

## 探究是否能加入新的节点

build:{在docker-compose.yml文件中只添加前四个节点， 修改前四个文件的config.toml文件：  
build/node\*/config/config.toml文件的persistent\_peers， 删除最后一个} docker-compose up启动 只有四个节点启动 新建docker-compose1.yml文件， 按照上述docker-compose.yml文件添加最后一个节点 在另一个窗口 docker-compose -f docker-compose1.yml up 能看到， 节点迅速上升到前四个节点的高度

```
node4 | I[2021-03-25]15:11:26.151] Committed state
node4 | I[2021-03-25]15:11:26.157] Executed block
node4 | I[2021-03-25]15:11:26.159] Committed state
node4 | I[2021-03-25]15:11:26.166] Executed block
node4 | I[2021-03-25]15:11:26.168] Committed state
node4 | I[2021-03-25]15:11:26.174] Executed block
node4 | I[2021-03-25]15:11:26.176] Committed state
node4 | I[2021-03-25]15:11:26.182] Executed block
node4 | I[2021-03-25]15:11:26.184] Committed state
node4 | I[2021-03-25]15:11:26.190] Executed block
node4 | I[2021-03-25]15:11:26.192] Committed state
node4 | I[2021-03-25]15:11:26.198] Executed block
node4 | I[2021-03-25]15:11:26.200] Committed state
node4 | I[2021-03-25]15:11:26.206] Executed block
node4 | I[2021-03-25]15:11:26.208] Committed state
node4 | I[2021-03-25]15:11:26.215] Executed block
node4 | I[2021-03-25]15:11:26.217] Committed state
node4 | I[2021-03-25]15:11:26.224] Executed block
node4 | I[2021-03-25]15:11:26.226] Committed state
node4 | I[2021-03-25]15:11:26.233] Executed block
node4 | I[2021-03-25]15:11:26.235] Committed state
node4 | I[2021-03-25]15:11:26.242] Executed block
node4 | I[2021-03-25]15:11:26.245] Committed state
node4 | I[2021-03-25]15:11:26.251] Executed block
node4 | I[2021-03-25]15:11:26.253] Committed state
node4 | I[2021-03-25]15:11:26.260] Executed block
node4 | I[2021-03-25]15:11:26.262] Committed state

module=state height=137 txs=0 appHash=D08C010000000000
module=state height=138 validTxs=0 invalidTxs=0
module=state height=138 txs=0 appHash=D08C010000000000
module=state height=139 validTxs=0 invalidTxs=0
module=state height=139 txs=0 appHash=D08C010000000000
module=state height=140 validTxs=0 invalidTxs=0
module=state height=140 txs=0 appHash=D08C010000000000
module=state height=141 validTxs=0 invalidTxs=0
module=state height=141 txs=0 appHash=D08C010000000000
module=state height=142 validTxs=0 invalidTxs=0
module=state height=142 txs=0 appHash=D08C010000000000
module=state height=143 validTxs=0 invalidTxs=0
module=state height=143 txs=0 appHash=D08C010000000000
module=state height=144 validTxs=0 invalidTxs=0
module=state height=144 txs=0 appHash=D08C010000000000
module=state height=145 validTxs=0 invalidTxs=0
module=state height=145 txs=0 appHash=D08C010000000000
module=state height=146 validTxs=0 invalidTxs=0
module=state height=146 txs=0 appHash=D08C010000000000
module=state height=147 validTxs=0 invalidTxs=0
module=state height=147 txs=0 appHash=D08C010000000000
module=state height=148 validTxs=0 invalidTxs=0
module=state height=148 txs=0 appHash=D08C010000000000
module=state height=149 validTxs=0 invalidTxs=0
module=state height=149 txs=0 appHash=D08C010000000000
module=state height=150 validTxs=0 invalidTxs=0
module=state height=150 txs=0 appHash=D08C010000000000
```

查看验证者集合 curl localhost:26657/validators （如果要看其他节点就只需要改动端口号即可）

```

    },
    {
      "address": "0F71644863D3E3A21C403546DBA1BBBF341168CE",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "faPdi/HT2d8Q5zQxeQW7Ys/NvL/HaRXPxJk2yEEF44s="
      },
      "voting_power": "1",
      "proposer_priority": "-3"
    },
    {
      "address": "1F4E965AD6523F92553395189156BF2580A706B2",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "ZS2e+10uQDTp2yMqb0AwKnq5jBgVmZ0p/ELt0K7sUjw="
      },
      "voting_power": "1",
      "proposer_priority": "2"
    },
    {
      "address": "6EF6BF942A6D2C3C1B95DF527F09C6EE8983AD84",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "1GbhCu9JSqv/4ykn/r0U7y0du663Kw+z0H5yHhGVVhg="
      },
      "voting_power": "1",
      "proposer_priority": "2"
    },
    {
      "address": "F3835457BC0F8359A1978A0FD8FA34F3CD4ABAFE",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "0cnooWAuvDM0GjnYywHN5qeSwCmg+9grqvySJAjmNNI="
      },
      "voting_power": "1",
      "proposer_priority": "2"
    }
  ],
  "count": "5",
  "total": "5"
}

