Giraph 基于 MapReduce v1 部署

1 单机伪分布式部署

1.1 准备工作&修改配置并启动Hadoop和Giraph

- 修改 `~/giraph-1.2.0-for-hadoop-1.2.1/bin/giraph-env`, 指定 Hadoop 安装路径：

```
# resolve links - $0 may be a softlink
sed -i '1i\export HADOOP_HOME=~/hadoop-1.2.1' ~/giraph-1.2.0-for-hadoop-1.2.1/bin/giraph-env
THIS="${BASH_SOURCE:-0}"
while [ -h "$THIS" ]; do
  ls=`ls -ld "$THIS"`
```

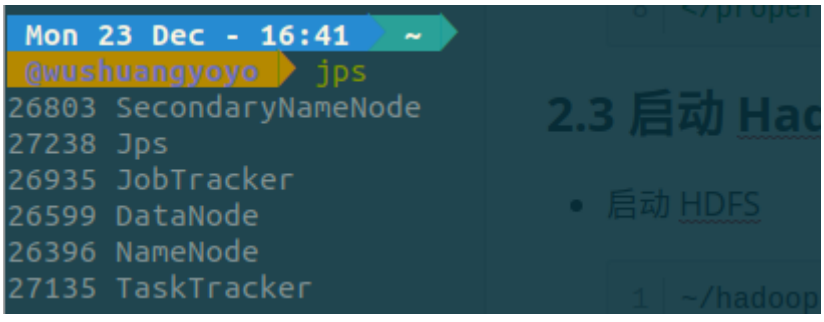
- 修改 `~/hadoop-1.2.1/conf/mapred-site.xml`，结果如下：

```
<configuration>
    <property>
            <name>mapred.job.tracker</name>
            <value>219.228.135.32:9001</value>
    </property>
    <property>
            <name>mapred.tasktracker.map.tasks.maximum</name>
            <value>4</value>
    </property>
    <property>
            <name>mapred.map.tasks</name>
            <value>3</value>
    </property>
</configuration>
```

- 启动 HDFS及 MapReduce

```
1 ~/hadoop-1.2.1/bin/start-dfs.sh
2 ~/hadoop-1.2.1/bin/start-mapred.sh
```

- 通过运行`jps`来检验进程状态：



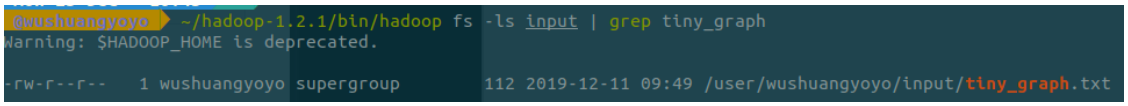
1.2 运行 Giraph 应用程序

Simple shortest paths computation 示例程序

- 将 `tiny_graph.txt` 上传至 `hdfs:///user/you/input` 下

```
~/hadoop-1.2.1/bin/hadoop fs -mkdir input
~/hadoop-1.2.1/bin/hadoop fs -put ~/tiny_graph.txt input/
```

