**创智链区块链共识算法系统**

**用户手册**

**北京新创智链科技有限公司**

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# 1、引言

## 1.1编写目的

本文档提供的对象主要是区块链共识算法系统用户。本文档对区块链共识算法系统主要功能和各界面的操作进行介绍，为用户操作、使用区块链共识算法系统软件提供参考和指导。

## 1.2概念解释

什么是Tendermint 。

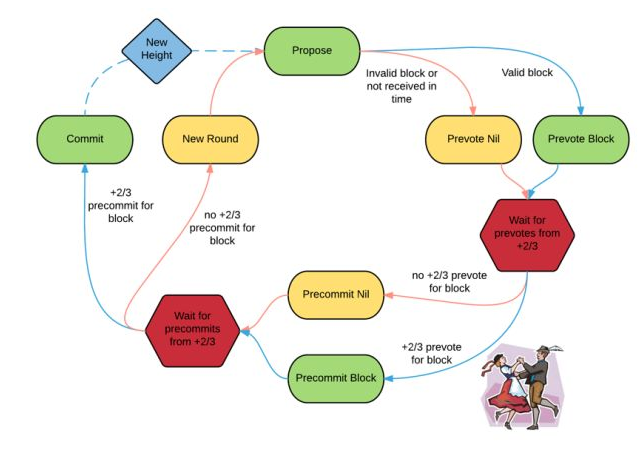
​ Tendermint 是一个模块化的区块链软件框架，支持开发者个性化定制自己的区块链，它提供了一个已存在的包含网络层和共识层的通用引擎，通过一个基于socket协议的ABCI（ Application Blockchain Interface）接口来连接应用，便于在之上构建任意的应用程序。

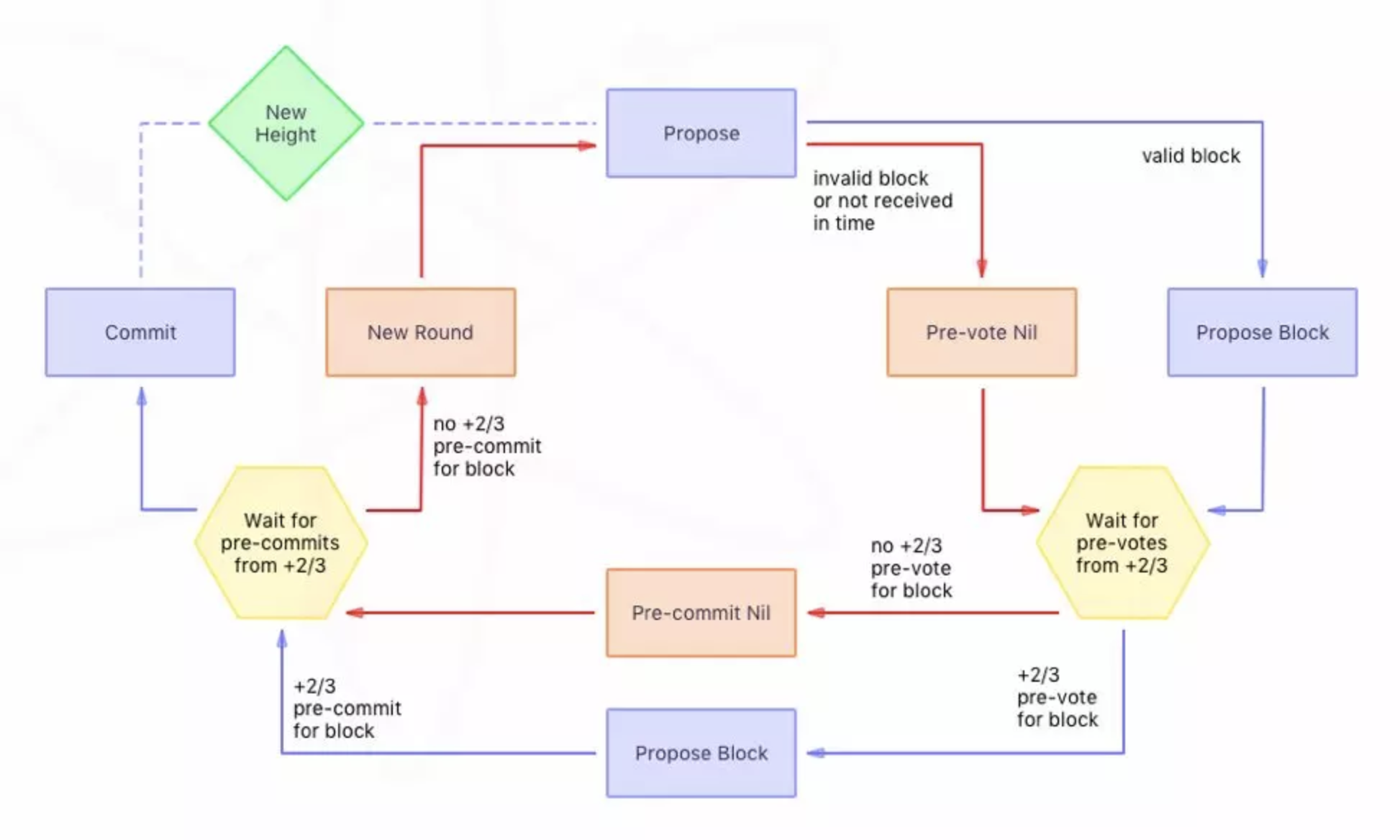
能够容忍机器以任何一种，甚至包括危害系统的方式发生故障，被称为拜占庭容错（BFT）。拜占庭理论已经有几十年的历史，但是很大程度上，直到最近像比特链，以太坊这样区块链技术的成功，它的软件实现才得以进一步发展。区块链技术只是以一种现代化的方式对 BFT 的再形式化，而且重点关注 p2p 网络和密码验证。区块链这个名词来源于transaction的处理方式，通过区块的批量方式处理transaction，每个块包含了前一个块的加密哈希，以此来形成一个链。实际上，区块链数据库真正地优化了 BFT 设计。