```

有

5个验证者 发送交易

|       |                            |                 |  |
|-------|----------------------------|-----------------|--|
| node4 | I[2021-03-25 15:00:02.601] | Committed state | module=state height=77 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:03.922] | Executed block  | module=state height=78 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:03.925] | Committed state | module=state height=78 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:05.427] | Executed block  | module=state height=79 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:05.430] | Committed state | module=state height=79 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:06.745] | Executed block  | module=state height=80 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:06.747] | Committed state | module=state height=80 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:08.053] | Executed block  | module=state height=81 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:08.056] | Committed state | module=state height=81 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:09.462] | Executed block  | module=state height=82 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:09.464] | Committed state | module=state height=82 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:10.887] | Executed block  | module=state height=83 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:10.889] | Committed state | module=state height=83 txs=0 appHash=0000000000000000    |
| node4 | I[2021-03-25 15:00:12.164] | Executed block  | module=state height=84 validTxs=1000 invalidTxs=0        |
| node4 | I[2021-03-25 15:00:12.171] | Committed state | module=state height=84 txs=1000 appHash=000F000000000000 |
| node4 | I[2021-03-25 15:00:13.579] | Executed block  | module=state height=85 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:13.580] | Committed state | module=state height=85 txs=0 appHash=000F000000000000    |
| node4 | I[2021-03-25 15:00:14.897] | Executed block  | module=state height=86 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:14.899] | Committed state | module=state height=86 txs=0 appHash=000F000000000000    |
| node4 | I[2021-03-25 15:00:16.346] | Executed block  | module=state height=87 validTxs=4000 invalidTxs=0        |
| node4 | I[2021-03-25 15:00:16.359] | Committed state | module=state height=87 txs=4000 appHash=904E000000000000 |
| node4 | I[2021-03-25 15:00:17.794] | Executed block  | module=state height=88 validTxs=0 invalidTxs=0           |
| node4 | I[2021-03-25 15:00:17.797] | Committed state | module=state height=88 txs=0 appHash=904E000000000000    |

五个节点均能正常处理交易 查看节点的addbook

```
{
  "key": "abeb9351671a45cd246b1a0c",
  "addrs": [
    {
      "addr": {
        "id": "d1924a9535d7061b67d47e36ebe1b41a7c5257a8",
        "ip": "192.167.10.3",
        "port": 26656
      },
      "src": {
        "id": "672d758d9230d0393cf3b4c3ab05f69c305e1171",
        "ip": "0.0.0.0",
        "port": 26656
      },
      "buckets": [
        56
      ],
      "attempts": 1,
      "bucket_type": 1,
      "last_attempt": "2021-03-25T15:46:30.441199419Z",
      "last_success": "0001-01-01T00:00:00Z",
      "last_ban_time": "0001-01-01T00:00:00Z"
    },
    {
      "addr": {
        "id": "2b68206352f5d2d7ce03c0489b9971f9dd8aa96f",
        "ip": "192.167.10.4",
        "port": 26656
      },
      "src": {
        "id": "672d758d9230d0393cf3b4c3ab05f69c305e1171",
        "ip": "0.0.0.0",
        "port": 26656
      },
      "buckets": [
        56
      ],
      "attempts": 0,
      "bucket_type": 1,
      "last_attempt": "2021-03-25T15:46:29.438579354Z",
      "last_success": "0001-01-01T00:00:00Z",

