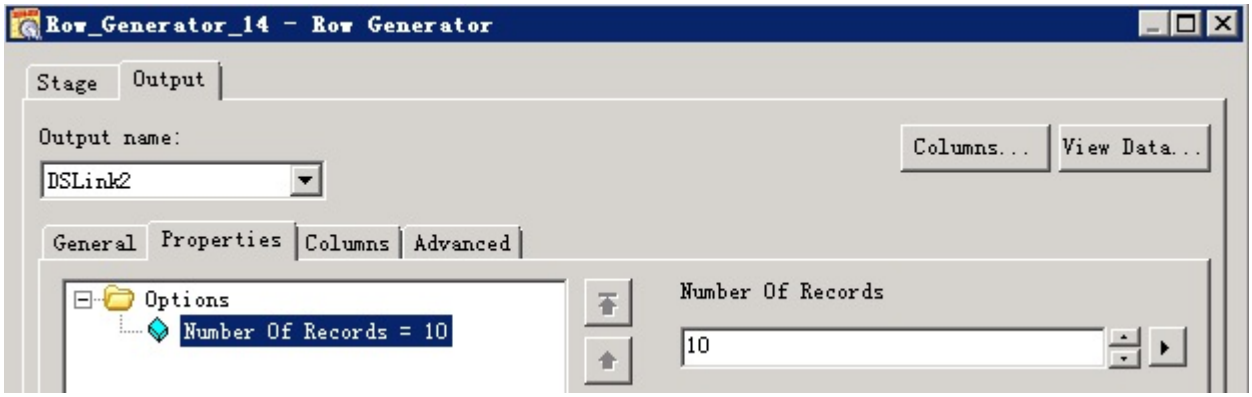
发送消息到kafka

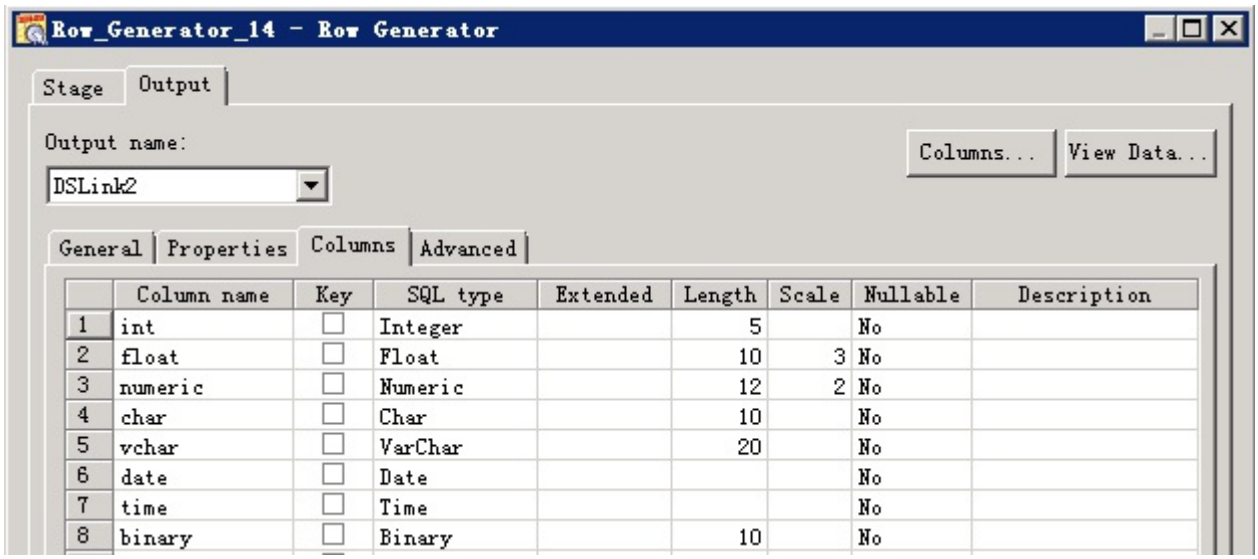
- 创建作业



- 修改配置

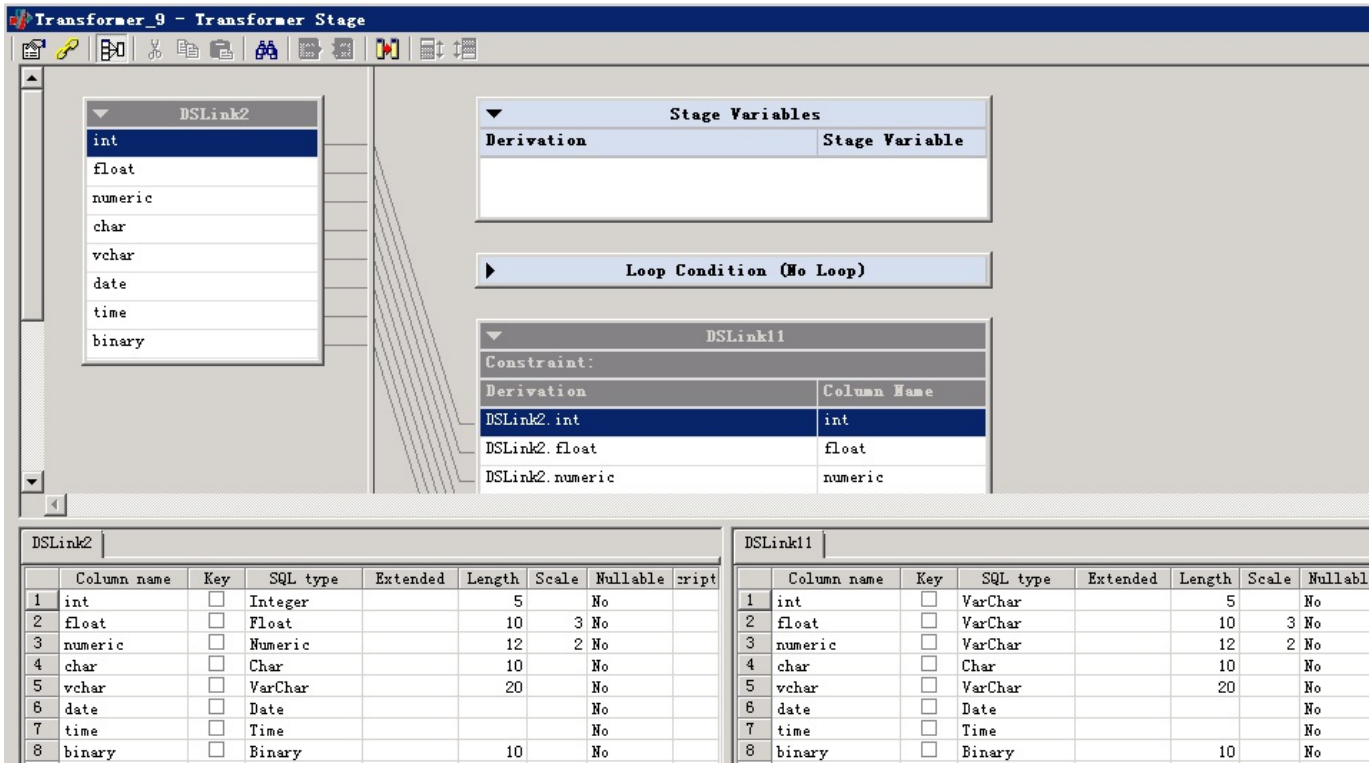
  RowGenerator 生成数据





	Column name	Key	SQL type	Extended	Length	Scale	Nullable	Description
1	int		Integer		5		No	
2	float		Float		10	3	No	
3	numeric		Numeric		12	2	No	
4	char		Char		10		No	
5	vchar		VarChar		20		No	
6	date		Date				No	
7	time		Time				No	
8	binary		Binary		10		No	