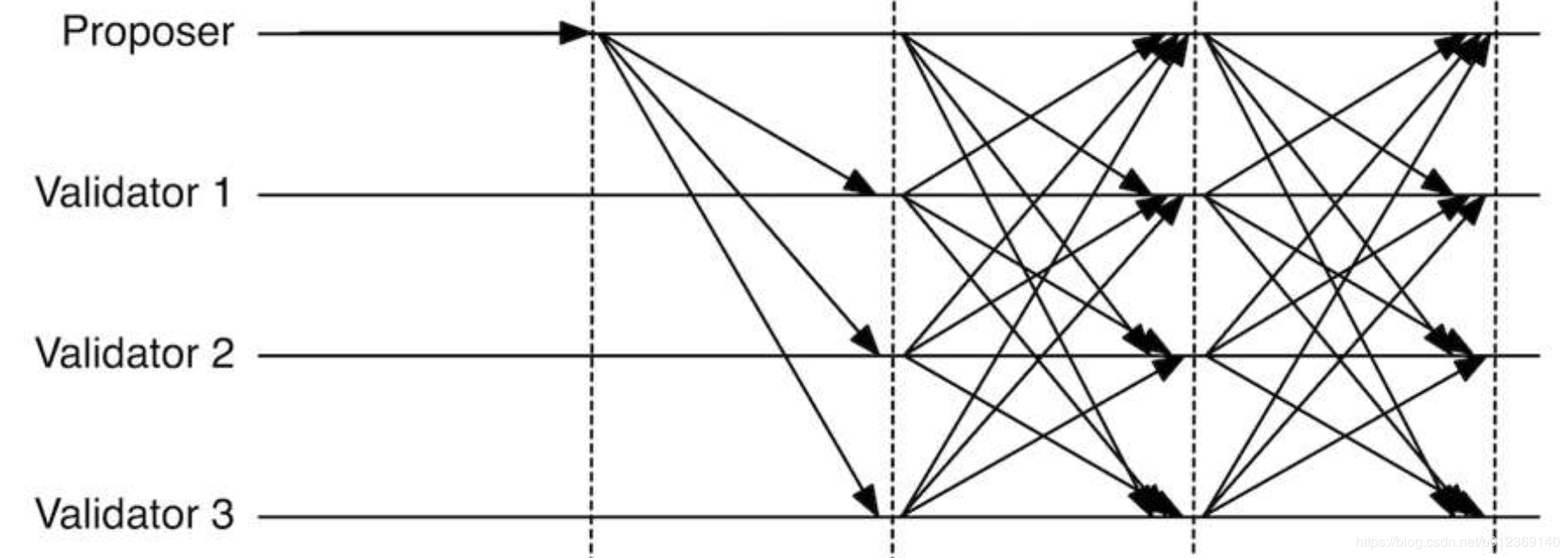
# 2、关于区块链共识算法系统

## 2.1概要说明

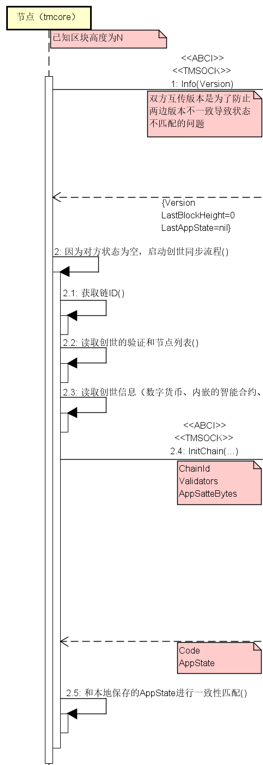
Tenermint core作为区块链共识散发系统的核心模块，用于在多台机器安全一致地复制一个应用。所谓安全，指的是即使有多达 1/3 的机器出现任意故障的情况下， Tendermint 仍然能够正常工作。所谓一致，指的是每一个正常工作的机器都会有着同样的transaction日志，计算相同的状态。安全一致的复制是分布式系统中一个至关重要的问题：从通证到选举，到基础设施规划，它在广泛应用的容错中承担了一个极其重要的角色。

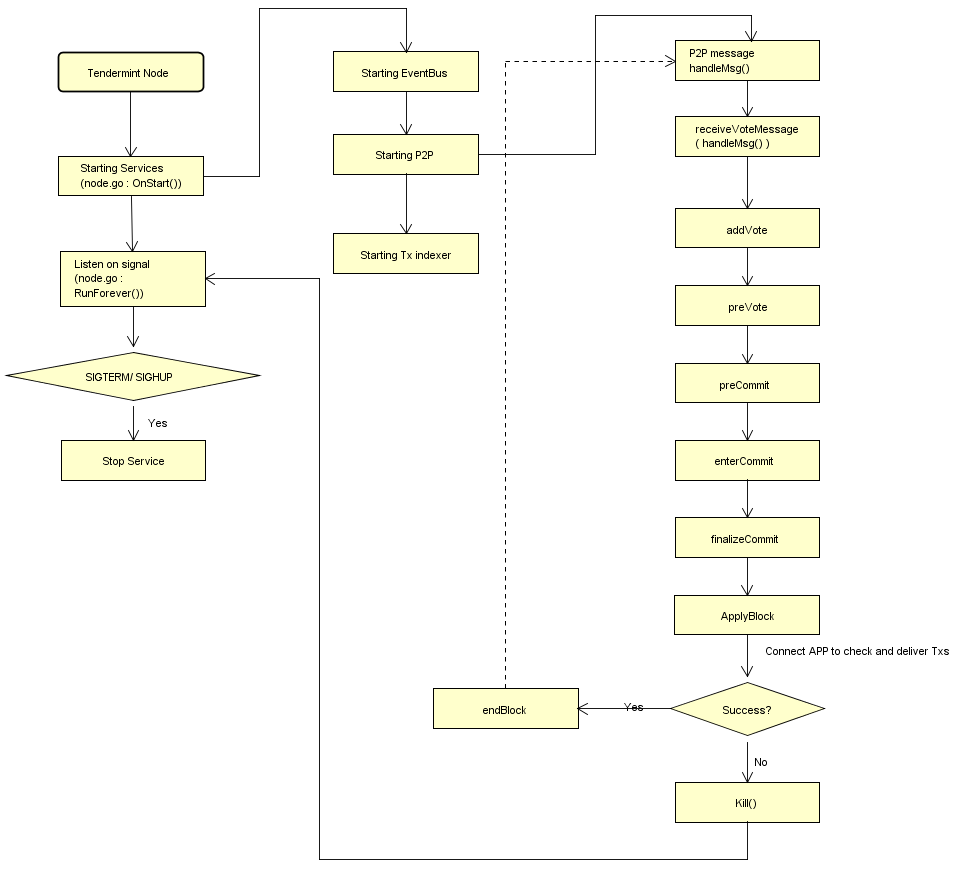


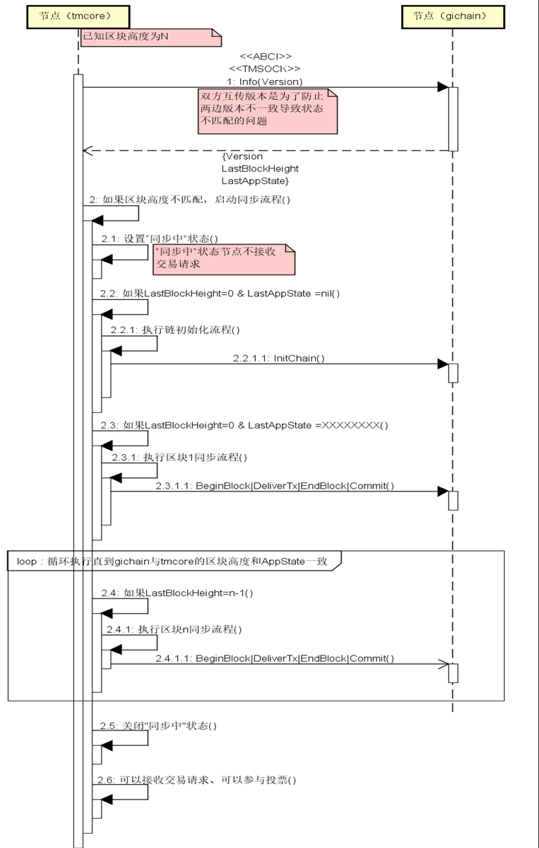




以下为系统设计的流程图。







## 2.2 使用方法

命令运行格式如下：

Tendermint Core (BFT Consensus) in Go

Usage:

tendermint [command]

