前期热身报告

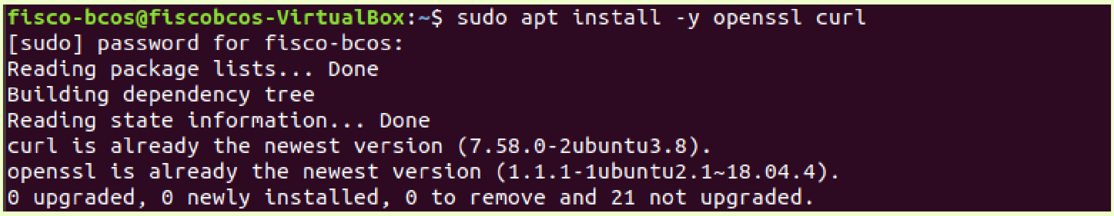
准备环境

- **安装依赖**

`build_chain.sh`脚本依赖于`openssl, curl`，使用下面的指令安装。若为CentOS，将下面命令中的`apt`替换为`yum`执行即可。macOS执行`brew install openssl curl`即可。

FISCO BCOS所需的必要安装和配置
先在Vbox上复制安装了老师提供的虚拟机，配置好网络，一个是NAT，一个是host-only，之前在云计算课程中配置过的，所以直接用了

```
sudo apt install -y openssl curl
```



```
fisco-bcos@fiscobcos-VirtualBox:~$ sudo apt install -y openssl curl
[sudo] password for fisco-bcos:
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.58.0-2ubuntu3.8).
openssl is already the newest version (1.1.1-1ubuntu2.1~18.04.4).
0 upgraded, 0 newly installed, 0 to remove and 21 not upgraded.
```

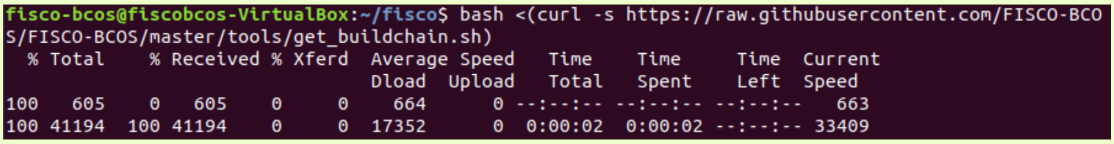
- 创建操作目录

```
cd ~ && mkdir -p fisco && cd fisco
```

```
fisco-bcos@fiscobcos-VirtualBox:~$ cd ~ && mkdir -p fisco && cd fisco
```

- 下载`build_chain.sh`脚本

```
bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/FISCO-BCOS/master/tools/get_buildchain.sh)
```

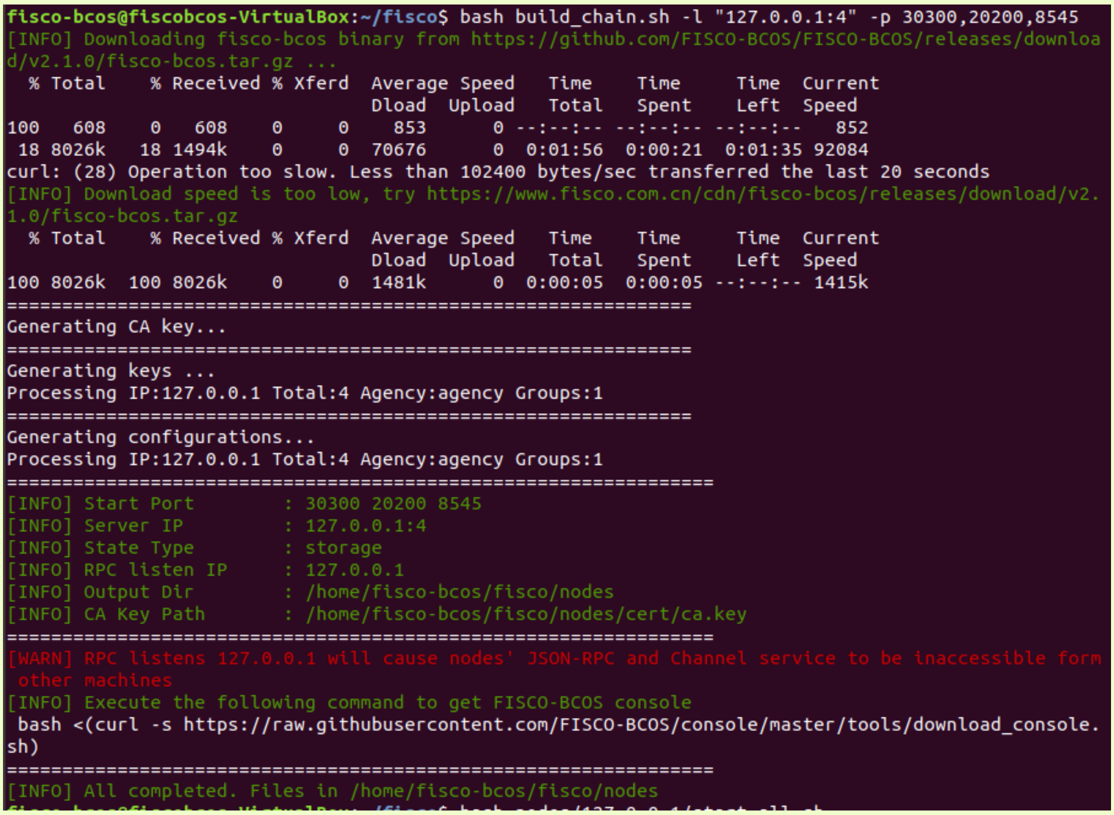


```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash <(curl -s https://raw.githubusercontent.com/FISCO-BCO
S/FISCO-BCOS/master/tools/get_buildchain.sh)
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   605    0   605    0     0    664      0 --:--:-- --:--:-- --:--:--   663
100 41194  100 41194    0     0  17352      0  0:00:02  0:00:02 --:--:-- 33409
```

搭建单群组4节点联盟链

在 fisco 目录下执行下面的指令，生成一条单群组 4 节点的 FISCO 链。请确保机器的 `30300~30303，20200~20203，8545~8548` 端口没有被占用。

```
bash build_chain.sh -l "127.0.0.1:4" -p 30300,20200,8545
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash build_chain.sh -l "127.0.0.1:4" -p 30300,20200,8545
[INFO] Downloading fisco-bcos binary from https://github.com/FISCO-BCOS/FISCO-BCOS/releases/downloa
d/v2.1.0/fisco-bcos.tar.gz ...
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   608    0   608    0     0    853      0 --:--:-- --:--:-- --:--:--   852
 18 8026k   18 1494k    0     0  70676      0  0:01:56  0:00:21  0:01:35 92084
curl: (28) Operation too slow. Less than 102400 bytes/sec transferred the last 20 seconds
[INFO] Download speed is too low, try https://www.fisco.com.cn/cdn/fisco-bcos/releases/download/v2.
1.0/fisco-bcos.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 8026k  100 8026k    0     0  1481k      0  0:00:05  0:00:05 --:--:-- 1415k
==============================================================
Generating CA key...
==============================================================
Generating keys ...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
==============================================================
Generating configurations...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
================================================================
[INFO] Start Port        : 30300 20200 8545
[INFO] Server IP         : 127.0.0.1:4
[INFO] State Type        : storage
[INFO] RPC listen IP     : 127.0.0.1
[INFO] Output Dir        : /home/fisco-bcos/fisco/nodes
[INFO] CA Key Path       : /home/fisco-bcos/fisco/nodes/cert/ca.key
================================================================
[WARN] RPC listens 127.0.0.1 will cause nodes' JSON-RPC and Channel service to be inaccessible form
 other machines
[INFO] Execute the following command to get FISCO-BCOS console
 bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/console/master/tools/download_console.
sh)
================================================================
[INFO] All completed. Files in /home/fisco-bcos/fisco/nodes
```

注解

- 其中-p 选项指定起始端口，分别是 p2p_port,channel_port,jsonrpc_port，出于安全考虑 jsonrpc/channel 默认监听 127.0.0.1，**需要外网访问请添加-i 参数**。

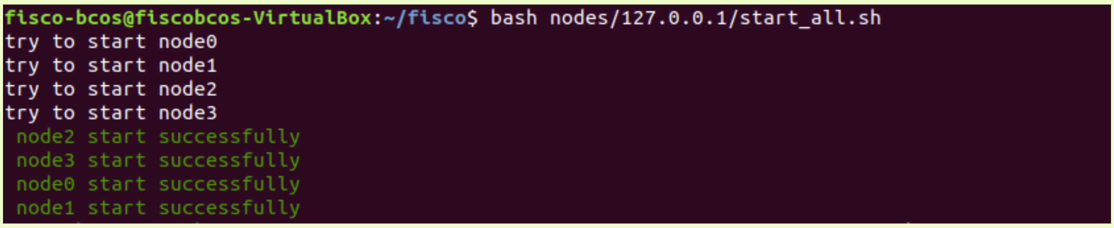
命令执行成功会输出 `All  completed`。如果执行出错，请检查 `nodes/build.log` 文件中的错误信息。

```
Checking fisco-bcos binary...
Binary check passed.
==============================================================
Generating CA key...
==============================================================
Generating keys ...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
==============================================================
Generating configurations...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
==============================================================
[INFO] Execute the following command to get FISCO-BCOS console
 bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/console/master/tools/download_console.sh)
==============================================================
[INFO] FISCO-BCOS Path   : bin/fisco-bcos
[INFO] Start Port        : 30300 20200 8545
[INFO] Server IP         : 127.0.0.1:4
[INFO] State Type        : storage
[INFO] RPC listen IP     : 127.0.0.1
[INFO] Output Dir        : /home/ubuntu16/fisco/nodes
[INFO] CA Key Path       : /home/ubuntu16/fisco/nodes/cert/ca.key
============================================================
[INFO] All completed. Files in /home/ubuntu16/fisco/nodes
```

启动 FISCO BCOS 链

- 启动所有节点

```
bash nodes/127.0.0.1/start_all.sh
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash nodes/127.0.0.1/start_all.sh
try to start node0
try to start node1
try to start node2
try to start node3
 node2 start successfully
 node3 start successfully
 node0 start successfully
 node1 start successfully
```

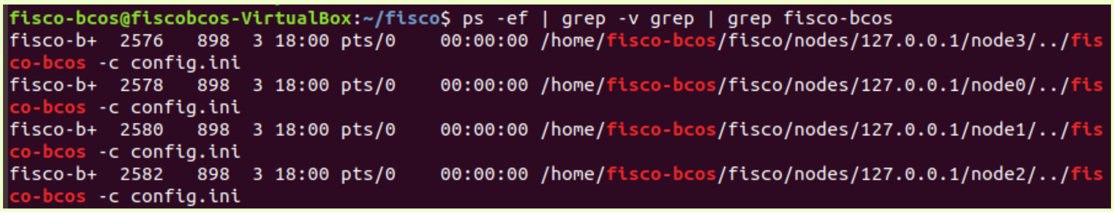
启动成功会输出类似下面内容的响应。否则请使用 `netstat -an | grep tcp` 检查机器的 `30300~30303，20200~20203，8545~8548` 端口是否被占用。

```
try to start node0
try to start node1
try to start node2
try to start node3
 node1 start successfully
 node2 start successfully
 node0 start successfully
 node3 start successfully
```

检查进程

- 检查进程是否启动

```
ps -ef | grep -v grep | grep fisco-bcos
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ ps -ef | grep -v grep | grep fisco-bcos
fisco-b+  2576   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node3/../fis
co-bcos -c config.ini
fisco-b+  2578   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node0/../fis
co-bcos -c config.ini
fisco-b+  2580   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node1/../fis
co-bcos -c config.ini
fisco-b+  2582   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node2/../fis
co-bcos -c config.ini
```

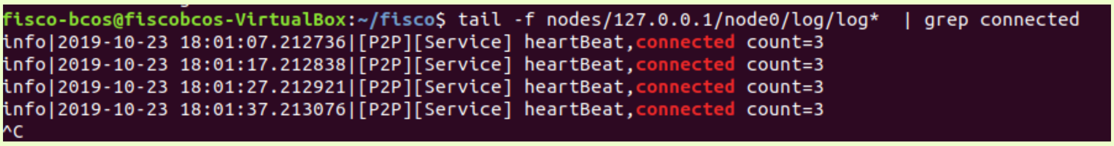
正常情况会有类似下面的输出；如果进程数不为 4，则进程没有启动（一般是端口被占用导致的）

```
fisco       5453     1   1 17:11 pts/0    00:00:02
/home/fisco/fisco/nodes/127.0.0.1/node0/../fisco-bcos -c config.ini
fisco       5459     1   1 17:11 pts/0    00:00:02
/home/fisco/fisco/nodes/127.0.0.1/node1/../fisco-bcos -c config.ini
fisco       5464     1   1 17:11 pts/0    00:00:02
/home/fisco/fisco/nodes/127.0.0.1/node2/../fisco-bcos -c config.ini
fisco       5476     1   1 17:11 pts/0    00:00:02
/home/fisco/fisco/nodes/127.0.0.1/node3/../fisco-bcos -c config.ini
```

检查日志输出

- 如下，查看节点 node0 链接的节点数

```
tail -f nodes/127.0.0.1/node0/log/log*  | grep connected
```