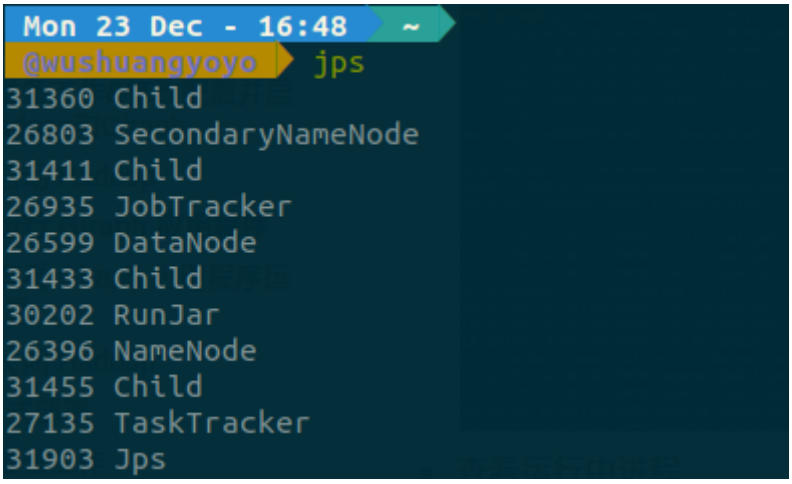
- 查看 HDFS 的文件信息：



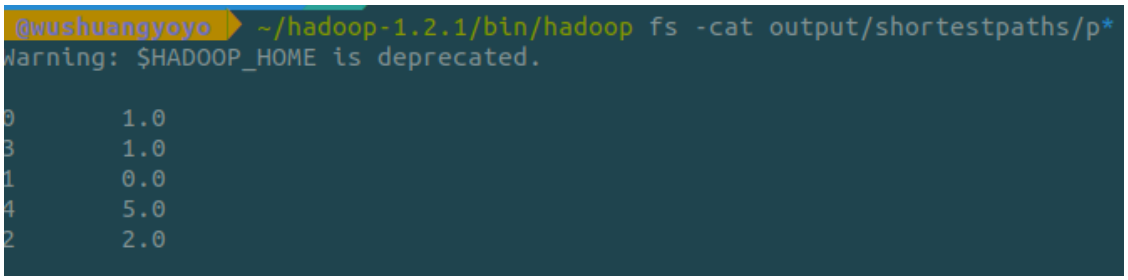
- 执行程序

  按照如下代码执行：

- 查看运行中进程

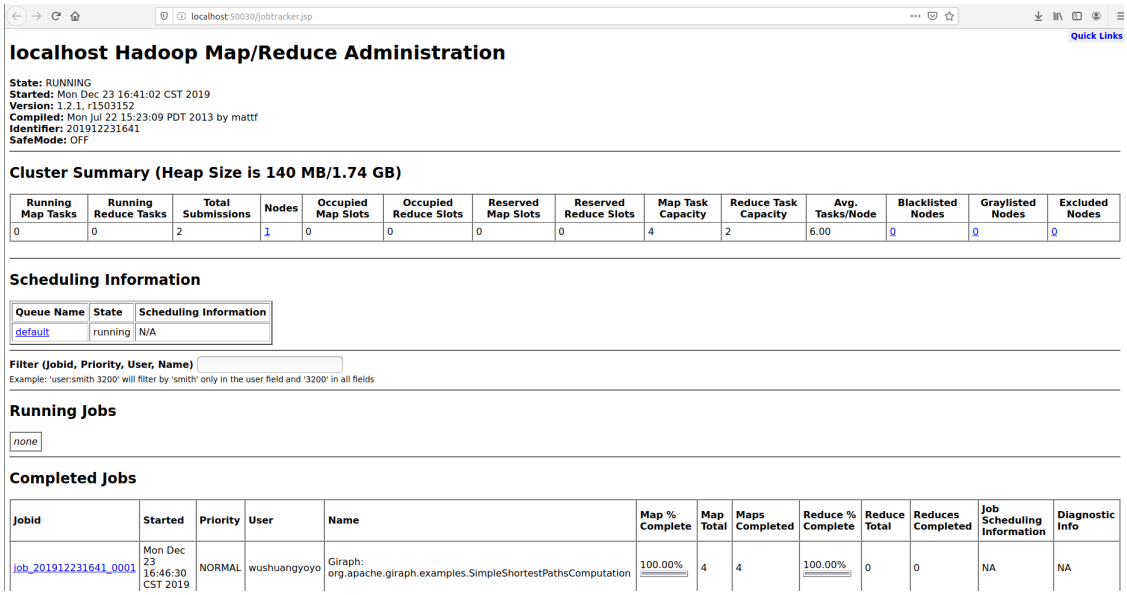


- 运行完成后查看输出



1.3 查看 Giraph 应用程序运行信息

- 访问 JobTracker 网页 (http://localhost:50030)，



localhost:50030/jobtracker.jsp

Quick Links

localhost Hadoop Map/Reduce Administration

State: RUNNING
Started: Mon Dec 23 16:41:02 CST 2019
Version: 1.2.1, r1503152
Compiled: Mon Jul 22 15:23:09 PDT 2013 by mattf
Identifier: 201912231641
SafeMode: OFF

