区块链期末项目热身

内容

1. 使用已有的开源区块链系统FISCO-BCOS，完成私有链的搭建以及新节点的加入。（截图说明搭建流程）
2. 自行编写一个智能合约并部署到私有链上，同时完成合约调用。（截图说明部署流程）
3. 使用命令查看一个区块，并对各个字段进行解释。

环境和参考

> 环境说明：使用的是 win10 环境下的 wsl ， linux 版本为 ubuntu 18.04

```
root@LAPTOP-QTCGESHO:/mnt/d/blog# uname -a
Linux LAPTOP-QTCGESHO 4.4.0-19041-Microsoft #488-Microsoft Mon Sep 01 13:43:00 PST 2020 x86_64 x86_64 x86_64 GNU/Linux
```

> 教程参考为 fisco **官方文档**

单群组 FISCO BCOS 联盟链的搭建

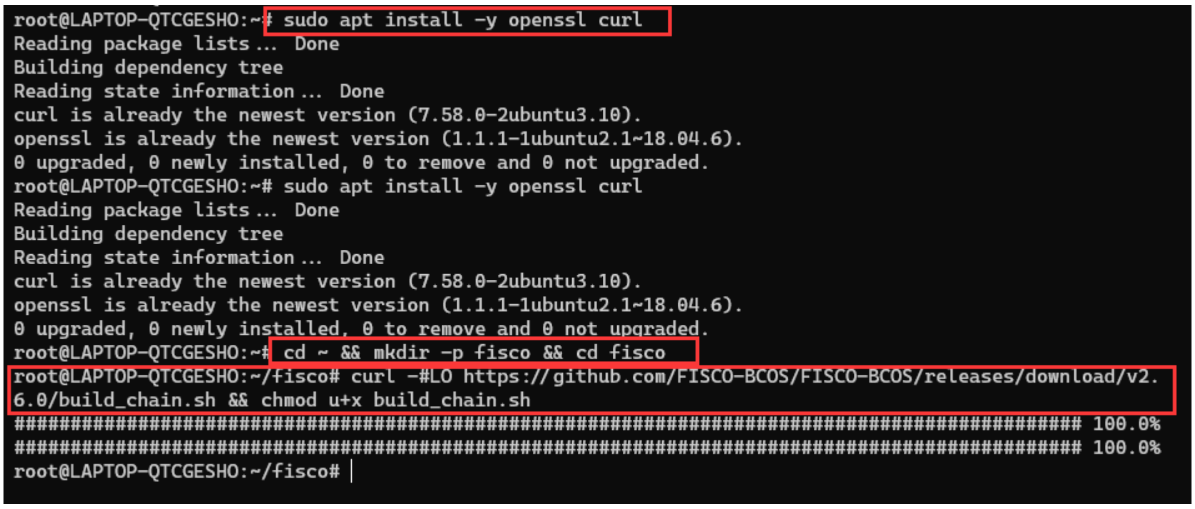
准备环境

根据教程步骤

- 安装 `curl` 依赖
- 创建操作目录
- 下载对应脚本 `build_chain.sh`

```
sudo apt install -y openssl curl
cd ~ && mkdir -p fisco && cd fisco
curl -#LO https://github.com/FISCO-BCOS/FISCO-BCOS/releases/download/v2.6.0/build_chain.sh && chmod u+x build_chain.sh
```

结果如下



```
root@LAPTOP-QTCGESHO:~# sudo apt install -y openssl curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.58.0-2ubuntu3.10).
openssl is already the newest version (1.1.1-1ubuntu2.1~18.04.6).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@LAPTOP-QTCGESHO:~# sudo apt install -y openssl curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.58.0-2ubuntu3.10).
openssl is already the newest version (1.1.1-1ubuntu2.1~18.04.6).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
root@LAPTOP-QTCGESHO:~# cd ~ && mkdir -p fisco && cd fisco
root@LAPTOP-QTCGESHO:~/fisco# curl -#LO https://github.com/FISCO-BCOS/FISCO-BCOS/releases/download/v2.
6.0/build_chain.sh && chmod u+x build_chain.sh
############################################################################################### 100.0%
############################################################################################### 100.0%
root@LAPTOP-QTCGESHO:~/fisco#
```