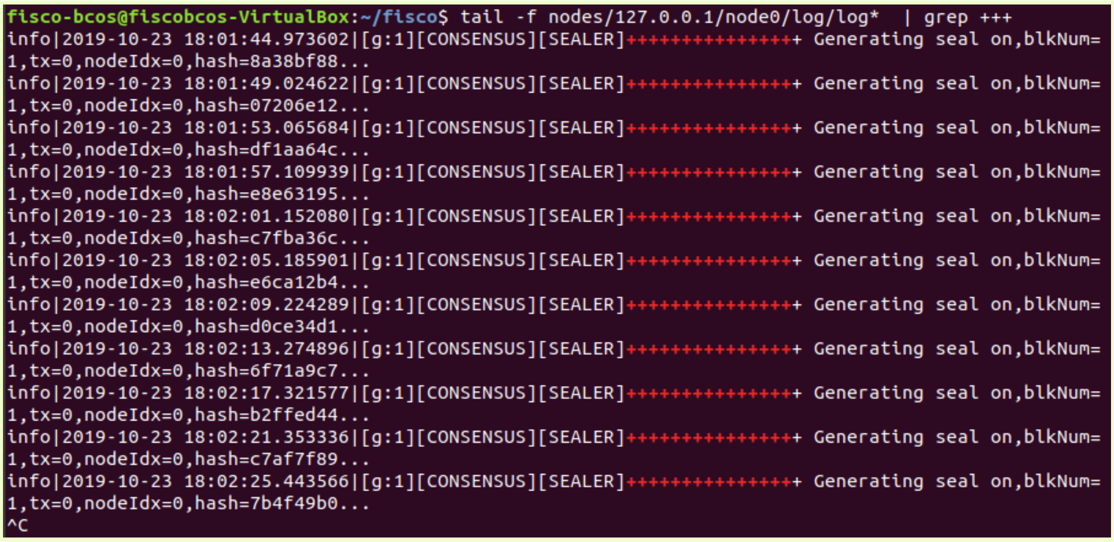
```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ tail -f nodes/127.0.0.1/node0/log/log*  | grep connected
info|2019-10-23 18:01:07.212736|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:17.212838|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:27.212921|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:37.213076|[P2P][Service] heartBeat,connected count=3
^C
```

正常情况会不停地输出链接信息，从输出可以看出 node0 与另外 3 个节点有链接。

```
info|2019-01-21 17:30:58.316769| [P2P][Service] heartBeat connected count,size=3
info|2019-01-21 17:31:08.316922| [P2P][Service] heartBeat connected count,size=3
info|2019-01-21 17:31:18.317105| [P2P][Service] heartBeat connected count,size=3
```

- 执行下面指令，检查是否在共识

```
tail -f nodes/127.0.0.1/node0/log/log*  | grep +++
```

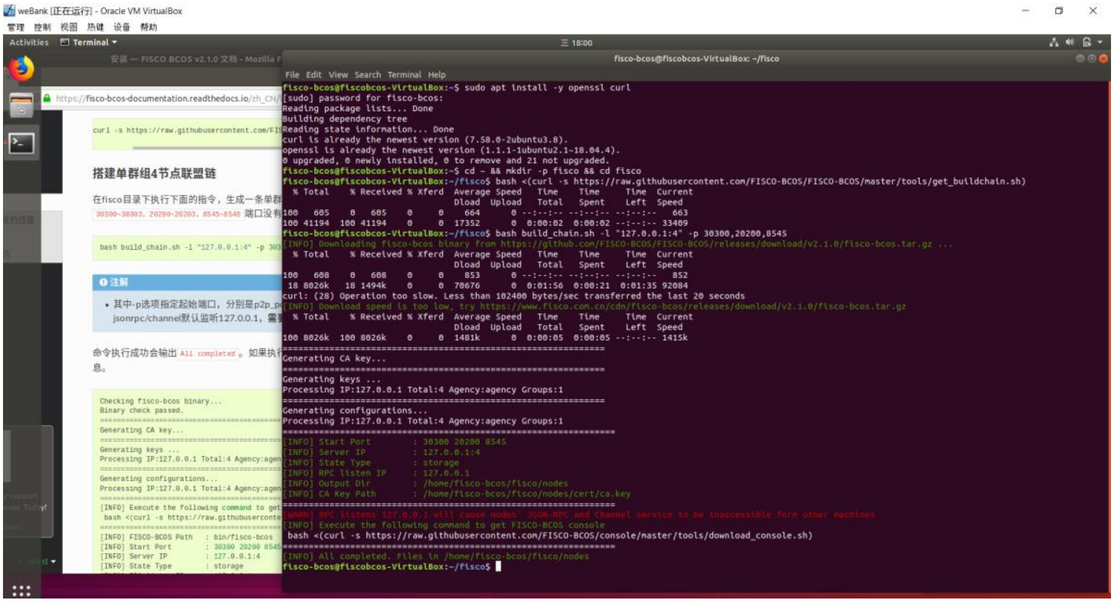


```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ tail -f nodes/127.0.0.1/node0/log/log*  | grep +++
info|2019-10-23 18:01:44.973602|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=8a38bf88...
info|2019-10-23 18:01:49.024622|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=07206e12...
info|2019-10-23 18:01:53.065684|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=df1aa64c...
info|2019-10-23 18:01:57.109939|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=e8e63195...
info|2019-10-23 18:02:01.152080|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=c7fba36c...
info|2019-10-23 18:02:05.185901|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=e6ca12b4...
info|2019-10-23 18:02:09.224289|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=d0ce34d1...
info|2019-10-23 18:02:13.274896|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=6f71a9c7...
info|2019-10-23 18:02:17.321577|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=b2ffed44...
info|2019-10-23 18:02:21.353336|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=c7af7f89...
info|2019-10-23 18:02:25.443566|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeIdx=0,hash=7b4f49b0...
^C
```

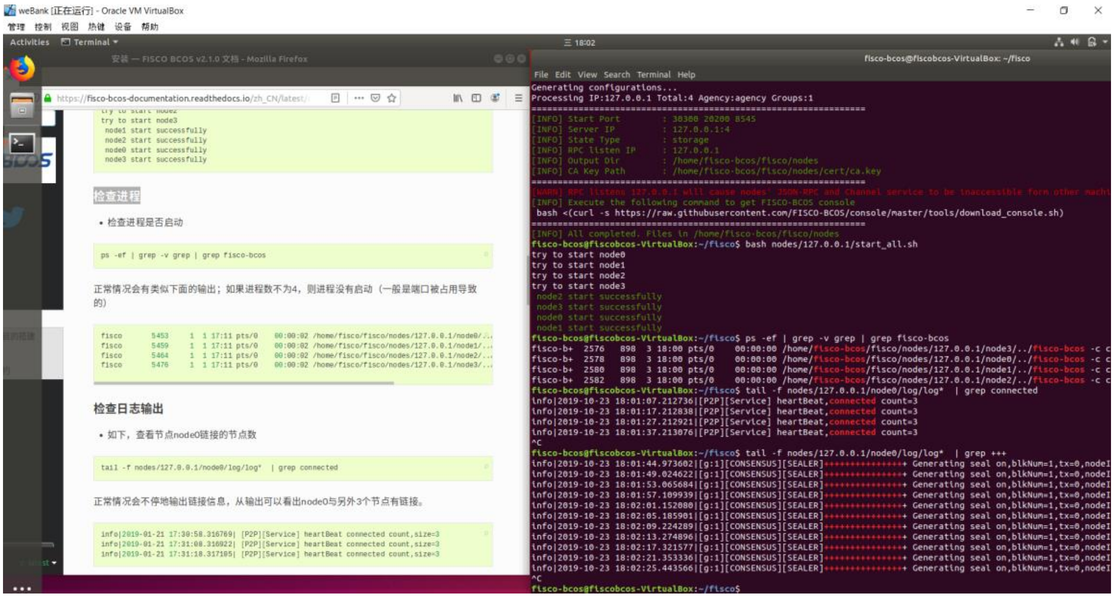
正常情况会不停输出`++++Generating seal`，表示共识正常。

```
info|2019-01-21 17:23:32.576197|
[g:1][p:264][CONSENSUS][SEALER]++++++++++++++++Generating seal
on,blkNum=1,tx=0,myIdx=2,hash=13dcd2da...
info|2019-01-21 17:23:36.592280|
[g:1][p:264][CONSENSUS][SEALER]++++++++++++++++Generating seal
on,blkNum=1,tx=0,myIdx=2,hash=31d21ab7...
info|2019-01-21 17:23:40.612241|
[g:1][p:264][CONSENSUS][SEALER]++++++++++++++++Generating seal on,
```

上述过程：


weBank [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Activities
Terminal
18:00
fisco-bcos@fiscobcos-VirtualBox: ~/fisco
File Edit View Search Terminal Help
搭建单群组4节点联盟链

```
fisco-bcos@fiscobcos-VirtualBox:~$ sudo apt install -y openssl curl
[sudo] password for fisco-bcos:
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.58.0-2ubuntu3.8).
openssl is already the newest version (1.1.1-1ubuntu2.1~18.04.4).
0 upgraded, 0 newly installed, 0 to remove and 21 not upgraded.
fisco-bcos@fiscobcos-VirtualBox:~$ cd ~ && mkdir -p fisco && cd fisco
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/FISCO-BCOS/master/tools/get_buildchain.sh)
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   605    0   605    0     0    664      0 --:--:-- --:--:-- --:--:--   663
100 41194  100 41194    0     0  17352      0  0:00:02  0:00:02 --:--:-- 33409
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash build_chain.sh -l "127.0.0.1:4" -p 30300,20200,8545
[INFO] Downloading fisco-bcos binary from https://github.com/FISCO-BCOS/FISCO-BCOS/releases/download/v2.1.0/fisco-bcos.tar.gz ...
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   608    0   608    0     0    853      0 --:--:-- --:--:-- --:--:--   852
 18 8026k   18 1494k    0     0  70676      0  0:01:56  0:00:21  0:01:35 92084
curl: (28) Operation too slow. Less than 102400 bytes/sec transferred the last 20 seconds
[INFO] Download speed is too low, try https://www.fisco.com.cn/cdn/fisco-bcos/releases/download/v2.1.0/fisco-bcos.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 8026k  100 8026k    0     0  1481k      0  0:00:05  0:00:05 --:--:-- 1415k
==============================================================
Generating CA key...
==============================================================
Generating keys ...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
==============================================================
Generating configurations...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
================================================================
[INFO] Start Port        : 30300 20200 8545
[INFO] Server IP         : 127.0.0.1:4
[INFO] State Type        : storage
[INFO] RPC listen IP     : 127.0.0.1
[INFO] Output Dir        : /home/fisco-bcos/fisco/nodes
[INFO] CA Key Path       : /home/fisco-bcos/fisco/nodes/cert/ca.key
================================================================
[WARN] RPC listens 127.0.0.1 will cause nodes' JSON-RPC and Channel service to be inaccessible form other machines
[INFO] Execute the following command to get FISCO-BCOS console
 bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/console/master/tools/download_console.sh)
================================================================
[INFO] All completed. Files in /home/fisco-bcos/fisco/nodes
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ 
```


weBank [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Activities
Terminal
18:02
安装 — FISCO BCOS v2.1.0 文档 - Mozilla Firefox
https://fisco-bcos-documentation.readthedocs.io/zh_CN/latest/
fisco-bcos@fiscobcos-VirtualBox: ~/fisco
File Edit View Search Terminal Help

```
try to start node2
try to start node3
 node1 start successfully
 node2 start successfully
 node0 start successfully
 node3 start successfully
```

检查进程

- 检查进程是否启动

```
ps -ef | grep -v grep | grep fisco-bcos
```

正常情况会有类似下面的输出；如果进程数不为4，则进程没有启动（一般是端口被占用导致的）

```
fisco       5453     1  1 17:11 pts/0    00:00:02 /home/fisco/fisco/nodes/127.0.0.1/node0/...
fisco       5459     1  1 17:11 pts/0    00:00:02 /home/fisco/fisco/nodes/127.0.0.1/node1/...
fisco       5464     1  1 17:11 pts/0    00:00:02 /home/fisco/fisco/nodes/127.0.0.1/node2/...
fisco       5476     1  1 17:11 pts/0    00:00:02 /home/fisco/fisco/nodes/127.0.0.1/node3/...
```

检查日志输出

- 如下，查看节点node0链接的节点数

```
tail -f nodes/127.0.0.1/node0/log/log*  | grep connected
```

