华东师范大学数据科学与工程学院实验报告

课程名称：分布式模型与编程	年级：2017	上机实践成绩：
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上机实践名称：Spark部署与编程		上机实践日期：2019.11.17-2019.11.24【第10周】
上机实践编号：实验二	组号：11	上机实践时间：18:00-19:30

一. 实验目的

- 学习Storm的部署，体会ZooKeeper在其中的作用
- 练习Storm的简单编程
- 了解系统日志的查看
- 体会流计算系统与批处理系统之间输入方式的异同

二. 实验任务

- Storm部署【第10周】：单机集中式、单机伪分布式（在个人用户下独立完成）、分布式（多位同学新建一个相同的用户，例如ecnu，协作完成）
- Storm编程【第10周】

三. 使用环境

1. Ubuntu18.04
2. zookeeper-3.4.13
3. apache-storm-1.2.3

四. 实验过程

Storm-deployment

1. 单机集中式

- **准备工作**
  - 安装配置JDK

    下载软件包：访问Oracle官网，下载jdk-8u202-linux-x64.tar.gz

    解压：`tar -zxvf jdk-8u192-linux-x64.tar.gz`，保存在/home/dase/jdk1.8.0_192目录下，其中假设本机用户名为dase

    配置环境变量:

```
vi ~/.bashrc
```

在该配置文件中添加以下内容

```
export JAVA_HOME=/home/dase/jdk1.8.0_192

export CLASSPATH=.:JAVA_HOME/lib/tools.jar:JAVA_HOME/lib/dt.jar

export PATH=JAVA_HOME/bin:PATH

```

```
source ~/.bashrc
```

验证是否安装配置成功: `java -version` ，终端出现版本信息则安装成功

- 安装Storm

  下载软件包：访问Storm官网， 下载storm-1.2.3.tar.gz

  解压: `tar -zxvf apache-storm-1.2.3.tar.gz` ，保存在/home/dase/storm-1.2.3 下载示例代码jar包：wordcount.jar，保存在/home/dase/storm-1.2.3

- **运行Storm应用程序**

  - 运行应用程序命令

    `cd /home/dase/apache-storm-1.2.3`

    ```
    bin/storm jar wordcount.jar StormWordCount local
    ```

    示例代码的输出结果如图所示

    ```
    5834 [Thread-24-Spout-executor[3 3]] INFO  o.a.s.d.executor - Activating sp
    out Spout:(3)
    (and,1)
    (the,1)
    (snow,1)
    (dwarfs,1)
    ```

  - 查看运行过程中的进程

    另启一个终端，jps查看进程

    ```
    syx@syx-OptiPlex-7050:~$ jps
    27489 DataNode
    27281 NameNode
    31505 Worker
    32355 HistoryServer
    31320 Master
    6616 StormWordCount
    6889 Jps
    27739 SecondaryNameNode
    ```

    由图可知，只有单一进程StormWordCount，此时的linux系统中并没有Storm的nimbus、supervisor等进程

- **结束应用程序:**

由于流式应用程序是长期运行的，需要人工终止。当需要关闭应用程序时，在应用程序提交终端(输出终端)按下ctrl+c即可。也可以在代码中指定程序运行的终止条件，比如运行10s后终止，详细内容将在Storm编程模块介绍

2. 单机伪分布式

由于Storm系统利用zookeeper做任务调度和元数据存储，故欲部署Storm须先部署Zookeeper，JDK默认已配好不再赘述

2.1 部署zookeeper

- **准备工作**
  - 下载软件包：zookeeper官网 ,下载zookeeper-3.4.13.tar.gz
  - 解压：`tar -zxvf zookeeper-3.4.13.tar.gz` ， 保存在/home/dase/zookeeper-3.4.13
- **修改配置文件**
  - 进入目录：`cd home/dase/zookeeper-3.4.13/`
    - 复制模板：`cp zoo_sample.cfg zoo.cfg`
  - 配置修改：`vi zoo.cfg`

    将内容修改为如下所示：

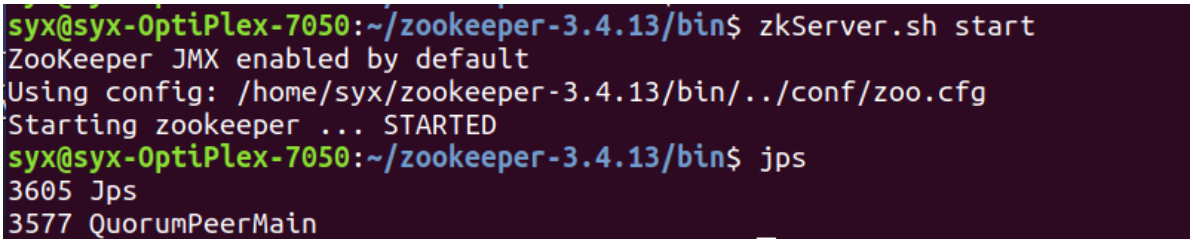
```
tickTime=2000   #心跳间隔
initLimit=10   #初始容忍的心跳数
syncLimit=5   #等待最大容忍的心跳数
dataDir=/home/syx/zookeeper-3.4.13/data  #存放数据的目录
clientPort=2181   #客户端默认的端口号
dataLogDir=/home/syx/zookeeper-3.4.13/data/log  #存放log的目录
autopurge.snapRetainCount=20  #保留的快照数目
autopurge.purgeInterval=48   #定期清理快照，时间单位：时
server.1=127.0.0.1:2888:3888  #主机名，心跳端口，数据端口
```

```
# administrator guide before turning on autopurge.
#
# http://zookeeper.apache.org/doc/current/zookeeperAdmin.html#sc_maintenance
#
# The number of snapshots to retain in dataDir
#autopurge.snapRetainCount=3
# Purge task interval in hours
# Set to "0" to disable auto purge feature
#autopurge.purgeInterval=1
tickTime=2000
initLimit=10
syncLimit=5
dataDir=/home/syx/zookeeper-3.4.13/data
clientPort=2181
dataLogDir=/home/syx/zookeeper-3.4.13/data/log
autopurge.snapRetainCount=20
autopurge.purgeInterval=48
server.1=127.0.0.1:2888:3888
```

  - 创建data目录，然后再在data目录下面创建一个myid，写入机器对应配置里的数字

```
mkdir data
cd data
mkdir log
echo 1 > myid
```

- **启动zookeeper服务，注意关闭防火墙**
  - 启动命令: `zkServer.sh start`
  - jps查看进程



    QuorumPeerMain即为zookeeper的服务进程

  - 查看zookeeper启动日志：输入命令 `cat ./zookeeper-3.4.13/zookeeper.out`

```
2019-11-06 20:38:10,272 [myid:] - INFO  [main:QuorumPeerConfig@136] - Reading configuration from: /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
2019-11-06 20:38:10,279 [myid:] - INFO  [main:QuorumPeer$QuorumServer@184] - Resolved hostname: 127.0.0.1 to address: /127.0.0.1
2019-11-06 20:38:10,279 [myid:] - ERROR [main:QuorumPeerConfig@347] - Invalid configuration, only one server specified (ignoring)
2019-11-06 20:38:10,280 [myid:] - INFO  [main:DatadirCleanupManager@78] - autopurge.snapRetainCount set to 20
2019-11-06 20:38:10,280 [myid:] - INFO  [main:DatadirCleanupManager@79] - autopurge.purgeInterval set to 48
2019-11-06 20:38:10,280 [myid:] - WARN  [main:QuorumPeerMain@116] - Either no config or no quorum defined in config, running  in standalone mode
2019-11-06 20:38:10,280 [myid:] - INFO  [PurgeTask:DatadirCleanupManager$PurgeTask@138] - Purge task started.
2019-11-06 20:38:10,286 [myid:] - INFO  [PurgeTask:DatadirCleanupManager$PurgeTask@144] - Purge task completed.
2019-11-06 20:38:10,287 [myid:] - INFO  [main:QuorumPeerConfig@136] - Reading configuration from: /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
2019-11-06 20:38:10,287 [myid:] - INFO  [main:QuorumPeer$QuorumServer@184] - Resolved hostname: 127.0.0.1 to address: /127.0.0.1
2019-11-06 20:38:10,288 [myid:] - ERROR [main:QuorumPeerConfig@347] - Invalid configuration, only one server specified (ignoring)
2019-11-06 20:38:10,288 [myid:] - INFO  [main:ZooKeeperServerMain@98] - Starting server
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:zookeeper.version=3.4.13-2d71af4dbe22557fda74f9a9b4309b15a7487f03, built on 06/29/2018 04:05 GMT
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:host.name=syx-OptiPlex-7050
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:java.version=1.8.0_221
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server
```

```
environment:java.vendor=Oracle Corporation
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:java.home=/usr/local/jdk1.8/jre
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:java.class.path=/home/syx/zookeeper-3.4.13/bin/../build/classes:/home/syx/zookeeper-3.4.13/bin/../build/lib/*.jar:/home/syx/zookeeper-3.4.13/bin/../lib/slf4j-log4j12-1.7.25.jar:/home/syx/zookeeper-3.4.13/bin/../lib/slf4j-api-1.7.25.jar:/home/syx/zookeeper-3.4.13/bin/../lib/netty-3.10.6.Final.jar:/home/syx/zookeeper-3.4.13/bin/../lib/log4j-1.2.17.jar:/home/syx/zookeeper-3.4.13/bin/../lib/jline-0.9.94.jar:/home/syx/zookeeper-3.4.13/bin/../lib/audience-annotations-0.5.0.jar:/home/syx/zookeeper-3.4.13/bin/../zookeeper-3.4.13.jar:/home/syx/zookeeper-3.4.13/bin/../src/java/lib/*.jar:/home/syx/zookeeper-3.4.13/bin/../conf:.:/usr/local/jdk1.8/lib:/usr/local/jdk1.8/jre/lib
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:java.library.path=/usr/java/packages/lib/amd64:/usr/lib64:/lib64:/lib:/usr/lib
2019-11-06 20:38:10,290 [myid:] - INFO  [main:Environment@100] - Server environment:java.io.tmpdir=/tmp
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:java.compiler=<NA>
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:os.name=Linux
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:os.arch=amd64
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:os.version=5.0.0-32-generic
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:user.name=syx
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:user.home=/home/syx
2019-11-06 20:38:10,291 [myid:] - INFO  [main:Environment@100] - Server environment:user.dir=/home/syx/zookeeper-3.4.13/bin
2019-11-06 20:38:10,292 [myid:] - INFO  [main:ZooKeeperServer@836] - tickTime set to 2000
2019-11-06 20:38:10,292 [myid:] - INFO  [main:ZooKeeperServer@845] - minSessionTimeout set to -1
2019-11-06 20:38:10,292 [myid:] - INFO  [main:ZooKeeperServer@854] - maxSessionTimeout set to -1
2019-11-06 20:38:10,295 [myid:] - INFO  [main:ServerCnxnFactory@117] - Using org.apache.zookeeper.server.NIOServerCnxnFactory as server connection factory
2019-11-06 20:38:10,297 [myid:] - INFO  [main:NIOServerCnxnFactory@89] - binding to port 0.0.0.0/0.0.0.0:2181
```