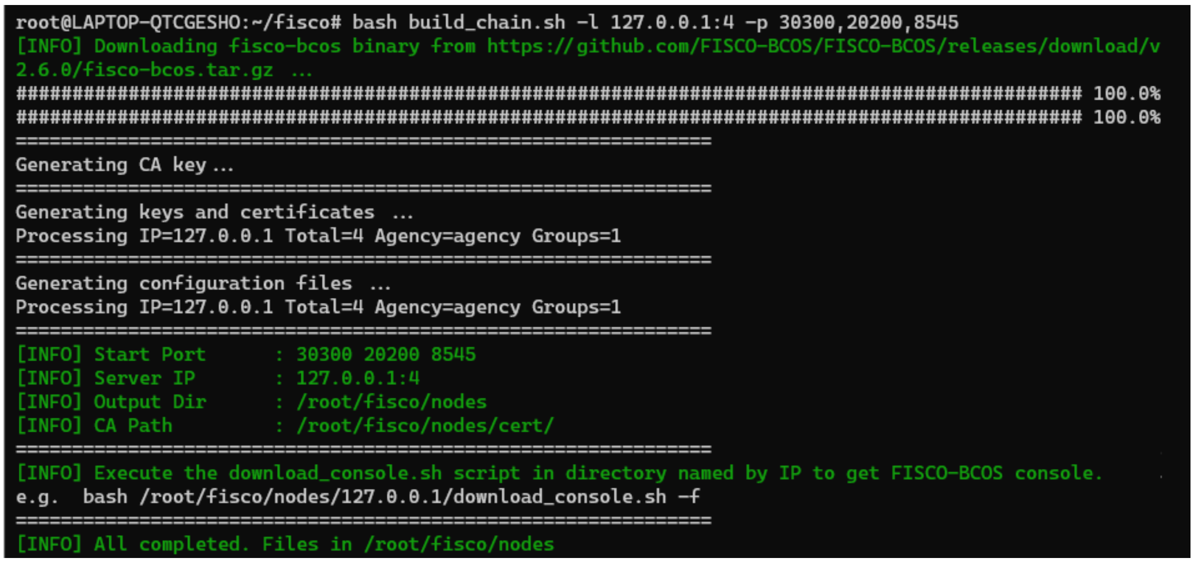
搭建单群组4节点联盟链

命令为

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

> - -p 指定起始端口，分别是 p2p_port, channel_port, jsonrpc_port
> - -l 指定对应 ip 和端口

结果如图：



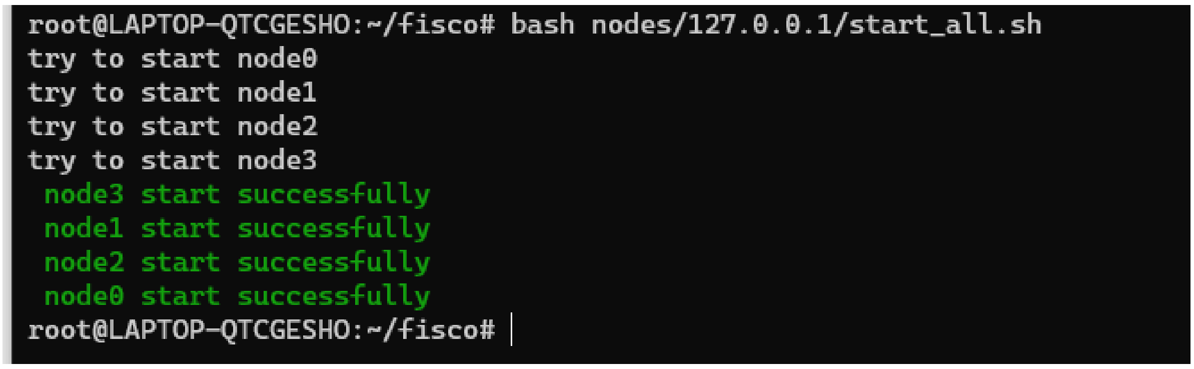
```
root@LAPTOP-QTCGESHO:~/fisco# bash build_chain.sh -l 127.0.0.1:4 -p 30300,20200,8545
[INFO] Downloading fisco-bcos binary from https://github.com/FISCO-BCOS/FISCO-BCOS/releases/download/v
2.6.0/fisco-bcos.tar.gz ...
############################################################################################### 100.0%
############################################################################################### 100.0%
==============================================================
Generating CA key...
==============================================================
Generating keys and certificates ...
Processing IP=127.0.0.1 Total=4 Agency=agency Groups=1
==============================================================
Generating configuration files ...
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] Output Dir      : /root/fisco/nodes
[INFO] CA Path         : /root/fisco/nodes/cert/
==============================================================
[INFO] Execute the download_console.sh script in directory named by IP to get FISCO-BCOS console.
e.g.  bash /root/fisco/nodes/127.0.0.1/download_console.sh -f
==============================================================
[INFO] All completed. Files in /root/fisco/nodes
```

启动联盟链

执行如下命令：

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

结果如图：

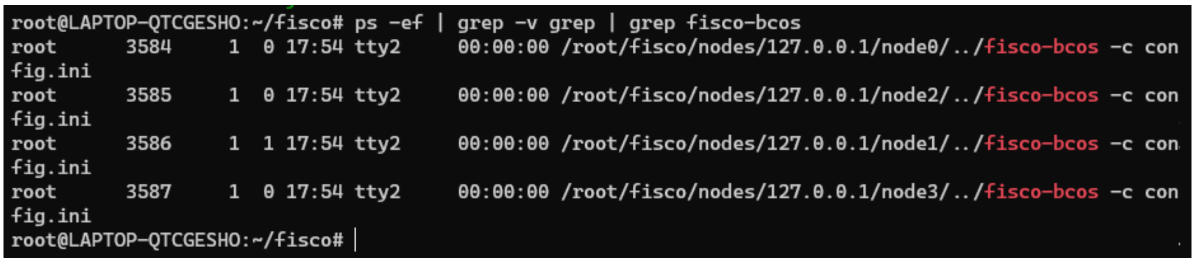


```
root@LAPTOP-QTCGESHO:~/fisco# bash nodes/127.0.0.1/start_all.sh
try to start node0
try to start node1
try to start node2
try to start node3
 node3 start successfully
 node1 start successfully
 node2 start successfully
 node0 start successfully
root@LAPTOP-QTCGESHO:~/fisco#
```

检查进程和日志输出

检查进程：

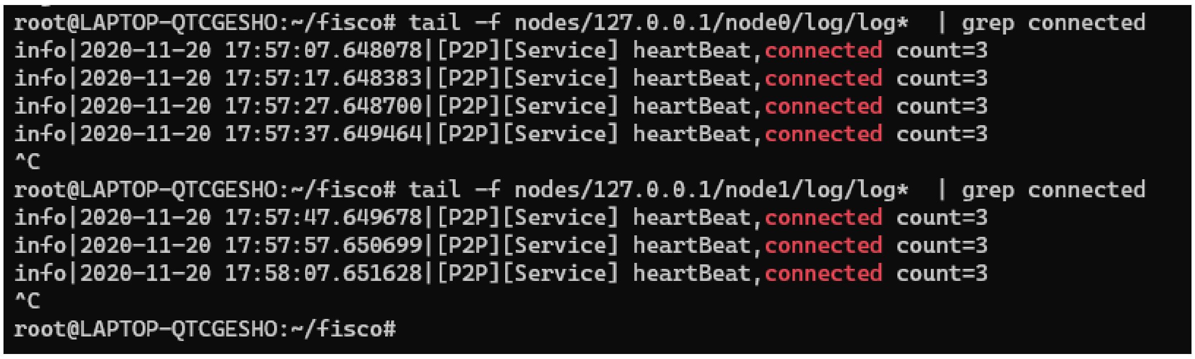
```
ps -ef | grep -v grep | grep fisco-bcos
```



```
root@LAPTOP-QTCGESHO:~/fisco# ps -ef | grep -v grep | grep fisco-bcos
root      3584     1  0 17:54 tty2     00:00:00 /root/fisco/nodes/127.0.0.1/node0/../fisco-bcos -c con
fig.ini
root      3585     1  0 17:54 tty2     00:00:00 /root/fisco/nodes/127.0.0.1/node2/../fisco-bcos -c con
fig.ini
root      3586     1  1 17:54 tty2     00:00:00 /root/fisco/nodes/127.0.0.1/node1/../fisco-bcos -c con
fig.ini
root      3587     1  0 17:54 tty2     00:00:00 /root/fisco/nodes/127.0.0.1/node3/../fisco-bcos -c con
fig.ini
root@LAPTOP-QTCGESHO:~/fisco#
```

检查日志输出：

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



```
root@LAPTOP-QTCGESHO:~/fisco# tail -f nodes/127.0.0.1/node0/log/log*  | grep connected
info|2020-11-20 17:57:07.648078|[P2P][Service] heartBeat,connected count=3
info|2020-11-20 17:57:17.648383|[P2P][Service] heartBeat,connected count=3
info|2020-11-20 17:57:27.648700|[P2P][Service] heartBeat,connected count=3
info|2020-11-20 17:57:37.649464|[P2P][Service] heartBeat,connected count=3
^C
root@LAPTOP-QTCGESHO:~/fisco# tail -f nodes/127.0.0.1/node1/log/log*  | grep connected
info|2020-11-20 17:57:47.649678|[P2P][Service] heartBeat,connected count=3
info|2020-11-20 17:57:57.650699|[P2P][Service] heartBeat,connected count=3
info|2020-11-20 17:58:07.651628|[P2P][Service] heartBeat,connected count=3
^C
root@LAPTOP-QTCGESHO:~/fisco#
```