Available Commands:

help Help about any command

init Initialize Tendermint

node Run the tendermint node

probe\_upnp Test UPnP functionality

show\_node\_id Show this node's ID

show\_validator Show this node's validator info

sync Sync the tendermint node

unsafe\_reset\_all (unsafe) Remove all the data and WAL, reset this node's validator

unsafe\_reset\_priv\_validator (unsafe) Reset this node's validator

version Show version info

Flags:

-h, --help help for tendermint

--home string directory for config and data (default "/root/.tendermint")

--log\_file string Log file

--log\_level string Log level (default "main:info,state:info,\*:error")

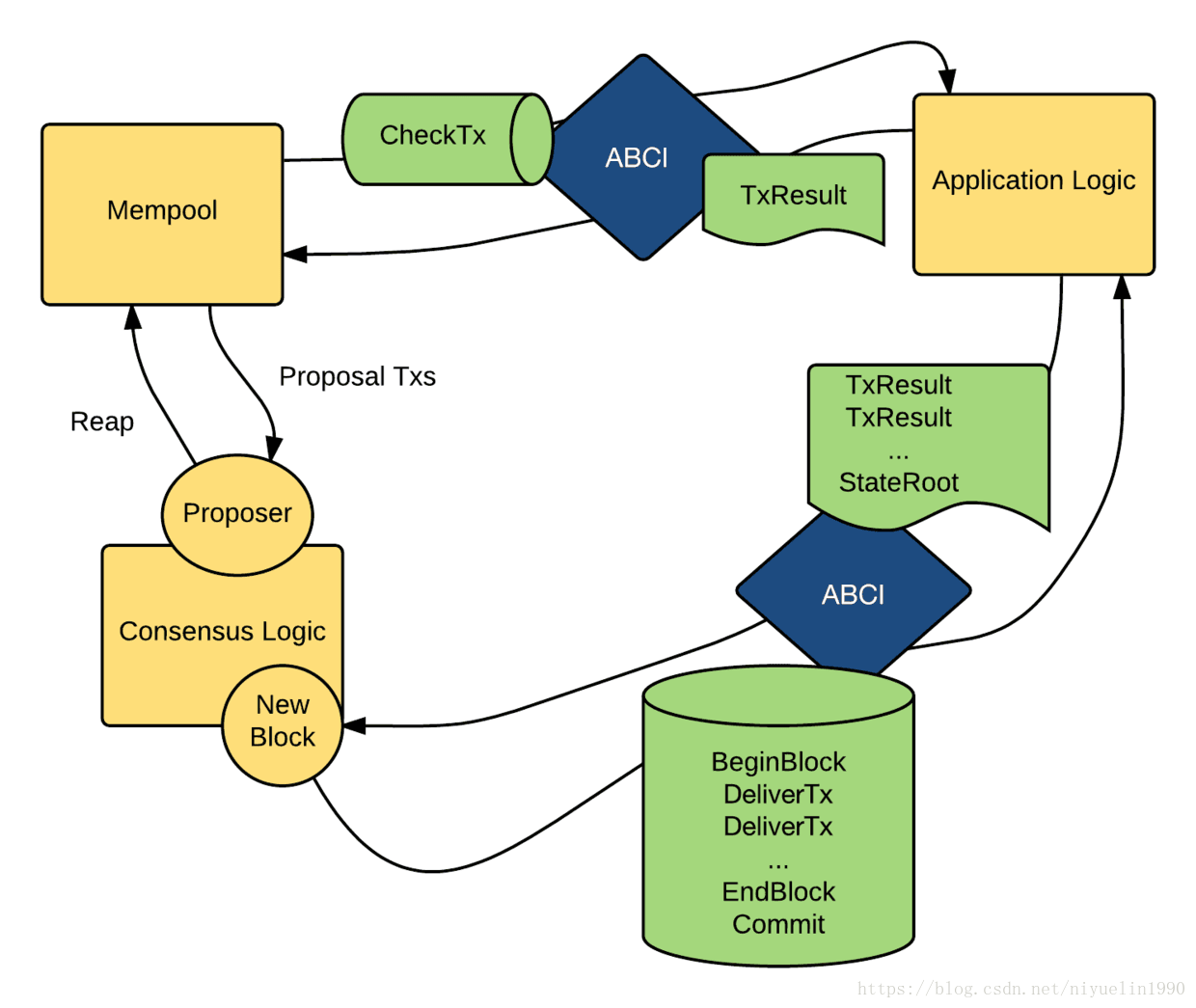
--trace print out full stack trace on errors

Use "tendermint [command] --help" for more information about a command.

## **2.3** tendermint core

区块链数据的默认目录为/etc/tmcore, 通过设置TMHOME环境变量来覆盖它。

由于在部署安装时在脚本中已经集成，所以这里只介绍几种比较常见的命令。



### 2.3.1 初始化

tendermint初始化命令有如下几种子命令：

Initialize Tendermint

Usage:

tendermint init [flags]

Flags:

--a\_address string ReAnnounce listen address(only for follower)

--chain\_id string Specify the chain ID

--follow string Main nodes to follow, split by comma(only for follower)

--genesis\_path string Specify the path of genesis files

-h, --help help for init

--listen\_port string p2p listen port(only for follower)

--proxy\_app string Gichain's ip address(only for follower)

Global Flags:

--home string directory for config and data (default "/root/.tendermint")

--log\_file string Log file

--log\_level string Log level (default "main:info,state:info,\*:error")

--trace print out full stack trace on errors

1. 验证者节点通过运行以下命令初始化根目录

tendermint init --genesis\_path /root/genesis --chain\_id [chainid]

在$TMHOME/config 目录下我们要先船事件个新的私钥（priv\_validator\_key.json）和一个包含相关公钥的创世文件（genesis.json）

1. 如果要搭建观察者节点通过以下命令搭建：

./tendermint init --follow ip:port

此处follow的ip以及端口即为验证者的ip和端口，多个验证者节点以逗号“,”间隔。

初始化参数：

|  |  |  |
| --- | --- | --- |
| **选项** | **类型** | **注释** |
| genesis\_path | String | 指定创世文件的路径 |
| chain\_id | String | 指定链的chain\_id |
| a\_address | String | 重新拟定监听地址（follower） |
| follow | String | 验证者的监听地址（follower） |
| listen\_port | String | P2p的监听端口（follower） |
| proxy\_app | String | Bcchain的ip地址 |