正常情况会不停地输出链接信息，从输出可以看出node0与另外3个节点有链接。

```
info|2019-01-21 17:30:58.316769| [P2P][Service] heartBeat connected count,size=3
info|2019-01-21 17:31:08.316922| [P2P][Service] heartBeat connected count,size=3
info|2019-01-21 17:31:18.317105| [P2P][Service] heartBeat connected count,size=3
```

```
Generating configurations...
Processing IP:127.0.0.1 Total:4 Agency:agency Groups:1
==============================================================
[INFO] Start Port        : 30300 20200 8545
[INFO] Server IP         : 127.0.0.1:4
[INFO] State Type        : storage
[INFO] RPC listen IP     : 127.0.0.1
[INFO] Output Dir        : /home/fisco-bcos/fisco/nodes
[INFO] CA Key Path       : /home/fisco-bcos/fisco/nodes/cert/ca.key
==============================================================
[WARN] RPC listens 127.0.0.1 will cause nodes' JSON-RPC and Channel service to be inaccessible form other machi
[INFO] Execute the following command to get FISCO-BCOS console
 bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/console/master/tools/download_console.sh)
==============================================================
[INFO] All completed. Files in /home/fisco-bcos/fisco/nodes
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ bash nodes/127.0.0.1/start_all.sh
try to start node0
try to start node1
try to start node2
try to start node3
 node2 start successfully
 node3 start successfully
 node0 start successfully
 node1 start successfully
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ ps -ef | grep -v grep | grep fisco-bcos
fisco-b+  2576   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node3/../fisco-bcos -c c
fisco-b+  2578   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node0/../fisco-bcos -c c
fisco-b+  2580   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node1/../fisco-bcos -c c
fisco-b+  2582   898  3 18:00 pts/0    00:00:00 /home/fisco-bcos/fisco/nodes/127.0.0.1/node2/../fisco-bcos -c c
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ tail -f nodes/127.0.0.1/node0/log/log*  | grep connected
info|2019-10-23 18:01:07.212736|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:17.212838|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:27.212921|[P2P][Service] heartBeat,connected count=3
info|2019-10-23 18:01:37.213076|[P2P][Service] heartBeat,connected count=3
^C
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ tail -f nodes/127.0.0.1/node0/log/log*  | grep +++
info|2019-10-23 18:01:44.973602|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:01:49.024622|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:01:53.065684|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:01:57.109939|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:01.152080|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:05.185901|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:09.224289|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:13.274896|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:17.321577|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:21.353336|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
info|2019-10-23 18:02:25.443566|[g:1][CONSENSUS][SEALER]++++++++++++++++ Generating seal on,blkNum=1,tx=0,nodeI
^C
fisco-bcos@fiscobcos-VirtualBox:~/fisco$
```

配置及使用控制台

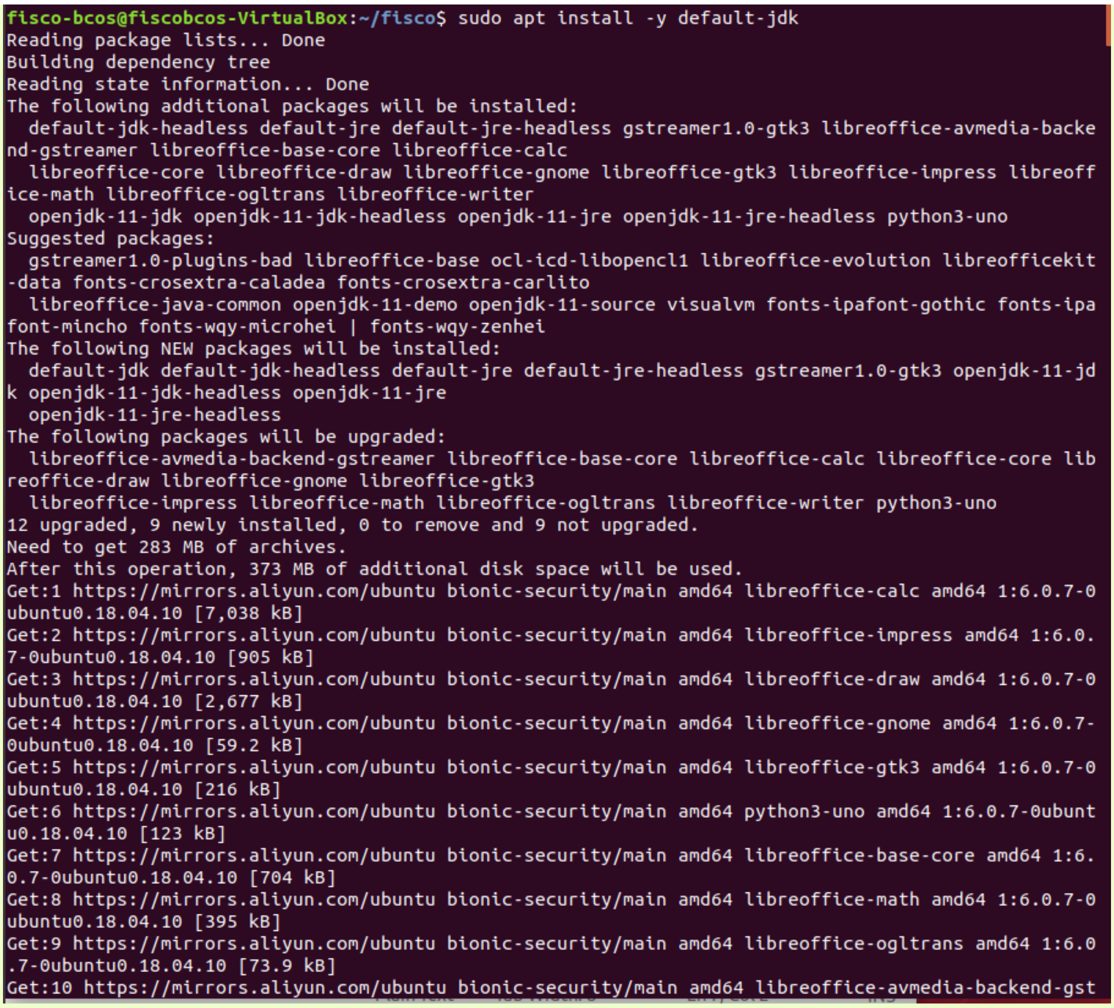
在控制台通过 Web3SDK 链接 FISCO BCOS 节点，实现**查询区块链状态、部署调用合约**等功能，能够快速获取到所需要的信息。控制台指令详细介绍参考这里。

准备依赖

- 安装 openjdk

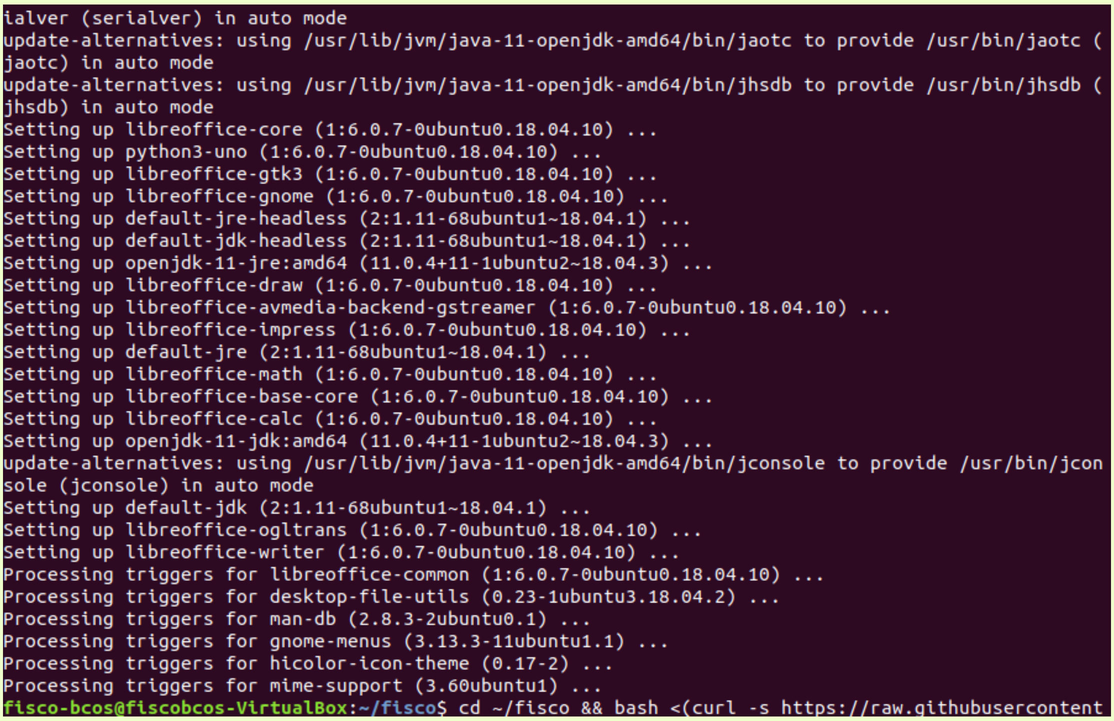
Ubuntu 使用下面命令安装 Java，CentOS 请手动安装，macOS 执行 `brew cask install java` 安装。

```
sudo apt install -y default-jdk
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ sudo apt install -y default-jdk
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  default-jdk-headless default-jre default-jre-headless gstreamer1.0-gtk3 libreoffice-avmedia-backe
nd-gstreamer libreoffice-base-core libreoffice-calc
  libreoffice-core libreoffice-draw libreoffice-gnome libreoffice-gtk3 libreoffice-impress libreoff
ice-math libreoffice-ogltrans libreoffice-writer
  openjdk-11-jdk openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless python3-uno
Suggested packages:
  gstreamer1.0-plugins-bad libreoffice-base ocl-icd-libopencl1 libreoffice-evolution libreofficekit
-data fonts-crosextra-caladea fonts-crosextra-carlito
  libreoffice-java-common openjdk-11-demo openjdk-11-source visualvm fonts-ipafont-gothic fonts-ipa
font-mincho fonts-wqy-microhei | fonts-wqy-zenhei
The following NEW packages will be installed:
  default-jdk default-jdk-headless default-jre default-jre-headless gstreamer1.0-gtk3 openjdk-11-jd
k openjdk-11-jdk-headless openjdk-11-jre
  openjdk-11-jre-headless
The following packages will be upgraded:
  libreoffice-avmedia-backend-gstreamer libreoffice-base-core libreoffice-calc libreoffice-core lib
reoffice-draw libreoffice-gnome libreoffice-gtk3
  libreoffice-impress libreoffice-math libreoffice-ogltrans libreoffice-writer python3-uno
12 upgraded, 9 newly installed, 0 to remove and 9 not upgraded.
Need to get 283 MB of archives.
After this operation, 373 MB of additional disk space will be used.
Get:1 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-calc amd64 1:6.0.7-0
ubuntu0.18.04.10 [7,038 kB]
Get:2 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-impress amd64 1:6.0.
7-0ubuntu0.18.04.10 [905 kB]
Get:3 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-draw amd64 1:6.0.7-0
ubuntu0.18.04.10 [2,677 kB]
Get:4 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-gnome amd64 1:6.0.7-
0ubuntu0.18.04.10 [59.2 kB]
Get:5 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-gtk3 amd64 1:6.0.7-0
ubuntu0.18.04.10 [216 kB]
Get:6 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 python3-uno amd64 1:6.0.7-0ubunt
u0.18.04.10 [123 kB]
Get:7 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-base-core amd64 1:6.
0.7-0ubuntu0.18.04.10 [704 kB]
Get:8 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-math amd64 1:6.0.7-0
ubuntu0.18.04.10 [395 kB]
Get:9 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-ogltrans amd64 1:6.0
.7-0ubuntu0.18.04.10 [73.9 kB]
Get:10 https://mirrors.aliyun.com/ubuntu bionic-security/main amd64 libreoffice-avmedia-backend-gst
```

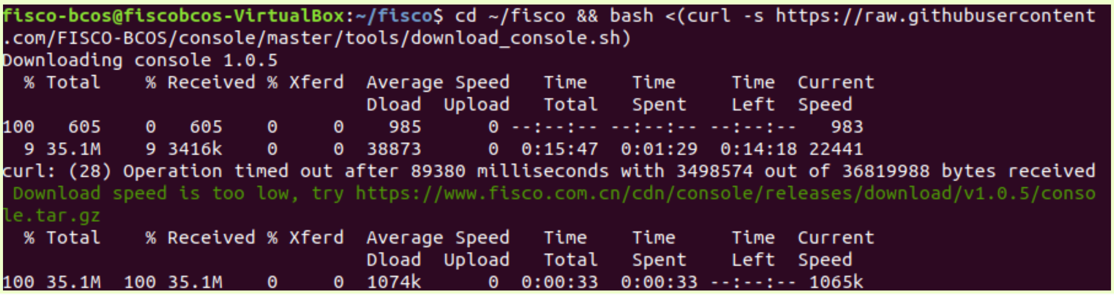
……



```
ialver (serialver) in auto mode
update-alternatives: using /usr/lib/jvm/java-11-openjdk-amd64/bin/jaotc to provide /usr/bin/jaotc (
jaotc) in auto mode
update-alternatives: using /usr/lib/jvm/java-11-openjdk-amd64/bin/jhsdb to provide /usr/bin/jhsdb (
jhsdb) in auto mode
Setting up libreoffice-core (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up python3-uno (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-gtk3 (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-gnome (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up default-jre-headless (2:1.11-68ubuntu1~18.04.1) ...
Setting up default-jdk-headless (2:1.11-68ubuntu1~18.04.1) ...
Setting up openjdk-11-jre:amd64 (11.0.4+11-1ubuntu2~18.04.3) ...
Setting up libreoffice-draw (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-avmedia-backend-gstreamer (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-impress (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up default-jre (2:1.11-68ubuntu1~18.04.1) ...
Setting up libreoffice-math (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-base-core (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-calc (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up openjdk-11-jdk:amd64 (11.0.4+11-1ubuntu2~18.04.3) ...
update-alternatives: using /usr/lib/jvm/java-11-openjdk-amd64/bin/jconsole to provide /usr/bin/jcon
sole (jconsole) in auto mode
Setting up default-jdk (2:1.11-68ubuntu1~18.04.1) ...
Setting up libreoffice-ogltrans (1:6.0.7-0ubuntu0.18.04.10) ...
Setting up libreoffice-writer (1:6.0.7-0ubuntu0.18.04.10) ...
Processing triggers for libreoffice-common (1:6.0.7-0ubuntu0.18.04.10) ...
Processing triggers for desktop-file-utils (0.23-1ubuntu3.18.04.2) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for gnome-menus (3.13.3-11ubuntu1.1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for mime-support (3.60ubuntu1) ...
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cd ~/fisco && bash <(curl -s https://raw.githubusercontent
```