transformer数据类型转换：



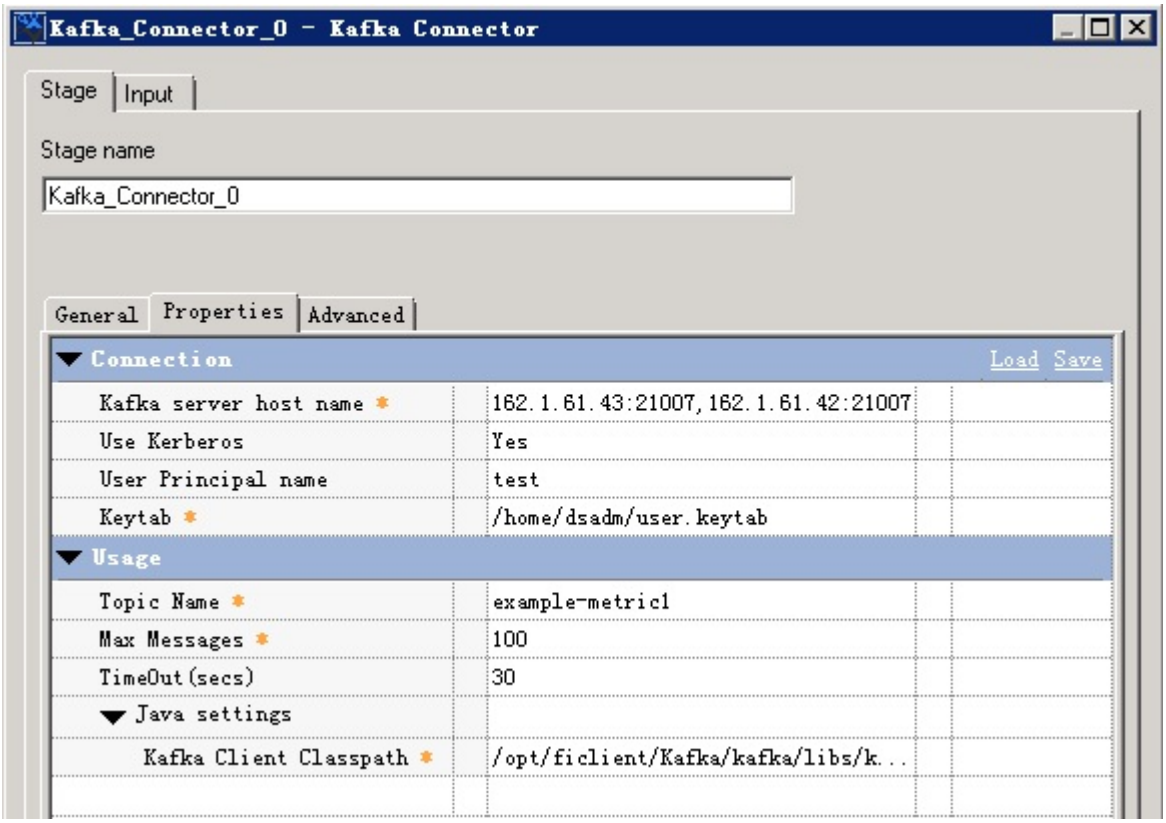
DSLink2

	Column name	Key	SQL type	Extended	Length	Scale	Nullable	cript
1	int		Integer		5		No	
2	float		Float		10	3	No	
3	numeric		Numeric		12	2	No	
4	char		Char		10		No	
5	vchar		VarChar		20		No	
6	date		Date				No	
7	time		Time				No	
8	binary		Binary		10		No	

DSLink11

	Column name	Key	SQL type	Extended	Length	Scale	Nullabl
1	int		VarChar		5		No
2	float		VarChar		10	3	No
3	numeric		VarChar		12	2	No
4	char		Char		10		No
5	vchar		VarChar		20		No
6	date		Date				No
7	time		Time				No