### 2.3.2 创世

创世文件genesis.json定义了区块链初始时的tendermint core的状态以及初始化的一些信息。

具体genesis.json内容详见安装包的[chainid]-genesis.json文件

For example local-genesis.json:

{

"chain\_id": "local",

"chain\_version": "2",

"genesis\_time": "2019-12-16T21:08:03.162191+08:00",

"app\_hash": "",

"app\_state": {

"organization": "genesis",

"token": {

"address": "",

"owner": "localETK7Zh9hNSPrEKdmCgnHDtFPatcs9WwVL",

"name": "LOC",

"symbol": "LOC",

"totalSupply": 2000000000000000000,

"addSupplyEnabled": false,

"burnEnabled": false,

"gasPrice": 2500

},

"rewardStrategy": [

{

"name": "validators",

"rewardPercent": "20.00",

"address": ""

},

{

"name": "r\_d\_team",

"rewardPercent": "20.00",

"address": "localEmmLk4GiJCkZNZcHhTCXihEZoLJdD4oQD"

},

{

"name": "bonus",

"rewardPercent": "30.00",

"address": "localHYDwRSoNEyCsZ8KYavyRBZsGHD7iLxjnX"

},

{

"name": "reserved",

"rewardPercent": "30.00",

"address": "localzVt3pfe75cuVdvwzZLkASQsKc3bf93fi"

}

],

"contracts": [

{

"name": "governance",

"version": "2.3",

"code": "governance-2.3.tar.gz",

"codeHash": "03f37133334a77cc76c8fb9ead95ef04058c54f2312ef55cb9e9bb14a317259a",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "E145295A6FB66AE156F91723906D04831F9C4B4D1AC76197D87CB80109590CD29505E9709BBCF65E6E75E6B303313FA5802F8DF9DA74A853E673C1A9DFCBC305"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "380C870817033E0CAFA0479EF092A5C212BB1C194512773F23EF6FA3C3DD075E4228AA821C5BAADA7029CE02557D0DE28B7F308E1191D3F8A5DF07471CBF7C0D"

}

},

{

"name": "ibc",

"version": "2.1",

"code": "ibc-2.1.tar.gz",

"codeHash": "3d283675da7f4f8df827572b63cfe5f06639e23ff22a404b58b2b0614dd9e1f7",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "BFD2C1E72716386C5C70937921433BB1DCE6B86B2CDDD030EA5D3BB122586EAD510227385FD861C67364506914C8042D8A07B6AF1FD1AD7BEE81122A6032B201"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "3B85304E2059FEB2BC6C07C1FA61085A5DFD9D0FB374CC47792C387D678A8D0A3E815DBE019F4BDAB2E4BB8CA05D48286364CB0AF171462AFBF2E9D6A6460901"

}

},

{

"name": "mining",

"version": "2.0",

"code": "mining-2.0.tar.gz",

"codeHash": "0a5cc3f8d4a1e457f1ceedb5332e5f0dda2c9aed44cda2fce4b8e37c81fc9efd",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "8658277D7FE10FC5DC7E32F559ED10BFEA799D13B522C37DBA1F0F4D598B433717AB77AF495BCE5E21FA3B4464089FC0E13AD7BE8A6F22AB551AEF4C2346F903"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "D6D81CC1700E969F6ADF8295FA23FDBC9E4F16FAFF1BF116A8BD684BF77FD41135627A34CDDEDEFD336E20CACCAAF03D0A4F503FA7C49A03D59943F43293F90E"

}

},

{

"name": "netgovernance",

"version": "2.1",

"code": "netgovernance-2.1.tar.gz",

"codeHash": "3d49148264c78cd6e1498460148bb06f5062e5e79ec236640f1c42bea700af03",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "BC99F691AF57740132C06B853836417CAD04C65859CBA83D54059E487C2CD28F80E97B151213AE3EF9DC1BE49B01C7A875B40558DCB5B74EB22FE2729EBF6100"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "F905ED020E3217E45433173E4A69C9C2B51FFCD9B884004BD9710AF688948C09934369F647CA246443B12305352D92B2D478B718C316C4A8D377BF76AC12A603"

}

},

{

"name": "organization",

"version": "2.2",

"code": "organization-2.2.tar.gz",

"codeHash": "441891d7000386d0bcd9602940a5cc7c88ce503cc375a1424286cacd847176eb",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "795AD608B03A12B0BB5929220FE73F00401B9D87601E4BB5CDC1688118534B1BC60FB7C34F9FD5FF22EA919611680EBF1A8D8FDFBB8A261D15F649F48F69910B"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "9B515E8CA1AC4E672B1A38C069869A57EDE8B9FC6D8339864571DCC975FA7312305B3A48CE8484217181473ECF8FA489E8048738BE3DB47E74D41C1042754B04"

}

},

{

"name": "smartcontract",

"version": "2.2",

"code": "smartcontract-2.2.tar.gz",

"codeHash": "ab7643c75f4d7c322627ffad8ee79cb232c092a42fd9e70ac19b937576e48261",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "F35E8C4927A452DA8D2486D414CDEB4037ED23036B24A0A87CDF799ADD1CC4BAAC0D95E019D5E0E0CE6CE40CFAFFE34E44DE332DB7F8D9E3C9B091959E547D0A"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "C0CF3EA6DFBBF9E4383515B0AE82E4C850DFF71F20D386591928BB6C15DC76E43E2966F2D5218C75E02041841F54A6DD43A1D3F91F2FC8F0EB39F22DE004B805"

}

},

{

"name": "token-basic",

"version": "2.1",

"code": "token-basic-2.1.tar.gz",

"codeHash": "1697c42311e808fd86dd2ac38eb062895f4c2789eba35449423c22ebe64f0b88",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "36B9617736D072116214CA37E6227A18693FE5D752105F99AE8C4A216CF4D92419E1720F890BD07969687F67C54DCD533EEA866FA4730805020D153FBF373506"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "B9D1838DA2B161A0178836F29160CF23F65FD8FC6A8550605B5882494B89DB0D5ACFAC6E2688E4C67C7B42C9AA38F0E80736ACBD8E5B95CABE18C012A5D66203"

}

},

{

"name": "token-issue",

"version": "2.2",

"code": "token-issue-2.2.tar.gz",

"codeHash": "3d5b845764723ebca54470188b8aa94fa5f6610c5fd579b84639cc016a5a413c",

"codeDevSig": {

"pubkey": "5e8339cb1a5cce65602fd4f57e115905348f7e83gie38dd77694dbe1f8903c9",

"signature": "0114C1082F097628A60CC5C87BD1496B0D77EEB1C43F33E642E00FE72767912A66B6ACA4FA066A005D5976ADC502C26EE792FA47432CF458BBC450487801E90B"