Cluster Summary (Heap Size is 140 MB/1.74 GB)

Running Map Tasks	Running Reduce Tasks	Total Submissions	Nodes	Occupied Map Slots	Occupied Reduce Slots	Reserved Map Slots	Reserved Reduce Slots	Map Task Capacity	Reduce Task Capacity	Avg. Tasks/Node	Blacklisted Nodes	Graylisted Nodes	Excluded Nodes
0	0	2	1	0	0	0	0	4	2	6.00	0	0	0

Scheduling Information

Queue Name	State	Scheduling Information
default	running	N/A

Filter (Jobid, Priority, User, Name)
Example: 'user:smith 3200' will filter by 'smith' only in the user field and '3200' in all fields

Running Jobs

none

Completed Jobs

Jobid	Started	Priority	User	Name	Map % Complete	Map Total	Maps Completed	Reduce % Complete	Reduce Total	Reduces Completed	Job Scheduling Information	Diagnostic Info
job_201912231641_0001	Mon Dec 23 16:46:30 CST 2019	NORMAL	wushuangyoyo	Giraph: org.apache.giraph.examples.SimpleShortestPathsComputation	100.00%	4	4	100.00%	0	0	NA	NA

点击正在运行或已完成的 Giraph 应用程序, 可看到 Giraph 应用程序的统计信息

Hadoop job_201912231641_0002 on localhost

User: wushuangyoyo
Job Name: Giraph: org.apache.giraph.examples.SimpleShortestPathsComputation
Job File: hdfs://localhost:9000/home/wushuangyoyo/pdos-tmp-1.2.1/mapred/staging/wushuangyoyo/.staging/job_201912231641_0002/job.xml
Submit Host: Master-yoyo
Submit Host Address: 127.0.0.1
Job-ACLs: All users are allowed
Job Setup: Successful
Status: Succeeded
Started at: Mon Dec 23 16:48:29 CST 2019
Finished at: Mon Dec 23 16:48:52 CST 2019
Finished in: 22sec
Job Cleanup: Successful

Kind	% Complete	Num Tasks	Pending	Running	Complete	Killed	Failed/Killed Task Attempts
map	100.00%	4	0	0	4	0	0 / 0
reduce	100.00%	0	0	0	0	0	0 / 0

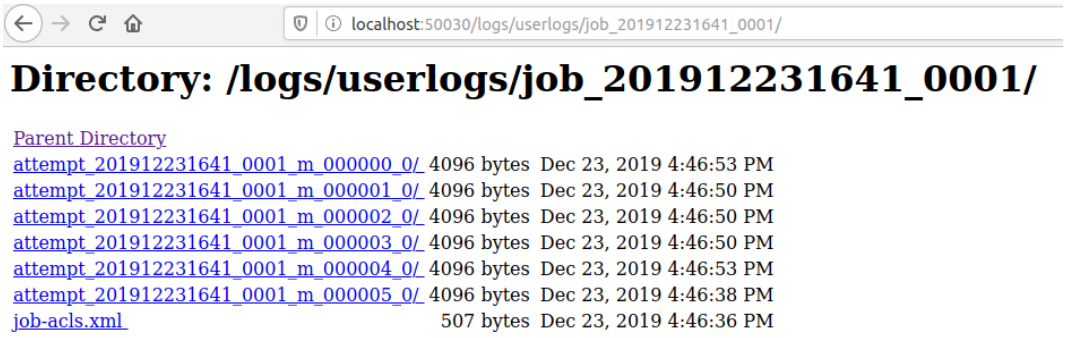
	Counter	Map	Reduce	Total
Map-Reduce Framework	Spilled Records	0	0	0
	Virtual memory (bytes) snapshot	0	0	8,750,948,352
	Map input records	0	0	4
	SPLIT_RAW_BYTES	176	0	176
	Map output records	0	0	0
	Physical memory (bytes) snapshot	0	0	893,489,152
	CPU time spent (ms)	0	0	6,690
	Total committed heap usage (bytes)	0	0	1,237,319,680
Zookeeper halt node	/_hadoopBsp/job_201912231641_0002/_haltComputation	0	0	0
Zookeeper server:port	localhost:22181	0	0	0
	Superstep 1 SimpleShortestPathsComputation (ms)	58	0	58
	Initialize (ms)	1,070	0	1,070
	Superstep 0 SimpleShortestPathsComputation (ms)	63	0	63