8	binary		Binary		10		No

Kafka配置：

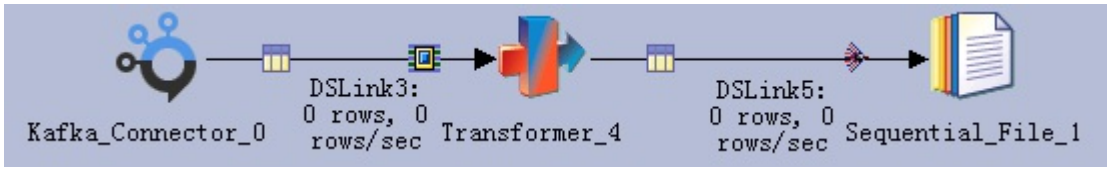


- 编译运行

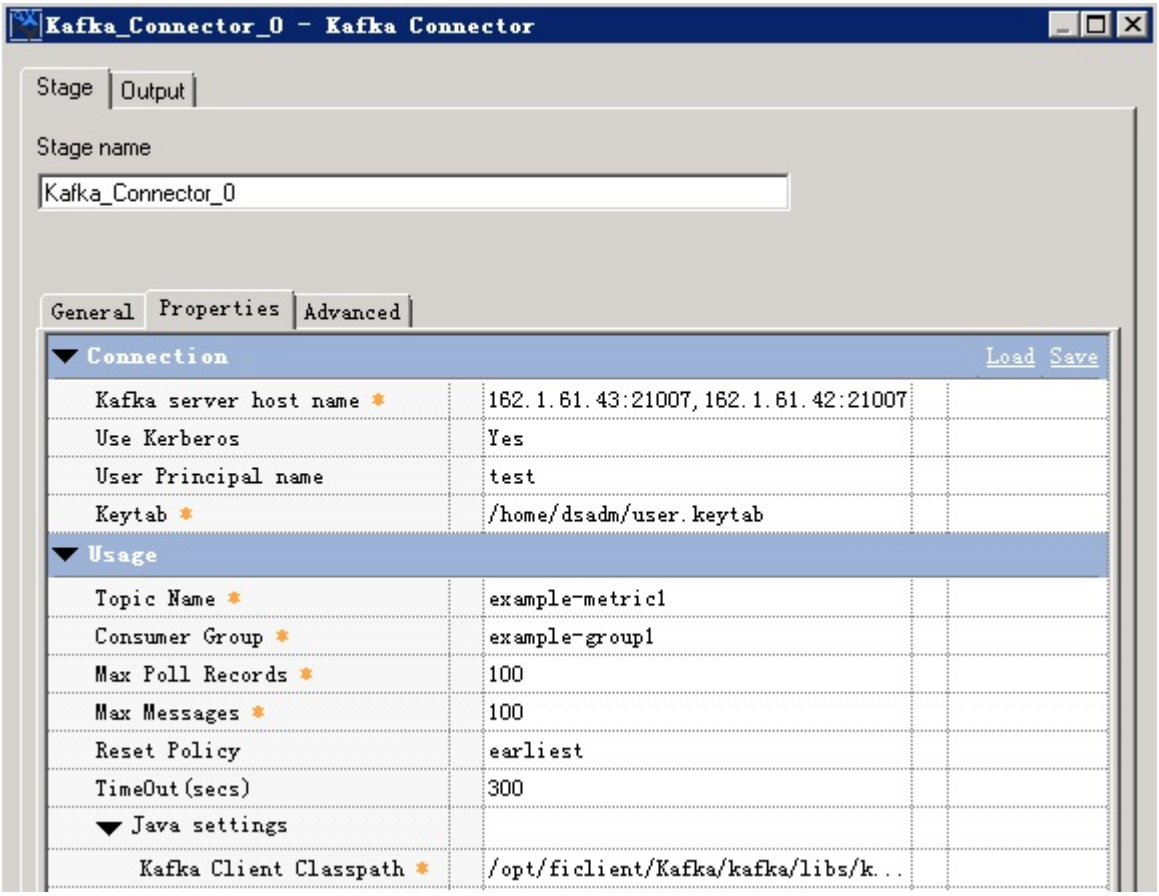
```
11:28:23    2017/7/7    Info        Kafka_Connector_0,1: [JGSS_DBG_CTX]  kafka-producer-network-thread
11:28:23    2017/7/7    Info        main_program: Step execution finished with status = OK.
11:28:23    2017/7/7    Info        main_program: Startup time, 0:00; production run time, 0:01.
11:28:23    2017/7/7    Info        Parallel job reports successful completion
11:28:23    2017/7/7    Control     Finished Job kafkatest.
```