> 图中分别查看了两个节点 node0 和 node1 的日志

配置并且使用控制台

> 选择的基于 `Java JDK` 实现的控制台2.6

准备依赖

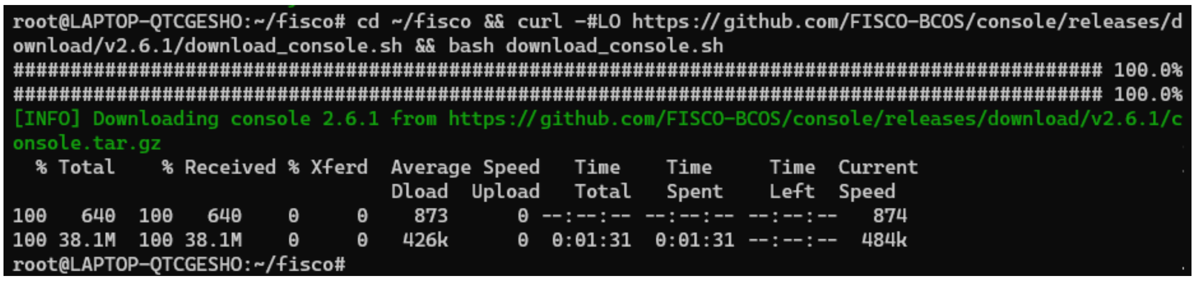
> 需要安装 JDK，命令如下

```
sudo apt install -y default-jdk # ubuntu系统安装java
```

- 获取控制台：

```
cd ~/fisco && curl -#LO https://github.com/FISCO-BCOS/console/releases/download/v2.6.1/download_console.sh && bash download_console.sh
```

结果如下：



```
root@LAPTOP-QTCGESHO:~/fisco# cd ~/fisco && curl -#LO https://github.com/FISCO-BCOS/console/releases/d
ownload/v2.6.1/download_console.sh && bash download_console.sh
############################################################################################ 100.0%
############################################################################################ 100.0%
[INFO] Downloading console 2.6.1 from https://github.com/FISCO-BCOS/console/releases/download/v2.6.1/c
onsole.tar.gz
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   640  100   640    0     0    873      0 --:--:-- --:--:-- --:--:--   874
100 38.1M  100 38.1M    0     0   426k      0  0:01:31  0:01:31 --:--:--  484k
root@LAPTOP-QTCGESHO:~/fisco#
```

- 拷贝控制台配置文件：

```
cp -n console/conf/config-example.toml console/conf/config.toml # 最新版本控制台使用如下命令拷贝配置文件
```

> 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channel端口。

- 配置控制台证书：

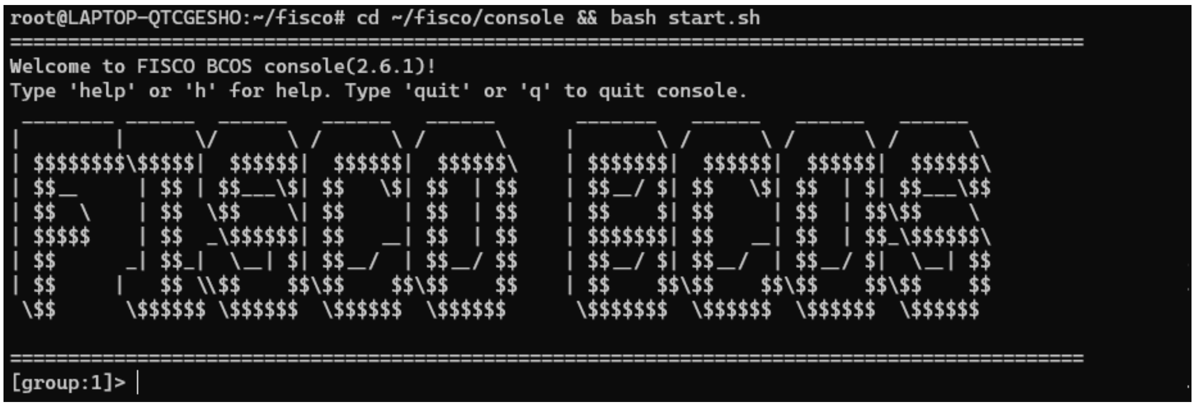
```
cp -r nodes/127.0.0.1/sdk/* console/conf/
```

启动控制台

- 启动控制台：

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

输出如下，说明控制台配置成功：

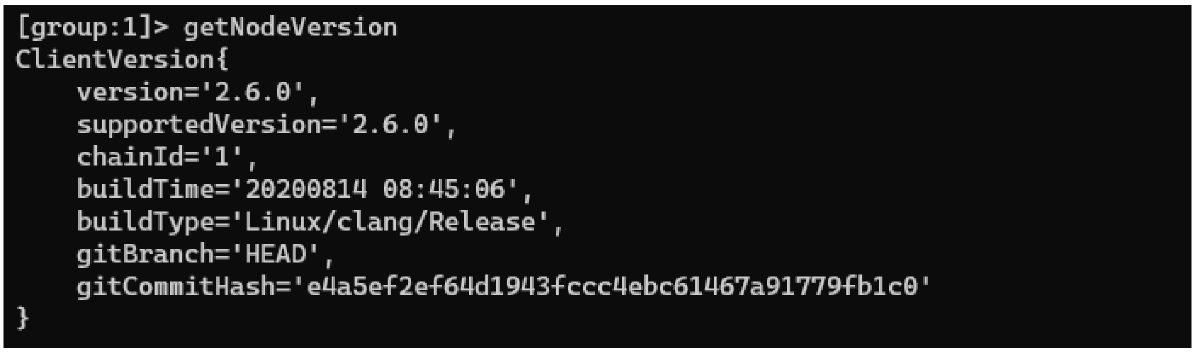


```
root@LAPTOP-QTCGESHO:~/fisco# cd ~/fisco/console && bash start.sh
=============================================================================================
Welcome to FISCO BCOS console(2.6.1)!
Type 'help' or 'h' for help. Type 'quit' or 'q' to quit console.
 ________ ______  ______   ______   ______       _______   ______   ______   ______
|        \      \/      \ /      \ /      \     |       \ /      \ /      \ /      \
| $$$$$$$$\$$$$$|  $$$$$$|  $$$$$$|  $$$$$$\    | $$$$$$$|  $$$$$$|  $$$$$$|  $$$$$$\
| $$__     | $$ | $$___\$| $$   \$| $$  | $$    | $$__/ $| $$   \$| $$  | $| $$___\$$
| $$  \    | $$  \$$    \| $$     | $$  | $$    | $$    $| $$     | $$  | $$\$$    \
| $$$$$    | $$  _\$$$$$$| $$   __| $$  | $$    | $$$$$$$| $$   __| $$  | $$_\$$$$$$\
| $$      _| $$_|  \__| $| $$__/  | $$__/ $$    | $$__/ $| $$__/  | $$__/ $|  \__| $$
| $$     |   $$ \\$$    $$\$$    $$\$$    $$    | $$    $$\$$    $$\$$    $$\$$    $$
 \$$      \$$$$$$ \$$$$$$  \$$$$$$  \$$$$$$      \$$$$$$$  \$$$$$$  \$$$$$$  \$$$$$$

=============================================================================================
[group:1]> |
```