2.2 Storm安装配置

- **准备工作**

  下载软件包：访问Storm官网， 下载storm-1.2.3.tar.gz

解压: `tar -zxvf apache-storm-1.2.3.tar.gz` ，保存在/home/dase/storm-1.2.3

下载示例代码jar包：wordcount.jar，保存在/home/dase/storm-1.2.3

- **修改配置文件**

  Storm配置文件为storm.yaml，修改配置文件命令: `vi apache-storm-1.2.3/conf/storm.yaml` 添加如下设置，注意空格

```
# right
storm.zookeeper.servers: #zookeeper节点
 - "127.0.0.1"
nimbus.seeds: ["127.0.0.1"] #nimbus进程服务器ip
storm.local.dir: "/home/xxx/apache-storm-1.2.2/data"  #需要自己创建
ui.port: 18081 #ui端口
supervisor.slots.ports: #给supervisor四个端口，即supervisor可以创建四个worker进程
 - 6700
 - 6701
 - 6702
 - 6703
```

```
#         - "worker"
#     report.period: 10
#     report.period.units: "SECONDS"
#     filter:
#         class: "org.apache.storm.metrics2.filters.RegexFilter"
#         expression: ".*my_component.*emitted.*"

storm.zookeeper.servers:
 - "127.0.0.1"
nimbus.seeds: ["127.0.0.1"]
storm.local.dir: "/home/syx/apache-storm-1.2.3/data"
ui.port: 18081
supervisor.slots.ports:
 - 6700
 - 6701
 - 6702
 - 6703
```

保存并退出

- **启动Storm服务**

  - 启动命令

```
bin/storm nimbus >/dev/null 2>&1 &
bin/storm ui >/dev/null 2>&1 &
bin/storm logviewer > /dev/null 2>&1 &
bin/storm supervisor >/dev/null 2>&1 &
```

    jps查看进程

```
^Csyx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm nimbus >/dev/null 2>&1 &
[7] 19181
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm ui >/dev/null 2>&1 &
[8] 19335
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm logviewer > /dev/null 2>&1
 &
[9] 19459
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm supervisor >/dev/null 2>&1
 &
[10] 19570
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ jps
19459 logviewer
19686 config_value
19335 core
19706 Jps
19181 nimbus
18829 QuorumPeerMain
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ jps
19776 Jps
19570 Supervisor
19459 logviewer
19335 core
19181 nimbus
18829 QuorumPeerMain
```

由图可知，同一台机器上运行不同进程，此时的Storm中的nimbus，supervisor，core和logviewer进程在同一台机器上均已启动，其中core为ui进程，logviewer为日志进程

- 参数说明

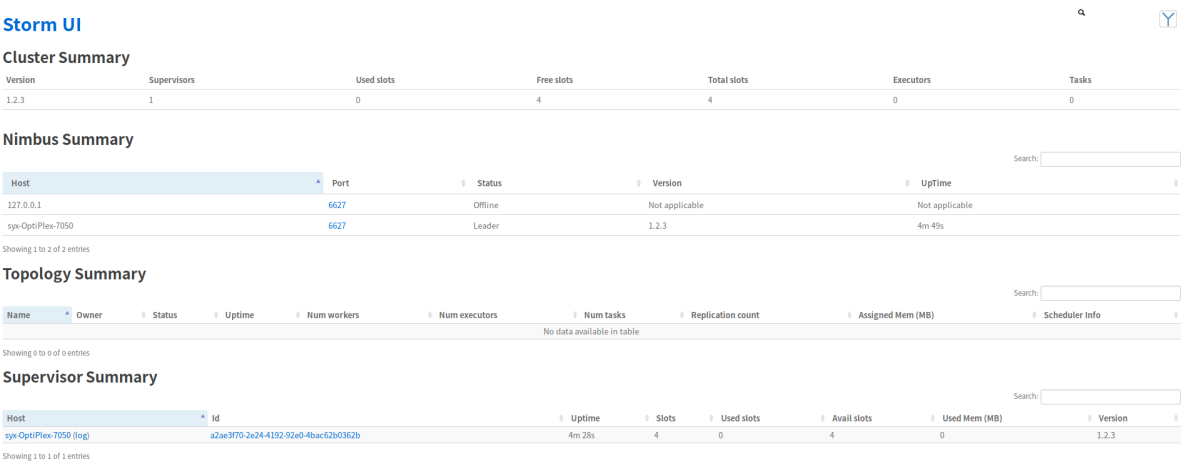
```
>/dev/null ：代表空设备文件`
>  ：代表重定向到哪里，例如：echo "123" > /home/123.txt
1  ：表示stdout标准输出，系统默认值是1，所以">/dev/null"等同于"1>/dev/null"
2  ：表示stderr标准错误
&  ：表示等同于的意思，2>&1，表示2的输出重定向等同于1
1 > /dev/null 2>&1 语句含义：
1 > /dev/null ：  首先表示标准输出重定向到空设备文件，也就是不输出任何信息到终端，说白了就是不显示任何信息。
2>&1 ：接着，标准错误输出重定向（等同于）标准输出，因为之前标准输出已经重定向到了空设备文件，所以标准错误输出也重定向到空设备文件。
最后的&表示脱离终端控制
```

- **查看Storm服务信息**
  - 查看Storm服务日志

    日志信息在 /apache-storm-1.2.3/logs 目录

```
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/logs$ ls
access-logviewer.log       access-web-supervisor.log  supervisor.log
access-nimbus.log          access-web-ui.log          supervisor.log.metrics
access-supervisor.log      logviewer.log              ui.log
access-ui.log              logviewer.log.metrics      ui.log.metrics
access-web-logviewer.log   nimbus.log                workers-artifacts
access-web-nimbus.log      nimbus.log.metrics
```