localhost:50030/jobconf.jsp?jobid=job_201912231641_0002

- 查看程序日志
  - JobHistory 日志默认位置: `~/hadoop-1.2.1/logs`

    job_201912111815_0002_conf.xml 98508 bytes Dec 11, 2019 6:20:25 PM
    job_201912231641_0001_conf.xml 98508 bytes Dec 23, 2019 4:46:30 PM
    job_201912231641_0002_conf.xml 98508 bytes Dec 23, 2019 4:48:29 PM
    userlogs/ 4096 bytes Dec 23, 2019 4:48:30 PM

  - Task 日志默认位置: `~/hadoop-1.2.1/logs/userlogs/<jobid>/<attempt-id>`



3.6 关闭 Hadoop

- 关闭 HDFS

```
~/hadoop-1.2.1/bin/stop-dfs.sh
```

- 关闭 MapReduce

```
~/hadoop-1.2.1/bin/stop-mapred.sh
```

分布式在构建过程中有很多错误，实在无法进行，故放弃。

Giraph 应用编程实践

1. 编写Giraph程序

- 创建maven项目

参考文档：create maven.md

- 添加pom依赖

在pom.xml文件中添加以下依赖：`giraph-core`、`giraph-examples`、`hadoop-common`和`hadoop-client`。

```
<dependencies>
  <!-- https://mvnrepository.com/artifact/org.apache.giraph/giraph-core -->
  <dependency>
      <groupId>org.apache.giraph</groupId>
      <artifactId>giraph-core</artifactId>
      <version>1.2.0</version>
  </dependency>
  <!-- https://mvnrepository.com/artifact/org.apache.giraph/giraph-examples
-->
  <dependency>
      <groupId>org.apache.giraph</groupId>
      <artifactId>giraph-examples</artifactId>
      <version>1.2.0</version>
  </dependency>
  <!-- https://mvnrepository.com/artifact/org.apache.hadoop/hadoop-core -->
  <dependency>
      <groupId>org.apache.hadoop</groupId>
      <artifactId>hadoop-core</artifactId>
      <version>1.2.1</version>
```

```
  </dependency>
  <!-- https://mvnrepository.com/artifact/org.apache.hadoop/hadoop-client --
>
  <dependency>
      <groupId>org.apache.hadoop</groupId>
      <artifactId>hadoop-client</artifactId>
      <version>1.2.1</version>
  </dependency>
</dependencies>
```