},

"codeOrgSig": {

"pubkey": "0c27b3396bdc1b486af51e84accbdd23a0d55a49c34fa51cf0ed6aedccf984d4",

"signature": "C3A53D618E9486E90145D01C6C39DABDAE804A3826ABD08378316D9F9A6159DB7B146C2FC4E1E639311E4CF35A0B2283EF02D8B94B592360AFAFEFB7ABFC7009"

}

}

]

},

"validators": [

{

"name": "node1",

"reward\_addr": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"power": 10

}

]

}

### 2.3.3 运行

通过运行以下命令可以运行一个tendermint节点：

tendermint node

执行上述命令后，默认tendermint将尝试连接ABCI application ，这时需要启动我们的区块链应用系统即bcchain在其他的窗口。

几秒钟后，您应该看到块开始生成。请注意，即使没有transaction事务，块也会定期生成，在我们的最新2.2版本默认会在3s内产生一个块。

如果您的应用不是用Go语言编写的，则只需在另一个进程中运行它，然后使用该 --proxy\_app标志指定它正在监听的套接字的地址即可，例如：

tendermint node --proxy\_app=/var/run/abci.sock

参数：

|  |  |  |
| --- | --- | --- |
| **选项** | **类型** | **注释** |
| abci | String | 指定abci传输，默认以socket进行传输 |
| consensus.create\_empty\_blocks | Bool | 默认为true，可以设置为false，仅当有transaction或apphash改变时产生区块 |
| fast\_sync | Bool | 进行快速同步，默认值为true |
| moniker | String | 节点名称 |
| p2p.laddr | String | 节点监听地址，默认值为"tcp://0.0.0.0:46656" |
| p2p.persistent\_peers | String | 以逗号间隔每个节点的地址 |
| p2p.pex | Bool | 是否禁用节点交换，默认值为true |
| p2p.private\_peer\_ids | String | 以逗号间隔私有节点ID |
| p2p.seed\_mode | Bool | 是否是种子模式 |
| p2p.seeds | String | 种子节点以逗号间隔地址 |
| p2p.skip\_upnp | Bool | 忽略UPNP配置 |
| persist | String | 用于数据库目录 |
| priv\_validator\_laddr | String | 从外部验证者加点监听连接的套接字地址 |
| proxy\_app | String | 代理应用地址数组 |
| rpc.grpc\_laddr | String | GRPC监听地址，仅用于BroadcastTx |
| rpc.laddr | String | GPC监听地址端口请求 |
| rpc.unsafe | Bool | 启用不安全的RPC方法 |

### 2.3.4 transaction

1. 发送transaction后，可以使用curl命令进行请求查询从tendermint RPC服务接口

命令如下：

curl [http://localhost:46657/broadcast\_tx\_commit?tx=\"abcdef\](http://localhost:46657/broadcast_tx_commit?tx=\%22abcdef\)"

注：abcdef为使用具体transaction格式组的包

1. 我们也可以查询当前区块链的状态在/status:

curl <http://localhost:46657/status>

**Request JSONRPC over HTTP：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"node\_info": {

"id": "localL23DxundN87BJwh7nrvaXoxUKTUdsqNum",

"listen\_addr": "127.0.0.1:46656",

"network": "local",

"channels": "4020212223303800",

"version": "2.2.1.17357",

"base\_version": "0.19.1",

"moniker": "dev5",

"other": [

"amino\_version=0.9.7",

"p2p\_version=0.5.0",

"consensus\_version=v1/0.2.2",

"rpc\_version=0.7.0/3",

"tx\_index=on",

"rpc\_addr=tcp://0.0.0.0:46657"

]

},

"sync\_info": {

"latest\_block\_hash": "DED51A36D7F1458773BCC6AD50C199B99C63E03E",

"latest\_app\_hash": "1957138884BC76F2FD52876559FB008C8AF13024B50EAE1DA42F2476C79F9365",

"latest\_block\_height": 1818,

"latest\_block\_time": "2019-12-25T17:35:21.805700044+08:00",

"syncing": false

},

"validator\_info": {

"address": "localU64nGNwcmNAnd68tRpXLzcnEFd8KcYyZ",

"pub\_key": {

"type": "AC26791624DE60",

"value": "Q+BXJOWFwdYUmkYMS/clSy5G/q6XGLAFxvzOqkh8BNU="

},

"voting\_power": 10,

"reward\_addr": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"name": "node1"

}

}

}

1. 在浏览器访问<http://localhost:46657> 可以查看其它端点列表。一些不带参数的（例如：/ abci\_info）, 而其他一些则指定参数名称并\_用作占位符。

### 2.3.5 重置

**注意：此操作是不安全的，只有在开发中或者你可以承担的起丢失区块数据的风险，才可以进行此操作。**

要重置区块链需要停止节点运行以下命令：

tendermint unsafe\_reset\_all

此命令将移除区块链的数据目录，重置验证者节点以及地址数据列表文件。

tendermint unsafe\_reset\_priv\_validator

此命令重置验证者节点以及地址数据列表文件。

### 2.3.6 节点

Tendermint节点操作可以使用以下命令：

./tendermint show\_validator

此命令用于展示节点的验证者信息

./tendermint show\_node\_id

此命令用于展示节点的node id

./tendermint sync

此命令用于同步tendermint节点信息

### 2.3.7 配置化

Tendermint 使用config.toml文件来进行配置，这其中除了包括区块链应用系统的套接字地址（proxy\_app）Tendermint节点的监听地址（p2p.laddr）以及RPC服务的监听地址（rpc.laddr）还包括创世文件信息路径，日志信息路径等等一些相关配置化的信息。具体详见：/etc/tmcore/config/config.toml

**注：如需修改配置，需要再修改完配置文件后 重新启动Tendermint程序才可生效。**

## 2.4 RPC接口说明

共识算法系统提供了RPC接口，便于查询区块链上的区块信息。



以下示例可能由于返回json信息太长使用“。。。。。。。。”省略。

下面进行几个常用的RPC访问示例

### abci\_info

向创智链区块链提交查询区块链abci信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/abci_info>

**Response SUCCESS**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"response": {

"version": "2.2.1.17357",

"last\_block\_height": 29386,

"last\_app\_state": ""

}

}

}

### dump\_consensus\_state

向创智链区块链提交查询区块链共识状态信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/dump_consensus_state>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"round\_state": {

"height": 29542,

"round": 0,

"step": 1,

"start\_time": "2019-12-25T19:23:57.357690265+08:00",

"commit\_time": "2019-12-25T19:23:56.357690265+08:00",

"validators": {

"validators": [

。。。。。。。。。。。。。。。

"votes": [

"Vote{0:localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov 29541/00/2(Precommit) 6F6F52E946B7 /2B3DB09F2D9C.../ @ 2019-12-25T11:23:56.355Z}"