  - 访问Storm Web界面

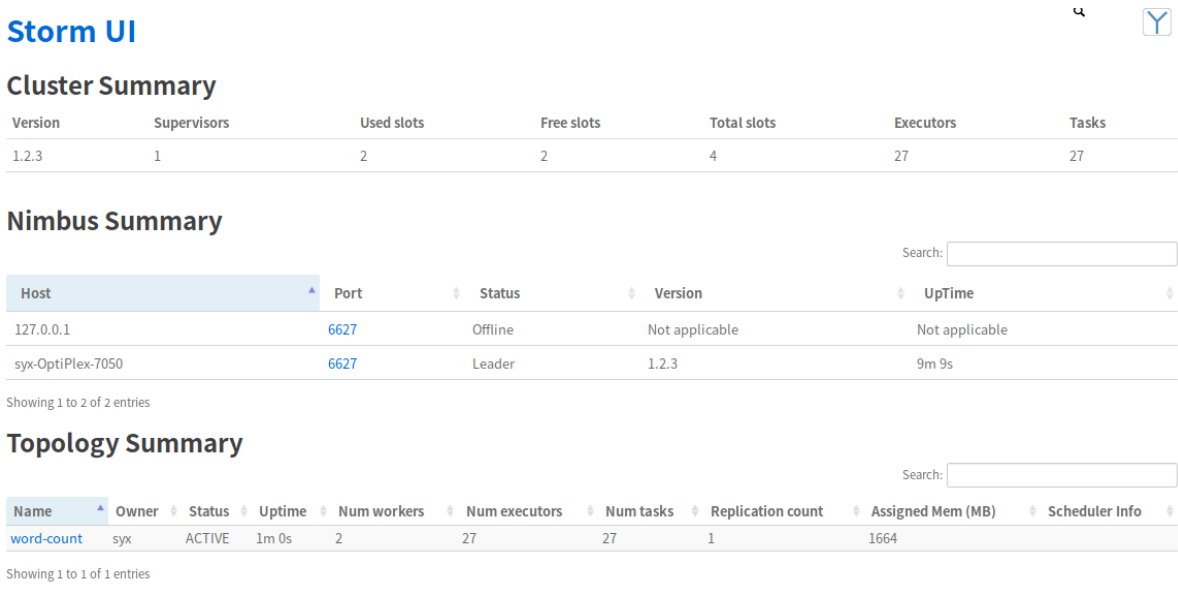


- Cluster Summary是集群的总体信息，可以看到本文使用的Storm版本为1.2.3共有一个Supervisor进程，共有4个slot资源, 且目前使用0个
- Nimbus Summary是集群的Nimbus进程信息，可以看到只有在本地启动的一个Nimbus进程
- Topolopy Summary是用户提交的拓扑信息
- Supervisor 是集群中Supervisor进程信息

- **运行Storm应用程序**
  - 运行Storm应用程序命令: `bin/storm jar wordcount.jar StormWordCount cluster`
  - jps查看进程

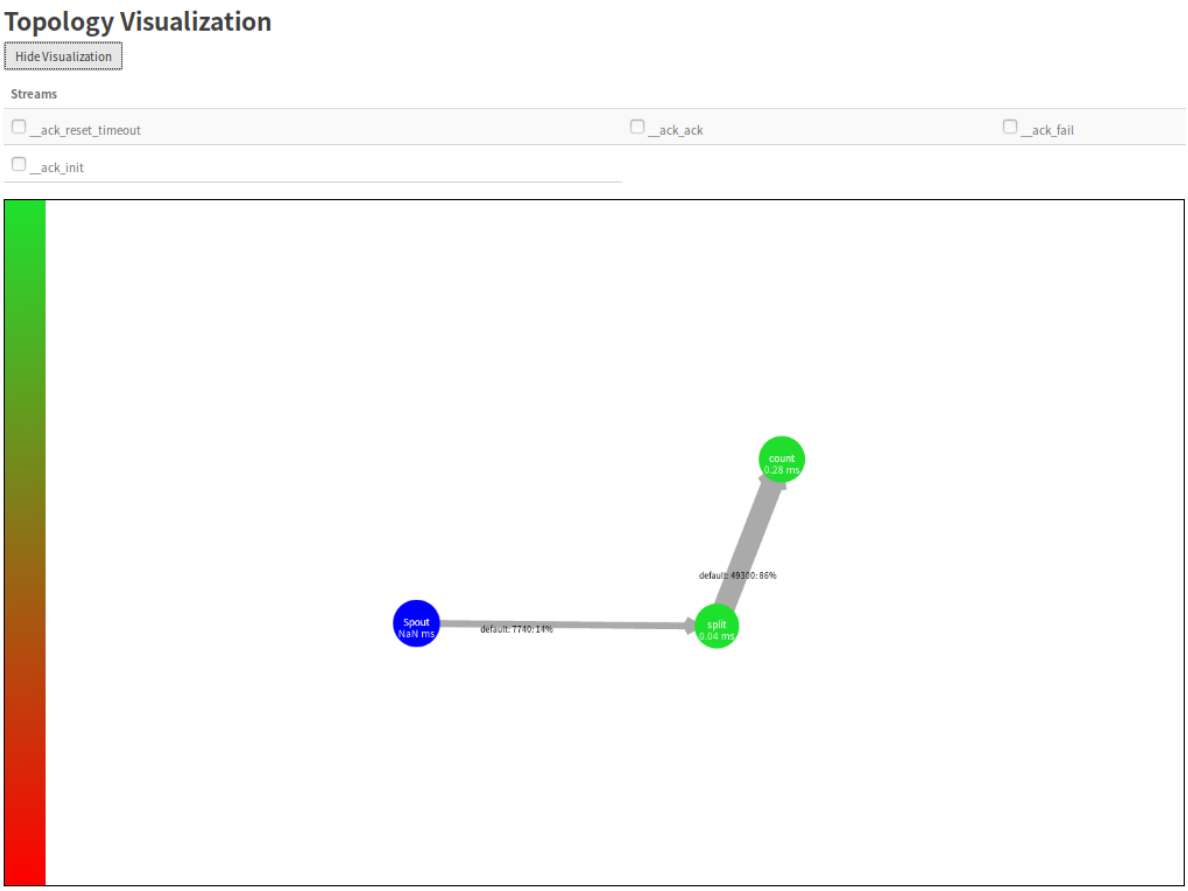
```
syx@syx-OptiPlex-7050:~$ jps
19570 Supervisor
20530 Jps
19459 logviewer
20309 worker
19335 core
20312 worker
20265 LogWriter
20266 LogWriter
19181 nimbus
18829 QuorumPeerMain
20510 config_value
```

    可以看到运行应用程序时相比不运行时多出来两个worker进程和其对应的两个日志进程LogWriter
  - 访问Storm Web界面



可以看到应用程序已经在运行了，它的执行状态是ACTIVE，共有两个worker进程，27个Task

- 查看拓扑图



Spout作为数据源，一个分词Bolt一个计数Bolt构成了WordCount应用程序

- **终止Storm应用程序**

方法一：终端命令 `./bin/storm kill word-count`

方法二：ui界面kill

kill之后可以在ui界面看到应用程序的状态变为KILLED

- **停止Storm服务**
  - 停止服务命令

```
kill -9 nimbusNum
kill -9 supervisorNum
kill -9 logviewerNum
kill -9 coreNum
zkServer.sh stop
```

```
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ jps
19570 Supervisor
19459 logviewer
19335 core
19181 nimbus
18829 QuorumPeerMain
21102 Jps
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ kill -9 19570
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ kill -9 19181
[10]   已杀死               storm supervisor > /dev/null 2>&1
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ kill -9 19335
[7]   已杀死               storm nimbus > /dev/null 2>&1
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ kill -9 19459
[8]   已杀死               storm ui > /dev/null 2>&1
```

nimbusNum为nimbus进程号，supervisorNum为supervisor进程号，logviewerNum为logviewer进程号，coreNum为core进程号，进程号可以通过jps命令查看

  - jps查看进程

```
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ ~/zookeeper-3.4.13/bin/zkServer.
sh stop
ZooKeeper JMX enabled by default
Using config: /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
Stopping zookeeper ... STOPPED
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ jps
21171 Jps
```

可以看到Storm所有进程都已关闭

3. 分布式部署

由于Storm系统利用zookeeper做任务调度和元数据存储，故欲部署Storm须先部署Zookeeper，JDK默认已配好不再赘述

3.1 部署zookeeper

- **准备工作**
  - 下载软件包：zookeeper官网 ,下载zookeeper-3.4.13.tar.gz
  - 解压：`tar -zxvf zookeeper-3.4.13.tar.gz` ， 保存在/home/dase/zookeeper-3.4.13
- **修改配置文件**

- 进入目录：`cd home/dase/zookeeper-3.4.13/`
  - 复制模板：`cp zoo_sample.cfg zoo.cfg`
- 配置修改：`vi zoo.cfg`

```
dataDir=/home/ecnu/zookeeper-3.4.13/data
# the port at which the clients will connect
clientPort=2181
# the maximum number of client connections.
# increase this if you need to handle more clients
#maxClientCnxns=60
#
# Be sure to read the maintenance section of the
# administrator guide before turning on autopurge.
#
# http://zookeeper.apache.org/doc/current/zookeeperAdmin.html#sc_maintenance
#
# The number of snapshots to retain in dataDir
#autopurge.snapRetainCount=3
# Purge task interval in hours
# Set to "0" to disable auto purge feature
#autopurge.purgeInterval=1
dataLogDir=/home/ecnu/zookeeper-3.4.13/data/log
autopurge.snapRetainCount=20
autopurge.purgeInterval=48
server.1=219.228.135.71:2888:3888
server.2=219.228.135.124:2888:3888
```