- 编写Giraph应用程序代码

- 新建 `src/main/java/example/MaxVertexValue.java` 类

```
package example;

import org.apache.giraph.graph.BasicComputation;
import org.apache.giraph.graph.Vertex;
import org.apache.hadoop.io.DoubleWritable;
import org.apache.hadoop.io.FloatWritable;
import org.apache.hadoop.io.LongWritable;

import java.io.IOException;

/**
 * Vertex ID: LongWritable
 * Vertex value: DoubleWritable
 * Edge value: FloatWritable
 * Message: DoubleWritable
 * <p>
 * Assumption:
 * 1. The graph is strongly connected
 */
public class MaxVertexValue extends BasicComputation<
      LongWritable, DoubleWritable, FloatWritable, DoubleWritable> {
  public void compute(Vertex<LongWritable, DoubleWritable,
FloatWritable> vertex, Iterable<DoubleWritable> messages) throws
IOException {
      boolean changed = false;

      for (DoubleWritable msg : messages) {
          /* Collect messages from in-neighbours and update if necessary
*/
          if (vertex.getValue().get() < msg.get()) {
              vertex.setValue(new DoubleWritable(msg.get()));
              changed = true;
          }
      }
    /* Send the message to out-neighbours at Superstep 0 or Vertex value
is changed */
      if (getSuperstep() == 0 || changed) {
          sendMessageToAllEdges(vertex, vertex.getValue());
      }
      vertex.voteToHalt();
  }
}
```

- 新建 `src/main/java/GiraphDemoRunner.java` 类

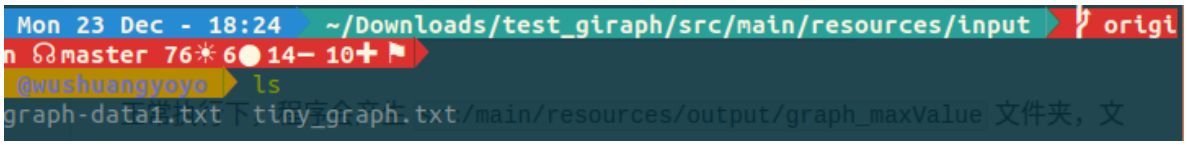
```
import example.MaxVertexValue;
import org.apache.giraph.conf.GiraphConfiguration;
//import org.apache.giraph.examples.SimpleShortestPathsComputation;
import org.apache.giraph.io.formats.*;
import org.apache.giraph.job.GiraphJob;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.Tool;
import org.apache.hadoop.util.ToolRunner;

public class GiraphDemoRunner implements Tool{

  private Configuration conf;
  public Configuration getConf() {
      return conf;
  }
  public void setConf(Configuration conf) {
      this.conf = conf;
  }

  public int run(String[] arg0) throws Exception {
      /**
       * 设置输入输出路径
       * */
//      String inputPath="src/main/resources/input/tiny_graph.txt";
//      String outputPath="src/main/resources/output/graph_shortestPaths";
      String inputPath="src/main/resources/input/graph-data1.txt";
      String outputPath="src/main/resources/output/graph_maxValue";

      GiraphConfiguration giraphConf = new GiraphConfiguration(getConf());

      /**
       * 配置具体用户自定义应用计算类
       * */
//giraphConf.setComputationClass(SimpleShortestPathsComputation.class);
      giraphConf.setComputationClass(MaxVertexValue.class);


 giraphConf.setVertexInputFormatClass(JsonLongDoubleFloatDoubleVertexInputFormat.class);
      GiraphFileInputFormat.addVertexInputPath(giraphConf, new Path(inputPath));

 giraphConf.setVertexOutputFormatClass(IdWithValueTextOutputFormat.class);
      giraphConf.setLocalTestMode(true);
      giraphConf.setWorkerConfiguration(1, 1, 100);
      giraphConf.SPLIT_MASTER_WORKER.set(giraphConf, false);
      InMemoryVertexOutputFormat.initializeOutputGraph(giraphConf);
      GiraphJob giraphJob = new GiraphJob(giraphConf,"GiraphDemo");
```

```
47        FileOutputFormat.setOutputPath(giraphJob.getInternalJob(), new
Path(outputPath));
48        giraphJob.run(true);
49        return 0;
50    }
51
52    public static void main(String[] args) throws Exception{
53        ToolRunner.run(new GiraphDemoRunner(), args);
54    }
55  }
```