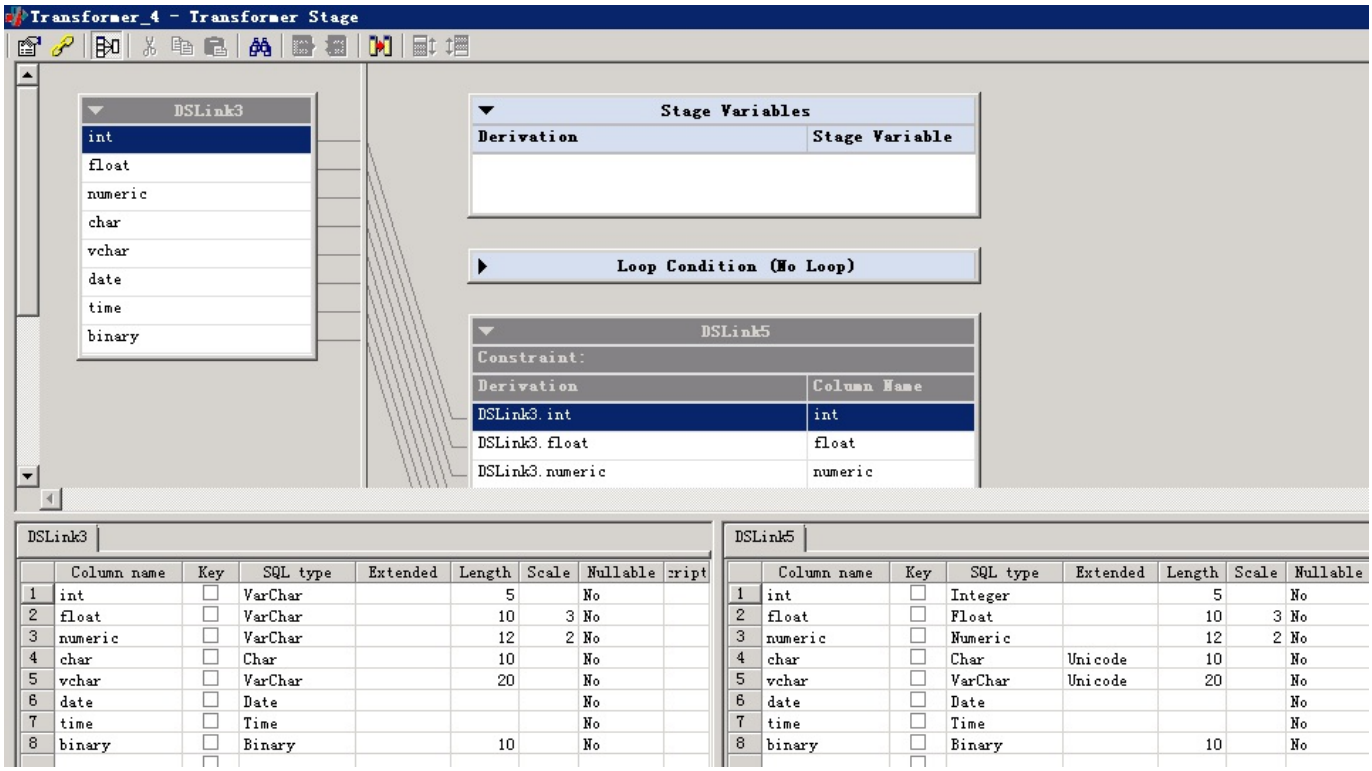
读取Kafka消息

- 创建作业



- 修改配置



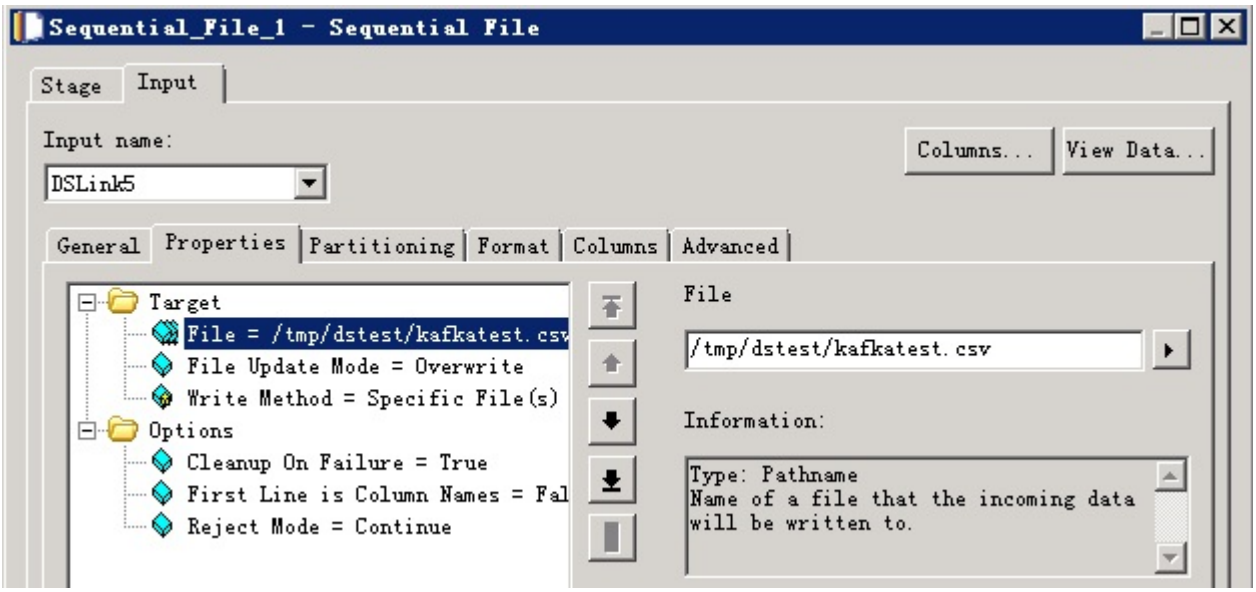


DSLink3

	Column name	Key	SQL type	Extended	Length	Scale	Nullable	ript
1	int		VarChar		5		No	
2	float		VarChar		10	3	No	
3	numeric		VarChar		12	2	No	
4	char		Char		10		No	
5	vchar		VarChar		20		No	
6	date		Date				No	
7	time		Time				No	
8	binary		Binary		10		No	

DSLink5

	Column name	Key	SQL type	Extended	Length	Scale	Nullable
1	int		Integer		5		No
2	float		Float		10	3	No
3	numeric		Numeric		12	2	No
4	char		Char	Unicode	10		No
5	vchar		VarChar	Unicode	20		No
6	date		Date				No
7	time		Time				No
8	binary		Binary		10		No



- 编译运行

  查看读取的数据

```
[root@datastage11502 dstest]# cat kafkatest.csv