  - 创建data目录，然后再下面创建一个myid，写入机器对应配置里的数字

```
mkdir data
cd data
mkdir log
echo 1 > myid
```

  - 复制zookeeper文件夹到别的机器上去，并且修改myid

```
scp -r~/zookeeper-3.4.13 219.228.135.124:/home/ecnu/
echo 2 > zookeeper-3.4.13/data/myid
```

```
ecnu@syx-OptiPlex-7050:~/zookeeper-3.4.13/bin$ scp -r /home/ecnu/zookeeper-3.4.1
3 ecnu@219.228.135.71:/home/ecnu/
ivysettings.xml                               100% 1709     1.6MB/s   00:00
zookeeper-3.4.13-tests.jar                    100%  710KB  51.8MB/s   00:00
zookeeper-3.4.13.pom.asc                      100%  833     2.7MB/s   00:00
zookeeper-3.4.13-sources.jar.md5              100%   33   174.6KB/s   00:00
zookeeper-3.4.13-tests.jar.asc                100%  833     3.2MB/s   00:00
zookeeper-3.4.13.jar.md5                      100%   33   162.4KB/s   00:00
```

- **启动各节点zookeeper服务，注意关闭防火墙**
  - 启动命令：`zkServer.sh start`
  - jps查看进程

```
ecnu@may-lab:~$ echo 2 > zookeeper-3.4.13/data/myid
ecnu@may-lab:~$ jps
14447 Jps
ecnu@may-lab:~$ ~/zookeeper-3.4.13/bin/zkServer.sh start
ZooKeeper JMX enabled by default
Using config: /home/ecnu/zookeeper-3.4.13/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
ecnu@may-lab:~$ jps
14505 Jps
14476 QuorumPeerMain
```

```
ecnu@syx-OptiPlex-7050:~/zookeeper-3.4.13/bin$ jps
28039 Jps
27102 QuorumPeerMain
```

可以看到各个节点上都有QuorumPeerMain即zookeeper的服务进程

```
ecnu@may-lab:/home/ecnu/zookeeper-3.4.13/bin$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /home/ecnu/zookeeper-3.4.13/bin/../conf/zoo.cfg
Mode: follower
```

```
ecnu@syx-OptiPlex-7050:~/zookeeper-3.4.13/bin$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /home/ecnu/zookeeper-3.4.13/bin/../conf/zoo.cfg
Mode: leader
```

- 查看zookeeper启动日志，输入命令：`cat ./zookeeper-3.4.13/zookeeper.out`

```
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3/logs$ ls
access-logviewer.log      access-web-nimbus.log  nimbus.log
access-nimbus.log         access-web-ui.log      nimbus.log.metrics
access-ui.log             logviewer.log          ui.log
access-web-logviewer.log  logviewer.log.metrics  ui.log.metrics
```

3.2 Storm配置

- **准备工作**

  下载软件包：访问Storm官网，下载storm-1.2.3.tar.gz

  解压：`tar -zxvf apache-storm-1.2.3.tar.gz`，保存在/home/dase/storm-1.2.3

  下载示例代码jar包：wordcount.jar，保存在/home/dase/storm-1.2.3

- **修改配置文件**

  Storm配置文件为storm.yaml，修改配置文件命令：`vi apache-storm-1.2.3/conf/storm.yaml`

  添加如下设置，注意空格

```yaml
storm.zookeeper.servers: #zookeeper节点
    - "219.228.135.71"
    - "219.228.135.124"
nimbus.seeds: ["219.228.135.71","219.228.135.124"] #nimbus进程服务器ip列表
storm.local.dir: "/home/ecnu/apache-storm-1.2.3/data"  #需要自己创建
ui.port: 18080 #ui端口
supervisor.slots.ports: #给supervisor四个端口，即supervisor可以创建四个worker进程
    - 6700
    - 6701
    - 6702
    - 6703
```

- **启动Storm服务**
  - 启动命令

    主节点上

    ```
    bin/storm nimbus >/dev/null 2>&1 &
    bin/storm ui >/dev/null 2>&1 &
    bin/storm logviewer > /dev/null 2>&1 &
    ```

    从节点上

    ```
    bin/storm supervisor >/dev/null 2>&1 &
    bin/storm logviewer > /dev/null 2>&1 &
    ```

  - jps查看进程

```
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$ bin/storm nimbus >/dev/null 2>&1 &
[1] 24713
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$ bin/storm ui >/dev/null 2>&1 &
[2] 24770
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$ bin/storm logviewer > /dev/null 2>&1
 &
[3] 24828
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$ jps
24657 QuorumPeerMain
24770 core
24713 nimbus
24828 logviewer
25070 Jps
```

```
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3$ bin/storm supervisor >/dev/null 2>&
1 &
[1] 24640
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3$ bin/storm logviewer > /dev/null 2>&
1 &
[2] 24720
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3$ jps
24640 Supervisor
24849 Jps
24582 QuorumPeerMain
24829 config_value
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3$ jps
24640 Supervisor
24720 logviewer
24977 Jps
24582 QuorumPeerMain
```

1 有图可以看到，主节点上的nimbus进程，core进程和logviewer进程均已启动，从节点上supervisor和 logviewer进程也以启动

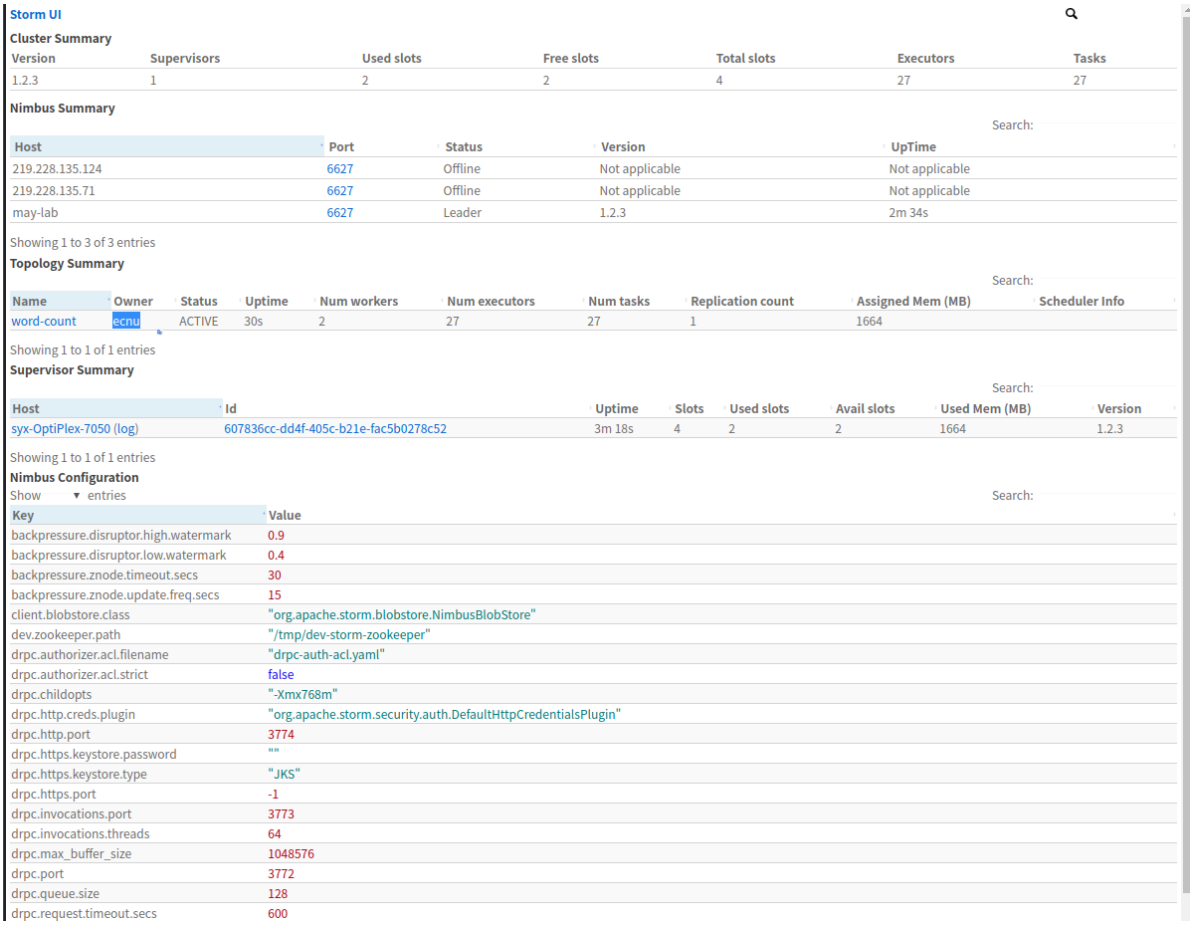
- **查看Storm服务信息**
  - 查看Storm服务日志

    日志信息在 /apache-storm-1.2.3/logs 目录

```
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3/logs$ ls
access-logviewer.log       access-web-nimbus.log  nimbus.log
access-nimbus.log          access-web-ui.log      nimbus.log.metrics
access-ui.log              logviewer.log          ui.log
access-web-logviewer.log   logviewer.log.metrics  ui.log.metrics
```

```
ecnu@syx-OptiPlex-7050:~$ cd  ~/apache-storm-1.2.3/logs
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3/logs$ ls
access-logviewer.log    access-web-logviewer.log    logviewer.log          supervisor.log
access-nimbus.log       access-web-nimbus.log       logviewer.log.metrics  supervisor.log.metrics
access-supervisor.log   access-web-supervisor.log   nimbus.log             ui.log
access-ui.log           access-web-ui.log           nimbus.log.metrics     ui.log.metrics
```