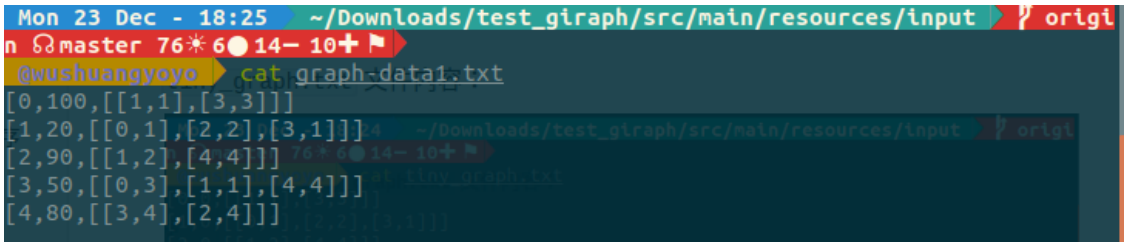
2. 调试Giraph程序

- 配置程序输入

在 `src/main/resources/input/` 路径下添加输入文件 `graph-data1.txt` 和 `tiny_graph.txt`：



- `graph-data1.txt` 文件内容：

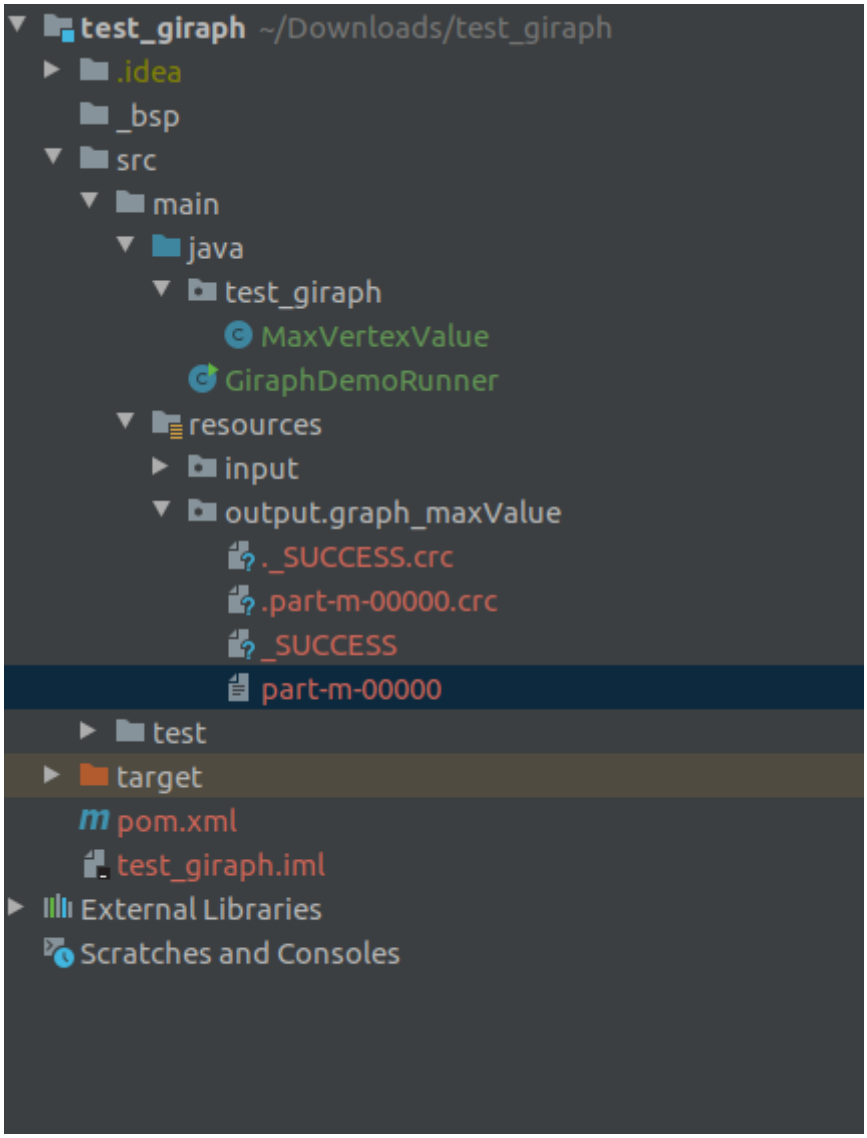


- `tiny_graph.txt` 文件内容：

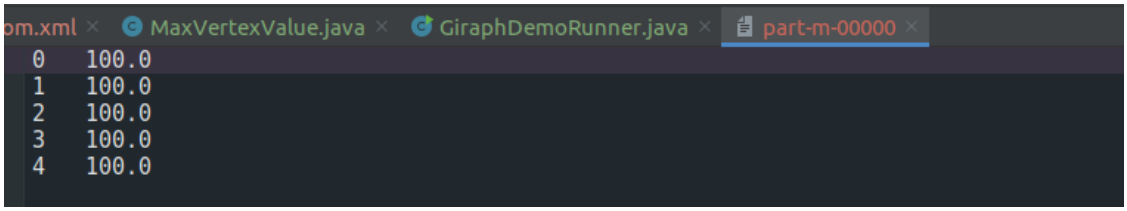
- IDE中直接运行Giraph `MaxVertexValue` 应用程序

直接在 IDEA 中运行 `src/main/java/GiraphDemoRunner.java` 类，并查看输出结果。 正常执行下，程序会产生 `src/main/resources/output/graph_maxValue` 文件夹，文件夹内包含程序输出内容。