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"11","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"33","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"55","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"77","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"99","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
"0","0.0000000E+00"," 0000000000.00","","","0001-01-01","00:00:00",""
```

对接MPPDB

获取MPPDB JDBC Driver

- 从MPPDB发布包中获取，包名为Gauss200-OLAP-VxxxRxxxCxx-xxxx-64bit-Jdbc.tar.gz
- 解压后得到gsjdbc4.jar，上传到DataStage Server

修改JDBC Driver配置文件

- 修改$DSHOME路径的isjdbc.config文件，CLASSPATH变量中添加MPPDB Driver 的路径，CLASS_NAMES变量中添加org.postgresql.Driver

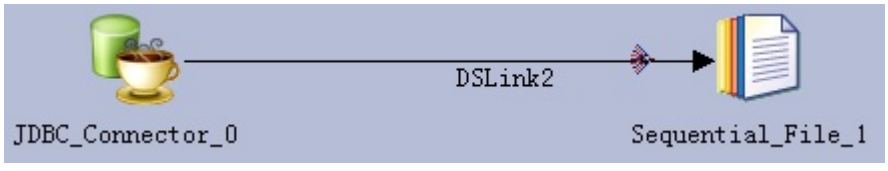
```
su - dsadm
cd $DSHOME
vi isjdbc.config
```