```

前四个节点的addr有四个address 第五个节点的addr有四个address

## 查看启动四个节点的验证者集合

按照build内的步骤，只启动前四个节点 查看验证者集合

```

    "voting_power": "1",
    "proposer_priority": "-3"
  },
  {
    "address": "1F4E965AD6523F92553395189156BF2580A706B2",
    "pub_key": {
      "type": "tendermint/PubKeyEd25519",
      "value": "ZS2e+10uQDTp2yMqb0AwKnq5jBgVmZ0p/ELt0K7sUjw="
    },
    "voting_power": "1",
    "proposer_priority": "2"
  },
  {
    "address": "6EF6BF942A6D2C3C1B95DF527F09C6EE8983AD84",
    "pub_key": {
      "type": "tendermint/PubKeyEd25519",
      "value": "1GbhCu9JSqv/4ykN/r0U7y0du663Kw+z0H5yHhGVVhg="
    },
    "voting_power": "1",
    "proposer_priority": "2"
  },
  {
    "address": "F3835457BC0F8359A1978A0FD8FA34F3CD4ABAFE",
    "pub_key": {
      "type": "tendermint/PubKeyEd25519",
      "value": "0cnooWAuvDM0GjnYywhN5qeSwCmg+9grqvySJAjmNNI="
    },
    "voting_power": "1",
    "proposer_priority": "2"
  }
],
"count": "5",
"total": "5"
}

```

还是五

个？不对劲

## 继续检验启动四个节点的验证者集合

按照build内的步骤，继续删除前四个文件中最后一个节点的地址信息，build/node\*/config/genesis.json 启动节点，查看验证者集合

```

    },
    {
      "address": "676A6BA06B1579F4632C59D203E95CAB3996A435",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "vRuhAZqfxwamws7y4U4qHHETZoDYYXoHv0MTuWo190o="
      },
      "voting_power": "1",
      "proposer_priority": "0"
    },
    {
      "address": "77122021B81693B00EBECE958CD1302F6DEB0082",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "wFsoX5hY2Yn2615siiY19tonDH2xMP0F1T6D/jQvx3g="
      },
      "voting_power": "1",
      "proposer_priority": "0"
    },
    {
      "address": "8CABEC9952542A76E2E771652E514E37A8E7C3B3",
      "pub_key": {
        "type": "tendermint/PubKeyEd25519",
        "value": "EGN4PP0TqrJ/Q40C9oAI7ip1mIJQXcd3ExpaP7Ke0Qg="
      },
      "voting_power": "1",
      "proposer_priority": "0"
    }
  ],
  "count": "4",
  "total": "4"
}

```

很好，只

有四个验证者集合，说明和创世文件有关 继续启动第五个节点，报错

```

node4 | E[2021-03-25]15:50:05.899] error while stopping peer module=p2p error="already stopped"
node4 | E[2021-03-25]15:50:06.203] Stopping peer for error module=p2p peer="Peer(MConn{192.167.10.2:26656} 672d758d9230d0393cf3b4c3ab05f69c305e1171 out)" err="erro
r with peer 672d758d9230d0393cf3b4c3ab05f69c305e1171: invalid peer" module=p2p peer="Peer(MConn{192.167.10.2:26656} 672d758d9230d0393cf3b4c3ab05f69c305e1171 out)" err="read
node4 | E[2021-03-25]15:50:06.203] Stopping peer for error module=p2p peer="Peer(MConn{192.167.10.2:26656} 672d758d9230d0393cf3b4c3ab05f69c305e1171 out)" err="read
tcp 192.167.10.6:52248->192.167.10.2:26656: use of closed network connection" module=consensus height=194 round=0 peer=fdec0f067a7180552305a366f5a4be2d8227b09a err="error adding vote
node4 | E[2021-03-25]15:50:06.203] error while stopping peer module=consensus height=194 round=0 peer=fdec0f067a7180552305a366f5a4be2d8227b09a err="error adding vote
node4 | E[2021-03-25]15:50:06.507] Stopping peer for error module=p2p peer="Peer(MConn{192.167.10.2:26656} 672d758d9230d0393cf3b4c3ab05f69c305e1171 out)" err="erro
r with peer 672d758d9230d0393cf3b4c3ab05f69c305e1171: invalid peer" module=p2p peer="Peer(MConn{192.167.10.2:26656} 672d758d9230d0393cf3b4c3ab05f69c305e1171 out)" err="read
node4 | E[2021-03-25]15:50:06.507] Stopping peer for error module=state height=194 validTxs=0 invalidTxs=0
tcp 192.167.10.6:52250->192.167.10.2:26656: use of closed network connection" module=state height=194 txs=0 appHash=0000000000000000