通过控制台获取信息

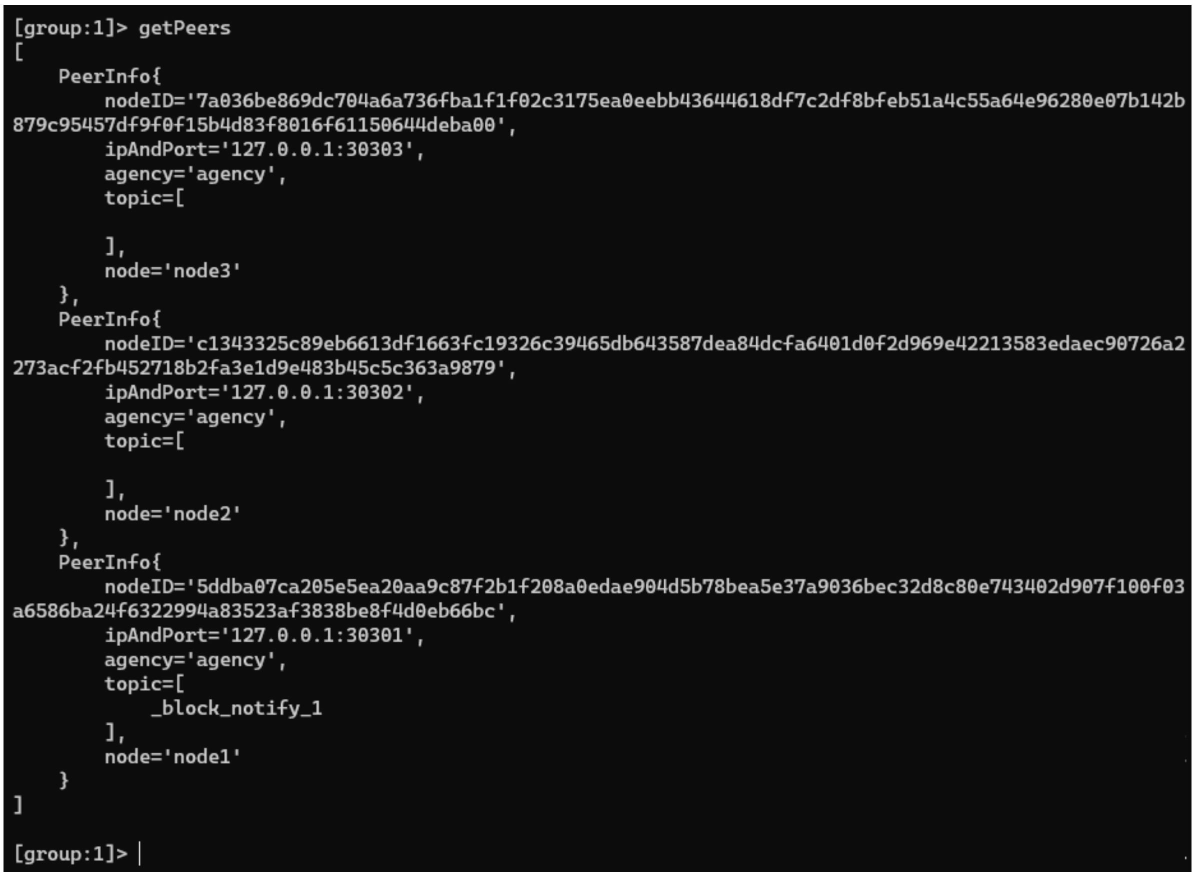
在控制台执行 `getNodeVersion` 和 `getPeers` 获取客户端版本和节点信息

获取客户端版本：



```
[group:1]> getNodeVersion
ClientVersion{
    version='2.6.0',
    supportedVersion='2.6.0',
    chainId='1',
    buildTime='20200814 08:45:06',
    buildType='Linux/clang/Release',
    gitBranch='HEAD',
    gitCommitHash='e4a5ef2ef64d1943fccc4ebc61467a91779fb1c0'
}
```

获取节点链接信息：

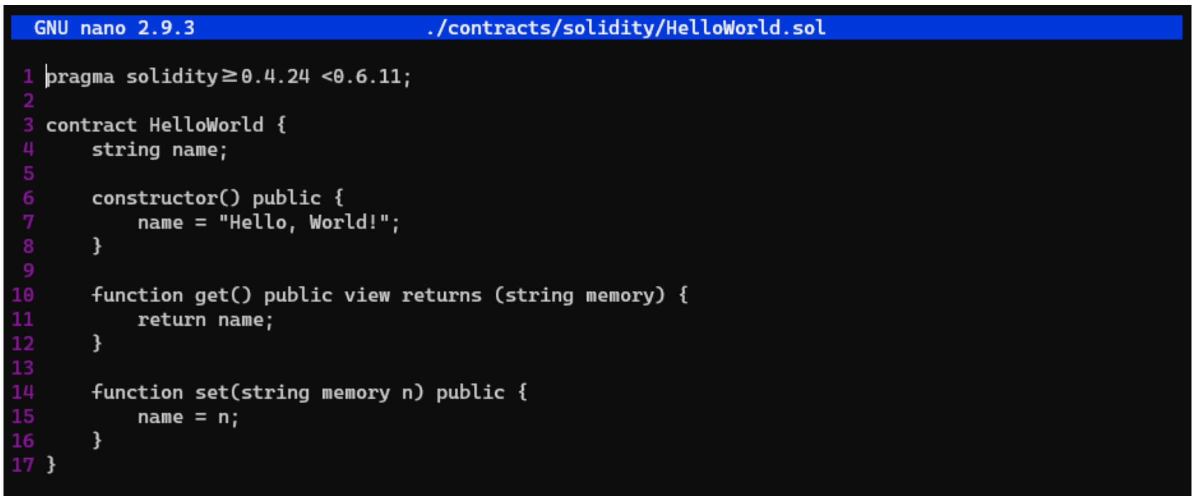


```
[group:1]> getPeers
[
    PeerInfo{
        nodeID='7a036be869dc704a6a736fba1f1f02c3175ea0eebb43644618df7c2df8bfeb51a4c55a64e96280e07b142b
879c95457df9f0f15b4d83f8016f61150644deba00',
        ipAndPort='127.0.0.1:30303',
        agency='agency',
        topic=[

        ],
        node='node3'
    },
    PeerInfo{
        nodeID='c1343325c89eb6613df1663fc19326c39465db643587dea84dcfa6401d0f2d969e42213583edaec90726a2
273acf2fb452718b2fa3e1d9e483b45c5c363a9879',
        ipAndPort='127.0.0.1:30302',
        agency='agency',
        topic=[

        ],
        node='node2'
    },
    PeerInfo{
        nodeID='5ddba07ca205e5ea20aa9c87f2b1f208a0edae904d5b78bea5e37a9036bec32d8c80e743402d907f100f03
a6586ba24f6322994a83523af3838be8f4d0eb66bc',
        ipAndPort='127.0.0.1:30301',
        agency='agency',
        topic=[
            _block_notify_1
        ],
        node='node1'
    }
]

[group:1]> |
```