配置：

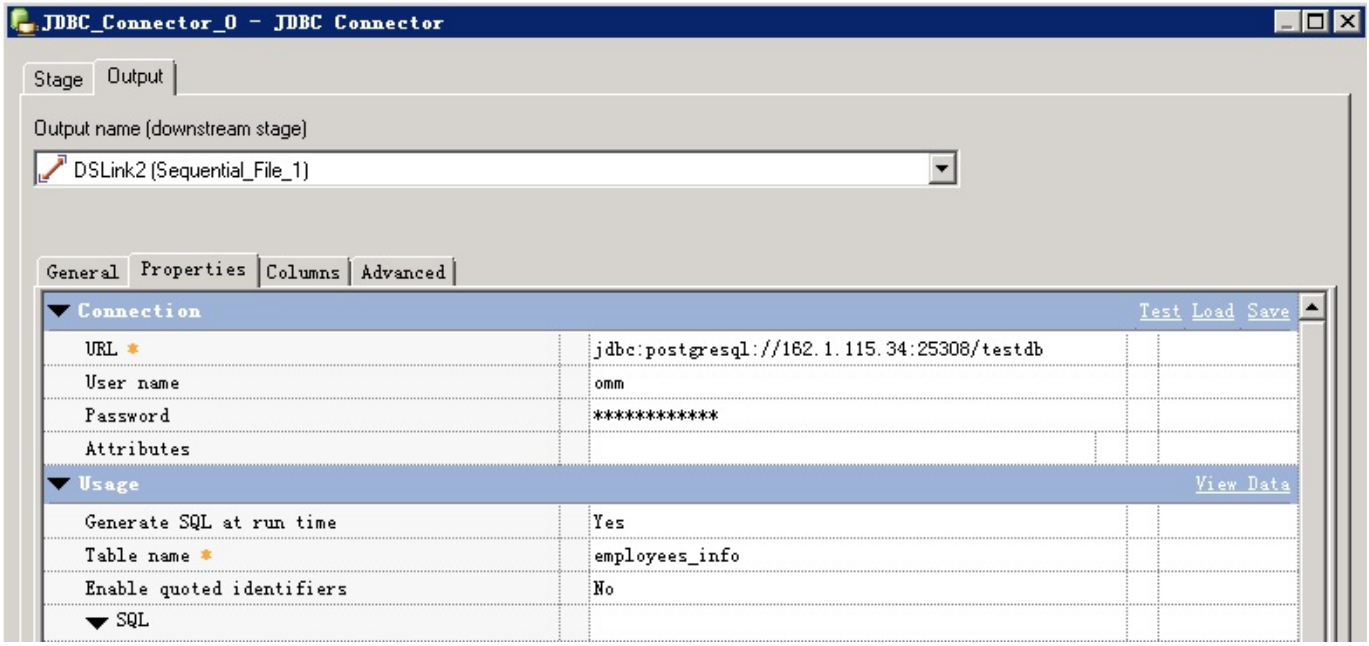
```
CLASSPATH=/opt/IBM/InformationServer/ASBNode/lib/java/IShive.jar;/opt/mppdb/jdbc/gsjdbc4.jar;
CLASS_NAMES=com.ibm.isf.jdbc.hive.HiveDriver;org.postgresql.Driver;
```