- 获取控制台并回到 fisco 目录

```
cd ~/fisco && bash <(curl -s https://raw.githubusercontent.com/FISCO-BCOS/console/master/tools/download_console.sh)
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cd ~/fisco && bash <(curl -s https://raw.githubusercontent
.com/FISCO-BCOS/console/master/tools/download_console.sh)
Downloading console 1.0.5
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   605    0   605    0     0    985      0 --:--:-- --:--:-- --:--:--   983
  9 35.1M    9 3416k    0     0  38873      0  0:15:47  0:01:29  0:14:18 22441
curl: (28) Operation timed out after 89380 milliseconds with 3498574 out of 36819988 bytes received
 Download speed is too low, try https://www.fisco.com.cn/cdn/console/releases/download/v1.0.5/conso
le.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 35.1M  100 35.1M    0     0  1074k      0  0:00:33  0:00:33 --:--:-- 1065k
```

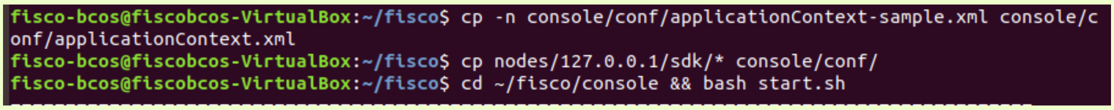
- 拷贝控制台配置文件

若节点未采用默认端口，请将文件中的 20200 替换成节点对应的 channle 端口。

```
cp -n console/conf/applicationContext-sample.xml console/conf/applicationContext.xml
```

- 配置控制台证书

```
cp nodes/127.0.0.1/sdk/* console/conf/
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cp -n console/conf/applicationContext-sample.xml console/c
onf/applicationContext.xml
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cp nodes/127.0.0.1/sdk/* console/conf/
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cd ~/fisco/console && bash start.sh
```

重要

- 如果控制台配置正确，但是在 CentOS 系统上启动控制台出现如下错误：

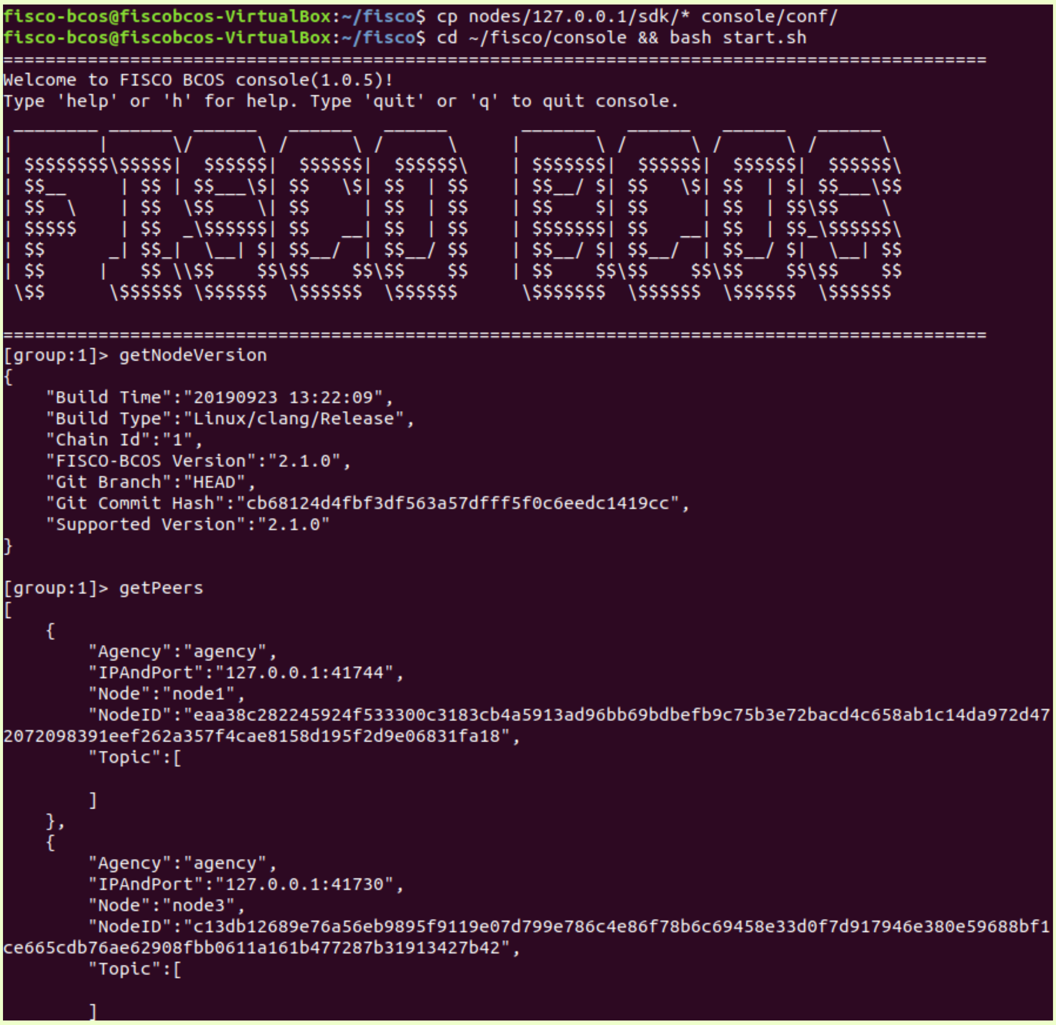
> Failed to connect to the node. Please check the node status and the console configuration.

是因为使用了 CentOS 系统自带的 JDK 版本(会导致控制台与区块链节点认证失败)，请从 OpenJDK 官网 或 Oracle 官网 下载并安装 Java 8 或以上版本(具体安装步骤 参考附录)，安装完毕后再启动控制台。

启动控制台

- 启动

```
cd ~/fisco/console && bash start.sh
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cp nodes/127.0.0.1/sdk/* console/conf/
fisco-bcos@fiscobcos-VirtualBox:~/fisco$ cd ~/fisco/console && bash start.sh
=============================================================================================
Welcome to FISCO BCOS console(1.0.5)!
Type 'help' or 'h' for help. Type 'quit' or 'q' to quit console.
 ________ ______  ______   ______   ______        _______   ______   ______   ______
|        |      \/      \ /      \ /      \      |       \ /      \ /      \ /      \
| $$$$$$$$\$$$$$|  $$$$$$|  $$$$$$|  $$$$$$\     | $$$$$$$|  $$$$$$|  $$$$$$|  $$$$$$\
| $$__     | $$ | $$___\$| $$   \$| $$  | $$     | $$__/ $| $$   \$| $$  | $| $$___\$$
| $$  \    | $$  \$$    \| $$     | $$  | $$     | $$    $| $$     | $$  | $$\$$    \
| $$$$$    | $$  _\$$$$$$| $$   __| $$  | $$     | $$$$$$$| $$   __| $$  | $$_\$$$$$$\
| $$      _| $$_|  \__| $| $$__/  | $$__/ $$     | $$__/ $| $$__/  | $$__/ $|  \__| $$
| $$     |   $$ \\$$    $$\$$    $$\$$    $$     | $$    $$\$$    $$\$$    $$\$$    $$
 \$$      \$$$$$$ \$$$$$$  \$$$$$$  \$$$$$$       \$$$$$$$  \$$$$$$  \$$$$$$  \$$$$$$

=============================================================================================
[group:1]> getNodeVersion
{
    "Build Time":"20190923 13:22:09",
    "Build Type":"Linux/clang/Release",
    "Chain Id":"1",
    "FISCO-BCOS Version":"2.1.0",
    "Git Branch":"HEAD",
    "Git Commit Hash":"cb68124d4fbf3df563a57dfff5f0c6eedc1419cc",
    "Supported Version":"2.1.0"
}

[group:1]> getPeers
[
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41744",
        "Node":"node1",
        "NodeID":"eaa38c282245924f533300c3183cb4a5913ad96bb69bdbefb9c75b3e72bacd4c658ab1c14da972d47
2072098391eef262a357f4cae8158d195f2d9e06831fa18",
        "Topic":[

        ]
    },
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41730",
        "Node":"node3",
        "NodeID":"c13db12689e76a56eb9895f9119e07d799e786c4e86f78b6c69458e33d0f7d917946e380e59688bf1
ce665cdb76ae62908fbb0611a161b477287b31913427b42",
        "Topic":[

        ]
```

以上信息表明启动成功 否则请检查 conf/applicationContext.xml 中节点端口配置是否正确

各字段解释：

getBlockNumber	Query the number of most recent block.
getNodeVersion	Query the current node version.
getPeers	Query peers currently connected to the client.

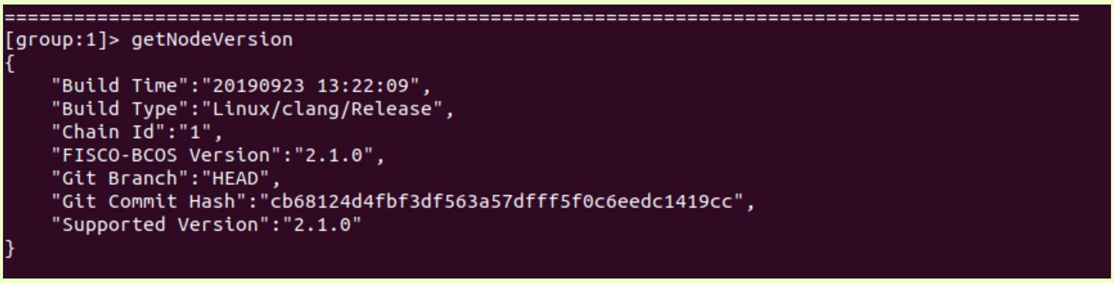
```
[group:1]> getNodeVersion
{
    "Build Time":"20190923 13:22:09",节点创建时间
    "Build Type":"Linux/clang/Release",节点类型
    "Chain Id":"1",节点号
    "FISCO-BCOS Version":"2.1.0",FISCO 版本号
    "Git Branch":"HEAD",
    "Git Commit Hash":"cb68124d4fbf3df563a57dfff5f0c6eedc1419cc",
    "Supported Version":"2.1.0"
}
```

```
[group:1]> getPeers  返回已经连接的 p2p 节点信息
[
    {
        "Agency":"agency",代理
        "IPAndPort":"127.0.0.1:41744",节点连接的 IP 和端口
        "Node":"node1",节点
    节点 ID
"NodeID":"eaa38c282245924f533300c3183cb4a5913ad96bb69bdbefb9c75b3e72bacd4c658ab1c14da
972d472072098391eef262a357f4cae8158d195f2d9e06831fa18",
        "Topic":[
            节点关注的 topic 信息
        ]
    },
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41730",
        "Node":"node3",

"NodeID":"c13db12689e76a56eb9895f9119e07d799e786c4e86f78b6c69458e33d0f7d917946e380e59
688bf1ce665cdb76ae62908fbb0611a161b477287b31913427b42",
        "Topic":[

        ]
    },
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41738",
        "Node":"node2",

"NodeID":"5d3e3c3813f67b1d790530a57b78ea7aebc9205d173152d9e897c90f0d993bd86969fe16b6e
6a8d25463c0c39dfefa90a060537850cde8cfe8007c7ab749b51f",
        "Topic":[

        ]
    }
]

[group:1]> deploy HelloWorld
contract address: 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718

[group:1]> getBlockNumber 区块高度
1
```

```
[group:1]> call HelloWorld 0xb3c223fc0bf6646959f254ac4e4a7e355b50a344 get
The contract address is incorrect.

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 get
Hello, World!

[group:1]> getBlockNumber
1

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 set
"Hello,FISCO BCOS"
transaction hash: 0x0a099fe4cb860a9d5155cae8e82bb63b4a9ae748addc1f55537819f3df98f402

[group:1]> getBlockNumber
2

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 get
Hello,FISCO BCOS

[group:1]> quit 退出
```