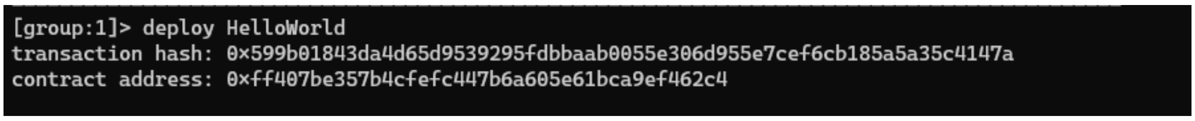
部署和调用智能合约

部署 HelloWorld 合约

在控制台目录下 `/contracts/solidity/` 已经已经有 `HelloWorld.sol` ，查看代码如下：


```
  GNU nano 2.9.3                    ./contracts/solidity/HelloWorld.sol

pragma solidity≥0.4.24 <0.6.11;

contract HelloWorld {
    string name;

    constructor() public {
        name = "Hello, World!";
    }

    function get() public view returns (string memory) {
        return name;
    }

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

部署该合约，得到如下输出

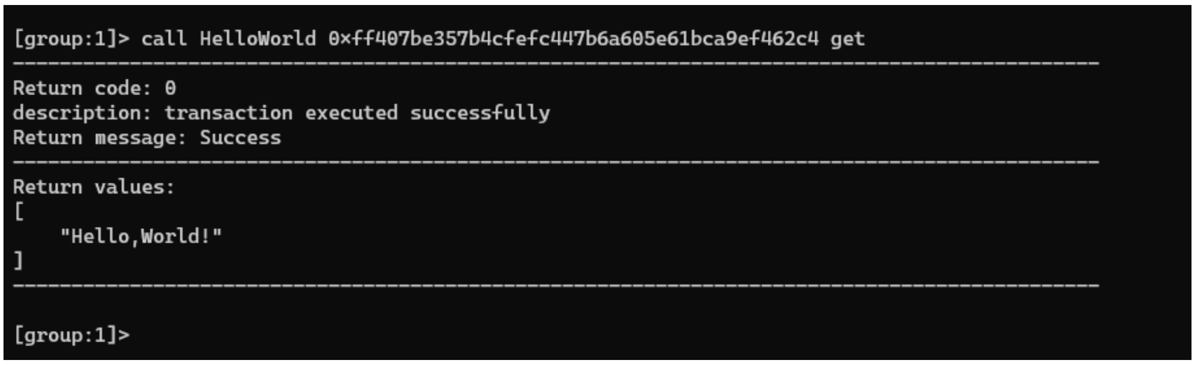

```
[group:1]> deploy HelloWorld
transaction hash: 0x599b01843da4d65d9539295fdbbaab0055e306d955e7cef6cb185a5a35c4147a
contract address: 0xff407be357b4cfefc447b6a605e61bca9ef462c4
```

> 返回的合约地址 `0xff407be357b4cfefc447b6a605e61bca9ef462c4` 比较重要，因为后续调用合约需要用到

调用 HelloWord 合约

查看变量

调用 get 接口，获取 `name` 变量，输出如下：


```
[group:1]> call HelloWorld 0xff407be357b4cfefc447b6a605e61bca9ef462c4 get
---------------------------------------------------------------------------------------------
Return code: 0
description: transaction executed successfully
Return message: Success
---------------------------------------------------------------------------------------------
Return values:
[
    "Hello,World!"
]
---------------------------------------------------------------------------------------------