读取MPPDB表数据

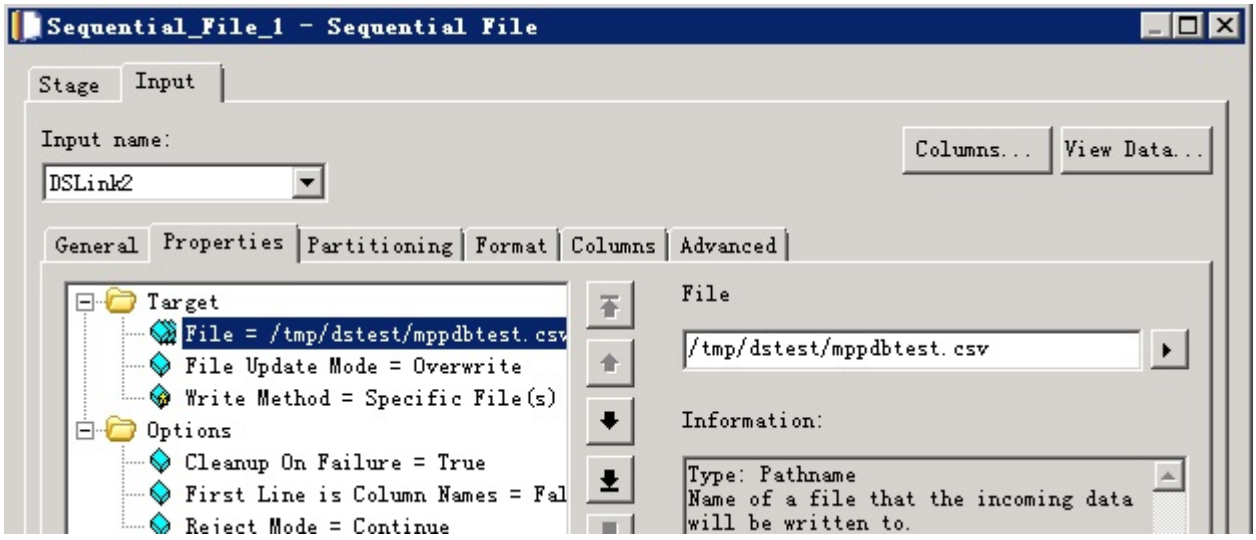
- 创建作业



- 修改配置



URL格式为： jdbc:postgresql://host:port/database



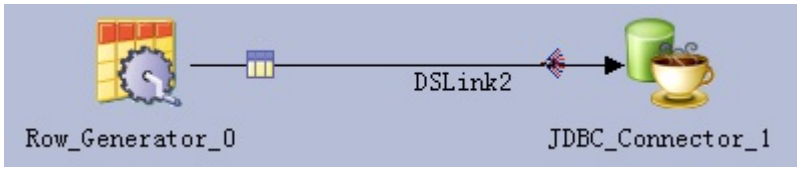
- 编译运行

```
17:19:35    2017/7/7    Info        JDBC_Connector_0,0: Number of rows fetched on the current node: 5.
17:19:35    2017/7/7    Info        JDBC_Connector_0,0: The connector closed the connection to the data source.
17:19:35    2017/7/7    Info        Sequential_File_1,0: Export complete; 5 records exported successfully, 0 rejected.
17:19:35    2017/7/7    Info        JDBC_Connector_0: The connector closed the connection to the data source.
17:19:35    2017/7/7    Info        main_program: Step execution finished with status = OK.
17:19:35    2017/7/7    Info        main_program: Startup time, 0:01; production run time, 0:01.
17:19:35    2017/7/7    Info        Parallel job reports successful completion
17:19:35    2017/7/7    Control     Finished Job mppdb_read.
```

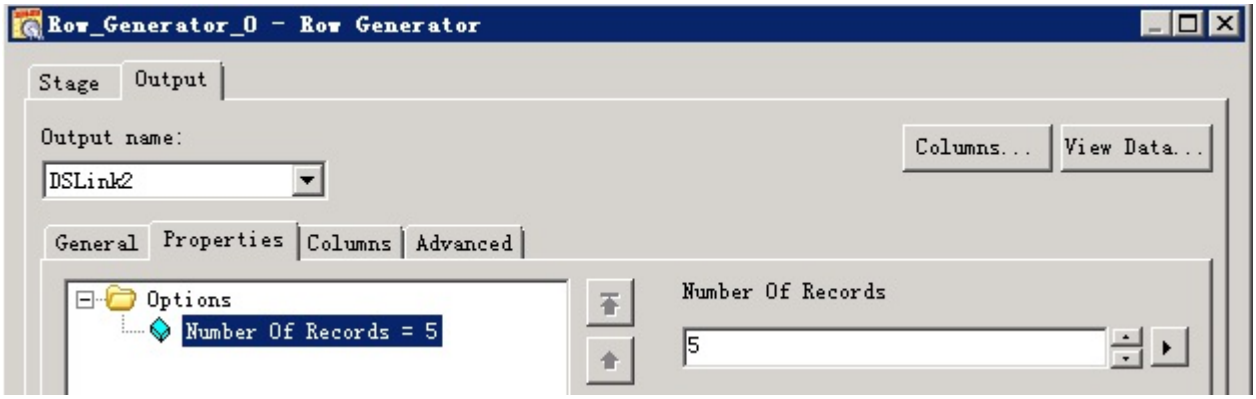
```
[root@datastage1502 dstest]# cat mppdbtest.csv
"4","Jack","D","2.400002999999999988E+04","America:Manhattan","2014"
"6","Linda","D","3.600004000000000009E+04","America:NewYork","2014"
"1","Wang","R","8.00001000000000022E+03","China:Shenzhen","2014"
"8","Zhang","R","9.00004999999999927E+03","China:Shanghai","2014"
"3","Tom","D","1.20000200000000004E+04","America:NewYork","2014"
```