  - 访问Storm Web界面



Storm UI

Cluster Summary

Version	Supervisors	Used slots	Free slots	Total slots	Executors	Tasks
1.2.3	1	2	2	4	27	27

Nimbus Summary

Search:

Host	Port	Status	Version	UpTime
219.228.135.124	6627	Offline	Not applicable	Not applicable
219.228.135.71	6627	Offline	Not applicable	Not applicable
may-lab	6627	Leader	1.2.3	2m 34s

Showing 1 to 3 of 3 entries

Topology Summary

Search:

Name	Owner	Status	Uptime	Num workers	Num executors	Num tasks	Replication count	Assigned Mem (MB)	Scheduler Info
word-count	ecnu	ACTIVE	30s	2	27	27	1	1664	

Showing 1 to 1 of 1 entries

Supervisor Summary

Search:

Host	Id	Uptime	Slots	Used slots	Avail slots	Used Mem (MB)	Version
syx-OptiPlex-7050 (log)	607836cc-dd4f-405c-b21e-fac5b0278c52	3m 18s	4	2	2	1664	1.2.3

Showing 1 to 1 of 1 entries

Nimbus Configuration

Show ▾ entries

Search:

Key	Value
backpressure.disruptor.high.watermark	0.9
backpressure.disruptor.low.watermark	0.4
backpressure.znode.timeout.secs	30
backpressure.znode.update.freq.secs	15
client.blobstore.class	"org.apache.storm.blobstore.NimbusBlobStore"
dev.zookeeper.path	"/tmp/dev-storm-zookeeper"
drpc.authorizer.acl.filename	"drpc-auth-acl.yaml"
drpc.authorizer.acl.strict	false
drpc.childopts	"-Xmx768m"
drpc.http.creds.plugin	"org.apache.storm.security.auth.DefaultHttpCredentialsPlugin"
drpc.http.port	3774
drpc.https.keystore.password	""
drpc.https.keystore.type	"JKS"
drpc.https.port	-1
drpc.invocations.port	3773
drpc.invocations.threads	64
drpc.max_buffer_size	1048576
drpc.port	3772
drpc.queue.size	128
drpc.request.timeout.secs	600

Cluster Summary是集群的总体信息，可以看到本文使用的Storm版本为1.2.3共有两个个Supervisor进程，共有8个slot资源且目前均未使用

Nimbus Summary是集群的Nimbus进程信息，可以看到只有在本地启动的一个Nimbus进程

Topology Summary是用户提交的拓扑信息

Supervisor 是集群中Supervisor进程信息

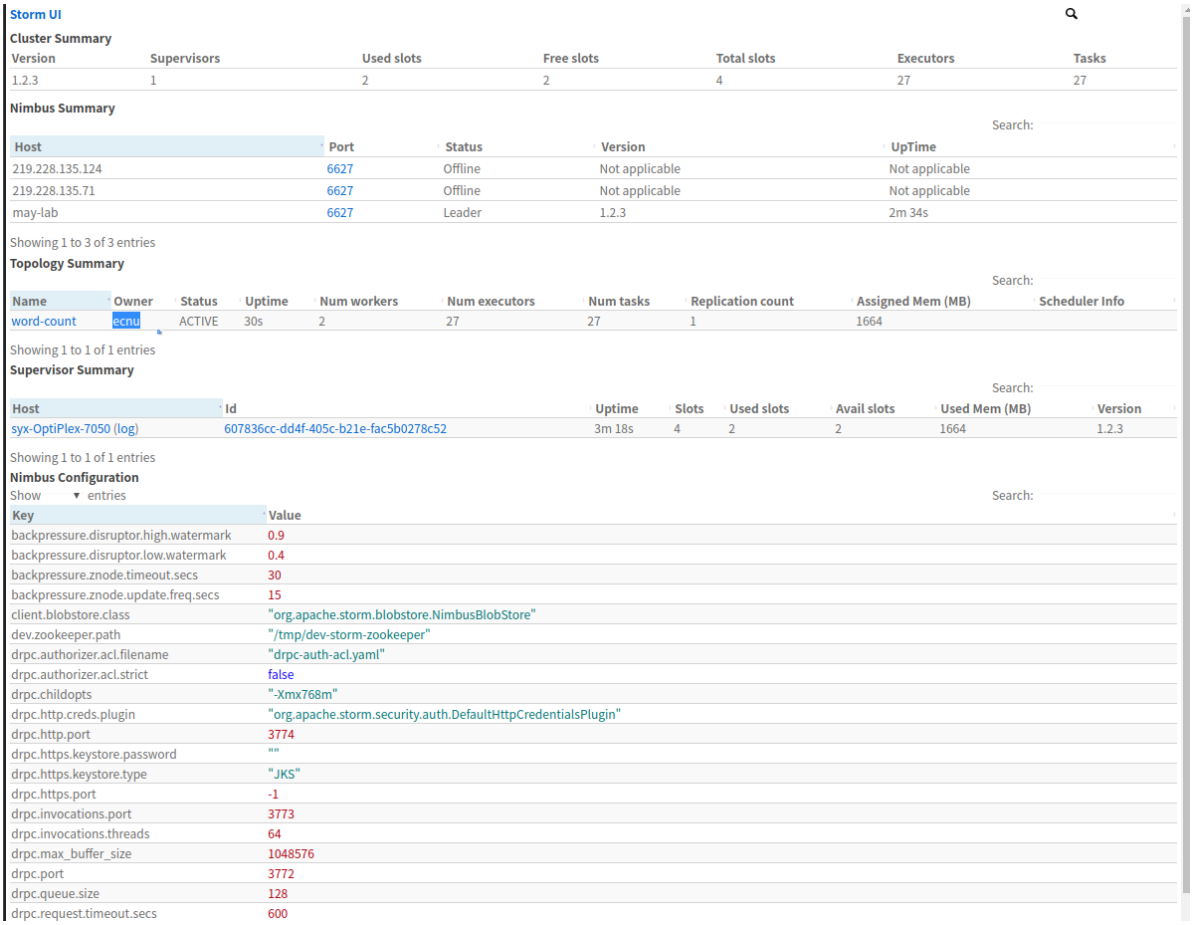
- **运行Storm应用程序**
  - 运行Storm应用程序命令 `bin/storm jar wordcount.jar StormWordCount cluster`

```
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3$ bin/storm jar wordcount.jar StormW
ordCount cluster
Running: java -client -Ddaemon.name= -Dstorm.options= -Dstorm.home=/home/ecnu/
apache-storm-1.2.3 -Dstorm.log.dir=/home/ecnu/apache-storm-1.2.3/logs -Djava.l
ibrary.path=/usr/local/lib:/opt/local/lib:/usr/lib -Dstorm.conf.file= -cp /hom
e/ecnu/apache-storm-1.2.3/*:/home/ecnu/apache-storm-1.2.3/lib/*:/home/ecnu/apa
che-storm-1.2.3/extlib/*:wordcount.jar:/home/ecnu/apache-storm-1.2.3/conf:/hom
e/ecnu/apache-storm-1.2.3/bin -Dstorm.jar=wordcount.jar -Dstorm.dependency.jar
s= -Dstorm.dependency.artifacts={} StormWordCount cluster
477  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old null
498  [main] INFO  o.a.s.StormSubmitter - Generated ZooKeeper secret payload fo
r MD5-digest: -6379772984455069911:-5090947615134487650
561  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : may-lab:6627
569  [main] INFO  o.a.s.s.a.AuthUtils - Got AutoCreds []
573  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : may-lab:6627
588  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - jars...
588  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - artifacts...
589  [main] INFO  o.a.s.StormSubmitter - Dependency Blob keys - jars : [] / ar
tifacts : []
591  [main] INFO  o.a.s.StormSubmitter - Uploading topology jar wordcount.jar
to assigned location: /home/ecnu/apache-storm-1.2.3/data/nimbus/inbox/stormjar
-8c8c3430-fcd7-470d-b911-b6df98af7b83.jar
597  [main] INFO  o.a.s.StormSubmitter - Successfully uploaded topology jar to
 assigned location: /home/ecnu/apache-storm-1.2.3/data/nimbus/inbox/stormjar-8
c8c3430-fcd7-470d-b911-b6df98af7b83.jar
597  [main] INFO  o.a.s.StormSubmitter - Submitting topology word-count in dis
tributed mode with conf {"storm.zookeeper.topology.auth.scheme":"digest","stor
m.zookeeper.topology.auth.payload":"-6379772984455069911:-5090947615134487650"
,"topology.workers":2,"topology.debug":false}
598  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old 1.2.3
905  [main] INFO  o.a.s.StormSubmitter - Finished submitting topology: word-co
unt
[4]   已完成               bin/storm nimbus > /dev/null 2>&1
```