[group:1]>
```

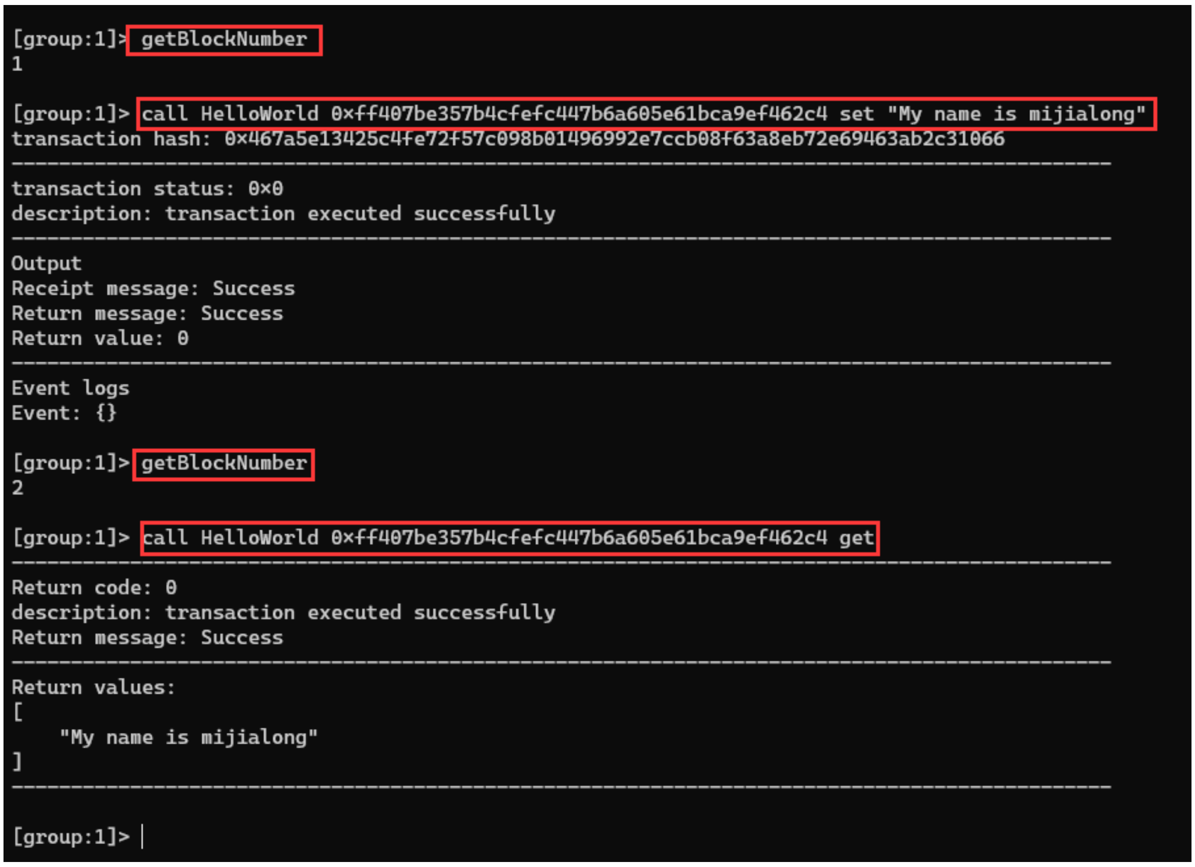
修改变量

> 修改变量会导致块增加

进行如下操作

- 先查看一次当前区块数量
- 设置 `name` 变量值为 `My name is mijialong.`
- 再次查看当前区块数量
- 再次调用 get 接口查看 `name` 变量的值

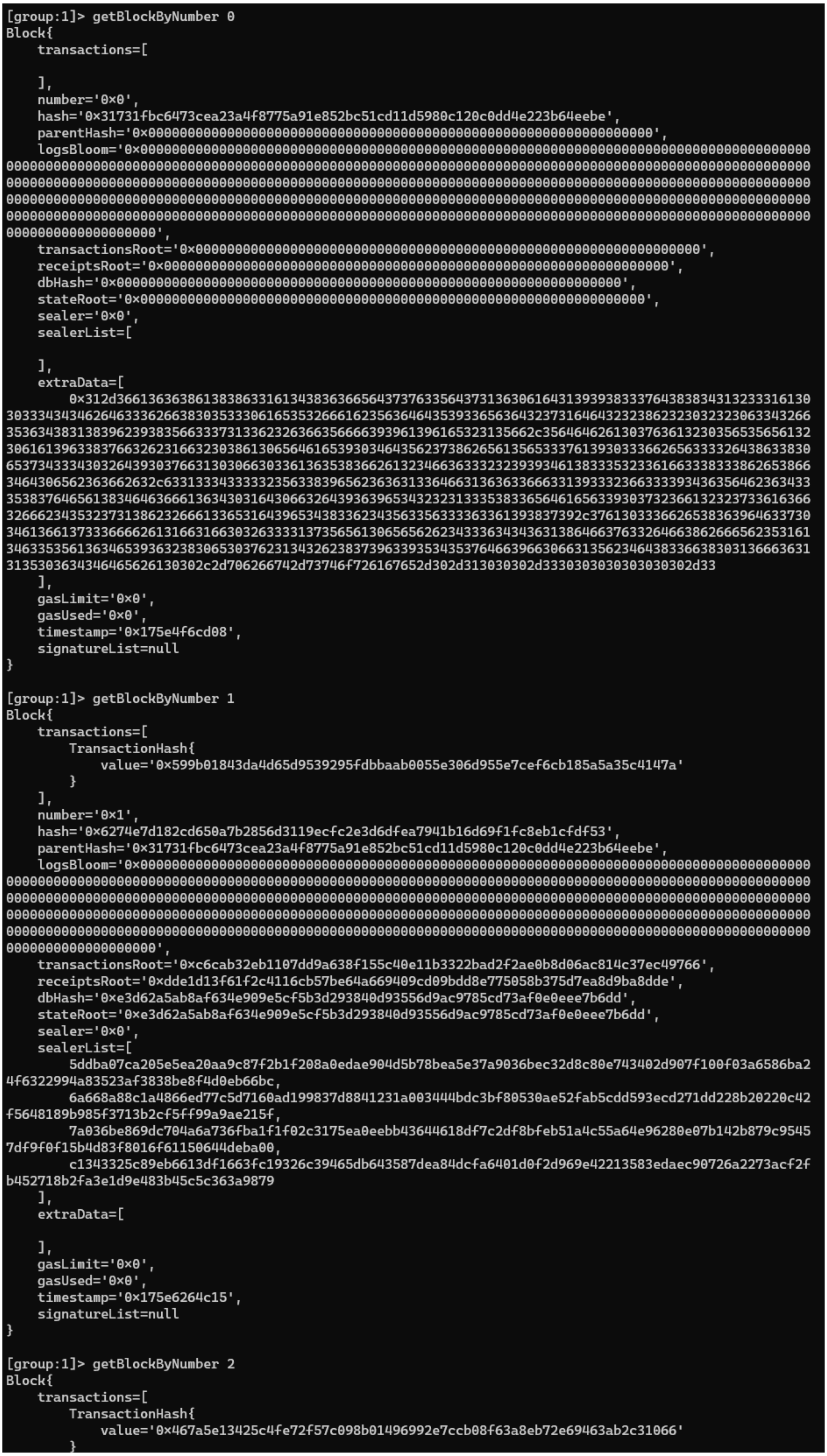
操作结果如下：



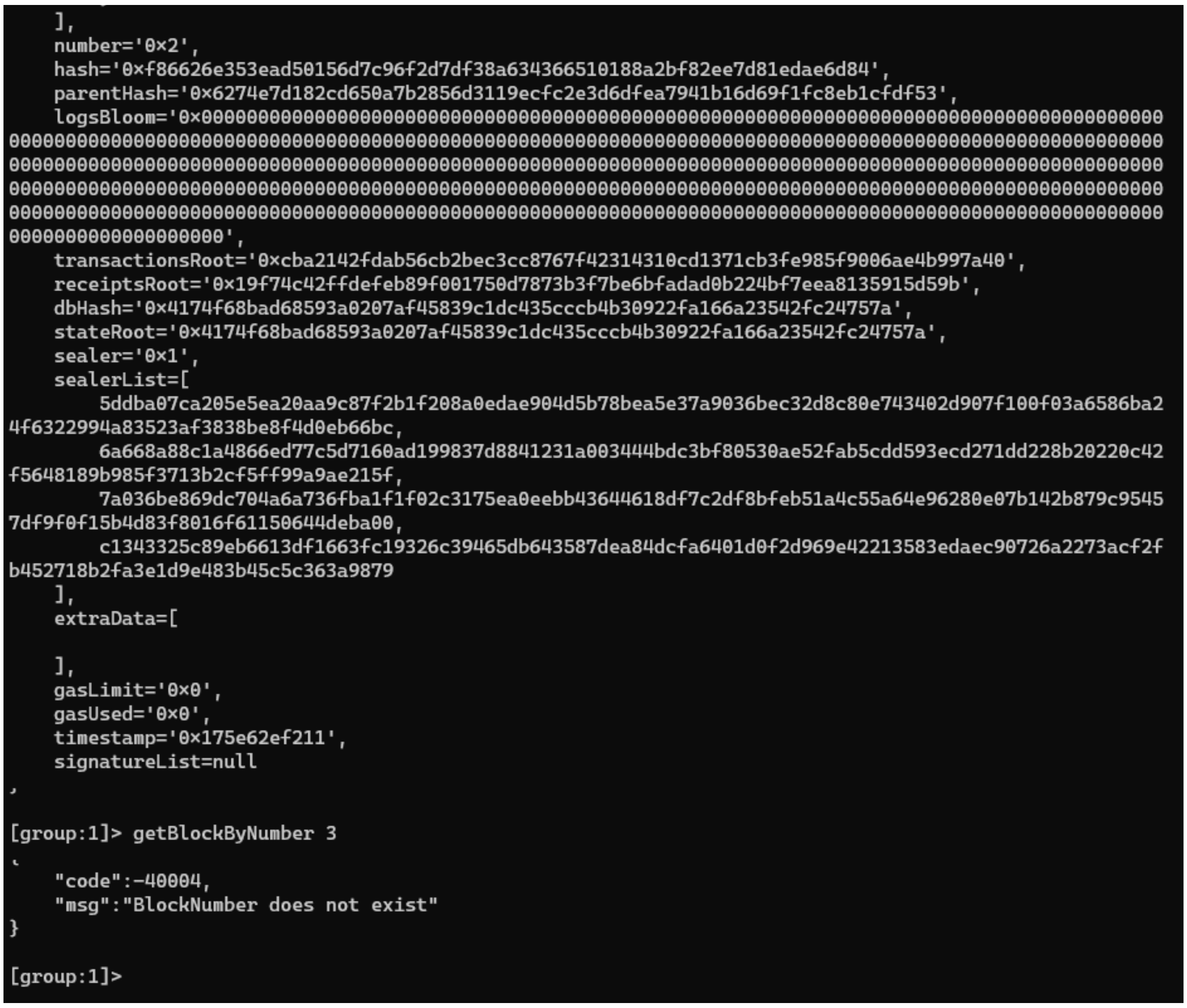
```
[group:1]> getBlockNumber
1