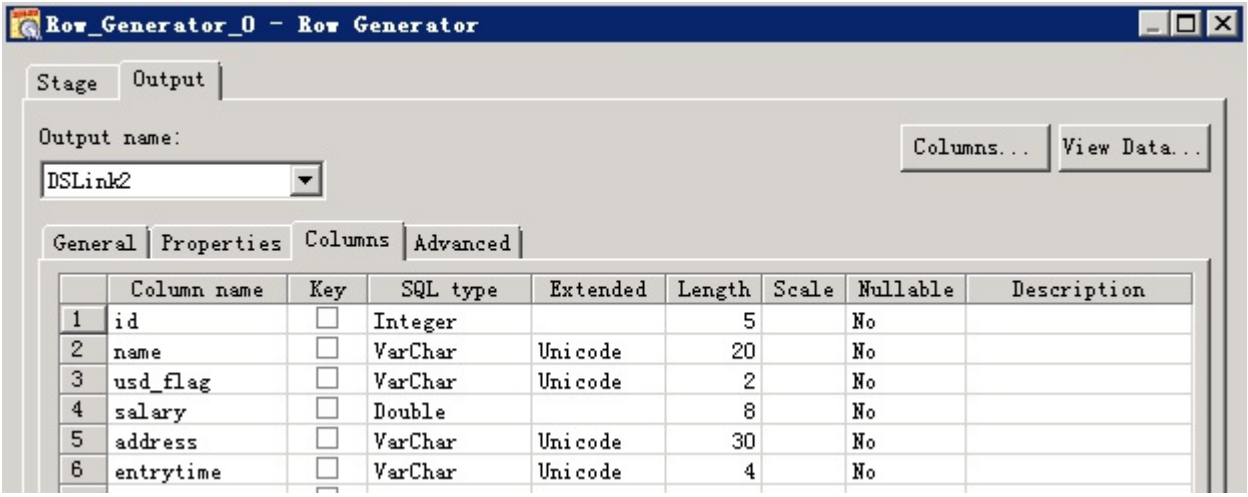
数据写入MPPDB表

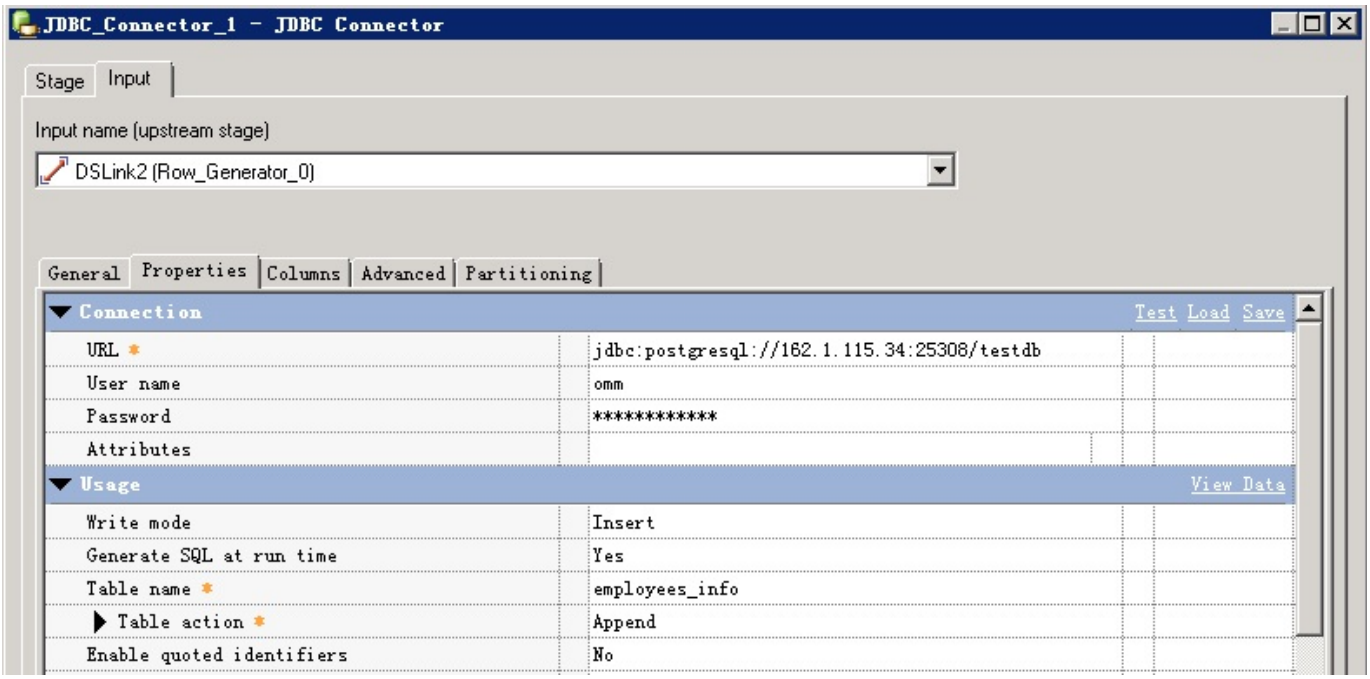
- 创建作业



- 修改配置







URL格式为： jdbc:postgresql://host:port/database

- 编译运行

```
17:52:16    2017/7/7    Info        JDBC_Connector_1,1: Number of rows inserted on the current node: 5.
17:52:16    2017/7/7    Info        JDBC_Connector_1,1: The connector closed the connection to the data source.
17:52:16    2017/7/7    Info        JDBC_Connector_1,0: Number of rows inserted on the current node: 5.
17:52:16    2017/7/7    Info        JDBC_Connector_1,0: The connector closed the connection to the data source.
17:52:16    2017/7/7    Info        JDBC_Connector_1: The connector closed the connection to the data source.
17:52:16    2017/7/7    Info        main_program: Step execution finished with status = OK.
17:52:16    2017/7/7    Info        main_program: Startup time, 0:01; production run time, 0:01.
17:52:16    2017/7/7    Info        Parallel job reports successful completion
17:52:16    2017/7/7    Control     Finished Job mppdb_write.
```

- 查看MPPDB表数据：

SQLTerminal | employees_info

id	name	usd_flag	salary	address	entrytime
4	Jack	D	24000.0299999999988	America:Manhattan	2014
4	4444444	44	4	444444	4
3	Tom	D	12000.0200000000004	America:NewYork	2014
3	33333333333333	33	3	333333333333333333333333	33
0	0000000000000000000		0		
8	Zhang	R	9000.04999999999927	China:Shanghai	2014
5	55555555555555	5	5	5555555555555	55
8	88888888888888	8	8	8888888888888	888
7	77777777	77	7	77777777777777777777777...	7
6	Linda	D	36000.0400000000009	America:NewYork	2014
6	666666		6	66666	
1	Wang	R	8000.01000000000022	China:Shenzhen	2014
1	11111	11	1	111111111111111111111	1111
9	999999	9	9	99999999999999999999	9
2	2	22	2	222222222222222	2