],

"votes\_bit\_array": "x",

"peer\_maj\_23s": {}

},

"last\_validators": {

"validators": [

{

"address": "localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov",

"pub\_key": {

"type": "AC26791624DE60",

"value": "JdF2zhrZdYga0x8Dh8eI25o1IQbspoJ/ragKCgmozKo="

},

"voting\_power": 10,

"reward\_addr": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"name": "node1",

"accum": 0

}

],

"proposer": {

"address": "localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov",

"pub\_key": {

"type": "AC26791624DE60",

"value": "JdF2zhrZdYga0x8Dh8eI25o1IQbspoJ/ragKCgmozKo="

},

"voting\_power": 10,

"reward\_addr": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"name": "node1",

"accum": 0

}

}

},

"peer\_round\_states": []

}

}

### genesis

向创智链区块链提交查询区块链创世信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/genesis>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"genesis": {

"genesis\_time": "2019-12-16T21:08:03.162191+08:00",

"chain\_id": "local",

"chain\_version": "2",

"consensus\_params": {

"block\_size\_params": {

"max\_bytes": 22020096,

"max\_txs": 100000,

"max\_gas": -1

},

"tx\_size\_params": {

"max\_bytes": 10240,

"max\_gas": -1

},

"block\_gossip\_params": {

"block\_part\_size\_bytes": 65536

},

"evidence\_params": {

"max\_age": 100000

}

},

"validators": [

。。。。。。。。。。。

}

}

}

}

### genesis\_pkg

向创智链区块链提交查询区块链被观察者节点创世信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/genesis_pkg>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"f":” H4sICAAAAAAA/2xvY2FsLnRhcgDs+3OMLN66

。。。。。。。。。

03A/t2/+3f/7v9b/f8CAAD//wgBE9MAIAIA”

}

}

### health

向创智链区块链提交查询区块链健康状况信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/health>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"chain\_id": "local",

"version": "2.2.1.17357",

"chain\_version": 2,

"last\_block\_height": 30456,

"validator\_count": 1

}

}

### net\_info

向创智链区块链提交查询区块链网络信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/net_info>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"listening": true,

"listeners": [

"127.0.0.1:46656"

],

"peers": null

}

}

### num\_unconfirmed\_txs

向创智链区块链提交查询区块链等待transaction数量数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/num_unconfirmed_txs>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"n\_txs": 0,

"txs": null

}

}

### status

向创智链区块链提交查询区块链状态信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/status>

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"node\_info": {

"id": "local3TZ9w8huJXtamkwJ4C8RQSQTgjm8F7ova",

"listen\_addr": "127.0.0.1:46656",

"network": "local",

"channels": "4020212223303800",

"version": "2.2.1.17357",

"base\_version": "0.19.1",

"moniker": "centos7mini",

"other": [

"amino\_version=0.9.7",

"p2p\_version=0.5.0",

"consensus\_version=v1/0.2.2",

"rpc\_version=0.7.0/3",

"tx\_index=on",

"rpc\_addr=tcp://0.0.0.0:46657"

]

},

"sync\_info": {

"latest\_block\_hash": "707F6CB831BFFDE0967D0F9BDA8D9CAB88113112",

"latest\_app\_hash": "901ECDD0987F34B2F0B3B50A91A6D09EE8DFB0FCCFE42827693BA0DE03CB479E",

"latest\_block\_height": 31532,

"latest\_block\_time": "2019-12-25T19:57:34.619283946+08:00",

"syncing": false

},

"validator\_info": {

"address": "localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov",

"pub\_key": {

"type": "AC26791624DE60",

"value": "JdF2zhrZdYga0x8Dh8eI25o1IQbspoJ/ragKCgmozKo="

},

"voting\_power": 10,

"reward\_addr": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"name": "node1"

}

}

}

### abci\_query

向创智链区块链提交区块链abci查询状态数据库数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/abci_query?path=_&data=_&height=_&trusted=_>

此例查询所有token， path=” /token/all/0”

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"response": {

"code": 200,

"key": "L3Rva2VuL2FsbC8w",

"value": "WyJsb2NhbEhMRGhxeW9KMXZSdW84cmU5R3hGQUZVMkJrc3cya051cCJd"

}

}

}

### abci\_query\_ex

向创智链区块链提交区块链abci批量查询数据的请求。

此例查询所有token， path=” /token/all/0”

**Request URI over HTTP：**

<http://192.168.80.160:46657/abci_query_ex?path=_>

此例查询合约地址为local49jxx7zxKFnw2YfSXTeLwqhpxRYSh97tu和localgw684B84Sak9q5ZrcAmG4WF8EGjWmnvo的信息

Path=” /contract/[local49jxx7zxKFnw2YfSXTeLwqhpxRYSh97tu,localgw684B84Sak9q5ZrcAmG4WF8EGjWmnvo]”

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"response": {

"code": 200,

"KeyValues": [

{

"key": "L2NvbnRyYWN0L2xvY2FsNDlqeHg3enhLRm53MllmU1hUZUx3cWhweFJZU2g5N3R1",

"value": ""

},

{

"key": "L2NvbnRyYWN0L2xvY2FsZ3c2ODRCODRTYWs5cTVacmNBbUc0V0Y4RUdqV21udm8=",

"value": ""

}

]

}

}

}

### block

向创智链区块链提交查询区块链块高信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/block?height=_>

此例查询块高为15878信息，height=15878

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"block\_meta": {

"block\_id": {

"hash": "379051634C1795E3733F4B57E83A743E35A7077E",

"parts": {

"total": 1,

"hash": "A0698F8543C3377EED938705061ED67A1B4CFA00"

}

},

"header": {

"chain\_id": "local",

"height": 15878,

"time": "2019-12-25T07:32:12.005187877Z",

"num\_txs": 1,

"last\_block\_id": {

"hash": "5652E179BB7C3F4320752C4FCB9E604798ECFBAD",

"parts": {

"total": 1,

"hash": "840CFB54C486F8661CA2FCF1F3A3A6F310BDBBE2"

}

},

。。。。。。。。。。

"block\_size": 995

}

}

### block\_results

向创智链区块链提交查询区块链transaction收据等信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/block_results?height=_>

此例查询块高为15878信息，height=15878

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"height": 15878,

"results": {

"DeliverTx": [

{

"code": 200,

"gas\_limit": 500000,

"gas\_used": 500,

"fee": 1250000,

"tags": [

{

"key": "LzAvMC9zdGQ6OmZlZQ==",

"value": "eyJuYW1lIjoic3RkOjpmZWUiLCJjb250cmFjdEFkZHJlc3MiOiJsb2NhbEhMRGhxeW9KMXZSdW84cmU5R3hGQUZVMkJrc3cya051cCIsInJlY2VpcHRCeXRlcyI6ImV5SjBiMnRsYmlJNklteHZZMkZzU0V4RWFIRjViMG94ZGxKMWJ6aHlaVGxIZUVaQlJsVXlRbXR6ZHpKclRuVndJaXdpWm5KdmJTSTZJbXh2WTJGc1JWUkxOMXBvT1doT1UxQnlSVXRrYlVObmJraEVkRVpRWVhSamN6bFhkMVpNSWl3aWRtRnNkV1VpT2pFeU5UQXdNREI5IiwicmVjZWlwdEhhc2giOiJFNTQ4M0QzMDY5RDcwOTNEOTUyRkQ5NzQ2RTJGQTJBMDY1MEE5NjlDRjhGMTlCMDVGRDZENjQzNjkwQjRGMEQ1In0="