[group:1]> call HelloWorld 0xff407be357b4cfefc447b6a605e61bca9ef462c4 set "My name is mijialong"
transaction hash: 0x467a5e13425c4fe72f57c098b01496992e7ccb08f63a8eb72e69463ab2c31066
---------------------------------------------------------------------------------------------
transaction status: 0x0
description: transaction executed successfully
---------------------------------------------------------------------------------------------
Output
Receipt message: Success
Return message: Success
Return value: 0
---------------------------------------------------------------------------------------------
Event logs
Event: {}

[group:1]> getBlockNumber
2

[group:1]> call HelloWorld 0xff407be357b4cfefc447b6a605e61bca9ef462c4 get
---------------------------------------------------------------------------------------------
Return code: 0
description: transaction executed successfully
Return message: Success
---------------------------------------------------------------------------------------------
Return values:
[
    "My name is mijialong"
]
---------------------------------------------------------------------------------------------

[group:1]> 
```

查看区块

可以通过 `getBlockByNumber` 方法查看每个区块：



```
[group:1]> getBlockByNumber 0
Block{
    transactions=[

    ],
    number='0x0',
    hash='0x31731fbc6473cea23a4f8775a91e852bc51cd11d5980c120c0dd4e223b64eebe',
    parentHash='0x0000000000000000000000000000000000000000000000000000000000000000',
    logsBloom='0x0000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000',
    transactionsRoot='0x0000000000000000000000000000000000000000000000000000000000000000',
    receiptsRoot='0x0000000000000000000000000000000000000000000000000000000000000000',
    dbHash='0x0000000000000000000000000000000000000000000000000000000000000000',
    stateRoot='0x0000000000000000000000000000000000000000000000000000000000000000',
    sealer='0x0',
    sealerList=[

    ],
    extraData=[
        0x312d3661363638613838633161343836366564373763356437313630616431393938333764383834313233316130
303334343462646333626638303533306165353266616235636464353933656364323731646432323862323032323063343266
353634383138396239383566333731336232636635666639396139616532313566 2c356464626130376361323035656561
3230616139633837663262316632303861306564616539303464356237386265613565333761393033366265633332643863383
0653734333430326439303766313030663033613635383662613234663633323239393461383335323361663338333862653866
34643065623636626332c6331333433333235633839656236363133646631363633666331393332366333393436356462363433
35383764656138346463666136343031643066326439363965343232313335383336656461656339303732366132323733616366
32666234353237313862326661336531643965343833623435633563333633613938373922c37613033366265383639646337303
34613661373366666261316631663032633331373565613065656262343336343436313864663763326466386266656235316134
63353561363465393632383065303762313432623837396339353435376466396630663135623464383366383031366663631
3135303634346465626130302c2d706266742d73746f726167652d302d313030302d3330303030303030302d33
    ],
    gasLimit='0x0',
    gasUsed='0x0',
    timestamp='0x175e4f6cd08',
    signatureList=null
}

[group:1]> getBlockByNumber 1
Block{
    transactions=[
        TransactionHash{
            value='0x599b01843da4d65d9539295fdbbaab0055e306d955e7cef6cb185a5a35c4147a'
        }
    ],
    number='0x1',
    hash='0x6274e7d182cd650a7b2856d3119ecfc2e3d6dfea7941b16d69f1fc8eb1cfdf53',
    parentHash='0x31731fbc6473cea23a4f8775a91e852bc51cd11d5980c120c0dd4e223b64eebe',
    logsBloom='0x0000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000',
    transactionsRoot='0xc6cab32eb1107dd9a638f155c40e11b3322bad2f2ae0b8d06ac814c37ec49766',
    receiptsRoot='0xdde1d13f61f2c4116cb57be64a669409cd09bdd8e775058b375d7ea8d9ba8dde',
    dbHash='0xe3d62a5ab8af634e909e5cf5b3d293840d93556d9ac9785cd73af0e0eee7b6dd',
    stateRoot='0xe3d62a5ab8af634e909e5cf5b3d293840d93556d9ac9785cd73af0e0eee7b6dd',
    sealer='0x0',
    sealerList=[
        5ddba07ca205e5ea20aa9c87f2b1f208a0edae904d5b78bea5e37a9036bec32d8c80e743402d907f100f03a6586ba2
4f6322994a83523af3838be8f4d0eb66bc,
        6a668a88c1a4866ed77c5d7160ad199837d8841231a003444bdc3bf80530ae52fab5cdd593ecd271dd228b20220c42
f5648189b985f3713b2cf5ff99a9ae215f,
        7a036be869dc704a6a736fba1f1f02c3175ea0eebb43644618df7c2df8bfeb51a4c55a64e96280e07b142b879c9545
7df9f0f15b4d83f8016f61150644deba00,
        c1343325c89eb6613df1663fc19326c39465db643587dea84dcfa6401d0f2d969e42213583edaec90726a2273acf2f
b452718b2fa3e1d9e483b45c5c363a9879
    ],
    extraData=[