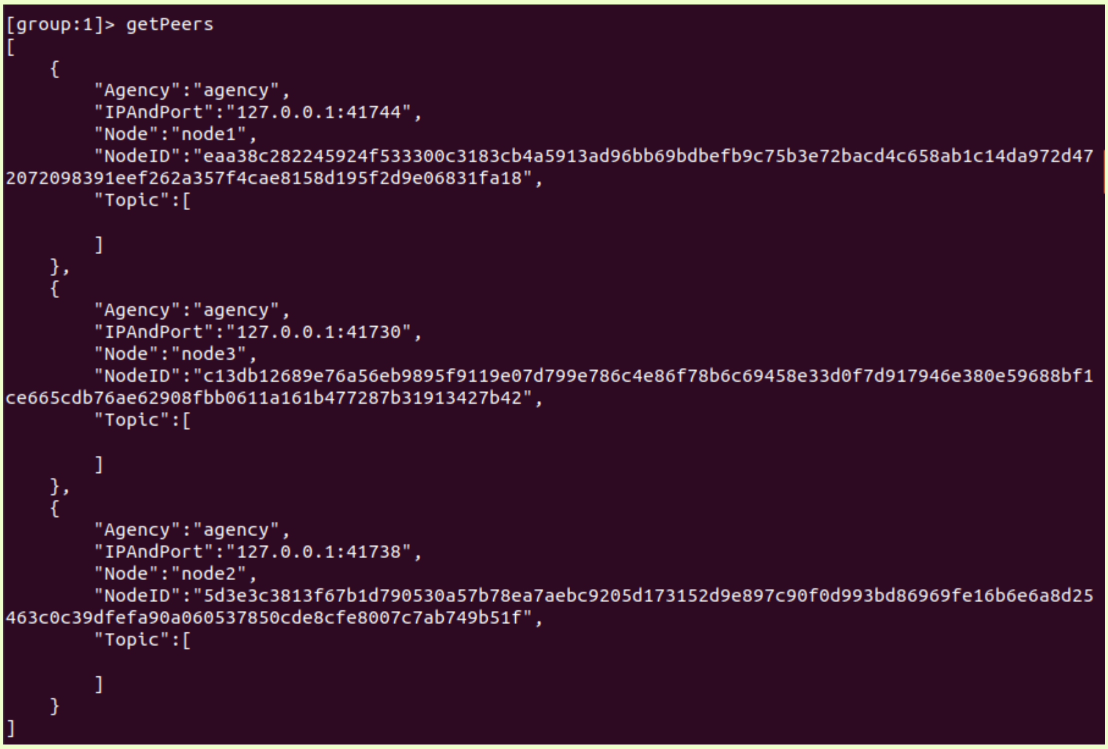
使用控制台获取信息

```
# 获取客户端版本
[group:1]> getNodeVersion
{
    "Build Time":"20190121 06:21:05",
    "Build Type":"Linux/clang/Debug",
    "FISCO-BCOS Version":"2.0.0",
    "Git Branch":"master",
    "Git Commit Hash":"c213e033328631b1b8c2ee936059d7126fd98d1a"
}
```



```
=====================================================================================================
[group:1]> getNodeVersion
{
    "Build Time":"20190923 13:22:09",
    "Build Type":"Linux/clang/Release",
    "Chain Id":"1",
    "FISCO-BCOS Version":"2.1.0",
    "Git Branch":"HEAD",
    "Git Commit Hash":"cb68124d4fbf3df563a57dfff5f0c6eedc1419cc",
    "Supported Version":"2.1.0"
}
```

```
# 获取节点链接信息
[group:1]> getPeers
[
    {
        "IPAndPort":"127.0.0.1:49948",

"NodeID":"b5872eff0569903d71330ab7bc85c5a8be03e80b70746ec33cafe27cc4f6f8a71f8c84fd8af9d
7912cb5ba068901fe4131ef69b74cc773cdfb318ab11968e41f",
        "Topic":[]
    },
    {
        "IPAndPort":"127.0.0.1:49940",

"NodeID":"912126291183b673c537153cf19bf5512d5355d8edea7864496c257630d01103d89ae26d17740
daebdd20cbc645c9a96d23c9fd4c31d16bccf1037313f74bb1d",
        "Topic":[]
    },
    {
        "IPAndPort":"127.0.0.1:49932",

"NodeID":"db75ab16ed7afa966447c403ca2587853237b0d9f942ba6fa551dc67ed6822d88da01a1e4da9b
51aedafb8c64e9d208d9d3e271f8421f4813dcbc96a07d6a603",
        "Topic":[]
    }
]
```



```
[group:1]> getPeers
[
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41744",
        "Node":"node1",
        "NodeID":"eaa38c282245924f533300c3183cb4a5913ad96bb69bdbefb9c75b3e72bacd4c658ab1c14da972d47
2072098391eef262a357f4cae8158d195f2d9e06831fa18",
        "Topic":[

        ]
    },
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41730",
        "Node":"node3",
        "NodeID":"c13db12689e76a56eb9895f9119e07d799e786c4e86f78b6c69458e33d0f7d917946e380e59688bf1
ce665cdb76ae62908fbb0611a161b477287b31913427b42",
        "Topic":[

        ]
    },
    {
        "Agency":"agency",
        "IPAndPort":"127.0.0.1:41738",
        "Node":"node2",
        "NodeID":"5d3e3c3813f67b1d790530a57b78ea7aebc9205d173152d9e897c90f0d993bd86969fe16b6e6a8d25
463c0c39dfefa90a060537850cde8cfe8007c7ab749b51f",
        "Topic":[

        ]
    }
]
```

部署及调用 HelloWorld 合约

HelloWorld 合约

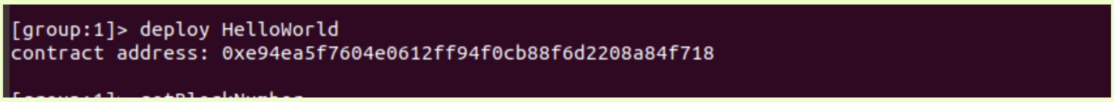
HelloWorld 合约提供两个接口，分别是 `get()` 和 `set()`，用于获取/设置合约变量 `name`。合约内容如下:

```
pragma solidity ^0.4.24;

contract HelloWorld {
    string name;

    function HelloWorld() {
        name = "Hello, World!";
    }

    function get()constant returns(string) {
        return name;
    }

    function set(string n) {
        name = n;
    }
}
```

部署 HelloWorld 合约

为了方便用户快速体验，HelloWorld 合约已经内置于控制台中，位于控制台目录下 `solidity/contracts/HelloWorld.sol`，参考下面命令部署即可。

```
# 在控制台输入以下指令 部署成功则返回合约地址
[group:1]> deploy HelloWorld
contract address:0xb3c223fc0bf6646959f254ac4e4a7e355b50a344
```

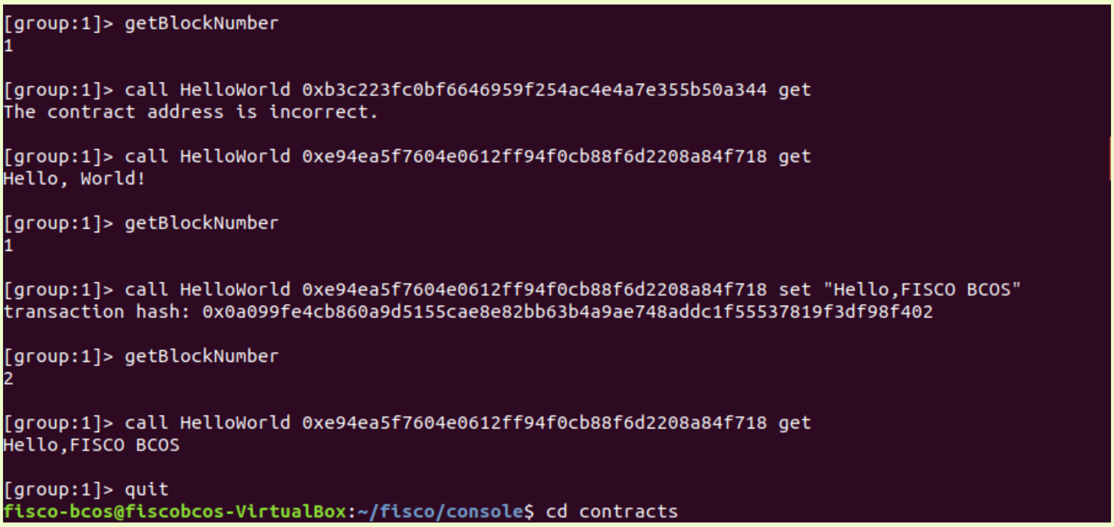


```
[group:1]> deploy HelloWorld
contract address: 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718
```

调用 HelloWorld 合约

```
# 查看当前块高
[group:1]> getBlockNumber
1
# 调用 get 接口获取 name 变量 此处的合约地址是 deploy 指令返回的地址
```

```
[group:1]> call HelloWorld 0xb3c223fc0bf6646959f254ac4e4a7e355b50a344 get
Hello, World!

# 查看当前块高，块高不变，因为 get 接口不更改账本状态
[group:1]> getBlockNumber
1

# 调用 set 设置 name
[group:1]> call HelloWorld 0xb3c223fc0bf6646959f254ac4e4a7e355b50a344 set "Hello, FISCO BCOS"
0x21dca087cb3e44f44f9b882071ec6ecfcb500361cad36a52d39900ea359d0895

# 再次查看当前块高，块高增加表示已出块，账本状态已更改
[group:1]> getBlockNumber
2

# 调用 get 接口获取 name 变量，检查设置是否生效
[group:1]> call HelloWorld 0xb3c223fc0bf6646959f254ac4e4a7e355b50a344 get
Hello, FISCO BCOS

# 退出控制台
[group:1]> quit
```



```
[group:1]> getBlockNumber
1

[group:1]> call HelloWorld 0xb3c223fc0bf6646959f254ac4e4a7e355b50a344 get
The contract address is incorrect.

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 get
Hello, World!

[group:1]> getBlockNumber
1

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 set "Hello,FISCO BCOS"
transaction hash: 0x0a099fe4cb860a9d5155cae8e82bb63b4a9ae748addc1f55537819f3df98f402

[group:1]> getBlockNumber
2

[group:1]> call HelloWorld 0xe94ea5f7604e0612ff94f0cb88f6d2208a84f718 get
Hello,FISCO BCOS

[group:1]> quit
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ cd contracts
```

注：

1. 部署合约还可以通过 `deployByCNS` 命令，可以指定部署的合约版本号，使用方式参考这里。
2. 调用合约通过 `callByCNS` 命令，使用方式参考这里。

接下来是构建第一个区块链应用：

构建第一个区块链应用

本章将会介绍一个基于 FISCO BCOS 区块链的业务应用场景开发全过程，从业务场景分析，到合约的设计实现，然后介绍合约编译以及如何部署到区块链，最后介绍一个应用模块的实现，通过我们提供的 Web3SDK 实现对区块链上合约的调用访问。

本教程要求用户熟悉 Linux 操作环境，具备 Java 开发的基本技能，能够使用 Gradle 工具，熟悉 Solidity 语法。

通过学习教程，你将会了解到以下内容：

1. 如何将一个业务场景的逻辑用合约的形式表达
2. 如何将 Solidity 合约转化成 Java 类
3. 如何配置 Web3SDK
4. 如何构建一个应用，并集成 Web3SDK 到应用工程
5. 如何通过 Web3SDK 调用合约接口，了解 Web3SDK 调用合约接口的原理

教程中会提供示例的完整项目源码，用户可以在此基础上快速开发自己的应用。

重要

请参考 安装文档 完成 FISCO BCOS 区块链的搭建和控制台的下载工作，本教程中的操作假设在该文档搭建的环境下进行。

示例应用需求

区块链天然具有防篡改，可追溯等特性，这些特性决定其更容易受金融领域的青睐，本文将会提供一个简易的资产管理的开发示例，并最终实现以下功能：

- 能够在区块链上进行资产注册
- 能够实现不同账户的转账
- 可以查询账户的资产金额

合约设计与实现

在区块链上进行应用开发时，结合业务需求，首先需要设计对应的智能合约，确定合约需要储存的数据，在此基础上确定智能合约对外提供的接口，最后给出各个接口的具体实现。

存储设计

FISCO BCOS 提供合约 CRUD 接口开发模式，可以通过合约创建表，并对创建的表进行增删改查操作。针对本应用需要设计一个存储资产管理的表 `t_asset`，该表字段如下：

- account: 主键，资产账户(string 类型)
- asset_value: 资产金额(uint256 类型)

其中 account 是主键，即操作 `t_asset` 表时需要传入的字段，区块链根据该主键字段查询表中匹配的记录。`t_asset` 表示例如下：

account	asset_value
Alice	10000
Bob	20000

接口设计

按照业务的设计目标，需要实现资产注册，转账，查询功能，对应功能的接口如下：

```
// 查询资产金额
function select(string account) public constant returns(int256, uint256)
// 资产注册
function register(string account, uint256 amount) public returns(int256)
// 资产转移
function transfer(string from_asset_account, string to_asset_account, uint256 amount)
public returns(int256)
```