- jps查看进程,可以明显地看到worker节点多出来一个worker进程和其对应的一个日志进程LogWriter:

```
ecnu@syx-OptiPlex-7050:~/apache-storm-1.2.3$ jps
5632 worker
5568 LogWriter
5616 worker
5569 LogWriter
5209 Supervisor
5210 logviewer
5882 Jps
28492 QuorumPeerMain
```

- 访问Storm Web界面



Storm UI

Cluster Summary

Version	Supervisors	Used slots	Free slots	Total slots	Executors	Tasks
1.2.3	1	2	2	4	27	27

Nimbus Summary

Search:

Host	Port	Status	Version	UpTime
219.228.135.124	6627	Offline	Not applicable	Not applicable
219.228.135.71	6627	Offline	Not applicable	Not applicable
may-lab	6627	Leader	1.2.3	2m 34s

Showing 1 to 3 of 3 entries

Topology Summary

Search:

Name	Owner	Status	Uptime	Num workers	Num executors	Num tasks	Replication count	Assigned Mem (MB)	Scheduler Info
word-count	ecnu	ACTIVE	30s	2	27	27	1	1664	

Showing 1 to 1 of 1 entries

Supervisor Summary

Search:

Host	Id	Uptime	Slots	Used slots	Avail slots	Used Mem (MB)	Version
syx-OptiPlex-7050 (log)	607836cc-dd4f-405c-b21e-fac5b0278c52	3m 18s	4	2	2	1664	1.2.3

Showing 1 to 1 of 1 entries

Nimbus Configuration

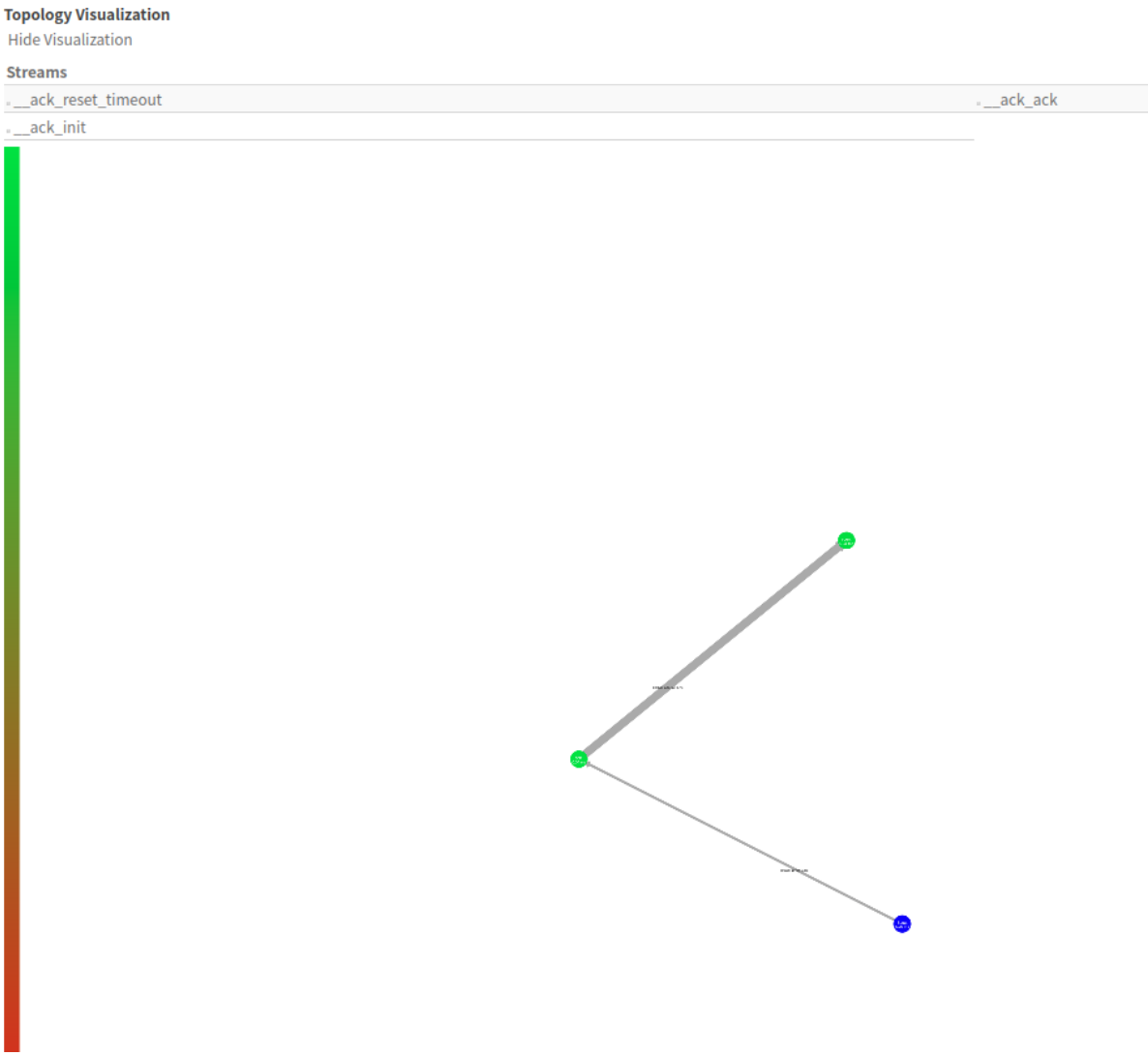
Show ▾ entries

Search:

Key	Value
backpressure.disruptor.high.watermark	0.9
backpressure.disruptor.low.watermark	0.4
backpressure.znode.timeout.secs	30
backpressure.znode.update.freq.secs	15
client.blobstore.class	"org.apache.storm.blobstore.NimbusBlobStore"
dev.zookeeper.path	"/tmp/dev-storm-zookeeper"
drpc.authorizer.acl.filename	"drpc-auth-acl.yaml"
drpc.authorizer.acl.strict	false
drpc.childopts	"-Xmx768m"
drpc.http.creds.plugin	"org.apache.storm.security.auth.DefaultHttpCredentialsPlugin"
drpc.http.port	3774
drpc.https.keystore.password	""
drpc.https.keystore.type	"JKS"
drpc.https.port	-1
drpc.invocations.port	3773
drpc.invocations.threads	64
drpc.max_buffer_size	1048576
drpc.port	3772
drpc.queue.size	128
drpc.request.timeout.secs	600

可以看到应用程序已经在运行了，它的执行状态是ACTIVE，共有两个worker进程，27个Task

- 查看拓扑图



Spout作为数据源，一个分词Bolt,一个计数Bolt构成了WordCount应用程序

- **终止应用程序**

  方法一：终端命令 `./bin/storm kill word-count`

  方法二：ui界面kill

Storm-programming

1. 编写Storm程序

- **新建Maven项目并添加pom依赖**
- **IDE环境编写代码**

  一个基本的Strom程序由Spout、bolt和Topology三部分组成，Spout是是用于数据生成的组件，Bolt是Storm的计算基本单位可以称其为算子，Topology就是Spout和Boltd的摆放组合加上一些配置信息，本文将按照Spout,Bolt和Topology 这个顺序介绍Storm程序的编写

  现在创建一个能够无限产生String数据的数据源Spout，在src/mian/java/目录下新建Java class取名RandomSentenceSpout 填写如下代码

- 不启用ACK机制

- 启用ACK机制

2. 调试Storm程序

- ### IDE中直接运行

  Run->Edit-configuration->Main class 填写内容 `WordCount` 表示入口类 Program arguments 填写内容 `local` 表示本地运行 点击 `OK` 按钮

  Run->Run `WordCount`

  结果如图

```
6246 [Thread-38-__acker-executor[4 4]] INFO  o.a.s.d.executor - Prepared bolt __acker:(4)
(two,1)
(am,1)
(i,1)
(at,1)
(with,1)
(and,1)
(seven,1)
(years,1)
(ago,1)
(nature,1)
(four,1)
(score,1)
(a,1)
(an,1)
(apple,1)
(day,1)
(keeps,1)
(the,1)
(doctor,1)
```