    ],
    gasLimit='0x0',
    gasUsed='0x0',
    timestamp='0x175e6264c15',
    signatureList=null
}

[group:1]> getBlockByNumber 2
Block{
    transactions=[
        TransactionHash{
            value='0x467a5e13425c4fe72f57c098b01496992e7ccb08f63a8eb72e69463ab2c31066'
        }
```



```
    ],
    number='0x2',
    hash='0xf86626e353ead50156d7c96f2d7df38a634366510188a2bf82ee7d81edae6d84',
    parentHash='0x6274e7d182cd650a7b2856d3119ecfc2e3d6dfea7941b16d69f1fc8eb1cfdf53',
    logsBloom='0x0000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000',
    transactionsRoot='0xcba2142fdab56cb2bec3cc8767f42314310cd1371cb3fe985f9006ae4b997a40',
    receiptsRoot='0x19f74c42ffdefeb89f001750d7873b3f7be6bfadad0b224bf7eea8135915d59b',
    dbHash='0x4174f68bad68593a0207af45839c1dc435cccb4b30922fa166a23542fc24757a',
    stateRoot='0x4174f68bad68593a0207af45839c1dc435cccb4b30922fa166a23542fc24757a',
    sealer='0x1',
    sealerList=[
        5ddba07ca205e5ea20aa9c87f2b1f208a0edae904d5b78bea5e37a9036bec32d8c80e743402d907f100f03a6586ba2
4f6322994a83523af3838be8f4d0eb66bc,
        6a668a88c1a4866ed77c5d7160ad199837d8841231a003444bdc3bf80530ae52fab5cdd593ecd271dd228b20220c42
f5648189b985f3713b2cf5ff99a9ae215f,
        7a036be869dc704a6a736fba1f1f02c3175ea0eebb43644618df7c2df8bfeb51a4c55a64e96280e07b142b879c9545
7df9f0f15b4d83f8016f61150644deba00,
        c1343325c89eb6613df1663fc19326c39465db643587dea84dcfa6401d0f2d969e42213583edaec90726a2273acf2f
b452718b2fa3e1d9e483b45c5c363a9879
    ],
    extraData=[

    ],
    gasLimit='0x0',
    gasUsed='0x0',
    timestamp='0x175e62ef211',
    signatureList=null
,

[group:1]> getBlockByNumber 3
{
    "code":-40004,
    "msg":"BlockNumber does not exist"
}

[group:1]>
```

参考文档中的 getBlockByNumber 函数接口，具体如下：

- 参数
  - `groupID` : `unsigned int` - 群组ID
  - `blockNumber` : `string` - 区块高度(十进制字符串或0x开头的十六进制字符串)
  - `includeTransactions` : `bool` - 包含交易标志(true 显示交易详细信息，false 仅显示交易的 hash)
- 返回值
  - object - 区块信息，字段如下：
    - `extraData` : `array` - 附加数据
    - `gasLimit` : `string` - 区块中允许的gas最大值
    - `gasUsed` : `string` - 区块中所有交易消耗的gas
    - `hash` : `string` - 区块哈希
    - `logsBloom` : `string` - log 的布隆过滤器值
    - `number` : `string` - 区块高度
    - `parentHash` : `string` - 父区块哈希
    - `sealer` : `string` - 共识节点序号
    - `sealerList` : `array` - 共识节点列表
    - `stateRoot` : `string` - 状态根哈希
    - `timestamp` : `string` - 时间戳
    - `transactions` : `array` - 交易列表，当 `includeTransactions` 为 false 时，显示交易的哈希。当 `includeTransactions` 为 true 时，显示交易详细信息

以 `getBlockByNumber 2` 的结果为例：

```
Block{
    transactions=[
        TransactionHash{
            value='0x467a5e13425c4fe72f57c098b01496992e7ccb08f63a8eb72e69463ab2c31066' // 转移的值
        }
    ], // 交易列表
    number='0x2', // 区块高度
    hash='0xf86626e353ead50156d7c96f2d7df38a634366510188a2bf82ee7d81edae6d84', // 区块哈希
    parentHash='0x6274e7d182cd650a7b2856d3119ecfc2e3d6dfea7941b16d69f1fc8eb1cfdf53', // 父区块哈希
    logsBloom='0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000', // log 的布隆过滤器值
    transactionsRoot='0xcba2142fdab56cb2bec3cc8767f42314310cd1371cb3fe985f9006ae4b997a40', // 交易根哈希
    receiptsRoot='0x19f74c42ffdefeb89f001750d7873b3f7be6bfadad0b224bf7eea8135915d59b', // 接受根哈希
    dbHash='0x4174f68bad68593a0207af45839c1dc435cccb4b30922fa166a23542fc24757a', // 数据库哈希
    stateRoot='0x4174f68bad68593a0207af45839c1dc435cccb4b30922fa166a23542fc24757a', // 状态根哈希
    sealer='0x1', // 共识节点序号
    sealerList=[
        5ddba07ca205e5ea20aa9c87f2b1f208a0edae904d5b78bea5e37a9036bec32d8c80e743402d907f100f03a6586ba24f6322994a83523af3838be8f4d0eb66bc,
        6a668a88c1a4866ed77c5d7160ad199837d8841231a003444bdc3bf80530ae52fab5cdd593ecd271dd228b20220c42f5648189b985f3713b2cf5ff99a9ae215f,
        7a036be869dc704a6a736fba1f1f02c3175ea0eebb43644618df7c2df8bfeb51a4c55a64e96280e07b142b879c95457df9f0f15b4d83f8016f61150644deba00,
        c1343325c89eb6613df1663fc19326c39465db643587dea84dcfa6401d0f2d969e42213583edaec90726a2273acf2fb452718b2fa3e1d9e483b45c5c363a9879
    ], // 共识节点列表
    extraData=[

    ], // 额外数据
    gasLimit='0x0', // 区块中允许的 gas 最大值
    gasUsed='0x0', // 区块中所有交易消耗的 gas
    timestamp='0x175e62ef211', // 时间戳
    signatureList=null // 签名列表
}
```