完整源码

```
pragma solidity ^0.4.24;

import "./Table.sol";

contract Asset {
    // event
    event RegisterEvent(int256 ret, string account, uint256 asset_value);
    event TransferEvent(int256 ret, string from_account, string to_account, uint256 
amount);

    constructor() public {
        // 构造函数中创建 t_asset 表
        createTable();
    }

    function createTable() private {
        TableFactory tf = TableFactory(0x1001);
        // 资产管理表, key : account, field : asset_value
        // |  资产账户(主键)      |     资产金额       |
        // |-------------------- |-------------------|
        // |        account      |     asset_value    |
        // |---------------------|-------------------|
        //
        // 创建表
        tf.createTable("t_asset", "account", "asset_value");
    }

    function openTable() private returns(Table) {
        TableFactory tf = TableFactory(0x1001);
        Table table = tf.openTable("t_asset");
        return table;
    }

    /*
    描述 : 根据资产账户查询资产金额
    参数 :
            account : 资产账户

    返回值:
            参数一：  成功返回0, 账户不存在返回-1
            参数二：  第一个参数为0时有效，资产金额
    */
    function select(string account) public constant returns(int256, uint256) {
        // 打开表
        Table table = openTable();
        // 查询
        Entries entries = table.select(account, table.newCondition());
        uint256 asset_value = 0;
        if (0 == uint256(entries.size())) {
            return (-1, asset_value);
        } else {
            Entry entry = entries.get(0);
            return (0, uint256(entry.getInt("asset_value")));
        }
    }

    /*
    描述 : 资产注册
    参数 :
            account : 资产账户
            amount  : 资产金额
    返回值:
            0  资产注册成功
            -1 资产账户已存在
            -2 其他错误
    */
    function register(string account, uint256 asset_value) public returns(int256){
        int256 ret_code = 0;
        int256 ret= 0;
        uint256 temp_asset_value = 0;
        // 查询账户是否存在
        (ret, temp_asset_value) = select(account);
        if(ret != 0) {
            Table table = openTable();

            Entry entry = table.newEntry();
            entry.set("account", account);
            entry.set("asset_value", int256(asset_value));
            // 插入
            int count = table.insert(account, entry);
            if (count == 1) {
                // 成功
                ret_code = 0;
            } else {
                // 失败? 无权限或者其他错误
                ret_code = -2;
            }
        } else {
            // 账户已存在
            ret_code = -1;
        }

        emit RegisterEvent(ret_code, account, asset_value);

        return ret_code;
    }

    /*
    描述 : 资产转移
    参数 :
            from_account : 转移资产账户
            to_account ：  接收资产账户
            amount ：  转移金额
    返回值：
            0  资产转移成功
            -1 转移资产账户不存在
            -2 接收资产账户不存在
            -3 金额不足
            -4 金额溢出
            -5 其他错误
    */
    function transfer(string from_account, string to_account, uint256 amount) public returns(int256) {
        // 查询转移资产账户信息
        int ret_code = 0;
        int256 ret = 0;
        uint256 from_asset_value = 0;
        uint256 to_asset_value = 0;

        // 转移账户是否存在?
        (ret, from_asset_value) = select(from_account);
        if(ret != 0) {
            ret_code = -1;
            // 转移账户不存在
            emit TransferEvent(ret_code, from_account, to_account, amount);
            return ret_code;
        }

        // 接受账户是否存在?
        (ret, to_asset_value) = select(to_account);
        if(ret != 0) {
            ret_code = -2;
            // 接收资产的账户不存在
            emit TransferEvent(ret_code, from_account, to_account, amount);
            return ret_code;
        }

        if(from_asset_value < amount) {
            ret_code = -3;
            // 转移资产的账户金额不足
            emit TransferEvent(ret_code, from_account, to_account, amount);
            return ret_code;
        }

        if (to_asset_value + amount < to_asset_value) {
            ret_code = -4;
            // 接收账户金额溢出
            emit TransferEvent(ret_code, from_account, to_account, amount);
            return ret_code;
        }

        Table table = openTable();

        Entry entry0 = table.newEntry();
        entry0.set("account", from_account);
        entry0.set("asset_value", int256(from_asset_value - amount));
        // 更新转账账户
        int count = table.update(from_account, entry0, table.newCondition());
        if(count != 1) {
            ret_code = -5;
            // 失败? 无权限或者其他错误?
            emit TransferEvent(ret_code, from_account, to_account, amount);
            return ret_code;
        }

        Entry entry1 = table.newEntry();
        entry1.set("account", to_account);
        entry1.set("asset_value", int256(to_asset_value + amount));
        // 更新接收账户
        table.update(to_account, entry1, table.newCondition());
        emit TransferEvent(ret_code, from_account, to_account, amount);

        return ret_code;
    }
}
```

注： `Asset.sol`合约的实现需要引入 FISCO BCOS 提供的一个系统合约接口文件 `Table.sol` ，该系统合约文件中的接口由 FISCO BCOS 底层实现。当业务合约需要操作 CRUD 接口时，均需要引入该接口合约文件。`Table.sol` 合约详细接口参考这里。

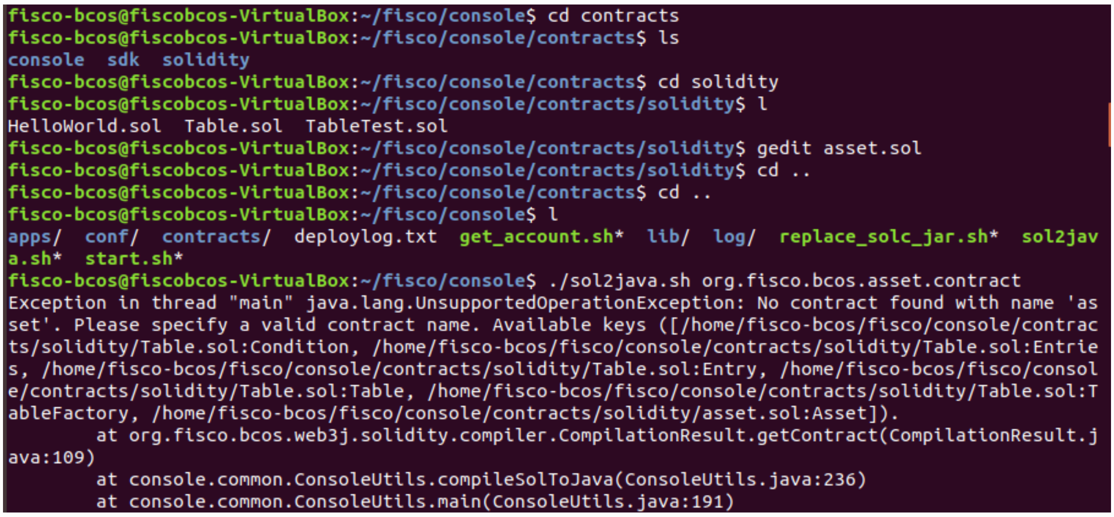
合约编译

上一小节，我们根据业务需求设计了合约`Asset.sol`的存储与接口，给出了完整实现，但是 Java 程序无法直接调用 Solidity 合约，需要先将 Solidity 合约文件编译为 Java 文件。

控制台提供了编译工具，可以将`Asset.sol`合约文件存放在`console/contracts/solidity`目录。利用 console 目录下提供的`sol2java.sh`脚本进行编译，操作如下：

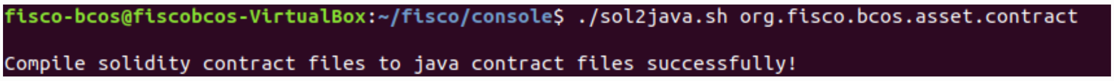
```
# 切换到 fisco/console/目录
$ cd ~/fisco/console/
# 编译合约，后面指定一个 Java 的包名参数，可以根据实际项目路径指定包名
$ ./sol2java.sh org.fisco.bcos.asset.contract
```

这里遇到了一个问题，就是一开始我编译合约后报错说找不到 asset 合约，检查多次之后发现是把文件名写错了，把 Asset.sol 写成了 asset.sol 所以一直编译不过：



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ cd contracts
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts$ ls
console  sdk  solidity
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts$ cd solidity
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts/solidity$ l
HelloWorld.sol  Table.sol  TableTest.sol
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts/solidity$ gedit asset.sol
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts/solidity$ cd ..
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console/contracts$ cd ..
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ l
apps/  conf/  contracts/  deploylog.txt  get_account.sh*  lib/  log/  replace_solc_jar.sh*  sol2jav
a.sh*  start.sh*
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ./sol2java.sh org.fisco.bcos.asset.contract
Exception in thread "main" java.lang.UnsupportedOperationException: No contract found with name 'as
set'. Please specify a valid contract name. Available keys ([/home/fisco-bcos/fisco/console/contrac
ts/solidity/Table.sol:Condition, /home/fisco-bcos/fisco/console/contracts/solidity/Table.sol:Entrie
s, /home/fisco-bcos/fisco/console/contracts/solidity/Table.sol:Entry, /home/fisco-bcos/fisco/consol
e/contracts/solidity/Table.sol:Table, /home/fisco-bcos/fisco/console/contracts/solidity/Table.sol:T
ableFactory, /home/fisco-bcos/fisco/console/contracts/solidity/asset.sol:Asset]).
        at org.fisco.bcos.web3j.solidity.compiler.CompilationResult.getContract(CompilationResult.j
ava:109)
        at console.common.ConsoleUtils.compileSolToJava(ConsoleUtils.java:236)
        at console.common.ConsoleUtils.main(ConsoleUtils.java:191)
```

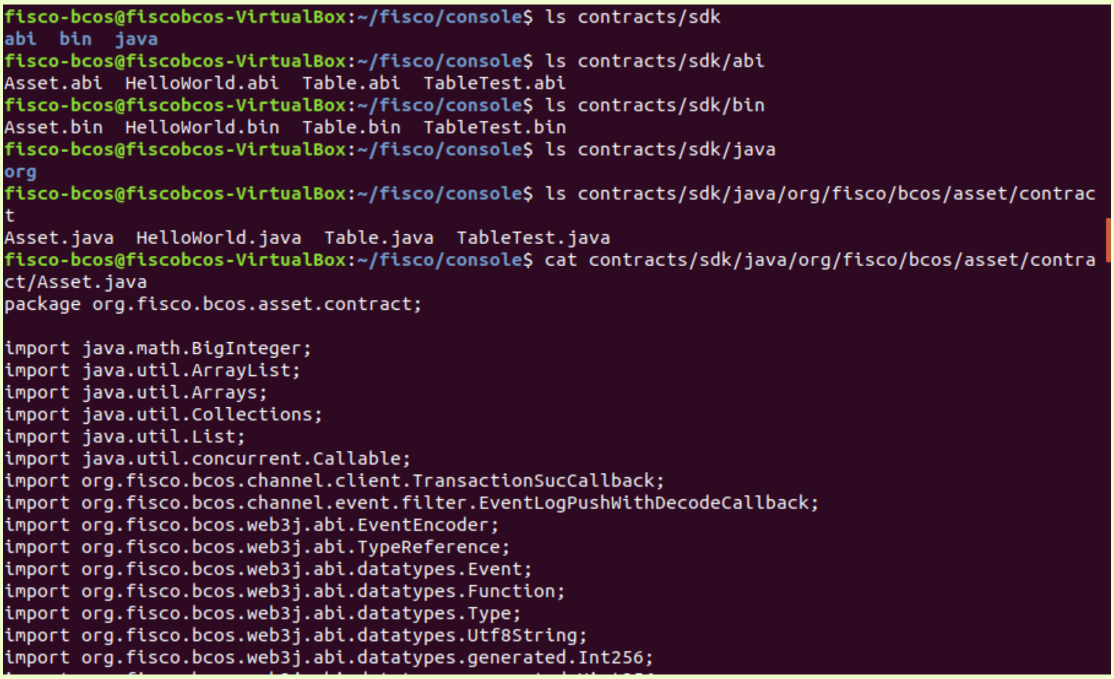
更改之后删除 asset.sol 后成功编译：



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ./sol2java.sh org.fisco.bcos.asset.contract

Compile solidity contract files to java contract files successfully!
```

运行成功之后，将会在 `console/contracts/sdk` 目录生成 java、abi 和 bin 目录，如下所示。

```
|-- abi # 生成的 abi 目录，存放 solidity 合约编译生成的 abi 文件
|   |-- Asset.abi
|   |-- Table.abi
|-- bin # 生成的 bin 目录，存放 solidity 合约编译生成的 bin 文件
|   |-- Asset.bin
|   |-- Table.bin
|-- contracts # 存放 solidity 合约源码文件，将需要编译的合约拷贝到该目录下
|   |-- Asset.sol # 拷贝进来的 Asset.sol 合约，依赖 Table.sol
|   |-- Table.sol # 默认提供的系统 CRUD 合约接口文件
|-- java  # 存放编译的包路径及 Java 合约文件
|   |-- org
|        |--fisco
|             |--bcos
|                  |--asset
|                       |--contract
|                             |--Asset.java  # Asset.sol 合约生成的 Java 文件
|                             |--Table.java  # Table.sol 合约生成的 Java 文件
|-- sol2java.sh
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk
abi  bin  java
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/abi
Asset.abi  HelloWorld.abi  Table.abi  TableTest.abi
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/bin
Asset.bin  HelloWorld.bin  Table.bin  TableTest.bin
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/java
org
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/java/org/fisco/bcos/asset/contrac
t
Asset.java  HelloWorld.java  Table.java  TableTest.java
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ cat contracts/sdk/java/org/fisco/bcos/asset/contra
ct/Asset.java
package org.fisco.bcos.asset.contract;

import java.math.BigInteger;
import java.util.ArrayList;
import java.util.Arrays;
import java.util.Collections;
import java.util.List;
import java.util.concurrent.Callable;
import org.fisco.bcos.channel.client.TransactionSucCallback;
import org.fisco.bcos.channel.event.filter.EventLogPushWithDecodeCallback;
import org.fisco.bcos.web3j.abi.EventEncoder;
import org.fisco.bcos.web3j.abi.TypeReference;
import org.fisco.bcos.web3j.abi.datatypes.Event;
import org.fisco.bcos.web3j.abi.datatypes.Function;
import org.fisco.bcos.web3j.abi.datatypes.Type;
import org.fisco.bcos.web3j.abi.datatypes.Utf8String;
import org.fisco.bcos.web3j.abi.datatypes.generated.Int256;
```

java 目录下生成了`org/fisco/bcos/asset/contract/`包路径目录，该目录下包含`Asset.java`和`Table.java`两个文件，其中`Asset.java`是 Java 应用调用`Asset.sol`合约需要的文件。