- ### 调试经验

  - IDE中设置断点

3. 运行Storm程序

- ### 利用IDE打包jar文件

  IDEA打jar包教程

- ### 伪分布模式下提交Storm程序

  经过上述步骤，我们已经得到打包好的Storm代码myjar.jar,接下来在Storm服务进程中运行Storm代码

  进入Storm目录：`cd ~/apache-storm-1.2.2/`

  执行命令：`bin/storm jar myjar.jar WordCountTopology local` (单机模式)

```
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm jar /home/syx/test/out/art
ifacts/storm_wordcount/storm_wordcount.jar WordCount local
Running: /usr/local/jdk1.8/bin/java -client -Ddaemon.name= -Dstorm.options= -Dst
orm.home=/home/syx/apache-storm-1.2.3 -Dstorm.log.dir=/home/syx/apache-storm-1.2
.3/logs -Djava.library.path=/usr/local/lib:/opt/local/lib:/usr/lib -Dstorm.conf.
file= -cp /home/syx/apache-storm-1.2.3/*:/home/syx/apache-storm-1.2.3/lib/*:/hom
e/syx/apache-storm-1.2.3/extlib/*:/home/syx/test/out/artifacts/storm_wordcount/s
torm_wordcount.jar:/home/syx/apache-storm-1.2.3/conf:/home/syx/apache-storm-1.2.
3/bin -Dstorm.jar=/home/syx/test/out/artifacts/storm_wordcount/storm_wordcount.j
ar -Dstorm.dependency.jars= -Dstorm.dependency.artifacts={} WordCount local
```

```
43375 [Thread-18-split-executor[8 8]] INFO  o.a.s.d.executor - Prepared bolt spl
it:(8)
43398 [Thread-20-Spout-executor[2 2]] INFO  o.a.s.d.executor - Opening spout Spo
ut:(2)
43399 [Thread-20-Spout-executor[2 2]] INFO  o.a.s.d.executor - Opened spout Spou
t:(2)
43399 [Thread-20-Spout-executor[2 2]] INFO  o.a.s.d.executor - Activating spout
Spout:(2)
(the,1)
(and,1)
(cow,1)
(the,2)
(dwarfs,1)
(over,1)
(the,3)
(moon,1)
(snow,1)
(white,1)
(seven,1)
(jumped,1)
(seven,2)
(and,2)
(four,1)
(years,1)
(score,1)
```

`storm jar /home/ecnu/test/out/artifacts/storm_wordcount/storm_wordcount.jar WordCount cluster` (分布式模式)

```
syx@syx-OptiPlex-7050:~/apache-storm-1.2.3/bin$ storm jar /home/syx/test/out/art
ifacts/storm_wordcount/storm_wordcount.jar WordCount cluster
Running: /usr/local/jdk1.8/bin/java -client -Ddaemon.name= -Dstorm.options= -Dst
orm.home=/home/syx/apache-storm-1.2.3 -Dstorm.log.dir=/home/syx/apache-storm-1.2
.3/logs -Djava.library.path=/usr/local/lib:/opt/local/lib:/usr/lib -Dstorm.conf.
file= -cp /home/syx/apache-storm-1.2.3/*:/home/syx/apache-storm-1.2.3/lib/*:/hom
e/syx/apache-storm-1.2.3/extlib/*:/home/syx/test/out/artifacts/storm_wordcount/s
torm_wordcount.jar:/home/syx/apache-storm-1.2.3/conf:/home/syx/apache-storm-1.2.
3/bin -Dstorm.jar=/home/syx/test/out/artifacts/storm_wordcount/storm_wordcount.j
ar -Dstorm.dependency.jars= -Dstorm.dependency.artifacts={} WordCount cluster
302  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old null
317  [main] INFO  o.a.s.StormSubmitter - Generated ZooKeeper secret payload for
MD5-digest: -7015927174038814268:-5639053222713017896
376  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : syx-OptiPlex-7050
:6627
386  [main] INFO  o.a.s.s.a.AuthUtils - Got AutoCreds []
389  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : syx-OptiPlex-7050
:6627
404  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - jars...
405  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - artifacts...
405  [main] INFO  o.a.s.StormSubmitter - Dependency Blob keys - jars : [] / arti
facts : []
410  [main] INFO  o.a.s.StormSubmitter - Uploading topology jar /home/syx/test/o
ut/artifacts/storm_wordcount/storm_wordcount.jar to assigned location: /home/syx
/apache-storm-1.2.3/data/nimbus/inbox/stormjar-3a692ad2-cb63-4f1e-a7ab-021059db0
cbf.jar
418  [main] INFO  o.a.s.StormSubmitter - Successfully uploaded topology jar to a
ssigned location: /home/syx/apache-storm-1.2.3/data/nimbus/inbox/stormjar-3a692a
d2-cb63-4f1e-a7ab-021059db0cbf.jar
419  [main] INFO  o.a.s.StormSubmitter - Submitting topology word-count in distr
ibuted mode with conf {"topology.acker.executors":2,"storm.zookeeper.topology.au
th.scheme":"digest","storm.zookeeper.topology.auth.payload":"-701592717403881426
8:-5639053222713017896","topology.workers":2,"topology.debug":false,"topology.ma
x.task.parallelism":3}
419  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old 1.2.3
751  [main] INFO  o.a.s.StormSubmitter - Finished submitting topology: word-coun
t
```

- 分布式模式下提交Storm程序

  在真实的生产环境中，一个Storm应用程序通常是运行在集群上以满足计算性能的需求。下面介绍如何在集群环境中运行Storm代码其实很简单，首先是上传jar包，执行scp命令将jar包上传至集群

  `scp myjar.jar usrname@ip:/home/usrname/apache-storm-1.2.3`

  再进入集群执行提交应用程序命令，进入Storm目录：`cd ~/apache-storm-1.2.3/`

  执行命令：

```
ecnu@may-lab:/home/ecnu/apache-storm-1.2.3/bin$ storm jar /home/ecnu/test/out/ar
tifacts/storm_wordcount/storm_wordcount.jar WordCount cluster
Running: /usr/local/jdk/bin/java -client -Ddaemon.name= -Dstorm.options= -Dstorm
.home=/home/ecnu/apache-storm-1.2.3 -Dstorm.log.dir=/home/ecnu/apache-storm-1.2.
3/logs -Djava.library.path=/usr/local/lib:/opt/local/lib:/usr/lib -Dstorm.conf.f
ile= -cp /home/ecnu/apache-storm-1.2.3/*:/home/ecnu/apache-storm-1.2.3/lib/*:/ho
me/ecnu/apache-storm-1.2.3/extlib/*:/home/ecnu/test/out/artifacts/storm_wordcoun
t/storm_wordcount.jar:/home/ecnu/apache-storm-1.2.3/conf:/home/ecnu/apache-storm
-1.2.3/bin -Dstorm.jar=/home/ecnu/test/out/artifacts/storm_wordcount/storm_wordc
ount.jar -Dstorm.dependency.jars= -Dstorm.dependency.artifacts={} WordCount clus
ter
322  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old null
336  [main] INFO  o.a.s.StormSubmitter - Generated ZooKeeper secret payload for
MD5-digest: -8722885759096815589:-6247394527533958394
388  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : may-lab:6627
398  [main] INFO  o.a.s.s.a.AuthUtils - Got AutoCreds []
402  [main] INFO  o.a.s.u.NimbusClient - Found leader nimbus : may-lab:6627
414  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - jars...
414  [main] INFO  o.a.s.StormSubmitter - Uploading dependencies - artifacts...
414  [main] INFO  o.a.s.StormSubmitter - Dependency Blob keys - jars : [] / arti
facts : []
417  [main] INFO  o.a.s.StormSubmitter - Uploading topology jar /home/ecnu/test/
out/artifacts/storm_wordcount/storm_wordcount.jar to assigned location: /home/ec
nu/apache-storm-1.2.3/data/nimbus/inbox/stormjar-57a8d19c-ea20-4f95-b8fe-3a51fa4
efd7a.jar
422  [main] INFO  o.a.s.StormSubmitter - Successfully uploaded topology jar to a
ssigned location: /home/ecnu/apache-storm-1.2.3/data/nimbus/inbox/stormjar-57a8d
19c-ea20-4f95-b8fe-3a51fa4efd7a.jar
422  [main] INFO  o.a.s.StormSubmitter - Submitting topology word-count in distr
ibuted mode with conf {"topology.acker.executors":2,"storm.zookeeper.topology.au
th.scheme":"digest","storm.zookeeper.topology.auth.payload":"-872288575909681558
9:-6247394527533958394","topology.workers":2,"topology.debug":false,"topology.ma
x.task.parallelism":3}
422  [main] WARN  o.a.s.u.Utils - STORM-VERSION new 1.2.3 old 1.2.3
647  [main] INFO  o.a.s.StormSubmitter - Finished submitting topology: word-coun
t
```