},

。。。。。。。。

{

"key": "LzEvNC90cmFuc2ZlckZlZQ==",

"value": "eyJuYW1lIjoidHJhbnNmZXJGZWUiLCJyZWNlaXB0Qnl0ZXMiOiJleUowYjJ0bGJpSTZJbXh2WTJGc1NFeEVhSEY1YjBveGRsSjFiemh5WlRsSGVFWkJSbFV5UW10emR6SnJUblZ3SWl3aVpuSnZiU0k2SW14dlkyRnNSVlJMTjFwb09XaE9VMUJ5UlV0a2JVTm5ia2hFZEVaUVlYUmpjemxYZDFaTUlpd2lkRzhpT2lKc2IyTmhiSHBXZEROd1ptVTNOV04xVm1SMmQzcGFUR3RCVTFGelMyTXpZbVk1TTJacElpd2lkbUZzZFdVaU9qTTNOVEF3TUgwPSIsInJlY2VpcHRIYXNoIjoiMDJDQTNCODdGQkE2NTNFOTExRjdGMkNBMUVGRUFCMjJDMkY2MjNEN0I2MjUzNzgwQjU4NUMxNUIzNEU0QzRGQiJ9"

}

],

"tx\_hash": "C41172646573394DA892A305D249BDA0768754563B71D6B40947BD1DA1868DD8"

}

],

"EndBlock": {

"validator\_updates": null,

"rewardAmount": 150000000,

"chainVersion": 2,

"SCGenesis": null

}

}

}

}

### blockchain

向创智链区块链提交查询区块链某一段高度信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/blockchain?minHeight=_&maxHeight=_>

此例查询块高从1到3的信息，minHeight=1&maxHeight=3

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"last\_height": 32462,

"block\_metas": [

{

"block\_id": {

"hash": "A481648CA978CF5785996BC0B8D3044BB2C88620",

"parts": {

"total": 1,

"hash": "2FE54D445488843AF5D7F2800096D96DEB060075"

}

},

"header": {

"chain\_id": "local",

"height": 3,

"time": "2019-12-24T13:50:38.837762459Z",

"num\_txs": 0,

"last\_block\_id": {

"hash": "00A3192F2CEB1E646CD166CBFA3D56ECC90534A9",

"parts": {

"total": 1,

"hash": "0EBEB492F89B65A0CDAD4B7E0DE34959BBB78402"

}

},

"total\_txs": 0,

"last\_commit\_hash": "3D493310CAE0A770089F007586010B47318D8935",

"data\_hash": "",

"validators\_hash": "EEB6BFA68C27E705EFC88CA3570965EC02A08733",

"consensus\_hash": "F66EF1DF8BA6DAC7A1ECCE40CC84E54A1CEBC6A5",

"last\_app\_hash": "6353D43CC69EAF167D54367DA49034432F22CBF4EADE156835791FA5B8D6251F",

"last\_results\_hash": "",

。。。。。。。。。。。。。

"last\_fee": 0,

"last\_allocation": null,

"proposer\_address": "localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov",

"reward\_address": "local8LtT8AonWgJ8nMCEdAR5UGrbRfUmuoeiz",

"random\_of\_block": "78F8E4D6C138DD3822E20E30C63BD5B9BF86B54D9F25053101EE4567F05753F0",

"version": "2.2.1.17357",

"chain\_version": 2

}

}

]

}

}

### broadcast\_tx\_async

向创智链区块链异步提交transaction数据信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/broadcast_tx_async?tx=_>

此例提交v2的transaction格式的信息，tx="local<tx>.v2.iGhKiTSxwCXBXUaztMhTyHfp1SBhqE4vMfDkpWJ8ExUWAExKvK6257hwASzwni5ZKQdMbcK9S22rtVsppAJw3zCYzVYk63wWvY9Y8Eav9CEg8eg7vktFR3pRi2ZKMmoycEWkYBrQc83qTzvD5VCvHLw3YWHjFfGuc6S3mrGW7WCewydZurK69zyM7Jcxviq1D9.<1>.YTgiA1gdDGi2L8hw4m73eYYfpkLgrWEtRzU5fUbW2ztgSccoydemsQMNPAVsYWPMDxiVYJRHF7ZrHh8V5Jnnta3BWYe3zz6BN4iQZa3eVzVXGdUZ3728xNJjbWu8XjqZjCUpWXu7kFskrNg6Jsfwt"

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"code": 0,

"data": "",

"log": "",

"hash": "6C24F12C6E20EAECF17C3A54668409D1BBF92F41322AD5008895A57B5806A7C4"

}

}

提交成功后根据hash字段去查询transaction结果信息

### broadcast\_tx\_commit

向创智链区块链提交一笔transaction请求信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/broadcast_tx_commit?tx=_>

此例提交v2的transaction格式的信息，tx="local<tx>.v2.iGhLD8SzjGdLQmSTFLAxDWatAwnnJDTPJc8zQ8xFseE39T1YaM6UzYMmyGhpMURdzBx1V8tt1qEJYvQWsUz1SoWjbeNKG77MEuV2VRUaD6JHV1664Qzpk1QfqZMAZ54kXcnjFCJAa4nAcBxtUpemS3GmMWFxg8VGdi7pzmw5dpvUJDzBbiN2dEambj27kgdgyM.<1>.YTgiA1gdDGi2L8hw4m73eYYfpkLgrWEtRzU5fUbW2ztgSccoydemsQMNPAVsYYR9L2X7D1H5xFYgBho1XMgw6uQ6CutqMRmhS42qzjomJCBmwHc9oADXGGFznrr5w91hTNEHSgCvES3x8yQCWP6Qx"

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"check\_tx": {

"code": 200,

"log": "CheckTx success",

"tx\_hash": "F5650304F65CE33139A7CED48B4304570E52F93453AA4127D8653788F7522B32"