`Asset.java`的主要接口：

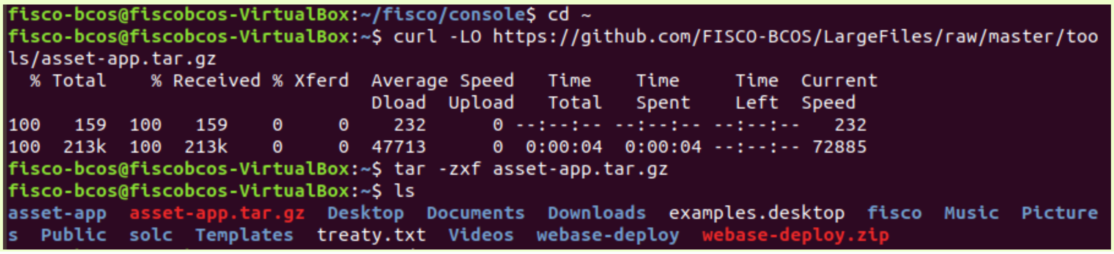
```
package org.fisco.bcos.asset.contract;

public class Asset extends Contract {
    // Asset.sol 合约 transfer 接口生成
    public RemoteCall<TransactionReceipt> transfer(String from_account, String to_account, BigInteger amount);
    // Asset.sol 合约 register 接口生成
    public RemoteCall<TransactionReceipt> register(String account, BigInteger asset_value);
    // Asset.sol 合约 select 接口生成
    public RemoteCall<Tuple2<BigInteger, BigInteger>> select(String account);

    // 加载 Asset 合约地址，生成 Asset 对象
    public static Asset load(String contractAddress, Web3j web3j, Credentials credentials, ContractGasProvider contractGasProvider);

    // 部署 Assert.sol 合约，生成 Asset 对象
    public static RemoteCall<Asset> deploy(Web3j web3j, Credentials credentials, 
ContractGasProvider contractGasProvider);
}
```

其中 load 与 deploy 函数用于构造 Asset 对象，其他接口分别用来调用对应的 solidity 合约的接口，详细使用在下文会有介绍。

SDK 配置

我们提供了一个 Java 工程项目供开发使用，首先获取 Java 工程项目：

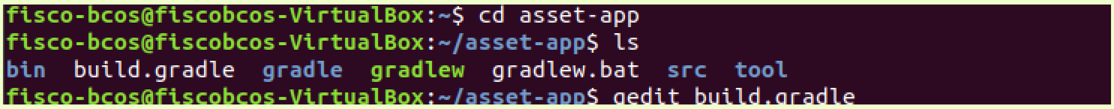
```
    # 获取 Java 工程项目压缩包
    $ cd ~
    $ curl -LO https://github.com/FISCO-BCOS/LargeFiles/raw/master/tools/asset-
app.tar.gz
    # 解压得到 Java 工程项目 asset-app 目录
    $ tar -zxf asset-app.tar.gz
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ cd ~
fisco-bcos@fiscobcos-VirtualBox:~$ curl -LO https://github.com/FISCO-BCOS/LargeFiles/raw/master/too
ls/asset-app.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   159  100   159    0     0    232      0 --:--:-- --:--:-- --:--:--   232
100  213k  100  213k    0     0  47713      0  0:00:04  0:00:04 --:--:-- 72885
fisco-bcos@fiscobcos-VirtualBox:~$ tar -zxf asset-app.tar.gz
fisco-bcos@fiscobcos-VirtualBox:~$ ls
asset-app  asset-app.tar.gz  Desktop  Documents  Downloads  examples.desktop  fisco  Music  Picture
s  Public  solc  Templates  treaty.txt  Videos  webase-deploy  webase-deploy.zip
```

asset-app 项目的目录结构如下：

```
|-- build.gradle // gradle 配置文件
|-- gradle
|   |-- wrapper
|       |-- gradle-wrapper.jar // 用于下载 Gradle 的相关代码实现
|       |-- gradle-wrapper.properties // wrapper 所使用的配置信息，比如 gradle 的版本等
信息
|-- gradlew // Linux 或者 Unix 下用于执行 wrapper 命令的 Shell 脚本
|-- gradlew.bat // Windows 下用于执行 wrapper 命令的批处理脚本
|-- src
|   |-- main
|   |   |-- java
|   |         |-- org
|   |             |-- fisco
|   |                   |-- bcos
|   |                         |-- asset
|   |                               |-- client // 放置客户端调用类
|   |                                        |-- AssetClient.java
|   |                                 |-- contract // 放置 Java 合约类
|   |                                        |-- Asset.java
|   |-- test
|       |-- resources // 存放代码资源文件
|           |-- applicationContext.xml // 项目配置文件
|           |-- contract.properties // 存储部署合约地址的文件
|           |-- log4j.properties // 日志配置文件
|           |-- contract //存放 solidity 约文件
|                    |-- Asset.sol
|                    |-- Table.sol
|
|-- tool
    |-- asset_run.sh // 项目运行脚本
```



```
fisco-bcos@fiscobcos-VirtualBox:~$ cd asset-app
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ ls
bin   build.gradle   gradle   gradlew   gradlew.bat   src   tool
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ gedit build.gradle
```

项目引入 Web3SDK

项目的`build.gradle`文件已引入 Web3SDK，不需修改。其引入方法介绍如下：

- Web3SDK 引入了以太坊的 solidity 编译器相关 jar 包，因此在`build.gradle`文件需要添加以太坊的远程仓库：

```
repositories {
    maven {
        url ”http：//maven.aliyun.com/nexus/content/groups/public/”
    }
    maven { url ”https：//dl.bintray.com/ethereum/maven/” }
    mavenCentral()
}
```

- 引入 Web3SDK jar 包

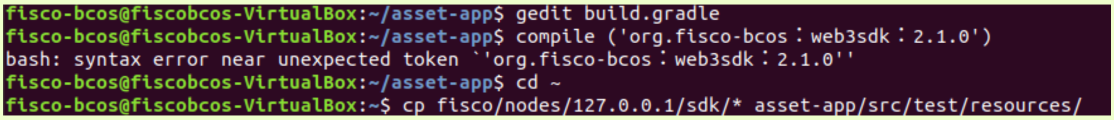
```
compile ('org.fisco-bcos：web3sdk：2.1.0')
```

证书与配置文件

- 区块链节点证书配置

拷贝区块链节点对应的 SDK 证书

```
# 进入~目录
# 拷贝节点证书到项目的资源目录
$ cd ~
$ cp fisco/nodes/127.0.0.1/sdk/* asset-app/src/test/resources/
```



```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ gedit build.gradle
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ compile ('org.fisco-bcos：web3sdk：2.1.0')
bash: syntax error near unexpected token `'org.fisco-bcos：web3sdk：2.1.0''
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ cd ~
fisco-bcos@fiscobcos-VirtualBox:~$ cp fisco/nodes/127.0.0.1/sdk/* asset-app/src/test/resources/
```

- applicationContext.xml

注意： 如果搭链时设置的 rpc_listen_ip 为 127.0.0.1 或者 0.0.0.0，channel_port 为 20200， 则 `applicationContext.xml` 配置不用修改。若区块链节点配置有改动，需要同样修改配置 `applicationContext.xml`，具体请参考 SDK 使用文档。

业务开发

我们已经介绍了如何在自己的项目中引入以及配置 Web3SDK，本节介绍如何通过 Java 程序调用合约，同样以示例的资产管理说明。asset-app 项目已经包含示例的完整源码，用户可以直接使用，现在介绍核心类 `AssetClient` 的设计与实现。

`AssetClient.java`： 通过调用 `Asset.java` 实现对合约的部署与调用，路径 `/src/main/java/org/fisco/bcos/asset/client`，初始化以及调用流程都在该类中进行。

- 初始化

初始化代码的主要功能为构造 Web3j 与 Credentials 对象，这两个对象在创建对应的合约类对象(调用合约类的 deploy 或者 load 函数)时需要使用。

```
// 函数 initialize 中进行初始化
```

```
ApplicationContext context = new
ClassPathXmlApplicationContext("classpath:applicationContext.xml");
Service service = context.getBean(Service.class);
service.run();
ChannelEthereumService channelEthereumService = new ChannelEthereumService();
channelEthereumService.setChannelService(service);
// 初始化 Web3j 对象
Web3j web3j = Web3j.build(channelEthereumService, 1);
// 初始化 Credentials 对象
Credentials credentials = Credentials.create(Keys.createEcKeyPair());
```

- 构造合约类对象

可以使用 deploy 或者 load 函数初始化合约对象，两者使用场景不同，前者适用于初次部署合约，后者在合约已经部署并且已知合约地址时使用。

```
// 部署合约
Asset asset = Asset.deploy(web3j, credentials, new StaticGasProvider(gasPrice,
gasLimit)).send();
// 加载合约地址
Asset asset = Asset.load(contractAddress, web3j, credentials, new
StaticGasProvider(gasPrice, gasLimit));
```

- 接口调用

使用合约对象调用对应的接口，处理返回结果。

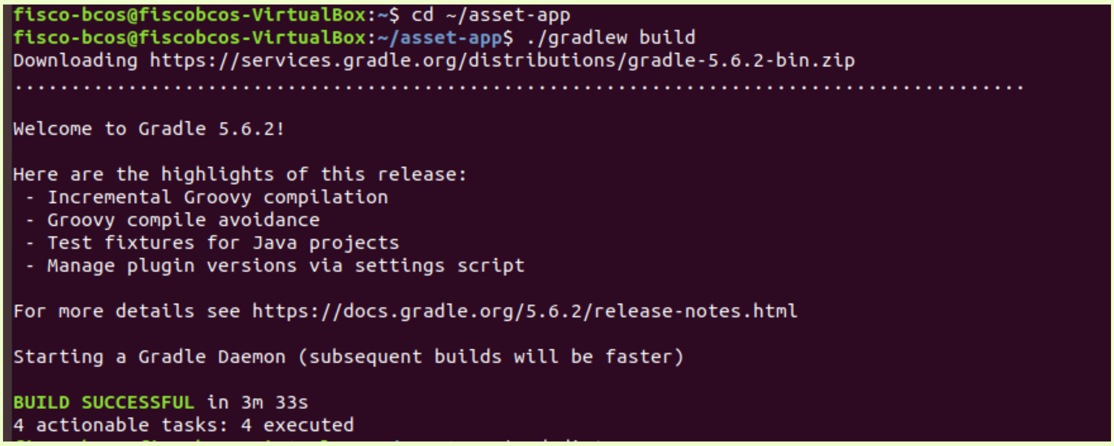
```
// select 接口调用
Tuple2<BigInteger, BigInteger> result = asset.select(assetAccount).send();
// register 接口调用
TransactionReceipt receipt = asset.register(assetAccount, amount).send();
// transfer 接口
TransactionReceipt receipt = asset.transfer(fromAssetAccount, toAssetAccount,
amount).send();
```

运行

至此我们已经介绍使用区块链开发资产管理应用的所有流程并实现了功能，接下来可以运行项目，测试功能是否正常。

- 编译

```
# 切换到项目目录
$ cd ~/asset-app
# 编译项目
$ ./gradlew build
```

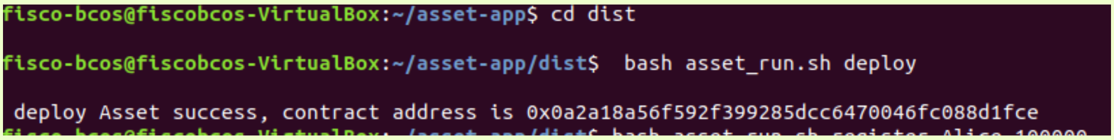


```
fisco-bcos@fiscobcos-VirtualBox:~$ cd ~/asset-app
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ ./gradlew build
Downloading https://services.gradle.org/distributions/gradle-5.6.2-bin.zip
.........................................................................................

Welcome to Gradle 5.6.2!

Here are the highlights of this release:
 - Incremental Groovy compilation
 - Groovy compile avoidance
 - Test fixtures for Java projects
 - Manage plugin versions via settings script

For more details see https://docs.gradle.org/5.6.2/release-notes.html

Starting a Gradle Daemon (subsequent builds will be faster)

BUILD SUCCESSFUL in 3m 33s
4 actionable tasks: 4 executed
```

编译成功之后，将在项目根目录下生成`dist`目录。dist 目录下有一个`asset_run.sh`脚本，简化项目运行。现在开始一一验证本文开始定下的需求。

部署`Asset.sol`合约

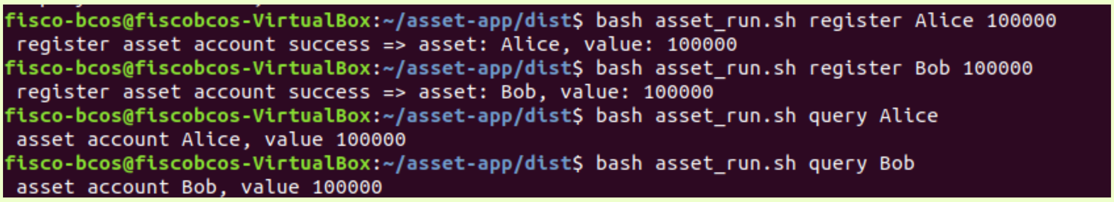
```
# 进入 dist 目录
$ cd dist
$ bash asset_run.sh deploy
Deploy Asset succesfully, contract address is
0xd09ad04220e40bb8666e885730c8c460091a4775
```



```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ cd dist

fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$  bash asset_run.sh deploy

 deploy Asset success, contract address is 0x0a2a18a56f592f399285dcc6470046fc088d1fce
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Alice 100000
```