```

和创世文件有关

## 探究一个新节点创世文件中没有全部验证节点的信息如何加入网络

按照build内的步骤，继续删除前四个文件中最后一个节点的地址信息，build/node\*/config/genesis.json，对node4中的genesis.json删除node1,node2,node3的地址信息，对node4的config.toml文件删除node1,node2,node3的地址和IP信息 启动前四个节点，正常 启动最后一个节点 报错

```

node4 | E[2021-03-26]02:27:01.923] Error with msg module=consensus height=194 round=0 peer=fdec0f067a7180552305a366f5a4be2d8227b09a err="error adding vote
" msg="[Vote Vote{0:3CB3E1F4A39 194/0/SIGNED_MSG_TYPE_PRECOMMIT(F418BB398381 CB65B0A7FA78 @ 2021-03-26T02:25:10.138422238Z)}]" module=consensus height=194 round=0 peer=fdec0f067a7180552305a366f5a4be2d8227b09a err="error adding vote
node4 | E[2021-03-26]02:27:01.923] Error with msg module=consensus height=194 round=0 peer=fdec0f067a7180552305a366f5a4be2d8227b09a err="error adding vote
" msg="[Vote Vote{2:7C49BBB3BE80 194/0/SIGNED_MSG_TYPE_PRECOMMIT(F418BB398381 983BF1880825 @ 2021-03-26T02:25:10.13840355Z)}]" module=state height=194 validTxs=0 invalidTxs=0
node4 | I[2021-03-26]02:27:01.991] Executed block module=state height=194 txs=0 appHash=0000000000000000
node4 | I[2021-03-26]02:27:01.993] Committed state module=state height=194 txs=0 appHash=0000000000000000

```

而且很显然node4节点的区块高度和前四个节点的区块高度不一致 说明直接启动节点来连接到网络是不可行的 关闭前四个节点的网络 发现node4可以正常出块

```
node4 | I[2021-03-26 02:27:16.297] Executed block module=state height=208 validTxs=0 invalidTxs=0
node4 | I[2021-03-26 02:27:16.299] Committed state module=state height=208 txs=0 appHash=0000000000000000
node4 | I[2021-03-26 02:27:17.319] Executed block module=state height=209 validTxs=0 invalidTxs=0
node4 | I[2021-03-26 02:27:17.321] Committed state module=state height=209 txs=0 appHash=0000000000000000
node4 | I[2021-03-26 02:27:18.342] Executed block module=state height=210 validTxs=0 invalidTxs=0
node4 | I[2021-03-26 02:27:18.344] Committed state module=state height=210 txs=0 appHash=0000000000000000
node4 | E[2021-03-26 02:27:18.689] dialing failed (attempts: 1): dial tcp 192.167.10.2:26656: i/o timeout module=pex addr=fdcc9f867a7180552305a366f5a4be2d0227b09a@192.167.10.2:26656
node4 | E[2021-03-26 02:27:18.689] dialing failed (attempts: 1): dial tcp 192.167.10.3:26656: i/o timeout module=pex addr=df3180af1d3aac7c9842fd4bc10efd336eefd922@192.167.10.3:26656
node4 | E[2021-03-26 02:27:18.689] dialing failed (attempts: 1): dial tcp 192.167.10.4:26656: i/o timeout module=pex addr=a57da93cfe15603df3c1e1745cfb6b5cd4f1ea76@192.167.10.4:26656
node4 | E[2021-03-26 02:27:18.689] dialing failed (attempts: 1): dial tcp 192.167.10.5:26656: i/o timeout module=pex addr=c784b8c87093152dd82f654571432bf418631301@192.167.10.5:26656
node4 | I[2021-03-26 02:27:19.363] Executed block module=state height=211 validTxs=0 invalidTxs=0
node4 | I[2021-03-26 02:27:19.365] Committed state module=state height=211 txs=0 appHash=0000000000000000
node4 | I[2021-03-26 02:27:20.383] Executed block module=state height=212 validTxs=0 invalidTxs=0
node4 | I[2021-03-26 02:27:20.385] Committed state module=state height=212 txs=0 appHash=0000000000000000
```

只是会dial error说明node4在网络共识的过程中，还是得到了其他节点的IP地址（因为我只让他连接到node0）因此加入节点的一种方法是在前四个节点初始化的genesis.json在运行前已有新加入节点的address信息，但是这种方法于现实生活中肯定不够，于是需要探究网络没有新加入节点的address信息，如何加入新节点

查找资料显示

选取validator节点有两种方式：

- 1. 可以在创世状态（genesis state）对应的创世配置文件genesis.json中进行预先设置；
- 2. 每次 commit 新区块后，Application logic通过ABCI（Application Blockchain Interface）接口发送的针对EndBlock消息的回复中，会包含有validator集合的更新。 [Tendermint 动态更新网络节点](#) 网络运行时，验证者集合更新也需要通过交易发送 因此可以通过发送交易进入到