},

"deliver\_tx": {

"code": 200,

"gas\_limit": 500000,

"gas\_used": 500,

"fee": 1250000,

"tags": [

{

"key": "LzAvMC9zdGQ6OmZlZQ==",

"value": "eyJuYW1lIjoic3RkOjpmZWUiLCJjb250cmFjdEFkZHJlc3MiOiJsb2NhbEhMRGhxeW9KMXZSdW84cmU5R3hGQUZVMkJrc3cya051cCIsInJlY2VpcHRCeXRlcyI6ImV5SjBiMnRsYmlJNklteHZZMkZzU0V4RWFIRjViMG94ZGxKMWJ6aHlaVGxIZUVaQlJsVXlRbXR6ZHpKclRuVndJaXdpWm5KdmJTSTZJbXh2WTJGc1JWUkxOMXBvT1doT1UxQnlSVXRrYlVObmJraEVkRVpRWVhSamN6bFhkMVpNSWl3aWRtRnNkV1VpT2pFeU5UQXdNREI5IiwicmVjZWlwdEhhc2giOiJFNTQ4M0QzMDY5RDcwOTNEOTUyRkQ5NzQ2RTJGQTJBMDY1MEE5NjlDRjhGMTlCMDVGRDZENjQzNjkwQjRGMEQ1In0="

},

。。。。。。。。。。。。。。

],

"tx\_hash": "F5650304F65CE33139A7CED48B4304570E52F93453AA4127D8653788F7522B32",

"height": 81866

},

"hash": "F5650304F65CE33139A7CED48B4304570E52F93453AA4127D8653788F7522B32",

"height": 81866

}

}

### broadcast\_tx\_sync

向创智链区块链同步提交transaction数据信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/broadcast_tx_sync?tx=_>

此例提交v2的transaction格式的信息，tx="local<tx>.v2.iGhLhoT2XLjJ5vxxSk2WWRBHSoWQBNtFEf9r5coEWXtqCyGgeBMFB4GdjEjVNh45MeUBGhvJdmcc516jWRX4GSz4Vwgh43GKoFbfrW3jQHeu7Yyzr2Lt5wP7SR9jJURRBj8moJJUYaShDPiyLHvaEVSodU8h4g7nHtBYy5XsxHZv1XSwGnSYFAZBaLjQa7egAb.<1>.YTgiA1gdDGi2L8hw4m73eYYfpkLgrWEtRzU5fUbW2ztgSccoydemsQMNPAVsYVDjhauXR3FbjhtzkUieeeChQJ936vu9VvFCK1q5MicQScf5vtf7Sgqe6EWZcLxYhPByd9AikZYrHPS8Pqui7RYz5"

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"code": 200,

"data": "",

"log": "CheckTx success",

"hash": "A653DF86AF93722B6AABEE03A41907D1AD07F2DBD7A8F2BD1EFB96C6EE738F9C"

}

}

### commit

向创智链区块链提交查询某一高度的commit信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/commit?height=_>

此例提交的高度是15878， height=15878

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"SignedHeader": {

"header": {

"chain\_id": "local",

"height": 15878,

"time": "2019-12-25T07:32:12.005187877Z",

"num\_txs": 1,

。。。。。。。。。。。。。。

},

"commit": {

"block\_id": {

"hash": "379051634C1795E3733F4B57E83A743E35A7077E",

"parts": {

"total": 1,

"hash": "A0698F8543C3377EED938705061ED67A1B4CFA00"

}

},

"precommits": [

{

"validator\_address": "localBLNtHBMe1uiApFEvCGEGBAWVWa5WUr2ov",

"validator\_index": 0,

"height": 15878,

"round": 0,

"timestamp": "2019-12-25T07:32:12.018875835Z",

"type": 2,

"block\_id": {

"hash": "379051634C1795E3733F4B57E83A743E35A7077E",

"parts": {

"total": 1,

"hash": "A0698F8543C3377EED938705061ED67A1B4CFA00"

}

},

"signature": {

"type": "6BF5903DA1DB28",

"value": "tW5dwV0q15Q8q6eDlBwcyY11iKKBjWJCSruuGMVpYnNQZCpbK6uMOf3lQoyONAkJiMXCAR06HfcSWaxtB1mYAQ=="

}

}

]

}

},

"canonical": true

}

}

### tx

向创智链区块链提交查询transactionhash信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/tx?hash=_&prove=_>

此例查询v2transaction返回的transactionhash，hash="6C24F12C6E20EAECF17C3A54668409D1BBF92F41322AD5008895A57B5806A7C4"

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"hash": "6C24F12C6E20EAECF17C3A54668409D1BBF92F41322AD5008895A57B5806A7C4",

"height": 81362,

"index": 0,

"deliver\_tx": {

"code": 200,

"gas\_limit": 500000,

"gas\_used": 500,

"fee": 1250000,

"tags": [

。。。。。。。。。。。。。

],

"tx\_hash": "6C24F12C6E20EAECF17C3A54668409D1BBF92F41322AD5008895A57B5806A7C4",

"height": 81362

},

"check\_tx": {

"code": 200,

"log": "CheckTx success",

"tx\_hash": "6C24F12C6E20EAECF17C3A54668409D1BBF92F41322AD5008895A57B5806A7C4"

},

"tx": null,

"state\_code": 4

}

}

### validators

向创智链区块链提交查询验证者信息数据的请求。

**Request URI over HTTP：**

<http://192.168.80.160:46657/validators?height=_>

此例查询devtest验证者信息 ，height=20

**Response SUCCESS：**

{

"jsonrpc": "2.0",

"id": "",

"result": {

"block\_height": 20,

"validators": [

{

"address": "devtest6VCkPBGTrsr5aHbeZz65rTLw1ShvLVuUN",

"pub\_key": {

"type": "AC26791624DE60",

"value": "NEJxSF3tSjjyvE7Ts6rr87+jsYtJqMc6f1LXvthgBsI="

},

"voting\_power": 10,

"reward\_addr": "devtestJidNDnFRL2AsdTD1ijuVoP8FXAXMoQRr5",

"name": "node-4.devtest",

"accum": -30

},

{

"address": "devtestKJVhUuspUsveKKkctb8FB9gWn5svL4gca",

"pub\_key": {

"type": "AC26791624DE60",

"value": "ZuWQZA69VzRwZH4tTSdxlImW8oO0vV3NlYAaWllKOpM="

},

"voting\_power": 10,

"reward\_addr": "devtest2QrpnDnVEAUFpqSRELCaoA517wtj9r2xc",

"name": "node-3.devtest",

"accum": 10

},

{

"address": "devtestPQsBfyC7oxGVg1cBBm9CRCjYuiuFs2GCw",

"pub\_key": {

"type": "AC26791624DE60",

"value": "5fcdkfy44qNkR1PgCKika9WATiT4cZ3q4F7ONB6H8SQ="

},

"voting\_power": 10,

"reward\_addr": "devtestGMbsj6xXoNBDgGkAHb8yHd1qQG2aWdmKA",

"name": "node-1.devtest",

"accum": 10

},

{

"address": "devtestqYt1bGQR6na76ym2K4TShn1HKi7T8hk7",

"pub\_key": {

"type": "AC26791624DE60",

"value": "2bIdmysfQHQD8GBnQN0veXvZ3Rbc1BwHs6DTAiv8qxw="

},

"voting\_power": 10,

"reward\_addr": "devtest8ZMgB7kkXMbPs1feiosFaLq4MprABm8nE",

"name": "node-2.devtest",

"accum": 10

}

]

}

}