- 注册资产

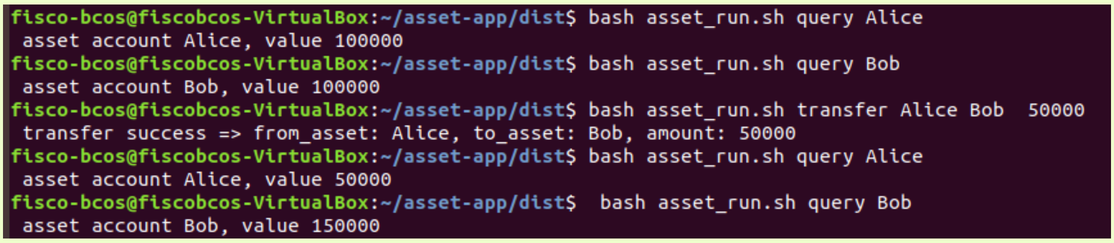
```
$ bash asset_run.sh register Alice 100000
Register account succesfully => account: Alice, value: 100000
$ bash asset_run.sh register Bob 100000
Register account succesfully => account: Bob, value: 100000
```



```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Alice 100000
 register asset account success => asset: Alice, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Bob 100000
 register asset account success => asset: Bob, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Bob
 asset account Bob, value 100000
```

- 查询资产

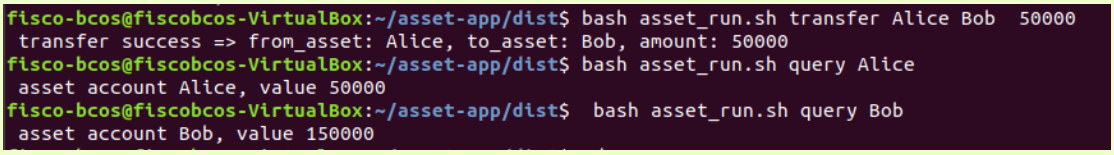
```
$ bash asset_run.sh query Alice
account Alice, value 100000
$ bash asset_run.sh query Bob
account Bob, value 100000
```



```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Bob
 asset account Bob, value 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh transfer Alice Bob  50000
 transfer success => from_asset: Alice, to_asset: Bob, amount: 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$  bash asset_run.sh query Bob
 asset account Bob, value 150000
```

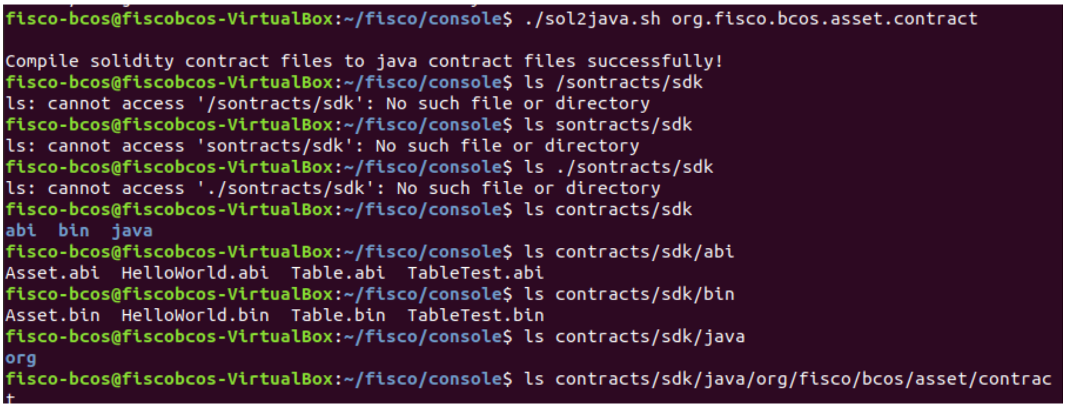
- 资产转移

```
$ bash asset_run.sh transfer Alice Bob  50000
Transfer successfully => from_account: Alice, to_account: Bob, amount: 50000
$ bash asset_run.sh query Alice
account Alice, value 50000
$ bash asset_run.sh query Bob
account Bob, value 150000
```

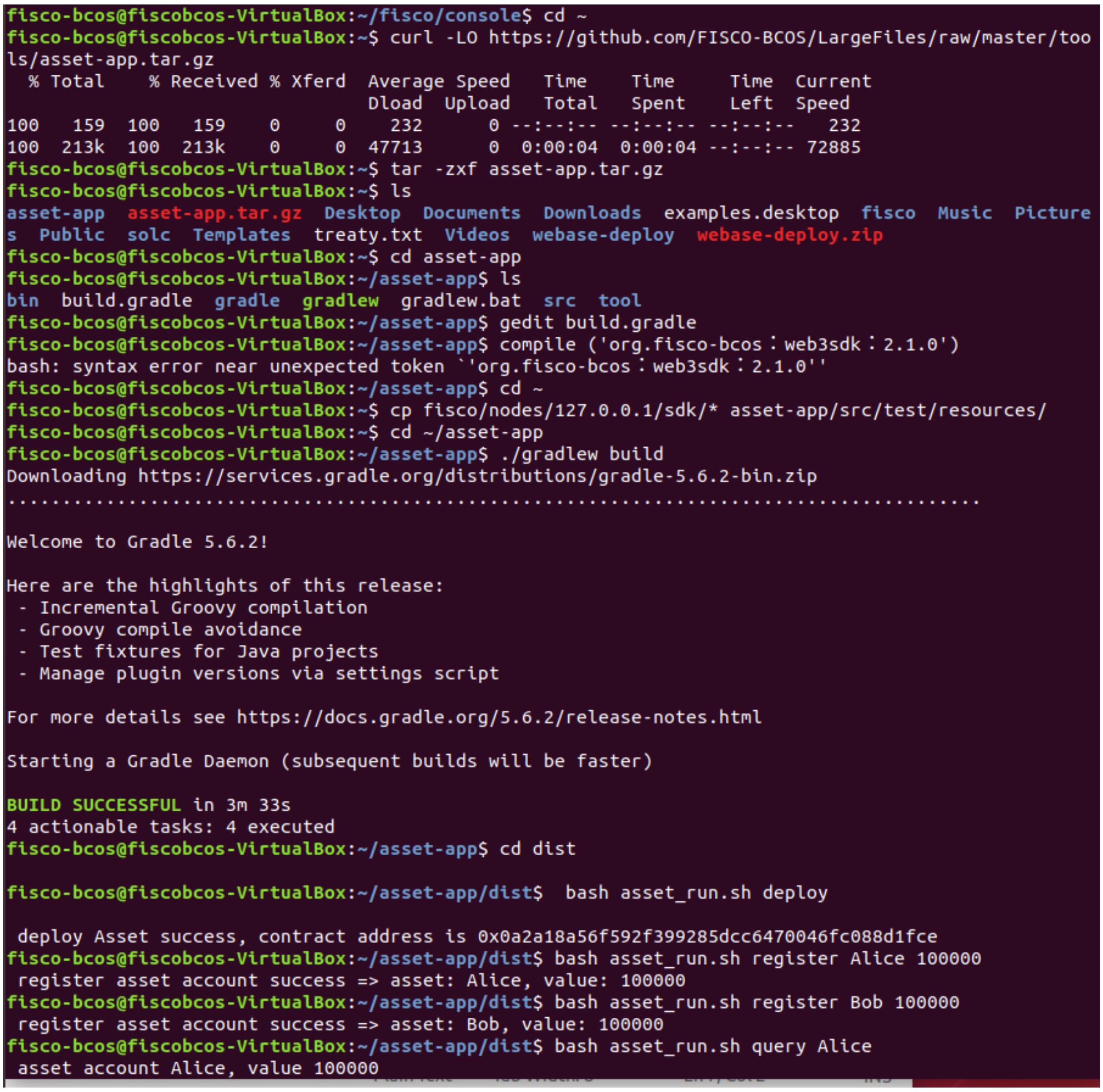


```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh transfer Alice Bob  50000
 transfer success => from_asset: Alice, to_asset: Bob, amount: 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$  bash asset_run.sh query Bob
 asset account Bob, value 150000
```

总结： 至此，我们通过合约开发，合约编译，SDK 配置与业务开发构建了一个基于 FISCO BCOS 联盟区块链的应用。以上过程：



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ./sol2java.sh org.fisco.bcos.asset.contract

Compile solidity contract files to java contract files successfully!
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls /sontracts/sdk
ls: cannot access '/sontracts/sdk': No such file or directory
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls sontracts/sdk
ls: cannot access 'sontracts/sdk': No such file or directory
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls ./sontracts/sdk
ls: cannot access './sontracts/sdk': No such file or directory
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk
abi  bin  java
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/abi
Asset.abi  HelloWorld.abi  Table.abi  TableTest.abi
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/bin
Asset.bin  HelloWorld.bin  Table.bin  TableTest.bin
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/java
org
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ ls contracts/sdk/java/org/fisco/bcos/asset/contrac
t
```



```
fisco-bcos@fiscobcos-VirtualBox:~/fisco/console$ cd ~
fisco-bcos@fiscobcos-VirtualBox:~$ curl -LO https://github.com/FISCO-BCOS/LargeFiles/raw/master/too
ls/asset-app.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   159  100   159    0     0    232      0 --:--:-- --:--:-- --:--:--   232
100  213k  100  213k    0     0  47713      0  0:00:04  0:00:04 --:--:-- 72885
fisco-bcos@fiscobcos-VirtualBox:~$ tar -zxf asset-app.tar.gz
fisco-bcos@fiscobcos-VirtualBox:~$ ls
asset-app  asset-app.tar.gz  Desktop  Documents  Downloads  examples.desktop  fisco  Music  Picture
s  Public  solc  Templates  treaty.txt  Videos  webase-deploy  webase-deploy.zip
fisco-bcos@fiscobcos-VirtualBox:~$ cd asset-app
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ ls
bin  build.gradle  gradle  gradlew  gradlew.bat  src  tool
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ gedit build.gradle
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ compile ('org.fisco-bcos：web3sdk：2.1.0')
bash: syntax error near unexpected token `'org.fisco-bcos：web3sdk：2.1.0''
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ cd ~
fisco-bcos@fiscobcos-VirtualBox:~$ cp fisco/nodes/127.0.0.1/sdk/* asset-app/src/test/resources/
fisco-bcos@fiscobcos-VirtualBox:~$ cd ~/asset-app
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ ./gradlew build
Downloading https://services.gradle.org/distributions/gradle-5.6.2-bin.zip
.........................................................................................

Welcome to Gradle 5.6.2!

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 register asset account success => asset: Alice, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Bob 100000
 register asset account success => asset: Bob, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 100000
```

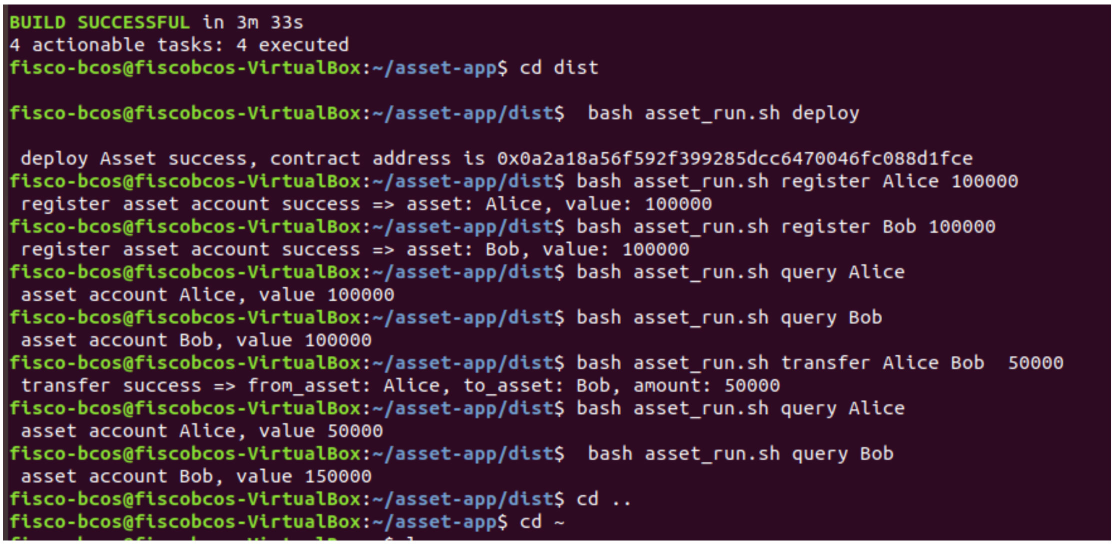

```
BUILD SUCCESSFUL in 3m 33s
4 actionable tasks: 4 executed
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ cd dist

fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$  bash asset_run.sh deploy

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fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Alice 100000
 register asset account success => asset: Alice, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh register Bob 100000
 register asset account success => asset: Bob, value: 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 100000
```

```
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Bob
 asset account Bob, value 100000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh transfer Alice Bob  50000
 transfer success => from_asset: Alice, to_asset: Bob, amount: 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ bash asset_run.sh query Alice
 asset account Alice, value 50000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$  bash asset_run.sh query Bob
 asset account Bob, value 150000
fisco-bcos@fiscobcos-VirtualBox:~/asset-app/dist$ cd ..
fisco-bcos@fiscobcos-VirtualBox:~/asset-app$ cd ~
```