- 正常执行情况下，项目结构：



- 程序输出内容：

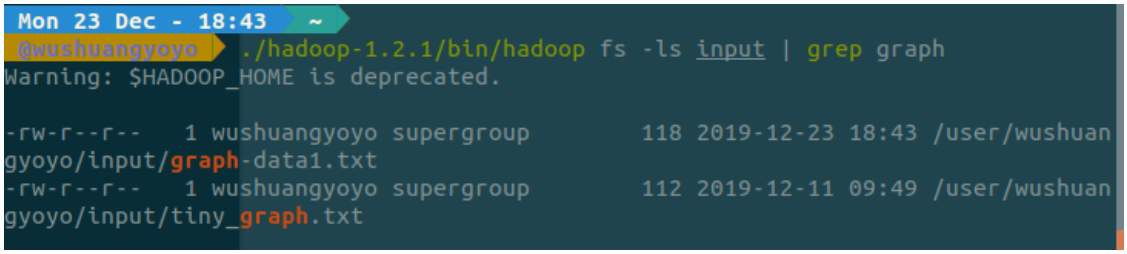


3. 运行Giraph程序

- 利用IDE打包jar文件

- 伪分布式模式下运行Giraph `MaxVertexValue` 程序

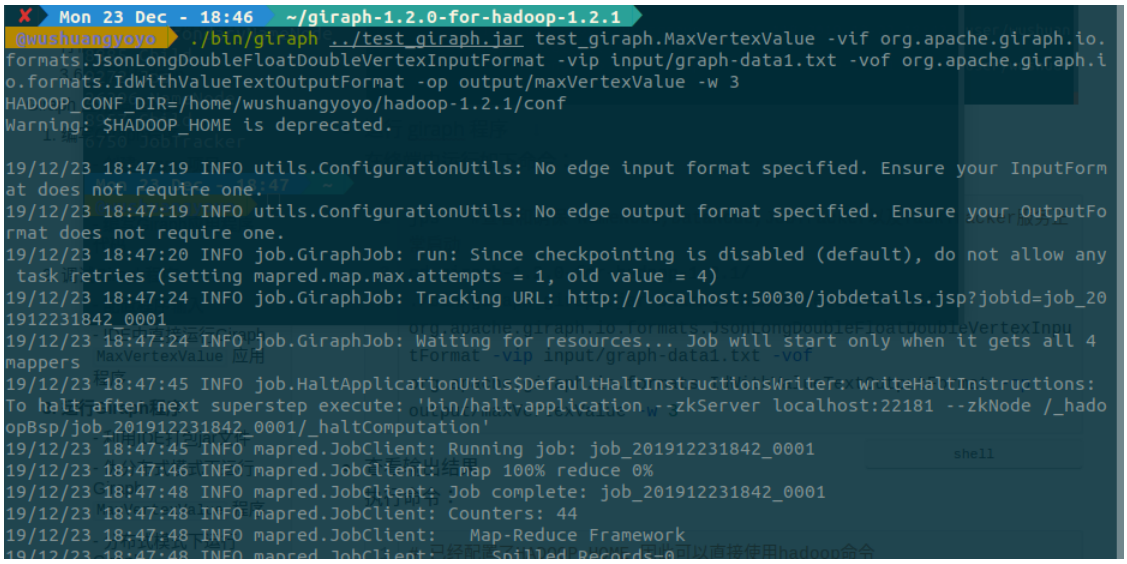
- 上传输入文件至 HDFS



- 运行 giraph 程序
  在终端中运行如下命令：

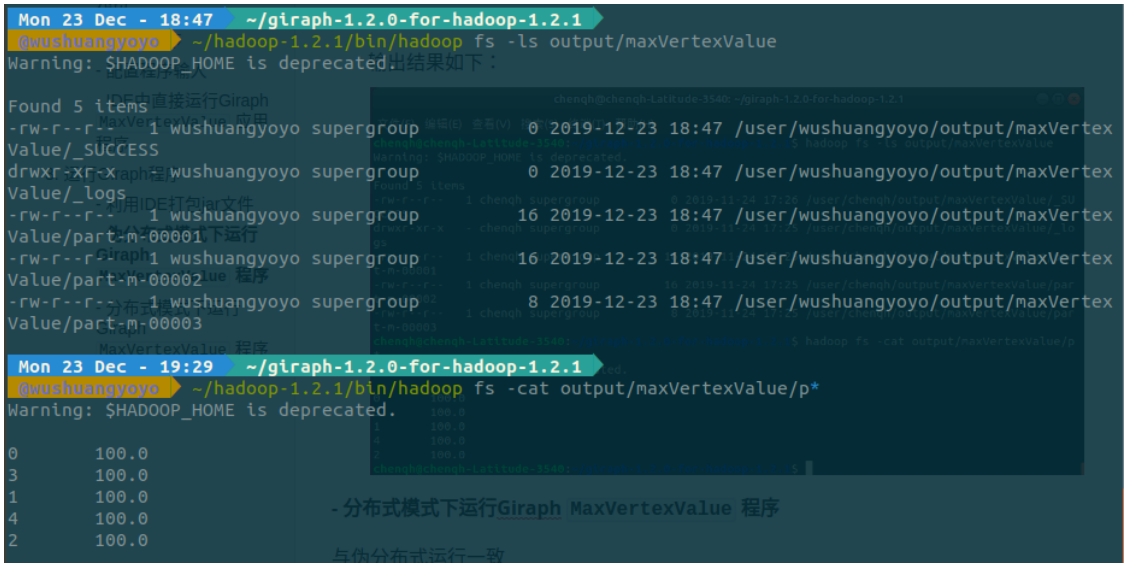
```
jps   #查看和确保 NameNode,DataNode,JobTracker以及TaskTracker服务正常启动
cd giraph-1.2.0-for-hadoop-1.2.1/
./bin/giraph giraph.jar example.MaxVertexValue -vif
org.apache.giraph.io.formats.JsonLongDoubleFloatDoubleVertexInputFormat -
vip input/graph-data1.txt -vof
org.apache.giraph.io.formats.IdWithValueTextOutputFormat -op
output/maxVertexValue -w 3
```

结果如下：



- 查看输出结果

  执行命令：



- 分布式模式下运行Giraph `MaxVertexValue` 程序

和上一部分一致，无法完成。