这样一个Storm应用程序就在集群中跑起来了

上述程序在cluster方式运行看不到输出，试修改以上程序使得cluster方式下将结果输出到文件中。

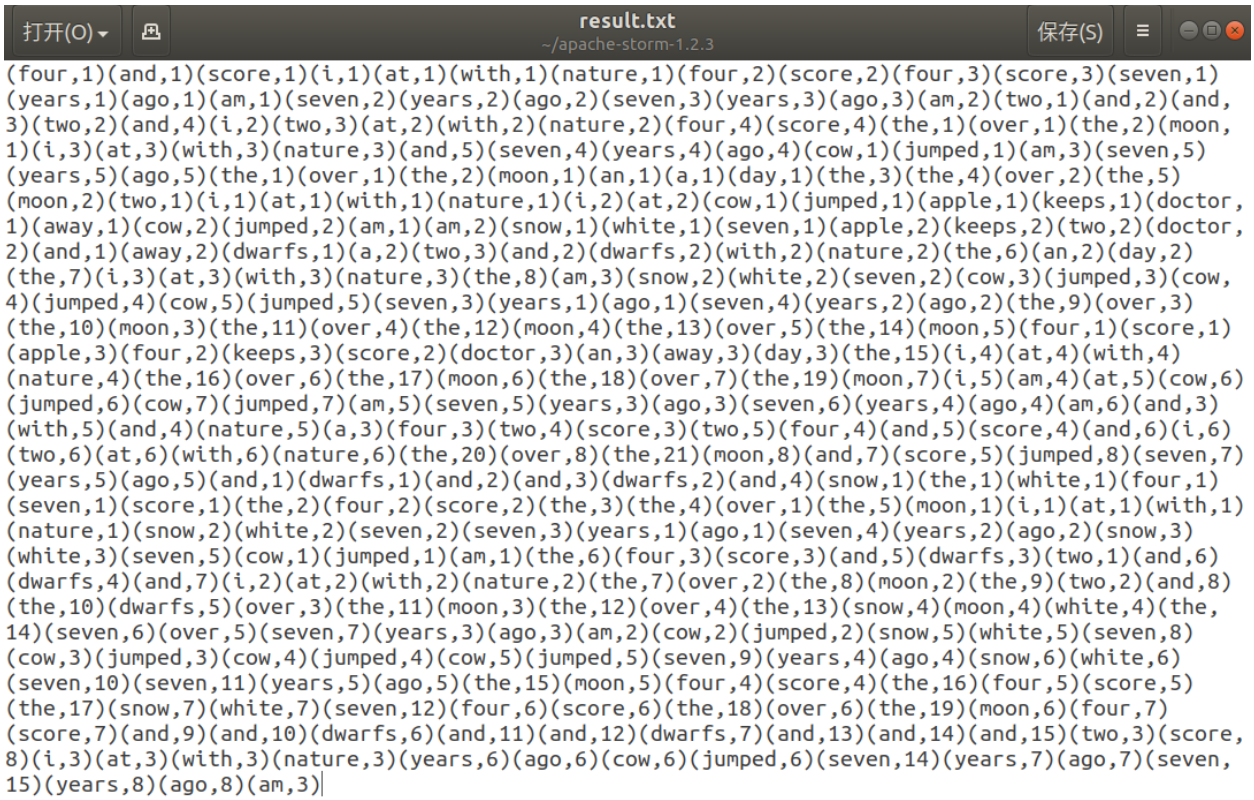
change the file CountBolt.java as follows:

```java
package example.storm.wordcount;

import org.apache.storm.task.TopologyContext;
import org.apache.storm.topology.BasicOutputCollector;
import org.apache.storm.topology.OutputFieldsDeclarer;
import org.apache.storm.topology.base.BaseBasicBolt;
import org.apache.storm.tuple.Fields;
import org.apache.storm.tuple.Tuple;
import org.apache.storm.tuple.Values;

import java.io.*;
import java.nio.channels.FileChannel;
import java.nio.channels.FileLock;
import java.util.Calendar;
import java.util.HashMap;
import java.util.Map;

```

```java
/*
 定义一个Bolt，用于单词计数
 */
public class CountBolt extends BaseBasicBolt {
    Map<String, Integer> counts = new HashMap<String, Integer>();

    @Override
    public void execute(Tuple tuple, BasicOutputCollector collector) {
        // 接收一个单词
        String word = tuple.getString(0);
        // 获取该单词对应的计数
        Integer count = counts.get(word);
        if (count == null) {
            count = 0;
        }
        // 计数增加
        count++;
        // 将单词和对应的计数加入map中
        counts.put(word, count);
        String data = "(" + word + "," + count + ")";
        Calendar calstart= Calendar.getInstance();
        try {
            File file =new File("/home/syx/apache-storm-1.2.3/result.txt");
            FileOutputStream fos = null;
            if(!file.exists()){
                file.createNewFile();//如果文件不存在，就创建该文件
                fos = new FileOutputStream(file);//首次写入获取
            }
            else if (file.ecists)
            {
                //参数true,表示在文件末尾追加写入
                fos = new FileOutputStream(file,true);
            }
            //对文件加锁
            RandomAccessFile out = new RandomAccessFile(file, "rw");
            FileChannel fcout=out.getChannel();
            FileLock flock=null;
            while(true){
                try {
                    flock = ((FileChannel) fcout).tryLock();
                    break;
                } catch (Exception e) {
                    Thread.sleep(100);
                }
            }
            //指定以UTF-8格式写入文件
            OutputStreamWriter osw = new OutputStreamWriter(fos, "UTF-8");
            osw.write(data);

            osw.close();
            flock.release();
            fcout.close();

            out.close();
```

```
            out=null;
        }
        catch (Exception e) {
            e.printStackTrace();
        }
        // 发送单词和计数（分别对应字段word和count）
        collector.emit(new Values(word, count));

    }
    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
        // 定义两个字段word和count
        declarer.declare(new Fields("word", "count"));
    }
}
```

Output:



Mistakes

1. annotation shouldn't follow the code in the same line

```
tickTime=2000
initLimit=10
syncLimit=5
dataDir=/home/syx/zookeeper-3.4.13/data
clientPort=2181
dataLogDir=/home/syx/zookeeper-3.4.13/data/log
autopurge.snapRetainCount=20
autopurge.purgeInterval=48  #hi
server.1=127.0.0.1:2888:3888
"zoo.cfg" 42L, 1490C                                          41,31
```

```
syx@syx-OptiPlex-7050:~/zookeeper-3.4.13/bin$ zkServer.sh start
ZooKeeper JMX enabled by default
Using config: /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
syx@syx-OptiPlex-7050:~/zookeeper-3.4.13/bin$ jps
3164 Jps
```

```
2019-11-06 20:36:33,736 [myid:] - INFO  [main:QuorumPeerConfig@136] - Reading configuration from: /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
2019-11-06 20:36:33,738 [myid:] - ERROR [main:QuorumPeerMain@88] - Invalid config, exiting abnormally
org.apache.zookeeper.server.quorum.QuorumPeerConfig$ConfigException: Error processing /home/syx/zookeeper-3.4.13/bin/../conf/zoo.cfg
    at org.apache.zookeeper.server.quorum.QuorumPeerConfig.parse(QuorumPeerConfig.java:156)
    at org.apache.zookeeper.server.quorum.QuorumPeerMain.initializeAndRun(QuorumPeerMain.java:104)
    at org.apache.zookeeper.server.quorum.QuorumPeerMain.main(QuorumPeerMain.java:81)
Caused by: java.lang.NumberFormatException: For input string: "48 #hi"
    at java.lang.NumberFormatException.forInputString(NumberFormatException.java:65)
    at java.lang.Integer.parseInt(Integer.java:580)
    at java.lang.Integer.parseInt(Integer.java:615)
    at org.apache.zookeeper.server.quorum.QuorumPeerConfig.parseProperties(QuorumPeerConfig.java:211)
    at org.apache.zookeeper.server.quorum.QuorumPeerConfig.parse(QuorumPeerConfig.java:152)
    ... 2 more
Invalid config, exiting abnormally
```

2. configure: change '\t' to ' '

```
# wrong
storm.zookeeper.servers: #zookeeper节点
    - "127.0.0.1"
nimbus.seeds: ["127.0.0.1"] #nimbus进程服务器ip
storm.local.dir: "/home/xxx/apache-storm-1.2.2/data"  #需要自己创建
ui.port: 18081 #ui端口
supervisor.slots.ports: #给supervisor四个端口，即supervisor可以创建四个worker进程
    - 6700
    - 6701
    - 6702
    - 6703
```

```
# right
storm.zookeeper.servers: #zookeeper节点
 - "127.0.0.1"
nimbus.seeds: ["127.0.0.1"] #nimbus进程服务器ip
storm.local.dir: "/home/xxx/apache-storm-1.2.2/data"  #需要自己创建
ui.port: 18081 #ui端口
supervisor.slots.ports: #给supervisor四个端口，即supervisor可以创建四个worker进程
 - 6700
 - 6701
 - 6702
 - 6703
```